

May 22, 1962

P. M. COLE

3,035,329

DOUBLE PLEATED FABRIC

Filed March 13, 1957

4 Sheets-Sheet 1

Fig. 1

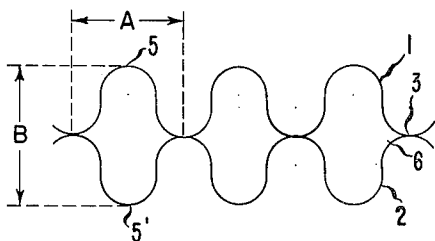


Fig. 2

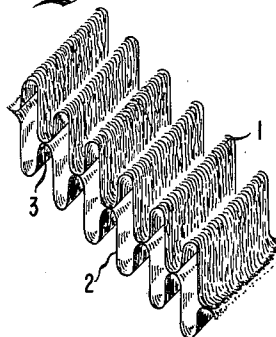


Fig. 3



Fig. 4

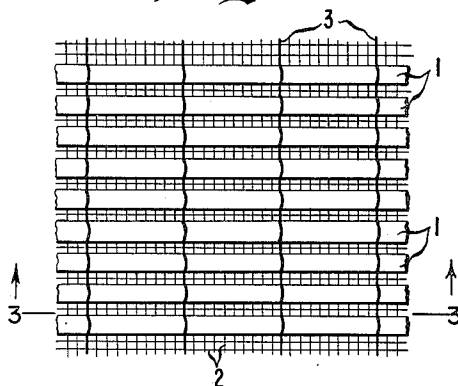


Fig. 5

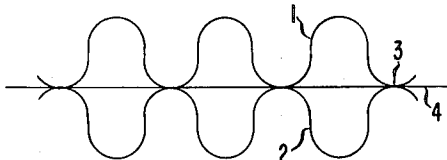


Fig. 6

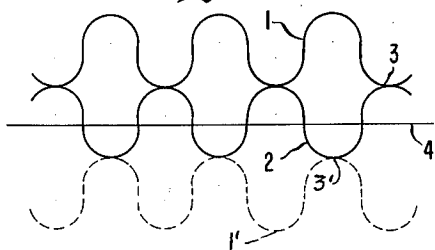
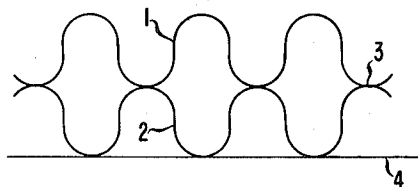


Fig. 7



INVENTOR
PAUL M. COLE

BY *Raymond E. Clements*

ATTORNEY

May 22, 1962

P. M. COLE

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4 Sheets-Sheet 2

Fig. 8

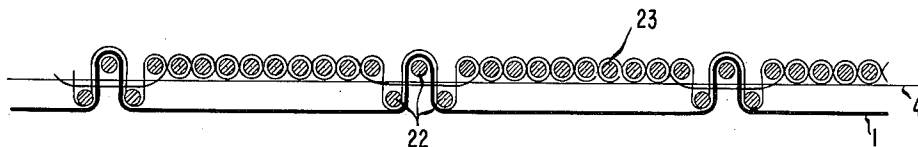


Fig. 9

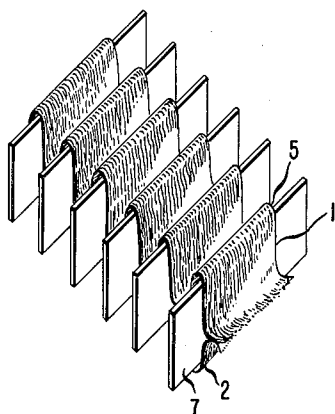


Fig. 10

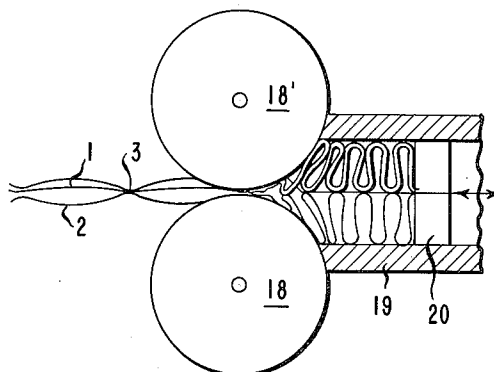
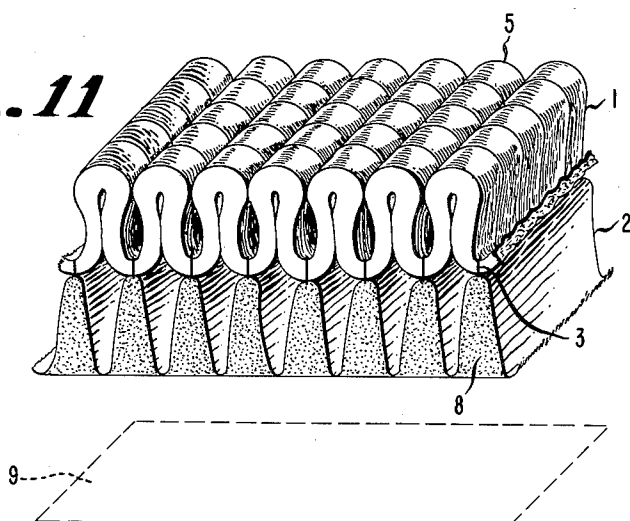


