This invention relates to pile fabrics and more particularly to apparatus for producing a carved or sculptured pile in a floor covering such as a rug or carpet.

In line with the current acceptability and demand for floor coverings having a patterned or sculptured effect achieved by means of variations in the pile height, the present invention provides a novel manner in which the pile of a previously fabricated carpet may be sheared by means of a template to provide the desired cut out or carved pattern.

The present invention can be employed with any type of non-woven or woven pile fabric such as Wilton, velvet, Axminster, tufted, or knitted. Where, however, the backing material of the previously fabricated pile fabric is relatively inflexible, special features of the invention are employed to insure adequate displacement of the ground fabric, as will be explained more fully hereinafter.

A primary object of the invention, therefore, is to provide an endless pattern web or template which is fed through the shear simultaneously with the fabric and which either masks or accentuates certain selected areas of the pile so that a pattern of different height pile is formed.

A further object of the invention is to provide an endless belt having an embossed or raised pattern formed thereon which presents only selected pile areas to the shear.

A further object of the invention is to provide means for retaining the pile fabric in close relationship to an embossed belt during a shearing operation.

Further objects will be apparent from the specification and drawings in which:

Fig. 1 is a top view showing a sculptured pile fabric produced in accordance with the present invention.

Fig. 2 is an enlarged sectional detail as seen at 2-2 of Fig. 1.

Fig. 3 is a view of a portion of the mask or template used in producing the fabric of Figs. 1 and 2.

Fig. 4 is a section as seen at 4-4 of Fig. 3.

Fig. 5 is a sectional detail of the apparatus used in producing the fabric of Figs. 1 and 2.

Fig. 6 is a view showing a portion of the apparatus of Fig. 5 but using a modified form of template to produce the patterned pile height.

Fig. 7 is a view of the template used in Fig. 6.

Fig. 8 is a section as seen at 8-8 of Fig. 7.

Fig. 9 is a sectional view of the fabric of Fig. 6 and corresponding generally to Fig. 2.

Fig. 10 is a sectional detail of a modified form of the shearing apparatus employing a hold-down member, and

Fig. 11 is a further modification in which suction is applied in place of the hold-down member of Fig. 10.

The invention comprises essentially the provision of

an endless belt or web having the desired pattern impressed thereon. The belt is fed through a conventional carpet shear in such a way that the pattern is transferred from the belt to the fabric pile. In one form of the belt comprises a perforated mask positioned on top of the pile and running underneath the ledger blade. In another form of the invention the belt comprises a flexible rubber-like web running underneath the fabric and against which the fabric is tightly held to present relatively raised pile areas to the shear. Further aspects of the invention contemplate the provision of means for holding the fabric tightly against the embossed belt. This means may take the form of a presser bar or other elongated arcuate element held in spaced relation to the fabric and which may be used separately, in conjunction with suction, or the suction may be used without the presser foot.

Referring now more particularly to the drawings, a section of sculptured carpet 15 is shown in Fig. 1 having uniformly high pile areas 16, 16 and a patterned area 17, 17 formed of carved or cut out areas of lower pile. The raised or high pile areas 16, 16 are formed in the case of Figs. 1-5 by means of a perforated flexible mask or template 18 (Figs. 3 and 4) having pattern perforations 19, 19 which correspond to the low pile areas 17, 17. The template 18 is preferably in the form of an endless belt running over rollers 20 and 21 mounted on shafts 22 and 23 respectively. Either or both of the shafts 22 and 23 may be driven or the template 18 may be driven by further rollers not shown. The pile fabric 15 which has the conventional backing or ground fabric 25 is fed horizontally across a plate or bed 26 and over a roller 27 on shaft 28. A rotary shearing blade 30 mounted in bracket 31 shears the pile of fabric 15 as it bends across the periphery of roller 27. Template 18 is fed with and compresses the pile except in the perforated portions 19 so that the pile areas 32, 32 in alignment with the perforated portions of the template are held down below the cutting action of the ledger blade 31 and shears 29. A guard 35 is mounted by means of a bolt and wing nut 36 to maintain the template in its proper pile-depressing position by preventing the template from floating on top of the pile. Ordinarily the tension between rollers 20 and 21 will be sufficient for this purpose. The cut pile is carried away through a suitable exhaust system comprising a hood 36 and duct work 37 in conventional manner.

It will thus be understood that the template is guided and held into the pile by the rollers 20 and 21 and guide 35, thus permitting only selected areas of the pile to protrude through the perforations 19 of the template, which pile then ultimately forms the low pattern areas 17 after the compressed pile areas 32 are permitted to expand when leaving contact with the template 18.

A comparable result may be achieved by substituting for template 18 a flexible embossed template 40 (Figs. 6-8) which is carried over roller 27 and under the fabric 15 rather than on top of it. In this form the raised pattern surfaces 41, 41 on the template 40 force the pile in the fabric 15 farther up into the shear 29 so that the cut out or low pile areas 17a, 17a are formed to provide the same or a similar fabric to that of the preceding example.

