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(54) **ENERGY ABSORPTIVE/MOISTURE RESISTIVE UNDERLAYMENT FORMED USING RECYCLED MATERIALS AND A HARD FLOORING SYSTEM INCORPORATING THE SAME**

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(60) Provisional application No. 60/632,315, filed on Dec. 1, 2004.

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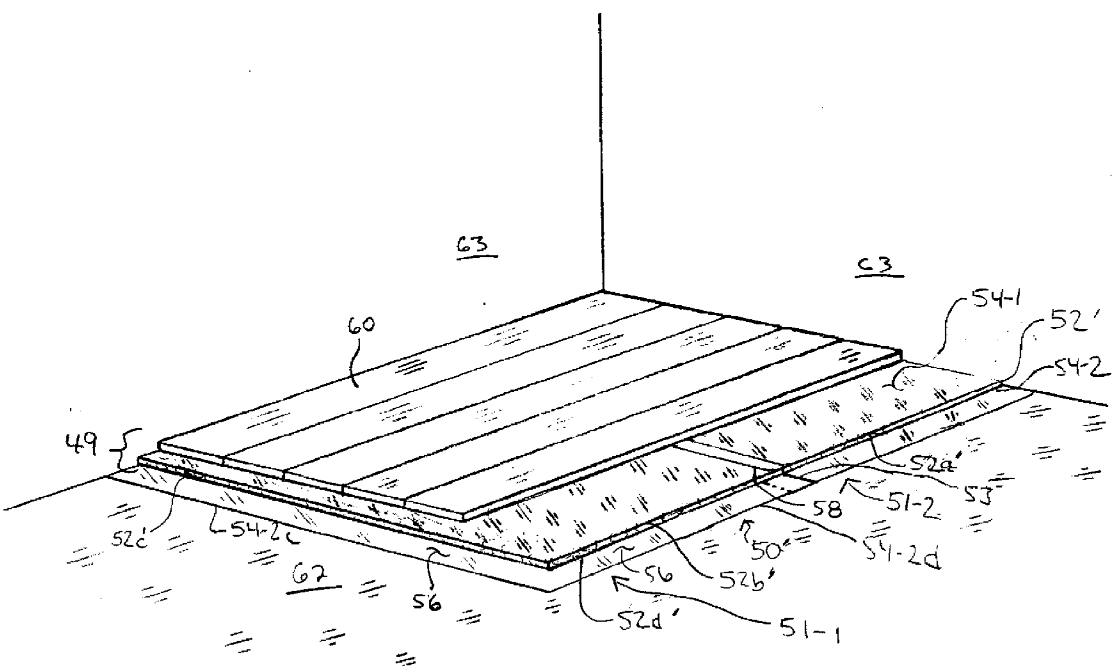
(52) **U.S. Cl.** **52/403.1**

(57) **ABSTRACT**

A recycled energy absorptive/moisture resistive underlayment includes a recycled energy absorbing layer comprised of either a nonwoven fiber batt formed from shoddy fibers or a foam pad formed from bonded foam. To protect the recycled energy absorbing layer from moisture, a moisture barrier is laminated on either one or preferably both side surfaces of the recycled energy absorbing layer. The moisture barrier laminated on a lower side surface of the recycled energy absorbing layer has a projecting flap which projects from first and second edge surfaces of the recycled energy absorbing layer to which the moisture barrier is laminated to the lower side surface thereof. The projecting flap enhances protection of the recycled energy absorbing layer from moisture by preventing moisture from migrating through seams and/or other exposed portions of the recycled energy absorbing layer.



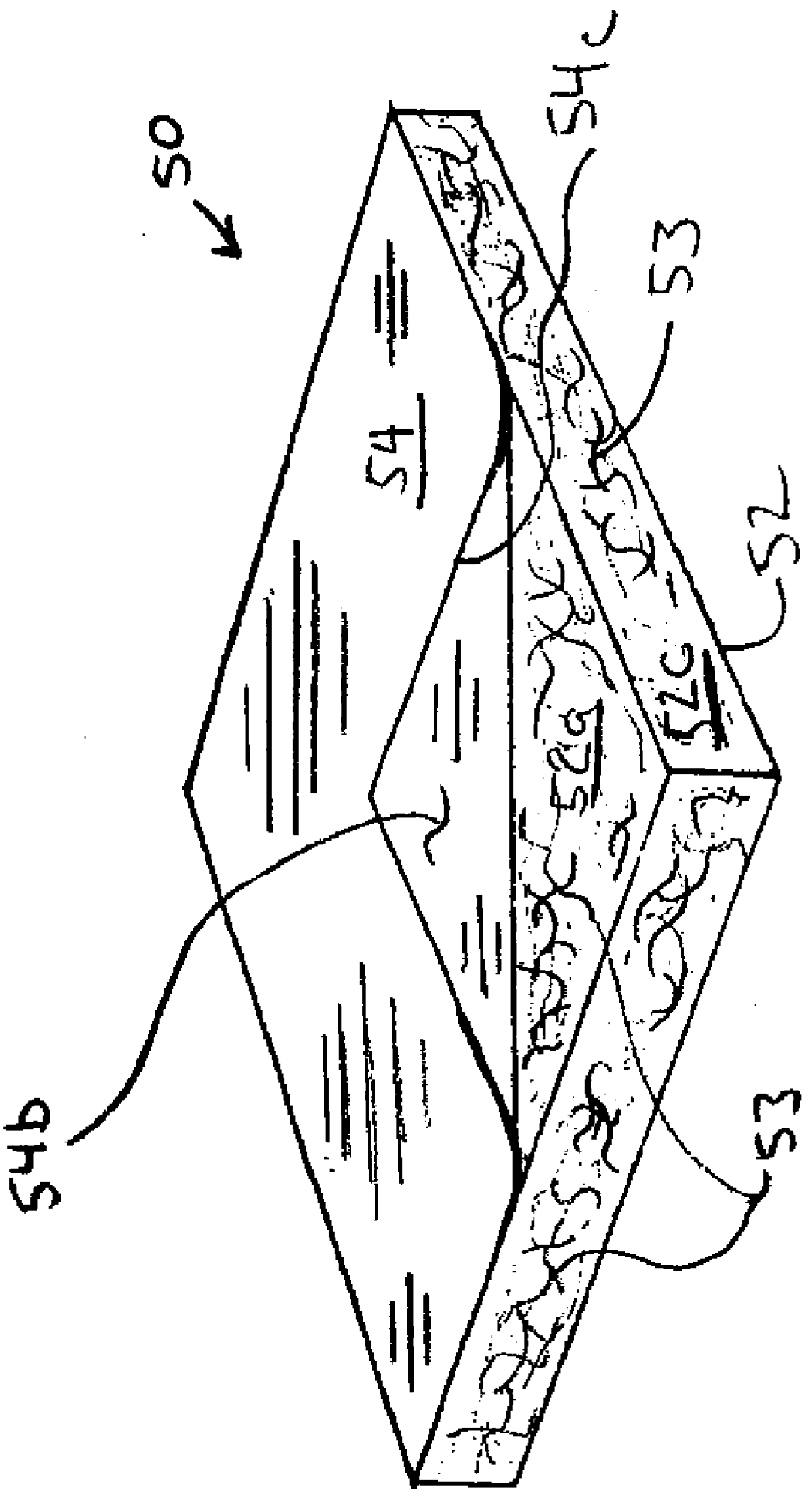


FIG. 1

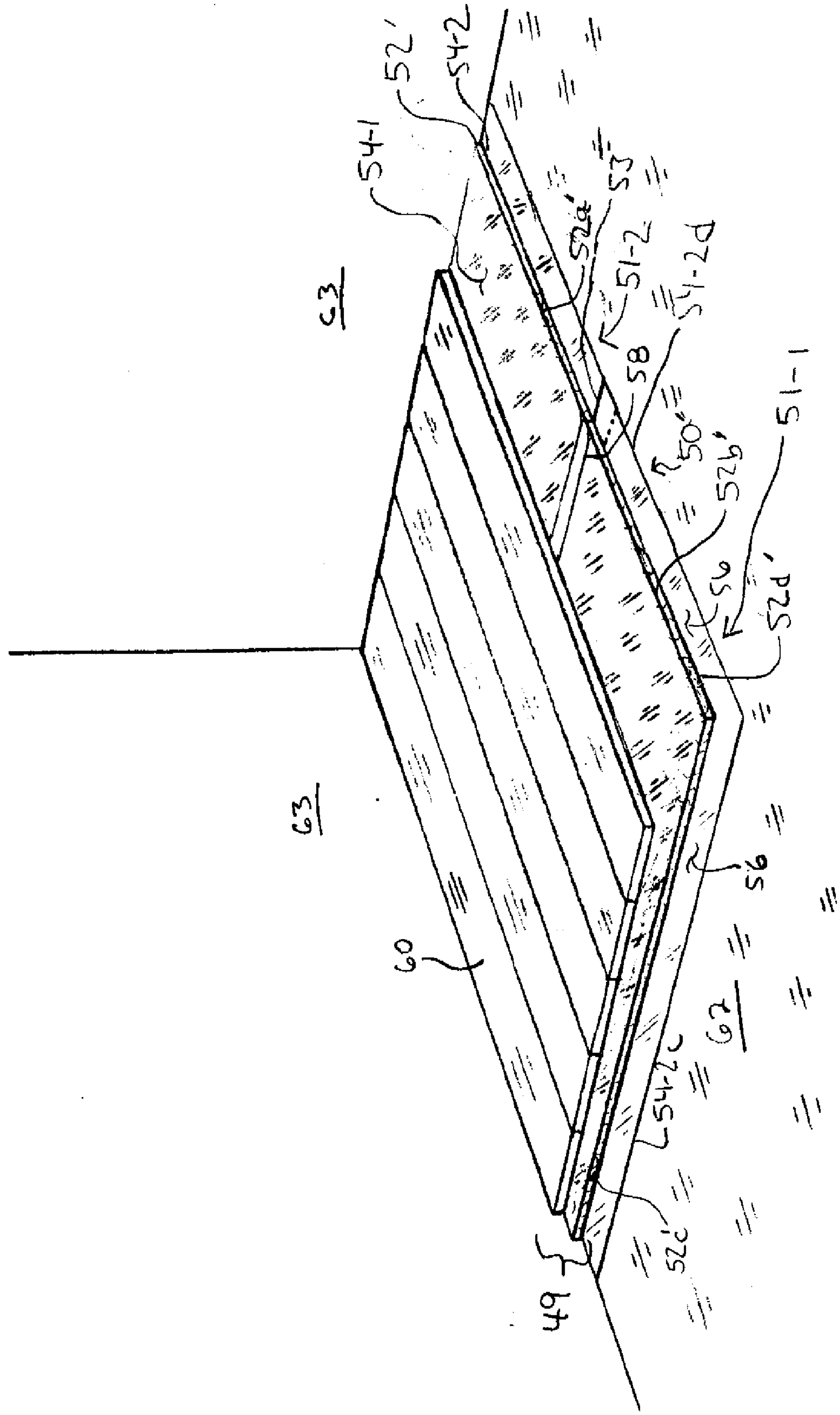

54-2
52'
54-1
53
52a'
51-2
54-2d
58
50'
52b'
51-1
56
52d'
63
63
60
56
62
54-2c
52c'
49

