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(54) **TANK CAR ACCESS LADDER**

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B60R 3/00	(2006.01)
B61D 49/00	(2006.01)
E06C 7/48	(2006.01)

(52) **U.S. Cl.**

CPC ***E06C 1/34*** (2013.01); ***B60R 3/007*** (2013.01); ***B61D 49/00*** (2013.01); ***E06C 7/48*** (2013.01)

(58) **Field of Classification Search**

CPC .. E06C 1/34; E06C 7/48; B60R 3/007; B61D 49/00

See application file for complete search history.

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(57) **ABSTRACT**

A portable ladder having a pair of elongate stiles spaced from one another and each having first and second ends, and extending in a first direction; and a plurality of rungs each extending between the elongate stiles transverse to the first direction and having opposed ends one of each attached to each of the elongate stiles and each of the plurality of rungs being spaced from one another along the first direction, the rungs being arcuate in shape between the opposed ends.

11 Claims, 5 Drawing Sheets

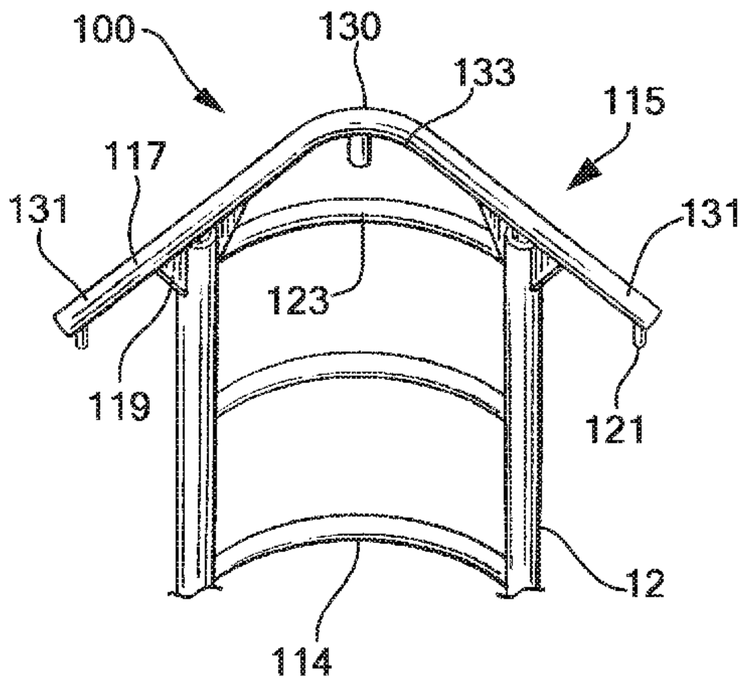

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FIG. 1

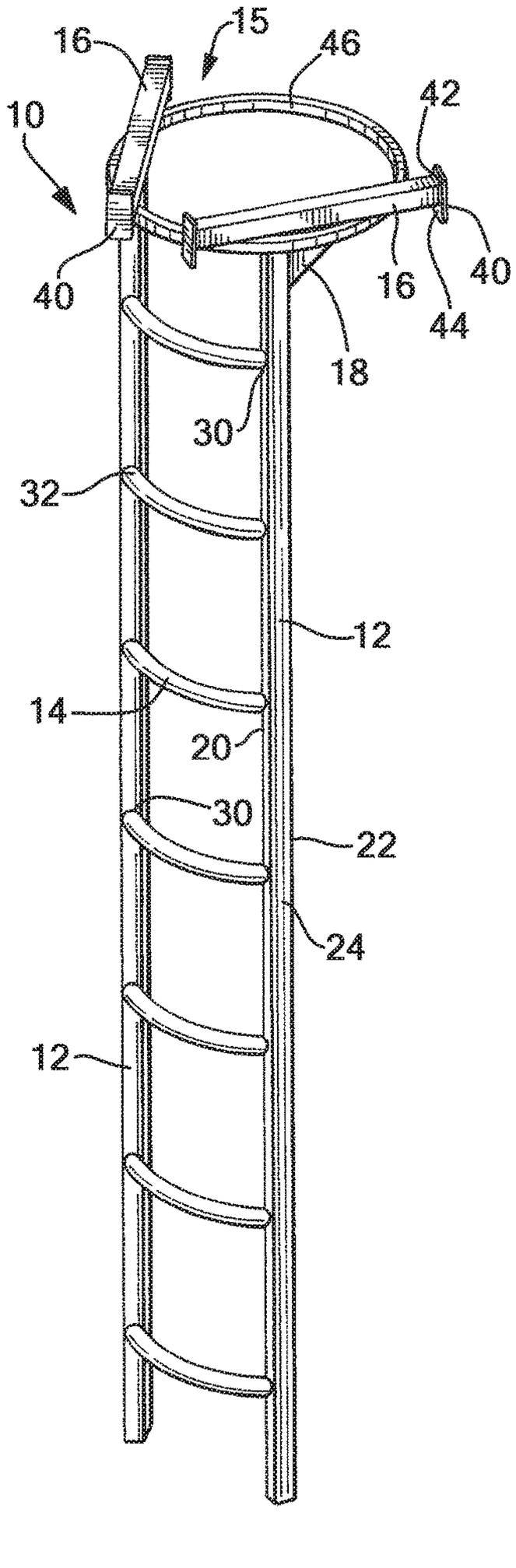


FIG. 2

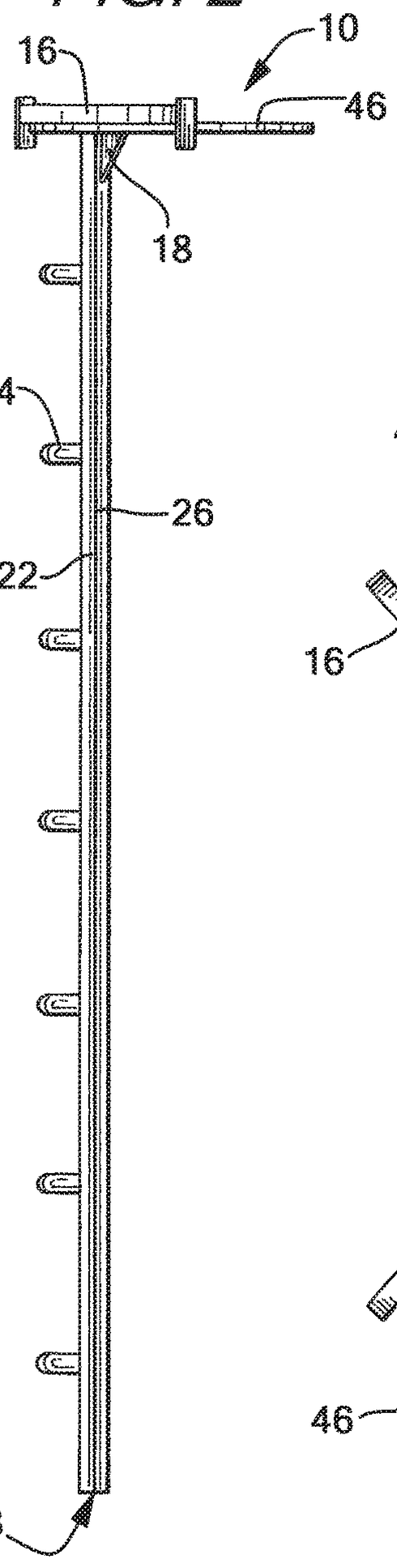


FIG. 3