The other elements of the apparatus shown in Fig. 6 correspond to those shown in Fig. 5. The embossed belt or template 40 is shown in Fig. 7 in which the raised areas 41, 41 correspond precisely with the perforated areas 19, 19 of Fig. 3. The non-raised or low areas 42 of the template 40 produce relatively higher pile areas 16a, 16a. Also, in the form of Figs. 6-8 a further improvement is possible since a plurality of
pile heights can be provided. Figure 8, for example, shows three different raised areas. The highest one is shown at 43, the medium height raised area at 44, and the low raised area at 45. To this extent a wider range of pile height variations is permissible with the embossed template of Figs. 6–8 as compared with the perforated template of Figs. 3 and 4.

It will be understood that the pile fabric should desirably be sheared in accordance with either Fig. 5 or 6 before it is back sized in order to permit maximum flexibility and conformity with the template 16 or 49. If the ground fabric 25 is extremely stiff, then satisfactory results in a fine detail, design, or pattern would be unlikely with the apparatus of Figs. 6–8, so that the perforated template of Figs. 3–5 is desirably used with fabrics having a relatively heavy or inflexible backing.

In order to improve the conformability of the fabric to the embossed template 40, we provide additional means for holding the fabric against the embossed template. Figure 10 illustrates a fabric fed for nearly 180° around a shear roller 47 on shaft 48 instead of bending the fabric only 90° across the shear roller as shown in Figs. 5 and 6. In this form the shear 29 and ledger blade 30 may be shifted to provide a substantially vertical mounting instead of the 45° mounting. A presser foot 50 is shaped and positioned to hold down the fabric so that it will follow the contours of the relief surfaces 41–45 on the template 40. For this purpose the presser foot or bar 50 is mounted so that its fabric contact surface is generally concentric to the periphery of roller 47.

There is, however, a carefully defined radial relationship between the presser bar and the surface of the pile fabric so that a compression slot through which the pile passes is provided from a completely pile crushing element. This relationship is clearly illustrated by the bending shown in the pile yarns radially opposite the raised portions 41 on the pattern. Note that the pile is far less compressed in the radially aligned depressions 42 since little or no shearing is necessary in these areas which eventually form the high pile. The presser foot or shoe 50 may extend forwardly within close proximity to the ledger blade as shown in Fig. 10.

A further means for insuring close adherence between the fabric and the template is to modify the construction of the shear roller so that it is in the form of a hollow drum 51 (Fig. 11) having a series of perforations 52, 53 around its periphery. A suction duct 53 is connected to a suitable source of low pressure air so that the relatively thick ground 54 of fabric 55 may be held tightly against the template 56. This template or belt corresponds generally to belt 40 except that it is also of a foraminous nature having suitable air perforations or passages 57, 57 thus insuring that the fabric 55 follows the embossed contours of the template 56. In the form of Fig. 11, it will be understood that the pile is, in effect, drawn down or patterned before it reaches the cutting edge of ledger blade 30. Since the ledger blade and the shear 29 are fixed, the pile is cut in the form of an arc as shown in Figure 11, but when the carpet 55 passes beyond the suction area of drum 51 as well as template 56, the areas 16a which were held down into the lower portions 42 of the belt now are permitted to extend to their full height, thus giving the high pile areas shown in Figs. 9 and 11.

It will thus be understood that we have provided a simple and effective means for producing patterned, carved, or sculptured pile carpeting which is currently much in demand on the market. With careful design it is possible to achieve satisfactory sharp definition regardless of whether the perforated template or the embossed template may be used. The invention can be applied to carpeting having flexible as well as relatively inflexible backing when added pull-down means is employed.

Having thus described our invention, we claim:

Apparatus for producing pattern sheared pile broadloom carpet which comprises a revolving shear, a ledger blade having a cutting edge cooperating with said shear in pile cutting relationship, a roller positioned in spaced relation to said shear and with the cutting edge of the ledger blade substantially on the line joining the centers of the roller and the shear, a pattern template trained over 180° of the periphery of said roller and passing away from said roller for the remaining 180°, a pile control slot, one wall formed by said template and the other wall formed by a shoe in spaced relation to the template, and a tapered nose on the downstream edge of said shoe extending towards the ledger blade and substantially between the shear and the roller.

References Cited in the file of this patent

UNITED STATES PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Inventor</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,253,049</td>
<td>Kitsee</td>
<td>Jan. 8, 1918</td>
</tr>
<tr>
<td>1,708,763</td>
<td>Huss et al.</td>
<td>Apr. 9, 1929</td>
</tr>
<tr>
<td>1,737,085</td>
<td>Horstmann</td>
<td>Nov. 26, 1929</td>
</tr>
<tr>
<td>1,992,194</td>
<td>Cluett</td>
<td>Feb. 26, 1935</td>
</tr>
<tr>
<td>2,021,975</td>
<td>Wrigley et al.</td>
<td>Nov. 26, 1935</td>
</tr>
<tr>
<td>2,199,011</td>
<td>Schreiner</td>
<td>Apr. 30, 1940</td>
</tr>
<tr>
<td>2,758,355</td>
<td>Kradoska</td>
<td>Aug. 14, 1956</td>
</tr>
</tbody>
</table>

FOREIGN PATENTS

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Country</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>28,330</td>
<td>Great Britain</td>
<td>Oct. 17, 1912</td>
</tr>
</tbody>
</table>