

PATENT SPECIFICATION (11)

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- (21) Application No. 10058/74 (22) Filed 6 March 1974 (19)
 (31) Convention Application No. 354 708 (32) Filed 26 April 1973 in
 (33) United States of America (US)
 (44) Complete Specification published 3 June 1976
 (51) INT. CL.² D06C 21/00
 (52) Index at acceptance
 DIS 18 4



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(54) APPARATUS FOR COMPRESSIVELY SHRINKING FABRICS

(71) We, CLUETT, PEABODY & Co. INC., a corporation organised and existing under the laws of the State of New York, U.S.A., of 433, River Street, Troy, New York, U.S.A., do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an apparatus for the compressive shrinking of fabrics, the apparatus employing a cylinder and an elastomeric belt forming a nip therebetween.

Methods and machines for accomplishing compressive shrinking have been developed extensively and are exemplified in U.S. Patents 2,021,975 and 2,146,694 which disclose machines working on essentially the same principle, wherein a constraining belt of thick rubber is provided and the moisture imparted by a water spray device is prevented from escaping during the shrinking action. The maximum speed of such machines is 110 yards per minute on light fabrics and 40—45 yards per minute on heavier fabrics.

There are innumerable problems which develop as a result of trying to operate apparatus of the above type at speeds of 110 yards or more per minute, one of the greatest being the skips or belt vibrations due to the centrifugal force which is created by the mass of the belt following a curved path. When these vibrations occur, they cause the rubber belt to lose contact with the heated drum and those sections of the fabric in that area are not compressively shrunk to the same degree as the rest of the fabric.

According to the invention, we provide an apparatus for longitudinally compressively shrinking a lightweight textile fabric web, which apparatus comprises a cylinder having a surface of low frictional resistance; a plurality of rollers, each of which is rotatable about an axis parallel to the axis of the cylinder, at least one of said rollers being driven; and a belt of elastomeric material mounted on the rollers; the belt passing round a first roller and then

round a second roller, which two rollers are so arranged that a portion of the belt that passes therebetween is wrapped round the cylinder along an arc; the first roller being a nip roller which is movable radially relative to the cylinder to form an adjustable nip between the belt and the cylinder; the second roller being a take-up roller that is movable in a direction substantially tangential with respect to the cylinder, whereby the length and tension of the belt may be varied; the take-up roller also being movable, in a direction substantially perpendicular to the said tangential direction, towards and away from the cylinder, whereby the length of the arc along which the belt is wrapped around the cylinder may be varied.

Preferably, mounting means are provided for the tension roll, which means comprise a first pair of elongated screws pivotally mounted at one end within the perimeter of the belt for swinging movement toward and away from the said cylinder; a pair of journals mounting each end of the said tension roll for rotation and threaded for connection to the said first screw pair to permit movement of the journals along the screw pair so that the said tension roll is adjustable in position generally tangentially of the cylinder; a second pair of elongated screws rigidly mounted externally of the said belt adjacent to each end of the tension roll in a direction generally perpendicular to the said first screw pair; and a pair of yokes each threaded to the said second screw pair for traversing movements along the second screw pair and each slidably connected to respective screws of the said first screw pair so that the position of the yokes can be varied along the second screw pair to vary the length of the arc along which the belt is wrapped around the cylinder.

The advantages obtained by the present invention are that the textile fabric material may be compressively shrunk at high speeds without skips due to belt vibration, and that total production of preshrunk fabric may be greatly increased per unit of apparatus.

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The apparatus and method of the invention will now be described with reference to the accompanying drawings, in which

5 Figure 1 is a schematic side elevation of one form of apparatus suitable for practicing the method of the invention;

10 Figure 2 is an enlarged view of a section of the apparatus of Figure 1 showing the improvement of the present invention with the belt shown in maximum position,

Figure 3 is an enlarged view similar to Figure 2 showing the belt in minimum wrap position, and

