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F. H. UNTIEDT

2,434,527

MANUFACTURE OF DECORATIVE FABRIC ARTICLES HAVING A DESIGN IN RELIEF

Filed Sept. 22, 1944

3 Sheets-Sheet 1

FIG. 1.

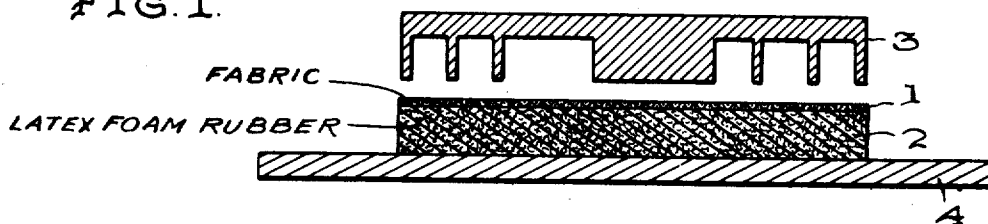


FIG. 2.

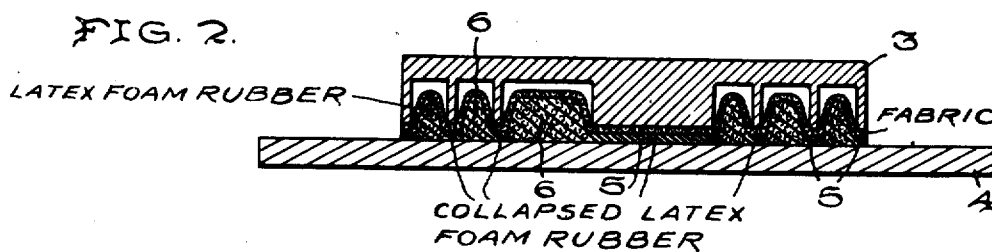


FIG. 3.

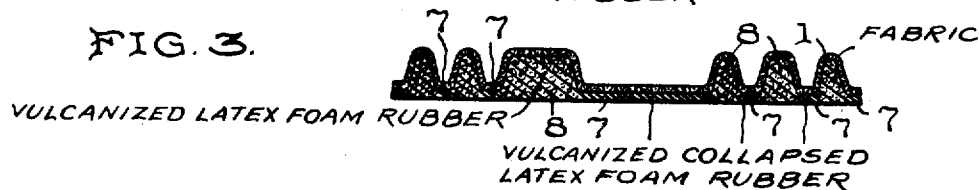


FIG. 4.

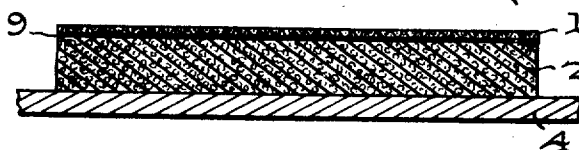


FIG. 5.

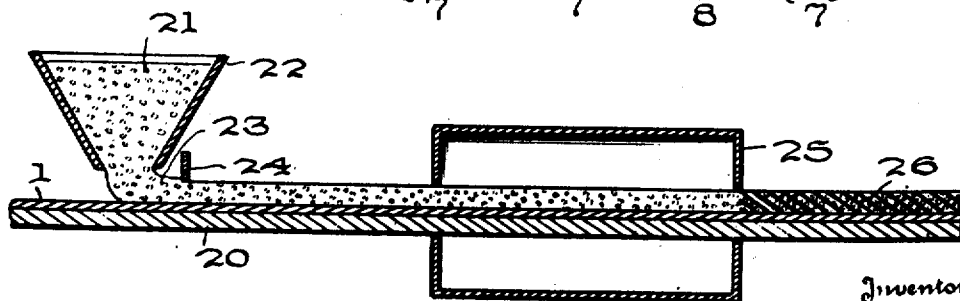
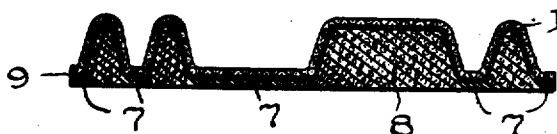


FIG. 6.

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FIG. 7.

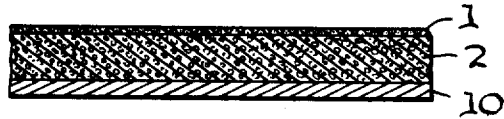


FIG. 8.

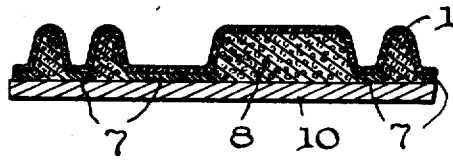


FIG. 9.

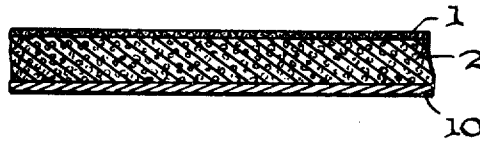


FIG. 10.

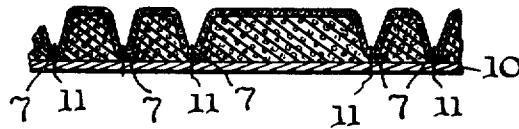


FIG. 11.

