



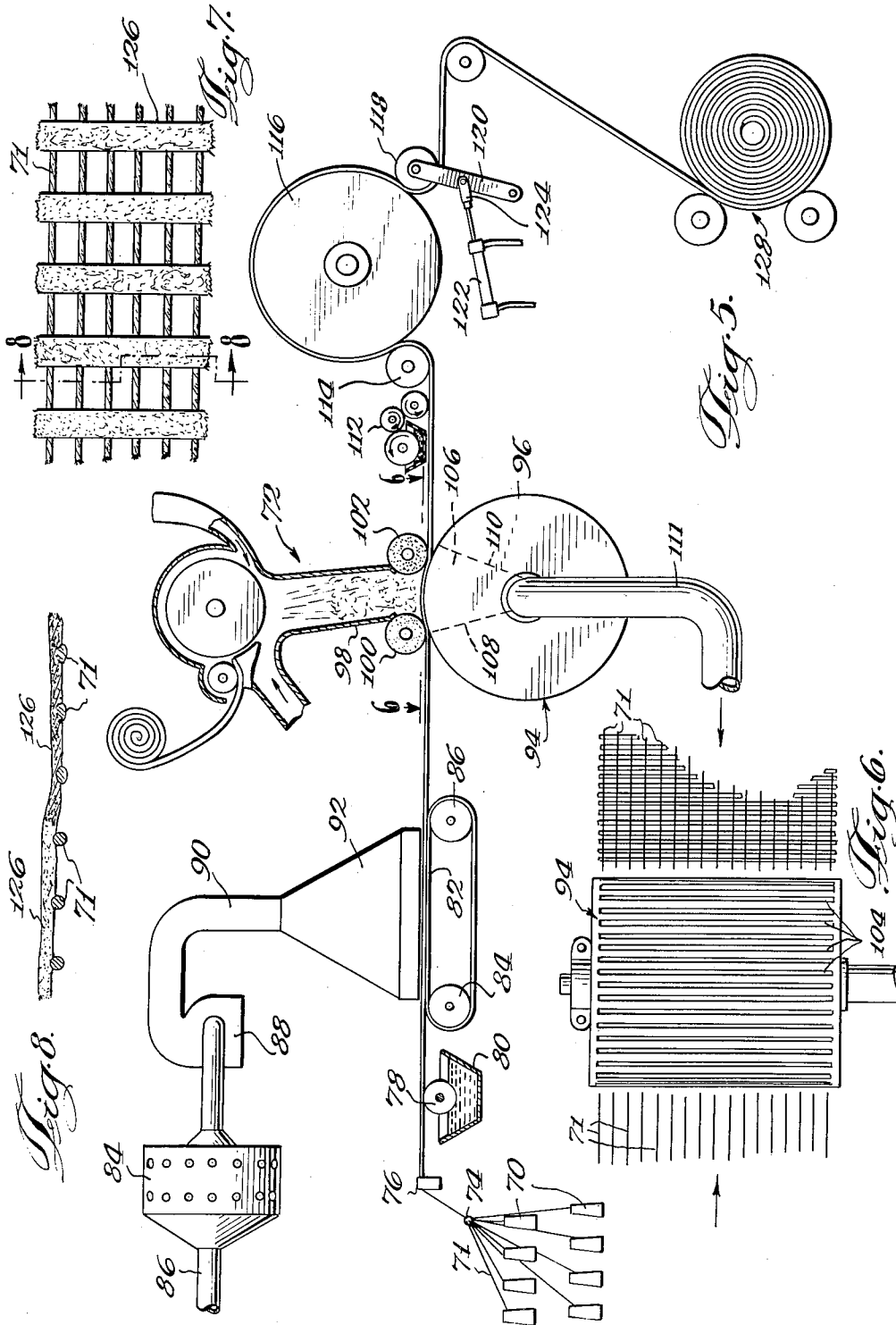
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APPARATUS AND METHOD FOR THE MANUFACTURE  
OF CELLULOSIC PRODUCTS

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## APPARATUS AND METHOD FOR THE MANUFACTURE OF CELLULOSIC PRODUCTS

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This invention relates to an improved method of making a non-woven web-like fabric, to an improved apparatus for carrying out the method, and to the resulting fabric.

A major object of the invention is to provide improved techniques for the production of non-woven fabric at relatively high speeds.

