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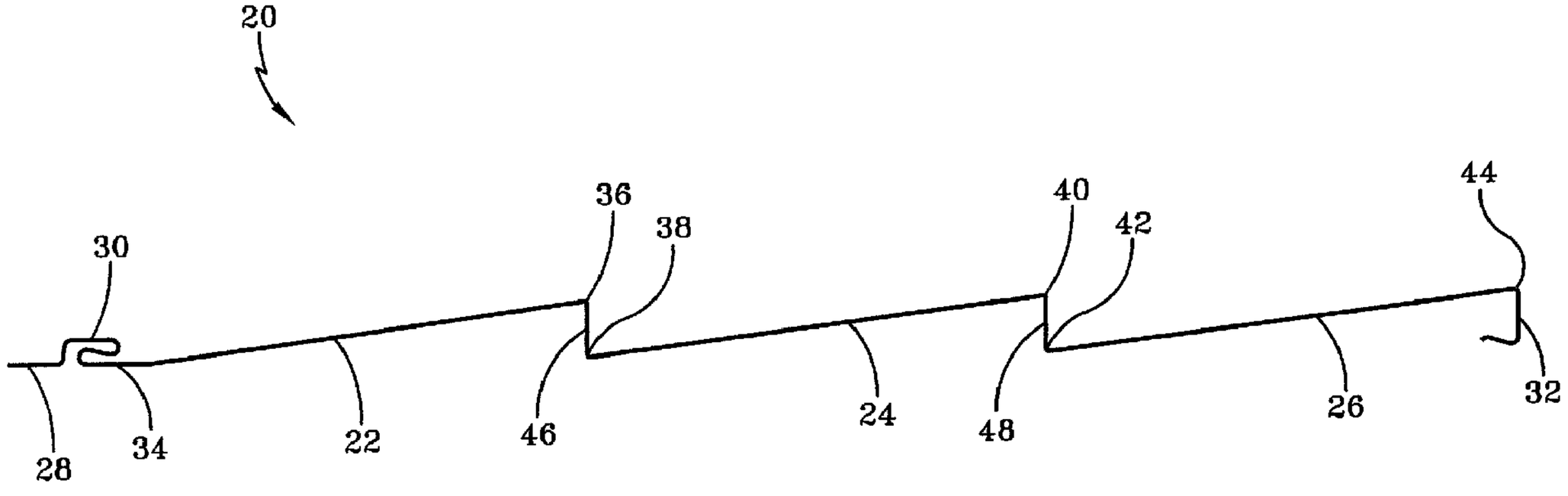


(57) Abrégé/Abstract:
The present invention is a vinyl siding panel and a method of making the vinyl siding panel. One embodiment of the vinyl siding panel comprises a planar row extending the longitudinal length of the vinyl siding panel. The siding panel may also have a slightly curved row. A reinforcement panel may be secured to the siding panel. In such case, the slightly curved row of siding may be secured to a planar portion of the reinforcement panel. In addition, an intermediate portion of the siding panel may be thicker than the outer portions of the siding panel.

ABSTRACT

The present invention is a vinyl siding panel and a method of making the vinyl siding panel. One embodiment of the vinyl siding panel comprises a planar row extending the longitudinal length of the vinyl siding panel. The siding panel may also have a slightly curved row. A reinforcement panel may be secured to the siding panel. In such case, the slightly curved row of siding may be secured to a planar portion of the reinforcement panel. In addition, an intermediate portion of the siding panel may be thicker than the outer portions of the siding panel.

VINYL SIDING

BACKGROUND AND SUMMARY OF THE INVENTION

[0002] The present invention relates generally to vinyl siding. However, it should be recognized that the present invention also includes siding panels made from other materials. For example, a siding panel of the present invention may be made from any suitable material including, but not limited to, metals, woods, synthetic wood composites, and other plastics.

[0003] Vinyl siding may be produced by extruding at least one vinyl composition. For example, vinyl siding can be made by co-extruding a vinyl substrate and a vinyl capstock. The extruded vinyl is passed through a calibrator to obtain a final net shape. However, as the vinyl cools after passing through the calibrator, it has an inherent tendency to oil can. As is well known in the art, oil canning refers to the inherent tendency of a sheet of vinyl to curve in either a concave or convex direction as it cools.

[0004] As a result of the oil canning effect, it has been believed by those skilled in the art that it is not possible to produce vinyl siding having at least one relatively flat, planar portion. Thus, the designs of vinyl siding have been limited. Vinyl siding commonly has at least one horizontal row. Each row of the siding is subject to the oil canning effect. Consequently, in order to limit the oil canning effect, it has been tried to limit the width of each row and the height of each seam connecting adjacent rows. Moreover, it is common to produce the vinyl siding such that each row already has a significant amount of curvature as it exits the calibrator so as to minimize the oil canning effect. These design considerations have limited and/or diminished the appearance of the vinyl siding. Therefore, a need exists for an improved vinyl siding panel design as well as an improved method of making vinyl siding.

[0005] One embodiment of the present invention provides a siding unit comprising: a reinforcement panel having a portion at least about 3 inches wide, said portion having a surface variance less than about 0.05 inch; and a vinyl siding panel secured to said reinforcement panel such that a first row of said siding panel is adjacent to said portion of said reinforcement panel, said first row of said siding panel having a surface variance between about 0.01

inch and about 0.1 inch prior to said siding panel being secured to said reinforcement panel; wherein the surface variance of said first row of said siding panel is greater than the surface variance of said portion of said reinforcement panel prior to said siding panel being secured to said reinforcement panel; and wherein said siding unit simulates the appearance of straight face siding.

[0006] A second embodiment of the present invention is a vinyl siding panel comprising a portion extending the longitudinal length of the vinyl siding panel. The portion comprises a first edge and a second edge, wherein the width from the first edge to the second edge is at least about 3.0 inches. In addition, the radius curvature between the first edge and the second edge is at least about 85 inches.

[0007] A method of producing a vinyl siding panel is disclosed. The method comprises extruding at least one vinyl composition and passing the vinyl composition(s) through a calibrator defining a passageway. The passageway has a first edge and a second edge. The width from the first edge to the second edge is at least about 3.0 inches, and the surface variance is less than about 0.05 inches relative to an imaginary straight line connecting the first edge and the second edge.

[0008] A method of producing a vinyl siding panel is also disclosed. In this embodiment, the method comprises extruding at least one vinyl composition. The vinyl is then passed through a calibrator defining a passageway. The passageway has a first edge and a second edge. The width is at least about 3.0 inches from the first edge to the second edge, and the

radius curvature between the first edge and the second edge is at least about 85 inches.

[0009] The present invention also provides a siding panel unit comprising: a vinyl siding panel comprising: a first row having a radius curvature between about 20 inches and about 300 inches; and a second row connected to said first row by a first seam to define a stepped contour, said second row having a radius curvature between about 10 inches and about 215 inches; and a reinforcement panel adjacent to said siding panel; wherein the radius curvature of said first row is greater than the radius curvature of said second row; wherein the radius curvature is determined prior to said siding panel being positioned adjacent to said reinforcement panel; and wherein said siding panel unit simulates the appearance of straight face siding.

[0010] The present invention also provides a siding panel unit comprising: a vinyl siding panel comprising: a first outer portion having a thickness between about 30 mils and about 48 mils; a second outer portion having a thickness between about 30 mils and about 48 mils; and an intermediate portion between said first outer portion and said second outer portion, said intermediate portion having a thickness between about 31 mils and about 55 mils; and a reinforcement panel adjacent to said siding panel; wherein the thickness of said intermediate portion is greater than the thickness of said first outer portion and the thickness of said second outer portion; and wherein said siding panel unit simulates the appearance of straight face siding.

[0011] The present invention further provides a siding unit comprising: a reinforcement panel having a portion at least about 3 inches wide, said portion having a surface variance less than about 0.05 inch; and a vinyl siding panel secured to said reinforcement panel such that a row of said siding panel is adjacent to said portion of said reinforcement panel, said row of said siding panel having a surface variance between about 0.01 inch and about 0.1 inch prior to said siding panel being secured to said reinforcement panel; wherein the surface variance of said row of said siding panel is reduced after being secured to said reinforcement panel; and wherein said siding unit simulates the appearance of straight face siding.

