



US 20140193196A1

(19) **United States**(12) **Patent Application Publication**
FOURNIER(10) **Pub. No.: US 2014/0193196 A1**(43) **Pub. Date: Jul. 10, 2014**(54) **GROUND COVER MATS WITH
RECTANGULAR ENDS**(71) Applicant: **MAXXIMAT, INC.**, Nisku (CA)(72) Inventor: **Robert FOURNIER**, Nisku (CA)(21) Appl. No.: **13/798,434**(22) Filed: **Mar. 13, 2013**(30) **Foreign Application Priority Data**

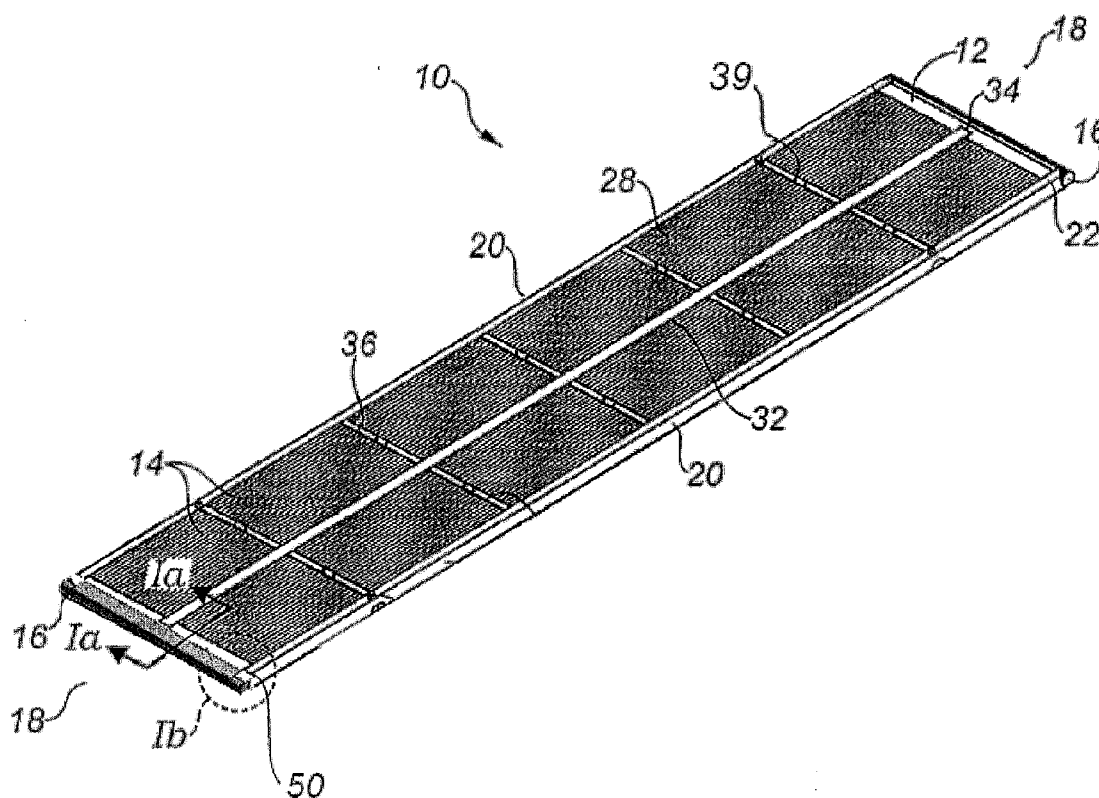
Jan. 4, 2013 (CA) 2800524

Publication Classification(51) **Int. Cl.**
E01C 9/08 (2006.01)(52) **U.S. Cl.**CPC .. **E01C 9/083** (2013.01); **E01C 9/08** (2013.01)USPC **404/35**

(57)

ABSTRACT

Reinforced ground cover mats are used to facilitate the passage of heavy equipment and vehicles on wet or disturbed ground. The ground cover mats are comprised of boards contained within a peripheral metal frame having two substantially parallel opposing end members that are I-beams, the upper and lower horizontal flanges and vertical webs of which define an outer slot into which a reinforcing member is inserted such that the reinforcing member contacts the vertical web and upper and lower horizontal flanges. Flanged caps may be attached to the ends of the reinforcing member to retain a sling looped around the reinforcing member for pulling the mat.