FIG. 2A

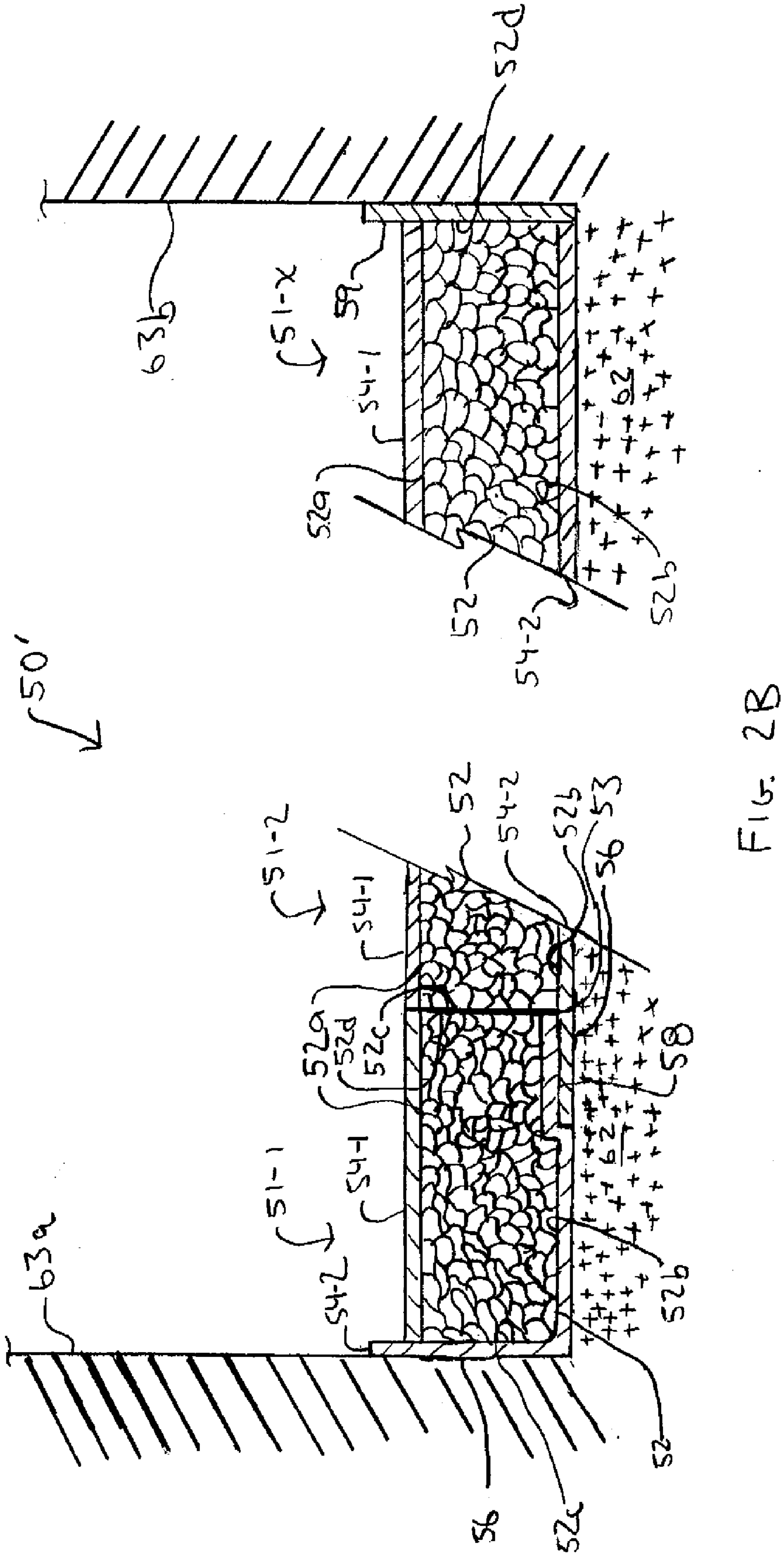


FIG. 2B

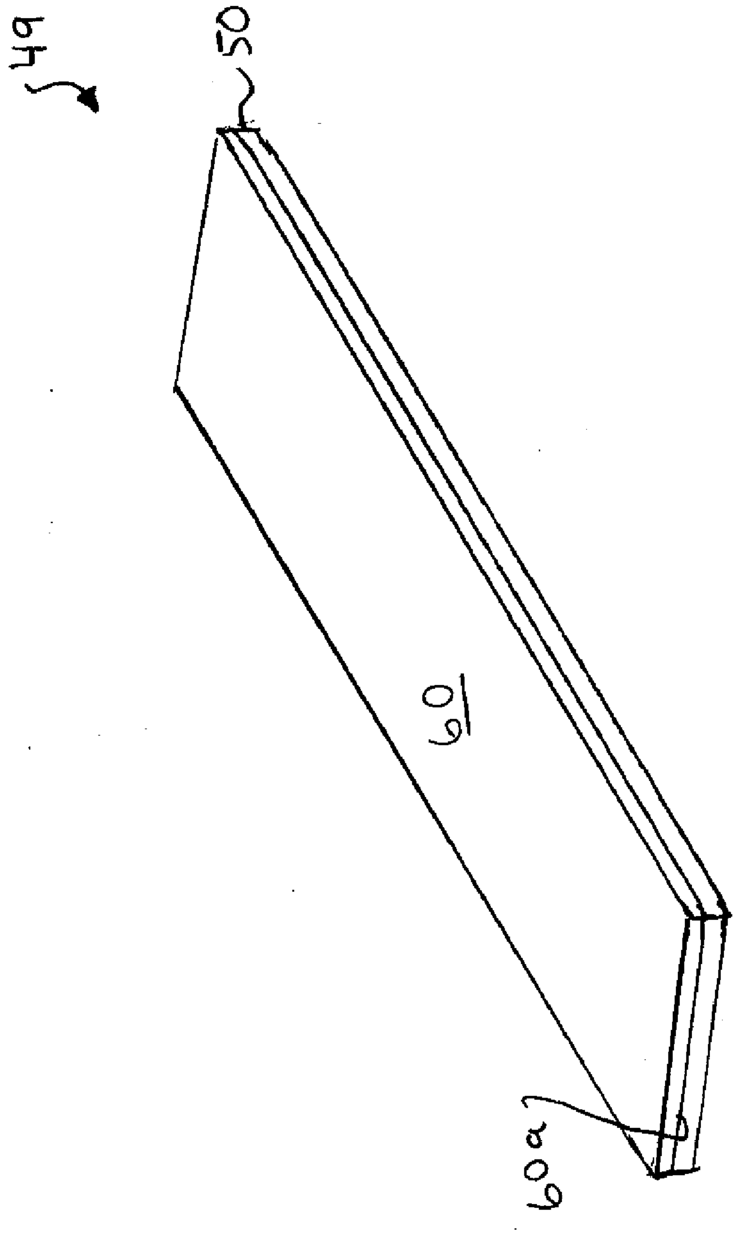


FIG. 3

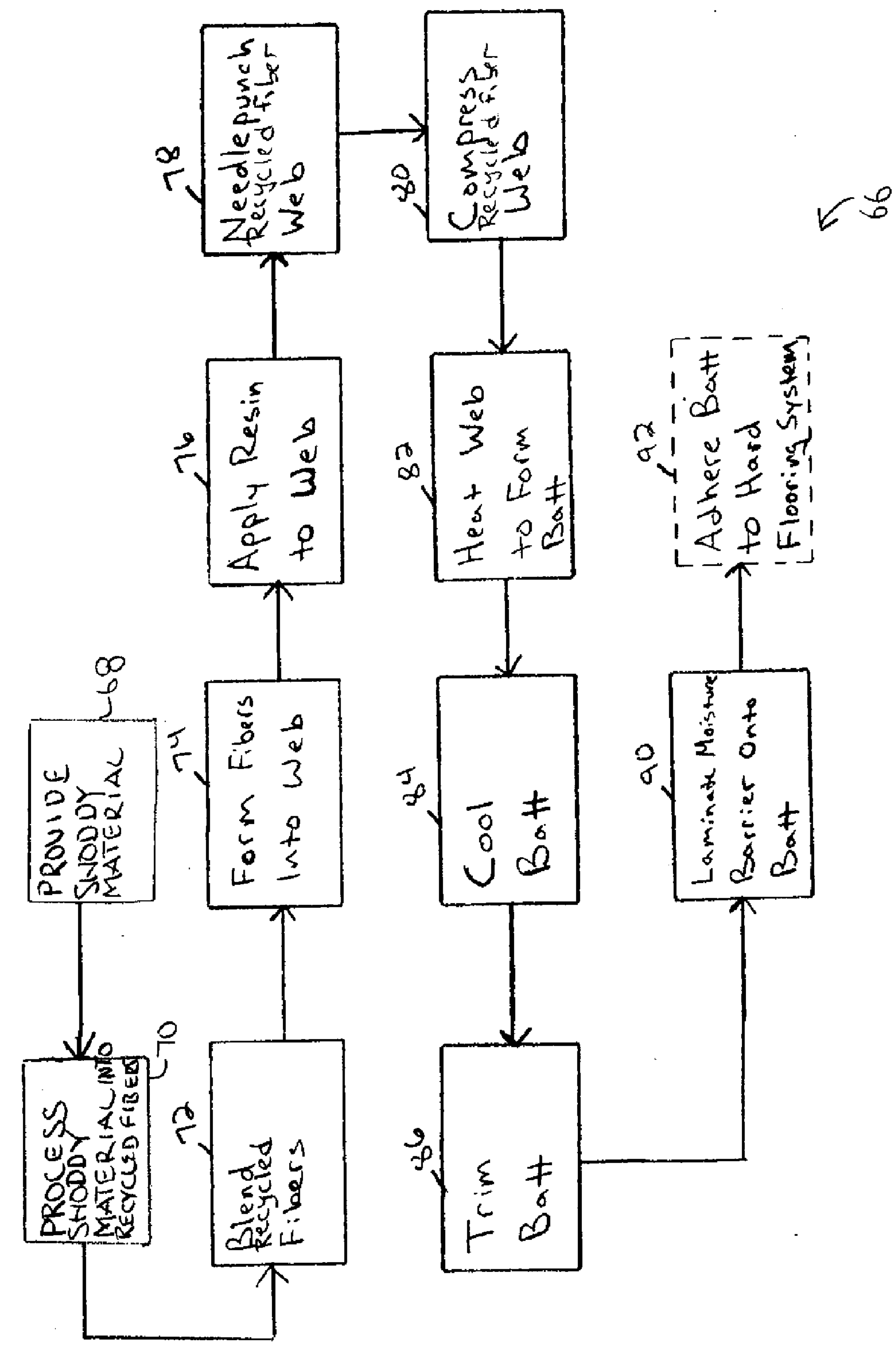

PROVIDE SHODDY MATERIAL
68
PROCESS SHODDY MATERIAL INTO RECYCLED FIBERS
70
Blend Recycled Fibers
72
Form Fibers Into Web
74
Apply Resin to Web
76
Needlepunch Recycled fiber Web
78
Compress Recycled fiber Web
80
Heat Web to Form Batt
82
Cool Batt
84
Trim Batt
86
Laminate Moisture Barrier Onto Batt
90
Adhere Batt to Hard Flooring System
92
66

FIG. 4

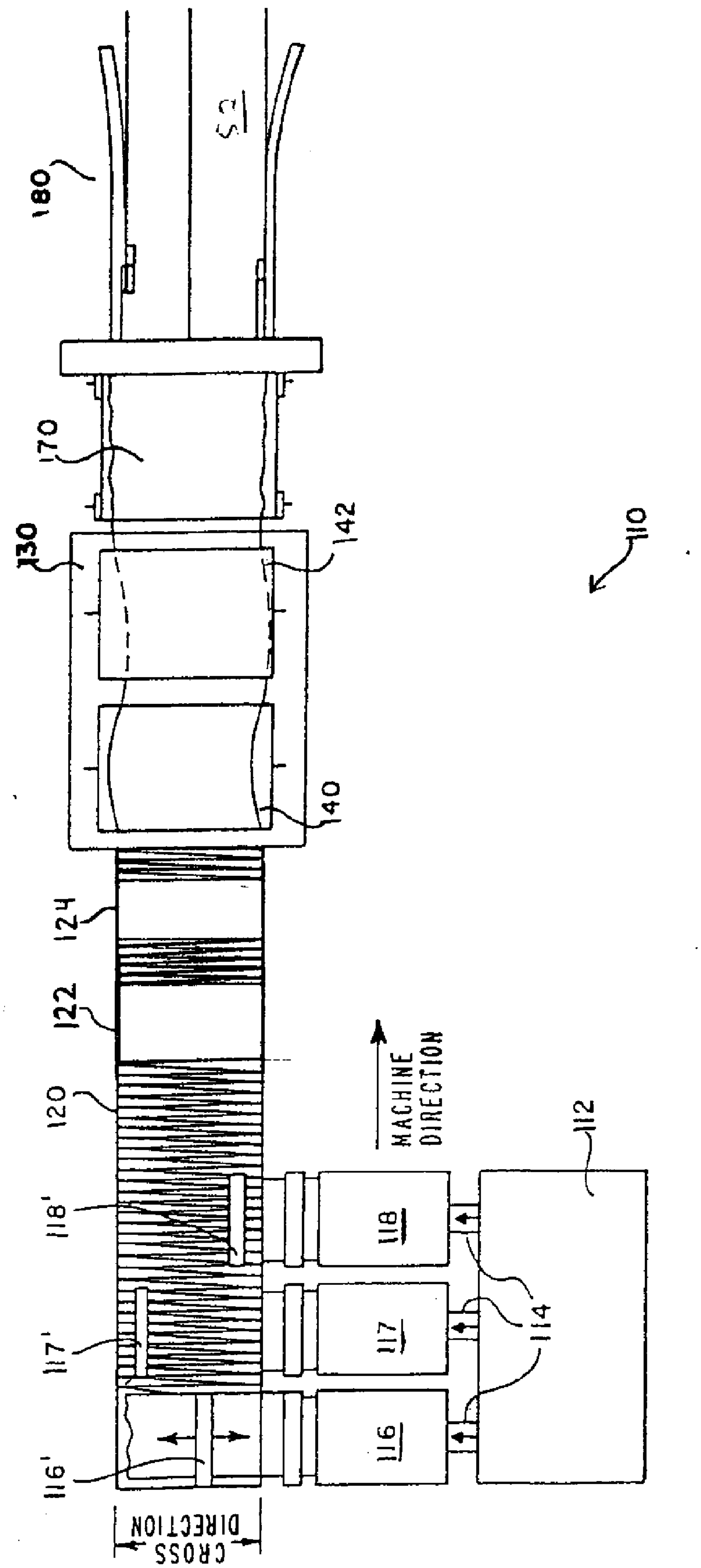

180
52
170
130
142
140
124
122
120
118'
117'
116'
118
117
116
114
112
110
MACHINE DIRECTION
CROSS DIRECTION

FIG. 5

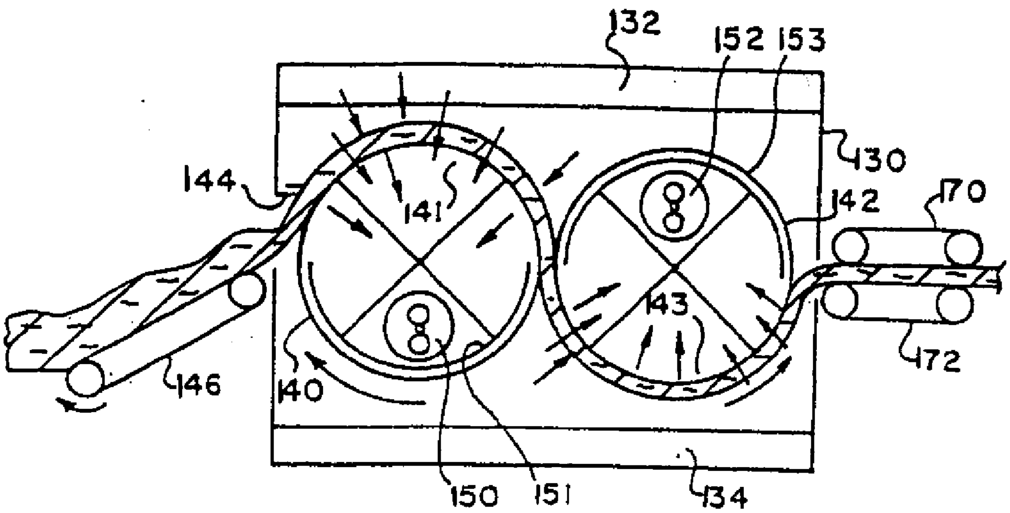

132
152
153
130
144
141
142
170
143
172
146
140
150
151
134

FIG. 6A

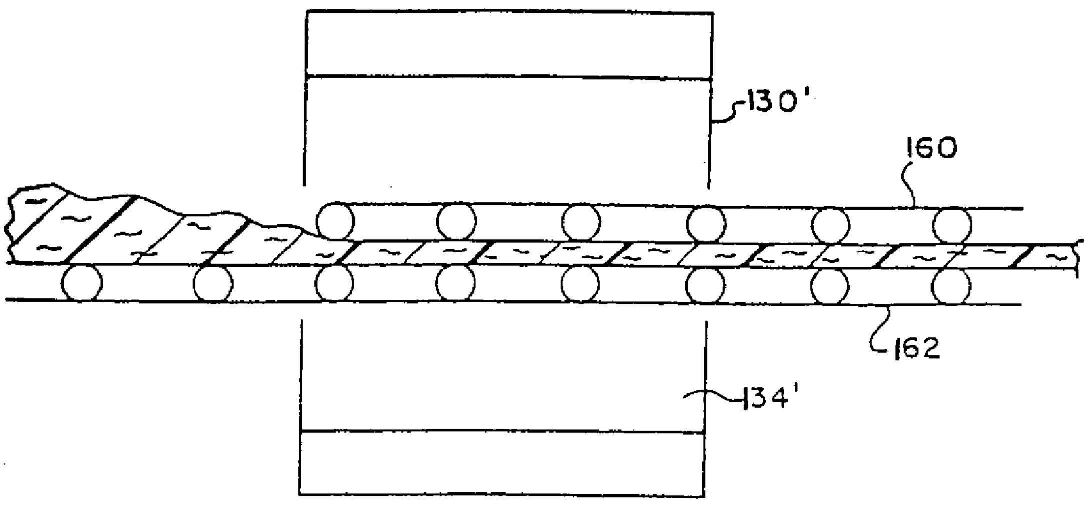

130'
160
162
134'

FIG. 6B

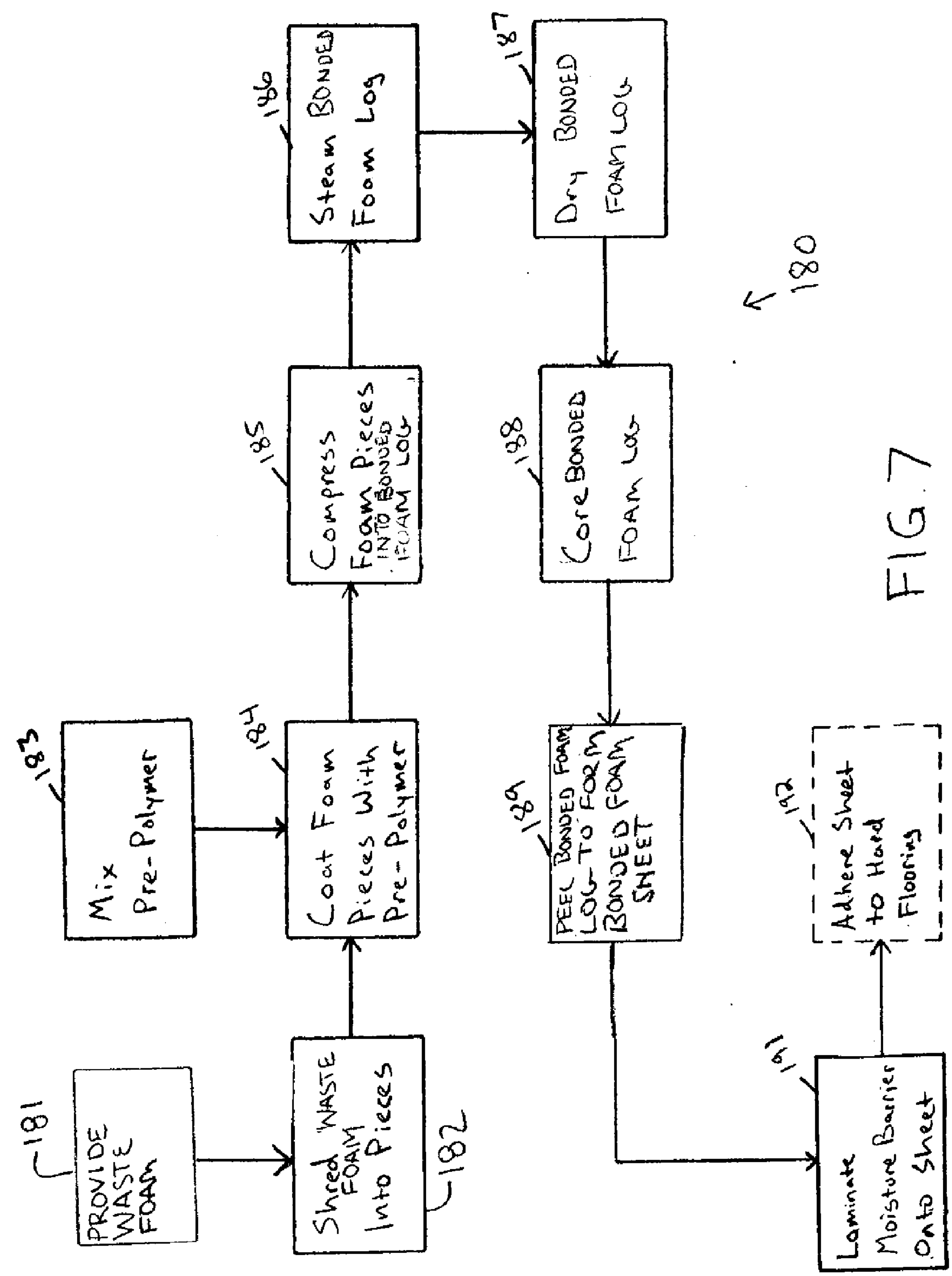

181
PROVIDE WASTE FOAM
182
Shred WASTE FOAM Into Pieces
183
Mix Pre-Polymer
184
Coat Foam Pieces With Pre-Polymer
185
Compress Foam Pieces INTO BONDED FOAM LOG
186
Steam BONDED Foam Log
187
Dry BONDED FOAM LOG
188
Core BONDED FOAM LOG
189
PEEL BONDED FOAM LOG TO FORM BONDED FOAM SHEET
191
Laminate Moisture Barrier Onto Sheet
192
Adhere Sheet to Hard Flooring
180