15 Figure 4 is a section taken along line 4—4 of Figure 3 of one type of belt useful for this invention.

Referring to Figure 1 of the drawing, a continuous web 5 of a textile fabric is fed from fabric roll 4 by unbatcher rolls 6 to a pair of scray feed rolls 7, the fabric then follows a scray chute 8, into which the material is overfed to provide storage of fabric before it is drawn from the scray through a pair of swivel tension bars 9 over a sky roll 10, downwardly through an automatic fabric guider 11 and around an idler roller 12 by a feed roll assembly 13 which includes rolls 13a, 13b and input measuring roll 13c. The fabric passes over the input measuring roll 13c through a conditioning chamber 14 wherein both faces of the web are exposed to moisture such as steam. The web 5 then passes over a web straightening device 15 prior to contacting one or more heated dry cans 16 which serve to evenly distribute the moisture through the fibers of the web 5. Upon leaving the dry can 16, the web enters the rubber belt compressive shrinking unit 17 after passing over rolls 18 and 19 and a scrimp bar 19a. The web 5, after leaving the shrinking unit 17, passes over a stripper roll 20 and an entering roll 20a and into the felt belt drying unit 40. Output measuring roll 20b in conjunction with the input measuring roll 13c are interconnected electrically by tachometer generators 21a and to a visual metering device 21b whereby an operator may make any web feed adjustments necessary to indicate that the proper amount of compressive shrinkage and pull-out is taking place to ensure that the web 5 is properly treated prior to discharge from the treatment range. This system of tachometer generators and related devices are disclosed in U.S. Patent 2,885,763. It should additionally be mentioned that before textile fabric web 5 is subjected to compressive shrinking, a test sample thereof having marked length measurements, is laundered, dried and measured to determine the total shrinkage that has occurred to the textile fabric and thus indicate the amount of compressive shrinking that must be applied.

20 The fabric web 5 leaves the felt belt dryer and passes over rollers 41, 42 and 43 before

being engaged by cooler entry roller 44. The web 5 passes through the air cooling unit 45 over rollers 46, 47 and 48, and around roller 49 and into scray feed rolls 50 before entering and being stored tensionless in scray chute 51. There is a batcher 52 which serves to rewind the web on a roll following drying, cooling and storage in the scray chute 51. The web is drawn over swivel tension rolls 53 and sky rolls 54 through automatic fabric guiders 55 around roll 56 and is wound on a roll 57 by the batcher mechanism. Batcher 52 is equipped with a constant torque winding apparatus and is common in equipment of this type. This results in winding of the web on the roll 57 with controlled tension.

It will be understood that the apparatus disclosed and described in connection with Figure 1 is known. The improvement provided by the present invention will now be described in more detail in connection with Figure 2 and Figure 3.

Referring to Figure 2, there is a large-diameter, heated drum 30 with a hard surface that is highly polished (thereby giving a low frictional resistance) and relatively thick rubber belt 23 that passes beneath drum 30 and around nip roll 24, adjustable take-up roll 25 and rolls 26 all of which are relatively small diameter rolls. A variable adjustment mechanism 31 is provided to increase or decrease the distance between nip roll 24 and the heated drum 30 thereby creating greater or lesser distance between roll 24 and drum 30. Adjustment mechanism 31 includes a pair of screws 32 manually or otherwise rotatable to effect translation thereon of internally threaded yokes 33. Yokes 33 are connected to the ends of mounting bars 34 which include means for journalling the nip roll 24. The other ends of bars 34 are pivotally mounted to structure at 34a so that translation of yokes 33 will cause movement of nip roll 24 toward and away from drum 30.

The coaction of elements illustrated longitudinally compresses or shrinks the web in a known manner by the action of the belt as the surface portion thereof functionally bonded to the web changes from an elongated condition under tension around nip roll 24 to a compacted condition under compression around drum 30. Nip roll 24 is mounted considerably below the horizontal center line of drum 30 and is urged selectively toward and away from drum 30 by actuation of interconnection mechanism 31.

Take-up roll 25 in its maximum wrap position is situated between the horizontal center lines of roll 24 and drum 30 and considerably below the horizontal center line of nip roll 24 in its minimum wrap position by virtue of the adjustment elements 60 to 65. Referring now to Figure 3, there is a pair of

belt tensioning screws 60, each of which is rotationally connected at one end to a lever 61 and to an axis bearing (not shown) of take-up roll 25 through an internally threaded journal 62. There is also a pair of wrap-adjusting screws 63, each of which is rotationally connected at one end to the machine frame 64, and also slidably connected to a yoke 65, which is internally threaded, to which yoke a tensioning screw 60 is attached. The turning of wrap-adjusting screws 63, through the yokes 65 and tensioning screws 60 which are rotationally mounted to levers 61, causes the take-up roll 25 to be raised or lowered, depending on the rotation of wrap-adjusting screws 63, through an arcuate path to increase or decrease the amount of wrap of belt 23 around cylinder 30. This arcuate adjustment and the attendant varying wrap of belt 23 against the outer periphery of roll 22 is an important advance in respect of this type of compressive shrinking machinery. The adjustment of roll 25 to increase or decrease belt wrap is arcuate and as such, does not change the tension in belt 23. If additional tension or less tension is desired in belt 23 actuation is effected through rotation of belt tensioning screws 60. There are water spray devices 67 which coat the inner and outer faces of the rubber belt to effect cooling of the belt and water removal rolls 68 to remove water or moisture from the belt 23 as it approaches the nip roll 24.

