

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
20 July 2006 (20.07.2006)

PCT

(10) International Publication Number
WO 2006/076351 A2

(51) International Patent Classification:
H01B 1/12 (2006.01)

(21) International Application Number:
PCT/US2006/000802

(22) International Filing Date: 11 January 2006 (11.01.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
11/036,941 14 January 2005 (14.01.2005) US
11/329,605 11 January 2006 (11.01.2006) US

(71) Applicant (for all designated States except US): **ZA-XXON USA, INC.** [US/US]; 3511 Silverside Road, Suite 105, Wilmington, DE 19810 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **MAO, Chen-Chi** [US/—]; 20 Chih-Shan Road, Lane 421, Section 2, Taipei (TW).

(74) Agents: **APICELLI, Samuel, W.** et al.; Duane Morris LLP, 30 S. 17th Street, Philadelphia, PA 19103-4196 (US).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

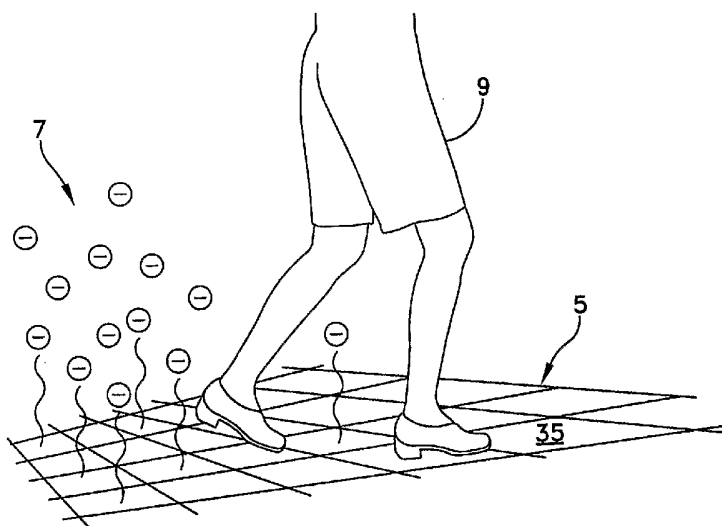
(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— without international search report and to be republished upon receipt of that report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: ION-GENERATING FLOOR COVERING AND METHOD FOR FORMING SAME



(57) Abstract: The present invention provides a floor covering having a surface that forms a boundary with an ambient environment, and that includes a structure comprising an effective quantity of electrically polarizable, pyroelectric particles disposed substantially below that surface. A method for generating negative ions is also provided that includes positioning a flooring cover within a building, where the floor covering includes a surface that forms a boundary with the ambient environment of the building. The floor covering comprises an effective quantity of pyroelectrically polarizable material disposed no more than one millimeter from the surface, so that when a person or thing travels across that surface so as to frictionally heat the pyroelectrically polarizable material, negative ions are generated. Such generation of negative ions neutralizes or reduces odor, airborne bacteria, mold spores, pollens, and other harmful particles in the air.

Ion-Generating Floor Covering And Method For Forming Same

5 Cross-Reference To Related Applications

[0001] This application is a continuation-in-part of, and claims priority from, co-pending patent application Serial No.11/036,941, filed January 14, 2005, and entitled Ionic Or Ion Generating Floor Covering And Method For Embedding Ion Particles Within A Floor Covering.

10

Background Of The Invention

[0002] Ambient air is composed of molecules of gases that can often become positively or negatively charged due to static electricity discharges and/or other natural causes. High concentrations of negatively charged
15 molecules, often referred to as "negative ions" or "minus ions", are often found near waterfalls, country meadows, beaches and mountains. High concentrations of positively charged molecules, often referred to as "positive ions", are often found in polluted areas, such as, cities, office buildings, factories and other urban settings.

20 [0003] Scientists now recognize that the level of concentration of negative ions in the ambient air we breathe can be beneficial. For example, high levels of negative ions in the ambient air often have the beneficial effect of removing normally positively charged harmful particulate contaminants, such as, pollens, mold spores, smoke, dust particles, airborne germs, and

bacteria, from the air. These pollutants are often removed from air through collisions between negative ions and the pollutants. Collisions between negative ions and airborne pollutants causes the negative ions to lose their mobility and effectiveness. These collisions cause the airborne pollutants to slow down and settle out of the ambient air. The use of negatively charged ions to purify air in a room is well known, as shown in U.S. Patents Nos. 3,973,927 and 6,610,127.

[0004] Air inside buildings tends to become stale and unpleasant to breathe as a result of, in part, the depletion of the negative ion content in the air. Various conventional air ionizers have been developed to counteract the depletion of negative ions and also to purify air by causing the precipitation of particulate contaminants out of the air, and onto nearby surfaces. Such conventional air ionizers typically include pointed electrodes that are connected to high voltage supplies to produce intense electrical fields adjacent to the pointed electrodes. Neutral gas molecules in the vicinity of these intense electrical fields are transformed to positive or negative ions, depending on the polarity of the high voltages on the electrodes. Electrostatic repulsions from the similarly charged electrodes, along with air blowers, disperse the negatively charged ions throughout the room to cause precipitation of particulate contaminants from the air and to promote the concomitant beneficial physiological effects.

[0005] This technology of has been introduced into ordinary household and healthcare goods, such as, hairbrushes, tooth brushes, footwear,

cosmetics, air-conditioners, clothing, water-treatment systems, toilets, hair
dryers and other electrical goods. Examples of ion implantation in a plastic
material are disclosed in U.S. Patent Nos. 4,526,832, and 4,743,493. In U.S.
Patent No. 6,964,808, issued to Shintome, a wall material is disclosed that is
5 formed by adding a predetermined amount of binding agent and water to
volcanic ash sediment comprised of mineral silicates including at least silicic
acid and aluminum oxide, kneading them together, and applying them to a
wall surface. Through a natural reaction of positive ions included within the
mineral silicate and moisture from the atmosphere, charge is exchanged, and
10 negatively charged ions are generated at the wall's surface. Humidity control
apparatus are also suggested as a negatively charged ion generation system
through adjustment of the amount of moisture included within the air so as to
control the ion exchanging rate. In one embodiment, volcanic ash sediment is
employed that includes titanium oxide, which reacts with hydrogen or oxygen
15 generating active oxygen species or oxygen free radicals. The generation of
active oxygen species, provides an air filter.

[0006] There is a need in the art for a flooring material that exhibits all
of the foregoing benefits associated with negative ion generation, but without
the need for high voltage or humidity control, and that allows for the
20 generation of efficacious quantities of negative ions as a by-product of normal
use.

