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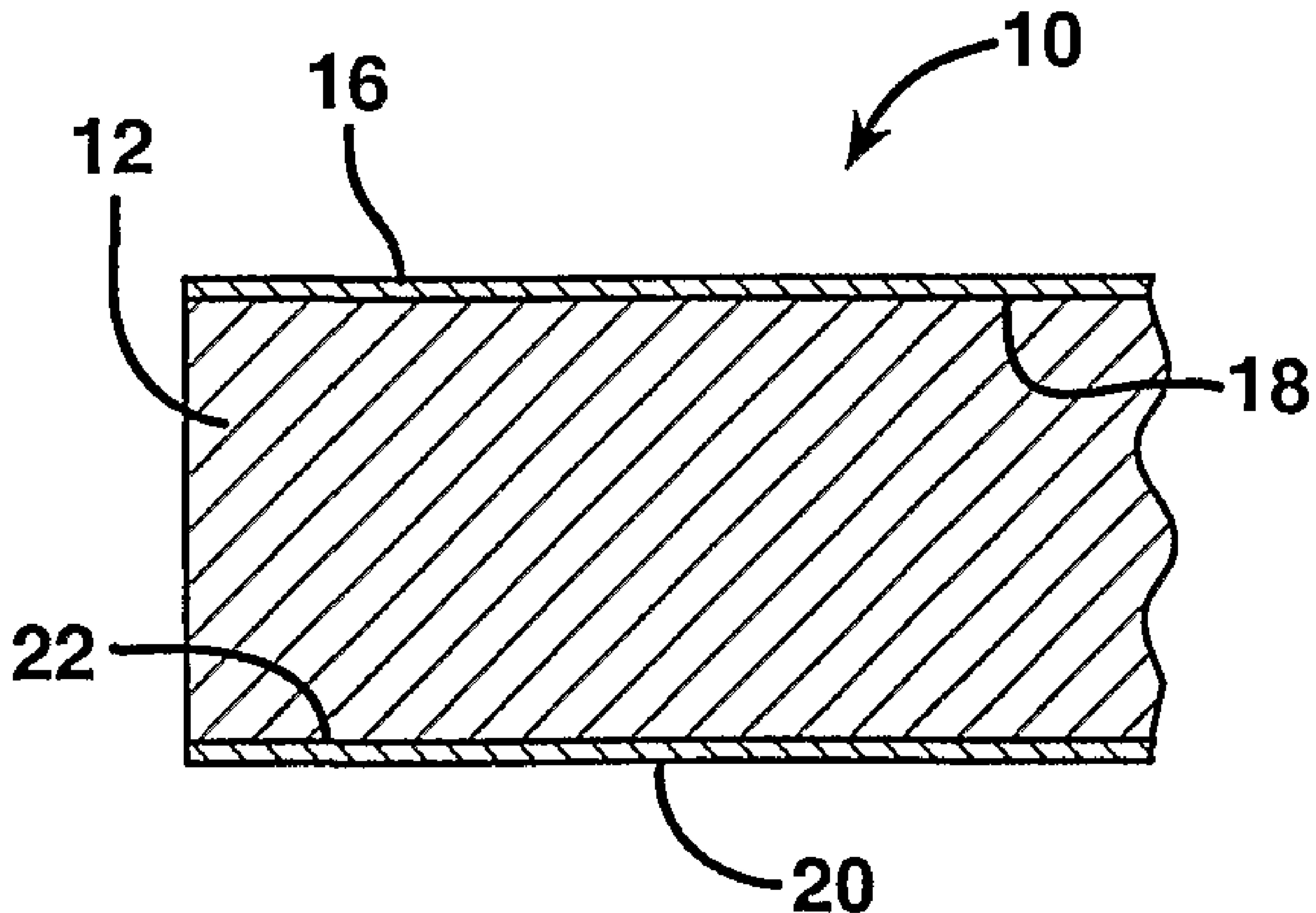
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(54) Titre : GARNITURE OU GARNITURE ISOLANTE AVEC COUCHE D'ISOLATION ACOUSTIQUE ET THERMIQUE
NON STRATIFIEE

(54) Title: LINER OR INSULATOR WITH NONLAMINATE ACOUSTICAL AND THERMAL INSULATING LAYER



(57) Abrégé/Abstract:

A liner or insulator is provided for a vehicle. The liner or insulator may include a nonlaminated acoustical and thermal insulating layer of polymer fiber that shows no signs of any thickness increase, delamination, deterioration or any undesirable effect which may

(57) **Abrégé(suite)/Abstract(continued):**

affect performance for at least 330 hours when maintained at a temperature of at least approximately 150°C (302°F). The liner may include a relatively high density, nonlamine skin of polymer fiber and/or one or more facing layers constructed from polymer material. The liner may be a hood, dash, firewall or engine cover liner.

Abstract of the Disclosure:

A liner or insulator is provided for a vehicle. The liner or insulator may include a
5 nonlamine acoustical and thermal insulating layer of polymer fiber that shows no signs of
any thickness increase, delamination, deterioration or any undesirable effect which may
affect performance for at least 330 hours when maintained at a temperature of at least
approximately 150°C (302°F). The liner may include a relatively high density, nonlamine
skin of polymer fiber and/or one or more facing layers constructed from polymer material.
10 The liner may be a hood, dash, firewall or engine cover liner.

