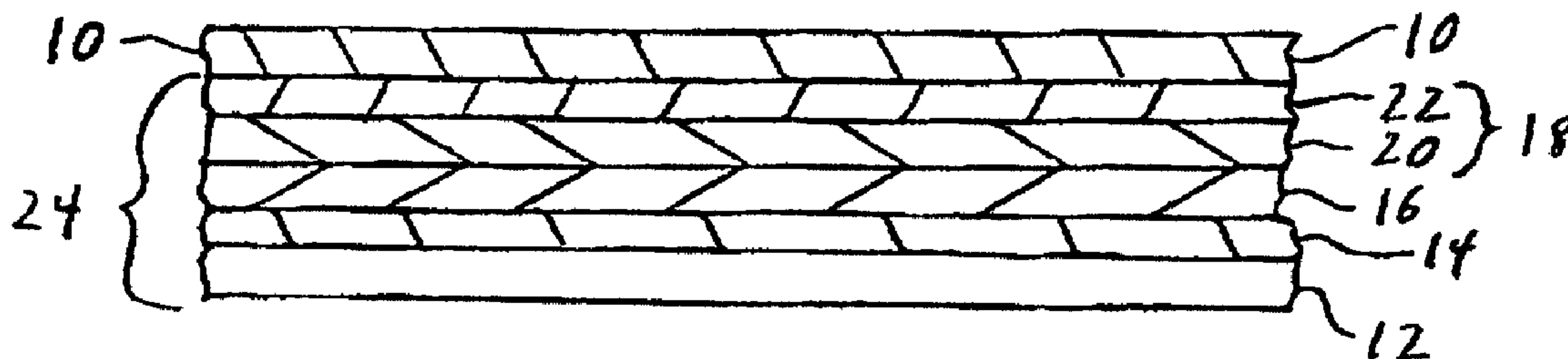




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(57) Abrégé/Abstract:

A heat sealed package including a first package wall having an inner surface and an outer surface and a second package wall having an inner surface and an outer surface. The first package wall is formed of spunbonded olefin. The second package wall includes an inner layer laminated to an outer layer. The inner layer is formed of a blend of polybutylene and one other constituent. The other constituent preferably comprises a 2% ethylene vinyl acetate copolymer of polyethylene. The inner layer forms the inner surface of the second package wall and is heat sealed to the inner surface of the first package wall to form an object receiving chamber. The first package wall is joined to the second package wall by the heat seal such that the first package wall can be peelably removed from the second package wall without tearing of the first package wall.

Abstract of the Invention

A heat sealed package including a first package wall having an inner surface and an outer surface and a second package wall having an inner surface and an outer surface. The first package wall is formed of spunbonded olefin. The second package wall includes an inner layer laminated to an outer layer. The inner layer is formed of a blend of polybutylene and one other constituent. The other constituent preferably comprises a 2% ethylene vinyl acetate copolymer of polyethylene. The inner layer forms the inner surface of the second package wall and is heat sealed to the inner surface of the first package wall to form an object receiving chamber. The first package wall is joined to the second package wall by the heat seal such that the first package wall can be peelably removed from the second package wall without tearing of the first package wall.

PEELABLE HEAT SEALS AND METHOD FOR MAKING SAME**Introduction**

This application relates to peelable heat seals between two sheets of packaging material and a method for producing such seals in a manner which will provide a clean separation between the sheets when the latter are peeled apart. More particularly, the invention relates to a clean peelable heat seal between a first sheet of fibrous spunbonded olefin, such as is sold under the registered trademark TYVEK by DuPont, and a polymeric thermoplastic second sheet. The invention has particular application to the packaging of medical supplies and instruments because the heat seal produced creates an interface that exhibits good seal integrity, provides a controlled peel strength, exhibits minimal fiber tear from the spunbonded olefin, and when peeled open, results in a visual whitening of the polymeric material in the heat seal area, thereby providing evidence of good initial seal integrity. Typical of the applications would involve medical packaging in various forms such as pouches, rigid packages or trays with lid stocks, or other flexible packaging types.

