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(54) **INTEGRAL ROOFING MEMBRANE, OR
FLASHING MEMBER, AND BATTEN OR
REINFORCEMENT STRIP ASSEMBLY**

(57)

ABSTRACT

A new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly, and a method of fabricating the same, wherein a roofing membrane or flashing member is fabricated either from polyvinyl-chloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO) material so as to be heat-weldable or heat-sealable. The roofing membrane or flashing member is therefore capable of being heat-welded or heat-sealed, not only to other adjacent and overlapping roofing membranes, that are fabricated from the same or similar materials, so as to effectively form a composite roofing membrane structure which can be installed over the entire area expanse of a building roof, or at junctures defined between different roofing sections, but in addition, each roofing membrane or flashing member is capable of being heat-welded or heat-sealed to itself so as to effectively capture a batten or reinforcement strip therewithin without requiring the use of auxiliary bonding means which must conventionally be applied thereto by means of auxiliary bonding procedures or operations.

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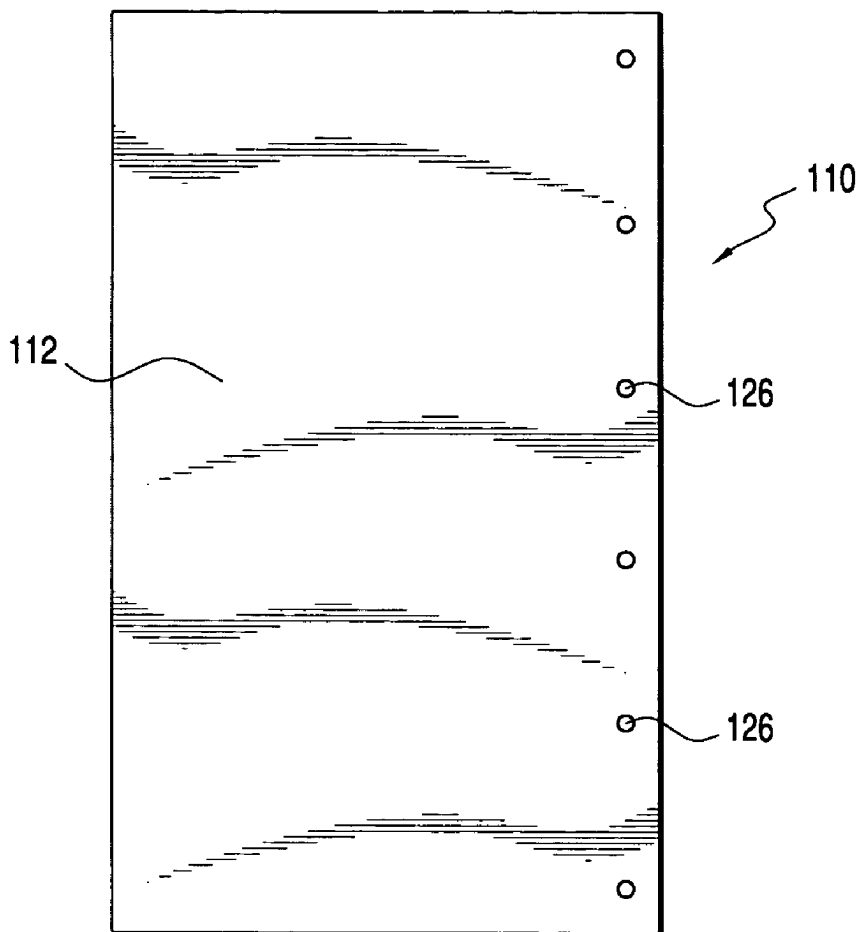
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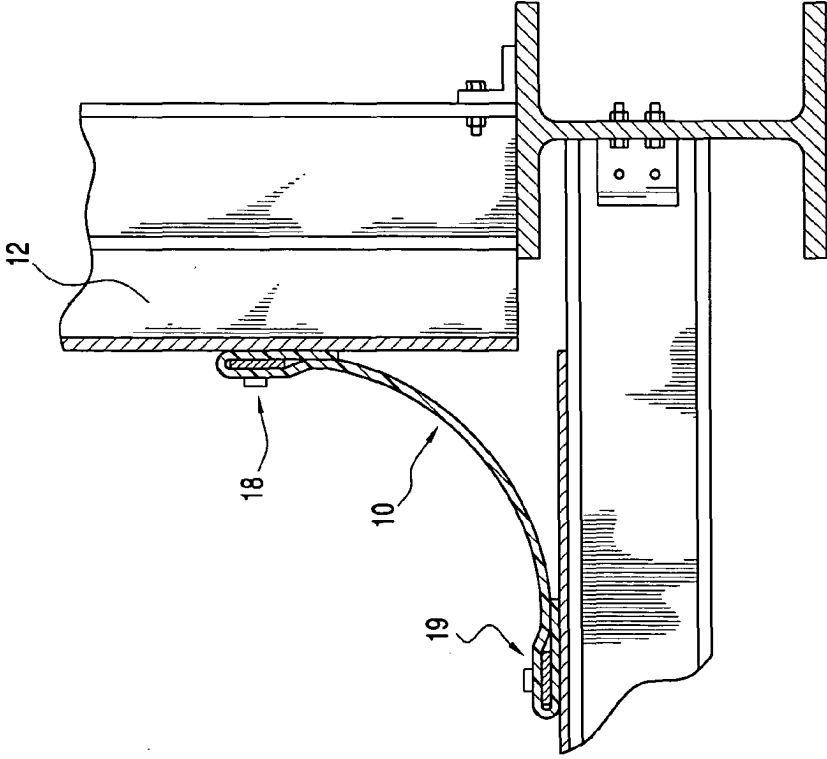
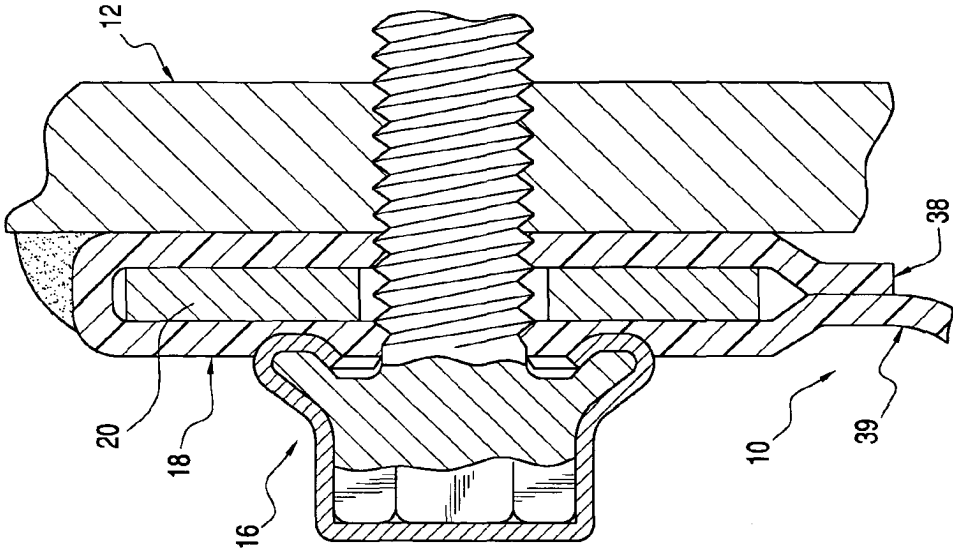
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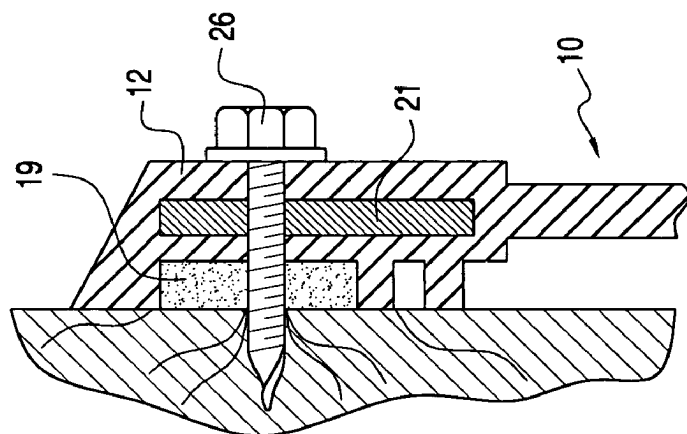
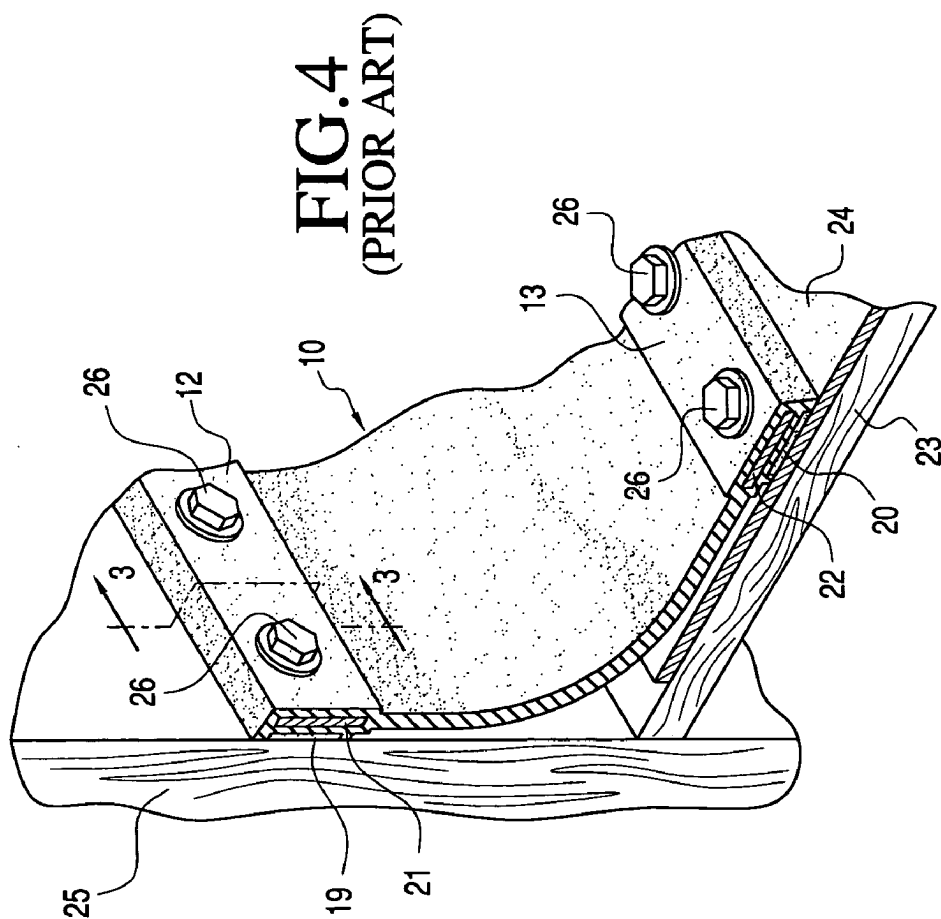
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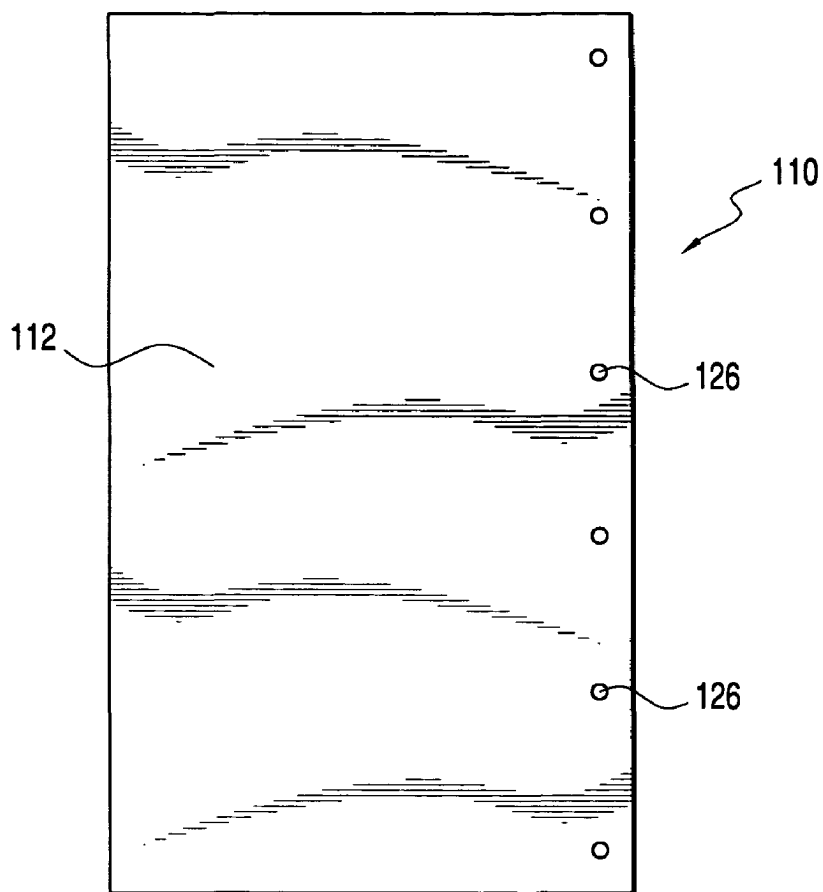


