

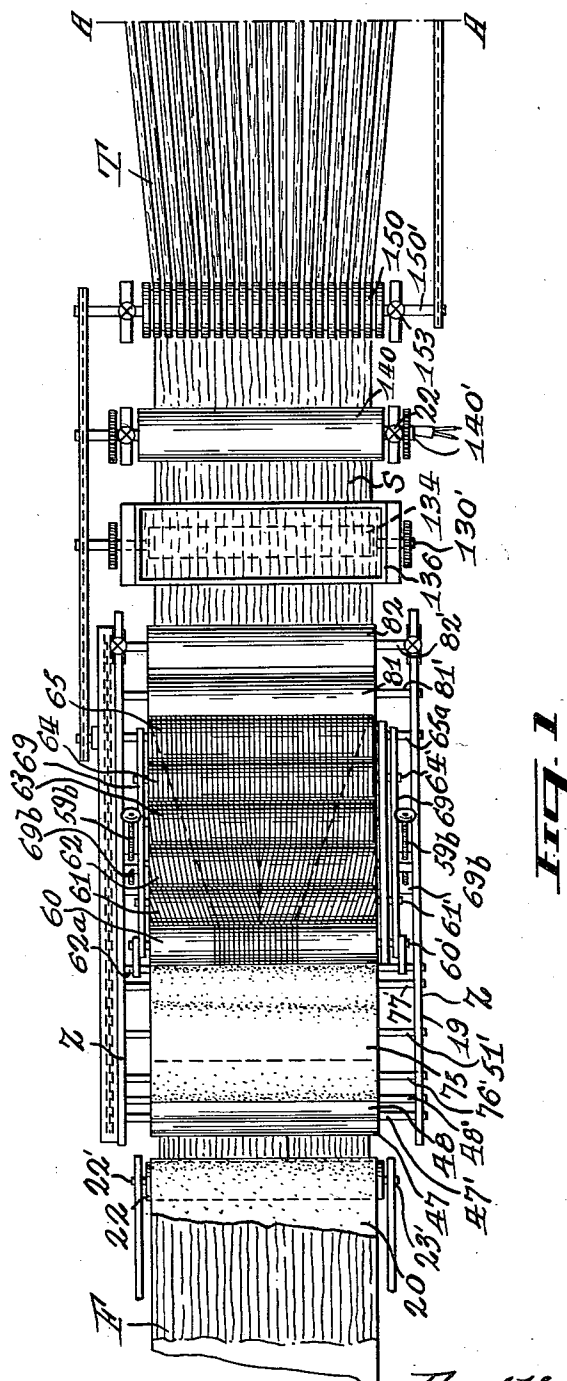
Nov. 20, 1956

E. BOBKOWICZ
METHOD AND APPARATUS FOR MAKING UNWOVEN
FABRIC FROM BAST FIBERS

2,771,118

Filed Oct. 3, 1952

4 Sheets-Sheet 1



