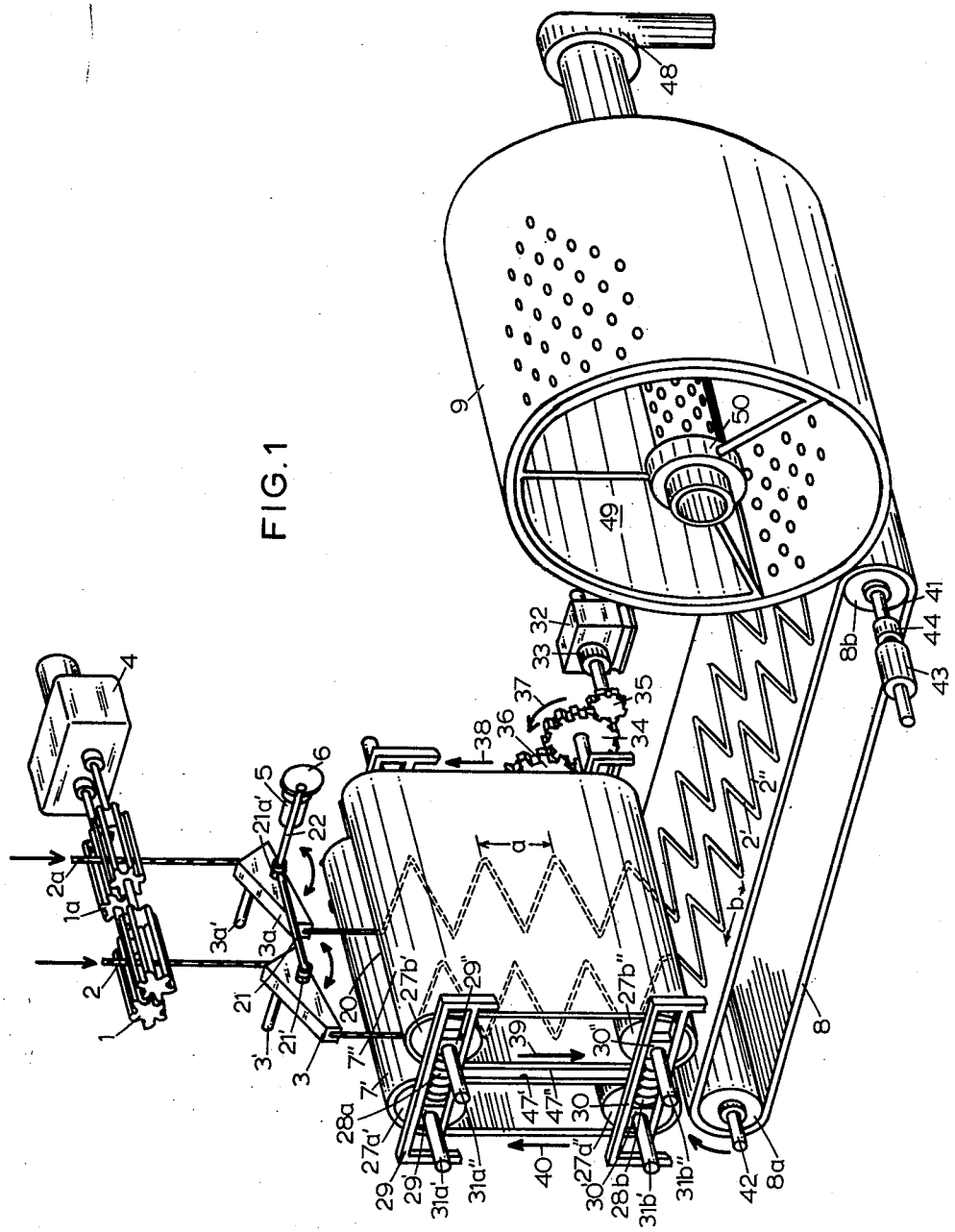
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APPARATUS FOR ORIENTING TEXTILE BANDS

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FIG. 1



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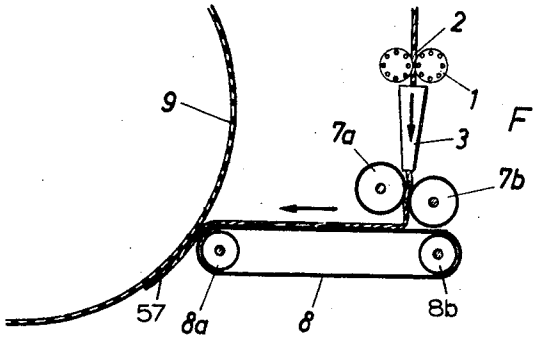


