

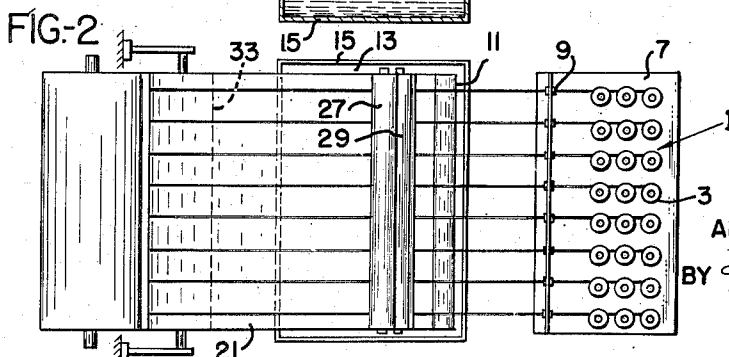
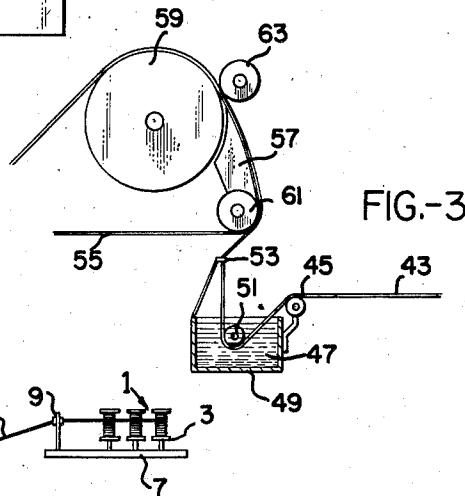
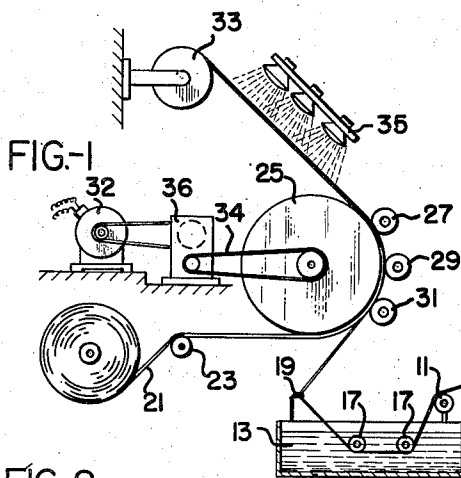
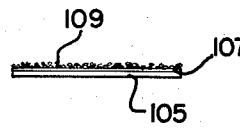
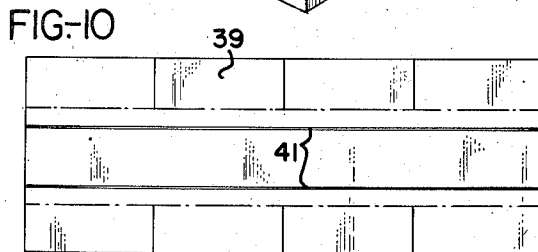
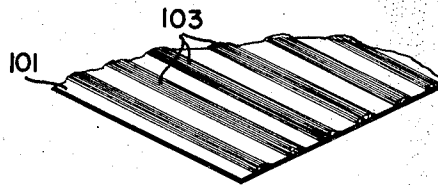
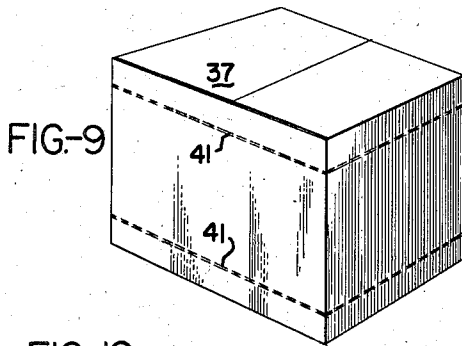
March 11, 1958

