Jan. 10, 1967 R. M. INGHAM, JR., ETAL 3,296,664

AIR DRAFTING ARRANGEMENT

Original Filed Aug. 14, 1963 2 Sheets-Sheet 1

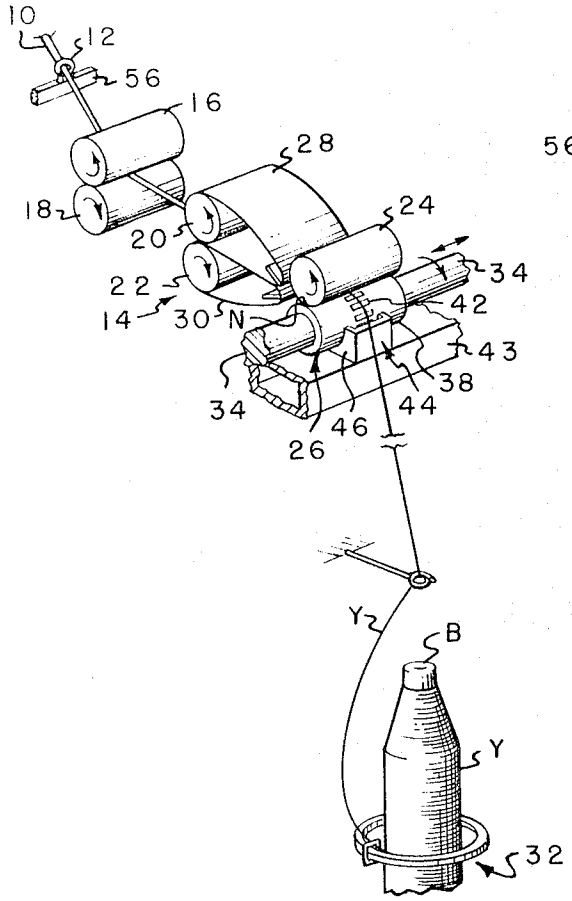



FIG.-1-

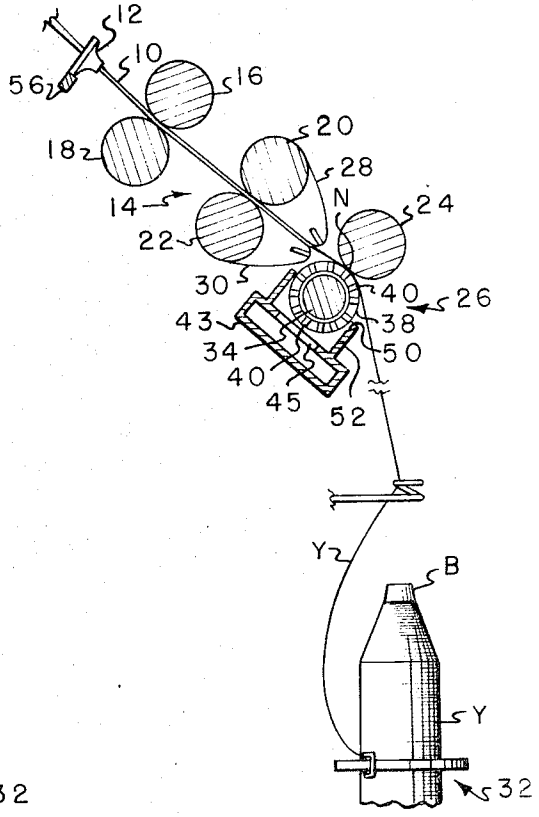



FIG.-2-

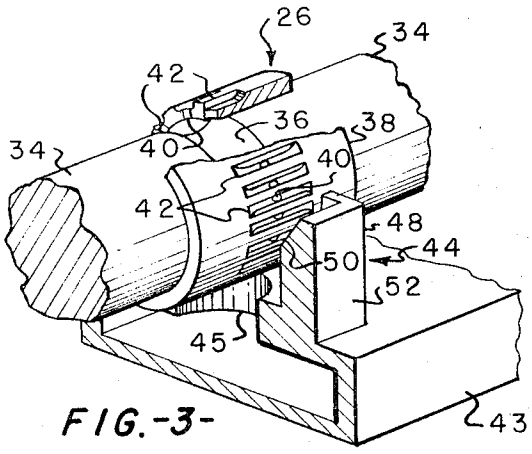



FIG.-3-


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AIR DRAFTING ARRANGEMENT

Original Filed Aug. 14, 1963 2 Sheets-Sheet 3

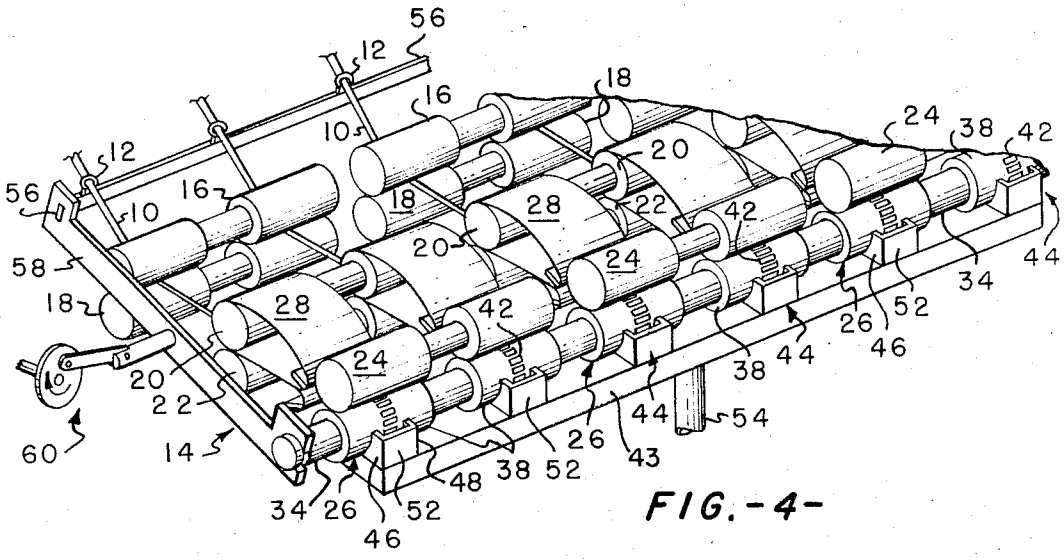



FIG.-4-

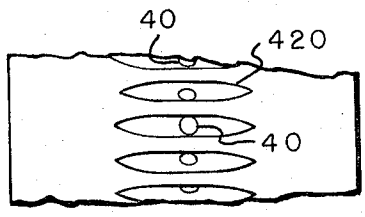



FIG.-6-

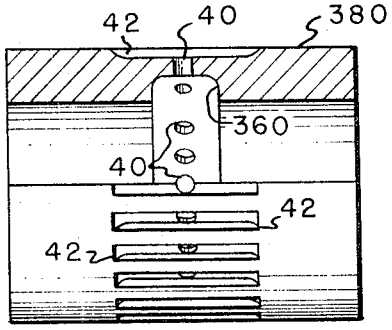



FIG.-5-

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3,296,664

Patented Jan. 10, 1967



3,296,664

# AIR DRAFTING ARRANGEMENT

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Continuation of application Ser. No. 302,211, Aug. 14, 1963. This application Oct. 22, 1965, Ser. No. 507,628

20 Claims. (Cl. 19—288)

This application is a continuation of our prior copending application, application Serial No. 302,211, filed August 14, 1963, now abandoned.

This invention relates generally to textile fiber handling apparatus and more particularly to fiber drafting systems which serve to exert a compacting action on a mass of staple fiber preparatory to forming the fibers into a yarn or the like.

