Aug. 7, 1956 D. D. McCORD ET AL 2,757,434

PROCESS FOR PRODUCTION OF PUFFED FABRICS

Filed March 31, 1955

2 Sheets-Sheet 1

Fig. 1

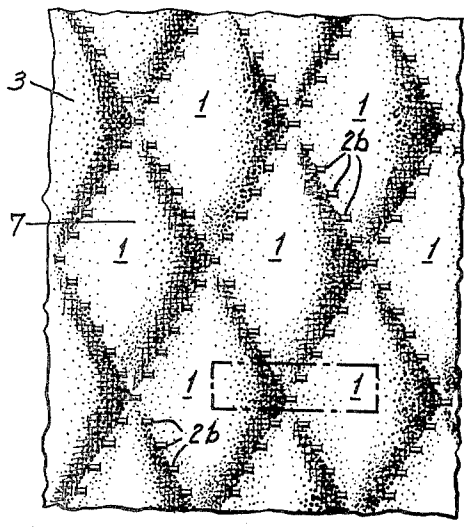


Fig. 2

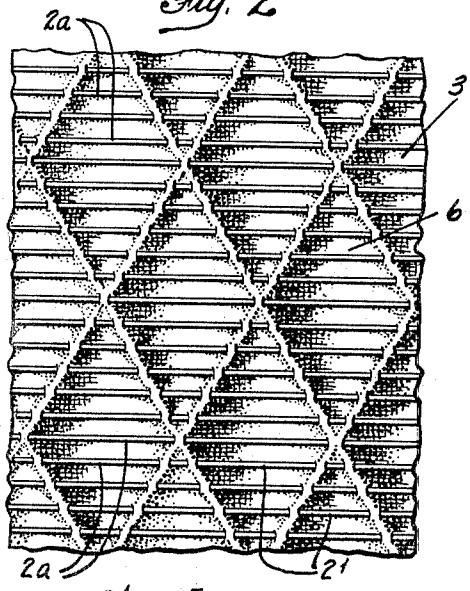
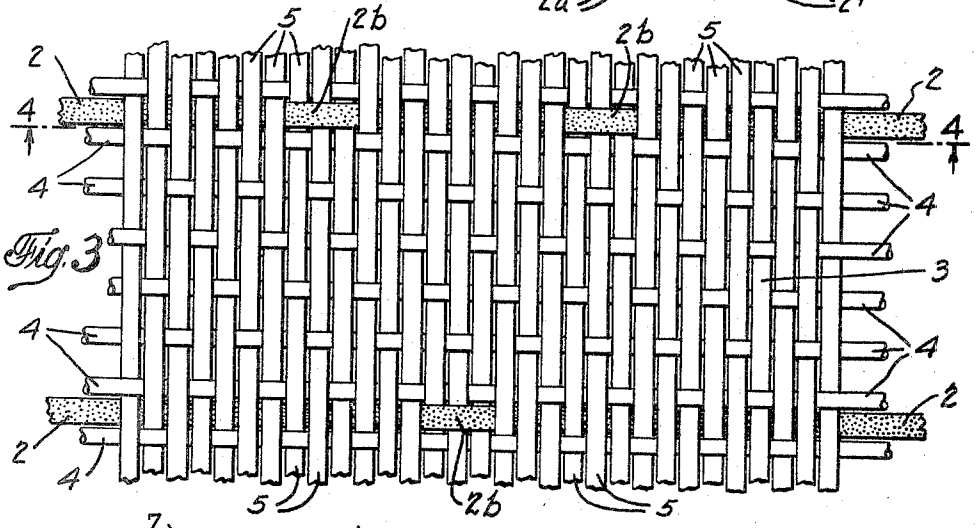