A more specific object is to provide improved techniques for the formation by air-laying, and the subsequent cross-laying, densifying, and interbonding of unspun strands formed of haphazardly disposed fibers in a manner that the strands serve both as warp and woof elements of an improved fabric-like fibrous material.

A further object is to provide apparatus for the continuous production of a multiply apertured fabric of cellulosic or other fibers at operating speeds sufficiently high to insure low cost production of a quality product.

A still further object is to provide apparatus for the continuous formation of fibrous strands of loosely and haphazardly assembled fibers as unspun woof strands which are continuously laid, as formed, across a continuously moving net-like backing material, or across a plurality of moving pre-formed warp threads, and then condensed and interbonded to form a soft, light-weight and highly porous fabric.

A still further object is to provide an improved low cost light-weight fabric of the non-woven type, produced by the method of forming and the apparatus herein described, and presenting an attractive appearance while having sufficient inherent strength in both the cross direction and in the machine direction, plus the required porosity and softness for use as an ideal wrapper for sanitary napkins, surgical dressings, and the like.

Other objects and advantages will become apparent to persons skilled in the art, as will various modifications thereof without departure from the inventive principles as defined in the appended claims.

In the drawings:

FIG. 1 is a side elevational view, partially in broken section, of web forming apparatus with the invention incorporated therein,

FIG. 2 is a plan view taken along line 2—2 of FIG. 1 with portions of the cylinder enveloping screens broken away to show the construction of those rolls,

FIG. 3 is a fragmentary plan view of fabric formed by the method and apparatus taught herein,

FIG. 4 is a fragmentary section taken along line 4—4 of FIG. 3,

FIG. 5 is a side elevational view, partially in section, of web forming apparatus with an alternate embodiment of the invention incorporated therein,

FIG. 6 is a plan view taken along line 6—6, FIG. 5, with threads and fabric broken away over the forming cylinder for convenience of illustration,

FIG. 7 is a fragmentary plan view of a fabric produced by the apparatus of FIG. 5, and

FIG. 8 is a section taken along line 8—8 of FIG. 7.

The current demand for a very low cost fabric material particularly adapted for use as a sanitary napkin wrapper has resulted in intense competition in that field. Such a wrapper must have substantial strength in the machine direction, and a lesser but acceptable amount of strength in the cross direction. It must also be soft and pliable while offering substantial porosity to fluids, but

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preferably should be of attractive appearance for sales appeal of the product to which it is applied. While some known types of fabrics may meet many of these requirements, the cost thereof is considered to be quite high for use, for example, as a sanitary napkin wrapper. To be commercially acceptable, cost-wise, for the above purpose, such a fabric must be produced at a cost of not more than a few cents per square yard. The apparatus illustrated in the drawings operates at satisfactory speeds to produce, at a cost within the acceptable range, an improved fabric which has proved particularly effective as a sanitary napkin wrapper.

The inventive concept as incorporated in the apparatus first described below employs an improved method of forming a highly porous fabric consisting of a plurality of spaced warp strands of low density, each of which is continuously formed of haphazardly disposed non-woven fibers, with a plurality of spaced fibrous low density woof strands formed in like manner and cross-laid onto the elongate strands, with the resultant loosely assembled webbing then compressed to increase the density of the strands either with or without an adhesive being applied thereto for bonding of the strands together in the area of the crossings and retention of the fibers in the strands to provide a soft and pliable fabric particularly adapted for a wrapper for sanitary napkins, bandages and the like. The fibers may be either natural or synthetic fibers, or mixtures thereof. The application of adhesive to the fibers after strand formation may be eliminated by inclusion of a certain percentage of fibers of the thermo-plastic type and subjecting the strands, after formation, to sufficient heat to bond the fibers therein together to render the strands form-sustaining.

Referring to FIG. 1, a pair of suction type forming cylinders 10 and 12 are mounted on axes 11 and 13 for rotation in opposite directions by driving means, not shown. Fluid conduits 15 and 17 lead from the interior of suction boxes positioned within cylinders 10 and 12, later described, to suitable suction fans, not shown, for the continuous evacuation of upper portions of the cylinder interiors in a known manner.