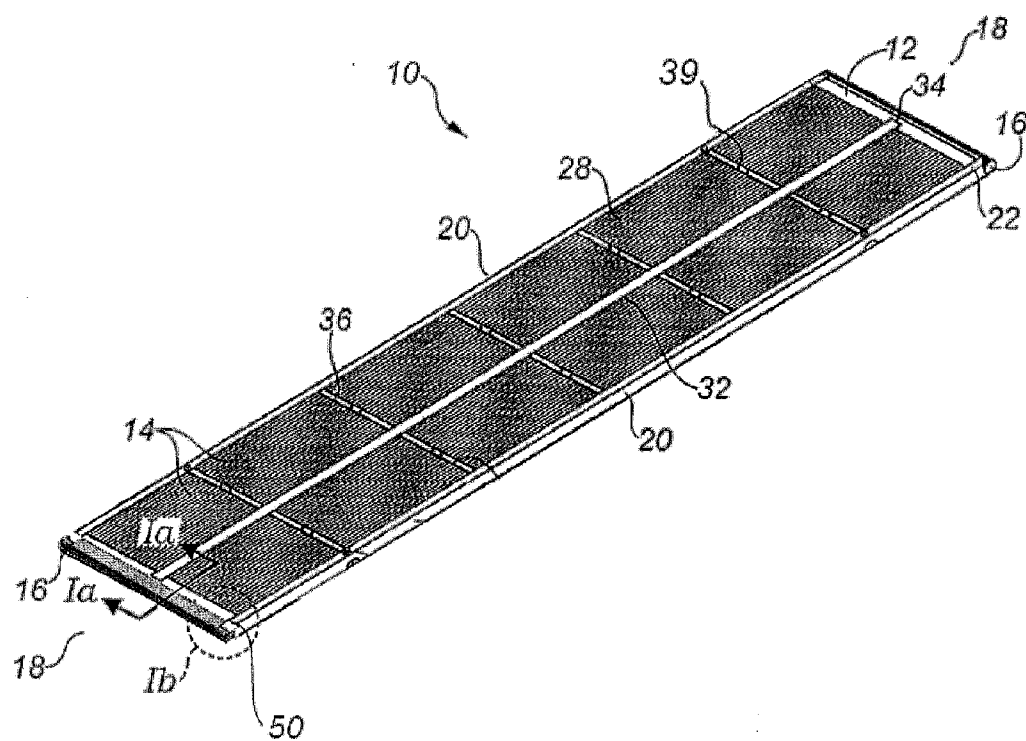


FIG. 1

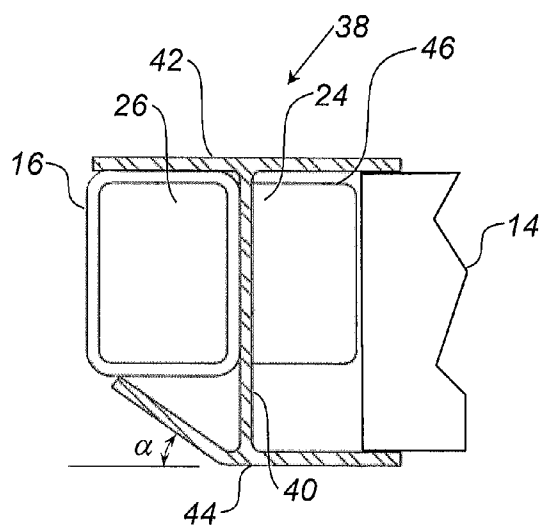


FIG. 2

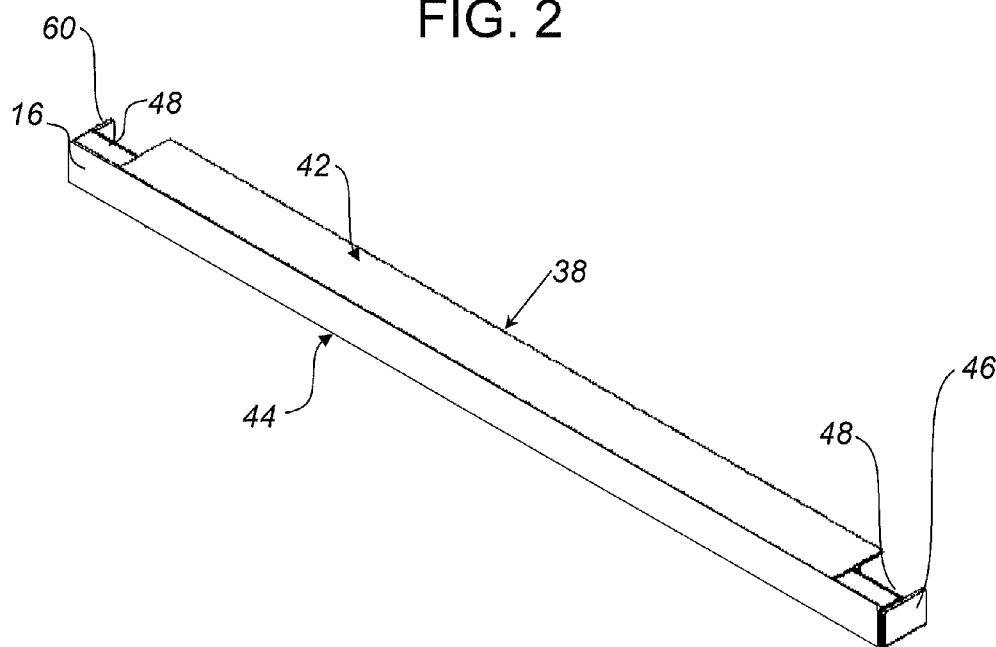


FIG. 3

GROUND COVER MATS WITH RECTANGULAR ENDS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the priority benefit of Canadian Patent Application No. 2,800,524 filed on Jan. 4, 2013 entitled Ground Cover Mats With Rectangular Ends, the contents of which are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to improved ground cover mats.

BACKGROUND OF THE INVENTION

[0003] In the oil and gas industry, it is sometimes necessary to provide ground cover mats with sufficient strength to support heavy equipment and transport trucks over wet or disturbed ground.

[0004] Several prior art ground cover mats exist; however, they sometimes lack sufficient reinforcement to withstand the pressure of heavy equipment and transport trucks, and are expensive to produce. What is needed is an improved ground cover mat which is simple and relatively inexpensive and has sufficient strength and durability to support heavy equipment.

[0005] Further, ground cover mats tend to be extremely heavy and lengthy, making the mats difficult to store, lift, transport, assemble or disassemble. Since a series of mats are generally required to construct a temporary road, an improved ground cover mat which is easy to handle is desirable.

[0006] There have been attempts in the prior art to solve such problems. For example, U.S. Pat. No. 4,462,712 issued Jul. 31, 1984 to Penland, Sr. describes an interlocking mat assembly comprising assemblies of two-ply laminated mats which interlock and are secured together by nailing a top layer of planks over the interlocked mats. However, this mat assembly is particularly labor intensive.

[0007] Canadian Patent No. 1,285,166 issued Jun. 25, 1991 to Pouyer describes a temporary road which includes a plurality of sets, each defined by upper and lower matrices with the upper matrices comprising boards and the lower matrices comprising cross-support members for supporting the boards. The road is constructed by interlocking series of sets in a superimposed assembly, necessitating significant redundancy of effort in assembly and disassembly.

