

[54] **AIR AND FIBER SEPARATOR**

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[58] Field of Search **55/290, 337, 400,**
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88, 89

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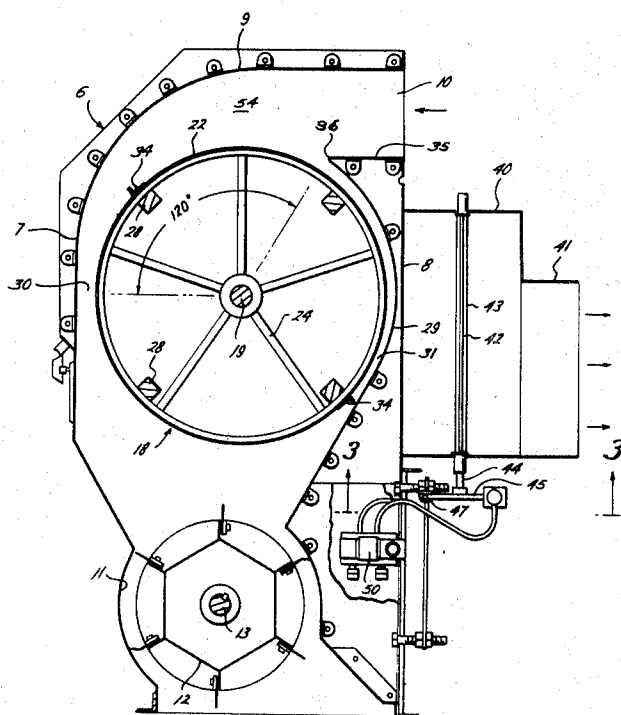
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[57] **ABSTRACT**

A separator for textile fibers and a pneumatic stream of carrier air therefor comprising a housing having an inlet for directing the stream of carrier air substantially tangentially of and at substantially the same speed as a cylindrical drum surface rotatively mounted in the housing. The cylindrical drum wall closely approaches opposed housing walls for restricting the tendency of the carrier air to pass around the drum. The cylindrical wall of the drum has relatively fine perforations, but the total area of perforations in any portion of the cylinder wall which spans the casing interior between the inlet and the first of said opposed housing walls substantially greater than the cross sectional area of the inlet. The resulting reduction in velocity of the carrier air together with movement of the drum surface substantially at the speed of and in the same direction as the transported fibers results in continuation of the fibers around the drum due to inertia, while the carrier air tends to pass into the drum.

