March 3, 1942. B. R. ANDREWS 2,275,278

METHOD OF SHRINKING CLOTH

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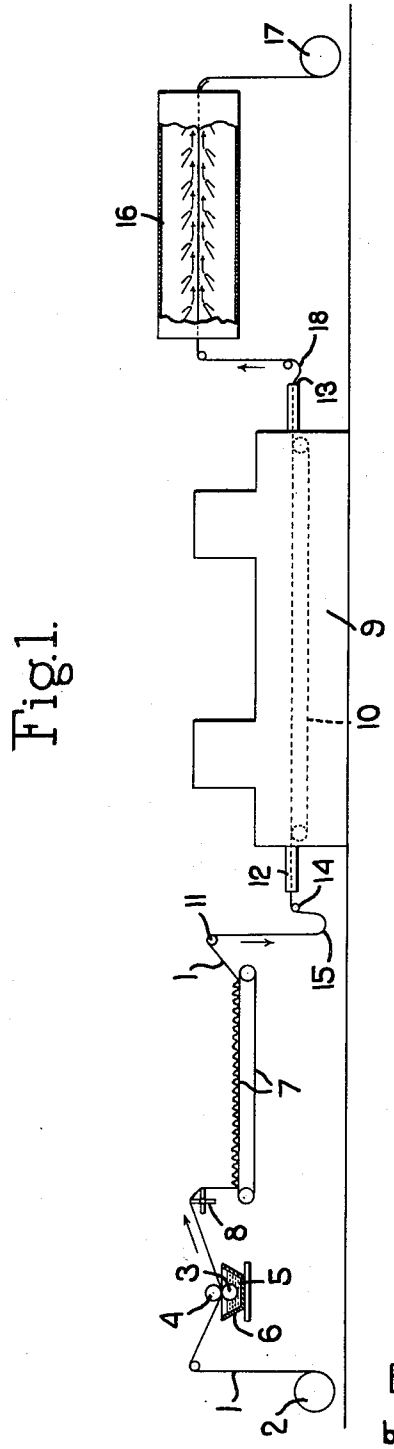


Fig. 1.

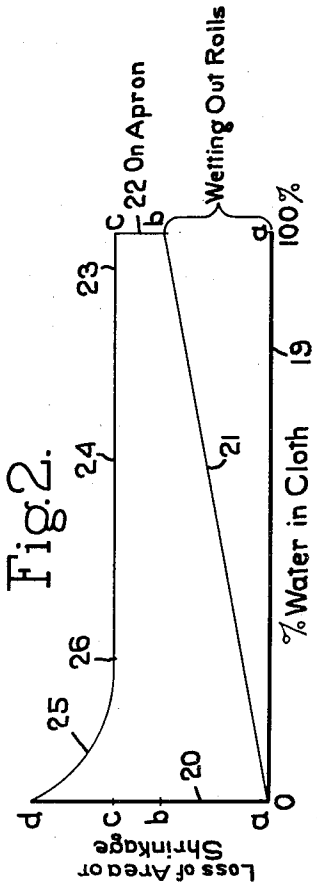


Fig. 2.

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METHOD OF SHRINKING CLOTH

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7 Claims. (Cl. 26—18.5)

This invention relates to shrinking cloth and it has for its general object to provide a novel method of shrinking cloth by which the cloth may be shrunk to approximately its maximum amount in a natural way as distinguished from producing the shrinkage in the cloth by mechanically rearranging the yarn or threads of the fabric to produce the shrinkage.

It is well known that when unshrunk cloth is moistened or wetted while in a relaxed or untensioned condition, it will shrink both warpwise and weftwise.