Fig. 11



INVENTOR

PAUL M. COLE

BY *Sydney E. Salomstett*

ATTORNEY

May 22, 1962

P. M. COLE

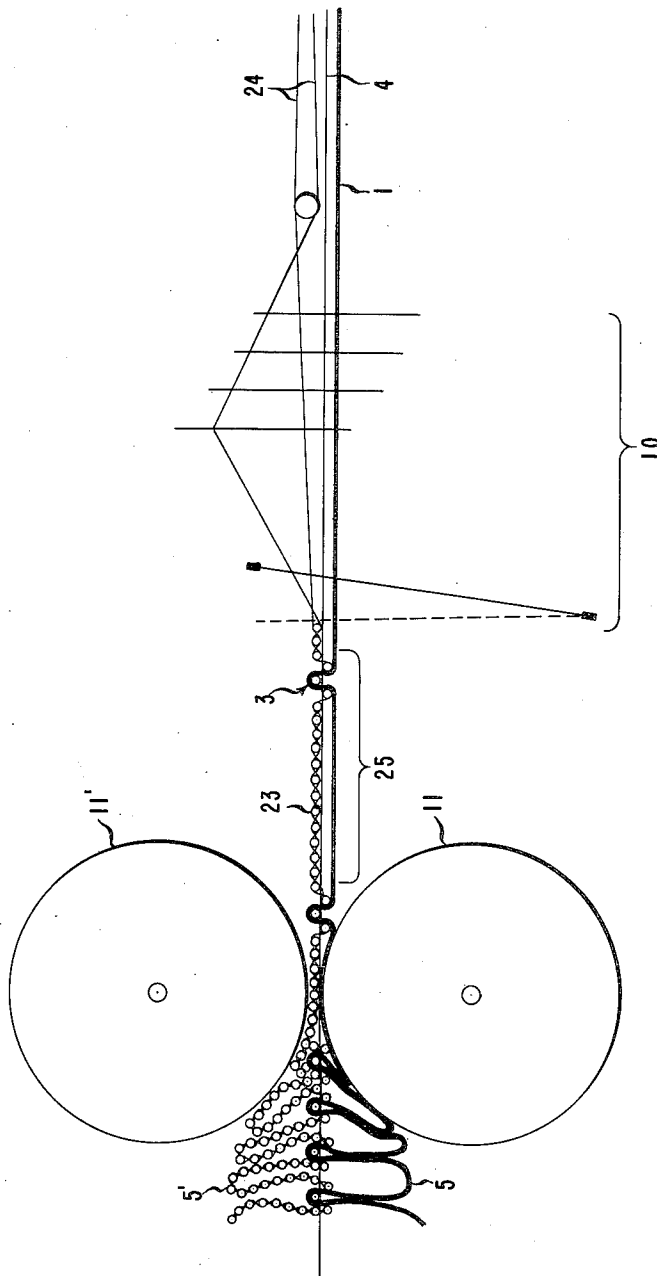
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4 Sheets-Sheet 3

Fig. 12



INVENTOR
PAUL M. COLE

BY *Raymond E. Blomstedt*

ATTORNEY

May 22, 1962

P. M. COLE

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DOUBLE PLEATED FABRIC

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4 Sheets-Sheet 4

Fig. 13

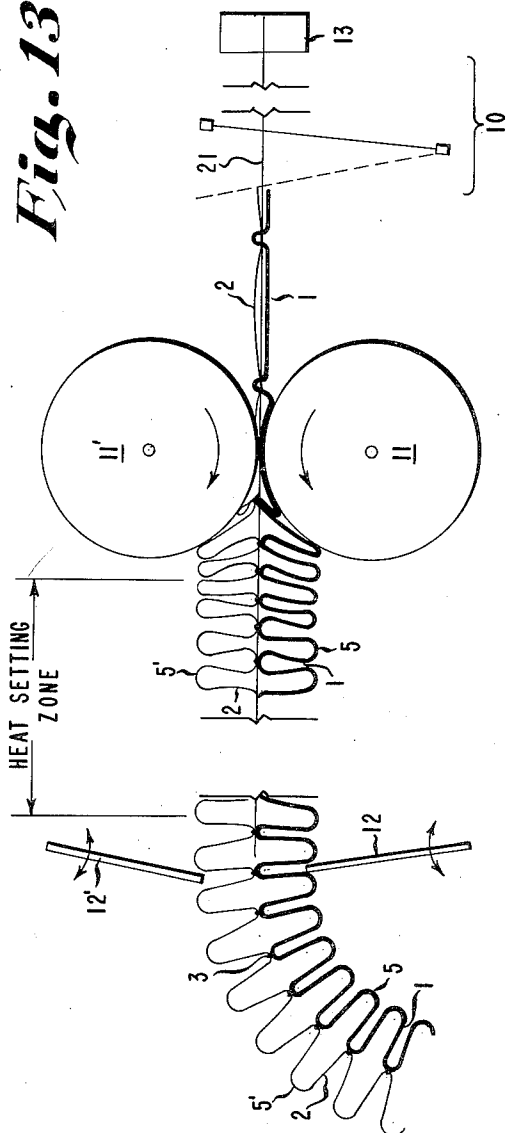
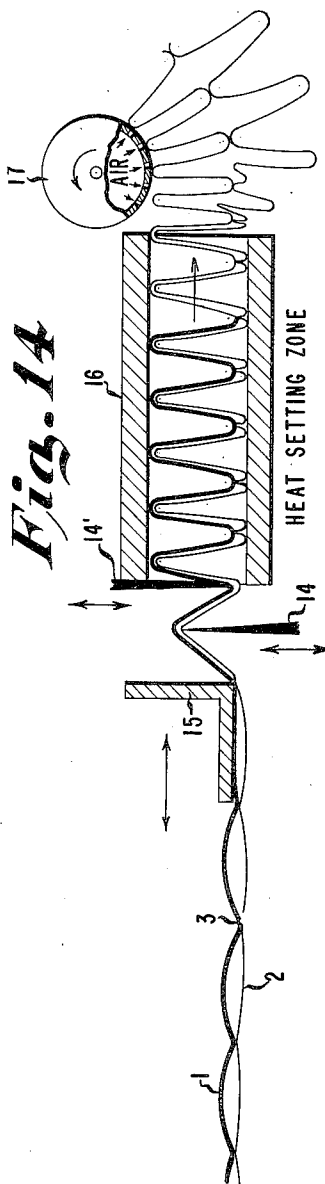


