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Inventor(s)	Fiutak; Jon C. et al.

FRAME ASSEMBLY FOR A TEMPORARY STRUCTURE AND METHOD OF ASSEMBLY

Abstract

A frame assembly for use in a temporary structure includes two compression members, two tension members, a roof support assembly, a restraint member, and a plurality of tension rods. A first end of each compression member is attached to the roof support assembly. Each tension member is attached a lower portion of one of the compression members and to a distal end of the roof support assembly, and the restraint member is connected between a second end of each of the two compression members.

Inventors: **Fiutak; Jon C. (Cape Elizabeth, ME), Joyce; Sean P. (Veazie, ME), Weber, Jr.; James F. (Eugene, OR)**

Applicant: **Anthony Hardwood Composites, Inc.** (Sheridan, AR)

Family ID: **1000008477461**

Assignee: **Anthony Hardwood Composites, Inc. (Sheridan, AR)**

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Background/Summary

BACKGROUND OF THE INVENTION

[0001] This invention relates in general to a temporary structure. In particular, this invention relates to an improved frame assembly used in a temporary structure, a method of assembling the individual frame assembly, and a method for assembling a temporary structure from multiple assembled individual frame assemblies.

[0002] There is a need in outdoor work environments, particularly at construction sites, for temporary structures. However, conventional structures may be large, heavy, and/or difficult to move, assemble, and disassemble. Thus, it would be desirable to provide an improved frame assembly used in a temporary structure, a method of assembling the individual frame assembly, and a method for assembling a temporary structure from multiple assembled individual frame assemblies.

SUMMARY OF THE INVENTION

[0003] This invention relates to an improved frame assembly used in a temporary structure, a method of assembling the individual frame assembly, and a method for assembling a temporary structure from multiple assembled individual frame assemblies. The frame assembly includes two compression members, two tension members, a roof support assembly, a restraint member, and a plurality of tension rods. A first end of each compression member is attached to the roof support assembly. Each tension member is attached to a lower portion of one of the compression members and to a distal end of the roof support assembly, and the restraint member is connected between a second end of each of the two compression members.

[0004] In another embodiment, a method of assembling a frame assembly for use in a temporary structure includes attaching two compression members to an roof support assembly with a plurality of straps, attaching a first end of each of a pair of tension members to the roof support assembly with a plurality of the straps, attaching a second end of each of the pair of tension members to each compression member with a plurality of the straps, attaching a first pair of tension rods between a mid-point of each compression member and each tension member, attaching two second pairs of the tension rods between first ends of the compression members on opposite sides thereof, and attaching a restraint member between second ends of each of the two compression members, thereby defining the frame assembly.

[0005] In an additional embodiment, a temporary structure includes a plurality of frame assemblies, wherein each frame assembly includes two compression members, two tension members, a roof support assembly, a restraint member, two first pairs of tension rods, and two second pairs of tension rods. A first end of each compression member is attached to the roof support assembly. Each tension member is attached to a lower portion of one of the compression members and to a distal end of the roof support assembly, and the restraint member is connected between a second end of each of the two compression members. The temporary structure also includes two third pairs of tension rods, wherein each of the plurality of frame assemblies is connected to an adjacent one the plurality of frame assemblies with the two third pairs of tension rods.

[0006] In a further embodiment, a method of assembling a temporary structure includes attaching two compression members to a roof support assembly with a plurality of straps, attaching a first

end of each of a pair of tension members to the roof support assembly with a plurality of the straps, attaching a second end of each of the pair of tension members to each compression member with a plurality of the straps, attaching a first pair of tension rods between a mid-point of each compression member and each tension member, attaching two second pairs of the tension rods between first ends of the compression members on opposite sides thereof, and attaching a restraint member between second ends of each of the two compression members, thereby defining a frame assembly. Adjacent ones of a plurality of the frame assemblies are then attached together with two third pairs of the tension rods.

[0007] Various aspects of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in view of the accompanying drawings.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. **1** is a perspective view of a temporary structure in accordance with this invention.

[0009] FIG. **2** is a front elevational view of a first embodiment of the frame assembly illustrated in FIG. **1** shown fully assembled.

[0010] FIG. **3** is a top plan view of the temporary structure illustrated in FIG. **1**, shown with the roof removed.

[0011] FIG. **4** is a side elevational view of the temporary structure illustrated in FIGS. **1** and **3**.

[0012] FIG. **5** is an enlarged view taken within circle **5** in FIG. **4**.

[0013] FIG. **6** is a perspective view of the frame assembly illustrated in FIG. **2**.

