April 8, 1952 K. E. PANNACI 2,591,861

METHOD AND APPARATUS FOR THE CONTINUOUS SETTING OF KNITTED FABRICS FORMED OF THERMOPLASTIC MATERIAL

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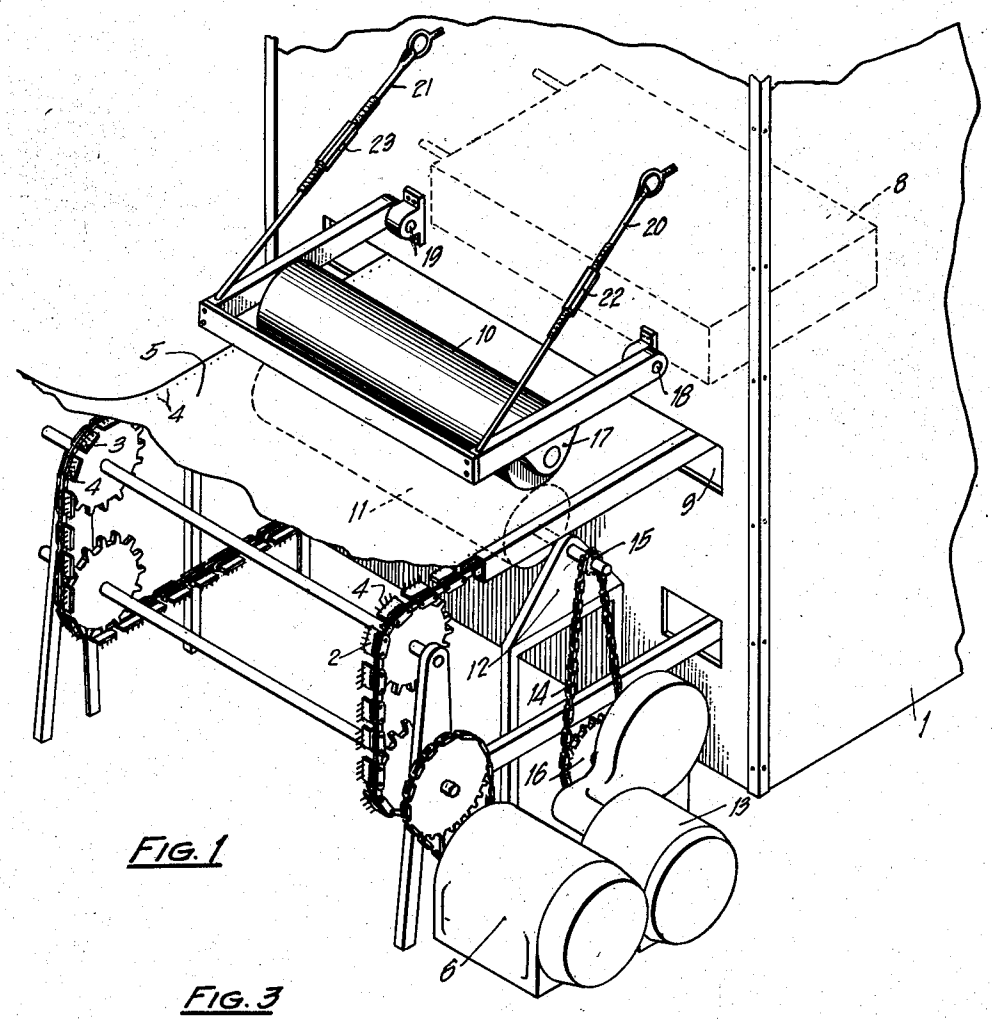
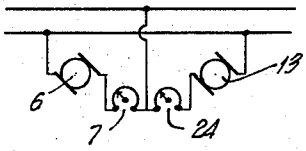