Background of the Invention

Spunbonded olefin sheets have been used for a number of years for various types of packaging. The sheets are formed of high density polyethylene fibers which are spun in continuous strands and bonded together with heat and pressure. Because sheets formed of this material are highly opaque, it is frequently desirable to form one side of a container or package of a transparent lamination, such as a composite of polyester and polyethylene, which is heat sealed to the spunbonded olefin sheet. In order to open the sealed package, the transparent sheet is peeled from the spunbonded olefin sheet. In the packaging of medical goods, it is essential that in opening the package, the seal between the opposing sheets

separate cleanly with substantially no tearing or linting and without the production of strings which could affect the sterile condition of the medical goods contained in the package.

It has been particularly difficult to obtain a satisfactory peel seal between the spunbonded olefin first sheet and the preferably transparent second sheet of polymeric thermoplastic heat sealable material. Such a seal must be easy to open and highly reliable but it must provide an extremely low incidence of tearing and linting of the fibers, and it is highly desirable that the seal, when opened, provide on the transparent second sheet a clear indication of the initial integrity of the seal.

Various attempts have been made to produce a seal which will part cleanly at the interface between a spunbonded olefin sheet and the transparent polymeric sheet. One such effort is set forth in United States Patent No. 4,125,985 dated November 21, 1978 which attempts to provide a peel seal container or pouch with low incidence of tearing or linting. However, this process involves the pretreatment of the spunbonded olefin sheet by the application of a heated die in the shape of the peel seal desired. This process is difficult to control. Heat and pressure must be applied very carefully to get the desired effect and even when performed optimally it still results in fiber tear when the package is opened.

Other prior methods used to produce a peel seal between spunbonded olefin sheets and a sheet of synthetic polymeric thermoplastic heat sealable material have involved coating the spunbonded olefin sheet in order to provide a suitable sealing surface for the thermoplastic sheet. However, the spunbonded olefin material has uneven surface characteristics which tend to affect the sealing quality, and the coating of the spunbonded olefin material not only increases the cost but also changes the porosity characteristics relative to uncoated

spunbonded polyolefin.

Another attempt to accomplish a satisfactory peel seal between a spunbonded olefin sheet and a polymeric thermoplastic heat sealable material, such as an oriented polyester, has been to apply a primer to the polyester and then coat the primed oriented polyester with a low density polyethylene. However, the seal produced is one having inconsistent peel characteristics and a narrow heat seal range. It also often results in fiber tear due to its narrow heat seal range.

Various suggestions (see United States Patent No. 4,189,519) have been made for producing peelable heat seals but these have not been applied to a fibrous sheet material such as that formed of spunbonded olefin. Such sheets are generally designed to seal to themselves or very similar materials, not fibrous materials such as spunbonded polyolefin. Films that seal well to themselves tend to have a narrow range of heat seal temperatures when sealed to spunbonded polyolefin and they do not peel easily or cleanly when opened. It is well known in the art that at high levels such as 25% of polybutylene such materials seal to themselves with such small opening force as to be unacceptable to package even the lightest of articles.

The problems of the prior art are overcome by the present invention which broadly provides a package including a first package wall formed of spunbonded olefin, the first package wall having an inner surface and an outer surface; a second package wall formed of a film laminate having an inner layer and an outer layer, the inner layer formed of a blend of polybutylene and one other constituent, the inner layer of the second package wall being peelably joined to the inner surface of the first package wall along the perimeter thereof so as to define a product receiving chamber in which a product can be sealed within the package.

Furthermore, the present invention may be considered as providing a method of forming a package comprising the steps of providing a first package wall having an outer layer and an inner sealant layer, the sealant layer including an inner layer formed of a blend of polybutylene and one other constituent; providing a second package wall formed of spunbonded olefin; placing the first package wall over the second package wall; heat sealing the sealant layer of the first package wall to the second package wall along edges of the first and second package walls so as to define a product receiving chamber within the package in which a product can be enclosed within the package.