1958	A. E. CARLSON	2,826
LONGITUDINALLY REINFORCED BACKINGS AND APPARATUS FOR PRODUCING THE SAME		

2,826,237

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2 Sheets-Sheet 1



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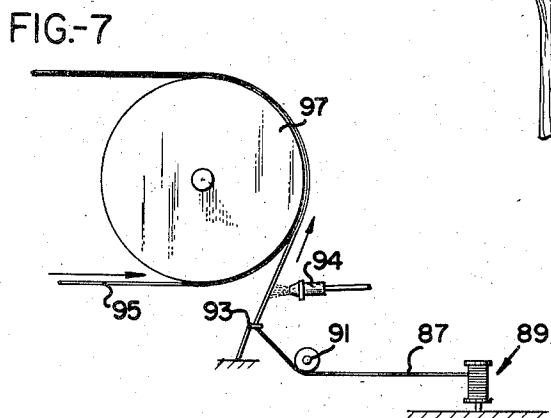
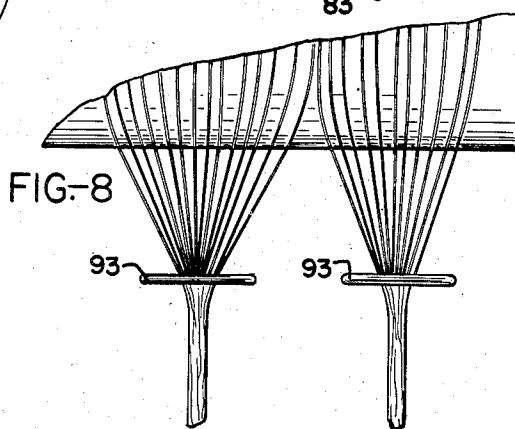
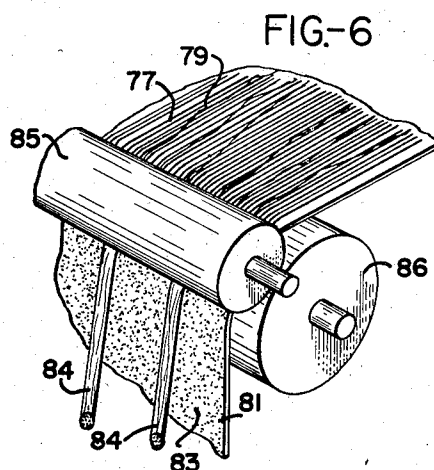
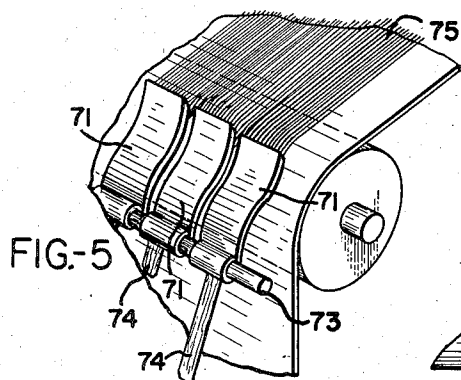
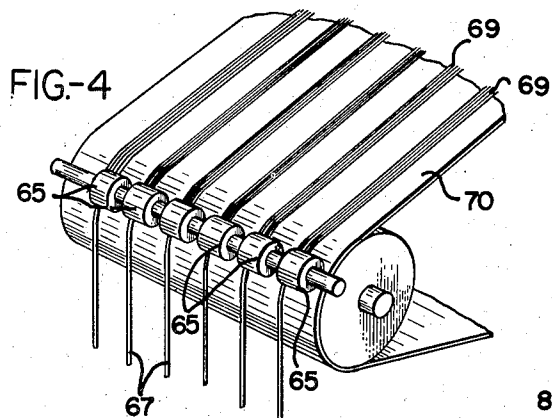
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2 Sheets-Sheet 2



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LONGITUDINALLY REINFORCED BACKINGS AND APPARATUS FOR PRODUCING THE SAME

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Application August 9, 1955, Serial No. 527,249

4 Claims. (Cl. 154—1.7)

This invention relates to reinforced materials, such as reinforced flexible backings of cardboard, paper and the like.

This application is a continuation-in-part of my application Serial No. 216,054, filed March 16, 1951, now Patent No. 2,719,804, and which application is a continuation-in-part of my applications, Serial No. 109,482, filed August 10, 1949, now Patent No. 2,610,936, and Serial No. 140,532, filed January 25, 1950, now abandoned.