Fig. 14



INVENTOR
PAUL M COLE

BY *Raymond E. Slomkowski*

ATTORNEY

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3,035,329

DOUBLE PLEATED FABRIC

Paul M. Cole, Wilmington, Del., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

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8 Claims. (Cl. 28—78)

This invention relates to a novel fabric and more particularly to a double pleated fabric having a unique structure.

Pile fabrics, such as rugs and blankets, are well known and various procedures for preparing them are established in the art. Good quality pile fabrics, however, are sufficiently expensive to be beyond the reach of many potential consumers. This is primarily due to the high cost of the pile materials. Wool and synthetic fibers are relatively expensive and particularly so when employed in the large quantities required for pile fabrics. The problem of reducing the cost of pile fabrics without sacrifice in quality has concerned the trade for decades.

It is an object of this invention to provide a double pleated fabric. Another object of this invention is to provide a double pleated pile fabric suitable for a rug or blanket but containing only a fraction of the pile material normally necessary in a pile fabric of comparable quality and having a similar end use. A further object is to provide a process for preparing a double pleated fabric. Other objects will appear hereinafter.

In accordance with this invention there is provided a double pleated fabric comprising pleated face material superposed upon a pleated skeletal material, the materials being attached at peaks of the folds. The double pleated fabric is illustrated schematically in longitudinal cross section in FIGURE 1 and generally comprises pleated face material 1 attached to pleated skeletal material 2 at peaks 3 so that the intervening face and skeletal material form an enclosure elongated in a direction athwart a line joining the points of attachment. In such a fabric the distance A between points of attachment 3 is less than the distance B between free peaks 5, 5' of opposed intervening pleats. Preferably, B will be greater than about 2(A). Depending upon the materials used and the spacing between the points of attachment, the enclosure may assume various forms, for example, a generally elliptical form (as shown in FIGURE 1) or an oblong, obovate, spatulate, panduriform, or similar configuration, account being taken of the parallel relationship of the materials at the points of attachment which necessarily causes slight notch 6 at these points. FIGURES 10, 11, and 12 illustrate how the configuration formed by the face and skeleton between points of attachment may vary depending upon the distance between points of attachment, differential thickness and/or stiffness between face and skeletal material and the like.

FIGURES 1, 5, 6, and 7 are schematic longitudinal cross-sectional views of various double pleated fabrics of this invention. The dotted lines in FIGURE 6 show how a second pile material may be attached to the skeleton to provide a triple pleated fabric.

FIGURE 2 is a perspective view of a double pleated fabric.

FIGURES 3 and 4 are schematic longitudinal cross-sectional and plan views of a pile warp attached to a skeletal sheet according to this invention.

FIGURE 8 shows a preferred method of attaching a pile to a skeletal material.

FIGURE 9 shows one method for forming pleats between a pile and skeletal material.

FIGURE 10 shows pleating with a stuffer box.

FIGURE 11 is a perspective view of a double pleated fabric in which the pleats of the skeletal material contain

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a filler and are optionally covered with a backing layer.

FIGURES 12 and 13 illustrate loom pleating to produce a double pleated fabric.

FIGURE 14 shows a mechanical pleating device and method.

In preparing a double pleated fabric suitable for a rug, blanket, or the like, a pile warp is attached at spaced points along its length to a skeletal sheet in a lengthwise or transverse direction. FIGURES 3 and 4 are illustrative. The pile and skeletal material intervening between points of attachment are then separated to form an elongated enclosure which is at least equal in length (longest direction) to the distance between points of attachment. The resulting double pleated fabric is then maintained in this configuration.