FIG. 6

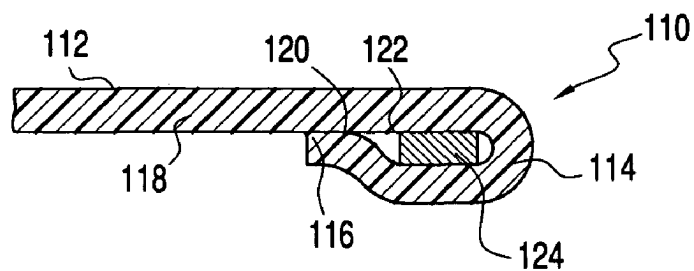


FIG. 7

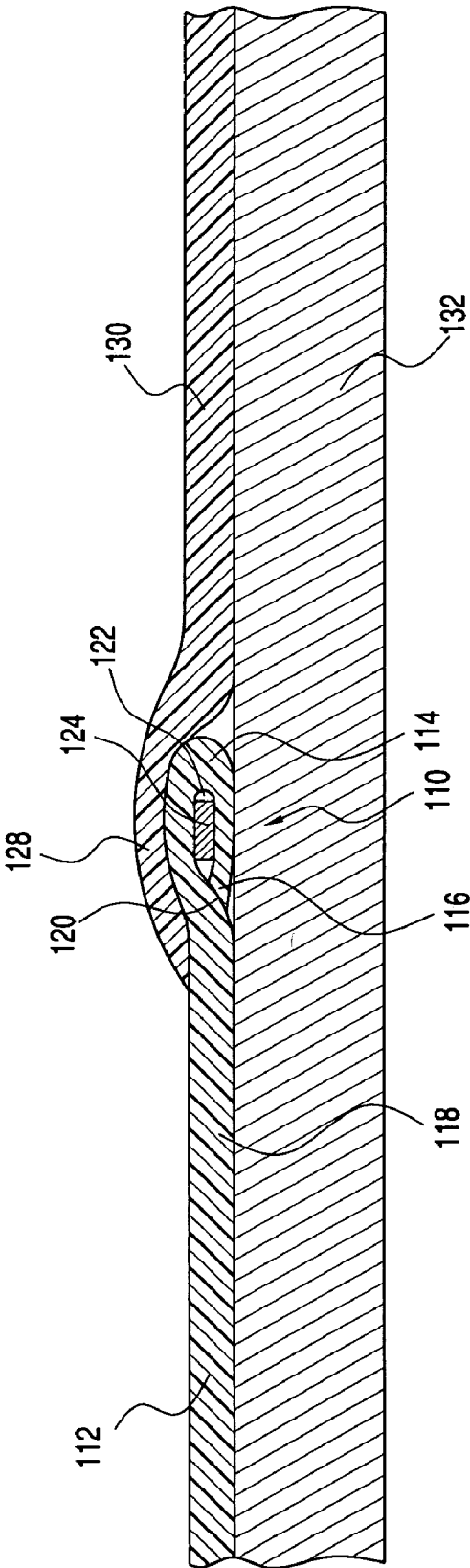


FIG. 8

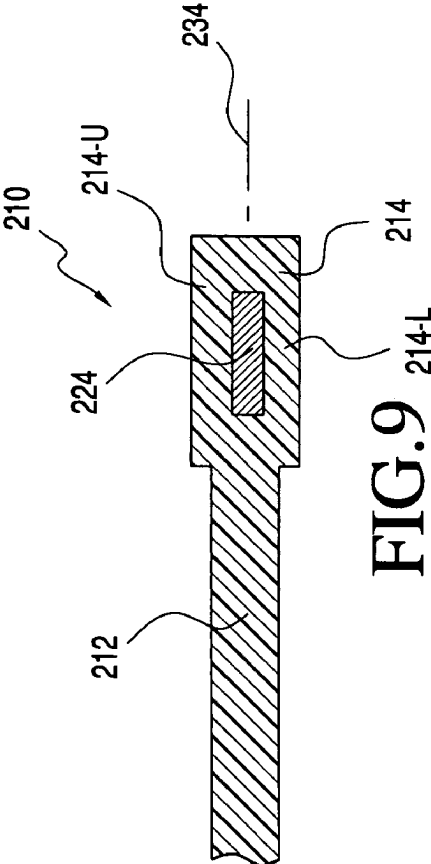


FIG. 9

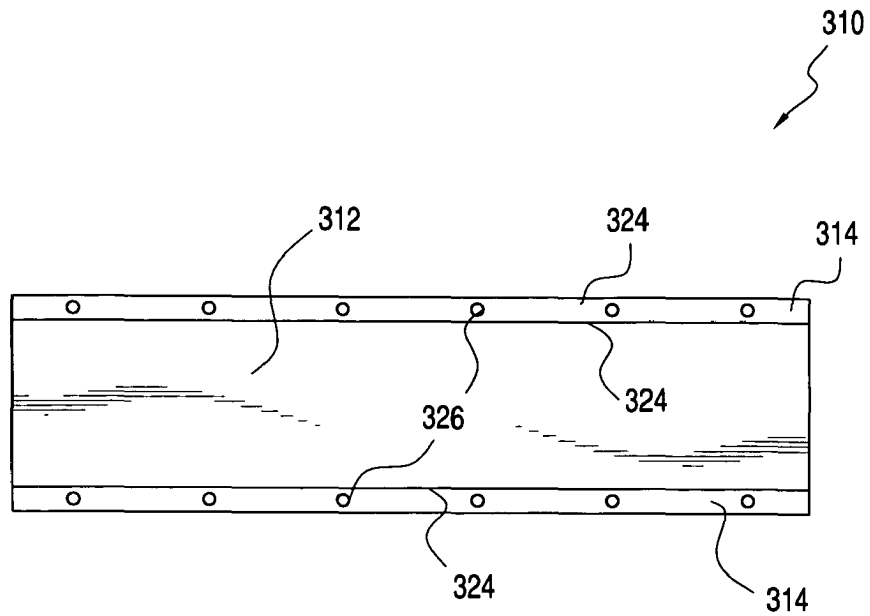


FIG. 10

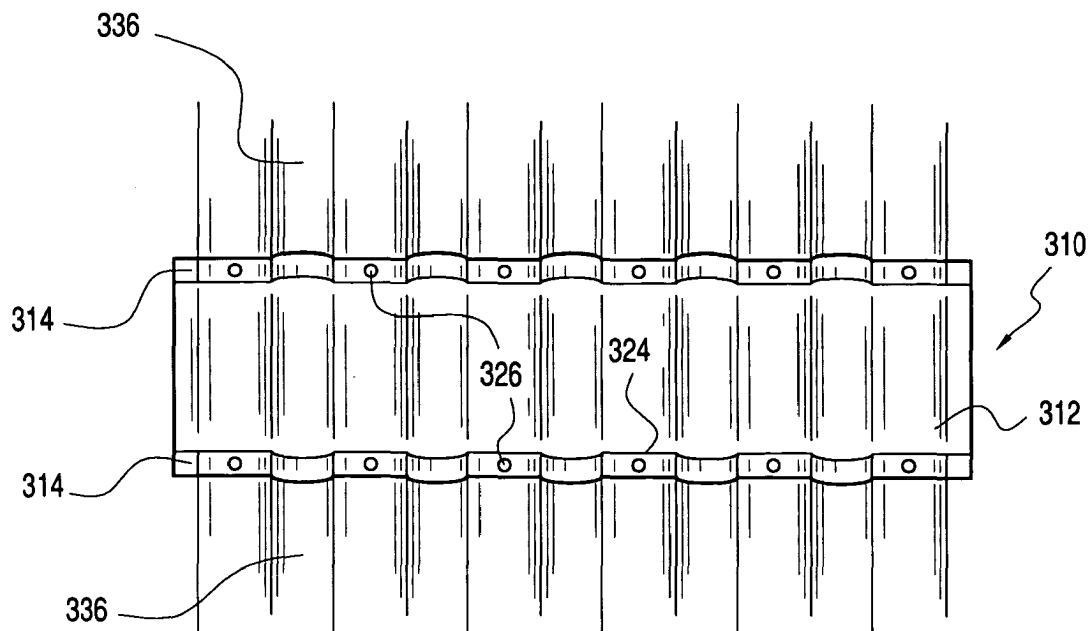


FIG. 11

INTEGRAL ROOFING MEMBRANE, OR FLASHING MEMBER, AND BATTEN OR REINFORCEMENT STRIP ASSEMBLY

FIELD OF THE INVENTION

[0001] The present invention relates generally to roofing membrane or flashing assemblies, and more particularly to a new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly, and a method of fabricating the same, wherein the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly comprises a roofing membrane or flashing member that is fabricated either from polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO) material so as to be heat-weldable or heat-sealable and therefore capable of being heat-welded or heat-sealed, not only to other adjacent and overlapping roofing membranes which are fabricated from the same or similar materials so as to effectively form a composite roofing membrane structure which can be installed over the entire area expanse of a building roof, or at junctions defined between different roofing sections, but in addition, each roofing membrane or flashing member is capable of being heat-welded or heat-sealed to itself such that each roofing membrane or flashing member can have a batten or reinforcement strip integrally incorporated within a central or core region of at least one side edge portion extending along the roofing membrane or flashing member whereby auxiliary bonding means, installed by auxiliary bonding operations or procedures, are rendered unnecessary. Suitable fasteners can then be inserted through the upper or top side or surface of the roofing membrane or flashing member, through the batten or reinforcement strip, through the lower or bottom side or surface of the roofing membrane or flashing member, and into an underlying roof decking or similar roof substructure so as to fixedly secure the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assemblies upon the roof decking or similar roof substructure.