Positioned above each cylinder 10 and 12 is a picker-type fiber laying device, 14 and 16 respectively, each of which operates in a known manner to divellicate fibrous stock and entrain the resulting fibers in a pneumatic stream. Air-laying devices of the general type shown at 14 and 16 are more fully disclosed in U.S. Patents 2,719,339 and 2,726,423, owned by the assignee of this application, the detailed construction of the devices forming no part of the present invention.

Referring to unit 14, unit 16 being a mirror image thereof, stock from a cotton lap roll 18 is drawn between feed roll 20 and a feed plate 22 for exposure to a plurality of needles, not shown, fixed to extend radially of the peripheral surface of a picker roll 24 which is driven to rotate counter-clockwise, as shown, at high speed to divellicate the cotton roll stock for entrainment of the individual fibers in an air stream. Roll 24, with some of the fibers attached to and conveyed by the needles, establishes a peripheral air stream in a counter-clockwise direction, the fibers being picked off the roll near the bottom thereof by a clockwise air jet supplied through nozzle 26.

Atmospheric air is drawn into the device through a port 28, with the pressure below roll 24 and throughout a downwardly directed outlet nozzle 30 being maintained below atmospheric pressure by a suction box 32 which extends from a radial wall 34, across nozzle 30, and through the nip between the suction rolls to a radial wall 36 to define an upwardly open sector-shaped enclosure. The individual fibers thus separated from the feed stock, entrained haphazardly in the air stream, are rapidly conveyed toward suction box 32 through outlet nozzle 30

with the result that a large percentage of those fibers are disposed in a patterned configuration conforming to elongate openings in the surface of forming cylinder 10. Cylinders 10 and 12 may, for example, have a plurality of narrow elongate slots through the surface of an otherwise closed circumferential surface, or they may have a screen-like surface, partially blocked out by solid material to define slots above the screen. The cylinders may be constructed in a number of known ways, the details of which form no part of this invention. Cylinder 10 as shown is provided with plural axially spaced circumferentially extending slots 38, FIG. 2, and cylinder 12 is provided with plural slots 40 extending axially of the cylinder, thus the slots in one cylindrical surface are in right angularity to the slots in the other cylindrical surface, although one set of slots may be obliquely disposed in respect to the other set if desired.

As shown in FIG. 1, an endless forming screen 42, also known as a wire, partially encompasses cylinder 10 to be driven thereby through a path having a vertical leg through which the screen travels downwardly, and around an idler 44 in a generally clockwise direction as shown. Roll 12 has a similarly associated screen 46 and idler 48 positioned to define a vertical path portion through which screen 46 also moves downwardly, but in a counter-clockwise direction through its path and in close parallel spaced relation through screen 42 to form a conveyor for a fibrous webbing, the warp and woof strands of which initially are respectively air-laid on the forming screens, the woof strands being cross-laid onto the warp strands in the nip area between cylinders 10 and 12, as described more fully below.

As the fiber entraining air stream from nozzle 30 passes through screen 42 and slots 38 as aided by suction from box 32, most of the fibers entrained therein are deposited on screen 42 in random or haphazard distribution directly above the slots, it being understood that there is no relative movement between the screen and the surface of the cylinder. A few of the fibers initially will pass through both the screen and the slots as they move into the mouth of nozzle 30, but as fibrous deposits very rapidly build up on the screen they prevent further passage of subsequently laid fibers therethrough. As forming cylinder 10 rotates clockwise, the circumferentially extending slots therein move past the nozzle 30, and spaced strand-like deposits quickly form longitudinally of screen 42, due to the rate at which the air entrained fibers are drawn downwardly onto the forming screen. Upon completion of passage through the nozzle mouth these strands, which serve as warp threads, are well formed and move into the nip between counter-rotating cylinders 10 and 12. Adhesive may be applied to the strands after formation and prior to arrival at the nip area, as by a suitable dispenser 43 which preferably is of the roll type as shown.

In a similar manner, a plurality of axially extending fibrous deposits simultaneously are formed on screen 46 as it moves counter-clockwise over cylinder 12, also to move into the nip area, and adhesive may be applied thereto at a corresponding position by applicator 45. The strand-like fibrous deposits formed on screen 46 above roll 12 are shown to be in 90° angularity to the fibrous strands formed on screen 42 about cylinder 10, but as mentioned they may be obliquely or otherwise disposed in respect thereto, such as in a zig-zag pattern, it being merely necessary that the woof strands are cross-laid onto the warp strands. While it is preferred that cylinder 10 be provided with slots confined to a single plane to result in a linear strand formation for maximum strength in the machine direction, a zig-zag or other configuration may also be employed if maximum machine directional strength is not required. The simultaneous counter-rotation of the forming cylinders and the screens driven thereby result in the cross-laying, in the nip area between the rolls, of the fibrous strands so formed on screen 42 cir-

cumferentially of roll 10 onto the axially extending strands similarly formed on screen 46.

