



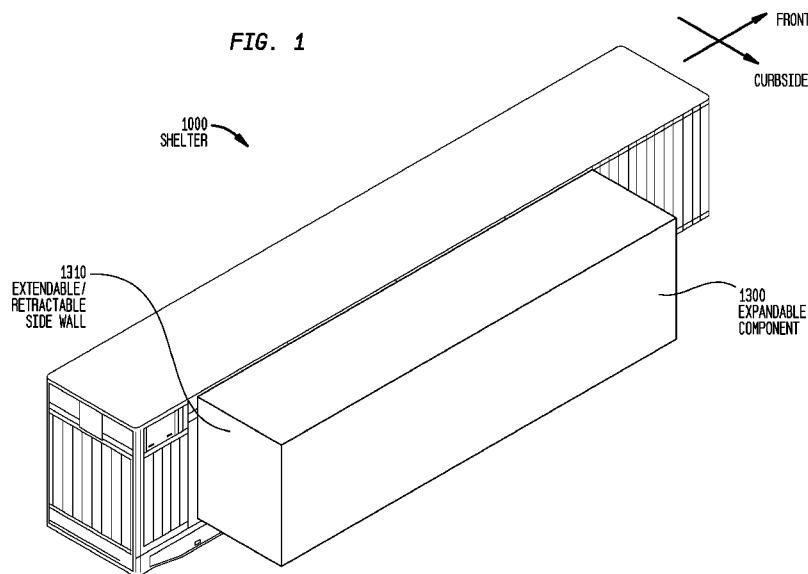
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(54) Title: SHELTER EXPANDABLE COMPONENT SUPPORTS



(57) Abstract: A portable shelter including an expandable component and an expandable component support. The expandable component including at least one structural element, e.g., a wall, configured to extend from, and retract into, an opening in a wall of the portable shelter. The expandable component support including a first non-roller bearing assembly affixed to the portable shelter to bear at least a portion of the weight of the at least one structural element.

SHELTER EXPANDABLE COMPONENT SUPPORTS

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority from U.S. Provisional Patent Application No. 61/647,377 entitled “SHELTER EXPANDABLE COMPONENT SUPPORTS”, filed on May 15, 2012.

BACKGROUND

Field of Invention

[0002] The present technology relates generally to shelter systems. More specifically, embodiments of the technology relate to supporting expandable components in portable shelter systems.

Related Art

[0003] Portable shelters are often used to provide temporary facilities for various purposes, such as military, civilian, and medical applications. Such portable shelters may be used to supplement permanent structures when additional space is desired, or to provide new facilities for temporary use, such as the provision of emergency response services after a disaster. Motorized vehicles, such as vans, buses, and recreational vehicles (RVs), etc., may be used as portable shelters under certain circumstances. While these types of motorized vehicles are able to transport themselves to a desired location, they may provide limited interior space for intended use, while also being relatively expensive.

[0004] Some portable shelters are configured to be in the size and shape of a standard International Organization for Standardization (ISO) intermodal shipping container. In this way, such shelters may be shipped by commercial means, such as by railway, boat, or aircraft, including military aircraft.

[0005] The floor space of conventional portable shelters is limited by the fixed external dimensions of the shelter. Expansion modules akin to “slide out” sections of RVs have been used to increase the floor space enclosed by a shelter. Such modules, also known as “expandable components,” may be hydraulically or mechanically driven to extend and retract from the shelter

on support beams. Such shelters are known to incorporate heavy, load bearing, dynamic, metal rolling element bearings (also referred to herein as “metal roller bearings”) in supporting an expandable component on the shelter chassis, e.g., using captive metal ball bearings or needle bearings.

SUMMARY

[0006] The present technology includes portable shelters including an expandable component and an expandable component support. The expandable component includes at least one structural element, e.g., a wall, configured to extend from, and retract into, an opening in a wall of the portable shelter. The expandable component support includes a non-roller bearing assembly affixed to the portable shelter to bear at least a portion of the weight of the at least one structural element.

[0007] In some embodiments, the non-roller bearing assembly includes a first self-lubricating engineering plastic as a bearing surface. In some embodiments, the expandable component support further comprises one or both of a displacement inhibiting member and a deformation inhibiting member adjacent at least one longitudinal vertical side of the first self-lubricating engineering plastic. In some embodiments, the engineering plastic is a nylon plastic containing first lubricant powder, e.g., molybdenum disulfide. In some embodiments, the first non-roller bearing assembly includes a low friction coating, e.g., a ceramic-filled abrasion-resistant epoxy, as the bearing surface. In some embodiments, the structural element is a wall with a curved horizontal cross section, and the expandable component is configured to pivot about a first axis substantially at the center of the curve.

[0008] In some embodiments, the structural element includes a second non-roller bearing assembly at the surface of the structural element that contacts the expandable component support. This second non-roller bearing assembly can include a second self-lubricating engineering plastic, e.g., a nylon plastic containing a lubricant powder such as molybdenum disulfide. The second non roller bearing can include a ceramic-filled abrasion-resistant epoxy as the bearing surface. In some embodiments, the structural element comprises first feature, and the expandable component support comprises a second feature. In those embodiments, the second feature is configured to mate with the first feature to align the structural element and the

expandable component support. In some embodiments the first feature can be a keel, and the second feature can be a groove.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] Embodiments of the disclosed technology are described below with reference to the attached drawings, in which:

[0010] FIG. 1 illustrates a shelter with an expandable component in perspective view;

[0011] FIG. 2 illustrates a roller bearing expandable component support in context of the shelter of FIG. 1, the shelter being shown without the expandable component to illustrate placement of the roller bearing;

[0012] FIG. 3 illustrates a non-roller bearing assembly of an expandable component support assembly of the present technology in perspective view;

[0013] FIG. 4 illustrates an end view of a non-roller bearing assembly of the present technology;

[0014] FIG. 5 illustrates a perspective view of shelter expandable component supports of the present technology in an expandable shelter configured as a fifth wheel trailer, along with a partial detail thereof; and

[0015] FIG. 6 illustrates a perspective view of a shelter expandable component support of the present technology in a partial view of an expandable shelter.