In accordance with the invention and the foregoing description, the roll 25 is made variable in its tension and wrap functions. The wrap of the belt about the drum 30 can be increased for slower speed operation, or can be decreased for higher speed operation without changing the tension already being applied by the roll 25. Thus it is possible to greatly increase the speed of the compressive shrinking apparatus without the harmful effects such as belt skip or vibration previously encountered by merely adjusting the tensioning screw 60 to decrease the amount of wrap about the cylinder 30.

A belt such as 23 in previous or conventional rubber belt compressive shrinking apparatus has been approximately $2\frac{1}{4}$ inches in thickness and between shore durometer hardness of 35 to 40. In accordance with the present invention it has been found that belt 23 may advantageously have a thickness of only a maximum of one inch which lesser thickness produces highly satisfactory and efficient operation at the speeds employed in the present apparatus, i.e. wherein the speed of the belt's elastomeric surface is from 110 yards per minute (minimum) and 250 yards per minute (maximum). It has also been found advantageous to mold longitudinal, horizontal equally spaced cords or threads within the belt 23 closely adjacent to the

rear face thereof. By inclusion of these cords or threads within the belt there is a shift in the neutral axis of the belt. The neutral axis of the belt may be defined as that line intermediate the top and bottom surfaces which remains unaffected by bending or curvature of the belt away from the heated drum. This results in enabling the use of a thinner belt because with the neutral axis relocated in a direction away from the heated drum and the back face being restrained against extension or compression the belt surface in contact with the heated drum is forced to stretch appreciably more than if the same thickness belt was used without these cords or threads.

Although the method so far described provides for moistening or conditioning the fabric prior to compressive shrinking, it will be understood that certain lightweight fabrics would not need such pretreatment and the conditioning chamber 14 will be bypassed.

WHAT WE CLAIM IS:—

1. An apparatus for longitudinally compressively shrinking a lightweight textile fabric web, which apparatus comprises a cylinder having a surface of low frictional resistance; a plurality of rollers, each of which is rotatable about an axis parallel to the axis of the cylinder, at least one of said rollers being driven; and a belt of elastomeric material mounted on the rollers; the belt passing round a first roller and then round a second roller, which two rollers are so arranged that a portion of the belt that passes therebetween is wrapped round the cylinder along an arc; the first roller being a nip roller which is movable radially relative to the cylinder to form an adjustable nip between the belt and the cylinder; the second roller being a take-up roller that is movable in a direction substantially tangential with respect to the cylinder, whereby the length and tension of the belt may be varied, the take-up roller also being movable, in a direction substantially perpendicular to the said tangential direction, towards and away from the cylinder, whereby the length of the arc along which the belt is wrapped around the cylinder may be varied.

2. An apparatus as claimed in claim 1, wherein mounting means are provided for the tension roll, which means comprise a first pair of elongated screws pivotally mounted at one end within the perimeter of the belt for swinging movement toward and away from the said cylinder; a pair of journals mounting each end of the said tension roll for rotation and threaded for connection to the said first screw pair to permit movement of the journals along the screw pair so that the said tension roll is adjustable in position generally tangentially of the cylinder; a second pair of elongated screws rigidly mounted externally of the said belt adjacent

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2. An apparatus as claimed in claim 1, wherein mounting means are provided for the tension roll, which means comprise a first pair of elongated screws pivotally mounted at one end within the perimeter of the belt for swinging movement toward and away from the said cylinder; a pair of journals mounting each end of the said tension roll for rotation and threaded for connection to the said first screw pair to permit movement of the journals along the screw pair so that the said tension roll is adjustable in position generally tangentially of the cylinder; a second pair of elongated screws rigidly mounted externally of the said belt adjacent



to each end of the tension roll in a direction generally perpendicular to the said first screw pair; and a pair of yokes each threaded to the said second screw pair for traversing movements along the second screw pair and each slidably connected to respective screws of the said first screw pair so that the position of the yokes can be varied along the second screw pair to vary the length of the arc along which the belt is wrapped around the cylinder.

3. An apparatus as claimed in claim 1 or 2 wherein the elastomeric belt is a maximum of one inch in thickness.

4. An apparatus as claimed in claim 1, 2 or 3, wherein the elastomeric belt is of a minimum 30 shore durometer hardness and

a maximum 60 shore durometer hardness.

5. An apparatus as claimed in any one of claims 1 to 4 wherein the elastomeric belt contains longitudinally disposed threads equally spaced across the belt and located between the rear face and the horizontal centre of the belt.

6. An apparatus for compressively shrinking a web substantially as hereinbefore described and as illustrated in the accompanying drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1976.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

