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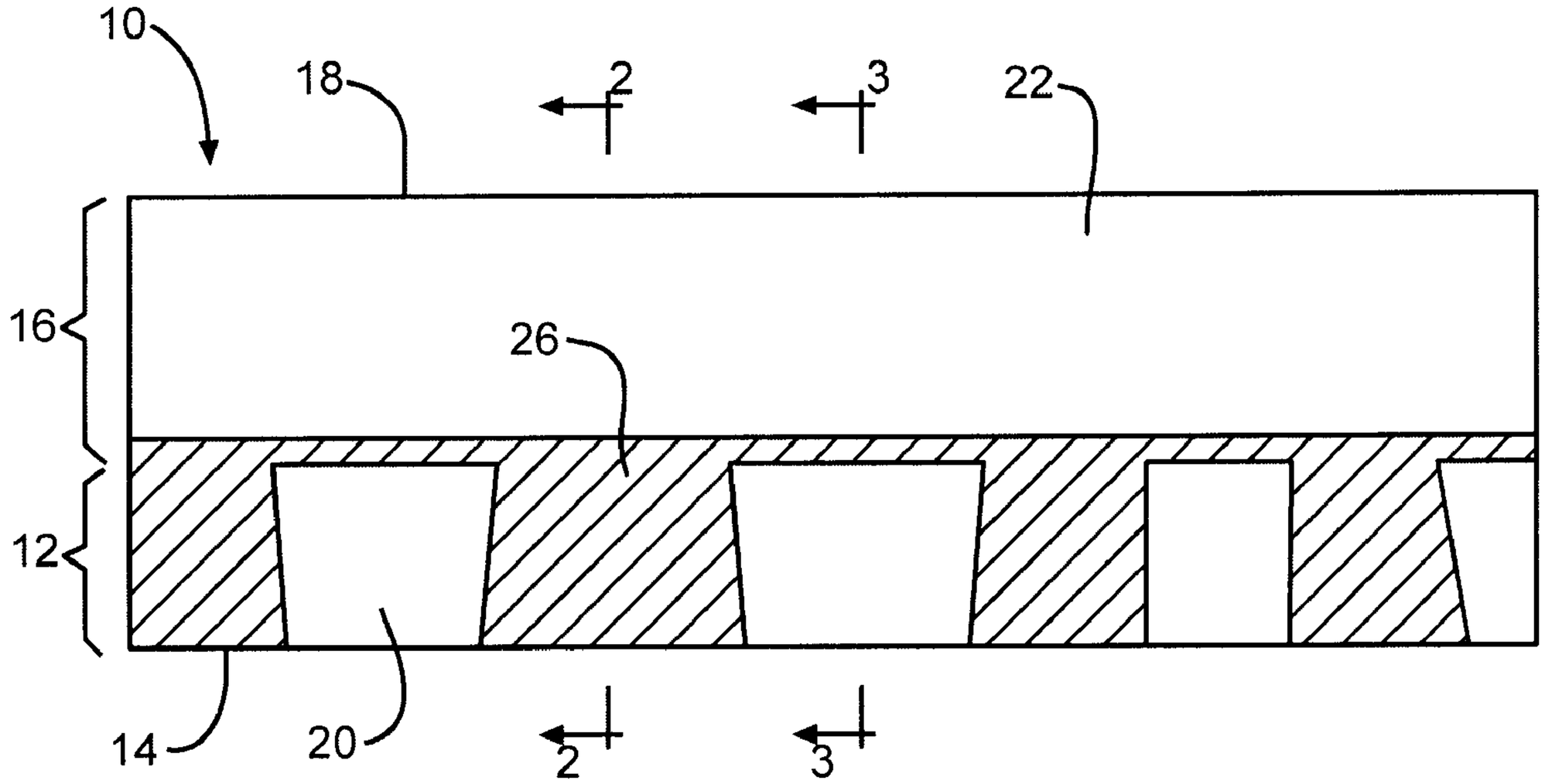

(57) Abrégé/Abstract:
A roofing shingle includes a headlap portion and a tab portion. A layer of a first granular material is adhered to a back side of the headlap portion and defines a first surface. A bead of tab sealant extends longitudinally on a back side of the tab portion. A longitudinally extending groove is formed in the first surface of the back side of the headlap portion.

ABSTRACT

[0091] A roofing shingle includes a headlap portion and a tab portion. A layer of a first granular material is adhered to a back side of the headlap portion and defines a first surface. A bead of tab sealant extends longitudinally on a back side of the tab portion. A longitudinally extending groove is formed in the first surface of the back side of the headlap portion.

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METHOD OF MANUFACTURING A SHINGLE

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RELATED APPLICATIONS

[0001] This application is a Continuation-in-Part of pending U.S. patent application serial no. 13/155,600, filed June 8, 2011, entitled "Roofing Shingle Including Sheet as Headlap," which is a Continuation of pending U.S. patent application serial no. 11/396,498, filed April 3, 2006, entitled "Roofing Shingle Including Sheet as Headlap," which is a Continuation-in-Part of U.S. Patent No. 7,836,654 filed August 5, 2005, entitled "Shingle with Reinforced Nail Zone and Method of Manufacturing", all of which are incorporated by reference herein in their entirety.

BACKGROUND

[0002] Typical asphalt-based roofing shingles include a roofing mat coated with asphalt and covered with a layer of roofing granules. The shingles include a buttlap portion that is exposed when the shingles are installed on a roof and a headlap portion that is covered by the upper adjacent course of shingles when the shingles are installed on a roof. Laminated roofing shingles also include an overlay made from a second asphalt-coated mat on the buttlap portion of the shingles.

[0003] Asphalt-based roofing materials, such as roofing shingles, roll roofing, and commercial roofing, are installed on the roofs of buildings to provide protection from the elements, and to give the roof an aesthetically pleasing appearance. Typically, the roofing material is constructed of a substrate such as a

glass fiber mat or an organic felt, an asphalt coating on the substrate, and a surface layer of granules embedded in the asphalt coating.

[0004] A common method for the manufacture of asphalt shingles is the production of a continuous sheet of asphalt material followed by a shingle cutting operation which cuts the material into individual shingles. In the production of asphalt sheet material, either a glass fiber mat or an organic felt mat is passed through a coater containing hot liquid asphalt filled with limestone to form a tacky, asphalt coated sheet. Subsequently, the hot asphalt coated sheet is passed beneath one or more granule applicators which discharge protective and decorative surface granules onto portions of the asphalt sheet material.

[0005] In certain types of shingles, it is especially desired that the shingles define a sufficiently wide area, often known in the industry as the "nail zone," in order to make installation of roofs using shingles, such as laminated shingles, more efficient and secure. One or more lines or other indicia painted or otherwise marked longitudinally on the surface of the shingle may define such a nail zone. It is especially desired that the shingles define a nail zone to guide installers in the placement of nails.

[0006] Additionally, shingles may experience lift in high wind situations. This lift may be exacerbated if the shingle tabs are not sealed or adhered to the shingle below. Therefore, there is also a need for shingles that have a sufficiently high nail pull-through value so that the installed shingles have improved performance in high wind situations.

[0007] After manufacture, laminated shingles may be packaged in a stack or bundle. The laminated shingles are often stacked by turning every other shingle 180 degrees relative to the adjacent shingles. This stacking method minimizes uneven build in the bundle caused by the difference in thickness between the area

of the shingle that includes the underlay and the area that does not include the underlay. However, stacking the shingles in this manner may result in an undesirable thickness along the central area of the bundle because the longitudinal central areas of the shingles are double-layered and the cutout areas of the shingles on the sides of the central areas are single-layered. The difference in thickness causes an unsightly hump or ridge along the central area of the bundle that becomes progressively higher as the number of shingles in the bundle is increased. When multiple shingle bundles are stacked on a pallet, the humps amplify themselves and may cause unsightly pallet build, instability of the stacked bundles, and high contact pressures at the intersections of the overlapping bundles. The high contact pressures may cause shingle deformation and sticking between individual shingles.

[0008] This undesirable thickness or humping in a bundle of shingles is not limited to laminated shingles. Both laminated shingles and single-layered, such as "three-tab" shingles, often include a sealant bead at an edge of the shingle to seal or adhere the tabs of one course of shingles to an adjacent overlapping course of shingles when the shingles are installed on a roof. The added thickness of the sealant beads may also cause undesirable thickness or humping along the edges of the bundle of shingles.

SUMMARY OF THE INVENTION

[0009] The present application describes various embodiments of a roofing shingle. One embodiment of the roofing shingle includes a headlap portion and a tab portion. A layer of a first granular material is adhered to a back side of the headlap portion and defines a first surface. A bead of tab sealant extends

longitudinally on a back side of the tab portion. A longitudinally extending groove is formed in the first surface of the back side of the headlap portion.

[0010] In another embodiment, the roofing shingle includes a headlap portion and a tab portion. A layer of a first granular material is adhered to a back side of the headlap portion and defines a first surface. A bead of tab sealant extends longitudinally on a back side of the tab portion. A longitudinally extending groove is formed in the first surface of the back side of the headlap portion, wherein the longitudinally extending groove is defined by a second granular material having a granule size relatively smaller than the first granular material. The longitudinally extending bead of tab sealant and the longitudinally extending groove are configured such that when a plurality of the roofing shingles are stacked in a bundle such that every other of the roofing shingles is inverted and turned 180 degrees relative to an adjacent one of the roofing shingles, the bead of tab sealant aligns with and nests within the longitudinally extending groove of an adjacent one of the roofing shingles. Leading and trailing edges of the roofing shingles define edge zones of the bundle. The nesting of the bead of tab sealant within the longitudinally extending groove of the stacked shingles results in the edge zones of the bundle having a height substantially identical to a height of a remainder of the bundle outside of edge zones.

[0011] In a further embodiment, the roofing shingle includes an overlay sheet having a headlap portion and a tab portion. A layer of a first granular material adhered to a back side of the headlap portion and defining a first surface. An underlay sheet is secured to the overlay sheet such that a region of the underlay sheet overlaps a region of the headlap portion of the overlay sheet, thereby defining a two-layer portion and a single-layer portion of the roofing shingle. A bead of tab sealant extends longitudinally on a back side of the underlay sheet. A

longitudinally extending groove is formed in the first surface of the back side of the headlap portion.

[0012] Other advantages of the roofing shingle will become apparent to those skilled in the art from the following detailed description, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Fig. 1 is a plan view of a roofing shingle according to a first embodiment of the invention.

[0014] Fig. 2 is a cross-sectional view taken along the line 2-2 of Fig. 1.

[0015] Fig. 3 is a cross-sectional view taken along the line 3-3 of Fig. 1.

[0016] Fig. 4 is a cross-sectional view of a roofing shingle according to a second embodiment of the invention.

[0017] Fig. 5 is an alternate cross-sectional view of the roofing shingle illustrated in Fig. 4.

[0018] Fig. 6 is a perspective view of a third embodiment of a laminated shingle having reinforcement material in accordance with the invention.

[0019] Fig. 7 is a plan view of the front of the laminated shingle illustrated in Fig. 6.

[0020] Fig. 8 is a plan view of the back of the laminated shingle illustrated in Figs. 6 and 7.

[0021] Fig. 9 is a perspective view of a portion of a fourth embodiment of a laminated shingle having reinforcement material in accordance with the invention.

[0022] Fig. 10 is a plan view of the back of a fifth embodiment of a laminated shingle in accordance with the invention.

[0023] Fig. 11 is a schematic sectional view of a pair of the laminated roofing shingles illustrated in Fig. 10, shown stacked together in a bundle and in exaggerated thickness.

[0024] Fig. 12 is an exploded schematic sectional view of a pair of a sixth embodiment of laminated roofing shingles according to the invention, shown stacked together in a bundle and in exaggerated thickness.

DETAILED DESCRIPTION

[0025] The present invention will now be described with occasional reference to the illustrated embodiments of the invention. This invention may, however, be embodied in different forms and should not be construed as limited to the embodiments set forth herein, nor in any order of preference. Rather, these embodiments are provided so that this disclosure will be more thorough, and will convey the scope of the invention to those skilled in the art.

[0026] Unless otherwise defined, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. The terminology used in the description of the invention herein is for describing particular embodiments only and is not intended to be limiting of the invention. As used in the description of the invention and the appended claims, the singular forms "a," "an," and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0027] Unless otherwise indicated, all numbers expressing quantities of ingredients, properties such as molecular weight, reaction conditions, and so forth as used in the specification and claims are to be understood as being modified in all instances by the term "about." Accordingly, unless otherwise indicated, the

numerical properties set forth in the specification and claims are approximations that may vary depending on the desired properties sought to be obtained in embodiments of the present invention. Notwithstanding that the numerical ranges and parameters setting forth the broad scope of the invention are approximations, the numerical values set forth in the specific examples are reported as precisely as possible. Any numerical values, however, inherently contain certain errors necessarily resulting from error found in their respective measurements.