LINER OR INSULATOR WITH NONLAMINATE ACOUSTICAL AND THERMAL INSULATING LAYER

TECHNICAL FIELD AND INDUSTRIAL APPLICABILITY OF THE INVENTION

5 The present invention relates generally to the field of acoustical and thermal insulation and, more particularly, to a hood, dash, firewall or engine cover liner for a vehicle.

BACKGROUND OF THE INVENTION

10 Acoustical and thermal liners for application to vehicles are well known in the art. These liners typically rely upon both sound absorption, that is, the ability to absorb incident sound waves and transmission loss, that is, the ability to reflect incident sound waves, in order to provide sound attenuation. They also rely upon thermal shielding properties to prevent or reduce the transmission of heat from various heat sources (for
15 example, engine, transmission and exhaust system), to the passenger compartment of the vehicle. Such insulation is commonly employed as a hoodliner, dash liner and firewall liner. More recently, such liners have been employed on engine covers so as to attenuate the sound of the engine closer to its source.

 Examples of acoustical and thermal insulation in the form of liners are disclosed in
20 a number of prior art patents including U.S. Patents 4,851,283 to Holtrop et al. and 6,008,149 to Copperwheat. As should be apparent from a review of these two patents, engineers have generally found it necessary to construct such liners from a laminate incorporating (a) one or more layers to provide the desired acoustical and thermal insulating properties and (b) one or more additional layers to provide the desire
25 mechanical strength properties which allow simple and convenient installation as well as proper functional performance over a long service life.

 While a number of adhesives, adhesive webs and binding fibers have been specifically developed over the years to secure the various layers of the laminates together, laminated liners and insulators have an inherent risk of delamination and failure. The
30 potential is, in fact , significant mainly due to the harsh operating environment to which such liners and insulators are subjected. Many liners and insulators are located near and/or are designed to shield high heat sources such as the engine, transmission and components of the exhaust system. As a result, the liners and insulators are often subjected to

temperatures in excess of 93°C (200°F) which have a tendency to degrade the adhesives or binders over time.

Additionally, many liners and insulators are subjected to water from the surface of the roadways which has a tendency to be drawn by capillary action into the interface
5 between the layers of the liners or insulators. Such water may have a deleterious effect upon the integrity of the adhesive layer over time. This is particularly evident when one considers that water may also include in solution salt or other chemicals from the roadway, which are corrosive and destructive.

A need is therefore identified for a hood, dash, firewall or engine cover liner
10 incorporating a nonlamine acoustical and thermal insulating layer of polymer fibers which avoids any inherent potential for delamination. Such a liner is suitable for use in the high temperature operating environment of the engine compartment and capable of providing the desired mechanical strength and rigidity for ease of installation as well as the desired acoustical and thermal insulating properties.

15 SUMMARY OF THE INVENTION

Accordingly, it is desirable to provide a liner or insulator for a vehicle. The liner or insulator may be a hood, dash, firewall or engine cover liner.

In accordance with one aspect of the present invention, there is provided a hood,
20 dash, firewall or engine cover liner for a vehicle, consisting essentially of: a single, nonlamine acoustical and thermal insulating layer of polymer fiber selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof or substantially 100% polyethylene terephthalate, characterized by a nonlamine skin of polymer fiber along at least one face of the acoustical and thermal insulating layer, the
25 nonlamine skin of polymer fiber having a higher density than a remainder of the single, nonlamine acoustical and thermal insulating layer of polymer fiber.

In accordance with another aspect of the present invention, there is provided a hood, dash, firewall or engine cover liner for a vehicle, consisting essentially of: a single, nonlamine acoustical and thermal insulating layer of substantially 100% polyethylene
30 terephthalate nonwoven fabric characterized by a nonlamine skin of polymer fiber along at least one face of the acoustical and thermal insulating layer, the nonlamine skin of polymer fiber having a higher density than a remainder of the single, nonlamine acoustical and thermal insulating layer of polymer fiber.

In accordance with another aspect of the present invention, there is provided a hood, dash, firewall or engine cover liner for a vehicle, consisting essentially of: a single, nonlamine acoustical and thermal insulating layer of polymer fiber selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof
 5 that shows no signs of any thickness increase, delamination, deterioration or any undesirable effect which may affect performance for at least 330 hours at 150°C (302°F) the single nonlamine acoustical and thermal insulating layer being characterized by a nonlamine skin of polymer fiber along at least one face of the acoustical and thermal insulating layer, the nonlamine skin of polymer fiber having a higher density than a
 10 remainder of the single, nonlamine acoustical and thermal insulating layer of polymer fiber.

In accordance with another aspect of the present invention, there is provided a liner for a vehicle, comprising: a nonlamine acoustical and thermal insulating layer of polymer fiber, the polymer fiber comprising polyester, polypropylene, polyethylene, rayon, nylon, or
 15 a mixture thereof, wherein the insulating layer comprises a nonlamine skin of polymer fiber along at least one face of the insulating layer, the nonlamine skin of polymer fiber having a higher density than a remainder of the insulating layer. The insulating layer may comprise polyester and glass fibers. The insulating layer may comprise polypropylene. The liner may further comprise a first facing layer over a first face of the insulating layer. The
 20 first facing layer may comprise polyester, rayon, polyethylene, polypropylene, ethylene vinyl acetate, polyvinyl chloride, or a mixture thereof. The insulating layer and the first facing layer may have the same color. The liner may further comprise a second facing layer over a second face of the insulating layer. The first facing layer and the second facing layer may have the same color. The insulating layer may have a density of between about 40 to
 25 about 130 g/ft².