FIG. 7

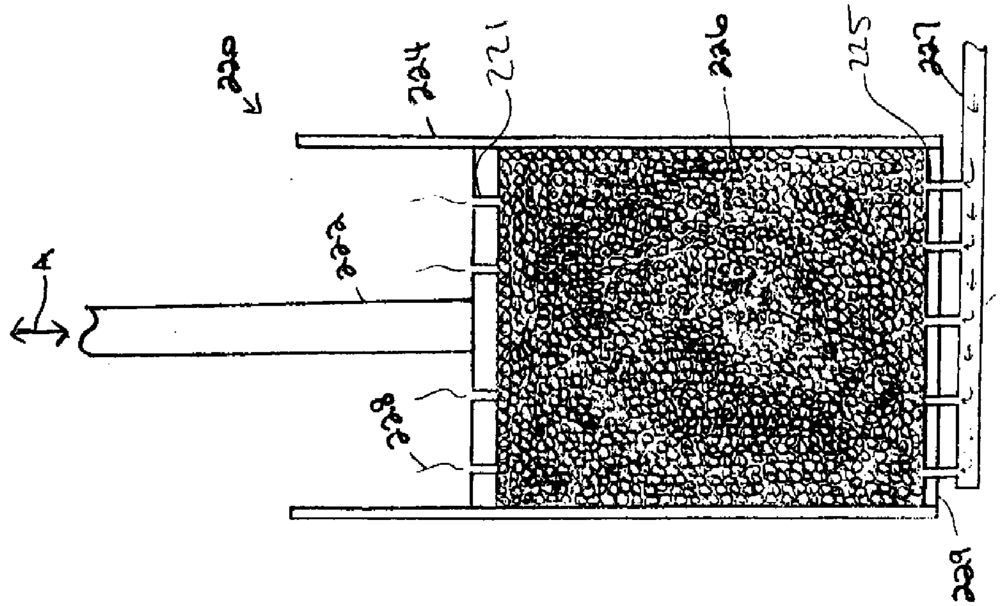


FIG. 9

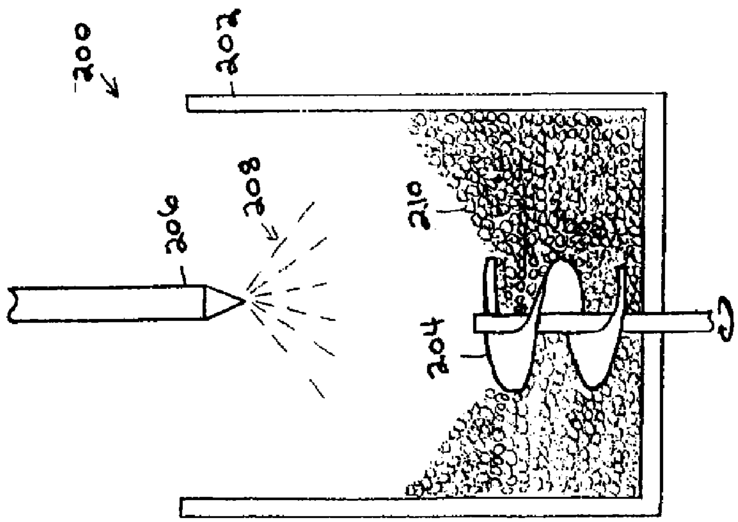


FIG. 8

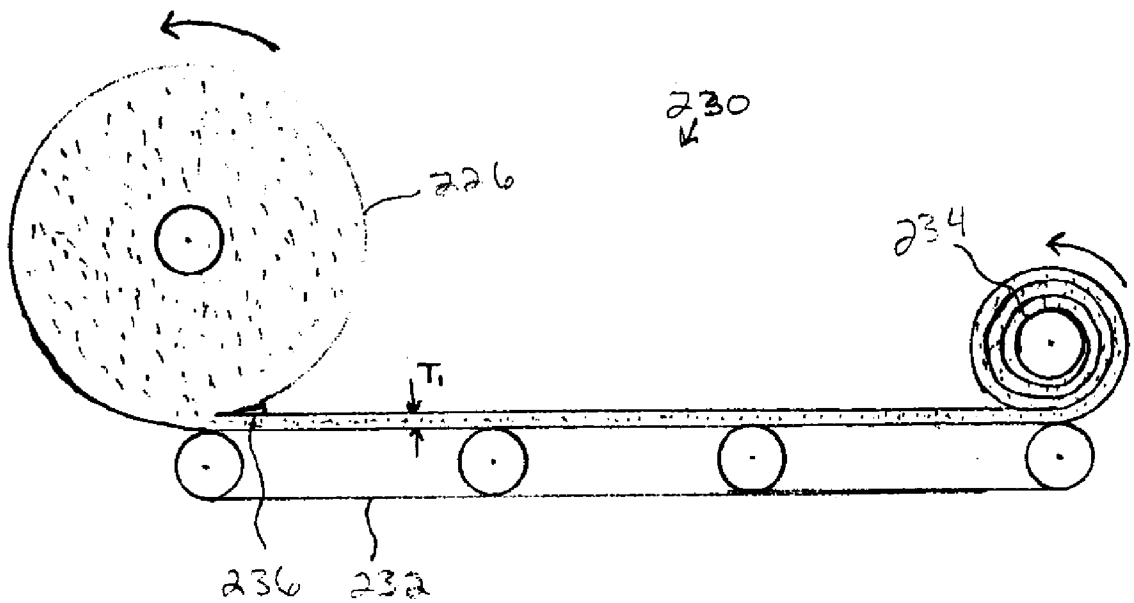


FIG. 10

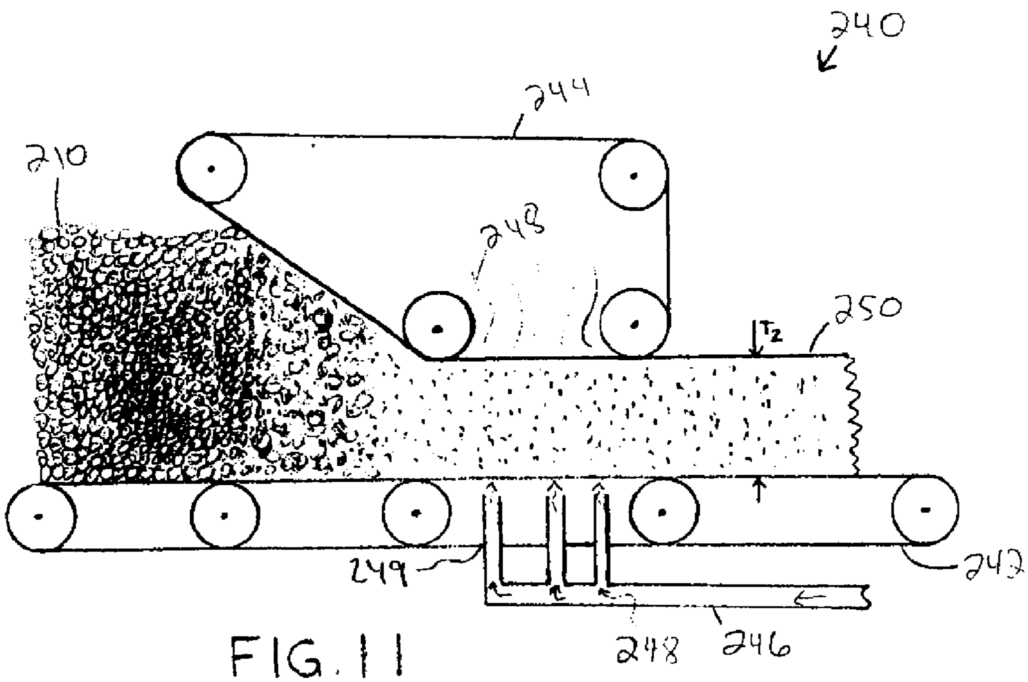


FIG. 11

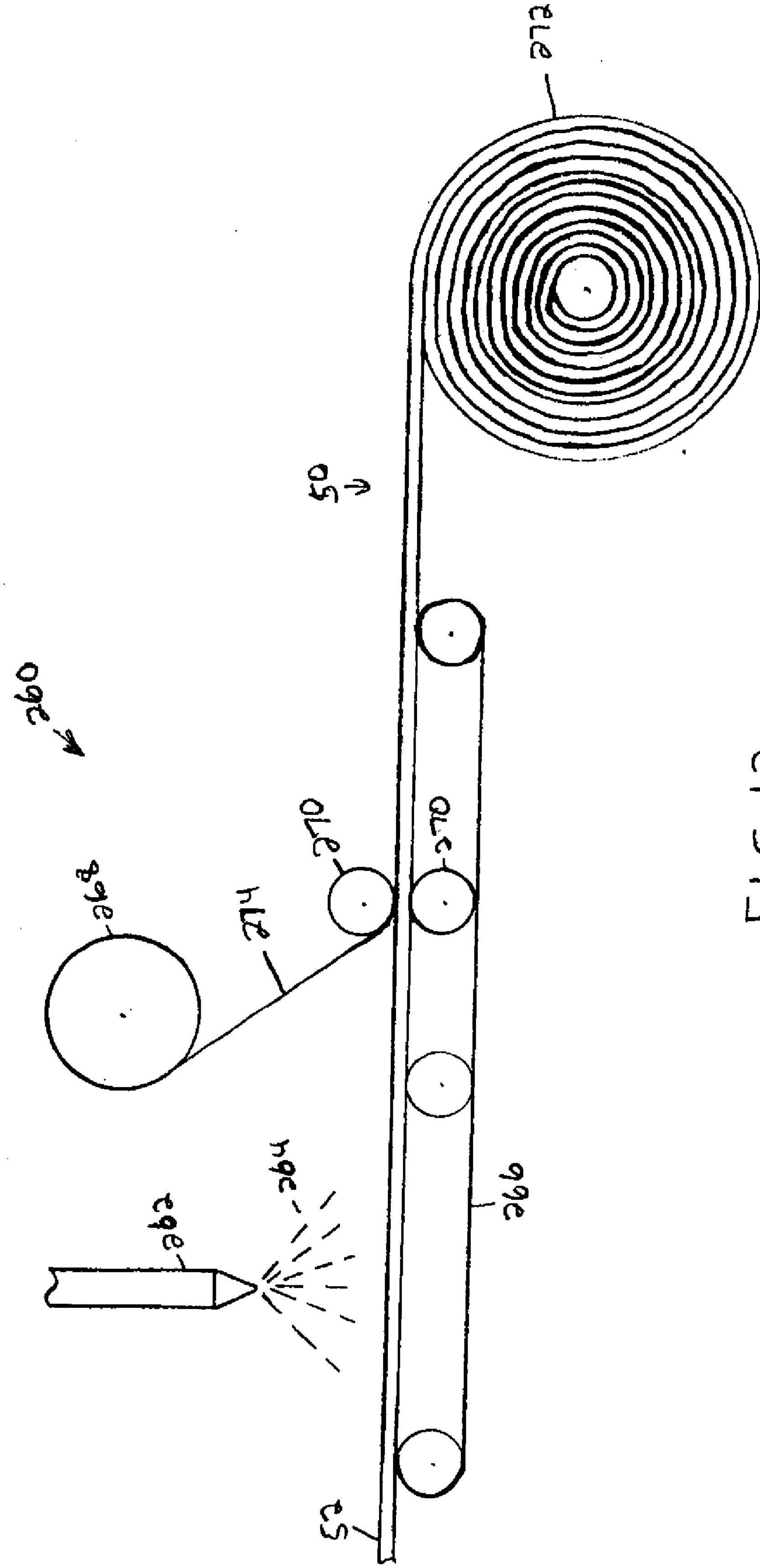


FIG. 12

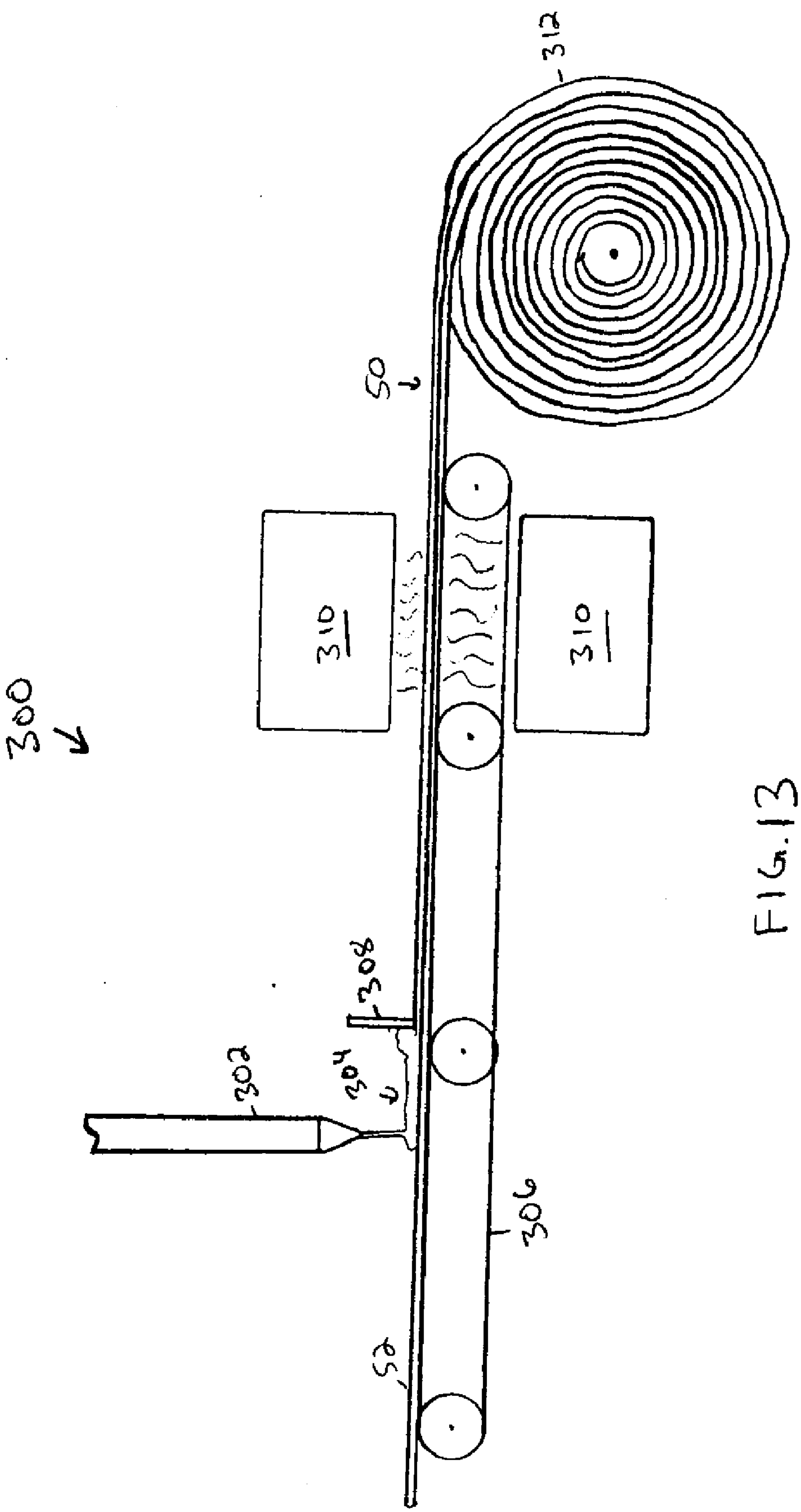


FIG. 13

ENERGY ABSORPTIVE/MOISTURE RESISTIVE UNDERLAYMENT FORMED USING RECYCLED MATERIALS AND A HARD FLOORING SYSTEM INCORPORATING THE SAME

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a Continuation-In-Part (C-I-P) of U.S. patent application Ser. No. 11/291,633 filed Dec. 1, 2005, which, in turn, claims priority from U.S. Provisional Patent Application Ser. No. 60/632,315 filed Dec. 1, 2004, both of which are assigned to the Assignee of the present application and hereby incorporated by reference as if reproduced in their entirety.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

REFERENCE TO A MICROFICHE APPENDIX

[0003] Not applicable.

TECHNICAL FIELD

[0004] The present disclosure relates to recycled underlayments suitable for use with hard flooring and, more particularly, to an energy absorptive/moisture resistive underlayment formed using recycled materials and suitable for incorporation into a hard flooring system.

BACKGROUND

[0005] A subfloor is either a slab of concrete or one or more sheets of plywood supported by a combination of joists, beams, posts and, in multiple-story buildings, bearing walls while a flooring system encompasses all of the various materials, layers and the like which are installed above the subfloor. In one sense, a flooring system is comprised of a flooring and an underlayment located between the subfloor and the flooring. Most flooring used in structures may be characterized as either a "soft" flooring or a "hard" flooring. For example, carpeting is a common soft flooring while wood is an equally common hard flooring. As its name suggests, soft flooring is typically soft to the touch, quiet underfoot and tends to yield upon application of a force thereto. Conversely, hard flooring tends to be hard to the touch and, as a result, is durable and easy to maintain. However, hard flooring also tends to be relatively noisy, cold, and hard underfoot.

[0006] Most hard flooring systems, particularly those which include wood and/or laminate flooring, include an underlayment which serves as a moisture barrier, an energy absorber and a leveler for the hard flooring. When used in a hard flooring system, the moisture barrier will prevent the migration of moisture from the subfloor into the hard flooring. As a result, whether or not an underlayment is capable of functioning as a moisture barrier is often an important consideration when selecting an underlayment for use with a hard flooring system. This is particularly true if the hard flooring system is to cover a concrete subfloor as moisture frequently seeps through the concrete subfloor and, in the absence of a moisture barrier, into the wood or laminate flooring where it causes the wood flooring to warp or the laminate flooring to delaminate. Likewise, energy absorption is often an important consideration when selecting an underlayment for use with a hard flooring system because such an underlayment would absorb some of the sound or "echo" created by a person walking on the hard flooring. As a result, the hard flooring would be quieter and, therefore, more appealing to those concerned with the noise typically generated by hard flooring. Finally, by smoothing high points (peaks), low points (valleys), and other irregularities in a subfloor, an underlayment can help ensure that the relatively inflexible hard flooring rests on a more level surface.

[0007] A wide variety of underlayments are used in conjunction with hard flooring. For example, a thin, continuous film of a polymeric material, for example, polyethylene or vinyl, may be installed over the subfloor to provide a moisture barrier for the hard flooring. Oftentimes, a polymeric open cell foam layer is positioned over the polymer film to provide a degree of cushioning to the hard flooring placed above it. Variously, the polymer film and open cell foam layer may be laminated to one another or may be discrete components installed one over the other. Alternatively, a solid sheet of polymer having some cushioning characteristics, for example, a slightly polymerized vinyl chloride polymer, can function as both a moisture barrier and a cushion between the subfloor and the hard flooring. Another suitable underlayment is a laminate composite formed of a moisture impervious vinyl, polyethylene, or polyester film attached to latex or vinyl foam. Other underlayments used with hard flooring include nonwoven fiber batts of polyester, nylon, or polypropylene with a moisture barrier attached to one side of the fiber batt.

[0008] One of the goals of all flooring manufacturers is to reduce the time and complexity of installing the flooring. While this goal is important for those types of flooring, for example, carpeting, installed by professional installers, it is a particularly important consideration for those floorings, for example, a laminate or other type of hard flooring, to be installed by consumers as consumers will often base their purchase decisions on the complexity of the installation process, the length of time required to install the hard flooring and/or the price of the hard flooring. These consumer needs have led to an increase in the number of hard flooring systems that have tongue-and-groove, click-together, or other connection mechanisms on a plurality of their edges so that the hard flooring is quick and easy to install. However, with all of these advances in hard flooring installation, the consumer is still required to install an underlayment in the conventional manner, which often includes laying down sheets of the underlayment on the subfloor prior to installing the hard flooring. Therefore, a need exists for a method of simplifying the process of installing an underlayment for hard floorings while simultaneously reducing the time required to install the underlayment.

[0009] One of the ongoing concerns of many underlayment manufacturers is the need to reduce manufacturing costs. Lowered manufacturing costs result in lower product costs, which, in turn, make the final product more appealing to the consumers. Underlayment consumers, particularly large retail outlets and flooring installers, are constantly seeking the lowest price on flooring underlayment and frequently change suppliers in order to save a few cents per square foot of underlayment. Thus, it is in the manufacturers' best interest to produce flooring underlayment for the lowest possible price. As the cost of upgrading manufacturing equipment to improve efficiency can be prohibitive, most manufacturers seek to lower production costs by using less expensive materials to manufacture the underlayment. Consequently, what is needed is a flooring underlayment material that is less expensive than the existing flooring underlayment material, thereby allowing manufacturers to produce and sell a flooring underlayment that is less expensive than existing flooring underlayment.

[0010] Another ongoing concern for many manufacturers is the consumer's perception of the manufacturer. Manufacturers who use recycled materials to manufacture their product are perceived as environmentally friendly or "green", a trait preferred by consumers who are environmentally conscious. Consumers who are environmentally conscious are willing to pay a premium for goods that contain recycled materials. Even those environmentally conscious consumers who are unwilling to pay a premium for goods that contain recycled materials will, if given the opportunity of selecting between two otherwise equal products, be more likely to select the product containing recycled materials. Typically, recycled products are partially or entirely made from previously used or waste materials. If the cost of processing the previously used or waste material to render it suitable for re-use is less than the cost of purchasing new material, a recycled product can be less expensive than a product wholly made from new materials. Because recycled materials are both cost-effective and consumer-preferable, a need exists for a flooring underlayment that utilizes recycled materials.