[0028] As used in the description of the invention and the appended claims, the term "asphalt coating" is defined as any type of bituminous material suitable for use on a roofing material, such as asphalts, tars, pitches, or mixtures thereof. The asphalt may be either manufactured asphalt produced by refining petroleum or naturally occurring asphalt. The asphalt coating may include various additives and/or modifiers, such as inorganic fillers, mineral stabilizers, non-polymers, and organic materials such as polymers, recycled streams, or ground tire rubber. Preferably, the asphalt coating is a filled-asphalt that contains asphalt and an inorganic filler or mineral stabilizer.

[0029] As used in the description of the invention and the appended claims, the term "longitudinal" or "longitudinally" is defined as substantially parallel with the machine direction.

[0030] As used in the description of the invention and the appended claims, the terms "shingle blow off" or "blow off" are defined as the occurrence of installed shingles being forced off a roof deck when the installed shingles are subjected to high winds. Also, the term "shingle blow through" or "blow through" are defined as the situation that occurs when a nail has been driven too deeply into the shingle and the nail head penetrates through at least the shingle overlay.

[0031] As used in the description of the invention and the appended claims, the term "wet" or "wet out" is defined as the ability of sealant or adhesive to flow and/or reflow over a surface to maximize bond strength based on a larger contact area.

[0032] Composite shingles, such as asphalt shingles, are a commonly used roofing product. Asphalt shingle production generally includes feeding a base material from an upstream roll and coating it first with a roofing asphalt material, then a layer of granules. The base material is typically made from a fiberglass mat provided in a continuous shingle membrane or sheet. It should be understood that the base material may be any suitable support material.

[0033] Composite shingles may have a headlap region and a prime region. The headlap region may be ultimately covered by adjacent shingles when installed upon a roof. The prime region will be ultimately visible when the shingles are installed upon a roof.

[0034] The granules deposited on the composite material shield the roofing asphalt material from direct sunlight, offer resistance to fire, and provide texture and color to the shingle. The granules generally involve at least two different types of granules. Headlap granules are applied to the headlap region. Headlap granules are relatively low in cost and primarily serve the functional purposes of covering the underlying asphalt material for a consistent shingle construction, balancing sheet weight, and preventing overlapping shingles from sticking to one another. Colored granules or other prime granules are relatively expensive and are applied to the shingle at the prime regions. Prime granules are disposed upon the asphalt strip for both the functional purpose of protecting the underlying asphalt strip and for providing an aesthetically pleasing appearance of the roof.

[0035] The performance of an installed shingle, such as in high wind conditions, may be enhanced by reinforcing the nail zone of the shingle. By reinforcing the nail zone, the occurrence of nail blow through during shingle installation may be reduced. Reducing the occurrence of nail blow through advantageously reduces the possibility of a roof leak if water travels under the shingle tab. A reinforced nail zone also improves the efficiency of the shingle installer by reducing the likelihood of nail blow through when the shingle is weakened due to high temperatures, such as when the temperature is above about 120 degrees F, or when nail gun air pressure is too high. The reinforced nail zone may also provide a defined and relatively wide area in which the installer may nail. Advantageously, the reinforced nail zone will increase the force required to pull a nail through the shingle, thereby reducing the likelihood of shingle blow off.

[0036] The nail zone may also be used as the bonding substrate area or bonding surface for tab sealant bonded to the underside of the tabs of the overlay sheet. The nail zone may provide an improved bonding surface for tab sealant.

[0037] It is known that most debonding energy, such as is generated between the tab sealant and the bonding surface is due to viscoelastic loss in the tab sealant as it is stretched during debonding. Further, the polymer modified asphalt sealants typically used as tab sealants on shingles may lose their viscoelastic characteristics when the temperature drops to 40 degrees F or below.

[0038] Advantageously, the use of woven or non-woven fabric to reinforce the nail zone and to define the bonding surface for tab sealant has been shown to improve or retain debonding loads of polymer modified asphalt sealants relative to shingles without a reinforced nail zone at relatively low temperatures, such as temperatures below about 40 degrees F. This relatively strong debonding load between woven or non-woven fabric and modified asphalt sealants, including

polymer and non-polymer modified asphalt tab sealants, occurs because the woven or non-woven fabric mechanically bonds to the sealant. For example, mechanical attachment occurs as the polymer modified asphalt sealant flows around individual filaments and fiber bundles within the woven or non-woven fabric during bonding. The energy required to debond the polymer modified asphalt sealant from the woven or non-woven fabric is increased or comparable to the energy required to debond the polymer modified asphalt sealant from a shingle without a reinforced nail zone. Because the tab sealant is reinforced with the filaments and fiber bundles within the woven or non-woven fabric at the interface between the polymer modified asphalt sealant and the woven or non-woven fabric, the interior of the sealant becomes the weakest portion of the bond.

[0039] An additional advantage of using woven or non-woven fabric to reinforce the nail zone is that the fabric may be installed during shingle production. During shingle production, the woven or non-woven fabric may be pushed into the hot, filled-asphalt coating, such that some of the filled-asphalt bleeds up and around the individual fibers and fiber bundles of the fabric. This creates a positive mechanical bond between the fabric and the shingle substrate. Further, the filled-asphalt that bleeds up and into the fabric aids in forming a bond between the tab sealant and the shingle because the filled-asphalt diffuses into the tab sealant. When installed on a roof, this creates a robust continuous path for the transfer of debonding loads from the tab above to the nail in the shingle below.

[0040] The roofing shingles of the invention may be laminated or non-laminated (e.g., three-tab) shingles. As known in the roofing industry, non-laminated shingles may be made with or without tabs, and three-tab roofing shingles usually include three tabs in the buttlap portion of the shingle and relatively narrow cutouts between the tabs. Laminated roofing shingles usually

include an overlay that extends the entire width of the shingle and includes relatively wide cutouts in the buttlap portion of the shingle, and an underlay positioned below the overlay that extends the width of the buttlap portion under the cutouts and a short distance into the headlap portion of the shingle. Numerous alternate laminate constructions are available, such as full length laminates, trilaminates, and other constructions known to one skilled in the art.

[0041] The buttlap is the portion of the roofing shingle that is exposed when the shingle is installed on a roof, and the headlap is the portion of the roofing shingle that is not exposed when the shingle is installed on a roof because it is covered by the adjacent upper row of shingles. On a laminated roofing shingle or a three-tab roofing shingle, the buttlap portion usually extends about to the inner edge of the cutouts. If the cutouts have different widths, the buttlap portion usually extends about to the inner edge of the cutout(s) with the largest width. The lower edge of the roofing shingle is often referred to as the butt edge while the upper edge of the shingle may be referred to as the head edge.

[0042] As discussed below, a preferred roofing shingle of the invention includes a coated roofing mat and a water impermeable sheet. The term "roofing shingle," as used herein, includes the sheet attached to the coated roofing mat, and it also includes an assembly of the sheet and the coated roofing mat where the sheet is adjacent to the mat but not attached to it. For example, the sheet may be attached to the roof separately from the coated roofing mat and/or it may be attached to the coated roofing mat when it is installed on the roof. Alternatively, the sheet may be unattached on the roof but held in place by the adjacent upper and lower coated roofing mats or by other means. In an alternative embodiment, the sheet comprises the reinforcement for the wide nail zone, as described in commonly assigned U.S. Patent No. 7,836,654.

[0043] The coated roofing mat includes a roofing mat typically coated with an organic-based coating material. The roofing mat may be any type suitable for reinforcing the roofing shingle, such as a web, scrim, or felt of synthetic or natural fibrous materials, including nonwoven or woven mats. The fibrous materials may include, for example, mineral fibers, polymer fibers, carbon fibers, cellulose fibers, rag fibers, or mixtures of these fibers. Suitable mineral fibers may include fibers of a heat-softenable mineral material, such as glass, ceramic, rock, slag, or basalt. In one embodiment, the roofing mat is a nonwoven web of glass fibers.

[0044] The organic-based coating material may be any type suitable for use on a roofing shingle. Typically, the coating material is a bituminous material and/or a polymeric material (e.g., a polymer, a recycled polymer stream or ground tire rubber). Any type of suitable bituminous material may be used, such as asphalt, tar, pitch, or a mixture thereof. By "organic-based" is meant that the organic material forms the continuous phase of the coating material. The coating material usually includes at least about 20% organic material by weight, and often at least about 40%. The coating material may also include various additives and/or modifiers, such as inorganic fillers or mineral stabilizers. In a typical asphalt roofing shingle, the coating material includes asphalt and a filler of finely ground inorganic particulate matter, such as ground limestone, dolomite or silica, in an amount of from about 40% to about 80% by weight of the coating material.

[0045] The water impermeable sheet may be any type suitable for use on a roofing shingle. By "water impermeable" is meant that the sheet forms a barrier that substantially prevents penetration by water through the sheet during normal use of the roofing shingles on a roof. Optionally, the water impermeability of the sheet may be tested by any suitable method, for example, by placing 0.5 liter of water at room temperature over a section of the sheet having an area of 400 cm2,

and observing no substantial penetration of the sheet by the water after 24 hours. The sheet may have any thickness suitable for providing the water barrier, although relatively thin sheets are usually preferred for cost and weight reduction. The term "sheet" includes films, membranes, tapes, foils, and the like, usually in substantially continuous form. Alternatively, the "sheet" may be formed on site by extruding a polymer sheet, or by applying a liquid to the surface of the coated mat 38 by rolling, spraying, or other known processes.

[0046] In some embodiments, the sheet is made from a polymer or a metal. Any suitable polymer or mixture of different polymers may be used to make the sheet. For example, the polymer may be a polyolefin such as polypropylene, polyethylene, polybutene, or polyisoprene. Some other examples of polymers that may be suitable include polypropylene, polyethylene, polyester terephthalate, polyester, polyethylene terephthalate, polyvinyl chloride, EPDM (terpolymer elastomer made from ethylene-propylene diene monomer), and other polymers and polymer blends known to one skilled in the art. The polymer may be high or low density. A polymer sheet may also include additives to improve the flame retardancy of the sheet, as known to one skilled in the art. Furthermore, the sheet materials may be chemically treated or surface charged to improve properties.

[0047] Any suitable metal or combination of metals may be used to make the sheet. Recycled metals may also be used. Some examples of metals that may be suitable include aluminum and copper. Preferably, the sheet is a nonlaminated sheet made from polymer or metal. It is also preferred that the sheet does not have an ionic charge. The sheet may also be made from a roofing mat as described above, provided the mat is made sufficiently water impermeable by coating or other means.

[0048] In the embodiments of the invention where the sheet is attached to the coated mat, these materials may be attached together by any suitable means. For example, they may be attached by the use of any suitable type of adhesive. Some examples of adhesives that may be suitable include polymeric hot-melt adhesives and modified asphalt hot-melt adhesives. Alternatively, the sheet and the coated mat may be attached together by mechanical means such as by sewing, stitching, stapling, or by the use of any other suitable fasteners, or may be adhered to the coating material in molten form.

[0049] The roofing shingles of the invention may provide advantages compared to conventional shingles. In one embodiment of the invention, roofing shingles are made in which the headlap portion of a conventional shingle is mostly replaced with the water impermeable sheet. The replacement of most of the headlap portion may provide weight and cost advantages. A reduction in the weight of the shingle could provide freight and installation benefits. Replacing most of the headlap portion of the shingle could increase the capacity of existing shingle manufacturing lines and reduce the amount of raw material brought into a plant.