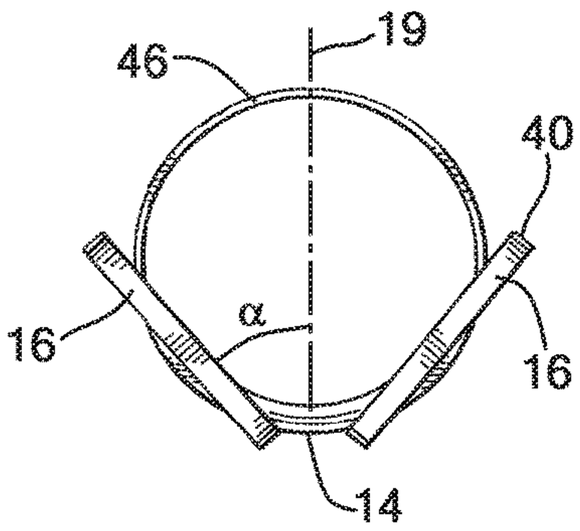


FIG. 4

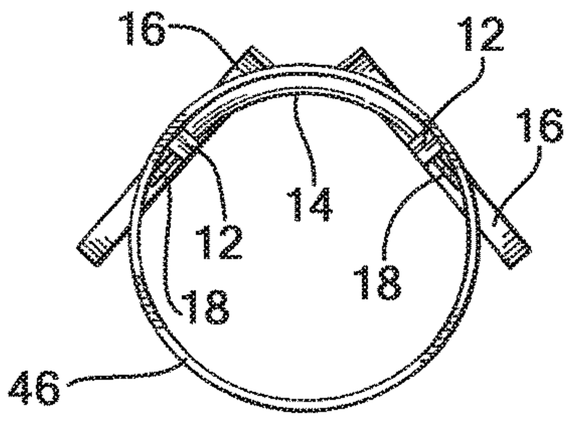


FIG. 5

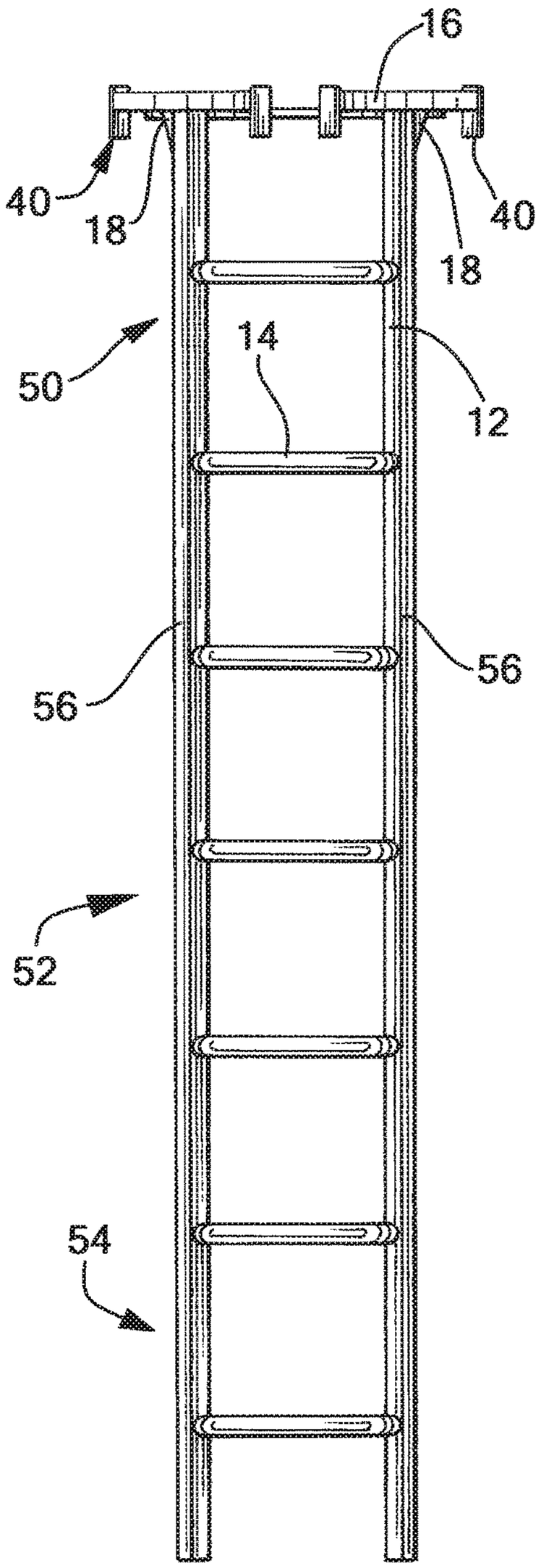


FIG. 6

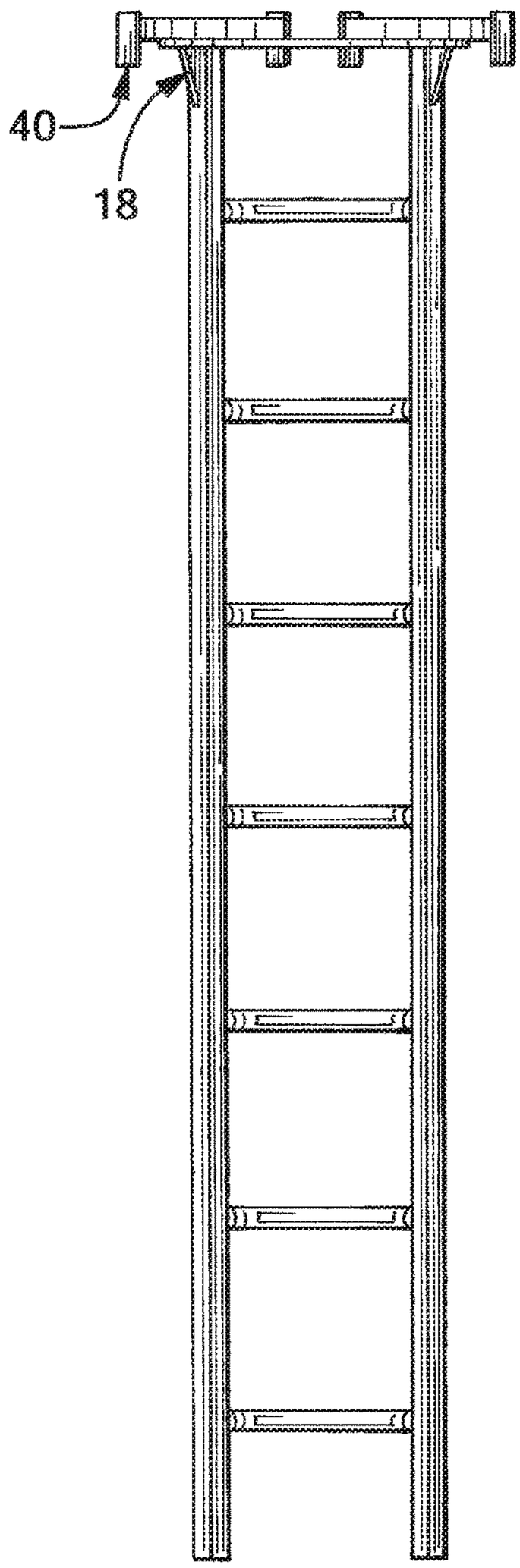


FIG. 7

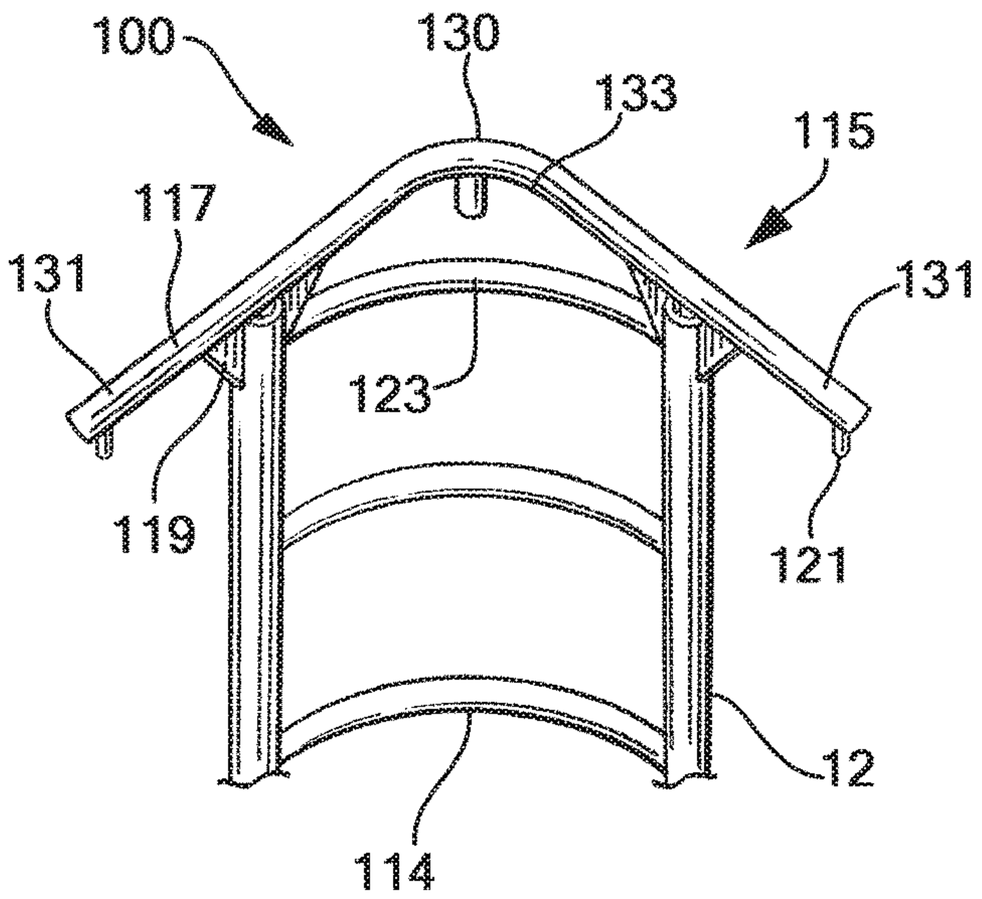


FIG. 8

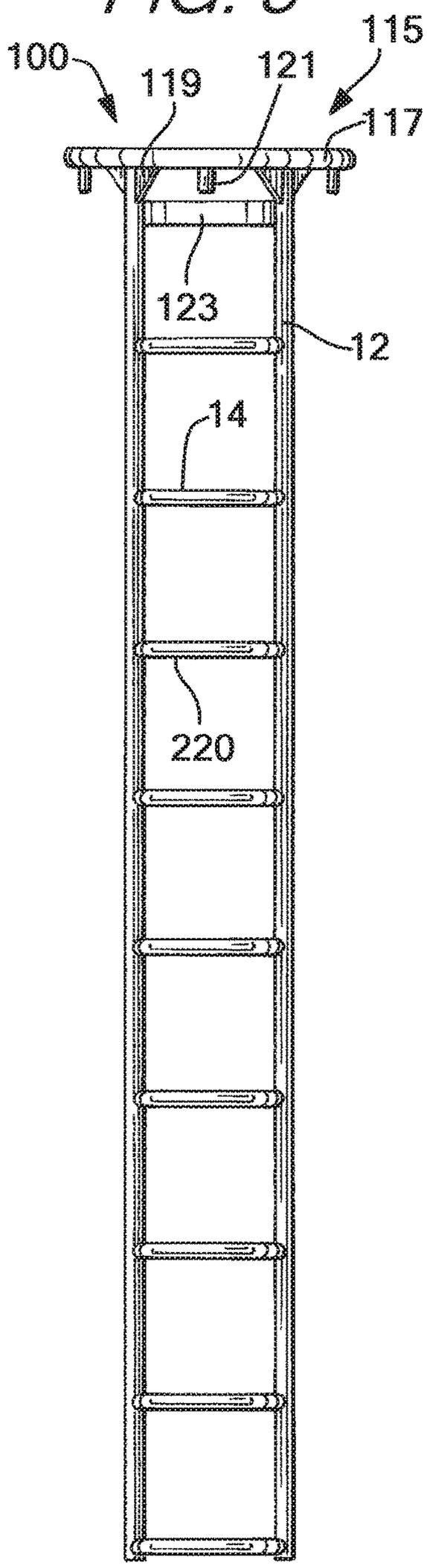


FIG. 9

