Office de la Propriété Intellectuelle du Canada
Un organisme d'Industrie Canada

Canadian Intellectual Property Office
An agency of Industry Canada

CA 2011032 C 2004/11/23

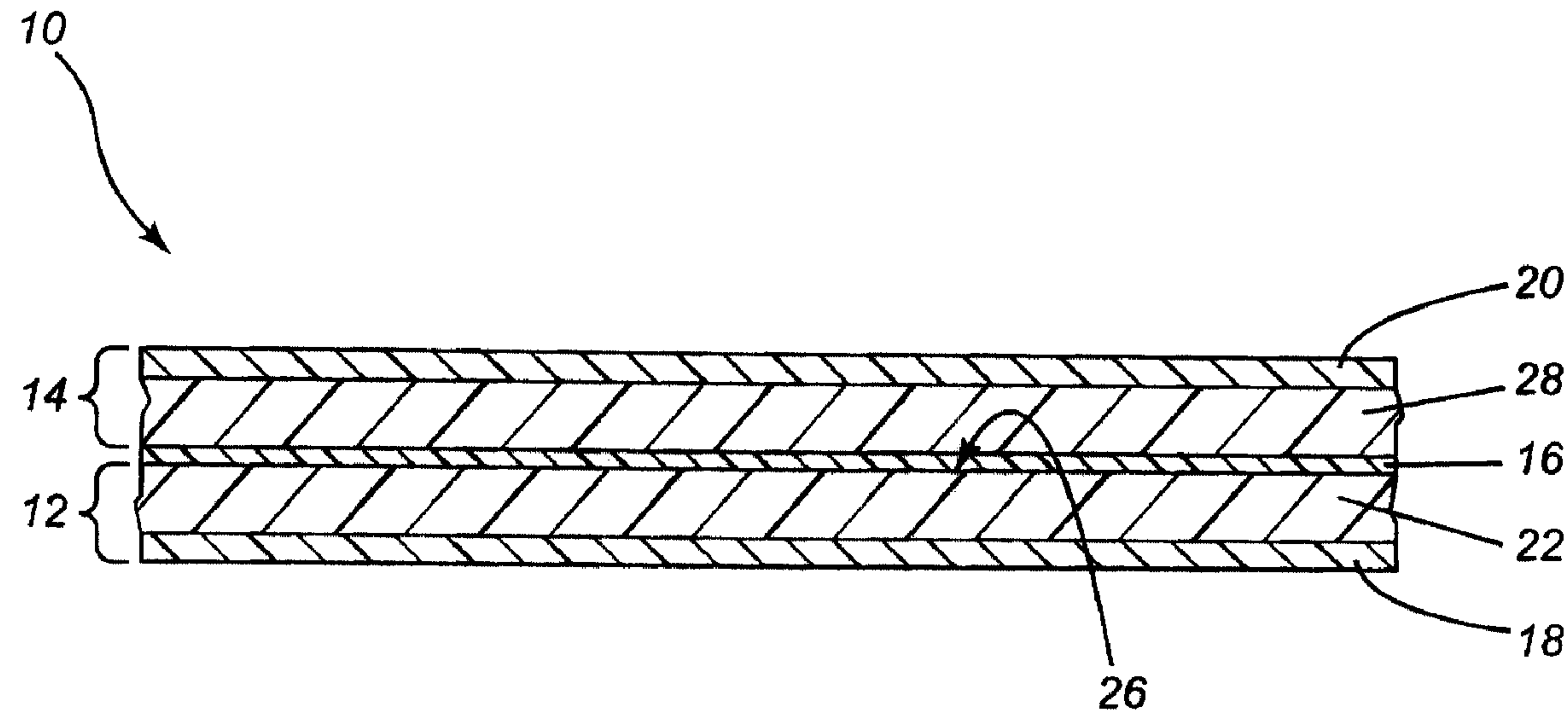
(11)(21) 2 011 032

(12) BREVET CANADIEN
CANADIAN PATENT

(13) C

(22) Date de dépôt/Filing Date: 1990/02/27
(41) Mise à la disp. pub./Open to Public Insp.: 1991/08/27
(45) Date de délivrance/Issue Date: 2004/11/23
(51) Cl.Int.^{5}/Int.Cl.^{5} B32B 15/08, B32B 27/08
(72) Inventeurs/Inventors:
BALLONI, RICCARDO, US;
NAHMIAS, ALAN MICHAEL, US
(73) Propriétaire/Owner:
EXXONMOBIL OIL CORPORATION, US
(74) Agent: GOWLING LAFLEUR HENDERSON LLP

(54) Titre : PELLICULE D'EMBALLAGE MULTICOUCHE
(54) Title: LAMINATED PACKAGING FILM



(57) Abrégé/Abstract:
A polymer film laminate is provided having improved machinability on modern high speed belt drive machines, particularly when these machines are set up to form lap back seals. A method of assembling such a film is also provided. The film includes an outside web having an upper surface layer containing a silicone oil. This laminating web can be used with virtually any co-laminate, metallized or not, which is bonded thereto with an adhesive. Upon winding the composite film laminate upon a core, silicone oil is transferred to the inside surface of the laminate, thus providing an inside coefficient of friction which is about equal to or less than the outside coefficient of friction. Hot slip properties are also improved upon such transfer. The outside and inside webs are independently formed, which allows the inside web to include coatings or film layers which are not ordinarily usable in a silicone oil-containing film.

2011032 MAR 13 1997

ABSTRACT

A polymer film laminate is provided having improved machinability on modern high speed belt drive machines, particularly when these machines are set up to form lap back seals. A method of assembling such a film is also provided. The film includes an outside web having an upper surface layer containing a silicone oil. This laminating web can be used with virtually any co-laminate, metallized or not, which is bonded thereto with an adhesive. Upon winding the composite film laminate upon a core, silicone oil is transferred to the inside surface of the laminate, thus providing an inside coefficient of friction which is about equal to or less than the outside coefficient of friction. Hot slip properties are also improved upon such transfer. The outside and inside webs are independently formed, which allows the inside web to include coatings or film layers which are not ordinarily usable in a silicone oil-containing film.