[0013] Any embodiment of the present Invention may include any optional or preferred feature of any other embodiment of the present invention. In addition to the novel features and advantages mentioned above, other objects and advantages of the present invention will be readily apparent from the following descriptions of the drawings and exemplary embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] Figure 1 is a side elevation view of a vinyl siding panel having significantly curved row.

[0015] Figure 2 is a side elevation view of one exemplary embodiment of a vinyl siding panel of the present invention.

[0016] Figure 3 is a side elevation view of one exemplary embodiment of a calibrator of the present invention.

[0017] Figure 4 is a side elevation view of one exemplary embodiment of a siding panel of the present invention.

[0018] Figure 5 is a schematic view of one exemplary embodiment of a manufacturing system of the present invention.

[0019] Figure 6 is a side elevation view of one exemplary embodiment of a siding panel of the present invention.

[0020] Figure 7 is a side elevation view of one exemplary embodiment of a siding panel of the present invention.

[0021] Figure 8 is a side elevation view of one exemplary embodiment of a siding panel of the present invention.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENT(S)

[0022] The present invention is directed to siding. In addition, the present invention includes a method of making siding. The present invention will be described primarily with regard to vinyl siding and an improved method and system for making vinyl siding. However, the present invention also includes siding made from other suitable materials including, but not limited to, woods, metals, synthetic wood composites, and other plastics.

[0023] Figure **1** shows an example of a vinyl siding panel **10** having a plurality of curved rows **12**. Each of the rows **12** has an edge **14** and an edge **16**. The degree of curvature between edge **14** and edge **16** can be measured in at least a couple different ways. In the first method, an imaginary straight line **a** is made between edge **14** and edge **16**. The surface variance may then be measured between the outer surface of the vinyl siding panel **10** and the line **a** as indicated by arrow **b** and arrow **c**. If the outer surface of the siding panel **10** is not smooth (e.g., the outer surface may be embossed),

the surface variance may also be measured between an imaginary straight line **d** and edge **14** or edge **16**. Alternatively, the radius curvature may be measured between edge **14** and edge **16**.

[0024] Figure **2** illustrates one example of a vinyl siding panel **20** of the present invention. In this example, the vinyl siding panel **20** is comprised of a row **22**, a row **24**, and a row **26**. In addition, the vinyl siding panel **20** may include a nailing strip **28**, a tongue **30**, and a groove **32**. Nails or any other suitable mechanical fastening means may be extended through apertures in the nailing strip **28** in order to secure the vinyl siding panel **20** to a building structure. The tongue **30** is adapted to fit in the groove of another siding panel when installed on a building structure. Likewise, the groove **32** is adapted to receive the tongue of another siding panel when installed on a building structure. The tongue-and-groove connection may also be referred to as a hanger section.

[0025] In this embodiment, each of the rows **22**, **24**, and **26** is a substantially planar portion. Row **22** has an edge **34** and edge **36**. Row **24** has an edge **38** and an edge **40**, and row **26** has an edge **42** and an edge **44**. The nailing strip **28** and the tongue **30** are connected to the edge **34** of row **22**. Edge **36** of row **22** is connected to edge **38** of row **24** by seam **46**. Similarly, edge **40** of row **24** is connected to edge **42** of row **26** by seam **48**. As a result, this example of the vinyl siding panel **20** has a stepped contour.

[0026] As in this example, each of the rows **22**, **24**, and **26** may be substantially similar. However, it should be recognized that a vinyl siding panel of the present

invention may have none or only one relatively straight, planar portion. It should also be recognized that a vinyl siding panel of the present invention may have any plural number of relatively straight, planar portions.

[0027] For ease of description, the dimensions of a planar portion of the present invention will be described with regard to row **24** of vinyl siding panel **20**. In this example, the width of row **24** from edge **38** to edge **40** is at least about 3.0 inches, more preferably at least about 5.0 inches, and still more preferably at least about 6.0 inches (e.g., 7 or 8 inches). The surface variance of this embodiment, as defined with regard to Figure **1**, from edge **38** to edge **40** is less than about 0.05 inch, more preferably less than about 0.04 inch, and still more preferably less than about 0.03125 inch. In addition, the radius curvature from edge **38** to edge **40** is at least about 85 inches, more preferably at least about 117 inches, and even more preferably at least about 148 inches.

[0028] The row **24** may have any desired thickness from its outer surface to its inner surface. However, it is preferred that the row **24** of this embodiment has an average thickness in the range from about 0.04 inch to about 0.05 inch. More preferably, the average thickness of the row **24** is in the range from about 0.041 inch and 0.046 inch.

[0029] The inventors have discovered that the height of the seams **46** and **48** may be greater than in conventional vinyl siding. In fact, it is believed that the increased height of the seams **46** and **48** may facilitate the production of the vinyl siding of the present invention. In particular, the height of each of the seams **38** and **40** may

be at least about 0.5 inch. More preferably, the height of each of the seams **38** and **40** may be at least about 0.6 inch (e.g., about 0.75 inch or about 0.8 inch).

[0030] If desired, a reinforcement panel may be secured to, or positioned behind, the inner surface of the vinyl siding panel **20**. For example, a foam reinforcement panel may be secured to the inner surface of the vinyl siding panel **20** by an adhesive. An example of an adhesive is a low temperature adhesive such as neoprene. The reinforcement panel may tend to further straighten out rows **22**, **24** and **26** of the vinyl siding panel **20**. Nevertheless, it should be recognized that the dimensions of the planar portion(s) discussed above are taken prior to the application of a reinforcement panel or any other straightening means.

[0031] Another embodiment of a siding panel of the present invention is shown in Figure **4**. This siding panel **90** may include any of the optional or preferred features of the other embodiments of the present invention. The siding panel **90** may have at least one row with a radius curvature between about 10 inches and about 215 inches. This embodiment of the siding panel **90** may also have at least one row with a radius curvature between about 20 inches and about 300 inches. It should be recognized that other embodiments of the siding panel may include additional curved or planar rows. In the example shown in Figure **4**, row **92** and row **94** each have a radius curvature between about 10 inches and about 215 inches, and row **96** has a radius curvature between about 20 inches and about 300 inches. Row **92** and row **94** may have a similar curvature if desired. For reasons discussed below, row **96** may have a lower surface variance and higher radius curvature than row **92** and row **94**.

[0032] Each of the rows may have any desired width. In an exemplary embodiment of the siding panel **90**, each of the rows may have a width between about 3 inches and about 8 inches. For an example of a siding panel **90** having 3-inch rows, the radius curvature of rows **92** and **94** may be between about 10 inches and about 50 inches, and the radius curvature of row **96** may be between about 20 inches and about 60 inches. On the other hand, for an exemplary embodiment of a siding panel **90** having 8-inch rows, the radius curvature of rows **92** and **94** may be between about 70 inches and about 215 inches, and the radius curvature of row **96** may be between about 90 inches and 300 inches.

[0033] Furthermore, in an exemplary embodiment of the siding panel **90**, the surface variance of each of the rows may be between about 0.01 inch and about 0.1 inch. For instance, the surface variance of each of the rows may be between about 0.015 inch and about 0.089 inch. It should be recognized that the rows may have the same surface variance or different surface variances. For example, rows **92** and **94** may have surface variances greater than about 0.05 inch, and row **96** may have a surface variance less than about 0.05 inch.

[0034] Optionally, the siding panel **90** may include a reinforcement panel **100**. The siding panel **90** may be secured to the reinforcement panel **100** using an adhesive such that each row of the siding panel **90** is adjacent to a respective portion of the reinforcement panel **100**. For example, a low temperature adhesive such as neoprene may be used to secure the siding panel **90** to the reinforcement panel **100**. In this example, the reinforcement panel **100** has portions **102**, **104**, and **106** that are secured

to rows **96**, **92**, and **94**, respectively. However, a top portion **108** of the siding panel **90** may be allowed to float relative to the reinforcement panel **100**. In other words, the top portion **108** may not be secured to the reinforcement panel **100** by an adhesive. Allowing the top portion **108** to float may enable the tongue **110** to be adjusted to engage a groove of an adjacent siding panel when installed. Similarly, a bottom portion **112** of the siding panel **90** may be allowed to float relative to the reinforcement panel **100** to allow the groove **114** to be adjusted to engage a tongue of an adjacent siding panel when installed. Also, a side edge portion of the siding panel **90** may be allowed to float relative to the reinforcement panel **100** such that the side edge portion may be placed in an overlapping arrangement with the side edge portion of an adjacent siding panel when installed. Elsewhere, it is preferred that there is substantially full coverage of the adhesive everywhere it is desired for the siding panel **90** to be adhered to the reinforcement panel **100**. Substantially full coverage of the adhesive in these areas may help to limit telegraphing of the adhesive. In addition, substantially full coverage of the adhesive in these areas may help to limit oil canning of the siding panel **90**. The adhesive may, for example, be applied by sprayers or rollers to obtain substantially full coverage. Nevertheless, it should be recognized that there may be spot or bead coverage of the adhesive in these areas in lieu of substantially full coverage of the adhesive.

