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# United States Patent [19]

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Donahue et al.

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[54] **MOLDABLE AUTOMOTIVE TRUNK LINER**

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[21] Appl. No.: **850,755**

[57] **ABSTRACT**

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A moldable fibrous composite comprising a first layer comprising a non-woven fabric, a second intermediate layer comprising a thermoformable material, and a third layer comprising a non-woven fabric is provided. This moldable fibrous composite can be utilized to form a one-piece trunk liner for an automobile trunk compartment. Additionally, the thermoformable material can be comprised of the same polymeric material as that of the staple fiber of the non-woven fabric of the first and third layer, thereby allowing recyclability of the moldable fibrous composite. A method is provided for the production of the moldable fibrous composite, and, additionally, a method is provided for the production of a moldable automotive trunk liner.

[51] Int. Cl.<sup>5</sup> ..... **B32B 27/36; B32B 5/06; B32B 5/22**

[52] U.S. Cl. .... **428/284; 428/286; 428/287; 428/300; 428/301; 428/298**

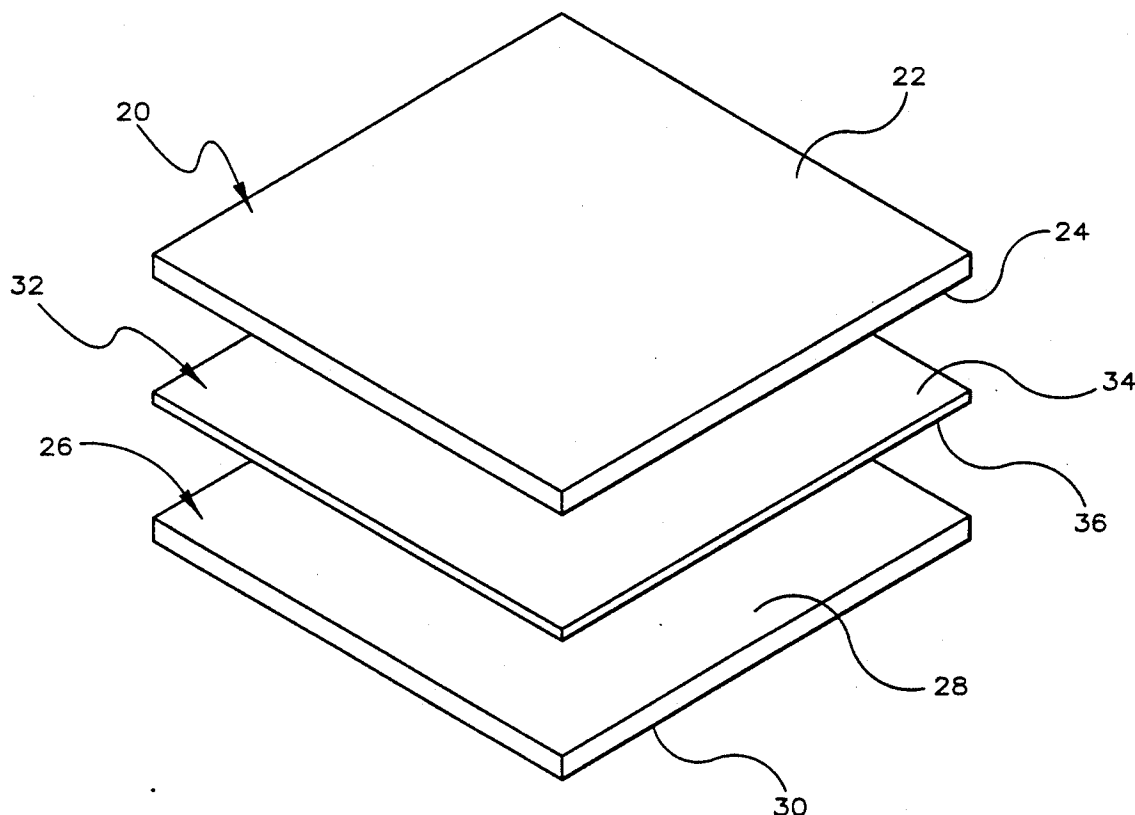
[58] Field of Search ..... **428/284, 286, 287, 300**

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**18 Claims, 3 Drawing Sheets**



