United States Patent

Johnson

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[54] APPARATUS FOR PRODUCING NONWOVEN FABRICS

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[52] **U.S. Cl.** .....**28/1 CL,** 156/181

[51] **Int. Cl.** **D02g 3/00,** D04h 3/08

[58] **Field of Search** .....28/1 CL, 21; 156/181, 430, 156/440, 441

[56] **References Cited**

UNITED STATES PATENTS

1,895,293	1/1933	Morton	28/1 CL X
3,422,511	1/1969	Sequin	28/1 CL
3,505,712	4/1970	Servage	28/1 CL

FOREIGN PATENTS OR APPLICATIONS

1,435,080	10/1968	Germany	28/1 CL
1,635,610	8/1969	Germany	28/1 CL

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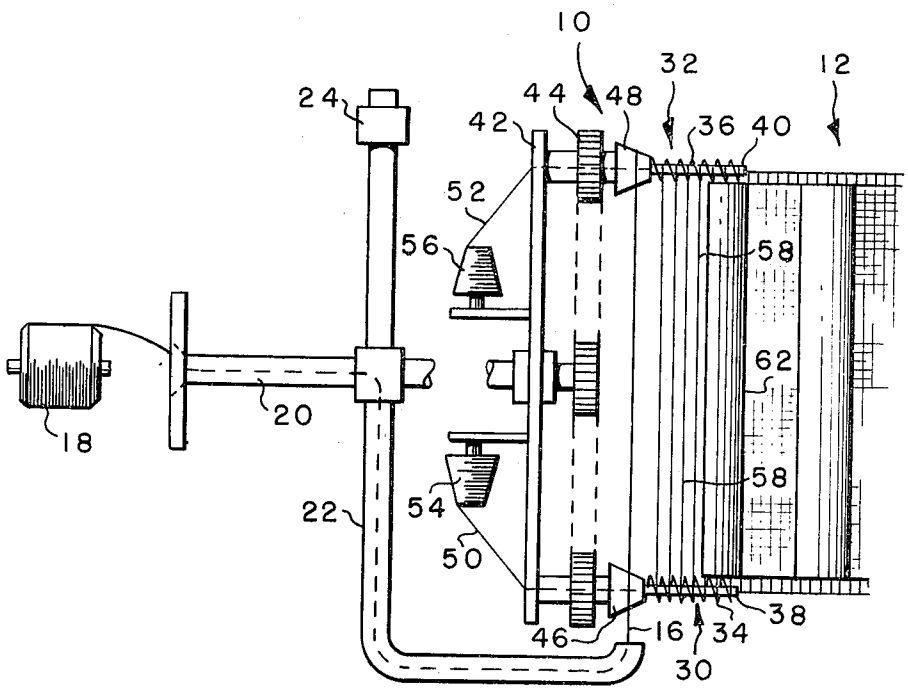
[57] **ABSTRACT**

Apparatus for producing nonwoven scrim fabrics wherein the weft thread sheet-forming support means comprises a helical member having a centrally disposed thread support element extending along the axis of the helical member for supporting the weft thread reaches during weft sheet formation.