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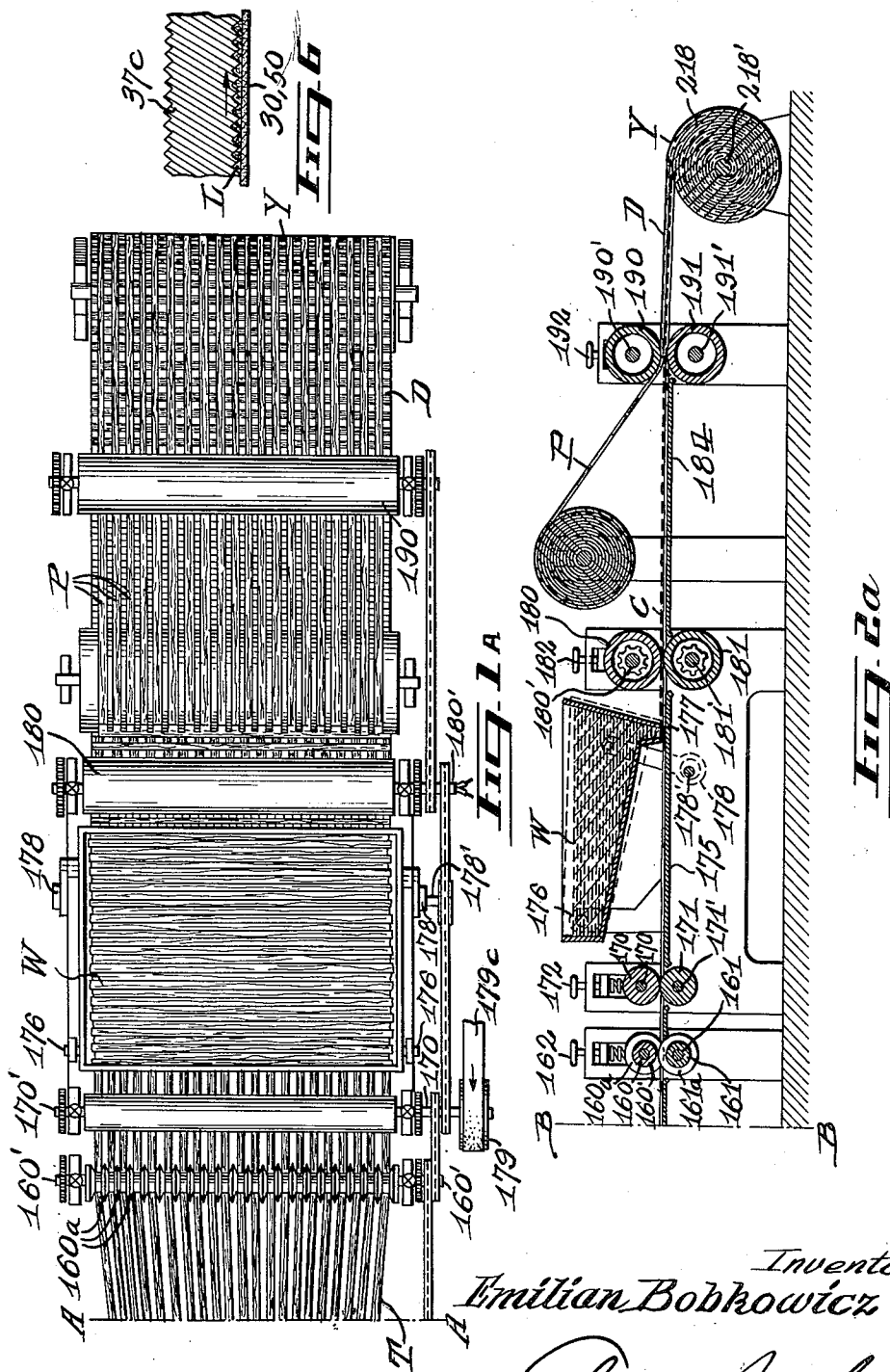
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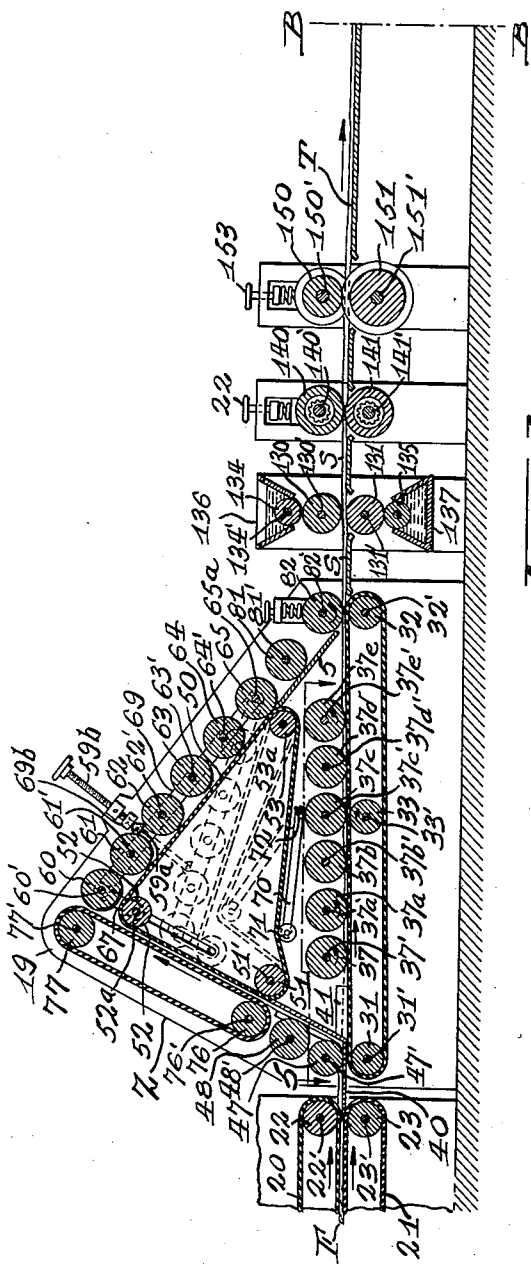