BACKGROUND OF THE INVENTION

[0002] When environmental roofing systems are to be installed upon roof decking substructures, the fabrication costs of such roofing systems, and the time and costs attendant the installation of such roofing system, comprise significant factors in connection with the selection of the particular components comprising the roofing systems. For example, environmental membranes are usually secured upon roof decking substructures by means of a plurality of roofing seam plates which are disposed within linear arrays that are located adjacent to the edge portions of the environmental membranes which are to be heat-welded or heat-sealed to edge portions of adjacent environmental membranes, and wherein further, the plurality of roofing seam plates are spaced pre-determined distances apart from each other so as to provide the environmental membranes with suitable wind uplift force resistance characteristics. As may therefore be readily appreciated, literally thousands of roofing seam plates are required in order to properly secure the plurality of environmental membranes onto the underlying roof decking substructure. It is to be further appreciated that in order to in fact properly secure the environmental membranes to the underlying roof decking substructure, the seam

plates must be placed at the predetermined locations, and must be installed properly, that is, for example, they cannot be installed upside down. Obviously, the use of such seam plates entails significant costs, such as, for example, the costs to fabricate or manufacture the seam plates. In addition, it is quite time-consuming to have on-site personnel individually install such seam plates onto the underlying roof decking substructure, whereby the entire roofing process is rendered still more costly.

[0003] Accordingly, in order to address the aforementioned costly fabrication procedures, as well as the costly installation requirements, attendant the use of the multitude of roofing seam plates, other environmental membrane installation and securement systems, techniques, or methods have been developed and implemented commercially. For example, as disclosed within U.S. Pat. No. 5,711,116, which issued to Hasan on Jan. 27, 1998, U.S. Pat. No. 5,469,671, which issued to Rathgeber et al. on Nov. 28, 1995, and U.S. Pat. No. 5,309,685, which issued to Rathgeber et al. on May 10, 1994, there have been developed composite, pre-assembled roofing elements which comprise an elastomeric membrane to which a plastic batten strip has been adhesively bonded. With reference being made, for example, to **FIG. 1**, which corresponds substantially to **FIG. 2** of any one of the Rathgeber et al. or Hasan patents, the pre-assembled roofing element is disclosed at **28** and is seen to comprise an elastomeric membrane **30** to which a plastic batten strip **32** is adhesively bonded as at **34**. Fasteners **38** are adapted to be inserted into apertures **36** defined within the batten strip **32** so as to pass through the batten strip **32** and the membrane **30** whereby the same can fixedly secure the composite roofing element **28** to the underlying roof decking substructure **10**.

[0004] It can therefore be appreciated that while such composite, pre-assembled roofing element **28** may have, for example, economic advantages over the aforementioned conventional, PRIOR ART seam plate roofing membrane systems, in that the need to supply and install a multitude of individual seam plates has been obviated, other operational drawbacks or disadvantages, characteristic of such composite, pre-assembled roofing element **28**, and the elastomeric membrane **30** comprising an integral component thereof, are nevertheless still present. For example, it is noted that the elastomeric membrane **30** is fabricated from an ethylene propylene diene monomer (EPDM) rubber material which is not heat-weldable or heat-sealable. Consequently, the membrane **28** cannot, by itself, be welded, sealed, or seamed to an adjacent elastomeric membrane, and accordingly, additional means must be employed in order to effectively overlap or seam adjacent elastomeric membranes together. In addition, the membrane cannot be welded, sealed, or seamed to itself in order to, for example, secure the batten strips within the composite roofing element **28**. Therefore, again, as has been noted, the batten strip **32** must be secured to the underlying elastomeric membrane **30** by additional means, such as, for example, the adhesive bonding **34**. It will be readily appreciated, however, that such adhesive bonding requires an additional processing or assembly operation which, again, enhances the costs of fabricating the composite roofing element **28**.

[0005] In addition to the aforementioned patents which issued to Hasan and Rathgeber et al., and which disclose the aforementioned roofing membrane assemblies, still other struc-

tures are known, and have likewise been disclosed within the patent literature, for use in connection with various other roofing applications. For example, as disclosed within U.S. Pat. No. 4,655,009, which issued to DeGraan on Apr. 7, 1987, as well as within U.S. Pat. No. 4,462,190, which issued to Allen on Jul. 31, 1984, different roof flashing structures are disclosed. It is noted, for example, from **FIGS. 2 and 3**, which correspond substantially to **FIGS. 3 and 4** of the Allen patent, that the sheet member **10** is fabricated from a vapor permeable silicone rubber material, and that opposite edge portions **18,19** of the sheet member **10** are folded over onto themselves, as at **38,39** so as to effectively capture or envelop ductile strips **20** therewithin. Screw fasteners **16** are adapted to be inserted through the folded over portions **38** of the sheet member **10**, as well as through the ductile strips **20**, so as to be threadedly engaged within the underlying building structure **12**. It is noted, however, that in view of the fact that the sheet member **10** is fabricated from the aforementioned vapor permeable silicone rubber material, it is likewise not readily heat-weldable or heat-sealable. Accordingly, it cannot be readily heat-weldable or heat-sealable to itself, and therefore, the folded over edge portions **38** thereof must necessarily be secured to each other by means of a suitable auxiliary bonding material which, again, requires an additional processing or assembly operation that, in turn, enhances the costs of fabricating such roof flashing structures.

[0006] In a similar manner, it is noted, for example, from **FIGS. 4 and 5**, which correspond substantially to **FIGS. 2 and 3** of the DeGraan patent, that the sheet member **10**, which comprises the primary component of the roof flashing structure, is fabricated, in a manner similar to that of the aforementioned membranes disclosed within the Hasan and Rathgeber et al. patents, from an ethylene propylene diene monomer (EPDM) rubber material, and that opposite edge portions **12,13** of the sheet member **10** comprise thickened regions within which a pair of metal strips **21,22** are respectively embedded. Screw fasteners **26** are adapted to be inserted through the thickened edge portions **12,13** of the sheet member **10**, as well as through the embedded metal strips **21,22**, so as to be threadedly engaged within the underlying building structures **23,25**. Accordingly, it is to again be appreciated that in view of the fact that the material comprising the sheet member **10** is not heat-weldable or heat-sealable, then when the roof flashing structure is to be sealed, for example, to the roof panel membrane **24**, which is also fabricated from the same ethylene propylene diene monomer (EPDM) rubber material, a separate sealing strip **19,20** must be incorporated within the undersurface region of each thickened edge portion **12,13** of the sheet member **10**. The incorporation of the sealing strips **19,20** within the undersurface regions of the thickened edge portions **12,13** of the sheet member **10** again requires an additional processing or assembly operation which, in turn, enhances the costs of fabricating such roof flashing structures.

[0007] A need therefore exists in the art for a new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly, and a method of fabricating or manufacturing the same, wherein the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly can be fabricated from a suitable material which is heat-weldable or heat-sealable so as to be heat-welded or heat-sealed, not only to itself such that each roofing membrane or flashing member can have a batten or

reinforcement strip integrally incorporated within a central or core region, which extends along at least one side edge portion of the roofing membrane or flashing member, without the need for auxiliary bonding materials, or the performance of auxiliary bonding procedures or operations, in order to secure the batten or reinforcement strips within the roofing membrane or flashing member, whereby the roofing membrane or flashing member can then be fixedly secured to an underlying roof decking or similar roof substructure by suitable fasteners inserted through the roofing membrane or flashing member, and the batten or reinforcement strips, but in addition, the roofing membrane can be heat-welded or heat-sealed to other adjacent or overlapping roofing membranes which are fabricated from the same or similar materials so as to effectively form a composite roofing membrane structure which can be installed over the entire area expanse of a building roof, or between different roofing sections, without the need for auxiliary bonding materials, or the performance of auxiliary bonding procedures or operations, in order to secure the roofing membranes or flashing members to each other.

