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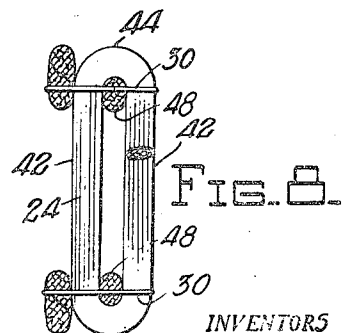
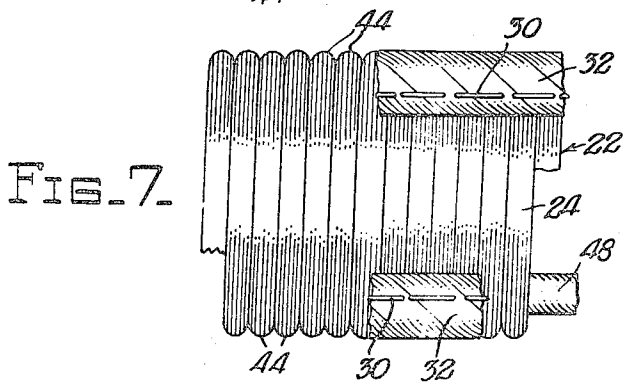
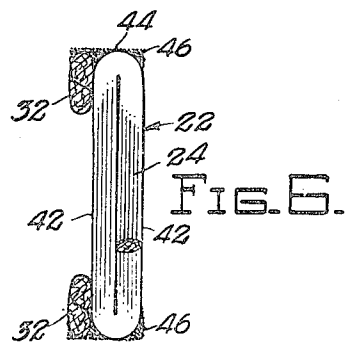
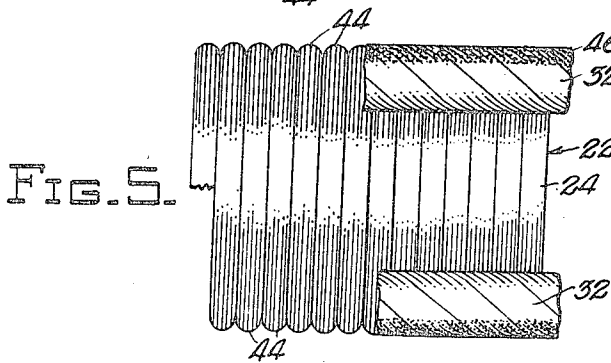
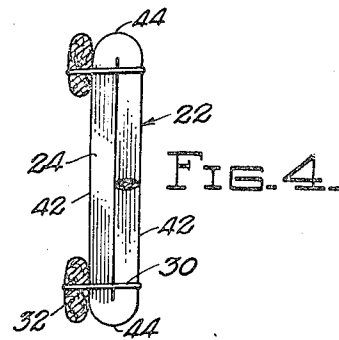
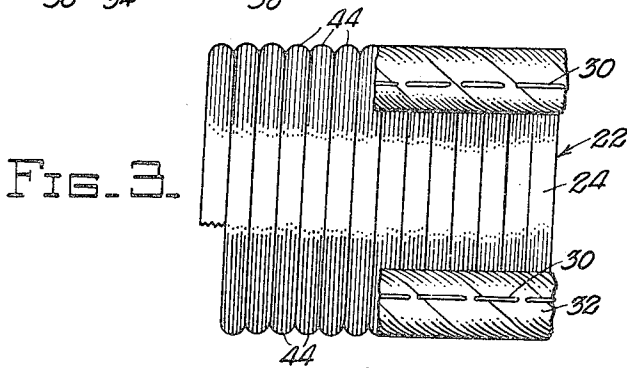
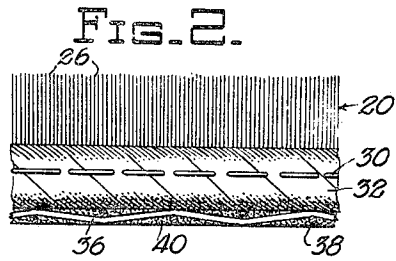
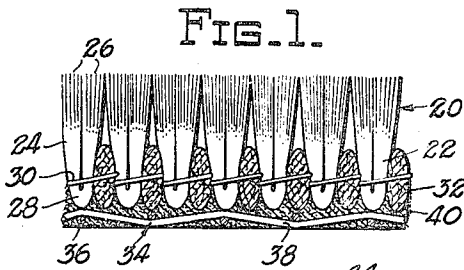
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2,521,831

