

[54] **CROSSWISE PNEUMATIC CARD FEEDING SYSTEM**

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[51] Int. Cl. **B65g 53/04, B65g 53/34**

[58] Field of Search **302/28, 11, 12, 13, 302/65**

[56] **References Cited**

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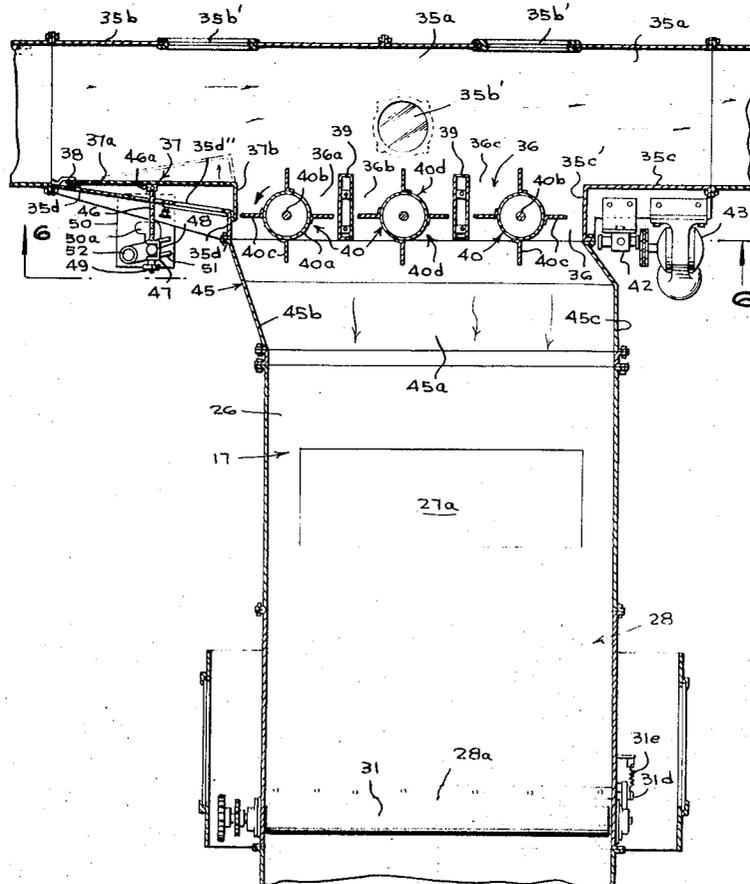
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[57] **ABSTRACT**

A pneumatic card feeding system including a vertical feed chute for each card defining an air tight vertical bin laterally coextensive with the card width for receiving fibers and delivering a batt to the feed end of the associated card, and a pneumatic overhead conveyor duct having a transverse width much smaller than the lateral dimension of the chute for conveying fibers by vehicle air from a supply source across the tops of a series of the chutes along a fiber feed path extending cross-wise of the cards. Multiple extractor rollers at the top of each chute mechanically transfer fibers from the air stream into the chutes.