[0008] U.S. Pat. No. 6,695,527 issued Feb. 24, 2004 to Seaux et al. describes interlocking mats constructed of two mirror half pieces which are joined together to form a complete single mat containing an internal cellular structure. Traction promoting elements in the form of raised strips extending outward from the planar surfaces of the mats and aligned with the internal cell forming walls are provided to improve traction and to absorb heavy loading from vehicles and equipment. However, Seaux et al. indicates that when a large number of the raised strips are not specifically positioned in such a manner, the relatively thin outer skin defining the roughly planar surfaces of the mats can become easily deformed by such direct loading.

[0009] U.S. Pat. Nos. 4,600,336 and 5,087,149 issued Jul. 15, 1986 and Feb. 11, 1992 respectively, to Waller describe mat systems having individual mats with alternating offset extensions and recesses along the edges. These systems are

disadvantageous in that the offset extensions are comprised of individual planks which may be subject to warping or splintering when exposed to heavy loads. Further, the offset extensions need to be nailed in place to be secured within the recess of an adjacent mat. An extra plank is secured over the exposed nailed joints of adjacent mats to interlock the mat assemblies together as a roadway, which significantly increases material and labor requirements.

[0010] Canadian Patent No. 2,348,328 issued Oct. 22, 2002 to Stasiewicz et al describes a road mat including, at both of its ends, couplings having retaining lips which engage complementary retaining lips of adjacent mats to prevent separation when weight applied by a vehicle to one road mat is transferred to an adjacent road mat. Canadian Patent No. 2,364,968 issued Jun. 22, 2004 to Stasiewicz et al describes a road mat having end and side interlocks to secure adjacent mats. However, there is no provision in either patent of details regarding attachment of the retaining lips to the mat ends, or the use of any reinforcing structural support.

[0011] The present invention addresses the above shortcomings of the prior art, meeting the need for an improved ground cover mat which has sufficient strength to support heavy equipment, provides easy handling, and is simple and relatively inexpensive.

SUMMARY OF THE INVENTION

[0012] The present invention is directed to ground cover mats. In one aspect of the invention, the invention comprises a ground cover mat comprising:

[0013] (a) a quadrilateral frame comprised of:

[0014] (i) two substantially parallel opposing I-beam end members each comprising an I-beam comprising a vertical web and upper and lower horizontal flanges connected to opposite ends of the vertical web, said horizontal flanges forming inner and outer slots; and

[0015] (ii) two substantially parallel outside longitudinal members, each having an inner channel;

[0016] (b) two opposing major surfaces formed from a plurality of elongate boards retained within the frame, whereby said boards insert into, and are retained by the inner slots of the end members or the inner channel of the longitudinal members, or both;

[0017] (c) a reinforcing member having a rectangular cross-section, attached at each end of the mat, whereby each reinforcing member directly inserts into, and is retained by the outer slots of the I-beams, such that the reinforcing member contacts the vertical web and upper and lower horizontal flanges.

[0018] In another aspect, the invention comprises a method of forming a ground cover mat comprising the steps of

[0019] (a) forming a quadrilateral frame comprised of:

[0020] (i) two substantially parallel opposing I-beam end members each comprising an I-beam comprising a vertical web and upper and lower horizontal flanges connected to opposite ends of the vertical web, said horizontal flanges forming inner and outer slots; and

[0021] (ii) two substantially parallel outside longitudinal members, each having an inner channel;

[0022] (b) forming two opposing major surfaces from a plurality of elongate boards retained within the frame, whereby said boards insert into, and are retained by the inner slots of the end members or the inner channel of the longitudinal members, or both;

[0023] (c) and reinforcing each end member with a reinforcing member having a rectangular cross-section by inserting and attaching the reinforcing member in the outer slot of the I-beams, such that the reinforcing member contacts the vertical web and upper and lower horizontal flanges.

