

Dec. 28, 1954

L. A. RUNTON ET AL

2,698,045

METHOD AND APPARATUS FOR MAKING PILE FABRIC

Filed Jan. 18, 1954

Fig. 1

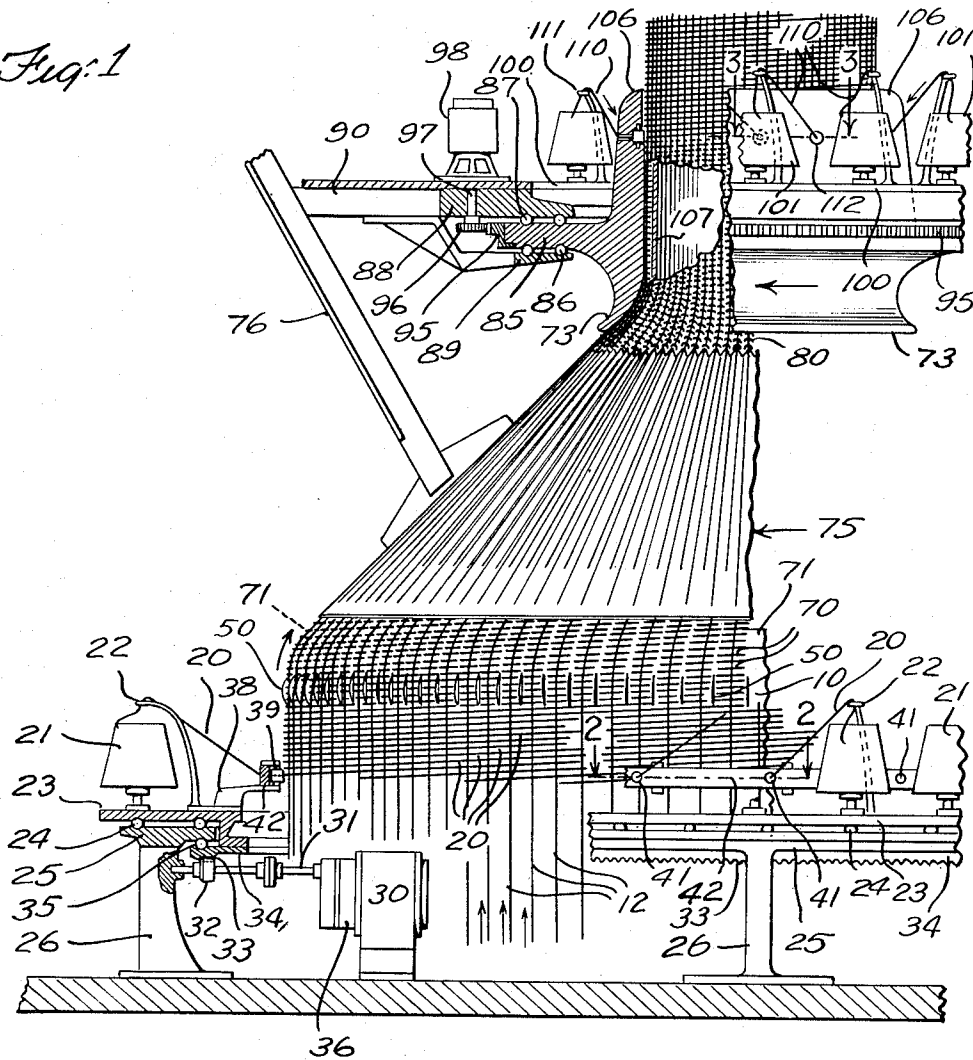


Fig. 2

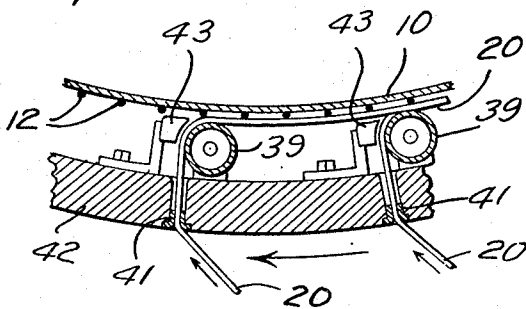
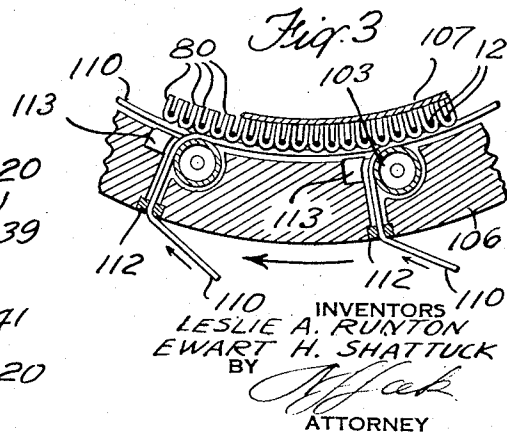


Fig. 3



INVENTORS  
LESLIE A. RUNTON  
EWART H. SHATTUCK  
BY  
ATTORNEY

1

2,698,045

## METHOD AND APPARATUS FOR MAKING PILE FABRIC

Leslie A. Runtun, Harrison, and Ewart H. Shattuck, Ardsley, N. Y., assignors to Alexander Smith, Incorporated, White Plains, N. Y., a corporation of New York

Application January 18, 1954, Serial No. 404,630

8 Claims. (Cl. 154—1.1)

This invention relates to a method and apparatus for making pile fabric wherein the pile is secured to a non-woven backing and wherein yarns having thermoplastic characteristics are used for the pile and for at least a part of the backing.

An object is to provide a novel and improved method and apparatus for securing the pile yarn to the backing by the application of heat and pressure and without requiring the usual weaving operations.

The operations according to this invention are generally similar to those described in a co-pending application of Runtun and Shattuck, Serial No. 382,962, filed September 29, 1953, for Method and Apparatus for Making Pile Fabrics, except that the present method and apparatus utilize heat sealing of thermoplastic yarns whereas sealing by use of adhesive is described in said copending application.

More specifically the present invention provides for feeding warp yarn having thermoplastic characteristics from a creel axially along the surface of a large circular drum with the individual yarns spaced around the periphery of the drum. As the warp yarns advance in cylindrical formation along the drum a series of pile yarns are wrapped around the drum over the warp yarns and are secured in place by heat and pressure.