I have discovered that when a wet textile fabric that is not fully shrunk is being dried, the fabric has no tendency to shrink during the first part of the drying operation, but during the final part of the drying operation there is a marked tendency for the fabric to shrink. In carrying out my invention, I make use of this discovery by providing a method of shrinking cloth which consists in first wetting cloth while in a relaxed or untensioned condition, thereby to produce shrinkage thereof, and then drying the cloth in two stages, the first stage involving the portion of the drying operation during which there is no appreciable tendency for the cloth to shrink, and the second stage being the final drying operation during which there is a marked tendency for the cloth to shrink. The first stage of the drying operation is preferably carried out while the cloth is in a flat condition and under no strain either warpwise or weftwise. This may conveniently be done by performing the first or non-shrink-producing portion of the drying operation while the cloth is mechanically supported in a straight flattened condition, as it would be in a tenter frame. The second stage of the drying operation, which is the shrink-producing stage, is carried out while the cloth is in a relaxed untensioned condition, so that there is nothing to interfere with the shrinkage of the cloth which occurs during this final part of the drying operation. One way of carrying out the final shrink-producing stage of the drying operation is to floatingly convey the cloth through a drying chamber on a current of drying medium in a manner disclosed in Gautreau Patent No. 2,144,919, January 24, 1939. While thus being floatingly conveyed the cloth is not mechanically supported but is supported entirely by the current of drying medium, that is, it is pneumatically supported as distinguished from being supported by mechanical means.

By the time that the first or non-shrink-producing portion of the drying operation is completed, the fabric will be sufficiently set or firmed so that the right angular arrangement of the warp threads and filling threads, as well as the straightness of the fabric will be maintained during the final shrink-producing stage of the drying operation, in spite of the fact that this latter stage is carried out while the fabric is in a relaxed and unrestrained condition.

In order to give an understanding of my invention, I have illustrated in the drawing diagrammatically an apparatus by which my improved method can be carried out.

In the drawing:

Fig. 1 is a somewhat diagrammatic view illustrating the improved method of drying cloth;

Fig. 2 is a graph showing the two drying stages.

In the drawing, 1 indicates the cloth to be shrunk, said cloth being shown as wound on a suitable roll 2.

The first step in my improved process is to wet the cloth and thereby produce shrinkage thereof. Such wetting of the cloth may be carried out in any suitable way, but I will preferably wet the cloth to such an extent that the water absorbed thereby will be about one hundred per cent of the dry weight of the cloth, although the invention can be successfully carried out by wetting the cloth to a greater or lesser extent.

In the drawing, I have shown, merely for illustrative purposes, a wetting-out device comprising two rolls 3 and 4 between which the cloth passes, the roll 3 being partially immersed in water 5 contained in a tank 6. Instead of using the wetting-out rolls, however, the wetting of the cloth may be done by spraying moisture on to it, or in any other desirable way.

After the cloth has been wet, it is subjected to the two-stage drying operation, but before this is done, it is desirable to allow the cloth to remain in a wet condition for a sufficient time interval to permit the water to permeate the fibres of the cloth. To provide for this, there is shown a travelling apron 7 on to which the cloth is delivered in a relaxed condition, said apron conveying the cloth slowly to the drying device in which the first stage of the drying operation occurs.

8 indicates a beater over which the cloth passes in its travelling movement from the wetting-out rolls to the endless apron 7, this beater serving to lay the cloth evenly on the apron. The apron 7 is a slowly moving apron so that the cloth will be delivered thereon in a relaxed condition, and the time interval elapsing while it is being con-

veyed along the upper run of the apron 7 is sufficient to allow the moisture to thoroughly permeate the fibres of the cloth.

This operation of wetting the cloth while in a relaxed condition produces shrinkage thereof, part of the shrinkage occurring when the water is applied to the cloth at the wetting-out rolls and part occurring while the cloth is in a relaxed condition on the travelling apron 7 and the moisture is permeating the fibres. As a result, the cloth comes from the endless apron in a partially shrunk condition, the shrinkage being in both a warpwise and weftwise direction.

After the cloth has undergone the shrinkage resulting from its being wet, it is then subjected to the first stage or non-shrink-producing portion of the drying operation.