[0050] Referring now to the drawings, Figs. 1-3 illustrate a first embodiment of the invention in which most of the headlap portion of a conventional roofing shingle is replaced with the water impermeable sheet. The roofing shingle 10 includes a buttlap portion 12 with a butt edge 14 and a headlap portion 16 with a head edge 18. The roofing shingle includes a coated mat 20 comprising a roofing mat coated with an organic-based coating material. The coated mat 20 has a width that extends entirely through the buttlap portion 12 and preferably does not extend more than 20% into the headlap portion 16 of the shingle. In some embodiments, the coated mat 20 does not extend more than 15%,

10%, or 5% of the distance into the headlap portion 16. The roofing shingle 10 also includes a water impermeable sheet 22 adjacent to the coated mat. The term "adjacent," as used herein, includes overlapping or end-to-end. Either the coated mat 20 or the sheet 22 may be on top when they overlap. In the illustrated embodiment, the coated mat 20 and the sheet 22 overlap a short distance into the headlap portion 16 of the roofing shingle and they are attached together by an adhesive 24. The sheet 22 has a width that extends from the head edge 18 through at least 80% of the headlap portion 16 and does not extend to the butt edge 14 of the roofing shingle. In some embodiments, the sheet 22 extends through at least 85%, 90%, or 95% of the headlap portion 16. The illustrated roofing shingle is a laminated shingle in which the coated mat 20 is the underlay, and the shingle further includes an overlay in the form of a second coated mat 26 cut in a dragon-tooth pattern. In a laminated shingle, the end of the sheet 22 could alternatively be attached between the overlay and the underlay, although it is usually positioned either above the overlay or below the underlay. Although the figures relate to a laminated roofing shingle, the invention also includes non-laminated roofing shingles as discussed above.

[0051] The second coated mat 26 is adhered to the first coated mat 20 using a laminate adhesive as is well known to one skilled in the art. The shingle further includes a sealant, preferably a polymer modified asphalt (PMA) such as described in commonly assigned US patent 4,824,880 to Algrim et al., which is incorporated herein by reference in its entirety. A preferred laminate adhesive includes a polymer-modified asphalt, typically including one or more styrene block polymer materials, such as those taught in the sealant of the '880 patent. In a preferred embodiment, the adhesive comprises less than ten percent by weight of polymer material, up to sixty percent or more of a mineral filler, such as limestone or

dolomite, and the balance being primarily asphalt, and may include additional other modifiers and such, including for example extender oils, acid treatments and other known modifiers in the asphalt industry. The filler percentage may be more or less, depending on adhesive properties needed, but typically at least about forty percent filler is desirable. For improved economy and adhesion, more preferably, the polymer is less than six percent, and even more preferably about four percent or less. As an adhesive, it is preferable the asphalt has a penetration hardness greater than 8 dmm at 77 degrees F and a softening point greater than 130 degrees F, and more preferably a penetration hardness greater than 10 dmm at 150 degrees F.

[0052] The roofing shingles of the invention may also be characterized in terms of their limited width. The roofing shingles disclosed in U.S. Patent 6,990,779 B2 (to Elk Premium Building Products, Inc.) use conventional width shingles but increase the width of the buttlap portion of the shingles. Then an interply material is attached to the head edge of the shingle. For purpose of comparison with the roofing shingles of the invention, if the "shingle" disclosed in U.S. 6,990,779 is considered to be the combination of the roofing shingle and the interply material, the shingle has a greatly increased width compared to conventional shingles. In contrast, the roofing shingles of the invention may replace most of the headlap portion of the shingles with the water impermeable sheet, and therefore the total width of the shingles is not greatly increased compared to conventional shingles, and in some embodiments the total width is the same as conventional shingles.

[0053] Thus, a preferred roofing shingle according to the invention may have a limited width characterized by at least one of the following: (a) the entire roofing shingle (including the coated mat and the water impermeable sheet) has a

width of not more than about 17 inches (about 43 cm), and preferably not more than about 15 inches (about 38 cm), (b) the buttlap portion of the roofing shingle has a width of not more than about 7 inches (about 18 cm), and preferably not more than 6 inches (about 15 cm), and (c) the sheet has a width of not more than 8 inches (about 20 cm), and preferably not more than 7 inches (about 18 cm). In some embodiments, the limited width of the roofing shingle is characterized by at least two of (a), (b) and (c), and in some embodiments by all three of (a), (b) and (c). Alternatively, other size shingles, such as larger format shingles, for example the Berkshire® shingle sold by Owens Corning, may be made using the present invention, using proportionally sized buttlap and sheet materials.

[0054] Replacing most of the headlap portion of the roofing shingles with the water impermeable sheet may allow shingles to be made in which the overall weight of the shingles is decreased compared to conventional shingles, in contrast to the roofing shingles disclosed in U.S. Patent 6,990,779 B2 which will be increased in weight. For example, the roofing shingle may have a weight reduction of at least about 25% compared to another roofing shingle that is identical except that it does not include the water impermeable sheet and the coated mat extends the full width of the roofing shingle, and sometimes a weight reduction of at least about 40%.

[0055] While not illustrated in the Figures, the lower portion of the sheet may be printed with lines or other markings to indicate a preferred nail zone for attaching the shingle to the roof. Such a nail zone is described in U.S. Patent No. 7,836,654. However, where the sheet covers substantially the entire headlap area, a preferred embodiment provides a nail zone between the bottom of the exposed portion of the film and a line provided on the film parallel to the bottom of the film (or other markings). Accordingly, the sheet provides the function of the

reinforcement described and claimed in U.S. Patent No. 7,836,654. Alternatively, the film may be located above the nail zone region, and a separate reinforcement applied to the nail zone as described in U.S. Patent No. 7,836,654, and shown in Fig. 6.

[0056] In yet another embodiment as shown in Fig. 2, a nail zone may be formed at a portion of the roofing shingle where the coated mat 20, second coated mat 26 and sheet 22 overlap. As shown in Fig. 2, the buttlap portion 12 of the roofing shingle 10 may be coated with roofing granules. However, in this embodiment, the nail zone region of the buttlap portion 12 may be marked by a dissimilar material to indicate the nail zone region. The term "dissimilar material," as used herein, is defined to mean a material having different characteristics from the roofing granules covering the buttlap portion 12 of the roofing shingle 10. Examples of dissimilar materials include granules having a different color or surface treatment, or another material, such as for example sand or a lightweight material, or materials having a finer grade than the roofing granules. Use of the dissimilar materials to mark the nail zone region may result in a reduced thickness of the roofing shingle 10 in the nail zone region, and may reduce the weight of the shingle and improve the bundle flatness.

[0057] Figs. 4-5 illustrate a second embodiment of the invention in which the buttlap portion of the roofing shingle is coated with roofing granules, but the use of the water impermeable sheet allows the shingles to be made without roofing granules on at least most of the headlap portion of the shingles. The roofing shingle 30 includes a buttlap portion 32 with a butt edge 34 and a headlap portion 36. The roofing shingle includes a coated mat 38 comprising a roofing mat coated with an organic-based coating material. The coated mat 38 has a width that extends entirely through the buttlap 32 and headlap 36 portions of the roofing

shingle. A layer of roofing granules 40 is adhered to the coating material in the buttlap portion 32. However, the roofing granules are substantially excluded in a non-granule area having a width that extends through at least most (at least more than 50%, preferably at least more than 80%) of the headlap portion 36. The roofing shingle also includes the water impermeable sheet 42 adjacent to the coated mat 38. The sheet 42 has a width that extends entirely through at least the non-granule area and does not extend to the butt edge 34 of the roofing shingle. Although the sheet 42 is attached above the coated mat 38 in the embodiment shown, alternatively it could be attached below the coated mat. The illustrated roofing shingle is a laminated shingle in which the coated mat 38 is the underlay, and the shingle further includes an overlay in the form of a second coated mat 44. Optionally, a UV resistant material could be added to the coating in the headlap portion and/or a layer of backdust material could be applied instead of roofing granules in the non-granule area.

[0058] In an alternative embodiment, a shingle may comprise a strip shingle, and the second coated mat 44 would not be present. In such an embodiment, the buttlap portion of the sheet 38 would be covered by granules (similar to that shown in the cutout areas shown in Fig. 5 below the overlay 44). When a strip shingle comprises a tabbed shingle, the sheet 42 must have a color and appearance which is acceptable through the tab cutouts, and should include a UV inhibitor.

[0059] In a further embodiment, the invention relates to a roofing shingle including a buttlap portion with a butt edge and a headlap portion. The roofing shingle includes a coated mat comprising a roofing mat coated with an organic-based coating material. The coated mat has a width that extends entirely through the buttlap and headlap portions of the roofing shingle. The roofing shingle also

includes a layer of roofing granules adhered to the coating material in the buttlap portion. However, the roofing granules are substantially excluded in a non-granule area having a width that extends through at least most of the headlap portion. The roofing shingle further includes a water impermeable sheet adjacent to the coated mat. The sheet has a width that extends through at least the non-granule area and does not extend to the butt edge of the roofing shingle.

[0060] It is known to include an adhesive material known as a sealant on roofing shingles to seal the shingles together when they are installed on a roof. For example, a typical laminated roofing shingle includes a line of sealant on the back surface of the shingle near the butt edge, as clearly shown at 50 in Figs. 2-5. When the next upper row of shingles is installed on the roof, the upper shingles cover the headlap portions of the lower shingles, and the sealant causes the back surfaces of the upper shingles to adhere to the top surfaces of the lower shingles. Sealing the shingles together on the roof helps to prevent wind uplift of the shingles. The sealant may be any suitable adhesive material, such as an adhesive made from asphalt, a polymer, or a combination of asphalt and polymer. The sealant may be applied in a discontinuous or continuous manner, and in any suitable configuration, and alternatively may be applied to the upper surface of the shingle to seal to the bottom of the adjacent course of shingles.

[0061] Advantageously, the roofing shingles of the present invention, and the reinforced nail zone shingles disclosed in U.S. Patent No. 7,836,654, may improve the wind resistance of the shingles by improving the adhesion between the shingles when they are sealed together on the roof. As described above, the shingles of the present invention include a water impermeable sheet, such as a polymer or metallic sheet, in the headlap portion of the shingle. Similarly, the reinforced nail zone shingles include a reinforcement member, typically made

from a polymer, adhered to the headlap portion of the shingle. The sheet or the reinforcement member may be positioned on the shingle so that when the next upper row of shingles is installed on the roof, the sealant on the back of an upper shingle comes into contact with the sheet or reinforcement member on the lower shingle. The sealant may adhere better to a polymer or metallic material than to an asphalt-based coating material with roofing granules on a typical roofing shingle, and preferably the sealant comprises a polymer modified asphalt sealant such as those taught in commonly assigned U.S. patent 4,824,880, or a variation thereof.

[0062] A preferred film for comprises a polymer having good adhesion to a polymer modified asphalt, such as a surface charged PET material. Additionally, the film may be mechanically locked to the coated mat by physical overlap of granules (i.e. the granules are preferably dropped onto the sheet after the film is applied, and the granules are adhered to the molten organic-based coating material, and a number of the granules will extend over the film and mechanically lock the film, as the granule will be adhered to the sheet by the organic-based coating material after solidification). One skilled in the art will further improve adhesion of the film by applying pressure to the film at application to imbed the film into the coating, as well as the further mechanical interlock of the granules after the granules are pressed into the sheet.

[0063] Thus, another embodiment of the invention relates to a roofing shingle including a buttlap portion and a headlap portion. The roofing shingle includes a coated mat comprising a roofing mat coated with an organic-based coating material. A sealant is applied on a back surface of the coated mat in the buttlap portion of the roofing shingle. A reinforcement member or a water impermeable sheet is attached to the coated mat and forms a top surface of the roofing shingle that is located at least partly in the headlap portion. The sealant

and the reinforcement member or the water impermeable sheet are positioned such that when a second identical shingle is laid over the headlap portion of the shingle, the sealant on the back surface of the second shingle comes into contact with the reinforcement member or the water impermeable sheet, thereby creating a strong bond between the shingles.

[0064] Preferably, the sealant forms a bond with the reinforcement member or the water impermeable sheet that is at least twice as strong at 21°C as the bond between the sealant and an asphalt-based coating material containing 40% asphalt and 60% ground limestone, and more preferably at least three times as strong. To enhance the bonding, in a preferred embodiment of the invention the sealant is a polymer modified asphalt and/or the reinforcement member or the water impermeable sheet is a polymer film. A specific example of a preferred polymer film is a polyester terephthalate film.

[0065] In addition to the improved wind resistance caused by the improved bonding between the shingles, the invention may also provide other advantages. For example, the sealant may be able to seal faster than a sealant on a conventional roofing shingle, because a sealant to film bond is quicker than a sealant to asphalt/granule bond. Preferably, the sealant is able to seal at least 50% faster. The sealant may also be able to develop a stronger bond at lower temperatures than a sealant on a conventional roofing shingle.