The pile and warp yarns may be a thermoplastic monofilament such as a copolymer of vinyl and vinylidene chlorides or other common synthetic thermoplastic materials such as acetate rayon, nylon, Dacron, Orion, etc. The yarns may be composed of a twisted continuous filament bundle or may be spun from staple having at least some fibers of thermoplastic material.

As the pile yarn feeds axially along the drum with the warp yarns, the pile yarn is severed midway between each pair of warp yarns and the severed ends turned inward around the warp yarns to form U-shaped pile tufts. The spacing is reduced between warp yarns and filler yarns are wrapped around the cylinder of warp yarns and secured thereto to form a non-woven backing. The filler yarns may be thermoplastic and secured by heat as in the case of the pile yarns or they may be secured by adhesive as in said copending application.

The resultant pile fabric is delivered in the form of a cylinder with the pile tufts on the inside. The cylinder may be split and opened and the fabric rolled or processed as desired.

A further backing of latex or other back sizing may be applied to bind the yarns and to provide the desired body or stiffness.

Although the novel features which are characteristic of the invention are pointed out in the claims, the nature of the invention will be better understood by referring to the following description, taken in connection with the accompanying drawings in which certain specific embodiments have been set forth for purposes of illustration.

In the drawings:

Fig. 1 is a broken side elevation of a machine embodying the present invention; and

Figs. 2 and 3 are sections taken on the lines 2—2 and 3—3 respectively of Fig. 1.