This application is also related to my co-pending applications, Serial No. 340,029, filed March 3, 1953, now Patent No. 2,780,572, for "Reinforced Sheet Material, Apparatus and Method of Producing Same"; Serial No. 178,434, filed August 9, 1950, now Patent No. 2,718,254, for "Apparatus for and Method of Producing Reinforced Sheet Material"; Serial No. 179,302, filed August 14, 1950, now Patent No. 2,699,813, for "Apparatus for and Method of Producing Reinforced Sheet Material"; Serial No. 294,335, filed June 19, 1952, now Patent No. 2,722,366, for "Carton Joint Assembly and Method of Producing Same."

The invention has particular relation to the production of longitudinally reinforced backing materials including materials utilized for formation into cartons; plastic materials for tapes such as sealing tape; and paper for stay tapes for example.

The invention particularly contemplates the provision of apparatus for applying to backings reinforcing materials constituted of bundles of fine substantially continuous elements arranged in sufficiently untwisted relation for ready lateral displacement under pressure.

The invention further contemplates a reinforced backing in which the reinforcing elements extend over substantially the full width of the backing. The reinforcing elements are very fine and are supplied to the apparatus in bundles which when subjected to a suitable force spread into wide thin bands; the multiplicity of filaments of a bundle is such that in the guiding of the filaments to the spread condition some filaments overlie others of the filaments and the product is thus characterized by a plurality of levels of the filaments over at least some portion of the width of the reinforcement. Further some few of the filaments will generally overlie others of the filaments laterally in the longitudinal extension of the filaments and the product is further characterized thereby. The reinforcement however is of such a thinness overall that these slight variations are not in any way detrimental to the product appearance.

A further object of the invention is the provision of a carton in which the reinforcement is applied directly to the material of the carton without the utilization of a separate backing material.

In the practice of the invention the reinforcing elements are suitably fed to the apparatus in bundles and are caused, by the operation of the apparatus, to be spread laterally into bands on a backing material. The lateral spreading and the spacing of the bundles are preferably such that as the filaments of a bundle spread in the bands

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they move into contact with the filaments of an adjacent spreading bundle to provide a continuous reinforcing surface. Normally it will be found that, as in the guiding of the bundles, some filaments of one band will overlie a few filaments of an adjacent band.

The reinforcing elements most suitably employed are synthetic materials such as rayon, Dacron, nylon, glass and the like. The materials are preferably in bundles of substantially untwisted, substantially continuous, substantially parallel filaments; however bundles or groups of tiny twisted substantially continuous yarns in which each twisted yarn lies substantially parallel to and is readily spreadable from adjacent tiny twisted yarns may also be employed.

The arrangement of the filaments of the bundles in sufficiently untwisted relation for ready lateral displacement into wide thin bands under the application of the relatively light pressure employed by the apparatus of this invention is most important. It has been found, for example, that 1650 denier zero twist rayon yarn is entirely suitable and may be spread to a thickness of .002" with a width of about .255"; with 840 denier rayon having substantially no twist per inch a band-like reinforcing element may be produced having a thickness of slightly less than .002" with a width of about .125". In utilizing 3 strands of glass fiber rovings of substantially zero twist a band-like reinforcing element of a thickness of less than .002" and a width of about .062" is produced. Employing 3 strands of 150 1/0 glass fibers yarn with each yarn having a twist of one turn per inch, the yarns not themselves being twisted together—that is, there being no twist of the three ends—a band-like reinforcing element of a width of about .062" and a thickness of less than .002" is also producible.

It is also possible to apply twenty strands of 40 denier nylon, each of which strands may be highly twisted but without having the strands twisted together, to a backing material with the apparatus of invention and to obtain a band-like reinforcement having a thickness of slightly more than .002" and a width of about .062".

The backing to which the reinforcing elements are applied may be a box board, a paper such as kraft paper, a thin plastic film, or a stretchable material such as X-creped paper. The substantially non-stretch backings provide that there will be no degree of movement of the backing when the reinforcing elements are spread out in contact with the backing, the pressure required for such spreading being insufficient to affect the backings of box board, kraft paper and plastic.

The reinforcing elements are secured to the backing with adhesive. The adhesive may be applied to the elements alone and carried to the backing therewith; or the adhesive may be applied to the backing alone, or it may be carried on both the backing and the reinforcing elements. The spreading of the bundles may be accomplished while the elements are dry or after the adhesive has been applied.