[0035] The inventors have achieved surprising and unexpected results by securing a row of the siding panel **90** to a portion of the reinforcement panel **100**, wherein the row of the siding panel **90** has a greater surface variance (and/or smaller

radius curvature) than the portion of the reinforcement panel **100** prior to the siding panel **90** being secured to the reinforcement panel **100**. For example, the portion of the reinforcement panel **100** may have a width of at least about 3 inches and a surface variance less than about 0.05 inch (e.g., the portion may be planar). On the other hand, the row of siding may have a surface variance of at least about 0.01 inch, wherein the surface variance of the row of siding is greater than the surface variance of the respective portion of the reinforcement panel **100** prior to the siding panel **90** being secured to the reinforcement panel **100**. Additionally, the radius curvature of the row of siding may be less than the radius curvature of the respective portion of the reinforcement panel **100** prior to the siding panel **90** being secured to the reinforcement panel **100**. The surface variance and radius curvature of a portion of a reinforcement panel **100** may be measured in a manner similar to which the surface variance and radius curvature of a siding panel **90** is measured. It should be recognized that a reinforcement panel **100** such as a foam backer may have a slightly uneven surface due to the nature of the materials or method of manufacturing. Accordingly, the surface variance of a reinforcement panel **100** may also be determined by measuring the dimensions of the tool used to shape or form the reinforcement panel **100** (the surface variance of a row of siding may also be measured in this manner). In the example of Figure **4**, portions **104** and **106** of the reinforcement panel **100** are planar, and rows **92** and **94** of the siding panel **90** have higher surface variances and lower radius curvatures than respective corresponding portions **104** and **106**. The inventors have discovered that this type of configuration results in an improved seam when the side

edge portions of adjacent siding panels are overlapped. In particular, the inventors have discovered that the side edge portions of rows **92** and **94** regain at least a portion of their respective natural curvatures and surface variances at the seam area because the side edge portions are not directly adhered to the reinforcement panel **100**. In other words, the differences between the portion of the reinforcement panel **100** and the row of siding results in natural forces in the seam area that tend to resist buckling of the side edge portion of the siding panel. Consequently, this unique combination of features significantly lessens the possibility of a gap between the overlapping side edge portions at the seam between adjacent siding panels. This improves the aesthetic appearance of the siding. In addition, since the rows of siding may only have a slight curvature, the siding may appear very similar to straight face siding to the naked eye. In addition, the step of securing the siding panel **90** to the reinforcement panel **100** may reduce the surface variance and curvature of each row of the siding panel **90** without significantly increasing the likelihood of oil canning, thereby further enhancing the straight face appearance to the naked eye.

[0036] Referring again to the embodiment shown in Figure **4**, row **96** of the siding panel **90** and portion **102** of the reinforcement panel **100** may have surface variances less than about 0.05 inch. Since the top portion **108** of the siding panel **90** is allowed to float relative to the reinforcement panel **100**, the side edge portion of row **96** also resists buckling. Consequently, there is also a significantly reduced possibility of a gap in the portion of the seam that includes the side edge portion of row **96**. In addition, row **96**

may still appear to be similar to rows **92** and **94** to the naked eye, thereby resulting in an improved appearance of the siding.

[0037] It should be recognized that other configurations of the siding unit are possible. For example, the bottom row of the siding panel may be planar and secured to a planar portion of the reinforcement panel. For another example, the top row of the siding panel may have more curvature and be secured to a planar portion of the reinforcement panel. For still another example, a slightly curved row of the siding panel may be secured to a portion of the reinforcement panel having a similar curvature. In addition, the siding unit may include any number of rows of siding (e.g., less than three or greater than three), and there may be various configurations that include different combinations of the aforementioned features.

[0038] The inventors have also discovered other improvements to siding. Any siding panel (including, but not limited to, shake siding and siding having rows) may be considered to have three portions, namely two outer portions and an intermediate portion between the two outer portions. The span of each portion may vary to suit the shape and dimensions of each particular panel. Accordingly, there are no set portions of the siding panel which define the outer portions and the intermediate portion. In some embodiments of the present invention, the intermediate portion may not extend across any seams joining the rows or other portions of the siding panel. In another example, the intermediate portion may extend across one or more seams joining the rows or other portions of the siding panel. Referring to the example of Figure **4**, the boundaries between the outer portions and the intermediate portion are indicated by

dashed lines **e** and **f**. As can be seen, the intermediate portion in this embodiment extends across the seams joining the rows of siding.

[0039] The inventors have discovered that it is beneficial for the intermediate portion to be thicker than the outer portions. In an exemplary embodiment, the intermediate portion is between about 1 mil and about 7 mils thicker than each outer portion, more preferably between about 1 mil and about 4 mils thicker than each outer portion. The extra thickness of the intermediate portion improves the physical characteristics of the siding panel. A surprising and unexpected result is that the outer portions may be thinner without significantly diminishing the physical characteristics of the siding panel, thereby improving the manufacturing cost of the siding. In an exemplary embodiment, each outer portion has a thickness between about 30 mils and about 48 mils, whereas the intermediate portion has a thickness between about 31 mils and about 55 mils. More preferably, the intermediate portion has a thickness between about 43 mils and about 55 mils. This feature of the present may be implemented in a siding panel having any desired height. However, the inventors have discovered that this feature is particularly beneficial for wide body panels. A wide body panel has a height of at least about 12 inches (e.g., 16 inches). In fact, one exemplary embodiment of a wide body panel may have a height of at least 32 inches, and another exemplary embodiment of a wide body panel may have a height of at least about 48 inches.

[0040] It is preferred that the siding meets or exceeds the ASTM D3679 standard. The siding of the present invention may be made from any known, suitable, or conventional vinyl composition(s). For example, the vinyl siding may be comprised

of a vinyl substrate layer and an optional vinyl capstock layer. The vinyl composition(s) may include one or more additives. For instance, the vinyl composition(s) may include one or more additives to improve processing, durability, weatherability, resistance to ultraviolet (UV) degradation, impact resistance, and other qualities of vinyl siding. An example of a weathering agent is titanium dioxide, and examples of a vinyl substrate composition and a vinyl capstock composition are polyvinyl chloride (PVC) compositions. For instance, these compositions may include the following ingredients in about the following amounts:

VINYL SUBSTRATE COMPOSITION

PVC resin	100
Tin Stabilizer(s)	0.5 - 2.0
Processing Aid(s)	0 - 2.0
Lubricant(s)	1.5 - 3.5
Impact Modifier(s)	2.0 - 6.0
Mineral Filler(s)	0 - 12
Weathering Agent(s)	0.5 - 12
Colorant(s)	As Desired

VINYL CAPSTOCK COMPOSITION

PVC resin	100
Tin Stabilizer(s)	0.5 - 2.0
Processing Aid(s)	0 - 2.0
Lubricant(s)	1.5 - 3.5
Impact Modifier(s)	2.0 - 6.0
Weathering Agent(s)	9 -11
Colorant(s)	As Desired

[0041] Although the present invention has been described primarily with regard to vinyl siding, alternative embodiments of the present invention include panels made from other extrudable or moldable plastic materials. For example, panels of the present invention may also be made from polystyrene, acrylonitrile-butadiene-styrene (ABS), nylon, ethylene-vinyl acetate (EVA), polycarbonate, polyethylene (PE), polypropylene (PP), polyethylene terephthalate (PET), thermoplastic olefins, acrylonitrile-styrene-acrylic (ASA), other similar or conventional plastics, and alloys, blends, and coextrusions of these resins.