In accordance with another aspect of the present invention, there is provided an insulator for a vehicle, comprising: a nonlamine acoustical and thermal insulating layer of polymer fiber, the polymer fiber comprising polyester, polypropylene, polyethylene, rayon, nylon, or a mixture thereof, wherein the insulating layer comprises a nonlamine skin of
 30 polymer fiber along at least one face of the insulating layer, the nonlamine skin of polymer fiber having a higher density than a remainder of the insulating layer. The insulating layer may comprise polyester and glass fibers. The insulating layer may comprise polypropylene. The insulator may further comprise a first facing layer over a first face

of the insulating layer. The first facing layer may comprise polyester, rayon, polyethylene, polypropylene, ethylene vinyl acetate, polyvinyl chloride, or a mixture thereof. The insulating layer and the first facing layer may have the same color. The insulator may further comprise a second facing layer over a second face of the insulating layer. The first facing layer and the second facing layer may have the same color. The insulating layer may have a density of between about 40 to about 130 g/ft².

Exemplary embodiments of the invention may include a nonlamine acoustical and thermal insulating layer of polymer fiber selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof. The thermal insulating layer is preferably a nonwoven fabric and may further include additional fibers selected from a group consisting of glass fibers and natural fibers to meet the specific performance requirements of a particular application.

The acoustical and thermal insulating layer may include a relatively high density, non-lamine skin of polymer fiber along at least one face thereof. Still further, the liner may include a first facing layer over a first face of the acoustical and thermal insulating layer. Similarly, a second facing layer may be provided over a second face of the acoustical and thermal insulating layer. Either of the facing layers may be constructed from a polymer material selected from a group consisting of polyester, rayon, polyethylene, polypropylene, ethylene vinyl acetate, polyvinyl chloride and mixtures thereof. The first and second facing layer typically have a weight between about 0.50-3.00 ounces per square yard.

For aesthetic reasons more particularly described below, the acoustical and thermal insulating layer is typically white, gray or black in color. It should be appreciated, however, that substantially any appropriate color may be provided so that the acoustical and thermal insulating layer may be made approximately the same color as the first and/or second facing layer if desired for a particular application.

More specifically, an exemplary hood, dash, firewall or engine cover liner may comprise a nonlamine acoustical and thermal insulating layer of polymer fiber selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof that shows no signs of any thickness increase, delamination, deterioration or any undesirable effect which may affect performance when subjected to a temperature of about 150°C (302°F) for a period of at least 330 hours. Still more specifically, the hood, dash, firewall or engine cover liner may comprise a nonlamine acoustical and thermal insulating layer of substantially 100% polyethylene terephthalate.

The benefits and advantages of the present invention will become readily apparent to those skilled in this art from the following description wherein there is shown and described several preferred embodiments of this invention, simply by way of illustration of some of the modes best suited to carry out the invention. As it will be realized, the invention is
5 capable of still other different embodiments and its several details are capable of modification in various, obvious aspects all without departing from the invention.

Accordingly, the drawing and descriptions will be regarded as illustrative in nature and not as restrictive.

10 BRIEF DESCRIPTION OF THE DRAWING

The accompanying drawing incorporated in and forming a part of the specification, illustrates several aspects of the present invention, and together with the description serves to explain the principles of the invention. In the drawing:

Figure 1 is a schematical side elevational view of one possible embodiment of the
15 present invention;

Figures 2-4 are schematical side elevational illustrations of other possible alternative embodiments of the present invention; and

Figure 5 is a graphical illustration comparing the acoustical insulating performance of a 100% polyethylene terephthalate liner of the present invention with a state of the art
20 polyester and fiberglass liner of sandwich construction.

Reference will now be made in detail to the present preferred embodiment of the invention, an example of which is illustrated in the accompanying drawing.

DETAILED DESCRIPTION OF THE INVENTION

5 Reference is now made to Figure 1 showing a first embodiment of the hood, dash, firewall or engine cover liner 10 of the present invention. The liner 10 comprises an acoustical and thermal insulating layer 12 of polymer fiber. More specifically, a single, nonlaminated layer 12 is provided with the necessary mechanical strength and rigidity to allow easy installation and the desired acoustical and thermal insulating properties.

10 Advantageously, all of these benefits are achieved in a light weight liner 10 which may even be used in compact vehicles where fuel economy concerns lead manufacturers to seek weight savings wherever possible.

 As best shown in Figure 5, a hood liner 10 of the present invention constructed of 100% polyethylene terephthalate provides an absorption coefficient over a frequency range

15 of from 355-5000 hertz that is generally superior to that of a state of the art hood liner constructed from a layer of fiberglass sandwiched between two layers of polyester when tested in accordance with ASTM C423. Further, the hood liner 10 of the present invention has a density of only 60 g/ft² while the state of the art hood liner has a density of 90 g/ft². Thus, the hood liner of the present invention provides generally equal or superior acoustical

20 performance at approximately a 33% weight savings.