[0066] Referring now to Figs. 6, 7, and 8, a third embodiment of a laminated roofing shingle is shown generally at 74. In the illustrated embodiment, the shingle 74 has a length L and includes the overlay sheet 68 attached to the underlay sheet 66 and has a first end or leading edge 74A and a second end or trailing edge 74B. In the illustrated embodiment, the laminated roofing shingle 74 has a length L of about 39.375 inches. Alternatively, the length L may be within the range of from

about 39.125 inches to about 39.625 inches. The shingle 74 may also be manufactured having any other desired length. The shingle 74 also includes a longitudinal axis A. The overlay sheet 68 may include a headlap portion 76 and a tab portion 78. The headlap portion 76 may include a lower zone 76A and an upper zone 76B. The tab portion 78 defines a plurality of tabs 80 and cutouts 82 between adjacent tabs 80.

[0067] In the illustrated embodiment, the tab portion 78 includes four tabs 80, although any suitable number of tabs 80 may be provided. The headlap portion 76 and the tabs 80 may include one or more granule patterns thereon. Each cutout 82 has a first height H1. In the illustrated embodiment, the cutout 82 has a first height H1 of about 5.625 inches. Alternatively, the first height H1 may be within the range of from about 5.5 inches to about 5.75 inches. In the illustrated embodiment, the cutouts 82 are shown as having the same height H1. It will be understood however, that each cutout 82 may be of different heights. A line B is collinear with an upper edge 82A of the cutouts 82 and defines an upper limit of an exposed region 84 of the underlay sheet 66. In the illustrated embodiment, the height of the exposed region 84 is equal to the first height H1, although the height of the exposed region 84 may be any desired height. In a shingle wherein the cutouts 82 have different heights, the line B may be collinear with an upper edge 82A of the cutout 82 having the largest height. In the illustrated embodiment, the overlay sheet 68 has a second height H2.

[0068] The reinforcement material 19 has a width W of about 1.0 inch. Alternatively, the width W may be within the range of from about 0.75 inch to about 1.5 inches. Additionally, the width W may be within the range of from about 0.5 inch to about 2.0 inches. The reinforcement material 19 may be disposed longitudinally on the headlap portion 76. In the illustrated embodiment, the

reinforcement material 19 extends longitudinally from the first end 74A to the second end 74B of the shingle 74 within the lower zone 76A of the headlap portion 76. A lower edge 19A of the reinforcement material 19 may be spaced apart from the line B by a distance D1. In the illustrated embodiment, the distance D1 is about 0.25 inch. Alternatively, the distance D1 may be within the range of from about 0.125 inch to about 0.375 inch. The distance D1 may, however, be of any other desired length. For example, if desired, the reinforcement material 19 may substantially cover the entire headlap portion 76 of the overlay sheet 68. It will be understood that the reinforcement material 19 need not extend from the first end 74A to the second end 74B of the shingle 74, and may be disposed in one or more sections or portions on the shingle 74.

[0069] The reinforcement material 19 defines a reinforced nail zone 98 and may include text such as "NAIL HERE •", as shown in Fig. 6. It will be understood, however, that any other text or other indicia may be included on the reinforcement material 19. It will also be understood that the reinforcement material 19 may be provided without such text or indicia. These indicia on the reinforcement material 19 ensure that the reinforced nail zone 98 may be easily and quickly identified by the shingle installer.

[0070] In the embodiment illustrated in Figs. 6 and 8, the underlay sheet 66 includes a leading edge 66A and a trailing edge 66B and has a third height H3. In the illustrated embodiment, the height H3 of the underlay sheet 66 is about 6.625 inches. Alternatively, the height H3 may be within the range of from about 6.5 inches to about 6.75 inches. The underlay sheet 66 may also be manufactured having any other desired height.

[0071] In the illustrated embodiment, the third height H3 of the underlay sheet 66 is equal to about one-half the second height H2 of the overlay sheet 68. The

overlay sheet 68 and the underlay sheet 66 thereby overlap to define a two-layer portion of the laminated shingle 74 and a single-layer portion of the laminated shingle 74. More specifically, a region of the underlay sheet 66 overlaps a region of the headlap portion 76 of the overlay sheet 68, thereby defining a two-layer portion and a single-layer portion of the laminated shingle 74 within the headlap portion 76. At least a portion of the reinforcement material 19 is adhered to the single-layer portion of the laminated shingle 74. Alternately, the third height H3 of the underlay sheet 66 may be greater than one-half of the second height H2 of the overlay sheet 68. This relationship between the underlay sheet 66 and the overlay sheet 68 allows the reinforcement material 19 to be positioned such that a reinforced nail zone is provided at the two-layer portion of the laminated shingle 74.

[0072] Referring now to Fig. 8, a bottom or back side of the laminated shingle 74 is shown. The back side of the laminated shingle 74 may be covered in a backdust material. The backdust material is useful to prevent the back side of the laminated shingle 74 from undesirably adhering or sticking to another laminated shingle 74 when a plurality of the laminated shingles 74 are stacked together in a bundle. The backdust material may be made from any desired material, such as crushed rock in the form of talc, carbonate, or rock dust, and sand, such as silica sand.

[0073] A discontinuous bead of tab sealant 96 may extend longitudinally and may be adhered to a lower surface of the back side of the laminated shingle 74 adjacent and parallel to a leading edge 74A of the laminated shingle 74. The tab sealant 96 may be spaced a distance D2 from the leading edge 74A of the laminated shingle 74. In the illustrated embodiment, the tab sealant 96 is spaced about 0.5 inches from the leading edge 74A of the laminated shingle 74.

Alternatively, the tab sealant 96 may be spaced within the range of from about 0.375 inch to about 0.625 inch from the leading edge 74A of the laminated shingle 74. In the illustrated embodiment, the tab sealant 96 includes segments 96S having a length 96L of about 3.0 inches. Alternatively, the tab sealant segments 96S may have a length 96L within the range of from about 2.25 inches to about 4.25 inches. The tab sealant segments 96S may be spaced apart a distance 96D. In the illustrated embodiment, the tab sealant segments 96S are spaced about 1.0 inch apart. Alternatively, the tab sealant segments 96S may be spaced within the range of from about 0.25 inch to about 1.5 inches apart.

[0074] The tab sealant segments 96S may have a width 96W. In the illustrated embodiment, the tab sealant segments 96S have a width 96W of about 0.5 inch. Alternatively, the tab sealant segments 96S may have a width 96W within the range of from about 0.375 inches to about 0.675 inches. The tab sealant segments 96S may also be applied having any other desired width. In the illustrated embodiment, the tab sealant segments 96S have a thickness of about 0.035 inch. Alternatively, the tab sealant segments 96S may have a thickness within the range of from about 0.028 inches to about .050 inches. The tab sealant segments 96S may also be applied having any other desired thickness. It will be understood that the bead of tab sealant 96 may be applied as a continuous bead of sealant.

[0075] If desired, a continuous strip of release tape 94 may extend longitudinally and may be adhered to an upper surface of the back side of the laminated shingle 74 adjacent and parallel to a trailing edge 74B of the laminated shingle 74. The release tape 94 is positioned such that it will be opposite the tab sealant 96 when the laminated shingles 74 are stacked, such as when packaged for shipment. The release tape 94 may be spaced a distance D1 from the trailing edge 74B of the laminated shingle 74. In the illustrated embodiment, the release tape 94

is spaced about 0.125 inches from the trailing edge 74B of the laminated shingle 74. Alternatively, the release tape 94 may be placed at any desired location on the back side of the laminated shingle 74, such that the release tape 94 contacts and covers the sealant 96 when a plurality of the laminated shingles 74 are stacked in a bundle, such as for shipping.

[0076] In the illustrated embodiment, wherein the reinforcement material 19 has a width W of about 1.0 inch, the reinforcement material 19 is positioned such that about 75 percent (0.75 inch) of the reinforced nail zone is positioned over the two-layer portion of the laminated shingle 74, and about 25 percent (0.25 inch) of the reinforced nail zone is positioned over the single-layer portion of the laminated shingle 74. Alternatively, a portion of the reinforced nail zone within the range of from about 62.5 percent (0.625 inch) to about 87.5 percent (0.875) of the nail zone is positioned over the two-layer portion of the laminated shingle 74, and a portion of the reinforced nail zone within the range of from about 12.5 percent (0.125 inch) to about 37.5 percent (0.375 inch) of the nail zone is positioned over the single-layer portion of the laminated shingle 74.

[0077] Additionally, a portion of the reinforced nail zone within the range of from about 50 percent (0.50 inch) to about 100 percent (1.0 inch) of the nail zone is positioned over the two-layer portion of the laminated shingle 74, and a portion of the reinforced nail zone within the range of from about 0.0 percent (0.0 inch) to about 50 percent (0.50 inch) of the nail zone is positioned over the single-layer portion of the laminated shingle 74. For example, a second embodiment of the laminated shingle 174 is shown in Fig. 9, and includes the underlay sheet 166 and the overlay sheet 168. The reinforcement material 19 is attached to the overlay sheet 168 as described above and is positioned such that about 100 percent of the reinforced nail zone 198 is positioned over the two-layer portion of the laminated

shingle 174, and about 0 percent of the reinforced nail zone 198 is positioned over the single-layer portion of the laminated shingle 174.

[0078] Referring to Fig. 10, the back side of a fifth embodiment of the laminated shingle is shown at 274. The laminated shingle 274 includes an overlay sheet 268 and an underlay sheet 266. If desired, a depression or groove 194 may be formed in the back side of the laminated shingle 274 in lieu of the continuous strip of release tape 94 described above.

[0079] Fig. 11 is a schematic sectional view of a representative pair of the third embodiment of the laminated shingles 274 manufactured according to the present invention. As shown in Fig. 11, the laminated roofing shingles 274 are stacked such that every other of the shingles 274 is inverted and turned 180 degrees relative to an adjacent one of the shingles 274 to define a bundle 200. It will be understood however, that the shingles 274 may be stacked such that every other of such shingles 274 are either inverted or turned 180 degrees, or both.

[0080] As best shown in Fig. 11, the groove 194 is positioned such that it will be opposite the tab sealant 96 when the laminated shingles 274 are stacked in the bundle 200, such as when packaged for shipment. As disclosed above regarding the release tape 94, the groove 194 may be spaced a distance D1 from the trailing edge 274B of the laminated shingle 274. In the illustrated embodiment, the groove 194 is spaced about 0.125 inches from the trailing edge 274B of the laminated shingle 274. Alternatively, the groove 194 may be placed at any desired location on the back side of the laminated shingle 274, such that the sealant 96 nests within the groove 194 when a plurality of the laminated shingles 274 are stacked in the bundle 200. As used in the description of the invention and the appended claims, the term "nest" or "nests" is used to describe embodiments wherein the sealant 96 fits completely within the groove 194, and embodiments wherein less than 100

percent of the sealant 96 fits within the groove, such as embodiments wherein the sealant 96 fits substantially within the groove 194, or fits partially within the groove 194.

[0081] The groove 194 may have a width 194W that need only be slightly wider than the width 96W (described in detail above) of the tab sealant 96. In the illustrated embodiment, the groove 194 has a width 194W of about 0.625 inches. Alternatively, the groove 194 may have a width 194W within the range of from about 0.0625 inches to about 0.125 inches larger than the width 96W of the tab sealant 96. Additionally, the groove 194 may have a width 194W within the range of from about 0.125 inches to about 0.25 inches larger than the width 96W of the tab sealant 96.

[0082] In the illustrated embodiment, the groove 194 has a depth 194D of about 0.030 inches. Alternatively, the groove 194 may have a depth 194D within the range of from about 0.020 inches to about 0.040 inches. Additionally, the groove 194 may have a depth 194D within the range of from about 0.010 inches to about 0.050 inches.

[0083] As described above, the back side of the overlay sheet 268 of the laminated shingle 274 is typically coated with a layer of first granular or backdust material, as described above. In a first embodiment of the laminated shingle 274 as shown in Fig. 11, the portion 268G of the overlay sheet 268 that will define the groove 194 may be coated with a second granular material. In the illustrated embodiment, the second granular material is a material having granules relatively smaller than the granules of the backdust material that covers a remainder of the back side of the overlay sheet 268. The second granular material may be any desired material, such as relatively finer crushed rock, talc, carbonate, or rock

dust, relatively finer sand, and other materials having a finer grade than the backdust material.

[0084] By coating the portion 268G of the overlay sheet 268 with one of the second material, the groove 194 will be formed between areas of the back side of the overlay sheet 268 covered by backdust granules. As shown in Fig. 11, the tab sealant 96 will nest in the groove 194, thereby improving bundle flatness by reducing the thickness of the bundle 200 of roofing shingles 274 along edge zones 200E of the bundle 200 of shingles. Additionally, the groove 194 may reduce the weight of the shingle 274 relative to the weight of otherwise identical shingles formed without the groove 194.

