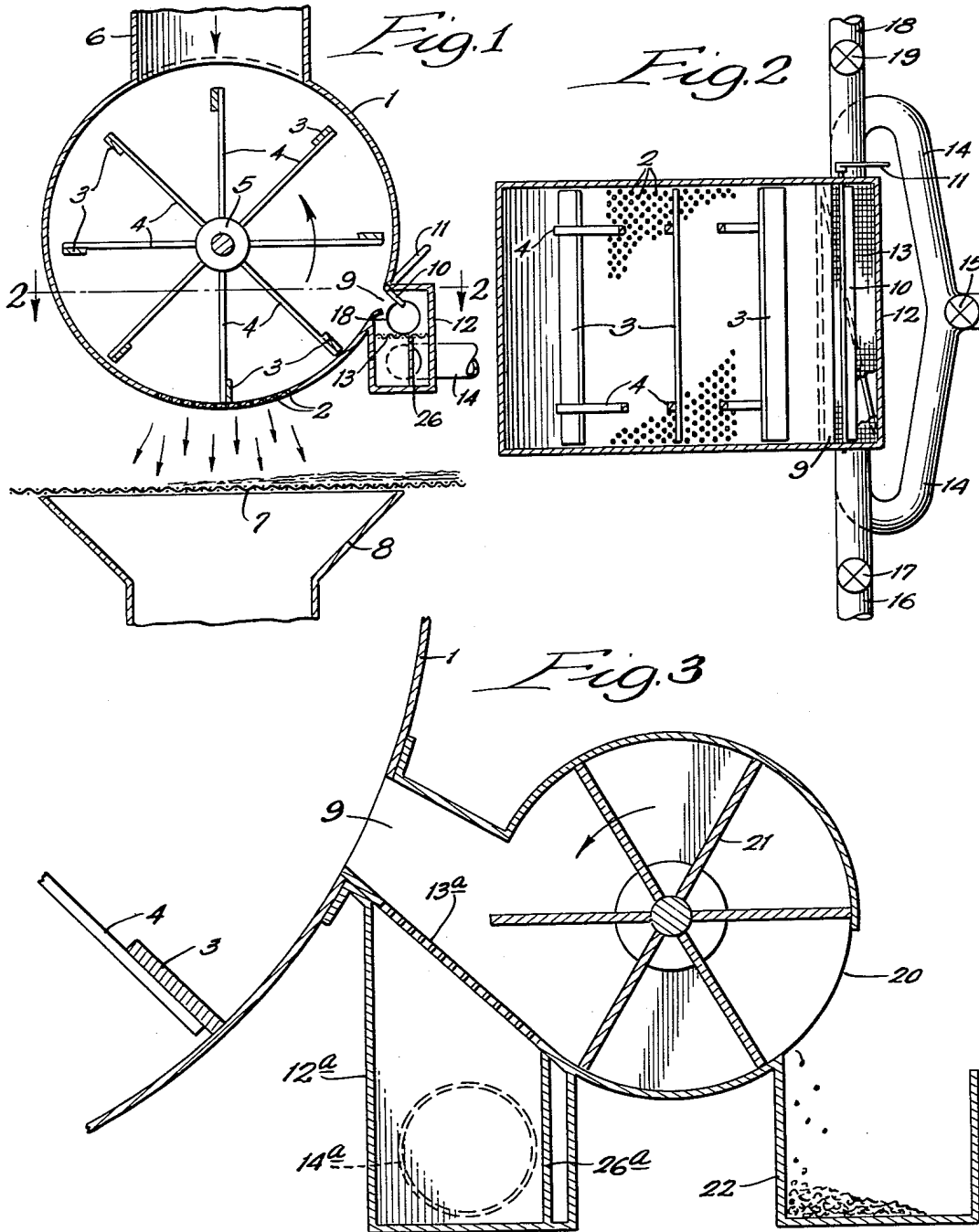


June 26, 1956

J. D'A. CLARK
METHOD AND APPARATUS FOR REMOVING
DENSE FROM LIGHTER MATERIAL
Filed Sept. 10, 1949

2,751,633



INVENTOR:
James d'A. Clark.
BY *Duross, Coors, Brothaus & Spangenberg,*
ATTORNEYS.