The adhesive may be heat activated, activated by a chemical solvent, pressure sensitive or suitably a water activated animal glue; latex type adhesives have been found very satisfactory for most purposes. Preferably the adhesive is as hard as possible over the entire temperature range of normal use while still having sufficient pliability to prevent undesired stiffness in the product. It should have an adhesive grab for the backings and for the reinforcing elements and should be selected accordingly in part depending upon whether organic or inorganic filaments are utilized as reinforcement. Non-asphaltic water-proof adhesives such as the synthetic resin and latex-base adhesives are satisfactory; one example of a suitable such adhesive in the polyblend latex adhesive

sold by B. F. Goodrich Company in water dispersion form under the designation No. 550-20.

One embodiment of the product which is of particular economic interest is the combination in a tape of the reinforcing element with a thin membrane of plastic. Presently similar tapes are produced utilizing as the longitudinal reinforcement single parallel-lying yarns; the yarns and the method of production involve considerable cost and the denier of the useful yarn is limited thus involving further expense. With the apparatus of this invention relatively heavy denier, less expensive yarns may be employed—and since they will consist of hundreds of substantially untwisted filaments they may be readily spread to a thickness which is even thinner than the single parallel-lying yarns may economically achieve. As already noted yarns of 1640 denier may be readily used in the practice of this invention.

The spreading of the filaments requires only a moderate force which may be in the nature of a tensile stress or a pressure on the filament bundle. Sharply bending the bundle while drawing serves to spread the filaments readily as will be noted hereinafter. Where pressure is utilized the force is most suitably attained with rollers or paddles as noted hereinafter.

The term "filament" as used herein is a tiny diameter member. In the textile industry hundreds of such filaments are twisted together to form a yarn for weaving. The term "filament" is not intended to include a large member where a single filament constitutes a weaving material—such materials are properly termed mono-filaments.

The term "bundle" is intended to include a very considerable number of individual filaments, at least approximately 50 or more, and in some cases as many as 500 or more filaments of rayon, nylon, Dacron, Orlon or glass fibers.

The terms "band" or "ribbon-band" as used herein are intended to refer to a plurality of substantially parallel contacting filaments having a thickness equal to the diameter of that of a number of the filaments and a width many times—as much as 30 to 70 times—greater than the band thickness.

The invention will be more fully understood by reference to the following detailed description and accompanying drawings wherein:

Figure 1 is a side elevational view schematically illustrating one embodiment of apparatus useful in the production of backings reinforced longitudinally;

Figure 2 is a plan view of the major components of the apparatus of Figure 1;

Figure 3 is a side elevational schematic view of another embodiment of the apparatus of invention;

Figure 4 is a perspective and fragmentary view of a further modification of the apparatus of invention illustrating roller means for effecting filament spreading;

Figure 5 is a view similar to that of Figure 4 but illustrating the spreading of the filamentary material with paddle means;

Figure 6 is a perspective view illustrating the application of the filaments to a backing which is itself provided with adhesive over a surface thereof, the filaments being spread to an extent sufficient to bring the material of adjacent bands into contact;

Figure 7 is a schematic side elevational view of a further embodiment of the apparatus of invention in which adhesive is applied to the filamentary material after the same is spread;

Figure 8 is a fragmentary and enlarged elevational view illustrating to a somewhat exaggerated degree the spreading of the filaments into wide bands when employing the apparatus of Figure 7;

Figure 9 is a perspective view of a carton provided on the inside thereof with reinforcing bands which are useful also as tear tapes;

Figure 10 is a plan view of the blank from which the carton of Figure 9 is formed;

Figure 11 is a fragmentary perspective view of an article of manufacture produced in accordance with the invention; and

Figure 12 is a transverse view of an article of manufacture, produced in accordance with this invention and illustrating a plastic backing provided with the reinforcing filaments across the whole surface thereof.

Referring to the drawings and initially particularly to Figures 1 and 2, there is generally indicated at 1 a plurality of supply packages consisting of bobbins 3 of reinforcing material; the reinforcing material is designated by the numeral 5 and the reinforcing elements are in the form of bundles of filaments of rayon, for example. The bobbins are mounted upon a stationary support 7.