[0016] The drawings are intended to illustrate aspects of the technology, and as such, are not necessarily to scale and may omit aspects well known to those of skill in the art and aspects not relevant to the disclosed features.

DETAILED DESCRIPTION

[0017] Referring to FIG. 1, a shelter 1000 with an extended expandable component 1300 is shown in perspective view. One side wall 1310 (the rear side wall of the expandable component 1300) that is extendable and retractable is shown; a front side wall of the expandable component 1300 (substantially parallel to side wall 1310) is hidden in this view.

[0018] Referring to FIG. 2, the shelter 1000 is shown without the expandable component 1300, with Detail A illustrating the placement and configuration of a metal roller bearing assembly 400 for supporting an expandable component 1300 at the position where a front side wall of the expandable component 1300 would be situated, i.e., substantially adjacent a cage frame 1200 of the shelter 1000. Metal roller bearing support assembly 400 includes eleven (11) metal roller bearing 410 pairs in a roller bearing support 420. As the expandable component 1300 is extended, e.g., by the hydraulic-driven power beam assembly 1500, the bottom of the front side wall rolls on the metal roller bearings 410. At full extension of the expandable component 1300, the weight of the expandable component 1300 is supported by the power beam assembly(s) 1500 and the metal roller bearing assembly(s) 400 installed on the shelter 1000. A fully loaded expandable component can approach 5000 lbs. The weight borne by the rolling metal bearing assembly 400 is typically supported on the last few inches (e.g., four inches) of the metal roller bearings 410. In the retracted configuration the metal roller bearing assembly 400 supports the weight of the expandable component 1300 along with follower assembly 1420.

[0019] Various factors can cause metal roller bearings used as expandable component supports for shelters to fail or to be disadvantageous. Typical limits to the lifetime of a metal roller bearing include abrasion from the introduction of contaminants (a common factor for supports exposed to the environment), fatigue from repeated loading and unloading, and degradation of the metal roller bearing from rust caused by moisture. Further, metal roller bearings may comprise bearing races of complex shape, making them difficult and expensive to manufacture.

[0020] Some metal roller bearing assemblies require routine addition of lubricants, while others are factory sealed, requiring no further maintenance for the life of the mechanical assembly. Although seals are appealing, they increase friction, and in a permanently-sealed metal roller bearing the lubricant may become contaminated by hard particles, such as steel chips from the

race or bearing, sand, or grit that gets past the seal. Contamination in the lubricant is abrasive and greatly reduces the operating life of the bearing assembly.

[0021] Embodiments of the technology disclosed herein provide expandable component support on solid, non-rolling, static low friction surfaces, referred to herein as “non-roller bearings.” Such an approach can be configured to be more fault tolerant than use of metal roller bearings, and can be configured to be more likely to keeping an expandable component guided during extension and retraction.

[0022] “Low friction” refers to a low coefficient of friction (COF). COF is a measure of resistance to sliding of one surface over another, and can be measured in accordance with ASTM D 3702 promulgated by the American Society of Testing and Materials. The results of COF measurement in accordance with ASTM D 3702 do not have a unit of measure, since COF is the ratio of sliding force to normal force action on two mating surfaces. COF values are useful to compare the relative “slickness” of various materials, usually run un-lubricated over or against polished steel.

[0023] Referring to FIG. 3, a low friction bearing assembly 1410 is shown in perspective view. The illustrated bearing assembly 1410 includes a first channel 1411 and a second channel 1412 supporting a bearing block 1414. The bearing block presents bearing surface 1416.

[0024] The first channel 1411 is a substantially U-shaped channel with the opening oriented upward. The second channel 1412 is a substantially U-shaped channel with the opening oriented downward. Both the first channel 1411 and the second channel 1412 can be fabricated from various materials, including 1018 hot rolled steel (HRS), aircraft grade aluminum, and composite materials. Second channel 1412 can be secured inside first channel 1411 by various means including welding, adhesives, and mechanical fasteners. In the illustrated embodiment, both channels are fabricated from 1018 HRS, and second channel 1412 is secure in first channel 1411 by welding. In exemplary embodiments, the walls of each of first channel 1411 and second channel 1412 are 0.25” thick, with first channel 1411 having an width of 3”, a height of 2.125”, and a length that is both substantially greater than either height or width (though this is not required) and that is substantially commensurate with the length of bearing block 1414.

[0025] Referring now to both FIG. 3 and to FIG. 4 (in which the bearing assembly 1410 of FIG. 3 is shown in an end view), bearing block 1414 is shown as substantially contained by first channel 1411 and second channel on three sides of bearing block 1414. Each longitudinal side of bearing block 1414 is partially exposed, thereby presenting a bearing surface 1416 as the interface for loads placed on the bearing assembly 1410.

[0026] Bearing block 1414 can be fastened to second channel 1412 using mechanical fasteners (not shown). Mechanical fasteners, e.g., cap screws, can be inserted in countersunk bearing block mounting holes 1415 through bearing block 1414 and secured to threaded second channel mounting holes 1413 in second channel 1412. In some embodiments, bearing block 1414 can be secured in bearing assembly 1410 by adhesives, and by adhesives in combination with mechanical fasteners. Securing bearing block 1414 in the bearing assembly 1410 using mechanical fasteners is preferred, in part because it allows bearing block 1414 to be readily replaced without removing adhesives or replacing the first channel 1411 or the second channel 1412. In some embodiments, mechanical fasteners are used to secure the bearing block 1414 in the first channel 1411 through horizontal holes in the bearing block and the first channel 1411 walls. In the particular bearing assembly 1410 shown in FIG. 3 and FIG. 4, inverted second channel 1412 allows bearing block 1414 to be dimensioned less than the interior height of the first channel 1411. In addition to allowing fastener to extend through second channel threaded mounting holes 1413, use of second channel 1412 can offer cost savings whereas the costs associated with a thicker bearing block 1414 are greater than the cost associated with the second channel 1412.