SUMMARY OF THE INVENTION

[0008] The foregoing and other objectives are achieved in accordance with the teachings and principles of the present invention through the provision of a new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly, and a method of fabricating the same, wherein the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly comprises a roofing membrane or flashing member that is fabricated either from polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO) material so as to be heat-weldable or heat-sealable. The roofing membrane or flashing member is therefore capable of being heat-welded or heat-sealed, not only to other adjacent and overlapping roofing membranes, that are fabricated from the same or similar materials, so as to effectively form a composite roofing membrane structure which can be installed over the entire area expanse of a building roof, or at junctures defined between different roofing sections, but in addition, each roofing membrane or flashing member is capable of being heat-welded or heat-sealed to itself. In this manner, each roofing membrane or flashing member can have a batten or reinforcement strip integrally incorporated within a central or core region, extending along at least one side edge portion of the roofing membrane or flashing member, without requiring the use of auxiliary bonding means which must be applied thereto by means of auxiliary bonding procedures or operations, and in addition, adjacent roofing membranes or flashing members can likewise be integrally connected to each other so as to cover the entire area expanse of a building roof, or at junctures defined between different roofing sections, without requiring such auxiliary bonding means which must be applied thereto by means of auxiliary bonding procedures or operations. The reinforcement battens or strips can be incorporated within the side edge portions of the roofing membranes by folded-over, extrusion, molding, or similar techniques. Suitable fasteners can then be inserted through the upper or top side or surface of the roofing membrane or flashing member, through the batten or reinforcement strip, through the lower or bottom side or surface of the roofing membrane or flashing member, and into an underlying roof

decking or similar roof substructure so as to fixedly secure the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assemblies upon the roof decking or similar roof substructure.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Various other features and attendant advantages of the present invention will be more fully appreciated from the following detailed description when considered in connection with the accompanying drawings in which like reference characters designate like or corresponding parts throughout the several views, and wherein:

[0010] **FIG. 1** is a perspective view of a conventional, PRIOR ART composite, pre-assembled roofing element which comprises an elastomeric membrane to which a plastic batten strip has been adhesively bonded;

[0011] **FIG. 2** is a cross-sectional view of a conventional, PRIOR ART flashing structure wherein opposite edge portions of the sheet member of the flashing structure are folded over upon themselves and bonded together so as to effectively capture ductile strips therewithin;

[0012] **FIG. 3** is an enlarged cross-sectional of one of the opposite edge portions of the flashing structure as disclosed within **FIG. 2** showing the details of the edge portions of the flashing structure wherein the edge portion of the flashing structure is fixedly secured to the underlying substructure by means of a threaded fastener inserted through the folded over sheet member and one of the ductile strips captured therein;

[0013] **FIG. 4** is a cross-sectional perspective view of a conventional, PRIOR ART flashing structure wherein opposite edge portions of the sheet member have thickened regions in which metal strips are embedded;

[0014] **FIG. 5** is an enlarged cross-sectional of one of the opposite edge portions of the flashing structure as disclosed within **FIG. 4**, as taken along the lines 5-5 of **FIG. 4**, showing the details of the metal strip being embedded within the thickened edge portion of the sheet member of the flashing structure and the fixation of the thickened edge portion of the flashing structure to the underlying substructure by means of a fastener inserted through the thickened edge portion of the sheet member and the ductile strip embedded therein;

[0015] **FIG. 6** is a top plan view of a new and improved roofing membrane and batten or reinforcement strip assembly wherein a flexible batten strip has been integrally incorporated within at least one side edge portion of the roofing membrane;

[0016] **FIG. 7** is a cross-sectional view of the new and improved roofing membrane and batten or reinforcement strip assembly as disclosed within **FIG. 6**, and as taken along lines 7-7 of **FIG. 6**, showing the details of how the side edge portion of the roofing membrane is folded over upon itself and heat-welded or heat-sealed to itself so as to effectively capture and retain the batten or reinforcing strip within a substantially central or core region extending along the side edge portion of the roofing membrane;

[0017] **FIG. 8** is a cross-sectional view of a roofing assembly comprising a pair of roofing membranes, one of which has a batten or reinforcement strip integrally incor-

porated within a side edge portion thereof in accordance with the technique illustrated within **FIG. 7**, wherein side edge portions of the roofing membranes are heat-welded or heat-sealed to each other so as to form a sealed interface between the pair of roofing membranes;

[0018] **FIG. 9** is a cross-sectional view similar to that of **FIG. 7** but showing an alternative method of integrally incorporating the batten or reinforcement strip within the side edge portion of the roofing membrane;

[0019] **FIG. 10** is a top plan view, similar to that of **FIG. 6**, showing, however, a new and improved roofing flashing member and batten or reinforcement strip assembly wherein a pair of flexible batten strips have been respectively integrally incorporated within both opposite side edge portions of the roofing flashing member; and

[0020] **FIG. 11** is a top plan view showing the use of the new and improved roofing flashing member and batten or reinforcement strip assembly, as disclosed within **FIG. 10**, in use as a flashing structure in order to effectively interconnect roofing sections in an environmentally sealed manner.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0021] Referring now to the drawings, and more particularly to **FIGS. 6 and 7** thereof, a new and improved roofing membrane and batten or reinforcement strip assembly, which has been constructed in accordance with the principles and teachings of the present invention, is disclosed and is generally indicated by the reference character **110**. More particularly, the new and improved roofing membrane and batten or reinforcement strip assembly **110** is seen to comprise a membrane member **112** which is preferably fabricated from a heat-weldable or heat-sealable material such as, for example, polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO), and it is noted that the thickness of the membrane member **112** can be within the range of 0.030-0.070 inches, and preferably within the range of 0.035-0.064 inches. In accordance with one of the unique and novel characteristics of the present invention, at least one longitudinally extending side edge portion **114** of the heat-weldable or heat-sealable membrane member **112** is folded over beneath itself, as can clearly be seen from **FIG. 7**, such that the distal edge region **116** of the side edge portion **114** can be heat-welded or heat-sealed to a relatively central region **118** of the heat-weldable or heat-sealable membrane member **112** as at **120**. In this manner, a longitudinally extending tubular region **122** is effectively formed within which a longitudinally extending, flexible batten or reinforcement strip **124** is fixedly enveloped, encased, or encapsulated.

[0022] In particular, during the membrane manufacturing web feed process, the side edge portion **114** of the heat-weldable or heat-sealable membrane member **112** is folded over the flexible batten or reinforcement strip **124** and passed through a web feed flame heat welder, or similar welding device or mechanism, so as to fixedly envelop, encase, or encapsulate the flexible batten or reinforcement strip **124** within the folded over side edge portion **114** of the heat-weldable or heat-sealable membrane member **112**. It is to be noted that the feed rate of the membrane member **112**

is predeterminedly adjusted to a particular value as a function of various structural parameters characteristic of the particular membrane member 112, such as, for example, the specific chemical composition of the membrane member 112, its thickness dimension, and the like, so as to effectively ensure that proper heat-welding or heat-sealing of the membrane member 112 is in fact achieved while simultaneously preventing any burning of the membrane member 112 so as not to deleteriously affect the structural composition and structural integrity of the membrane member 112. It is noted that the flexible batten or reinforcement strip 124 may comprise or be fabricated from any one of several different materials, such as, for example, aluminum, lead, steel, a thermoplastic material, or the like, and that while a single batten or reinforcement strip 124 is disclosed within FIGS. 6 and 7 as being integrally incorporated within only one lateral side edge portion 114 of the membrane member 112, a second batten or reinforcement strip 124 may likewise be integrally incorporated within the opposite lateral side edge portion of the membrane 112, depending upon the particular application or use of the composite roofing membrane and batten or reinforcement strip assembly 110.