Referring to the drawings more in detail the apparatus is shown as comprising a drum 10 which is supported from the floor by brackets, not shown. The warp yarn 12 is drawn upwardly over the outer surface of the drum 10 and so disposed around the periphery of the drum 10 that the warp yarns are spaced apart by a distance equal to twice the pile height. For example, for a one-half inch pile the warp yarns are spaced an inch apart around the periphery of the drum 10.

2

Pile yarns 20 are fed from packages 21 through guides 22. The packages 21 are supported on a ring 23 which extends entirely around the drum 10 and is supported by roller bearings 24 on a fixed ring 25 which is carried by a standard 26. The ring 23 is driven continuously by a motor 30, having a reduction gear in housing 36 from which an output shaft 31 drives pinion 32 engaging a circular rack 33 mounted on a ring 34 which is attached to the ring 23 and is provided with a roller bearing 35 which rides on the underside of the supporting fixed ring 25.

The ring 23 also carries a series of brackets 38 carrying heated rollers 39 in a position to apply heat and pressure to the warp yarns 12 which are disposed around the outer surface of the drum 10.

The pile yarns 20, after passing through the guides 22, pass through holes 41 in guide ring 42 carried on the brackets 38 and disposed adjacent the outer surface of the drum 10. The pile yarns 20 from the respective packages 21 are fed through individual guide holes 41 to be wrapped around the outside of the drums 10, and over the outside of the warp yarns 12 which are disposed thereon. The guide holes 41 are disposed adjacent the heated rollers 39 so that as the pile yarns 20 are wrapped around the drum over the warp yarns 12 the pile yarns are heated and made pliable.

Heated shoes 43 are carried by ring 42 in a position to supply radiant heat to the pile yarn 20 and warp yarn 12 so as to render the contacting surfaces tacky so that they are caused to adhere firmly together. The speed of rotation of the ring 23 and the number of pile yarns 20 are so selected with respect to the rate of feed of the warp yarns 12 that the pile yarns are continuously wrapped around the warp yarns in a helical pattern having a pitch such that the spacing between successive pile yarns conforms to the desired spacing of the pile rows in the finished fabric.

The shoes 43 may be heated by suitable means as by Calrods (not shown) and are maintained at a higher temperature than the rollers 39 which are only required to render the yarn sufficiently pliable, or if sufficient heat is supplied to the shoes 43 the rollers 39 may be unheated.

A rotating knife 50 is disposed on the inside of drum 10 and extends through a slot in said drum between each pair of warp yarns 12 at a point above the wrapping of pile yarn 20. The arrangement of the knives is such that as the pile yarns 20 feed upwardly past the knives 50 they are cut to leave a series of spaced pile lengths 70 attached to the individual warp yarns 12. For making uncut pile loops the knives 50 are omitted.

The upper end of the drum 10 is formed with a curved flange 71 over which the warp yarns 12 are now guided and passed under the inner surface of a ring guide 73. The ring guide 73 is of smaller diameter than the drum 10 and is spaced axially thereof so that the yarns passed thereunder are drawn together in frusto-conical formation as they pass from the drum 10 to the ring guide 73. The ring guide 73 is of a diameter such that the warp yarns 12 are brought close together and are spaced to correspond generally to the spacing of the warp yarns in the finished fabric.

A frusto-conical fluted guide plate 75 is disposed over the warp yarns 12 as they pass between the top of the drum 10 and the guide ring 73. This plate 75 is supported by brackets 76 and is shaped as a series of channels of progressively decreasing width which are adapted to fold the pile lengths 70 progressively inwardly around the warp yarns so as to form U-shaped pile tufts with inwardly extending legs 80 as indicated in Fig. 3.

When the pile tufts leave the ends of the guide 72 the warp yarns are so close together that the pile tufts are in contact and are substantially rigidly supported against each other so that they cannot open up.