[0027] In some embodiments, bearing block 1414 is a single block of self-lubricating engineering plastic e.g., nylon plastic filled with lubricant powder. One example of such a material is Nylatron[™] NSM, a nylon plastic filled with molybdenum disulfide lubricant powder. Solid lubricant additives impart self-lubricating, high pressure/velocity and superior wear resistance characteristics. In some embodiments of the bearing assembly 1410, each bearing block 1414 is secured to the second channel using cap screws as described above through holes in the bearing block 1414. The holes can be countersunk to allow the screw heads to sit below the surface of the bearing block 1414 when installed.

[0028] In embodiments of the technology using a bearing block, such as bearing block 1414, to present a bearing surface, such as bearing surface 1416, to the underside of an expandable component structural element, e.g., side wall 1310, and front side wall (not shown), features such as first channel 1411 and second channel 1412 inhibit displacement and deformation (e.g., twisting, skewing) of the bearing block 1414. Means other than first channel 1411 and second channel 1412 can be used for the same purpose, i.e., as displacement and deformation inhibiting members – at least on the longitudinal vertical sides of the bearing block. For example, a single block of machined metal with threaded holes for receiving fastener inserted through holes in the bearing block can be used. As a further example, a bearing block can be held in place with “L” brackets mounted to the shelter at regular intervals along each side of the bearing block. The bearing block can be secured directly to threaded holes in the frame of the shelter through holes in the bearing block, with additional support to inhibit displacement and deformation secured horizontally through the bearing block.

[0029] In some embodiments of the technology, bearing block 1414 includes a bearing surface longitudinal channel 1417. The bearing surface longitudinal channel 1417 can mate with a feature, such as a keel 1321, on the bottom of an expandable component side wall 1310 to assist in maintaining expandable component side wall alignment during extension and retraction of the shelter expandable component 1300.

[0030] In some embodiments of the technology, a non-rolling low friction bearing surface can be presented to the bottom of a side wall of an expandable component 1300 by using a low friction coating on a base. Such a coating can be a low-friction ceramic-filled abrasion resistant epoxy (e.g., Nordbak® 2-part ceramic filled epoxy). By using a coating, instead of a bearing block as described above, the bearing surface can more readily be formed in irregular shapes. For example, the base can be formed with a feature (such as a detent or ridge) to coincide with a compatible feature (such as a trough or a chicane) in the bottom of the expandable component 1300.

[0031] Referring to FIG. 5, the shelter 1000 is shown without the expandable component 1300, with Detail A illustrating the placement and configuration of a curbside expandable component support assembly 1400A to support the front side wall of a curbside expandable component

1300. A roadside expandable component support assembly 1400B is also shown. The expandable component support assembly 1400A includes a non-rolling low friction bearing surface assembly 1410 as described in conjunction with FIG. 3 and FIG. 4, along with a follower assembly 1420.

[0032] The follower assembly 1420 illustrated in FIG. 5 (with an exemplary embodiment described in connection with FIG. 6 herein), is mounted to the shelter 1000 chassis in line with, and further toward the interior of the shelter 1000 than, the bearing assembly 1410.

[0033] While the bearing assembly is shown as forming about 30% of the length of the expandable component support assembly 1400A, the bearing assembly 1410 can form both more and less of the expandable component support assembly 1400A.

[0034] The illustrated bearing assembly 1410 is positioned longitudinally on the shelter curbside substantially adjacent a cage frame 1200 of the shelter 1000. As the expandable component 1300 is extended, e.g., by the hydraulic-driven power beam assembly 1500, the bottom of the front side wall slides along the expandable component support assembly 1400A. At full extension of the expandable component 1300, the weight of the expandable component 1300 is supported by the power beam assembly(s) 1500 and the bearing assembly 1410 (one at the front side wall and one at the rear side wall) of the expandable component support assembly 1400.

[0035] Referring to FIG. 6, a portion of roadside expandable component support assembly 1400A is shown mounted in a shelter such as shelter 1000. In the illustrated embodiment, a mounting plate 610 is secured to the shelter chassis 1100, e.g., by fasteners, by adhesives, by welding. In the illustrated embodiment, the mounting plate 610 is formed of steel and is secured to an aluminum shelter chassis 1100.

[0036] Follower assembly 1420 (partially shown) is shown as comprising Ultra-High Molecular Weight (UHMW) polyethylene (a thermoplastic polyethylene) blocks 1421, secured by mechanical fasteners to an aluminum follower assembly mounting channel 1422. The follower assembly mounting channel 1422 can have welded thereto “L” brackets that are mechanically fastened to the chassis or to another mounting plate (not shown). UHMW polyethylene blocks 1421 also are shown as attached to a beam of the shelter chassis 1100 using mechanical fasteners. In some embodiments of the present technology, the follower assembly can be formed from a low friction coating on a base (as opposed to a UHMW polyethylene block). Such a

coating can be a low-friction ceramic-filled abrasion resistant epoxy (e.g., Nordbak® 2-part ceramic filled epoxy).

[0037] Bearing assembly 1410 supports roadside expandable component front side wall 1320. Bearing assembly 1410 is shown as secured to mounting plate 610 with welds 620. Two out of four of the welds 610 are visible in FIG. 6; two additional welds are symmetrical to the first two welds on the non-visible side of bearing assembly 1410. Bearing assembly 1410 includes bearing surface longitudinal channel 1416, which channel 1416 mates to a keel 1321 on the bottom of the roadside expandable component front side wall 1320.

