

[54] **PROCESS OF APPLYING ADHESIVE TO A FLOOR COVERING**

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Related U.S. Application Data

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 [52] U.S. Cl. **117/38, 117/111 B, 156/277, 161/63, 161/67, 161/148, 161/159, 161/167, 161/406**
 [51] Int. Cl. **B41c 1/18**
 [58] Field of Search **117/38, 111 B, 138.8 D, 117/138.8 PV; 156/72, 277; 161/63, 67, 146, 148, 159, 167, 406**

[56] **References Cited**

UNITED STATES PATENTS

3,463,690 8/1969 Converse et al. 156/291

3,014,829 12/1961 Curtin 154/49

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[57]

ABSTRACT

An adhesive backed removable carpet tile comprising a foam backing and a carpet layer is disclosed which may be applied to a subfloor and subsequently removed therefrom without delaminating the foam backing. The adhesive provides a release strength lower than the delamination strength of the foam backing. To provide the proper release strength, the adhesive is applied to the foam backing by a figured roller to cover between 10 and 50 percent of the foam backing.

4 Claims, 8 Drawing Figures

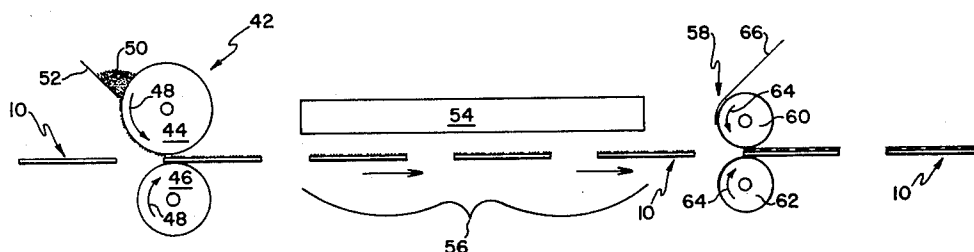


FIG. 1

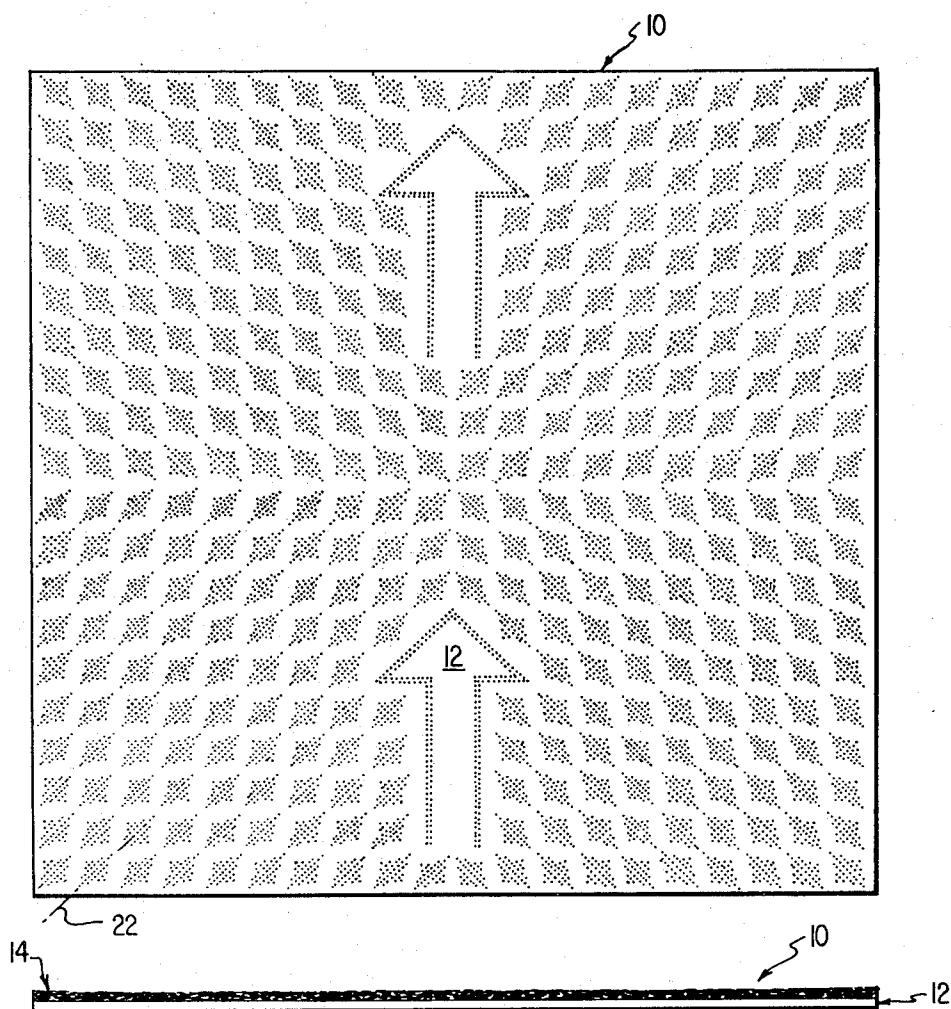


FIG. 2

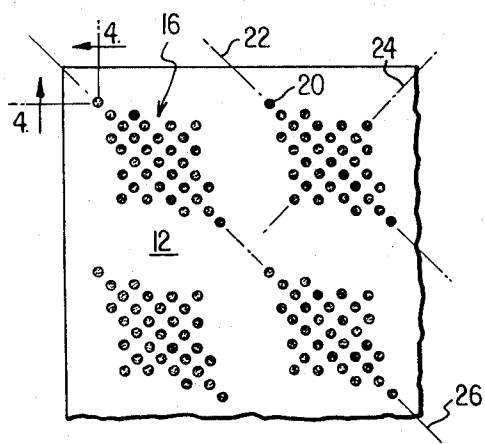


FIG. 3

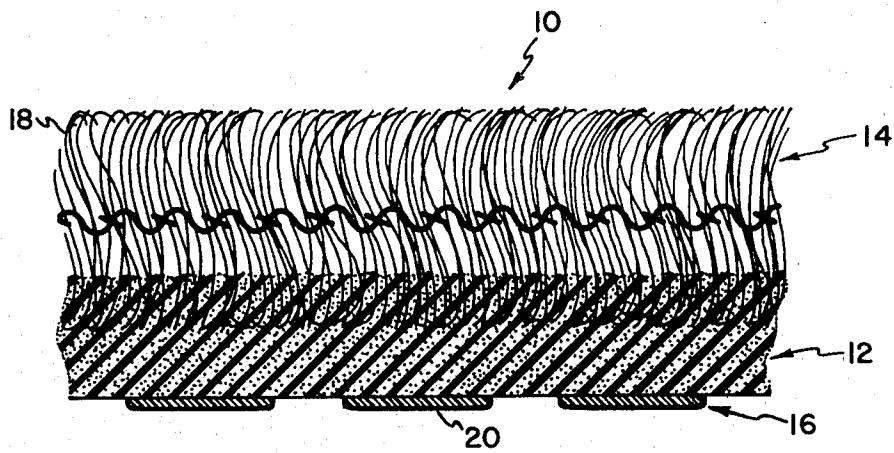


FIG. 4

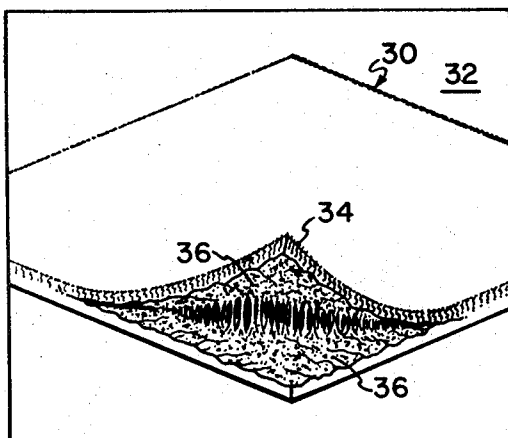


FIG. 5 (Prior art)