[0023] It is lastly seen that a plurality of apertures 126, which may be formed either during the manufacturing or fabrication process of the composite roofing membrane and batten or reinforcement strip assembly 110, or alternatively, may be formed onsite by roofing installation personnel, are provided within the lateral side edge portion of the composite roofing membrane and batten or reinforcement strip assembly 110, in a linearly aligned, longitudinally spaced array, so as to extend through the folded-over side edge portion 114 of the membrane member 112, as well as through the batten or reinforcement strip 124, whereby a plurality of fasteners, not shown, can be inserted through the apertures 126 for engagement within an underlying roofing substructure to which the composite roofing membrane and batten or reinforcement strip assembly 110 is to be secured. It can therefore be readily appreciated from the foregoing discussion that not only do the one or more batten or reinforcement strips 124 therefore effectively take the place of, or obviate the need for, the plurality of conventional, PRIOR ART membrane or roofing seam plates, but in addition, the particular fabrication or manufacturing process or technique likewise eliminates the need for auxiliary bonding processes or steps since the folding over and enveloping, encasing, or encapsulating of the one or more batten or reinforcement strips 124, within the one or more side edge portions 114 of the membrane member 112, is performed during the membrane manufacturing web feed process.

[0024] Still further, as can best be appreciated from FIG. 8, in view of the fact that the folded-over side edge portion 114 of the heat-weldable or heat-sealable membrane member 112 completely envelops, encases, or encapsulates the flexible batten or reinforcement strip 124, the externally disposed regions of the folded-over side edge portion 114 of the heat-weldable or heat-sealable membrane member 112 are readily accessible so as to be capable of being heat-welded or heat-sealed to an overlapping side edge portion 128 of a second heat-weldable or heat-sealable membrane member 130. In this manner, a sealed interface is effectively defined between the adjacent heat-weldable or heat-sealable membrane members 112,130 whereby, for example, an

entire roofing substructure 132 may be covered by means of the environmental membrane members 112,130.

[0025] With reference now being made to FIG. 9, an alternative method of integrally incorporating the batten or reinforcement strip, within the side edge portion of the roofing membrane, so as to form a new and improved roofing membrane and batten or reinforcement strip assembly, which has been constructed in accordance with the principles and teachings of the present invention, is disclosed and is generally indicated by the reference character 210. It is to be noted that those components of the new and improved roofing membrane and batten or reinforcement strip assembly 210 which correspond substantially to those components of the new and improved roofing membrane and batten or reinforcement strip assembly 110 will be designated by corresponding reference characters except that they will be within the 200 series. More particularly, and in a manner similar to the new and improved roofing membrane and batten or reinforcement strip assembly 110, the new and improved roofing membrane and batten or reinforcement strip assembly 210 is seen to comprise a membrane member 212 which is preferably fabricated from a heat-weldable or heat-sealable material such as, for example, polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO), and it is noted that the thickness of the membrane member 212 can be within the range of 0.030-0.070 inches, and preferably within the range of 0.035-0.064 inches. Contrary to the fold-over fabrication techniques disclosed in connection with the manufacture of the new and improved roofing membrane and batten or reinforcement strip assembly 110, however, different fabrication techniques are utilized in connection with the manufacture of the new and improved roofing membrane and batten or reinforcement strip assembly 210.

[0026] More particularly, it is noted that during the membrane manufacturing web feed process, the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212 is effectively divided into upper and lower half-sections 214-U and 214-L, along a dividing line denoted at 234, such that the upper and lower half-sections 214-U, 214-L of the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212 are effectively maintained separated from each other so as not to be capable of meeting each other at this point in the fabrication process. The flexible batten or reinforcement strip 224 is then effectively inserted between the aforementioned upper and lower half-sections 214-U,214-L of the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212 whereupon further downstream feeding of the new and improved roofing membrane and batten or reinforcement strip assembly 210, the fabrication of the new and improved roofing membrane and batten or reinforcement strip assembly 210 is completed whereby the flexible batten or reinforcement strip 224 is fixedly embedded within the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212. Still yet further, in lieu of the separation technique as disclosed above in connection with the upper and lower half-sections 214-U,214-L, the flexible batten or reinforcement strip 224 may be embedded, encased, or encapsulated within the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212 by means of suitable extrusion or molding techniques. Regardless of

the particular manufacturing technique which is employed, the resulting structure, as illustrated within FIG. 9, is effectively achieved.

[0027] As was the case with the flexible batten or reinforcement strip 124 incorporated within the new and improved roofing membrane and batten or reinforcement strip assembly 110, the flexible batten or reinforcement strip 224 may comprise or be fabricated from any one of several different materials, such as, for example, aluminum, lead, steel, a thermoplastic material, or the like, and still further, while a single batten or reinforcement strip 224 has been disclosed as being integrally incorporated within only one lateral side edge portion 214 of the membrane member 212, a second batten or reinforcement strip 224 may likewise be integrally incorporated within the opposite lateral side edge portion of the membrane 212, depending upon the particular application or use of the composite roofing membrane and batten or reinforcement strip assembly 210. Still yet further, it is to be understood that a plurality of apertures, not shown but similar to the apertures 126, may be formed either during the manufacturing or fabrication process of the composite roofing membrane and batten or reinforcement strip assembly 210, or alternatively, may be formed onsite by roofing installation personnel, so as to be provided within the lateral side edge portion of the composite roofing membrane and batten or reinforcement strip assembly 210, in a linearly aligned, longitudinally spaced array, so as to extend through the side edge portion 214 of the membrane member 212, as well as through the batten or reinforcement strip 224, whereby a plurality of fasteners, not shown, can be inserted through the apertures for engagement within an underlying roofing substructure to which the composite roofing membrane and batten or reinforcement strip assembly 210 is to be secured.

[0028] Continuing further, it can be readily appreciated from the foregoing discussion that not only do the one or more batten or reinforcement strips 224 therefore effectively take the place of, or obviate the need for, the plurality of conventional, PRIOR ART membrane or roofing seam plates, but in addition, the particular fabrication or manufacturing process or technique likewise eliminates the need for any auxiliary bonding processes or steps since the enveloping, encasing, or encapsulating of the one or more batten or reinforcement strips 224, within the one or more side edge portions 214 of the membrane member 212, is performed during the membrane manufacturing web feed process. Still further, as was the case with the new and improved roofing membrane and batten or reinforcement strip assembly 110, in view of the fact that the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212 completely envelops, encases, or encapsulates the flexible batten or reinforcement strip 224, the externally disposed regions of the side edge portion 214 of the heat-weldable or heat-sealable membrane member 212 are readily accessible so as to be capable of being heat-welded or heat-sealed to an overlapping side edge portion of a second heat-weldable or heat-sealable membrane member, as was shown within FIG. 8 in connection with the new and improved roofing membrane and batten or reinforcement strip assembly 110. In this manner, a sealed interface can effectively be readily defined between the adjacent heat-weldable or heat-sealable membrane members whereby, for example, an entire roofing substructure may be covered by means of the environmental membrane members.