[0038] In some embodiments of the technology, the portable shelter includes an expandable component that comprises a wall characterized by a curved horizontal cross section. Such an expandable component can pivot about an axis substantially at the center of the curve of the wall to extend and retract.

[0039] In some embodiments, a wall of an expandable component of a shelter can include a non-roller bearing at the surface of the wall that contacts the expandable component support, e.g., at the bottom of the wall. Such a non-roller bearing surface can comprise either, or both of, the bearing assembly 1410 or coating described above. In some embodiments, a bearing surface assembly can be used between the top of an expandable component structure and the shelter, e.g., at the top of a side wall of the expandable component and at the portion of the shelter contacting thereto.

[0040] While various embodiments of the present technology have been described above, it should be understood that they have been presented by way of example only, and not limitation. It will be apparent to persons skilled in the relevant art that various changes in form and detail can be made therein without departing from the spirit and scope of the technology. For example, the shelter illustrated in FIG. 6 can be an ISO shelter instead of a fifth-wheel trailer. Features described as part of one implementation can be used on another implementation to yield a still further implementation. Thus, the breadth and scope of the present technology should not be limited by any of the above-described exemplary embodiments, but should be defined only in accordance with the following claims and their equivalents.

CLAIMS

What is claimed is:

1. A portable shelter comprising:
an expandable component comprising at least one structural element configured to extend from, and retract into, an opening in a wall of the portable shelter; and
an expandable component support:
comprising a first non-roller bearing assembly,
affixed to the portable shelter to bear at least a portion of the weight of the at least one structural element.
2. The portable shelter of claim 1 wherein:
the at least one structural element is a wall.
3. The portable shelter of claim 1 wherein:
the first non-roller bearing assembly comprises a first self-lubricating engineering plastic.
4. The portable shelter of claim 2 wherein:
the expandable component support further comprises a displacement inhibiting member adjacent at least one longitudinal vertical side of the first self-lubricating engineering plastic.
5. The portable shelter of claim 2 wherein:
the expandable component support further comprises a deformation inhibiting member adjacent at least one longitudinal vertical side of the first self-lubricating engineering plastic.
6. The portable shelter of claim 2 wherein:
the self-lubricating engineering plastic is a nylon plastic containing first lubricant powder.

7. The portable shelter of claim 4 wherein:
the first lubricant powder is molybdenum disulfide.
8. The portable shelter of claim 1 wherein:
the first non-roller bearing assembly comprises a first low friction coating.
9. The portable shelter of claim 8 wherein:
the first low friction coating is a ceramic-filled abrasion-resistant epoxy.
10. The portable shelter of claim 1 wherein:
the at least one structural element is characterized by a curved horizontal cross section,
and
the expandable component is configured to pivot about a first axis substantially at the
center of the curve of the at least one structural element.
11. The portable shelter of claim 1 wherein:
the at least one structural element comprises a second non-roller bearing assembly at the
surface of the at least one structural element that contacts the expandable
component support.
12. The portable shelter of claim 11 wherein:
the second non-roller bearing assembly comprises a second self-lubricating engineering
plastic.
13. The portable shelter of claim 12 wherein:
the second self-lubricating engineering plastic is a nylon plastic containing second
lubricant powder.
14. The portable shelter of claim 13 wherein:
the second lubricant powder is molybdenum disulfide.
15. The portable shelter of claim 11 wherein:
the second non-roller bearing assembly comprises a second low friction coating.

16. The portable shelter of claim 15 wherein:
the second low friction coating is a ceramic-filled abrasion-resistant epoxy.
17. The portable shelter of claim 1 wherein:
the at least one structural element comprises first feature, and
the expandable component support comprises a second feature;
wherein the second feature is configured to mate with the first feature to align the at least
one structural element and the expandable component support.
18. The portable shelter of claim 12 wherein:
the first feature comprises a keel, and the second feature comprises a groove.