SUMMARY

[0011] In one embodiment, disclosed herein is a flooring underlayment configured for installation between hard flooring and a subfloor. The flooring underlayment is comprised of an energy absorbing layer formed from a recycled material and a first moisture barrier affixed to a first side surface of said energy absorbing layer. When mechanical energy is applied to the hard flooring, the energy absorbing layer absorbs at least a portion of the acoustic energy produced by the hard flooring. In various aspects thereof, the energy absorbing layer is a nonwoven fiber batt formed of recycled material, a nonwoven fiber batt formed from shoddy fiber, a foam pad formed from recycled material or a foam pad formed from bonded foam.

[0012] In further aspects thereof, the first moisture barrier may be a moisture impermeable film laminated to the first side surface of the energy absorbing layer or a closed cell foam attached to the first side surface of the energy absorbing layer. In still further aspects thereof, the flooring underlayment may further include a second moisture barrier laminated onto a second side surface of the energy absorbing layer. In this aspect, the first moisture barrier engages the subfloor while the second moisture barrier engages the hard flooring. As before, in various further aspects thereof, the energy absorbing layer may be a nonwoven fiber batt formed from shoddy fibers or a foam pad formed from bonded foam. In the alternative, the first and/or second moisture barriers may instead be formed of a closed cell foam.

[0013] In another embodiment, a flooring underlayment configured for installation between hard flooring and a subfloor is disclosed. The flooring underlayment is comprised of an energy absorbing layer formed from a recycled material, a first moisture barrier for engaging a subfloor and a second moisture barrier for engaging hard flooring. The energy absorbing layer includes a first side surface, a second side surface and a plurality of edge surfaces. The first moisture barrier is laminated to the first side surface of the energy absorbing layer and includes at least one edge surface laying flush with a corresponding one of the edge surfaces of the energy absorbing layer and at least one edge surface projecting past a corresponding one of the edge surfaces of the energy absorbing layer. The second moisture barrier is laminated to the second side surface of the energy absorbing layer and includes plural edge surfaces, each of which corresponds to and lays flush with one of the edge surfaces of the energy absorbing layer. When mechanical energy is applied to the hard flooring, the energy absorbing layer absorbs at least a portion of the acoustic energy produced by the hard flooring. In various aspects thereof, the energy absorbing layer is a nonwoven fiber batt formed from shoddy fiber or a foam pad formed from bonded foam.

[0014] In still another embodiment, disclosed herein is a hard flooring system configured for installation in a space defined by a subfloor, a first wall and a second wall. The hard flooring system is comprise of a first energy absorptive/moisture resistive underlayment section, a second energy absorptive/moisture resistive underlayment section, a hard flooring and a moisture resistive section. In turn, each of the first and second energy absorptive/moisture resistive underlayment sections is comprised of an energy absorbing layer formed from a recycled material, a first moisture barrier for engaging a subfloor and a second moisture barrier engaging the hard flooring. The first moisture barrier is laminated to a first side surface of the energy absorbing layer and includes at least one edge surface laying flush with a corresponding one of the edge surfaces of the energy absorbing layer and at least one edge surface projecting past a corresponding one of the edge surfaces of the energy absorbing layer. The second moisture barrier is laminated to a second side surface of the energy absorbing layer and includes plural edge surfaces, each of which lays flush with one of the plurality of edge surfaces of the energy absorbing layer.

[0015] As further disclosed herein, the projecting edge surface of the first moisture barrier laminated to the energy absorbing layer of the first energy absorptive/moisture resistive underlayment section engages a portion of the first wall while the projecting edge surface of the first moisture barrier laminated to the energy absorbing layer of the second energy absorptive/moisture resistive underlayment is positioned underneath a portion of the first moisture barrier laminated to the energy absorbing layer of the first energy absorptive/moisture resistive underlayment section. Finally, the moisture resistive section engages the second wall and an edge surface of the energy absorbing layer of the second energy absorptive/moisture resistive underlayment section which abuts the second wall.

[0016] In one aspect thereof, the moisture resistive section extends underneath a portion of the first moisture barrier laminated to the energy absorbing layer of the second energy absorptive/moisture resistive underlayment section. In others, the energy absorbing layer is a nonwoven fiber batt formed from shoddy fiber or a foam pad formed from bonded foam.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] For a more complete understanding of the present invention, and for further details and advantages thereof, reference is now made to the accompanying drawings, in which:

[0018] FIG. **1** is a perspective view of an energy absorptive/moisture resistive underlayment formed using recycled materials;

[0019] FIG. **2**A is a perspective view of a hard flooring system which incorporates an energy absorptive/moisture resistive underlayment formed using recycled materials;

[0020] FIG. **2**B is a partially cut-away, cross-sectional view of the energy absorptive/moisture resistive underlayment of FIG. **2**A;

[0021] FIG. **3** is a perspective view of an alternate embodiment of the energy absorptive/moisture resistive underlayment of FIG. **1** or FIG. **2**;

[0022] FIG. **4** is a block diagram of a first method of manufacturing an energy absorptive/moisture resistive underlayment using recycled materials;

[0023] FIG. **5** is a plan view of an apparatus for manufacturing an energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **4**;

[0024] FIG. **6**A is a side view of a first thermal bonding apparatus suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **4**;

[0025] FIG. **6**B is a side view of a second, alternative, thermal bonding apparatus suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **4**;

[0026] FIG. **7** is a block diagram of a second method of manufacturing an energy absorptive/moisture resistive underlayment using recycled materials;

[0027] FIG. **8** is a side view of a mixing tank suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **7**;

[0028] FIG. **9** is a side view of an apparatus for forming bonded foam suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **7**;

[0029] FIG. **10** is a side view of an apparatus for forming sheets of bonded foam suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **7**;

[0030] FIG. **11** is a side view of a second, alternative, apparatus for forming bonded foam suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **7**;

[0031] FIG. **12** is a side view of an apparatus for laminating a moisture resistive film onto an energy absorbing layer suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **4** or the method of FIG. **7**; and

[0032] FIG. **13** is a side view of an apparatus for laminating a moisture resistive closed cell foam onto an energy absorbing layer suitable for use in manufacturing a recycled energy absorptive/moisture resistive underlayment in accordance with the method of FIG. **4** or the method of FIG. **7**.

DETAILED DESCRIPTION

[0033] A recycled energy absorptive/moisture resistive underlayment **50** will now be described in detail. As used herein the term "recycled energy absorptive/moisture resistive underlayment" shall refer to an energy absorptive/moisture resistive underlayment formed using one or more recycled materials as a component thereof. Thus, by definition, the recycled energy absorptive/moisture resistive underlayment **50** is formed using one or more recycled materials. As best seen in FIG. **1**, the recycled energy absorptive/moisture resistive underlayment **50** is comprised of a moisture barrier **54** bonded to an energy absorbing layer **52**, for example, by laminating side surface **54***b* of the moisture barrier **54** onto side surface **52***a* of the energy absorbing layer **52**. Of course, in FIG. **1**, the moisture barrier **54** has been partially pulled away to better show the side surfaces **52***a* and **54***b* of the energy absorbing layer **52** and the moisture barrier **54**, respectively.

[0034] Uniquely, the energy absorbing layer **52** illustrated in FIG. **1** is formed from a selected type of recycled materials. Thus, in accordance with the nomenclature set forth hereinabove, the energy absorbing layer **52** may properly be referred to as recycled energy absorbing layer **52**. In the embodiment illustrated in FIG. **1**, the recycled energy absorbing layer **52** is a nonwoven fiber batt formed from shoddy fibers **53** bonded together in a manner to be more fully described below. In an alternate embodiment not shown in FIG. **1**, the recycled energy absorbing layer **52** is a foam pad formed from recycled foam, which is commonly known in the art as bonded foam.

[0035] Unfortunately, in the past, the term "shoddy" has been used somewhat inconsistently. Accordingly, for purposes of the foregoing disclosure, the term "shoddy material" shall refer to materials that have been collected so that the fibers forming the shoddy material may be reused. The term "shoddy fibers" shall refer to recycled fibers, including both loose waste fibers and fibers that have reclaimed from shoddy material. Finally, the term "shoddy products" shall refer to products formed using shoddy fibers. For example, if bedding material, for example, a nonwoven fiber batt, is acquired for reuse, the nonwoven fiber batt shall be termed "shoddy material." The polyester fibers reclaimed from the nonwoven fiber batt for reuse shall be termed "shoddy polyester fibers." Finally, if a recycled nonwoven fiber batt is constructed from the shoddy polyester fiber, the recycled nonwoven fiber batt may be termed as either a "shoddy nonwoven fiber batt" or a "nonwoven fiber batt formed using shoddy polyester fibers."

[0036] As previously set forth, shoddy fibers is comprised of fibers, previously used in clothing, bedding, fabric and other natural and synthetic materials, which have been collected for purposes of recycling the fibers thereof. Because recycled fibers originate from multiple sources, shoddy fibers are often a blend of a variety of types of fibers. Alternatively, the recycled fibers may be collected from a single fiber source. If so, the shoddy fiber would be comprised of a specific type of fiber. In one example, the recycled fibers may be comprised of the fibers which tends to accumulate as a unwanted by-product of a manufacturing process, e.g., when some of the polyester fibers consumed during the manufacture of nonwoven fiber batts for use in bedding products are wasted, for example, when untangling a newly formed nonwoven fiber web or trimming edges of a newly formed nonwoven fiber batt. Similarly, some cotton fibers are wasted during yarn spinning processes. In another example, consumer products formed from a single type of fiber, for example, the 100% polyester fiber batts used in some bedding materials, may be collected for recycling. Whether comprised of a single fiber type or plural fiber types, shoddy material is generally cleaned and shredded to form a homogeneous blend of fibers prior to being formed into a shoddy nonwoven fiber batt suitable for use as the recycled energy absorbing layer **52**. Further details of the process by which a nonwoven fiber batt suitable for use as the recycled energy absorbing layer **52** is formed will be described later with respect to FIGS. **4**, **5**, **6**A and **6**B.

[0037] When a foam pad is employed as the recycled energy absorbing layer **52**, the foam pad is typically formed from bonded foam-foam comprised of a plurality of recycled foam pieces bonded to one another. The recycled foam pieces may be acquired from a variety of sources, including manufacturing processes in which foam is wasted during the formation of prime or bond foam pads, for example, while trimming edges of newly formed prime foam or bond foam pads. Used carpet pads that have been collected for recycling purposes is another source of the recycled foam pieces used to form the bonded foam pads. The foam pieces are preferably polyurethane foam, but may also be other materials such as latex foam, polyvinyl chloride (PVC) foam, or any other polymeric foam.

[0038] The moisture barrier **54** is a thin layer of material that is attached or otherwise laminated onto the recycled energy absorbing layer **52**. As its name implies, the moisture barrier **54** is formed from a material that is impervious to liquid moisture and moisture vapor. Alternatively, the moisture barrier **54** may be permeable with respect to moisture vapor, but impervious to liquid moisture. Such moisture barriers **54** are advantageous because they discourage the transmission of liquid moisture across the energy absorptive/moisture resistive underlayment **50** yet allow the energy absorptive/moisture resistive underlayment **50** to "breathe." In the alternative, the moisture barrier **54** may be configured such that it includes a hydrophobic side and a hydrophilic side. If so, the moisture barrier **54** would encourage the migration of moisture in one direction but not in the opposite direction.

[0039] The moisture barrier **54** is typically a polymeric film, such as polyethylene or ethylene vinyl acetate (EVA) copolymer. An example of a suitable film is 150 gauge low density polyethylene film weighing 35 grams per square meter, available from numerous manufacturers including The Dow Chemical Company of Midland, Mich. and E.I. du Pont de Nemours and Company of Wilmington, Del. Alternatively, the moisture barrier **54** may be a layer of closed cell foam, such as a styrene butadiene rubber (SBR), latex, or PVC foam. By definition, closed cell foam has too few interconnecting cells to allow the transmission of bulk fluids through the foam. The formulation of a typical closed cell foam is disclosed in U.S. patent application Ser. No. 10/306,271 filed Nov. 27, 2002 to Brodeur et al., entitled "Moisture Barrier and Energy Absorbing Cushion," assigned to the Assignee of the present application and hereby incorporated by reference as if reproduced in its entirety. A number of other moisture barriers **54** are commercially available, any one of which may be suitable for use with the recycled energy absorptive/moisture resistive underlayment **50**.

[0040] While the recycled energy absorptive/moisture resistive underlayment **50** is described in conjunction with a hard flooring system, it is fully contemplated that the recycled energy absorptive/moisture resistive underlayment **50** can be used as an underlayment for any type of flooring system. As used herein, the term "flooring system" refers to any type of flooring used in combination with an underlayment. The term "flooring" includes both soft flooring and hard flooring. As used herein, the term "soft flooring" refers to non-rigid flooring products such as carpets and rugs while the term "hard flooring" refers to rigid flooring products such as ceramic tile, linoleum, vinyl, wood flooring, and laminate flooring. Hard floorings typically require an underlayment with a moisture barrier that keeps moisture from migrating from the subfloor into the hard flooring layer. Moisture in the hard flooring is not preferred because the moisture tends to warp, rot, or delaminate the hard flooring. As used herein, the term "laminate flooring" describes any flooring product that contains various layers attached or otherwise laminated together and includes laminated pressboard, paper, wood particles, and the like. The term "laminate flooring" also includes ceramic tile or other flooring attached to laminated pressboard, paper, or wood particles, and the like. Examples of laminate flooring are the products sold under the names PERGO® by Pergo AB of Stockholm, Sweden laminate flooring and EDGE GTL™ by Edge Flooring of Dalton, Ga.

[0041] It is further contemplated that the orientation of the recycled energy absorptive/moisture resistive underlayment **50** relative to the subfloor and flooring may be varied. For example, the recycled energy absorptive/moisture resistive underlayment **50** may be oriented such that the moisture barrier **54** is positioned above the energy absorbing layer **52** and adjacent the hard flooring or oriented such that the moisture barrier layer **54** is positioned below the energy absorbing layer **52** and adjacent the subfloor. It should be readily appreciated that the recycled energy absorptive/moisture resistive underlayment illustrated in FIG. **1** may be used in either of the aforementioned orientation. Typically, the orientation of the recycled energy absorptive/moisture resistive underlayment **50** is determined during the installation or the hard flooring system. For example, if the recycled energy absorptive/moisture resistive underlayment **50** is oriented such that the moisture barrier **54** faces the subfloor, the moisture barrier **54** will prevent the migration of moisture from the subfloor into the energy absorbing layer and the hard flooring. Such an orientation is particularly well suited for the installation of hard flooring systems in basements and onto slab foundations directly. Alternatively, if the recycled energy absorptive/moisture resistive underlayment **50** is placed such that moisture barrier **54** faces the hard flooring, the moisture barrier **54** prevents the migration of moisture from the hard flooring into the recycled energy absorbing layer **52**. Such an orientation is particularly well suited for the installation of hard flooring systems in upper floors. It should be clearly understood, however, that the orientation of the moisture barrier **54** relative to the recycled energy absorbing layer **54** within any particular recycled energy absorptive/moisture resistive underlayment **50** and associated hard flooring system may vary from the foregoing based upon any number of considerations unique to that particular hard flooring system.

[**0042**] Rather than the recycled energy absorptive/moisture resistive underlayment having a moisture barrier laminated on one side of the recycled energy absorbing layer which is illustrated in FIG. **1**, it is contemplated that the recycled energy absorptive/moisture resistive underlayment may instead be configured such that a moisture barrier is laminated on both sides of the recycled energy absorbing layer. Such an alternate configuration for a recycled energy absorptive/moisture resistive underlayment is illustrated in FIGS. **2**A-B. As may now be seen, a recycled energy absorptive/moisture resistive underlayment **50'** is comprised of a recycled energy absorbing layer **52'** having a first moisture barrier **54-1** laminated onto a first side surface **52***a*' of the recycled energy absorbing layer **52'** and a second moisture barrier **54-2** Laminated onto a second side surface **52***b*' of the recycled energy absorbing layer **52'**. As before, the recycled energy absorbing layer **52'** is formed from a selected type of recycled materials, typically, either a non-woven fiber batt formed from shoddy fibers or a foam pad formed from bonded foam. In the embodiment illustrated in FIGS. **2**A-B, however, the recycled energy absorbing layer **52'** is comprised of a foam pad formed from bonded foam.

[**0043**] By being configured such that moisture barriers are laminated on first and second side surfaces of the recycled energy absorbing layer, it is contemplated that the recycled energy absorptive/moisture resistive underlayment **50'** illustrated in FIGS. **2**A-B will enjoy the benefits of both embodiments described hereinabove, specifically, those benefits which result from placement of the moisture barrier between the subfloor and the recycled energy absorbing layer and those benefits which result from placement of the moisture barrier between the recycled energy absorbing layer and the hard flooring. It is contemplated that the alternate configuration illustrated in FIGS. **2**A-B is particularly desirable when the recycled energy absorbing layer **52'** contains greater amounts of absorbent materials as such materials tend to more readily absorb moisture into the recycled energy absorbing layer **52'**, thereby promoting the growth of mildew, mold, fungus, and/or microbes. Accordingly, it is further contemplated that the recycled energy absorptive/moisture resistive underlayment **50'** may also contain an antimicrobial additive to discourage the growth of mildew, mold, fungus, and microbes, particularly when the recycled energy absorbing layer **52'** is formed using greater amounts of absorbent materials. Two examples of an antimicrobial, antifungal, or similar additives suitable for the purposes contemplated herein are the Sanitized™ and Actigard™ product lines available from Sanitized AG of Burgdorf, Switzerland or other antimicrobial product line suitable for use in bonded foam products. The incorporation of an antimicrobial, antifungal, or similar additive to an underlayment is described in U.S. patent application Ser. No. 10/840, 309 filed May 6, 2004, entitled "Anti-Microbial Carpet Underlay and Method of Making", assigned to the Assignee of the present application and hereby incorporated by reference as if reproduced in its entirety.

