

[54] **METHOD AND APPARATUS TO PRODUCE NON-WOVEN FABRIC**

[75] Inventor: **Paul W. Eschenbach, Inman, S.C.**

[73] Assignee: **Deering Milliken Research Corporation, Spartanburg, S.C.**

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[58] Field of Search **28/1 CL, 72 R, 72 NW; 242/47.12; 156/439, 440, 391**

[56]

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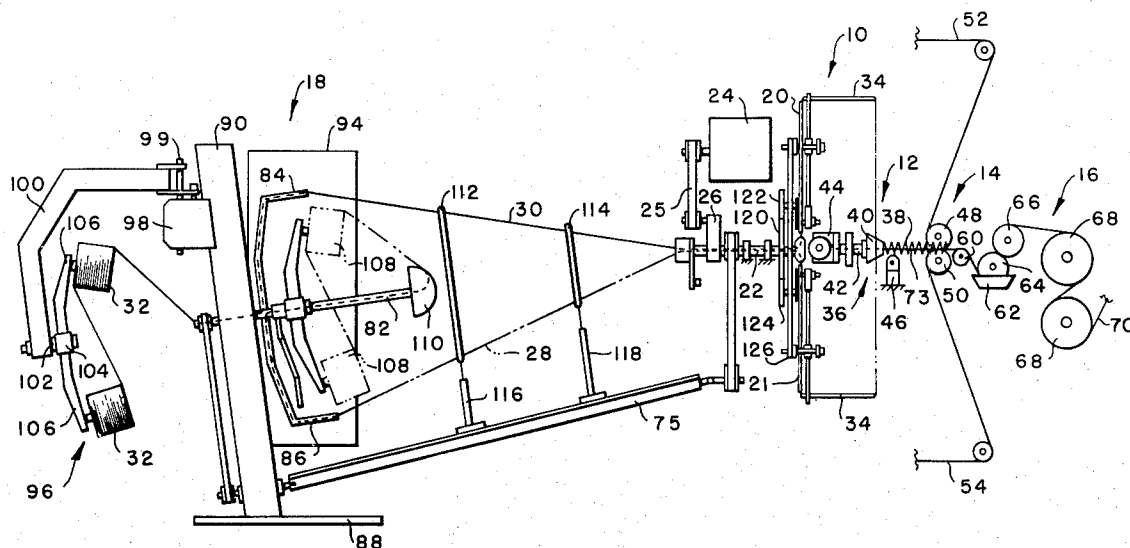
Primary Examiner—Louis K. Rimrodt
Attorney, Agent, or Firm—H. William Petry; Earle R. Marden

[57]

ABSTRACT

A machine and method to provide a non-woven fabric which employs a multiplicity of yarn lay down arms which are driven by a unique gearing arrangement to provide a substantially uniform yarn velocity.