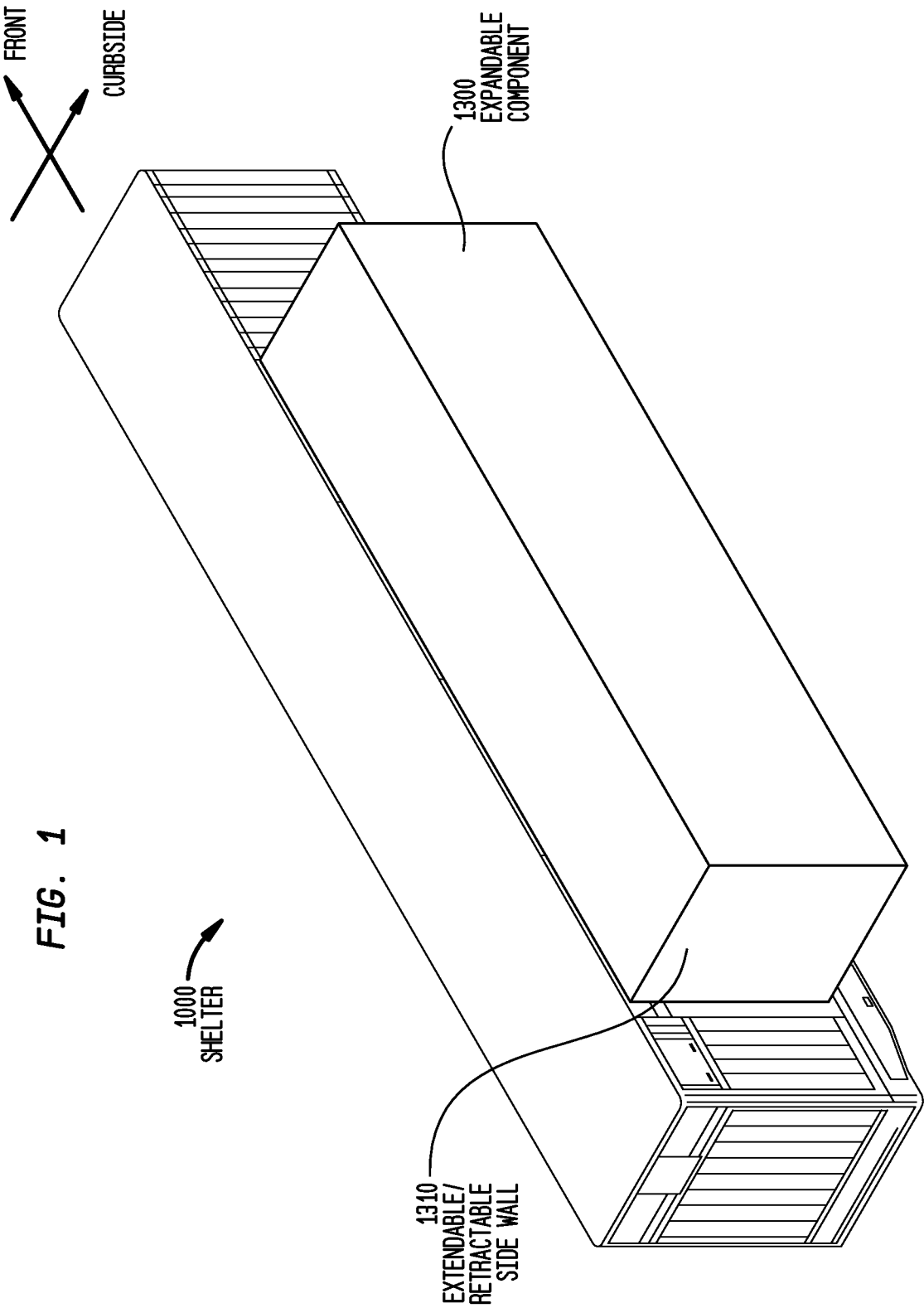


FIG. 2

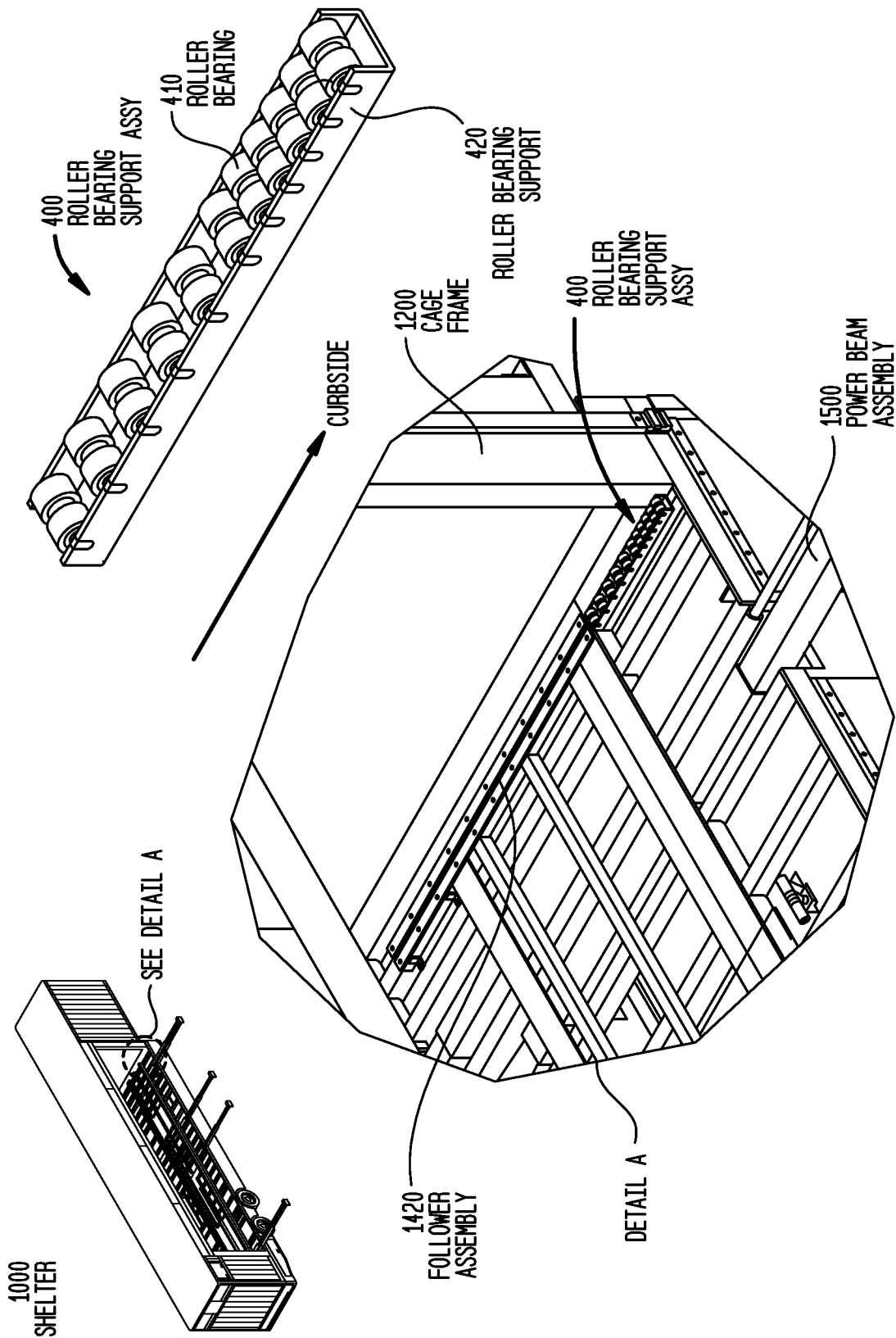