1

2,751,633

METHOD AND APPARATUS FOR REMOVING DENSE FROM LIGHTER MATERIAL

James D'A. Clark, Longview, Wash., assignor to A. B. Dick Company, Chicago, Ill., a corporation of Illinois

Application September 10, 1949, Serial No. 114,942

11 Claims. (Cl. 19—156)

This invention relates to a method for removing relatively dense material and the invention is particularly useful in connection with the separation or removal of heavy unwanted material from a rotary screen or a distributing head to which dry fibrous materials are supplied for screening or distribution.

The present application constitutes a continuation-in-part or an improvement upon my co-pending application, Serial No. 61,674, filed November 23, 1948, for Apparatus and Method for Producing Fibrous Structures.

In the disposition of fibers for the forming of a fibrous mat, as for example, in accordance with the method described in my above-mentioned application, it is found that as the fibrous material is continuously added to the machine, foreign material will gather that cannot pass the perforations in the distributing screens; and if the fibers are long and fine, by the action of the moving parts in contact with them they may be rolled up into the form of small balls or "rice" which are not redispersed and which accumulate above the distributing screen. Such material, along with other heavy unwanted material, forms an obstruction within the machine which it is desirable to remove as quickly as possible and without stopping the operation of the machine. Other types of fiber-treating processes and machines are subject to the same problem in that unwanted heavy materials accumulate therein and they present a problem with respect to such removal without stopping the operation.

An object of the present invention is to provide a novel method and apparatus for the removal of heavy unwanted material from a chamber providing a screen or distributing head to which dry fibrous materials are supplied for screening or distribution. A further object is to provide a structure involving few parts by which such balls or "rice" and other heavy unwanted materials may be regularly removed and in a substantially automatic manner from the machine. A still further object is to provide a method for removal of relatively dense material from a mixture of dense and light fibrous material while at the same time recovering fibers from the removed dense material and returning the same to the screen or distributing chamber. Yet another object is to provide means for the removal of unwanted heavy material from a screen-equipped chamber while at the same time providing for the intermittent or continuous separation of the removed dense material from a light material carried with the heavy material. Other specific objects and advantages will appear as the specification proceeds.

The invention is illustrated in preferred embodiments by the accompanying drawings, in which—

Figure 1 is a broken vertical sectional view of one form of apparatus with which my invention may be employed; Fig. 2, is a transverse sectional view, the section being taken as indicated at line 2—2 of Fig. 1; and Fig. 3, an enlarged broken and vertical sectional view of a modified form of structure with which the invention may be practiced.

In the illustration given in Figs. 1 and 2, there is a cy-

2

lindrical drum 1 having an area provided with perforations 2 at its bottom through which the fibers are induced to pass by the agitator blades 3 carried on arms 4. The arms 4 are mounted upon a hub 5 fixed to a driven shaft. The structure is shown in greater detail in my said co-pending application, Serial No. 61,674.

Fibers or fibrous material is fed into the cylindrical drum 1 through duct 6 which may also carry a stream of air under slight pressure. The combined effect of the air stream and the agitator blades is to carry the separate or smaller fibers through the perforations 2 whence they may be deposited on a moving wire screen 7 which may pass over the inlet of a suction duct 8. The suction duct 8 may be connected to the same fan that supplies the air pressure to duct 6.

If it is desired to ensure that only substantially separate fibers are deposited on traveling screen 7 the dimensions of the holes 2 should be less than the length of the fibers and the speed of the blades 3 and the action of the air stream may also be used to separate the individual fibers in the added fibrous material. However, part of the added material may be resistant to such disintegration and, with continuous operation of the equipment, there would be no way to remove this unwanted material except by stopping the operation and opening up the drum.

To overcome the necessity for thus stopping the operation, a slot 9 is provided across the cylindrical part of the drum preferably below the center line and preferably in the side to which the lower part of the agitator moves. As shown in Figs. 1 and 2, means, such as a flap 10 operated by a lever 11, is added to open and close slot 9 intermittently. If nothing else were provided and slot 9 were opened from time to time the action of the blades 3 and the air pressure in drum 1 would blow both separated and unseparated material through the opening 9 and thus keep the drum clear. However, it is obvious that this would result in a temporary disruption of the flow of air and fibers through perforations 2, so that a uniform continuous flow could not be preserved as is desirable when a uniform felted fibrous structure is to be deposited on a uniformly moving screen 7.