[0029] With reference now being lastly made to FIGS. 10 and 11, there is disclosed a new and improved roofing flashing member and batten or reinforcement strip assembly which is generally indicated by the reference character 310. The new and improved roofing flashing member and batten or reinforcement strip assembly 310 is adapted for use as a flashing structure in order to effectively interconnect roofing sections in an environmentally sealed manner. More particularly, it is to be noted that the new and improved roofing flashing member and batten or reinforcement strip assembly 310 is similar in structure to the new and improved roofing membrane and batten or reinforcement strip assemblies 110, 210, and accordingly, those structural components of the new and improved roofing flashing member and batten or reinforcement strip assembly 310 which correspond substantially to those structural components of the new and improved roofing membrane and batten or reinforcement strip assemblies 110, 210 will be designated by corresponding reference characters except that they will be within the 300 series. It can therefore be readily appreciated that the new and improved roofing flashing member and batten or reinforcement strip assembly 310 is seen to comprise a membrane member 312 which is preferably fabricated from a heat-weldable or heat-sealable material such as, for example, polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO), and it is noted that the thickness of the membrane member 312 can be within the range of 0.030-0.070 inches, and preferably within the range of 0.035-0.064 inches.

[0030] Still further, it is noted that both of the longitudinally extending side edge portions 314, 314 of the heat-weldable or heat-sealable membrane member 312 are adapted to have flexible batten or reinforcement strips 324, 324 fixedly mounted therewithin, and in connection with the actual formation of the longitudinally extending side edge portions 314, 314 of the heat-weldable or heat-sealable membrane member 312, either one of the fabrication techniques, as disclosed, for example, within FIG. 7 or 9, that is, wherein the side edge portions 314, 314 are either folded over upon themselves or, alternatively, wherein the side edge portions 314, 314 comprise substantially thickened sections, within which the flexible batten or reinforcement strips 324, 324 can be enveloped, encased, or encapsulated, may be implemented. As was the case with the flexible battens or reinforcement strips 124 incorporated within the new and improved roofing membrane and batten or reinforcement strip assemblies 110, 210, the flexible battens or reinforcement strips 324 may comprise or be fabricated from any one of several different materials, such as, for example, aluminum, lead, steel, a thermoplastic material, or the like, and a plurality of apertures 326 may be formed either during the manufacturing or fabrication process of the composite roofing flashing member and batten or reinforcement strip assembly 310, or alternatively, may be formed onsite by roofing installation personnel, so as to be provided within the lateral side edge portions of the composite roofing flashing member and batten or reinforcement strip assembly 310, in a linearly aligned, longitudinally spaced array so as to extend through the side edge portions 314, 314 of the membrane member 312, as well as through the battens or reinforcement strips 324, 324 whereby a plurality of fasteners, not shown, can be inserted through the apertures for engagement within underlying roof decking substructures 336, 336 to which the composite roofing flashing member

and batten or reinforcement strip assembly **310** is to be secured. It is noted that the composite roofing flashing member and batten or reinforcement strip assembly **310**, and particularly the battens or reinforcement strips **324,324**, are sufficiently flexible so as to permit the same to conform to the profiles of the underlying metal roof decking substructures **336,336**.

[0031] It can therefore again be readily appreciated from the foregoing discussion that not only do the batten or reinforcement strips **324,324** therefore effectively take the place of, or obviate the need for, the plurality of conventional, PRIOR ART membrane or roofing seam plates, but in addition, the particular fabrication or manufacturing process or technique likewise eliminates the need for any auxiliary bonding processes or steps since the enveloping, encasing, or encapsulating of the batten or reinforcement strips **324,324**, within the side edge portions **314,314** of the membrane member **312**, is performed during the membrane manufacturing web feed process. Still further, as was the case with the new and improved roofing membrane and batten or reinforcement strip assemblies **110,210**, in view of the fact that the side edge portions **314,314** of the heat-weldable or heat-sealable membrane member **312** completely envelops, encases, or encapsulates the flexible battens or reinforcement strips **324,324**, the externally disposed regions of the side edge portions **314,314** of the heat-weldable or heat-sealable membrane member **312** are readily accessible so as to be capable of being heat-welded or heat-sealed to an overlapping side edge portion of an adjacent heat-weldable or heat-sealable membrane member, as was shown within **FIG. 8** in connection with the new and improved roofing membrane and batten or reinforcement strip assembly **110**. In this manner, a sealed interface can effectively be readily defined between the heat-weldable or heat-sealable membrane member of the composite roofing flashing member and batten or reinforcement strip assembly **310** and the heat-weldable or heat-sealable membrane member of an adjacent one of the composite roofing membrane and batten or reinforcement strip assemblies **110,210** whereby, for example, an entire roofing substructure may be covered by means of the roofing membrane and flashing members.

[0032] Thus, it may be seen that in accordance with the teachings and principles of the present invention, there has been disclosed a new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly, and a method of fabricating the same, wherein the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assembly comprises a roofing membrane or flashing member that is fabricated either from polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), or a flexible thermoplastic polyolefine (FPO), material so as to be heat-weldable or heat-sealable. The roofing membrane or flashing member is therefore capable of being heat-welded or heat-sealed, not only to other adjacent and overlapping roofing membranes, that are fabricated from the same or similar materials, so as to effectively form a composite roofing membrane structure which can be installed over the entire area expanse of a building roof, or at junctures defined between different roofing sections, but in addition, each roofing membrane or flashing member is capable of being heat-welded or heat-sealed to itself.

[0033] In this manner, each roofing membrane or flashing member can have a batten or reinforcement strip integrally

incorporated within a central or core region, extending along at least one side edge portion of the roofing membrane or flashing member, without requiring the use of auxiliary bonding means which must conventionally be applied thereto by means of auxiliary bonding procedures or operations, and in addition, adjacent roofing membranes or flashing members can likewise be integrally connected to each other so as to cover the entire area expanse of a building roof, or at junctures defined between different roofing sections, without requiring such auxiliary bonding means which must be applied thereto by means of auxiliary bonding procedures or operations. The reinforcement battens or strips can be incorporated within the side edge portions of the roofing membranes by folded-over, extrusion, molding, split-membrane, or similar manufacturing or fabrication techniques. Suitable fasteners can then be inserted through the upper or top side or surface of the roofing membrane or flashing member so as to extend through the batten or reinforcement strip, through the lower or bottom side or surface of the roofing membrane or flashing member, and into an underlying roof decking or similar roof substructure so as to fixedly secure the new and improved roofing membrane, or flashing member, and batten or reinforcement strip assemblies upon the roof decking or similar roof substructure.

[0034] Obviously, many variations and modifications of the present invention are possible in light of the above teachings. It is therefore to be understood that within the scope of the appended claims, the present invention may be practiced otherwise than as specifically described herein.

What is claimed as new and desired to be protected by Letters Patent of the United States of America, is:

1. A composite roofing membrane and batten reinforcement strip assembly, comprising:

a roofing membrane fabricated from a heat-weldable and heat-sealable material so as to be capable of being heat-weldable and heat-sealable with respect to itself and with respect to an adjacent roofing membrane; and

at least one batten reinforcement strip fixedly secured to a side edge portion of said roofing membrane so as to permit said roofing membrane to be fixedly secured to an underlying roofing substructure by means of fasteners passing through said side edge portion of said roofing membrane and said at least one batten reinforcement strip,

said at least one batten reinforcement strip being fixedly secured within an internal portion of said side edge portion of said roofing membrane as a result of said roofing membrane being heat-weldable and heat-sealable with respect to itself, while an external portion of said side edge portion of said roofing membrane is capable of being heat-welded and heat-sealed to an adjacent roofing membrane so as to form an environmental membrane system covering the underlying roof substructure.