FIG. 3

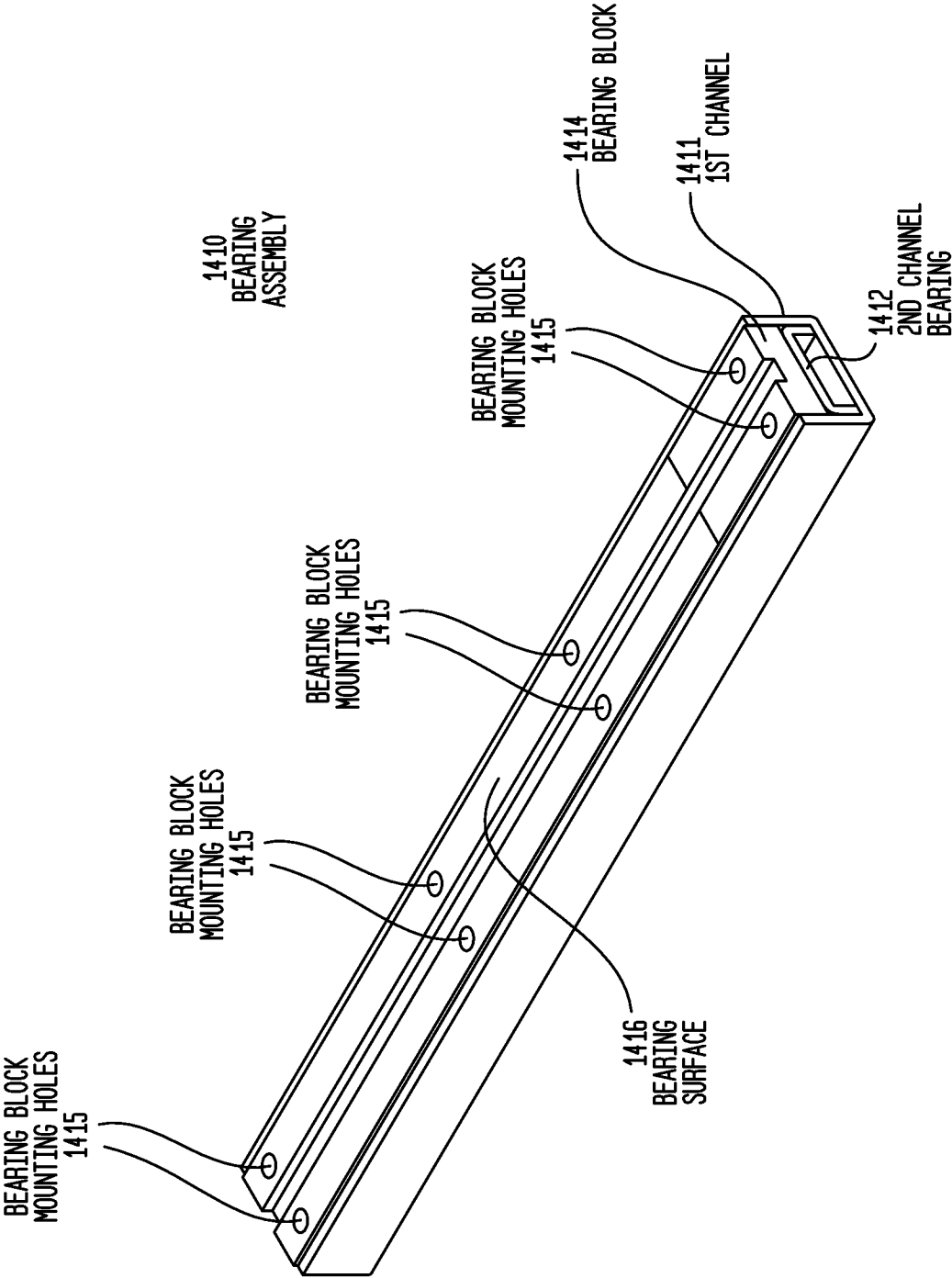


FIG. 4

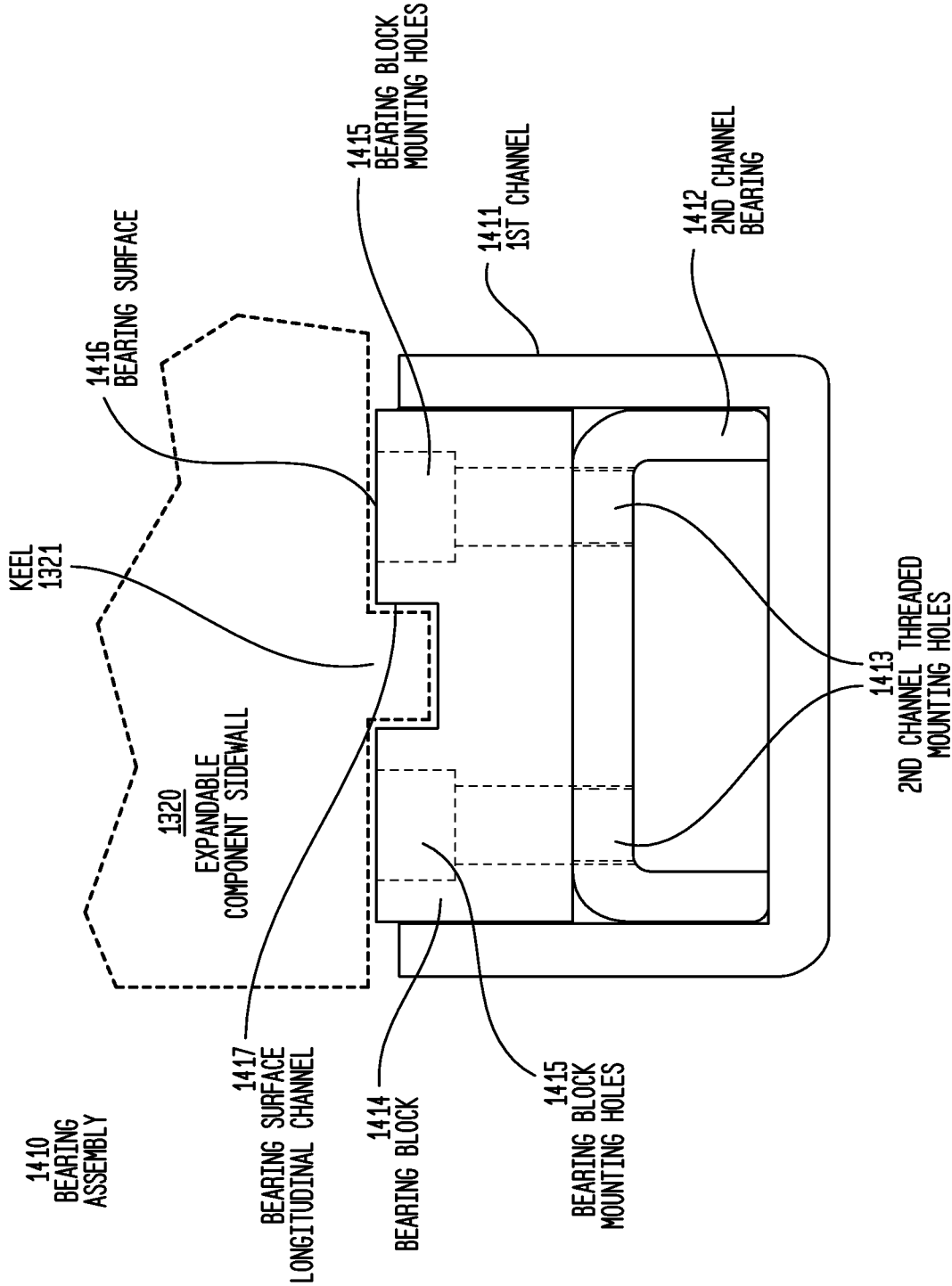