 The polymer fiber is not foamed and typically is a nonwoven fabric. The polymer fiber may be selected from a group of fibers consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof. The acoustical and thermal insulating layer 12 is engineered to show no signs of any thickness increase, delamination,

25 deterioration or any undesirable effect which may affect performance when subjected to a temperature of approximately 150°C (302°F) for a period of at least 330 hours. Advantageously, such a liner 10 has a density of between about 40-130 g/ft². Thus, for example, the acoustical and thermal insulating layer 12 may comprise substantially 100% polyethylene terephthalate.

30 In a first alternative embodiment shown in Figure 2, the liner 10 also comprises a single, nonlaminated acoustical and thermal insulating layer 12 of polymer fiber (for example, a nonwoven fabric) selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof. The layer 12 also

includes a relatively high density, nonlamine or unitary skin 14 of that polymer fiber along at least one face thereof.

Advantageously, the high density skin 14 will not delaminate from the layer 12 under the environmental conditions existing in the engine compartment and also adds structural integrity and strength to the liner 10 which aids significantly in handling and fitting the part during installation. The high density skin 14 is also more aesthetically pleasing. Still further, for many applications the high density skin 14 eliminates the need to provide an additional facing layer of another type of fabric material. This serves to virtually eliminate any potential for failure of the lining due to delamination. It also results in a liner 10 made exclusively of one material that is, therefore, fully recyclable.

Further, since the skin may be formed with a hot platen during the molding of the liner 10 to its desired shape, no additional processing step is required. This reduces production cost relative to a liner with a fabric or other facing since such a facing must be adhered to the acoustical and thermal insulating layer in a separate processing step.

In yet another embodiment shown in Figure 3, the liner 10 includes a single, nonlaminated acoustical and thermal insulating layer 12 of polymer fiber (for example, a nonwoven fabric) selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof in combination with a facing layer 16 over a first face 18 of the acoustical and thermal insulating layer. The facing layer 16 may be constructed from a polymer material selected from a group consisting of polyester, rayon, polyethylene, polypropylene, ethylene vinyl acetate, polyvinyl chloride and mixtures thereof.

In yet another alternative embodiment shown in Figure 4, the liner 10 comprises a single, nonlaminated acoustical and thermal insulating layer 12 of polymer fiber as described above in combination with a first facing layer 16 covering a first face 18 thereof and a second facing layer 20 covering a second, opposite face 22 thereof. The second facing layer 20 may be constructed from the same or a different material as the first facing layer 16. Preferably the first and second facing layers have a weight of between about 0.50 - 3.00 ounces per square yard.

In accordance with yet another aspect of the present invention, the acoustical and thermal insulating layer 12 may be a natural white or include any appropriate form of coloring or pigment in order to provide a gray or black color. Alternatively, the acoustical and thermal insulating layer 12 may incorporate any appropriate color or pigment so as to

substantially approximate the color of the first and/or second facing layers 16, 20 and/or the paint color of the vehicle. This provides significant aesthetic benefits. Specifically, when the liner 10 is molded under heat and pressure in order to nest with the hood, firewall or other appropriate body panel or superstructure of the engine compartment, the
5 liner 10 is often subjected to deep drawing at one or more points. This deep drawing has a tendency to spread the weave of the fabric facing 16, 20 thereby exposing a portion of the underlying face 18, 22 of the acoustical and thermal insulating layer to light. If the acoustical and thermal insulating layer 12 does not substantially match the color of the facing layer 16, 20 this creates an undesirable color variation in these deep drawn areas.
10 In contrast, by matching the color of the layer 12 with the facings 16, 20, this color variation may be substantially eliminated.

It should further be appreciated that during use the facing layer 16, 20 may become snagged or subjected to a partial tear exposing some of the face of the underlying acoustical and thermal insulating layer 12. Once again, by matching the color of the layer
15 12 with the facing 16, 20, any color variation is substantially eliminated and one's attention is not as readily drawn to the damaged area. Accordingly, an overall improved aesthetic appearance is maintained over the service life of the liner 10.

In any of the embodiments described above and illustrated in Figures 1-4, the acoustical and thermal insulating layer 12 may further include from about 10 - 60 weight
20 percent of glass and/or natural fibers such as, but not limited to E-glass, S-glass, kenaf, hemp and mixtures thereof. Use of such glass and natural fibers may be desirable to meet the performance parameters necessary for some potential applications.

In summary, numerous benefits result from employing the concepts of the present invention. A hood, dash, firewall or engine cover liner 10 constructed in accordance with
25 the teachings of the present invention provides a unique combination of mechanical strength and rigidity as well as thermal and acoustical insulating properties which are consistently and reliably maintained over a long service life even in the high temperature and high moisture operating environment of the engine compartment. Such performance characteristics have heretofore been unavailable in a liner incorporating a single,
30 nonlaminated layer of acoustical and thermal insulating material. In one of the embodiments of the present invention, a relatively high density, nonlaminated skin is provided which aids in handling, is aesthetically pleasing and maintains the full recycleability of the liner. In another embodiment the color of the acoustical and thermal

insulating layer and any fabric facing that might be present are substantially matched so as to provide a more aesthetically pleasing product which can better maintain a high quality appearance over a longer service life.

The foregoing description of a preferred embodiment of the invention has been
5 presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed. Obvious modifications or variations are possible in light of the above teachings. For example, the liner 10 could include a relatively high density nonlamine skin 14 on both opposing faces and/or along the edges of the liner. Additionally, a liner 10 with one or more high density, nonlamine
10 skins 14 could also include one or more facings 16, 20 if required to meet the aesthetic requirements of a particular application.