The ring 73 is carried by an annular platform 85 which is journaled for rotation by means of roller bearings 86 and 87 between a fixed ring 88 and a lower bracket 89. Ring 88 is attached to truss members 90. The platform 85 carries a circular rack 95 engaging a pinion 96 on the shaft 97 of a motor 98, by means of which the platform 85 is continuously rotated. Platform 85 carries, on brackets 100, a plurality of packages 101 of filler yarn.

A ring guide 106 is attached to the platform 85 and extends around the outer surfaces of the ring of warp yarns 12 and pile yarns. A fixed cylinder 107 is mounted on the inside of the ring of pile yarn so as to engage and support the inner ends of the pile legs 30 as they pass this zone.

The filler yarns 110 are drawn from the packages 101 through eyes 111 and through guide openings 112 in the ring 106 to be wrapped around the outer surface of the warp yarns 12. The speed of rotation of the platform 85 is so selected with respect to the number of filler yarns 110 and the rate of feed of the warp yarns 12 that the filler yarns are wrapped around the warp yarns in a helix of a pitch such that the spacing conforms to the desired spacing of the filler yarns in the finished fabric.

A plurality of heated rollers 103 are carried by the ring guide 106 in a position to heat the filler yarns 110 as they are laid against the warp yarns 12 and to apply pressure to cause the filler yarns to adhere to the warp yarns. The rollers 103 are heated to a temperature to render the thermoplastic filler yarns pliable. Heated shoes 113 carried by the ring 106 serve to make the contacting surfaces of the filler yarn 110 and the warp yarn 12 tacky for sealing. The rollers 103 and shoes 113 may be heated by any suitable means as by Calrods and are similar in action to the rollers 39 and shoes 43.

The material is now in the form of a tubular fabric with pile tufts extending on the inside. The backing thus formed is similar to a woven backing but without the interlacing of the yarn characteristic of a woven backing. The tubular fabric is fed upwardly at the predetermined rate as above mentioned. The fabric may then be slit longitudinally and opened, or may be fed to other treating devices as desired.

The above apparatus is generally similar to that shown in said copending application and only so much thereof has been described herein as is necessary to an understanding of the present invention.

The yarns may comprise monofilaments or twisted continuous filament bundles or staple of a thermoplastic material or containing thermoplastic filaments or fillers as the case may be.

The rollers may be heated by steam or by electrical units. A temperature of about 310° F. is suitable for sealing filaments of vinyl and vinylidene chlorides. The temperature and pressure may vary with the material used.

It will be noted that in this system the fabric is formed continuously without weaving. It is to be understood that a suitable backing such as latex may be applied to the back of a finished fabric so as to impart the necessary body and to cover the pile yarns.

Various changes and modifications may also be made as will be readily apparent to a person skilled in the art. What is claimed is:

1. Apparatus for making pile fabric composed of yarns having thermoplastic characteristics, comprising a circular guide, means spacing a series of parallel warp yarns peripherally around said guide to form elements of a cylinder, means feeding said warp yarns in an axial direction with respect to said cylinder, means rotating with respect to said cylinder of warp yarns to wrap a pile yarn around said warp yarns, means applying heat and pressure to said pile yarns for sealing to said warp yarns, means advancing and guiding said cylinder of warp yarns inwardly in conical formation to decrease the spacing therebetween to that in the finished fabric, means folding the pile yarn inwardly between adjacent warp yarns to form pile tufts, means advancing and guiding said warp yarns from said conical formation in the form of a second cylinder of smaller diameter than said first cylinder, and means rotating with respect to said last cylinder of warp yarns to wrap a series of filler yarns therearound, and means securing said filler yarns to said warp yarns to form a non-woven backing with pile tufts projecting inwardly therefrom.