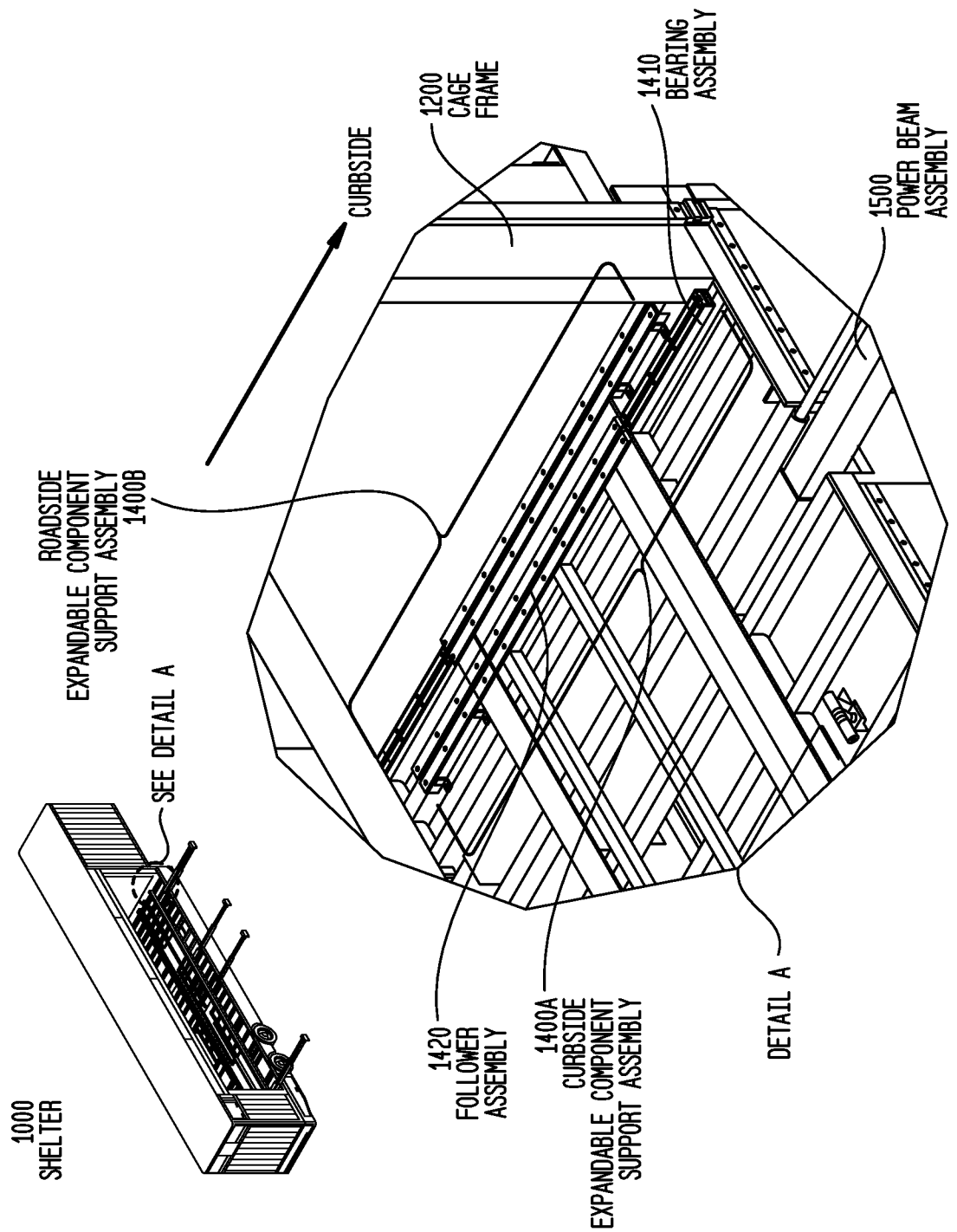
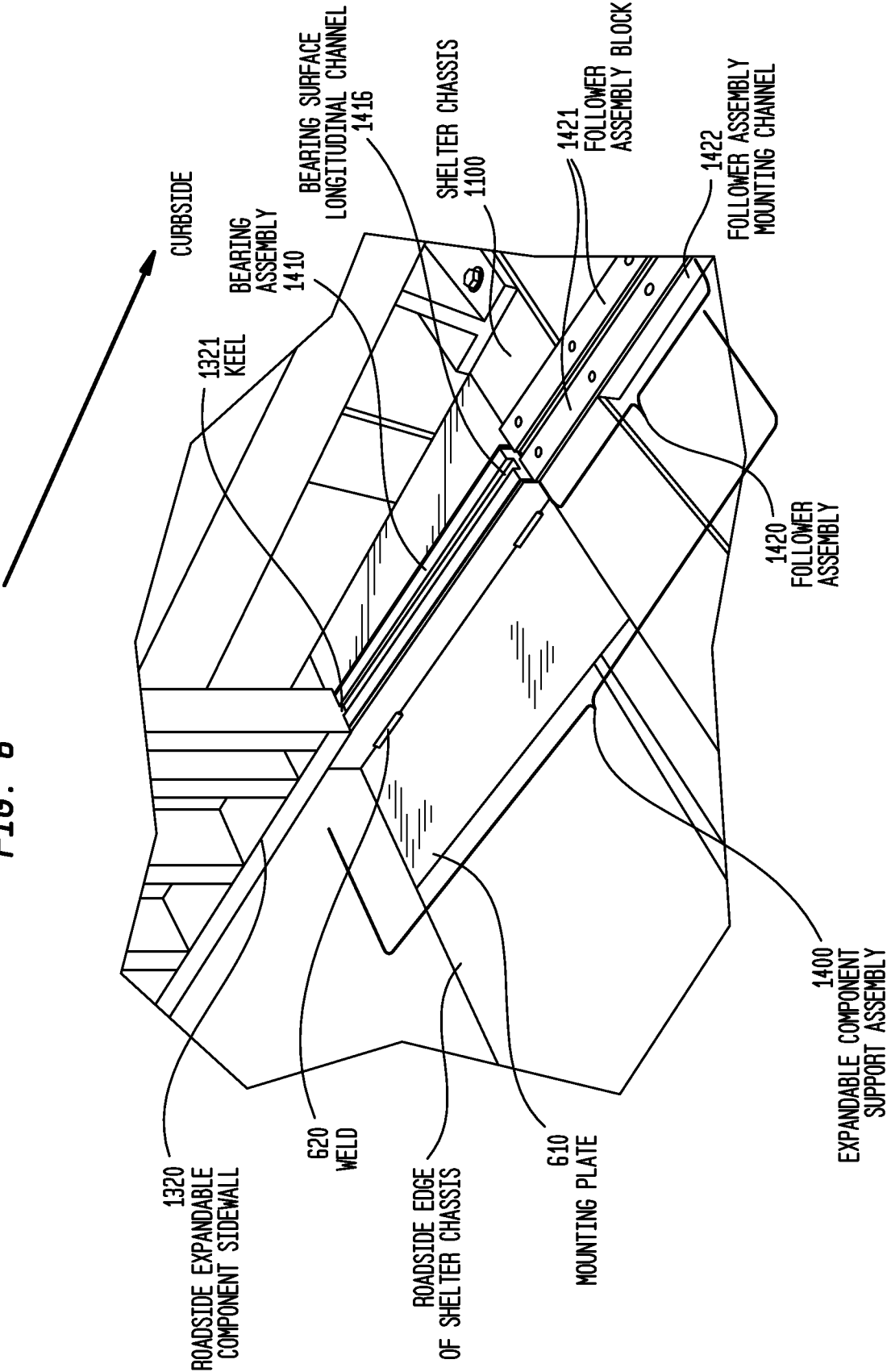


