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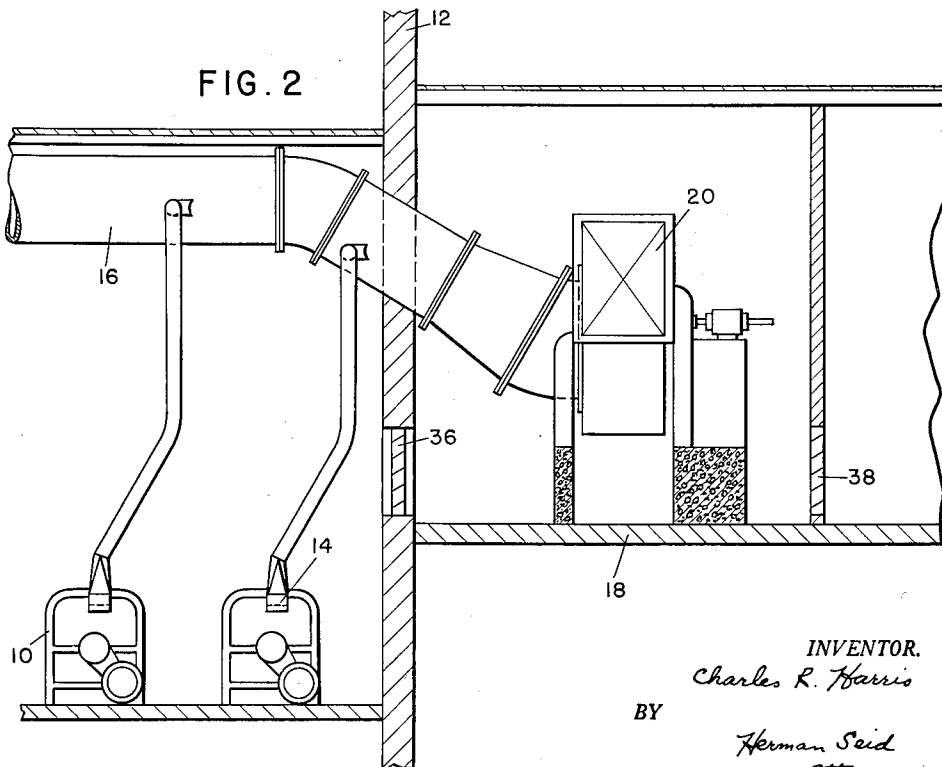
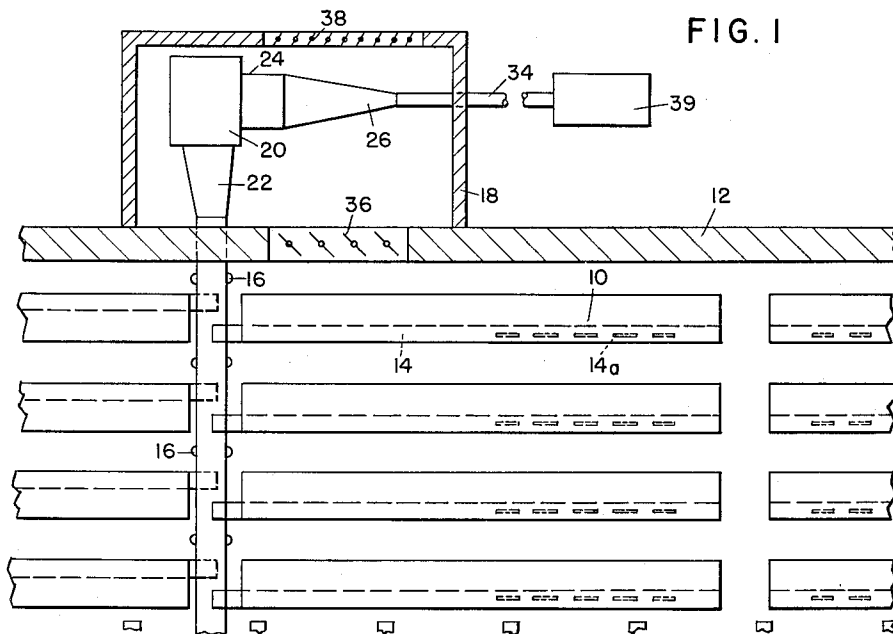
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PNEUMATIC WASTE COLLECTION APPARATUS FOR TEXTILE FRAMES