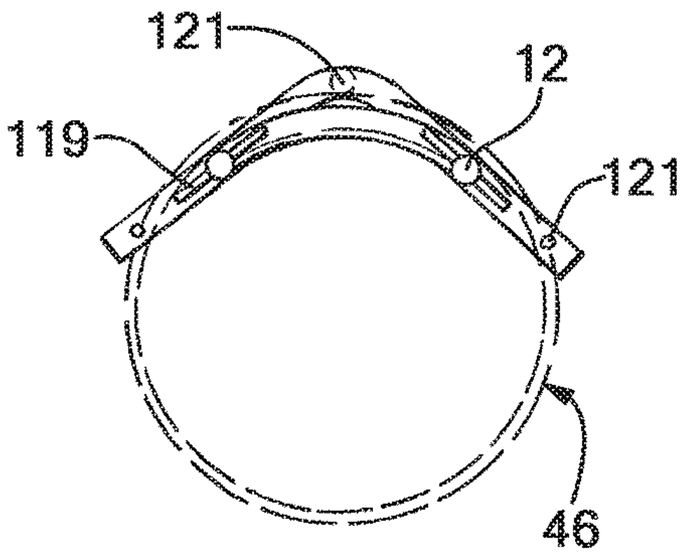


FIG. 10

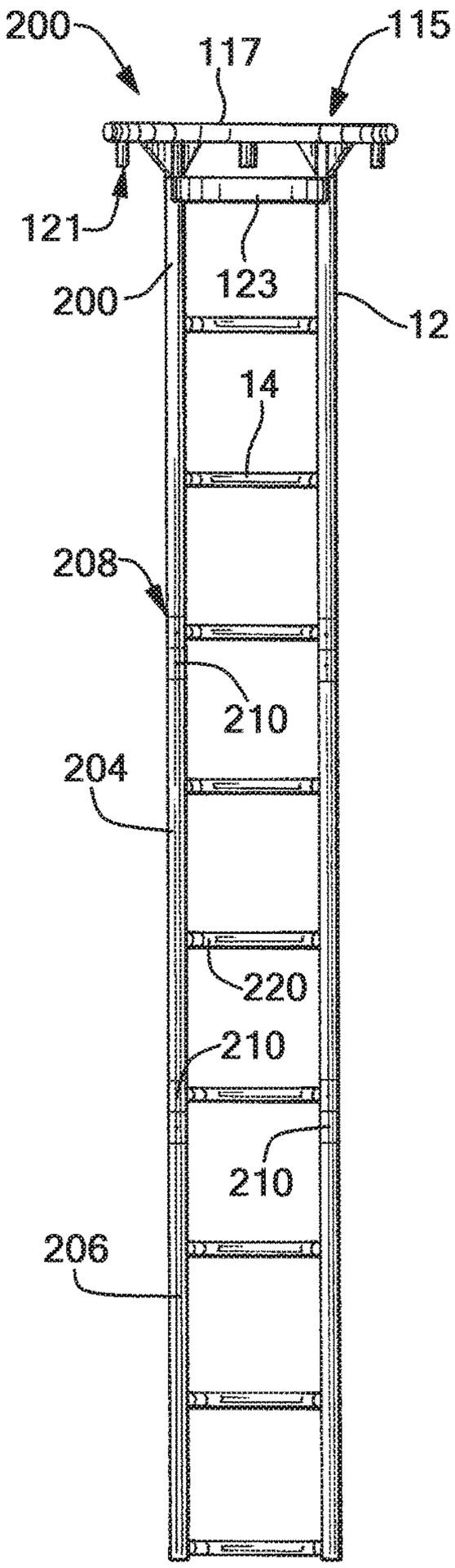

200
117
115
121
123
200
12
14
208
210
204
220
210
210
206

FIG. 11

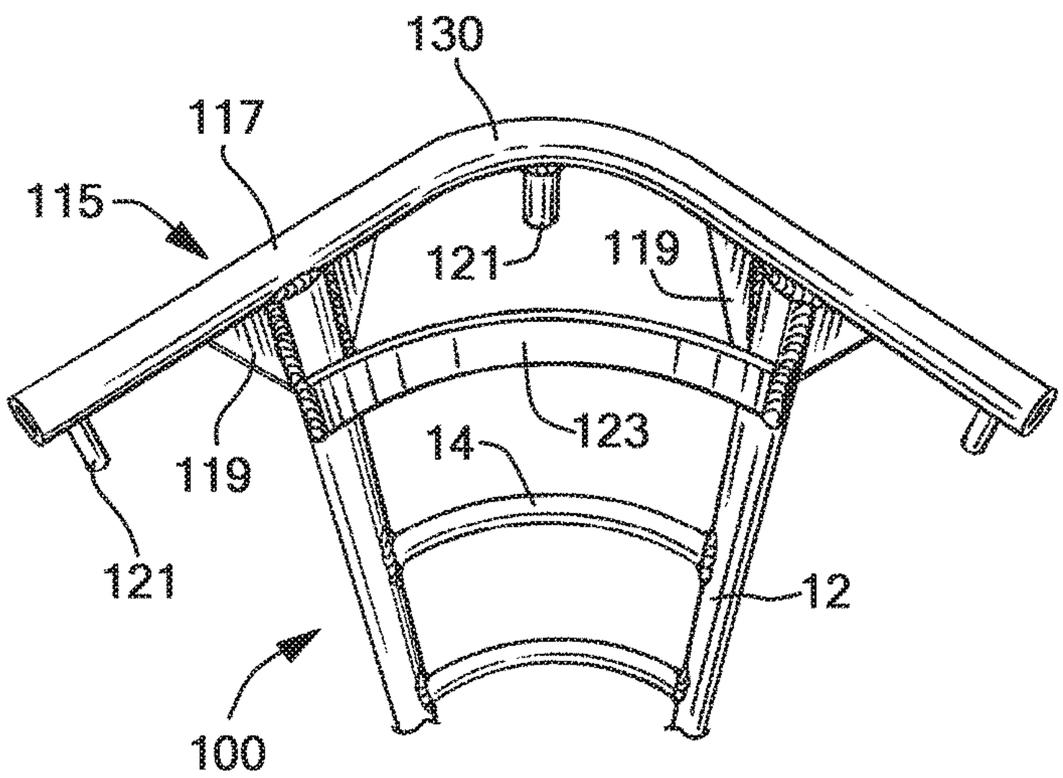

130
117
115
121
119
119
123
14
121
12
100

FIG. 12

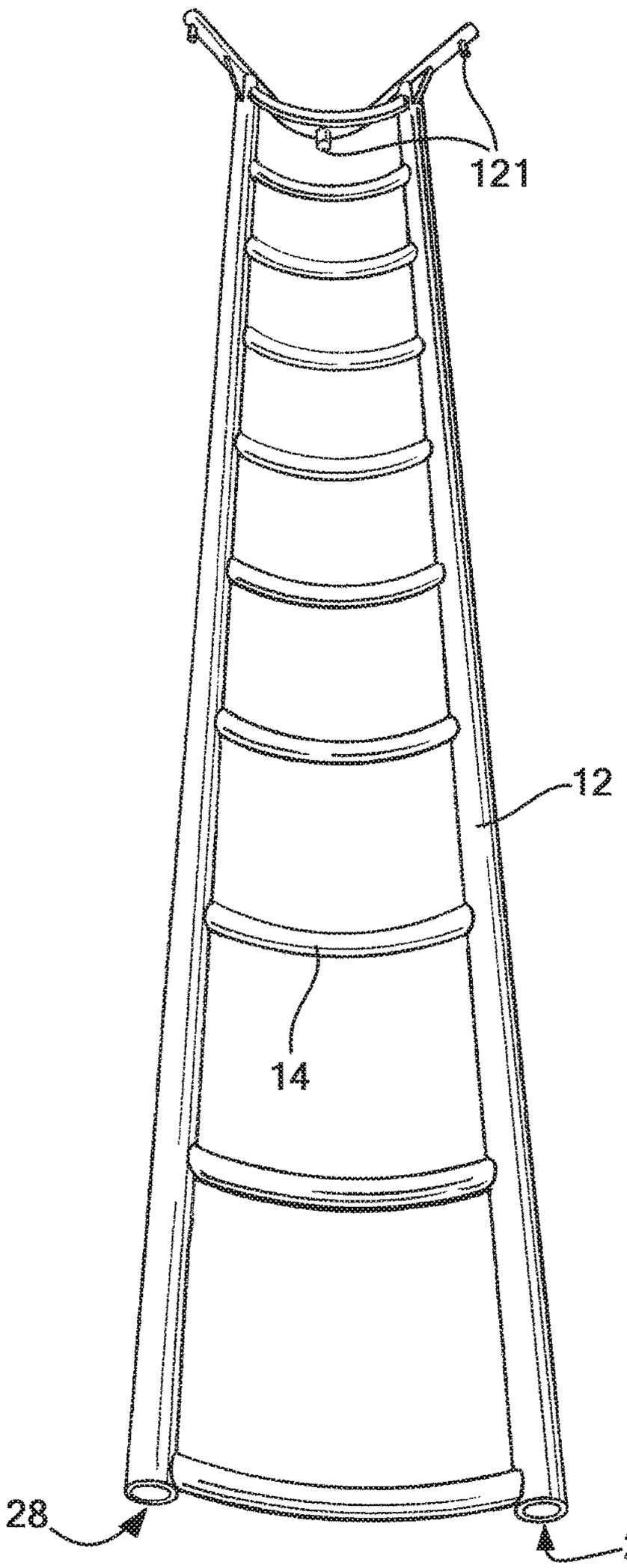
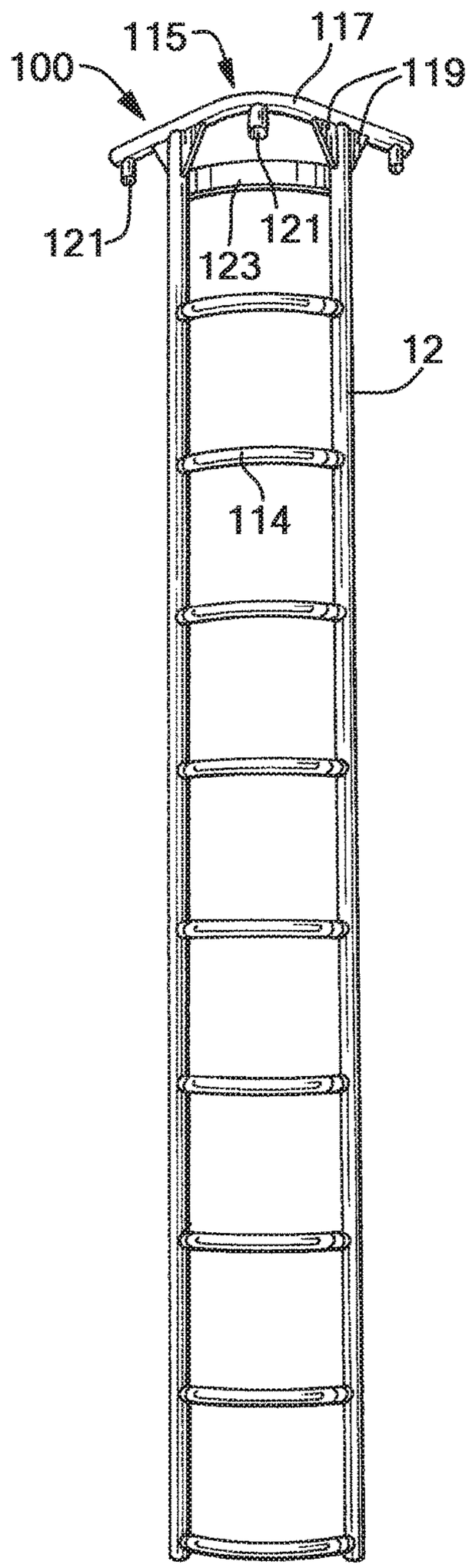