26 Claims, 12 Drawing Figures



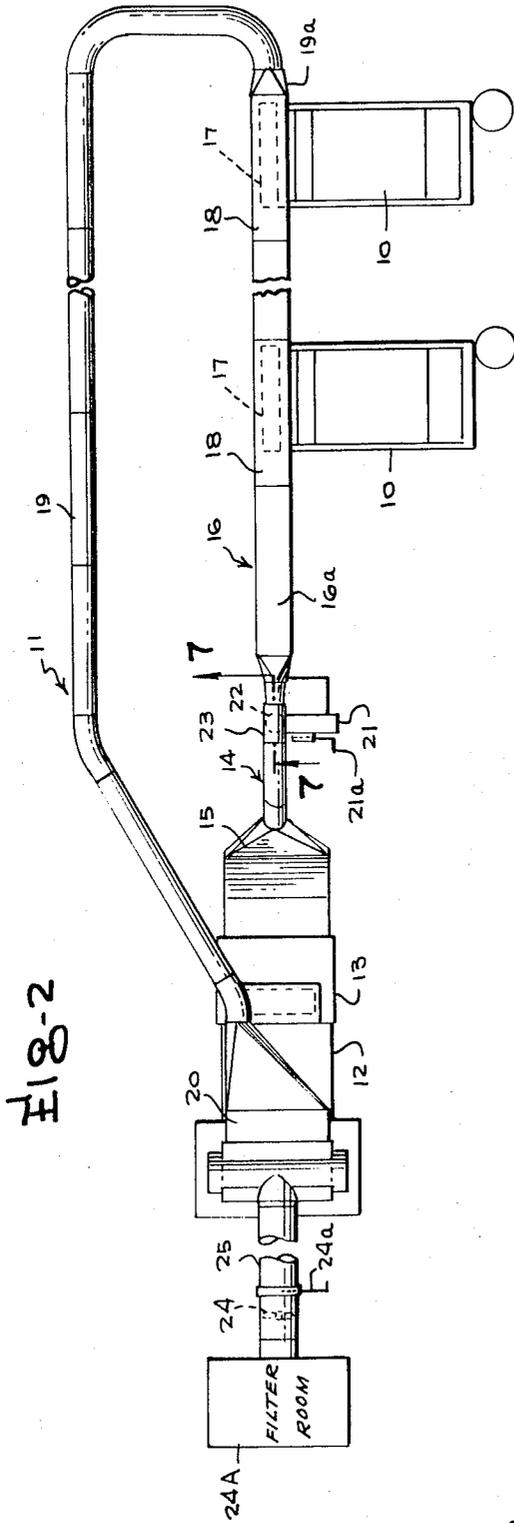


FIG-2

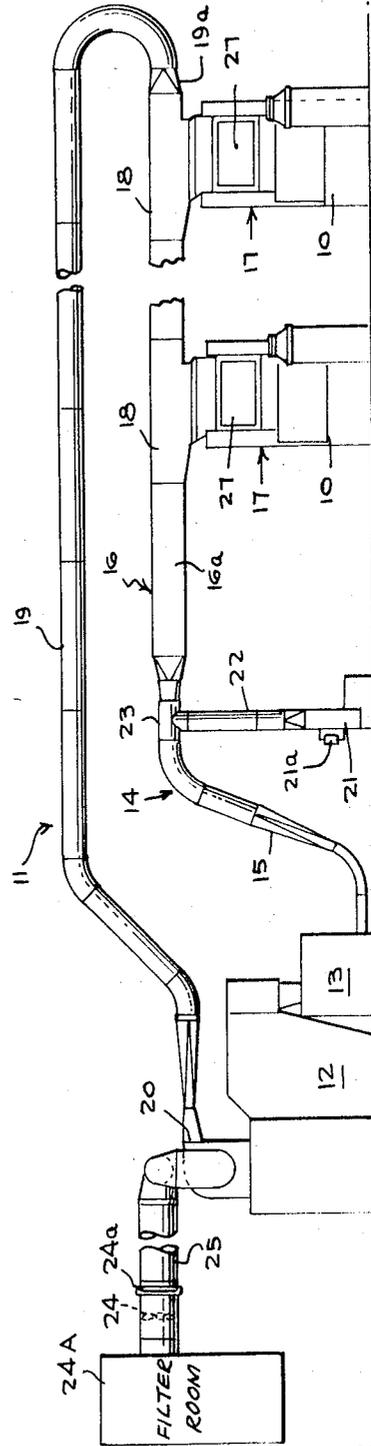


FIG-1

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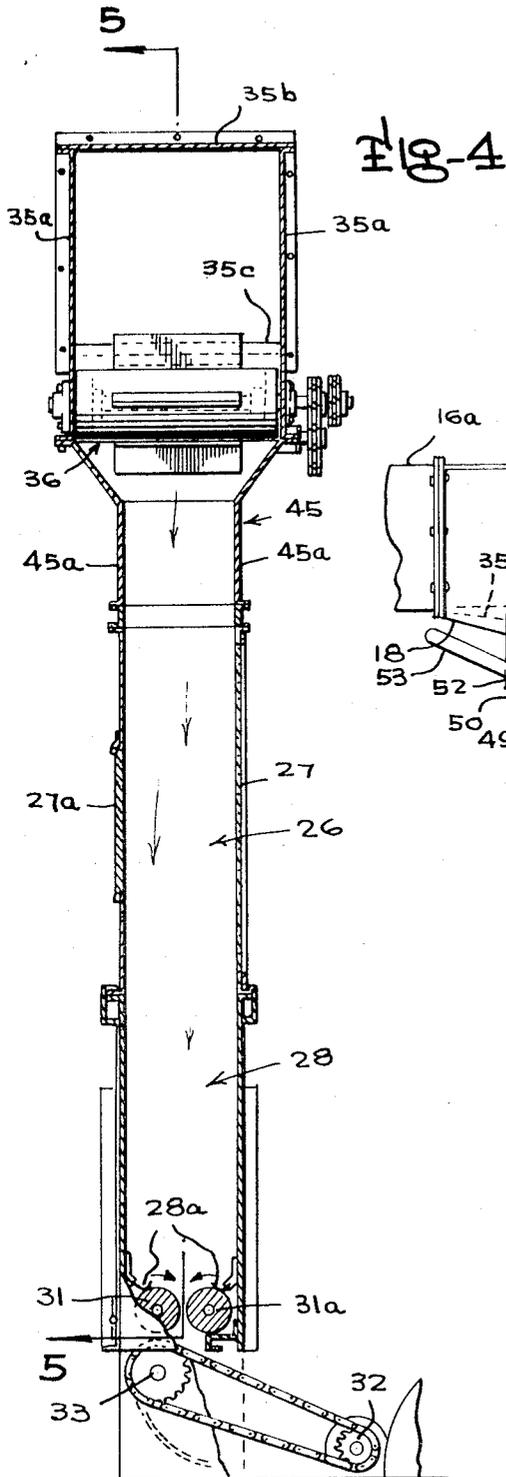


FIG-4

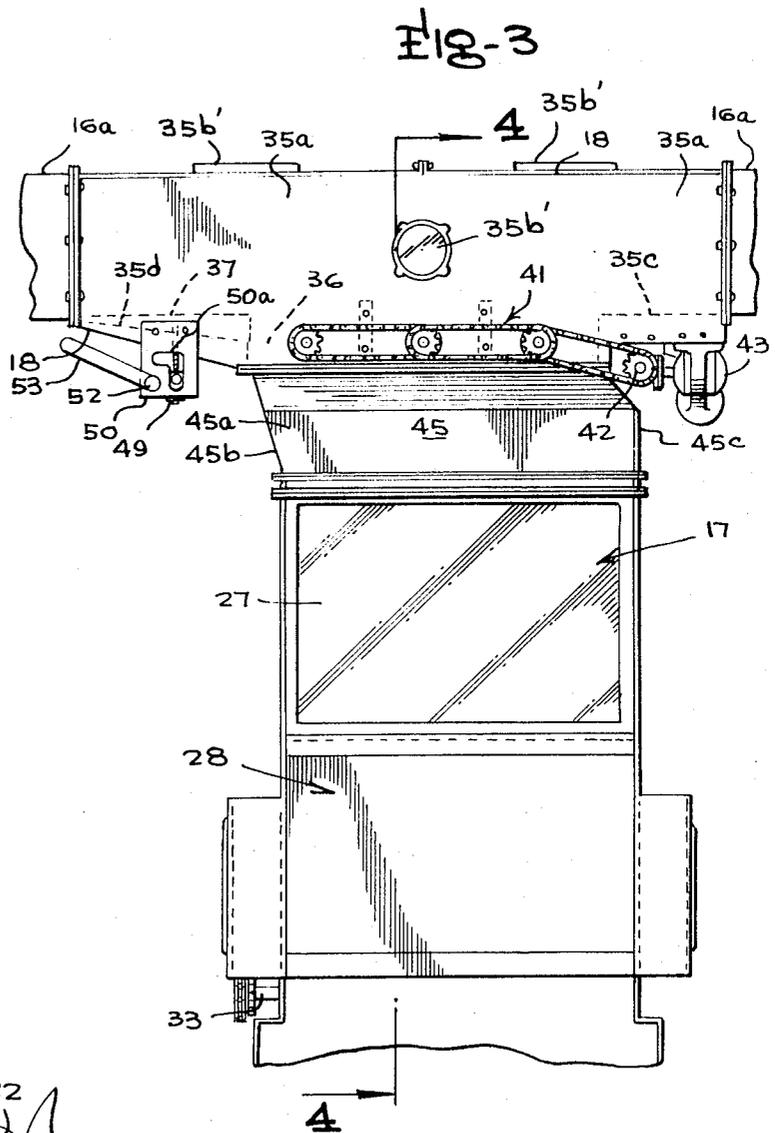


FIG-3

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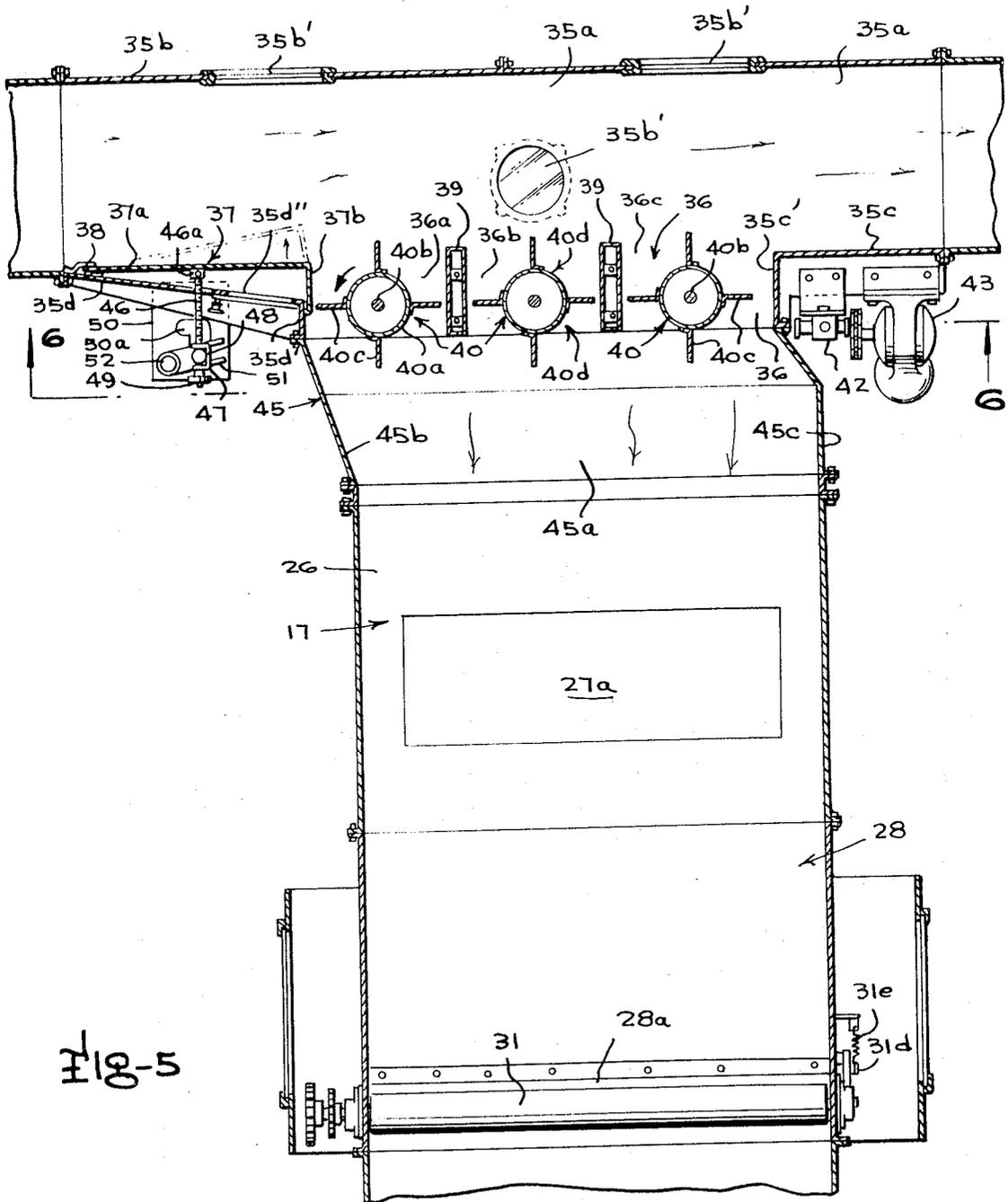