2. Apparatus for making pile fabric composed of yarns having thermoplastic characteristics, comprising a circular guide, means spacing a series of parallel warp yarns peripherally around said guide to form elements of a cylinder, means feeding said warp yarns in an axial direction with respect to said cylinder, means rotating with respect to said cylinder of warp yarns to wrap a pile yarn around said warp yarns, means applying heat and pressure to said pile yarns for sealing to said warp yarns, means cutting said pile yarn between adjacent warp yarns to leave a

straight length of pile yarn attached to each warp yarn, means advancing and guiding said cylinder of warp yarns inwardly in conical formation to decrease the spacing therebetween to that in the finished fabric, means folding the pile yarn inwardly between adjacent warp yarns to form pile tufts, means advancing and guiding said warp yarns from said conical formation in the form of a second cylinder of smaller diameter than said first cylinder, and means rotating with respect to said last cylinder of warp yarns to wrap a series of filler yarns therearound, and means securing said filler yarns to said warp yarns to form a non-woven backing with pile tufts projecting inwardly therefrom.

3. Apparatus for making pile fabric composed of yarns having thermoplastic characteristics, comprising a circular guide, means spacing a series of parallel warp yarns peripherally around said guide to form elements of a cylinder, means feeding said warp yarns in an axial direction with respect to said cylinder, means rotating with respect to said cylinder of warp yarns to wrap a pile yarn around said warp yarns, means applying heat and pressure to said pile yarns for sealing to said warp yarns, means advancing and guiding said cylinder of warp yarns inwardly in conical formation to decrease the spacing therebetween to that in the finished fabric, means folding the pile yarn inwardly between adjacent warp yarns to form pile tufts, means advancing and guiding said warp yarns from said conical formation in the form of a second cylinder of smaller diameter than said first cylinder, means rotating with respect to said last cylinder of warp yarns to wrap a series of filler yarns therearound, and means applying heat and pressure to said filler yarns to render the same tacky and to secure the same to said warp yarn to form a non-woven backing with pile yarns projecting inwardly therefrom.

4. An apparatus as set forth in claim 1 in which the heating means comprises a heated roller.

5. An apparatus as set forth in claim 1 in which the rotating means comprises a ring carrying yarn packages and heated rollers disposed to engage the yarn on said drum for heat sealing.

6. The method of making pile fabric, which comprises spacing a series of parallel warp yarns of thermoplastic material peripherally around a circle to form elements of a cylinder, feeding said yarns axially with respect to said cylinder, wrapping a pile yarn of thermoplastic material around said cylinder of warp yarns, heat sealing said pile yarns to said warp yarns, feeding said warp yarns inwardly as elements of a cone to reduce the spacing therebetween and then axially as elements of a second cylinder of lesser diameter than said first cylinder, folding the pile yarns inwardly between adjacent pairs of warp yarns as the latter advance in conical formation, wrapping a series of filler yarns around said second cylinder of warp yarns, and securing said filler yarns to said warp yarns to form a fabric in cylindrical form having a non-woven backing and pile extending inwardly therefrom.

7. The method of making pile fabric, which comprises spacing a series of parallel warp yarns of thermoplastic material peripherally around a circle to form elements of a cylinder, feeding said yarns axially with respect to said cylinder, wrapping a pile yarn of thermoplastic material around said cylinder of warp yarns, heat sealing said pile yarns to said warp yarns, feeding said warp yarns inwardly as elements of a cone to reduce the spacing therebetween and then axially as elements of a second cylinder of lesser diameter than said first cylinder, folding the pile yarns inwardly between adjacent pairs of warp yarns as the latter advance in conical formation, wrapping a series of filler yarns of thermoplastic material around said second cylinder of warp yarns, and heat sealing said filler yarns to said warp yarns to form a fabric in cylindrical form having a non-woven backing and pile yarns extending inwardly therefrom.

8. The method set forth in claim 6 in which the thermoplastic yarns are monofilaments composed of a copolymer of vinyl and vinylidene chlorides.

#### References Cited in the file of this patent

#### UNITED STATES PATENTS

Number	Name	Date
2,456,923	Cogovan	Dec. 21, 1948