[0042] For example, the vinyl siding of the present invention may be manufactured by extruding at least one vinyl composition. The vinyl is then passed through a calibrator. Figure **3** shows an example of a calibrator **50**. Optionally, a preforming guide, another calibrator, a die, and/or any other desired manufacturing components may be interposed between the extruder and the calibrator **50**. The

preforming guide and the other calibrator may be used to form the vinyl into the general shape of the vinyl siding, and the calibrator **50** is used to obtain the final net shape of the vinyl siding. However, it should be recognized that the vinyl siding may relax slightly after it exits the calibrator **50** and cools down. The vinyl siding may be passed under at least one embossing roller and at least one cooling roller before and/or after the calibrator **50**. In addition, the vinyl siding may be introduced into a cooling bath or cooling spray after exiting the calibrator **50**. The embossing roller(s) may be used to give the vinyl siding a wood-grain appearance, and the cooling roller(s) and the cooling bath or spray may be used to further cool down the vinyl siding to limit the effect of oil canning and distortion.

[0043] In the example of Figure **3**, the calibrator **50** is comprised of a housing **52** and optional inserts **54**, **56**, **58**, **60**, **62**, and **64**. In addition, the calibrator **50** may include at least one internal conduit to conduct at least one flow of water to help cool the calibrator **50**. The flow of water may be any desired temperature, but it is preferably between about 48 and about 52 degrees Fahrenheit. The housing **52** may be comprised of any suitable material such as aluminum, and the inserts **54**, **56**, **58**, **60**, **62**, and **64** may be comprised of any suitable material such as titanium or ferro-TIC. The inserts **54**, **56**, **58**, **60**, **62**, and **64** are mounted in the housing **52** and define passageways **66**, **68**, and **70** corresponding to the portions of the vinyl siding. Alternatively, the housing itself may define the passageways. In addition, it should be recognized that the calibrator **50** may have only one or any plural number of passageways as needed.

[0044] Passageway **66** has an edge **72** and edge **74**. Passageway **68** has an edge **76** and an edge **78**, and passageway **70** has an edge **80** and an edge **82**. For ease of description, the dimensions of a passageway of a calibrator of the present invention will be described with regard to passageway **68** of calibrator **50**. In one exemplary embodiment, the width of passageway **68** from edge **76** to edge **78** is at least about 3.0 inches, more preferably at least about 5.0 inches, and still more preferably at least about 6.0 inches (e.g., about 8 inches). For a planar portion, the surface variance from edge **76** to edge **78** is less than about 0.05 inch, more preferably less than about 0.04 inch, and still more preferably less than about 0.03125 inch. In addition, the radius curvature for a planar portion from edge **76** to edge **78** is at least about 85 inches, more preferably at least about 117 inches, and even more preferably at least about 148 inches.

[0045] Figure **5** shows one example of an improved extrusion system that may be used to make a siding panel of the present invention. The extrusion system **120** includes at least one hopper **122** that introduces the ingredients of the vinyl composition to the extruder **124**. The vinyl **126** exits a die. The vinyl is then passed over at least one cooling roller and/or embosser **130** prior to entering preforming guide or first calibrator **128** and then calibrator **132**, which forms the final net shape of the product. The siding panel is then passed through a water bath **134**, after which the vinyl siding may be cut to the desired size.

[0046] In one exemplary system, the temperature of the vinyl may be controlled such that it is below about 300 degrees Fahrenheit as it enters the calibrator **132**. For

example, the vinyl may be between about 215 degrees Fahrenheit and about 300 degrees Fahrenheit, more preferably between about 230 degrees Fahrenheit and about 250 degrees Fahrenheit, as it enters the calibrator to be formed into the final net shape of the siding panel. The temperature may be controlled in any suitable or conventional way to achieve the desired temperature of the vinyl. For example, the temperatures of the extruder and/or any preforming guides or intermediate calibrators may be controlled. For another example, the number and temperatures of the cooling rollers and/or embossers may also be controlled. These or other cooling techniques may be used alone or in combination to control the temperature of the vinyl such that it is in a desired temperature range prior to entering the final calibrator.

EXAMPLES

[0047] A vinyl siding panel as shown in Figure **2** was manufactured by extruding a PVC substrate composition and a PVC capstock composition. The extrusion temperature varied between about 340 and about 360 degrees Fahrenheit. After the extruder, the vinyl was passed through a preforming guide and a first calibrator to obtain the general shape of the vinyl siding. The vinyl was then passed through a second calibrator like the one shown in Figure **3** at a rate of about 48 to about 50 feet per minute to obtain the final net shape of the vinyl siding. Each passageway of the second calibrator had a width of about 6.0 inches, a surface variance of about 0.03125 inch, and a radius curvature of about 148.5 inches. The vinyl siding was then passed under embossing rollers to impart a wood-grain pattern. Thereafter, the vinyl siding was passed under cooling rollers and through a water bath to further cool it down. Each planar portion of the resulting vinyl siding had a thickness of about 0.045 inch, a width of about 6.0 inches, a surface variance of about or less than 0.03125 inch, and a radius curvature of about or more than 148.5 inches. Furthermore, the height of each of the seams connecting the planar portions was about 0.6875 inch.

[0048] Another exemplary embodiment of a siding panel is shown in Figure **6**. Each row of the siding panel **140** has a width of about 6.0 inches. The seam height between adjacent rows is about 0.69 inch. As indicated by arrows **g** and **h**, the surface variance of the top row is less than about 0.05 inch, more particularly about 0.03 inch. Also, the radius curvature of the top row is about 146 inches as indicated by arrow **i**. On the other hand, the surface variance of each of the bottom two rows is greater than

about 0.05 inch, more particularly about 0.06 inch, as indicated by arrows **j** and **k**. Furthermore, the radius curvature of each of the bottom two rows is about 73 inches as indicated by arrow **l**.

[0049] Figure **7** shows another exemplary embodiment of the present invention. In this example, each row of the siding panel **150** has a width of about 3.0 inches. The top row has a surface variance of less than about 0.05 inch, more particularly about 0.03 inch, as indicated by arrows **m** and **n**. As indicated by arrow **o**, the radius curvature of the top row is about 35 inches. On the other hand, the surface variance of the bottom three rows is greater than about 0.05 inch, more particularly about 0.06 inch, as indicated by arrows **p** and **q**. As indicated by arrow **r**, the radius curvature of each of the bottom three rows is about 17.5 inches. Additionally, the seam height between adjacent rows is about 0.54 inch in this embodiment of the present invention.

[0050] Yet another exemplary embodiment of a siding panel is shown in Figure **8**. Each row of the siding panel **160** has a width of about 4.0 inches. The seam height between adjacent rows is about 0.54 inch. As indicated by arrows **s** and **t**, the surface variance of the top row is less than about 0.05 inch, more particularly about 0.03 inch. Also, the radius curvature of the top row is about 63.5 inches as indicated by arrow **u**. On the other hand, the surface variance of each of the bottom three rows is greater than about 0.05 inch, more particularly about 0.06 inch, as indicated by arrows **v** and **w**. Furthermore, the radius curvature of each of the bottom three rows is about 31.75 inches as indicated by arrow **x**.

[0051] The exemplary embodiments herein disclosed are not intended to be exhaustive or to unnecessarily limit the scope of the invention. The exemplary embodiments were chosen and described in order to explain the principles of the present invention so that others skilled in the art may practice the invention. Having shown and described exemplary embodiments of the present invention, those skilled in the art will realize that many variations and modifications may be made to affect the described invention. Many of those variations and modifications will provide the same result and fall within the spirit of the claimed invention. It is the intention, therefore, to limit the invention only as indicated by the scope of the claims.

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

1. A siding panel unit comprising:

a vinyl siding panel comprising:

a first row having a radius curvature between about 20 inches and about 300 inches; and

a second row connected to said first row by a first seam to define a stepped contour, said second row having a radius curvature between about 10 inches and about 215 inches; and

a reinforcement panel adjacent to said siding panel;

wherein the radius curvature of said first row is greater than the radius curvature of said second row;

wherein the radius curvature is determined prior to said siding panel being positioned adjacent to said reinforcement panel; and

wherein said siding panel unit simulates the appearance of straight face siding.

2. The siding panel unit of claim 1 wherein said first row is a top row of said siding panel.

3. The siding panel unit of claim 1 wherein said first row and said second row each have a surface variance between about 0.01 inch and about 0.1 inch.