The fibers in each strand are pressed together by the screens which are backed by the cylinders upon passage through the nip, hence the density of the fibrous air-laid strands is increased. Maximum pressure is of course applied in those areas of maximum thickness at the crossings, and a plaid-like unitary fabric results, as shown in FIGS. 3 and 4. The fabric may not be form-sustaining as thus formed, since the adhesive, if applied, does not have time to set, but the fabric is not subjected to stretch as it is guided downwardly by the conveyor formed by the vertical legs of screens 42 and 46 which press against the fabric until they gradually diverge at the lower end and the fabric follows screen 46 around idler 48 and onto a second conveyor 50. Belt conveyor 50 travels clockwise between rolls 52 and 54, roll 52 being so positioned below idler roll 48 as to function both as a take-off roll and a compressing roll for the fabric.

The fibrous webbing-like material thus formed by air-laying and condensed between cylinders 10 and 12 and their associated screens and further compacted between rolls 48 and 52 is fed by conveyor 50 to a pick-up roll 56 about which the material is drawn upwardly by a heated drying drum 58, the nip between roll 56 and drum 58 preferably being such to provide still additional compressing of the strand fibers. There is no relative movement between the material and the surface of drum 58. The drum is sufficiently large and is maintained at a suitably high temperature to cause the thermo-plastic fibers or the applied adhesive in the strands to be sufficiently heated during the time interval of movement from the nip between roll 56 and drum 58 to a circumferentially spaced nip between a pressurized calender roll 60 and drum 58 to insure fiber interbonding during the resulting calendering operation between the latter rolls. Roll 60 may be rotatably mounted in a conventional manner to a pivot arm 62, the arm being urged toward drum 58 by a controllable pressure applied by a fluid cylinder 64 having a piston 66 connected to the pivot arm. The calendering operation is thus effected after either the applied adhesive or the thermo-plastic fibers, whichever used, have been heated at a sufficiently high temperature and for a period of time sufficient to insure inter-fiber bonding throughout the strands when subjected to relatively high calendering pressures. The attendant compression of the strand fibers when in that condition results in a smoothing out of the strands at their cross-over areas, since those areas will receive most of the calendering pressure. The fibers, not only at the areas of crossing, but throughout the strands become bonded together as they are pressed together after having received sufficient heat to insure heat sealing between the engaged portions thereof. The material is led from calender roll 60 to a known winder generically designated 68.

While the use of forming wires 42 and 46 in the manner above taught permits handling and the inter-conveyor transfer of light-weight material thus formed before it is rendered form-sustaining, the broad concept of forming both warp and woof strands on a pair of slotted cylinders and cross-laying one on the other in the nip area may be accomplished without use of wires when under conditions which permit withdrawal of the resulting fabric from the outlet side of the nip. A slightly greater fiber loss occurs before sufficient fibers straddle the cylinder slots to permit the strands to be built up, but those fibers may be recovered for later use. The use of wires or screens, while preferred when very light-weight material is produced, may be eliminated when heavier material is formed in the manner taught.

FIG. 5 illustrates alternate apparatus for cross-laying fibrous woof strands formed as above described onto a plurality of pre-formed warp threads which may, for example, be of the twisted type. The warp threads 71 are payed out from a plurality of supply cones 70 or the

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like for continuous movement past an air-laying mechanism 72 which cross-lays haphazardly assembled fibrous woof strands thereon. Plural warp threads 71 from supply cones 70 move through a guide ring 74 to a comb 76 which separates the threads for continuous movement over an adhesive applicator roll 78, fed from a liquid tank 80. The coated threads pass onto a conveyor belt 82 which moves through a path defined by rolls 84 and 86, one of which is driven. The conveyor belt serves as the bottom closure wall of a pneumatic heating system, described below, hence it is unimportant whether there is relative movement between the threads and belt or whether the threads are in contact with the belt. The threads are drawn over the conveyor and through the air-laying device by a heated drum, later described. Applicator roll 78 is continuously rotated by the threads being drawn over the surface thereof to continuously feed liquid adhesive from tank 80 to the threads prior to their movement onto or across conveyor belt 82. As the threads move onto or above belt 82 they are coated with a liquid adhesive which is sufficiently heat dried during passage over the conveyor by apparatus below described to become hardened to the extent of being non-tacky, in which condition the threads are conveyed into and through air-laying device 72.