One way in which this can be accomplished is by partially drying the cloth on a tenter frame 10 in a drying chamber 9. The cloth 1 passes from the travelling apron 7 over a guide roll 11 and then enters the drying chamber 9 at 12, and emerges from it in a partially dried condition at 13, said cloth being carried through the drying chamber 9 in a flat condition by the tenter frame 10. In order to retain in the cloth as much as possible of the shrink which was produced therein by the wetting-out process, it is desirable to introduce the cloth into the tenter frame under a minimum tension, and, therefore, the cloth is arranged so that there will be slack cloth, as shown at 15, between the roll 11 and the roll 14 which guides the cloth into the tenter frame.

As stated above, I have discovered that when cloth which is thoroughly wet is dried, there will be no appreciable tendency for the cloth to shrink during the first part of the drying operation, but that during the final portion of the drying operation, there will be a marked tendency for the cloth to shrink. The point in the drying operation where the tendency to shrink begins varies with different kinds of cloth and different kinds of fibres, but generally speaking, when the cloth which is thoroughly wet is being dried, there will be no tendency for shrinkage to occur until sixty per cent or more of the moisture has been removed from the cloth. In some fabrics the shrinkage during the final drying operation may not begin until as much as eighty per cent or more of the moisture has been removed from the fabric.

In carrying out my invention, therefore, the thoroughly wet cloth 1 is first partially dried in a drying chamber 9 while it is mechanically supported in a flat condition, as for instance, in a tenter frame 10 or by some other supporting means, the drying being continued until a point is reached where the fabric begins to shrink. The conditions for drying in the drying chamber 9 may be so regulated, according to the character of the cloth, by any known or usual means so as to dry the cloth to this desired extent. While the cloth 1 is held in a flat condition in the tenter frame 10 during the first stage of the drying operation, yet it is not held under tension or stretched so that when the cloth is delivered from the drying chamber 9, it will have the same potential shrinkage which it had when it entered the chamber. During this first or non-shrink-producing stage of the drying operation, the cloth will preferably be held in the tenter frame or by some other mechanical support with the warp threads and weft threads having their normal right angular arrangement. By the time this first stage of the drying operation has been completed, the cloth will have acquired a sufficient "set" to maintain its straightness, flat form and right angular arrangement of threads during the remainder of the shrinkage operation.

From the drying chamber 9 in which the first stage or non-shrink-producing portion of the drying operation is carried out, the cloth is taken to a second drying chamber 16 in which the second and final stage or shrink-producing portion of the drying operation is carried out. During this final stage or shrink-producing portion of the drying operation, the cloth is maintained in a relaxed, untensioned condition so that it is free to shrink in its natural way. One way in which this result can be obtained is by floatingly conveying the cloth through a drying chamber on a current of drying medium in a manner described in said Gautreau Patent 2,144,919, the cloth remaining in a relaxed untensioned condition as it is floatingly conveyed through the drying chamber. During this final drying stage, the cloth will undergo auditional shrinkage and thus will emerge from the drying chamber 16 in a fully shrunk condition.

While the cloth is undergoing the final or shrink-producing stage of the drying operation, it is pneumatically supported, its sole support being the current of drying medium. As the fully shrunk cloth comes from the chamber 16, it may be wound on a roll 17.

The travel of the cloth from the drying chamber 9 to the drying chamber 16 will be so controlled as to provide slack cloth between the chambers, as shown at 18, so as to avoid subjecting the cloth to any appreciable warpwise tension in its travelling movement.

Fig. 2 is a graph illustrative of my improved method of shrinking cloth. The horizontal line 19 indicates the per cent of water in the cloth, and the vertical line 20 indicates the loss of area by shrinkage. The inclined line 21 illustrates the shrinkage which occurs as the water is applied to the cloth, it being assumed that the amount of water absorbed by the cloth is one hundred per cent of the weight of the cloth. The loss of area or shrinkage which occurs at this time is indicated by the distance *a*, *b*. While the cloth is in a relaxed condition on the apron 7 and the water is thoroughly permeating the fibres, an additional shrinkage will occur but without any change in the moisture content in the cloth, this additional shrinkage being indicated by the distance *b*, *c*. During the first stage of the drying operation in the chamber 9, the cloth will undergo no shrinkage and this part of the drying operation is represented by the horizontal portion 23 of the drying line 24. The second or shrink-producing stage of the drying operation is indicated by the curved portion 25 of the line 24 and during this final stage, there will be an additional shrinkage or loss of area in the cloth indicated by the distance *c*, *d*, on the vertical line 20.