[0014] FIG. **7** an enlarged view taken within circle **7** in FIG. **6**.

[0015] FIG. **8** an enlarged view taken within circle **8** in FIG. **6**.

[0016] FIG. **9** an enlarged view taken within circle **9** in FIG. **6**.

[0017] FIG. **10** an enlarged view taken within circle **10** in FIG. **6**.

[0018] FIG. **11** an enlarged view taken within circle **11** in FIG. **6**.

[0019] FIG. **12**A is a front elevational view of a first step of the method of assembling the frame assembly illustrated in FIGS. **2** and **6**.

[0020] FIG. **12**B is a front elevational view of a second step of the method of assembling the frame assembly illustrated in FIGS. **2** and **6**.

[0021] FIG. **12**C is a front elevational view of a third step of the method of assembling the frame assembly illustrated in FIGS. **2** and **6**.

[0022] FIG. **12**D is a front elevational view of a fourth step of the method of assembling the frame assembly illustrated in FIGS. **2** and **6**.

[0023] FIG. **12**E is a front elevational view of a fifth step of the method of assembling the frame assembly illustrated in FIGS. **2** and **6**.

[0024] FIG. **12**F is a front elevational view of a sixth step of the method of assembling the frame assembly illustrated in FIGS. **2** and **6**.

[0025] FIG. **13** is a perspective view of a second embodiment of the temporary structure illustrated in FIG. **1**.

[0026] FIG. **14** an enlarged view taken within circle **14** in FIG. **13**.

[0027] FIG. **15** is an enlarged front elevational view of the frame foot connector illustrated in FIGS. **13** and **14**.

[0028] FIG. **16** is a side elevational view of the temporary structure illustrated in FIG. **13**.

[0029] FIG. **17** an enlarged view taken within circle **17** in FIG. **16**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0030] Referring now to the drawings, there is illustrated at **10** in FIGS. **1** through **4** a basic

structure of a temporary structure **10** in accordance with this invention. The temporary structure **10** includes a plurality of frame assemblies **12** connected by a plurality of third tension rods **35**, described below, and a roof **16**. The roof **16** may be formed by a plurality of roof panels **17**, formed from any desired material such as but not limited to wood, steel and other metals, fiberglass, PVC panels, and coated fabric.

[0031] As best shown in FIG. **2**, each frame assembly **12** includes a lower restraint member **18** connected between two compression members **20**. The frame assembly **12** also includes a roof support assembly **22** having three roof support members **24**, bound together, and extending between and beyond each of the two compression members **20**. Tension members **26** extend between a lower portion of each of the compression members **20** and the distal ends of the roof support assembly **22**. As best shown in FIG. **7**, a first one of the roof support members **24** (the lower roof support member when viewing FIGS. **2** and **7**) may be attached to the compression members **20** with a plurality of straps **28**. In the illustrated embodiment of the frame assembly **12**, the straps **28** are attached to opposite sides of the compression members **20** with threaded fasteners, such as bolts and nuts. Second and third ones of the roof support members **24** may be attached to the first one of the roof support members **24** with brackets **30** to define the roof support assembly **22**. It will be understood that the roof support assembly **22** may have more than three or less than three roof support members **24**.

[0032] Similarly, a third one of the roof support members **24** (the upper roof support member when viewing FIGS. **2** and **7**) may be attached to the tension members **26** with a plurality of the straps **28**. In the illustrated embodiment of the frame assembly **12**, the straps **28** are attached to opposite sides of the tension members **26** with threaded fasteners, such as bolts and nuts. A second end of each tension member **26** may be attached to each compression members **20** with a plurality of the straps **28**. In the illustrated embodiment of the frame assembly **12**, the straps **28** are attached to opposite sides of the compression members **20** and the tension members **26** with threaded fasteners, such as bolts and nuts, as shown in FIG. **10**.

[0033] As best shown in FIG. **9**, a pair of first tension rods **32** extend between a pair of the straps **28** mounted at a mid-point of each compression member **20** and one of the straps **28** that connect each side of the roof support assembly **22** to the tension members **26**. Two pairs of second tension rods **34** extend between first ends of the compression members **20** (the upper end when viewing FIG. **2**) on opposite sides thereof. A first end **34**A of each of the tension rods **34** is attached to one of the straps **28** that connects the compression member **20** to the roof support assembly **22**, as shown in FIG. **7**, and a second end **34**B of each of the tension rods **34** is attached to a strap **28** mounted to the compression member **20** adjacent to the first end **34**A (below the first end **34**A when viewing FIGS. **2** and **6**), as shown in FIG. **11**.

