July 10, 1962 I. BARNETT 3,042,976

FIBER OPENING AND CLEANING

Filed Aug. 2, 1957 2 Sheets-Sheet 1

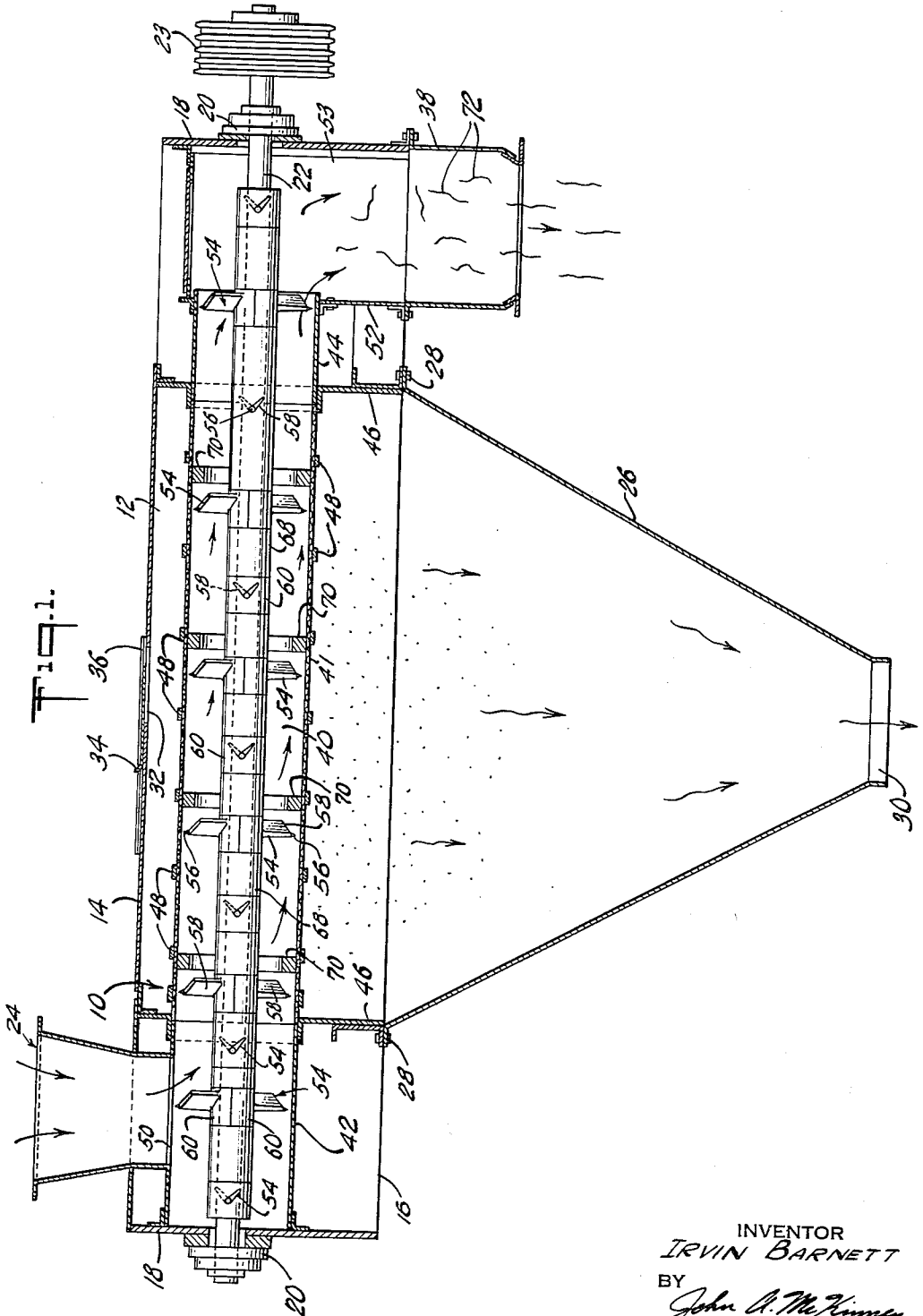


Fig. 1.

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Fig. 2.

