Oct. 28, 1952 S. L. CLUETT 2,615,230

COMPRESSIVE SHRINKING OF WEBS

Filed April 30, 1947 2 SHEETS—SHEET 1

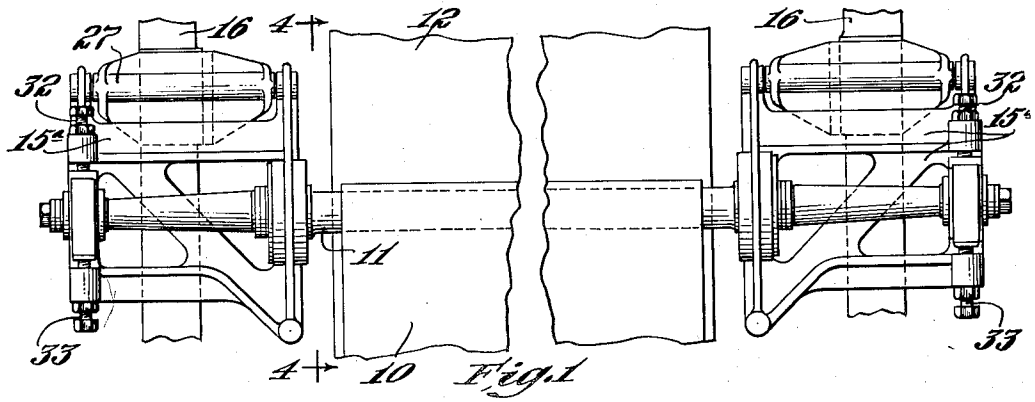


Fig. 1

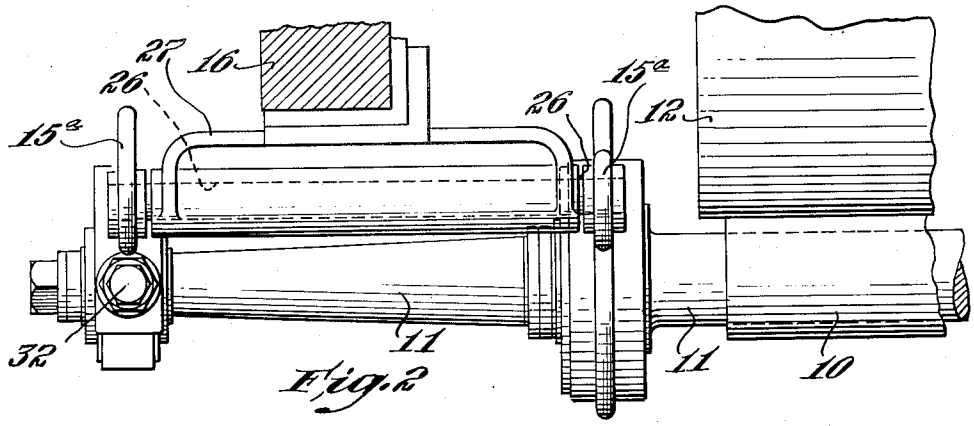


Fig. 2

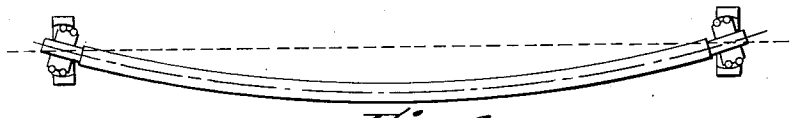


Fig. 6

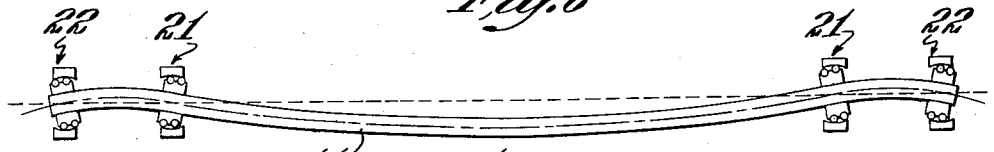


Fig. 7

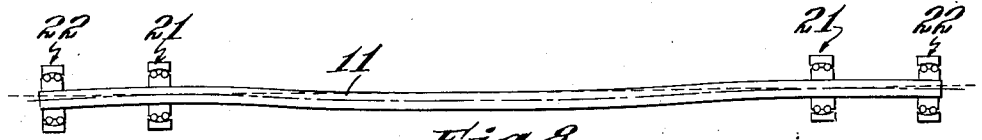


Fig. 8

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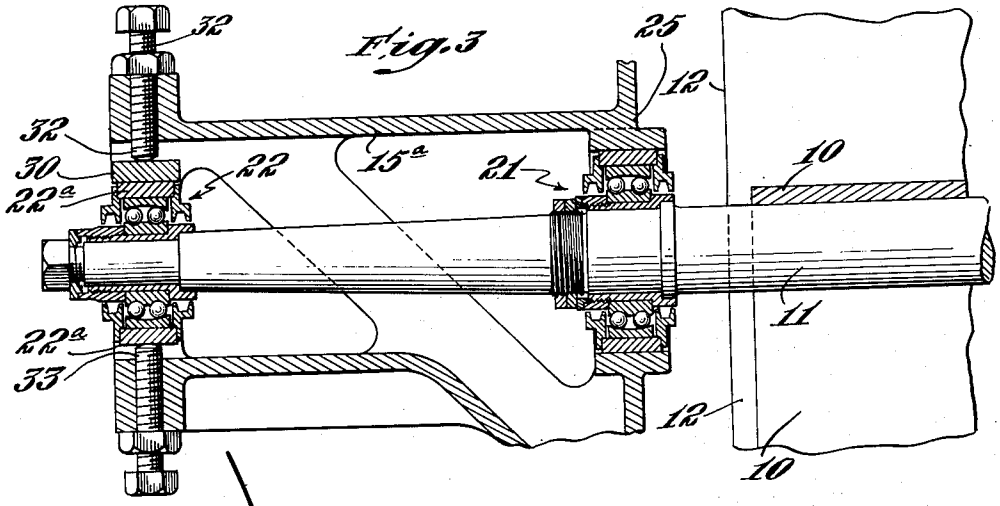


Fig. 3

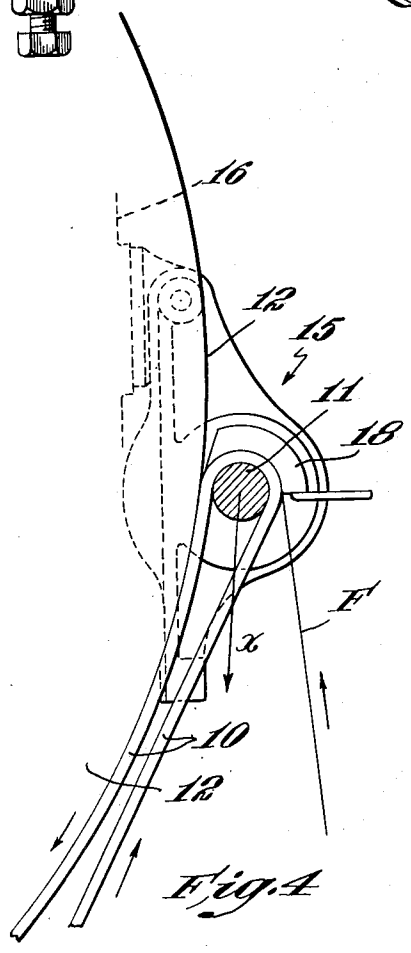


Fig. 4

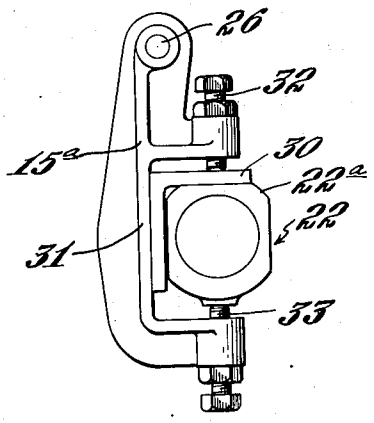


Fig. 5

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Patented Oct. 28, 1952

2,615,230

UNITED STATES PATENT OFFICE

2,615,230

COMPRESSIVE SHRINKING OF WEBS

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Application April 30, 1947, Serial No. 744,970

7 Claims. (Cl. 26—18.6)

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This invention relates to the compressive shrinking of webs, such as of fabrics, in which a traveling blanket reverses its curvature in passing from a relatively small-diameter intake roll onto a heated drum as described in my United States Patent 1,861,424. In machines of this type the fabric-carrying blanket undergoes a reversal of curvature which shortens its fabric-carrying surface and is nipped or held under pressure by the combined action of the intake roll and the drum. The traveling blanket passes around the intake roll under tension, and when the intake roll is supported in conventional manner at its two ends, a deflection of the intake roll occurs by reason of the pull exerted upon the roll by the tensioned blanket. Deflection of the intake roll is undesirable in causing a greater degree of nip or pressure to be exerted on the blanket between the intake roll and drum adjacent to the selvedges of the blanket than at the middle of the width of the blanket. Such differences in degree of nip or pressure can cause differences in the amount of compressive shrinking action secured and also can cause differences in the character of the finish of the fabric.