The heat drying mechanism positioned above the conveyor is conventional, and may comprise a suitable heater coil 84 through which atmospheric air from inlet 86 is drawn by a suction fan 88, the heated air from the exhaust side of fan 88 moving downwardly through a conduit 90 leading to a hood 92 for confined application of a heated air stream to the adhesive coated threads as they are moved on or above conveyor belt 82 past the hood 92 with belt 82 providing a bottom closure for hood 92. The applied heat is of a magnitude in respect to the drying characteristics of the adhesive and the time period of passage of the threads under hood 92 to render the adhesive "tacky" as above mentioned, and in that condition they are drawn into engagement with the upper surface of a suction type forming cylinder 94, as shown in FIG. 6, which is enclosed in an upwardly open housing 96, FIG. 1.

Roll 94 is driven in a clockwise or machine direction in the apparatus of FIG. 1, and at a circumferential speed which is synchronized with the linear speed of the warp threads, hence there is no relative movement between the warp threads and the surface of roll 94 during thread movement past the lower end of the air-laying device 72. Air-laying device 72 may be of the general type above described and shown in FIG. 1, hence its operation requires no further description. Outlet nozzle 98 is, however, of sufficient machine directional dimension to close the gap between a pair of spaced sealing rolls 100 and 102. The peripheral surface of roll 94 is provided with a plurality of axially extending slots 104 as shown in FIG. 6, with the slots extending substantially the length of the roll. Within housing 96 a sector shaped suction box 106 opens upwardly underneath the slotted surface of cylinder 94 with radial walls 108 and 110 thereof defining an opening which is wider in the machine direction than outlet nozzle 98 of device 72. The lower end of suction box 106 connects to an air evacuation conduit 111 which connects to a suitable vacuum pump, not shown.

As the material thus fabricated leaves the forming cylinder 94 and its associated air-laying unit 72, it consists, as shown in FIG. 7, of a plurality of warp threads across which a plurality of strands of haphazardly disposed fibers have been cross-laid, at preferably equal intervals, the strands as shown being several times the width of the threads upon which they are deposited. Some compression of the strand fibers may occur as the material passes under sealing roll 102. Depending upon the ultimate purpose of material thus formed, adhesive roll applicator 112 may optionally be employed to apply adhesive to

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both the fibers of the woof strands and to the warp threads. Interbonding of a portion of those fibers may be desirable, especially if a certain percentage of them are not of the thermo-plastic type which are later to be heat bonded. The material is next drawn around guide roll 114 and applied to the surface of a heated drying drum 116 which rotates at a circumferential speed which determines the linear speed of the material thus formed. Warp threads 71 adhesively engage the surface of drum 116 to permit the drum to draw the threads from their supply cones 70 and through the various components of the apparatus above described.

The material preferably is permitted to ride on the heated drum 116 through a major portion of the circumferential path thereof before removal by a calender roll 118 mounted on a pivot arm 120 and maintained in pressure engagement with the material by a fluid cylinder 122 and associated piston 124. The calendering operation is conducted under sufficient pressure to press the fibrous cross strands 126, FIG. 7, into firm engagement with the warp threads 71, thus condensing the fibers comprising the strands sufficiently to insure interbonding between a sufficient number of the fibers in each strand to render the strands form-sustaining. Upon arrival at the calender roll, the adhesive has been heated to the extent that the calendering operation permanently joins the fibers together.