The point 26 in the line 24 where the latter changes from the straight portion 23 to the curved portion 25 will vary with different kinds of cloth and cloth made of different fibres, but the graph shown in Fig. 2 illustrates the manner in which the shrinkage occurs in carrying out my improved method.

With my invention, the entire shrinking operation of the cloth is carried out in a natural way and without resorting to any mechanical treatment of the cloth by which its threads are rearranged to produce the shrinkage thereof. The

shrinkage which the cloth obtains according to my method has a high degree of permanency and is not lost by ironing during subsequent laundering operations nor by tension that may be applied to the cloth during subsequent manufacturing operations.

I claim:

1. The method of shrinking cloth which consists in wetting cloth thereby to produce shrinkage thereof, subjecting the wet cloth while mechanically supported in a flat condition to a partial drying operation which is continued only so long as the drying proceeds without any tendency for the cloth to shrink, and then producing additional shrinkage in the cloth by completing the drying thereof while it is in a relaxed condition by floatingly conveying the cloth through a drying chamber on a current of drying medium.

2. The method of shrinking cloth which comprises wetting the cloth while in a relaxed condition, thereby securing shrinkage thereof, subjecting the wet cloth to a partial drying operation while it is in a tenter frame and free from warpwise tension and continuing such partial drying operation during the time that removal of moisture from the cloth is not accompanied by a tendency for the cloth to shrink but terminating such partial drying operation before a point is reached at which further removal of moisture is accompanied by a tendency of the cloth to shrink, and producing additional shrinkage in the cloth by completing the drying operation while the cloth is in a relaxed, untensioned and unrestrained condition.

3. The method of shrinking cloth which comprises wetting the cloth while in a relaxed condition, thereby securing shrinkage thereof, partially drying the wet cloth in a tenter frame without subjecting it to warpwise tension and continuing the partial drying during the time that removal of moisture from the cloth has no tendency to shrink the latter but terminating such partial drying before the drying operation has been carried to a point where further removal of moisture from the cloth will be accompanied by a tendency of the cloth to shrink, and then producing additional shrinkage in the cloth by completing the drying operation by floatingly conveying the cloth through a drying chamber on a current of drying medium.

4. The method of shrinking cloth which consists in producing an initial shrinkage of the cloth by wetting the same, subjecting the cloth while in a tenter frame and free from warpwise tension to a drying operation which is continued during the time that removal of moisture from the cloth has no tendency to shrink it but which is terminated before the drying operation has reached a point where further removal of moisture from the cloth will be accompanied by a tendency for the cloth to shrink, and producing additional shrinkage in the cloth by completing the drying operation while the cloth is in a relaxed condition both warpwise and weftwise.

5. The method of shrinking cloth which consists in wetting the cloth thereby to produce shrinkage thereof and then drying the cloth by performing the non-shrinking portion of the drying operation while the cloth is held in a flat condition by shrink-resisting means, and performing the shrink-producing portion of the drying operation with the cloth in a relaxed unrestrained condition.

6. The method of shrinking cloth which consists in wetting the cloth thereby to produce shrinkage thereof and then drying the cloth by performing the non-shrinking portion of the drying operation while the cloth is mechanically held in a flat condition but free from tension sufficient to obliterate to any appreciable extent the shrinkage which the cloth experienced by the wetting operation, and performing the shrink-producing portion of the drying operation by floatingly conveying the partially dried cloth through a drying chamber on a current of drying medium.

7. The method of shrinking cloth which consists in wetting the cloth without applying any appreciable tension thereto in a warpwise direction, thereby producing shrinkage in the cloth, and then drying the cloth by performing the non-shrinking portion of the drying operation while the cloth is held in a flat condition by shrink-resisting means but under no appreciable tension, and performing the final or shrink-producing portion of the drying operation while the cloth is in a relaxed unrestrained condition, thereby producing additional shrinkage in the cloth.

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