7 Claims, 3 Drawing Figures



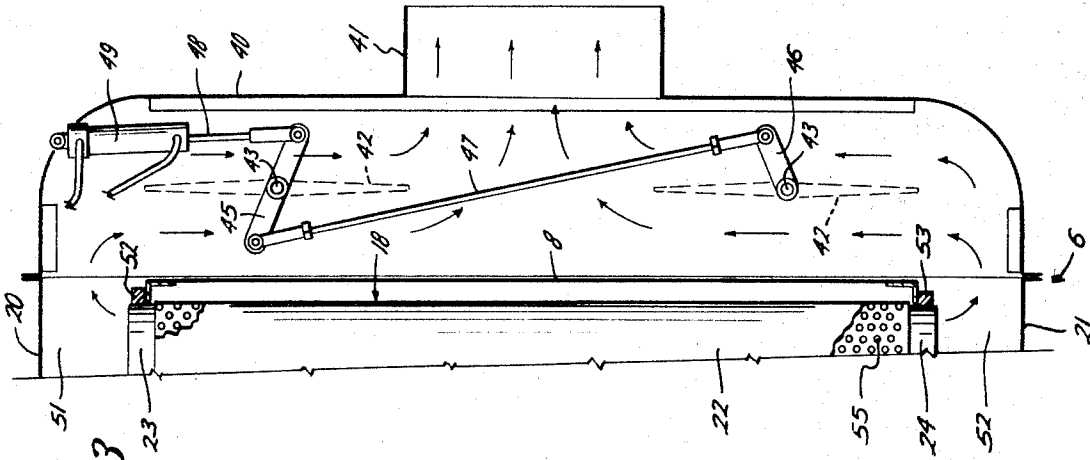


Fig. 3

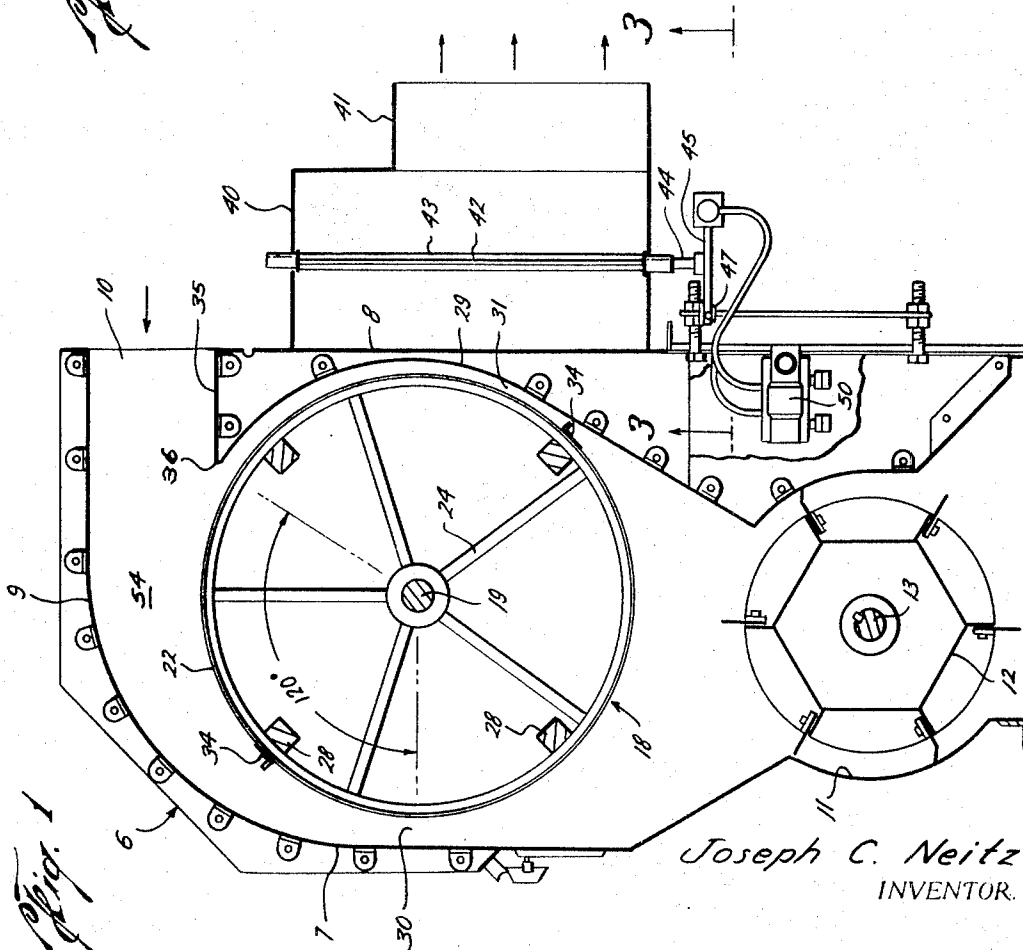


Fig. 1

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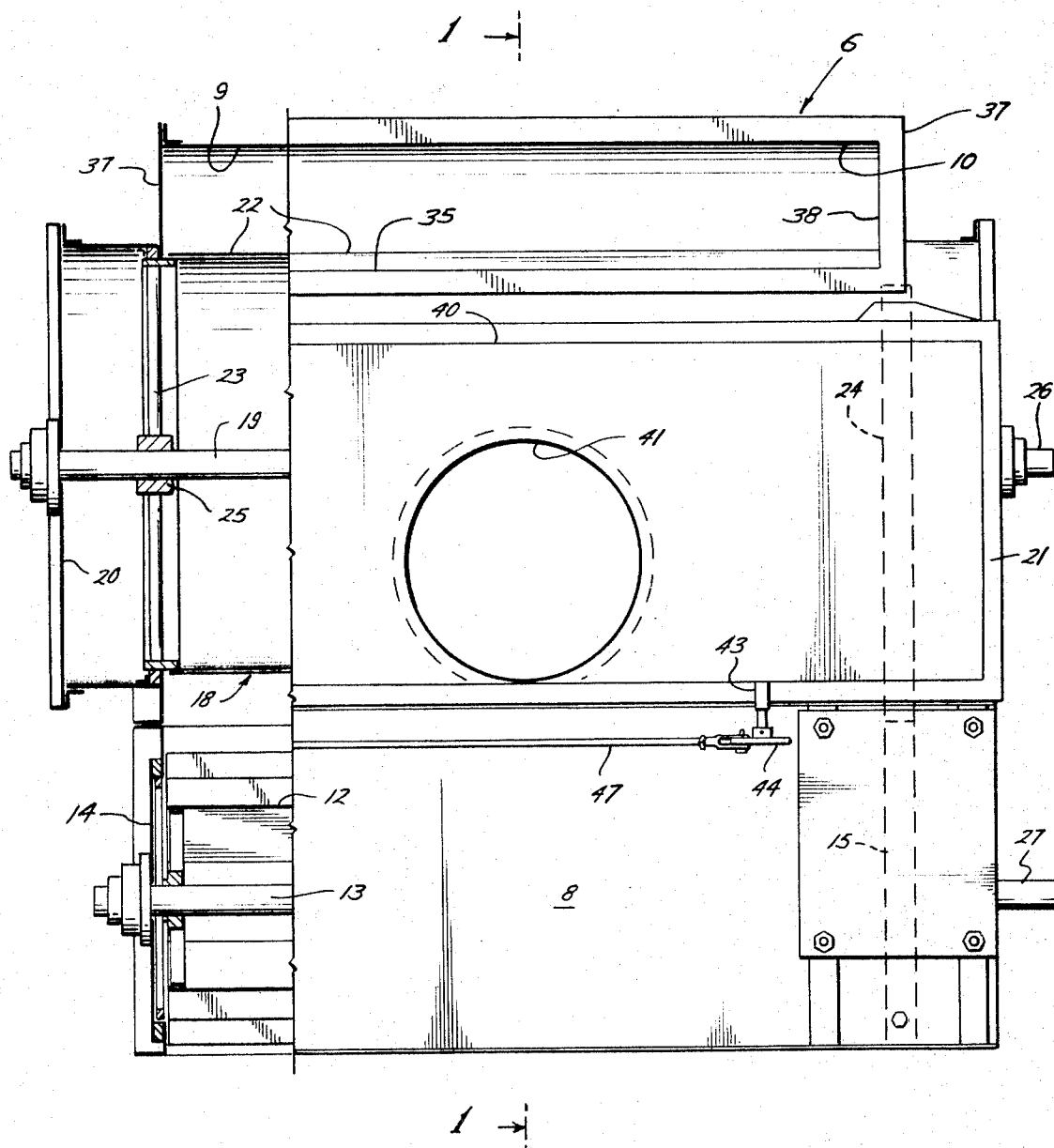


Fig. 2

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AIR AND FIBER SEPARATOR

BACKGROUND OF THE INVENTION

This invention relates to separators for particulate solid materials, such as textile fibers, and pneumatic carrier air therefor.

The present emphasis on pollution problems and means for correcting the same has directed attention to certain long-standing problems of air pollution. One such problem exists in the card rooms of textile mills where fly lint escaping into the atmosphere causes many workmen to wear protective masks. Furthermore, the re-circulation of such contaminated air adversely affects air conditioning and humidifying systems. Filter means have been provided for pneumatically carried fiber streams, but heretofore it has not been possible to satisfactorily remove the relatively minute fly lint particles from the card room atmosphere. One reason for this is that if the perforations or interstices in a filter screen are sufficiently small to catch such fly lint, they are soon clogged by the lint which is difficult to remove from the screen, even by a wiper. The result is that relatively coarse filter screens are used which permit return to the card room of a portion of the previously exhausted fibers.

Accordingly, an object of the present invention is to provide novel separator equipment which will effectively remove from a carrier air stream fly lint as dispersed and minute as that which is now returned to the card room after conventional filtering procedures.

Another object is to provide an air separator of the above type in which the pressure conditions are such that practically none of the fibers in the pneumatic stream actually touch the surface of the filter screen through which the carrier air then passes, freed from its fiber burden.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical transverse section through a separator device in accordance with the invention and taken substantially on line 1—1 of FIG. 2.

FIG. 2 is a rear elevation of the apparatus in FIG. 1, a part being cut away and sectioned on the axis of the drum.

FIG. 3 is a section substantially on line 3—3 of FIG. 1.