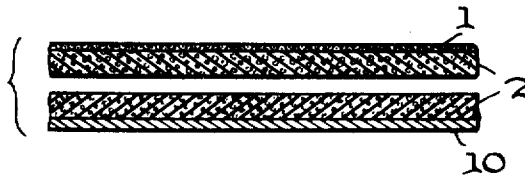
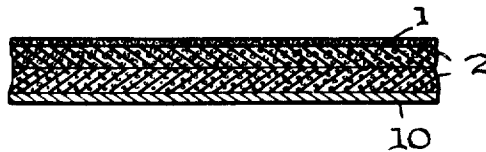


FIG. 12.



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3 Sheets-Sheet 3

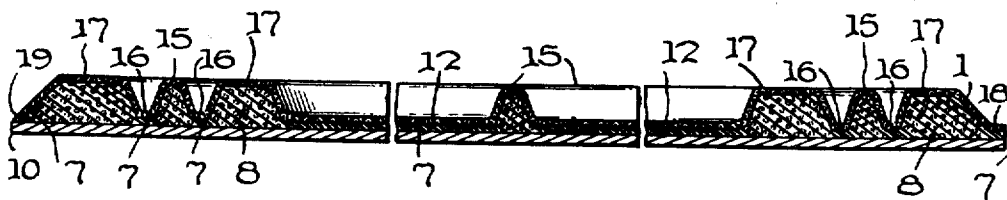
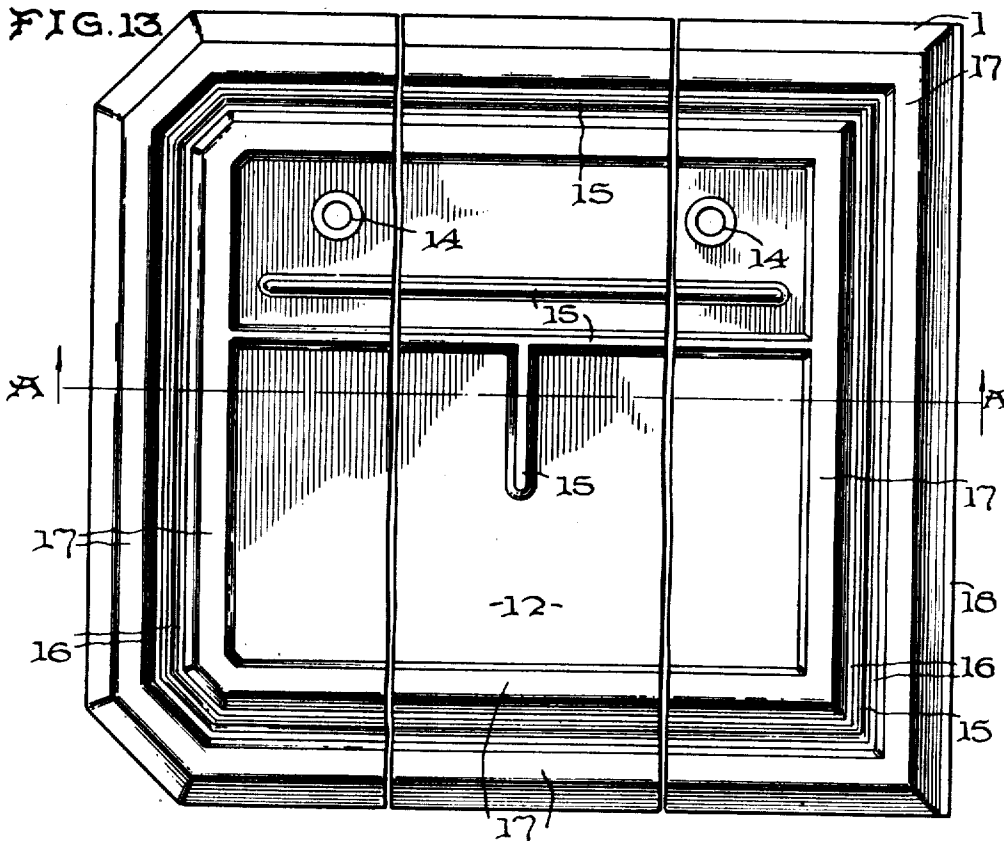


FIG. 14.

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MANUFACTURE OF DECORATIVE FABRIC
ARTICLES HAVING A DESIGN IN RELIEF

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Application September 22, 1944, Serial No. 555,336

9 Claims. (Cl. 154—106)

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This invention relates to the manufacture of decorative fabric articles having a design in relief.

The art of imparting a relief design to the surfaces of fabrics is an old one, and many patents have been issued describing various ways of making such materials. In general, such fabrics consist of fabric material overlying wadding of some kind, such as cellulose fibrous material, the assembled material being stitched to a backing with the stitches so arranged as to form indentations in the fabric and thus create an effect in relief. Panel boards for use in decorating the interior of automobiles, trains, airplanes, rooms, etc. are made in this manner. Frequently, riser strips of cardboard are inserted underneath the raised portions of the fabric and stitched to a backing in order to give support to the high areas of the design. In other instances the rigid backing is embossed and then covered with the fabric. More recently it has been suggested to decorate fabrics by interposing strips of uncured rubber between fabric and wadding, and then die-pressing the assembly. Heated dies are used and these cause the rubber strips to soften and flow, and create high areas in the design after the fashion of embossing. The use of rubber compositions which, when heated, will expand to form sponge rubber has been proposed. In this instance the rubber composition is heated during the design-forming operation and the rubber is intended to flow in such manner as to form high areas and to expand to form a sponge rubber supporting the high areas. Here again, the action is analogous to embossing. These various methods require a great deal of hand labor in positioning the rubber strips, assembling the laminated structure before applying heated dies, etc. Moreover, the success of the method depends largely on getting the heat-softened rubber to flow beneath those areas intended to be high areas in the finished fabric, and to "push up" the fabric. Indeed, special expedients, such as the creation of a vacuum above the fabric in the intended high areas, have been resorted to.