FIG. 1

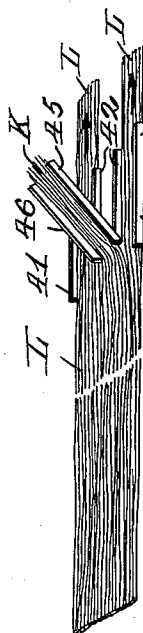


FIG. 2



FIG. 3

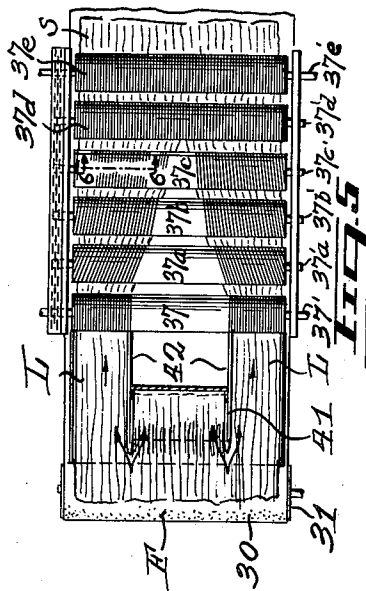


FIG. 4

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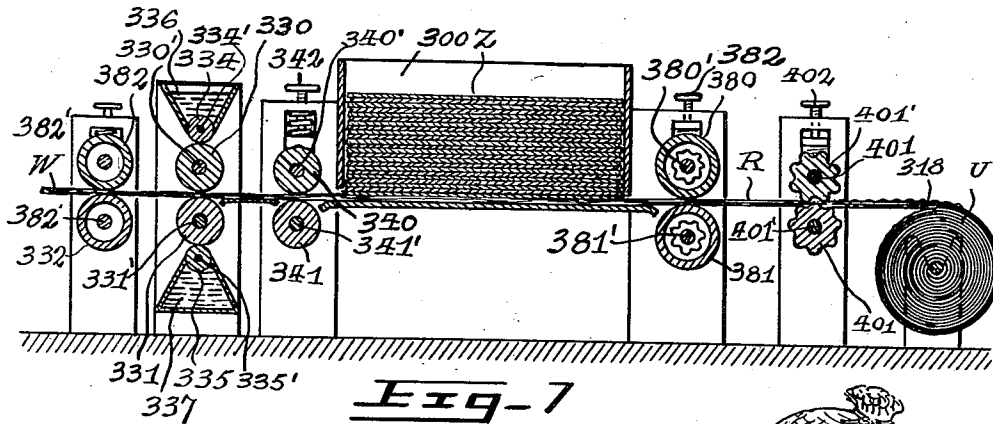