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2 Sheets-Sheet 1



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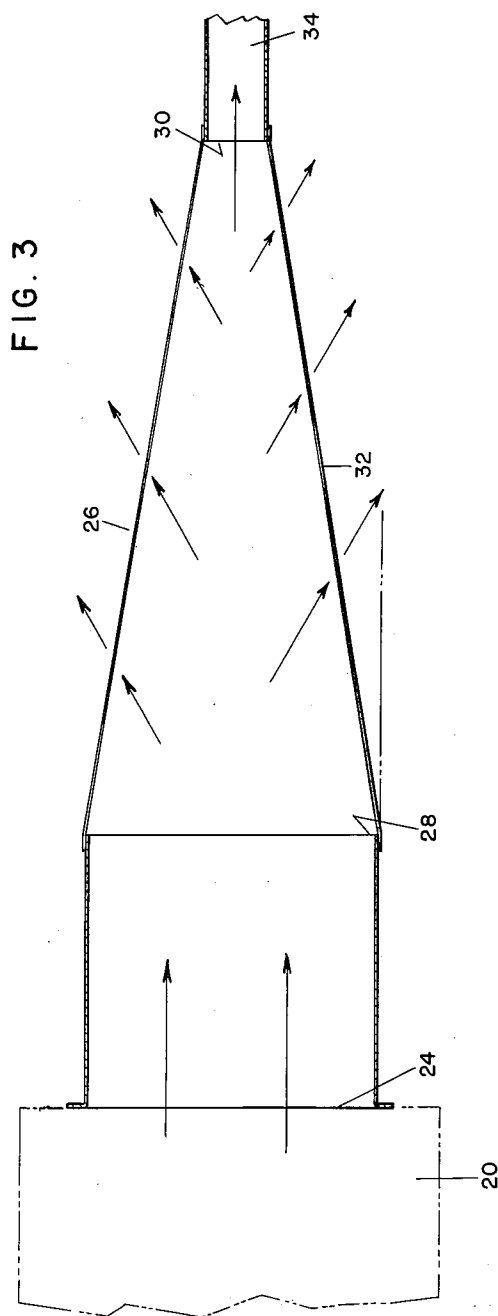
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**PNEUMATIC WASTE COLLECTION APPARATUS
FOR TEXTILE FRAMES**

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4 Claims. (Cl. 15—301)

The present invention relates to pneumatic waste-collection apparatus, and in particular to a novel lint collection and separation system and method for use in textile mills.

Plants for spinning cotton fibers and the like frequently employ central waste-collection systems for removal of fly and lint incident to operation of the spinning frames. A well-known process, commonly identified as the "Pneumafil" system, employs individual collecting heads arranged adjacent the rollers of the spinning frames which entrain waste such as lint and fly along with large quantities of air at low velocity supplying the air carrying the lint to a main trunk or duct from which the waste-carrying stream is pneumatically conveyed to a conventional equipment for collecting and baling the lint.

Although this system represents a notable advance, a number of practical difficulties have been encountered. Prominent among these problems has been the handling of exceptionally large volumes of air having relatively low waste concentration, typically as much as twelve thousand pounds of air to collect one pound of lint; the need for complicated filters requiring self-cleaning mechanisms; and, the incompatibility with existing waste-separation apparatus, which usually is capable of handling waste-to-air ratios of the order of one to five hundred.