FIG. 1

FIG. 3



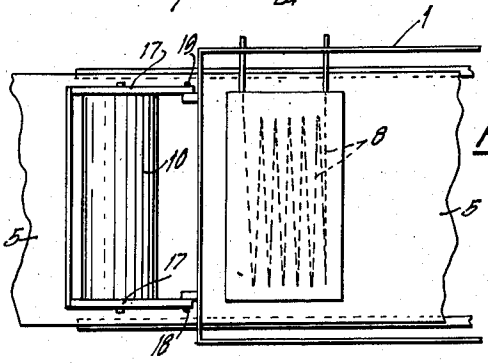


FIG. 2

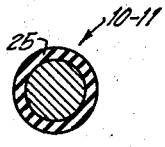


FIG. 4

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METHOD AND APPARATUS FOR THE CONTINUOUS SETTING OF KNITTED FABRICS FORMED OF THERMOPLASTIC MATERIAL

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9 Claims. (Cl. 26—52)

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My invention relates to a means and method for continuously setting warp knit and other easily stretchable fabrics formed of a thermoplastic material such, for example, as nylon. Setting, is the treatment or procedure by means of which such fabrics are made dimensionally stable to washing, stretching or other conditions which may effect a temporary distortion thereof, and is accomplished by raising the temperature of the material to a point within the heat stabilizing range which, in the case of nylon, is from 300° to 460° F., while holding the fabric to the desired width. The preferred range for nylon is from 400° to 450° F.

Warp knit fabrics come from the knitting machine in strips of substantial length, and may be easily stretched or distorted in substantially any direction although they are more readily stretched when subjected to tension longitudinally thereof or perpendicular to the courses which extend transversely across the strip. The fabric is washed, dyed, and otherwise treated in the form of these elongated strips, and, after washing or dyeing, for example, the fabric is dried by attaching the longitudinally-extending marginal edges thereof to closely spaced hooks or pins on parallel-disposed tenter chains which move the fabric continuously through a drying compartment.

The fabric may, thereafter, be set on a fixed tenter frame by means of which both the sides and ends thereof are held in fixed relation during the heat-setting. But it has been impossible to combine the setting operation with the drying operation, or otherwise to effect a continuous setting where the fabric is carried by moving tenter chains, because when setting heat is applied to a nylon fabric, for example, it tends to cause the fabric to contract or shrink in all directions. But, when only the longitudinally-extending marginal edges of the fabric are secured to a tenter chain and the fabric is thus heated, shrinkage in the marginal edge portions is prevented, because these portions are held in substantially fixed relation by the tenter hooks. Thus, the shrinkage occurs entirely, or substantially entirely, in those portions of the fabric between the tenter chains which are not held in fixed relative relation and results in an elongated strip of fabric which, in its normal, unstressed or dimensionally stable condition, is substantially shorter throughout the central portion thereof than it is in the opposite edge portions. This, of course, is extremely undesirable.

The principal object of my invention, therefore, is to provide a means and method of continuously setting a knitted fabric formed of a thermoplastic material, such as nylon, whereby the longitudinally-extending marginal edge portions and the portions between said edge portions are set to a substantially uniform length throughout the width of a fabric.

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I accomplish this end by the procedure hereinafter described which may be performed by the apparatus shown in the accompanying drawings in which—

Fig. 1 is a perspective view of the setting apparatus showing a fragmentary portion of the heating chamber within which the temperature of the fabric is raised to the heat-stabilizing point;

Fig. 2 is a smaller sectional plan view of the device;

Fig. 3 is a purely diagrammatic wiring diagram; and

Fig. 4 is a section through either of the rolls shown in Fig. 1.

Referring to the drawings—

1 is a fragmentary portion of the wall of a heating chamber through which the tenter chains 2 and 3 pass, and which may be positioned just behind a drying chamber (not shown) where the continuous setting treatment is to be combined with continuous drying. These chains have the usual hooks or pins 4 thereon which engage the marginal edges of the fabric 5 and draw it through the drying and heating chambers. The chains may be driven by motor 6, the speed of which may be controlled by a rheostat 7, a variable speed driving mechanism, or any other appropriate means.