The embodiment was chosen and described to provide the best illustration of the principles of the invention and its practical application to thereby enable one of ordinary skill in the art to utilize the invention in various embodiments and with various
15 modifications as are suited to the particular use contemplated. All such modifications and variations are within the scope of the invention as determined by the appended claims when interpreted in accordance with the breadth to which they are fairly, legally and equitably entitled.

WHAT IS CLAIMED IS:

1. A hood, dash, firewall or engine cover liner for a vehicle, consisting essentially of:
a single, nonlamine acoustical and thermal insulating layer of polymer fiber selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof or substantially 100% polyethylene terephthalate, characterized by a nonlamine skin of polymer fiber along at least one face of said acoustical and thermal insulating layer, said nonlamine skin of polymer fiber having a higher density than a remainder of said single, nonlamine acoustical and thermal insulating layer of polymer fiber.
2. The liner of claim 1, wherein said acoustical and thermal insulating layer is a nonwoven fabric.
3. The liner of claim 1, wherein said acoustical and thermal insulating layer further includes additional fibers selected from a group consisting of glass fibers and natural fibers.
4. The liner of claim 1, wherein said acoustical and thermal insulating layer is gray or black in color.
5. A hood, dash, firewall or engine cover liner for a vehicle, consisting essentially of:
a single, nonlamine acoustical and thermal insulating layer of substantially 100% polyethylene terephthalate nonwoven fabric characterized by a nonlamine skin of polymer fiber along at least one face of said acoustical and thermal insulating layer, said nonlamine skin of polymer fiber having a higher density than a remainder of said single, nonlamine acoustical and thermal insulating layer of polymer fiber.
6. The liner of claim 5, wherein said acoustical and thermal insulating layer is gray or black in color.
7. A hood, dash, firewall or engine cover liner for a vehicle, consisting essentially of:
a single, nonlamine acoustical and thermal insulating layer of polymer fiber selected from a group consisting of polyester, polypropylene, polyethylene, rayon, nylon and any mixtures thereof that shows no signs of any thickness increase, delamination, deterioration or any undesirable effect which may affect performance for at least 330 hours at 150°C

(302°F) said single nonlamine acoustical and thermal insulating layer being characterized by a nonlamine skin of polymer fiber along at least one face of said acoustical and thermal insulating layer, said nonlamine skin of polymer fiber having a higher density than a remainder of said single, nonlamine acoustical and thermal insulating layer of polymer fiber.

8. The liner of claim 7, wherein said acoustical and thermal insulating layer is a nonwoven fabric.

9. A liner for a vehicle, comprising:

a nonlamine acoustical and thermal insulating layer of polymer fiber, said polymer fiber comprising polyester, polypropylene, polyethylene, rayon, nylon, or a mixture thereof,

wherein said insulating layer comprises a nonlamine skin of polymer fiber along at least one face of said insulating layer, said nonlamine skin of polymer fiber having a higher density than a remainder of said insulating layer.

10. The liner of claim 9, wherein said insulating layer comprises polyester.

11. The liner of claim 9 or claim 10, wherein said insulating layer comprises polypropylene.

12. The liner of any one of claims 9 to 11, wherein said insulating layer further comprises glass fibers.

13. The liner of any one of claims 9 to 12, further comprising a first facing layer over a first face of said insulating layer.

14. The liner of claim 13, wherein said first facing layer comprises polyester, rayon, polyethylene, polypropylene, ethylene vinyl acetate, polyvinyl chloride, or a mixture thereof.

15. The liner of claim 13 or claim 14, wherein said insulating layer and said first facing layer have the same color.

16. The liner of any one of claims 13 to 15, further comprising a second facing layer over a second face of said insulating layer.

17. The liner of claim 16, wherein said first facing layer and said second facing layer have the same color.

18. The liner of any one of claims 9 to 17, wherein said insulating layer has a density of between about 40 to about 130 g/ft².

19. An insulator for a vehicle, comprising:

a nonlamine acoustical and thermal insulating layer of polymer fiber, said polymer fiber comprising polyester, polypropylene, polyethylene, rayon, nylon, or a mixture thereof,

wherein said insulating layer comprises a nonlamine skin of polymer fiber along at least one face of said insulating layer, said nonlamine skin of polymer fiber having a higher density than a remainder of said insulating layer.

20. The insulator of claim 19, wherein said insulating layer comprises polyester.

21. The insulator of claim 19 or claim 20, wherein said insulating layer comprises polypropylene.

22. The insulator of any one of claims 19 to 21, wherein said insulating layer comprises glass fibers.

23. The insulator of any one of claims 19 to 22, further comprising a first facing layer over a first face of said insulating layer.

24. The insulator of claim 23, wherein said first facing layer comprises polyester, rayon, polyethylene, polypropylene, ethylene vinyl acetate, polyvinyl chloride, or a mixture thereof.

25. The insulator of claim 23 or claim 24, wherein said insulating layer and said first facing layer have the same color.

26. The insulator of any one of claims 23 to 25, further comprising a second facing layer over a second face of said insulating layer.

27. The insulator of claim 26, wherein said first facing layer and said second facing layer have the same color.

28. The insulator of any one of claims 19 to 27, wherein said insulating layer has a density of between about 40 to about 130 g/ft³.

29. The liner of claim 16, wherein said first and second facing layer has a weight of between 0.50-3.00 ounces per square yard.