7 Claims, 4 Drawing Figures



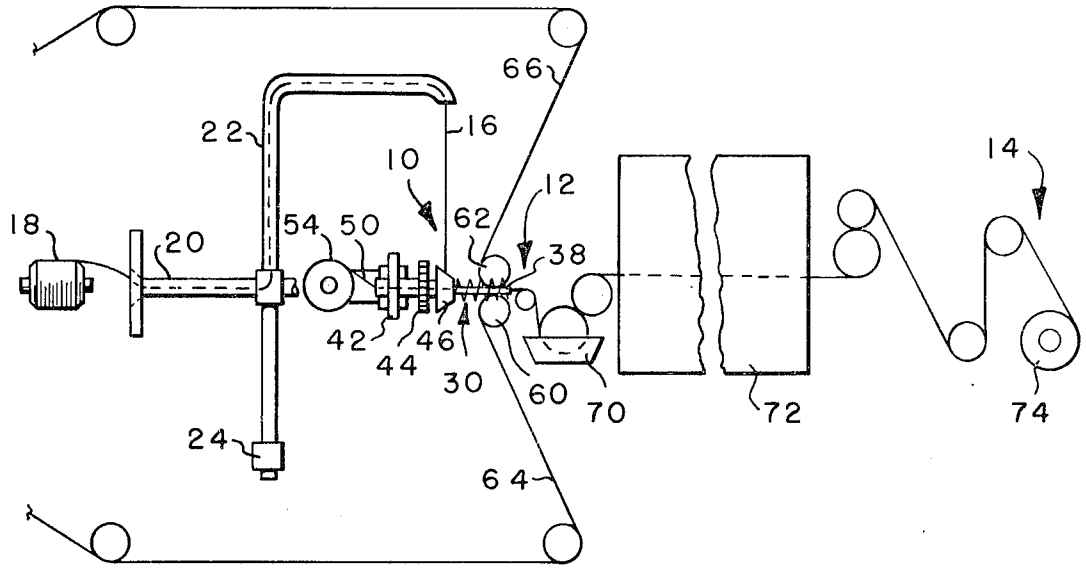


FIG. -1-

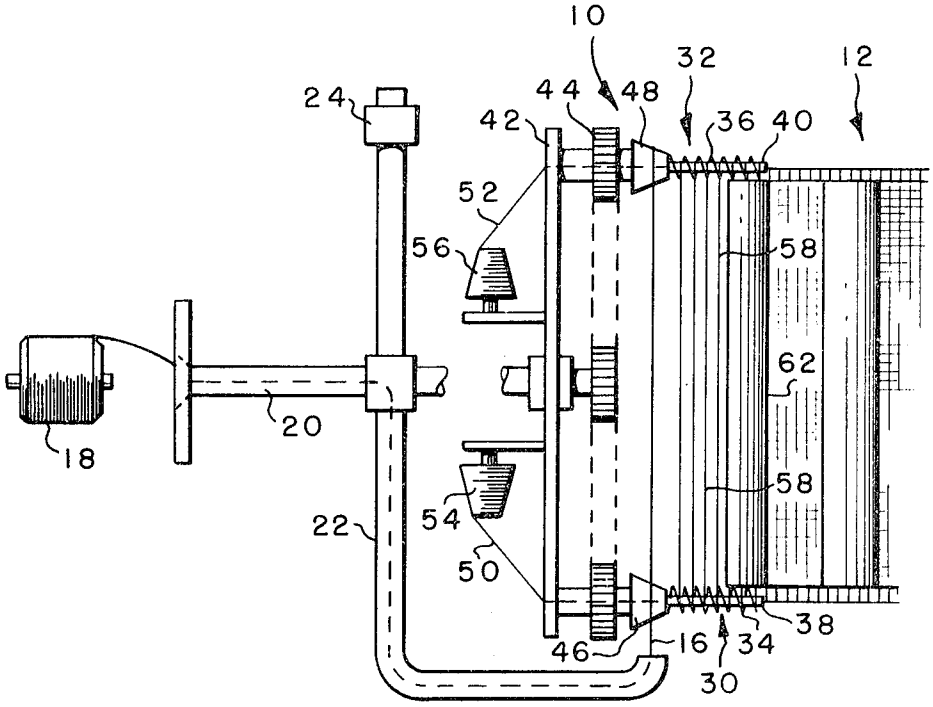


FIG. -2-

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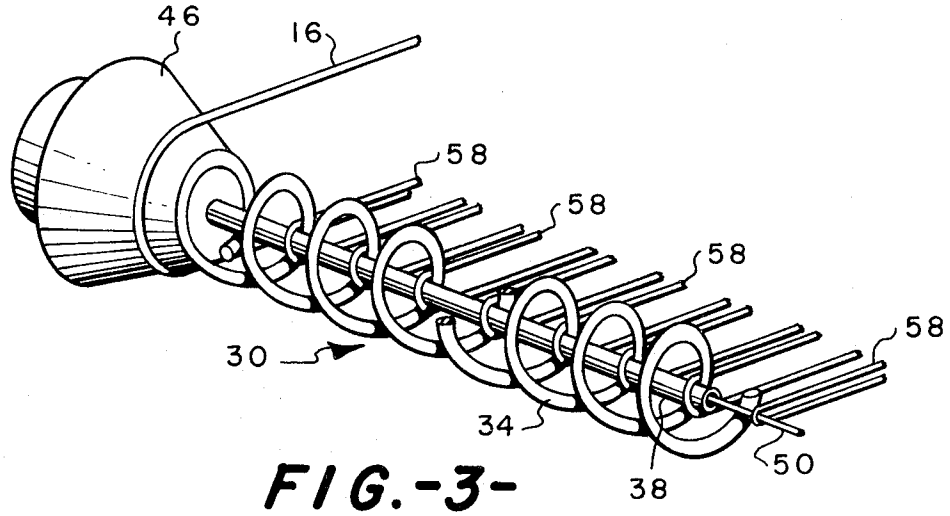