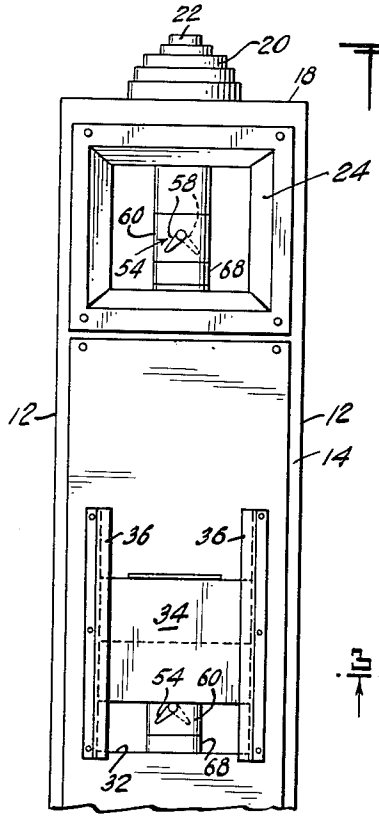


Fig. 3.

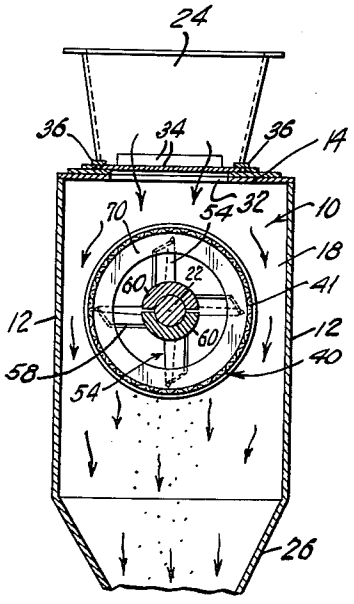


Fig. 5.

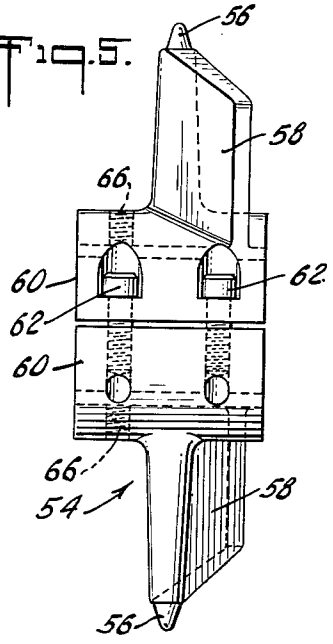


Fig. 4.

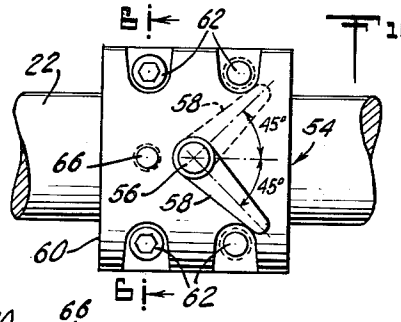
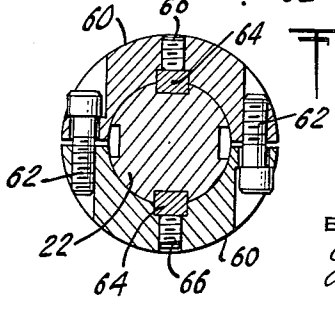


Fig. 6.



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FIBER OPENING AND CLEANING

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8 Claims. (Cl. 19—90)

This invention relates to a method and apparatus for opening fibrous masses and removing therefrom waste materials such as dust, short fiber, and the like, and although peculiarly adapted for use in opening, cleaning and "upgrading" asbestos fiber, the invention may also be found applicable to treatment of other types of fiber as well.

In the manufacture of asbestos textiles it has been customary in preparing the raw fiber for spinning into yarn, to subject the fiber to an opening and cleaning action. Conventional machines for accomplishing such opening and cleaning usually comprise a foraminous tube on the normally horizontal axis of which is mounted a rotatable shaft or drum having fiber opening or beating means extending radially therefrom and terminating closely adjacent the inner surface of the tube. In one such prior machine the beating means are in the form of spikes and fibrous materials are either blown or drawn axially through the tube by a fan located externally thereof, while in another prior machine the beating means is in the form of a screw which not only is intended to open the fibrous material but also to accomplish the feeding thereof. In both of these prior machines it is intended that dust, short fiber, and the like will become loosened from the fibrous masses when the masses are opened by the beating means and will fall or otherwise pass through the openings of the foraminous portion of the tube and thus be separated from the longer fiber. It will be apparent, however, that in each of these prior machines the fibrous material feeding means is of such a positive nature that the material passes axially through and out of the tube, regardless of the condition of openness of the fiber and, hence, regardless of whether it has ben cleaned or not.