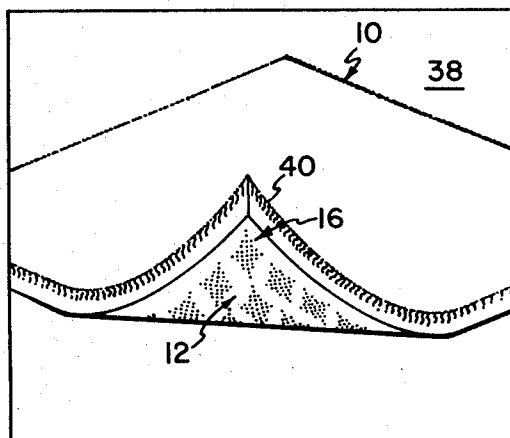


FIG. 6

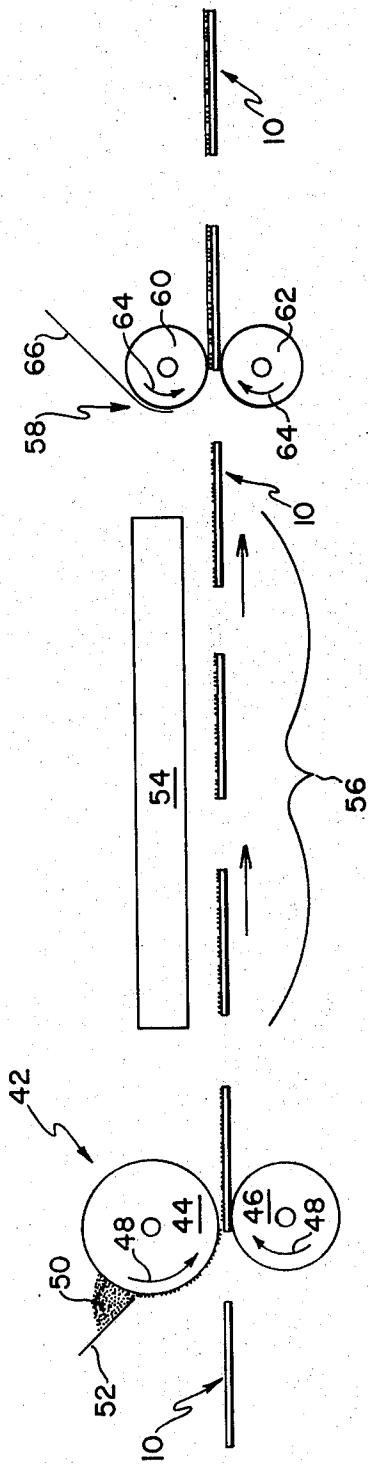


FIG. 7

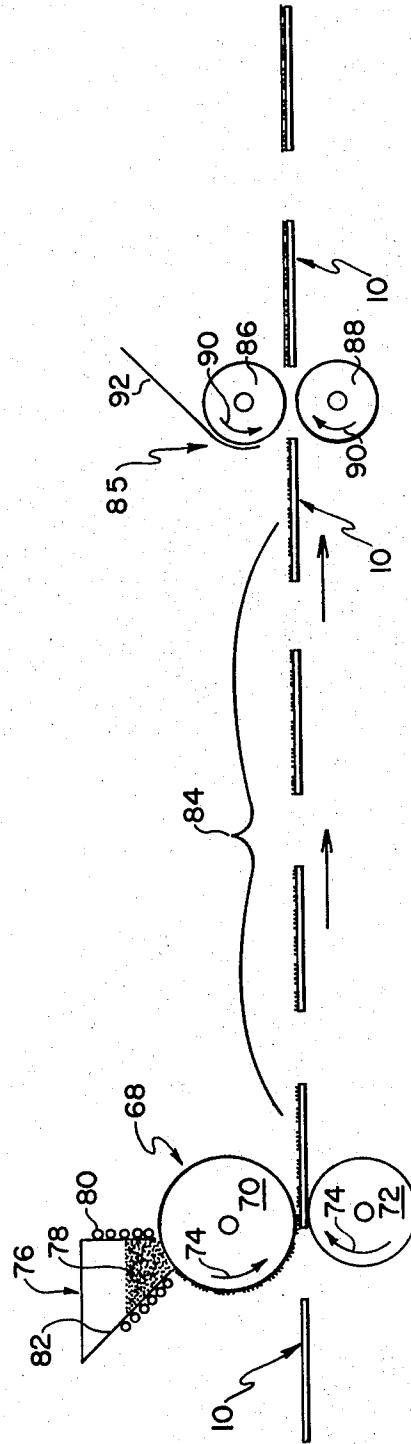


FIG. 8

PROCESS OF APPLYING ADHESIVE TO A FLOOR COVERING

This application is a continuation-in-part of application Ser. No. 131,019, filed Apr. 5, 1971, now U.S. Pat. No. 3,704,197.