Fig-5

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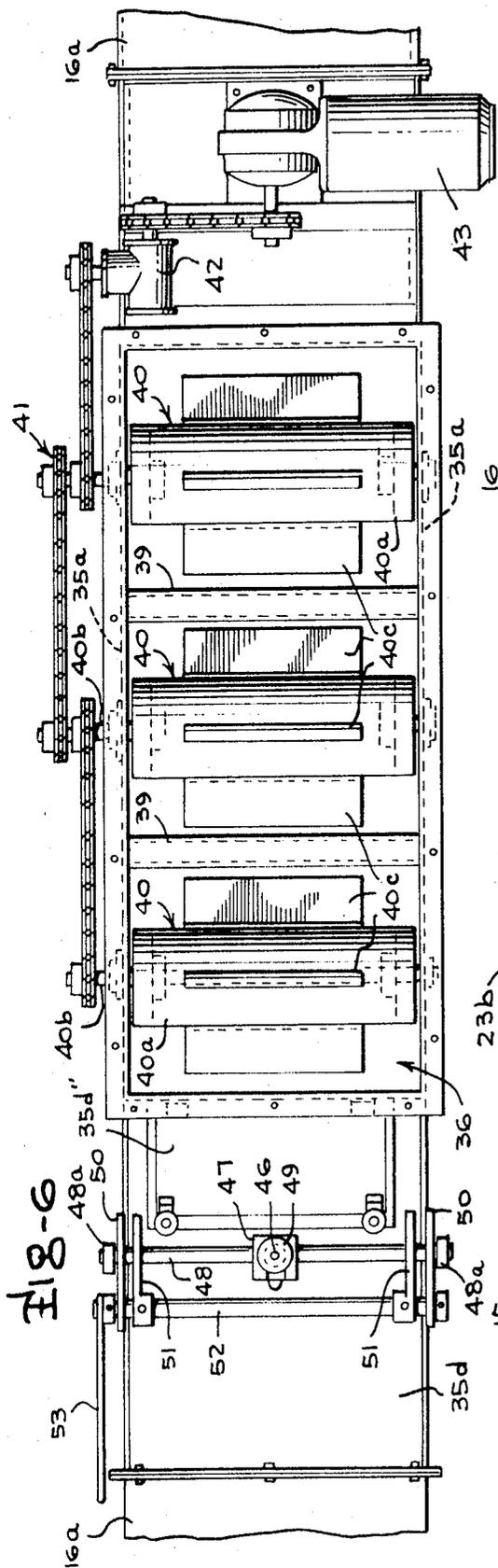


Fig-6

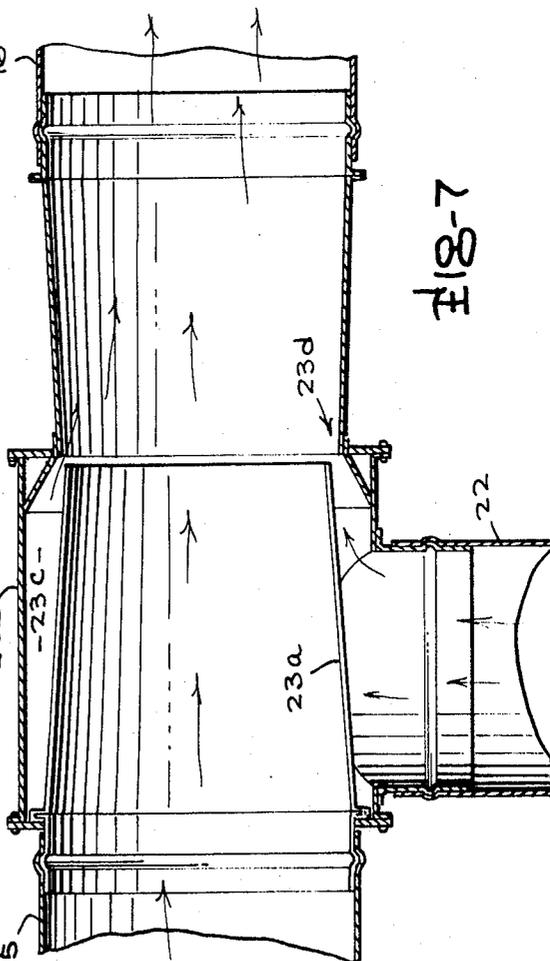
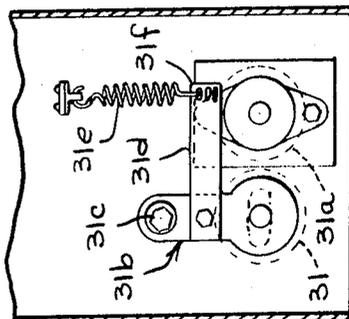


Fig-7

Fig-8



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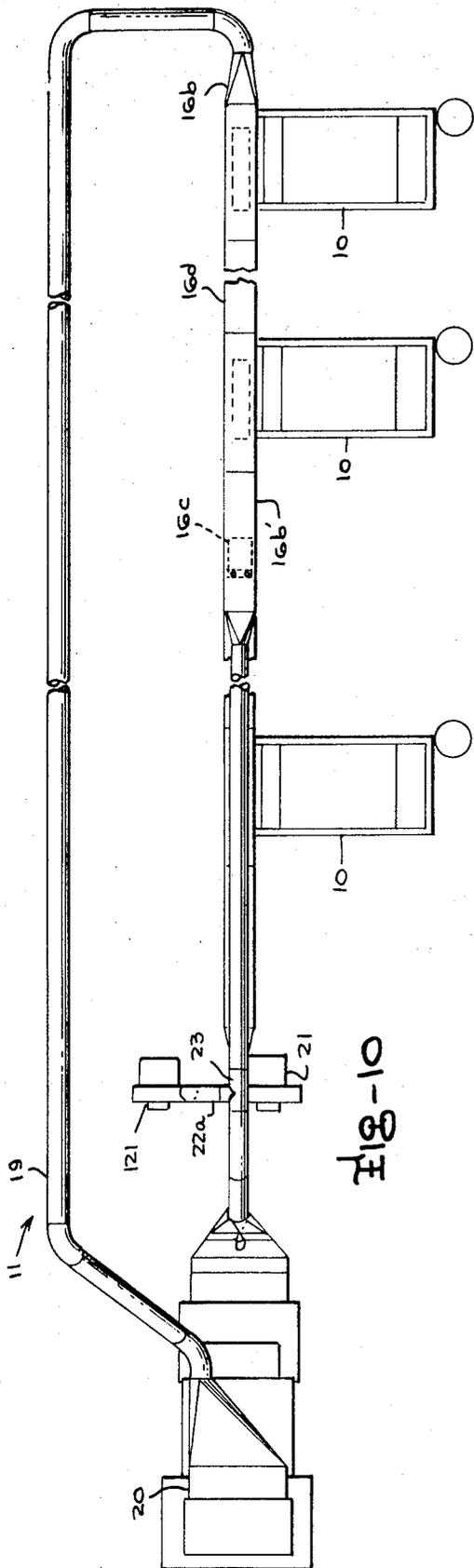