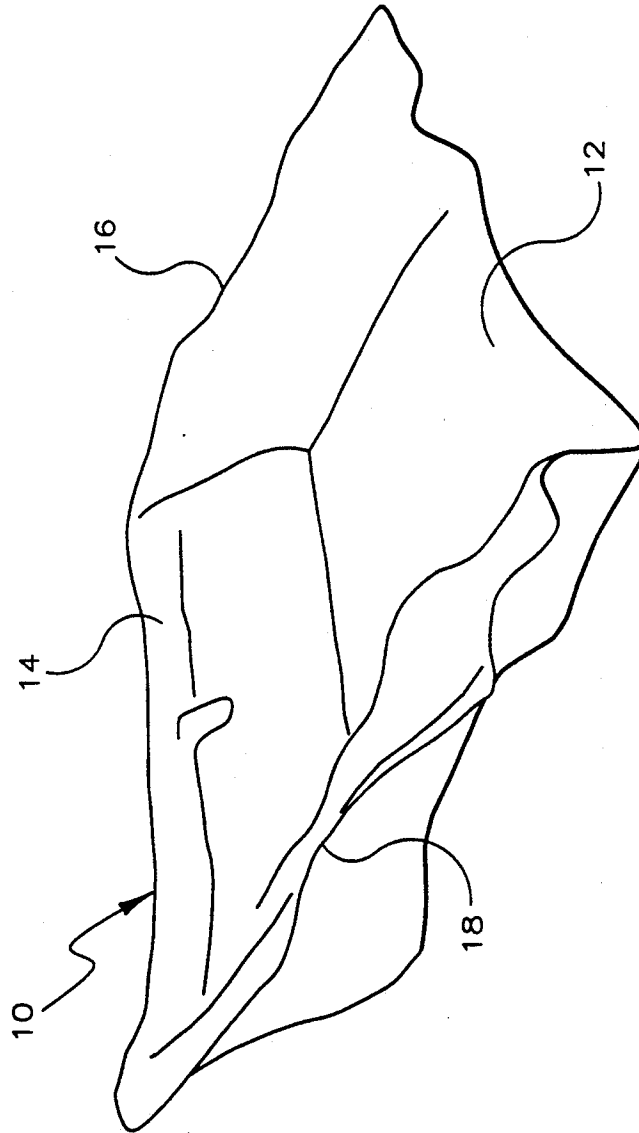


FIG. 1

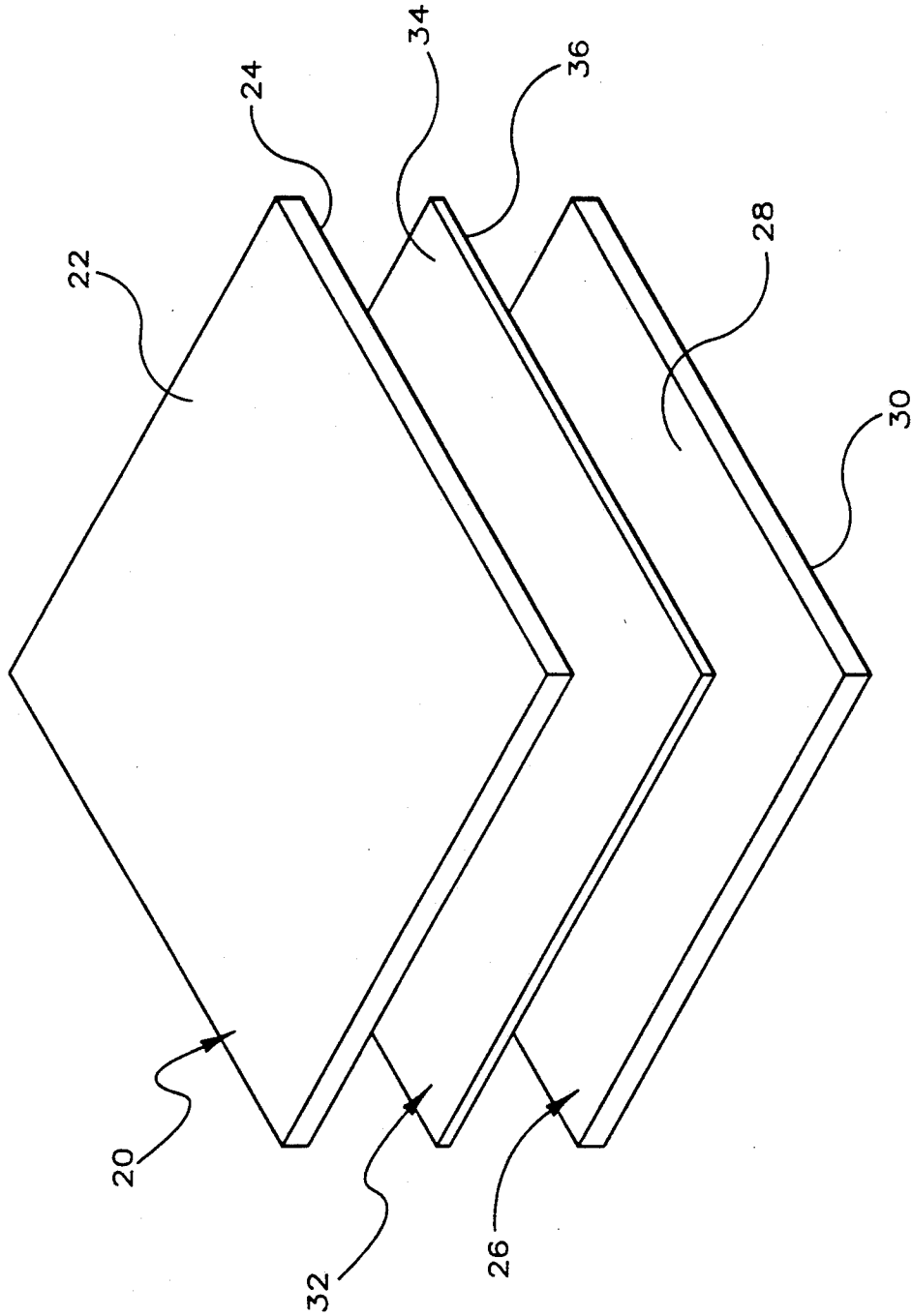


FIG. 2

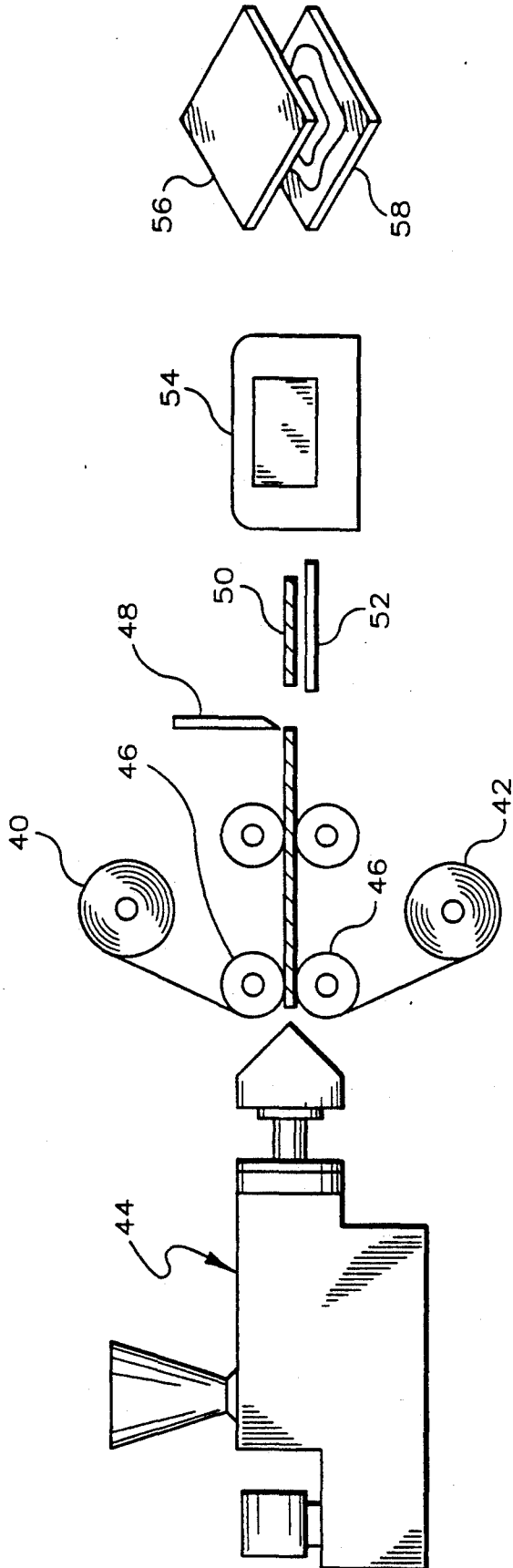


FIG. 3

## MOLDABLE AUTOMOTIVE TRUNK LINER

### BACKGROUND OF THE INVENTION

The present invention relates to moldable non-woven laminates and more particularly concerns moldable non-woven laminates that can be used for trunk liners for an automobile trunk compartment.