The reinforcing elements are fed in substantially parallel relation through suitable guides 9 over a roller 11 and thence downwardly into a bath of adhesive material 13 contained in a suitable vat 15. A plurality of rollers 17 guide the elements through the adhesive and the elements are drawn upwardly through metering devices 19 in the form of guide eyes.

The numeral 21 indicates sheet material in roll form, for example, cardboard, which is to be formed into cartons. The sheet material 21 passes over roller 23 into contact with the plurality of bundles emanating from the metering devices, and the composite body passes to the platen roller 25.

Pressure rollers 27, 29, 31 are utilized in this embodiment to spread the bundles in width and to reduce the thickness thereof. Suitably the rollers 27-31 are covered with teflon or some other suitable material having a low affinity for the adhesive material used. In passing from the platen roller 25 to the winding roll 33, the sheet material may be passed through a suitable adhesive curing device, for example a drying oven or a battery of infrared lights as indicated at 35.

Any suitable drive mechanism may be utilized to effect rotation of the platen roller 25. As illustrated schematically a motor 32 drives belt 34 through gear box 36.

The wide reinforced carton-forming sheet material may then be stamped as required for conversion into the cartons as indicated in Figures 9 and 10. The numeral 37 in Figure 9 designates the carton while numeral 39 (Figure 10) indicates a blank, stamped from a reinforced sheet formed as described in connection with Figures 1 and 2.

It will be noted that two reinforcing bands 41 are provided in this instance on blank 39 and are on the inside of the carton of Figure 9; the number and the position of the bands are variable according to the specific applications involved and the control of these factors may be achieved both at the apparatus designated in Figure 1 and at the stamping operation for the blank.

The manufacturer's joint for the carton may be made by an overlap of about 1½" of the cardboard blank or adhesively bonding one end to the other end of the carton blank. Here a full-tape of the tear tape may be extended outwardly so that a person may pull thereon and thereby cut the end of the carton off from the main body thus opening the carton.

In Figure 3 there is shown a further embodiment of the apparatus of invention by means of which the bundles are flattened before they are applied to the backing.

The numeral 43 designates glass filaments in bundle form. They are passed over roller 45 into adhesive 47 in vat 49; rollers 51 guide the bundles in their passage. To effect the spreading of the adhesive saturated filaments a doctor member 53 is provided and formed with a slit through which the yarn passes in contact with the doctor member. The slight drawing tension on the bundles causes the filaments to spread out in bands in contact with the member and this spread relation is maintained while the reinforcing elements make contact with

the backing 55 which in this instance may be kraft paper; the contact is maintained as the paper and reinforcing elements pass on to a curved guide form 57 which aids in the maintenance of the spread relation of the filaments as the composite travels to the drum 59. A suitable guide roller 61 is provided over which the backing travels to the guide form 57. The application of the filaments to the backing takes place when the backing and filaments pass over roller 61. To maintain optimum spread relation of the filaments the doctor member should be positioned as closely as possible to the point of contact of the filaments and backing.

The reinforcing elements, as clearly shown in Figure 3, travel tangentially toward the guide form 57 and roller 61 and are subjected to tension of such magnitude that a moderate pressure is developed for urging the bands into even contact with the web. The pressure also forces the adhesive carried by the filaments into spaces between the filaments; it also urges the filaments into contact with the backing.

Additional pressure may, if desired, be provided by roller 63 pressing against the drum 59 at a position slightly beyond the point of contact of the composite with the drum.

The drum may be heated to effect setting of the adhesive as it passes over the drum surface.

In the apparatus illustrated in Figures 1-3, inclusive, the bundles have been saturated with the adhesive in the course of the operation. Similar final products may be obtained however if the bundles are treated with a thermoplastic adhesive, for example, prior to the start of the operation. This eliminates the adhesive bath. Activation of the thermoplastic adhesive may be achieved by heating while the bands are on the backing, either with infra-red or with heating means in drum 59.

Where the bundles are coated initially with an adhesive capable of activation with a solvent such activation may also take place on the drum. Where the adhesive is applied wet it is preferable that such be maintained wet when in contact with the apparatus applying pressure or tensile forces; small diameter rollers are useful in this connection.

Figure 4 illustrates the use of a plurality of relatively short pressure rollers 65 for the spreading of the bundles 67, which may be of nylon filaments, into the bands 69 on the backing 70. The short rollers have substantially no tendency to bow and are therefore desirable when wide sheets are processed.