The employment of perforated drafting rolls systems to exert compacting forces on a mass of fibers generally is known in the art as exemplified in U.S. Patent 3,090,081, N. E. Klein, May 21, 1963. Such systems employ a vacuum source within the center of a lower perforated drafting roll. Necessarily, some type of suction nozzle has to be provided to connect the desired portion of the drafting roll to the vacuum source. These nozzles have to be properly aligned or they will restrict the rotation of the roll if they are too close or will not provide sufficient vacuum to the roll if the clearance between the internal diameter of the roll and the vacuum nozzle is too large. Further, because the internal vacuum system is introduced into one end or the other of the drafting roll it is only possible to employ two rolls on a common mounting. Also, because of the close tolerance of the suction nozzle to the internal diameter of the drafting roll, plugging and jamming of the suction nozzle becomes a problem resulting in a high percentage of yarn breakage due to the sucking of the fibers being compressed into the drafting roll and being caught by the accumulated fibers between the suction nozzle and the rotating drafting roll causing the fibers to be retained momentarily, thus breaking the fiber being treated. Still further, fiber handling systems of the type shown in U.S. Patent 3,090,081, supra, are not readily adaptive to existing drafting systems because of the limitation of having the perforated rolls in pairs only. Existing systems employ six or more drafting rolls in line and thus are not readily converted to the drafting systems shown in the prior art.

