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(54) **BARRIER HANDRAIL REINFORCED TRUSS BEAM**

(57) A barrier that includes a plurality of first wires that each extend in a horizontal direction is provided. The barrier can include a plurality of second wires that each have a first portion that extends in a vertical direction and a second portion that extends in a direction orthogonal to the vertical direction and at an angle between the horizontal direction and a transverse direction. The second portions of each of the plurality of second wires can collectively define a midline that extends in the horizontal direction and substantially bisects the second portions of the plurality of second wires. The second portions of each of the plurality of second wires can collectively form a zig-zag pattern along the midline.

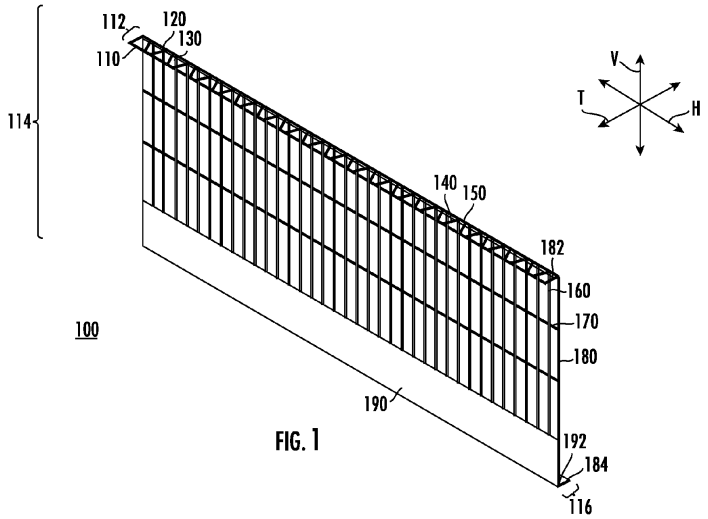


FIG. 1

EP 4 461 903 A1

Description

TECHNICAL FIELD

[0001] The present application, in some examples, relates generally to a barrier. More specifically, the present application, in some examples, relates to an edge protection barrier.

BACKGROUND

[0002] Barriers, such as steel mesh barriers, are often installed on or near an edge of a structure, such as a building, to prevent debris or an individual from falling from the edge of the structure. The inventors have identified numerous deficiencies and problems with the existing technologies in this field. For example, existing technologies are either too heavy or do not achieve a desired minimum strength or durability. Through applied effort, ingenuity, and innovation, many of these identified deficiencies and problems have been solved by developing solutions that are structured in accordance with the embodiments of the present disclosure, many examples of which are described in detail herein.

BRIEF SUMMARY

[0003] In an example embodiment, a barrier is provided that defines a horizontal direction H, a vertical direction V that is orthogonal to the horizontal direction H, and a transverse direction T that is orthogonal to the horizontal direction H and the vertical direction V. The example barrier includes a plurality of first wires that each extend in the horizontal direction H. The example barrier includes a plurality of second wires that each have a first portion that extends in the vertical direction V and a second portion that extends in a direction orthogonal to vertical direction V and at an angle between horizontal direction H and transverse direction T. In an example embodiment, the second portions of each of the plurality of second wires collectively define a midline that extends in the horizontal direction H and substantially bisects the second portions of the plurality of second wires. In an example embodiment, the second portions of each of the plurality of second wires collectively form a zig-zag pattern along the midline.

[0004] In an example embodiment, at least one of the plurality of first wires is coupled to the plurality of second wires.

[0005] In an example embodiment, the midline defines a proximal portion for each of the second portions of the plurality of second wires and a distal portion for each of the second portions of the plurality of second wires, and wherein at least one of the plurality of first wires is coupled to the distal portions of each of the second portions of the plurality of second wires.

[0006] In an example embodiment, each of the second portions of the plurality of second wires extends within forty-five degrees of the transverse direction T.

[0007] In an example embodiment, each of the plurality of second wires have a curved portion that connects the second portion to the first portion.

[0008] In an example embodiment, at least one of the plurality of first wires is coupled to the curved portions of each the plurality of second wires.

[0009] In an example embodiment, at least one of the plurality of first wires is coupled to the first portions of the plurality of second wires at a location proximate to the second portions of the plurality of second wires.

[0010] In an example embodiment, a zig-zag pattern is formed by the second portions of the plurality of second wires being alternately angled towards opposite horizontal directions.

[0011] In an example embodiment, each of the plurality of second wires have a third portion that extends in a direction opposite to the transverse direction T from which the second portions of the plurality of second wires are angled based on, and wherein the first portions of each of the plurality of second wires are positioned between the second portions and the third portions.

[0012] In an example embodiment, the barrier includes a sheet including a first section extending in the vertical direction V and the horizontal direction H is coupled to at least a sub-portion of each of the first portions of the plurality of second wires.

[0013] In an example embodiment, the sheet further includes a second section extending in the horizontal direction H and the transverse direction T, where the second section of the sheet is coupled to each of the third portions of the plurality of second wires.

[0014] In an example embodiment, the barrier further includes a bar, where the bar includes a vertical portion that extends in the vertical direction V and a transverse portion that extends in the transverse direction T. In an example embodiment, the vertical portion of the bar is parallel to the first portions of the plurality of second wires. In an example embodiment, the transverse portion of the bar is substantially bisected by the midline. In an example embodiment, the bar is coupled to the plurality of first wires.

[0015] In an example embodiment, an edge protection barrier configured to be coupled proximate to an edge of a building is provided that defines a horizontal direction H, a vertical direction V that is orthogonal to the horizontal direction H, and a transverse direction T that is orthogonal to the horizontal direction H and the vertical direction V. The example edge protection barrier includes a plurality of first wires that each extend in the horizontal direction H. The example edge protection barrier includes a plurality of second wires that each have a first portion that extends in the vertical direction V and a second portion that extends in a direction orthogonal to vertical direction V and at an angle between horizontal direction H and transverse direction T. In an example embodiment, the second portions of each of the plurality of second wires collectively define a midline that extends in the horizontal

direction H and substantially bisects the second portions of the plurality of second wires. In an example embodiment, the second portions of each of the plurality of second wires collectively form a zig-zag pattern along the midline.