Adhesive backed floor coverings are well known in the prior art. Vinyl surfaced tiles having an adhesive backing may be applied to a subfloor and subsequently removed therefrom without difficulty. Many carpet surfaced tiles provided by the prior art which are adhesively secured to a subfloor cannot be readily removed since the carpet layer delaminates from the foam backing thereby leaving the foam backing secured to the subfloor. The foam backing must then be removed, usually by scraping, using solvents and the like, which is an onerous task.

The problem of removing adhesive backed carpet tiles is particularly acute since the laying of indoor-outdoor type carpet tiles has become a popular do-it-yourself means of redecorating a dwelling. The need for removing previously laid adhesive backed carpet tiles normally occurs in two situations. The first is where the consumer is unsatisfied with his results in laying the tiles and desires to remove part or all of the tiles to correct a small error in laying. With the carpet tiles of the prior art, the consumer will succeed only in destroying the tiles he attempts to remove. If the consumer persists in correcting his errors, he will compound his difficulties and necessitate the expenditure of greater amounts of time, effort and money to provide a satisfactory floor covering. Under these circumstances, the possibility of a repeat sale is lost.

The second situation where it is necessary or desirable to remove previously laid adhesive backed carpet tiles is where the tiles have been in place for some length of time and begin to show wear. As the consumer attempts to remove the worn tiles, the tiles delaminate thereupon requiring considerable effort to clean the subfloor in preparation for laying new tiles. In this situation also, the possibilities of repeat sales evaporate.

In the prior art, pressure sensitive adhesive has been applied to foam-rubber backed carpet tiles by knife coating, kiss-roller coating, overall engraved print roller coating and by spraying. Application by knife coating or kiss-roller coating provides an uneven adhesive application whenever the foam backing has a physically nonuniform surface. Accordingly, the prior art carpet tiles manufactured by these processes exhibit uneven release strengths whereby the tile delaminates upon removal. Application of adhesive by overall engraved print rollers or by spraying causes varying amounts of adhesive to be absorbed by foam backing of differing cell structures. The release strength of the adhesive cannot be duplicated from one batch of carpet to the next since the foam cell structures usually differ significantly.

It is an object of this invention to provide a process of applying adhesive to a foam backed floor covering by contacting the foam backing with a design configured roller to apply adhesive to a fraction of the foam backing.

In summary, the process of applying adhesive to a floor covering in accordance with this invention comprises selecting a foam backing of 8.5-19 pounds/cubic foot bulk density having a traffic bearing layer bonded to the foam backing exhibiting a delamination strength

of 1.0-2.25 pounds/inch; applying a liquid adhesive having a dry tack level between 1.25-1.75 pounds/inch when applied .001 inch thick to a multiplicity of adhesive carrying cups provided by a roller, each of the cups having an area less than about .01 square inches and aggregating between 10-50 percent of the area of the foam backing; contacting the roller and the foam backing; transferring the adhesive from the cups to the foam backing to produce a multiplicity of adhesive areas on the foam backing; and solidifying the adhesive to produce a release strength for the floor covering between .1-9 pounds/inch.

FIG. 1 is a view of the back of a carpet tile made in accordance with this invention;

FIG. 2 is a side elevation of the carpet tile of FIG. 1;

FIG. 3 is an enlarged view of part of the back of the carpet tile of FIGS. 1 and 2;

FIG. 4 is an enlarged cross sectional view of the carpet tile of FIG. 3 taken substantially along line 4-4 thereof as viewed in the directions shown by the arrows;

FIG. 5 illustrates a prior art adhesive backed carpet tile during removal thereof from a subfloor;

FIG. 6 illustrates a carpet tile of this invention during removal from a subfloor;

FIG. 7 is a schematic view of one technique for applying adhesive in accordance with this invention; and

FIG. 8 is a schematic view of another technique for applying adhesive in accordance with this invention.

Referring to FIGS. 1-3 there is shown a floor covering 10 having a foam backing 12 and a traffic bearing layer 14. The foam backing 12 has thereon adhesive means 16 for securing the floor covering 10 to a subfloor.