To overcome this difficulty, slot 9 and flap 10 are enclosed in a housing 12, part of which preferably is transparent. The housing is divided horizontally by a perforated screen 13 and beneath this screen there is connected a uniform air supply having air-adjustable pressure. The pressure of the air is slightly greater than that in drum 1 so that there is an inflow into drum 1 through slot 9. In order to secure a uniform flow of air across the face of the drum, particularly if it is of a substantial width, it is desirable to supply this air through two pipes 14 connected to both ends of the housing 12 and to split the housing 12 diagonally beneath the perforated plate 13 with vertical plate 26. This splitting of the air supply, together with the evening effect of perforated plate 13 has been found to give a very uniform flow across the drum. The air flow is regulated by a valve 15 in the common air supply to both pipes 14 or by individual valves in these pipes.

By means of valve 15 the flow of air into the drum is regulated so that the centrifugal action of the blades 3 and the effect of the air pressure on fibrous and other material is overcome in the case of the less dense fibrous material but not overcome in the case of dense fibrous or lumps of foreign material which thus are thrown through the slot 9 in opposition to the flow of air and deposit on the perforated screen 13. By their rolling and bouncing on the screen 13 any fibers adhering to this rejected material are freed and floated back into the drum.

A sufficient portion of the housing 12 should be made transparent and illumination provided so that the type

3

of material being discharged can be observed and the air flow adjusted to secure the discharge of only unwanted material.

In this manner the heavy material will be abstracted from the drum and will pile up on the plate 13. If only a very little foreign material is to be encountered and the fibrous material keeps free from agglomerations, the attachments, as so far described, may be used satisfactorily as a safety device to remove any tramp metals or other trash from the drum before they have much chance to do harm. Then any accumulated trash may be removed during periods when the fiber distributing apparatus is shut down.

Any suitable means may be provided for the removal of the balls or other heavy material on screen 13. In the illustration given in Figs. 1 and 2, I equip the portion of the housing 12 above the screen on one side thereof with an inlet pipe 16 which is controlled by a valve 17. The opposite side of the housing is provided with an outlet pipe 18 and this is controlled by a valve 19.

Operation

In the operation of the structure shown in Figs. 1 and 2, fibrous material is fed through conduit 6 into the chamber of drum 1 under relatively slight air pressure. Individually separated fibers are passed through the apertures 2 and deposited upon the screen 7 under the influence of suction provided within the conduit 8. The rotating blades 3 are mounted so as to barely touch or closely approach the inner face of the drum 1 in the lower portion thereof as the blades are carried in circumferential movement. In the described arrangement, cooperation takes place between the air stream, the blades 3, and the separating wall of the drum to provide a disintegrating action for separating fiber bundles into their individual components.

After the balls or "rice" or other dense material are whipped along the inner face of the drum, they fall into the upper chamber provided by casing 12. The stream of air delivered within casing 12 and entering the chamber of drum 1 through opening 9 tends to remove individual fibers and to carry the same back into the drum while the balls or other dense material pass against the air stream into the housing 12. In the housing 12 the "rice" or balls dance or move upwardly and downwardly upon the screen 13 and in this movement any separate fibers which may be attached to the balls are dislodged and are returned to the drum chamber.

When it is desired to remove the accumulated balls or other heavy material resting on screen 13, this may be accomplished in the structures shown in Figs. 1 and 2 by operating the lever 11 to move the flap 10 across the opening 9. At the same time, valve 19 in exit pipe 18 is open and valve 17 in inlet pipe 16 is open. Line 16 is a relatively high pressure air supply line and when this line is open there is a whipping of air across the screen 13 and the accumulated dense material is carried through outlet pipe 18 to a collector receptacle or disintegrator or other apparatus (not shown). Valves 17 and 19 may then be closed and flap 10 opened to permit the collection of heavy material from drum 1 to be resumed. If desired, lever 11 and the valves 17 and 19 may be operated mechanically at fixed intervals controlled by a suitable timing-device and through the use of solenoids in a well-known manner to effect such a removal of heavy material intermittently.