Such methods do not permit imparting a relief design to the fabric in the cold, i. e., without the application of heated dies, and it is one of the objects of this invention to devise processes for imparting relief designs in which the design can be formed on the fabric without the application of any heat at all during the design-forming stage. This results in much simplification, avoidance of fabric damage, reduction in wastage, and permits operating in such a manner that the fab-

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ric assembly is die-pressed to impart the design, and the assembly then removed from the design-forming apparatus.

The present invention is based upon the discovery of the great utility of unvulcanized latex foam rubber in the art of decorating fabrics in relief.

At this time it will be helpful to an understanding of my invention if I first describe the characteristics of unvulcanized and vulcanized latex foam rubber. These materials are made by whipping latex, or other aqueous dispersion or emulsion of rubber, including the various synthetic rubbers now available as a latex. During the whipping operation air is beaten into the latex and the result is a highly aerated latex foam. Many patents describe ways of making this material. The usual practice is to incorporate vulcanizing agents in the latex prior to whipping, and foaming agents can also be added if desired. After the foam is made it is poured into suitable molds, allowed to gel (gelling agents being added prior to pouring into the molds), and the mold and contents then subjected to heat to vulcanize the rubber. The result is vulcanized latex foam rubber.

Latex foam, if allowed to dry with or without added gelling agents, will yield a soft cellular material. This solidified foam, prior to vulcanization, can be compressed or deformed readily to collapse the cellular structure in the pressed areas. During the pressing there is substantially no flow of the material as would be the case were a layer of ordinary rubber sheeting heat-softened and pressed. That is to say, the dried latex foam rubber simply collapses or "deflates" to a compact, substantially non-cellular rubber sheet in those areas where pressure has been applied. Thus, the unvulcanized latex foam rubber is capable of taking and retaining an impression in relief. Where indentations have been formed, they remain dimensionally stable. Since the rubber is not resilient at this stage, there is no tendency for the indented areas to revert to expanded material after the pressure applied for creating the indentations is removed. This means that the latex foam rubber can be decorated in relief designs as desired to impart high and low areas and that once such are formed they remain dimensionally stable unless acted upon by an outside force.

No heat is necessary for deflating or collapsing the latex foam rubber, and only slight pressure is required. One can write with a pencil on the surface of such a material and the slight writing

pressure is sufficient to create depressions or indentations. When such a material is pressed to form the design in relief and then vulcanized, the resulting product will have high areas of vulcanized latex foam rubber which are resilient, and depressions which, in effect, amount to vulcanized rubber sheeting of greatly reduced porosity continuous with the markedly cellular high areas.

In the present invention I utilize the unique characteristics of such unvulcanized latex foam rubber (hereinafter referred to simply as latex foam rubber) in the manufacture of decorative fabrics having a relief design, and by so doing I am able to overcome objectionable features of prior processes, greatly simplify the art, and, moreover, provide methods which permit creating relief designs having much detail.

Broadly speaking, my process consists in providing the fabric with a layer of latex foam rubber, impressing a design on the fabric, and vulcanizing the rubber. This results in a product in which the high areas of the design are supported by vulcanized latex foam rubber and the low areas, or depressions, overlie the collapsed and vulcanized latex foam rubber. During and after the vulcanization, the fabric overlying the collapsed foam rubber should be secured thereto, as I shall describe in detail.

The latex foam rubber used as a starting material, whether it be as a separate sheet, or as a layer formed directly on the fabric or base material, as I shall presently describe, is advantageously made by whipping a mixture of latex containing vulcanizing agents, etc., to a foam in the well known way. One suitable composition may consist of about 100 parts by weight of latex (60 percent rubber), 1 part by weight of sulfur, a small amount of zinc oxide, say 2 parts by weight, and a suitable vulcanization accelerator such as zinc diethyl dithiocarbamate or the corresponding butyl compound. Such latex mixings are old. This mixture, to which a small amount of a suitable foaming agent such as potassium castor oil soap, ammonium oleate, saponin, etc. (say 0.5 percent by weight) can be added, if desired, is then whipped to a froth or foam. At this point a gelling agent such as sodium silicofluoride can be added or, alternatively, the gelling agent can be omitted, since the relatively thin layers of foam to be dried will dry quite well without first gelling the foam by the specific addition of a gelling agent. I claim no novelty in ways of making the foam, nor in the particular latex mixings to be employed. The latter can vary over wide limits, and can contain fillers such as carbon black, fibrous materials, etc. Indeed, the latex foam can also be made by incorporating gases other than air in the latex. Carbon dioxide and nitrogen have been suggested in the past.