Fig. 7

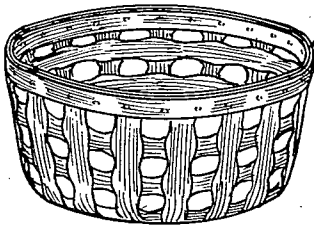


Fig. 8

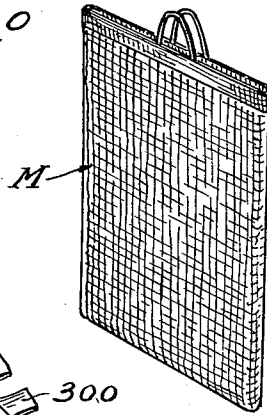


Fig. 9

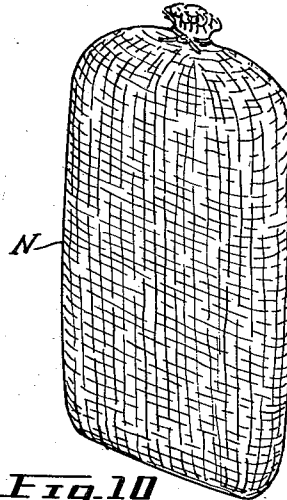


Fig. 10

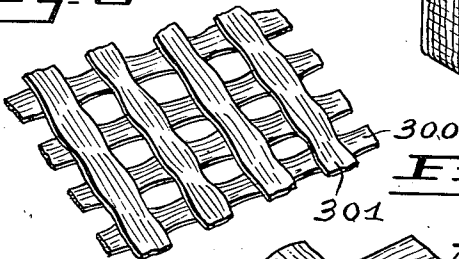


Fig. 11

Fig. 16

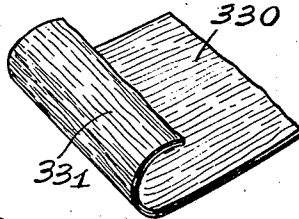


Fig. 13

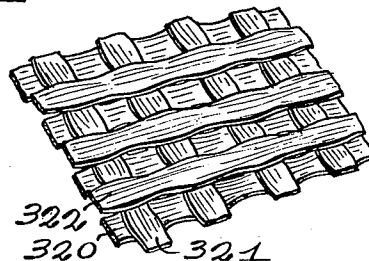


Fig. 12

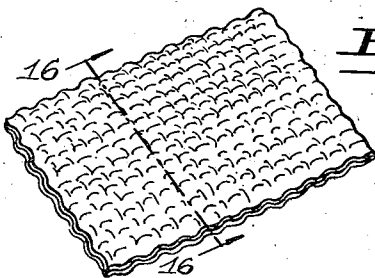


Fig. 15

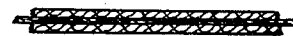


Fig. 14

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METHOD AND APPARATUS FOR MAKING UNWOVEN FABRIC FROM BAST FIBERS

Emilian Bobkowicz, Montreal, Quebec, Canada

Application October 3, 1952, Serial No. 312,968

Claims priority, application Canada August 28, 1952

3 Claims. (Cl. 154—1.75)

Introduction

This invention relates to a fabric made from bast fibers. Jute and other bast fibers have been used extensively for making woven fabrics, particularly for bags and sacks. These materials have the disadvantage that the relatively low cost required of packaging materials is offset greatly by the necessity of working the fabrics in the usual textile operations.

The present invention aims to convert bast fibers directly into fabrics capable of being used to make bags and other containers without the usual textile operations associated with the comparatively expensive spinning and weaving process.

Applicant's development

With these thoughts in mind, the applicant provides a non-woven fabric comprising bast fibers which are laid substantially parallel and bonded together with an adhesive thermoplastic resin. These are crude fibers in the form of a fleece and may be, and preferably are derived by extraction from a bast fiber plant in accordance with the method of the applicant's copending application, Serial Number 274,570, now Patent 2,706,312.

A preferred fabric is made up of a plurality of plies. In one ply the bast fibers overlap lengthwise but are substantially parallel. A similar ply is arranged so that the fibers run transversely to the first mentioned ply. The fibers and plies are bonded together with a thermoplastic resin. This is preferably accomplished by applying an aqueous emulsion of a resin. This fabric can be given the appearance of a woven fabric, by passing it through hot calendering rollers having a knurled surface. The material treated in the latter way is also improved in respect of the bonding of the fibers together and in flexibility and in tearing strength in all directions.