LAMINATED PACKAGING FILM

This invention relates to polymer film laminates; more particularly, this invention relates to polymer film laminates suitable as packaging film; to processes for their preparation; and to their use with belt-driven packaging machines.

Certain polymer films, for example oriented polypropylene, have a number of advantageous properties such as transparency, stiffness and moisture barrier while having coefficients of friction (COF) which are unacceptably high for use as such in modern packaging technology. Treatment of such polymer films with silicone oils has been found to provide satisfactory reductions in their COF; but films so treated are then relatively difficult to treat in other conventional manners: for example, the bond strengths of such films, when laminated to themselves or to metallised coatings, may be unacceptably low; furthermore, corona or flame treatment reduces their heat sealability and increases their COF.

This invention seeks to provide polymer film laminates which are sealable on both surfaces with excellent bond strength and COF thereon; and which permit great flexibility in combining film layers of selected properties.

In one aspect, this invention provides a polymer film laminate which comprises:

a first web including an upper surface layer which layer contains a silicone oil and an anti-blocking agent, and a core layer wherein the surface of the core layer remote from the upper surface layer may be ink receptive;

a second web including a lower surface layer which layer contains an anti-blocking agent but is substantially free from compounded silicone oil; and an adhesive layer bonding the first web to the second web such that the upper surface layer of the first web and the lower surface layer of the second web remain exposed and silicone oil transfers from the upper surface layer of the first web to the lower surface layer of the second web in processing.

This invention also provides a process for the preparation of a polymer film laminate as herein defined, which process comprises:

i) providing a first web as herein defined;
ii) providing a second web as herein defined;
iii) applying an adhesive layer between the first and second webs;
iv) bonding the first web to the second web such that the upper surface layer of the first web and the lower surface layer of the second web remain exposed; and
v) contacting the upper surface layer of the first web with the lower surface layer of the second web so that silicone oil transfers from the upper surface layer of the first web to the lower surface layer of the second web.