5 Claims, 3 Drawing Figures



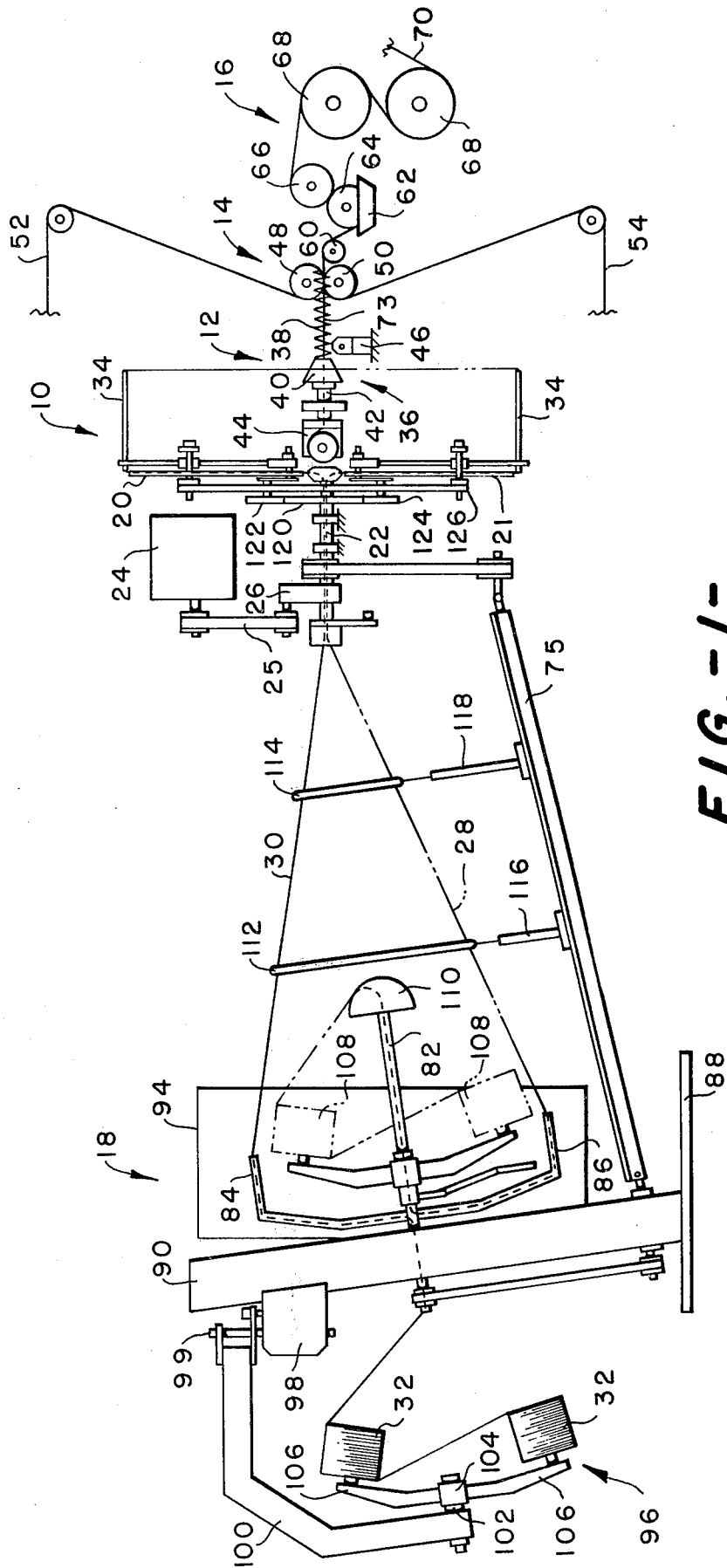