As shown in Figure 5 bundles are spread by spring biased paddle means 71 supported on a suitable shaft 73. The means 71 urged against the bundle 74 of filaments to spread them as shown at 75. The bundles 74 may be composed of Dacron filaments. A large plurality of such paddles in staggered relation are preferably employed for providing complete coverage of the backing.

The number and size of the bundles in Figures 4 and 5 appropriately may be such as shown at 77 in Figure 6 wherein the filaments at the edges of the spread bundles engage each other to thereby completely cover the surface of the backing. While in the drawings the filaments when spread appear to extend precisely longitudinally of the backing, the filaments do overly to some extent as indicated at 79. Further the filaments are not perfectly arranged longitudinally as an occasional filament will overly other filaments laterally in the longitudinal extension of the filaments.

As illustrated in Figure 6 the backing may itself be provided with the adhesive and the fed bundles may be free of adhesive. Thus numeral 81 designates a thin sheet of plastic material having thereon a heat activatable adhesive 83. The bundles 84 pass under roller 85 and over roller 86. These rollers are so spaced that the filaments when spread, contact at the edges to form a complete reinforcement 77 across the plastic. In con-

nection with the application of the filaments to a plastic film to provide the longitudinal reinforcement relatively large denier material may be employed. Thus 1640 denier rayon is useful; or a bundle 84 may consist of two or even three strands of 840 denier. This is tremendously important for economical reasons.

A further embodiment of apparatus useful in the practice of the invention is illustrated in Figures 7 and 8.

The numeral 87 designates bundles passing from the source generally indicated at 89 to guide roller and tension means 91. Eyes 93 receive the bundles which are tensioned against the inner sides of the eyes to spread the same. In this instance the bundles are dry—not treated with adhesive—as they pass to the eyes. The eyes themselves are preferably of a hard polished material so that the abrasion of the filaments in their passage will not occur.

The bands of spread filaments present, as they leave the guides, a wide surface for receiving an adhesive sprayed thereon by a nozzle 94, whereby the bands are well coated. The view of the spread filaments set out in Figure 8 is greatly exaggerated as adjacent filaments will be in contact and form a continuous laterally extending band there being substantially no completely open spaces between the filaments. Further the number of filaments involved will be much greater. However the principle is illustrated by Figure 8.

The bands contact the backing 95 and pass therewith to roller 97; the tension is sufficient to adhere the adhesive saturated filaments to the backing member. Additional pressure rollers may be provided if required.

Figure 11 illustrates bands of filaments 103 applied to backing 101 in a spaced relationship of the bands, as indicated in Figure 12 the filaments 109 secured by adhesive 107 may cover all of the backing 105 of plastic film—the filaments overlying each other to some extent and the thickness of the filaments and backing itself being somewhat enlarged for sake of clarity in the drawing. Most suitably the thickness of the plastic film is not greater than the thickness of the band; thus a very thin tape is attainable in the practice of the invention.

There has thus been described a product having longitudinally applied reinforcing elements and novel apparatus arrangements for the attainment of the product. Most particularly to be noted is the economy achieved by the features of the invention.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. Apparatus for making reinforced sheet material composed of a backing member and reinforcing elements which extend longitudinally of the backing member and are composed of bundles of tiny filaments, the filaments being secured to each other and to the backing member with adhesive, said apparatus comprising a support member, means for passing sheet material over the support member, means for feeding bundles of reinforcing filaments to the sheet material, means for relatively wetting the bundles of filaments and the surface of the sheet material upon which the filaments are to be secured, and means for applying squeezing pressure to the bundles at a location where the sheet material engages the support member to effect spreading of the filaments of the bundles into relatively wide thin bands.

2. Apparatus as in claim 1 in which the bundle feeding means includes means for maintaining the bundles in spaced substantially parallel relation as they are fed to the sheet material and at such distances between bundles that when spread on the sheet material, the adjacent edges of the filament bands so formed substantially engage each other.

3. Apparatus as in claim 1 in which means are provided for applying tension to and spreading the bundles of filaments while in a dry state, and that spray means are provided for wetting the filaments at a location between the spreading means and the support member.

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4. Apparatus as in claim 1 in which means are provided for drying the adhesive after the sheet material and the spread bundles leave the support member.

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