DETAILED DESCRIPTION OF THE DRAWINGS

The novel separator device includes a housing, generally designated 6, having opposed front and rear walls 7 and 8 and top wall 9 beneath which is provided a tangential inlet passage 10 for the fiber and carrier air stream. At the bottom of the casing there is provided an outlet opening 11 for the extracted lint or fibers within which is rotatively mounted the suction holding or vacuum wheel 12 having a central shaft 13 rotatively mounted in the housing sidewalls 14 and 15. A separator or condenser drum, generally designated 18, is also rotatively mounted in the housing on its axial shaft 19, parallel to vacuum wheel shaft 13, and journaled in outstanding sidewall portions 20 and 21. The drum includes a foraminous cylindrical wall 22 having bearing spiders 23 and 25 at its ends with central bosses, as 25, rigidly secured to driving shaft 19. Shafts 19 and 13 extend beyond the housing sidewalls, as at 26 and 27 for

attachment of synchronized powering means (not shown). In an exemplary embodiment of the machine, drum 18 was rotated at approximately 170 RPM while vacuum wheel 12 was rotated at approximately 200 RPM. Cylindrical wall 22 is braced by longitudinal beams or bars 28 conveniently arranged in quadrature, as shown.

A portion of cylindrical drum wall 22 at the 9 o'clock position closely approaches sidewall 7. Drum wall 22 also approaches very close to rear scroll wall 29. In the mentioned exemplary embodiment, the drum diameter was 20 inches, the restricted region 30 between the drum and front wall 7 was approximately 1½ inches in width (radially of the drum), while the minimum width of the region 31 at the 4 o'clock position between drum wall 22 and scroll wall 29 was approximately three-eighths inches in width or thickness. These restricted regions, of course, extend the entire length of the drum which, as shown in FIG. 2, is the distance between sidewalls 14 and 15 in the lower part of casing. Secured to the exterior surface of the drum and extending longitudinally the full length thereof and located at intervals therearound, in this instance at a 180° interval, are small angle bars 34 for a purpose to be described. Scroll plate 29, at its upper end, joins at 36 a flat plate 35 which cooperates with housing top wall 9 to define rectangular inlet 10, the sidewalls of this inlet being shown at 37 and 38.

Exhaust ducting 40, 41 projects transversely and rearwardly from the sidewall 8 of the housing. A pair of dampers 42 are mounted in transverse exhaust ducting 40, which extends entirely across the housing as best shown in FIG. 3, on vertical shafts 43. These shafts extend below ducting 40, as at 44 and are there secured to levers 45 and 46 connected by a link 47. Lever 45, in turn, is connected by a link 48 to an operating pneumatic cylinder 49. The pneumatic cylinder, in turn, is controlled by solenoid valving 50 which may be energized in any suitable way, not part of the present invention. Transverse exhaust duct 40 connects at its ends through chambers 51 and 52 with the hollow interior of drum 18. The ends of the drum include running seals at 52 and 53 with the casing wall so that exhaust duct 40 communicates with inlet 10 and throat 54 only through perforations 55 in the drum wall.

In the aforementioned exemplary embodiment, inlet 10 was 6 inches in height and 36 inches in length, thus, having a total cross sectional area of 216 square inches. As best shown in FIG. 1, inlet passage 10 is disposed so as to direct the entering stream of fibers and pneumatic carrier air through throat 54 substantially tangentially of cylindrical drum surface 22. The rotating drum 18 was 20 inches in diameter and the perforations 55 therein were seven sixty-fourths inch in diameter and located on staggered centers spaced five thirty-seconds inch apart. This arrangement of perforations resulted in the total area of openings equalling approximately 45 percent of the peripheral area of the drum. The length of wall 22 between the most restricted portion of casing region 30 and point 36 between the meeting ends of scroll wall 29 and inlet bottom wall 35 is approximately 120°. Thus, the total open area in this 120° of drum wall is 340 square inches which is slightly more than 50 percent greater than the cross sectional area of inlet 10. This is a significant proportion, as will be explained.

Also of significance in connection with operation of the novel apparatus, is the restricted region 30 which, of course, is of substantially less cross sectional area, radially of the drum, than the cross sectional area of inlet 10. The region 31 at the 4 o'clock position of the drum is even more highly restricted than the region 30, being, in the mentioned embodiment three-eighths inch in width or thickness. However, the region 31 increases in width in the counter-clockwise direction around the drum, to a thickness of approximately seven-eighths inch at the point 36.