FIG. 5



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FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2013/041098

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B60P 3/34 (2013.01)

USPC - 296/26.13

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - B60P 3/34; F16B 7/10; F16C 29/02, 33/00, 33/02, 33/04, 33/10, 33/12, 33/20; F16M 11/26 (2013.01)

USPC - 52/67, 79.5; 248/354.1; 296/26.12, 26.13, 26.14, 165; 384/26, 42; 403/109.1, 109.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
CPC - B60P 3/34; B66C 23/701; F16C 29/02, 33/02, 33/04, 33/20, 33/201; F16M 11/26 (2013.01)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PatBase, Google

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/0006369 A1 (CANTIN et al) 12 January 2012 (12.01.2012) entire document	1-2, 11
Y		3-10, 12-18
Y	GB 1,032,833 A (FEDERAL-MOGUL-BOWER BEARINGS) 15 June 1966 (15.06.1996) entire document	3-7, 12-14
Y	US 6,619,713 B2 (EICHORN) 16 September 2003 (16.09.2003) entire document	4-5, 8-9, 15-16
Y	US 7,942,581 B2 (LEONARDELLI) 17 May 2011 (17.05.2011) entire document	9, 16
Y	US 6,866,317 B2 (FERREN) 15 March 2005 (15.03.2005) entire document	10
Y	US 6,402,216 B1 (MCMANUS et al) 11 June 2002 (11.06.2002) entire document	17-18
A	US 6,658,798 B1 (FRERICHS et al) 09 December 2003 (09.12.2003) entire document	1-18

☐ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

01 September 2013

Date of mailing of the international search report

12 SEP 2013

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