[0085] Fig. 12 is a schematic sectional view of a representative pair of a sixth embodiment of laminated shingles 374 manufactured according to the present invention. As shown in Fig. 12, the laminated roofing shingles 374 are stacked such that every other of the shingles 374 is inverted and turned 180 degrees relative to an adjacent one of the shingles 374 to define a bundle 202. It will be understood however, that the shingles 374 may be stacked such that every other of such shingles 374 are either inverted or turned 180 degrees, or both.

[0086] In a second embodiment of the laminated shingle 374 as shown in Fig. 12, a longitudinally extending strip of material 204 may be applied to the back side of the laminated shingle 374 in lieu of the continuous strip of release tape 94 described above, and in lieu of the groove 194.

[0087] Referring again to Fig. 12, the strip of material 204 may be formed from materials having a thickness which causes a second broad face 204B of the material 204 to extend outwardly of a broad face 374B of the back side of the laminated shingle 374. These materials may compress when the laminated shingles 374 are stacked in the bundle 202, such that the tab sealant 96 will form a

groove 206 in the material 204, thereby nesting within the groove 206 and improving bundle flatness by reducing the thickness of the bundle 202 of roofing shingles 374 along the edge zones 202E of the bundle 202 of shingles. Additionally, the use of material 204 may reduce the weight of the shingle 374, relative to the weight of otherwise identical shingles formed without the material 204.

[0088] Alternatively, as shown at 208 in Fig. 12, the second broad face 208B of the material 208 may be substantially parallel to the broad face 374B of the laminated shingle 374. Examples of suitable compressible materials include foamed rubbers such as EPDM Styrene Butadiene Rubber (SBR) foam, polyurethane, and texturized fabrics.

[0089] Although the invention has been disclosed in the context of a laminated shingle 74, it will be understood that the reinforcement material 19 may be attached to any other type of shingle, such as a single layer shingle.

[0090] The present invention should not be considered limited to the specific examples described herein, but rather should be understood to cover all aspects of the invention. Various modifications, equivalent processes, as well as numerous structures and devices to which the present invention may be applicable will be readily apparent to those of skill in the art. Those skilled in the art will understand that various changes may be made without departing from the scope of the invention, which is not to be considered limited to what is described in the specification.

CLAIMS

What is claimed is:

1. A roofing shingle comprising:

a headlap portion and a tab portion, a layer of a first granular material adhered to a back side of the headlap portion and defining a first surface;

a bead of tab sealant extending longitudinally on a back side of the tab portion; and

a longitudinally extending groove formed in the first surface of the back side of the headlap portion.

2. The roofing shingle according to Claim 1, wherein the longitudinally extending groove is defined by a second granular material having a granule size relatively smaller than the first granular material.

3. The roofing shingle according to Claim 2, wherein the second granular material is formed from sand.

4. The roofing shingle according to Claim 2, wherein the second granular material is formed from materials having a finer grade than the first granular material.

5. The roofing shingle according to Claim 1, wherein the longitudinally extending bead of tab sealant and the longitudinally extending groove are configured such that when a plurality of the roofing shingles are stacked in a bundle such that every other of the roofing shingles is inverted and turned 180 degrees relative to an adjacent one of the roofing shingles, the bead of tab sealant

aligns with and nests within the longitudinally extending groove of an adjacent one of the roofing shingles.

6. The roofing shingle according to Claim 5, wherein leading and trailing edges of the roofing shingles define edge zones of the bundle, wherein the nesting of the bead of tab sealant within the longitudinally extending groove of the stacked shingles results in the edge zones of the bundle having a height substantially identical to a height of a remainder of the bundle outside of edge zones.

7. The roofing shingle according to Claim 1, further including a strip of material disposed within the longitudinally extending groove.

8. The roofing shingle according to Claim 7, wherein the strip of material is formed from compressible material.

9. The roofing shingle according to Claim 8, wherein the longitudinally extending bead of tab sealant and the strip of material are configured such that when a plurality of the roofing shingles are stacked in a bundle such that every other of the roofing shingles is inverted and turned 180 degrees relative to an adjacent one of the roofing shingles, the bead of tab sealant aligns with and engages the strip of material of an adjacent one of the roofing shingles.

10. The roofing shingle according to Claim 9, wherein when the plurality of the roofing shingles are stacked in the bundle, an outwardly facing surface of the strip of material is compressed by the bead of tab sealant of an

adjacent one of the roofing shingles and defines a groove within the strip of material, and wherein the bead of tab sealant nests within the groove formed within the strip of material of an adjacent one of the roofing shingles.

11. The roofing shingle according to Claim 10, wherein leading and trailing edges of the roofing shingles define edge zones of the bundle, and wherein the nesting of the bead of tab sealant within the groove formed within the strip of material of an adjacent one of the roofing shingles results in the edge zones of the bundle having a height substantially identical to a height of a remainder of the bundle outside of edge zones.

12. The roofing shingle according to Claim 1, wherein the groove has a width within the range of from about 0.0625 inches to about 0.25 inches larger than a width of the bead of tab sealant.

13. A roofing shingle comprising:

a headlap portion and a tab portion, a layer of a first granular material adhered to a back side of the headlap portion and defining a first surface;

a bead of tab sealant extending longitudinally on a back side of the tab portion; and

a longitudinally extending groove formed in the first surface of the back side of the headlap portion, wherein the longitudinally extending groove is defined by a second granular material having a granule size relatively smaller than the first granular material, wherein the longitudinally extending bead of tab sealant and the longitudinally extending groove are configured such that when a plurality of the roofing shingles are stacked in a bundle such that every other of the roofing

shingles is inverted and turned 180 degrees relative to an adjacent one of the roofing shingles, the bead of tab sealant aligns with and nests within the longitudinally extending groove of an adjacent one of the roofing shingles, wherein leading and trailing edges of the roofing shingles define edge zones of the bundle, and wherein the nesting of the bead of tab sealant within the longitudinally extending groove of the stacked shingles results in the edge zones of the bundle having a height substantially identical to a height of a remainder of the bundle outside of edge zones.

14. A roofing shingle comprising:

an overlay sheet including a headlap portion and a tab portion, a layer of a first granular material adhered to a back side of the headlap portion and defining a first surface;

an underlay sheet secured to the overlay sheet such that a region of the underlay sheet overlaps a region of the headlap portion of the overlay sheet, thereby defining a two-layer portion and a single-layer portion of the roofing shingle;

a bead of tab sealant extending longitudinally on a back side of the underlay sheet; and

a longitudinally extending groove formed in the first surface of the back side of the headlap portion.

15. The roofing shingle according to Claim 14, wherein the longitudinally extending groove is defined by a second granular material having a granule size relatively smaller than the first granular material.

16. The roofing shingle according to Claim 15, wherein the second granular material is formed from sand.

17. The roofing shingle according to Claim 15, wherein the second granular material is formed from materials having a finer grade than the first granular material.

18. The roofing shingle according to Claim 14, wherein the longitudinally extending bead of tab sealant and the longitudinally extending groove are configured such that when a plurality of the roofing shingles are stacked in a bundle such that every other of the roofing shingles is inverted and turned 180 degrees relative to an adjacent one of the roofing shingles, the bead of tab sealant aligns with and nests within the longitudinally extending groove of an adjacent one of the roofing shingles.

19. The roofing shingle according to Claim 18, wherein leading and trailing edges of the roofing shingles define edge zones of the bundle, wherein the nesting of the bead of tab sealant within the longitudinally extending groove of the stacked shingles results in the edge zones of the bundle having a height substantially identical to a height of a remainder of the bundle outside of edge zones.

20. The roofing shingle according to Claim 14, further including a strip of material disposed within the longitudinally extending groove.

21. The roofing shingle according to Claim 20, wherein the strip of material is formed from compressible material.

22. The roofing shingle according to Claim 21, wherein the longitudinally extending bead of tab sealant and the strip of material are configured such that when a plurality of the roofing shingles are stacked in a bundle such that every other of the roofing shingles is inverted and turned 180 degrees relative to an adjacent one of the roofing shingles, the bead of tab sealant aligns with and engages the strip of material of an adjacent one of the roofing shingles.

23. The roofing shingle according to Claim 22, wherein when the plurality of the roofing shingles are stacked in the bundle, an outwardly facing surface of the strip of material is compressed by the bead of tab sealant of an adjacent one of the roofing shingles and defines a groove within the strip of material, and wherein the bead of tab sealant nests within the groove formed within the strip of material of an adjacent one of the roofing shingles.

24. The roofing shingle according to Claim 23, wherein leading and trailing edges of the roofing shingles define edge zones of the bundle, and wherein the nesting of the bead of tab sealant within the groove formed within the strip of material of an adjacent one of the roofing shingles results in the edge zones of the bundle having a height substantially identical to a height of a remainder of the bundle outside of edge zones.

25. The roofing shingle according to Claim 14, wherein the groove has a width within the range of from about 0.0625 inches to about 0.25 inches larger than a width of the bead of tab sealant.