It is an object of the present invention to provide a novel method and apparatus obviating one or more of the aforesaid difficulties. Specifically, it is within the contemplation of the present invention to produce a simple, economical, and reliable pneumatic system for handling relatively large volumes of air having a comparatively low lint or fiber content, and disposing of most of the air, free of waste, with the remainder of the air carrying all of the waste and of a volume and velocity suited for handling by standard collecting and baling apparatus.

As a specific feature of the present invention, there is provided a plenum concentrator or separator to be employed in conjunction with the "Pneumafil" system used for removing waste from textile spinning frames. In accordance with this aspect of the invention, the collected air which has a relatively low lint content is converted into a stream of limited volume at higher velocity and having a marked increase in lint concentration.

Certain objects and features of the invention are realized by the provision of a pneumatic-waste collection system having a duct for a collecting stream of air at relatively low velocity which delivers lint to conventional separation apparatus, a concentrator being disposed in advance of the separation apparatus for increasing the waste-to-air ratio of the collecting stream. A presently preferred concentrator embodies an inlet, an outlet of decreased cross-sectional area as compared to the inlet, and a foraminous wall interconnecting the inlet and outlet and defining a duct section of progressively decreasing cross-section from the inlet and outlet. The duct section is arranged to permit escape of filtered air from the col-

2

lecting stream, yet convey the lint in the residual of the collecting stream toward the waste-separation apparatus. As will be later appreciated from the detailed description, a major portion of the air may be permitted to escape, free of waste, with the residual carrier stream having a high lint concentration of a volume appropriate for the capacity of existing waste separation apparatus.

Other features and advantages of the invention will become apparent upon reference to the following detailed description of an illustrative construction embodying features of the invention, when taken in conjunction with the accompanying drawings, wherein:

Figure 1 is a fragmentary plan view diagrammatically showing a plurality of spinning frames associated with a waste-collecting system embodying features of the invention;

Figure 2 is a view in end elevation with parts broken away, showing further details of the waste-collection system; and

Figure 3 is a sectional view on an enlarged scale, showing the concentrator of the waste-recovery system.

Referring now specifically to the drawings, there is shown in Figure 1 plural spinning frames 10 enclosed within a room or mill area, generally designated by the reference numeral 12. Since the details of the spinning frames and of the mill area form no part of the present invention, further description will be dispensed with in the interests of simplicity and clarity. It will suffice to point out that air conditioning apparatus may be provided to control the humidity and temperature of the mill area 12.

In accordance with the techniques described in United States Patent No. 2,431,726, assigned to the assignee of the present invention, each of the frames 10 is served by respective suction ducts 14, the several suction ducts or collecting heads communicating with a main line or trunk 16. Each of the collecting heads 14 includes plural nozzles or orifices 14a arranged adjacent the rollers of the respective spinning frames 10 to assure complete removal of the lint and fly developed during the spinning process from within the immediate surrounds of the spinning frames. At the outset, it should be appreciated that suction systems of this general type handle vast quantities of air at low velocities to effect the removal of comparatively small quantities of lint. In practice, it is frequently necessary to remove between six thousand and fifteen thousand pounds of air to remove one pound of lint from the mill area. Accordingly, as a practical matter, separation of the lint from this large volume of removed air must be accomplished in a manner facilitating return of the air to the mill area or spinning room 12 in dependence upon temperature and atmosphere conditions within the mill, especially when it is appreciated that the large volumes of removed air are often air conditioned.

The main trunk or duct 16 is arranged to deliver the collected air stream having a relatively low lint concentration to a plenum chamber or room 18, shown adjoining the mill. In the alternative, the chamber or housing may be removed from the mill if this is more practical from the standpoint of mill operation and waste collection. Located within the plenum chamber or room 18, is a conventional suction fan 20, suited for handling both air and lint and having an inlet conduit 22 connected to the main trunk 16. Although the fan has been illustrated as within the plenum chamber 18, it is to be expressly understood that the fan may be located in the main trunk 16 at any point subsequent to the discharge into the trunk of air from the individual collecting heads 14. For example, the fan 20 may be arranged within the mill at the end of the trunk 16. As is apparent, the fan is of a size adequate for handling the large volumes of

air hereinbefore mentioned necessary for effective removal of lint from the mill area 12.