4. The siding panel unit of claim 1 wherein said siding panel has a width of at least about 12 inches.

5. The siding panel unit of claim 1 wherein said first row and said second row each have a width between about 3 inches and about 8 inches.

6. The siding panel unit of claim 5 wherein:

said first row and second row each have a width of about 3 inches;

the radius curvature of said first row is between about 20 inches and about 60 inches; and

the radius curvature of said second row is between about 10 inches and about 50 inches.

7. The siding panel unit of claim 5 wherein:

said first row and second row each have a width of about 8 inches;

the radius curvature of said first row is between about 90 inches and about 300 inches; and

the radius curvature of said second row is between about 70 inches and about 215 inches.

8. The siding panel unit of claim 1 further comprising:

a third row connected to said second row by a second seam to define said stepped contour, said third row having a radius curvature between about 70 inches and about 215 inches;

wherein the radius curvature of said first row is greater than the radius curvature of said third row.

9. The siding panel unit of claim 8 wherein the radius curvature of said third row is substantially similar to the radius curvature of said second row.

10. The siding panel unit of claim 8 further comprising:

a fourth row connected to said third row by a third seam to define said stepped contour, said fourth row having a radius curvature between about 70 inches and about 215 inches;

wherein the radius curvature of said first row is greater than the radius curvature of said fourth row.

11. The siding panel unit of claim 10 wherein the radius curvature of said fourth row is substantially similar to the radius curvature of said second row and said third row.

12. The siding panel unit of claim 1 wherein an upper portion of said first row is unsecured to said reinforcement panel.

13. The siding panel unit of claim 1 wherein at least one side edge portion of said first row and said second row is unsecured to said reinforcement panel.

14. The siding panel unit of claim 1 further comprising a nailing strip connected to an edge portion of said first row opposite said second row.

15. The siding panel unit of claim 14

wherein said nailing strip is unsecured to said reinforcement panel.

16. A siding panel unit comprising:

a vinyl siding panel comprising:

a first outer portion having a thickness between about 30 mils and about 48 mils;

a second outer portion having a thickness between about 30 mils and about 48 mils; and

an intermediate portion between said first outer portion and said second outer portion, said intermediate portion having a thickness between about 31 mils and about 55 mils; and

a reinforcement panel adjacent to said siding panel;

wherein the thickness of said intermediate portion is greater than the thickness of said first outer portion and the thickness of said second outer portion; and

wherein said siding panel unit simulates the appearance of straight face siding.

17. The siding panel unit of claim 16 wherein said intermediate portion has a thickness between about 43 mils and about 55 mils.

18. The siding panel unit of claim 16 wherein the thickness of said intermediate portion is between about 1 mil and about 7 mils greater than the thickness of said first outer portion and the thickness of said second outer portion.

19. The siding panel unit of claim 18 wherein the thickness of said intermediate portion is between about 1 mil and about 4 mils greater than the thickness of said first outer portion and the thickness of said second outer portion.

20. The siding panel unit of claim 16 wherein said first outer portion, said second outer portion, and said intermediate portion are comprised of vinyl.

21. The siding panel unit of claim 16 wherein said intermediate portion includes at least one seam that connects a row of the siding panel to another row of the siding panel.

22. The siding panel unit of claim 16 wherein said siding panel has a width of at least about 12 inches.

23. A siding unit comprising:

a reinforcement panel having a portion at least about 3 inches wide, said portion having a surface variance less than about 0.05 inch; and

a vinyl siding panel secured to said reinforcement panel such that a first row of said siding panel is adjacent to said portion of said reinforcement panel, said first row of said siding panel having a surface variance between about 0.01 inch and about 0.1 inch prior to said siding panel being secured to said reinforcement panel;

wherein the surface variance of said first row of said siding panel is greater than the surface variance of said portion of said reinforcement panel prior to said siding panel being secured to said reinforcement panel; and

wherein said siding unit simulates the appearance of straight face siding.

24. The siding unit of claim 23 wherein said first row of said siding panel has a surface variance between about 0.015 inch and about 0.089 inch prior to said siding panel being secured to said reinforcement panel.

25. The siding unit of claim 23 wherein said first row has a width between about 3 inches and about 8 inches.

26. The siding unit of claim 25 wherein said first row has a width of about 3 inches and a radius curvature between about 10 inches and about 50 inches.

27. The siding unit of claim 25 wherein said first row has a width of about 8 inches and a radius curvature between 70 inches and about 215 inches.

28. The siding unit of claim 23 wherein:

said reinforcement panel has a second portion at least about 3 inches wide and having a surface variance less than about 0.05 inch; and

said siding panel has a second row connected to said first row by a first seam to define a stepped contour, said second row adjacent to said second portion of said reinforcement panel, said second row having a surface variance between about 0.01 inch and about 0.1 inch prior to said siding panel being secured to said reinforcement panel;

wherein the surface variance of said second row of said siding panel is greater than the surface variance of said second portion of said reinforcement panel.

29. The siding unit of claim 28 wherein said second row is a top row of said siding panel.

30. The siding unit of claim 29 wherein an upper portion of said second row is unsecured to said reinforcement panel.

31. The siding unit of claim 29 further comprising a nailing strip connected to an edge portion of said second row.

32. The siding unit of claim 31 wherein said nailing strip is unsecured to said reinforcement panel.

33. The siding unit of claim 28 wherein:

said first row has a radius curvature between about 10 inches and about 215 inches; and

said second row has a radius curvature between about 20 inches and about 300 inches;

wherein the radius curvature of said second row is greater than the radius curvature of said first row.

34. The siding unit of claim 33 wherein said first row and said second row each have a width between about 3 inches and about 8 inches.

35. The siding unit of claim 28 wherein said siding panel has a width of at least about 12 inches.

36. The siding unit of claim 23 wherein at least one side edge portion of said first row of said siding panel is unsecured to said reinforcement panel.

37. The siding unit of claim 23 wherein said siding panel is secured to said reinforcement panel by an adhesive.

38. A siding unit comprising:

a reinforcement panel having a portion at least about 3 inches wide, said portion having a surface variance less than about 0.05 inch; and

a vinyl siding panel secured to said reinforcement panel such that a row of said siding panel is adjacent to said portion of said reinforcement panel, said row of said siding panel having a surface variance between about 0.01 inch and about 0.1 inch prior to said siding panel being secured to said reinforcement panel;

wherein the surface variance of said row of said siding panel is reduced after being secured to said reinforcement panel; and

wherein said siding unit simulates the appearance of straight face siding.

39. The siding unit of claim 38 wherein said siding panel has a width of at least about 12 inches.

40. The siding unit of claim 38 wherein said row of said siding panel has a surface variance between about 0.015 inch and about 0.089 inch prior to said siding panel being secured to said reinforcement panel.

41. The siding unit of claim 38 wherein said row has a width between about 3 inches and about 8 inches.

42. The siding unit of claim 41 wherein said row has a width of about 8 inches and has a radius curvature between about 70 inches and about 300 inches.