FIG. 13



TANK CAR ACCESS LADDER

FIELD OF THE INVENTION

A portable ladder having arcuate rungs and is deployable through a hatchway of a tank.

BACKGROUND OF THE INVENTION

Tanks for containing liquids are often mounted on a railcar, a semi-trailer, or other vehicle for transporting liquids, often in large volumes. Human access to the tank is provided through a hatchway on a top of the tank. The vertical distance from the hatchway to a bottom wall of the tank can be large enough to require a ladder to safely traverse this distance. The inner chamber of a tank must be accessed, from time to time, for cleaning, inspection and maintenance. Accordingly, the present invention provides a ladder that can be deployed through the hatchway of the tank and secured thereto for safe access and removed upon exit from the tank.

SUMMARY OF THE INVENTION

A portable ladder is disclosed having a pair of spaced elongate stiles extending generally parallel to one another and connected together by a plurality of rungs extending along a line generally perpendicular to the stiles and spaced from one another along a length of the stiles. The rungs extend along an arcuate path from one opposed end to another.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a ladder secured to a hatchway;

FIG. **2** is a side elevation view of the ladder of FIG. **1**;

FIG. **3** is a top view of the ladder of FIG. **1** mounted on a hatchway;

FIG. **4** is a bottom view of the ladder of FIG. **1** mounted on a hatchway;

FIG. **5** is a front view of a multi-piece ladder assembly;

FIG. **6** is a front view of another embodiment of a one-piece ladder;

FIG. **7** is a perspective view of another embodiment of a ladder;

FIG. **8** is a front view of the ladder of FIG. **7**;

FIG. **9** is a bottom view of the ladder of FIG. **7** mounted on a hatchway;

FIG. **10** is a front view of another embodiment of a multi-piece ladder assembly;

FIG. **11** is a perspective view of a ladder viewed from a top end;

FIG. **12** is a perspective view of a ladder viewed from a bottom; and

FIG. **13** is a perspective view of a front face of a ladder in a deployed condition.

DETAILED DESCRIPTION

While this invention is susceptible of embodiment in many different forms, there is shown in the drawings, and will be described herein in detail, specific embodiments thereof with the understanding that the present disclosure is to be considered as an exemplification of the principles of the invention and is not intended to limit the invention to the specific embodiments illustrated.

FIG. **1** shows a ladder **10** in an upright position having a pair of horizontally spaced stiles **12** extending vertically in parallel spaced relationship and a plurality of rungs **14** vertically spaced from one another and extending between and connecting the stiles. The ladder has a member or an assembly **15** for securing the ladder to a hatchway **46** of a tank. In one preferred form of the invention, the securing assembly **15** has a pair of arms **16**, one of each, attached to a top end of each stile and forms an angle α (FIG. **3**) on opposite sides of a plane **19** extending along a centerline of the ladder. The angle α is from about 25° to about 60°, more preferably from about 30° to about 45°, and most preferably about 30°. In a preferred form of the invention, a gusset **18** connects an arm **16** to a stile **12**. In some embodiments, the ladder **10** will be assembled from separate parts for use (FIGS. **5** and **10**) and can be disassembled for storage, for example. In another embodiment, the ladder will be sectionalized for ease of storage and portability. In yet another preferred form of the invention, the ladder will be fully assembled for use (FIGS. **1**,**6** and **8**) and cannot be disassembled without damaging or destroying the ladder.