FIG. 2

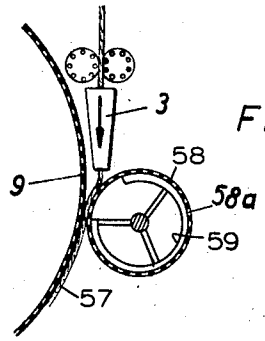


FIG. 3

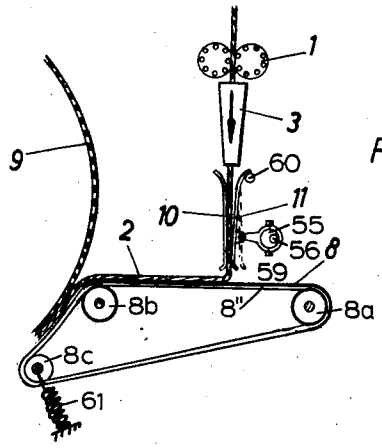


FIG. 4

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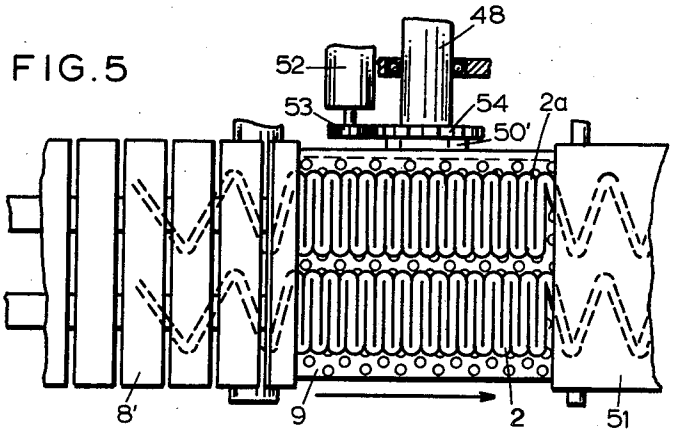
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FIG.5



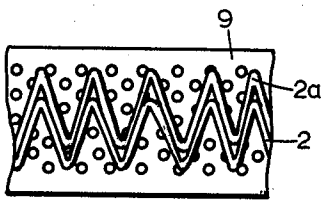


FIG.6

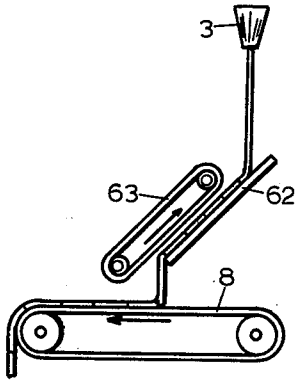


FIG.7

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3,112,054

APPARATUS FOR ORIENTING TEXTILE BANDS

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Claims priority, application Germany Feb. 7, 1961
19 Claims. (Cl. 226—95)

My present invention relates to apparatus for orienting textile filaments and the like and, more particularly, to apparatus for handling loosely coherent ribbons of fibrous material.

In the manufacture of textile yarns from fibrous materials such as cotton and wool, the fibrous mass, separated from solid foreign matter and, in some cases, washed or treated with a liquid, is carded to produce a web of loosely coherent fibers. The web is generally subdivided into ribbons or slivers for further handling in slubbing frames whence the sliver, now termed a "roving," is passed through the initial and subsequent combing frames wherein the fibers are straightened. The roving treated in the combing frames may be somewhat wet, depending upon the circumstances, and from these frames is sent to the spinning apparatus wherein, usually in a dry or only slightly damp state, it is twisted to increase the coherence of the fibers and is spun into yarn. Between the initial carding stage and the spinning stage, and usually before and/or after introduction to the slubbing frames, the sliver or roving of loosely coherent fibrous material, which for convenience shall be termed herein a "ribbon," is frequently coiled in a sliver can for convenience in handling. During the coiling, and at other stages in the treatment of the ribbon, the latter may be condensed by pressure rollers or the like but care must be taken not to stretch the ribbon unduly so as to cause its parting.

It is an object of the present invention to provide an apparatus for orienting fibrous ribbons of the aforementioned type adapted to be incorporated in a yarn-producing assembly in place of or in series with a sliver-coiling device.