The resulting fabric can also be single ply sheet material of a non-woven type, laminated with other materials, for example, paper or cloth. The single ply sheet material may be cut into strips longitudinally of the fiber to form bands which may be used for laminating to other fabrics to add strength or used as binder twines. The fabric may be multi-ply as indicated above, in one ply the bast fibers running longitudinally and continuously, and in the other ply, of continuous sheet running transversely to the first ply, or one or both plies may be of relatively narrow strips forming an open work or network. For stronger materials, three or more plies may be laminated together.

The fabrics as described above can be used for a variety of purposes, for example, for packaging, for containers, bags, upholstery, upholstery lining for decorating purposes, wall coverings, and so on.

In a preferred method of making non-woven fabrics which forms another phase of the invention, bast fibers are brought into substantially parallel relationship to form a continuous fleece. The fibers are as long as possible and overlap in the longitudinal direction. The fleece is then passed through applicator rollers to apply thermoplastic

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resin either from one side or both sides. The resulting sheet is then passed through hot rollers or calender rolls to compact the sheet and soften the resins.

According to another aspect of the invention, means is provided for overlapping the fibers in a longitudinal direction so that there will be a continuity in the fibrous content of the sheet. Briefly, this means includes apparatus for causing a part of the fibers to form a circuitous while the remainder of the fibers move more directly. The fibers in the circuitous path and those in the direct path are then brought together to form a composite sheet in which the fibers overlap lengthwise.

At the same time, both the fibers following the circuitous path and those following the direct path are spread out so that they have substantially the same width, when they come together again and are juxtaposed.

Detailed description

The invention will be understood in more detail by referring to the accompanying drawings which illustrates preferred forms of non-woven fabric made according to the invention, preferred processes of making such fabrics and preferred apparatus by which the processes can be carried out.

Figures 1 and 1a make up a plan view of an apparatus capable of making non-woven fabrics from bast fibers in accordance with the invention.

Figures 2 and 2a make up a longitudinal vertical cross-section through the apparatus.

Figure 3 is a perspective view showing the way in which the fleece is divided into parts in accordance with the invention.

Figure 4 is a perspective view of a similar nature showing the way in which the parts of fleece are brought together to make a composite sheet.

Figure 5 is a horizontal cross-section along the line 5—5 of Figure 2.

Figure 6 is a vertical cross-section, enlarged, through one of the feeding rollers along the line 6—6 of Figure 5.

Figure 7 is a vertical cross-section through an apparatus for making closed-work fabric as opposed to the open work fabric made by the apparatus of the previous figure.

Figure 8 is a finished article, in this case, a basket made from fabric as shown in Figure 11 and produced by the method and apparatus of the invention.

Figure 9 is a perspective view of, in this case, a bag, made in accordance with the invention.

Figure 10 shows another type of bag according to the invention.

Figure 11 shows an open work single-ply fabric according to the invention.

Figure 12 shows a double-ply open work fabric according to the invention.

Figure 13 shows a two-ply closed-work fabric according to the invention.

Figure 14 shows a laminated fabric of material according to the invention with ordinary textile fabric as a component.

Figure 15 shows a closed-work fabric according to the invention, embossed to give the appearance of a woven fabric.

Figure 16 is a cross-section along the lines 16—16 of Figure 15.

A fleece of fibers is shown entering the apparatus on the left hand side of Figures 1 and 2. This fleece comprises crude bast fibers laid substantially parallel. It may, for example, be a crude fiber fleece as prepared by the process and apparatus of my copending application Serial No. 274,570, now Patent 2,706,312.

First, the fleece is shown leaving the feeding mechanism between belts 20 and 21 running on rollers 22 and

23. This latter apparatus does not form a part of the present invention.

The fleece is then divided as will be explained for the purpose of assuring that ends of the fibers do not all come at the same place longitudinally of the fleece. But, they are randomly distributed in the longitudinal direction. That is, the ends of certain fibers overlap and interlap the ends of the other fibers so as to make a continuous sheet of fibers without interruption between them.