PILE FABRIC

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2 Sheets-Sheet 1



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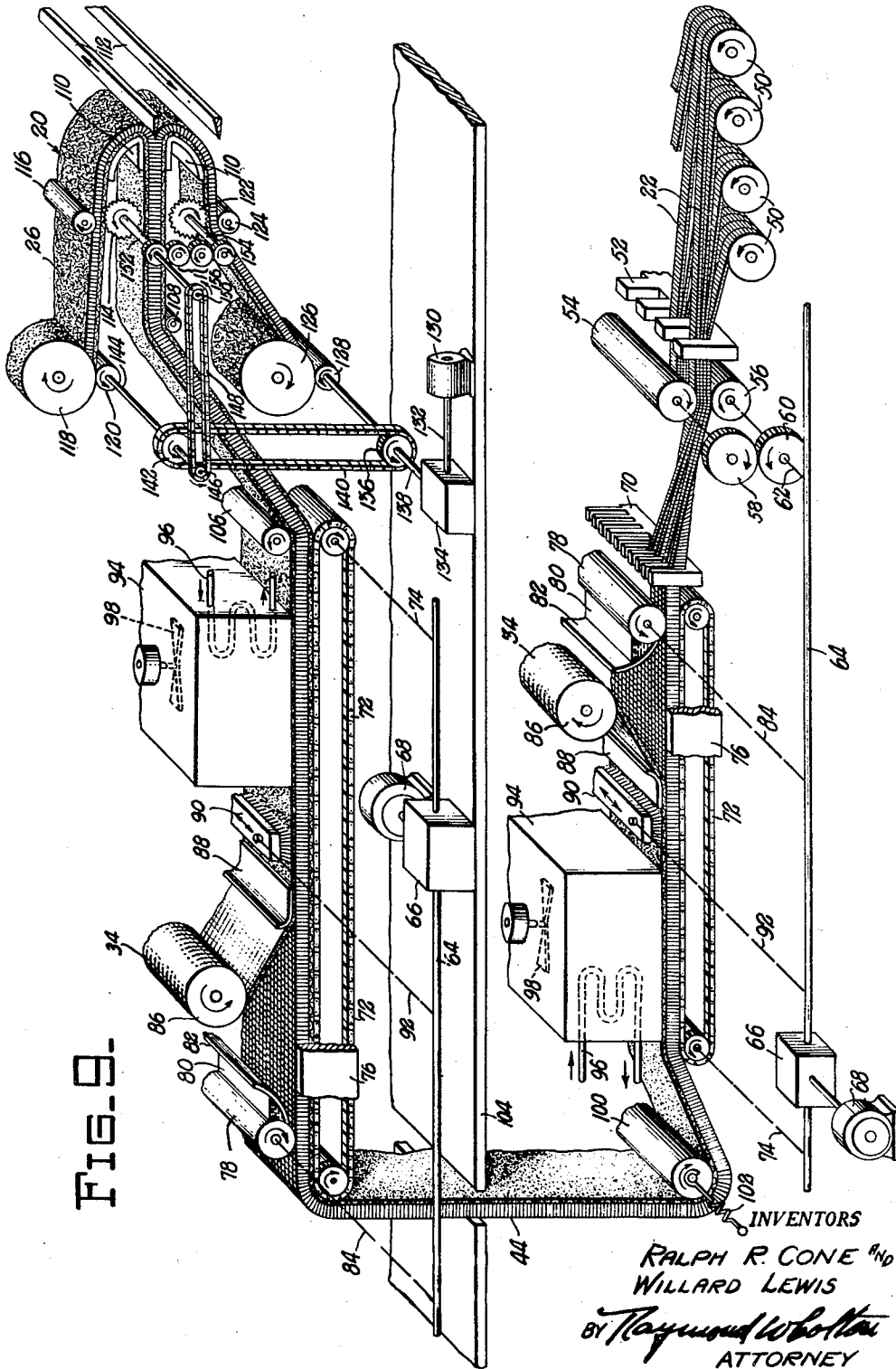


FIG. 9.