A further object of this invention is to provide an apparatus for orienting textile bands, ribbons, slivers, rovings, loosely or tightly spun yarn and similar flexible elongated members in convenient manner for further treatment, e.g., drying.

Still another object of the invention is the provision of an apparatus for feeding flexible elongated members to a drying apparatus including one or more perforated drums (e.g., of the type disclosed in my copending application Ser. No. 142,561, filed Oct. 3, 1961) with a minimum of stretching of the members.

In its broad aspects my invention provides conveyor means in combination with a reciprocating feeder oscillating in a direction generally transverse to the conveyor motion for delivering a ribbon (as hereinabove defined) to the conveyor inlet, the rate of oscillation of the feeder and the conveyor speed being so selected that the ribbon forms an undulating strip with more or less closely spaced turns, but free from overlapping on the surface of the conveyor means. The latter may include, for example, a rotating drum onto whose periphery the oncoming undulating strip is temporarily held by suction, the pressure of a co-operating roller, apron or band, and/or similar means.

In accordance with a more particular feature of this invention I divide the conveyor means into a succession of individual conveyor stages of progressively decreasing surface speeds arranged in cascade for decreasing, in one or more steps, the spacing of the undulations until on the last conveyor (which may be the aforementioned drying drum) the transverse passes of the ribbon are nearly

parallel and contiguous to one another. With two or more ribbons deposited alongside one another, however, it is also possible to arrange them in interleaved zig-zag formations, again with substantial contiguity and consequent full utilization of the conveyor surface in the last stage.

The term "conveyor" is broadly intended to encompass means for advancing an object by positive entrainment or by gravity. Thus, the first-stage conveyor may be a chute delivering the ribbon or ribbons over a vertical or sloping guiding surface to the second-stage conveyor which, in an advantageous embodiment, has a substantially horizontal receiving surface undershooting the drum-shaped third-stage conveyor. The chute can be defined by a single inclined surface or by a pair of closely juxtaposed surfaces formed by positively acting transport elements, such as moving bands or rollers, or simply by plates; combinations thereof are, of course, also possible. If the chute lacks a transport element, i.e., consists of one or two plates, it will be desirable to vibrate it in order to provide a controlled rate of descent of the undulating ribbon or ribbons therewithin. In such case the operating speed of this conveyor stage will depend on the slope, the rate and intensity of the vibrations, and (in a two-plate chute) the mutual separation of the plates which may slightly converge toward the bottom.

The above and other objects, features and advantages of the present invention will become more readily apparent from the following description, reference being made to the accompanying drawing in which:

FIG. 1 is a perspective view, partly in section, of an apparatus for orienting textile ribbons according to the invention;

FIG. 2 is a fragmentary cross-sectional view of an apparatus constituting another embodiment of the invention;

FIGS. 3 and 4 are views similar to FIG. 2 illustrating further embodiments of the invention;

FIG. 5 is a bottom-plan view of a drying drum showing the oriented ribbons thereon;

FIG. 6 is a plan view of a conveyor surface with interleaved ribbons; and

FIG. 7 is another view similar to FIG. 2, illustrating yet a further modification.

In FIG. 1 of the drawing I show an apparatus according to the invention, designed for orienting textile-fiber ribbons, which may be employed in place of conventional sliver-coiling apparatus and sliver cans or which may be interposed between the processing elements of the initial stages of a yarn-producing plant, e.g. between the carding engine and the slubbing frames, along the path of the roving, between the slubbing frames and the combing frames, between the latter and the spinning machine, and at other intermediate locations in the yarn-processing chain whereat a temporary storage or reduction in the feeding speed of the ribbon must be effected. The apparatus comprises feeding means, advantageously including a pair of meshing lath-type feed rollers **1**, **1***a* which positively engage each of the slivers **2**, **2***a* drawn thereby from a sliver can or a previous stage in the yarn-producing chain, driven by a motor **4**. The sliver is fed downwardly into a pair of funnel-shaped guide elements **3**, **3***a* pivotally mounted upon rods **3'**, **3***a'* at spaced locations along the mouth of a chute **20** formed by a pair of vertically disposed closely spaced first-stage conveyor belts **7'**, **7''**. Guide elements **3**, **3***a* are interconnected by a bar **21** articulated to them at its extremities **21'** and **21***a'* while another bar **22** connects the guide elements with an eccentric **6** which is rotated by a motor **5**. The guide elements thus swing periodically in the plane of the chute **20** generally transversely to the direction of displacement of the conveyor belts **7'**, **7''** whose supporting rollers **27***a'*, **27***b'* and **27***a''*, **27***b''* are biased inwardly, i.e.