[0016] In an example embodiment, at least one of the plurality of first wires is coupled to the plurality of second wires.

[0017] In an example embodiment, the midline defines a proximal portion for each of the second portions of the plurality of second wires and a distal portion for each of the second portions of the plurality of second wires, and wherein at least one of the plurality of first wires is coupled to the distal portions of each of the second portions of the plurality of second wires.

[0018] In an example embodiment, each of the second portions of the plurality of second wires extends within forty-five degrees of the transverse direction T.

[0019] In an example embodiment, each of the plurality of second wires have a curved portion that connects the second portion to the first portion.

[0020] In an example embodiment, at least one of the plurality of first wires is coupled to the curved portions of each the plurality of second wires.

[0021] In an example embodiment, at least one of the plurality of first wires is coupled to the first portions of the plurality of second wires at a location proximate to the second portions of the plurality of second wires.

[0022] In an example embodiment, a zig-zag pattern is formed by the second portions of the plurality of second wires being alternately angled towards opposite horizontal directions.

[0023] In an example embodiment, each of the plurality of second wires have a third portion that extends in a direction opposite to the transverse direction T from which the second portions of the plurality of second wires are angled based on, and wherein the first portions of each of the plurality of second wires are positioned between the second portions and the third portions.

[0024] In an example embodiment, the edge protection barrier includes a sheet including a first section extending in the vertical direction V and the horizontal direction H is coupled to at least a sub-portion of each of the first portions of the plurality of second wires.

[0025] In an example embodiment, the sheet further includes a second section extending in the horizontal direction H and the transverse direction T, where the second section of the sheet is coupled to each of the third portions of the plurality of second wires.

[0026] In an example embodiment, the edge protection barrier further includes a bar, where the bar includes a vertical portion that extends in the vertical direction V and a transverse portion that extends in the transverse direction T. In an example embodiment, the vertical portion of the bar is parallel to the first portions of the plurality of second wires. In an example embodiment, the transverse portion of the bar is substantially bisected by the midline. In an example embodiment, the bar is coupled to the plurality of first wires.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Having thus described certain example embodiments of the present disclosure in general terms above, non-limiting and non-exhaustive embodiments of the subject disclosure are described with reference to the following figures, which are not necessarily drawn to scale and wherein like reference numerals refer to like parts throughout the various views unless otherwise specified. The components illustrated in the figures may or may not be present in certain embodiments described herein. Some embodiments may include fewer (or more) components than those shown in the figures.

FIG. 1 provides a perspective view of a barrier, in accordance with an example embodiment.

FIG. 2 provides a perspective view of a portion of the barrier of FIG. 1, in accordance with an example embodiment.

FIG. 3 provides a bottom view of the barrier of FIG. 1, in accordance with an example embodiment.

FIG. 4 provides a front view of the barrier of FIG. 1, in accordance with an example embodiment.

FIG. 5 provides a top view of the barrier of FIG. 1, in accordance with an example embodiment.

FIG. 6 provides a top view of a portion of the barrier of FIG. 1, in accordance with an example embodiment.

FIG. 7 provides a side view of the barrier of FIG. 1, in accordance with an example embodiment.

FIG. 8 provides a side view of a portion of the barrier of FIG. 1, in accordance with an example embodiment.

DETAILED DESCRIPTION

[0028] One or more embodiments are now more fully described with reference to the accompanying drawings, wherein like reference numerals are used to refer to like elements throughout and in which some, but not all embodiments of the inventions are shown. In the following description, for purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the various embodiments. It is evident, however, that the various embodiments can be practiced without these specific details. It should be understood that some, but not all embodiments are shown and described herein. Indeed, the embodiments may be embodied in many different forms, and accordingly this disclosure should not be construed as limited to the embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements.

[0029] As used herein, the term "exemplary" means serving as an example, instance, or illustration. Any aspect or design described herein as "exemplary" is not

necessarily to be construed as preferred or advantageous over other aspects or designs. Rather, use of the word exemplary is intended to present concepts in a concrete fashion. In addition, while a particular feature may be disclosed with respect to only one of several implementations, such feature may be combined with one or more other features of the other implementations as may be desired and advantageous for any given or particular application. Furthermore, to the extent that the terms "includes" and "including" and variants thereof are used in either the detailed description or the claims, these terms are intended to be inclusive in a manner similar to the term "comprising."

[0030] As used herein, the term "or" is intended to mean an inclusive "or" rather than an exclusive "or". That is, unless specified otherwise, or clear from context, "X employs A or B" is intended to mean any of the natural inclusive permutations. That is, if X employs A; X employs B; or X employs both A and B, then "X employs A or B" is satisfied under any of the foregoing instances. In addition, the articles "a" and "an" as used in this application and the appended claims should generally be construed to mean "one or more" unless specified otherwise or clear from context to be directed to a singular form.

[0031] As used herein, the terms "coupled," "fixed," "attached to," and the like refer to both direct coupling, fixing, or attaching, as well as indirect coupling, fixing, or attaching through one or more intermediate components or features, unless otherwise specified herein. As used herein, coupling can be accomplished through welding one component to another component.

[0032] As used herein, the term "positioned directly on" refers to a first component being positioned on a second component such that they make contact. Similarly, as used herein, the term "positioned directly between" refers to a first component being positioned between a second component and a third component such that the first component makes contact with both the second component and the third component. In contrast, a first component that is "positioned between" a second component and a third component may or may not have contact with the second component and the third component. Additionally, a first component that is "positioned between" a second component and a third component is positioned such that there may be other intervening components between the second component and the third component other than the first component.

[0033] As used herein, the term "substantially bisects" refers to into divides into two substantially equal parts. Similarly, the term "substantially bisected" refers to divided into two substantially equal parts. As used herein, the term "substantially equal parts" refers to two parts that are within 10% of equal in length, width, or height, with the 10% being calculated based on the total length, width, or height of the combination of the two parts. For example, a wire that is "substantially bisected" may be divided into a first part that is 5.5 cm in length and a second part that is 4.5 cm in length. In contrast, a wire that is divided into a first part that is 6 cm in length and a second part that is 4 cm in length is not "substantially bisected."