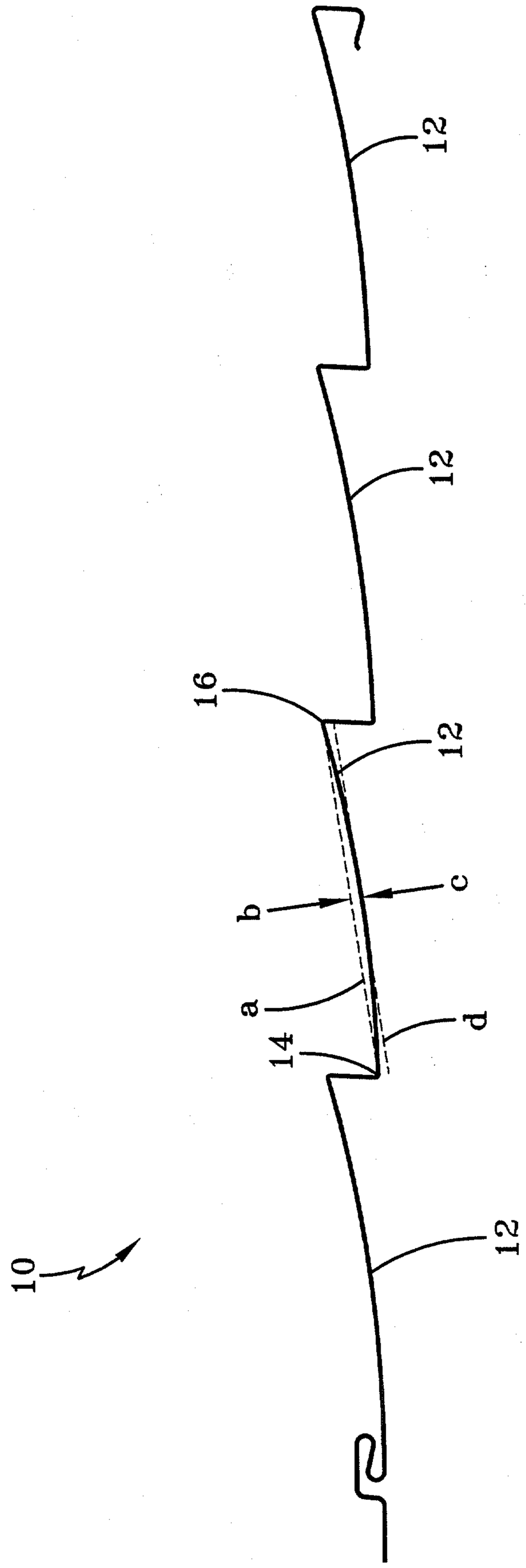


FIG-1

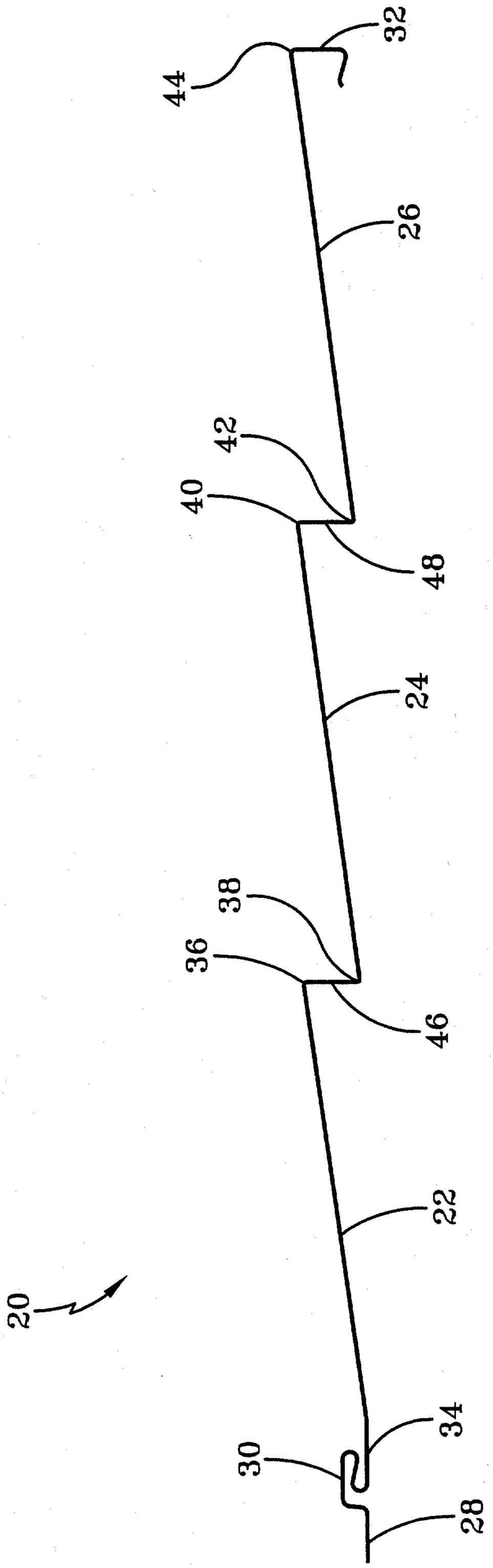


FIG-2

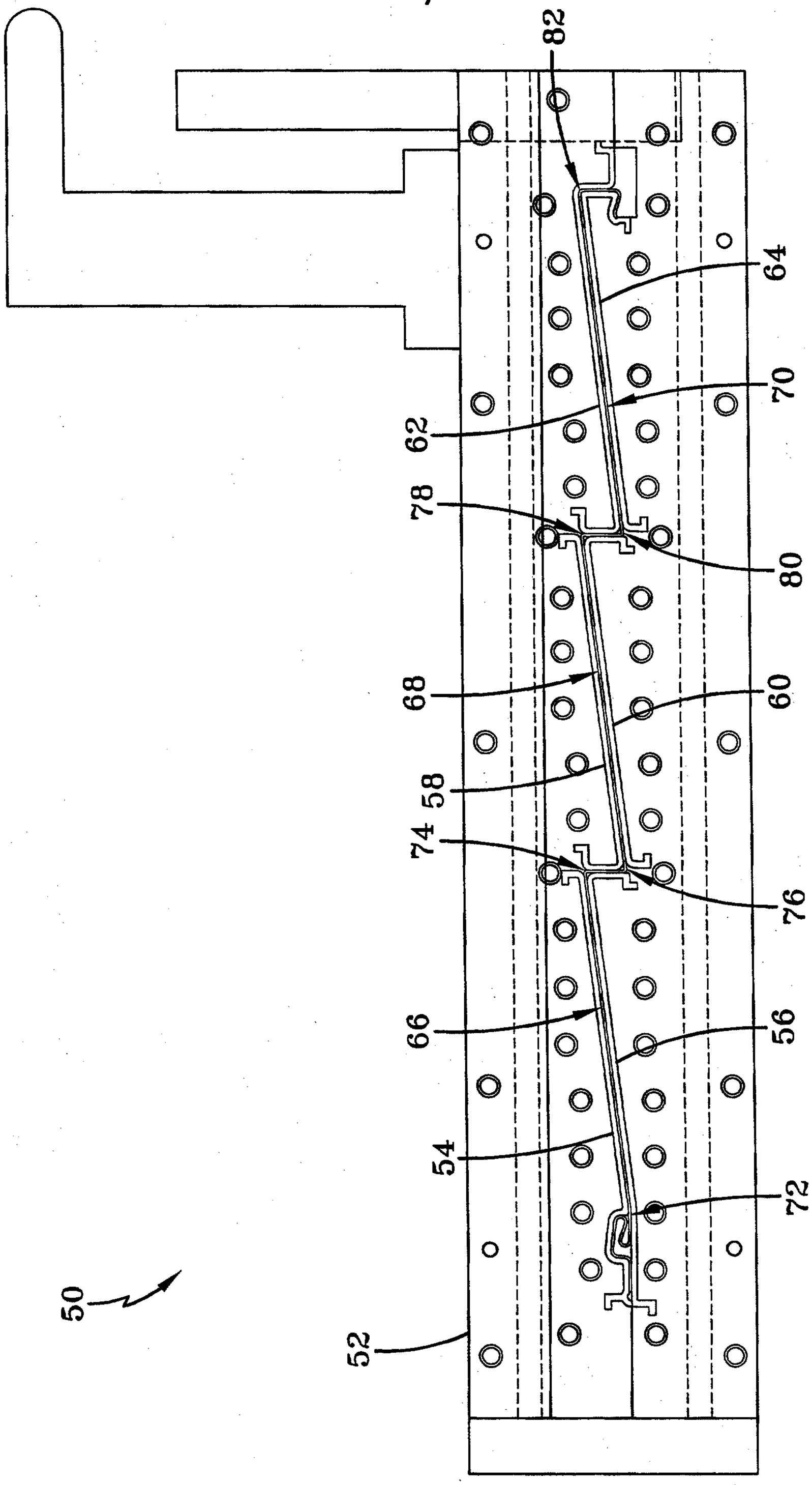


FIG-3