[0024] In one embodiment, the reinforcing member comprises a hollow structural section comprising steel.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The invention will now be described by way of an exemplary embodiment with reference to the accompanying simplified, diagrammatic, not-to-scale drawings.

[0026] FIG. 1 is a diagrammatic representation of a mat of one embodiment of the present invention.

[0027] FIG. 2 is a cross-sectional view of the end assembly of a mat of one embodiment of the present invention in FIG. 1 along line Ia-Ia.

[0028] FIG. 3 is a detail perspective view of the end assembly of a mat of one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0029] The present invention provides for reinforced ground cover mats. When describing the present invention, all terms not defined herein have their common art-recognized meanings. To the extent that the following description is of a specific embodiment or a particular use of the invention, it is intended to be illustrative only, and not limiting of the claimed invention. The following description is intended to cover all alternatives, modifications and equivalents that are included in the spirit and scope of the invention, as defined in the appended claims.

[0030] The invention will now be described having regard to the accompanying Figures. The mat (10) is comprised of a quadrilateral frame (12), and planar surfaces formed from a plurality of elongate boards (14). A suitable mat is described in Applicant's co-owned U.S. Pat. No. 7,934,885, the entire contents of which are incorporated herein by reference, where permitted.

[0031] The quadrilateral frame (12) comprises two substantially parallel opposing end members (18) and two substantially parallel outside longitudinal members (20). Each end member (18) has an inner slot (24) facing the opposing end member (18) and an outer slot (26) facing away from the opposing end member (18). Each longitudinal member (20) has a slot (not shown) facing the opposing longitudinal member (20).

[0032] The elongate boards (14) are retained within the frame (12). The plurality of boards (14) forms two opposing major surfaces (28). The boards (14) insert into, and are retained by the inner slots (24) of the end members (18). In FIG. 2, a board (14) is shown partially inserted into the inner slot of the end member (18). A reinforcing member (16) is attached at each end of the mat (10) in an orientation parallel to the end member (18). Each reinforcing member (16) inserts into, and is retained by the outer slots (26) of the end members (18).

[0033] In one embodiment, each board (14) has a substantially rectangular cross-section and is disposed such that the vertical dimension of the board (14) is larger than the horizontal dimension, thus increasing the bending strength of the mat (10). The boards may be glued together and staggered to increase the strength of the mat. The boards (14) may be

single 2x4 or 2x6 boards or may be constructed using wood layers bonded to composite material layers.

[0034] In one embodiment, the board comprises at least one wood layer bonded to at least one composite material layer. As used herein, the term "composite" refers to any engineered material made from two or more constituent materials with significantly different physical or chemical properties and which remain separate and distinct on a macroscopic level within the finished structure. In one embodiment, the composite material layers may comprise fiberglass; however, such other materials as are commonly used in the art may also be employed for the boards (14).

[0035] The frame (12) is constructed from any suitable material such as steel. In one embodiment, the frame (12) may comprise a third longitudinal member comprising a mid rail (32) which is connected at each end to the midpoint of each end member (18) in an orientation that is substantially parallel to each longitudinal member (20). In one embodiment, the mid rail (32) is an I-beam, thereby having slots (34) facing the longitudinal members (20). The boards (14) insert into, and are retained by the slots (34) on the mid rail (32).

[0036] In one embodiment, a plurality of cross beam straps (36) are arranged in an orientation that is substantially parallel to the opposing end members (18). In one embodiment, each cross-beam strap (36) comprises a flat metal bar, and is connected at one end to the mid rail (32) and at the other end to a longitudinal member (20). The cross beam strap (36) may be butt-welded to the longitudinal members (20) and the mid rail (32), such that they are disposed on top of the boards (14) and flush with the longitudinal members (20) and mid rail (32). In an alternative embodiment, each cross-beam strap (36) is lengthened slightly such that the ends overlap and slide under the longitudinal member (20) channel on one side, and either within the mid rail (32) I-beam channel on the other side or, where there is no mid rail (rail), under the longitudinal member (20) channel (20) on the other side. The strap (36) is then lap welded to the longitudinal member (20) and the mid rail (32) or the other longitudinal rail (20). A transverse groove having a depth approximately equal to the thickness of the cross beam strap (36) is cut into the boards (14) so that the strap (36) is interface of the strap (36) is flush with the major surfaces (28) formed by the boards (14). The cross beam straps (36) may be aligned on either side of the mat, and held together by a pin (38) which is welded in place.