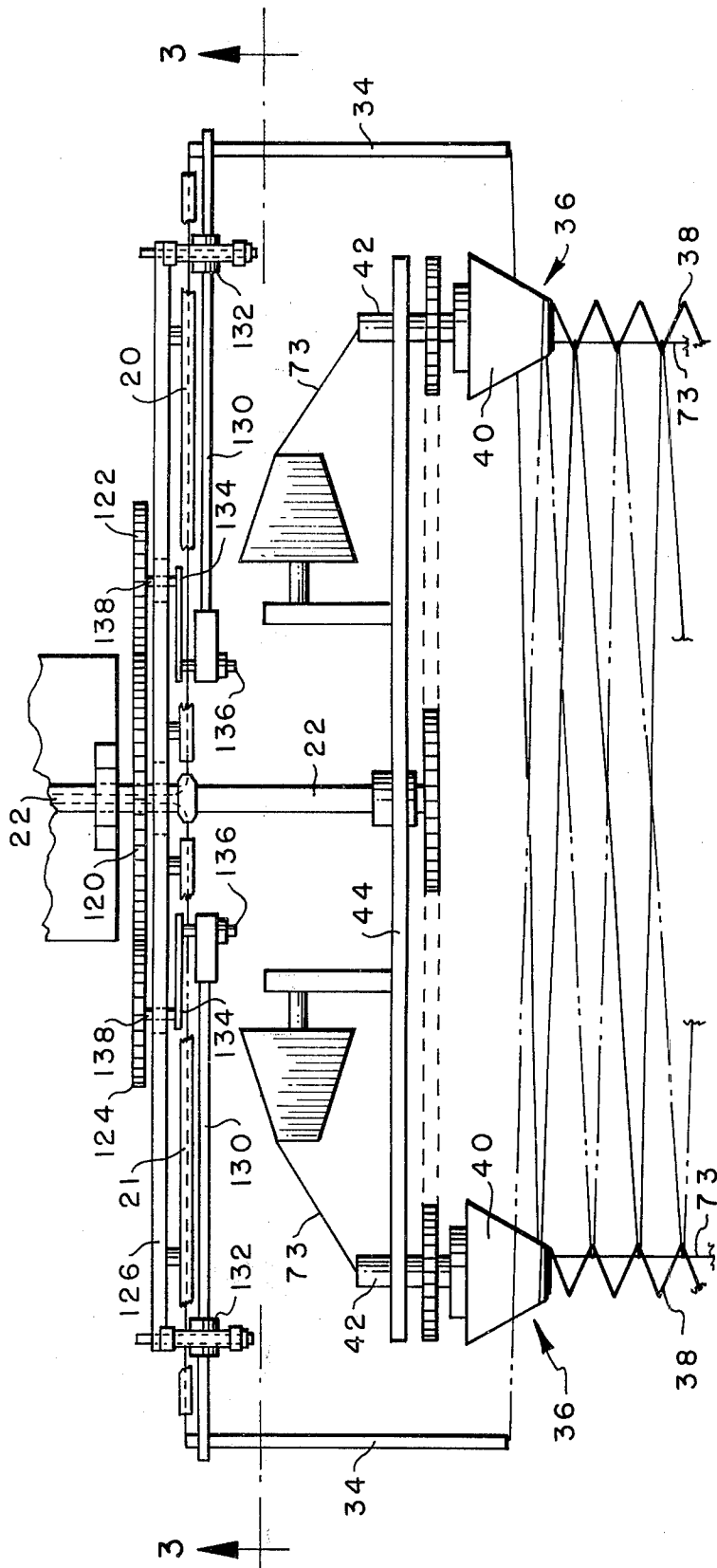