FIG.-3-

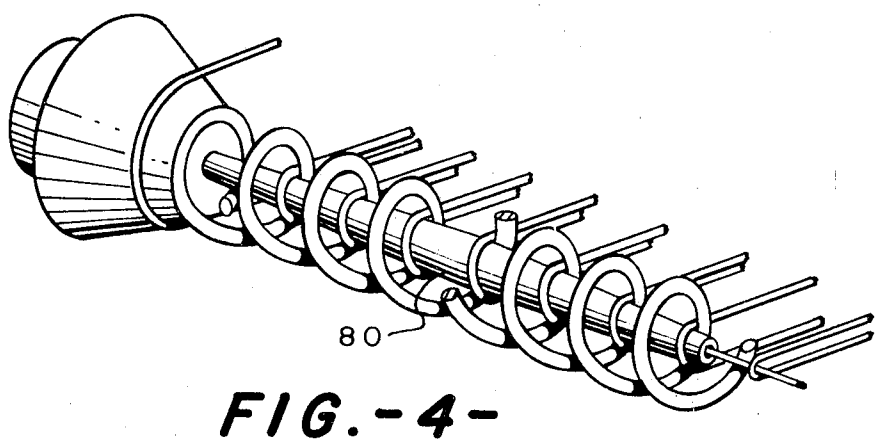

FIG.-4-

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APPARATUS FOR PRODUCING NONWOVEN FABRICS

This invention relates to the production of nonwoven net fabrics, and, more particularly, to an improved apparatus for the production of nonwoven, open-mesh or net textile fabrics commonly referred to as "scrim" fabrics.

Scrim fabrics are widely employed in a variety of end products. Such fabrics are generally constructed of multiple layers of generally parallel yarn threads which are adherred to each other by a suitable bonding agent at the crossover points of the threads. A major end use of these scrim fabrics is as a reinforcement layer in paper, plastic film, and fibrous batt laminates. The scrim fabrics are also widely used by themselves as netting reinforcements in packaging, as screening, and as backing reinforcement of floor tiles and the like.

One apparatus for producing such scrim fabrics comprises a thread-winding mechanism which winds one or more continuous length threads about a pair of spaced support members to form a plurality of generally parallel thread reaches or sections therebetween. These thread sections are advanced in generally spaced parallel relation along the support members to form a "weft" or transverse thread sheet which is combined with and suitably bonded to one or more "warp" or longitudinal thread sheets. The thread support members which form the weft thread sheet consist of a pair of rotatable helical members or springs which extend in generally side-by-side, parallel, spaced relation and are supported at one end for rotation. A rotatable thread guide arm, through which a continuous thread is passed, is positioned adjacent the supported ends of the helical springs and its outer end describes an arc about the ends of the springs to lay a plurality of reaches of the threads therebetween. As the thread reaches are laid on the springs, the springs engage the adjacent looped ends of the reaches and continuously rotate to advance the reaches in generally parallel, spaced relation along the helices of the springs to form the weft thread sheet. A selvage thread is advanced through the central axis of each spring from a suitable supply package so as to be placed within the looped ends of the weft thread reaches. The weft thread reaches approaching the ends of the springs are released thereby and combined with and adhered to one or more warp thread sheets of yarn.