spring-loaded by a set of tension spring 28*a*, 28*b* (only two of which are shown) secured to respective journal boxes 29′, 29″ and 30′, 30″ at the extremities of the shafts 31*a*′, 31*b*′ and 31*a*″, 31*b*″ of the supporting rollers. The journal boxes 29′, 29″ and 30′, 30″ are horizontally slidable in rails 29, 30 which in turn are held in suitable brackets (not shown) with freedom of relative vertical adjustment for the purpose of retensioning the belts 7′, 7″.

A motor 32, equipped with a reduction-gear assembly 33, drives a pinion 35 in mesh with a gear 34 keyed to the shaft 31*b*″. Another gear 36, keyed to shaft 31*b*′ of conveyor belt 7′, meshes with gear 34 so that operation of the motor 32 to rotate gear 34 in the counterclockwise direction (arrow 37) drives the belt 7″ in the direction of arrows 38, 39 while the counter-rotating gear 36 drives its belt 7′ in the direction of arrows 39, 40. The juxtaposed surfaces 47′, 47″ are thus simultaneously displaced in the direction of arrow 39 and clamp between them the undulating strands of the slivers 2, 2*a* while conducting these strands downwardly with a pitch *a* determined by the relative speeds of motors 5 and 32. The surface speed of the belts 7′, 7″ must be less than the feeding speed of ribbons 2, 2*a* so as to prevent distension thereof but should be sufficient to avoid the superimposition of successive strips of sliver upon successive passes of the feeding guides 3, 3*a*. According to requirements, the spacing between adjacent strands of sliver in two or more zig-zag rows, as shown in FIG. 1, may be varied to provide a selected degree of interleaving thereof.

The bands 7′, 7″ deposit the oriented zig-zag strands 2, 2*a* upon a receiving surface formed by the horizontally disposed second-stage conveyor belt 8 whose supporting rollers 8*a*, 8*b* are carried by shafts 41, 42, the former of which is driven by a motor 43 via the usual reduction gearing 44. Advantageously, the surface speed of belt 8 is somewhat less than that of belts 7′, 7″ so that the pitch *b* of the strands upon belt 8 is less than pitch *a* and the connected strips 2′, 2″ of the sliver laid down upon successive passes of the guide element 3 are less divergent from each other on the belt 8 than between the bands 7′, 7″.

From the belt 8 the oriented sliver 2, 2*a* is fed a third-stage conveyor in the form of a drying device which may be of the type disclosed in my above-identified copending application. While a conveyor-type drier having a perforated band may also be used, I prefer to dry the sliver, when such drying is necessary, upon perforated drums such as those illustrated somewhat diagrammatically at 9 in FIG. 1. Drum 9, which may be one of a plurality of alternately undershot and overshot drums arranged in cascade as shown in the copending application, is rotated relatively slowly in the counterclockwise direction so that the undulations of the strands are drawn closer together, preferably into a compact orientation wherein the successive passes 2′, 2″ are virtually parallel to one another and substantially contiguous with or without interleaving (see FIGS. 5 and 6). Perforated drum 9 is connected to a source 48 of reduced pressure to that the resulting partial vacuum draws the accordion-pleated strands arrayed on the underside of the drum against the latter. The suction is confined to the working portion of the lower drum surface by a fixed shield 49 connected to the stationary portion of a bearing 50 within which the drum is journaled; the forward wall of the drum has been removed in FIG. 1. The air drawn into the drum may be heated and dehumidified, as disclosed in my copending application mentioned above, to facilitate the drying of the sliver.

While generally it is desirable that the chute-forming surfaces of the apparatus between which the sliver is compressed to a greater or lesser extent (i.e., belts 7′, 7″ in FIG. 1) be highly polished, in order to prevent snagging with resulting loop formation, the receiving surface 8 may be unpolished and even discontinuous or perforated to facilitate drying, e.g., formed by a lath-type conveyor belt 8′ whose underside is shown in FIG. 5. The latter view also shows the underside of the undershot drum 9 against which the accordion-pleated strands 2, 2*a* are drawn by suction and from which the strands are transferred to an additional conveyor belt 51 for further processing. The drum 9, journaled at 50 on the suction pipe 48 which constitutes the axle of the drum, is driven by a motor 52 via a pinion 53 and a ring gear 54 secured to the drum. Whereas FIG. 5 shows the undulating strips 2 and 2*a* to be separated along the drum surface, they can also be more or less closely interleaved in chevron fashion, as illustrated in FIG. 6.