It is, therefore, an object of the invention to provide a fiber handling system which is simple in construction, more efficient, and readily adaptable to existing systems.

Another object of the invention is to provide a fiber handling system which readily compacts the fibers being handled without the employment of complicated drafting equipment.

A third object of the invention is to provide a fiber handling system which can efficiently compact fiber on a multiplicity of manifolded drafting systems and which is readily adaptable to existing systems.

A still further object of the invention is to provide a fiber handling system which employs perforated drafting rolls to exert a compressing action on the fibers being handled through the use of a vacuum system that pulls the air through the perforated rolls.

A fifth object of the invention is to provide a perforated drafting roll fiber handling system which efficiently compacts the fibers being handled by the use of a suction system to pull air completely through the roll to compact the fibers and reduce the effect of windage.

A still further object of the invention is to provide a perforated drafting roll fiber handling system in which the perforated drafting rolls employed are self-cleaning and do not require numerous shut downs for the purpose of lint removal.



Other objects and advantages of this invention will be readily apparent as the specification proceeds to describe the invention with reference to the accompanying drawing in which:

FIGURE 1 is a schematic view in perspective of a drafting arrangement according to the preferred form of the invention;

FIGURE 2 is a schematic elevation view of the construction shown in FIGURE 1 looking at one end of the drafting rolls;

FIGURE 3 is an enlarged, partially cut-away view of the lower front drafting roll shown in FIGURES 1 and 2;

FIGURE 4 is a schematic view of the preferred manifolded operation of the invention;

FIGURE 5 shows a modification of the drafting roll shown in FIGURES 1–4; and

FIGURE 6 is a modification of the slot design shown in detail in FIGURE 3.

Referring now to the figures of the drawings, in the illustrative example a linear mass of staple fibers in the form of roving **10** is fed from a supply source (not shown) through a traversing guide trumpet **12** to a drafting arrangement, generally designated as **14**. The drafting arrangement is schematically illustrated for purposes of simplicity of explanation and it will be understood by those skilled in the art that conventional refinements may be added thereto, if desired.

In the illustrated drafting arrangement **14** as shown, three sets of drafting rolls are provided, namely back rolls **16** and **18**; middle rolls **20** and **22**, and front rolls **24** and **26**. As in conventional practice, at least one of each of these sets of rolls is driven, and each succeeding set of rolls is as usual driven at a faster rate than the preceding rolls in order to give the desired degree of drafting of the fibers in the zones between the respective pair of rolls. As is well known in the art, drafting aprons **28** and **30** are employed in conjunction with middle rolls **20** and **22**, respectively, to control the flow of fibers to the front rolls **24** and **26**. The fiber mass is twisted as it leaves the nip N of the front pair of rolls **24** and **26** by the twisting action of a twisting and take-up device, which in this illustrative embodiment takes the form of a conventional ring and traveler twister take-up **32** onto which the drafted and twisted fiber mass is then taken up as yarn Y.

In a drafting arrangement incorporating the present invention, at least one, and preferably the lower front one **26** of the drafting rolls is formed in a novel manner and serves to aid in imparting a unique and highly advantageous lateral pneumatic compacting action on the fiber mass.

Looking now to FIGURES 1–4, one form of the invention is shown in detail. Lower rolls **26** are formed as an integral part of the drive shaft **34**. An annular groove **36** is cut or milled into shaft **34** and a perforated collar member **38** is telescoped over the annular groove **36** to provide a lower drafting roll. An annular series of holes **40** are drilled in the center of milled slots **42** in the collar **38** to provide communication with the annular groove **36**.

A suction conduit manifold **43** connected to a source of negative pressure (not shown) is supported in any suitable manner under the lower front roll **26**. Suction conduit riser **44**, of any suitable material connected to the suction manifold **43** provides communication between the groove **36** and the suction manifold through an aperture **45** in the suction conduit and holes **40** in the collar **38**.