[0034] The illustrated tension rods **32**, **34**, and **35** are formed from steel, however the tension rods **32**, **34**, and **35** may also be formed from other metals, including, but not limited to, other metals, cable, nylon, and composite pultrusion. The distal ends of the tension rods **32**, **34**, and **35** are threaded and are connected to the frame assembly **12** by a pivoting mount **36**. The second tension rods **34** may be formed in sections and connected by a threaded coupling nut **38**.

[0035] The illustrated lower restraint member **18** may be a strap formed from any desired material including, but not limited to, steel, wood, rope, and composite materials. The distal ends of the lower restraint member **18** are attached to each compression member by any desired means including, but not limited to threaded fasteners and straps. Alternatively, the lower restraint member **18** may be a chain, a cable that is formed from any desired material such as steel, or the lower restraint member **18** may be a rod, similar to the tension rods **32**, **34**, and **35**.

[0036] The illustrated straps **28** are steel straps about 3.0 in wide, 0.375 in thick, and have holes formed therethrough spaced about 3.0 in apart. The lengths of the straps **28** will vary depending on where on the frame assembly **12** the straps **28** are used. It will be understood that the straps **28** may may be formed from other materials, and have other widths and thicknesses.

[0037] Each of the compression members **20**, roof support members **24**, and tension members **26** may be formed from laminated hardwood beams. Alternatively, the compression members **20**, roof support members **24**, and tension members **26** may be formed from laminated softwood beams.
[0038] Advantageously, the components of the frame assembly **12**, i.e., the roof support members **24**, the compression members **20**, the tension rods **32**, **34**, and **35**, and the lower restraint member **18** are shipped un-assembled and may be assembled together at a work or construction site. The method of assembling each frame assembly **12** from its components is shown in FIGS. **12**A through **12**F.
[0039] As shown in FIG. **12**A, each frame assembly **12** may be assembled such that it includes two compression members **20** attached to the roof support assembly **22** via the straps **28**, and two tension members **26**, attached via the straps **28** as described above. The pairs of first tension rods **32** are also attached and extend between the straps **28** mounted at the mid-point of each compression member **20** and the straps **28** that connect each tension member **26** to the roof support assembly **22**. As shown in FIG. **12**A, the roof support assembly **22** is in a first position wherein the roof support assembly **22** is flat, i.e., wherein the roof support assembly **22** has not been bent into an arcuate shape.
[0040] As shown in FIGS. **12**B through **12**E, distal ends **21** of the compression members **20** are pulled together, thus bending the roof support assembly **22** into a second or arcuate shape. As shown in FIG. **12**E, the distal ends **21** of the compression members **20** are pulled together until the compression members **20** are vertically oriented, but not necessarily parallel, with each other (see the arrows A). For example, the compression members **20** may be pulled together until they are as an angle B of about 10 degrees to about 20 degrees from a line L2 that is parallel to a center line L1 of the frame assembly **12**. The compression members **20** may be pulled together by any desired means, including, but not limited to, a ratchet strap, a come-along tool, and other mechanical means.
[0041] As the distal ends **21** of the compression members **20** are pulled together and achieve the shape shown in FIG. **12**E, the roof support assembly **22** is bent into the second or arcuate shape, the compression members **20** are compressed, and tension is applied to the tension members **26**.
[0042] As shown in FIG. **12**F, after the frame assembly **12** has achieved the shape shown in FIG. **12**E, the pairs of second tension rods **34** are attached as described above, and the lower restraint member **18** is connected between the distal ends **21** of the compression members **20**, thus completing assembly of the frame assembly **12**.
[0043] Once a desired number of frame assemblies **12** are assembled, they may then be assembled together with the third tension rods **35**. As best shown in FIGS. **1** and **3** through **5**, adjacent and spaced apart frame assemblies **12** are connected together with two pairs of the third tension rods **35**. One end of a first one of each pair of third tension rods **35** is connected to one of the straps **28** that connects the compression member **20** to the roof support assembly **22** at an upper end of the compression member **20** of a first frame assembly **12**A (see FIGS. **4** and **5**). The other end of the first one of each pair of third tension rods **35** is connected to one of the straps **28** that connects the tension member **26** to the compression member **20** of a second, adjacent frame assembly **12**B (see FIG. **4**). Similarly, one end of a second one of each pair of third tension rods **35** is connected to one of the straps **28** that connects the compression member **20** to the roof support assembly **22** at an upper end of the compression member **20** of the second frame assembly **12**B (see FIGS. **4** and **5**). The other end of the second one of each pair of third tension rods **35** is connected to one of the straps **28** that connects the tension member **26** to the compression member **20** of the first frame assembly **12**A (see FIG. **4**).
[0044] Roof panels **17** may then be mounted to the roof support assemblies **22** to define the roof **16**, thus defining the temporary structure **10**. In the illustrated embodiment of the temporary structure **10**, five frame assemblies **12** are shown. It will be understood that a temporary structure **10** as described herein may be assembled with more or less than five frame assemblies **12**.