This invention further provides use of a film laminate as herein defined in a belt-driven packaging system.

The surface of the first web which is adhered to the second web may be treated so that it is receptive to ink. The bonding of the second web to the first web thereby locks in any printing on this surface so that it cannot be damaged in a packaging operation.

Figure 1 is a schematic of the polymer film laminate of the present invention.

Figure 2 is a schematic of an alternative polymer film laminate of the present invention.

A polymer film laminate (10) is provided which includes a first (or outside) web (12), second (or inside) web (14), an adhesive layer (16) bonding the webs to each other, the first web (12) including an upper surface layer (18) containing a silicone oil, the second web (14) including a lower surface layer (20) substantially devoid of silicone oil except for oil which is transferred by contact with upper surface layer (18). The outer surfaces of the polymer film laminate are preferably heat sealable, Such a film laminate can be used for packaging in either belt-driven or non-belt-driven packaging machines and regardless of whether fin or lap seals are formed thereby.

When polymer films are formed into bags or sacks for receiving articles, the outer surfaces thereof can become scratched if the coefficient of friction is relatively high at the temperature at which such bags are constructed. The excessive drag which may cause such scratching may also cause the packaging apparatus to jam. With the advent of belt-driven packaging apparatus including an inside shaping tube which allows the belts to engage the film between the tube and belts, it is now important that both surfaces of the film have satisfactory hot slip performance. This allows the film to be processed on both the new belt-driven apparatus as well as older equipment.

Silicone oils of the types described in U.S. Patent 4,659,612 have been found to impart satisfactory slip characteristics to oriented polypropylene films. In accordance with the present invention, the first web (12) of the polymer film laminate (10) includes and upper surface layer (18) (about 2 to 6 gauge units in thickness) containing an amount of silicone oil sufficient to maintain a low coefficient of friction thereon. The upper surface layer (18) is preferably a heat seal layer and is preferably a ethylene-propylene random copolymer and/or ethylene-propylene-butene-1 terpolymer.

The latter includes from 2 to 9 wt. and preferably from 3 to 7 wt.% ethylene, and from 2 to 9 wt.% and preferably from 3 to 7 wt.% of 1-butene. Suitable polymers generally have a melt flow rate at 446°F from 1 to 15 and preferably form 2 to 7. The crystalline melting point is from 245 to 302°F. The average molecular weight range is from 25,000 to 100,000 and the density is from 0.89 to 0.90. The silicone oil, preferably polydimethylsiloxane, is added in an amount form 0.3 wt.% to 5.0 wt.% of the heat sealable skin layer. The preferred range is from 1.1 to 1.5 wt.%.

The upper surface layer (18) is compounded with an anti-blocking agent to help maintain a low coefficient of friction. A finely divided, particulate, inorganic material is preferred having a mean particle size from 0.5 to 5 microns. One commercially available silica has a mean particle size of 0.75 microns and another has a mean particle size of 4.5 microns, Materials having either particle size or particle sizes within this range can be employed. Metal silicates, glasses, clays and numerous other finely comminuted inorganic materials may also be used. The anti-blocking agent is preferably present in an amount from 0.05 to 0.5 wt.%, preferably from 0.1 to 0.3 wt.% of each of the skin layers.

The core layer (22) of the first web (12) is preferably derived from isotactic polypropylene which may contain anti-static agents as described in U.S. Patent 4,764,425. The polypropylene homopolymer has a melting point from 321 to 325°F.

The polypropylene core layer (22) provides a moisture barrier and stiffness to the first web. Other possible core materials include oriented high density polyethylene, oriented polystyrene, oriented polyethylene terephthalate, polycarbonate and nylon.