Preferably, the double pleated fabric is prepared by weaving together a pile warp yarn with a skeletal warp and skeletal filling in a manner so that the pile warp is attached to the resulting skeletal fabric at uniformly spaced intervals. The pile warp and skeletal fabric intervening between points of attachment are then separated by any suitable double pleating procedure as, for example, by running slats through the loops or enclosures formed by the pile and skeleton and then turning the slats perpendicular to a plane of the points of attachment as shown in FIGURE 9. The fabric materials may then be set or otherwise treated to maintain the fabric in this double pleated configuration despite removal of the slats.

In accordance with a preferred procedure a drawstring warp yarn may be simultaneously introduced into the fabric at uniformly spaced intervals during the weaving step. The drawstring may simply pass through the double pleated fabric at the points of attachment as shown in FIGURE 5 or may pass through the free peaks of the pleated skeleton (FIGURE 7) or may pass through the skeleton at intervening points as shown in FIGURE 6. Preferably, the drawstring passes through the points of attachment as shown in FIGURE 5, and, more preferably, the drawstring 4 will be tied-in to the skeletal material as indicated in FIGURE 8. The particular tie-in method shown in FIGURE 8 is important for producing a double pleated fabric, having uniform pile and skeleton pleats, automatically on a loom.

When drawstrings are utilized to produce double pleated fabrics, the drawstring may remain in the resulting product (with ends fixed) to assist in maintaining the dimensional stability of the double pleated fabric or the drawstring may be removed or otherwise destroyed.

Attachment of face material to skeleton material may be effected by sewing, stapling, adhesives or other securing means. Regardless of the specific method used, the attachment is made at points along the face material at spaced intervals equal to about twice the desired pile height. In attaching a pile warp to a skeleton by sewing, the pile warp is placed directly on the skeleton and a chain or lock stitch of carpet sewing thread run through the warp and the skeleton fabric as illustrated in FIGURES 3 and 4. If weaving is utilized, the warp of pile yarn is preferably combined in the weave as an auxiliary warp having long floats equal to about twice the ultimate pile height. If knitting is employed, the pile yarn may be parallel or transverse to direction of movement of the fabric through the knitting machine.

Peak-to-peak attachment between face material and skeleton is a highly desirable and novel aspect of the invention and is particularly valuable in constructing pile rugs. This construction provides rugs comparable to highest quality prior art rugs but with only half the quantity of experience pile yarn. If desired, there may be a face material attached to both sides of the skeleton, forming a triple pleated fabric in which a pleated skeleton is sandwiched between two pleated face materials. This

construction has specific advantages in making finished products such as blankets. The pleating may be carried out on a loom (FIGURES 12, 13), pleating machine, by inserting slats into the pile/skeleton structure after attachment and turning the slats on their sides (FIGURE 9), by mechanically pleating the pile and skeleton elements of the structure by pressing them into a stuffing box (FIGURE 10), or by using drawstrings to form pleats in the already attached pile/skeleton structure.

Preparation of a double pleated pile fabric of this invention on a loom using a drawstring to facilitate pleating is illustrated in FIGURE 12. Pile yarn 1, skeleton warp yarns 24, and drawstring 4 are fed into loom 10 which has been adjusted to produce initially a two-ply fabric 25 in which the pile warp yarn is tied-in to the resulting skeleton fabric, as shown in cross section in FIGURE 8. In FIGURE 8, the warp yarn is tied-in to the skeleton by means of filling threads 22 which are relatively heavy (stronger) as compared with ordinary filling threads 23 in the skeleton fabric. When the end product desired is a printed double pleated fabric, it is convenient to provide printing means so that two-ply fabric 25 may be printed while flat and prior to pleating by rolls 11 and 11'. In operating the process and apparatus illustrated by FIGURE 12, drawstring 4 is fed to the loom at a rate slower than that of either pile warp yarn or skeleton warp yarns. Rolls 11 and 11' (which are preferably knurled) advance fabric 25 formed by the loom at about the same rate as the pile warp yarn and skeleton warp yarns are fed to the loom but are unable to advance the drawstring 4 at this rate because the latter is fed to the loom at a lower rate. The inability of the drawstring to advance at the same rate as the fabric leaving the nip of rolls 11 and 11' advances the fabric along the drawstring and thereby pleats the fabric as illustrated. Because of the particular tie-in of the pile warp yarn with the skeleton and the manner in which the drawstring passes between the relatively heavy filling threads at the tie-in points, pleating of the pile fabric is uniform and efficient. The tie-in points are maintained in their respective positions relative to the drawstring, and the pile warp yarn and skeleton fabric assume the configuration of a double pleated pile fabric of this invention.

The drawstring-pleated pile fabric produced as illustrated by FIGURE 12 may be processed to fix the drawstring in place and thereby maintain the pleated configuration. One manner of accomplishing this is to impregnate the double pleated fabric with adhesive along two transverse bands spaced apart a distance equal to the length of fabric desired. Any suitable bonding material may be used so long as it is effective to maintain the pile, skeleton, and drawstring in the band in a fixed relationship. Thereafter, by cutting along the middle of the band there will be produced a double pleated fabric having both ends fixed and the drawstrings held intact. Alternatively, the plates are provided with memory so that, thereafter, the pleated configuration will be the natural configuration. The memory may be provided by coating, impregnating, or point bonding, but preferably is provided by heat-setting the fabric—that is, subjecting the fabric to sufficient heat to set the pleats in the skeleton or face material or both. Drawstrings may be then removed.