FIG. 1-

FIG. - 2-



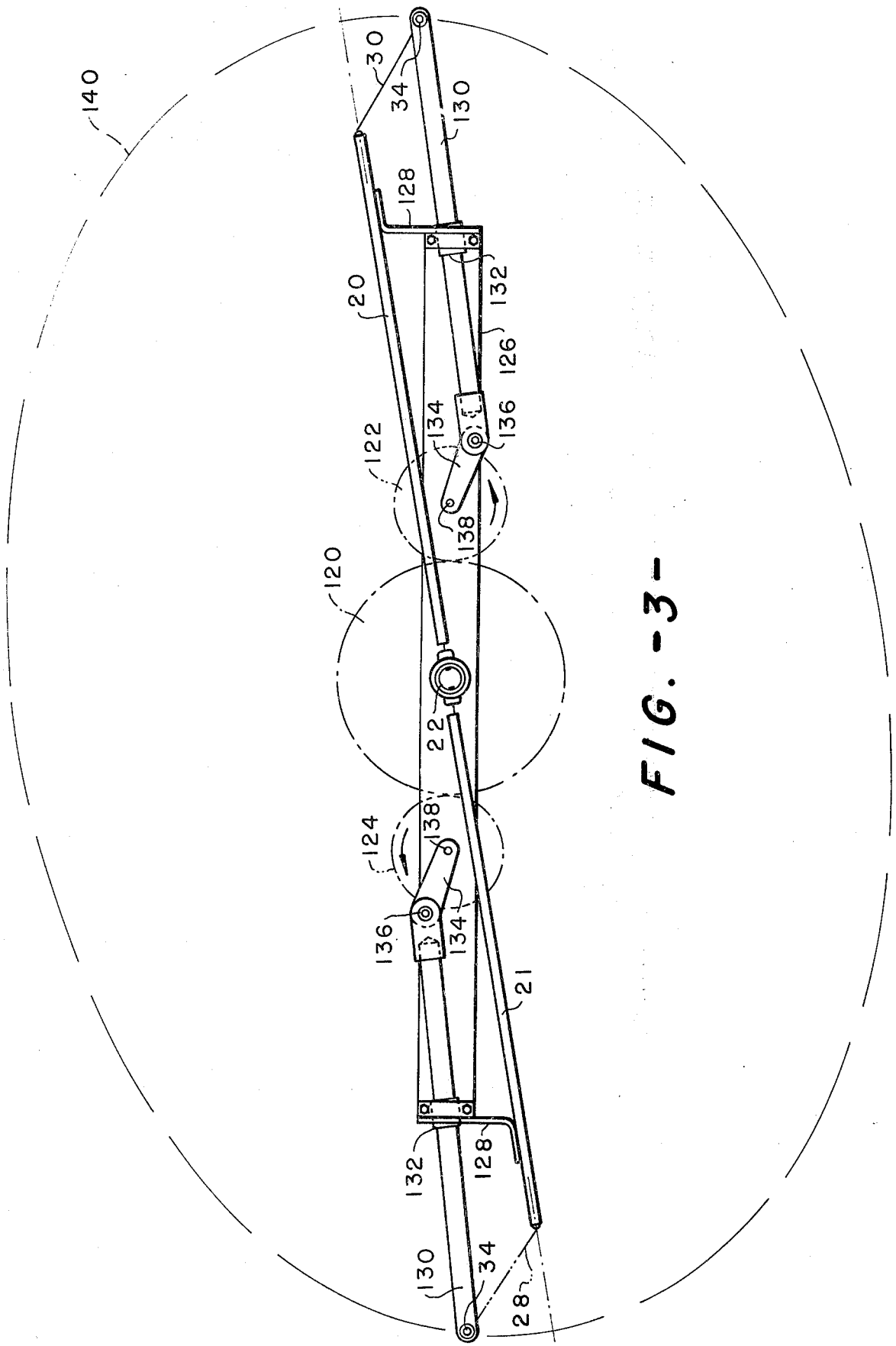


FIG. -3-

METHOD AND APPARATUS TO PRODUCE NON-WOVEN FABRIC

It is an object of this invention to provide a non-woven fabric producing machine in which the weft yarn flows through the machine at a substantially uniform velocity.

Other objects and advantages of the invention will become clearly apparent as the specification proceeds to describe the invention with reference to the accompanying drawings, in which:

FIG. 1 is an overall schematic view of the new improved machine.

FIG. 2 is a blow-up ablow-up top view of the thread guiding and weft sheet forming section of the machine with the thread guide arms in the horizontal position and

FIG. 3 is a view taken on line 3—3 of FIG. 2 showing the thread guide arms drive members.

Referring now more particularly to the drawings and in particular to FIG. 1, an apparatus is shown for continuously forming non-woven net fabrics which generally includes a thread winding section 10, a weft sheet forming section 12, a warp and weft sheet combining section 14, a section 16 for securing the sheets in contiguous coplanar relation to form a non-woven net fabric and a creel section 18.

As shown in FIGS. 1 and 2, thread winding section 10 includes thread winding means comprising a pair of hollow tubular thread guide arms 20 and 21 operably associated with a hollow central shaft 22 for rotation therewith. Shaft 22 is suitably supported for rotation about its central axis and is rotably driven by motor 24 through endless belt 25 and gear box 26. During rotation of thread guide arms 20 and 21 continuous threads or weft yarns 28 and 30 are continuously passed from the creel section 18 and yarn package 32, respectively, through the hollow shaft 22 with yarn 28 passing outwardly through guide arm 21 and yarn 30 passing outwardly through guide arm 20 through their respective tubular outlets 34.

The weft sheet forming section 12 includes a pair of spaced thread support members 36 which supportably receive the threads or weft yarns 28 and 30 passing from the tubular outlets 34 from the guide arms 20 and 21 in a plurality of generally parallel thread reaches therebetween. Thread support members 36 are of preferably substantially identical construction and each comprises an elongated helical member or spring 38 of high strength, rigid material such as spring steel. If desired, one of the thread support members 36 may use a double wound helical spring. The elongated helical member 38 is removably mounted in and rotably with a frusto-conical collar member 40 which facilitates placement of the thread or yarn in the spaces of the helical members 38 and is connected to rotably driven stub shaft 42. Stub shaft 42 is rotably mounted on the end of cross arm 44 which is supported by a suitable bearing surrounding the drive shaft 22. Each thread support member 36 is rotated about its horizontal axis. To facilitate positional support of the helical members 38, suitably supported blocks or stop members 46 are positioned beneath each helical member and abuttingly engage the same to prevent rotation of the cross arm 44 and helical member 38 about the shaft 22 during its rotation and thereby positionally stabilize the same.