In conventional machines of this type the intake roll is so positioned with relation to the drum as to reduce so far as practicable the differences in pressure which are caused by the deflection of the roll, but nevertheless these deflections of the roll and the resulting differences in pressure constitute a limitation on the effectiveness of the machine and on the practicable width of the machine.

Moreover, the extreme fiber stresses set up in the intake roll must be kept within permissible limits, and this presents a problem when an attempt is made to increase the width of a conventional machine.

For various economic and technical reasons, it is undesirable to increase the diameter of the intake roll of a conventional compressive shrinking machine. If, with a given diameter of the intake roll, the width of such machine were increased, the deflection of the roll would then be very greatly increased, and the extreme fiber stresses in the roll would also be greatly increased.

One object of the invention is to overcome these limitations upon the practical width of compressive shrinking machines. Deflection of a roll which is simply supported at each end varies as the cube of the length between the supports of the roll. Thus, if the width of a conventional machine and the length of its intake

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roll were increased, the diameter of the roll would need to be disproportionately increased in order to keep the deflection of the roll within permissible values. Increase in diameter of the roll would also be necessary because of the increase in extreme fiber stresses resulting from lengthening the roll.

On the other hand, the amount of compressive shrinking action accomplished by passage of the traveling blanket from the intake roll onto the drum varies inversely as the diameter of the intake roll. Hence, increase in diameter of this roll is generally undesirable in reducing the shrinking capacity of the machine.

The intake roll of a shrinking machine must be removed fairly frequently, for instance in connection with changing the traveling blanket, or in substituting one intake roll for another intake roll. Undue weight of the intake roll is thus an inconvenience, particularly in wide machines where the long length of this roll, coupled with its necessarily considerably increased diameter, makes the roll so heavy that it is difficult to handle.

An object of the invention is to provide an improved method and apparatus for use in the compressive shrinking of fabrics, with which greater uniformity in the shrinking across the width of the fabric may be obtained, and uniform and satisfactory shrinking obtained for greater widths of fabrics than has heretofore been possible.

Another object of the invention is to improve machines of this general type by so mounting the intake roll as to reduce its tendency to deflect from its intended position under the influence of the blanket. By accomplishing this object, smaller-diameter and hence lighter rolls can be applied than could otherwise be used, and machines can satisfactorily be made with very wide widths without the previously necessary increase in both diameter and weight of the roll.

Other objects and advantages of the invention will be apparent from this specification and its drawings wherein one example of this invention is disclosed.

In the drawings:

Fig. 1 is a front elevation showing the intake roll of the cloth shrinking machine, the mountings for each end of the intake roll, and portions of the frame of the machine of the drum and of the blanket, various parts of the machine being omitted for clarity of illustration;

Fig. 2 is a fragmentary plan view, partly in horizontal section, on a larger scale than Fig. 1,

showing the left end portion of the apparatus of Fig. 1;

Fig. 3 is a vertical sectional view of the apparatus of Fig. 2, this view omitting certain parts;

Fig. 4 is a diagrammatic view of the intake end of the cloth shrinking machine, this figure being taken on the line 4—4 of Fig. 1;

Fig. 5 is a left end detail view of the intake roll mounting of Figs. 2 and 3, this view omitting certain parts in rear of those shown;

Fig. 6 is a diagrammatic view showing on a greatly exaggerated scale the deflecting tendency of an intake roll when simply supported in bearings at its two ends;

Fig. 7 is a diagrammatic view showing on a greatly exaggerated scale the deflecting tendency of the intake roll in the case of one adjustment of the intake roll bearings of the machine of this application; and

Fig. 8 is a diagrammatic view showing on a greatly exaggerated scale the deflecting tendency of the intake roll when the intake roll bearings are adjusted relatively to each other in a manner rendered possible by the present invention.