Fig. 3



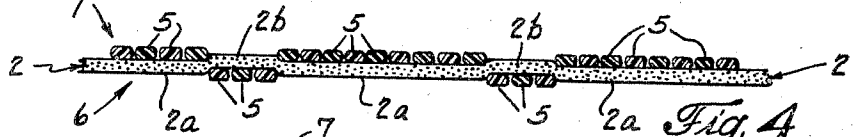


Fig. 4

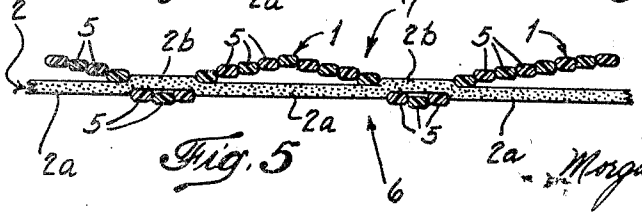


Fig. 5

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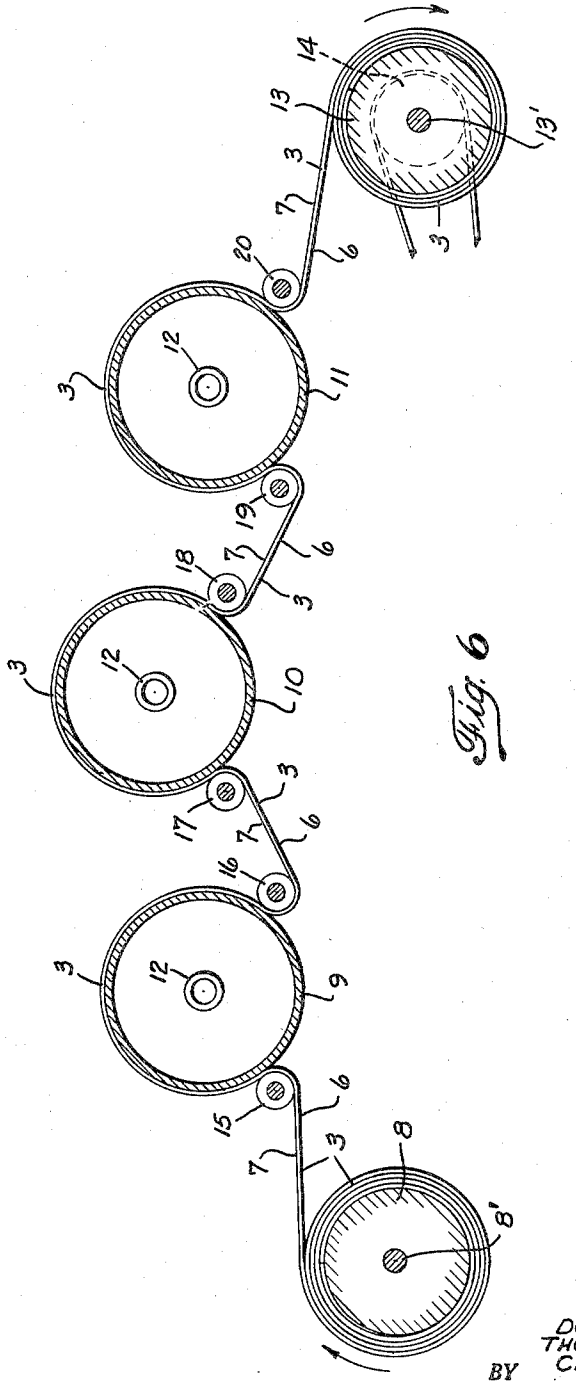


Fig. 6

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PROCESS FOR PRODUCTION OF PUFFED FABRICS

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Application March 31, 1955, Serial No. 498,286

4 Claims. (Cl. 28—72)

The present invention relates to a novel process for the production of woven fabrics having puffed portions to provide three-dimensional patterns thereon. The puffed fabrics produced in accordance with our novel process are advantageously useful as upholstery fabrics, particularly, automobile upholstery.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the steps and processes shown and described herein.

The invention consists in the novel steps and processes shown and described herein.

The production of puffed fabrics is not new. Various methods of producing these known puffed fabrics have been used employing different types of filaments. In one known method, heat shrinkable filaments are woven with non-shrinkable filaments to form a fabric body which when subjected to a heat treatment forms the desired puffs, due to the shrinking of the heat shrinkable filaments. In another modification, fabrics made of yarns or filaments of a thermoplastic material are heated on one side only, causing the formation or buckling of the fabric with the formation of a three-dimensional pattern effect. The patterns produced in accordance with the prior processes are not entirely satisfactory, however, for the puffs produced are often not as sharp and accentuated as desired. Moreover, the patterns formed by the puffs are not always retained while the fabric is in use.

The object of the present invention is to provide a simple and efficient process whereby puffed fabrics having sharp and accentuated puffs may be readily produced. A further object of our invention is to provide a novel process for producing a puffed fabric, wherein the pattern design formed by the puffs retains its original appearance after the fabric has been in use for a considerable period of time.

Broadly, our process relates to a differential heat treatment process wherein a fabric, having heat shrinkable shrinkers incorporated on its main body, is subjected to a selective differential heat treatment whereby heat is transmitted primarily to the portions of said shrinkers adjacent the back of the fabric, causing said portions to shrink, which in turn causes the main body adjacent thereto to rise, thus forming the desired puffs. In order to carry out the foregoing selective heat treatment, wherein the heat is transmitted primarily to the portions of the shrinkers on the back of the fabric, rather than the main body or the portions of the shrinkers adjacent the front face, two essential conditions are necessary, first, the shrinkers are incorporated on the main body in such a manner that they are floated predominantly at the back of the main body, and, secondly, that during the heat treatment step the temperature at the back of the main body be higher than the temperature at the face of the fabric. By the term "floated," as used hereinabove and hereinafter, is meant that the shrinkers are not interwoven with the fibers of the main body but instead pass over or under a plurality of threads of the main body.