Preparation and double pleating of a double pleated fabric of this invention may also be accomplished on a loom without use of drawstrings. FIGURE 13 illustrates an apparatus suitable for such a procedure. In FIGURE 13 piano wires 21 held by piano wire clamp 13 replace the drawstrings of FIGURE 12. Pile and skeleton yarns are fed to the loom as described previously, utilizing the same tie-in configuration between pile yarn and skeleton filling yarn. The piano wires assume the same position relative to the yarns as the drawstrings of FIGURE 12. Pleating is also accomplished in the same manner as before with the exception that the piano wires, unlike draw-

strings 4, remain stationary. As rolls 11 and 11' advance the double pleated fabric along the piano wires, heat is applied to the fabric for the purpose of setting the fabric in its double pleated configuration. The length of the piano wires is adjusted so that the double pleated fabric will be fully set by the time it reaches the end of the wires. Escapement pieces 12, 12' regulate the movement of the heat-set double pleated fabric from the piano wires. Thereafter, the double pleated fabric is collected and utilized as such or extended longitudinally temporarily for flat printing, dyeing, or other textile processing, or a backing material, either a sheet backing material or a filling backing material or both may be applied to the back of the skeleton fabric depending upon the properties desired and end use.

Double pleated fabrics of this invention may also be produced from a two-ply fabric such as illustrated in FIGURES 3 and 4 by utilizing other pleating procedures and devices. FIGURE 10 illustrates a stuffer box pleater whereby a two-ply fabric is fed between rolls 18 and 18' and into stuffer box 19. Friction block 20 impedes the movement of the fabric through the box, thereby resulting in the double pleated fabric. Movement of the friction block may be regulated to control cross-sectional configuration of the double pleated fabric. Optionally, the stuffer box may contain longitudinal partitions to facilitate pleating uniformity.

FIGURE 14 illustrates still another method of producing a double pleated fabric from a two-ply fabric such as illustrated in FIGURES 3 and 4. In this case a timed and regulated oscillation of clamps 14, 14' in combination with reciprocating longitudinal movement of pressure plate 15 produces pleats in the fabric as shown. While in the pleater box the face material is heat-set, and as the material exits from the box the skeletal material is separated from the face material by mechanical means or by blowing gas through the face material to produce a double pleated fabric of this invention. One convenient method for separating the face and skeletal materials is to advance the pleated material around a perforated drum 17 which contains air under pressure. The air passing through the face material blows the skeletal material outward and away from the face material. Thereafter, a backing material may be applied to the skeleton for dimensional stability.

The skeletal material may be a woven, knitted, non-woven fabric, film, or other sheet material and is preferably a low-cost material of light weight construction. It may be formed from any convenient material such as cotton, high tenacity rayon, nylon, polyethylene, etc. Any fibers making up the skeletal fabric should be compatible with elastomeric materials suitable for backing and by this is meant that the skeletal fibers should preferably bond readily with elastomeric fillers which may be used as backing. The skeletal material may be chosen so that it may be heat-set or not, depending upon the end use desired.

In accordance with a preferred embodiment, the double pleated fabric carries on its back side (i.e., the side away from the pile) and attached to the skeleton a backing material. The backing material may be in the form of a sheet material, for example, woven, knitted or non-woven fabrics, felt, plastic film or sheet, paper, or any suitable form capable of providing dimensional stability. The sheet may be an elastomeric material or not, as desired, and is preferably attached to the free peaks of of the skeleton as shown by sheet 9 in FIGURE 11. When the backing material is a non-elastic sheet, longitudinal stretch of the double pleated fabric is minimized. Elastomeric sheets are desirable as backing when the double pleated fabric is to be subsequently stretched for further processing or stretch is necessary (as for form fitting) in the end use. Alternatively, the backing material may be an elastomeric composition 8 suitable for filling pleats of the back of the skeleton as shown in

FIGURE 11. Such a composition provides the skeleton with a yielding stable configuration and provides dimensional stability. Preferably, the filling material adheres to the skeleton to provide added stability. When both filling material 8 and sheet material 9 are employed together as backing, it is preferred that the filling material be an elastomeric composition to provide resilience and bounce to the double pleated fabric and that the sheet material be non-elastic to provide maximum dimensional stability. An elastomeric filling material also reduces wear and tends to prevent pilling of the pile surface. Instead of a sheet material, a thread warp may be used to add lengthwise strength to the fabric. A backing material with a good appearance and corrugated to allow free passage of air is desirable for the purpose of minimizing mildew and for increasing insulating properties, particularly when used as a rug in buildings in which the floor is in contact with the ground. Backing material, when elastomeric, may be composed of natural rubber, rubber latex, sponge rubber, synthetic rubber, vinyl foam, polyurethane foam, or any other material having high elasticity. Thermoplastic or thermosetting resins may also be used as backing materials.