As diagrammatically shown in Fig. 4 a traveling endless blanket 10, a portion only of which is shown in this figure, runs generally upwardly, thence over and around an intake roll 11 and thence onto and around a large drum 12. A roll mounting indicated generally at 15 is located at each end of intake roll 11 and is pivotally connected to the frame 16 of the machine somewhat above the intake roll. The force of the blanket upon the roll tends to swing the roll and its mountings about the pivotal connections of the roll mountings to the frame, and hence urges the intake roll inwardly toward the drum 12 and presses the blanket between the roll and drum.

Fabric F, to be shrunk, is drawn into the apparatus and approaches the blanket in the general direction shown in Fig. 4 and makes contact with the blanket in a region where the outer surface of the blanket is extended by reason of the curvature of the blanket around the intake roll 11. The fabric then accompanies the surface of the blanket, being held in frictional contact therewith by heated ironing blocks or shoes 18 whose lower surfaces are smooth and polished.

Passage of the blanket from the intake roll 11 onto the drum 12 reverses the curvature of the outer surface of the blanket, changing this surface from convex to concave, and correspondingly shortens this surface and compressively shrinks the accompanying fabric F. On the heated drum 12, against which the fabric F is held by the blanket 10, the fabric is dried and set in its longitudinally shrunk condition.

The machine as thus far described in connection with Fig. 4 operates essentially as described in my Patent 1,861,424 which may be referred to for a fuller explanation of this type of machine. Figs. 1, 2 and 3 omit illustration of the ironing blocks or shoes 18 and the mechanism for holding and adjusting these ironing blocks or shoes, because illustration of this mechanism would tend to obscure certain parts with which the present invention is concerned, and said Patent 1,861,424 or Patent 2,199,011 may be referred to as showing such mechanism.

The said ironing blocks or shoes 18 have previously been constructed in relatively short lengths so that a plurality of such blocks or shoes rest independently on the cloth, because of flexure of the intake roll, as explained in said Patent 1,816,424. While by the present invention flexure of the intake roll can be materially reduced, the use of a plurality of relatively short pressure blocks or shoes is still preferred since such construction facilitates their handling and inspection.

In the illustrated apparatus according to the present invention, the mountings for intake roll 11 are constructed so as to minimize flexure of the roll in the region where the roll presses the blanket against the drum. When the intake roll is pressing the blanket 10 against the drum 12 as shown in Fig. 4, the resultant deflecting tendency of the blanket upon the portion of the roll engaged by the blanket is in a direction such as shown by the nearly vertical arrow x. This deflecting tendency of the blanket upon the roll is due not only to the tension in the blanket itself, but also to the weight of the series of ironing blocks or shoes 18 which bear upon the blanket over the roll 11 throughout practically the entire width of the blanket 10.

As shown in Fig. 3, the bearings for each end of the intake roll are constructed and arranged to fix the relative positions of two longitudinally spaced portions of the intake roll which lie outwardly beyond the widthwise extent of the drum.

Thus as shown in Fig. 3 each end of the intake roll 11 is mounted in two sets of anti-friction bearings such as ball bearings indicated respectively at 21 and 22 which cooperate to fix the positions of the respective portions of the roll which they engage. The bearings 21 and 22 are mounted in a frame or bracket 15a which is sufficiently wide to carry these bearings at its respective ends, and bracket 15a is pivoted at each end to a stationary pivot shaft 26 (Fig. 5) carried by a stationary bracket 27 (Figs. 1 and 2) which is attached to a vertical upright 16 of the frame of the machine. The inner bearing 21 is located slightly outwardly beyond the width of drum 12 and supports the intake roll 11 against the generally downward pull of the traveling blanket 10. The outer bearing 22, which may for example be spaced approximately 15 inches from the inner bearing 21, is located adjacent to the outer end of the intake roll 11. Outer bearing 22 opposes generally upward deflection of the outer end portion of roll 11 such as would occur if the roll 11 were simply supported at each end as in Fig. 6, that is, deflection in a direction opposite to the direction of the deflecting tendency of the blanket upon the portion of the roll between the two inner bearings. Extending the roll 11 outwardly beyond the bearings 21 and holding its outer end portions down by means of the outer bearings 22 reduces the tendency of the main middle portions of the roll to be deflected downwardly by the pull exerted by the blanket 10. The efficient performance of this function by the outer bearings 22 requires that the portion of the roll between the inner and outer bearings, which portion constitutes in effect a lever arm, shall be sufficiently long to avoid the creation of excessive pressures upon the bearings. Thus where a drum of for example 100 inches width is to be used, a distance of about 15 inches from center to center of the inner and outer bearings is recommended.