For example, in the preparation of the fleece, according to my copending application Serial No. 274,570, bark is removed from each stalk of bast fiber plant and the resulting fiber laid parallel so that a number of the fibers would end at the same spot depending upon the length of the stalk. This is obviated by the present method.

This apparatus includes a horizontal conveyor belt 30 mounted on rollers 31, 32 and 33. The belt 30 is preferably of flexible metal construction and maintains a substantially straight path.

For dividing the fleece the following arrangement is provided. A supporting table 40 underlies the fleece. This table has side flanges 41 to limit the sideways movement of the fibers. The table is also provided with middle flanges 42 and extending upwards from the beginning of these flanges is a diverting chute 45 provided with side flanges 46.

As will be seen, as the fleece is fed, the central portion (about 50%) of the fibers K is diverted by the chute 45 in upward direction. The remainder of the fibers pass along on the conveyor 30 between the flanges 41 and 42, at each side of the central chute. The portion K of the fibers is substantially equal to the total of the portions L.

Overlying the chute 45 are two feed rollers 47 and 48 adapted to feed the fibers upward on the chute 45. Overlying the conveyor 30 are feed rollers, 37, 37a, etc., for feeding the side portions of the fibers.

A central conveyor belt 50 is supported by rollers 51, 52 and 53, to follow a triangular path. This conveyor tends to guide the middle part K of the fibers upwards and then downwards back again into overlapping relationship with the fiber parts L.

Overlying the downward forward run of the belt 50 are a series of rollers, 60, 61, 62, 63, 64 and 65. These rollers are mounted on common bracket 69 pivoted on the shaft 65a of the roller 65 so the bracket 69 is pivotable about this shaft 65a and the rollers are movable from the position shown in full lines to the position shown in dotted lines.

Adjustment is provided so that the bracket 69 may be moved and retained in any intermediate position between the upper and lower limits shown. This is accomplished by set screws 59b mounted on each side of the frame. The bracket is connected to the set screws 59b by pivoting links 69b in such a manner that, by turning the set screw 59b one way or the other lowers or raises the bracket 69.

The rollers 60, 61, etc., and the rollers 37, 37a, etc., are driven at a faster peripheral speed than the conveyors 30 and 50, so that the fleece portion K is, at the same time, spread laterally as it is fed forward, and its forward speed remains the same as the forward speed of the side portions.

Rollers 60, 61 are screw-threaded so as to spread the central portion K of the fleece as it is fed forward. Likewise, the rollers 37, 37a, etc. are screw-threaded in the opposite direction so as to spread the side portion L in a forward direction as it is being fed forward.

So, when the portions K and L come together again, they are substantially the same width, and are off-set due to the fact that portion K has travelled a longer distance than portion L, both portions travelling at the same speed.

The roller 52 is mounted on a bracket 67 pivoted on a shaft 60' of the roller 60.

The end of the shaft 60' slidably fits in a slot on the

side plates Z. Thus the roller 52 is guided to maintain the upward run of the belt 50 parallel to the belt 75.

This arrangement permits the belt 50 to be moved downward from the position shown in full lines to the position shown in dotted lines so as to change the length of the path through which the middle part K of the fiber has to move.

To take up the slack in the belt when moved down to this position, a take-up arrangement is provided. This includes a lever 70 having a roller 71 engaging the belt. The lever 70 is pivoted to the frame at 72. Over the upper feed run of the belt 50 is provided a belt 75 mounted on rollers 76 and 77.

At the take-off end of the belt 50 there is provided a chute member 80 onto which the middle portion K of the fibers run from the belt 50. A feed roller 81 serves to feed the portion K over this chute. Finally, the central portion K of the fiber is laid onto the take-off end of the belt 30.

The rollers 37, 37a, etc., are all threaded on their peripheral surfaces in such a manner as, on rotation, to move the side portions L of the fiber in an inward direction from each side towards the center. So, by the time these portions reach a feeding and pressure roller 82 they cover the whole width of the belt 30.