Side walls **46** and **48** of the suction conduit riser **44** abut the collar member **38** on opposite sides of the slots **42** and provide radial bearing surfaces for the rotating collar and also tend to provide a sealing surface so that

the full effect of the suction source will act through the holes **40** to pull the required quantity of ambient air through the perforated collar member **38**. A chamfer **50** is provided on the top edge of the front wall **52** of the riser **44** to collect any ambient lint or fly and to catch the end of the fiber if the yarn should break between the front rolls **24** and **26** and the ring and traveler device **32**. Chamfer **50** in conjunction with the vacuum source will continue to take away any fiber forwarded from the front rolls until such time that the break in the fiber is repaired.

Looking now at FIGURE 4 the suction manifold **43** is shown in operative relationship with a plurality of lower front rolls **26**. The number of such rolls in operative relationship with the suction manifold **43** is optional and does not constitute a part of the invention. Conduit **54** is connected to the source of negative pressure (not shown).

Preferably both the trumpet member **12** and the lower front rolls **26** are traversed to evenly distribute the wear on the front and back rolls. Schematically shown, the trumpet bar **56** and the shaft **34** are connected together by a cross bar **58** which is reciprocally driven by an eccentric crank arrangement **60**. The particular traversing arrangement is only schematic and does not form part of the invention since any suitable traversing mechanism can be substituted. The extent of traverse and the rate of traverse is within the judgment of one skilled in the art except that it is preferred that the front roll traverse be so limited that the slots **42** remain within the confines of the walls **46** and **48** of the suction conduit takeoffs **44**.

In the operation of the illustrative embodiment of FIGURES 1–4 the linear mass of staple fibers is passed through the forming trumpet **12** and drafting assembly **14** to the ring and traveler twister take-up **32**. The perforated roll **26** exerts a sucking action on the mass of fibers **10** in the zone immediately preceding, including, and subsequent to the nip N. This sucking action is effective to exert compacting forces on the fiber mass transverse to its direction of travel, thereby tending to compact the fiber mass against the roll surface and to hold the fiber mass on the roll surface in the zone of the holes **40**. The perforated roll **26** is also traveling at a peripheral rate in excess of the mass of fibers **10** approaching this roll from the middle pair of rolls **20** and **22** and accordingly there is linear motion between the perforated roll surface and the fibers lying on the surface of the perforated roll **26** in the zone preceding the nip N. In the zone, the roll **26** is traveling faster than a substantial number of the fibers therein and substantial drafting takes place in this zone.

In addition to the better compacting of the fiber mass by the sucking action exerted on the fibers by the perforated roll **26**, this sucking immediately preceding the nip N tends to effect a straightening of the fibers, particularly a straightening of the leading hooks which normally occur in various masses of staple fibers, including carded sliver, roving, etc. This is a unique and important function of this invention, particularly as applied in a drafting arrangement for the straightening of such leading hooks on the fibers is of considerable importance in the forming of high quality yarn.

The drafted and straightened fibers in the compacted mass are then nipped in sequence in respect to their respective ordered linear position in the fiber group as such fibers successively approach and reach the nip N. The mass of fibers leaving the nip N is twisted by the twisting action of the ring and traveler take-up **32** and proceeds in the form of yarn Y or other desired strandular material to the take-up bobbin B. While a twister take-up is disclosed for illustrative purposes, it will be apparent that a non-twist imparting take-up may be employed, if desired, for the formation and handling of a particular other mass product or intermediate product.

FIGURE 5 shows a modified lower front roll in the form of a perforated collar member **380**. Perforated collar member **380** is similar to collar member **38** except the groove **360** is cut or milled in the collar member **380** rather than in the shaft **34** as shown in FIGURES 1–4.

FIGURE 6 shows a further modification which can be applied to either the preferred embodiment of FIGURES 1–4 or to the modification of FIGURE 5. In FIGURE 6 the elongated slots **420** are hobbed into the perforated collar member rather than being milled. Other ways of forming the slot can be employed, if desired, since the particular way of forming the slot is not within the scope of the invention.

The herein disclosed improved drafting system has many advantages over that previously employed. As an example, the suction action in the vicinity of the nip N tends to reduce the amount of fly formed as a result of the normally substantial drafting action which takes place between the middle and front pairs of rolls. Also, as an important result of the partial vacuum that exists in the approach areas to the nip N of the rolls, the fibers approaching the nip N do not tend to spread out laterally as they approach the nip as they do in conventional drafting arrangements at high speeds due to the normal positive pressure air pocket and consequently laterally outward air movement in the nip approach zone. On the contrary, the partial vacuum in the approach area to the nip N enables the fibers to come into and maintain closer lateral relationship under the compacting action exerted thereon by the air stream entering the slots **42** and **420**.