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PILE FABRIC

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12 Claims. (Cl. 154-49)

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Apart from the mechanization of the loom, there has been but little progress of a basic nature in the commercial production of rugs and carpeting over the many centuries during which the art has been practiced. For the most part, weaving has been resorted to entirely as the only acceptable method for producing such pile fabrics commercially.

There have been attempts in the past to fabricate pile fabrics by the use of adhesives, including latices of natural and synthetic rubber, but as far as is known prior to the present invention, no products of this type have proved to be satisfactory to the consuming public, nor has any method been developed to a point which has been considered as acceptable as a substitute for weaving.

Manufacturers have readily conceded that there must be a more rapid and less expensive method of producing fabrics of this type than the increasingly costly and time consuming operations involved in weaving, but despite the expenditure of vast amounts of time and research on the subject, they have been unsuccessful in producing an acceptable solution.

Many of the problems encountered and various steps towards their solution have been recounted in the patent to Ralph R. Cone, No. 2,344,537, dated March 21, 1944; and in applications filed in the name of Ralph R. Cone, Serial No. 575,232, filed January 30, 1945, now Patent No. 2,482,655, September 20, 1949; Serial No. 640,350, filed January 10, 1946, and Serial No. 662,837, filed April 17, 1946.

The products resulting from the methods and apparatus of these prior disclosures have proved to be eminently satisfactory as the pile elements employed for the production of the pile fabrics contemplated as well as the methods set forth in the present application.

The advantages of the fabrics produced in accordance with the present invention, from the standpoints of appearance, wearing qualities, costs and adaptability, are outstanding. Now that the extensive research required by this invention has overcome the many difficulties accounting for previous failures, the method has evolved as a relatively simple one, requiring a minimum of manual operation in its application.

The pile fabrics contemplated herein comprise a plurality of textile pile elements having base portions secured by an adhesive, to one another and/or to a backing. The free ends of the pile elements define a surface of the fabric, usually the finished surface. The fabric may comprise

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a plurality of layers of textile pile elements having base portions of adjacent layers secured together in compacted contacting relationship and/or to a backing, by an adhesive. Attachment of the pile elements to the backing is preferably accomplished solely by an adhesive of natural or synthetic latex which can be cured. The backing itself may be of textile material, which may be loosely woven to produce a relatively open mesh. Spacer elements may be interposed between certain of the pile elements, within loops defined at their base portions and/or between adjacent layers of the elements, secured thereto by means of stitching or adhesively, or both. The free ends of the pile elements may be substantially coextensive and accordingly, substantially coplanar, although surface modifications of the product are also definitely contemplated.

The method contemplates the production of pile fabrics comprising arranging a plurality of layers of flattened helically formed self supporting textile bodies with their narrow edges substantially coplanar and adjacent layers in contacting relationship, adhesively securing the edges together, and severing the bodies in spaced relationship with respect to the edges. Inasmuch as a backing material will be employed for a large proportion of the products, the method contemplates securing the edges of the layers to such backing material adhesively. The various operations may be performed while the textile bodies are advancing to render the method a continuous one. Since the arrangement of the textile bodies produces two surfaces defined by their narrow edges, backing material may be adhesively secured to both such surfaces while the bodies are advancing. This may be accomplished by adhesively applying a backing to one of the advancing surfaces defined by the narrow edges, curing the adhesive, exposing the other advancing surface defined by the edges, adhesively applying a backing to this other surface, curing the second adhesive, and splitting the bodies intermediate the backings. Where the backing material is pervious, the adhesive may be applied either before or after the application of the backing material, to the edges and/or to the backing material itself, and the adhesive may be worked into the fibers of the material involved, as by a scrubbing action effected before or after the application of the backing to the textile bodies. Since in many cases, the textile bodies will be originally wound on their broad surfaces, provision has been made to unwind them and turn

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them through an angle of 90° through suitable arrangements of reeds, and feed them to a conveyor on which they will be compacted with their narrow edges defining an exposed surface to which the adhesive is applied. After the application of the adhesive, together with any backing material, the assembly may be subjected to elevated temperatures for curing the adhesive, following which a similar series of operations may be applied to the opposite surface defined by the narrow edges of the textile bodies.