After the foam is made, it is then spread out in a layer to dry. It can be dried at relatively low temperatures, well below the usual vulcanizing temperatures. If dried at a vulcanizing temperature, it should be dried before any substantial amount of vulcanization occurs. Since I desire the dried foam to be deformable, as I have hitherto pointed out, vulcanization should not be allowed to occur to such an extent that the depressed areas later imparted to the dried foam contain resilient rubber, i. e., tend to spring back to the original thickness of the dried foam layer. The characteristics I seek are such that the dried foam (referred to as latex foam rubber) is capable of taking and retaining an impression in

relief. Although I prefer to dry the foam so that the foam structure "solidifies," so to speak, to give a soft, compressible material, this does not mean that the foam is necessarily dried to "bone-dryness." The important criterion is whether the resulting latex foam rubber will take and retain the desired impression and thus support the overlying fabric areas, while also permitting it to be collapsed in the low areas.

The thickness of the latex foam rubber layer attached to the fabric will naturally depend upon the height of the raised or high portions desired in the ultimate design on the fabric. A layer about one-quarter to three-eighths inch thick gives good results, and permits forming designs on the fabric which stand out in pronounced relief. Where the design has rather narrow ridges or high areas, some decrease in the height of the ridges (in comparison with the original thickness of the latex foam rubber layer) may be noticed. This is because the latex foam rubber is a coherent cellular mass and the pressure forming indentations tends to decrease the thickness of the foam rubber on either side of the indentation for a very short distance. Thus, when the ridges in the design are quite narrow, say an eighth to a quarter inch in width, the cellular rubber lying between the indentations (and constituting the ridge) may be of less thickness than the broader areas lying remote from the ridges. This effect is much less noticeable when the indentations are spaced from each other for a great distance. However, the effect referred to is not so very apparent and, indeed, contributes to the pleasing character of the design. Likewise, since the fabric, after the design is imparted thereto, is under slight tension, allowance should be made for a tendency for the tension in the fabric to compress the latex foam rubber underlying the high portions in the design. Such compression effect is due to fabric tension resulting from forcing the fabric into depressed areas. But the latex foam rubber underlying the high areas in the design is essentially cellular, in contrast with the markedly collapsed, non-cellular structure of the rubber underlying the depressions. I point out the above characteristics so that those practicing my invention can take them into account when deciding upon the thickness of the foam rubber layer for any particular design.

In the appended three sheets of drawings I have illustrated ways of practicing my invention.

In the drawings,

Figs. 1, 2, and 3 show steps in the manufacture of the decorative fabrics of the present invention in one of the broad aspects, the showings being in cross section;

Figs. 4 and 5 illustrate the method and article when the latex foam rubber is adhesively attached to the fabric;

Fig. 6 diagrammatically illustrates one way of forming the latex foam rubber on the fabric or on a backing material;

Figs. 7 to 10, inclusive, illustrate ways of providing the decorated fabric with a reinforcing backing;

Figs. 11 and 12 illustrate a further way of providing a laminated article composed of fabric, backing, and intermediate layer of latex foam rubber, preliminary to the steps of imparting the design and vulcanizing; and

Figs. 13 and 14 illustrate a panel board made in accordance with the present invention.

Like numerals in the drawings refer to like elements in the respective showings.

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Referring now to Fig. 1, a fabric 1, of woven or felted material, is assembled in contact with a sheet of latex foam rubber 2 which will take and retain a design in relief. This layer is of any desired thickness, depending upon the height of the high areas in the final relief design. As stated, it is desirable to make allowance for some slight compression or deflation of the latex foam rubber underlying the high portions due to fabric tension. A die 3 is shown in cross-section and arranged to impress a design in relief on the fabric. A base plate 4 serves to support the assembly during the pressing operation, the final product being removed from the base after vulcanization is completed, as I shall describe.

Die 3 has any desired configuration. After the layer of latex foam rubber and fabric are assembled, the die is then pressed down on the fabric. The pressure need not be great since the die need only compress or collapse the readily deflated latex foam rubber layer and force the fabric into the depressions. After the pressing operation the arrangement appears as in Fig. 2. Underlying the depressions is a thin sheet of collapsed foam rubber shown at 5. This rubber has lost most of its cellular structure, although it may still be slightly porous. Underlying the high portions of the design, and supporting them, is cellular rubber 6 which has not been markedly collapsed. It still retains to a high degree its original cellular structure, although its density may be somewhat increased because of the tendency for the fabric in the high areas to compress the foam rubber due to fabric tension. This will vary with different fabrics.

The rubber is now vulcanized. Conveniently this is done by including vulcanizing agents in the latex foam rubber during the manufacture thereof, as described above. When the assembly as in Fig. 2 is submitted to a vulcanizing temperature, the vulcanizing agents in the foam rubber then react. Such procedures are well known. The whole assembly, with the die positioned as in Fig. 2, can simply be placed in a heated chamber and kept there until vulcanization is completed. The temperature and time depends upon the latex mixing from which the latex foam rubber is made, vulcanization accelerators used, etc. This curing step is well known to those skilled in the art of vulcanizing latex foam rubber.

During the curing or vulcanization the low portions of the fabric design should be kept in contact with the collapsed areas in the underlying foam rubber. This insures that the rubber will be vulcanized to the fabric in these low areas. Were the die released before vulcanization, the tension in the fabric might tend to pull the fabric out of the depressions. I shall presently describe ways of practicing my invention which make it impossible to impart the design to the fabric, remove the die at once, and vulcanize the article without any outwardly applied restraint to prevent the fabric from withdrawing from the depressed areas.