Another advantage of the herein disclosed invention is that the smooth unmachined area between the slots in the collar members in cooperation with the slots provide a gear type surface which physically grabs the fibers, compacts them due to the suction effect and releases them after they are supplied to the nip N.

Further, our new and improved suction drafting arrangement is not prone to clog with fibers like a system such as shown in U.S. Patent 3,090,081, supra. It is obvious, since the suction source is below the perforated lower roll, that any fibers which are pulled into the roll through the apertures which are exposed to the ambient air pressure will be automatically pulled out of the roll when that portion of the roll rotates to a position when the inner surface of the roll is in direct communication with the suction source thereby pulling such collected fibers from within the interior of the roll through the particular apertures and directed to waste through the suction system. Furthermore, our new and improved suction manifold arrangement not only provides a system which can be readily adapted to existing systems employing a multiplicity of rolls on one machine but also provides suction take-offs which perform the triple function of providing suction pressure to the perforated roll, provides a close seal, and acts as a radial bearing for support of the drafting roll and drive shaft.

Although we have described in detail the preferred embodiments of our invention we contemplate that many changes may be made without departing from the scope or spirit of our invention, and we desire to be limited only by the claims.

That which is claimed is:

**1.** Textile drafting apparatus comprising: a plurality of drafting rolls including a pair of rolls in nip forming engagement, one roll of said pair of rolls having a cavity therein, means forming a plurality of apertures in the periphery of said one roll of said pair of rolls, said apertures communicating with said cavity, said pair of rolls being the fiber discharge end of said drafting apparatus and means external of and supporting said one roll of said pair of rolls and connected to a negative fluid pressure to pull air into a portion of said apertures, through said cavity, and out another portion of said apertures.

**2.** The structure of claim **1** wherein a plurality of elongated slots are provided in said one roll of said pair of rolls, said apertures being located in said slots.

3. The structure of claim 2 wherein the major axis of said elongated slots is substantially parallel to the axis of rotation of said one roll of said pair of rolls.

4. In a textile drafting apparatus having a plurality of drafting rolls, one of said rolls comprising a shaft member, a collar member mounted on said shaft member, means forming a plurality of apertures in the periphery of said collar member, an annular groove in the inner diameter of said collar member forming a cavity in communication with said apertures, and means external of said one roll and connected to a negative fluid pressure source to pull air into a portion of said apertures, through said cavity, and out another portion of said apertures.

5. Textile drafting apparatus comprising: a first drafting roll, means forming a plurality of apertures in said first drafting roll, said first drafting roll having a cavity therein, said apertures communicating with said cavity, a second roll in peripheral engagement with said first drafting roll, means supplying fiber to be drafted between said rolls, suction conduit means external of and adjacent to said first drafting roll, conduit means connecting a first portion of said apertures to said suction conduit means, means connecting said suction conduit means to a source of negative pressure to draw air through a second portion of said apertures, through said cavity and into said conduit means through said first portion of said apertures, take-up means to take up the fiber as it passes through said first and second rolls, said means connecting said first portion of said apertures to said suction conduit means having a wall portion spaced from said first roll whereby the fiber from between said first and second rolls will be drawn into said suction conduit means through said space between said wall portion and said first roll if said fiber should be disengaged from said take-up means.

6. Textile drafting apparatus comprising: a first drafting roll, means forming a plurality of apertures in said first drafting roll, said first drafting roll having a cavity therein, said apertures communicating with said cavity, a second roll in peripheral engagement with said first drafting roll, means supplying fiber to be drafted between said rolls, suction conduit means external of and adjacent to said first drafting roll, conduit means connecting a first portion of said apertures to said suction conduit means, means connecting said suction conduit means to a source of negative pressure to draw air through a second portion of said apertures, through said cavity and into said conduit means through said first portion of said apertures, said first roll having a plurality of elongated slots therein, said apertures being located in said slots, said means connecting said first portion of said apertures to said suction conduit means abutting said first roll on both sides of said elongated slots.

7. The structure of claim 6 wherein said means connecting said suction conduit means to said first portion of said apertures is located below said first roll and provides a radial bearing support for said first roll.