[0045] Although the temporary structure **10** is shown with the lower restraint member **18**, it will be understood that other methods may be used to ensure that after the distal ends **21** of the compression members **20** are pulled together to achieve the shape shown in FIG. **12**E, the compressed shape is retained. For example, the distal ends **21** of the compression members **20** may be anchored into the ground or other surface material upon which the temporary structure is built. If built on a paved or other hard surface, such as concrete, the distal ends **21** of the compression members **20** may be positioned in holes or grooves formed in the hard surface to retain the compression members **20** in place. Additionally, each compression member **20** may be pinned or otherwise attached to a stake **40** embedded in the ground or paved surface, as shown in FIG. **4**. Alternatively, each compression member **20** may abut a stake **42** or other retaining structure that extends outwardly from the ground or paved surface, such as shown in FIG. **2**.
[0046] Advantageously, the illustrated temporary structure **10** may be assembled and erected on a plurality of surfaces, including the ground, a paved or other hard surface, such as concrete, and wood, wood laminate, or composite mat and road products, such as described in U.S. Pat. Nos. 7,137,226, 7,818,929, 8,906,480, and 10,125,458, the disclosures of which are incorporated herein by reference in their entireties.
[0047] FIGS. **13** through **17** illustrate a second embodiment of the temporary structure **110**. As shown in FIGS. **13** through **17**, the temporary structure **110** is similar to the temporary structure **10**, but is configured for erecting on two parallel elongated mats **50** formed from billets **52**. Adjacent billets **52** are spaced apart by longitudinally extending spaces **54**. For example, when the temporary structure **10** will be assembled and erected on a wood, wood laminate, or composite mat or road product, such as the mats **50**, a frame foot connector **44** may be mounted to the distal ends **21** of the compression members **20**. As shown in FIG. **15**, each frame foot connector **44** includes a body **46** having two outwardly extending blades **48** configured to be inserted into the longitudinally extending spaces **54** between the adjacent billets **52** of the elongated mat **50**. Additionally, a chain assembly **56** may be attached to each frame assembly **12** after assembly to aid in lifting and erecting the frame assembly **12**. If desired, the chain assembly **56** may be used to anchor the end-most frame assemblies **12** of the temporary structure **10** to the mats **50**.
[0048] If desired, as shown in FIG. **13**, a plurality of the lower restraint members **18** may be attached between the two mats **50** to connect the two mats **50** together and ensure that the two mats **50** remain a fixed distance apart.
[0049] The principle and mode of operation of this invention have been explained and illustrated in its preferred embodiment. However, it must be understood that this invention may be practiced otherwise than as specifically explained and illustrated without departing from its spirit or scope.

Claims

1. A frame assembly for use in a temporary structure comprising: two compression members; two tension members; a roof support assembly in a first position wherein the roof support assembly is flat; a restraint member; and a plurality of tension rods; wherein a first end of each compression member is attached to the roof support assembly; wherein each tension member is attached a lower portion of one of the compression members and to a distal end of the roof support assembly; and wherein the restraint member is connected between a second end of each of the two compression members, such that when the restraint member is connected, the second ends of the compression members are pulled together, thus bending the roof support assembly into a second, arcuate shape.
2. The frame assembly according to claim 1, wherein the roof support assembly includes three roof support members, bound together, and extending between and beyond each of the two compression members.
3. The frame assembly according to claim 1, wherein the compression members are attached to the roof support assembly with a plurality of straps.