The primary object of the present invention is to provide a method and apparatus for treatment of fibrous material wherein the materials are caused to remain in an opening and cleaning zone for repeated subjection to an opening and cleaning action until a desired degree of opening has been attained, whereupon the treated material may be propelled through and out of the zone.

A further object of the present invention is to provide a method and means for removing dust and the like from an opening and cleaning zone in a manner which aids in retaining fibrous masses in the zone until the desired degree of opening is attained.

These objects are accomplished in accordance with the present invention by an apparatus having the same general elements as the prior machines described above but including, on a rotatable shaft, beating means preferably in the form of spikes cooperating with fiber propelling means preferably in the form of fan blades, the ends of the blades being spaced from the inner surface of the tube by a greater distance than the ends of the spikes. Also, the tube is located in a chamber under a slight negative pressure, which not only enhances separation of dust and the like from the fibrous masses within the tube, but also tends to cause the fiber to lie against the inner surface of the screen whereby movement of the masses axially of the screen is retarded and the masses may then be subjected to a greater opening and cleaning action before being discharged from the tube.

The invention will be more fully understood and further objects and advantages thereof will become more apparent when reference is made to the following detailed description of a preferred embodiment and to the accompanying drawing in which like numerals designate like parts, and in which:

FIG. 1 is a longitudinal, sectional view of an apparatus embodying the present invention;

FIG. 2 is a partial top plan view of the apparatus of FIG. 1;

FIG. 3 is a sectional view, taken on the plane of line 3—3 of FIG. 2;

FIG. 4 is an enlarged fragmentary top plan view showing a beating means included in the apparatus of FIG. 1;

FIG. 5 is a side elevational view showing the beating means of FIG. 4 prior to the attachment to the shaft; and

FIG. 6 is a sectional view, taken on the plan of line 6—6 of FIG. 4 showing the attachment of the hubs to the shaft.

Referring to the drawing there is disclosed a chamber 10 enclosed by side walls 12, a top wall 14, a bottom wall 16 and end walls 18. Journalled for rotation in the bearings 20, which are secured in the end walls 18, is a shaft 22, the free end of which carries a pulley 23 driven by a suitable source of power. At one end of the chamber, fibrous masses are introduced through a vertically arranged inlet 24 in communication with the chamber 10 through the top wall 14. A converging hopper 26 is secured by bolts 28 to the bottom wall 16 and has a collar 30 which is attached to a cyclone or other suction forming means in the usual manner. Directly above the hopper 26, the top wall is provided with an opening 32 the size of which is regulated by the cover 34 slidably mounted in the tracks 36. The hopper 26 and the cover 34 cooperate to produce a variable negative pressure in the chamber 10. Dust and other fiber waste flow with the air from the opening 32 through the collar 30. At the other end, the chamber 10 is provided with a downwardly disposed outlet 38 through which the cleaned long fibers pass and are collected by the ordinary means.

A tube 40 having a foraminous section constituting a screen 41 and imperforate sections 42 and 44 is mounted in the housing 10 by a pair of plates 46. The plates 46 are secured to the housing walls and encircle the tube at the junction of the foraminous and imperforate sections. A plurality of strengthening bands 48 are spaced along the screen 41 which lies directly above the hopper 26. The imperforate section 42 is secured to the end wall 18 and has an opening 50, the walls of which are joined to the inlet 24 allowing the fibrous masses to enter the tube 40. At the other end of tube 40, the imperforate section 44 passes through a side 52 of a housing 53 connected to the outlet 38 so that the cleaned long fiber will flow out of the tube 40 and into the outlet 38. The tube 40 is mounted in the chamber 10 so that the longitudinal axis of the tube 40 coincides with the longitudinal axis of the shaft 22.

Mounted in axially spaced relationship on the shaft 22 for rotation therewith inside the tube 40 are a plurality of propeller-picks 54. As shown in FIG. 5, each propeller-pick 54 has a radially projecting beater or pick 56 and a trailing blade 58. Each beater or pick 56 lies adjacent to the inner wall of the tube 40. The blade 58 of each propeller-pick 54 is inclined toward the outlet 38 to form an included angle of 45° between the longitudinal axis of shaft 22 and the median line of the blade 58. When the blade 58 is rotated, this mounting effectively propels the cleaned fiber along the tube 40 parallel to its longitudinal axis. The propeller-picks 54 are integrally formed on split hubs 60 that are fastened together on the shaft 22 by the bolts 62, as shown in FIG. 6, so that the propeller-picks 54 are 180° apart. The hubs 60 are mounted for rotation with the shaft 22 by keys 64 retained in position by screws 66. In this manner, each pair of propeller-picks 54 cooperate to move

the surrounding air generally in an axial direction to provide the effective propelling force. Successive pairs of split hubs **60** are separated by spacers **68** and are rotated 90° about the shaft **22** and then secured thereto. Thus, as viewed in FIG. 3, to adjacent pairs of split hubs **60** will present four propeller-picks **54** spaced 90° apart.