A more complete understanding of the invention will follow from a detailed description of the illustrative embodiments depicted in the accompanying drawings wherein:

Fig. 1 is a fragmentary sectional elevation of one form of textile pile fabric contemplated;

Fig. 2 is an elevation as it would appear from the right end of Fig. 1;

Figs. 3, 5 and 7 are plan views of some of the textile elements or bodies suitable for use in practicing this invention;

Figs. 4, 6 and 8 are sectional elevations as they would appear from the right ends of Figs. 3, 5 and 7 respectively; and

Fig. 9 is a somewhat diagrammatic fragmentary perspective view depicting the sequence of operations illustrating one embodiment of the method contemplated by this invention.

The rug or other pile fabric 20 depicted in Figs. 1 and 2 comprises a plurality of layers of pile elements 22, each of which is defined by a filament or strand of textile material 24 having free ends 26 defining a surface of the fabric, and a looped base 28, to one side of which is secured by stitching 30, a spacer element 32. The textile bodies thus constituted, are assembled in compacted, contacting relationship to a backing 34 which may be a loosely woven material having warp threads 36 and weft threads 38. The textile bodies or layers 22 are secured to the backing and to one another by means of an adhesive 40 which may be a cured latex of natural or synthetic rubber.

The textile body depicted in Figs. 3 and 4 may be produced in accordance with the disclosures of the Ralph R. Cone applications to which reference has been previously made, or otherwise. It is the form represented by these figures which has been employed by way of example for producing the fabrics depicted in Figs. 1 and 2. The textile filament or strand 24 having been arranged as a flattened helically formed self-supporting textile body with a spacer element 32 of textile or other suitable material secured near its base portions by stitching 30, provides relatively broad surfaces 42 and relatively narrow edges 44.

Another form of textile body or layer, selected by way of example from the applications previously referred to, has been depicted in Figs. 5 and 6 wherein the assembly of the spacer elements to the flattened helix is accomplished by means of an adhesive 46, in lieu of or in addition to stitching or sewing illustrated in the preceding figures.

Figs. 7 and 8 illustrate another example selected from the applications referred to, somewhat similar to Figs. 3 and 4, but including in addition, a spacer element 48 of textile or similarly suitable material included within each loop formed by the filament or strand 24 at the narrow edges of the flattened helical body. These internal spacer elements 48 are secured in this case by stitching 30 which also serves the function described with reference to Figs. 3 and 4.

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It should be emphasized that these examples of textile bodies which have been found to be satisfactory for the present purposes, are by no means exhaustive, since spacer elements may be omitted entirely or otherwise related, and produced in any convenient manner so long as they possess the characteristics essential to performing the method and producing the products contemplated herein.

Textile bodies such as those illustrated in Figs. 3 to 8 inclusive have been depicted in Fig. 9 as reeled upon cylinders 50 arranged in four banks. The number of such textile bodies reeled upon each cylinder in edge to edge relationship will be governed by the dimensions in a transverse direction to be imparted to the completed fabric. The textile bodies 22 are passed through a reed 52 in adjacent stacks, each stack comprising a body from each of the four reels. From the reed 52, the stacks are fed between positively driven advancing rolls 54 and 56, rotated by means of gears 58 and 60 respectively through suitable shafting 62 suitably coupled with a line shaft 64 which is in turn driven through reduction gearing 66 by a source of power such as a motor 68. The driving speed may be varied by suitably controlling the motor and/or the reduction gearing, or in any other convenient manner known in the arts.