An additional layer (24) may be provided having a surface which is receptive to ink. This layer (24) may comprise the same copolymer and/or terpolymer blend as layer (18), but is subjected to corona, flame, plasma or chemical treatment to impart ink receptivity. This layer (24) may alternatively be omitted and the inner surface (26) of the core layer (22) instead subjected to such treatment.

A primer may be added to the layer (24) depending upon the ink which is to be used thereon. Any of a number of commercially available primers would be suitable for enhancing receptivity to ink and/or adhesive, including poly(ethyleneimine), acrylic styrene copolymers, urethane and epoxy. The application of several such primers is discussed in U.S. Patent 4,565,739.

The second web (14) includes a lower surface layer (20), a core layer (28) and a bonding surface layer (30) for bonding with the adhesive. The lower surface layer core and bonding surface layer, respectively, may be comprised of the same materials which are mentioned as suitable for the upper surface layer (18), core layer (22), and additional layers (24) of the first web. The lower surface layer (20) of the second web (14) is substantially devoid of silicone oil, however, which enhances the adhesion of a metallized coating which may be applied to the second web bonding surface layer. The latter is preferably between about two and seventeen gauge units in thickness. It may contain a slip agent (for example, from 700 to 3,000 ppm oleamide, stearamide, erucamide or a blend thereof.

While not required, each web is preferably manufactured by employing commercially available systems for coextruding resins. A polypropylene homopolymer of comparatively high stereoregularity is co-extruded with the resins which constitute one or both skin layers thereof. The polymers can be brought into the molten state and co-extruded from a conventional extruder through a flat sheet die, the melt streams being combined in an adapter prior to being extruded from the die. After leaving the die orifice, the multi-layer film structure is chilled and the quenched sheet then preferably reheated and stretched, for example, three to six times in the machine direction and subsequently four to ten times in the transverse direction. The edges of the web can be trimmed and the film wound onto a core.

A metallized coating may be applied to the bonding surface layer of the second (inside) web using any acceptable method such as that described in U.S. Patent 4,345,005. Other coatings may alternatively be employed depending on the properties desired for the film. A PVDC coating may, for example, be provided to improve the gas and moisture barrier properties of the web.

The fist (outside) and second (inside) webs are bonded to each other through the use of commercially available adhesives and conventional bonding processes. The choice of adhesives depends on the properties which one wishes the laminated film to have. A urethane adhesive provides mainly only adhesion. Extruded polymer resins can provide thickness, stiffness and durability. As discussed above, PVDC provides a gas barrier and an additional moisture barrier. If a dry bonding technique is used, the adhesive is applied to one of the webs, the solvent is evaporated out of the adhesive, and the adhesive-coated web is combined with the other web by heat and pressure or pressure only.

Extrusion laminating involves the use of an extruder to melt and continuously apply a controlled amount of a very viscous melted resin, usually polyethylene, directly between the web materials being laminated. The bound is achieved as the melted resin resolidifies in situ. Primers or precoatings may be employed to augment the bound or improve resistance or chemical attack.

Once the first (outside) web has been bonded to the second (inside) web, the resulting laminated film is wound onto a core and maintained in this form for a period of about six hours to one week at a temperature of about 80° to about 125°F. The winding of the film causes the upper layer (18) of the first (outside) web to contact the lower surface layer (20) of the second (inside) web. The silicone oil, which is generally substantially uniformly distributed on the exposed surface of upper layer (18), is responsible for imparting a reduced coefficient of friction to this surface as well as to the exposed surface of the lower surface layer (20) when some of the oil is transferred thereto after these surfaces have been placed in mutual contact. A sufficient amount of silicone oil should be employed to provide a coefficient of friction of layers (18) and (20), following transfer of silicone oil microglobules to the latter, of about 0.4 to less, preferably 0.25 - 0.3, up to at least about 60°C.

The thickness of the first (outside) web is primarily due to the thickness of the oriented polypropylene core, The surface layers (18) and (24) may comprise, for example, a total of about eight percent of the total thickness of an 80 gauge web. The total outside web thickness is ordinarily in the range of about 0.35 to 2.0 mils, The total thickness of the inside and outside webs are not critical to the present invention.