[0034] It is desirable, in some examples, for barriers to be as light as possible while achieving a minimum strength. Embodiments of the present disclosure include, but are not limited to, a barrier that, in some examples, is lighter than traditional barriers while achieving a desired minimum strength or durability.

[0035] Referring now to Figure 1, a perspective view of barrier 100 is provided, in accordance with an example embodiment. In one or more embodiments, barrier 100 defines a horizontal direction H, a vertical direction V that is orthogonal to the horizontal direction H, and a transverse direction T that is orthogonal to the horizontal direction H and the vertical direction V. In some embodiments, the barrier 100 defines a top portion 112 and a main portion 114. In some embodiments, the barrier 100 includes a bottom portion 116.

[0036] In some embodiments, the top portion 112 extends generally along a plane defined by the horizontal direction H and the transverse direction T (e.g., within forty-five degrees, such as within thirty degrees, such as within fifteen degrees, such as within ten degrees, such as within five degrees, such as within two degrees of the plane defined by the horizontal direction H and the transverse direction T).

[0037] In some embodiments, the main portion 114 extends generally along a plane defined by the horizontal direction H and the vertical direction V. In some embodiments, the bottom portion 116, when included, extends generally along a plane defined by the horizontal direction H and the transverse direction T (e.g., within forty-five degrees, such as within thirty degrees, such as within fifteen degrees, such as within ten degrees, such as within five degrees, such as within two degrees of the plane defined by the horizontal direction H and the transverse direction T).

[0038] In some embodiments, the top portion 112 is configured as a truss beam handrail of the barrier 100. In some embodiments, the main portion 114 is configured as a debris mesh for the barrier 100. In some embodiments, the bottom portion 116, when included is configured as a toeboard for the barrier 100.

[0039] In one or more embodiments, barrier 100 includes a sheet having a first section 190 and a second section 192. In one or more embodiments, the first section 190 of the sheet extends in the vertical direction V and the horizontal direction H. In one or more embodiments, the second section 192 of the sheet extends in the horizontal direction H and the transverse direction T.

[0040] In one or more embodiments, the barrier 100 is configured to be coupled at a location proximate to an edge of a structure, such as a building. In one or more embodiments, the barrier 100 is configured as an edge protection barrier 100 that prevents, in some examples, an individual and/or debris from falling from the edge of the structure. In one or more embodiments, multiple bar-

riers 100 are coupled together to form an edge protection system.

[0041] Referring now to Figure 2, a perspective view of a portion of the barrier 100 of FIG. 1 is provided, in accordance with an example embodiment. In one or more embodiments, the barrier 100 includes a plurality of first wires extending in the horizontal direction H (e.g., the wires represented by reference characters 110, 120, 130, and 170), and a plurality of second wires (e.g., the wires represented by reference characters 140, 150, 160, 210, and 220). Each of the plurality of second wires can have a first portion 160 that extends in the vertical direction V and a second portion 140 that extends in a direction orthogonal to vertical direction V and at an angle between horizontal direction H and transverse direction T (e.g., at an angle within forty-five degrees of transverse direction T, such as within thirty degrees, such as within fifteen degrees, such as within ten degrees, such as within five degrees, such as within two degrees of transverse direction T). In one or more embodiments, each of the plurality of second wires has a curved portion 150 that joins the first portion 160 with the second portion 140. In one or more embodiments, each of the plurality of second wires comprises a metal, such as aluminum or steel.

[0042] In one or more embodiments, the barrier 100 includes a bar. In one or more embodiments, the bar includes a vertical portion 180 that extends in the vertical direction V and a transverse portion 182 that extends in the transverse direction T. In one or more embodiments, the transverse portion 182 is extended at an angle from transverse direction T (e.g., at an angle within forty-five degrees of transverse direction T, such as within thirty degrees, such as within fifteen degrees of transverse direction T). In one or more embodiments, the vertical portion of the bar 180 runs parallel to the first portions 160 of the plurality of second wires. In one or more embodiments, the transverse portion 182 of the bar is substantially bisected by the midline. In one or more embodiments, the vertical portion 180 of the bar is coupled (e.g., welded) to one or more of the plurality of first wires, e.g., wires 120, 130, and 170. In one or more embodiments, the bar is a rectangular shape. However, in other embodiments, the bar may be any one of a number of different shapes, such as a cylindrical shape. In some embodiments, a round wire is used at the end of the barrier 100.

[0043] Referring back to Figure 1, in one or more embodiments, the first portions 160 of the second wires define a main portion 114 of the barrier 100, which can be configured as debris mesh or debris netting for the barrier. In one or more embodiments, the second portions 140 of each of the plurality of second wires defines the top portion 112 of the barrier 100, which can be configured as a truss beam handrail for the barrier 100. In one or more embodiments, each of the first portions 160 of the plurality of second wires can extend generally parallel to each other along a full length of each of the first portions 160 of the plurality of second wires.

[0044] Referring again to Figure 2, in one or more embodiments, the second portions 140 of each of the plurality of second wires collectively define a midline 230 that extends in the horizontal direction H and substantially bisects the second portions 140. In one or more embodiments, the second portions of each of the plurality of second wires collectively form a zig-zag pattern along the midline. In one or more embodiments, the zig-zag pattern is formed by the second portions of the plurality of second wires being oppositely angled towards opposite horizontal directions from transverse direction T. In one or more embodiments, the zig-zag pattern formed by the second portions of the second wires increases the strength of the barrier. In one or more embodiments, the increased strength resulting from the zig-zag pattern allows a narrower diameter to be used for the second wires, thereby reducing weight of the barrier and decreasing material costs in some examples. In one or more embodiments, using a single wire for the first portion and second portion of a second wire reduces manufacturing cost by allowing less components to be used in some examples while manufacturing the barrier. In one or more embodiments, the diameter of each of the plurality of first wires and each of the plurality of second wires ranges between 3mm and 10mm.