I prefer, in the process described by reference to Figs. 1, 2, and 3, to impart the relief design to the fabric by using an unheated die, since any tendency for fabric damage is thus avoided and the die construction is simplified. However, it will be understood that the design can be imparted through the medium of a heated die for the purpose of softening the collapsed foam rubber underlying the depressions and to thus heat-seal fabric and rubber together. This is a kind

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of way of adhesively securing fabric and underlying collapsed rubber together prior to vulcanization, and, when this is done, the need for outward restraint during vulcanization is lessened.

Likewise, it is desirable to maintain the under surface of the rubber in contact with the supporting base during the vulcanization to reduce any tendency for the design to also appear on the underside of the rubber. A supporting base of metal will permit the vulcanized article to be stripped therefrom readily. When, however, a permanent reinforcing backing material, such as a composition board, underlies the rubber layer, there is, of course, no necessity to maintain the pressed article in contact with a supporting base during vulcanization. I shall presently describe this in detail.

The final article resulting from vulcanizing the latex foam rubber of Fig. 2 is shown in Fig. 3. Here fabric 1 has a relief design (shown in cross-section) in which the high portions are supported by vulcanized latex foam rubber 8 and the depressions overlie, and are secured to, collapsed and vulcanized foam rubber 7. This article is flexible. It can be used as an upholstery material, fastened to a backing for making a panel board, used as a decorative fabric for making handbags, luggage, seat covers, etc. It has good resistance against wear, and the fabric is always smooth because of the rubber backing.

In Fig. 4 I illustrate an alternative way of making the fabric articles of the present invention. In this method I adhesively secure the latex foam rubber layer 2 to the fabric 1. A separately applied adhesive 9, such as latex is useful, or, since the surface of the latex foam rubber can be made "tacky," the fabric can be laid in contact with the tacky surface. After assembling the laminated structure as in Fig. 4 on a rigid base 4 from which the final article can be stripped as described above, a design in relief is impressed on the fabric by any suitable die arrangement such as that shown in Figs. 1 and 2. The result then is a fabric adhesively secured to the underlying foam rubber, and it thus becomes necessary to keep the die in contact with the fabric during vulcanization or curing. The adhesion of fabric to rubber prevents the fabric in the depressions from pulling out therefrom. Here again, it is desirable, but not necessary, to maintain the underside of the rubber layer in contact with the supporting base 4 during vulcanization to restrain any tendency for the design to show up on the underside of the rubber. This is readily achieved by temporarily securing the underside of the rubber layer to the base, for example by fastening the laminated assembly of foam rubber and fabric along the edges of the base, by interposing a thin film of latex between the supporting base and the rubber layer to act as an adhesive. However, the use of a removable base to support the article during the vulcanization is not absolutely essential. I have obtained good results by simply securing the latex foam rubber layer to the fabric, impressing the design thereon and vulcanizing. Some fabrics behave differently than others, and, in some instances, depressions in the underside of the rubber layer, corresponding to the indentations in the fabric, may be noticeable. Such depressions in the rubber layer are not as deep as those in the fabric, but, when they form, they lessen somewhat the effective depth of the depressions obtainable in the fabric. By temporarily mounting the assembly of fabric and foam rubber layer on a rigid base, a greater

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depth of depression in the fabric can be secured.

The final product, after vulcanization, appears as in Fig. 5. The high portions are supported by markedly cellular, vulcanized foam rubber 8, and the depressions overlie, and are secured to, collapsed or deflated vulcanized foam rubber 7.

While it is desirable to incorporate vulcanizing agents in the latex foam rubber during the manufacture thereof, and then permit these agents to vulcanize the rubber after the relief design has been imparted to the fabric, it is to be understood that other curing processes can be employed, such as the "cold" cures using sulfur chloride, but damage to the fabric should be avoided, and a cold cure should not be used if the curing agents would damage or discolor the fabric.

In Fig. 6 I illustrate yet another way of initially forming a layer of latex foam rubber in contact with the fabric, a method which is also useful in forming the foam rubber in contact with a reinforcing backing material where the latter is employed. In this showing the latex foam rubber is directly formed on the fabric 1 (or on the reinforcing backing material if such is to be used). The fabric 1 is carried along on a moving belt conveyor 20 from left to right as shown. Latex foam 21 containing vulcanizing agents, fillers, etc., is maintained in a hopper 22 above the moving fabric and is allowed to descend and form a layer 23 thereon. A doctor blade 24 regulates the thickness of the layer and the coated fabric is then moved along through a drier 25 where the foam is dried at low temperature, say about 50° C., or at room temperature. After leaving the drier, the fabric carries a layer of latex foam rubber 26 adhesively secured thereto since the foam "wets" the fabric to a slight extent and forms a good adhesive bond with the fabric. This fabric material can then be impressed in relief, as I have hitherto described, and the rubber vulcanized.