The following Examples illustrate this invention.

Example 1

A laminated film comprising an outside web having a coextruded abc structure, an inside web having a coextruded $a^1b^1c^1$ structure, and an adhesive bonding the c layer of the outside web to the c^1 layer of the inside web is provided.

The "a" layer is an ethylene propylene random copolymer containing about six percent ethylene. This layer is about 2.2 gauge units (0.55 microns) in thickness, is 1.2 wt. percent polydimethylsiloxane, and includes about 2300 ppm SiO_2. The "b" layer of the outside web is an isotactic polypropylene containing about 0.1% N,N bis hydroxyethylamine and is about seventy-five gauge units in thickness. The "c" layer is about three gauge units in thickness, is made from the same copolymer as layer "a", is flame treated and coated with a polyethylenemine primer.

The c^1 layer is made from an isotactic polypropylene homopolymer and contains about 2300 ppm SiO_2. It is about three gauge units in thickness and is flame treated. The b^1 layer is about seventy-five gauge units in thickness and is made from isotactic polypropylene with no additives. Finally, the a^1 layer is fourteen gauge units in thickness (for hermetic sealability) and is formed from an ethylene-propylene random copolymer (about 6% ethylene)containing 2300 ppm SiO_2 and a slip agent (e.g. oleamide, stearamide, erucamide and blends thereof).

The urethane adhesive bonds the c layer of the outside web to the c^1 layer of the inside web. The laminated film is wound upon a roll whereupon some of the polydimethylsiloxane within the "a" layer is transferred to the a^1 layer.

Examples 2 - 3

The same film structure as Example 1 is provided except that the a^1 layer is four and six gauge units, respectively, in thickness.

Example 4

The same film structure as Example 1 is provided except that the abd a^1 layers are both made from EPB-1 random terpolymers containing about 5% ethylene, 8% butene-1 and 87% polypropylene.

Example 5

The same film structure as Example 1 is provided except that the c^1 layer has a metallized (aluminium) coating deposited thereon.

Example 6

The same film structure as Example 1 is provided except that the "a" layer is formed from a random copolymer containing about 6% butene-1 and 94% polypropylene.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A polymer film laminate which comprises:

a first web including an upper surface layer which layer contains a silicone oil and an anti-blocking agent, and a core layer wherein the surface of the core layer remote from the upper surface layer may be ink receptive;

a second web including a lower surface layer which layer contains an anti-blocking agent but is substantially free from compounded silicone oil, and

an adhesive layer bonding the first web to the second web such that the surface of the upper surface layer and the lower surface layer remote from the adhesive layer remain exposed and silicone oil transfers from the upper surface layer to the lower surface layer in processing.

2. A laminate according to claim 1 wherein the first web includes an additional layer wherein the surface of the additional layer remote from the core layer is ink receptive.

3. A laminate according to claim 1 or claim 2 wherein any ink receptive surface present adjoins, either directly or with the interposition of a primer layer, the adhesive layer.

4. A laminate according to claim 1 wherein the second web comprises a core layer.

5. A laminate according to claim 1 or claim 4 wherein the second web comprises an additional layer.

6. A laminate according to claim 1 wherein at least one of the upper surface layer and lower surface layer is heat sealable.

7. A laminate according to claim 1 wherein at least one of the upper surface layer and lower surface layer comprises at least one of a random copolymer and terpolymer.

8. A laminate according to claim 2 wherein the additional layer comprises a random copolymer and/or terpolymer.

9. A laminate according to claim 7 or claim 8 wherein the random copolymer includes a binary copolymer of ethylene and propylene; and the terpolymer includes a ternary copolymer of ethylene, propylene and butene-1.