[**0044**] In still another alternate embodiment not shown in the drawings, it is further contemplated that the recycled energy absorptive/moisture resistive underlayment can be configured without a moisture barrier laminated onto either of the side surfaces of the recycled energy absorbing layer. It is contemplated that lower production costs for the recycled energy absorptive/moisture resistive underlayment would be achieved if the recycled energy absorbing layer were manufactured without a moisture barrier laminated thereto. In this regard, it is noted that the moisture barrier may be unnecessary for certain applications in which discouraging the migration of moisture is not of particular concern. For example, in dry climates such as the southwest United States, moisture is not as problematic as in coastal and other humid regions of the country. As a result, the need for a moisture barrier is not as great in these areas. In addition, multi-story homes may not require a moisture barrier on the upper floors because the migration of moisture from the subfloor is typically limited to the bottom floor of the residence. Accordingly, the need for a moisture barrier may be less for those underlayments to be installed on upper floors. Consequently, in some applications, it is contemplated that the moisture barrier may be eliminated from the manufacturing process described herein, thereby reducing the production costs of the recycled energy absorptive/moisture resistive underlayment and, in turn, making the recycled energy absorptive/moisture resistive underlayment less expensive and, as a result, more appealing to consumers.

[**0045**] Returning to FIG. **2**A, in a still further alternative embodiment, the recycled energy absorptive/moisture resistive underlayment **50'** can be configured to still further enhance the moisture resistance thereof. In the embodiment illustrated in FIG. **1**, the recycled energy absorptive/moisture resistive underlayment **50** is configured such that the recycled energy absorption layer **52** and the moisture barrier **54** have generally equal surface areas and are aligned on all four edge surfaces thereof. For example, edge surface **52***c* of the recycled energy absorbing layer **52** is aligned with edge surface **54***c* of the moisture barrier **54**. In the embodiment illustrated in FIG. **2**, however, the second moisture barrier **54-2** is formed to include a projecting side flap **56** that results in edge surfaces **54-2***c* and **54-2***d* of the second moisture barrier **54-2** to extend past the corresponding edge surfaces **52***c*' and **52***d*' of the recycled energy absorbing layer **52'**. Preferably, the projecting side flap **56** is sized such that the edge surface **54-2***c* of the second moisture barrier **54-2** is about 4 inches beyond the edge surface **52***c*' of the recycled energy absorbing layer **52'** and the edge surface **54-2***d* of the second moisture barrier **54-2** is about 4 inches beyond the edge surface **52***d*' of the recycled energy absorbing layer **52'**.

[**0046**] The advantage of configuring the second moisture barrier **54-2** to include the projecting side flap **56** is readily apparent when one considers that an underlayment is rarely, if ever, installed in one section. For example, the recycled energy absorptive/moisture resistive underlayment **50'** illustrated in FIG. **2**A is comprised of a first section **51-1** and a second section **51-2**, each having a edge surface which abuts the edge surface of the other. By configuring the energy absorptive/moisture resistive underlayment **50'** such that the second moisture barrier **54-2** includes the projecting side flap **56**, the second, subsequently installed, section **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'** is positioned, relative to the first, previously installed, section **51-1** of the recycled energy absorptive/moisture resistive underlayment **50'** such that a portion of the second moisture barrier **54-2** of the second section **51-2** extends underneath a portion of the first moisture barrier **54-1** of the first section **51-1**, thereby creating an overlapping moisture barrier at seam **53** which separates the first section **51-1** of the recycled energy absorptive/moisture resistive underlayment **50'** from the second section **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'**.

[**0047**] It is contemplated that an overlapping moisture barrier is advantageous over a non-overlapping moisture barrier in that the overlapping moisture barrier is better equipped to prevent moisture from circumventing the moisture barrier at the seam separating two sections of underlayment. Thus, the overlapping moisture barrier is additional assurance that the moisture barrier will discourage the migration of moisture from the subfloor to the hard flooring. It is contemplated that, if the moisture barrier is laminated onto a lower side surface of the recycled energy absorbing layer, the weight of the recycled energy absorbing layer will be sufficient to hold the projecting flap in place. If, however, the moisture barrier is laminated onto an upper side surface of the recycled energy absorbing layer, it is contemplated that tape may be used to secure the projecting flap in place. However, regardless as to which moisture barrier includes the projecting flap, it is further contemplated that the subsequently installed section **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'** is secured to the previously installed section **51-1** of the recycled energy absorptive/moisture resistive underlayment **50'** using a strip **58** of tape placed over the seam **53** between the first and second sections **51-1** and **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'**.

[**0048**] Continuing to refer to FIG. **2**A, the installation of a flooring system **49** comprised of the recycled energy absorptive/moisture resistive underlayment **50'** and a hard flooring **60** will now be described briefly. FIG. **2**A is a perspective view of a corner of a room where the recycled energy absorptive/moisture resistive underlayment **50'** has been installed between a subfloor **62** and the hard flooring **60**. As previously set forth, the recycled energy absorptive/moisture resistive underlayment **50'** may be installed with either the moisture barrier abutting the hard flooring **60**, with the moisture barrier abutting the subfloor **62** or, as illustrated in FIG. **2**A, with a first moisture barrier **54-1** abutting the hard flooring **60** and a second moisture barrier **54-2** abutting the subfloor **62**. As previously set forth, the recycled energy absorptive/moisture resistive underlayment **50'** is configured such that the second moisture barrier **54-2** includes the projecting flap **56**. As indicated by the phantom line appearing in FIG. **2**A, the projecting flap **56** of the second moisture barrier **54-2** of the second section **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'** is covered by the second moisture barrier **54-2** of the first section **51-1** of the recycled energy absorptive/moisture resistive underlayment **50'**.

[**0049**] When installing the second, subsequent, section **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'**, the installer places the subsequent section **51-2** of the recycled energy absorptive/moisture resistive underlayment **50'** directly adjacent to the first, previously installed, section **51-1** of the recycled energy absorptive/moisture resistive underlayment **50'**. If the second moisture barrier **54-2** of the subsequently installed section **51-2** includes a projecting flap **56**, the previously installed section **51-1** is pulled up so that the projecting flap **56** may be laid on the subfloor **62**. The previously installed section **51-1** is then placed such that the second moisture barrier **54-2** of the previously installed section **51-1** covers the projecting flap **56** of the second moisture barrier **54-2** of the subsequently installed section **51-2**. The previously and subsequently installed sections **51-1** and **51-2** are then secured in place with the strip **58** of tape. After the recycled energy absorptive/moisture resistive underlayment **50'** has been installed over the subfloor **62**, the hard flooring **60** is installed on top of the recycled energy absorptive/moisture resistive underlayment **50**, thereby completing assembly of the hard flooring system **49**. Variously, the seams of the hard flooring **60** may run parallel, perpendicular, diagonally, or any other orientation with respect to the seams **53** of the recycled energy absorptive/moisture resistive underlayment **50'**.

[**0050**] In an alternative embodiment of the installation process, an additional section of moisture barrier (not shown in FIG. 2A) may be installed under the lower and edge surfaces of the recycled energy absorptive/moisture resistive underlayment **50'** where the subfloor **62** meets the walls **63**. By doing so, the additional section of moisture barrier extends underneath the second moisture barrier **54-1** and up along the walls **63** of the room. If the recycled energy absorptive/moisture resistive underlayment **50'** is configured with the projecting flap **56**, the projecting flap **56** can be used to extend up along the wall **63** by simply bending the projecting flap **56** so that it engages the wall **63**. The additional section of moisture barrier extending up along the walls **63** may be concealed using trim (not shown) after the hard flooring **60** has been installed over the recycled energy absorptive/moisture resistive underlayment **50'**. By configuring the hard flooring system **49** so that the second moisture barrier extends upward along the walls **63**, the hard flooring **60** is protected from moisture migrating from the subfloor **62** along the edge surfaces of the recycled energy absorptive/moisture resistive underlayment **50'**

[**0051**] The use of the projecting flaps **56** and/or the additional section of moisture barrier to enhance the protection of the recycled energy absorbing layer from moisture will now be more fully described with respect to FIG. 2B. As may now be seen, the recycled energy absorptive/moisture resistive underlayment **50'** has been installed above the subfloor **62** of a room. The recycled energy absorptive/moisture resistive underlayment **50'** is comprised of plural underlayment sections **51-1** through **51**-X which enable the recycled energy absorptive/moisture resistive underlayment **50'** to extend from a first wall **63***a* of the room to a second wall **63***b* thereof. Each underlayment section **51-1** through **51**-X' is comprised of a recycled energy absorbing layer **52** formed from bonded foam. The recycled energy absorbing layer has a first side surface **52***a* on which a first moisture barrier **54-1** has been laminated and a second side surface **54***a* on which a second moisture barrier **54-2** has been laminated. Each of the second moisture barriers **54-2** includes a projecting flap **56** which extends beyond an edge surface **52***c* of the recycled energy absorbing layer **52** to which the second moisture barrier **54-2** is laminated. As a result, the projecting flaps **56** may be easily repositioned relative to the recycled energy absorbing layer **52** to which it is attached.

[0052] The edge surface **52***c* of the recycled energy absorbing layer **52** of the first underlayment section **51-1** is positioned to abut the wall **63***a*. The projecting flap **56** is bent at a 90° angle relative to the subfloor **62** so that it separates the wall **63***a* from the edge surface **52***c* of the recycled energy absorbing layer **52** which, absent the projecting flap **56**, would engage the wall **63***a*. As a result, the projecting flap **56** enhances the protection of the recycled energy absorbing layer **52** of the first underlayment section **51-1** from moisture migrating from the subfloor **62** along the wall **63***a* since, absent the projecting flap **56**, the edge surface **52***c* of the recycled energy absorbing layer **52** would be unprotected by any type of moisture barrier.

[0053] The edge surface **52***c* of the recycled energy absorbing layer **52** of the second underlayment section **51-2** is positioned to abut the edge surface **52***d* of the recycled energy absorbing layer **52** of the first underlayment section **51-1**, thereby forming seam **53** separating the first and second underlayment sections **51-1** and **51-2**. Here, however, the projecting flap **56** of the second moisture barrier **54-2** of the second underlayment section **51-2** extends along a portion of the subfloor **62** beyond the edge surface **52***c* of the second underlayment section **51-2** to which the second moisture barrier **54-2** is laminated. For that portion of the subfloor **63** for which the second moisture barrier **54-2** of the first underlayment section **51-1** and the projecting flap **56** of the second underlayment section **51-2** overlap, the second moisture barrier **54-2** of the first underlayment section **51-1** extends over the projecting flap **56** of the second moisture barrier **54-2** of the second underlayment section **51-2**. However, as the projecting flap **56** is relatively thin compared to the first underlayment section **51-1** as a whole, no other displacement of the first underlayment section **51-1** results from the second moisture barrier **54-2** of the first underlayment section **51-1** extending over the projecting flap **56** of the second moisture barrier **54-2** of the second underlayment section **51-2** instead of the subfloor **62**. By covering the seam **53** separating the first and second underlayment sections **51-1** and **51-2**, the projecting flap **56** of the second underlayment section **51-2** enhances the protection of the recycled energy absorbing layer **52** of both the first and second underlayment sections **51-1** and **51-2** from moisture migrating from the subfloor along the seam **53** between the first and second underlayment sections **51-1** and **51-2**.

[0054] The edge surface **52***d* of the recycled energy absorbing layer **52** of the underlayment section **51**-X is positioned to abut the wall **63***b*. As no projecting flap extends from the second moisture barrier **54-2** laminated to recycled energy absorbing layer **52** of the underlayment section **51**-X, an additional moisture barrier **59** is inserted between the edge surface **52***d* of the recycled energy absorbing layer **52** and the wall **63***b*. The moisture barrier **59** is sized to extend, along the wall **63***b*, from the subfloor **62** to above the first moisture barrier **54-1** of the underlayment section **51**-X and is preferably formed of a moisture resistive material similar to that use to form the first and second moisture barriers **54-1** and **54-2**. For ease of handling and installation, however, it is preferred that the moisture barrier **59** be somewhat thicker than the first and second moisture barriers **54-1** and **54-2**. The moisture barrier **59** separates the wall **63***b* from the edge surface **52***d* of the recycled energy absorbing layer **52** of the underlayment section **51**-X. As a result, the moisture barrier **59** enhances the protection of the recycled energy absorbing layer **52** of the underlayment section **51**-X from moisture migrating from the subfloor **62** along the wall **63***b* since, absent the moisture barrier **59**, the edge surface **52***d* of the recycled energy absorbing layer **52** of the underlayment section **51**-X would be unprotected by any type of moisture barrier.

[0055] In one aspect, it is contemplated that the moisture barrier **59** be configured such that it extends along the wall **63***b*, bends at a 90° angle at the juncture of the wall **63***b* and the subfloor **62** and then extend along a portion of the subfloor **62**. Such a configuration would further enhance the protection of the recycled energy absorbing layer **52** of the underlayment section **51**-X as the seam between the second moisture barrier **54-2** and the moisture barrier **59** would be protected in a manner similar to that protecting the seam **53** between the first and second underlayment sections **51-1** and **51-2**. To configure the moisture barrier **59** in this manner, however, the moisture barrier **59** would need to be relatively flexible so that it can bend in the aforedescribed manner at the juncture of the wall **63***b* and the subfloor **62**.

[0056] Referring next to FIG. **3**, still another alternative embodiment of the hard flooring system **49** may now be seen. In this embodiment, the recycled energy absorptive/moisture resistive underlayment **50** is fixedly secured to a lower side surface **60***a* of the hard flooring **60**. It is contemplated that, in many cases, securing the recycled energy absorptive/moisture resistive underlayment **50** to the lower side surface **60***a* of the hard flooring **60** is considered advantageous because it combines the installation of the recycled energy absorptive/moisture resistive underlayment **50** onto a subfloor and the installation of the hard flooring **60** onto the recycled energy absorptive/moisture resistive underlayment **50**. By utilizing the embodiment illustrated in FIG. **3**, the user can install the recycled energy absorptive/moisture resistive underlayment **50** and the hard flooring layer **60** in substantially less time than if the user was required to separately install the energy absorptive/moisture resistive underlayment **50** and the hard flooring layer **60**.

[0057] As before, the recycled energy absorptive/moisture resistive underlayment **50** is comprised of a recycled energy absorbing layer to which a moisture barrier is laminated to either the lower side surface, the upper side surface, both of the lower and upper side surfaces or to neither the lower nor the upper side surfaces. Again, as before, the recycled energy absorbing layer may be comprised of a nonwoven fiber batt formed from shoddy fibers or a foam pad formed from bonded foam. To enhance the protection of the recycled energy absorbing layer from moisture migrating from the subfloor, it is contemplated that the recycled energy absorptive/moisture resistive underlayment may be configured such that the second moisture barrier laminated to a lower side surface of the recycled energy absorbing layer include one or more projecting flaps similar in design to the projecting flaps described with respect to FIGS. **2**A-B. To further enhance the protection of the recycled energy absorbing layer from moisture migrating from the subfloor, it is further contemplated that the hard flooring system **49** may be further configured to include an additional section of moisture resistive material, again, similar to that previously described with respect to FIGS. **2**A-B.

[0058] Referring next to FIG. **4**, a first method **66** for manufacturing the energy absorptive/moisture resistive underlayment **50** will now be described in greater detail. As will be more fully described below, the method **66** is a process in which shoddy material is processed to yield recycled fibers for use in forming a nonwoven fiber batt which serves as the energy absorbing layer of the energy absorptive/moisture resistive underlayment **50**. As may now be seen, the method **66** includes providing shoddy material at **68**, processing the shoddy material into recycled fibers at **70**, blending the recycled fibers at **72**, forming a web from the recycled fibers at **74**, coating the web with a resin at **76**, needle punching the web at **78**, compressing the web at **80**, heating the web to form a nonwoven fiber batt at **82**, cooling the nonwoven fiber batt at **84**, trimming the nonwoven fiber batt at **86** and laminating a moisture barrier onto the nonwoven fiber batt at **90** to complete formation of the energy absorptive/moisture resistive underlayment **50**. If it is desired to attach the newly formed energy absorptive/moisture resistive underlayment **50** to the hard flooring layer **60** in the manner illustrated in FIG. **3**, then the method **66** further comprises further includes laminating or otherwise adhering the energy absorptive/moisture resistive underlayment **50** to the hard flooring **60**.

[0059] The method **66** will now be described in greater detail. The method **66** commences at **68** with the acquisition of sufficient shoddy material to form the desired energy absorbing layer **52** of the energy absorptive/moisture resistive underlayment **50**. It is contemplated that the acquisition of shoddy material at **68** will encompass the acquisition of previously formed nonwoven fiber batts, including carpet underlayments which themselves are typically formed from recycled and/or waste fibers. It is further contemplated that the acquisition of shoddy material at **66** will further encompass the purchase of bales of recycled fibers from another. It is also contemplated that the acquisition of shoddy material at **66** will further encompass the collection of waste fibers and/or nonwoven fibers at a processing line such as processing line **110** of FIG. **5**. For example, loose fibers which would otherwise be disposed of as waste materials may be collected at various stations of the processing line **110** such as at cross-lappers **116'**, **117'** and/or **118'**. Additionally, scrap materials are produced at cutting zone **180** where selected portions of the newly formed nonwoven fiber batt are trimmed from the edges of the nonwoven fiber batt.

[0060] After acquiring the shoddy material to be used to form the energy absorbing layer **52** of the energy absorptive/moisture resistive underlayment **50** at **68**, the method **66** continues with the processing of the acquired shoddy material into recycled fibers at **70**. Variously, it is contemplated that processing of the shoddy material into recycled fibers at **70** may include shredding shoddy material acquired in the form of nonwoven fiber batts into loose fibers and/or cleaning loose fibers to remove contaminants therefrom. If the recycled fibers have already been baled, processing of the shoddy material into recycled fibers at **70** shall also encompass the use of a bale breaker to literally break the bale into loose fibers.

[0061] The method **66** shall now be further described with respect to FIG. **5**. As may now be seen, FIG. **5** is a schematic top plan view of a processing line **110** suitable for constructing the energy absorbing layer **52** of the energy absorptive/moisture resistive underlayment **50**. Thus, the processing line performs **72** through **86** of the method **66**. At **72**, a homogeneous blend of the recycled fibers is produced by blending the fibers together in a fiber blender **112**. Of course, depending on the homogeneity of the recycled fibers produced at **70** and/or the desired homogeneity of the blend of recycled fibers to be formed into the energy absorbing layer **52**, blending of the recycled fibers at **72** of method **66** and the corresponding use of the fiber blender **112** may be omitted.

[0062] A suitably homogeneous blend of recycled fibers is then transported by conveyor pipes **114** from the fiber blender **112** or other source of recycled fibers to a web forming device, in this example, first, second and third web-forming devices **116**, **117** and **118**, for formation of a fiber web therefrom. Variously, the recycled fibers transported to the web-forming devices **116**, **177** and **118** are natural fibers such as cotton or wool, synthetic fibers such as polyester or polypropylene, a mixture of different types of natural fibers, a mixture of different types of synthetic fibers or a mixture of one or more types of nature fibers and one or more synthetic fibers. As disclosed herein, each of web-forming devices **116**, **117** and **118** is a garnett machine. Of course, an air laying machine, known in the trade as a Rando webber, or another suitable type of machine can be employed as the web-forming devices **116**, **117** and **118**.