The shrinkers, floated predominantly to the back of the main body, may be secured in a variety of configurations in order to produce different pattern designs. Preferably, they are secured on the main body in the manner disclosed in co-pending application Serial No. 498,306, filed March 31, 1955 by Douglas D. McCord, Harold P. Faris and Bernard R. Koenig. In this application there are disclosed puffed fabrics produced by floating the shrinkers predominantly on the back side of the main body of the fabric in such a manner that the puffs formed on shrinking of the shrinkers are defined where the shrinkers intersect the main body of the fabric. Also, as disclosed in said co-pending application, it is preferred that the shrinkers be floated slightly over the face of the main body of the fabric to accentuate and increase the sharpness of the puffs formed.

The differential heat treatment utilized in our process, whereby heat is transmitted primarily to the shrinker portions on the back of the fabric, may be carried out in various ways in order to provide a higher temperature at the back of the fabric than the front of the fabric. In one modification as illustrated in the accompanying drawings, the fabric with attached shrinkers is passed over a series of heated drums, wherein only the back side of the fabric contacts the heated surface of the drums to provide the required heat differential between the back and front of the fabric. The exposed shrinker portions on the back of the fabric, on contact with the heated surfaces, are caused to shrink, producing the desired puffs on the front face of the fabric. The body portion of the main body of the fabric adjacent the shrinkers is caused to rise on the shrinking of the shrinkers due to the grip exerted by the shrinkers where they intersect the main body portion.

Another method of effectuating the required heat differential is by passing hot gases, such as hot air, over the back side of the fabric and passing cool gases, such as cold air, over the face of the fabric.

As will be evident to those skilled in the field, the required shrinking temperature will vary depending upon the particular thermoplastic composition of the shrinkers. Also, the time of heat treatment varies with the particular thermoplastic composition used, as well as the temperature employed. Higher temperatures require less time to produce the desired shrinking than when minimum shrinking temperatures are used.

By utilizing the present process featuring a selective heat treatment of the shrinkers on the back of the fabric, the filaments forming the main body and the filaments forming the shrinkers may be of the same chemical composition. The aforesaid filaments, whether used as shrinkers or in the main body of the fabric, may be in the form of monofilaments, twisted multifilament strands, yarn spun from filament staple, etc. Likewise, filaments, different in chemical construction but having substantially the same shrinkage characteristics, may also be used for bothe the main body and the shrinkers. Preferably, however, the filaments forming the shrinkers have higher initial shrinkage characteristics than the filaments forming the main body of the fabric, since by providing a shrinkage characteristic differential, deeper puffs are produced than when the shrinkers and the main body are of the same material.

The preferred materials for forming the main body of the fabric and the shrinkers are those of the "saran" family of copolymers disclosed in co-jending application Serial No. 498,199 filed March 31, 1955, by J. Ferrell Nicholl. The applicant in this application incorporates on a main body of a fabric woven from a saran copoly-

mer, such as "Saran 11S," shrinking floats or shrinkers formed of a different saran copolymer, such as "Saran 23S," whereby the filaments forming the shrinkers have higher initial shrinkage characteristics than the filaments forming the main body, but which have substantially the same shrinkage characteristics after the initial shrinking step. Thus, by using filaments having such shrinkage characteristics, all of the filaments will shrink at the same rate after the formation of the puffs formed by the initial shrinking step, so that the appearance of the pattern formed by the puffs is retained in use of the fabric.

In order to describe our invention more specifically, reference is now made to the drawings. Figs. 1–5 show a fabric having incorporated shrinkers floated predominantly on the back of the main body of said fabric, the puffs on said fabric having been produced by subjecting said fabric to a differential heat treatment illustrated diagrammatically in Fig. 6. The particular mechanical structure of the fabric of Figs. 1–5 does not constitute a part of the present invention, but rather the selective heat treatment process for the production of the puffs on the fabric.

Fig. 1 is a view of the face of a puffed fabric produced by the incorporation of heat shrinkable floats or shrinkers on the main body of the fabric and subjecting the fabric to a heat shrinking operation whereby the heat is transmitted primarily to the portions of the shrinkers floated on the back side of the main body of said fabric.