Many modifications of the principles, without departure from the inventive concepts, will become apparent to persons familiar with the art. Various types of fabrics in addition to those shown can be produced by the apparatus disclosed herein. For example, while the apparatus of FIG. 1 provides a fabric wholly made up of strands formed of haphazardly disposed fibers, the strands being formed in groups which serve as both the warp and woof elements, the apparatus could also be employed to form a web-backed fabric of greater strength. This can be done merely by feeding a suitable webbing, such as a textile gauze, over either of the forming cylinders 10 or 12 at a proper angle to pass between one of the air-laying nozzles on the associated cylinder. Such a gauze, being largely open, would not substantially affect the manner in which the fibrous strands would form thereon, nor would the manner in which the two sets of strands are cross-laid in the nip area be altered. The fabric will of course pass through the associated equipment in the same manner as does the unbacked product. Alternately, by feeding a gauze simultaneously over each cylinder a sandwich-like product would result with a layer of gauze on each outer side of a center cross-laid non-woven fibrous material. Either of these resulting products would be quite useful in the sanitary napkin, bandage, packaging, and many other fields. The apparatus of FIG. 5 may be employed, without modification of the major components thereof, for the production of a web-backed fabric instead of one which is backed solely by warp threads as shown, merely by feeding a predetermined textile gauze or the like through the equipment instead of the plural warp threads illustrated. Since as above mentioned the forming cylinder slots may assume configurations other than linear, wide design variations of both the warp and woof strand and the angular relations therebetween are obtainable merely by suitably designing the cylinder slots.

The forming cylinders of the FIG. 1 apparatus, as slotted as shown in FIG. 2, result in the product of FIGS. 3 and 4, the fibrous warp strands formed on cylinder 10 shown at 130 and the woof strands formed on cylinder 12 shown at 132. The sectional view of that fabric is shown in FIG. 4 broken at the center to illustrate, at the left, the general configuration of the cross-laid strands as they move through the nip area of the forming cylinders. At the right thereof the fibers are shown in finalized configuration after the strands have been subjected to the calendering operation, with the fibers intertwined and

bonded together at the crossings in a manner to eliminate the clear demarcation between the two strands as first cross-laid, one on the other. FIG. 8, which shows in section the fabric of FIG. 7 as produced on the apparatus of FIG. 5, has been similarly modified to show at the left the fiber configuration at the forming cylinder and to show at the right a finalized product after calendering, with the fibers compressed to the extent that the warp threads are substantially imbedded in the fibrous wool strands.

We claim:

1. The method of forming a fibrous fabric material consisting of the steps of air laying fibers haphazardly over spaced elongate slots formed transversely of the surface of a cylinder while rotating the cylinder continuously to form a plurality of unspun fibrous strands, and concurrently air laying fibers over spaced circumferential slots in a second cylinder driven in counter-rotation to said first cylinder and spaced to form an open nip therewith into which the fibrous air-laid strands are fed by cylinder movement with said first mentioned strands cross-laid on said second mentioned strands to form a net-like fabric.

2. The method of claim 1 including the step of applying an adhesive to the fibers after formation of the strands prior to the movement thereof into the nip.

3. The method of claim 1 including the step of employing a roll applicator for the application of adhesive to the fibers after formation of the strands and prior to movement thereof into the nip.

4. The method of forming a fabric consisting of warp and wool elements comprising fibers assembled in haphazard disposition and inter-twined and cohesively engaged throughout the elements, the fibers of the warp elements being bonded to fibers of the wool elements at the area of cross-over, said method comprising the continuous deposit of air entrained fibers above axially spaced circumferential slots in a rotating cylinder for the continuous production of spaced warp elements, forming like fibrous deposits above a plurality of axially extending circumferentially spaced slots provided in a second counter-rotating cylinder forming an open nip with the first cylinder, said nip being circumferentially spaced from the position of fibrous deposits on each cylinder to receive the fibrous deposits after formation, the minimum width of the nip being less than the combined thickness of both the warp and the wool elements thus formed to provide compression between the elements within the nip area as the warp and wool elements move therein to be cross-laid and cohesively bonded by the counter-rotating cylinders, and thereafter removing the fabric thus formed from the cylinder after passage through the nip area.

5. In a device of the character described, a pair of cylinders mounted for rotation to form an open nip therebetween, means driving the cylinders in counter-rotation, one of the cylinders being provided with a plurality of spaced axially extending slots, the other cylinder being provided spaced circumferentially extending slots, and means associated with each cylinder and spaced from said nip counter to the direction of cylinder rotation for the air laying of fibers onto the surface of the associated cylinder to form fibrous strands across the cylinder slots for cylinder conveyance into the nip and joiner of the strands therein.