As best seen in FIG. 1, the warp and weft sheet combining section includes a pair of nip rolls 48 and 50 which are rotably supported by suitable means, not shown, between the free or open ends of the helical members 38. As seen in FIG. 1, as the helical members 38 rotate to advance the thread or yarn reaches in spaced parallel relation therealong to form the weft sheet, the thread reaches leaving the open ends of the members 38 pass between and are engaged by nip rolls 48 and 50. One or more sheets 52 and 54 of warp threads or yarns from the warp beams (not shown) are supplied continuously to the nip portion of the rolls 48 and 50 from the beams and, during their movement therethrough, the warp and weft sheets are brought into contiguous coplanar relation. As shown in FIG. 1 the loop ends of the weft thread or yarn reaches are released from the rotating helical members 38 and the combined sheets pass over a guide roller 60 to the sheet securing section 16.

The securing section 16 includes an adhesive bath 62 through which the composite sheet of warp and weft yarns are passed by rotatable squeeze rolls 64 and 66 to apply a suitable adhesive thereto. The sheet thereafter passes about the surface of a plurality of heated drying rolls 68 where the warp and weft yarns are secured together and the thus formed non-woven net fabric 70 is collected on a take-up roll (not shown). Although not shown, one or more of the rolls in the securing section 16 may be suitably driven to move the warp and weft sheets through the apparatus.

Looking again at FIG. 1, the stub shafts 42 and their respective helical members 38 have aligned central passageways through which selvage threads or yarns 73 continuously pass during formation of the weft sheet to be positioned within the loop ends of the weft thread or yarn reaches as the reaches leave the open ends of the helical members 38. The selvage threads not only strengthen the composite non-woven net fabric product 70 but provide additional support to the weft sheet during its passage through the securing section 16 of the apparatus.

As discussed briefly before, it is desired to run more than one weft strand so as to provide increased production and efficiency in the manufacture of non-woven fabric. In the preferred form of the invention the apparatus is shown running two strands of weft thread or yarn but it is understood that it is contemplated that any number of strands can be run within the scope of the invention. To this end the creel section 18 is employed. Creel section 18 is supported on a base plate 88 to which is attached an upright support 90 which rotably supports the hollow shaft 82, slidably supports the cage member 94 and the weft package support 96. The weft package support consists basically of a pair of plates 98 attached to the upright support 90 and support the rod 99 therebetween attached to the L-shaped arm 100. Rotably supported at the end of arm 100 is a shaft 102 to which is fixed a collar member 104 which rotates therewith and has a plurality of radially extending arms 106 to support the weft yarn packages 32. The packages 32 are connected to one another through the use of a transfer tail so that when one runs out the next package will automatically be unwound. This is accomplished by tying the tail of one package 32 to the lead end of the next adjacent package 32.

In operation continuous weft threads 28 and 30 are supplied from their respective packages 108 and 32,

respectively, through the hollow shaft 22 to hollow guide arms 21 and 20 through tube guides 34 to wind the threads or yarns about the ends of the spaced-apart guide members 36. The threads or yarns 28 and 30 are guided by the frusto-conical member 40 into the spaces between the first and second helices of the springs 38. As the outlet ends 34 of the guide arms 20 and 21 pass about the springs 38, the threads or yarns 28 and 30 are laid in a plurality of reaches extending therebetween. The looped ends of the yarn engage the springs 38 and the springs are continuously rotated to advance the reaches in spaced, generally parallel relation along the springs to form the weft yarn sheet. As the reaches of the yarn 28 and 30 approach the open ends of the springs, they engage the selvage yarns passing through the center of springs 38 and combine with the warp threads 52 and 54 as they pass through nip rolls 48 and 50. As previously pointed out, the combined weft and warp thread sheets are then impregnated with a suitable adhesive, dried and cured and thereafter collected.

The thread or yarn 30 is delivered from the package 32 to the hollow shaft 22 through the hollow shaft 82 and the rotating hollow arm 84. The thread or yarn 28 is delivered to the hollow shaft 22 from the package 108 through the hollow nose portion 110, hollow shaft 82 and the radial hollow arm 86. To control the balloon configuration of the yarns 28 and 30 as they rotate rings 112 and 114 are mounted on the housing of the transmission 75 by suitable supports 116 and 118.

It has been found that in a non-woven fabric producing machine utilizing a substantially circular weft yarn path the yarn flow through the machine tends to be jerky with high acceleration as the thread guide arms 20 and 22 pass the thread support members 36. To overcome this jerky yarn flow it has been found that if the yarn exit follows a substantially elliptical path that the non-uniform motion of the yarn exit tends to provide a yarn flow which approaches a constant. To this end the construction shown in FIGS. 2 and 3 is used to provide the desired motion of the yarn exit.