FIG-10

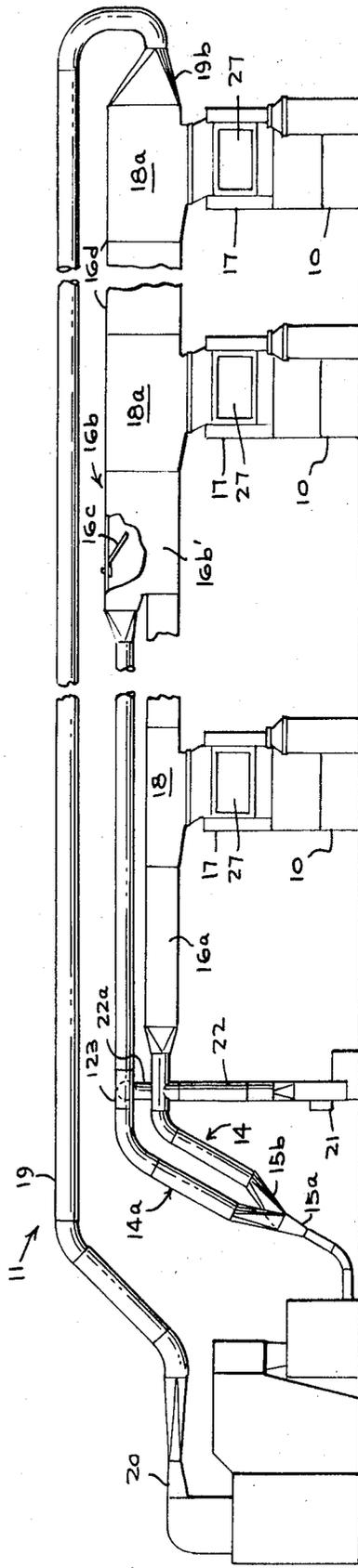


FIG-9

CROSSWISE PNEUMATIC CARD FEEDING SYSTEM

BACKGROUND AND OBJECTS OF THE INVENTION

The present invention relates in general to a pneumatic card feeding system for feeding cotton and/or other fibers in finely separated, small tufts to a plurality of vertical feed chutes each defining a substantially vertical column of fiber having a width transversely of the associated card coextensive with the width of the card to form and feed a continuous uniform and compressed fibrous batt to the card. The chutes are relatively shallow longitudinally of the associated card and the fibers are pneumatically transported through an overhead duct system from a blender and opener, or similar fiber preparatory machine, along a direction extending laterally, transversely, or crosswise of the cards across the tops of the series of vertical chutes for the transversely aligned group of cards, any surplus or overflow tufts over that required to keep all chutes filled to maximum being returned to the blending feeder for recycling through the system.

It had been customary until recent years to subject cotton which was delivered to the mill in bales of varying density to opening machinery which loosened the cotton into small tufts and removed as much dirt as possible. The cotton after being processed by the opening machinery was then conveyed to a picker room where the cotton was passed through machines known as pickers, which continued the cleaning, especially of heavier waste, and formed the cotton into a continuous sheet, or picker lap, which was a continuous, considerably compressed and felted sheet of cotton tufts rolled under pressure into a package about 40 inches wide by 15 to 18 inches in diameter. The picker lap was transported to the card room by truck or some mechanical means and positioned and fed initially by hand to the back of the card.

More recently, systems have been proposed for pneumatically feeding cotton or fibers from a feeder and opener station through overhead ducts and directly into vertical chutes which depend from the overhead duct to the back of associated cards. Representative of these are the Wildbolz et al. U. S. Pat. No. 3,029,477 and the Rieterer U. S. Pat. No. 3,408,115. In both of these prior art patents the flow stream defined by the overhead ducting which conveys the tufts down into the chutes is in the direction of, or in line with the longitudinal axes of the cards which are arranged in series spaced relation along the direction of their longitudinal axes. There is no suggestion in these prior patents that the feed leg of the overhead ducting could extend crosswise of a series of side-by-side cards with the axis of the feed path extending transversely of the cards, and in fact it was argued in the prosecution of the application for the Wildbolz et al patent that crosswise pneumatic feeding arrangements resulted in significant uneven level of the fibers across the wide dimension of the vertical feed chute. Mechanical conveyor systems have been proposed for conveying the fibers along feed troughs by rake belts in a direction extending crosswise of the vertical feed chutes and the associated cards, but these did not disclose any arrangement for pneumatically conveying the fibers crosswise of the vertical feed chutes and cards.

An object of the present invention, therefore, is the provision of a novel card feeding system for pneumatically conveying fiber tufts from a preparatory machine through an overhead duct of relatively narrow lateral dimensions which extends laterally or crosswise of the longitudinal axes of the cards and along the direction of the major horizontal dimension, referred to as the horizontal length or lateral span, of the vertical feed chutes for the respective cards, wherein a column of fibers of uniform height and density across the entire lateral span of the feed chute is achieved and continuously maintained throughout the entire carding operation so that an unbroken, even batt is always fed to each and every card in the line.

Another object of the present invention is the provision of a novel, self regulating card feeding system as described in the preceding paragraph, wherein surplus fiber, in excess of that required to maintain uniform density in each chute, is returned to the conveying duct so that any final surplus, downstream beyond the last card feeding chute in the series of chutes associated with the overhead duct, is returned to the upstream end of the system for recycling.

Another object of the present invention is the provision of novel card feeding system as described in either of the two preceding paragraphs, wherein each of the vertical feed chutes includes a horizontal head section comprising a rotatable mechanical extractor-packer roller assembly for intercepting a portion of the fibers flowing therethrough and firmly urging them downward into the upper end of the associated chute, so that the chute is completely filled and subsequently constantly maintained at the level of the roller assembly.

A further object is to provide an adjustable fiber deflector to control the amount of fiber presented to the extractor roller assembly and immediately adjacent the upstream end thereof.

A still further object of the present invention is the provision of a novel card feeding system especially adapted to feed very long, single lines of cards, or a double row of cards, from a single source or cotton preparatory machine, by dividing the output from such machine into two separate streams so that one of the streams feeds the first half of a line of cards, or the first line of a double row of cards, and the other stream is arranged to bypass the first group of cards but to enter the main distributing duct at an intermediate point, approximately half way between the first and the last card in the series in such manner that the second half of the line of cards, or the second row of cards, will be supplied with fiber in essentially the same condition as the first half of the system so that a higher degree of sliver uniformity is maintained by all cards in a single system.

Other objects, advantages and capabilities of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings illustrating preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a somewhat diagrammatic elevation view of a typical installation of the card feeding apparatus of the present invention, for a single row of preferably not more than eight cards;

FIG. 2 is a diagrammatic top plan view of the installation shown in FIG. 1;

FIG. 3 is a vertical front elevational view of the feed chute showing portions of the overhead duct and the extracting section connected thereto;

FIG. 4 is a vertical section view through the chute and extracting section taken along lines 4—4 of FIG. 3;

FIG. 5 is a vertical section view through the feed chute and the extracting section taken along lines 5—5 of FIG. 4;

FIG. 6 is a bottom view of the extracting section taken along lines 6—6 of FIG. 5;

FIG. 7 is a vertical sectional view of the venturi used to introduce additional conveying air into the upstream end of the conveying duct, which eliminates the need of the fiber going through the fan;

FIG. 8 is a partial vertical view of the outside end of the lower portion of the chute, showing the method of spring biasing one of the feed rollers against the opposing stationary roller for compressing the fiber into a batt as it is fed to the card;

FIG. 9 is a diagrammatic front elevation view of an installation of the card feeding apparatus recommended when feeding more than eight or ten cards in a single line;

FIG. 10 is a diagrammatic top plan view of the installation shown in FIG. 9;

FIG. 11 is a diagrammatic top plan view of the card feeding system when arranged to feed two rows of cards; and

FIG. 12 is a view of the special splitter section of the duct used to divide the single stream from the opener into two separate streams.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

The fiber feeding system of the present invention is designed to be employed in a fiber processing line which includes a number of carding machines or cards 10 arranged in laterally alined, side-by-side relation to form transverse or crosswise rows of cards, one of such lines and rows of cards being illustrated in FIGS. 1 and 2. At the upstream or supply end of the card feeding system line indicated generally at 11, a controlled blending feeder 12 and an associated fiber opener 13, both of which are commercially available devices, are provided to receive the cotton or other fibers which can be fed, either mechanically, pneumatically, or by hand, to the blending feeder 12. The blending feeder processes the cotton into large relatively dense tufts, and feeds them to the fiber opener 13 where they are opened into finely separated, small tufts and are conveyed pneumatically through a conveyor duct system 14 for a plurality of cards. The conveyor duct system 14 in the illustrated embodiment forms a circulating conveyor duct loop having a feed leg portion and a return leg portion. The conveyor duct includes an inlet riser section 15 which is of wide rectangular cross-section at its upstream inlet end and has a transition section changing to a circular cross-section as it rises to overhead level and connects by an appropriate transition section to the feed leg portion 16 formed of an elongated, rectangular cross-section flue or duct member 16a for conveying the cotton or the fiber from the opener 13 by vehicle air overhead through the card room in cross-wise relation over each of a laterally alined group of carding machines 10. The rectangular duct member 16a extends the length of the laterally alined row of cards, for example a line of eight, or even