Although the support springs are generally effective to provide the desired weft sheet construction, their operation presents some disadvantages. Since the springs are supported at only one end in order that the weft threads can be released from the open ends of the springs when they are combined with the warp thread sheet, positive positional support of the springs is difficult. For high density weft thread sheet constructions, i.e., a large number of thread picks per inch, it is necessary that the helices of the support springs be closely spaced. In such instances the springs are quite flexible and tend to be readily distorted and pulled inwardly by pressures exerted on the springs by the weft threads. This inward displacement of the unsupported ends of the springs tend to cause irregularities in the weft thread sheet construction. Additionally, since the helices of the springs directly engage and support the looped ends of the weft thread reaches to advance the reaches along the helices to form the weft sheet, there is a tendency for the looped ends of the threads to be frictionally pulled so as to ride up on the helices and become wrapped or entangled about the springs during their rotation.

It is therefore an object of the present invention to provide an improved apparatus of the type described for producing scrim fabrics which overcomes the aforementioned disadvantages of the prior art.

A further object of the present invention is to provide an improved apparatus for producing scrim fabrics having improved weft thread support members for advancing the threads in formation of the weft thread sheet.

The above as well as other objects of the present invention are accomplished by providing, as the support members for advancing the weft threads to form the weft thread sheet, rotatable helical members which have a central yarn support element positioned inside the main body of the members in longitudinal alignment of the central axis thereof. The weft

threads laid on the support members thus engage and are supported by the centrally disposed support element while the helices of the support members engage and push the threads along the central support element to form the weft thread sheet. Thus, it can be appreciated that the support of the thread reaches will be performed by the more rigid central support element, thereby relieving the helical members of the displacing pressures heretofore exerted thereon by the weft threads.

The foregoing, as well as other objects and the present invention will be better understood by reference to the accompanying drawings, in which

FIG. 1 is a diagrammatic side view of an apparatus for producing nonwoven scrim fabric which incorporates the novel feature of the present invention;

FIG. 2 is an enlarged diagrammatic plan view of the weft thread sheet-forming section of the apparatus of FIG. 1;

FIG. 2 is an enlarged diagrammatic perspective view of one of the weft thread support members of the weft thread sheet-forming section shown in FIG. 2; and

FIG. 4 is a diagrammatic perspective view of a modified form of the weft yarn support means seen in FIG. 3.

Referring more specifically to FIG. 1, the apparatus of the present invention generally includes a weft thread sheet-forming section 10, a warp and weft thread sheet-combining section 12, and a collection section 14.

As shown, in the section 10, an indefinite length textile thread 16 is continuously fed from a supply package 18 through a hollow rotatable support shaft 20 and outwardly through a thread winding arm or tube 22. The winding arm 22 is suitably counterbalanced by weight member 24 and the arm and shaft 20 are mounted by suitable means, not shown, for rotation about the axis of the support shaft 20.

Positioned adjacent the outlet end of winding tube 22 and inside the circumference of rotation thereof are a pair of spaced, side-by-side, elongate thread support means, generally indicated at 30, 32. Each support means 30, 32 includes a helical member or spring 34, 36 and a thread support element or rigid tube 38, 40 positioned inside the helical springs and extending along the central axis thereof. The support means 30, 32 are of substantially identical construction, and details thereof may be best understood by referring to FIG. 3 which is an enlarged perspective view of the thread support means 30. The ends of the helical springs 34, 35 adjacent the outlet of the winding tube 22 are rotatably mounted on a supporting cross arm 42 (FIG. 2) and the springs are rotatably driven about their central axes by a sprocket and chain drive arrangement 44 which is connected by suitable means to a common power supply, not shown. Surrounding the supported ends of the helical springs 34, 36 are frustoconical thread guides 46, 48, respectively, which facilitate accurate placement of the thread 16 on the support tubes 38, 40 within the first helices of the springs, as will be explained.

As seen in FIG. 3, each thread support tube is suitably mounted within the supported end portion of the helical support springs and extends along the central axis thereof. The tubes are hollow and a pair of selvage threads 50, 52 are continuously passed therethrough from supply packages 54, 56 (FIG. 2) so as to be located within the looped ends of the thread reaches 58 forming the weft thread sheet.

Positioned adjacent the open ends of the support springs 34, 36 are a pair of nip rolls 60, 62. A pair of warp thread sheets 64, 66 are directed by guide rollers from suitable supply beams (not shown) and are combined at the nip portion of the rollers 60, 62 with the just-formed weft thread sheet. The combined weft and warp thread sheets then are passed in contiguous relation through an adhesive bath 70 and a heating oven 72 where the adhesive coated sheets are dried and/or cured to form the composite scrim fabric product. The scrim fabric thereafter passes over guide rollers and is collected on a collection roll 74. The fabric may be transported through the warp and weft sheet combining section and collected by providing suitable drive means for one or more of the guide rollers shown in FIG. 1.