Thus in accordance with this invention, a package is provided which includes a first sheet of spunbonded olefin and a second sheet of polymeric, thermoplastic, heat sealable material. It is preferable that the thermoplastic material be transparent. The package includes a peelable seal between the first and second sheets by means formed by heat and pressure. The second sheet is preferably a lamination which can be accomplished by various means, one of which is to apply a primer to the polyester layer, then extrusion laminate that layer to a coextruded sealant using low density polyethylene (homopolymer). One coextruded layer of the sealant preferably is a low density polyethylene (homopolymer) and the other coextruded layer of the sealant preferably is a blend of an ethylene vinyl acetate copolymer of polyethylene

(preferably on the order of 75% of the blend), and a polybutylene resin (preferably on the order of about 25% of the blend). The ethylene vinyl acetate copolymer is preferably a 2% vinyl acetate composition and the blend forms the outside surface of a coextruded sealant, i.e., the surface which is to be heat sealed to the spunbonded olefin sheet.

Brief Description of the Drawings

Figure 1 is a cross-sectional view of a heat sealed portion of a package made in accordance with this invention showing the various layers of the heat seal between the first and second sheets of the package.

Figure 2 is a cross-sectional view of a package showing heat seals between the two sheets on the sides and a product, such as a sterile medical instrument, disposed within the package.

Detailed Description of the Preferred Embodiment

Figure 1 shows a portion of a package constructed in accordance with this invention in which there is a first sheet 10 formed of spunbonded olefin formed by spinning continuous strands of very fine interconnected fibers and then bonding them together with heat and pressure. The spunbonded olefin is a material such as sold by DuPont under the mark TYVEK. The second sheet 24 is a lamination of polymeric thermoplastic materials which is heat sealable on at least its inside surface and is preferably transparent. Outer layer 12 is preferably forty three to forty eight gauge oriented polyester film. It is contemplated that this layer 12 could be constructed of other materials such as polyethylene, polypropylene, polyamide nylon or other such materials.

In accordance with this invention the outer layer 12 is treated on its inner surface with a suitable primer 14 such as a polyethylene imine primer, and then a low density polyethylene (homopolymer) 16 is used to extrusion laminate outer layer 12 to a coextruded sealant 18 approximately 1.5 mil in thickness, with approximately 1.3 mil of that film consisting of a low density polyethylene (homopolymer) layer 20 and a second layer 22, approximately 0.2 mil in thickness, forming an inner surface for heat sealing to the spunbonded olefin sheet. This second layer 22 of the sealant 18 is made up of a blend of a polybutylene resin and a copolymer of ethylene and vinyl acetate, with suitable amounts of slip and antiblock processing aides being added to give the sealant proper characteristics, as is well known in the art. It is preferred that the copolymer of the second layer 22 be a 2% ethylene vinyl acetate copolymer of polyethylene and that this copolymer form about seventy five parts of the blend, with the polybutylene resin constituting the remaining twenty five parts of the blend which constitutes the approximately 0.2 mil inside surface or second layer 22 of the coextruded sealant 18. Layers 20 and 22 could also be polyethylene homopolymer based or utilize any of the copolymers well known in the art such as, for example, ethylene-acrylic acid (EAA), ionomers such as DuPont's Surlyn®, ethylene a-olefin copolymer, ethylene methyl acrylate (EMA) or ethylene methacrylic acid (EMAA) copolymers. In addition to other copolymers and homopolymers, other polymeric materials could be employed as would be readily apparent to those skilled in the art.

In United States Patent No. 4,189,519 there is a description of a process by means of which the outside surface layer 22 of the coextruded sealant 18 may be prepared. The coextruded sealant 18 may be produced on a circular die blown film extruder.

One suitable process for laminating the transparent polyethylene coextruded sealant 18 to the polyester sheet 12 is described in United States Patent No. 4,421,823.

After the extrusion lamination of the primed polymeric sheet 12 with the coextruded sealant 18, the second pouch wall 24 is brought into contact with the spunbonded olefin first sheet 10 around the perimeter of the package with the approximately 0.2 mil coextruded second layer 22 of the sealant 18 (comprising of the blend of the polyethylene vinyl acetate copolymer and the polybutylene) in contact with the surface of the spunbonded olefin sheet. The two sheets 10 and 24 are then heat sealed at the edges in the usual manner at a temperature in the range of between 240 and 300 degrees Fahrenheit. The temperature of the heat seal is important because if it is too cool a proper seal may not be obtained and if it is too hot the sealant bonds too well to the spunbonded olefin resulting in fiber tear when opened. For best results, the seal strength should be between one and three pounds per inch.