In the modification illustrated in Fig. 3, I provide a simpler and continuous means for the removal of such heavy material. In the structure shown in Fig. 3, an inclined perforated plate or screen 13a is provided and the heavy material passing through the opening 9 in drum 1 slides down the plate 13a into a casing provided with an outlet 20. A rotatably-mounted shaft equipped with vanes 21, preferably made of leather or other flexible material, is effective for slowly and continuously

4

scraping a heavy material into the receptacle 22. Below the screen or perforated plate 13a is a casing 12a providing a chamber to which air is supplied through the inlet pipe 14a.

It will be understood that the material to be separated may be whipped across a suitable exit for the lighter material, then carried across an exit for the heavier material, through which exit the material tends to pass by virtue of the action of gravity, its momentum, centrifugal action or fluid pressure or any combination of these. The lighter material is prevented from coming out of this opening by suitably adjusting the back pressure flow to overcome the tendency of the material to escape.

The invention herein has been described in connection with a fiber-depositing apparatus with which it is found to be particularly useful; it will be understood, however, that the separating apparatus may be employed with other devices for the recovery of dense material which may be either wanted or unwanted material and the process and apparatus herein described will be found readily applicable thereto.

For example, in the screening of paper pulp in dilute liquid suspension, the pulp suspension may be introduced into a drum similar to 1, either circumferentially as shown or preferably axially. The whole or the lower part of the drum may be submerged in water with the lower half or more of the circumference of the drum perforated with openings large enough only to pass the separated fibers. A stream of water of regulated pressure is introduced through pipe 14, for the same purpose or with the same effect as air in the dry fiber depositing process described. In this way, unwanted heavy fibrous particles and dirt may be abstracted and the individual separated fibers passed through the perforations into the water in which the drum is submerged.

While in the foregoing specification I have set forth specific apparatus and process steps in considerable detail for the purpose of illustrating embodiments of my invention, it will be understood that such details may be varied widely by those skilled in the art without departing from the spirit of my invention.

I claim:

1. In a fiber dry felting operation in which fibers are moved over a foraminous surface through which some fibers pass to be deposited in the form of a felt, the steps of moving the fibrous material over an exit opening, directing a counterflow of air through said exit opening for the selective removal of the heavier material through the opening, collecting said heavier material removed through the opening, repeatedly agitating the collected heavier material after passing through the opening to separate therefrom individual fibers and directing said counterflow of air through the collected heavier material to carry off the fibers separated therefrom.

2. In a method of the character set forth for the separation of aggregated fibrous material from individual fibers in a mixture thereof, the steps of moving the mixture over a surface provided with an outlet opening so that the aggregate material falls therethrough, collecting the aggregated material passing through said opening, directing a current of air through the collected aggregated material and thereby repeatedly agitating the collected aggregated material to separate therefrom individual fibers attached thereto and then directing said current of air and entrained separated fibers in a counter-flow through the exit opening to return individual fibers to the original mixture.

3. In apparatus for separating a dense material from lighter material, a casing providing a perforated surface and having also an outlet opening through which said material may fall, means for moving said material over said perforated surface and said opening, means for forming a counterflow of air through said opening to oppose the outflow of lighter material while permitting outflow of dense material, a housing connected to said

5

opening for collecting the dense material escaping there-through, and means connected with said housing for effecting agitation of the dense material collected in said housing to separate therefrom lighter material attached thereto.

4. In apparatus for separating a dense fibrous material from lighter fibrous material, a casing providing a perforated surface and having also an outlet opening through which said material may escape, means for moving said material over said perforated surface and said opening, a housing connected to said opening for collecting dense material escaping therethrough, said housing having a foraminous member therein for receiving the dense material collected therein, means for directing a current of air through said foraminous member and then through said housing and said opening into said casing to oppose the outflow of lighter material, the air current in passing through said foraminous member effecting agitation of the collected dense material to separate therefrom lighter fibers attached thereto.

5. In apparatus for separating a dense fibrous material from lighter fibrous material, a casing providing a perforated surface and having also an outlet opening through which said material may escape, means for moving said material over said perforated surface and said opening, means for forming a counterflow of fluid through said opening to oppose the outflow of lighter material, a screen interposed in said outlet opening for collecting the dense material and means for directing a current of fluid over said screen to remove the dense material collected thereon.