Mounted in the heating chamber 1 in close proximity to the fabric 5 is an electric resistance heating element 8 which is designed to raise the temperature of the fabric as it passes through the heating chamber to a temperature within the heat-stabilizing range of the fabric being treated which, as pointed out above, is preferably from 400° to 450° F., in the case of a nylon fabric. The fabric 5 passes out of the heating chamber through a slotted opening 9 and, just beyond this opening, is rotatively mounted a pair of rolls 10 and 11 through the pinch of which the fabric 5 passes. These rolls are shorter than the width of the fabric and, merely for example, may be about 80" long, where the fabric is to be set to any width between about 88" and 108". The lower roll 11 is rotatively mounted in suitable bearings 12 and is driven by a motor 13 by means of the chain 14 and sprockets 15 and 16.

The upper roll 10 is mounted in a frame carrying bearings 17 which is pivotally connected to the end wall of the heating chamber, as shown at 18 and 19. The roll 10 is held in adjustable relation to the roll 11, to engage the fabric therebetween, by means of the tension bars 20 and 21, and turnbuckles 22 and 23. The speed of the driven roll 11 may be regulated by a rheostat 24, a variable speed driving mechanism, or any other appropriate means so that the peripheral speed of the rolls may be varied with respect to the rate of travel of the fabric on the chains. Both of the rolls are covered with rubber 25, as shown in Fig. 4.

In operation, the nylon or other fabric to be set has its longitudinally-extending marginal edges secured to the hooks on the tenter chains with the ends of the transversely-extending courses in the fabric substantially directly opposite each other. The chains carry the fabric through the drying chamber and the heating chamber at a speed which is adjusted to produce the desired effects of drying and setting the fabric. Since the fabric is being progressed by the engagement of its longitudinally-extending, marginal edges with the tenter chains and there is no direct application of a progressing force to the portions of the fabric between the chains, these portions lag somewhat behind the edge portions, and the courses, instead of remaining straight, become curved.

When the fabric enters the heating chamber and its temperature is raised, it tends to shrink in all directions, as pointed out above. However, since the marginal portions of the fabric are held in substantially fixed relative relation by means of the tenter chains, these portions of the fabric cannot shrink longitudinally, but the portions between the chains shrink very rapidly so that the transversely-extending courses do not maintain the same positions and relative relation they had prior to entering the heating chamber but tend to shrink in a direction opposite the direction of movement, and the strip of fabric thus becomes shorter in the center than at the edges

The function of the rolls 10 and 11 is to maintain the transversely-extending courses while in the heating chamber and after they pass from the heating chamber in substantially the same relative relation that they occupied before they entered the heating chamber. To accomplish this, the peripheral speed of the rolls generally must be adjusted with respect to the speed of the chains so that they pull the central portions of the fabric forward at a rate somewhat faster than the rate at which the marginal portions of the fabric are moving. In this way, the length of the strip of fabric which is being treated, as measured through the center thereof, is maintained equal to the length of said strip as measured along its marginal edges.

While I have described my invention in its preferred embodiment, it is to be understood that the words which I have used are words of description rather than of limitation and that changes, within the purview of the appended claims, may be made without departing from the true scope and spirit of my invention in its broader aspects.

What I claim is—

1. The method of continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, which

comprises securing the longitudinally-extending, marginal edges of said fabric in relatively fixed, parallel-disposed relation at closely spaced points thereof with the ends of each course substantially directly opposite each other; continuously moving said fabric in a longitudinal direction; heating said moving fabric to a temperature at least equal to its stabilizing point as it passes through a zone of limited extent longitudinally of said fabric; and maintaining said transversely-extending courses, while moving through the zone of heating, in approximately the same relative position as before entering said zone, by applying tension in the direction of movement of said fabric in zones thereof intermediate said marginal edges.

2. The method of continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, which comprises continuously moving said fabric longitudinally thereof through a heated zone having a temperature adapted to heat said fabric to a stabilizing point; preventing shrinkage of the longitudinally-extending marginal edges of said fabric during the heating thereof by holding said portions in substantially fixed relative relation; and moving those portions of said fabric between said marginal edges, while in said heating zone, at a rate which will maintain said courses in substantially the same relative relation as existed before entering said heated zone.