A pouch or package formed in this manner is illustrated in Figure 2. A product receiving chamber 26 is defined between sheet 10 and sheet 24 which are sealed around three edges. A product 28 is inserted into the chamber 26 through the open edge. The product could be a medical instrument in need of sterilization or any of a wide variety of other medical instruments or products. The final seal is then made along the edge which was open.

Figure 2 illustrates a pouch or package wherein the heat seal is made face to face between the second layer 22 and the layer 10. It would also be possible to have either the lower sheet 24 extend beyond the side edge of the upper sheet 10, or to have the upper sheet 10 extend beyond the lower sheet 24, and then fold the longer sheet over on top of the edge of the shorter sheet and create a seal therebetween by means of double-sided pressure sensitive tape as is well known in the art or some other adhesive or other seal mechanism. U.S. Patent No. 4,276,982 demonstrates one such type of closure. A chevron-shaped heat seal may be formed at the end of the package opposite from the end having the opening through which the product is inserted into the package. The end of the package having the chevron-shaped seal

also includes gripping means formed by portions of the sheets 10 and 24 that are not sealed to one another and that are located outwardly from the chevron-shaped heat seal. The gripping means facilitate the peeling apart of the sheets 10 and 24 from one another to open the package along the heat seal which provides the "whitening" appearance as evidence of seal integrity. It is important to facilitate opening through a heat-sealed edge as opposed to an adhesively sealed edge. Only in this manner can one insure the appearance of "whitening" which demonstrates prior seal integrity.

When such a pouch or package is put in a sterilization device the sterilization medium easily permeates the layer of spunbonded olefin to perform the sterilization function. The package or pouch of the present invention includes a peelable seal between the sheet 10 of spunbonded olefin and the sheet 24 of polymeric thermoplastic heat sealable material. The seal has high integrity with minimal fiber transfer from the spunbonded olefin. The seal formed in the package or pouch of the present invention, when opened to remove the product contained in the chamber 26, provides a uniform indication that the package had previously been sealed and a telltale sign of the integrity of the previous seal due to a "whitening" appearance along the portion of second layer 22 that was previously sealed to sheet 10.

Such a sign results because, unlike prior art approaches, the polybutylene acts to weaken the structural strength of the sealant layer, not its surface characteristics. In sealing to spunbonded olefin you do not want to achieve a fusion seal. To do so would result in melting of the spunbonded olefin which would destroy its strength and other beneficial physical properties. The seal of the package of the present invention causes the portions of the second layer 22 to flow in among the fibers of the spunbonded olefin thereby creating a strong but peelable bond. When the seal is peeled away to expose the contents for removal the sealant fails internally leaving the portions which have flowed in among the fibers in

place. This can be confirmed with analytical tests such as surface infrared spectrometry which was used to confirm the presence of polybutylene and EVA in the seal area of the TYVEK spunbonded olefin after packages were opened. The spunbonded olefin fibers are stronger than the internal strength of the sealant layer so there is no resulting fiber tear. It is this internal sealant layer failure which produces the telltale "whitening" appearance on the layer 22 when it is peeled open. The present invention also produces a package having a uniform seal strength which is so important for medical packaging applications.

Various features of the invention have been particularly shown and described in connection with the illustrated embodiment of the invention, however, it must be understood that these particular arrangements merely illustrate, and that the invention is to be given its fullest interpretation within the terms of the appended claims.