The foam backing 12 and the traffic bearing layer 14 are made in any suitable manner. The traffic bearing layer 14 comprises carpeting of any suitable type and includes a multiplicity of fibers 18, such as fibers or yarns, as shown in FIG. 4. Typically the carpeting 14 is first manufactured and the foam backing 12, usually comprising a styrene-butadiene rubber, is cast thereon as a liquid. The liquid rapidly sets into a foam material bonded to the carpeting 14. The bulk density of the foam backing 12 varies between 8.5 and 19 pounds/cubic foot and weighs typically about 14.75 pounds/cubic foot. The tear strength of the foam backing 12 is between 1 and 2.25 pounds/linear inch with typical values lying in the lower part of this range.

One of the difficulties encountered in providing an adhesive backed carpet tile which may be removed without delamination resides in the variation in cell structure and porosity of the foam backing 12. As will be appreciated by those skilled in the art, the porosity and the cell structure of the backing 12 varies substantially from day to day depending on the latex shelf age, composition and/or the environmental conditions under which the liquid rubber is cast onto the carpeting 14. With high porosity, the foam backing 12 tends to absorb increased amounts of adhesive thereby increasing the strength of the bond between the carpet tile and the subfloor. When the release level of this bond exceeds the tear strength of the foam backing, the floor covering delaminates upon attempted removal from the subfloor.

One very desirable adhesive material for securing a floor covering to a subfloor is a water dispersed acrylic adhesive. If this adhesive is applied over the total of the foam backing 12, at for example .002 inch thickness, the release strength of the dried and cured adhesive exceeds the tear strength of the backing 12 whereupon the floor covering 10 delaminates during the removal. On the other hand it is desirable for the adhesive to be spread over the entire part of the backing to prevent edge curling and slippage.

In accordance with this invention, the adhesive means 16 comprises an adhesive material having a tack level in excess of the minimum tear strength of the foam backing 12 and desirably in the range of 1.25-1.75 pounds/inch when applied in a film .001 inches thick. An acceptable water-dispersed acrylic adhesive may be obtained from Manufacturer's Chemical Company, Camden, New Jersey, under the trade name Manuflex 3015. This adhesive typically has a tack level of about 1.3 pounds/inch at .001 inch thickness of film application. To provide a satisfactory release strength so that the floor covering 10 may be removed from a subfloor without delaminating, the adhesive material is applied to the backing 12 in a multiplicity of discrete portions 20 as shown best in FIGS. 3 and 4. Each of the portions 20 is desirably less than about .01 square inches in extent and is preferably between .001 and .002 square inches in area. The adhesive portions 20 are preferably between .015 and .02 inches in depth. As will be appreciated, the larger each of the portions 20 becomes the greater is the possibility for localized tearing of the backing 12 which tends toward general delamination. As will be more fully apparent hereinafter, the individual portions 20 are conveniently circular having a diameter between .04 and .05 inches.

The area of the backing 12 covered by the adhesive portions 20 desirably comprises between 10 and 50 percent thereof. Instead of distributing the adhesive portions 20 evenly over the backing 12, better release strengths are obtained by disposing the portions 20 in groups or sets which are spaced apart by areas aggregating approximately 30 percent of the backing 12. The area of each set covered by the adhesive portions 20 may be up to 80 percent provided the sets are small. In the embodiment illustrated in FIGS. 1 and 3, the adhesive portions 20 aggregates approximately 30 percent of the area of each adhesive set and aggregates approximately 11 percent of the area of the backing 12.

As shown best in FIGS. 1 and 3, the adhesive portions 20 are preferably arranged in sets of diamond or parallelogram configuration having a long axis 22 and a substantially perpendicular short axis 24 in order to debond the minimum number of portions 20 at any given time. The long axis 22 of the sets located in each quadrant of the carpet tile 10 are parallel to a line 26 extending from the corner and the center of the backing 12. The normal manner in which a tile is removed from a subfloor is to peel back one corner thereof as suggested in FIGS. 5 and 6. Orienting the long axis 22 of the adhesive sets in the manner shown in FIGS. 1 and 3 insures a minimum number of discrete portions 20 being debonded from the subfloor at all times during the removal operation.

It is essential that the release strength of the adhesive means 16 be less than the tear strength of the foam backing 12. Using a foam backing having a tear strength between 1.0 and 2.25 pounds/inch the maxi-

imum release strength of the adhesive means 16 is between .6 and .9 pounds/inch. The minimum release strength of the adhesive means 16 must be sufficient to adhere the carpet tiles 10 to a subfloor and desirably is between .1 and .5 pounds/inch.