In accordance with a presently preferred embodiment of the invention, the discharge end 24 of the fan 20 delivers the lint-containing air stream to a concentrator 26 which increases the lint-to-air ratio in the collecting stream and releases a limited volume of air for reuse in a manner to be subsequently described. As seen in Figure 3, the concentrator 26 includes an inlet end 28 and an outlet 30, the latter being of a substantially reduced cross-sectional area as compared to the inlet end 28. Interconnecting the inlet and outlet ends 28, 30 of the concentrator 26 is a foraminous frusto-conical wall 32. The gradually tapering foraminous wall 32, of the concentrator or separator 26, may be of any suitable material such as a loosely woven nylon mesh or a screen. Although the concentrator is shown as being a truncated cone, it is to be expressly understood that any configuration is suitable if the exit or outlet end 30 is smaller in cross-section than the entry or inlet end 28. In practice, applicant has found that a concentrator of frusto-conical configuration having a taper of approximately 7 to 15 degrees with respect to the horizontal achieves satisfactory results. The concentrator is capable of handling the initial large volume of air required for continuous lint removal from the air adjacent the spinning frames, and effects the desired concentration to within the capacity of conventional waste-separating apparatus 39 connected to the conduit or duct 34.

With the illustrated tapered conduit section 26, functioning to reduce the volume of the collecting air stream and allowing the escape of lint-free air, there is no need for cleansing of the foraminous wall 32. This may be attributed to the axial velocity component of the collecting air stream which is sufficient to maintain the interior of the conical wall 32 substantially free of lint. The concentrator 26 act as a relief chamber for escape of air free of lint and serves to funnel the remaining air into a carrier stream containing all of the lint. The carrier stream, of relatively small volume and expendable from the standpoint of economy, is of sufficient velocity to assure pneumatic conveying of the lint through the conduit 34 to the collecting and baling apparatus. As is well understood, the passage of the air stream through the progressively diminishing cross-sectional areas of the concentrator causes an appreciable increase in air velocity which contributes to the continuous cleaning of the internal surfaces of the perforated wall 32 and assures positive discharge of the accumulated lint into the duct 34.

An illustrative construction for the concentrator 26 includes an inlet end 28 approximately 18" in diameter, and outlet end approximately 3" in diameter with a nylon mesh truncated cone 32 having a taper of approximately 7° to 15°. With this construction, approximately 2% of the total air stream, containing the concentrated lint in a ratio of approximately 500 pounds of air to one pound of lint, is delivered to the conduit 34. This drastic decrease in the handling capacity permits use of a conventional lint-separation apparatus as previously described, it being found that the air velocity is sufficient to assure pneumatic delivery of the lint to the conduit 34.

With this illustrative separator, approximately twelve hundred pounds of air delivered from the fan 20 to the inlet 28 and containing one pound of lint was reduced volumetrically to approximately five hundred pounds of air carrying the same pound of lint at the exit 30, the air escaping from the foraminous wall 32 being approximately 95% of the air entering the inlet 28.

In respect to the filtered air delivered to the plenum chamber 18 through the perforated wall 32 of the concentrator 26, this air may be effectively utilized especially when the mill is air conditioned. It is apparent that

conditioning of air with respect to temperature and humidity involves great expense for large size installations and much less expense is involved in reconditioning this return air than to start with fresh or outside air. Obviously the return air will be much closer in temperature and relative humidity to the desired conditions employed in the mill. Accordingly, and referring again to Figure 1, there is shown one system for reusing or disposing of the return air emanating from the tapering wall 32 of the concentrator 26. Since the concentrator is located within the plenum chamber 18, the return air may be variably routed through air dampers 36 and air conditioning apparatus to the adjoining mill area or exhausted through relief dampers 38 to the outside atmosphere. As a practical matter, hand or automatic controls may be installed for returning all or any part of the air coming from the concentrator 26, depending upon the particular requirements for effective and economical operation. Although only one specific arrangement for using the returned air has been described, it is apparent that numerous other systems are equally within the contemplation of the present invention, such as disclosed in the aforementioned patent.