When the intake roll is subject to the deflecting force of the blanket, then if the bearings 21 and 22 are in axial alignment as diagrammatically shown in Fig. 7, the main middle portion of the roll between the inner bearings tends to assume a slightly curved form in the nature of a slight downward bow, the curvature of the roll reversing in the region of each inner bearing and

becoming slightly upwardly bowed between the spaced inner and outer bearings. Under these conditions, the portion of the roll at each inner bearing is slightly inclined to the horizontal and there forms a transition between the main silghtly downwardly bowed portion between the inner bearings and the shorter, slightly upwardly bowed portion, between the inner and outer bearings. The deflection of the middle portion, under load, can be substantially offset or counteracted by relative adjustment of the bearings 21 and 22 in a direction generally parallel to the direction of deflecting tendency of the blanket, that is, generally vertically in a machine arranged as illustrated. Although such relative adjustment can consist of displacement of the inner bearings upwardly or of the outer bearings downwardly, it is more convenient to provide for displacement of the outer bearings downwardly. As shown in Figs. 3 and 5, the outer housing 22a of outer bearing 22 is engaged at its top by an L-shaped bracket 30 which is slidable approximately vertically in a slideway 31 in the bracket 15a. An adjusting screw 32 in bracket 15a bears against the top of slidable bracket 30, so that adjustment of screw 32 enables the bearing 22 to be depressed or allowed to rise. Depression of the two outer bearings 22 by adjustment of their screws 32 tends to deflect each outer end portion of the roll downwardly. In the absence of the blanket, or with the blanket slack and not tending to deflect the roll, a slight depression of the outer bearings will cause the main middle portion of the roll to be slightly bowed upwardly between the inner bearings. Application of the load of the blanket to the roll, tending to deflect the main middle portion of the roll downwardly, will then offset the upward bowing tendency which is exerted by depression of the outer bearings.

After applying the load of the blanket, then by progressively depressing the outer bearings, the middle of the roll can be raised close to a horizontal undeflected position and be maintained in this position during running. Fig. 8 shows on a greatly exaggerated scale the tendency of the roll to be deflected by the blanket when the outer bearings 22 are depressed relatively to the inner bearings 21 (or the inner bearings 21 are correspondingly elevated relatively to the outer bearings 22), the amount of displacement of the bearings being likewise greatly exaggerated in this figure. Further depression of the outer bearings 22 or elevation of the inner bearings 21 is adapted to raise the middle portion of the roll up into horizontal alignment with the inner bearings 21 or even above such level if desired.

With the load of the blanket applied to the roll, the depression of the outer bearings by means of the adjusting screws 32 of Figs. 1 and 3 will ordinarily be such as to cause the portions of the roll engaged by the inner bearings to be substantially horizontal as shown in Fig. 8. The portion of the roll between the two inner bearings then resembles a fixed beam which is constrained to the horizontal at fixed supports at its ends. For a given load, the deflection of such beam at its middle amounts to only one-fifth the deflection of a simple beam such as indicated in Fig. 6.

The action of the outer bearings also results in a reduction of the maximum value of fiber stress existing in the roll. When the outer bearings are depressed relative to the inner bearings so that, under load, the portions of the roll engaged by the inner bearings 21 are horizontal,

the roll resembling a fixed beam as described above, then the fiber stress can be calculated as in the case of a fixed beam. Such calculations show that in the case of a roll which extends 100 inches between its inner bearings 21 the maximum fiber stress is only approximately two-thirds of the maximum fiber stress that would exist if the roll were simply mounted in the inner bearings alone. This reduction in maximum fiber stress is advantageous in rendering the roll stronger and less subject to crystallization of its metal, which is an important consideration because machines of this type are often run continuously for long periods.

It will be observed that the bearings 21 and 22 are of the self-aligning type and are preferably anti-friction bearings, either ball or roller. The self-aligning construction of the outer bearings 22 is particularly useful in enabling the roll to turn freely when its outer end is bent downwardly by depression of the outer bearings as above described. The self-aligning construction of the inner bearings 21 permits the roll to turn freely in its inner bearings notwithstanding tilt or inclination of the portions of the roll at the inner bearings before these portions are brought to horizontal position by depression of the outer bearings as above described.