[0045] In one or more embodiments, the midline 230 divides each of the second portions 140 of the plurality of second wires into a proximal portion 210 and a distal portion 220. For each of the plurality of second wires, the proximal portion 210 can be closer to the first portion 160 than the distal portion 220.

[0046] In one or more embodiments, each of the plurality of first wires includes a metal, such as aluminum or steel. In one or more embodiments, each of the plurality of first wires extends generally in the horizontal direction H along a full length of the plurality of first wires. In one or more embodiments, the plurality of first wires includes at least one first wire 110 coupled to (e.g., welded to) the distal portions 220 of each of the second portions 140 of the plurality of second wires. In one or more embodiments, the plurality of first wires includes at least one first wire 120 coupled to (e.g., welded to) the curved portions 150 of the plurality of second wires. In one or more embodiments, the plurality of first wires includes at least one wire 130 coupled to (e.g., welded to) the first portions 160 of the plurality of second wires at a location proximate to the second portions 140 of the plurality of second wires. In one or more embodiments, the plurality of first wires includes at least one wire 170 coupled to (e.g., welded to) the first portions 160 of the plurality of second wires.

[0047] Referring now to Figure 3, a bottom view of barrier 100 is provided, in accordance with an example embodiment. In one or more embodiments, the second section 192 of the sheet is configured as a toeboard for the barrier 100. In one or more embodiments, the second section 192 of the sheet extends in a direction opposite to the transverse direction T from which the second portions 140 of the plurality of second wires are angled based

on. In one or more embodiments, the second section 192 extends in a direction such that the first portions 160 (not shown in FIG. 3) of the plurality of second wires are positioned in between the second section 192 of the sheet and the second portions 140 of the plurality of second wires.

[0048] Referring now to Figure 4, a front view of barrier 100 is provided, in accordance with an example embodiment. In one or more embodiments, a distance D1 defines the length of the barrier extending in the horizontal direction H. In one or more embodiments, distance D1 is 2602 millimeters. In one or more embodiments, distance D1 may be greater than or less than 2602 millimeters. For example, distance D1 may be less than 2602 millimeters, such as less than 2202 millimeters, such as less than 1802 millimeters, such as less than 1402 millimeters, such as less than 1002 millimeters. In one or more embodiments, distance D1 may be greater than 2602 millimeters, such as greater than 3003 millimeters, such as greater than 3402 millimeters, such as greater than 3802 millimeters, such as greater than 4202 millimeters. In one or more embodiments, the length D1 may be greater than the height of the barrier in the vertical direction H. In one or more embodiments, the length D1 may extend the length or width of a structure for which fall protection is desired. In one or more embodiments, a plurality of barriers 100 may be used, and a length or width of a structure for which fall protection is desired may be greater than distance D1. In one or more embodiments, first section 190 of the sheet is coupled to at least a sub-portion of each of the first portions 160 of the plurality of second wires. In one or more embodiments, first section 190 of the sheet is configured as debris mesh for the barrier 100.

[0049] Referring now to Figure 5, a top view of barrier 100 is provided, in accordance with an example embodiment. In one or more embodiments, each of the plurality of second wires comprises a third portion 510. In one or more embodiments, the third portions 510 of the plurality of second wires extends in a direction opposite to the transverse direction T from which the second portions 140 of the plurality of second wires are angled based on. In one or more embodiments, the third portions 510 of the plurality of second wires extend in a direction such that the first portions 160 (not shown in FIG. 5) of the plurality of second wires are positioned between the second portions 140 and the third portions 510. In one or more embodiments, the second section of the sheet 192 is coupled to (e.g., welded to) each of the third portions 510 of the plurality of second wires.

[0050] Referring now to Figure 6, a close-up view of detail circle A of Figure 5 is provided, in accordance with an example embodiment. In one or more embodiments, the second portions 140 of the plurality of second wires are extended at an angle within forty-five degrees of transverse direction T. In one or more embodiments, the second portions 140 of the plurality of second wires are angled such as to form a zig-zag pattern along midline 230. In one or more embodiments, the second portions 140 of the plurality of second wires are alternatively angled in different horizontal directions so as to form a plurality of triangular shapes. On one or more embodiments, the second portions 140 of the plurality of second wires are bent in a direction orthogonal to first portions 160 (not shown in FIG. 6) of the plurality of second wires.

[0051] In one or more embodiments, the zig-zag pattern formed by second portions 140 of the plurality of second wires give strength and durability, in some examples, to the truss beam handrail embodied by top portion 112. In one or more embodiments, this increased strength allows less materials to be used, in some examples, leading to a reduction in weight.

[0052] In one or more embodiments, the plurality of second wires extend from an end 620 at the top portion 112 of barrier 100 to an end 610 at the bottom portion 116 of barrier 100. In one or more embodiments, the continuity of the plurality of second wires between one or more of sections 510, 160, 150, and 140 in allow less material to be used, which eases manufacturing burdens. In one or more embodiments, curved portions 150 of the plurality of second wires connects the first portions 160 and the second portions 140 of the plurality of second wires. In one or more embodiments, top portion 112 of barrier 100 comprises second portions 140 and curved portions 150 of the plurality of second wires. In one or more embodiments, second portions 140 and curved portions 150 of the plurality of second wires are coupled (e.g., welded) to a plurality of first wires, for example, first wires 110 and 120. In one or more embodiments, support from a plurality of first wires 110 and 120 increases strength and durability of the truss beam handrail embodied by top portion 112.

[0053] In one or more embodiments, the bar comprises a second transverse portion 184 coupled to second section 192 of the sheet. In one or more embodiments, the second transverse portion 184 is configured to extend in parallel with the third portions 510 of the plurality of second wires. In one or more embodiments, the second transverse portion is configured to extend in a direction opposite of transverse portion 182 of the same bar. In one or more embodiments, the second transverse portion 184 of the bar extends such that vertical portion 180 of the bar is positioned in between transverse portion 182 and second transverse portion 184 of the bar. In one or more embodiments, at least vertical portion 180 and transverse portion 182 of the bar is coupled to each of the plurality of first wires, e.g., wires 110 and 120.