[0063] The garnett machines **116**, **117** and **118** card the homogeneous blend of recycled fibers into a recycled fiber web having a desired width at **74** of the method **66**. The recycled fiber web is then transported to a cross lapper, or, as disclosed herein, first, second and third cross-lappers **116'**, **117'** and **118'** where the recycled fiber web is cross-lapped onto a slat conveyor **120** moving in the machine direction. The cross-lappers **116'**, **117'** and **118'** reciprocate back and forth in the cross direction from one side of the conveyor **120** to the other side such that the thickness of the recycled fiber web increases as the cross-lappers **116'**, **117'** and **118'** cause the recycled fiber web to repeatedly overlap itself, thereby layering the recycled fiber web. The number of layers that make up the recycled fiber web is determined by the speed of the conveyor **120** relative to the speed at which successive layers of the web are layered on top of each other and the number of cross-lappers **116'117'**, and **118'**. Thus, the number of layers which make up the recycled fiber web can be increased by slowing the relative speed of the conveyor **120** relative to the speed at which the cross-lappers **116'**, **117'** and **118'** layer the recycled fiber web on top of itself, by increasing the number of cross-lappers **116'**, **117'** and **118'**, or both. Conversely, the number of layers which make up the recycled fiber web can be decreased by increasing the speed of the conveyor **120** relative to the speed of at which the cross-lappers **116'**, **117'** and **118** layer the recycled fiber web on top of itself, by decreasing the number of cross-lappers **116'**, **117'**, and **118'**, or both. As disclosed herein, it is contemplated that the number of layers in the recycled fiber web may vary based upon the desired characteristics of the energy absorbing layer **52** and/or the energy absorptive/moisture resistive underlayment **50**. As a result, the speed of the conveyor **120** relative to the speed at which successive layers of the web are layered on top of one another by the cross-lappers **116'**, **117'** and **118'** and the number of cross-lappers **116'**, **117'** and **118'** for forming the web may vary accordingly.

[0064] Proceeding to **76** of method **66**, a heat curable resin is applied to the recycled fiber web by a resin applicator **122**. While there are a variety of techniques suitable for applying resins onto the web, most commonly, either a liquid resin is sprayed or a froth resin is extruded onto the recycled fiber web. More specifically, as the recycled fiber web moves along the conveyor **120** in the machine direction, the liquid resin is sprayed onto the recycled fiber web by one or more spray heads (not shown in FIG. **5**) that move in a transverse or cross direction to substantially coat the recycled fiber web. Alternatively, the froth resin can be extruded onto the recycled fiber web using a knife or other means. In still another alternative, the recycled fiber web may either be fed through or dipped into a resin bath. The recycled fiber web is then saturated with the applied resin by crushing the resin into the recycled fiber web using nip rollers (not shown in FIG. **5**), disposed along the transverse direction of the conveyor **122**, which apply pressure to the surface of the recycled fiber web. Finally, in still another alternative, the resin may be crushed into the recycled fiber web by applying vacuum pressure through the recycled fiber web.

[**0065**] It is contemplated that a heat curable resin would be suitable for the purposes disclosed herein. It is further contemplated that the any one of a variety of heat curable resins would be suitable. While the heat curable resin would typically be comprised of polyvinyl acetate, the heat curable resin may be a polymeric composition such as vinylidene chloride copolymer, latex, acrylic or other suitable chemical compound. For example, one heat curable resin suitable for the purposes disclosed herein is sold under the name SARAN 506 by the Dow Chemical Company of Midland, Mich. If desired, the resin may contain antimicrobial, anti-fungal, or hydrophobic additives, all of which would enhance the properties of the energy absorbing layer **52** formed by the method **66**.

[**0066**] After saturating the recycled fiber web with resin at **76**, the method **66** proceeds to **78** where the conveyer **120** transports the recycled fiber web to a needle loom **124**. Using a needle-punching process well known in the art, the needle loom **124** increases the density of the recycled fiber web. More specifically, the needle loom **124** bonds the recycled fibers of the recycled fiber web by mechanically entangling the recycled fibers within the web. To do so, the needle loom **124** includes a needle board containing a plurality of downwardly-facing barbed needles arranged in a non-aligned pattern. The barbs on the needles are positioned such that they capture fibers when the needle is pressed into the web, but do not capture any fibers when the needle is removed from the web. A variety of needles suitable for the purposes disclosed herein are offered by the Foster Needle Company, Incorporated of Manitowoc, Wis. As disclosed herein, use of the needle loom **124** provides mechanical compression of the recycled fiber web prior to the vacuum and/or mechanical compression of the recycled fiber web to be applied within housing **130** in the manner described hereinbelow. It should be fully understood, however, that the needle punching process described herein may be unnecessary if adequate compression of the recycled fiber web can be obtained by the vacuum and/or mechanical compression applied within the housing **130**. Similarly, it should be equally understood that, if adequate compression of the recycled fiber web using the needle loom **124**, the vacuum and/or mechanical compression applied to the recycled fiber web within the housing **130**, may be unnecessary and the housing **130** may be employed solely as an oven or other device which heats the compressed recycled fiber web.

[**0067**] After using the needle loom **124** to needle punch the recycled fiber web at **78**, the method **66** proceeds on to **80** and **82** for a generally simultaneous compressing and heating of the recycled fiber web. To do so, the conveyor **120** transports the recycled fiber web to housing **130** where vacuum pressure applied through perforations (not shown) in first and second counter rotating drums **140** and **142** positioned in a central portion of the housing **130**. The first and second counter rotating drums **140** and **142** heat the web to the extent necessary to cure the resin saturating the recycled fiber web. For example, heating the recycled fiber web to a temperature in the range of 225 to 275° F. for three to five minutes is suitable for the purposes disclosed herein. Alternatively, the recycled fiber web may be transported through an oven by substantially parallel perforated or mesh wire aprons that mechanically compress the recycled fiber web and simultaneously cure the resin saturating the recycled fiber web.

[**0068**] As the compressed and heated recycled fiber web exits the housing **130**, the method **66** proceeds to **84** where the recycled fiber web is cooled while the pressure applied on the recycled fiber web is maintained by a pair of substantially parallel wire mesh aprons **170**, only one of which is visible in FIG. **5**. The aprons **170** are mounted for parallel movement relative to each other to facilitate adjustment of the recycled fiber web to a wide range of web thicknesses. Variously, the recycled fiber web can be cooled slowly through exposure to ambient temperature air or, in the alternative, ambient temperature air can be forced through the perforations of one apron **170**, the recycled fiber web and the perforations of the other apron **170**, thereby cooling the recycled fiber web. By continuing to compress the recycled fiber web during the cooling process, the recycled fiber web becomes set in its compressed state. The recycled fiber web is maintained in its compressed state upon cooling since the solidification of the resin bonds the fibers together in that state. After being set in its compressed state, the recycled fiber web may now be characterized as a recycled fiber batt.

[**0069**] It is contemplated that a variety of resin bonding techniques are suitable for the purposes disclosed herein. One such technique may be seen by reference to FIG. **6**A. Here, the recycled fiber web is compressed by vacuum pressure generated using the counter-rotating drums **140**, **142**. As may now be seen, positioned in a central portion of the housing **130** are counter-rotating drums **140**, **142** having perforations **141**, **143**, respectively. Additionally, an air circulation chamber **132** is positioned in an upper portion of the housing **130** while a furnace **134** is positioned in a lower portion thereof. The drum **140** is positioned adjacent an inlet **144** though which the recycled fiber web is fed by an infeed apron **146**. A suction fan **150** is positioned in communication with the interior of the drum **140**. The lower portion of the circumference of the drum **140** is shielded by a baffle **151** positioned inside the drum **140** such that the suction-creating air flow is forced to enter the drum **140** through the perforations **141**, which are proximate the upper portion of the drum **140**, as the drum **140** rotates.

[**0070**] The drum **142** is downstream from the drum **140** in the housing **130**. The drums **140**, **142** can be mounted for lateral sliding movement relative to one another to facilitate adjustment for a wide range of web thicknesses (not shown). The drum **142** includes a suction fan **152** that is positioned in communication with the interior of the drum **142**. The upper portion of the circumference of the drum **142** is shielded by a baffle **153** positioned inside the drum **142** so that the suction-creating air flow is forced to enter the drum **142** through the perforations **143**, which are proximate the lower portion of drum **142**, as the drum **142** rotates. The recycled fiber web fed into the housing **130** by the infeed apron **146** is held in vacuum pressure as it moves from the upper portion of the rotating drum **140** to the lower portion of the counter rotating drum **142**. The furnace **134** heats the air in the housing **130** as it flows from the perforations **141**, **143** to the interior of the drums **140**, **142**, respectively, to cure the resin in the web to the extent necessary to bind together the fibers in the web.

[**0071**] Referring to FIG. **6**B, in an alternative resin bonding process, the recycled fiber web is fed into the housing **130'** where a pair of substantially parallel perforated or mesh wire aprons **160**, **162** compress the recycled fiber web to the desired extent. As the compressed recycled fiber web is transported through the housing **130'**, oven **134'** that the compressed recycled fiber web to cure the resin to the extent necessary to bind the fibers in the web together.

[**0072**] Collectively referring next to FIGS. **4**, **5**, **6**A and **6**B, the method **66** continues to **84** where a pair of substantially parallel first and second perforated or wire mesh aprons **170** and **172** maintain the recycled fiber web in the compressed state while the recycled fiber web is cooled to solidify the bonds formed between the fibers by the resin. Preferably, the aprons **170** and **172** are mounted for parallel movement relative to each other to facilitate adjustment for a wide range of web thicknesses (not shown). The web can be cooled slowly through exposure to ambient temperature air or, in the alternative, ambient temperature air can be forced through the perforations of one apron, through the web and through the perforations of the other apron to cool the web and set it in its compressed state. The web is maintained in its compressed form upon cooling since the resin bonds the fibers together in the compressed state.

[**0073**] The method **66** proceeds on to **86** where the recycled fiber web (which, after being set in the compressed state by the cooling process, shall now be referred to as a recycled fiber batt) is transported to cutting zone **180** where the lateral edges of the recycled fiber batt are trimmed to a desired width. The recycled fiber batt is then cut transversely to a desired length.

[**0074**] In an alternate embodiment it is contemplated that thermal bonding may be used to bond the recycled fiber batt together in lieu of the resin bonding method described herein. Thermal bonding uses low-melt binder fibers to bind the fibers together. Low-melt binding fibers do not actually melt as the term is generally understood. Instead, the low-melt binder fibers become sticky or tacky when heated to a certain temperature. If the recycled fiber batt is to be thermally bonded, the low-melt binder fibers are blended with the recycled fibers to make a homogeneous fiber blend of recycled fibers and low-melt binder fibers. The fiber blend is then carded into a recycled fiber web as described above. It is not necessary to apply a resin to the recycled fiber web if the web is to be thermally bonded, although, in many instances it may be desirable to do so to obtain the advantageous features of the resin set forth herein. The recycled fiber web is then needle punched, if a compression is desired prior to the generally simultaneous heating and compression thereof. The recycled fiber web is then sent to a compression and heating apparatus, such as those illustrated in FIGS. **6**A and **6**B, where the heat melts the low-melt binder fibers. The recycled fiber web is then cooled to complete formation of the recycled fiber batt and subsequently trimmed to desired dimensions, again in the same manner previously set forth with the resin-bonded embodiment of the disclosed recycled fiber batt.

[**0075**] In the thermal bonded embodiment, the recycled fiber batt is preferably formed from a homogeneous blend of binder fibers and recycled fibers. The binder fibers can be either natural or synthetic fibers. The binder fibers may also be mono-component binder fibers or bi-component binder fibers. While the homogeneous mixture of recycled fibers and binder fibers can be any of a number of suitable fiber blends, for purposes of illustrating the process and the blend, the mixture is comprised of binder finders in an amount sufficient for binding the fibers of the blend together upon application of heat at the appropriate temperature to melt the binder fibers. In one example, the binder fibers are in the range of about 5 percent to about 95 percent by total volume of the blend. Preferably, the binder finders are present in the range of about 10 percent to about 15 percent for a high-loft batt and in the range of about 15 percent to about 40 percent for a densified batt, as those characteristics are discussed below. The recycled fibers in the remaining blend volume ranges anywhere from about 5 percent to about 95 percent. Preferably, the recycled fibers are present in the range of about 85 percent to about 90 percent for a high-loft batt and in the range of about 60 percent to about 85 percent for a densified batt, as those characteristics are discussed below. Of course, the foregoing blends are provided by way of example and it is fully contemplated that other blends of binder fibers and recycled fibers are suitable for use when forming a recycled fiber batt in accordance with the techniques disclosed herein.

[**0076**] The weight per unit length of the binder fibers is also a consideration. While coarse binder fibers, e.g. those binder fibers having a weight per unit length of at least about 5 denier, are suitable for the purposes described herein, preferably the binder fibers are fine binder fibers. It is believed that a recycled fiber batt made of fine binder fibers have a lower porosity due to their ability to fill smaller void spaces within the recycled fiber batt. By filling more of the void spaces than coarse binder fibers, the use of fine binder fibers result in a recycled fiber batt characterized by better acoustical properties relative to a recycled fiber batt formed using coarse binder fibers. In various embodiments, it is contemplated that the weight per unit length of the fine binder fibers to be used in forming the recycled fiber batt shall be no greater than about 5 denier, no greater than about 3 denier or no greater than about 1 denier.

[**0077**] It is further contemplated that, in lieu of the resin or thermal bonding techniques disclosed herein, various mechanical bonding techniques may be used to bond the recycled fibers of the recycled fiber batt together. Broadly speaking, mechanical bonding is the process of bonding the fibers of a nonwoven fiber web together without the use of resins, adhesives, or heat. Examples of mechanical bonding techniques include, among others, needle punching, hydro entanglement and clustering. As previously set forth, needle punching is a technique which uses barbed needles to entangle fibers with one another. Hydro entanglement is a process uses streams of high pressure water to entangle the fibers of the nonwoven web. Clustering is the mechanical entanglement of fibers during the batt forming process. Clustering frequently uses crimped fibers or fibers that otherwise have a complex shape. It is also contemplated that the fiber batt may be manufactured using different combinations of resin bonding, mechanical bonding, and/or thermal bonding.

[0078] The use of resin in the batt is advantageous for many reasons. First, resin-bonded batts are less porous than mechanically bonded or thermally bonded batts. More specifically, the resin is able to permeate through the batt more thoroughly and effectively than fibers, such as recycled fibers or binder fibers, due to its liquid form. The decreased porosity makes the fiber batt less water permeable, gives the batt better acoustical insulating properties, and makes it easier to attach various items, such as the moisture barrier or a floor covering, to the surface of the batt. In fact, depending on the specific level of water and/or vapor permeability sought, it is possible to eliminate the need for the moisture barrier by applying a sufficient amount to resin to the fiber batt.

[0079] In the embodiment utilizing a nonwoven fiber batt as the energy absorbing layer **52**, the basis weight, density, and thickness of the underlayment are determined by, among other factors, the process of compressing the batt as it is cooled. The ratio of batt density to batt thickness generally dictates whether the underlayment is a high loft batt or a densified batt. For purposes herein, a densified energy absorbing layer has a ratio of basis weight (in ounces) per square foot to thickness (in inches) greater than approximately 2 to 1. Thus, a densified underlayment would have a density greater than approximately 1.5 pounds per cubic foot (pcf). Conversely, an underlayment having a ratio of basis weight to thickness of less than approximately 2 to 1 and a density less than 1.5 pcf are defined herein as high loft batts.

[0080] The expected amount of handling prior to installation should be a consideration when selecting the density of the fiber batt. Denser fiber batts provide better acoustical properties than less dense fiber batts. The acoustical properties of the fiber batt are important because a person of ordinary skill in the art will generally want the fiber batt to attenuate as much sound as possible. However, denser fiber batts are also less flexible than less dense fiber batts. Flexibility is important because a preferred feature of the fiber batt is the ability to be rolled up for storage, transportation, handling, and installation. Thus, when selecting the density of the fiber batt, a person of ordinary skill in the art must balance the need for acoustical performance with the need for flexibility. In various embodiments, a suitable balance for the density of the fiber batt is between about 1 pcf and about 10 pcf, between about 2 pcf and about 7 pcf, or between about 3 pcf and about 5 pcf.

[0081] Referring now to FIG. **7**, a second method **180** for manufacturing an energy absorptive/moisture resistive underlayment will now be described in greater detail. As disclosed herein, the method **180** is used to form either of the energy absorptive/moisture resistive underlayment **50-1** or the energy absorptive/moisture resistive underlayment **50-2** whenever the material to be recycled when forming the energy absorptive/moisture-resistive underlayment **50-1**, **50-2** is waste foam, for example, foam that was previously used in a product to be disposed of or scrap foam produced during the manufacture of a foam product such as the excess foam trimmed from a newly formed foam product so that it has a desired size and/or shape. As will be more fully described below, the method **180** recycles waste foam while forming an energy absorptive/moisture resistive underlayment by providing waste foam at **181**, shredding the waste foam into foam pieces at **182**, separately mixing a pre-polymer at **183**, coating the foam pieces with the pre-polymer at **184**, compressing the foam pieces into an unbonded foam log at **185**, steaming the unbonded foam log at **186**, thereby curing the pre-polymer such that bonds between the pieces of foam, thereby forming a bonded foam log from the unbonded foam log, drying the bonded foam log at **187**, coring the bonded foam log at **188**, peeling sheets of bonded foam from the bonded foam log at **189** and laminating at least one moisture barrier onto the sheets of bonded foam at **191**. If desired, the sheets of bonded foam may then be adhered or otherwise attached to the hard flooring at **192**.

[0082] The method **180** for manufacturing an energy absorptive/moisture resistive underlayment formed using recycled foam begins with a supply of waste foam, most commonly, variously sizes pieces of scrap prime foam produced by a prime foam manufacturer while trimming components formed using foam to a desired shape or size. It is fully contemplated, however, that both new and used foam are equally suitable for the purposes disclosed herein. Importantly, the size and shape of the foam to be recycled for use in the energy absorptive/moisture resistive underlayment is unimportant as the provided foam is shredded into smaller foam pieces prior to formation of a foam log therewith. Variously, the provided foam to be recycled for subsequent use in an energy absorptive/moisture resistive underlayment may be polyurethane, latex, polyvinyl chloride (PVC), or any other polymeric foam of any density. It is fully contemplated, however, that the energy absorptive/moisture resistive underlayment may instead be formed using a variety of foam compositions other than those specifically recited herein and the identification of certain foams as suitable for the purposes disclosed herein should not be characterized in a limiting manner.