6. The method of forming a fabric material consisting of the steps of continuously moving a plurality of warp strands over a rotating cylinder the surface of which is provided with transverse slots while continuously air laying fibers in a haphazard manner over the cylinder slots for deposit on said warp strands in the form of fibrous wool strands, and thereafter compressing and interbonding the fibers forming the wool strands both one to another and to the warp strands.

7. The method of forming a fabric material consist-

ing of continuously moving a backing material including a plurality of warp threads over an applicator to coat the threads with adhesive, drying said adhesive to render it non-tacky, continuously moving the coated threads over the surface of a rotating cylinder provided with spaced transverse slots, air-laying fibers over said warp threads above the slotted openings of said cylinder to dispose fibrous wool elements across said warp threads, compressing said fibrous wool strands against said warp threads to provide cohesive bonds between the fibers of the wool strands and the warp threads, heating the fabric thus formed to cause said thread coating to be rendered tacky, again subjecting the fabric thus formed to pressure to insure inter-bonding between wool strand fibers and the warp threads, and air-cooling the fabric to provide permanent adhesive bonds between the wool strand fibers and the warp threads.

8. In a device of the character described, a rotatably mounted cylinder the peripheral surface of which is provided with a plurality of circumferentially disposed transverse slots, means for the continuous rotation of said cylinder, means for the continuous movement of a plurality of spaced warp strands over the peripheral surface of said rotating cylinder, means positioned adjacent the surface of said cylinder in the area of material movement thereover for the deposit of air entrained fibers onto said warp strands in the area of the cylinder slots in the form of haphazardly assembled wool strands, means for withdrawing material thus assembled from the rotating cylinder, and means for adhesively interbonding the fibers of said wool strands to the fibers of said warp strands to provide a fabric.

9. In a device of the character described, a pair of peripherally slotted cylinders mounted on parallel axes and spaced to form an open nip therebetween, means driving said cylinders in counter-rotation, one cylinder being provided with axially spaced circumferentially extending slots, the other cylinder being provided with circumferentially spaced axially extending slots, and means associated with each cylinder and spaced from the nip formed therebetween in a direction counter to the rotation of each cylinder for the air-laying of fibers over the slots to form strands, whereby the fibrous strands thus formed on each cylinder are continuously fed into the nip by the counter-rotating cylinders with one set of strands being cross-laid onto and compressed against the other set of strands to form a webbing.

10. The device of claim 9 wherein said air-laying means provides for the entrainment of fibers into pneumatic streams, means directing a fiber entraining stream onto the surface of each of the cylinders, and suction means disposed interiorly of each cylinder to facilitate passage of the air stream through the peripheral slots thereof and for deposit of a majority of the stream entrained fibers onto the surfaces of the cylinders above the slots therein in the form of haphazardly assembled fibrous strands.

11. The device of claim 9 including a continuous belt of screen-like material associated with each cylinder to be moved therewith through a path having a semi-cylindrical portion through which the belt engages the cylinder and a portion tangentially of the cylinder through which the belt moves outwardly from the cylinder, said air laying means being associated with each cylinder within the area of belt engagement therewith, said tangential path portions extending outwardly of the nip in the direction of belt travel and moving in closely spaced parallel relation to provide means for conveying outwardly of the cylinders the web-like fabric formed by cross-laying of the fibrous strands in the nip area.

12. In a device of the character described, a pair of cylinders mounted for counter-rotation and forming an open nip therebetween, means for the counter-rotation of said cylinders, one cylinder being provided with a plu-

5 rality of spaced axially extending slots, the other cylinder being provided with spaced circumferentially extending slots, a continuous belt of screen-like material associated with each cylinder to rotate therewith, and means associated with each cylinder and spaced from said nip in a direction counter to that of cylinder rotation for the air-laying of fibers onto the surface of the associated cylinder for the formation of fibrous strands on the screen-like material over the areas of the cylinder slots, whereby the strands thus formed are conveyed by said belt into the cylinder forming nip to be cross-laid under pressure one on the other to provide a porous fabric.

10 13. The device of claim 12 including means for the application of adhesive to the fibrous strands prior to movement thereof into the nip.

15 14. The device of claim 12 including means for the application of adhesive to the strands prior to movement thereof into the nip and means for compressing said

strands and therefore setting said adhesive following movement of the cross-laid strands through the nip.

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