In Fig. 7 I show combining the decorated fabrics of the present invention with a backing material which may be flexible or rigid, as desired. Here a layer of latex foam rubber 2 is interposed between a fabric material 1 and a backing 10. The foam rubber is advantageously adhesively secured to the fabric and the backing by a separately applied adhesive, or by natural "tack" characteristics of the foam rubber, or by coating and drying the fabric or backing with a layer of the latex foam as in Fig. 6. After assembling the structure as in Fig. 7, the assembly is submitted to the action of a die to impress a relief design on the fabric, and then vulcanized. The result is a fabric having a relief design in which (see Fig. 8) the high portion of fabric 1 is supported by vulcanized latex foam rubber 8, the depressions in the fabric overlie and are secured to collapsed and vulcanized latex foam rubber 7, and the rubber is further secured to backing 10. In the case of panel boards for decorative purposes, backing 10 should be made of a relatively rigid material such as composition board or other fibrous pressed board material. If the final product should be flexible and easily cut, formed around corners, etc., then the backing can be paper, such as paper toweling, cloth, burlap, etc.

Figs. 9 and 10 illustrate still another way of practicing my invention. In Fig. 9, an assembly composed of the fabric 1, a layer of latex foam rubber 2, and a backing material 10 is first provided. Then the design is formed by stitches 11 passing through the fabric, foam rubber and backing to give depressions in the fabric (see Fig. 10).

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The latex foam rubber is readily stitched. After the design is formed, the rubber is then vulcanized as described above. The vulcanized product is shown in Fig. 10. The high areas of fabric 1 are supported by vulcanized cellular foam rubber 8, the low portions overlie the collapsed and vulcanized foam rubber 7, and the indentations are formed by stitches 11. Stitches 11 initially secure the collapsed rubber to the fabric prior to vulcanization. Vulcanization later on additionally seals the fabric to the rubber in these areas.

This procedure for imparting the design by indentation, and, at the same time, securing the fabric to the collapsed foam rubber, is especially useful when making decorative fabrics for luggage, chair coverings, etc., since the final product has a "hand-made" look about it which has customer appeal. It is especially worth while to point out at this time the marked differences between latex foam rubber which can be collapsed, i. e., is not vulcanized to that degree which would make the rubber resilient. The deformable nature of the latex foam rubber permits it to be stitched readily since the stitches merely collapse the rubber. The stitches do not have to hold the rubber against a tendency to expand, as would be the case were the rubber completely vulcanized and resilient. Thus, there is a marked difference in kind between using a collapsible or deformable latex foam rubber which will take and retain an impression in relief, and one which will not retain such an impression. If desired, the latex foam rubber can be adhesively secured to the fabric, or to the backing, or to both before the relief design is imparted by stitching. The backing material can be cloth, or other woven or felted fabric, or it can be a relatively rigid material such as heavy cardboard, capable of being stitched, depending upon the characteristics desired in the final article.

In Figs. 11 and 12 both the fabric 1 and the backing 10 are provided with a layer of latex foam rubber 2 which can be collapsed as described above. These layers can be adhesively secured to the respective materials, or they can be formed thereon by a coating operation, as shown in Fig. 6. Applying the foam rubber layer to both backing and fabric has advantages in that these layers need be but half the thickness ultimately desired. Thus, if it was desired to have a layer a quarter inch thick between fabric and backing prior to imparting the relief design, each of these layers would only have to be an eighth of an inch thick, and such thin layers can be easily made from the latex foam and dried, it taking less drying time to dry a layer an eighth of an inch thick than one twice as thick. The two "halves" of the assembly are then brought together with the respective latex foam rubber surfaces in contact, and the assembly is then processed to impart the relief design on the fabric. Under these conditions the two latex foam rubber layers, since they are readily collapsed or deflated where desired, and the depressed areas do not expand after the pressure is released, tend to "weld" into each other, and no adhesive is necessary for uniting the layers together in the depressed areas. However, an adhesive can be used to coat the surface of the foam rubber layers before they are brought into relation with each other.

In Figs. 13 and 14 I illustrate a panel board made in accordance with the processes of the present invention. Fig. 13 is a plane view, and Fig. 14 a cross-section, taken along the line A—A.

The panel board consists of fabric covering 1

having high areas 15 generally ridge-like in cross-section (for purposes of illustration), depressions 16 marking the boundaries of the ridges, broader high areas 17, and a flattened out, low area 12. Of course these areas are in no way limiting; they merely illustrate one style of relief design for the fabric of the panel board. The panel board also has a rigid backing 10 which is usually made of a fibrous board material such as composition board, or it can, of course, be sheet metal. The high portions of the design, namely, ridges 15 and broader raised areas 17, are supported by vulcanized latex foam rubber 8 of cellular structure and which is, therefore, resilient. The depressions in the fabric overlie and are secured to collapsed vulcanized foam rubber shown at 7. Both fabric and board 10 are best secured to the rubber intermediate layer as described heretofore. Holes for door handles, window-raiser handles, etc., are provided at 14.

This panel board is easily constructed by simply interposing a layer of the deformable or compressible foam rubber, which will take and retain an impression in relief, between fabric and board, securing the rubber layer to fabric and board, and die-pressing the design. Thereafter the assembly is raised to a vulcanizing temperature to cause vulcanizing agents in the rubber to react.