What is claimed is:

1. A package including:
a first package wall formed of spunbonded olefin, said first package wall having an inner surface and an outer surface;
a second package wall formed of a film laminate having an inner layer and an outer layer, said inner layer formed of a blend of polybutylene and one other constituent, said inner layer of said second package wall being peelably joined to said inner surface of said first package wall along the perimeter thereof so as to define a product receiving chamber in which a product can be sealed within said package.
2. The package of claim 1 wherein said other constituent blended with said polybutylene is selected from the group consisting of ethylene vinyl acetate copolymer, ethylene acid copolymer and low density polyethylene.
3. The package of claim 1 wherein said other constituent blended with said polybutylene comprises an ethylene vinyl acetate copolymer of polyethylene.
4. The package of claim 3 wherein said ethylene vinyl acetate copolymer of polyethylene comprises 2% ethylene vinyl acetate.
5. The package of claim 1 wherein said inner layer of said second package wall is comprised of approximately 25% by weight of polybutylene and approximately 75% by weight of said one other constituent.

6. The package of claim 1 wherein said inner layer of said second package wall is laminated to a first layer of low density polyethylene, said inner layer and said first layer of low density polyethylene forming a sealant layer.

7. The package of claim 6 including a second layer of low density polyethylene located between said sealant layer and said outer layer.

8. The package of claim 1 wherein said inner layer of said second package wall is heat sealed to said inner surface of said first package wall.

9. The package of claim 1 wherein said first package wall is heat sealed to said second package wall along a portion of its perimeter.

10. The package of claim 9 including a product receiving opening defined between a portion of said first package wall and said second package wall through which the product to be packaged can be inserted into said product receiving chamber.

11. The package of claim 10 including a heat seal formed between said first and second package walls to seal said product receiving opening thereby sealing said chamber of said package.

12. The package of claim 10 including means for sealing said first package wall to said second package wall at said product receiving opening to seal said product receiving opening.

13. The package of claim 12 wherein said means for sealing said product receiving opening comprises pressure sensitive tape.

14. The package of claim 1 in which said first package wall is formed of spunbonded olefin and said second package wall is a flexible film laminate of polymeric thermoplastic heat sealable material.

15. The package of claim 14 in which said second package wall is transparent to allow for viewing the contents of the package.

16. The package of claim 9 wherein when said heat seal is peeled apart a whitened appearance is produced on said inner layer in the area of the previous heat seal to evidence prior seal integrity.

17. A method of forming a package comprising the steps of:

- providing a first package wall having an outer layer and an inner sealant layer, said sealant layer including an inner layer formed of a blend of polybutylene and one other constituent;
- providing a second package wall formed of spunbonded olefin;
- placing said first package wall over said second package wall;
- heat sealing said sealant layer of said first package wall to said second package wall along edges of said first and second package walls so as to define a product receiving chamber within said package in which a product can be enclosed within said package.

18. The method of claim 17 wherein said heat sealing of said first package wall to said second package wall is performed at a temperature in the range between approximately 240°F and approximately 300°F.

19. The method of claim 17 wherein the step of providing said first package wall further comprises coextruding said inner layer of said sealant layer with a first layer of low density polyethylene and laminating said first layer of low density polyethylene to said outer layer of said first package wall.

20. The method of claim 19 wherein the step of providing said first package wall further comprises extrusion laminating said coextrusion of said inner layer and said first layer of low density polyethylene to said outer layer with a second layer of low density polyethylene.

21. The method of claim 17 including the further step of heat sealing said inner layer of said first package wall to said second package wall along a portion of the periphery thereof to thereby form a product receiving opening between a portion of said first package wall and said second package wall through which the product to be packaged can be inserted within said product receiving chamber.

22. The method of claim 21 wherein the heat sealing step causes portions of said inner layer of said first package wall to flow in among the fibers of spunbonded olefin of said second package wall thereby creating a strong but peelable bond in said heat seal area.

23. The method of claim 22 including the further step of providing means for sealing said product receiving opening on one of said first package wall and said second package wall.

24. The method of claim 22 including the step of sealing said product receiving opening to thereby seal said product receiving chamber.