Summary of the Invention

[0007] The present invention provides a floor covering having a surface that forms a boundary with an ambient environment, and that includes a structure comprising an effective quantity of electrically polarizable, pyroelectric particles disposed substantially below that surface. In some embodiments, a portion of effective quantity of the electrically polarizable particles is exposed to said ambient environment. In other embodiments, a wear layer is positioned atop the surface so as to locate the exposed portion of the electrically polarizable particles no more than one millimeter from the surface.

[0008] In one preferred embodiment, a floor covering is provided that includes a surface that forms a boundary with air and a layer of tourmaline particles that are disposed substantially below the surface.

[0009] A method for generating negative ions is provided that includes positioning a flooring cover within a building, where the floor covering includes a surface that forms a boundary with the ambient environment of the building. The floor covering comprises an effective quantity of pyroelectrically polarizable material disposed no more than one millimeter from the surface, so that when a person or thing travels across that surface so as to frictionally heat the pyroelectrically polarizable material, negative ions are generated.

[0010] In another method, a person or thing traverses a flooring cover so as to frictionally engage a surface that forms a boundary with the ambient environment so that frictional heating of a pyroelectrically polarizable material

located substantially below the surface causes negative ions to be generated by the floor covering.

Brief Description Of The Drawings

5 **[0011]** These and other features and advantages of the present invention will be more fully disclosed in, or rendered obvious by, the following detailed description of the preferred embodiments of the invention, which are to be considered together with the accompanying drawings wherein like numbers refer to like parts and further wherein:

10 **[0012]** Fig. 1 is a broken-away, perspective view of a person walking across a floor covering formed in accordance with the present invention;

[0013] Fig. 2 is a broken-away, perspective view of a person walking across a floor covering, similar to that of Fig. 1, but including the movement of a rolling object across the floor covering;

15 **[0014]** Fig. 3 is a partially broken-away, partially cross-sectioned and partially phantom perspective view of a floor tile formed in accordance with the present invention;

[0015] Fig. 4 is a cross-sectional view of the floor tile shown in Fig. 3, as taken along lines 4-4 in Fig. 3;

20 **[0016]** Fig. 5 is an enlarged view of a portion of the floor tile shown in Fig. 4;

[0017] Fig. 6 is a broken-away cross-sectional view of one embodiment of floor tile formed in accordance with the present invention;

[0018] Fig. 7 is a broken-away cross-sectional view of one embodiment of floor tile formed in accordance with the present invention;

5 **[0019]** Fig. 8 is a broken-away cross-sectional view of a further alternative embodiment of floor tile formed in accordance with the present invention;

[0020] Fig. 9 is a broken-away cross-sectional view of one embodiment of floor tile formed in accordance with the present invention;

10 **[0021]** Fig. 10 is a broken-away cross-sectional view of one embodiment of floor tile formed in accordance with the present invention;

[0022] Fig. 11 is a broken-away cross-sectional view of one embodiment of floor tile formed in accordance with the present invention;

[0023] Fig. 12 is a partially broken-away, partially cross-sectioned and
15 partially phantom perspective view of a floor tile formed in accordance with an alternative embodiment of the present invention, including a decorative image;

[0024] Fig. 13 is a broken-away cross-sectional view of a floor tile formed in accordance with the present invention, as taken along lines 13-13 in
20 Fig. 12; and

[0025] Fig. 14 is a broken-away cross-sectional view of similar to that shown in Figs. 12 and 13.

Detailed Description Of The Preferred Embodiments

5 [0026] This description of preferred embodiments is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description of this invention. The drawing figures are not necessarily to scale and certain features of the invention may be shown exaggerated in scale or in somewhat schematic form in the interest
10 of clarity and conciseness. In the description, relative terms such as "horizontal," "vertical," "up," "down," "top" and "bottom" as well as derivatives thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing figure under discussion. These relative terms are for convenience of
15 description and normally are not intended to require a particular orientation. Terms including "inwardly" versus "outwardly," "longitudinal" versus "lateral" and the like are to be interpreted relative to one another or relative to an axis of elongation, or an axis or center of rotation, as appropriate. Terms concerning attachments, coupling and the like, such as "connected" and
20 "interconnected," refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise. The term "operatively connected" is such an attachment, coupling or connection that allows the pertinent

structures to operate as intended by virtue of that relationship. In the claims, means-plus-function clauses, if used, are intended to cover the structures described, suggested, or rendered obvious by the written description or drawings for performing the recited function, including not only structural
5 equivalents but also equivalent structures.

[0027] The present invention provides a floor covering 5 that comprises air-purifying properties by having the capability of generating negative ions 7 continuously into the air without the use of electrodes or electricity. As a person 9 walks on floor covering 5, highly mobile negative ions 7 are moved
10 and circulated within the ambient environment. Floor covering 5 may be provided in the form of one or more tiles, sheets, planks or strip floor tiles, sheets or planks, including floor tiles, sheets, and planks or sections of varying sizes and shapes and surface types including those made from polyvinyl chloride, rubber, linoleum, polymeric resins, reinforced resins, vinyl
15 composite, or other resilient materials, carpet, stones, ceramic, metals, glass, textiles, wood, composites thereof in desired combinations, veneers thereof in desired combinations, and laminates thereof in desired combinations.

[0028] In one embodiment of the present invention floor covering 5 that takes the form of a tile 10 having a base layer 12, an aesthetic layer 14, and a
20 mixture of naturally ionized minerals or ceramic ingredients 16 that continually release negatively ionized particles or negative ions 7 into the ambient environment. Base layer 12 includes a substantially planar top surface 20 and a bottom surface 22, and often comprises a flat sheet formed from a

single layer including a mixture of polymer binder, fillers, stabilizers, and optional plasticizers, processing aids, pigment, etc. For example, plasticizer is required when the polymer is polyvinyl chloride (PVC) homo polymer. Of course, the composition of base 12 may include more than one polymer, e.g.,

5 PVC/vinyl acetate copolymer. Acceptable polymer binders may include PVC homo & copolymers, polyolefin homo & copolymers including metallocene polyolefins, acrylic polymers, polyesters, or other thermoplastic polymer materials. Other acceptable polymer binders may include thermoset polymers, such as, rubber, linoleum, epoxy, acrylic, polyesters, etc., but the

10 process for making base layer 12 may vary depending upon the choice of polymer binder. Top surface 20 may form a boundary with the ambient environment or may be covered by additional layers.