[0054] Referring now to Figure 7, a side view of the barrier 100 of FIG. 1 is provided, in accordance with an example embodiment. In various examples, at least one of the plurality of first wires (e.g., wires 110 and 120) are positioned directly on, or coupled to, the transverse portion 182 of the bar. In various examples, at least one of the plurality of first wires (e.g., wires 130 and 170) are positioned directly on, or coupled to, the vertical portion 180 of the bar. In one or more embodiments, the barrier

100 includes more or less first wires than depicted in FIG. 7.

[0055] In various examples, and as depicted in FIG. 7, a distance D2 that extends in the transverse direction from end 610 to end 620 is provided. In one or more embodiments, distance D2 represents the transverse distance covered by barrier 100. In one or more embodiments distance D2 is 158 millimeters. In one or more embodiments, D2 may be a distance greater than or less than 158 millimeters. For example, D2 may be less than 158 millimeters, such as less than 138 millimeters, such as less than 118 millimeters, such as less than 98 millimeters, such as less than 78 millimeters. In one or more embodiments, D2 may be greater than 158 millimeters, such as greater than 178 millimeters, such as greater than 198 millimeters, such as greater than 218 millimeters, such as greater than 238 millimeters.

[0056] In various examples, and as depicted in FIG. 7, a distance D3 that extends in the vertical direction for the length of the first portions 160 of the plurality of second wires and/or the vertical portion 180 of the bar is provided. In one or more embodiments, distance D3 represents the vertical distance covered by barrier 100. In one or more embodiments distance D3 is 1149 millimeters. In one or more embodiments, D3 may be a distance greater than or less than 1149 millimeters. For example, D3 may be less than 1149 millimeters, such as less than 1049 millimeters, such as less than 949 millimeters, such as less than 849 millimeters, such as less than 749 millimeters. In one or more embodiments, D3 may be greater than 1149 millimeters, such as greater than 1249 millimeters, such as greater than 1349 millimeters, such as greater than 1449 millimeters, such as greater than 1549 millimeters.

[0057] In one or more embodiments, a ratio D1:D2 may be between 16:1 and 17:1. In one or more embodiments, a ratio D1:D2 may be less than 16:1, such as less than 12:1, such as less than 9:1, such as less than 6:1, such as 3:1.

[0058] In one or more embodiments, a ratio D1:D3 is between 2:1 and 3:1. i be less than 2:1, such as less than 1.5:1, or greater than 3:1, such as greater than 4:1.

[0059] In one or more embodiments, a ratio D3:D2 may be between 7:1 and 8:1. In one or more embodiments, a ratio D3:D2 may be less than 7:1, such as less than 6:1, or greater than 8:1, such as greater than 9:1.

[0060] It should be understood that the specific dimensions provided in relation to FIG. 7 are exemplary and that the barrier 100 can be sized larger or smaller for certain applications. As such, the specific dimensions provided may increase or decrease as the barrier 100 is sized larger or smaller. Therefore, the distances D1, D2, and D3 can define ratios that may provide various benefits.

[0061] Referring now to Figure 8, a closeup view of detail circle B of FIG. 7 is provided, in accordance with an example embodiment. In one or more embodiments, the plurality of first wires may be coupled with transverse portion 182 and/or vertical portion 180 of the bar. In one or more embodiments, first wire 110 of the plurality of first wires is coupled with the transverse portion 182 of the bar at an end proximate to end 620 of the plurality of second wires. In one or more embodiments, first wire 120 of the plurality of first wires is coupled to a curved portion 810 of the bar that connects transverse portion 182 and vertical portion 180. In one or more embodiments, first wire 130 of the plurality of first wires is coupled to the vertical portion 180 of the bar at a position proximate to the curved portion 810 and the transverse portion 182 of the bar.

[0062] In various examples, each of the plurality of first wires (e.g., wires represented by reference characters 110, 120, 130, and 170) and each of the plurality of second wires (e.g., wires represented by reference characters 140, 150, 160, 210, and 220) are generally cylindrical shaped such that they have circular cross-sectional shapes. However, in various other examples, each of the plurality of first wires (e.g., wires represented by reference characters 110, 120, 130, and 170) and/or each of the plurality of second wires (e.g., wires represented by reference characters 140, 150, 160, 210, and 220) have non-circular cross-sectional shapes. For example, each of the plurality of first wires (e.g., wires represented by reference characters 140, 150, 160, 210, and 220) and/or each of the plurality of second wires (e.g., wires represented by reference characters 140, 150, 160, 210, and 220) can have cross-sectional shapes that are triangle-shaped, quadrilateral-shaped, pentagon-shaped, hexagon-shaped, etc.

Conclusion

[0063] The above descriptions of various embodiments of the subject disclosure and corresponding figures and what is described in the Abstract, are described herein for illustrative purposes, and are not intended to be exhaustive or to limit the disclosed embodiments to the precise forms disclosed. It is to be understood that one of ordinary skill in the art may recognize that other embodiments having modifications, permutations, combinations, and additions can be implemented for performing the same, similar, alternative, or substitute functions of the disclosed subject matter, and are therefore considered within the scope of this disclosure. Therefore, the disclosed subject matter should not be limited to any single embodiment described herein, but rather should be construed in breadth and scope in accordance with the appended claims below. Moreover, although the foregoing descriptions and the associated drawings describe example embodiments in the context of certain example combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly de-

scribed above are also contemplated as may be set forth in some of the appended claims. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. A barrier that defines a horizontal direction H, a vertical direction V that is orthogonal to the horizontal direction H, and a transverse direction T that is orthogonal to the horizontal direction H and the vertical direction V, wherein the barrier comprises:

   a plurality of first wires that each extend in the horizontal direction H; and
   a plurality of second wires that each have a first portion that extends in the vertical direction V and a second portion that extends in a direction orthogonal to vertical direction V and at an angle between horizontal direction H and transverse direction T,
   wherein the second portions of each of the plurality of second wires collectively define a midline that extends in the horizontal direction H and substantially bisects the second portions of the plurality of second wires, and
   wherein the second portions of each of the plurality of second wires collectively form a zig-zag pattern along the midline.