Stop means, such as an adjustable stop screw 33 are preferably provided in each bracket 15a in position to engage the lower face of the bearing housing 22a and so limit the extent to which bearing 22 is displaced downwardly by the screw 32. With stop screw 33 backed away, the bearing 22 can be adjusted downwardly by means of the screw 32, whereupon the stop screw 33 can be engaged with the bearing housing and be locked in place. In removing the roll the screw 32 can be retracted, relieving the bearing housing 22a from pressure and allowing the roll to straighten itself when the force of the blanket is removed from the roll. All the roll bearings are then in axial alignment and the bearing housings for the inner and outer bearings can then be slipped out of brackets 15a, and the roll removed from the machine. Upon replacement of the roll and the bearing housings, screw 32 can then be screwed down to restore the outer bearing housing to its previously adjusted depressed position in contact with the stop screw 33.

It will be observed from the foregoing that by use of this invention in compressively shrinking fabrics, the small diameter intake roll, over which the blanket is passed just before contacting the large drying cylinder, may be flexed or bowed by relative movement of the bearing of each pair at each end of the roll so as to tend to flex the mid-portion of the roll oppositely to the direction in which the blanket tends to flex this mid-portion. Thus by selected relative adjustment of the bearings of each pair, there can be applied to the intake roll flexing forces tending to create a longitudinally convex surface on that part of the roll which is engaged by the blanket and so counterbalancing or neutralizing to the desired extent, either wholly or partially, the oppositely acting flexing forces which are applied to that portion of the roll by the blanket. This enables the blanket-contacting portion of the roll and the blanket surface which contacts with the roll to be maintained substantially straight from side to side, with the result that the roll will press the blanket, and the fabric web on the blanket, against the large heated drum at the point of "nip" with substantially uniform pressure across the entire width of the fabric and the blanket.

Therefore, the shrinking in the fabric, caused by the contraction of the blanket while pressing the fabric against the heated drum, will be uniform across the entire width of the fabric even when the widths of the fabrics so treated are increased to 100 inches or more. This also results in a minimum distortion of the blanket.

I claim:

1. In the art of compressively shrinking a fabric in which a long, heated, rotatably mounted drum of relatively large diameter and a rotatably mounted, long intake roll of relatively small diameter are disposed side by side, with the roll mounted to move bodily in a direction crosswise of its length toward and away from the peripheral surface of said drum, and in which an endless blanket extends under tension over said roll and then around said drum and back to said roll, and in a direction to pull the roll towards the drum, and in which a web of fabric to be shrunk is conducted into face to face, abutting contact with the outside face of said blanket, just before it passes over said roll, to pass between the blanket and drum, that improved method of insuring increased uniformity of the shrinking of the fabric across its entire width which comprises applying oppositely directed and similar forces to each end of the roll beyond the margin of its blanket and in all positions of the roll as it moves toward and from the drum, said forces acting in a plane generally parallel to the direction of pull of the blanket on the roll and tending to flex the mid-portion of the roll oppositely to the direction in which the blanket tends to flex said mid-portion.

2. In the art of compressively shrinking a fabric in which a long, heated, rotatably mounted drum of relatively large diameter and a rotatably mounted, long intake roll of relatively small diameter are disposed side by side, with the roll mounted to move bodily in a direction crosswise of its length toward and away from the peripheral surface of said drum, and in which an endless blanket extends under tension over said roll and then around said drum and back to said roll, and in a direction to pull the roll towards the drum, and in which a web of fabric to be shrunk is conducted into face to face, abutting contact with the outside face of said blanket, just before it passes over said roll, to pass between the blanket and drum, that improved method of insuring increased uniformity of the shrinking of the fabric across its entire width which comprises rotatably supporting each end of said intake roll, in proximity to but beyond the margins of said blanket, and arcuately flexing the roll, between said rotatably supported ends, in a direction generally parallel to the direction of pull of the blanket in the roll, but in the opposite direction to said pull, and approximately counterbalance the opposing flexing forces applied to the same part of the roll by the blanket.