Likewise, the middle portion K of the fiber is spread as follows:

The rollers 60, 61, 62, etc. are all provided with grooves or threads about their peripheral surfaces arranged in such a manner that the central portion K of the fiber is gradually spread outwards so as to cover a width equivalent to that of the belt 30. So, when the side portions L and the center portion K meet each other again at the end of their run over the belt 30 and the belt 50, respectively, they are substantially the same width and superimposed one on the other to make a composite sheet.

But, the ends of the fibers of the original composite sheet F have been redistributed. So, the ends of the portion K and the ends of the portions L no longer fall in the same place longitudinally of the web. The ends are thus randomly distributed.

The webs thus formed are brought together and pass between a pair of press rolls 82, 32. The roll 82 is adjustable so as to pressure through an adjusting screw. The web then passes through a pair of kiss rolls 130 and 131. Resin is applied to the surface of the rollers 130 and 131 by feed rollers 134 and 135, respectively, working in respective supply baths 136 and 137. The rollers 130 and 131 apply resin to the surface of the fleece at top and bottom and serve to bond the fibers together into a sheet S which can be handled in further treatment.

The sheet S then passes between hot press rollers 140 and 141. The roller 140 is adjusted as to pressure by an adjusting screw 22. These two rollers press the fibers together compacting the sheet S and feeding it forward to the next operation.

The strip S then passes between a roller 151 provided with spaced apart rotary knives and a grooved roller 150 which co-operates with the roller 151. The pressure on the roller 150 is adjusted by an adjusting screw 153. The function of the rollers 151 and 150 is to divide the fleece into strips T. The strips are then fed forward between a pair of rollers 160 and 161 provided with annular flanges 160a and 161a, respectively, forming there between strip-receiving grooves. An adjusting screw 162 is provided to adjust the pressure on the roller 160. The function of these rollers is to spread the strips T between these flanges and to maintain them at a uniform distance and substantially parallel.

The strips T are then passed between a pair of press rollers 170 and 171. Pressure between these rollers is adjusted by an adjusting screw 172.

The strips T then pass over a table 175. Above the table 175 is a hopper 176 which is adapted to contain

a stack of strips W of bast fiber arranged transversely to the direction of movement of the strip T. The hopper 176 has a transverse opening 177. The strips W migrate through this opening by oscillation of the hopper 176 through cam mechanism 178 regularly spaced apart at intervals across the strips T. At this point the resin R which has been applied to the strips T is still tacky. The composite fabric thus formed then passes between hot press rollers 180, 181, the pressure between which is adjusted by an adjusting screw 182.

The composite fabric now designated as C then passes over a table 184 which serves to support it and then passes between press rolls 190, 191. Pressure adjusting screw 192 serves to adjust the pressure between the rolls 190 and 191.

At this juncture a third ply P may be fed as shown on top of the composite fabric C and between the rolls 190 and 191 to form a three-ply fabric D.

The fabric D is now taken up on a spindle 218 to form a roll Y.

Figure 7 illustrates a modified form of apparatus for making two-ply closed-work fabric, for example, like shown in Figures 13 and 15.

In referring to Figure 7, a warp of the single ply material may be considered as coming from the left of the figure, an apparatus for distributing the fibers longitudinally as shown on the left hand side of Figures 2 and 1. The web designated as W passes between heated press rolls 382 and 332.

The web then passes through a pair of kiss rolls 330 and 331. Resin is applied to the surface of the rollers 330 and 331 by feed rollers 334 and 335, respectively, working in respective supply baths 336 and 337. The rollers 330 and 331 apply resin to the surface of the fleece at top and bottom and serve to bond the fibers together into a sheet which can be handled in further treatment.

The sheet W then passes between press rollers 340 and 341. The roller 340 is adjusted as to pressure by an adjusting screw 342. These two rollers press the fibers together compacting the sheet W and feeding it forward to the next operation.

The web W then passes beneath a hopper 300 containing a number of sheets of bast fiber material made according to the process of the present invention, but with the fibers running transversely to those of the web W. This mechanism is adapted to deposit one sheet at a time on top of the web W in sequence so as to form a continuous web; in other words, the fibers are running one layer in one direction and the other layer in a transverse direction. This hopper operates on a well-known principle used in the handling of cardboard and other sheet material. This apparatus does not itself form a part of the invention, but only in combination with the other parts.