30. The insulator of claim 26, wherein said first and second facing layer has a weight of between 0.50-3.00 ounces per square yard.

31. The liner of claim 13, wherein said acoustical and thermal insulating layer is white in color and said first facing layer is black in color.

32. The insulator of claim 23, wherein said acoustical and thermal insulating layer is white in color and said first facing layer is black in color.

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FIG. 1

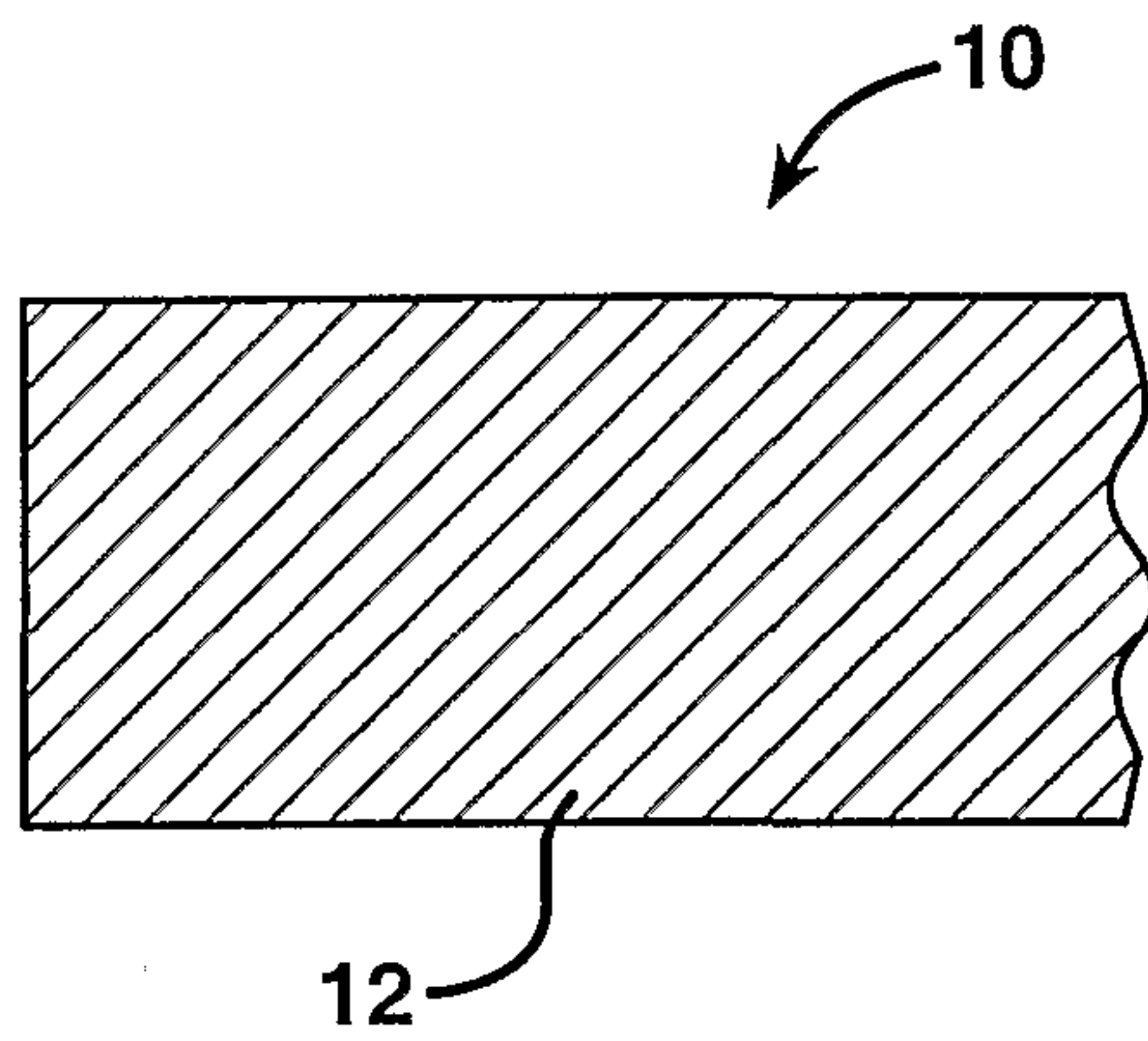


FIG. 2

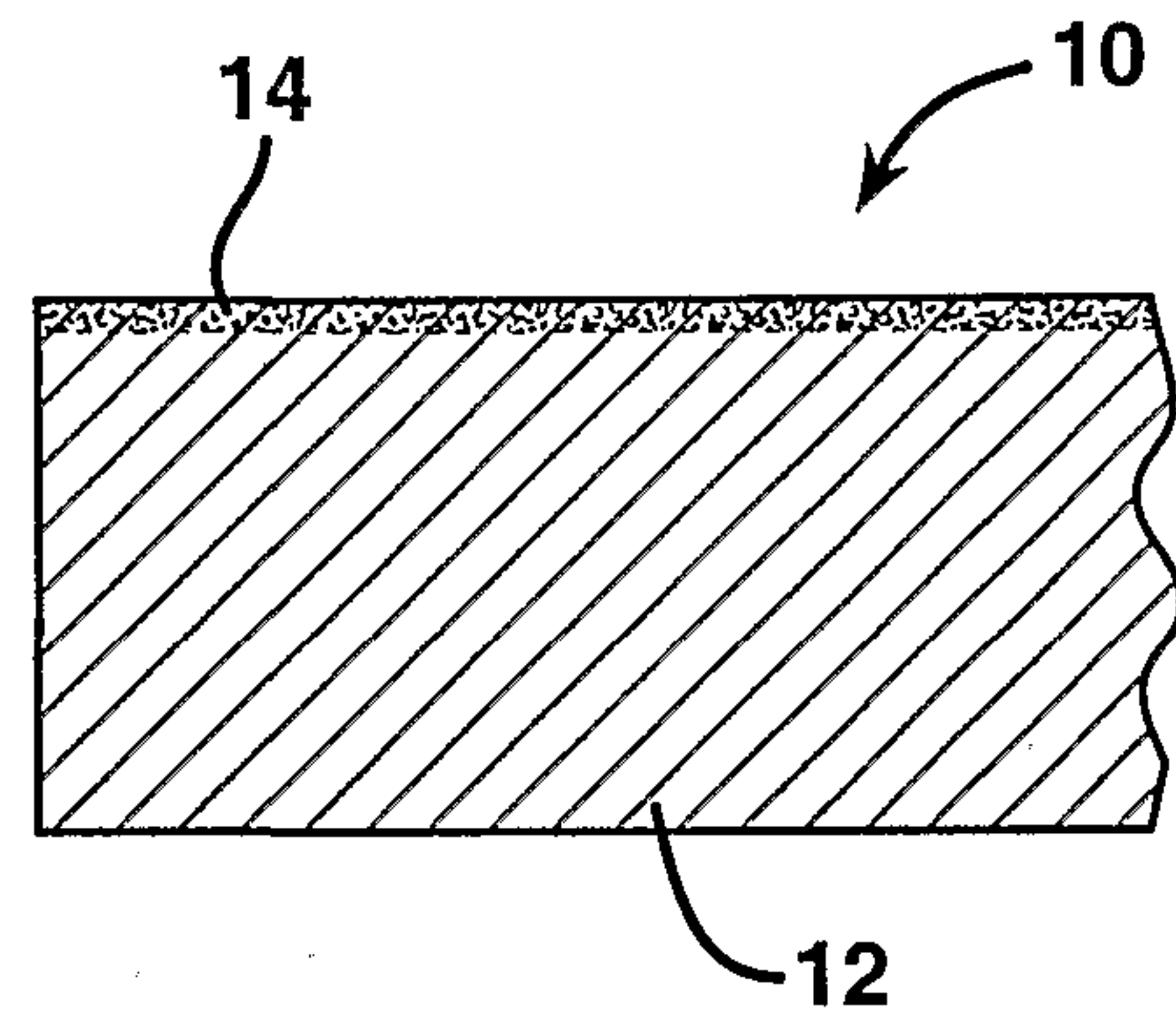


FIG. 3

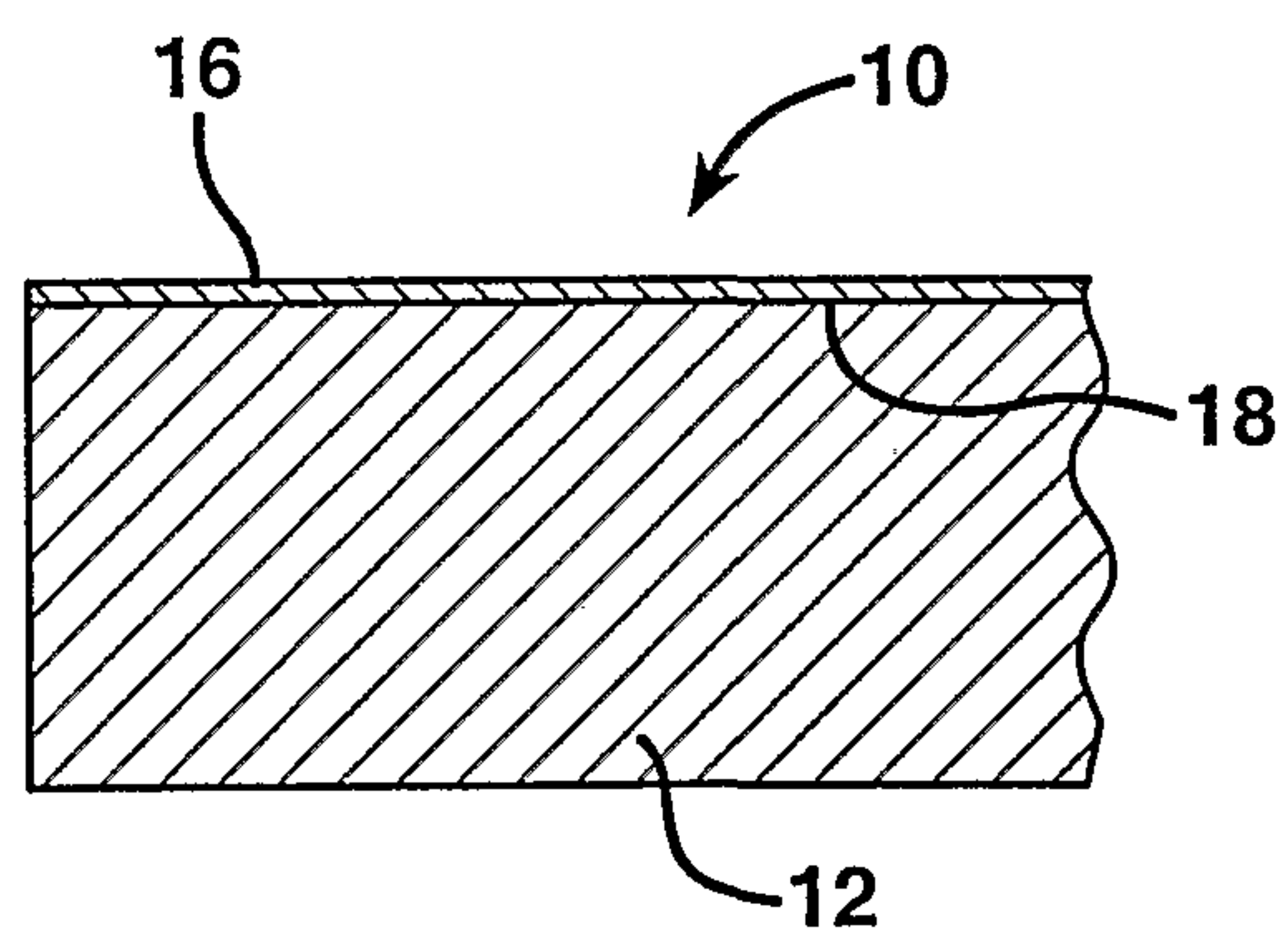
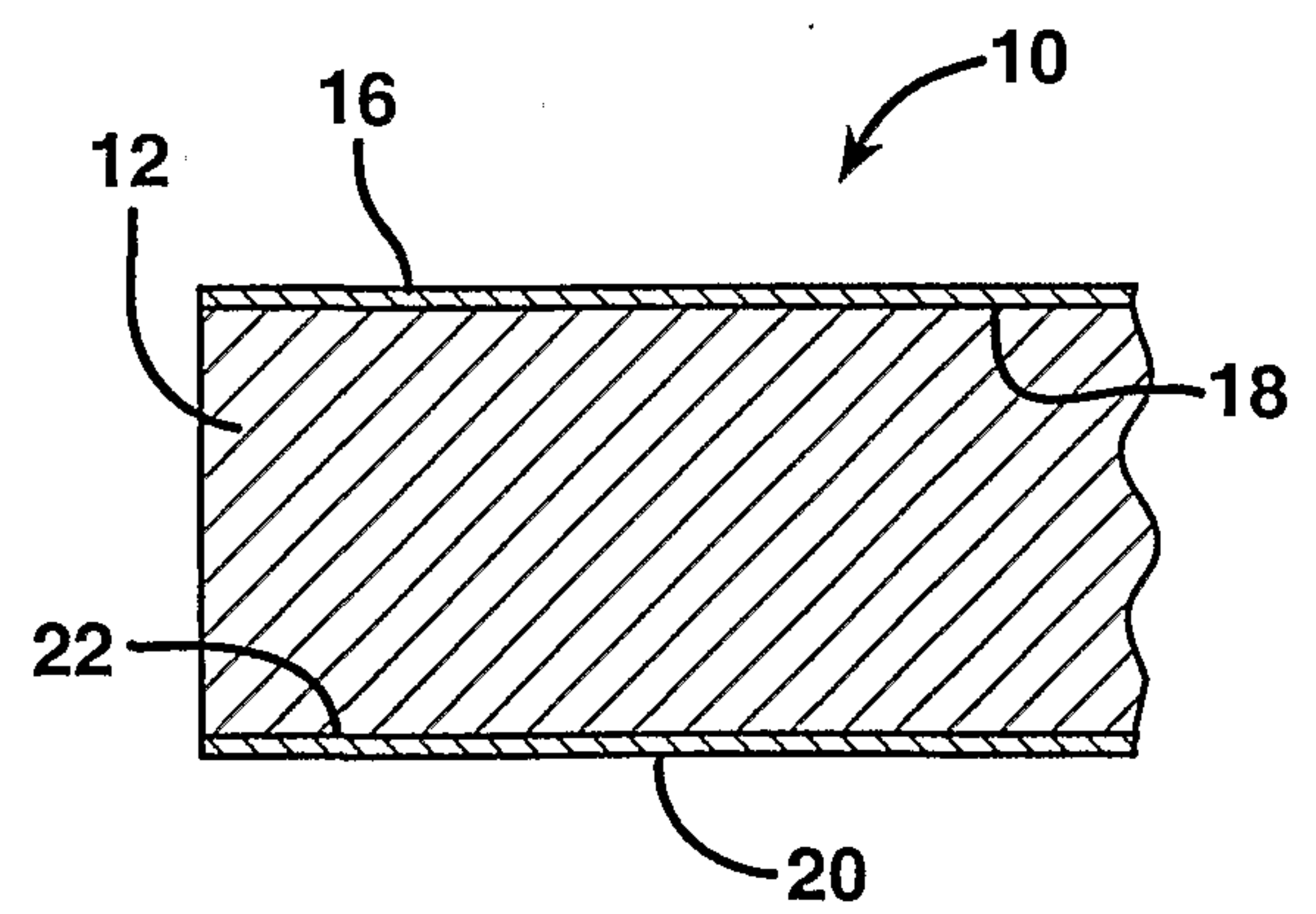


FIG. 4



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FIG. 5