The properties of the skeletal fabric may be modified after weaving, knitting, or sewing to increase the resilience, crease retention and strength of the fabric by impregnating or coating with thermoplastic or thermosetting resins, synthetic rubber, starch, paper, and the like. Also, special adhesives or binders may be applied to the back of the skeleton to bond the face material more securely to the skeletal material at the points of attachment in order to prevent pulling out of the pile yarn. Thermoplastic threads (e.g., either thermo-responsive or solvent-responsive threads, or threads which may be bonded by separate application of resin or fiber bonding agents) may be employed in making the skeletal fabric, said thermoplastic threads being suitably chosen to permit bonding of the pile yarns to the skeletal material, and/or to permit bonding between the warp and filling at their cross-over points of the skeletal yarns to further strengthen the skeletal fabric.

Pile yarn used in making the improved rugs of this invention may be spun staple yarn or continuous filament yarn composed of any suitable filamentary material which will withstand the repeated flexing, crushing and matting to which rugs are exposed in use. The preferred pile yarns will be made of synthetic filamentary materials such as those prepared from polyamides (e.g., polyhexamethylene adipamide, polycapromide, copolyamides and graft copolymers containing grafted salt groups, which may be obtained by reacting an unsaturated acid with a polyamide (e.g., polyhexamethylene adipamide), followed by forming the salt thereof), acrylic polymers and copolymers (e.g., polyacrylonitrile, and copolymers of acrylonitrile with methyl acrylate, vinyl chloride, vinyl pyridine, and vinylidene chloride, etc., said copolymers being prepared from monomers comprising at least about 75% acrylonitrile), polyesters such as polyethylene terephthalate and copolyesters, polyester amides, polyurethanes, vinyl polymers and copolymers such as polyvinylidene chloride and polyvinylidene cyanide, polyfluoroolefins such as polytetrafluoroethylene, polymonochlorotrifluoroethylene, polyhexafluoropropylene and copolymers, polyethylenes, and the like. For some uses, the pile yarns may be made of wool, cotton, rayon or other more conventional fibers, or the yarn may be composed of a blend of two or more fibers. After assembly of a double pleated pile fabric, the pile pleats may be cut or not, as desired, or partially cut to provide special effects.

It is not essential that the pile material be of uniform depth (height) or that pile depth be the same as skeleton depth. Pile depth in a double pleated fabric may vary to provide carved or sculptured effects. Pile depth preferably will be uniform, however, and equal to skeleton

depth although each may vary independently of the other.

According to a particular embodiment of this invention, a double pleated fabric is prepared in which the pleats of the face material are not parallel to the peaks of the skeleton although there is still peak-to-peak attachment. It is preferred in such a fabric that the face material be in the form of a sheet with pleats transverse to the pleats of the skeleton. Conveniently, the peak-to-peak attachment is effected with an adhesive in this case.

As mentioned heretofore, double pleated fabrics without drawstrings may be prepared, and this structure permits flexing or stretching of the fabric in an accordion-like movement of both the pile pleats and the skeleton pleats. A pile fabric of this invention containing no drawstrings may be prepared by different procedures: (1) a drawstring is used in the preparation of the double pleated fabric and is subsequently destroyed and (2) the fabric is prepared directly without any use of drawstrings. Thus, a pleated pile fabric may be woven or knitted and simultaneously or subsequently pleated using piano wire or synthetic drawstrings (such as polyamide, polyethylene, or high tenacity rayon) in the weaving or knitting operations. The double pleated fabric is then set by heat or otherwise before leaving the pleating equipment or at least before the double pleated configuration is lost. Any drawstrings in the product may be removed by dissolving the drawstrings in a solvent for same which is a non-solvent for the other materials making up the pleated structure. Also, the drawstrings may be pulled out or weakened by sufficient mechanical forces so that they may be broken and removed.

Double pleated pile rug structures containing no drawstrings differ from structures with drawstrings in that the former are stretchable like an accordion. These products are extensible lengthwise in the direction of the pile yarn to allow printing, dyeing, and other finishing operations to be performed on the pile after which the fabric is returned to the pleated configuration. Double pleated fabrics without drawstrings thus have advantages over structures containing drawstrings in that the former may be shipped from one factory to another with the fabric in extended form (as in FIGURE 4) as, for example, when wrapped on a roll. The receiving factory may unroll and unwrap the extended product, thereby allowing the fabric to assume its original double pleated configuration.

In a typical preferred process for making a double pleated fabric of this invention by weaving employing drawstrings, a pile warp yarn, drawstring warp yarn and skeletal warp yarn are fed into a weaving loom, as shown in FIGURE 12, alternating all skeletal filling yarns with skeletal warp yarns. At spaced intervals equal to about twice the desired pile height, a relatively heavy filling yarn passes under all pile warp yarns and over all drawstrings, each filling yarn adjacent on both sides of the spaced cross-over points also being of heavier denier than the remaining filling yarns and passing over all pile warp yarns and under all drawstring warp yarns. All remaining filling yarns pass over all pile warp yarns and over all drawstring warp yarns. The cross-sectional configuration is shown in FIGURE 8. The use of the heavier denier filling yarns at positions adjacent to the cross-over points act to minimize or preclude the possibility of the pile segment of the pleat being positioned on the skeleton side of the double pleated fabric.