2. The composite roofing membrane and batten reinforcement strip assembly as set forth in claim 1, wherein:

a pair of batten reinforcement strips are fixedly secured within oppositely disposed side edge portions of said roofing membrane so as to effectively render said

composite roofing membrane and batten reinforcement strip assembly useful in roof flashing applications.

3. The composite roofing membrane and batten reinforcement strip assembly as set forth in claim 1, wherein:

said roofing membrane is fabricated from a material selected from the group comprising polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), and a flexible thermoplastic polyolefine (FPO).

4. The composite roofing membrane and batten reinforcement strip assembly as set forth in claim 1, wherein:

said side edge portion of said roofing membrane is folded over upon itself, and heat-weldable and heat-sealable with respect to itself, so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is fixedly secured.

5. The composite roofing membrane and batten reinforcement strip assembly as set forth in claim 1, wherein:

said side edge portion of said roofing membrane is effectively separated from each other into upper and lower half-sections so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is disposed, whereupon subsequent mating together of said separated upper and lower half-sections of said side edge portion of said roofing membrane, said at least one batten reinforcement strip is fixedly embedded within said side edge portion of said roofing membrane.

6. The composite roofing membrane and batten reinforcement strip assembly as set forth in claim 5, wherein:

said upper and lower half-sections of said side edge portion of said roofing membrane are effectively formed by a manufacturing technique selected from the group comprising split-membrane, extrusion, and molding fabrication processes.

7. A method of forming a composite roofing membrane and batten reinforcement strip assembly, comprising the steps of:

fabricating a roofing membrane from a heat-weldable and heat-sealable material such that said roof-membrane is capable of being heat-weldable and heat-sealable with respect to itself and with respect to an adjacent roofing membrane;

fixedly securing at least one batten reinforcement strip within an internal portion of a side edge portion of said roofing membrane so as to permit said roofing membrane to be fixedly secured to an underlying roofing substructure by means of fasteners passing through said side edge portion of said roofing membrane and said at least one batten reinforcement strip; and

rendering an external portion of said side edge portion of said roofing membrane accessible so as to be capable of being heat-welded and heat-sealed to an adjacent roofing membrane so as to form an environmental membrane system covering the underlying roof substructure.

8. The method as set forth in claim 7, further comprising the steps of:

fixedly securing a pair of batten reinforcement strips within oppositely disposed side edge portions of said roofing membrane so as to effectively render said composite roofing membrane and batten reinforcement strip assembly useful in roof flashing applications.

9. The method as set forth in claim 7, further comprising the step of:

fabricating said roofing membrane from a material selected from the group comprising polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), and a flexible thermoplastic polyolefine (FPO).

10. The method as set forth in claim 7, further comprising the steps of:

folding over said side edge portion of said roofing membrane upon itself; and

heat-welding and heat-sealing said folded over side edge portion of said roofing membrane with respect to itself so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is fixedly secured.

11. The method as set forth in claim 7, further comprising the steps of:

effectively separating said side edge portion of said roofing membrane into upper and lower half-sections so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is disposed; and

subsequently mating together said effectively separated upper and lower half-sections of said side edge portion of said roofing membrane so as to fixedly embed said at least one batten reinforcement strip within said side edge portion of said roofing membrane.

12. The method as set forth in claim 11, further comprising the step of:

effectively forming said upper and lower half-sections of said side edge portion of said roofing membrane by a manufacturing technique selected from the group comprising split-membrane, extrusion, and molding fabrication processes.

13. A roofing system, comprising:

an underlying roofing substructure;

a roofing membrane fabricated from a heat-weldable and heat-sealable material so as to be capable of being heat-weldable and heat-sealable with respect to itself and with respect to an adjacent roofing membrane; and

at least one batten reinforcement strip fixedly secured to a side edge portion of said roofing membrane so as to permit said roofing membrane to be fixedly secured to said underlying roofing substructure by means of fasteners passing through said side edge portion of said roofing membrane and said at least one batten reinforcement strip,

said at least one batten reinforcement strip being fixedly secured within an internal portion of said side edge portion of said roofing membrane as a result of said roofing membrane being heat-weldable and heat-sealable with respect to itself, while an external portion of said side edge portion of said roofing membrane is capable of being heat-welded and heat-sealed to an

adjacent roofing membrane so as to form an environmental membrane system covering said underlying roof substructure.

14. The roofing system as set forth in claim 13, wherein:

a pair of batten reinforcement strips are fixedly secured within oppositely disposed side edge portions of said roofing membrane so as to effectively render said composite roofing membrane and batten reinforcement strip assembly useful in roof flashing applications.

15. The roofing system as set forth in claim 13, wherein:

said roofing membrane is fabricated from a material selected from the group comprising polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), and a flexible thermoplastic polyolefine (FPO).

16. The roofing system as set forth in claim 13, wherein:

said side edge portion of said roofing membrane is folded over upon itself, and heat-weldable and heat-sealable with respect to itself, so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is fixedly secured.

17. The roofing system as set forth in claim 13, wherein:

said side edge portion of said roofing membrane is effectively separated from each other into upper and lower half-sections so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is disposed, whereupon subsequent mating together of said separated upper and lower half-sections of said side edge portion of said roofing membrane, said at least one batten reinforcement strip is fixedly embedded within said side edge portion of said roofing membrane.

18. The roofing system as set forth in claim 17, wherein:

said upper and lower half-sections of said side edge portion of said roofing membrane are effectively formed by a manufacturing technique selected from the group comprising split-membrane, extrusion, and molding fabrication processes.

19. A method of forming a roofing system, comprising the steps of:

providing an underlying roofing substructure;

fabricating a roofing membrane from a heat-weldable and heat-sealable material such that said roof-membrane is capable of being heat-weldable and heat-sealable with respect to itself and with respect to an adjacent roofing membrane;

fixedly securing at least one batten reinforcement strip within an internal portion of a side edge portion of said roofing membrane so as to permit said roofing membrane to be fixedly secured to said underlying roofing substructure by means of fasteners passing through said

side edge portion of said roofing membrane and said at least one batten reinforcement strip; and

rendering an external portion of said side edge portion of said roofing membrane accessible so as to be capable of being heat-welded and heat-sealed to an adjacent roofing membrane so as to form an environmental membrane system covering the underlying roof substructure.

20. The method as set forth in claim 19, further comprising the steps of:

fixedly securing a pair of batten reinforcement strips within oppositely disposed side edge portions of said roofing membrane so as to effectively render said composite roofing membrane and batten reinforcement strip assembly useful in roof flashing applications.

21. The method as set forth in claim 19, further comprising the step of:

fabricating said roofing membrane from a material selected from the group comprising polyvinylchloride (PVC), a thermoplastic polyolefin (TPO), and a flexible thermoplastic polyolefine (FPO).

22. The method as set forth in claim 19, further comprising the steps of:

folding over said side edge portion of said roofing membrane upon itself; and

heat-welding and heat-sealing said folded over side edge portion of said roofing membrane with respect to itself so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is fixedly secured.

23. The method as set forth in claim 19, further comprising the steps of:

effectively separating said side edge portion of said roofing membrane into upper and lower half-sections so as to form said internal portion of said side edge portion of said roofing membrane within which said at least one batten reinforcement strip is disposed; and

subsequently mating together said separated upper and lower half-sections of said side edge portion of said roofing membrane so as to fixedly embed said at least one batten reinforcement strip within said side edge portion of said roofing membrane.

24. The method as set forth in claim 23, further comprising the step of:

effectively forming said upper and lower half-sections of said side edge portion of said roofing membrane by a manufacturing technique selected from the group comprising split-membrane, extrusion, and molding fabrication processes.

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