[0029] If base 12 is to be monochrome, the composition is mixed within a Banbury[®] or conventional extruder (of the type that is well known in the art)

15 and formed by feeding the heated mix through at least one calendar, thereby producing a consolidated sheet that can be cut into discrete floor tiles¹⁰, if desired. Optional planishing or finishing rolls may be present in the process. If a multicolored single layered base 12 is desired, i.e., so that base layer 12 also provides aesthetic value to the floor covering, different colored sheets are

20 made as above, but these are each subsequently ground into particles, chips, or cut into other shapes. In one embodiment, these particles or chips are then blended together, heat processed through the calendar operation to produce a consolidated single multicolored base layer 12. Typically, this calendaring process produces visuals with directional veining or distortion of the shapes.

One example of this type structure is a resilient flooring, vinyl composition tile, as described by Federal Specification SS-T-312b, Type IV, Composition I.

Flat bed pressing processes, among others known in the art, may be used that produce non-directional visuals. These can produce solid layers with

5 patterned regions, for example squares, chips, etc. Of course, base layer 12 may comprise other known flooring substrate structures, including but not limited to felts, glass mats, scrims, fabrics, filled and unfilled solid layers, filled and unfilled foam layers, or combinations thereof.

[0030] Aesthetic layer 14 is similar in composition to base layer 12
10 inasmuch as it often comprises a flat, substantially planar sheet formed from a single, heat processed layer including a mixture of polymer binder, fillers, stabilizers, and optional plasticizers, processing aids, pigment, etc., and including a top surface 26 and a bottom surface 28. Top surface 26 may form a boundary with the ambient environment or may be covered by one or more
15 additional layers. One or more pigments, in the form of particulates or chips, are often added to the polymer binder of aesthetic layer 14, in predetermined patterns, colors, textures, and quantities, to impart a predetermined color or pattern of colors to top surface 26. Aesthetic layer 14 is adhered to base
layer 12 such that top surface 20 of base layer 12 is securely engaged with or
20 bonded to bottom surface 28 of aesthetic layer 14 to form a finished tile 10. In some embodiments, aesthetic layer 14 may comprises a printed layer 50 (Figs. 12-14) having a colored design or pattern that is visible from top surface 26. The printed layer may be formed by rotogravure, screen, flexographic, intaglio, ink jet, or other printing processes that may also be used separately

or at the same time to deposit polarizable material 16 so as to form a portion of printed layer 50. Printed layer 50 may form a boundary with the ambient environment or may be covered by one or more additional layers.

[0031] The present invention provides a floor covering 5 that includes polarizable materials 16, i.e., an effective quantity of electrically polarizable particles, that may be embedded within a shallow region (relative to top surface 26 of aesthetic layer 14) so as to naturally release negative ions 7 into the ambient environment at room temperature. A preferred depth for positioning a layer 30 of polarizable materials 16 for adequate negative ion generation and cost-effective production would be no more than one millimeter from a surface that forms a boundary with the ambient environment, e.g., top surface 26 of aesthetic layer 14 (Figs. 8, 9, 10, and 11). Positioning layer 30 of polarizable materials 16 so that a portion of some of the polarizable particles are exposed to the ambient environment (Figs. 5, 5, and 10) with the remainder of the polarizable particles being located substantially below the surface, may also provide adequate results. This construction allows for direct frictional heating of the pyroelectrically polarizable particles through contact with the sole 27 of a foot, shoe 29, boot, or surface 31 of a wheel 33 rolling across the outer most surface or wear surface 35 of floor covering 5.

[0032] Polarizable material 16 may include any mineral, compound, or mixture of materials that exhibit a "pyroelectric effect", i.e., that exhibit a spontaneous change in polarization in response to changes in temperature in

either direction, which leads to the build-up of "static electric charge" on the surface of the material and its surroundings. It will be understood that frictional heating of polarizable materials 16, via foot or vehicle traffic moving across outer most surface or a wear surface 35 of urethane, drives the electrical polarization of polarizable materials 16 and thereby the production of negative ions 7. In some embodiments of the invention from forty to one hundred and forty negative ion counts per cubic centimeter of ambient air are generated upon application of frictional forces to wear surface 35 resulting from movement across floor covering 5 at a rate of about one hundred and fifty centimeters per minute, at a pressure of about nine hundred and ninety-five mPa. The time period necessary to achieve an equilibrium state is about five minutes, with a grounding condition including a surface resistance of floor covering 5 of less than about 1 megaohm, at sixty percent humidity and twenty-five degrees Celsius. These results have been detected using a Negative Ion Measurement System (ITC-403A-based measurement system) such as the type provided by Industrial Technology Research Institute, Materials Research Laboratories, Taiwan.

[0033] Some examples of the types of minerals that may be used as polarizable material 16 in connection with the present invention include, but are not limited to tourmaline, serpentine and zeolite as well as other polarizable compounds including those comprising, Ti, Na, Zn, and Si. Often a mixture of tourmaline, serpentine and other minerals may be used together to generate a preferred quantity of negative ions 8. Polarizable material 16 may also include forms of volcanic ash and pottery grade ceramic ingredients

that are known to facilitate the generation of negative ions 7 in sufficient quantities to have effect. Tourmaline is often preferred for use in the present invention as it is known exhibit a strong pyroelectric effect that facilitates the generation of negative ions 7 in efficacious quantities, e.g., in the range from
5 about one hundred particles per cubic centimeter to six hundred and fifty particles per cubic centimeter. Polarizable materials 16 are typically refined into particles that are size in the range from about 0.25 to about 0.35 microns, with about 0.30 microns on average being preferred.

[0034] Referring to Fig. 6, one embodiment of the present invention
10 positions a layer 40 of polarizable material 16 adjacent to top surface 26 of aesthetic layer 14 so that portions of polarizable material 16 are exposed at top surface 26 which forms a boundary with the ambient environment. In this embodiment, polarizable material 16 may be embedded in top surface 26 (Fig. 6) or applied to it (Fig. 7) so that the individual particles of polarizable material
15 16 are at least partially exposed at top surface 26. This embodiment would allow the use of polarizable material 16 having particle sizes in the range from about .6 to .8 millimeters. Of course, polarizable materials 16 may be mixed-in with aesthetic layer 14 so as to be distributed through out its thickness. In one embodiment, adequate results are obtained with an effective quantity of
20 about ten percent by weight per polymer system, (Figs. 8 and 9).