To aid in retarding the flow of the fibrous masses through the tube **40** there are secured at spaced intervals to the inner wall of the screen **41** a plurality of rings **70** having a square cross-section. The rings **70** are adjacent to the outlet side of every other set of propeller-picks **54** and cause the heavier fiber masses to build up so that they are subjected to repeated opening and cleaning action.

In operation, the fibrous masses containing dust and waste material are fed through the inlet **24** into the imperforate section **42** of the tube **40** where they are initially opened and imparted with a swirling action. From here they move into the foraminous section or screen **41** of the tube **40** which constitutes the opening and cleaning zone.

The cyclone or other vacuum forming means connected to the hopper **26** creates a negative pressure in the chamber **10** surrounding the screen **41** to retard the flow of the fibrous masses. The degree of negative pressure is regulated by the cover **34** over the opening **32**. As the fibrous masses enter the screen **41**, the negative pressure tends to draw the heavier masses to the walls of the screen where they are subjected to the action of the beaters **56**. The dust and other waste materials pass through the screen **41** and flow out through the hopper **26** under the propulsion induced by the vacuum forming means. The cleaner fibers are moved along the tube **40** in the air stream flowing generally in an axial direction and generated by the blades **58**. However, the blades do not impart a positive propelling force on the fibrous masses regardless of the degree of openness but only tend to pass them along the tube as a function of the openness of the fiber and the amount of the retarding force.

In starting the apparatus, a high suction is formed in the chamber **10** by keeping the cover **34** closed. The shaft **22** is rotated at approximately 1400 r.p.m. but because of the high suction no fibers will enter the air stream flowing generally in an axial direction of the screen. The cover **34** is gradually opened to reduce the negative pressure in the chamber **10**. This allows cleaned fibers to enter the air stream flowing generally in an axial direction and generated by the blades **58** while the dust or other waste flows out through the hopper **26**. The negative pressure in the chamber **10** is regulated by the cover **34** until the proper grade of fibers is flowing from the outlet **38**. Thus, the negative pressure in the chamber **10** and the speed of the shaft **22** determine the grade of the fibers passing through the outlet **38**.

During the passage of the fibrous masses axially through the screen **41**, they are repeatedly subjected to the opening and cleaning action of the propeller-picks **54**. The relatively clean fibers at one instant may become the heavier masses in the next instant to be retained on the walls of the screen for further beating. In this manner, the masses are repeatedly opened and cleaned so that only the clean long fibers **72** pass out of the tube **40** through the outlet **38**. Whenever a fiber reaches the desired degree of openness, it will enter the air stream flowing generally in an axial direction and finally flow through the outlet **38**.

The rings **70** provide an additional retarding force on the fibrous masses. The heavier dust filled masses tend to build up adjacent to the rings and are further subjected to the action of the beaters **56**. Thus, the rings **70** functionally divide the tube **40** into a plurality of opening and cleaning zones so that the fibrous masses are progressively opened and cleaned as they move through the tube. The opened and cleaned fibers pass through the tube **40** to the outlet **38** where they are collected.

As the fibrous masses pass through the screen, the existing negative pressure causes the heavier masses to lie against the inner surface of the screen whereby movement of the fibrous masses axially of the screen is retarded. This action allows the masses to be subjected to additional opening and cleaning before being moved along through the tube. The retarding and propelling forces are carefully balanced so that only the opened and cleaned fibers pass through and out of the opening and cleaning zone while the unopened masses are retained in the zone for repeated action.

Having thus described the invention in rather full detail, it will be understood that these details need not be strictly adhered to and that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. Apparatus for opening and cleaning fibrous masses containing waste material, such as dust, comprising a tube having openings in the wall thereof, said openings being of a size to permit passage of the waste materials therethrough, a shaft mounted for rotation on an axis coinciding with the axis of the tube, a plurality of fiber beating means connected to said shaft in axially spaced relationship and extending therefrom to positions adjacent said wall, a plurality of blade means connected to said shaft in axially spaced relationship and extending to positions more remote from said wall than said beater means, said blade means being arranged to direct fluid currents axially and generally centrally of said tube with the effective fiber carrying portion thereof being transversally spaced from said wall, means for rotating said shaft, a chamber communicating with the interior of said tube through said openings, means for creating a negative pressure in said chamber, means for varying the degree of said negative pressure, and means adjacent the inner surface of said tube and extending generally transversely thereof for partially obstructing the flow of said fibrous masses axially of said tube.