12 or 16, cards, and distributes the fiber to each card 10 in the line served by that conveyor duct system 14 by supplying the fiber tufts to the upper end of a substantially vertical feed chute, generally indicated at 17, opening upwardly into an associated head section 18 interposed in the duct section 16a. Each chute 17 terminates at its lower end immediately adjacent the lick-erin roll of the associated card 10 for direct delivery of the compressed batt of fiber into the associated card 10. The horizontal head section 18 of each of the vertical feed chutes 17 includes an extractor-packer roller assembly and collectively with the other head sections 18 in the rectangular duct member 16a constitute the feed leg portion 16. The conveyor duct system 14 is provided with an appropriate volume of air to cause the air borne fiber tufts to float at as low velocity as possible but without excessive "dragging," through the horizontal head sections 18 across the open top of each associated feed chute 17, where a portion of the fiber is mechanically extracted from the pneumatic conveyance stream and urged downwardly into the associated chutes 17 through the top thereof by extractor-packer rollers to be later described. In the illustrated embodiment, a circular cross-section return leg duct 19 connects by a transition 19a to the downstream end of the feed leg portion 16 to return any final overflow or surplus fiber that passes downstream from the last feed chute 17 to a location above the blending feeder 12 where the returning fiber is separated from the vehicle air by a condenser 20 and returned to the blending feeder 12 for recycling through the system.

A push-pull fan system is provided to effect flow of the vehicle air through the conveyor duct system 14, and includes a push fan 21 having a vertical outlet stack 22 which connects to the circular cross-section inlet riser section 15 near the downstream end thereof by a venturi fitting or Tee section 23, having a forwardly converging pipe section 23a joined at its upstream end to the circular duct portion of riser section 15, and surrounded by an outer jacket 23b which defines an annular chamber 23c. The pressurized air from the fan 21, which has its inlet open to ambient air, is discharged under adjustably controlled pressure through the stack 22 and enters through the restricted annular opening 23d surrounding the downstream end of the converging pipe section 23a, producing a controlled air stream in the duct section 15 to convey the fiber from the opener 13 and cause it to flow through the pipe section 23a into the zone immediately downstream thereof where the air from the fan 21 and stack 22 enters the overhead duct. The air stream produced by the pressurized air entering through the opening 23d about the pipe section 23a, in coaction with the suction fan 24 connected by the duct 25 to the condenser 20, produces the vehicle air movement within the conveyor duct system 14 between these two locations which delivers the fibers at the desired velocity through the length of the feed leg portion 16 and returns the surplus or overflow through the return leg 19 back to the blending feeder 12. The fan 24 is of the vane axial type located in duct 25, the duct extending from the condenser 20 to the dust room or filter indicated at 25A. The push fan 21 has an adjustable slide forming a blast gate 21a movable over its intake opening to ambient air, and the suction fan 24 has a similar adjustable slide forming a blast gate 24a immediately upstream of the impeller blades, so that the pressure exerted by the push fan and

suction or pull fan can be regulated by adjusting the blast gates 21a and 24a.

Each of the feed chutes 17 includes an upper section which is termed the bin section 26 and has a glass or other transparent side 27 facing the delivery end of the card 10. The opposite side, facing the aisle between cards, is provided with a service door 27a to allow clean-out and access to, or inspection of, the compression-feed rolls 31, 31a, and their associated air seals 28a provided to prevent the loss of air pressure.

The height of the bin section 26 may be varied to suit the overhead space available in the card room of the particular installation. A height of 40 inches has been found to afford completely adequate storage space to properly feed cards processing from 30 to 40 pounds of fiber per hour. The older, lower speed cards could use a lower bin height if overhead obstructions such as beams, air conditioning ducts, and the like, required a lower overall height. The lower or bottom section of the chute 17 is referred to as the compressing and batt feeding section 28. Immediately adjacent the lower end of the bottom section are located a pair of opposite rotatable compression-feed rollers 31, 31a geared together with one of the rollers movably mounted in bearings and spring loaded, to apply pressure to the opposite roller so that the columnar mass of fiber is tightly compressed as it is fed outwardly and downwardly therebetween. Resilient seal strip assemblies 28a are mounted on the side walls of feeding section 28 in sealing relationship with rollers 31, 31a to prevent escape of air between the rollers and adjacent walls. Specially designed long teeth gears are provided to drive the spring loaded roller from the fixed roller so that the gears remained in mesh, even when the rollers move apart as the column of fibers is moved downwardly and outwardly between the rollers. Spring tension on the movable roller can be adjusted to suit the nature of the fiber being processed and should always be great enough to bring the rollers together to form a seal when there is no fiber being fed outwardly, such as when the bin runs empty or prior to startup of a new run. Likewise, it may be necessary to adjust the draft on the batt between the compression-feed rollers 31, 31a and a card feed roller 32, which is accomplished by means of a counter shaft assembly 33 directly below the compression rollers. The counter shaft assembly 33 is mounted on one of the support panel 29 and 29a. These panels 29 and 29a are mounted on each side of the end of the card, adjacent the lickering cylinder, and serve not only as a mounting for counter shaft assembly 33 but also support the chute 17 and the associated head sections 18.

The batt of cotton or other fiber discharged between the feed rollers 31, 31a move downwardly and forwardly into the card element, by means of a slide or apron 30 attached to the lower end of the chute 27 so that the fiber is guided into the feed-in elements of the card.

The feed of the batted fiber mass from the feed chute 17 is controlled by the card 10 itself. The correct rate of the stock or batted fiber mass delivered to the card is controlled by the conventional card draft gear (not shown). The card feed roller 32 and the card draft gear are parts of a conventional card and do not per se form a part of this invention except to the extent of being associated with the chute 17 and especially the compression-feed rolls 31, 31a thereof.

Multiple carding machines, frequently referred to in the trade simply as cards, are fed from the distributing duct or flue system 14, and specifically the feed leg portion 16 thereof by the overhead rectangular duct section 16a. At the startup of operation each successive chute 16 counting from the upstream or number 1 chute begins to fill with the fiber, as soon as the pneumatically conveyed fiber reaches the extractor rollers in the head section 18. The velocity of the conveying air stream is preferably adjusted to that point which just barely keeps the fiber "floated" without too much "drag" along the bottom of the duct. The vanes 40c of the extractor rollers 40 project slightly into the lower strata of the conveying stream so that each blade extracts a small quantity of fiber tufts therefrom and urges it downwardly into the chute. The cards and consequently the compression-feed rollers 31, 31a are not started until each chute completely fills. As each chute becomes full the action of the extractor roller vanes 40c is to exert some compacting pressure on the mass of fiber in the chute by trying to deposit more fiber thereon so that a certain vibrating and compressive force is exerted on the entire column or mass of fiber so that there are no voids or open spaces between the tufts. This however, is a self limiting action because equilibrium pressure is reached between the force applied on the top of the cotton and the resistance of the fiber itself to be packed so that in effect, at equilibrium pressure, only the same amount of cotton leaving the compression-feed rollers at the bottom of the chute can enter the top of the chute and any excess is returned to the conveying air stream by the upsweeping vanes 40a of the rollers 40 which rotate in a counterclockwise direction as shown in FIG. 5. By virtue of this action, a constant density or "head" of fiber is maintained throughout the bin section 26. After all of the chutes have completely filled and equilibrium density obtained in the mass of fibers, any residual material, in excess of the total feed out rate of the combined chutes, is returned by means of the return leg flue or duct 19 to the condenser 25 mounted above the control blending feeder 12. This duct 19 is round in cross-section and also of somewhat less area than the feed duct 16a so that the velocity of the return stream is preferably somewhat greater than that through the duct 16a. This greater velocity prevents the balling up or wadding of the excess material in the relatively small, round, long return duct leg, that might otherwise occur. Ideally only a small quantity of overflow material results. If desired, a direct current motor may be employed to drive the lifting apron of the blender feeder 12 and be controlled by means of a solid state rectifier. A remote potentiometer located at the chute feeding the last card 10 can be used to set the speed of the lifting apron and the control blending feeder 12 to provide just enough fiber to supply all of the feed chutes 12 in the line, with only a sufficient excess to insure keeping all the chutes full at all times.