4. The frame assembly according to claim 3, wherein a first end of each tension member is attached to the roof support assembly with a plurality of the straps.
5. The frame assembly according to claim 4, wherein a second end of each tension member is attached to each compression member with a plurality of the straps.
6. The frame assembly according to claim 5, wherein the plurality of tension rods includes two first pairs of tension rods and two second pairs of tension rods; and wherein one of the two first pairs of tension rods extends between a mid- point of each compression member and the first end of each tension member.
7. The frame assembly according to claim 6, wherein a first end of each of the two first pairs of tension rods is attached to the straps that connect each tension member to the roof support assembly, and a second end of each of the two first pairs of tension rods is attached to a strap mounted at the mid-point of each compression member.
8. The frame assembly according to claim 7, wherein the two second pairs of tension rods extend between the first ends of the compression members on opposite sides thereof.
9. The frame assembly according to claim 8, wherein a first end of a first rod of each of the two second pairs of tension rods is attached to one of the straps that connects each compression member to the roof support assembly, and a second end of the first rod of each of the two second pairs of tension rods is attached to a strap mounted to the compression member adjacent to the first end of a second rod of each of the two second pairs of tension rods.
10. A method of assembling a frame assembly for use in a temporary structure, the method comprising: attaching two compression members to a roof support assembly with a plurality of straps, wherein the roof support assembly is in a first position wherein the roof support assembly is flat; attaching a first end of each of a pair of tension members to the roof support assembly with a plurality of the straps; attaching a second end of each of the pair of tension members to each compression member with a plurality of the straps; attaching a first pair of tension rods between a mid-point of each compression member and each tension member; attaching two second pairs of the tension rods between first ends of the compression members on opposite sides thereof; pulling distal ends of the compression members together, thus bending the roof support assembly into a second, arcuate shape, compressing the compression members, and applying tension to the tension members; and attaching a restraint member between second ends of each of the two compression members, thereby defining the frame assembly.
11. The method according to claim 10, wherein the first end of each of the first pair of the tension rods is attached to the straps that connect each tension member to the roof support assembly, and the second end of each of the first pair of the tension rods is attached to a strap mounted at the mid-point of each compression member.
12. The method according to claim 11, wherein the two second pairs of the tension rods extend between first ends of the compression members on opposite sides thereof.
13. The method according to claim 12, wherein the first end of a first rod of each of the two second pairs of tension rods is attached to one of the straps that connects each compression member to the roof support assembly, and a second end of the first rod of each of the two second pairs of tension rods is attached to a strap mounted to the compression member adjacent to the first end of a second rod of each of the two second pairs of tension rods.
14. A temporary structure comprising: a plurality of frame assemblies including: two compression members; two tension members; a roof support assembly in a first position wherein the roof support assembly is flat; a restraint member; two first pairs of tension rods; and two second pairs of tension rods; wherein a first end of each compression member is attached to the roof support assembly; wherein each tension member is attached a lower portion of one of the compression members and to a distal end of the roof support assembly; and wherein the restraint member is connected between a second end of each of the two compression members, such that when the restraint member is connected, the second ends of the compression members are pulled together,

thus bending the roof support assembly into a second, arcuate shape; and two third pairs of tension rods; wherein each of the plurality of frame assemblies is connected to an adjacent one the plurality of frame assemblies with the two third pairs of tension rods.

15. The temporary structure according to claim 14, wherein a first end of a first rod of each third pair of tension rods is connected to a first end of each compression member of a first frame assembly; wherein a second end of the first rod of each third pair of tension rods is connected to a second end of each compression member of a second frame assembly, adjacent the first frame assembly; wherein a first end of a second rod of each third pair of tension rods is connected to a second end of each compression member of the first frame assembly; and wherein a second end of the second rod of each third pair of tension rods is connected to a first end of each compression member of the second frame assembly, adjacent the first frame assembly.

16. A method of assembling a temporary structure, the method comprising: attaching two compression members to a roof support assembly with a plurality of straps, wherein the roof support assembly is in a first position wherein the roof support assembly is flat; attaching a first end of each of a pair of tension members to the roof support assembly with a plurality of the straps; attaching a second end of each of the pair of tension members to each compression member with a plurality of the straps; attaching a first pair of tension rods between a mid-point of each compression member and each tension member; attaching two second pairs of the tension rods between first ends of the compression members on opposite sides thereof; pulling distal ends of the compression members together, thus bending the roof support assembly into a second, arcuate shape, compressing the compression members, and applying tension to the tension members; attaching a restraint member between second ends of each of the two compression members, thereby defining a frame assembly; and attaching adjacent ones of a plurality of the frame assemblies together with two third pairs of the tension rods.

17. The method according to claim 16, wherein a first end of a first rod of each third pair of tension rods is connected to a first end of each compression member of a first frame assembly; wherein a second end of the first rod of each third pair of tension rods is connected to a second end of each compression member of a second frame assembly, adjacent the first frame assembly; wherein a first end of a second rod of each third pair of tension rods is connected to a second end of each compression member of the first frame assembly; and wherein a second end of the second rod of each third pair of tension rods is connected to a first end of each compression member of the second frame assembly, adjacent the first frame assembly.

18. The method according to claim 17, further including attaching a roof to the roof support assemblies of each frame assembly.