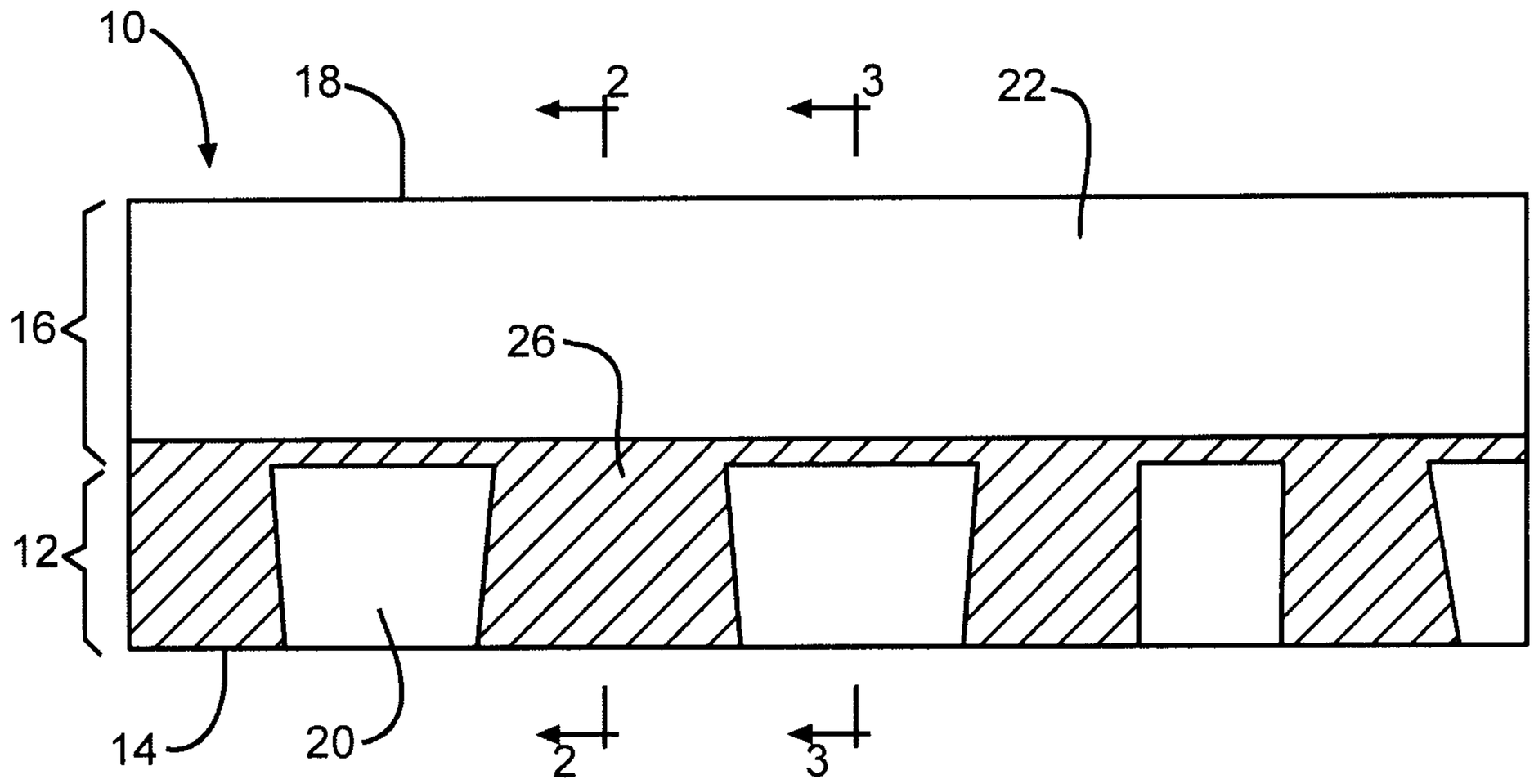

FIG. 1

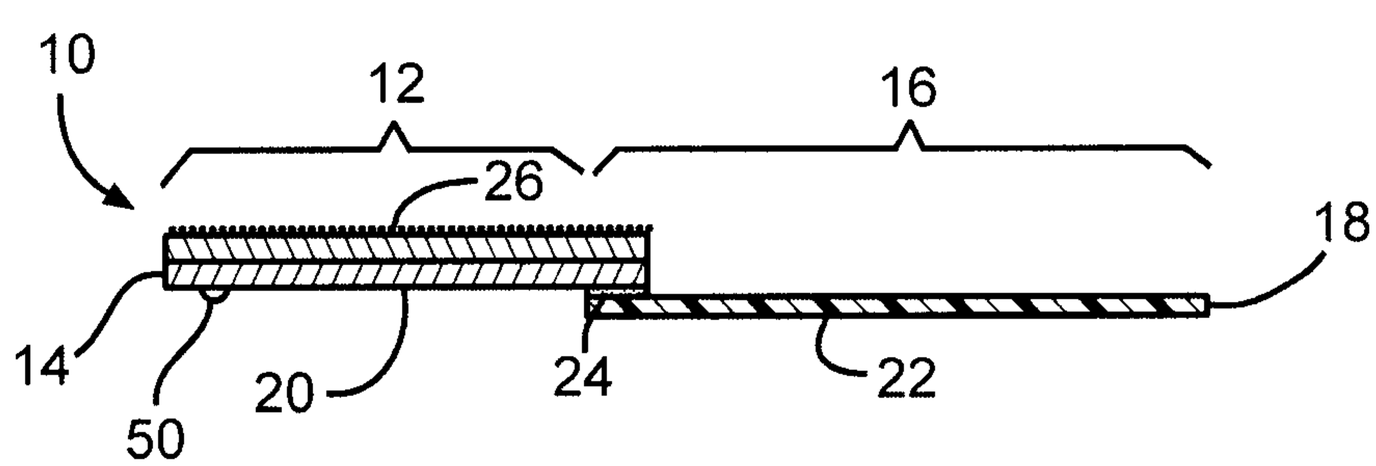

FIG. 2

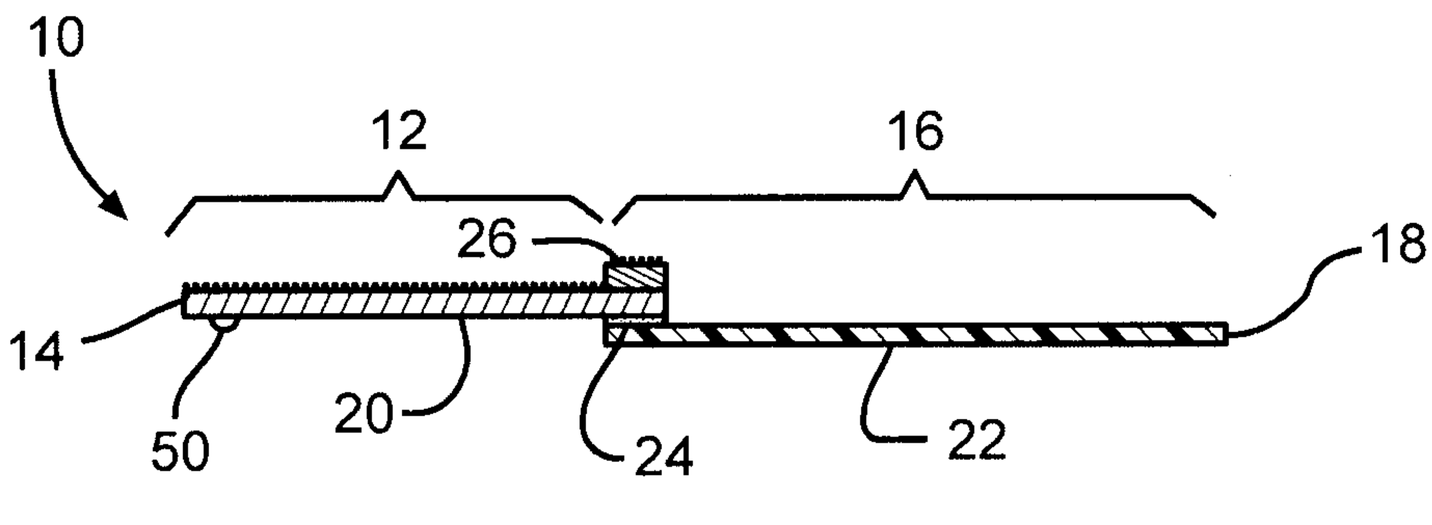

FIG. 3

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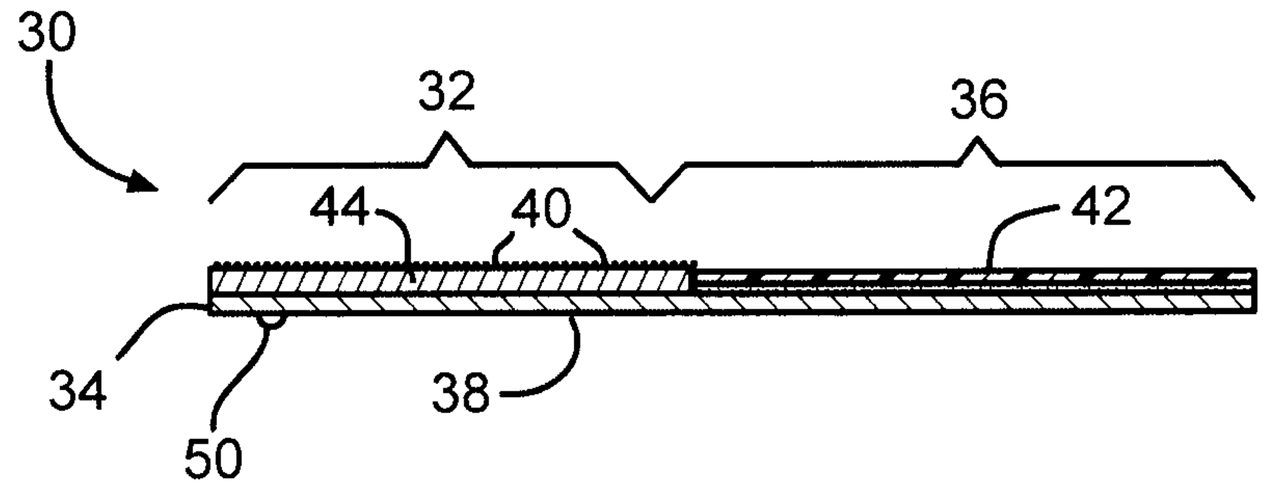