[0035] In a further embodiment of the invention, a relatively thin protective coating 42, having a wear surface 35 is sometimes, but not always applied to top surface 26 as a covering for polarizable materials 16 so as to

reduce wear of the system. Protective coating 42 may form a boundary with the ambient environment or may be covered by one or more additional layers. The types of coatings that may be used to protect and retain layer 40 include, but are not limited to finishes and polishes, urethanes, acrylics, urethane

5 acrylates, polyester acrylates, rubbers, thermoplastic rubbers, thermoplastic ethylene and other coatings well known in the art, e.g., alumina and alumina compounds. In one embodiment, a solvent base, thermal cured urethane coating containing an acrylic polyol is used with adequate results. Two coats of polyurethane coating 42 are often applied to floor covering 5 to ensure

10 more durability to the product at a thickness of from 0.15mm to 0.3mm. Hot press lamination is often used with floor covering 5 that includes protective coating 42 to increase the ion generation density of final product. Protective coating 42 may also comprise a preformed film, such as, clear pvc, surlyn, urethane that is applied to top surface 26. Of course, a layer 40 of polarizable

15 materials 16 may be disposed within coating 42 (Fig. 11) or, polarizable materials 16 may be mixed-in with coating 42 so as to be distributed throughout its thickness with adequate results (Fig. 5). In this embodiment, an even distribution through thorough mixing of polarizable materials 16 helps to reduce discoloration of the material. Additionally, it will be understood that

20 when polarizable materials 16 are located adjacent to or on a bottom surface of coating 42 (Fig. 10) they may be reverse coated or mixed in a printing ink (if a decorative printed layer 50 is employed as a layer directly beneath the coating 42, as shown in Figs. 12-14.

[0036] It is to be understood that the present invention is by no means limited only to the particular constructions herein disclosed and shown in the drawings, but also comprises any modifications or equivalents within the scope of the claims.

What Is Claimed Is:

1. A floor covering comprising a surface that forms a boundary with
5 an ambient environment and an effective quantity of electrically polarizable
particles disposed substantially below said surface.
2. A floor covering according to claim 1 wherein a portion of said
effective quantity of said electrically polarizable particles is exposed to said
10 ambient environment.
3. A floor covering according to claim 2 including a wear layer
positioned atop said surface so as to be located over said exposed portion of
said electrically polarizable particles.
15
4. A floor covering according to claim 3 wherein said wear layer is
less than one millimeter thick.
5. A floor covering according to claim 1 wherein said electrically
20 polarizable particles are selected from the group consisting of tourmaline,
serpentine and zeolite.
6. A floor covering according to claim 1 wherein said electrically
polarizable particles exhibit pyroelectric characteristics.

25

7. A floor covering according to claim 1 wherein said electrically polarizable particles comprise a size in the range from about 0.25 to about 0.35 microns on average.

5 8. A floor covering comprising an effective quantity of electrically polarizable particles disposed within a wear layer having a surface that forms a boundary with the ambient environment wherein said electrically polarizable particles are disbursed throughout said wear layer.

10 9. A floor covering according to claim 3 wherein said electrically polarizable particles comprise a size in the range from about 0.60 millimeters to about .8 millimeters on average.

10. A floor covering according to claim 8 wherein said electrically
15 polarizable particles comprise a size in the range from about 0.25 to about 0.35 microns on average.

11. A floor covering comprising:
a surface that forms a boundary with an ambient environment; and
20 an effective quantity of electrically polarizable particles disposed no more than one millimeter from said surface.

12. A floor covering comprising an effective quantity of tourmaline particles disposed within a wear layer having a surface that forms a boundary

with the ambient environment wherein said tourmaline particles are disbursed throughout said wear layer.

13. A floor covering comprising:

- 5 a surface that forms a boundary with an ambient environment; and
an effective quantity of pyroelectric material disposed no more than one millimeter from said surface.

14. A floor covering according to claim 13 wherein a portion of said
10 effective quantity of said pyroelectric material is exposed to said ambient environment.

15. A floor covering according to claim 14 including a wear layer
positioned atop said surface so as to be located between said ambient
15 environment and said surface so as to be disposed over said exposed portion of said pyroelectric material.

16. A floor covering according to claim 15 wherein said wear layer is
less than one millimeter thick.

20

17. A floor covering according to claim 13 wherein said pyroelectric material is selected from the group consisting of tourmaline, serpentine and zeolite.

18. A floor covering according to claim 13 wherein said pyroelectric material comprises particles having a size in the range from about 0.25 to about 0.35 microns on average.

5 19. A floor covering according to claim 15 wherein said pyroelectric material is disbursed throughout said wear layer.

20. A floor covering according to claim 15 wherein said pyroelectric material comprises particles having a size in the range from about 0.60
10 millimeters to about .8 millimeters on average.

21. A floor covering according to claim 15 wherein said pyroelectric material comprises particles having a size in the range from about 0.25 to about 0.35 microns on average.

15

22. A floor covering comprising a surface that forms a boundary with air having a layer of tourmaline particles disposed no more than one millimeter from said surface.

20 23. A floor covering comprising a surface that forms a boundary with air having a layer of tourmaline particles disposed substantially below said surface so that a portion of said tourmaline particles is exposed to said ambient environment.

24. A floor covering comprising a layer having a surface that forms a boundary with an ambient environment and an effective quantity of electrically polarizable particles distributed throughout said layer.

5 25. A floor covering according to claim 24 comprising a wear layer positioned atop said surface so as to be located over an exposed portion of said electrically polarizable particles.

26. A floor covering comprising a first layer having a surface that
10 forms a boundary with an ambient environment and an effective quantity of electrically polarizable particles distributed throughout said first layer.

27. A method for generating negative ions comprising the steps of:
(A) positioning within a building a flooring cover having;
15 (i) a surface that forms a boundary with the ambient environment of said building, and
 (ii) including an effective quantity of pyroelectrically polarizable material disposed no more than one millimeter from said surface; and
(B) traveling across said surface so as to frictionally heat said
20 pyroelectrically polarizable material.

28. A method according to claim 27 wherein movement across said surface is at a rate of about one hundred and fifty centimeters per minute, at a pressure of about nine hundred and ninety-five mPa.

29. A method for generating negative ions comprising the steps of:

- (A) traversing a flooring cover so as to frictionally engage a surface that forms a boundary with the ambient environment; and
- 5 (B) frictionally heating a pyroelectrically polarizable material located substantially below said surface.

30. A floor covering comprising an effective quantity of pyroelectric particles selected from the group consisting of tourmaline, serpentine and

10 zeolite, disposed within a wear layer having a surface that forms a boundary with the ambient environment and is no more than one millimeter thick, wherein said pyroelectric particles are disbursed throughout said wear layer and comprise an average size in the range from about 0.60 millimeters to about .8 millimeters.

15

31. A floor covering according to claim 30 wherein said pyroelectric particles comprise an average size in the range from about 0.25 to about 0.35 microns.

20 32. A floor covering comprising:

at least two laminated layers;

a surface that forms a boundary with an ambient environment; and

an effective quantity of pyroelectric material disposed adjacent to said surface.