The compression-feed roller 31 is spring loaded for movement toward and away from its companion roller 31a as previously mentioned, by means of the bearing bracket and spring mechanism as shown in FIG. 8 and the two compression-feed rollers 31, 31a are driven in the opposite direction relative to each other by the long tooth inter-connecting gear, with the roller 31a coupled to a sprocket on the shaft of the card feed roller 32 of the associated card. Roller 31 is journaled

at each end by means of a bearing bracket 31b, pivotally supported above the roller 31 by pivot pin 31c and arm 31d of the bracket 31b projects substantially horizontally over the axis of roller 31a, and has a coil tension spring 31e connected thereto and to the plate forming the end head of chute 17 by means of a small mounting bracket mounted thereto. The fulcrum arm 31d, is of sufficient length and spring 31e of sufficient strength to insure roller 31 bear against roller 31a to maintain adequate compressive force on the mass of fibers being fed outwardly therebetween. Arm 31d is provided with a series of vertically spaced holes 31f for attaching spring 31e so that the force exerted by spring 31e can be adjusted by selection of the proper hole for attachment.

The drive from the card feed roller 32 to roller 31 permits the flow of fiber to be stopped by disengaging the conventional draft gear of the carding machine in the normal manner well known to those skilled in the art. The batt continuity is not broken within the feed chute when rotation of the compression-feed rollers is terminated. Also, in conventional operation, the carding machine continues to operate with or without the flow of fiber. Because of the self-limiting nature of the amount of fiber deposited in the chutes 17 by the extractor-packer rollers previously described, it is possible to shut down or stop the rotation of any card in the line completely for adjustments or repairs, without interfering with the normal feeding and operation of the remaining cards in the line.

The head section 18 for each feed chute 17 is of generally rectangular cross-section, as is more clearly illustrated in FIGS. 4, 5 and 6, and includes a pair of side sheets or walls 35a and a top wall or sheet 35b, which may have sight glasses or windows 31b' therein for viewing the interior of the head section. A right angle bottom wall 35c is provided near the downstream end of the head section, having a horizontal portion extending upstream from the downstream end and a downwardly extending flange 35c' defining the downstream end of the bottom opening in the head section 18. A downwardly inclined upstream bottom wall portion 35d extends downstream from the upstream end and terminates in a downwardly extending flange 35d' defining the upstream end of the bottom opening 36 through which the fiber is to be discharged downwardly into the chute. The downwardly inclined bottom wall portion 35d may have a hinged access door 35d'' therein to facilitate clean out and servicing. An inlet sheet or approach sheet 37 overlies the bottom wall portion 35d and comprises a main planiform inlet sheet portion 37a and a downwardly extending flange 37b. The upstream end of the main inlet sheet portion 37a is pivoted by a hinge 38 to the inclined bottom wall portion 35d, and the depending flange 37b extends downwardly in partially lapping relation to the flange 35d' of the bottom wall portion 35d when in the approximate normal operating position illustrated in solid lines in FIG. 6.

The discharge opening 36 defined between the depending flanges 35c' and 35d', which opening is elongated longitudinally of the air flow axis through the overhead duct system, is normally sub-divided into three longitudinally spaced opening zones 36a, 36b and 36c by transversely extending vertical spreaders or partition members 39. These spreaders are removable as explained later. Within each of the discharge opening zones 36a, 36b and 36c is an extractor roller 40 com-

prising a cylindrical core 40a fixed on a transverse shaft 40b journaled in bearings provided in the lateral side sheets 35a, the extractor roller including multiple vane members 40c welded or otherwise fixed at their base flanges to the surface of the cylindrical core 40a and extending in a pair of relatively perpendicular diametric planes of the axis of the shaft 40b to define multiple circumferentially spaced pockets 40d between the successive vane members 40c. The extractor rollers 40 are driven at a selected speed, for example at 100 rpm, by a chain and sprocket drive train indicated generally at 41 driven from a gear box 42 which in turn is driven by a chain and sprocket drive linkage from the output shaft of an electric motor 43. Both the gear box 42 and electric motor 43 are supported by a suitable bracket member extending between and connected to the lower downstream portions of the side sheets 35a.

The lateral side sheets 35a may be provided with sight glass windows as illustrated in FIGS. 3 and 5, and if desired the top sheet 35b may be provided with one or more sight glass windows, three of such windows being illustrated in FIG. 5 at 35b', to permit observation of the fiber flowing with the air stream within the head section 18. For the transfer of the fibers extracted from the air stream by the extractor roller assembly to the open top of the associated chute 17, a hopper portion 45 is connected at its upper end to the lips at the lower ends of the flanges 35c', 35d', and the side sheets 35a, and is connected at its lower end to the top of the associated chute 17. Each hopper portion 45 connected to the head section 18 includes side sheets 45a which converge inwardly over a portion of the height of the side sheets from the width of the head section 18 to the narrow dimension (the width longitudinally of the associated card) of the vertical feed chute 17. The hopper portion 45 also has front and rear end sheets 45b and 45c which preferably incline at least over a portion of their height in a downstream direction, whereby the hopper portion 35 defines a transfer chamber or conduit which extends downwardly and is inclined somewhat in a downstream direction from the discharge opening 36 to the top of the associated chute 17.

The inlet sheet 37 is adjustable about its hinge 38 to an appropriate height to provide extraction of the proper amount of fiber at each of the chutes in the line, by means of an elongated threaded bolt 46 pivoted by a fin 46a at its upper end to the main portion 37a of the inlet sheet 37. The bolt 46 extends freely through openings in the upper flange of a channel-shaped bracket 47 and a transverse rod 48 and is threaded into the tapped opening through an adjustment knob 49 having a shank which extends through a slot opening through the free edge of the lower flange of the channel-shaped bracket 47. The knob 49 has an enlarged collar formation at the upper end of its shank which rests upon and is disposed immediately above the lower flange of the bracket 47 to restrain the knob 49 against axial movement relative to the bracket. Outer end portions of the rod 48 are guided in right angle slots 50a in guide plates 50 and the rod is restrained against axial movement by collars 48a fixed on the rod outwardly of the guide plates 50. The rod 48 is adjustable from its normal lowered position at the bottom of the vertical leg of the slots 50a, illustrated in FIG. 5, to a raised position at the front or left hand end of the upper horizontal leg of guide slot 50a by a pair of slotted levers 51 defining a pair of fin-

gers embracing the rod 48 above and below the rod, the slotted levers being fixed on a lever shaft 52 journaled in the guide plates 50 and controlled by a handle lever 53. It will be seen that the normal position or inclination of the inlet sheet 37 can be adjusted to provide the desired amount of feed to the chute 17 coupled to the associated head section by manually rotating the adjustment knob 49 to thereby raise or lower the inlet sheet 37 through desired increments. When it is desired to quickly elevate the inlet sheet 37 to a position causing the fibers to bypass the zone of action of the associated extractor rollers 40, by diverting the fibers in the air stream upwardly into the higher regions of the head section 18, the operator merely grasps the handle lever 53 and rotates it to the downward position, causing the slotted levers 51 to rotate upwardly in a counterclockwise direction as viewed in FIG. 5 and thereby cause the rod 48 to be moved to the top of the vertical legs of the guide slots 50a and then forwardly or in an upstream direction into the horizontal portions of the guide slots 50a. During this movement of the rod 48, the bolt 46 which is restrained against movement relative to the rod 48 by reason of the channel-shaped bracket 47 and the enlarged collar portion of the knob 49 is caused to rise through an appropriate distance to elevate the inlet sheet 37 to the broken line position illustrated in FIG. 5, which constitutes its bypass position.