An important advantage of this invention is the provision of a fabric suitable for rugs, blankets, and the like, and having a low cost cushioning base which gives to the pile an apparent depth (height) equal to about twice the actual pile depth while using only about half the amount of pile yarn normally necessary. A further advantage lies in the fact that rugs of this invention utilize almost 100% of the pile yarn at the working surface because all the pile is positioned above the base or backing

of the rug and none need be wasted beneath the surface of attachment as in conventional rugs.

Another advantage of the novel structure of this invention is that it permits achieving patterns on three dimensional pile fabrics using simplified techniques applicable to two dimensional fabrics. This has not been possible heretofore. Thus, a double pleated fabric made in accordance with this invention may be printed merely by extending the fabric longitudinally, which in this flattened condition may be impregnated and/or printed uniformly using conventional roller printing techniques to obtain variety of colored rug patterns without encountering the usual difficulties of non-uniformity incurred when trying to print an upstanding pile. After printing, the fabric is allowed to return to its double pleated configuration having a uniformly patterned high upstanding pile.

The double pleated fabrics of this invention are useful either without further processing or combined with a suitable backing material as rugs, carpets, blankets, upholstery, seat covers, overcoats, furs, linings for military vehicles and clothing, and many other uses.

The following examples illustrate specific embodiments of this invention, but other modifications will be apparent from the drawings and description of the invention.

Example I

A rug is woven and pleated on a Draper XD loom in accordance with the following details:

Pile warp—6 ends per inch of 6900 denier poly(hexamethylene adipamide) spun yarn, prepared from 15 denier per filament, 3 inch staple, in a 28 inch wide warp.

Skeleton warp—840 ends of #30 cotton sewing thread in a 28" wide warp.

Drawstring warp—168 ends of 600 denier poly(hexamethylene adipamide) monofilament in a 28" wide warp.

Filling—A #30 cotton sewing thread.

All filling picks are passed alternately over and under all skeleton warp ends, the over and under construction likewise alternating in the relation of successive filling picks with any one warp end. Every sixteenth filling pick is made to interlace the pile yarns with the skeleton fabric being woven. This is accomplished by passing these filling picks under all pile warp ends and over all of the drawstrings. The filling pick immediately preceding each pile yarn interlacing point and the filling pick immediately following each pile yarn interlacing point are passed over all pile yarn warp ends and under all drawstrings. All filling picks, other than the sets of three mentioned above, are passed over all pile yarn warp ends and over all drawstrings. Warp tensions and other loom adjustments are made to control the spacing of the pile yarn interlacing points to one-half inch measured in the warp direction.

Two knurled rolls, two inches in diameter, are mounted on the breast plate of the loom and geared together with an opening of .022" in the nip. The rolls extend the full width of the woven fabric and are at a distance of approximately eight inches from the point of weaving. The nip of the rolls is made as low as possible, but physical limitations of the loom necessitate it being slightly above the plane of weaving. The fabric is threaded from the point of weaving under a crepe rod and hence to the nip rolls. A weight is employed on a chain to provide torque to the nip rolls so as to cause these rolls to advance the woven skeleton and pile yarn at a speed equal to the rate of fabric weaving. The drawstrings are positively fed from a beam at a rate equal to approximately one-fifth the rate of fabric weaving. At the start of the run, the drawstrings at a point beyond the nip rolls are clamped to the woven fabric. Operation of the loom then causes the fabric to pleat at the exit from the rolls, the skeleton fabric pleating upward and the

pile yarn pleating downward. (The product is woven in an upside down position.) A support is provided a short distance from the exit to cause the pleated product to leave the rolls in a horizontal plane. Drawstring ends are then fixed with adhesive.

The resulting rug has nine pleats to the inch and 6½ pile loops per inch along each pleat. The pile weight of 1.6 lbs./yd.² provides better cover than that obtained with about two pounds of yarn in conventional rug weaving.

Example II

A six-inch wide strip of close woven cotton fabric is given a superficial pleating of ¼" width. A warp of 4300 denier spun yarn of polyhexamethylene adipamide is placed on the stretched cotton fabric and sewed with a double pass of lock stitch at the ½" spaced convex pleating points. Cotton sewing thread in a home sewing machine is employed in this operation. Steel strips ¾" wide x 0.035" thick are inserted between the base fabric and the pile warp after the sewing step, one strip being inserted at each pleating space. The strips are then turned up on edge so that their flat surfaces are parallel, thereby forming the desired pleated structure. The back is then coated with a commercial rug backing latex thickened with baking flour in the ratio of two parts flour to one part latex by volume. Some of the cement is worked into the pleats with a spatula. The underside of the pleated structure is covered with a light-weight woven cotton backing fabric and cemented in place with the above-mentioned latex. The assembly in the pleated formation is held in a frame until drying permits removal of the metal slats without disturbance of the pleated structure. The finished product has 8.8 pleats per inch with 10 pile yarn loops per inch in each pleat. Pile height is slightly under ¼" and has a weight of 1.5 lbs./sq. yd. The product has a total thickness slightly under one-half inch and a luxuriousness considerably superior to commercial rugs with two pounds of pile yarn per square yard.

Example III

Pile warp: 6 ends per inch 6900 denier polyhexamethylene adipamide spun yarn prepared from 15 denier per filament, 3 inch staple.