2. Apparatus for opening and cleaning fibrous masses containing waste material, such as dust, comprising an opening and cleaning chamber, a foraminous tube extending through said chamber and surrounded thereby, means for creating a negative pressure in said chamber, a shaft mounted for rotation on an axis substantially coinciding with the axis of said foraminous tube, means for rotating said shaft, means for depositing fibrous masses within said tube, a plurality of beating means connected to said shaft in axially spaced relationship for opening and cleaning said fibrous masses, a plurality of blade means connected to said shaft in axially spaced relationship for establishing a fluid stream moving generally in an axial direction within said foraminous tube and generally centrally thereof, said fluid stream moving at a velocity to carry opened and cleaned fibers therewith and with the effective fiber carrying portion thereof being transversally spaced from said wall, and said negative pressure means being of a strength to attract uncleaned and unopened fibers to the inner surface of the wall of said foraminous tube for subjection to said beating means.

3. Apparatus as in claim 2 including means adjacent the inner surface of said tube and extending generally transversely thereof for partially obstructing the movement of said fibrous masses axially of the tube.

4. Apparatus for opening and cleaning fibrous masses containing waste material, such as dust, comprising an opening and cleaning chamber, a foraminous tube extending through said chamber and surrounded thereby, means for creating a negative pressure in said chamber, a shaft mounted for rotation on an axis substantially coinciding with the axis of said foraminous tube, means for rotating said shaft, means for depositing fibrous masses within said foraminous tube, means extending generally transversely of said tube and dividing said foraminous tube into a plurality of axially spaced opening and cleaning zones, a plurality of beating means connected to said

shaft in axially spaced relationship for opening and cleaning said fibrous masses, each of said beating means comprising a pair of cooperating propeller-picks, each pair of said cooperating propeller-picks having blade means for establishing a fluid stream moving generally in an axial direction of said foraminous tube toward an exit end thereof, said fluid stream moving at a velocity to carry opened and cleaned fibers therewith and with the effective fiber carrying portions thereof being transversally spaced from said wall, and said negative pressure means being of a strength to attract uncleaned and unopened fibers to the inner surface of the wall of said foraminous tube for subjection to said beating means.

5. Apparatus for opening and cleaning fibrous masses containing waste material, such as dust, comprising a tube having openings in the wall thereof, said openings being of a size to permit passage of the waste materials therethrough, a shaft mounted for rotation on an axis coinciding with the axis of the tube, fiber beating means connected to the shaft and extending therefrom to positions adjacent said wall, blade means connected to the shaft and extending to positions more remote from said wall than said beater means, said blade means being arranged to direct fluid currents axially and generally centrally of the tube with effective fiber carrying portions thereof being transversally spaced from said wall, means for rotating said shaft, a chamber communicating with the interior of the tube through said openings, means for creating a negative pressure in said chamber, an adjacent opening in the wall of said chamber for varying the degree of negative pressure, and means adjacent the inner surface of said tube and extending generally transversally thereof for partially obstructing the flow of fibrous masses axially of the tube.

6. The apparatus of claim 5 wherein the beater means are formed as extensions of the blade means.

7. Apparatus for opening and cleaning fibrous masses containing waste material, such as dust, comprising a chamber, a foraminous tube extending through said chamber, means for depositing fibrous masses containing waste material in said tube, a shaft mounted for rotation on an axis coinciding with the axis of the tube, means for rotating said shaft, means for establishing a negative pressure in said chamber so that said fibrous masses tend to be attracted to the wall of said foraminous tube, fiber beating means connected to said shaft and extending therefrom to positions adjacent said wall to open and clean said fibrous masses, blade means connected to said shaft and extending to positions more remote from said wall than said beater means, said blade means being arranged to direct fluid currents axially and generally centrally of the tube for carrying therewith opened and cleaned fibers, said fluid currents flowing generally in the same direction with the effective fiber carrying portion thereof being transversely spaced from said wall, and means for rotating said shaft.

8. Apparatus as defined in claim 7 and further comprising means for varying the degree of negative pressure in said chamber.

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