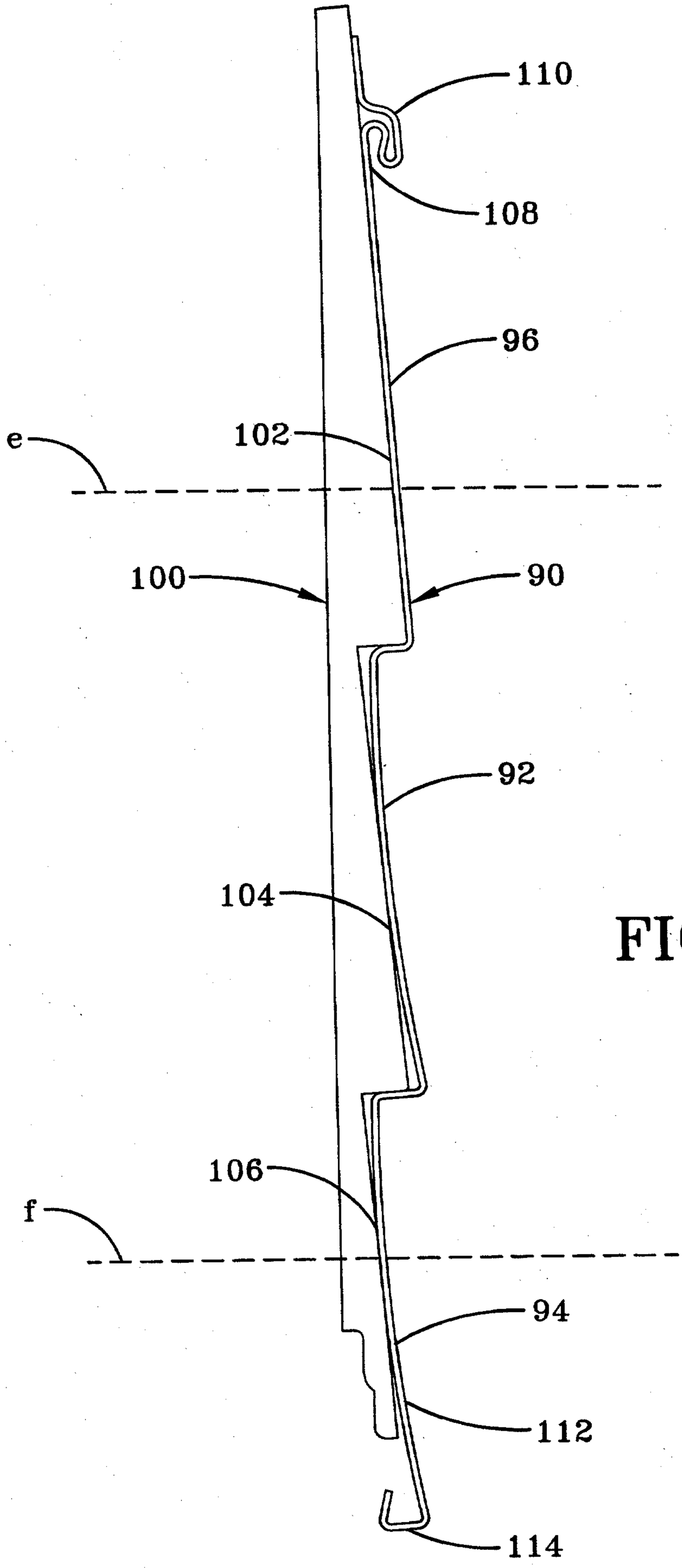


FIG-4

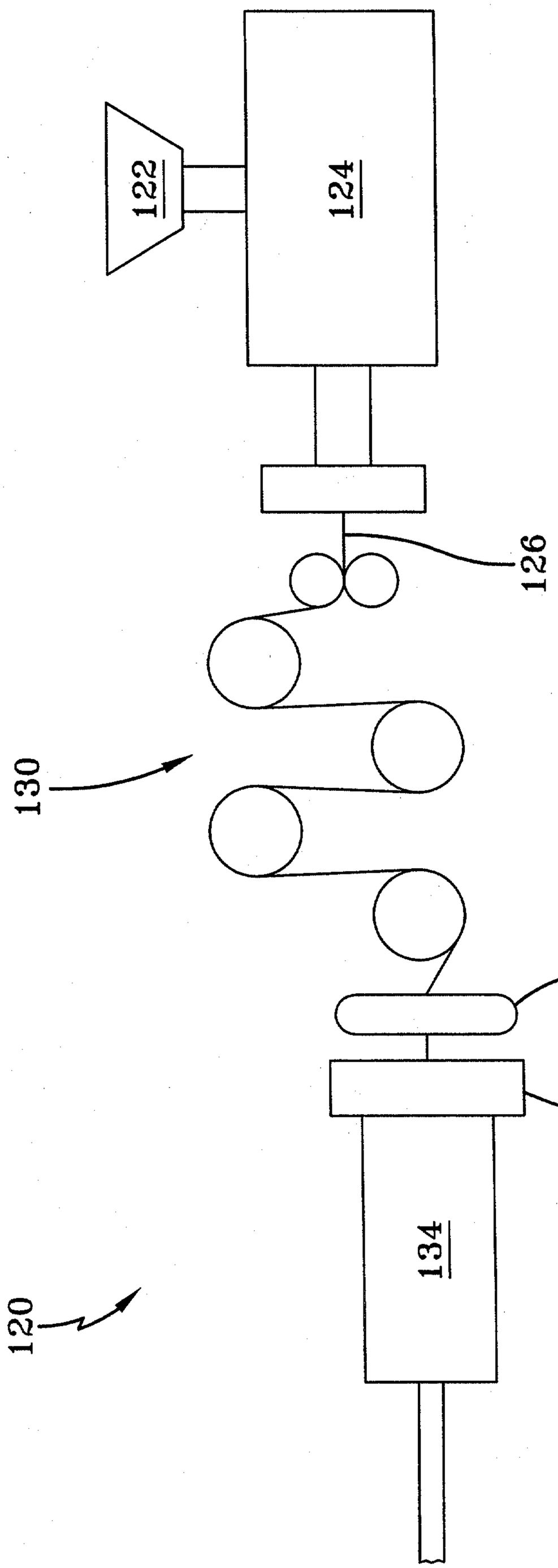
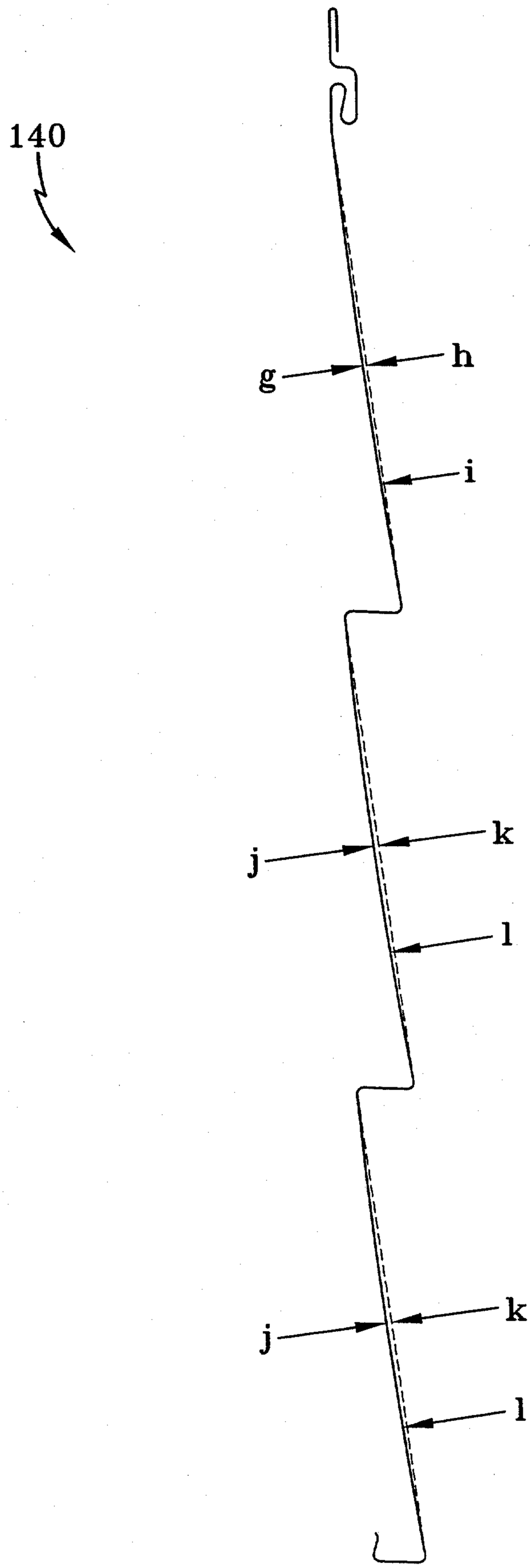
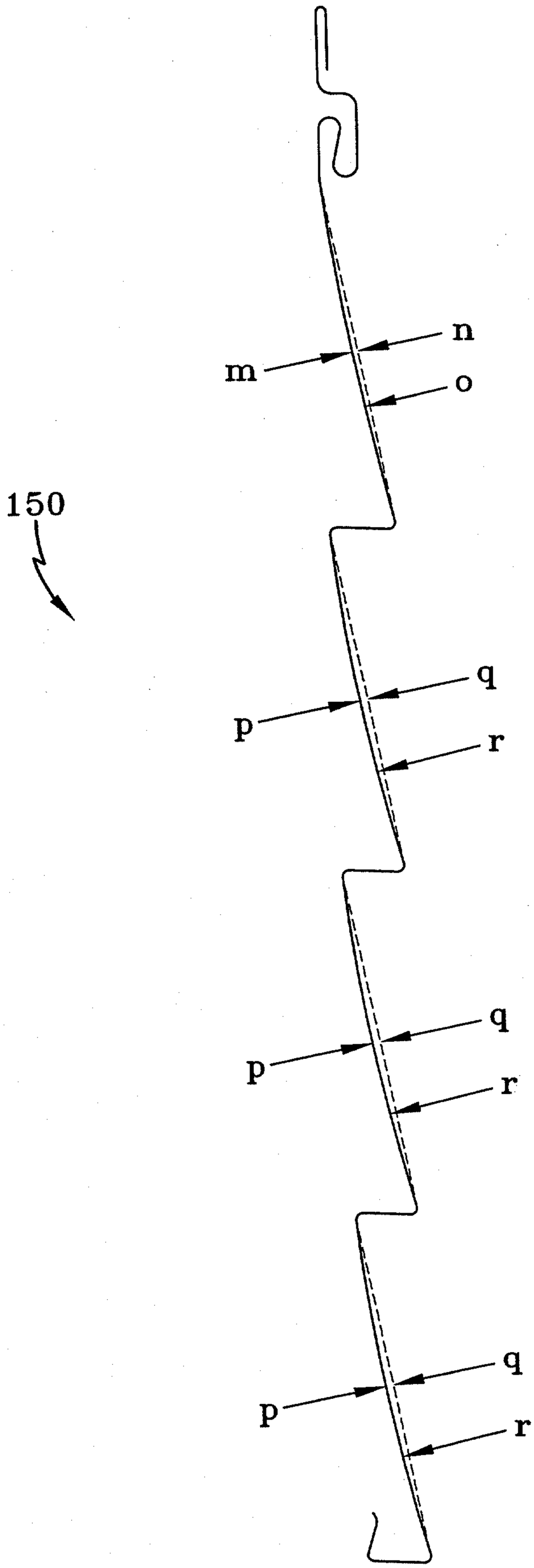