It is quite unnecessary to form the covering fabric around the edges of the board and this is one of the advantageous results flowing from my invention. By the use of a die having an appropriate configuration, the edge of the board can be die-pressed to give the structure shown generally at 18. Here fabric and foam rubber have been pressed to form a narrow flat border, and the fabric is sealed to the board through the intermediate layer of collapsed and vulcanized foam rubber. This seal is quite waterproof. At 19 a different treatment of the edge is shown. Here the fabric is brought down on a slant to give a beveled edge appearance to the board, the underlying layer of collapsed and vulcanized foam rubber effectively sealing board and fabric together. A bevel edge finish would be desirable where the edge of the board is exposed; a flattened edge treatment as at 18 would appear to be preferable where the edge of the board is to be inserted under a molding of some kind. This edge treatment, as stated, constitutes one of the marked advantages flowing from the practice of my process. There is no wastage of material, the board is provided with the foam rubber layer, the fabric laid over the layer and secured thereto at least in the areas to be depressed, and the assembly is simply die-cut and indented in one operation. There is no need for trimming afterward. The fabric always presents a smooth, unwrinkled surface, and its wearing qualities are enhanced.

Panel boards constructed by my invention can be made with great rapidity on automatic machinery. Fabric, latex foam rubber and backing are juxtapositioned, die-pressed from the fabric to the depth and configuration as desired to bring out the design, and the structure vulcanized. If the fabric and backing are secured to the foam rubber layer adhesively, the thus formed laminated article is pressed, die-cut to size, etc., in a single operation, removed from the pressing and cutting machinery and transferred to a vulcanizing chamber where it is heated to vulcanizing temperature. If the fabric is not secured to the foam rubber layer during the pressing operation,

the die should be left in place during vulcanization to insure that the depressions in the fabric are retained as pointed out above.

In the practice of the processes described above, it is desirable to vulcanize the rubber underlying the fabric within a week or so after imparting the design. Naturally vulcanization would be done immediately after the design has been imparted to the fabric, but I mention the desirability of not unduly prolonging vulcanization simply because a fabric which has been given a design in relief, and which overlies and is secured to the latex foam rubber is under some slight tension due to the fabric being somewhat stretched during the process. Consequently, prolonged storage of the assembly before vulcanization may in some instances result in a slight decrease in the height of the high areas. That is to say, the tension of the fabric slowly and gradually exerts pressure on the underlying unvulcanized latex foam rubber and this in time will tend to flatten out the high portions a little. The effect is not very noticeable, but may be taken into account. One of the surprising things about this process is the ability of the latex foam rubber prior to vulcanization to support the high portions of the fabric while at the same time it is so readily collapsed under direct pressure to form the depressions.

Throughout this specification I have referred to latex foam rubber and I have described what I mean by this material. It has, prior to vulcanization, the property of taking and retaining an impression in relief, of being indented in predetermined areas to varying depths, and of being completely or partially collapsed. That is to say, when an area of the foam rubber is depressed, that area is collapsed and stays collapsed, and is not resilient since it does not quickly spring back to original thickness when the pressure is released. That is what I mean, when, in the appended claims, I refer to latex foam rubber capable of taking and retaining an impression in relief. Such rubber advantageously contains vulcanizing agents capable of reacting with the rubber when, after imparting the design, I submit the assembly to vulcanization, but, as stated above, the rubber can be vulcanized by "cold" processes.

I wish to use the word "fabric" in a generic sense to include woven and felted fabrics, leather and the like, and such diversified fabrics as those made from cotton, wool, rayon, glass fibers, and synthetic fibers, for example those from Vinylite-type resins, nylon, etc.

By "latex" I mean to include latex containing natural rubber as well as the various man-made latices from synthetic rubbery materials. The latter, such as so-called GRS rubber latex are useful in making ordinary vulcanized latex foam rubber articles such as cushions, mattresses, etc., and are, therefore, useful in the practice of the present invention.

Where, in the appended claims, I refer to the depressed areas of the fabric being secured to the underlying collapsed foam rubber during and after vulcanization of the rubber, I mean to generically define holding the fabric in contact with the rubber as by a die, adhesively securing the fabric to the collapsed foam rubber, stitching the fabric to the foam rubber layer, the stitches defining the depressions, coating the fabric with the latex foam itself and drying at least to such a degree that the dried foam is sufficiently solidified to permit it to be indented in relief. "Dried"

is here used in a qualitative sense and not to define absolute bone-dryness. And by "adhesively securing" the latex foam rubber to the fabric or backing is included the application of a separate adhesive, putting tacky characteristics of the foam rubber surface, if present, to use as an adhesive, or by the adhesion of latex foam itself (as in coating) to the fabric or backing.

It will, of course, be understood that the latex foam rubber underlying the fabric can be collapsed, prior to vulcanization, to varying degrees, depending upon the ultimate appearance desired in the relief design. Thus, the design may have high areas, indentations where the fabric overlies latex foam rubber which is substantially completely collapsed, and areas intermediate in height between complete collapse of the underlying foam rubber and the height of the highest areas. Such effects may be secured by an appropriate die; they may also be secured, as I have hitherto pointed out by impressing a design in which the ridges are quite narrow since such ridges may then be of less height than the broader areas remote from the ridges. Where the effect of varying heights of the high areas (in contrast with deep depressions or indentations) is to be achieved by the use of an appropriate die then the face of the die is so designed that areas thereof partially collapse the latex foam rubber underlying the fabric, and thus create areas in the final product which are not so high as those areas where the fabric overlying the latex foam rubber has not been subjected to the pressure of the die. Therefore, the words "collapsing" or "collapsed" in the appended claims include either partially or wholly collapsing the latex foam rubber to form low areas or depressions as the requirements of the ultimate design may dictate.