33. A floor covering comprising:
- at least two layers that are laminated together;
- a surface that forms a boundary with an ambient environment; and
- 5 an effective quantity of pyroelectric material disposed throughout at least one of said layers.

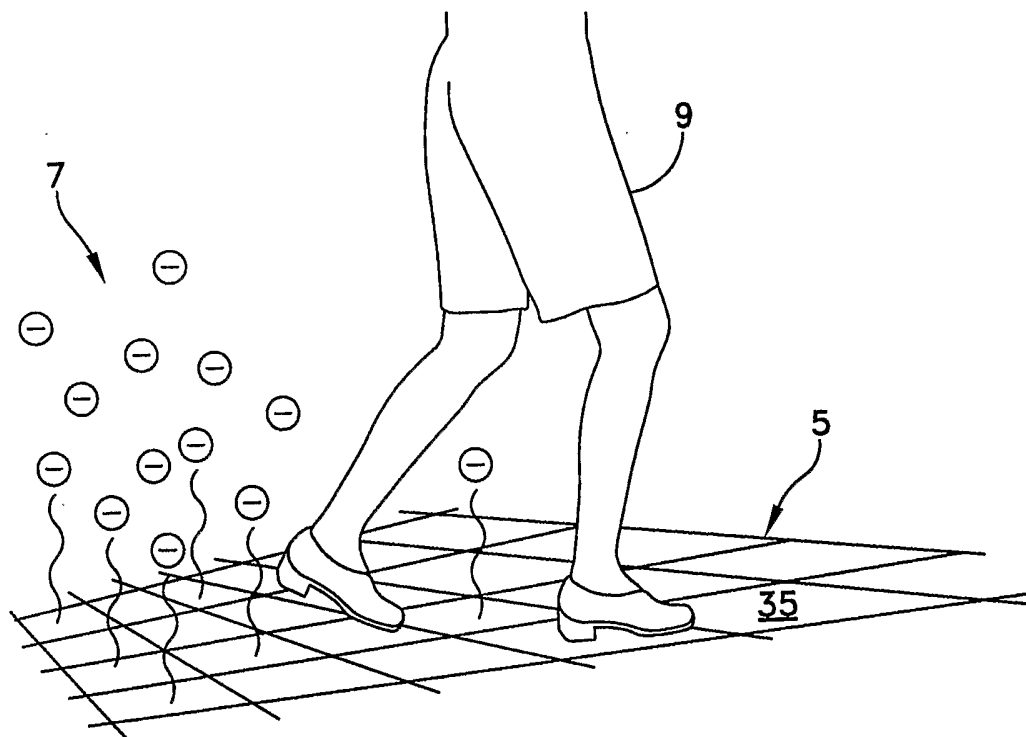


FIG. 1

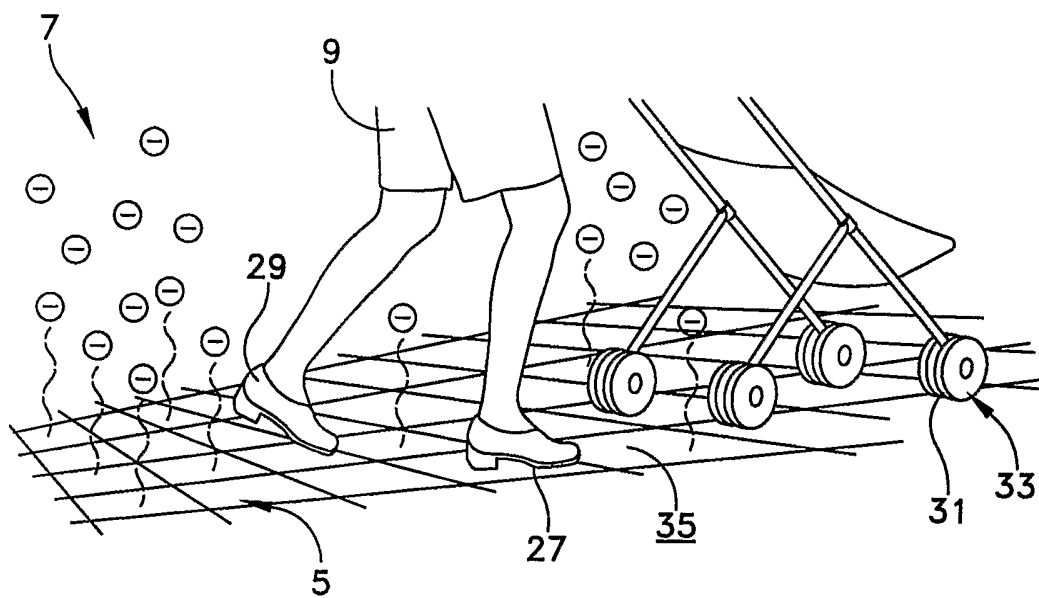


FIG. 2

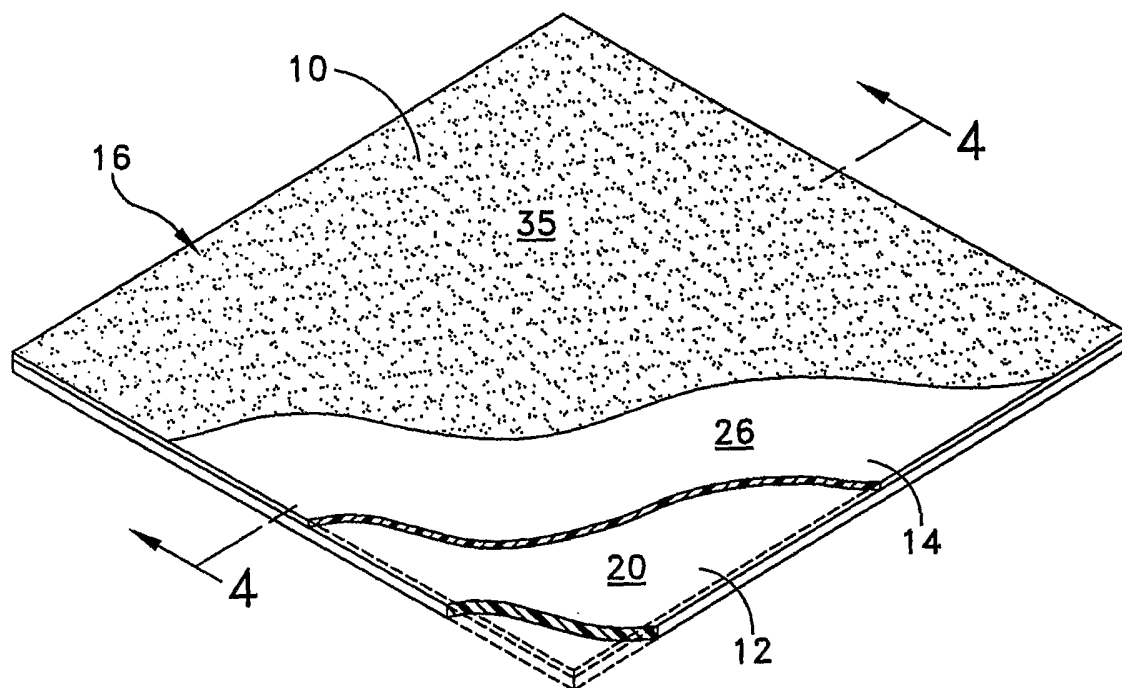


FIG. 3

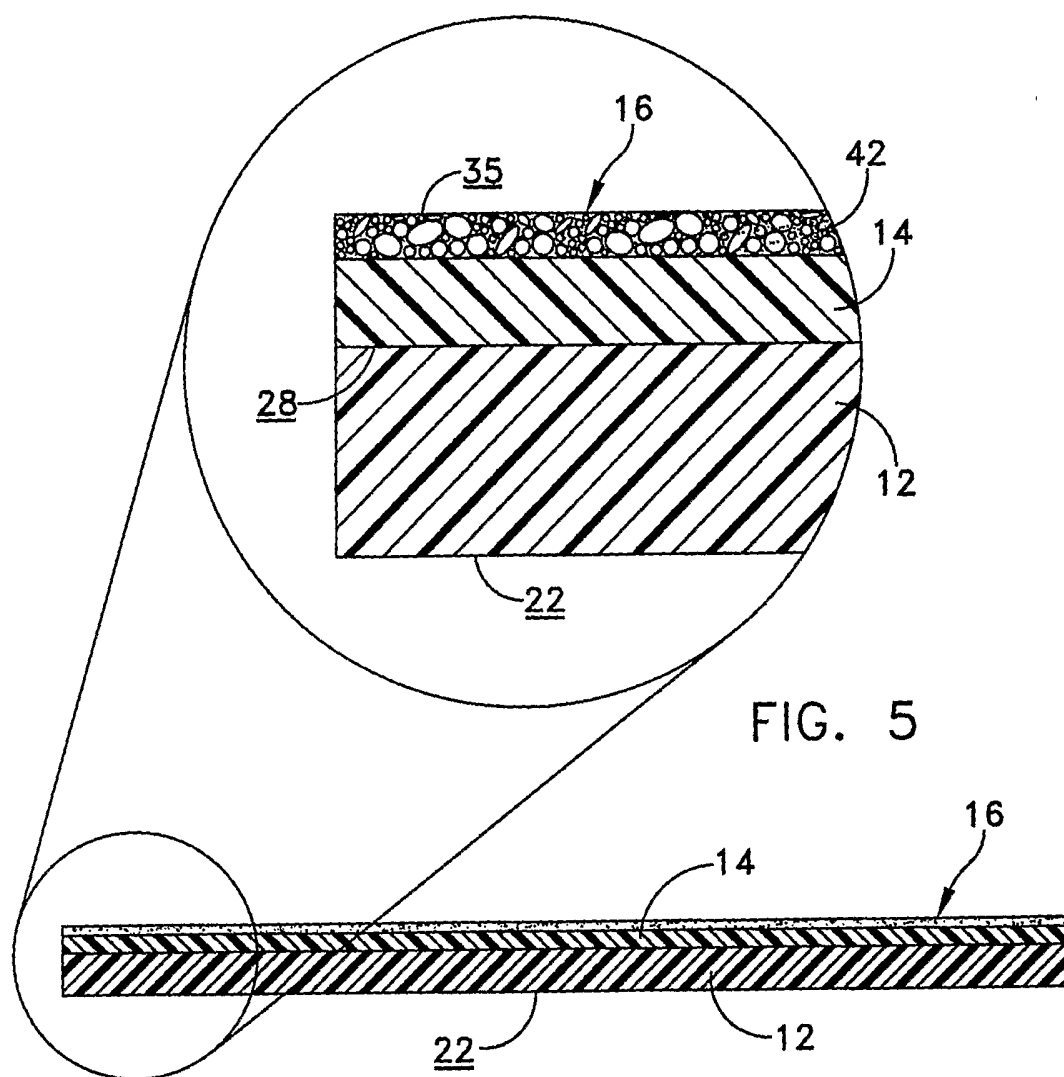