By reason of the above-described construction, wherein the discharge opening 36 of the head section 18, which communicates with the associated feed chute 17, is sub-divided into three longitudinally spaced discharge opening sections or zones 36a, 36b and 36c separated by the vertical spreader partitions 39 and each occupied by its own extractor roller 40, an even loading of the upstream and downstream end portions of the bin section of the associated chute 17, as well as the intermediate or middle portion thereof, is achieved with the flow axis of the overhead pneumatic conveying duct delivering fibers to the chutes being arranged crosswise or transversely of the longitudinal axes of the cards making up the row of cards being fed by that line. Since the system provides positive mechanical extraction at multiple locations longitudinally of the discharge opening 36 by the extractor rollers 40, rather than by gravity or air conveyance of the fiber downwardly in the chute, the problems of non-uniformity of loading along the lateral span of the chute or at the upstream and downstream ends of the chute, which arises when relying merely upon gravity or air conveyance of fibers downwardly into the chute is avoided. It will be apparent that uniform loading across the length of the lateral span of the chute is required to provide a batt which would have sufficient uniformity transversely between the lateral edges thereof, to insure production of an acceptably uniform sliver from the card being fed by the associated vertical feed chute.

The partition members 39 are bolted in place between the side heads 35a, by means of two cap screws on each end. These are made removable because it had been found that under certain conditions, as for example, when handling very light weight, finely tufted fibers, such as cotton, that removal of one or even both of these members facilitates filling the chute. Under most conditions adjustment of the inlet sheet 37, either upwardly or downwardly, is sufficient to bring the fiber in proper contact with the vanes 40c of the extractor

rollers 40 and observation of the stream of material can be made through the sight glasses provided in the head section 18. Since the velocity of the conveying air stream also affects the amount and consistency of the fibers being fed from the duct 16 into the chutes 17, the velocity should be such that the material is in the lower range of its "floating velocity," so that the lower strata keeps well within the reach of the vanes on the extractor rollers as it passes through each head section 18. Fine trim of the volume of air being handled through the system and, consequently, the velocity of the conveyed material, is controlled by means of the sliding blast gates 22a for the push fan, and 25a for the suction fan, used to move the air through the system.

When feeding very long single lines of cards of more than 8 or 10 cards or double rows of cards of 6 or 8 cards each, it has been found desirable to divide the output of the preparatory machine into two separate streams and to feed the first half or the first line of cards with one-half of the output and the last half or the second line of cards with the other half. By so doing a fresh supply of finely separated small tufts of fibers is introduced at an intermediate point approximately halfway between the first and last cards in the system so that the slivers produced by the cards in each section will have more nearly the same character and uniformity. A relatively minor variation in the ductwork as illustrated in FIGS. 9 through 12 is required to accomplish this. The fiber is discharged from the opener 13 through the rectangular duct into a pneumatic divider piece 15a having the dividing nose 15b facing upstream so that the air and fiber is divided into two separate streams discharging from the divider into two separate, oppositely turned, offset transitions 15c which in turn discharge each half of the fiber into supply duct 14 and 14a. Each line is provided with auxiliary fans 21 and 121 to introduce additional conveying air through venturies 23 and 123 into the two separate lines. Duct 14 discharges into the feed leg portion 16a feeding the first cards in line with half of the fiber in the duct system, while duct 14a conveys the other half of the fiber to a point approximately halfway between the first and last chute where it enters an enlarged section 16b' of the feed leg portion of 16b having the same width as portion of 16a but of approximately double the cross-section area and height. In this way the velocity of the two merged streams remains the same as the single stream through feed leg portion 16a.

The horizontal head section 18a is of identical configuration of that of head section 18 except for the extra space or height above the extractor packer roller assembly. As previously stated it is desirable to have the floating velocity of the conveying stream low enough so that the fibers are just barely kept floated in the duct without excessive drag along the bottom thereof. Since the fresh supply of fibers entering feed leg 16b are near the top of the conveying duct, it has been found advantageous to bring the fresh supply in slightly upstream of the mid-point between the first and last cards. For example, in a single line of 12 cards, it is recommended that the fresh fiber be introduced at a point upstream of the No. 6 chute. The reason for this is that it requires some distance of travel for the fresh supply of fibers entering near the top of the feed leg portion 16b to sink low enough in the duct to come within the influence of the vanes 40c of the rollers 40. This has been found to work better than if the fresh

supply of fibers were introduced between the 6th and 7th chute in a 12 card line.

Under some circumstances or with certain fibers, it may be found desirable to use a simple deflector, such as that indicated at 16c, bolted through the top covers of the feed leg section 16b immediately adjacent the entrance of the supply duct 14a. Deflector 16c is preferably made of a very light gauge sheet metal so formed as to have the downstream portion extending downward into the duct at an angle of something like 30° from the horizontal. The exact angle required is best attained by trial and error by bending up or down until the desired deflection of the stream is achieved. If the air velocity is carefully balanced, it is usually unnecessary to use the deflector itself since the tendency of the fiber is to drift downward gradually in the feed leg portion 16b so that by the time the fresh supply of fiber reaches the first horizontal head section 18a downstream of the center between the first and last chutes, it would have floated down within the influence of the extractor packer rollers 40.

Similarly, when feeding a double row of cards, i.e., for example, 6 or 8 cards on the outgoing line and the same number on the return line, it will be found desirable to introduce the fresh supply of fiber into the feed leg portion 16b just ahead of the last chute in the first or outgoing line as shown in FIG. 11. In either case the residual or overflow fibers are returned to the preparatory machine through return leg duct 19.

What is claimed is:

1. A card feeding system for distributing fibers from a fiber supply source to a series of laterally aligned, side-by-side spaced cards extending along a transverse axis, wherein the fibers are pneumatically conveyed along an overhead feed path extending crosswise of the series of cards parallel to said transverse axis, comprising a plurality of substantially vertical feed chutes arranged in series relation along the feed path for gravitational flow of the fibers down the total height of the chute and respectively cooperatively associated with the cards, each chute including walls defining a substantially air tight vertical bin having a lateral span paralleling the direction of the feed path coextensive with the card width and having a shallow depth transversely of the feed path; a pneumatic conveyor duct including an elongated feed portion along said feed path having a transverse width which is pronouncedly smaller than the lateral span dimension of each feed chute for conveying fiber in a continuously flowing stream of vehicle air from said fiber supply source, across the tops of the series of feed chutes, fan means communicating with said conveyor duct for producing the vehicle air stream therein, said feed chutes each having an elongated top opening having its major axis paralleling the feed path and communicating with said feed portion for passage of fiber into the chutes, and multiple extractor roller assembly adjacent the top of each feed chute for mechanically extracting fiber tufts from the air stream in said duct and conveying them without vehicle air downwardly into the top region of the chute for gravitational flow through the height thereof, said assembly including multiple rotatably driven extractor rollers each rotatable about respective axes at substantially the same horizontal level and extending transversely to said feed path and parallel to the longitudinal axes of the associated cards, said rollers being spaced along said feed path and occupying the major portion of the

area at the top of the associated chute and including radial vane members which reach into intercepting relation to fiber tufts flowing in the conveyor duct to extract the fiber tufts from the air stream and mechanically transport the same downward without vehicle air into the top of the associated feed chute.

2. Apparatus as defined in claim 1, including stationary vertical transverse partition members sub-dividing said top opening into a plurality of longitudinally spaced segments, each of said segments of said top opening having a respective one of said extractor rollers occupying the same.

3. Apparatus as defined in claim 1, wherein said conveyor duct includes a return leg portion connected to the downstream end of said feed portion and forming therewith a circulating conveying loop for receiving fiber from said fiber supply source and returning any overflow reaching said downstream end to said fiber supply source.

4. Apparatus as defined in claim 2, wherein said conveyor duct includes a return leg portion connected to the downstream end of said feed portion and forming therewith a circulating conveying loop for receiving fiber from said fiber supply source and returning any overflow reaching said downstream end to said fiber supply source.