By "backing material" or similar descriptive language, I mean to include flexible materials such as fabrics, paper, etc., and rigid materials such as composition board, fibrous boards such as those from sugar cane stalks, exploded fibers, laminated paper boards, sheets of artificial resinous materials, and backing materials of metal.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. The process of making a decorative fabric article having a relief design which comprises assembling fabric material and a layer of latex foam rubber which is capable of taking and retaining an impression in relief, imparting a relief design to the fabric and thus collapsing the structure of the foam rubber underlying the depressions in the fabric, the depressed areas of the fabric being secured to the underlying collapsed foam rubber during and after vulcanization, and vulcanizing the rubber to give a fabric having a relief design in which the high portions of the design are supported by vulcanized latex foam rubber, and the depressed areas of the design overlie and are secured to the collapsed and vulcanized foam rubber.

2. The process of making a decorative fabric article having a relief design which comprises adhesively securing a layer of latex foam rubber to the fabric, the latex foam rubber being capable of taking and retaining an impression in relief, imparting a relief design to the fabric and thus collapsing the structure of the foam rubber underlying the depressions in the fabric, and vulcanizing the rubber to give a fabric having a relief design in which the high portions of the design are supported by vulcanized latex foam rubber, and the depressed areas of the design overlie

and are adhesively secured to the collapsed and vulcanized foam rubber.

3. The process of making a decorative fabric article having a relief design which comprises forming a layer of latex foam on the fabric, drying the foam to provide a layer of latex foam rubber secured to the fabric, the latex foam rubber being capable of taking and retaining an impression in relief, imparting a relief design to the fabric and thus collapsing the structure of the foam rubber underlying the depressions in the fabric, and vulcanizing the rubber to give a fabric having a relief design in which the high portions of the design are supported by vulcanized latex foam rubber and the depressions of the design overlie and are secured to the collapsed and vulcanized foam rubber.

4. The process of making a decorative fabric article having a relief design which comprises adhesively securing one face of a layer of latex foam rubber to the fabric, and adhesively securing the other face of the foam rubber to a backing, the latex foam rubber being capable of taking and retaining an impression in relief, impressing a relief design on the fabric and thus collapsing the structure of the foam rubber underlying the depressions in the fabric, and vulcanizing the rubber.

5. The process of making a decorative fabric article having a relief design which comprises providing a reinforcing sheet material with a layer of latex foam rubber, the latex foam rubber being capable of taking and retaining an impression in relief, assembling a sheet of fabric material on the layer of latex foam rubber, imparting a relief design to the fabric and thus collapsing the structure of the foam rubber underlying the depressions in the fabric, the depressed areas of the fabric being secured to the underlying collapsed foam rubber during and after vulcanization, and vulcanizing the rubber.

6. The process of making a decorative fabric article having a relief design which comprises coating a reinforcing sheet material with a layer of latex foam, drying the foam to provide a layer of latex foam rubber secured to the sheet material, the latex foam rubber being capable of taking and retaining an impression in relief, assembling a sheet of fabric material on the layer of latex foam rubber, imparting a relief design to the fabric and thus collapsing the structure of the foam rubber underlying the depressions in the fabric, the depressed areas of the fabric being secured to the underlying collapsed foam rubber during and after vulcanization, and vulcanizing the rubber.

7. The process of making a decorative fabric article having a relief design which comprises providing a laminated structure composed of a fabric material, an intermediate layer of latex foam rubber, and a reinforcing backing of sheet material, the latex foam rubber being capable of taking and retaining an impression in relief, imparting a relief design to the fabric, and thus collapsing the latex foam rubber underlying the depressions in the fabric, and vulcanizing the rubber, the depressed areas of the fabric being secured to the underlying collapsed foam rubber during and after vulcanization.

8. The process of making a decorative fabric article having a relief design which comprises providing fabric material and reinforcing sheet material, applying a layer of latex foam to one of said materials, drying the foam, assembling the other material on the dried foam while the latter

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is "tacky" to adhesively secure the dried foam to both materials as an inner layer, the dried latex foam constituting latex foam rubber and being capable of taking and retaining an impression in relief, imparting a design in relief to the fabric and thus collapsing the latex foam rubber underlying the depressions in the fabric, and vulcanizing the rubber.

9. The process of making a fabric material having indented areas in a predetermined configuration therein which comprises indenting a fabric provided with an underlying layer of latex foam rubber capable of taking and retaining indentations therein, whereby the latex foam rubber underlying the indented areas in the fabric is collapsed, and vulcanizing the rubber under-

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lying the fabric to yield a fabric having indented areas overlying and secured to collapsed and vulcanized latex foam rubber and having unindented areas overlying and supported by vulcanized latex foam rubber.

FREDERICK H. UNTIEDT.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
2,071,647	Miller	Feb. 23, 1937
2,271,058	Binns	Jan. 27, 1942
2,341,979	Cunnington	Feb. 15, 1944

Certificate of Correction

Patent No. 2,434,527.

January 13, 1948.

FREDERICK H. UNTIEDT

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 5, line 61, for the word "impossible" read *possible*; column 6, line 45, for "necessary" read *unnecessary*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of March, A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

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