OPERATION

In the operation of the novel apparatus, drum 18 is rotated at such speed that its periphery moves in the same direction and at a speed closely approaching the velocity of pneumatically transported fibers in the throat portion 54 of the casing. In the embodiment above mentioned, the air velocity ranged from 1,000 to 1,300 feet per minute, while the peripheral speed of drum 18 was 900 feet per minute which, of course, closely approximated the velocity of the entering fibers in throat 54 which lag behind the carrier air. Drum 18 was powered to rotate counter-clockwise so that its surface portion, within throat 54, moved in the same direction, as well as substantially at the speed of the entering fibers. Due to the substantially greater open area in the 120° portion of the drum periphery between restricted region 30 and point 36, as mentioned above, both the velocity of the carrier air as it passes through the drum wall and the tendency of the fibers to change direction and also pass through the drum perforations was substantially reduced. Rather, practically all of the entering fibers were caused to continue their motion counter-clockwise around the drum and then drop through restricted region 30 and into discharge orifice 11. Restricted region 30 also has the effect of cooperating with the drum apertures to substantially reduce the passage of air therethrough and into the bottom of the casing. The air in the region between wheels 12 and 18 and between restrictions 30 and 31 is subject to very little movement, in fact, insufficient velocity to bring the entrained fibers to the drum. Thus, it is in this region that substantially complete separation of the air and fibers occurs. In case, however, that any solid material should tend to collect in the region 31, the small angle bars 34 will effectively agitate and dislodge the same, sliding it through the upper portions of the expanding restricted region 31. Vacuum wheel 12 preferably is caused to rotate slightly more rapidly than drum 18 for keeping the bottom of the housing clear of accumulated fiber.

Of course, the above mentioned exemplary dimensions and velocities in themselves are not essential, but merely represent exemplary proportions. For instance, the total open space in the drum wall exposed to entering carrier air need merely be substantially greater than the minimum cross sectional area of the inlet, while restricted regions 30 and 31 between the front and rear walls 7 and 29 and the drum portions immediately abreast thereof should be substantially less than the throat cross sectional area, as well as the total area of

drum perforations between point 36 and restricted region 30. These proportions have been found to result in separation of the fiber and carrier air substantially without any contact between the fibers and the surface of the separator drum so that relatively small perforations can be provided in the drum surface and no wiping action is necessary. This apparatus, installed in the return line to a card room air conditioning system in a textile mill has resulted in a substantially lint free atmosphere in this room for the first time.

The invention may be modified in various respects as will occur to those skilled in the art and the exclusive use of all modifications as come within the scope of the appended claims is contemplated.

I claim:

1. A separator for particulate matter and pneumatic carrier air therefor comprising a housing having a curved first wall and a second, opposed wall, a hollow drum rotatively mounted in said housing between said walls and having a uniformly perforated circumferential wall, a tangential inlet in said housing disposed to direct an incoming stream of particulate matter and air between said first wall and said drum and substantially tangentially along a portion of said drum wall equal to approximately 120° thereof, there being a restriction between said drum wall and said first wall at substantially the end of immediately beyond said 120° portion of said drum wall, a particulate matter discharge opening in said housing opposite said inlet, suction means connected with the interior of said drum, and means for causing rotation of said drum in the direction to cause movement of said portion of said drum wall in the direction of the entering air and particulate matter, the perforations in said drum wall being proportioned so that the total area of perforations in said 120-degree portion thereof is substantially greater than the cross-sectional area of said inlet whereby the velocity of entering air and particulate matter adjacent said drum is reduced and the tendency of the particulate material to travel around the drum is further increased.

2. The combination described in claim 1 further including a pressure sealing valve means in said particulate outlet.

3. The combination described in claim 1 further including restrictive portions in said chamber sealingly engaging said drum adjacent the ends thereof.

4. The combination described in claim 1 in which said suction means includes conduits connected to opposite ends of said drum.

5. The combination described in claim 1 further including fluid pressure control valves in said conduit means.

6. A separator as described in claim 1 in which a restricted cross-sectional area is also provided between said drum and said opposed wall.

7. A separator as described in claim 6 further including a radial projection on said drum for displacing particulate material which may become lodged in the portions of the housing interior between said drum and said opposed wall.

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