8. Textile drafting apparatus comprising: a rotating shaft member, a collar member fixed to said shaft member and rotating therewith, means forming an annular cavity between said shaft member and said collar member, said collar member having a plurality of apertures therein communicating with said cavity, a roll member in peripheral engagement with said collar member, means supplying fiber to be drafted between said collar member and said roll member, take-up means receiving fiber from between said collar member and said roll member, means external of and in supporting relation to said collar member and in fluid communication with said apertures and a source of negative fluid pressure source to pull air into a portion of said apertures, through said cavity, and out another portion of said apertures, and said collar member has a plurality of elongated slots therein with said apertures being in said slots.

9. The structure of claim 8 wherein the axis of said



elongated slots is substantially parallel to the axis of rotation of said collar member.

10. The structure of claim 9 wherein said means in fluid communication with a negative fluid pressure source is a suction conduit, said suction conduit having a take-off member abutting said collar member and providing fluid communication between said apertures and said suction conduit.

11. The structure of claim 10 wherein said take-off member is under said collar member and abuts said collar member on both sides of the major axis of said slots thereby providing a bearing surface for said collar member.

12. The structure of claim 11 wherein said take-off member has at least one wall member spaced from said collar member to draw said fiber into said suction conduit if said fiber being supplied from between said collar member and said roll to said take-up member should break.

13. The structure of claim 12 wherein said shaft member has a plurality of collar members and roll members operatively associated therewith, each of said collar members having a takeoff operably associated therewith, all of said take-off members being connected to a said suction conduit.

14. The structure of claim 13 wherein a fiber supplying means is provided for each collar member and roll member, all of said fiber supplying means and said collar members and roll members being operably associated together, means traversing said fiber supplying means and said collar members and roll members in a predetermined relationship.

15. The structure of claim 14 wherein the traverse of said collar member is so limited that said elongated slots are within the confines of said suction conduit take-off member.

16. In a textile drafting apparatus having a plurality of drafting rolls including a pair of rolls in nip forming engagement, a shaft member, one roll of said pair of rolls comprising a collar member mounted on said shaft member, means forming a plurality of apertures in the periphery of said collar member, means forming a cavity in said one roll of said pair of rolls between said collar member and said shaft member, said apertures communicating with said cavity, and means external of and supporting said one roll of said pair of rolls and connected to a negative fluid pressure source to pull air into a portion of said apertures, through said cavity, and out another portion of said apertures.

17. The structure of claim 16 wherein said means forming said cavity is an annular groove formed in said shaft member.

18. Textile drafting apparatus comprising: a first drafting roll, means forming a plurality of apertures in said first drafting roll, said first drafting roll having a cavity therein, said apertures communicating with said cavity, a second roll in peripheral engagement with said first drafting roll, means supplying fiber to be drafted between said rolls, suction conduit means external of and supporting said first roll, conduit means connecting a first portion of apertures to said suction conduit means, and means connecting said suction conduit to a source of negative pressure to draw air through a second portion of said apertures, through said cavity, and into said suction conduit means through said first portion of said apertures.

19. Textile drafting apparatus comprising: a rotating shaft member, a collar member fixed to said shaft member and rotating therewith, means forming an annular cavity between said shaft member and said collar member, said collar member having a plurality of apertures therein communicating with said cavity, a roll member in peripheral engagement with said collar member, means supplying fiber to be drafted between said collar member and said roll member, takeup means receiving fiber from between said collar member and said roll member, and means external of and in supporting relation to said

collar member and in fluid communication with said apertures and a source of negative fluid pressure source to pull air into a portion of said apertures, through said cavity, and out another portion of said apertures.

**20.** Textile drafting apparatus comprising: a plurality of drafting rolls including a pair of rolls in nip forming engagement, means to rotate said pair of rolls, means supplying fiber to the nip of said pair of rolls, one roll of said pair of rolls having a cavity therein, said one roll having a narrow annular band of small apertures therein in communication with said cavity, said apertures being in a plane substantially perpendicular to the axis of rotation of said one roll and suction means external of, closely adjacent to, and confining said narrow annular band of small apertures to pull air into a first portion of said



apertures, through said cavity, out another portion of said apertures to compact the fibers being supplied to the nip of said pair of rolls and to clean fibers out of said first portion of said apertures when said first portion of said apertures is rotated to said suction means.

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