Any natural or manmade yarns or threads may be employed in forming the scrim fabrics on the apparatus of the present invention. Similarly, the threads in the warp and weft thread sheets may be adhered in any convenient manner such as by application of a heat settable or curable adhesive composition as in the embodiment of the present apparatus, or the threads could be adhered by thermal fusion or the application of a hot melt type adhesive composition, in which case the warp and weft sheet combination sections of the apparatus would be suitably modified.

In operation, the continuous weft thread **16** is passed from supply package **18** through hollow guide arm **22** which rotates to wind the thread about the adjacent ends of the spaced thread support means. Thread **16** is guided by the guides **46, 48** into the space between the first and second helices of the springs **32, 34**. As the outlet end of the guide arm **22** passes about the springs, the thread is laid in a plurality of reaches extending therebetween. The looped ends of the reaches engage and are supported by the central guide tubes **38, 40** and the springs are continuously rotated to advance the reaches in spaced, generally parallel relation along the guide tubes to form the weft thread sheet. As seen in FIG. **3**, the thread reaches **58** are supported by the rigidly mounted guide tubes and are advanced therealong by the pushing action of the rotating springs. As the reaches **58** approach the open ends of the springs and the end of the support tubes, they engage selvage threads **50, 52** and combine with the warp thread sheet **64, 66** as they pass through nip rolls **60, 62**.

As previously pointed out, the combined weft and warp thread sheets then are impregnated with a suitable adhesive, dried and cured, and thereafter collected.

If desired, the position of the weft thread reaches **58** may be further positioned and controlled during the weft sheet formation by varying the diameter of the support elements **38, 40** along their lengths. As best shown in FIG. **4**, the weft threads may be subjected to a stretching action as they pass along the weft sheet-forming section, by providing that each support element **80** is flared over at least a first portion of its length to provide a positive tightening and straightening of the thread reaches before they are released from the weft sheet-forming section. Similarly, other surface configurations may be provided to the support tubes to arrange the threads in a desired manner during their passage along the support means.

Although the helical members **34, 36** have been particularly described and shown as helical springs, they may be otherwise constructed, such as by providing helical slots in rigid cylinders, or the like, to achieve the results desired. Similarly, although the rigid support elements **38, 40** are particularly described and shown as hollow tubes to facilitate passage of the selvage threads through the helical springs, they may be otherwise constructed, such as solid rods, or the like, and other provisions made for the selvage thread passage.

From the foregoing description of the invention, it can be seen that the central support tube of the thread support means provides improved control and positional uniformity of the thread reaches during the formation of the weft thread sheets. If desired, the thread support elements could be mounted in a bearing assembly to permit the elements to remain stationary during rotation of the helical members.

That which is claimed is:

1. In apparatus for producing nonwoven net fabrics including a pair of spaced, side-by-side elongate thread support means, means for laying a continuous thread about corresponding adjacent ends of said support means to form a plurality of thread reaches extending between said support means, and means for advancing said reaches along said support means to form a weft thread sheet; the improvement wherein each of said thread support means comprises a helical member, means supporting said member for rotation about its central axis, a thread support element positioned inside said helical member and extending along the central axis thereof for reception and support of loop ends of thread laid thereon by said laying means, and wherein said means for advancing the reaches along said thread support means includes means for rotating said helical members to advance thread placed on said thread support elements in spaced relation along said elements to form the weft thread sheet.

2. Apparatus as defined in claim **1** wherein said element has a relatively smooth outer surface.

3. Apparatus as defined in claim **1** wherein said element is of varying diameter along its length.

4. Apparatus as defined in claim **3** wherein said element is flared over at least portion of its length from its end adjacent said thread laying means.

5. Apparatus as defined in claim **1** wherein said helical member is attached for rotation at one end thereof adjacent said thread laying means and said element is supportably secured to said one end for rotation therewith.

6. Apparatus as defined in claim **1** wherein said thread support element comprises a rigid tube.

7. Apparatus as defined in claim **1** wherein said helical member comprises a helical spring.

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