FIG. 4

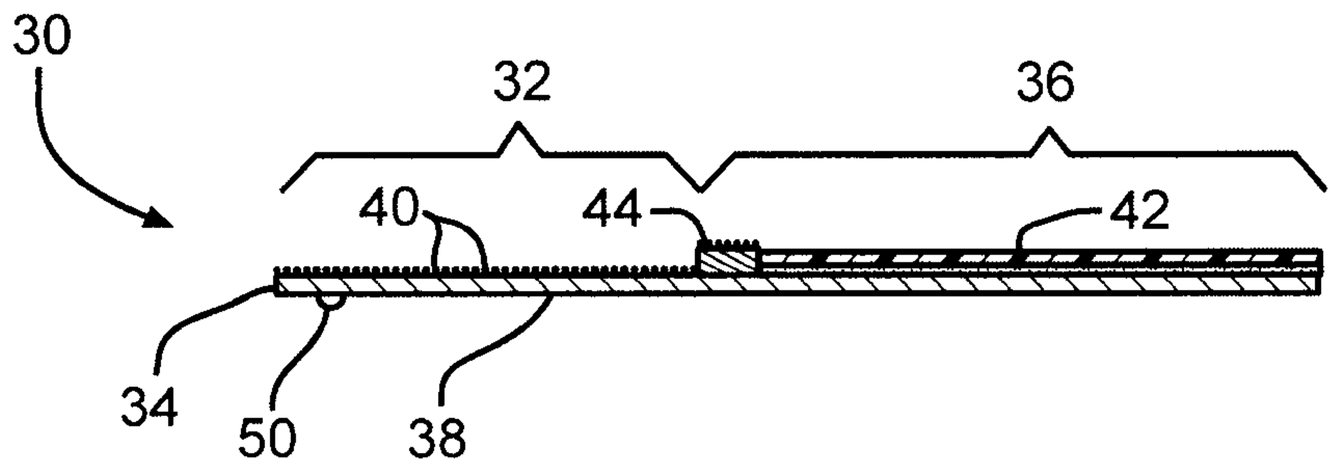

FIG. 5

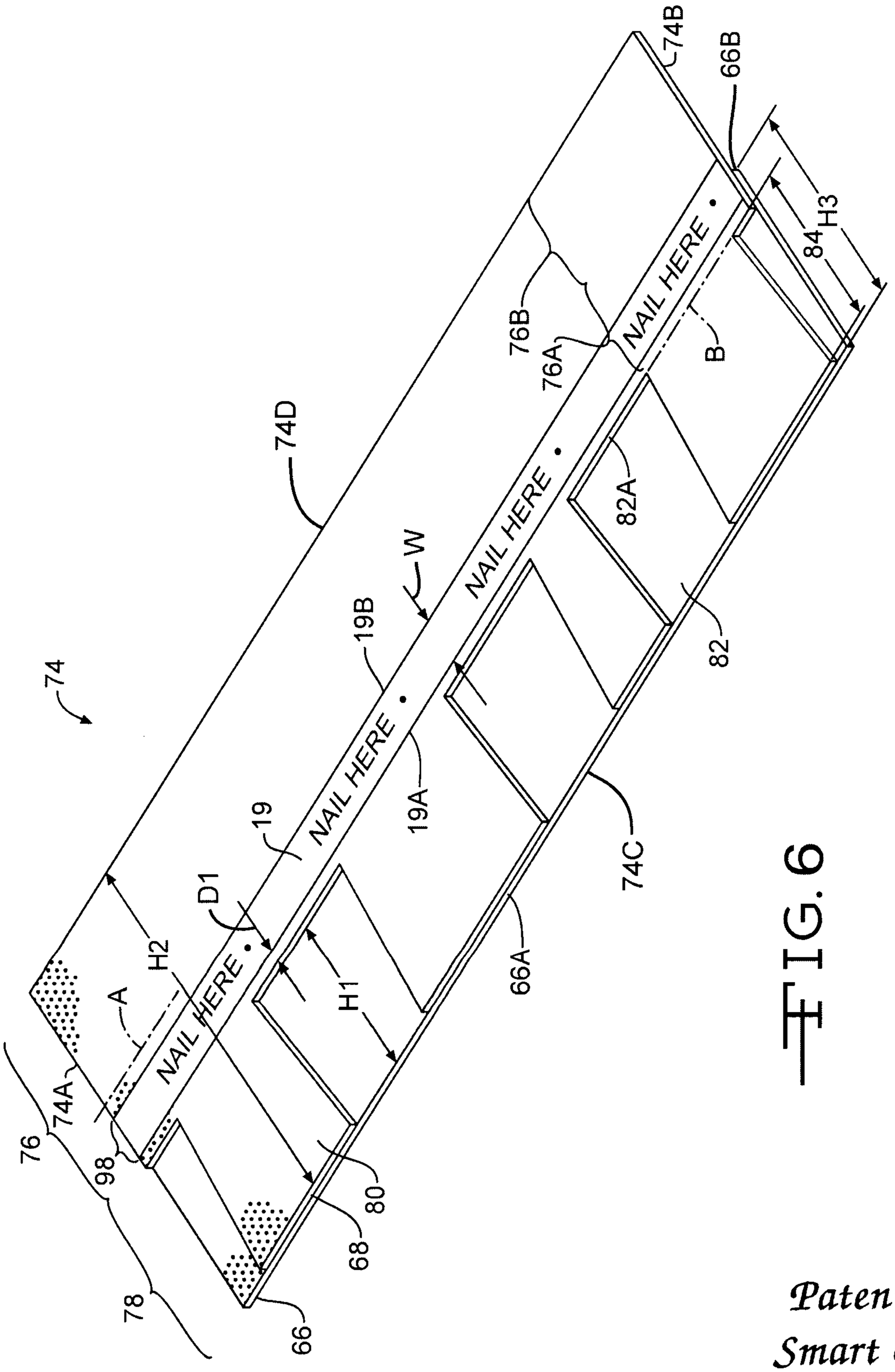

FIG. 6

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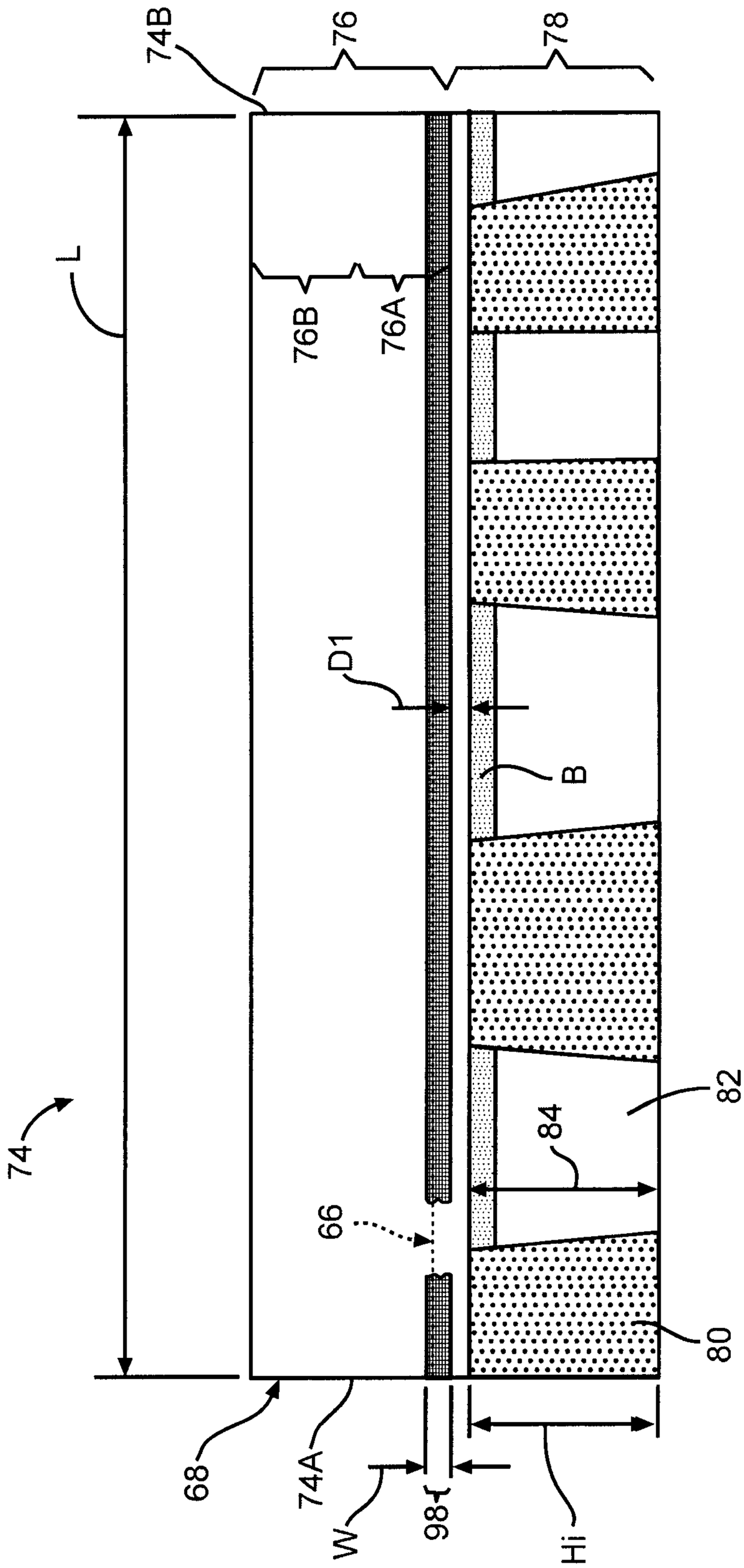

FIG. 7

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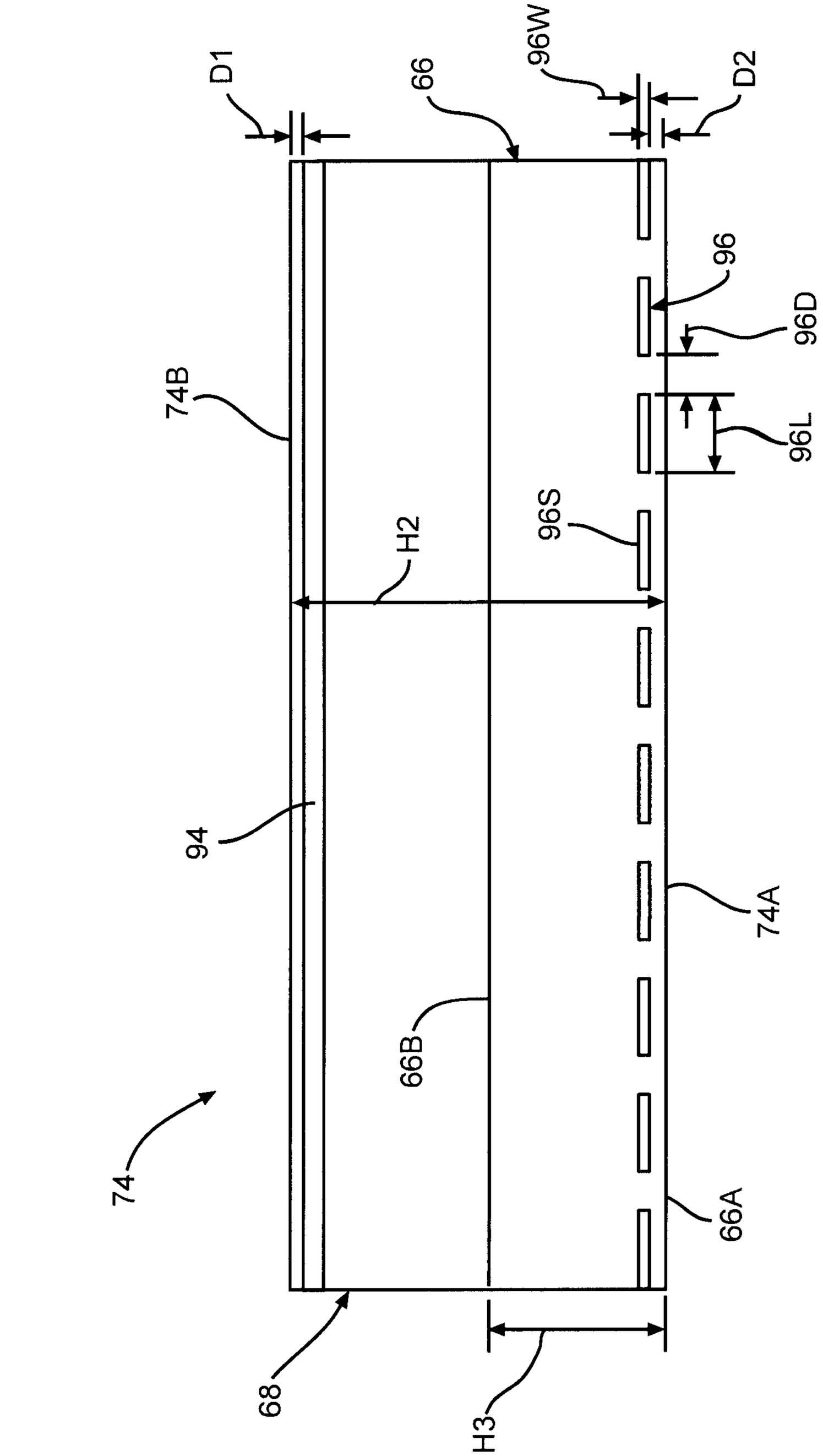

FIG. 8

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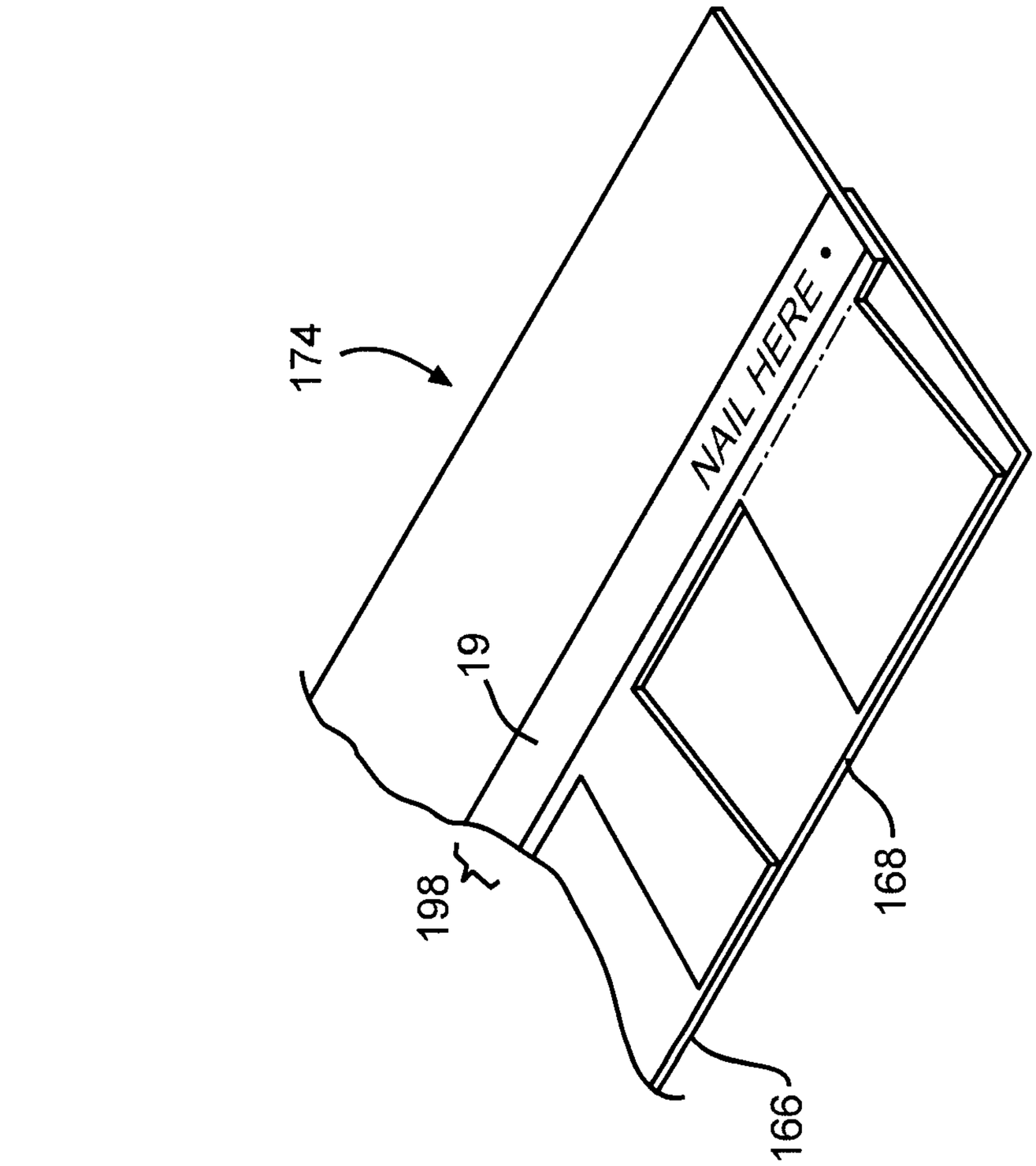