5. Apparatus as defined in claim 1, including condenser means at said fiber supply source coupled to a downstream portion of said conveyor duct for separating fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

6. Apparatus as defined in claim 2, including condenser means at said fiber supply source coupled to a downstream portion of said conveyor duct for separating fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

7. Apparatus as defined in claim 3, including condenser means at said fiber supply source coupled to the downstream end of said return duct for separating the return fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

8. Apparatus as defined in claim 5, including adjustable means for regulating pressure exerted by said suction fan, and said push fan.

9. Apparatus as defined in claim 6, including adjustable means for regulating pressure exerted by said suction fan, and said push fan.

10. Apparatus as defined in claim 1, including a horizontally elongated head section at each chute interposed in said feed portion of said conveyor duct, said extractor roller assembly being disposed at the juncture of the associated chute and head section with the ex-

tractor rollers thereof forming revolving baffles wherein their vane members penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically and forcibly transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute.

11. Apparatus as defined in claim 2, including a horizontally elongated head section at each chute interposed in said feed portion of said conveyor duct, said extractor roller assembly being disposed at the juncture of the associated chute and head section with the extractor rollers thereof forming revolving baffles wherein their vane members penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute.

12. Apparatus as defined in claim 5, including a horizontally elongated head section at each chute interposed in said feed portion of said conveyor duct, said extractor roller assembly being disposed at the juncture of the associated chute and head section with the extractor rollers thereof forming revolving baffles wherein their vane members penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute.

13. Apparatus as defined in claim 6, including a horizontally elongated head section at each chute interposed in said feed portion of said conveyor duct, said extractor roller assembly being disposed at the juncture of the associated chute and head section with the extractor rollers thereof forming revolving baffles wherein their vane members penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute.

14. A card feeding system for distributing fibers from a fiber supply source to a series of laterally aligned, side-by-side spaced cards extending along a transverse axis, wherein the fibers are pneumatically conveyed along an overhead feed path extending crosswise of the series of cards parallel to said transverse axis, comprising a plurality of substantially vertical feed chutes arranged in series relation along the feed path and respectively cooperatively associated with the cards, each chute including walls defining a substantially air tight vertical bin having a lateral span paralleling the direction of the feed path coextensive with the card width and having a shallow depth transversely of the feed path; a pneumatic conveyor duct including an elongated feed portion along said feed path having a transverse width which is pronouncedly smaller than the lateral span dimension of each feed chute for conveying fiber in a continuously flowing stream of vehicle air from said fiber supply source, across the tops of the series of feed chutes, fan means communicating with said conveyor duct for producing the vehicle air stream therein, said feed chutes each having an elongated top opening having its major axis paralleling the feed path and communicating with said feed portion for passage of fiber into the chutes, and multiple extractor roller assembly adjacent the top of each feed chute, said assembly including multiple rotatably driven extractor rollers each rotatable along an axis extending transversely to said feed

path and including radial vane members which reach into intercepting relation to fiber tufts flowing in the conveyor duct to mechanically extract a portion of the fiber tufts from the air stream and urge the same downward into the associated feed chute, a horizontally elongated head section at each chute interposed in said feed portion of said conveyor duct, said extractor roller assembly being disposed at the juncture of the associated chute and head section with the extractor rollers thereof forming revolving baffles wherein their vane members penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically and forcibly transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute, a deflector plate member in each head section disposed upstream of the plurality of extractor rollers hinged at an upstream end thereof about a hinge axis paralleling the axes of the extractor rollers and having a downstream end portion adjacent the upstream extractor roller, first adjustment means for adjusting the deflector plate member to selected angular positions to regulate elevation of the fibers and the vehicle air stream flowing through said head section and thereby regulate the extent of vane member penetration into the lower strata thereof for varying the rate of fiber fed by the extractor rollers into the associated chute, and second adjustment means for moving the deflector plate member to a by-passing position for diverting the air stream and fibers borne thereby in a by-pass path past the vane members.

15. Apparatus as defined in claim 11, including stationary vertical transverse partition members subdividing said top opening into a plurality of longitudinally spaced segments, each of said segments of said top opening having a respective one of said extractor rollers occupying the same.

16. Apparatus as defined in claim 12, including condenser means at said fiber supply source coupled to a downstream portion of said conveyor duct for separating fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

17. Apparatus as defined in claim 15, including condenser means at said fiber supply source coupled to a downstream portion of said conveyor duct for separating fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

18. A card feeding system for pneumatically conveying fibers along an overhead feed path from a single fiber supply source to a plurality of spaced cards extending along the feed path, comprising a plurality of substantially vertical feed chutes arranged along the feed path and respectively cooperatively associated with the cards, each chute including walls defining a substantially air tight vertical bin having an open top to receive the fibers and discharge a batt of the fibers from the bottom of the chute to an associated card, a pneumatic conveyor duct system for conveying fiber in

a continuously flowing stream of vehicle air from said fiber supply source across the tops of the feed chutes, including a first elongated feed leg spanning a first portion of said feed path to feed a first group of said cards and a second elongated feed leg joining the downstream end of said first leg and spanning a second feed path portion to feed a second group of the cards, fan means communicating with said conveyor duct system for producing the vehicle air stream therein, a by-pass duct extending from a location upstream of said first leg to the juncture between said first and second legs, and pneumatic diverter means at the juncture of said by-pass duct and first leg upstream of the latter to divide the fiber output of the source into a first fiber stream directed into said first leg and a second fiber stream directed through said by-pass duct and into said second leg at said juncture between said first and second legs.

19. Apparatus as defined in claim 18, wherein said first feed leg is coupled to the tops of the chutes for substantially one-half of the plurality of cards and the second feed leg is coupled to the tops of the chutes for the remaining cards along the feed path to supply fiber to the chutes respectively coupled thereto.

20. Apparatus as defined in claim 18, including an adjustable deflector member pivotally supported within the conveyor duct system immediately adjacent the juncture of the by-pass duct and said second leg to incline downwardly and selectively deflect the stream of fiber discharging from the by-pass duct.

21. Apparatus as defined in claim 18, wherein said feed chutes each have an elongated top opening having its major axis paralleling the feed path and communicating with said feed leg coupled thereto for passage of fiber into the chutes, and multiple extractor roller assembly adjacent the top of each feed chute, said assembly including multiple rotatably driven extractor rollers each rotatable along an axis extending transversely to said feed path and including radial vane members which reach into intercepting relation to fiber tufts flowing in the conveyor duct to mechanically extract a portion of the fiber tufts from the air stream and urge the same downward into the associated feed chute.

22. Apparatus as defined in claim 21, including stationary vertical transverse partition members subdividing said top opening into a plurality of longitudi-

nally spaced segments, each of said segments of said top opening having a respective one of said extractor rollers occupying the same.

23. Apparatus as defined in claim 18, including condenser means at said fiber supply source coupled to a downstream portion of said conveyor duct for separating fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

24. Apparatus as defined in claim 20, including condenser means at said fiber supply source coupled to a downstream portion of said conveyor duct for separating fiber from the vehicle air and discharging the separated fiber to said supply source, and said fan means including a suction fan communicating with said condenser means and a push fan communicating with said conveyor duct upstream of the series of feed chutes to form a push-pull fan system producing the vehicle air streams in said duct.

25. Apparatus as defined in claim 18, including a horizontally elongated head section at each chute interposed in the associated feed leg of said conveyor duct, an extractor roller assembly disposed at the juncture of the associated chute and head section having extractor rollers forming revolving baffles including vane members which penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically and forcibly transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute.

26. Apparatus as defined in claim 21, including a horizontally elongated head section at each chute interposed in the associated feed leg of said conveyor duct, said extractor roller assembly being disposed at the juncture of the associated chute and head section with the extractor rollers thereof forming revolving baffles wherein their vane members penetrate the lower strata of the vehicle air stream in the conveyor duct for mechanically transferring fiber tufts from the feed path downwardly into the upper region of the associated feed chute.

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