Typical carpet layers 14 have grain direction that must be aligned when the tiles 10 are placed to insure a uniform appearance. It is common in the prior art to print an arrow on the foam backing 12 to indicate the grain direction of the carpet layer 14. In the prior art, this necessarily involves a separate or complicated printing operation since the adhesives of the prior art are applied over substantially all of the backing 12. An advantageous side light of this invention may be taken advantage of where the adhesive material visibly contrasts with the foam backing 12. As shown in FIG. 1, some of the adhesive portions 20 are arranged to describe an arrow corresponding to the grain direction in the carpet layer 14. The arrows 28 are, of course, applied to the backing 12 simultaneously with the application of the remainder of the adhesive portions 20. When using this invention, the effort expended in separately printing a grain directing arrow on the foam backing 12 may be omitted.

In the process of this invention, the adhesive material is applied to the foam backing 12 with a design figured roller having a multiplicity of circular cups formed therein to receive the adhesive material from a container and transfer it to the backing 12. The cups and the roller are conveniently circular for convenience in making the roller. The cups are preferably between .04 and .05 inches in diameter and are between .015 and .02 inches in depth. Another reason for making the adhesive portions 20 small is the difficulty in applying adhesive material in larger areas.

As a specific example, carpet tiles presently made by the assignee were removed from the production line. The foam backing thereof had a bulk density of 14.75 pounds/cubic foot and a delamination strength of about 1.0 pounds/inch. The tiles were placed in a roller type printing machine wherein the roller had been engraved with a multiplicity of .045 inch diameter $\times$.015 inch deep cups disposed in a pattern reverse of that shown in FIG. 1. The area of the cups in each set aggregated approximately 30 percent of the area thereof. The aggregate area of the cups comprised approximately 11 percent of the area of the 12 inch $\times$ 12 inch carpet tile. Manuflex 3015 adhesive having a tack level of 600 grams/inch for a .001 inch dry film from Manufacturer's Chemical Company was placed in the receptacle of the printing machine. The engraved configured roller dipped into the receptacle and picked up a substantial amount of adhesive material. A doctor blade was used to remove excess adhesive from the periphery of the roller; approximately 1.3 grams of wet adhesive was transferred by the figured roller to each 12 inch $\times$ 12 inch tile passing through the printing machine. The tiles were allowed to dry at ambient temperature and humidity. Separate tiles were placed on alkaline subconcrete, glass, wood and vinyl asbestos subfloors and loaded at 20 pounds/square foot at 160°F. At the end of 3 days, the tiles were removed from the subfloors and all exhibited a release strength between 100 and 200 grams/inch.

Referring to FIGS. 5 and 6, the advantages of this invention are illustrated. In FIG. 5, a carpet tile 30 is secured to a subfloor 32 of any type. The tile 30 is re-

moved from the subfloor 32 by grasping on one corner 34 thereof and pulling. As the corner 34 moves away from the subfloor 32, the foam backing 36 tears or delaminates to leave a part thereof adhered to the subfloor 32. To prepare the subfloor 32 to receive another floor covering, the foam backing 36 adhering thereto must be removed, as by scraping or the like.

Referring to FIG. 6, a carpet tile 10 of this invention is secured to a subfloor 38 of any desirable type. One corner 40 of the tile 10 is pulled back from the subfloor 38. The release strength of the adhesive means 16 is sufficiently low to release from the subfloor 38 without tearing or delaminating the foam backing 12.

Referring to FIG. 7, there is schematically illustrated a technique for applying acrylic adhesive to the carpet tiles 10. The carpet tiles 10 are fed from conventional production equipment toward a roller assembly 42 comprised of an engraved roller 44 and a pressure roll 46. The rollers 44, 46 are driven by suitable means (not shown) in the direction indicated by the arrows 48. The figured roller 44 had been engraved with a multiplicity of .045 inch diameter $\times$.015 inch deep cups disposed in a pattern reverse of that shown in FIG. 1. A mass 50 of water dispersed acrylic adhesive sold by Manufacturer's Chemical Company, Camden, New Jersey, under the tradename Manuflex 3015 is positioned in contact with the roller 44. A conventional doctor blade 52 acts to remove excess adhesive from the roller 44. Consequently, each of the cups provided by the roller 44 carries a small quantity of adhesive which is transferred to the backing on the carpet tiles 10 as the tiles 10 pass through the nip between the rolls 44, 46. A suitable dryer 54 is positioned in a drying zone 56 adjacent the path of tile movement to remove water carried by the adhesive. As the tiles 10 exit from the drying zone 56, the adhesive has been converted to a pressure sensitive type.