2. The barrier of claim 1, wherein at least one of the plurality of first wires is coupled to the plurality of second wires.

3. The barrier of claim 1, wherein the midline defines a proximal portion for each of the second portions of the plurality of second wires and a distal portion for each of the second portions of the plurality of second wires, and wherein at least one of the plurality of first wires is coupled to the distal portions of each of the second portions of the plurality of second wires.

4. The barrier of claim 1, wherein each of the second portions of the plurality of second wires extends within forty-five degrees of the transverse direction T.

5. The barrier of claim 1, wherein each of the plurality of second wires have a curved portion that connects the second portion to the first portion.

6. The barrier of claim 5, wherein at least one of the plurality of first wires is coupled to the curved portions of each the plurality of second wires.

7. The barrier of claim 1, wherein at least one of the plurality of first wires is coupled to the first portions of the plurality of second wires at a location proximate to the second portions of the plurality of second wires.

8. The barrier of claim 1, wherein the zig-zag pattern is formed by the second portions of the plurality of second wires being alternately angled towards opposite horizontal directions.

9. The barrier of claim 1, wherein each of the plurality of second wires have a third portion that extends in a direction opposite to the transverse direction T from which the second portions of the plurality of second wires are angled based on, and wherein the first portions of each of the plurality of second wires are positioned between the second portions and the third portions.

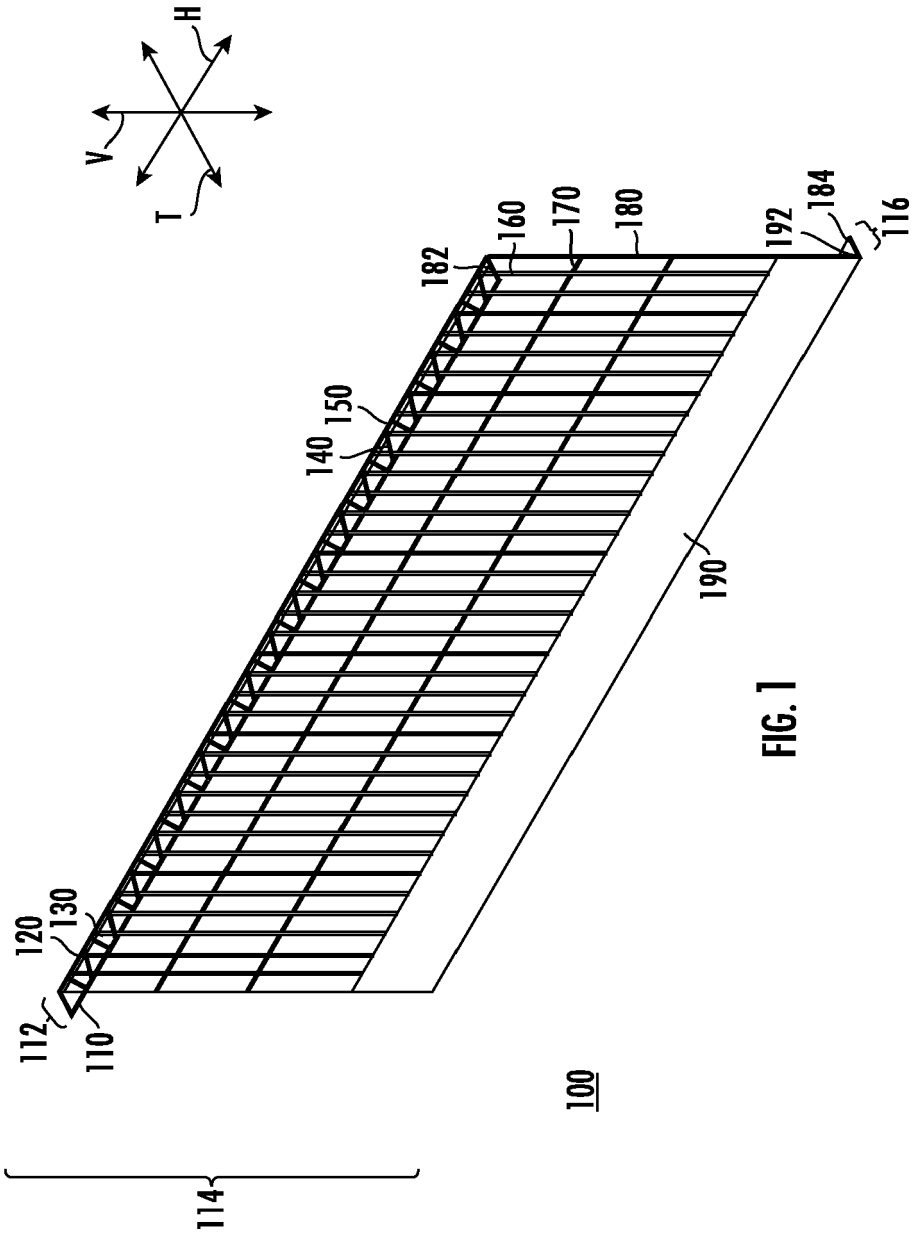
10. The barrier of claim 1, further comprising a sheet comprising a first section extending in the vertical direction V and the horizontal direction H is coupled to at least a sub-portion of each of the first portions of the plurality of second wires.

11. The barrier of claim 10, wherein the sheet further comprises a second section extending in the horizontal direction H and the transverse direction T, and wherein the second section of the sheet is coupled to each of the third portions of the plurality of second wires.

12. The barrier of claim 1, further comprising a bar,

    wherein the bar comprises a vertical portion that extends in the vertical direction V and a transverse portion that extends in the transverse direction T,
    wherein the vertical portion of the bar is parallel to the first portions of the plurality of second wires,
    wherein the transverse portion of the bar is substantially bisected by the midline, and
    wherein the bar is coupled to the plurality of first wires.