In order to obtain a satisfactory folding or accordion-pleating of the sliver so that successive passes are oriented parallel to each other and in longitudinal contact without superimposition, a progressive ratio between the surface speeds of the first-stage conveyor 7′, 7″, the second-stage conveyor 8 and the drum 9 should be maintained. Thus it is possible, by using conventional speed-control techniques, to employ, for example, servomotors as the driving elements 32, 43, 52 or to provide the vertical belts 7′, 7″, the horizontal belt 8 and the drum 9 with a common drive and individual variable-speed transmissions. I have found that for the usual slivers or rovings the peripheral speeds of the drum 9, the horizontal conveyor belt 8 and the vertical belts 7′, 7″ have an optimum ratio in the approximate range of 1 to 3 to about 4 or 5. Since space considerations are always a factor in the manufacture of yarn, I prefer to have the belts 7′, 7″ extend perpendicularly to the receiving surface 8 although effective operation may also be achieved with the belts 7′, 7″ inclined at a lesser angle to the latter.

In FIG. 2 I show an arrangement wherein the chute-forming belts are replaced by a pair of clamping or calendering rollers 7*a* and 7*b*, which also may be spring-biased toward each other and driven in the manner of belts 7′, 7″. The axes of rotation of rollers 7*a* and 7*b* extend transversely to the direction of displacement of the receiving belt 8 and, advantageously, lie in a plane which slightly diverges from the upper surface of the belt 8 in the direction of its motion so that at least the roller 7*a* closer to the drum 9 is elevated above this surface with sufficient clearance to permit unhindered passage of the sliver reposing on the belt. Thus, the sliver 2, which is fed by the reciprocating guide 3 into the slot formed between the rollers 7*a* and 7*b*, is advanced downwardly onto the belt 8 in the direction of the drying drum in the same zig-zag conformation as has been described with respect to the embodiment of FIG. 1. It will also be apparent that one of the rollers 7*a*, 7*b* may be replaced by a plate inclined to the belt 8 in the direction of drum 9 and adapted to compress the sliver between it and the remaining roller, in essentially the same manner as has been shown for the drum 9 which is yieldably engaged by an apron 57 bearing upon it in the region of roller 8*a*.

According to another embodiment of the invention, illustrated in FIG. 3, the sliver is delivered by the reciprocating guide element 3 to a first-stage conveyor constituted by an over-shot roller 58, the sliver being then transferred to a more slowly rotating second-stage conveyor, i.e. the undershot drying drum 9 turning in the opposite direction (i.e. clockwise) at a location at which this drum is yieldably contacted by an apron 57 as in the preceding embodiment. Roller 58, also contacted by the apron, is shown provided with peripheral perforations 58*a* and with a stationary internal shield 59 whereby localized suction may be exerted upon the sliver ahead of the point of transfer to apron 57 in the manner previously described for the drum 9.

In FIG. 4 I show yet another embodiment of the invention wherein the first-stage conveyor is a chute comprising a pair of juxtaposed plates 10, 11 underneath the feeding means 1, 3. A motor 55 is coupled by an eccentric 56 and a link 59 to the chute 10, 11 for vibrating it, thereby expediting the descent of the sliver 2 at a con-

trolled rate. The chute is shown oscillatable about a hinge pin **60**. Moreover, in this embodiment, the second-stage conveyor is formed by a belt **8''** which is led around rollers **8***a*, **8***b* and a further roller **8***c* so positioned that a section of the belt between rollers **8***b* and **8***c* (at least one of which may be spring-loaded as indicated at **61**) hugs the drum **9** over a predetermined arcuate contact zone in lieu of the apron **57** of FIGS. 2 and 3.

The chute **10**, **11** may also be inclined rather than vertical, e.g., as shown in FIG. 7 wherein, however, only a single plate **62** (which may be vibrated in the aforedescribed manner) has been provided. In order to prevent the doubling of the fiber layer, an upwardly running leg of an auxilary conveyor **63** is positioned so close to the sliver-bearing surface of plate **62** as to pick up overhanging ribbon sections and to return them to their proper locations whereby the single-layer pattern is restored and raveling of the fibers is prevented.