[0083] The provided foam is typically generally free of moisture but may contain an incidental amount of impurities, such as felt, fabric, fibers, leather, hair, metal, wood, plastic or the like. Preferably, the provided foam is polyurethane foam with a density similar to the desired density of the subsequently produced recycled energy absorptive/moisture resistive underlayment. If desired, the foam may be sorted by type and/or density prior to shredding such that foam pieces of similar composition and density are used to make a single foam log. Using foam of similar composition and density to make a single foam log produces a more uniform density throughout the foam log, and thus throughout the subsequently produced underlayment.

[0084] Once the waste foam to be used to form a bonded foam log has been provided at **181**, the method **180** proceeds to **182** where the waste foam is placed in a shredding machine for shredding into smaller foam pieces. Broadly speaking, a shredding machine is a device provided with a plurality of rotating or otherwise moving blades capable of cutting foam placed thereinto into smaller pieces. The amount of time that the waste foam spends in the shredding machine determines the size of the shredded pieces of foam provided thereby. Some shredding machines are configured to operate in a batch mode in which a load of unshredded foam is deposited into a holding tank where it is cut into small pieces of foam by the blades. The shredded foam is then removed from the holding tank and another load of unshredded foam is deposited thereinto. Other shredding machines are configured to operate in a continuous mode in which a flow of unshredded foam is continuously fed into the shredding machine, for example, using a conveyer or other type of transport system for shredding. As additional unshredded foam is fed into the shredding machine, a roughly equal amount of shredded foam is removed from the shredding machine by the conveyer or other transport system. A shredding machine suitable for the purposes disclosed herein is the foam shredder manufactured by the Ormont Corporation of Paramus, N.J.

[0085] It is contemplated that the foam pieces produced by the shredding machine may have a specific type of geometric shape such as a spherical or cubical shape. Most commonly, however, the shredding process performed by the shredding machine will produce foam pieces that are irregularly shaped and that tend to vary in shape from piece to piece. Generally, the shape of the smaller foam pieces produced by the shredding machine is unimportant because the foam pieces produced thereby will tend to conform to the shape of the mold later used to form bonded foam logs. Broadly speaking, however, the smaller foam pieces should be sized such that they are large enough to be easily handled yet small enough such that there is not an abundance of empty space between the foam pieces when used to fill a mold. Preferably, the smaller foam pieces should be sized such that they all range from about ¼-inch to about ¾-inch in length, width and height.

[0086] As disclosed herein, the method **180** includes two discrete processes—the shredding of waste foam into foam pieces at **182** and the mixing of a pre-polymer solution at **183**—which are performed generally simultaneous with one another. In the embodiment disclosed herein, it is contemplated that the primary components of the pre-polymer solution mixed at **183** are an isocyanate, a polyol and an oil. As will be more fully described below, the isocyanate reacts with the polyol at **183** and with moisture in the steam at **186** to bond the pieces of foam together. The oil lowers the overall viscosity of the pre-polymer solution to facilitate better mixing and distribution of the components of the pre-polymer mixture. The lowered viscosity of the pre-polymer solution also allows the pre-polymer solution to uniformly coat the foam pieces so that improved bonding occurs. In the embodiment disclosed herein, it is contemplated that the pre-polymer solution will contain generally equal amounts (by weight) of the isocyanate, the polyol and the oil. Thus, if the pre-polymer solution includes about 30 percent (by weight) of the isocyanate, it would also include about 30 percent (by weight) of the polyol and about 30 percent (by weight) of the oil.

[0087] It is contemplated that a variety of isocynates, such as toluene diisocyanate (TDI), diisocyanatodiphenyl methane (MDI) or blends thereof, may be used when forming the pre-polymer solution. For example, suitable isocyanates would include, among others, m-phenylene diisocyanate, p-phenylene diisocyanate, polymethylene polyphenyl isocyanate, 2,4-toluene diisocyanate, 2,6-toluene diisocyanate, 4,4-diisocyanatodiphenyl methane, dianisidine diisocyanate, bitolylene diisocyanate, naphthalene-1,4-diisocyanate, diphenylene-4,4'-diisocyanate, xylylene-1,4-diisocyanate, xylylene-1,2-diisocyanate, xylylene-1,3-diisocyanate, bis(4-isocyanatophenyl)-methane, bis(3-methyl-4-isocyanatophenyl)-methane, isophorone diisocyanate, 4,4-diphenylpropane diisocyanate, hexamethylene diisocyanate, methylene-bis-cyclohexylisocyanate, and mixtures thereof. Of course, it is fully contemplated that isocyanates other than those specifically recited herein are also suitable for the purposes disclosed herein and that the formulation of the pre-polymer solution should not be limited to the particular isocyanates disclosed herein. The preferred isocyanates are RUBINATE® 9041 MDI, available from the Huntsman Corporation of Salt Lake City, Utah, or POLYMERIC MDI 199, available from the Dow Chemical Corporation of Midland, Mich. The isocyanate comprises between about 10 percent (by weight) and about 90 percent (by weight) of the pre-polymer solution; preferably between about 20 percent (by weight) and about 50 percent (by weight) of the pre-polymer solution; and most preferably between about 25 percent (by weight) and about 40 percent (by weight) of the pre-polymer solution.

[0088] It is further contemplated that a variety of polyols, such as diol, triol, tetrol, polyol or blends thereof, may be used when forming the pre-polymer solution. For examples, suitable polyols would include, among others, ethylene glycol, propylene glycol, butylene glycol, hexanediol, octanediol, neopentyl glycol, 1,4-bishydroxymethyl cyclohexane, 2-methyl-1,3-propane diol, glycerin, trimethylolethane, hexanetriol, butanetriol, quinol, polyester, methyl glucoside, triethyleneglycol, tetraethylene glycol, polyethylene glycol, dipropylene glycol, polypropylene glycol, diethylene glycol, glycerol, pentaerythritol, trimethylolpropane, sorbitol, mannitol, dibutylene glycol, polybutylene glycol, alkylene glycol, oxyalkylene glycol, ethylene glycol, diethylene glycol, dipropylene glycol, triethylene glycol, tripropylene glycol, tetraethylene glycol, tetrapropylene glycol, trimethylene glycol, tetramethylene glycol, 1,4-cyclohexanedimethanol (1,4-bis-hydroxymethylcyclohexane) and mixtures thereof. Of course, it is fully contemplated that polyols other than those specifically recited herein are also suitable for the purposes disclosed herein and that the formulation of the pre-polymer solution should not be limited to the particular polyols disclosed herein. The preferred polyol is VORANOL® 3512A, available from the Dow Chemical Corporation of Midland, Mich. The polyol comprises between about 10 percent (by weight) and about 90 percent (by weight) of the pre-polymer solution; preferably between about 20 percent (by weight) and about 50 percent (by weight) of the pre-polymer solution; and most preferably, between about 25 percent (by weight) and about 40 percent (by weight) of the pre-polymer solution.

[0089] It is still further contemplated that a variety of oil may be used when forming the pre-polymer solution. The oil may be any aromatic or non-aromatic, natural or synthetic oil. For example, suitable oils would include, among others, naphthenic oil, soybean oil, vegetable oil, almond oil, castor oil, mineral oil, oiticica oil, anthracene oil, pine oil, synthetic oil, and mixtures thereof. Of course, it is fully contemplated that oils other than those specifically recited herein are also suitable for the purposes disclosed herein and that the formulation of the pre-polymer solution should not be limited to the particular oils disclosed herein. The preferred oil is VIPLEX® 222, available from the Crowley Chemical Company of New York, N.Y. The oil comprises between about 10 percent (by weight) and about 90 percent (by weight) of the pre-polymer solution; preferably between about 20 percent (by weight) and about 50 percent (by weight) of the pre-polymer solution; most preferably, between about 25 percent (by weight) and about 40 percent (by weight) of the pre-polymer solution.

[0090] In addition to the foregoing components, it is further contemplated that the pre-polymer solution may also contain any number of other additives which improve the characteristics of the bonded foam. For example, the pre-polymer solution may contain a flame retardant chemical compound, such as melamine, expandable graphite or dibromoneopentyl glycol, which improves the flame retardant properties of the bonded foam. The pre-polymer solution may also contain an antimicrobial additive, such as zinc pyrithione, which improves the antimicrobial properties of the bonded foam, as discussed in the aforementioned patent application. The pre-polymer solution may also contain an antioxidant, such as butylated hydroxy toluene, which improves the resistance of the bonded foam to oxidative-type reactions, such as scorch resulting from high exothermic temperatures. Finally, the pre-polymer solution may also contain colored dye, such as blue, green, yellow, orange, red, purple, brown, black, white, or gray dye, to distinguish certain bonded foam products from other bonded foam products. Of course, it is fully contemplated that the pre-polymer solution may contain still other additives other than those specifically recited herein and that the formulation of the pre-polymer solution should not be limited to the particular additives disclosed herein.

[0091] The selected components are combined at **183**, typically, using a mixer, to form a pre-polymer solution having the desired composition. It is contemplated that the mixer may be either a dynamic mixer or a static mixer. It is further contemplated that the mixer may be either a batch mixer or a continuous process mixer. Preferably, the mixer is a tank containing a motorized paddle-type mixing blade. Of course, it is fully contemplated that various types of mixers other than those specifically recited herein are also suitable for the disclosed purposes disclosed and that the mixer used to blend the selected components into the pre-polymer solution should not be limited to the particular types of mixers disclosed herein. Variously, it is contemplated that the components of the pre-polymer solution may be combined all at once, or they may be added one at a time to the pre-polymer solution as it is being mixed. Preferably, mixing of the pre-polymer solution continues until there are about 10 percent free isocyanates available for reacting with the steam during the steaming process. The mixed pre-polymer solution has a viscosity between about 100 and 1,000 centipoises, preferably between about 400 and 600 centipoises, at a temperature between about 100° F. and about 110° F. Although the time varies depending on the composition of the pre-polymer solution, it is contemplated that the components of the pre-polymer solution are mixed together for at least about 1 hour prior to application of the pre-polymer solution to the foam pieces. Preferably, the isocyanate, the polyol, and the oil are mixed together for at least about 4 hours and, at the end of the 4 hours, an amine catalyst is added to the pre-polymer solution and mixed for at least about an additional two hours.

[0092] After the components of the pre-polymer solution (isocyante, polyol, oil and any additives) have been mixed together for a suitable period of time at **182**, the method **180** proceeds to **184** where the pre-polymer solution is coated onto the foam pieces. Variously, it is contemplated that the coating machine may either be a batch-type coating machine or a continuous-type coating machine. A batch-type coating machine **200** suitable for the purposes disclosed herein is illustrated in FIG. **8**. As may now be seen, the coating machine is comprised of a tank **202**, an agitator **204**, and a pre-polymer solution applicator **206**. The size and shape of the tank **202** may be varied to suit the particular application. Similarly, the number and type of agitators **204** may be varied to suit the particular application. In this regard, it should be clearly understood that, for ease of illustration, a single agitator **204** is shown in FIG. **8**.

[0093] The process of coating a selected amount of foam pieces **210** begins by depositing the foam pieces **210** inside the tank **210**. The pre-polymer solution applicator **206** then sprays pre-polymer solution **208** onto the foam pieces **210**. While the pre-polymer applicator **206** is spraying the foam pieces **210** with the pre-polymer solution **208**, the agitator **204** rotates with respect to the tank **202**, thereby circulating the foam pieces **210** within the tank **202**. As the foam pieces **210** are circulated within the tank **202**, the foam pieces **210** are substantially coated with the pre-polymer solution **208**. The time required to substantially coat the foam pieces **210** with the pre-polymer solution **208** varies depending on the volume and density of the foam pieces **210**, the size of the tank **202**, the number and type of agitators **204** and the rate at which the pre-polymer solution is sprayed onto the foam pieces **210**. Generally, however, it is contemplated that the coating process will require between about 0.5 minutes and about 15 minutes to substantially coat the foam pieces **210** with the pre-polymer solution **208**. Preferably, the coating process should require between about 1 minute and about 10 minutes to substantially coat the foam pieces **210** with the pre-polymer solution **208**. Most preferably, the coating process should require between about 1.5 minutes and about 2.5 minutes to substantially coat the foam pieces **210** with the pre-polymer solution **208**. Although, in the coating process disclosed herein, the pre-polymer solution **208** is sprayed onto the foam pieces **210**, it is contemplated that the foam pieces **210** may be substantially coated with the pre-polymer solution **208** using a variety of other techniques such as dipping or roller coating. Accordingly, it is fully contemplated that techniques other than those specifically recited herein may be used to substantially coat the foam pieces **210** with the pre-polymer solution **208** and that the coating process should not be limited to the particular processes disclosed herein.

[0094] Referring next to FIG. **9**, after the foam pieces have been coated with the pre-polymer, the method **180** proceeds to **185** where the coated foam pieces are transported to a mold **220** for compression thereof. The mold **220** comprises a base **229**, a cylindrical wall **224**, a reciprocating piston **222**, and a steam injection system **227**. A drive system (not shown) coupled to the piston **222** enables the piston to be driven in either direction along axis A. By driving the piston **222** along the axis A, the volume of the cavity defined by the cylindrical wall **224**, and the base **229** can be selectively increased or decreased. In addition to being configured for movement along the axis A, the piston **222** is further configured for selective removal from the cavity and positioning away from the remainder of the mold **220** to facilitate easy loading of coated foam pieces into the cavity. Typically, the foam pieces are weighed before being loaded into the mold **220**. After the foam pieces are loaded into the mold **220**, the piston **222** compresses the coated foam pieces to form a foam log **226**. The compression ensures complete contact between the coated foam pieces forming the foam log **226**. As the weight of the coated foam pieces is known and the volume of the cavity into which the coated foam pieces are compressed may be readily determined based upon the extent to which the piston **222** penetrates the cavity, the density of the foam log **226** can be controlled by compressing the foam log **226** to a specific volume. For example, if the coated foam pieces weigh 100 pounds and the desired density of the foam log is 4 lbs/ft^3, then the piston **222** is driven in direction A until the volume of the interior cavity defined by the base **229**, the cylindrical sidewalls **224** and the piston **222** is reduced to 25 cubic feet.

[**0095**] The mold **222** illustrated in FIG. **9** employs a batch-type compression. It is fully contemplated, however, that the coated foam pieces may be compressed into a foam log using a variety of other techniques. For example, FIG. **11** illustrates an extruder suitable for forming a foam log using a continuous compression technique. Thus, it is fully contemplated that compression techniques other than those specifically recited herein may be used to compress the coated foam pieces **210** into the foam log **226**. Accordingly, the compression technique employed as part of the method **180** should not be limited to the particular processes disclosed herein.

[**0096**] After the foam pieces **210** are compressed into the foam log **226**, the method **180** proceeds to **186** where the foam log **226** is steamed to cure the pre-polymer. To do so, a steam supply (not shown) provides a flow of steam **228** to the steam injection system **229**. The steam **228** is forced, through apertures **225** in the base **229**, into the cavity holding the newly formed foam log **226**. The steam **228** passes through the foam log **226** and exits through apertures **221** in the piston **222**. As the steam passes through the foam log **226**, the moisture in the steam cures the pre-polymer, thereby establishing bonds between the foam pieces **210** forming the foam log **226**. After passing through the foam log **226**, any excess steam exits through perforations in the piston **222**. After being formed, the bonded foam log **226** is removed from the mold **220**. For example, the mold **220** may be configured such that the wall **224** is removable, thereby facilitating easy removal of the foam log **226** after the steaming process is complete. Alternately, the foam log **226** may be removed after the piston **222** has been removed from the cavity and repositioned in the manner hereinabove described. It is fully contemplated that steaming processes other than those specifically recited herein may be used to cure the foam log **226**. Accordingly, the steaming process employed as part of the method **180** should not be limited to the particular process disclosed herein.

[**0097**] The steam **228** may be any heated steam that is at least about 212° F. and a sufficient pressure to permeate the foam log **226**. Preferably, the temperature of the steam is between about 220° F. and about the combustion temperature of the foam (about 1400° F.). The pressure of the steam is preferably between about 10 pounds per square inch gauge (psi) and about 100 psi. Most preferably, the temperature of the steam is between about 246° F. and about 256° F. and the pressure of the steam is between about 13 psi and 15 psi for a batch operation and between about 30 psi and about 45 psi for a continuous operation. The steaming time is dependent on the steam pressure and the density of the foam log. For a 4 pcf foam log and using the most preferred steam, the steam time is between about 0.5 minutes and about 3 minutes, preferably about 1.0 minutes and about 1.5 minutes. For an 8 pcf foam log, the steam time is between about 1.5 minutes and about 5 minutes, preferably about 2 minutes and about 3 minutes. Steam times for foam logs of other densities can be interpolated or extrapolated from these steam times and steam data.

[**0098**] After the foam log **226** has been cured and removed from the mold **220**, the method **180** proceeds to **187** where the bonded foam log **226** is allowed to dry. The time required to dry the bonded foam log **226** varies based upon the density of the bonded foam log **226** and the amount of moisture present in the bonded foam log **226**. A lower density foam log may be sufficiently dry to allow immediate processing. However, to ensure that the bonded foam log **226** is sufficiently dry such that moisture in the foam log **226** will not affect any of equipment used to process the foam log **226**, the bonded foam log **226** is typically set aside to dry for a period between 12 and to 24 hours at ambient temperature and humidity. If desired, drying of the bonded foam log **226** may be sped up by forcing ambient, heated, and/or dried air over or through the bonded foam log **226**. It is fully contemplated that drying processes other than those specifically recited herein may be used to dry the bonded foam log **226**. Accordingly, the drying process employed as part of the method **180** should not be limited to the particular process disclosed herein.