FIG. 4

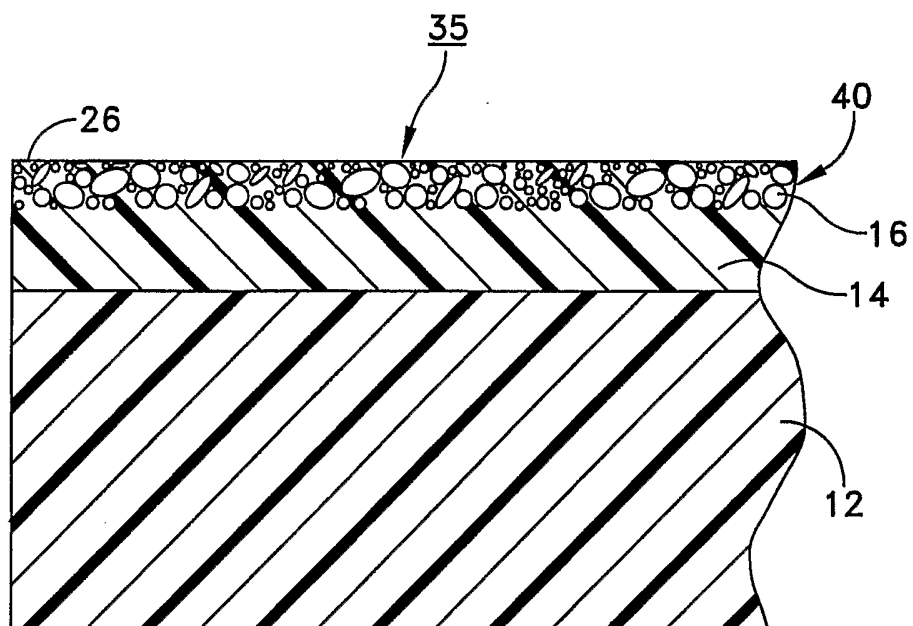


FIG. 6

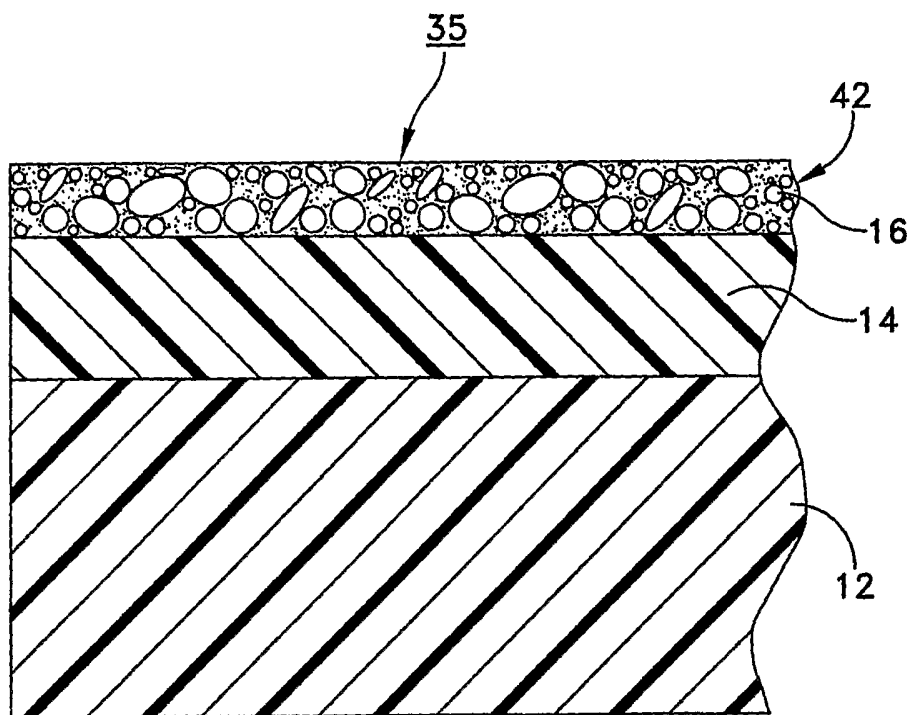


FIG. 7

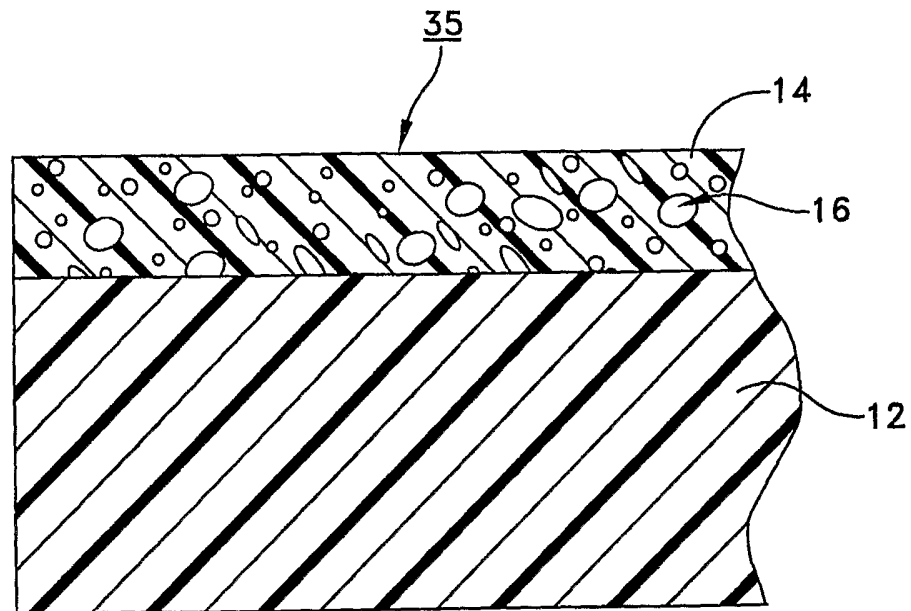


FIG. 8

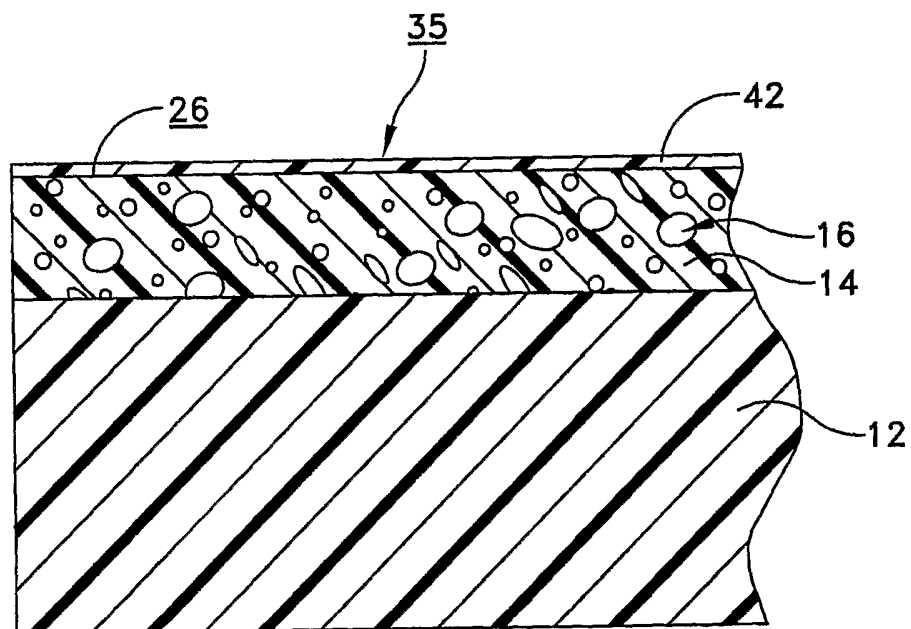