[0037] As shown in FIG. 2, each end member (18) is an I-beam (38) comprising a vertical web (40) and upper and lower horizontal flanges (42, 44) connected to opposite ends of the vertical web (40). The upper and lower horizontal flanges (42, 44) and vertical web (40) form the inner and outer slots (24, 26). The upper and lower horizontal flanges (42, 44) correspond to the top and bottom horizontal portions of the letter "I" as viewed in cross section in FIG. 2. As used herein, the terms "upper" and "lower" refer to the I-beam when in the orientation shown for example in FIG. 2. However, the artisan will recognize that the I-beam can adopt any particular orientation when in use.

[0038] The I-beam (38) is sized to accommodate the board (14) and the reinforcing member (16) accordingly. The I-beam (38) has a length which does not extend past the edges of the lateral members (20) or the length of the reinforcing member (16). In one embodiment, the width of the I-beam (38) is substantially identical to the width of the board (14), as shown in FIG. 1. In one embodiment, not shown, the board (14) may be notched to accommodate the I-beam (38) when

the width of the I-beam (38) is less than the width of the board (14). The I-beam (38) may be formed of structural steel or other suitable materials commonly used in the art.

[0039] The I-beam (38) is positioned in an orientation substantially parallel to the respective end member (18) and perpendicular to the lateral members (20) so as to encase the boards (14) on one side, and the tubular member (16) on the other side. The boards (14) are compressed by the upper and lower horizontal flanges (42, 44) of the I-beam (38). The I-beam (38) is joined to the reinforcing member (16) by welding or other suitable techniques commonly used in the art.

[0040] As shown in FIG. 3, the reinforcing members (16) are longer than the end members (18) and project beyond each end of the end members (18). In one embodiment, the reinforcing members (16) terminate before the outside edge of each lateral member (20) so that they do not impinge on adjacent mats. In one embodiment, the reinforcing members (16) are constructed of hollow structural sections, and have a rectangular cross-section profile. The reinforcing members (16) may be conveniently be formed of commercially available hollow structural sections or other suitable materials commonly used in the art.

[0041] Each end of the reinforcing member (16) has a flanged cap (46) extending beyond the width of the reinforcing member (16). In one embodiment, the flanged cap (46) may cap the entirety of the reinforcing member end (16) as shown in FIGS. 1 and 3. In one embodiment, the flanged cap (46) is formed substantially in the shape of a rectangle with rounded corners. The flanged cap (46) is constructed of steel or other suitable materials commonly used in the art, and are attached to each reinforcing member end (16) by welding or other techniques commonly used in the art. In one embodiment, the reinforcing member (16) is sized to fit fully against the vertical web (40) and between the upper and lower horizontal flanges (42, 44) of the I-beam (38), as shown in FIG. 2.

[0042] A recess (50) in the ends of each lateral member (20) is provided for allowing access to the flange capped ends (48) of the reinforcing members (16). It can be understood that to lift the mat, a sling (not shown) is looped around the flange capped ends (48) of each of the tubular members (16) and is then drawn tight.

[0043] In one embodiment, at least one of the horizontal flanges (42, 44) forming the outer slot (26) of each end member (18) is bent at an angle towards the opposing horizontal flange (42, 44) to contact the reinforcing member (16), thereby securing the reinforcing member (16) between the horizontal flanges (42, 44).