Beyond the rolls 54 and 56, the textile bodies are twisted through an angle of 90° and individually threaded through a reed 70 from which they pass to a conveyor 72, which may suitably assume the form of an endless belt as shown, driven through convenient mechanism coupled to the line shaft 64 through shafting 74. As the textile bodies advance to the conveyor, they are compacted to a desired degree of contact at their bases by means of vertical rails 76 which may be adjusted to assure the proper degree of compactness and contact as will eliminate undesirable spacing at the bases of the bodies or layers forming the finished fabric.

After the textile bodies have been assigned their proper relationship on the conveyor so that their upper edges are substantially coplanar, such edges pass under a roller 78 which deposits adhesive 80 from a fountain 82 over the entire surface thus defined. The nature of the adhesive is preferably such as would be provided by natural or synthetic rubber latex so as to produce a firm bond after suitable curing or drying.

The coating roller 78 is depicted as driven in opposition to the direction of the advancing textile bodies through a suitable mechanism comprising shafting 84 coupled with the line shaft 64. Following the application of the adhesive, the advancing textile bodies have applied over the adhesive, a backing material 34 which may be a woven fabric, of textile or other suitable material, and which may have a relatively open mesh. The backing material is supplied from a reel 86 and applied to the surface defined by the textile bodies and their adhesive coating under a curved guide or shoe 88. Where the backing material is of relatively open mesh, the adhesive may be worked through it, as by means of brushes 90 mounted for reciprocation transversely of the conveyor through suitable mechanism comprising shafting 92 coupled to the line shaft 64. The material thus far assembled passes into or under a drier 94 which may be heated by means of a steam coil 96 and the air circulated therein by means of a suitably driven fan 98. The adhesive thus applied and cured in the drier will cause the pile bodies to be secured together

and to the backing, the relatively open mesh of the latter having resulted in a coating of adhesive on its exposed surface. From the drier, the fabric is delivered from the conveyor 72 to a tensioning roller 100 around which the fabric is threaded and given a predetermined desired tension by means of springs 102. From the tensioning roller, the fabric passes through an upper floor 104 and is fed with its backing lowermost on to a conveyor 72 similar to that previously described, where the now exposed relatively narrow edges of the textile bodies are coated, backed, worked, and cured or dried by a mechanism corresponding with that already described for similar functions, and correspondingly identified.

The fabric delivered from the upper drier 94 comprises the layers of textile bodies having backing material adhesively united to both of the surfaces defined by the narrow edges of the textile bodies and with the adhesive material suitably cured, rendering the fabrics ready for splitting in accordance with practice which is generally known in the art. The fabric is delivered from the upper conveyor 72 under a guide roller 106, then it is elevated to travel over a positioning roller 108 between a pair of horns 110, at the bight of which a traveling or hand knife 112 is positioned to split or sever the textile bodies intermediate their backings. The upper portion of the pile fabric resulting from this splitting operation is advanced by engagement of a spiked or toothed member 114 engaging the backing under the pressure applied by an opposed cooperating roller 116, whereupon this portion of the pile fabric is wound upon a reel 118 under the influence of a driving roller 120 frictionally engaging the backing, and flexibly related, in a manner not shown, to compensate for varying diameters in a manner well known in the art.

The lower portion of the fabric resulting from the splitting operation is likewise fed by a spiked or toothed member 122 engaged with its backing and cooperating with an opposed pressure roller 124, to a reel 126 on which it is wound by a roller 128 similar in function and operation to the roller 120 described in connection with the upper portion of the fabric. The mechanism for feeding and reeling the two severed portions may be driven by a motor 130 connected through a shaft 132 with suitable gearing 134, which may be of a variable type, which in turn drives a sprocket 136 secured to a shaft 138. The remote end of the shaft 138 will suitably drive the winding roller 128, while the sprocket 136 transmits motion through its chain 140 to an upper sprocket 142. The upper sprocket 142 is secured to a shaft 144 for driving the winding or reeling roller 120 for the upper portion of the fabric, which shaft also carries a sprocket 146 for driving a chain 148 received by another sprocket 150 for driving the shaft 152 carrying the spiked member 114. Synchronism between the shaft 152 and the shaft 154 of the lower spiked member 122 is maintained through suitable gearing 156.