3. The method of continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, which comprises securing the longitudinally-extending, marginal edges of said fabric in relatively fixed, parallel-disposed relation at closely spaced points thereof with the ends of each course substantially directly opposite each other; continuously moving said edges of said fabric in a longitudinal direction at a substantially uniform rate of speed; heating said moving fabric at least to the stabilizing point during its passage through a zone of limited extent; and moving those portions of said fabric which are centrally disposed between said marginal edges through said heating zone at a higher rate of speed than said edges to offset longitudinal shrinkage of said fabric while in said zone and to maintain said courses in substantially the same relative position as before entering said zone.

4. The method of continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, which comprises securing the longitudinally-extending, marginal edges of said fabric in relatively fixed, parallel-disposed relation at closely spaced points thereof with the ends of each course substantially directly opposite each other; continuously moving said edges of said fabric in a longitudinal direction at a substantially uniform rate of speed; heating said moving fabric at least to the stabilizing point during its passage through a zone of limited extent; and adjusting the rate of movement through said zone of portions of said fabric intermediate said edges and relative to the rate of movement of said edges to maintain said courses in substantially the same relative position as before entering said zone.

5. The method of continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-

extending courses therein; which comprises securing the longitudinally-extending, marginal edges of said fabric in relatively fixed, parallel-disposed relation at closely spaced points thereof with the ends of each course substantially directly opposite each other; continuously moving said fabric in a longitudinal direction; heating said moving fabric to a temperature at least equal to its stabilizing point as it passes through a zone of limited extent longitudinally of said fabric; and adjusting the relative rates of movement of said edges of said fabric and those portions of said fabric centrally disposed between said edges while said fabric is passing through said heating zone to maintain said courses in substantially the same relative relation as before entering said zone.

6. In an apparatus adapted for continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, the combination with a tenter comprising a pair of parallel-disposed chains, of means for driving said chains, means forming a heating compartment through which said chains pass, an electrical resistance heating element in said compartment, a pair of rolls rotatively mounted between said chains with the pinch thereof disposed to engage a fabric having its marginal edges secured to said chains after said fabric has passed out of said compartment and in the centrally disposed zones of said fabric, and means for driving at least one of said rolls.

7. In an apparatus adapted for continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, the combination with a tenter comprising a pair of parallel-disposed chains, of means for driving said chains, means forming a heating compartment through which said chains pass, an electrical resistance heating element in said compartment, a pair of rolls rotatively mounted between said chains with the pinch thereof disposed to engage a fabric having its marginal edges secured to said chains after said fabric has passed out of said compartment and in the centrally disposed zones of said fabric, means for driving at least one of said rolls, and means for varying the relative speed of said chain driving means and said roll driving means.

8. In an apparatus adapted for continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, the combination with a tenter comprising a pair of parallel-disposed chains, an electric motor for driving said chains, means forming a heating compartment through which said chains pass, an electrical resistance heating element in said compartment adapted to raise the temperature of said fabric in passing therethrough at least to the stabilizing point, a pair of rolls rotatively mounted between said chains with the pinch thereof disposed to engage a fabric having its marginal edges secured to said chains after said fabric has passed out of said compartment and throughout a substantial portion of said fabric between said marginal edges thereof, a separate electric motor for driving at least one of said rolls, and means for varying the speed at which said roll is driven.

9. In an apparatus for continuously setting an elongated, knitted fabric formed of a thermoplastic material, such as nylon, and having transversely-extending courses therein, the combination with a tenter comprising a pair of parallel-disposed chains provided with means for attaching the opposite marginal edges of said fabric thereto, of means for driving said chains, means forming a heating compartment through which said chains pass, for heating said fabric at least to the stabilizing point thereof as it is moved through said compartment by said tenter, and means cooperating with said fabric in the centrally-disposed zones thereof after it passes out of said compartment for progressing said zones at a rate which will maintain said courses thereof in substantially the same relative relation as before entering said compartment.

KARL E. PANNACI.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,251,962	Sommaripa	Aug. 12, 1941
2,338,983	Thackston et al.	Jan. 11, 1944
2,343,892	Dodge et al.	Mar. 14, 1944