Then the composite sheet passes between heated press rolls 380 and 381. Adjustment is accomplished by adjusting screw 382.

The web W then passes between corrugating embossing rolls, 400, 401. Adjusting screw 402 is provided. These embossing rolls can be used, or need not be, as desired. Their function is to form an embossed fabric according to Figure 15, having a substantiative appearance of a woven fabric.

The web, embossed or not embossed, as the case may be, is then taken up on the take-up spindle 318 to form a roll U.

Drive mechanism

While the specific drive does not form a part of the invention, since many different forms could be used, in order that the function of the apparatus be fully understood, its drive will be described as follows.

Each shaft on which a roller is mounted is given the reference number of the roller qualified by having a subscript and driving members on the shaft, as for example,

sprocket wheels have been given the appropriate subscript *d*. These various members are drivably connected one with the other as clearly indicated in the drawing.

In the case of the overlapping apparatus, a suitable gear box transmission is shown diagrammatically and this contains the necessary gears and chains to drivably link the parts together so the rollers are driven in synchrony.

The main drive is applied to the shaft 170 from a pulley mounted upon it 179 which is driven by a belt 179C from a suitable source of power, for example, an internal combustion engine.

Figures 8 through 16 show fabric and articles made therefrom according to the invention.

Figure 11 shows an open-work fabric made in longitudinal strips 300 and transverse strips 301. These types of strips are prepared in accordance with the method described above and are superimposed as described.

Figure 8 shows a basket O made from fabric according to the invention.

Figures 9 and 10 show a shopping bag M and a potato sack N, both made from fabric according to the invention.

Figure 12 shows a fabric in which there are two sets of longitudinal strips 320 and 322, and one set of transverse strips 321.

Figure 13 shows a composite closed-work fabric comprising a lamination 330 and a lamination 331. This strip is prepared in accordance with the method performed by the apparatus of Figure 7, as described above.

This type of fabric may be embossed to give the embossed fabric instead of Figures 15 and 16.

Resins which may be employed for a bonding agent are polyamides, as, for example, nylon, synthetic rubbers, polyvinyl resins and acrylic resins.

Preferably the amount of resin in the emulsion should range from about 25% to about 40% by weight of solids. The ratio of resin to fiber should range from about 2% to about 5%.

I claim:

1. A method of making non-woven fabric from fleece of crude bast fibers which comprises feeding the fleece forward continuously, dividing the fleece into side-by-side portions, carrying one portion through a circuitous path and another portion through a direct path, said circuitous path being in a direction transverse to the width of the fleece, spreading both portions laterally to substantially the same width, and bringing the portions together whereby the ends of the fibers making up an individual stalk of the bast plant fall in different areas longitudinally of the resulting sheet.

2. An apparatus of the type described, comprising in combination means for conveying a fleece of long fibers in a substantially direct path and means for conveying a portion of the fleece through a circuitous path out of the plane of travel of the fleece, means for spreading the portions of the fleece in their respective paths in a lateral direction in the plane of travel of the fleece and for bringing the respective portions together again in the plane of travel of the fleece.

3. An apparatus of the type described, comprising in combination, means for feeding a bast fiber fleece through a horizontal path, including a first conveyor belt and feed rollers overlying said belt, means supporting a lever under said belt for diverging a portion of the fleece thereon in a direction away from said belt including a chute for the fleece, a second conveyor belt leading from said chute, away from said first belt and then back again in the direction of the first belt, and a second chute leading from a terminal of the second belt back to the end of the first belt, feed rollers over said first chute adapted to feed the fibers on to the chute and feeding means over the first run of said second conveyor belt adapted to feed the fibers thereover, plurality of feed rollers over the second run of said second belt, each roller being grooved diagonally, whereby, on rotation, the roller tends to feed the fleece in an outward direction thereby spread-

ing it, means adjacent the end of the second belt for feeding the fleece forward to a further operation.

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