Downstream of the drying zone 56 is a release paper applicator 58 of conventional design. The release paper applicator 58 comprises a pair of adjacent rolls 60, 62 driven by suitable means (not shown) in the direction shown by the arrows 64. A suitable release paper 66 is fed onto the roll 60 for placement against the adhesive side of the carpet tiles 10. As the carpet tiles 10 leave the release paper applicator 58, the tiles 10 are capable of being handled or packaged.

Referring to FIG. 8, there is illustrated a technique for applying a hot melt adhesive in lieu of the acrylic adhesive previously discussed. The carpet tiles 10 are fed from suitable production equipment to a roller assembly 68 comprised of a figured or engraved roller 70 and a pressure roll 72. The rollers 70, 72 are driven by suitable means (not shown) in the direction indicated by the arrows 74. Positioned adjacent the engraved roller 70 is a hopper 76 containing a quantity of hot melt adhesive 78. The hopper 76 and the roller 70 may be heated by any suitable means such as by an electrical resistance coil 80. A doctor blade 82 comprises part of the hopper 76 and is used to wipe excess adhesive from the external surface of the roller 70. A suitable hot melt adhesive is made by Manufacturer's Chemical Company, Camden, New Jersey, under the tradename Manuflex 6007. This particular adhesive is a mixture of ethylene vinyl acetate and tackifiers. The melting point of this adhesive is approximately 325° F.

Consequently, the heating element 80 should be sized sufficiently to melt the adhesive.

As the carpet tiles 10 pass through the nip of the rolls 70, 72, the adhesive carried by the cups of the engraved roller 80 is transferred to the tiles 10. As will be apparent to those skilled in the art, the roll 70 may be heated to assure that the adhesive, while in the cups, remains liquid. The tiles 10 then pass through a cooling zone 84 where the adhesive is cooled below its melting point and accordingly solidifies on the carpet tiles. After the tiles 10 pass from the cooling zone 84, they pass into a release paper applicator 84 comprised of a pair of rollers 86, 88 which are driven by suitable means (not shown) in the direction indicated by the arrows 90. Release paper 92 is fed to the rollers 86, 88 in a conventional manner for application to the adhesive side of the carpet tiles 10.

It will be apparent there is herein provided an improved process of making a floor covering.

I claim:

1. A process of applying adhesive to a floor covering having a foam backing of 8.5–19 pound/cubic foot density and a traffic bearing layer bonded to the foam backing having a delamination strength of 1.0–2.25 pound/inch, the process comprising the steps of

applying an effective amount of a liquid adhesive to the foam backing in a multiplicity of discrete portions each having an area of less than about .01 square inches and separated from the next adjacent portion by a non-adhesive area, the portions aggregating less than about 50 percent of the area of the foam backing; and

solidifying the adhesive to produce a release strength for the floor covering between .1–.9 pound/inch.

2. A process of applying adhesive to a floor covering having a foam backing of 8.5–19 pound/cubic foot density and a traffic bearing layer bonded to the foam backing having a delamination strength of 1.0–2.25 pound/inch, the process comprising the steps of

placing a liquid adhesive having a dry tack level between 1.25–1.75 pounds/inch at .001–.002 inch thickness of application in a multiplicity of adhesive carrying cups provided by a roller, each of the cups having an area less than about .01 square inches and aggregating between 10–50 percent of the effective area of the roller;

contacting the roller and the foam backing;

transferring the adhesive from the cups to the foam backing to produce a multiplicity of discrete adhesive areas on the foam backing; and

solidifying the adhesive to produce a release strength for the floor covering less than the delamination strength of the foam backing.

3. The process of claim 2 wherein the adhesive consists essentially of a water-dispersed acrylic adhesive and the solidifying step comprises drying the adhesive.

4. The process of claim 2 wherein the adhesive material consists essentially of a hot melt adhesive having a predetermined melting range, the applying step comprises the step of maintaining the hot melt adhesive above the melting range thereof, and the solidifying step comprises cooling the adhesive below the melting range thereof.

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