FIG. 9

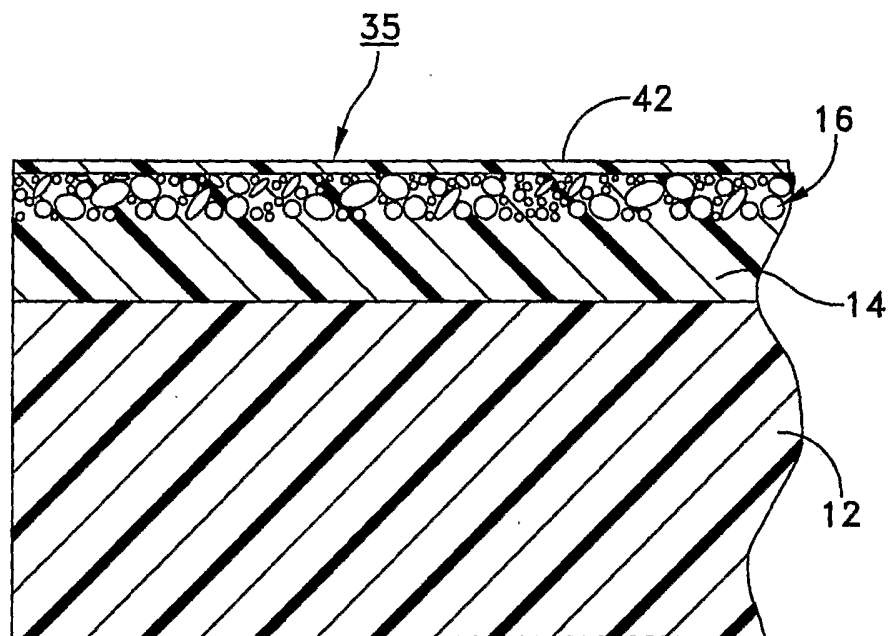


FIG. 10

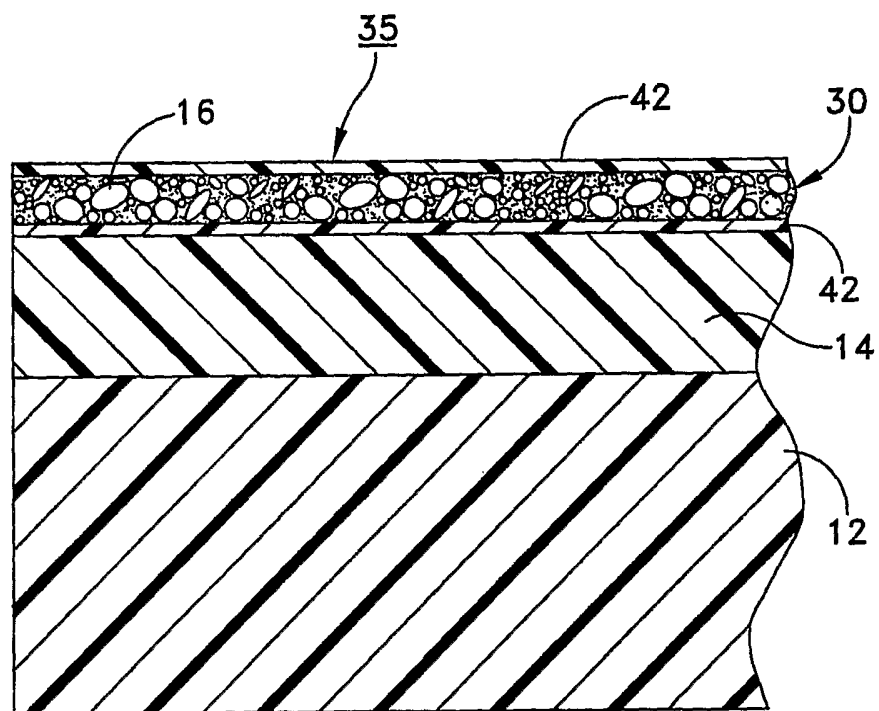


FIG. 11

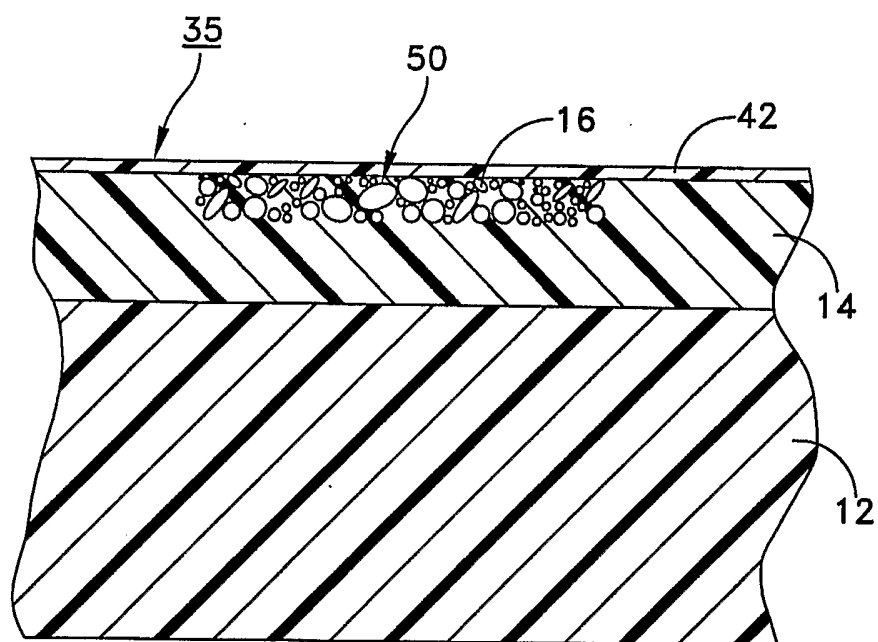


FIG. 13

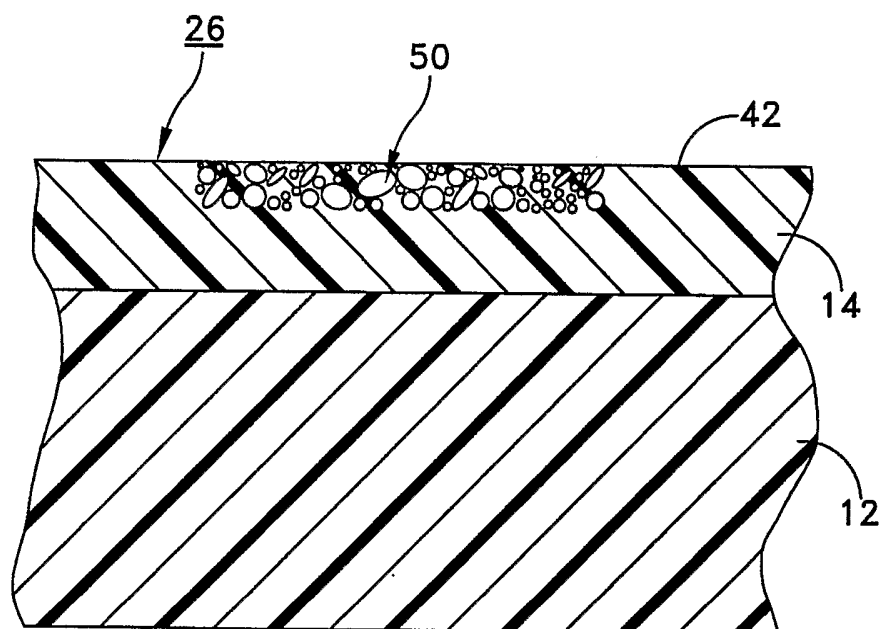


FIG. 14