[0044] The dimensions and mechanical properties of the end members (18), reinforcing members (16) and flanged caps (46) may vary according to the size and construction of the mat, and its intended application. In an exemplary configuration, as shown in FIG. 3, the end member (18) is approximately 84-inches long, with the I-beam (38) having a total depth of approximately 6-inches, horizontal flanges (42, 44) approximately 6-inches wide and 0.26-inches thick, and a web approximately 0.23-inches thick. The angle, α , between the horizontal and the bent arm of the lower flange (44) may be approximately 35°. The reinforcing member (16) is about 96-inches long, and has a hollow structural section approximately 4-inches in height, 3-inches in width and 0.25-inch in wall thickness. The flanged cap (46) is approximately 3.5-inches in height, 5-inches in width, and 0.375-inches in thickness. The end member (18) and the flanged caps (46) are

made of structural steel having a yield strength at least approximately 300 MPa, and the reinforcing member is made of structural steel having a yield strength of at least approximately 345 MPa.

1. A ground cover mat comprising:

(a) a quadrilateral frame defining a lateral direction and a longitudinal direction, and comprised of:

- (i) two substantially parallel opposing lateral I-beam end members each comprising an I-beam comprising a vertical web and upper and lower horizontal flanges connected to opposite ends of the vertical web, said horizontal flanges forming inner and outer slots; and
- (ii) two substantially parallel outside longitudinal members, each having an inner channel;

(b) two opposing major surfaces formed from a plurality of elongate boards retained within the frame, whereby said boards insert into, and are retained by the inner slots of the end members or the inner channel of the longitudinal members, or both;

(c) a reinforcing member having a rectangular cross-section, attached at each end of the mat, whereby each reinforcing member directly inserts into, and is retained by the outer slots of a different one of the I-beams, such that the reinforcing member contacts the vertical web and upper and lower horizontal flanges of that I-beam, and wherein the rectangular cross-section is sized to fit fully, in the longitudinal direction, within the outer slot of that I-beam.

2. The mat of claim 1 wherein the reinforcing member comprises a hollow structural section.

3. The mat of claim 1 wherein the reinforcing members are longer than the end members and project beyond each end of the end members, and wherein each end of the reinforcing member has a flanged cap extending beyond the width of the reinforcing member.

4. The mat of claim 3 wherein the flanged cap is a rectangular plate.

5. The mat of claim 1 wherein at least one of the horizontal flanges forming the outer slot of each end member is bent at an angle towards the opposing horizontal flange.

6. The mat of claim 5 wherein the lower horizontal flange is bent upwards at an angle of about 35°.

7. A method of forming a ground cover mat comprising the steps of

(a) forming a quadrilateral frame defining a lateral direction and a longitudinal direction, and comprised of:

- (i) two substantially parallel opposing lateral I-beam end members each comprising an I-beam comprising a vertical web and upper and lower horizontal flanges connected to opposite ends of the vertical web, said horizontal flanges forming inner and outer slots; and
- (ii) two substantially parallel outside longitudinal members, each having an inner channel;

(b) forming two opposing major surfaces from a plurality of elongate boards retained within the frame, whereby said boards insert into, and are retained by the inner slots of the end members or the inner channel of the longitudinal members, or both; and

(c) and reinforcing each end member with a reinforcing member having a rectangular cross-section by inserting and attaching the reinforcing member in the outer slot of one of the I-beams, such that the reinforcing member contacts the vertical web and upper and lower horizontal flanges of that I-beam, and wherein the rectangular

cross-section is sized to fit fully, in the longitudinal direction, within the outer slot of that I-beam.

8. The method of claim **7** wherein each reinforcing member comprises a hollow structural section comprising steel.

9. The mat of claim **1** wherein the rectangular cross-section is further sized to be substantially co-terminal, in the longitudinal direction, with the horizontal flange of that I-beam when inserted in the outer slot of that I-beam.

10. The method of claim **7** wherein the rectangular cross-section is further sized to be substantially co-terminal, in the longitudinal direction, with the horizontal flange of that I-beam when inserted in the outer slot of that I-beam.

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