10. A laminate according to claim 1 wherein the core layer comprises oriented homopolymeric polypropylene.

11. A laminate according to claim 10 wherein the polypropylene comprises isotactic polypropylene.

12. A laminate according to claim 10 wherein the silicone oil comprises a polydialkylsiloxane.

13. A laminate according to claim 1 or claim 12 wherein the silicone oil comprises from 1.1 to 1.5% by weight of layer (a) as extruded.

14. A laminate according to claim 1 wherein the second web includes a metallized layer adjoining the adhesive layer.

15. A laminate according to claim 1 wherein the second web includes a coating effective to improve the gas barrier properties of the laminate adjoining the adhesive layer.

16. A laminate according to claim 5 wherein the additional layer comprises random copolymer and/or terpolymer.

17. A laminate according to claim 4 wherein the core layer comprises oriented homopolymeric polypropylene.

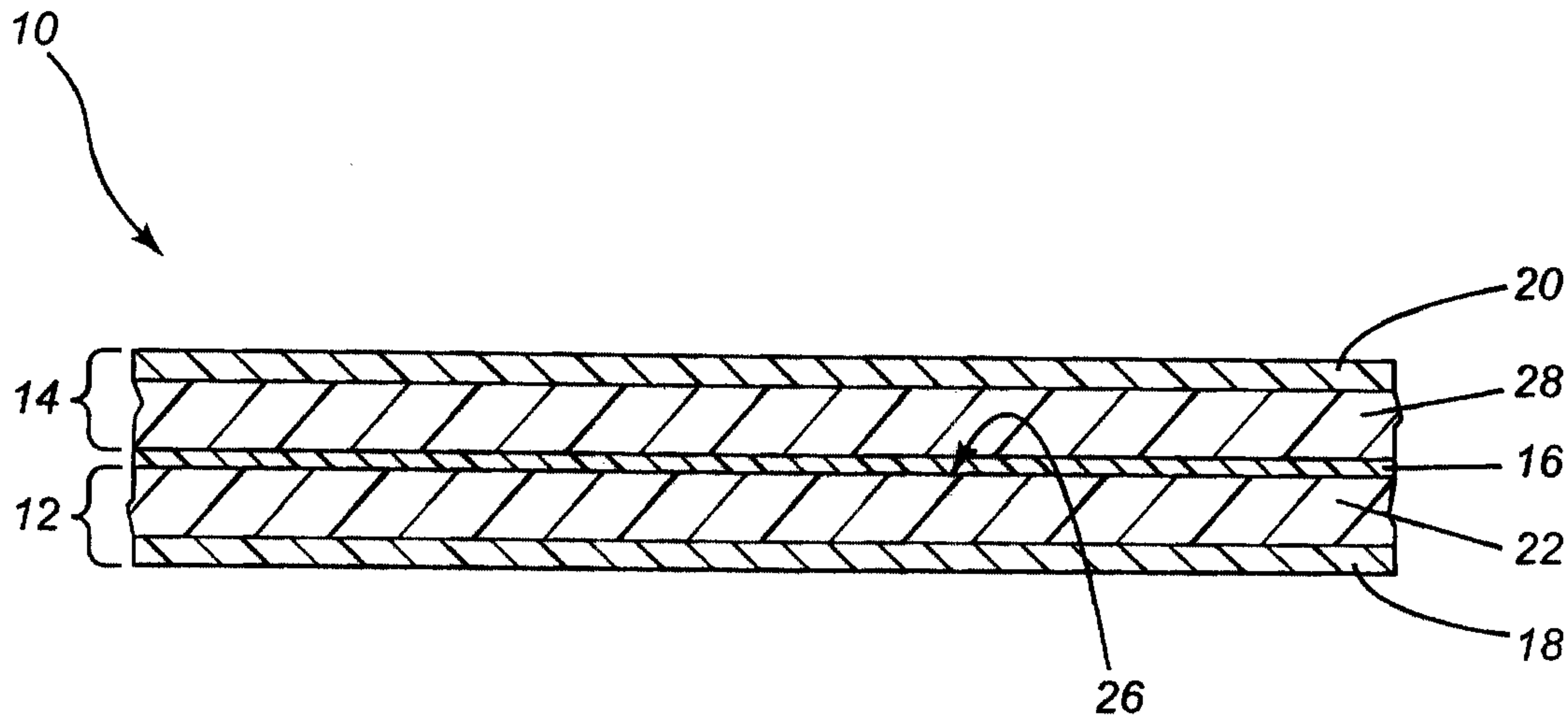


Fig. 1

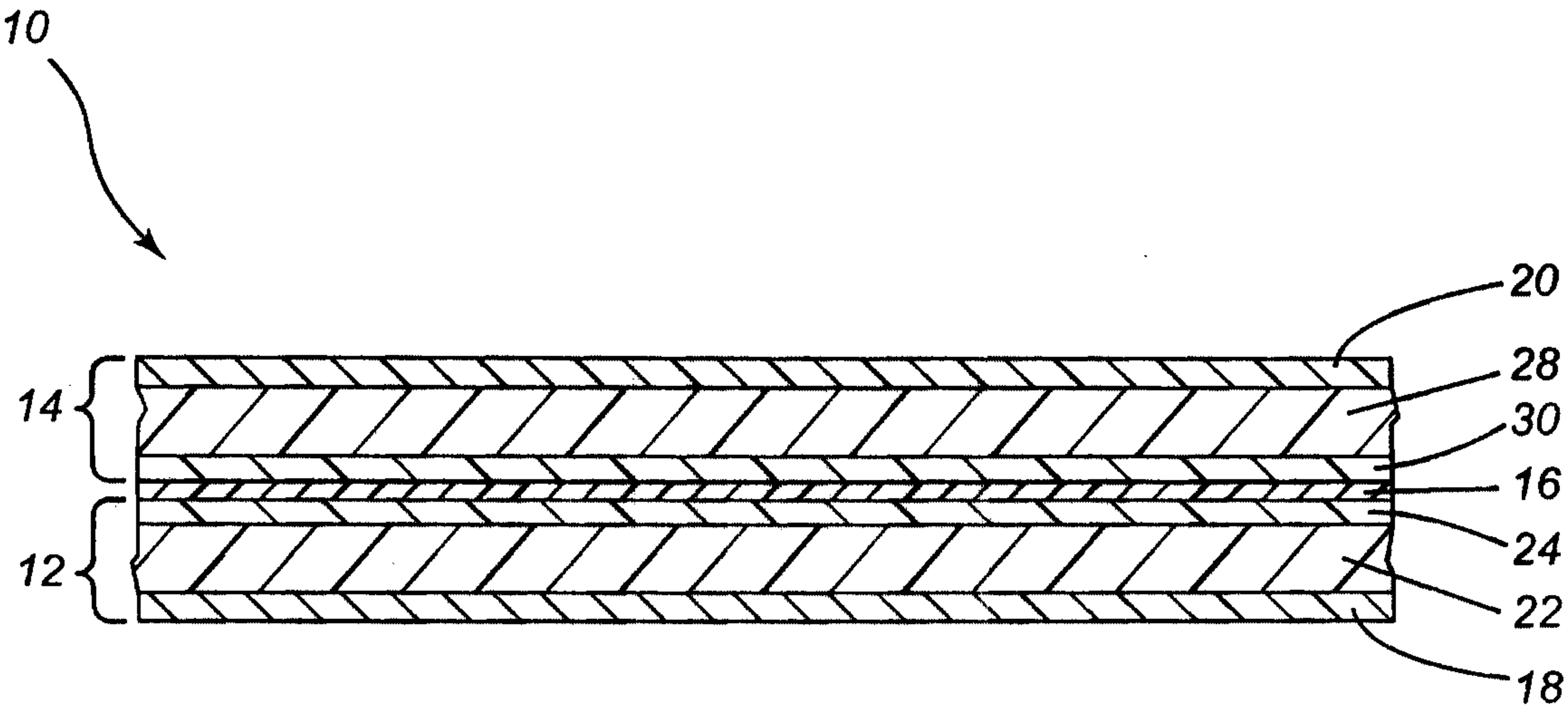
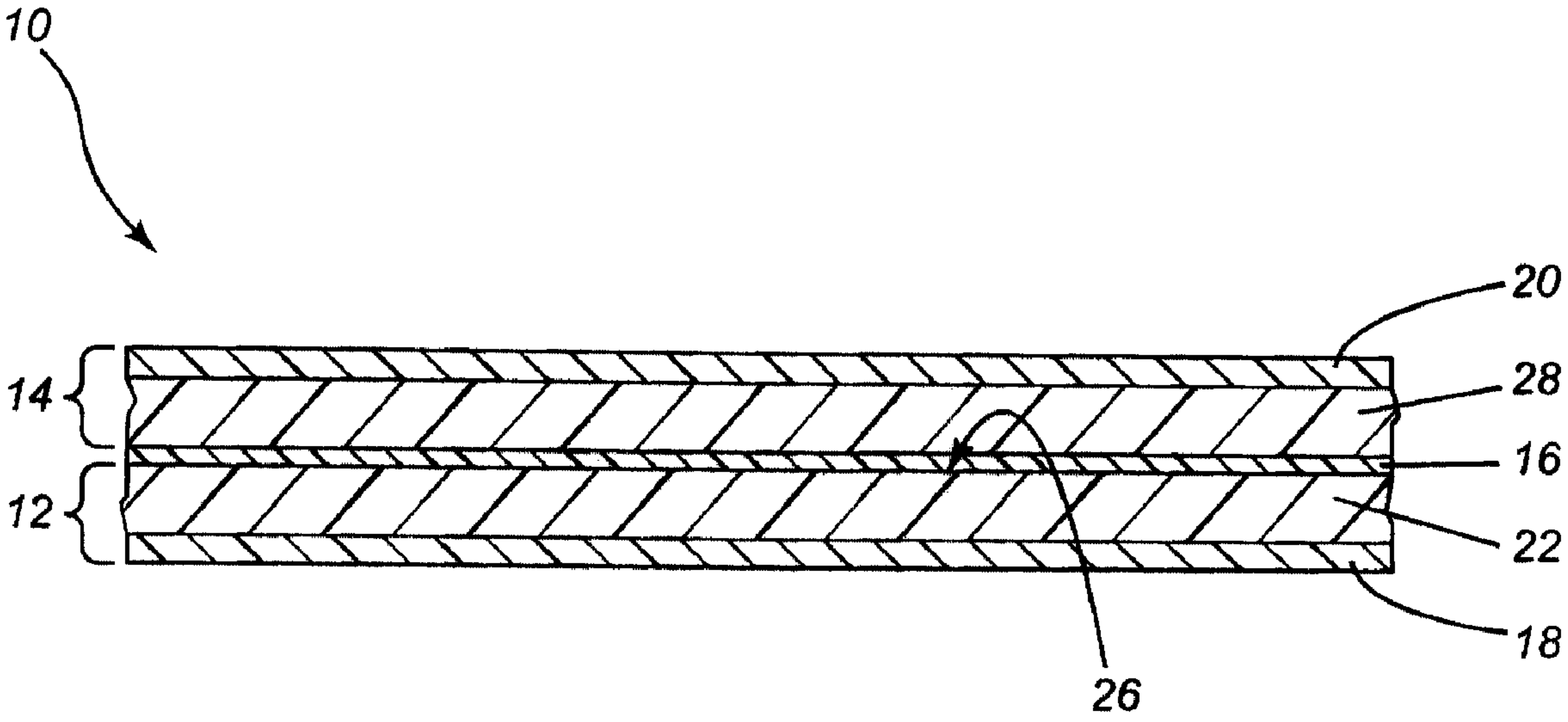


Fig. 2


10
20
28
14
16
12
22
18
26