3. In the art of compressively shrinking a fabric in which a long, heated, rotatably mounted drum of relatively large diameter and a rotatably mounted, long intake roll of relatively small diameter are disposed side by side, with the roll mounted to move bodily in a direction crosswise of its length toward and away from the peripheral surface of said drum, and in which an endless blanket extends under tension over said roll and then around said drum and back to said roll, and in a direction to pull the roll towards the drum, and in which a web of fabric to be shrunk is conducted into face to face, abutting contact with the outside face of said blanket, just before it passes over said roll, to pass between the blanket and drum, that improved method of insuring increased uniformity of the shrinking of the fabric across its entire width which comprises rotatably supporting said intake roll at each end in a pair of self-aligning bearings, movable together towards and from the drum, and applying flexing forces to the roll, tending to flex the roll, between the rotatably supported ends, in a direction opposite to the pull of the blanket, so as to partially counter balance the flexing forces of the blanket-engaging portion of said roll, due to the tension of the blanket.

4. In a compressive shrinking machine of the type which includes a drum, an intake roll disposed at one side of and parallel to said drum with each end mounted on a frame to move toward and from the drum, in a direction crosswise of the length of the roll, an endless, traveling blanket passing around said roll and then the drum under tension, for urging said roll against the drum and applying a resultant flexing force to the intermediate portion of the roll, the combination therewith of a pair of inner and outer bearings at each end of the roll, spaced apart there along beyond the margins of the blanket, and carried by said frame at that end, said bearings of each pair at each end being relatively movable on said frame at that end, in a direction crosswise of the longitudinal axis of the roll and generally parallel to said resultant force, but tending to flex the intermediate portion of the roll between the pairs of bearings oppositely to the direction in which the same said intermediate portion of the roll would be flexed by said resultant force if one of said bearings at each end was eliminated.

5. In a compressive shrinking machine of the type which includes a rotatable, heated drum, an intake roll disposed side by side with said drum, a separate, pivoted frame rotatably mounting each end of said roll for swinging movement sidewise toward and from said drum, and an endless, traveling blanket passing under lengthwise tension round said roll, then said drum, and then back to said roll to urge said roll against said drum and apply a bowing force to the intermediate portion of the roll, that improvement in the mounting of each end of said roll on its frame which comprises a pair of self-aligning bearings for each end of the roll, spaced apart lengthwise of the roll and beyond the margins of the blanket, and carried by said frame for that adjacent end of said roll, one bearing of each pair being adjustable on its said frame in a direction generally parallel to a plane through the axis of rotation of said roll and the direction of pull of the blanket on the roll, and in a direction which will tend to flex the intermediate portion of the roll oppositely to any flexing of said intermediate portion by the pull of the blanket.

6. In a compressive shrinking machine of the type which includes a rotatable, heated drum, an intake roll disposed side by side with said drum, a separate, pivoted frame rotatably mounting each end of said roll for swinging movement sidewise toward and from said drum, and an endless, traveling blanket passing under lengthwise tension around said roll, then said drum, and then back to said roll to urge said roll against said drum and apply a bowing force to the intermediate portion of the roll, that improvement in

the mounting of each end of said roll on its frame which comprises the combination therewith of a pair of self-aligning bearings for each end of the roll, spaced apart lengthwise of the roll and beyond the margins of the blanket, one bearing of each pair being relatively fixed on the adjacent frame and the other being free on that adjacent frame, and an adjustable abutment on each frame engaging said other bearing of the pair of that end to move it in a direction tending to flex the intermediate portion of the roll oppositely to any flexing of said intermediate portion caused by the blanket tension.

7. In a compressive shrinking machine of the type which includes a rotatable, heated drum, an intake roll disposed side by side with said drum, a separate, pivoted frame rotatably mounting each end of said roll for swinging movement sidewise toward and from said drum, and an endless, traveling blanket passing under lengthwise tension around said roll, then said drum, and then back to said roll to urge said roll against said drum and apply a bowing force to the intermediate portion of the roll, that improvement in the mounting of each end of said roll on its frame which comprises a pair of self-aligning bearings for each end of the roll, spaced apart lengthwise of the roll and beyond the margins of the blanket, one bearing of each pair being relatively fixed on said frame which is adjacent thereto, a member slidable on said adjacent frame and abutting against the other bearing of that pair, and a screw carried by said adjacent frame, engaging said member and operable to slide the latter in a direction to flex the intermediate portion of the roll in opposition to any flexing of that intermediate portion by the blanket tension thereon.

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