13. The barrier of claim 1, wherein the barrier comprises an edge protection barrier.


H
V
T
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192
180
170
160
182
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140
190
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130
112
110
114
100

FIG. 1

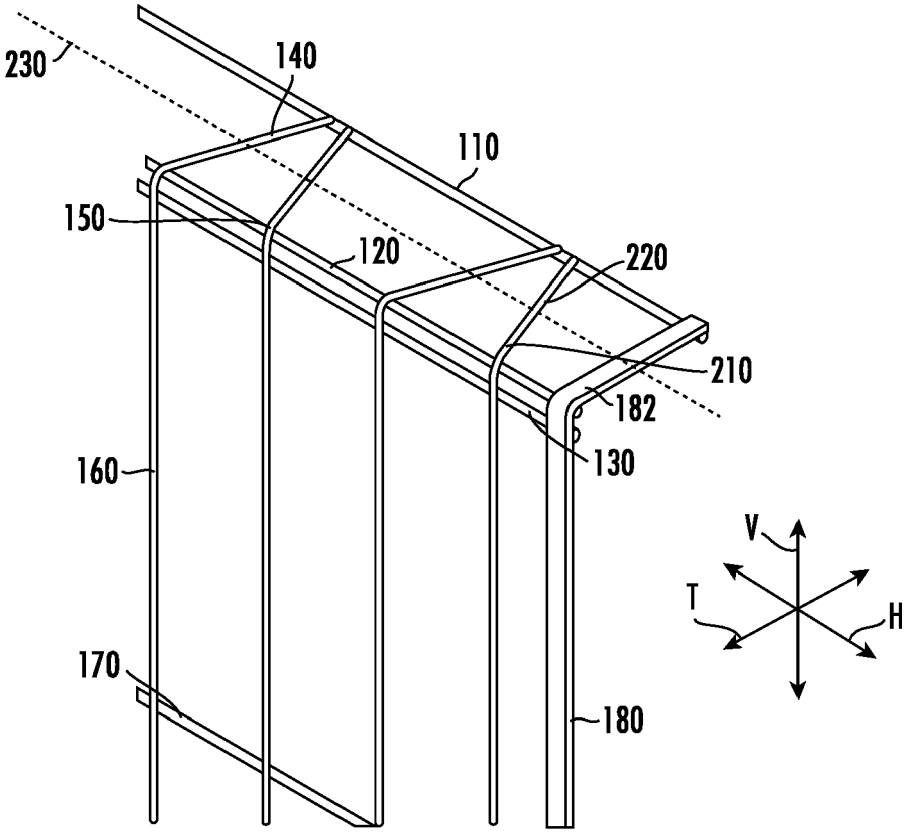

FIG. 2

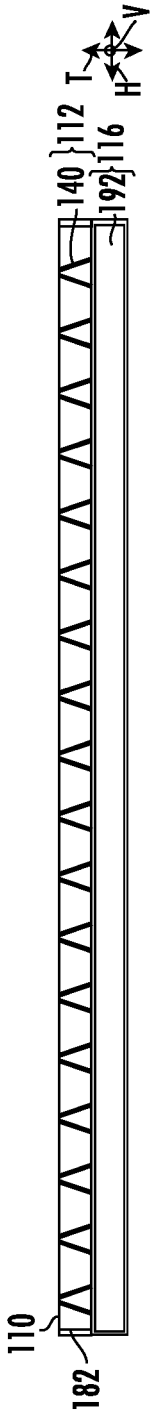

FIG. 3

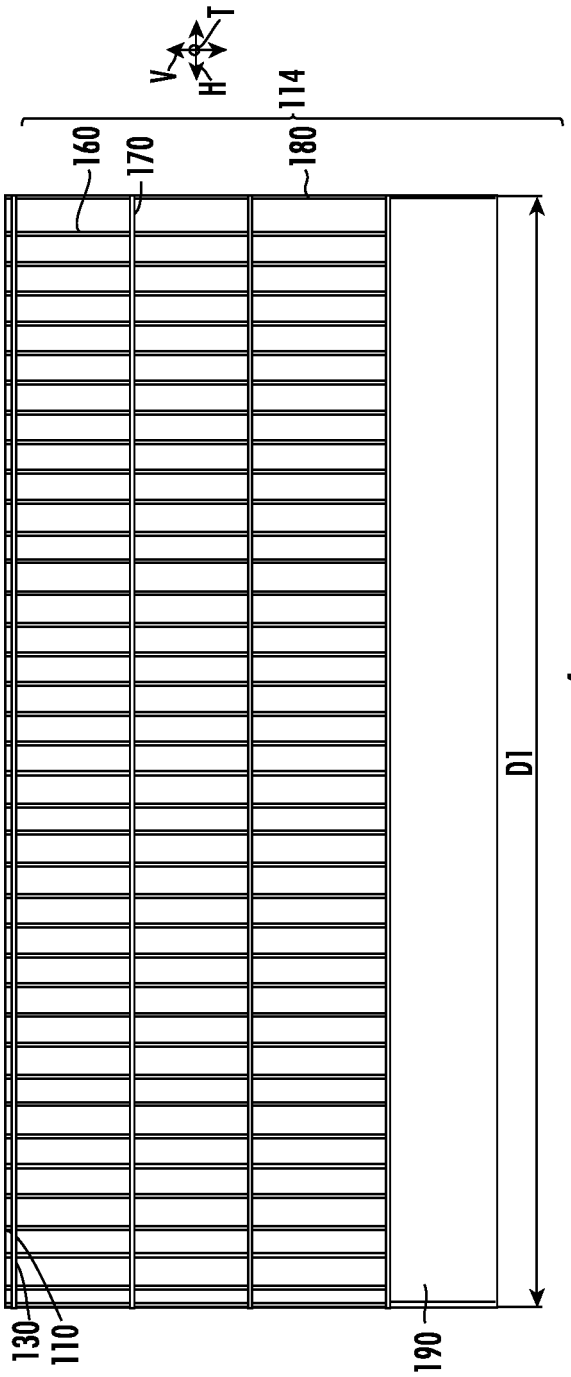

FIG. 4

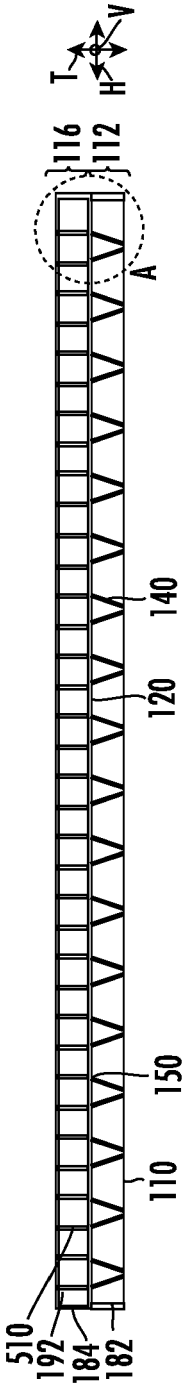

FIG. 5

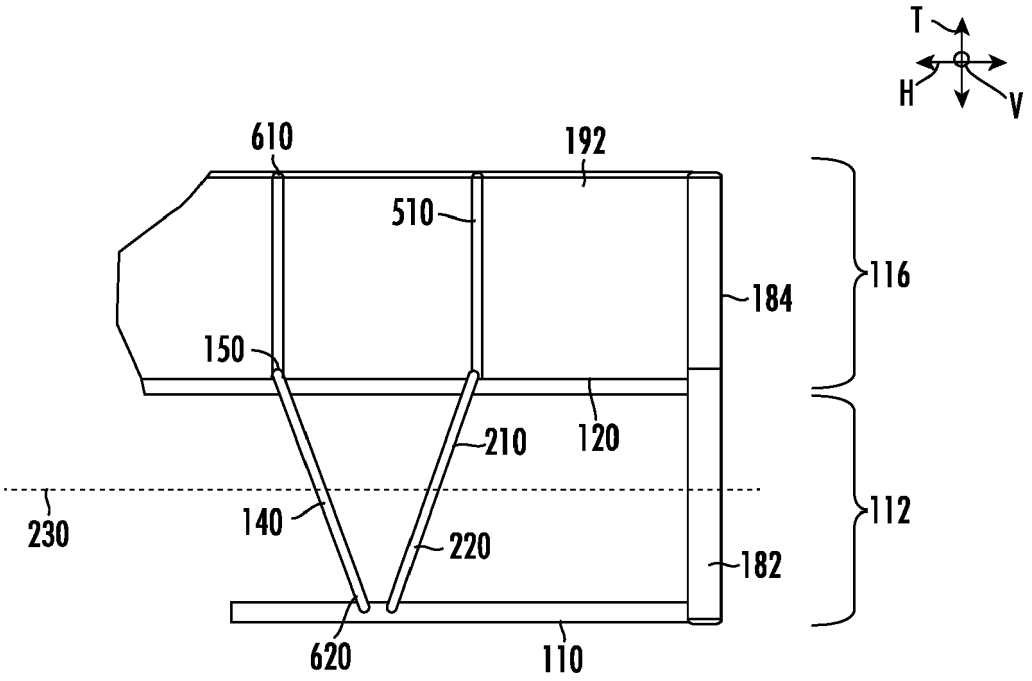

FIG. 6

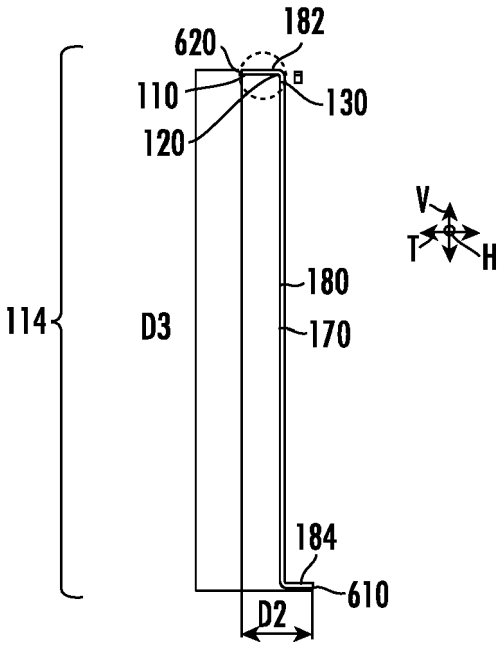
182
620
110
130
120
V
T
H
180
114
D3
170
184
610
D2

FIG. 7

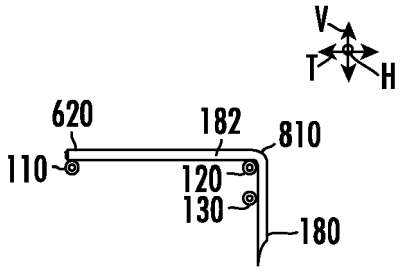
V
T
H
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FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 24 17 0386

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2021/254354 A1 (PERSSON SÖREN [SE]) 19 August 2021 (2021-08-19) * paragraph [0001] - paragraph [0037]; figures 1-4 *	1-13	INV. E04G5/14 E04G21/32 E04H17/16
A	GB 2 411 685 A (HARRIS MARK [GB]) 7 September 2005 (2005-09-07) * figures 1-3 *	1-13	
A	US 6 155 539 A (NAKAYAMA KIYOSHI [JP]) 5 December 2000 (2000-12-05) * figures 1-2 *	1-13	

TECHNICAL FIELDS SEARCHED (IPC)

E04G
E04H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 August 2024	Manera, Marco

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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29-08-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2021254354 A1	19-08-2021	CA 3110273 A1	19-03-2020
		DK 3620592 T3	01-02-2021
		EP 3620592 A1	11-03-2020
		ES 2843198 T3	16-07-2021
		PL 3620592 T3	19-04-2021
		PT 3620592 T	20-01-2021
		US 2021254354 A1	19-08-2021
		WO 2020052975 A1	19-03-2020
GB 2411685 A	07-09-2005	NONE	
US 6155539 A	05-12-2000	AU 7505296 A	11-08-1997
		DE 69632269 T2	26-08-2004
		EP 0882857 A1	09-12-1998
		JP 2954010 B2	27-09-1999
		JP H09195593 A	29-07-1997
		US 6155539 A	05-12-2000
		WO 9726431 A1	24-07-1997

EPO FORM P0459

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