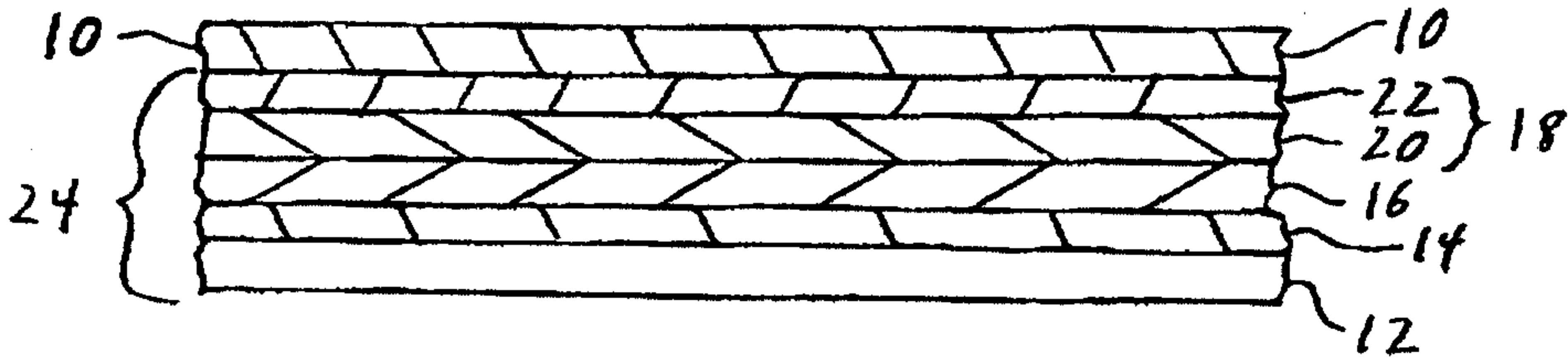


FIG. 1

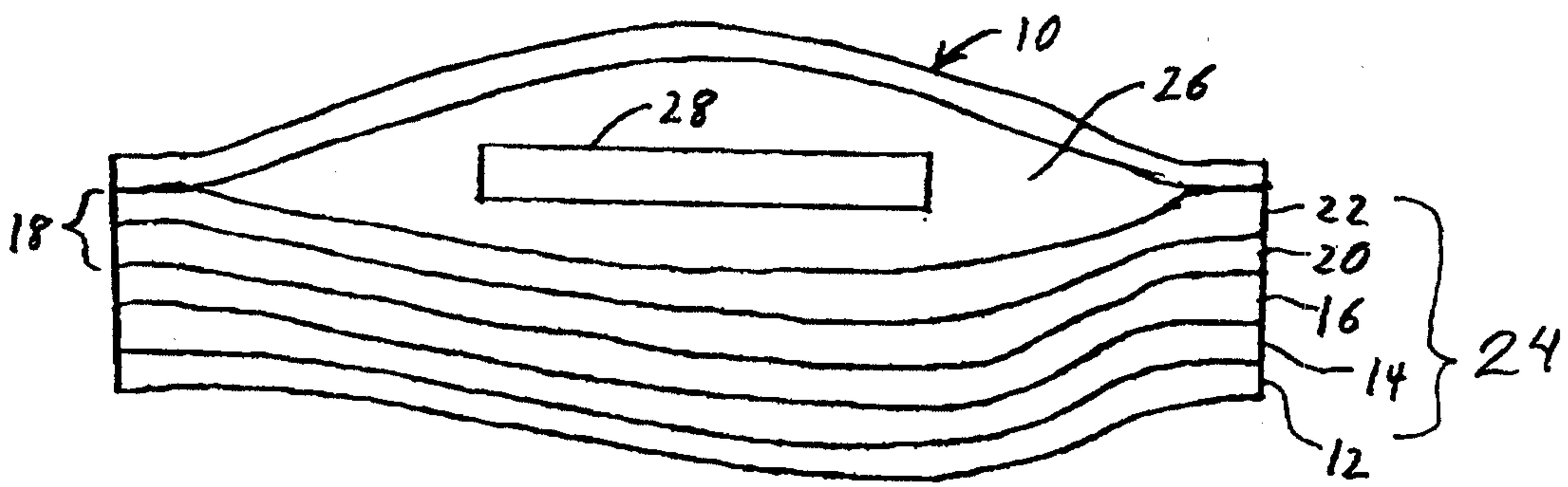


FIG. 2