The directions of movement of the various elements of the mechanism of Fig. 9 have been depicted by means of arrows to facilitate an understanding of the operations involved. The driving connections for the positively driven elements have been shown diagrammatically by broken lines, for the most part, to avoid obscuring the more important features, with the understanding that suitable mechanical movements of types well known in the art can be incorporated by any worker skilled in the art.

Whereas the examples of the products and method described herein are in themselves highly satisfactory, it will be appreciated by those skilled in the art, as it has been already recognized by the inventors, that various departures from these examples may be effected with highly desirable results, now that the basic problems have been solved. For example, the invention contemplates the production of pile fabrics utilizing various forms of textile pile elements, including any of those described in the Ralph R. Cone disclosures above referred to, with any number or arrangement of the spacer elements, applied internally and/or externally of the textile elements, by stitching and/or adhesively, or otherwise, or without such spacer elements. The fabric may be removed from the apparatus after application of a backing to only one surface, in which event, the exposed ends of the pile elements will assume the form of looped free ends, as distinguished from the severed free ends which result from the splitting operation. Accordingly, it is not intended that the invention be restricted to the examples illustrated and described beyond the scope of the appended claims.

We claim:

1. A pile fabric comprising a plurality of textile pile elements having base portions secured together by an adhesive and having free ends defining a finished surface of the fabric, and textile spacer elements secured between certain of said pile elements near their base portions only.

2. A pile fabric comprising a backing, a plurality of textile pile elements having base portions secured to said backing solely by an adhesive and having free ends defining a finished surface of the fabric, and textile spacer elements secured between certain of said pile elements near their base portions only.

3. A pile fabric comprising a plurality of textile pile elements having base portions secured together by an adhesive and free ends defining a finished surface of the fabric, and textile spacer elements secured to certain of said pile elements near their base portions only.

4. A pile fabric comprising a plurality of textile pile elements having base portions secured together by an adhesive and free ends defining a finished surface of the fabric, and textile spacer elements sewed to certain of said pile elements near their base portions only.

5. A pile fabric comprising a plurality of textile pile elements having base portions secured together by an adhesive and free ends defining a finished surface of the fabric, and textile spacer elements adhesively adhered to certain of said pile elements near their base portions only.

6. A pile fabric comprising a plurality of textile pile elements having free ends and looped base portions, said base portions being secured together by an adhesive and said free ends defining a finished surface of the fabric, and textile spacer elements secured between certain of said pile elements near their base portions only.

7. A pile fabric comprising a plurality of textile pile elements having base portions secured together by an adhesive and substantially co-extensive free ends defining a finished surface of the fabric, and textile spacer elements secured to certain of said pile elements near their base portions only.

8. A pile fabric comprising a plurality of textile pile elements having base portions secured

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together by an adhesive and substantially coplanar free ends defining a finished surface of the fabric, and textile spacer elements secured between certain of said pile elements near their base portions only.

9. A pile fabric comprising a plurality of layers of textile pile elements having base portions of adjacent layers secured together in compacted contacting relationship by an adhesive, a textile spacer secured to the base portions of said elements constituting certain of said layers, and free ends of said elements defining a finished surface of the fabric.

10. A pile fabric comprising a backing, a plurality of layers of textile pile elements having base portions of adjacent layers secured in compacted contacting relationship to said backing by an adhesive, a flexible spacer extending normally to said elements and secured to certain of said elements near the base portions thereof, and free ends of said elements defining a surface of the fabric.

11. A pile fabric comprising a backing, a plurality of layers of textile pile elements having looped base portions, the base portions of adjacent layers being secured together in compacted contacting relationship and to said backing by an adhesive, a flexible spacer embraced by said

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looped base portions and secured thereto, and free ends of said elements defining a surface of the fabric.

12. A pile fabric comprising a plurality of layers of textile pile elements having spacer elements secured only to base portions thereof, said layers being secured together in compacted contacting relationship by an adhesive, and free ends of said elements defining a surface of the fabric.

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