FIG-5



FIG–6



FIG–7

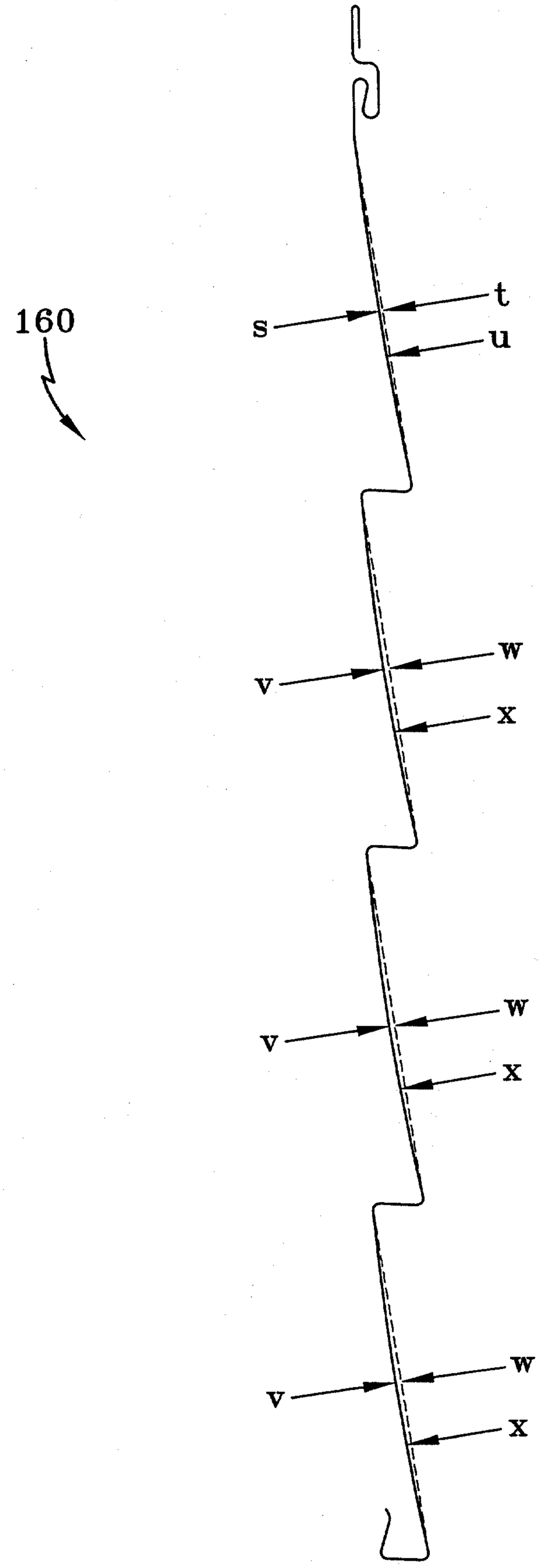
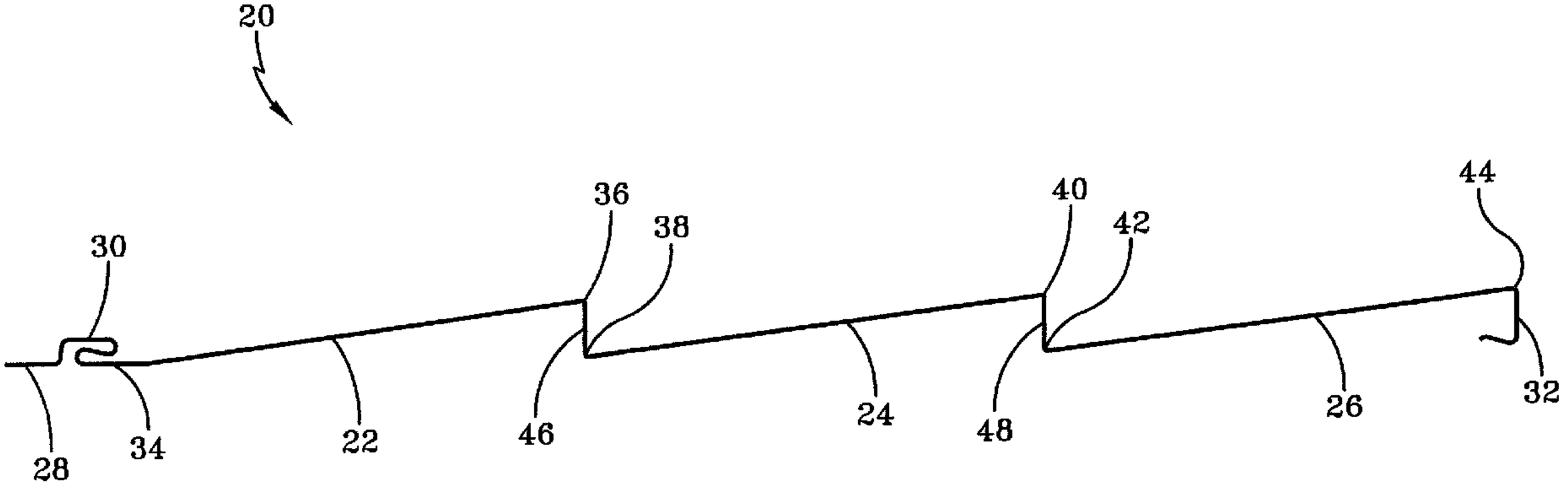


FIG-8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