Skeleton warp: 36 ends per inch No. 30 cotton sewing thread.

Filling yarn: 14 picks No. 30 cotton sewing thread followed by 6 picks 50 denier, 27 filaments, 6 turns Z twist continuous multifilament yarn of polyethylene terephthalate.

The above elements are fed to a Draper XD loom and woven as in Example I. All filling picks are passed alternately over and under all skeleton warp ends, the over and under construction likewise alternating in the relation of successive filling picks with any one warp end. Every nineteenth and twentieth filling pick is made to interlace the pile yarns with the skeleton fabric being woven. This is accomplished by passing these filling picks under all pile warp ends. The interlacing picks, the six picks immediately preceding, and the six picks immediately following the interlacing picks are No. 30 cotton sewing threads. The other six picks between the interlacing points are of 50 denier polyethylene terephthalate. When woven in this manner, the fabric has a distance of ⅞ inch between lines of interlacing. Steel strips of the same dimensions as those of Example II are inserted in the manner previously described and turned up on edge. The sample is clamped so as to hold the pleats tightly compressed and then heat-set by application of saturated steam at 250° F. for 30 minutes in an autoclave. The slats are then removed. When the double pleated fabric is repeatedly stretched, the product returns without assistance to the stable double pleated configuration having an "A" dimension of ¼ inch and a "B" dimension of ⅜ inch. The product is highly flexible and

bulky and is particularly useful as an insulation lining for overcoats.

Example IV

A sample rug A prepared as in Example III having one pound of pile yarn per square yard is compared with a rug sample C of Masland "Firmloc," a commercial woven loop pile velvet rug having two pounds of wool per square yard and a rug sample B made by Masland with approximately two pounds of nylon per square yard. The pile yarn in the rug sample A is 6900 denier spun yarn of polyhexamethylene adipamide made from 15 denier per filament, 3 inch staple. There are 7.3 pleats to the inch and 6.5 pile loops per inch along the pleats. The skeleton fabric has #30 cotton sewing thread in both warp and filling and the points of pile yarn interlacing are spaced three-eighths of an inch. Pleating is performed with the aid of metal slats temporarily inserted between the skeleton fabric and the warp yarns. A commercial latex rug undercoating is spread onto the underside and into the skeleton pleats. A 0.4 lb./yd.² burlap is then cemented to the underside of the product with the above adhesive.

The compression recovery of rugs A, B, and C is determined in a testing device consisting of a horizontal table for the sample, a plunger with a presser foot for application of load to the rug sample, and an actuating mechanism for raising and lowering the plunger. The test sample having dimensions of 4 inches square is retained on the table without distortion by a steel retaining wall providing an area slightly larger than the sample. The rug sample is subjected to compressive loads of 11.5 pounds per square inch for 2000 cycles at a rate of 36 cycles per minute, the presser foot being raised and lowered vertically a distance of approximately 1 inch per cycle. Double pleated rug sample A is found to have a twenty-four hour recovery of 92.9% compared with 89.6% for the nylon "Firmloc" sample B and 91.0% for the wool "Firmloc" sample C. The double pleated rug sample A has an initial thickness of .378", compared with .266" for the nylon "Firmloc" B and .284" for the wool "Firmloc" C. The double pleated rug A yields 30% more under the 11.5 p.s.i. load than either the nylon or the wool "Firmloc." The 33% greater thickness and the 30% greater yield of the double pleated rug A without sacrifice in recovery properties indicates a more luxurious rug achieved with half the weight of pile yarn of either commercial product.

The claimed invention:

1. A double pleated fabric comprising a face of pile fabric pleated only in parallel rows and a skeletal fabric pleated only in rows parallel to the face rows to form peaks coinciding with the peaks formed by the face pleats,

the double pleated fabric being woven so that coinciding peaks formed on adjacent sides of the face and skeletal fabrics are interlaced, the pleats of the two fabrics between said interlaced peaks being of opposed configurations to form enclosures of generally elliptical cross-section having the minor axis of the ellipse on the line of interlaced peaks, the construction being such that the double pleated fabric is fully extensible to a flat fabric under pleat-removing tension, and the pleated fabrics being of synthetic fiber material heat set in said pleated configuration to provide elastic recovery from deformation.

2. The double pleated fabric defined in claim 1 wherein the pile fiber material in the face fabric is a polyamide.

3. The double pleated fabric defined in claim 1 wherein the pile fiber material in the face fabric is polyhexamethylene adipamide.

4. The double pleated fabric defined in claim 1 wherein the pile fiber material in the face fabric is a polymer of acrylonitrile prepared from monomer material comprising at least 75% acrylonitrile.

5. A double pleated rug comprising the double pleated fabric defined in claim 1 and a backing cemented to said skeletal fabric.

6. A double pleated rug as defined in claim 5 wherein the backing comprises a fabric attached only to projecting pleats of the skeletal fabric.

7. A double pleated rug as defined in claim 5 wherein the backing comprises an elastomeric material which fills the interstices of the pleats on the back of the skeletal fabric.

8. A triple pleated fabric comprising the double pleated fabric defined in claim 1 and a correspondingly pleated backing fabric attached only to projecting pleats of the skeletal fabric.

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