FIG. 6

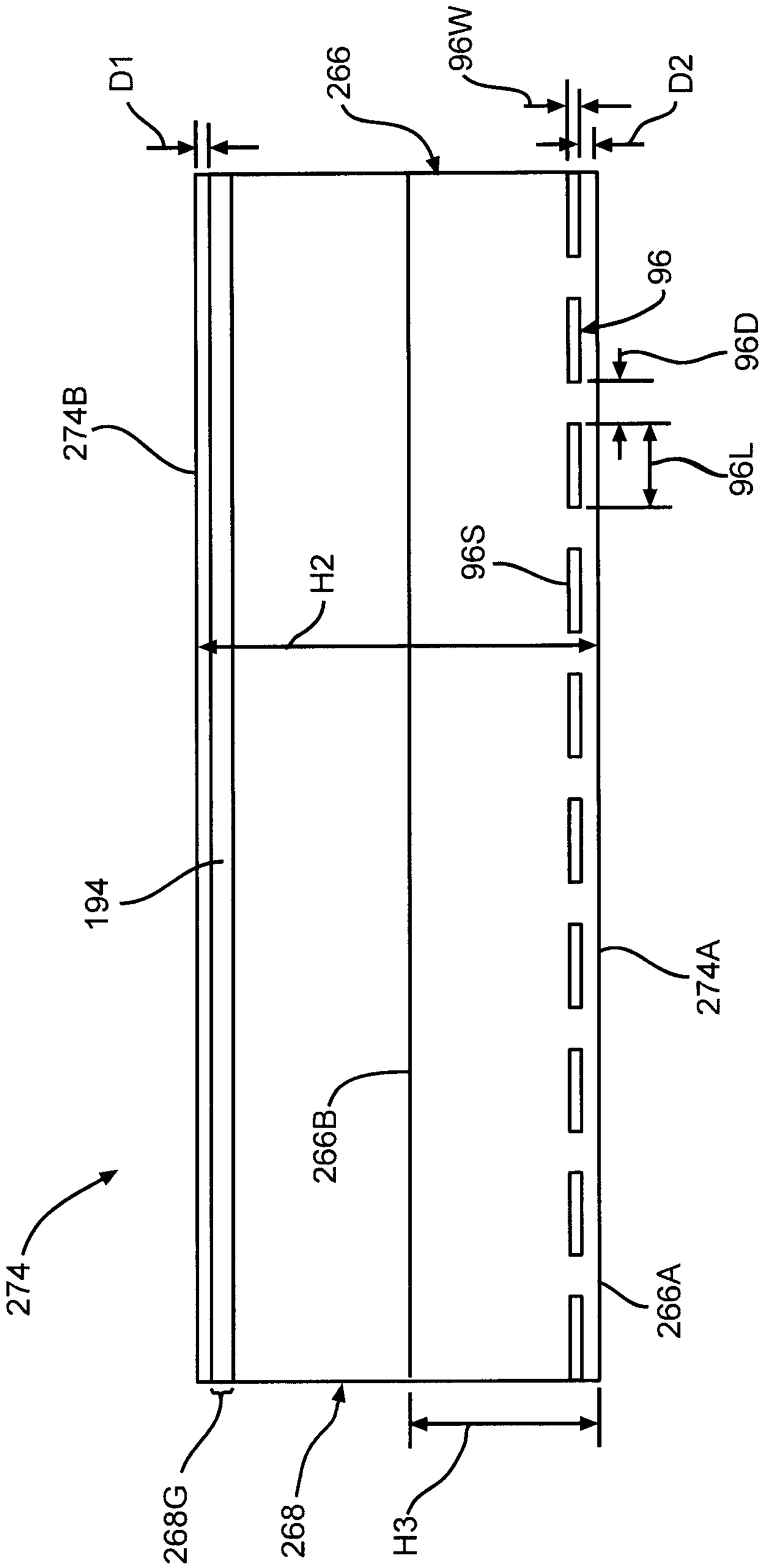

FIG. 10

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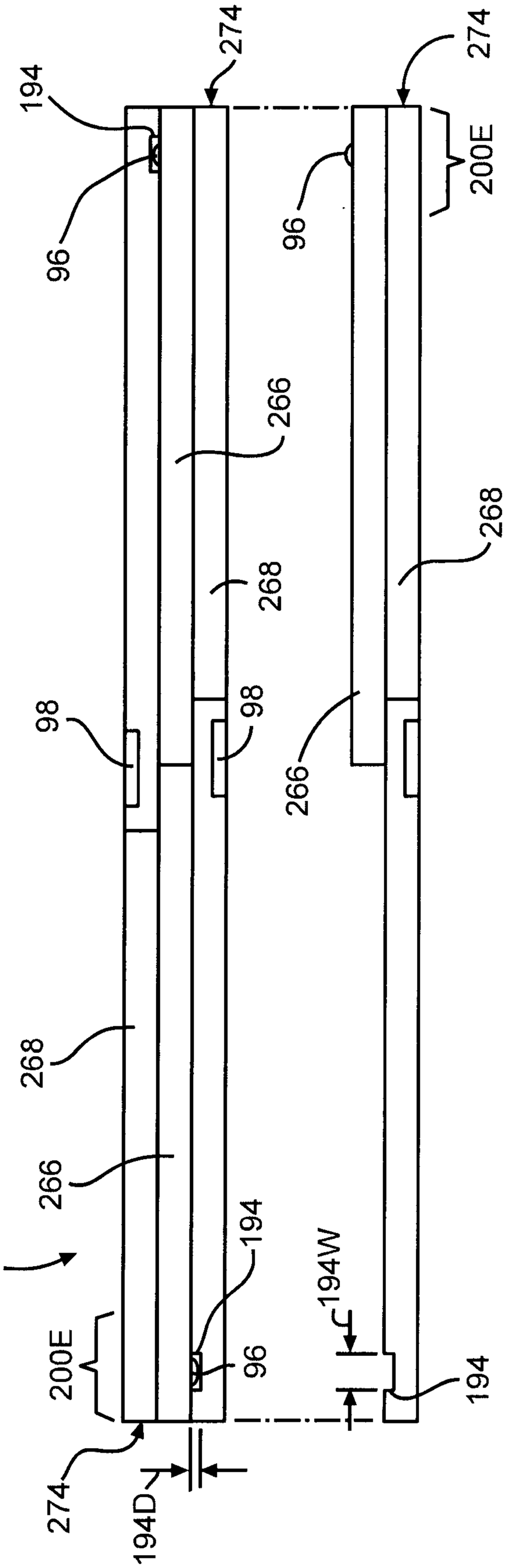

FIG. 11

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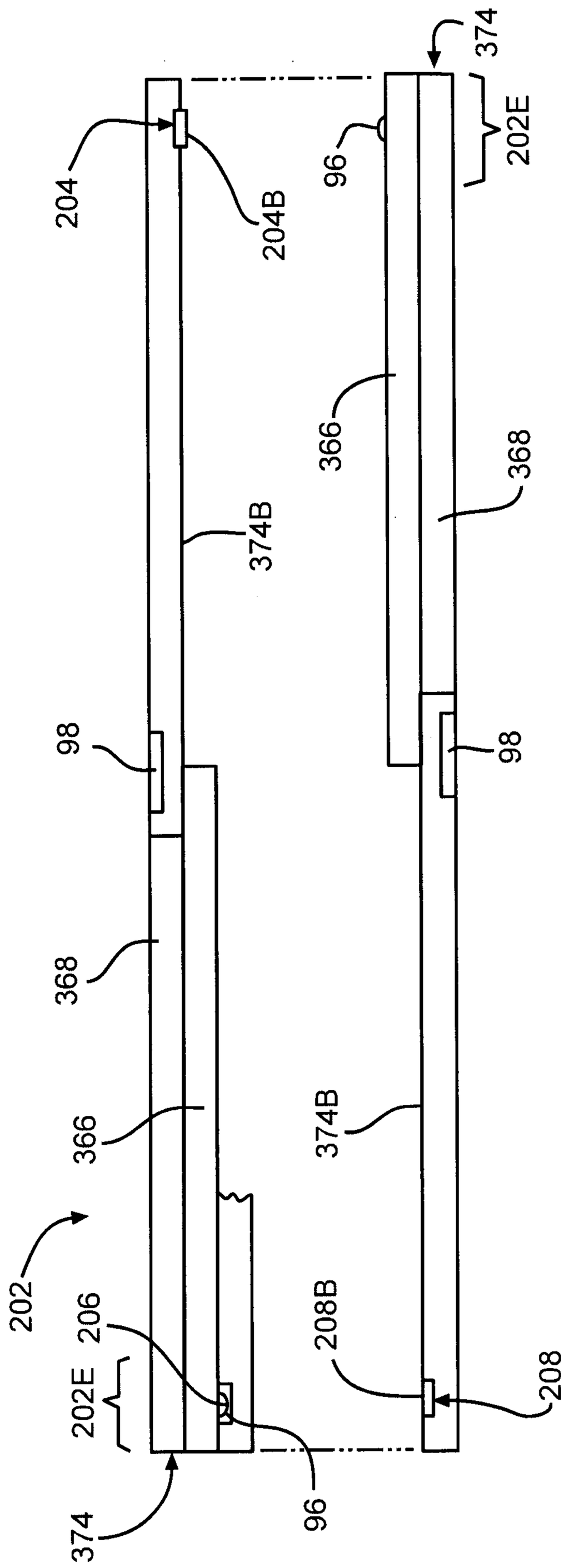

FIG. 12

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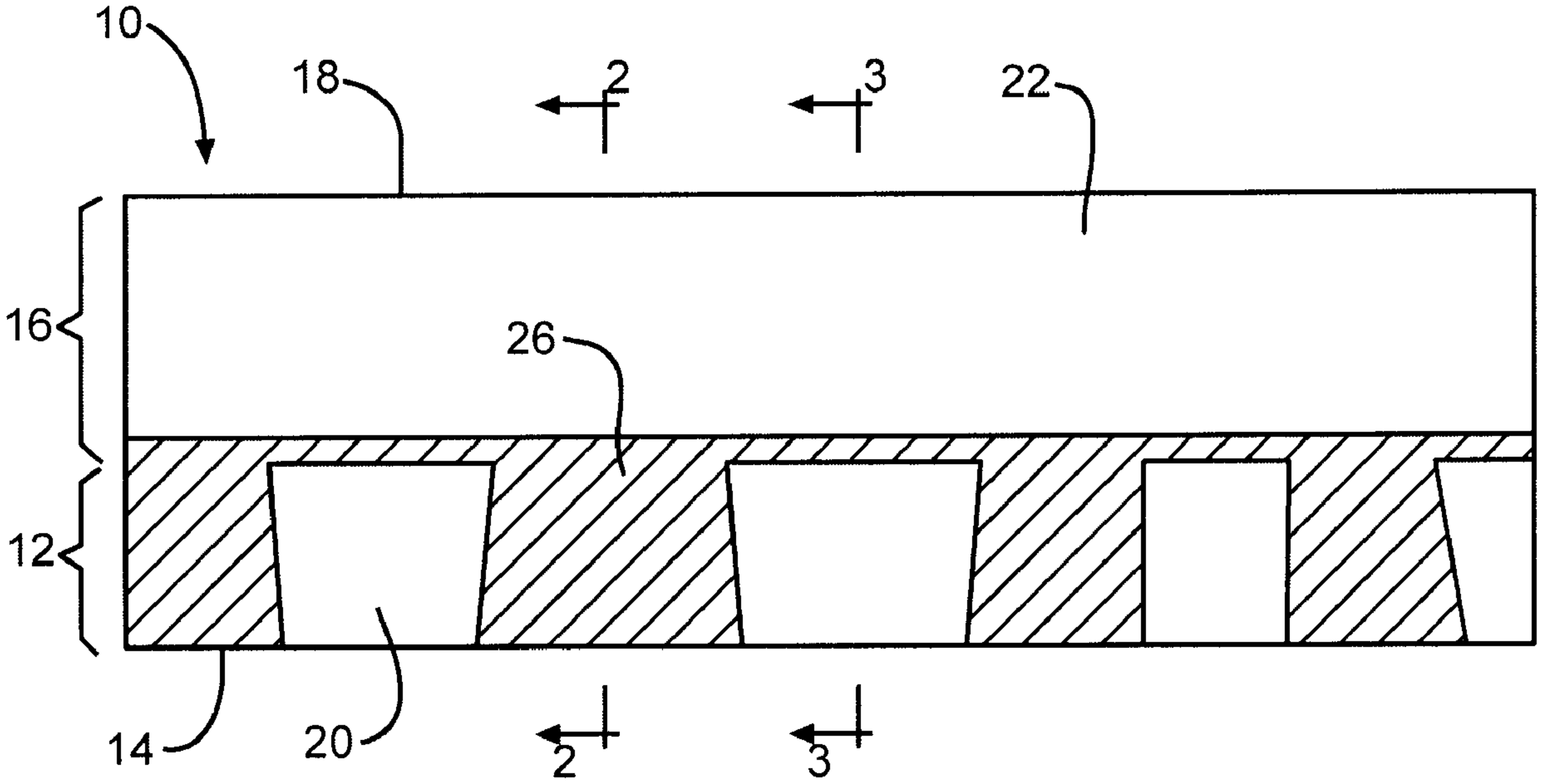
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