6. In apparatus for separating a dense fibrous material from lighter fibrous material, a casing providing a perforated surface and having also an outlet opening through which said material may escape, means for moving said material over said perforated surface and said opening, a housing connected to said opening for collecting dense material escaping therethrough, said housing having a foraminous bottom wall upon which the dense material temporarily collects means for directing a current of air through said foraminous member and then through said housing and said opening into said casing to oppose the outflow of lighter material, the air current in passing through said foraminous member effecting separation of the lighter fibers from the remainder, said foraminous member being inclined in the direction away from the opening toward an outlet in the housing.

7. In apparatus for separating a dense material from lighter material, a casing providing a perforated surface and having also an outlet opening through which said material may escape, means for moving said material over said perforated surface and said opening, means for forming a counterflow of fluid through said opening to oppose the outflow of lighter material, an inclined screen through which the fluid flows and onto which the abstracted dense material falls, and means associated with said inclined screen for continuously removing said dense material.

8. Apparatus for the air deposition of fibers to form fibrous structures comprising a cylindrical housing having a foraminous wall portion in which the openings are dimensioned to permit the passage of air and substantially separated fibers therethrough, means for feeding air and fibers into the housing, means for rapidly whirling the air with the fibers entrained therein circumferentially about the cylindrical housing whereby the centrifugal force carries the fibers outwardly towards the cylindrical peripheral walls of the housing, the foraminous separating wall forming a part of the housing over which the stream of air and fibers pass whereby separated fibers

6

are carried with the air by centrifugal action through the foramens for deposition on a collecting wall in the formation of the fibrous structure, an opening extending substantially continuously across the wall of the cylindrical housing dimensioned to permit fibrous aggregates to pass therethrough whereby said aggregates are thrown through the opening by centrifugal force and means in communication with the opening for causing a slight inflow of air through said opening into the housing whereby chiefly aggregates of higher density are capable of being thrown by centrifugal force out of the housing through the opening.

9. Apparatus for the air deposition of fibers to form fibrous structures comprising a cylindrical housing, means for feeding air and fibers into the housing, means including a rotary impeller in the housing for rapidly whirling the air with the fibers entrained therein circumferentially about the cylindrical wall of the housing, a foraminous separating wall forming a part of the cylindrical wall of the housing over which the stream of air and fibers pass whereby separated fibers are carried with the air through the foramens for deposition on a collecting wall in the formation of the fibrous structure, means for removing aggregates of higher density from within the housing including an elongate slot extending across a portion of the cylindrical wall of the housing and through which the aggregates are thrown by centrifugal action, and means in communication with the slot for causing a slight inflow of air therethrough into the housing to arrest the movement of the separated fibers thrown by centrifugal force with the aggregate through the opening.

10. Apparatus as claimed in claim 9 in which the elongate slot extending across the housing is located just beyond the separating wall and in which the impeller is deposited in closely spaced relation to the foraminous wall so that the aggregates are positively carried to said slot.

11. Apparatus for the air deposition of fibers to form fibrous structures comprising a cylindrical housing, means for feeding air and fibers into the housing, means for rapidly whirling the air with the fibers entrained therein circumferentially about the cylindrical wall of the housing, a foraminous separating wall forming a part of the housing over which the stream of air and fibers pass whereby separated fibers are carried with the air through the foramens for deposition on a collecting wall in the formation of the fibrous structure, means for removing aggregates of higher density from within the housing including an elongate opening through the cylindrical wall of the housing over which the whirling stream of air and fibers circulate, a separate chamber in communication with the opening, and means for supplying air to said chamber under pressure slightly greater than exists in the housing whereby a slight inflow of air occurs from the chamber into the housing to oppose the passage of non-aggregate material of lower density thrown by centrifugal force through the opening.

References Cited in the file of this patent

UNITED STATES PATENTS

60	743,814	Boyd	Nov. 10, 1903
	1,002,131	Broome	Aug. 29, 1911
	1,422,761	Hartman	July 11, 1922
	1,714,047	Reed et al.	May 21, 1929
65	2,152,901	Manning	Apr. 4, 1939
	2,239,059	Schwartz et al.	Apr. 22, 1941
	2,274,385	Schwartz et al.	Feb. 24, 1942
	2,362,965	Berkman	Nov. 21, 1944
	2,478,148	Wilson et al.	Aug. 2, 1949
70	2,497,532	Berkman	Feb. 14, 1950