It is to be understood that the feeding of the slivers to the first-stage conveyor is not limited to reciprocating funnels **3**, **3***a* but that the desired undulatory deployment may also be achieved by equivalent mechanical, pneumatic or other means. Furthermore, the receiving surface of the second-stage conveyor **8**, **8'**, **8''** need not always be horizontal and the relative and absolute positions of other elements of the apparatus, as well as their shapes, may likewise be altered. These and other modifications, variations and substitutions of elements, including combinations of compatible features from different embodiments, will be apparent to persons skilled in the art and are deemed included within the spirit and scope of the invention as claimed.

I claim.

1. An apparatus for orienting a filamentary material, comprising continuously movable conveyor means, feed means for said material adjacent said conveyor means, said feed means being oscillatable in a direction generally transverse to the motion of said conveyor means for depositing at least one ribbon of said material as an undulating strip upon a receiving surface of said conveyor means, the surface speed of said conveyor means and the rate of oscillation of said feed means being so related as to maintain the undulations of said strip on said surface closely spaced from one another, and a rotating drum with a perforated periphery and a reduced internal pressure cooperating with said receiving surface for removing the undulate strip therefrom.

2. An apparatus for orienting a filamentary material, comprising feed means for said material, and a plurality of conveyor stages for said material in cascade with one another, said feed means being positioned adjacent the first one of said stages and oscillatable in a direction generally transverse to the conveyor motion thereof for delivering at least one ribbon of said material as an undulating strip to a guiding surface of said first stage, said first conveyor stage having an operating speed higher than that of a subsequent conveyor stage whereby the undulations of said strip are compacted upon transfer to said subsequent stage.

3. An apparatus according to claim 2 wherein said first stage comprises a chute having an inlet adjacent said feed means and an outlet above a generally horizontal receiving surface of said subsequent stage.

4. An apparatus according to claim 3 wherein said chute comprises at least one continuously movable transport element with a descending motion along said guiding surface.

5. An apparatus according to claim 4 wherein said transport element is a conveyor belt.

6. An apparatus according to claim 4 wherein said transport element is a roller.

7. An apparatus according to claim 3 wherein said chute comprises at least one plate member forming said guiding surface.

8. An apparatus according to claim 7, further comprising mechanism for continuously vibrating said plate member.

9. An apparatus according to claim 7 wherein said plate member slopes downwardly toward said subsequent stage, further comprising auxiliary conveyor means with an ascending motion adjacent said guiding surface for upwardly entraining overhanging portions of said ribbon.

10. An apparatus according to claim 2 wherein said first stage comprises a pair of co-acting rollers positioned next to each other above a generally horizontal receiving surface of said subsequent stage.

11. An apparatus according to claim 10 wherein one of said rollers is positioned higher than the other above said receiving surface, said one roller being located forwardly of the other in the direction of advance of said subsequent stage.

12. An apparatus according to claim 2 wherein the last one of said stages is a rotating drum.

13. An apparatus according to claim 12 wherein the stage immediately preceding said drum is positioned to deliver said strip to a lower peripheral surface of said drum.

14. An apparatus according to claim 13 wherein said drum is provided with internal suction means and with peripheral perforations for maintaining said strip in contact with the underside of said drum.

15. An apparatus according to claim 13 wherein said last stage further includes belt means hugging an arcuate zone of said lower peripheral surface adjacent said immediately preceding stage for maintaining said strip in contact with the underside of said drum.

16. An apparatus according to claim 13 wherein said immediately preceding stage comprises a conveyor belt with a generally horizontal strip-supporting surface terminating at said lower peripheral surface.

17. An apparatus according to claim 13 wherein said immediately preceding stage comprises an overshot roller rotating in the reverse sense of said drum.

18. An apparatus according to claim 17 wherein said roller is provided with peripheral perforations and with internal suction means effective over a limited area thereof for maintaining said strip in contact with an upper peripheral portion of said roller prior to transfer to said drum.

19. An apparatus for orienting a filamentary material, comprising at least three cascaded conveyor stages with progressively reduced operating speeds, and feed means adjacent the first of said stages oscillatable in a direction generally transverse to the conveyor motion thereof for delivering to said first stage a ribbon of said material in the form of an undulating strip whose undulations are progressively compacted upon transfer from any of said stages to the next one as a result of said progressively reduced operating speeds of said conveyor stages.

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