From the foregoing, it can be appreciated that applicant has for the first time facilitated the handling of relatively vast volumes of lint-containing air, with provision for reuse of most of the air and concentration of the lint into a desirably smaller carrier stream, which then may be effectively handled in known collection and baling apparatus. The aforesaid is accomplished without the need of complicated filtering arrangements, and in fact effectively utilizes the collecting stream itself for maintaining the relatively simple filter of a concentrator free from lint accumulation.

While in accordance with the provisions of the statutes, I have illustrated and described the best form of embodiment of my invention now known to me, it will be apparent to those skilled in the art that changes may be made in the form of the apparatus disclosed without departing from the spirit of my invention, as set forth in the appended claims and that in some cases certain features of my invention may be used to advantage without a corresponding use of other features.

I claim:

1. For use in a textile mill having a plurality of spinning frames, a waste-removal system including pneumatic waste-collecting means individual to the respective spinning frames, a main trunk fed by said waste-collecting means, a waste separator connected to said main trunk, and a waste concentrator in said main trunk in advance of said waste separator for increasing the waste-to-air ratio in said main trunk and releasing a limited volume of air for reuse, said waste concentrator including an inlet end, an outlet end of reduced cross section as compared to said inlet end, and a foraminous wall interconnecting said inlet and outlet ends and defining a frusto-conical duct section.

2. For use in a textile mill having a plurality of spinning frames, a waste-removal system including pneumatic waste-collecting means individual to the respective spinning frames, a main trunk fed by said waste-collecting means, and a waste concentrator in said main trunk for increasing the waste-to-air ratio in said main trunk and releasing a limited volume of air for reuse, said waste concentrator including an inlet, an outlet of reduced cross section as compared to said inlet, and a foraminous wall interconnecting said inlet and outlet and defining a frusto-conical passageway.

3. For use in a textile mill having a plurality of spinning frames, a waste-removal system including means individual to the respective spinning frames for collecting waste by a large-volume air stream, a main trunk fed by the waste-collecting means, a waste separator connected to said main trunk and having a capacity smaller than said large-volume air stream, and a waste concentrator in

said main trunk in advance of said waste separator for reducing the volume of said air stream to within the capacity of said waste separator, said waste concentrator including an inlet, an outlet of reduced cross section as compared to said inlet end, and a foraminous wall interconnecting said inlet and outlet and defining a frusto-conical section of said main trunk.

4. In a textile mill, having air of given temperature and humidity conditions, a plurality of spinning frames, a pneumatic waste removal system including means individual to the respective spinning frames for collecting waste from said spinning frames, means for returning a major portion of the air taken up by said waste removal means to the mill, said means comprising: a main trunk handling a relatively large volume air stream fed by the waste collecting means; a waste separator connected to said main trunk; a waste concentrator coupled to said main trunk in advance of said separator for reducing the volume of said air stream; and adjustable means controlling the return of the air separated by said concentra-

tor to the mill area if desired, whereby temperature and humidity conditions in the mill may be controlled.

References Cited in the file of this patent

UNITED STATES PATENTS

519,026	Ringheim	May 1, 1894
645,469	Goodier	Mar. 13, 1900
879,663	McIvor	Feb. 8, 1908
1,443,286	Smith	Jan. 23, 1923
1,856,685	Anderson	May 3, 1932
2,140,420	Eaddy	Dec. 13, 1938
2,147,190	Cadden	Feb. 14, 1939
2,391,135	Cotchett	Dec. 18, 1945
2,425,577	Thoma	Aug. 12, 1947
2,669,744	Parrish	Feb. 23, 1954

FOREIGN PATENTS

256,989	Switzerland	Mar. 16, 1949
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