In the fabrication of automotive trunk liners, it is common to utilize an integrally molded fibrous trunk liner wherein the trunk liner is molded in such a manner that the sidewalls thereof are formed so as to extend upwardly and outwardly in a diverging manner relative to the center floor cover panel so as to resiliently engage the sidewalls of the trunk compartment when the sidewalls of the liner are biased inwardly toward an upright position when installed and mounted in a trunk compartment. This resilient engagement of the trunk liner with the walls of the trunk compartment facilitates the mounting of the trunk liner in the trunk compartment and the maintaining of the trunk liner in the installed position and engagement with the walls of the trunk compartment.

Generally, such a trunk liner is formed from a moldable felt applied to the backside of a non-woven fabric. This felt serves to impart shape retention and stiffness to the overall molded body upon the molding operation being completed. The upper surface is formed of soft fibrous material for an aesthetically pleasing appearance. The backside felt must be comprised of material that is capable of being thermoformed at temperatures that will not damage the look or feel of the upper surface material. For this reason, the upper surface material and the backside coating material are generally produced from dissimilar materials, thereby preventing trim or other waste from being reprocessed or recycled. It has been estimated that between 20 and 40 percent of the material utilized to produce current trunk liners becomes waste material, which results in excessive production costs.

It is an important object of the present invention to produce a thermoformable non-woven laminate in which all of the materials of the laminate are compatible and are thus capable of being recycled.

It is another object of this invention to produce an integral molded trunk liner wherein the materials of the trunk liner are compatible and are thus capable of being recycled.

It is a further object of this invention to produce an integral molded trunk liner with increased bulk thickness and increased acoustical value.

Other and further objects, aims, purposes, features, advantages, embodiments, and the like will be apparent to those skilled in the art from the present specification, taken with the associated drawings, and the appended claims.

More particularly, in one aspect, the present invention relates to a moldable fibrous composite comprising a first layer comprising a non-woven fabric, a second intermediate layer comprising a thermoformable material, and a third layer comprising a non-woven fabric. In accordance with another aspect of this invention, the three layers of the composite of the present invention are compatible with each other in order to provide for recyclability of the fibrous composite. In accordance with this aspect, the first and third layers of the composite each comprise a non-woven fabric comprised of polypropylene fibers. A second layer comprises an ex-

truded thermoplastic sheet comprised of polypropylene. In accordance with another aspect of this invention, a process is provided for producing a moldable fibrous composite comprising a first layer comprising a non-woven fabric, a second intermediate layer comprising a thermoplastic resin, and a third layer comprising a non-woven fabric.

In the drawings, further preferred embodiments and details of this invention are shown. These drawings should, however, not be interpreted to unduly limit the scope of this invention.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top perspective view of the trunk liner of the present invention substantially as the same appears when taken out of the mold.

FIG. 2 is an isometric view of the moldable fibrous composite of the present invention showing the layered configuration.

FIG. 3 is a schematic representation of a system for producing the moldable fibrous composite sheets of the present invention.

### DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings and to FIG. 1 in particular, the trunk liner 10 of the present invention is shown as removed from a typical pressure molding operation utilizing mating male and female molding components. The trunk liner 10 comprises a center floor cover panel 12 and a plurality of panels extending along the sides of said center floor cover panel 12 and integrally connected thereto. These panels include a rear end panel 14 having lower end portions connecting rear most portions of the floor cover panel 12 and divergently extending upwardly and outwardly therefrom. A first rear wheel housing cover panel 16 and a second rear wheel housing cover panel 18 are connected to opposite sides of the center floor cover panel 12 and divergently extend upwardly and outwardly therefrom.

The molded trunk liner 10 is formed of a fibrous material that may readily be subjected to molding. FIG. 2 illustrates the preferred construction of moldable fibrous composite from which the trunk liner 10 of this invention is manufactured. The moldable fibrous composite is preferably a 3-ply laminate of a first non-woven fabric 20 having a first face 22 and a second face 24, a second non-woven fabric 26 having a first face 28 and a second face 30, and an extruded thermoformable material 32 having a first face 34 and a second face 36. The first non-woven fabric 20 is bonded to the second non-woven fabric 26 by the extruded thermoformable material 32. The second face 24 of the first non-woven fabric 20 is bonded in contact with the first face 34 of the extruded thermoformable material, while the first face 28 of the second non-woven fabric 26 is bonded in contact with the second face 36 of the extruded thermoformable material 32 so that the first face 22 of the first non-woven fabric is exposed as the top surface of the moldable fibrous composite while the second face 30 of the second non-woven fabric is exposed as the bottom surface of the moldable fibrous composite.

Because the first face 22 of the first non-woven fabric 20 will be exposed within the trunk, it is important that the first non-woven fabric 20 comprise a material that has aesthetically pleasing look and feel as well as a material that is durable and tear resistant. The extruded

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