Fig. 2 is a view of the back of the puffed fabric of Fig. 1.

Fig. 3 is a greatly enlarged schematic view of the area enclosed by dot and dash lines, as shown in Fig. 1, but before the fabric has been subjected to the differential heat treatment of Fig. 6.

Fig. 4 is a section along the line **4—4** of Fig. 3.

Fig. 5 is similar to Fig. 4, but indicating the configuration of the fabric after the differential heat shrinking operation has taken place.

Referring now to Figs. 1–5, there is illustrated a fabric which, when subjected to the differential heat shrinking operation of Fig. 6, forms a diamond pattern seen pictorially in Fig. 1, due to the formation of puffs **1**. The main body **3**, woven of weft thermoplastic threads **4** and warp thermoplastic threads **5**, has incorporated thereon heat shrinkable shrinkers **2**. Shrinkers **2** are incorporated on main body **3**, in a weft or filler direction, by floating the shrinkers predominantly at the back **6** of the main body to form shrinkers portions **2***a* and slightly over the face **7** of the main body to form shrinker portions **2***b*.

As shown in Fig. 6, the fabric **3**, such as the embodiment of Figs. 1–5, is rolled on a let off roll **8** rotatably mounted on shaft **8'**. Fabric **3** is then forwarded over a plurality of internally heated drums **9**, **10** and **11**, each of said drums being rotatably mounted at their ends on hollow stub shafts **12**, said shafts **12** extending only partly into the interior of said drum to permit the passage of steam thereto so that the drums are internally heated. Fabric **3** is passed over said drums **9–11** so that the back **7** of the fabric contacts outer heated surfaces of the drums whereby the shrinker portions floated at the back of said fabric are heated to cause a shrinking thereof, which in turn causes the formation of puffs at the front of the fabric. The puffed fabric is then passed from drum **11** to take up roll **13** mounted on shaft **13'**, said shaft **13'** being driven by power driven pulley **14**. Hence drums **9–11** are fabric driven so that as the fabric shrinks warpwise, the successive drums **9–11** are driven at decreasing linear speeds. In order to guide the fabric as it passes over the drums **7** guide rolls **15–20** are provided adjacent the drums **9–11**.

By heating the fabric in the foregoing manner, heat is transmitted primarily to the portions **2***a* of the shrinkers floated on the back of the main body. This causes

the shrinker portions **2***a* to shrink from their position shown in Fig. 4 to that of Fig. 5; which, in turn, causes the warp threads **5***a* over said portions **2***a* to be pulled together, whereupon the body portion of the fabric adjacent said shrinker portions rises above the front face of the fabric to form the desired puffs. Also, by floating the shrnkers over a number of warp threads **5***b*, the warp threads **5***a* do not rise tangentially from the front face but at an angle, which contributes to the formation of sharp and accentuated puffs.

Our novel process provides a simple, efficient method of producing puffed fabrics of highly attractive three-dimensional appearance. The puffs produced in accordance with our process are sharp and accentuated, and the pattern formed thereby is retained while the fabric is in use. The fabrics in addition to the foregoing also possess desirable "breathing" properties which make them particularly useful in automobile upholstery. By "breathing properties" is meant that the fabrics are sufficiently porous to provide adequate ventilation. Thus, my fabrics may readily be used as seat covers without causing discomfort to any one coming in contact therewith.

The invention in its broader aspects is not limited to the specific processes and steps described but departures may be made therefrom within the scope of accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

We claim:

1. A process for the production of a puffed fabric from a fabric structure having a main body consisting predominantly of thermoplastic filaments and having heat-shrinkable thermoplastic filaments floated predominantly at the back of said main body and across areas in which the desired puffs are to be formed, said process comprising heating said fabric structure differentially by transmitting heat primarily to said heat-shrinkable thermoplastic filaments floated predominantly at the back of said main body, the temperature at the back of said fabric structure being higher than at the front thereof and being sufficiently high to cause said heat-shrinkable thermoplastic filaments floated predominantly at the back of said main body to shrink so as to form the desired puffs in said areas.

2. A process as defined in claim 1, wherein the differential heat treatment is effectuated by contacting the back of said fabric structure with a hot gas and the front of said fabric structure with a cooler gas to provide the desired temperature differential.

3. A process as defined in claim 1, wherein the differential heat treatment is effectuated by passing the back side of the fabric structure over at least one heated drum so as to cause the portions of the shrinkers floated at the back thereof to contact heated surfaces of each drum to cause a shrinking thereof.

4. A process as defined in claim 3, wherein the fabric structure is passed over a plurality of internally heated, freely rotatable drums, said drums being driven by said fabric material as it passes thereover.

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