[**0099**] After drying is complete, the method **180** proceeds to **188** for coring of the bonded foam log **226**. To core the bonded foam log **226**, an aperture is drilled through a center axis thereof. A rod is then inserted into the aperture, thereby enabling the bonded foam log **226** to be handled without damaging the foam. After coring the log at **188**, the method **180** then proceeds to **189** where a peeling machine peels the bonded foam log **226**. A peeling machine **230** suitable to peel the bonded foam log **226** may be seen by reference to FIG. **10**. As may now be seen, the peeling machine **230** includes a blade **236**, a conveyor **232**, and a take-up roll **234**. The bonded foam log **226** is rotated against the blade **236** such that the blade **236** peels off a sheet of bonded foam having a uniform thickness, T_1. As previously set forth, the sheet of bonded foam is employed as a recycled flooring underlayment for a hard flooring system. As the bonded foam is peeled off of the bonded foam log **226**, the bonded foam log **226** is continuously lowered with respect to the blade **236** such that the sheet of bonded foam peeled off of the bonded foam log **226** by the blade **236** maintains the desired thickness T_1 of foam. In other words, as the diameter of the bonded foam log **226** is reduced, the bonded foam log **226** is lowered so that a uniform thickness of sheet of bonded foam is continuously peeled off of the foam log **226**. If desired, a trim station (not shown) positioned along the conveyor system **232** may be employed to trim the bonded sheet of foam to a uniform width. The sheet of bonded foam, which is now suitable for use as part of a flooring underlayment, is transported by conveyor system **232** and is collected on the take-up roll **234** for delivery to distributors, wholesalers, retailers and/or other consumers of the underlayment. If desired, the conveyor system may be stopped periodically and the continuous sheet of underlayment may be cut lengthwise and the take-up roll **234** replaced with a new take-up roll so that the rolls of flooring underlayment **238** are lighter and easier to handle.

[0100] Rather than employing the described batch-type process to form the bonded foam log **226**, it is contemplated that the method **180** may instead be configured to employ a continuous-type processing technique to form the bonded foam log **226**. FIG. **11** illustrates an extruder **240** suitable for continuously compressing and steaming the foam pieces **210** into a generally continuous bonded foam log **250**. The continuous extruder **240** comprises an upper conveyor **244**, a lower conveyor **242** and a steam injection system **246**. The process of compressing and steaming a bonded foam log commences with the placement of foam pieces **210** onto the lower conveyor **242**. Because the density of the foam log **250** produced by the continuous extruder **240** depends on the mass flow rate of the foam pieces **210** through the continuous extruder **240** as well as the volumetric flow rate of the foam log **250** exiting the extruder, the foam pieces **210** are deposited onto the lower conveyor **242** at a specified weight per unit time. As the foam pieces **210** travel through the continuous extruder **240**, the foam pieces **210** are compressed by the upper conveyor **244**. Because the upper conveyor **244** and the lower conveyor **242** travel in the same direction and the foam pieces **210** are continuously entering the continuous extruder **240**, the foam pieces **210** are compressed by the downward traveling upper conveyor **244**. The height of the upper conveyor **244** over the lower conveyor **242** is adjustable and the density of the foam log **250** produced thereby can be adjusted by raising and lowering the upper conveyor **242** relative to the lower conveyor **242**.

[0101] When the pieces **210** have been compressed into a foam log **250** having a desired density, steam injection system **246** injects a flow of steam **248** into the foam log **250** through perforations **249** in the lower conveyor **242**. The steam passes through the foam log and any excess steam exits by passing through perforations (not shown) in the upper conveyor **244**. The continuous extruder **240** is configured such that the residence time of the foam log **250** in the steaming area of the continuous extruder **240** is generally equal to the steaming time required in the batch process previously described herein. The bonded foam log produced by the continuous extruder **240** is generally rectangular in cross section and, as a result, is sliced into sheets of flooring underlayment rather than being peeled in the manner described hereinabove.

[0102] After either a nonwoven fiber batt formed of shoddy material is formed at **86** or a sheet of bonded foam is formed at **189** (both of which are, as previously set forth, suitable for use as the recycled energy absorbing layer **52**), the moisture barrier **54** is laminated onto the recycled energy absorbing layer **52** at either 90 of method **66** or at **191** of method **180** to produce the recycled energy absorptive/moisture resistive underlayment **50**.

[0103] For the embodiment in which the moisture barrier **54** is a film, FIG. **12** illustrates an apparatus **260** for laminating a moisture impermeable film onto the recycled energy absorbing layer **52** in accordance with 90 of method **66** or **191** of method **180**. A conveyer **266** transports the recycled energy absorbing layer **52** to an adhesive applicator **262**. The adhesive applicator **262** sprays an adhesive **264** onto the recycled energy absorbing layer **52** positioned therebelow. Alternatively, the adhesive applicator **262** could extrude a frothed adhesive onto the recycled energy absorbing layer **52**. A moisture resistant film **274** from roll **268** is then layered onto a first side surface of the recycled energy absorbing layer **52**. Two nip rollers **270** compresses the moisture resistant film **274** and the recycled energy absorbing layer **52** together to form the recycled energy absorptive/moisture resistive underlayment **50** having a moisture barrier **54** on one side of the recycled energy absorbing layer **52**. If the adhesive **264** needs to be cured, the recycled energy absorptive/moisture resistive underlayment **50** can pass through an oven (not shown) to cure the adhesive. The recycled energy absorptive/moisture resistive underlayment **50** is then collected on roller **272** and shipped to wholesalers, distributors and/or retailers as needed.

[0104] For the embodiment in which the moisture barrier **54** is a closed cell foam, FIG. **13** illustrates an apparatus **300** for laminating a layer of closed cell foam **304** onto the recycled energy absorbing layer **52**. As may now be seen, a conveyor **306** transports the recycled energy absorbing layer **52** to a foam applicator **302** which deposits foam **304** onto the recycled energy absorbing layer **52** positioned therebelow. Alternatively, the foam **304** may be sprayed, roller coated, or otherwise applied to the recycled energy absorbing layer **52**. In still another alternative, the recycled energy absorbing layer **52** may be dipped into a vat of the foam **304**. A doctor blade **308** regulates the amount of foam **304** deposited on top of the recycled energy absorbing layer **52**. The foam **304** and recycled energy absorbing layer **52** are then transported through an oven **310** that cures the foam **304**. The resulting recycled energy absorptive/moisture resistive underlayment **50** having a moisture barrier **54** formed on one side thereof is then collected on a roller **312** and shipped to wholesalers, distributors, and/or retailers as needed.

[0105] If the recycled energy absorbing layer is **52** is a nonwoven fiber batt formed using shoddy fibers, the moisture barrier **54** may be produced by calendering one or more surfaces of the nonwoven fiber batt. Calendering is a process by which one surface of a nonwoven fiber batt is modified by passing the batt between a set of cylindrical drums, one of which is heated. Alternatively, the batt can be placed on a smooth conveyor belt and passed through an oven. The heat from the cylindrical drums or oven melts the synthetic fibers in the nonwoven fiber batt such that they form a thin layer of material similar to a moisture impermeable film. The calendered surface of the nonwoven fiber batt differs from a layer of moisture impermeable film laminated onto a surface of the nonwoven fiber batt in that the nonwoven fiber batt and the calendered surface are formed from the same material, generally polymeric material, but in fiber and sheet form, respectively. The calendered surface of the nonwoven fiber batt is generally moisture impervious but, depending on the specific temperature and calendering apparatus used, may be vapor permeable. Because the calendered surface of the nonwoven fiber batt is moisture impervious, the calendered surface of the nonwoven fiber batt acts as a moisture barrier, thereby eliminating the need for another type of moisture barrier. Thus, calendering the surface of the nonwoven fiber batt is advantageous because it eliminates the need to laminate a moisture barrier thereonto.

[0106] In an additional alternative embodiment, the recycled energy absorbing layer **52** and/or the moisture barrier **54** can contain a scented or deodorizing additive. Scented and deodorizing additives are advantageous because they improve the smell of the flooring and can mask or eliminate unwanted odors. Scented and deodorizing additives are well known in the art, as evidenced by scented and deodorizing carpet cleaner. It is fully contemplated that a scented or deodorizing additive may be included: (a) in the recycled fiber blend used to form the recycled energy absorbing layer **52** comprised of a nonwoven fiber batt formed from shoddy fibers; (b) within the pre-polymer used to form the recycled energy absorbing layer **52** comprised of a foam pad formed from bonded foam; or (c) within the moisture barrier **54** itself. Alternatively, the scented or deodorizing additive can be attached to the recycled energy absorbing layer **52**, the moisture barrier **54**, or both.

[0107] It is contemplated that methods other than the disclosed adhesive techniques may be used to laminate the moisture barrier **54** onto the energy absorbing layer **52**. For example, some moisture barriers **54** become tacky when heated. If such a moisture barrier **54** were used, the moisture barrier **54** would be layered onto the energy absorbing layer **52** without the use of an adhesive. The energy absorbing layer **52** and moisture barrier **54** would then be heated to make the moisture barrier **54** tacky such that the moisture barrier **54** bonds to the energy absorbing layer **52**. When the underlayment **50** cools, the moisture barrier **54** would then be attached to the energy absorbing layer **52** without the use of a separate adhesive. Alternatively, if the moisture barrier **54** and the energy absorbing layer **52** contain polymeric and/or thermoplastic materials, the moisture barrier **54** and the energy absorbing layer **52** can be integrally joined by heating the moisture barrier **54** and the energy absorbing layer **52**, contacting or compressing the moisture barrier **54** and the energy absorbing layer **52** together, and then cooling the moisture barrier **54** and the energy absorbing layer **52**. It is contemplated that any other bonding method that does not use an adhesive may also be used to laminate the moisture barrier **54** onto the energy absorbing layer **52** to form the recycled energy absorptive/moisture resistive underlayment **50**.

[0108] If it is desired that the recycled energy absorptive/moisture resistive underlayment **50** be attached to the hard flooring **60** at **92** of method **66** or at **192** of method **180**, the recycled energy absorptive/moisture resistive underlayment **50** is preferably attached to the hard flooring layer **60** after the moisture barrier **54** has been attached to the recycled energy absorbing layer **52**. The process of adhering the recycled energy absorbing layer **52** onto the hard flooring **60** is similar to the process of adhering the moisture barrier **54** onto the recycled energy absorbing layer **52**. More specifically, an adhesive is sprayed onto a side surface of the hard flooring **60** and the recycled energy absorptive/moisture resistive underlayment **50** is subsequently laminated onto an underside of the hard flooring **60**. A pair of nip rollers ensure that the recycled energy absorptive/moisture resistive underlayment **50** completely contacts the hard flooring **60**. As part of the process of attaching the recycled energy absorptive/moisture resistive underlayment **50** to the hard flooring **60**, the hard flooring **60** can be inverted so the side that faces up during the manufacturing process will be the underside of the hard flooring **60** when the hard flooring layer **60** is installed. By doing so, the force of gravity shall be able hold the recycled energy absorptive/moisture resistive underlayment **50** on the hard flooring **60** until the adhesive takes full effect and bonds the two together.

[0109] Another consideration for the recycled energy absorptive/moisture resistive underlayment **50** is the thickness of the recycled energy absorbing layer **52**. While thicker recycled energy absorbing layers **52** are preferred in some applications, for example, soft flooring applications such as carpet underlayment, thinner recycled energy absorbing layers **52** are preferred for use in conjunction with hard flooring. An example of a recycled energy absorbing layer **52** forming a component of a recycled energy absorptive/moisture resistive underlayment **50** suitable for use with hard flooring would have a thickness of between about 0.05 inches and about 0.25 inches, a density of between about 2 pcf and about 20 pcf, and a basis weight of between about 0.5 ounces per square foot and about 10 ounces per square foot. Preferably, the recycled energy absorbing layer **52** has a thickness between about 0.1 inches and about 0.3 inches, a density between about 5 pcf and about 10 pcf, and a basis weight between about 1 ounce per square foot and about 4 ounces per square foot. A recycled energy absorptive/moisture resistive underlayment formed in accordance with foregoing would typically come in a 3 foot by 60 foot roll and have a roll weight of about 28 pounds.

[0110] There are many advantages to using the recycled energy absorptive/moisture resistive underlayment **50** over existing underlayments. The recycled energy absorptive/moisture resistive underlayment **50** contains recycled fibers or bonded foam, either of which would tend to lower the cost of manufacturing the recycled energy absorptive/moisture resistive underlayment **50** whenever the cost of recycling those components of the recycled energy absorptive/moisture resistive underlayment **50** is less than the cost of using new components, for example, prime foam, in the recycled energy absorptive/moisture resistive underlayment **50**. With lowered manufacturing costs, the manufacturer can sell the recycled energy absorptive/moisture resistive underlayment **50** to the consumer at a lower cost. The recycled materials in the underlayment **50** are also appealing to consumers who prefer recycled materials for environmental reasons. The recycled energy absorptive/moisture resistive underlayment **50** can also be attached to a bottom side surface of hard flooring **60** so that the time and complexity of installing the hard flooring system **49** comprised of the recycled energy absorptive/moisture resistive underlayment **50** and the hard flooring **60** is reduced substantially. The recycled energy absorptive/moisture resistive underlayment **50** also acts a moisture barrier, absorbs the sound generated by a person walking on the recycled energy absorptive/moisture resistive underlayment **50** and smoothes irregularities in the subfloor **62** on which the hard flooring system **49** is installed.

[0111] While a number of preferred embodiments of recycled energy absorptive/moisture resistive underlayment and associated hard flooring system have been shown and described herein, modifications thereof may be made by one skilled in the art without departing from the spirit and scope of the disclosed teachings. Accordingly, the embodiments described herein are provided purely by way of example and are not intended to be limiting. Many variations, combinations, and modifications of the teachings disclosed herein are possible and are contemplated as being fully within the scope of the teachings set forth herein. Accordingly, the scope of protection is not limited by the description set out above, but is defined by the scope of the claims which follow, that scope including all equivalents of the subject matter thereof.

What is claimed is:

1. A flooring underlayment configured for installation between hard flooring and a subfloor, said flooring underlayment comprising:

an energy absorbing layer formed from a recycled material; and

a moisture barrier affixed to a first side surface of said energy absorbing layer;

wherein said energy absorbing layer absorbs acoustic energy produced by said hard flooring in response to an application of mechanical energy thereto.

2. The flooring underlayment of claim 1, wherein said energy absorbing layer is a nonwoven fiber batt.

3. The flooring underlayment of claim 2, wherein said nonwoven fiber batt is formed from shoddy fiber.

4. The flooring underlayment of claim 1, wherein said energy absorbing layer is a foam pad.

5. The flooring underlayment of claim 4, wherein said foam pad is formed from bonded foam.

6. The flooring underlayment of claim 1, wherein said moisture barrier further comprises a moisture impermeable film laminated to said first side surface of said energy absorbing layer.

7. The flooring underlayment of claim 6, wherein:

said first moisture barrier engages said subfloor;

said flooring underlayment further comprises a second moisture barrier laminated onto a second side surface of said energy absorbing layer; and

said second moisture barrier engages said hard flooring.

8. The flooring underlayment of claim 7, wherein said energy absorbing layer is a nonwoven fiber batt formed from shoddy fibers.

9. The flooring underlayment of claim 7, wherein said energy absorbing layer is a foam pad formed from bonded foam.

10. The flooring underlayment of claim 1, wherein said first moisture barrier attached to said first side surface of said energy absorbing layer is formed from a closed cell foam.

11. The flooring underlayment of claim 10, wherein:

said first moisture barrier engages said subfloor;

said underlayment further comprises a second moisture barrier attached to a second side surface of said energy absorbing layer and formed from a closed cell foam; and

said second moisture barrier engaging said hard flooring.

12. The flooring underlayment of claim 11, wherein said energy absorbing layer is a nonwoven fiber batt formed from shoddy fibers.

13. The flooring underlayment of claim 11, wherein said energy absorbing layer is a foam pad formed from bonded foam.

14. A flooring underlayment configured for installation between hard flooring and a subfloor, said flooring underlayment comprising:

an energy absorbing layer formed from a recycled material, said energy absorbing layer having a first side surface, a second side surface and a plurality of edge surfaces;

a first moisture barrier for engaging a subfloor, said first moisture barrier laminated to said first side surface of said energy absorbing layer, said first moisture barrier having at least one edge surface laying flush with a corresponding one of said plurality of edge surface of said energy absorbing layer and at least one edge surface projecting past a corresponding one of said plurality of edge surfaces of said energy absorbing layer; and

a second moisture barrier for engaging hard flooring, said second moisture barrier laminated to said second side surface of said energy absorbing layer, said second moisture barrier having a plurality of edge surfaces, each of which corresponds to and lays flush with one of said plurality of edge surfaces of said energy absorbing layer;

wherein said energy absorbing layer absorbs acoustic energy produced by said hard flooring in response to an application of mechanical energy thereto.

15. The flooring underlayment of claim 14, wherein said energy absorbing layer is a nonwoven fiber batt formed from shoddy fibers.

16. The flooring underlayment of claim 14, wherein said energy absorbing layer is a foam pad formed from bonded foam.

17. A hard flooring system configured for installation in a space defined by a subfloor, a first wall and a second wall, said hard flooring system comprising:

a first energy absorptive/moisture resistive underlayment section;

a second energy absorptive/moisture resistive underlayment section;

a hard flooring;

each of said first and second energy absorptive/moisture resistive underlayment sections comprising:

an energy absorbing layer formed from a recycled material, said energy absorbing layer having a first side surface, a second side surface and a plurality of edge surfaces;

a first moisture barrier for engaging a subfloor, said first moisture barrier laminated to said first side surface of said energy absorbing layer, said first moisture barrier having at least one edge surface laying flush with a corresponding one of said plurality of edge surface of said energy absorbing layer and at least one edge surface projecting past a corresponding one of said plurality of edge surfaces of said energy absorbing layer; and

a second moisture barrier engaging said hard flooring, said second moisture barrier laminated to said second side surface of said energy absorbing layer, said second moisture barrier having a plurality of edge surfaces, each of which corresponds to and lays flush with one of said plurality of edge surfaces of said energy absorbing layer;

said projecting edge surface of said first moisture barrier laminated to said energy absorbing layer of said first energy absorptive/moisture resistive underlayment section engaging a portion of said first wall;

said projecting edge surface of said first moisture barrier laminated to said energy absorbing layer of said second energy absorptive/moisture resistive underlayment positioned underneath a portion of said first moisture barrier laminated to said energy absorbing layer of said first energy absorptive/moisture resistive underlayment section; and

a moisture resistive section engaging said second wall and an edge surface of said energy absorbing layer of said second energy absorptive/moisture resistive underlayment section which abuts said second wall.

18. The hard flooring system of claim 17, wherein said moisture resistive section extends underneath a portion of said first moisture barrier laminated to said energy absorbing layer of said second energy absorptive/moisture resistive underlayment section.

19. The hard flooring system of claim 18, wherein said energy absorbing layer of each of said first and second energy absorptive/moisture resistive underlayment sections is a nonwoven fiber batt formed from shoddy fibers.

20. The hard flooring system of claim 18, wherein said energy absorbing layer of each of said first and second energy absorptive/moisture resistive underlayment sections is a foam pad formed from bonded foam.

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