To provide the above yarn flow a sun gear 120 is fixed to the machine frame while shaft 22 drives the planet gears 122 and 124 which are rotably supported by the propeller arm 126 which is fixed to the shaft 22 and rotates at the same speed. Attached to the propeller arm 126, by suitable brackets 128 and others not shown, are thread guide arms 20 and 21. To provide an elliptical yarn path, the yarn exit 34 is guided radially and angularly by the slider crank 130 slidably and pivotally mounted in the baring collar 132 and guided by the crank arm 134 pivotally connected thereto at 136. The crank arm 134 is fixed to the rotating shaft 138 rotably connected to the propeller arm 126 and being driven by the planet gear fixed thereto. In the preferred form of the invention the gear ratio of the sun gear to each of the planet gears is 2:1.

As discussed previously the crank arm 134 and the slider crank 130 inconjunction with the gear 124 cause the yarn guide exit 34, and consequently the yarns 28 and 30 to follow an elliptical path around the shaft 22. It should be noted, as indicated by the arrows on gears 122 and 124, that in the direction of rotation, the yarn exit 34 lags the thread guide arms 20 and 21 and that the ellipse 140 generated by the path of the yarn exit 34 has a major axis that does not fall on a horizontal line passing through the thread support members 36. In

FIG. 3 it can be seen that the outermost point of the major axis of the ellipse 140 is reached by the yarn exit 34 after contact of the yarn from the exit 34 with the respective thread support member. It should be noted that the ellipse 140 can be generated since the thread guide arms 20 and 21 and the propeller arm 126 rotates at a constant angular velocity while the yarn exits 34 rotate at varying angular velocity causing nonuniform motion of the yarns in a radial and angular direction with respect to the propeller arm 126.

Looking at FIGS. 1-3 it can be seen that the yarn tube guide exits 34 for yarns 28 and 30 have reached the extreme outward position after contact with the thread support members 36 so that the yarn guide exits 34 still have horizontal motion when the yarns contact the thread support members 36 so that the velocity of the yarn does not drop to zero as when the extreme outward position of the yarns coincides with the contact of the yarn with the thread guide members. This reduces the tendency of the yarn to be jerked after contact with the thread guide members to overcome inertia due to loss of momentum on contact with the thread support member.

Also, the elliptical generated path in combination with the spaced relationship of the thread guide arms relative to the yarn guide exit 34 provides an accumulator effect since the maximum pull is just prior to the contact of the yarn with the thread support. The distance between the yarn exit 34 and the thread guide arm 70 is being slowly reduced as the generated elliptical path is approaching its minor axis to supply extra yarn between yarn exit 34 and spring supports 38.

It can be readily be seen that a novel machine has been provided which will more efficiently produce a non-woven fabric.

Although the preferred embodiment of the invention has been described, it is contemplated that changes may be made without departing from the scope or spirit of the invention and therefore, it is desired that the invention be limited only by the scope of the claims.

That which is claimed is:

1. Method of producing a non-woven fabric on a machine having spaced apart yarn guides and a yarn guide arm to wrap yarn around the spaced apart yarn guides comprising the steps of: providing a supply of weft yarn, supplying weft yarn to the yarn guide arm and rotating the yarn guide arm in a substantially elliptical path to wind the weft yarn at a substantially uniform velocity around the spaced apart yarn guides.

2. Apparatus to produce a non-woven fabric comprising: yarn support means including a pass of yarn supports spaced from one another, means for supporting a package of yarn, rotatable yarn guide means operably associated with said pair of yarn supports to supply yarn from the yarn package support and to wind the yarn in an elliptical path about said pair of yarn supports at a substantially uniform velocity to form reaches therebetween and means to rotate said rotatable yarn guide means.

3. The apparatus of claim 2 wherein said means to rotate said yarn guide means includes a sun gear and at least one planet gear meshed therewith.

4. The apparatus of claim 3 wherein said rotatable yarn guide means includes a slider crank mechanism connected to said planet gear.

5. The apparatus of claim 4 wherein said rotatable yarn guide means further includes a yarn guide tube spaced from said slider crank mechanism and guiding yarn from the yarn package thereto.

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