The stiles are elongate, having a length dimension greater than a width and a depth dimension, and can have a variety of shapes in horizontal cross section such as a straight line, a curved line, a letter shape, a C-shape, a D-shape, an H-shape, a T-shape, an L-shape, a V-shape, circular, oval, polygonal, irregular, and sinusoidal. Polygonal shapes include triangular, square, rectangular, trapezoidal, pentagonal, hexagonal, heptagonal, and octagonal. Most preferably, the stile is a square tube having an inner face **20**, an outer face **22**, a front face **24**, a back face **26** and defines an inner channel **28**. The inner face **22** has a plurality of spaced holes **30** dimensioned to receive an end portion **32** of a rung **14**. The hole preferably extends through the entire thickness of the stile **12**, and the end portion **32** of the rung will be permanently affixed to the stile by a weld, solder joint, adhesive, bracket or fastener. The hole **32** can also extend through the front face and the back face and the end portion of the rung can be permanently affixed to the front face, back face, or both. The inner channel **28** can be empty or can be filled with a lightweight material such as a foamed polystyrene, foamed polypropylene, or other material, to provide sound dampening, strength and increase buoyancy. In another form of the invention, the rungs will be attached directly to the inner face **20** (no holes **30**) by weld, solder joint, adhesive, or indirectly through a bracket, or collar, or through both direct and indirect connections.

The rungs are elongate, having a length dimension greater than a width, a depth dimension or a diameter, and can also have a variety of shapes in cross section such as a straight line, a curved line, a C-shape, a D-shape, an H-shape, a T-shape, an L-shape, a V-shape, circular, oval, polygonal, irregular, and sinusoidal. Polygonal shapes include triangular, square, rectangular, trapezoidal, pentagonal, hexagonal, heptagonal, and octagonal. Most preferably, the rungs will have a circular shape in cross section. The rungs have an arcuate shape and a radius of curvature from one end to the other end. In a preferred form of the invention the radius of curvature of about 15¼ inches for a rung 12⅞ inches long. A portion **36** of each rung **14** extends outward beyond the outer face **22** of the stiles.

The arms **16** are elongate, having a length dimension greater than a width dimension, a depth dimension or a diameter, and can have a variety of shapes in cross section such as a straight line, a curved line, a C-shape, a D-shape, an H-shape, an L-shape, a V-shape, circular, oval, polygonal, irregular, and sinusoidal. Polygonal shapes include triangu-

lar, square, rectangular, trapezoidal, pentagonal, hexagonal, heptagonal, and octagonal. In one preferred form of the invention, the arms will have a square shape in cross section (FIGS. **1-6**). In another preferred form of the invention, the arms will have end caps **40** attached to each end of the arms and will have an upper and lower flanges **42**, **44**, respectively, to serve as stops to prevent or reduce the tendency for the ladder to slip or move when mounted to a hatchway structure such as the hoop structure **46** shown in the figures.

The gusset **18** preferably is generally three sided and preferably is triangular in shape and preferably in the form of a right triangle. One leg of the triangle will be permanently attached to a portion of the outer face **22** and extend at the same angle α or parallel to the arm and will have a second leg permanently attached to a bottom portion of the arm. The term permanently affixed or attached includes a connection by a weld, solder joint, adhesive, bracket or fastener.

FIG. **5** shows a ladder that is assembled from three parts, an upper part **50**, a middle part **52**, and an lower part **54**. The upper part **50** has the arms **16** connected thereto at an upper end and has a joint **56** on a lower end of each stile **12** for removably connecting to an upper end of the middle part **52**. In one preferred form of the invention the joint will include a pair of holes on one of each stile of the upper part that are brought into alignment with a pair of holes, one of each on a stile of the middle part, the holes extending through the width or depth dimension of the stile and being dimensioned to receive a pin or bolt to secure the parts together. In one embodiment, the pin will have a hole dimensioned to receive a cotter, hairpin cotter, quick release pins or the like, for example. Quick release pins typically have a generally cylindrical shaft with a spring-loaded ball at a distal end of the shaft and a ring grip at an opposed end. The ball springs inward during installation and then pops out to lock the pin in place. The middle part **52** is connected to the lower part **54** in similar fashion to removably fasten the parts together. In a preferred form of the invention, the middle part and the lower part will be interchangeable by having joints for connecting at both ends. While, the ladder shows three pieces, this is merely to demonstrate a ladder that can be assembled by separate parts and it is contemplated the ladder can be assembled from fewer or greater number of parts without departing from the present invention.

While FIG. **5** shows a means for connecting ladder parts together with bolts and pins at joints **56**, these joints **56** can alternatively include pivoting connecting members, such as hinges that allow the parts to be folded on top of one another so the length dimension of the ladder can be shortened or minimized for storage. Further, the dimensions of the stiles can be such that inner chamber **28** of the upper section **50** will be dimensioned to receive a portion of the middle part and likewise the middle part can have its inner chamber dimensioned to receive a portion of the lower section in telescoping fashion to reduce or adjust the length dimension of the ladder. Appropriate mechanisms will be provided to removably lock the respective ladder parts together while in use and to allow the ladder sections to slide with respect to one another during collapsing of the ladder for storage.

FIG. **6** shows a ladder that is fully assembled with the principal parts permanently connected together. While it may be possible to remove the end caps from the arms without destroying the ladder, most other connections will require the use of a tool to disconnect the parts and may even require damaging or destroying the part or parts altogether.

FIGS. **7-10** and **11-13** show another embodiment of a ladder **100** that differs from the embodiments discussed above with reference to FIGS. **1-6** by having stiles and rungs that are circular in horizontal cross section and has a securing assembly **115** that connects the stiles. In most other respects the embodiments are the same and like parts will be referred to with like numbers. The securing assembly **115** has a support bar **117**, four gussets **119**, three pins **121** and a strap **123**. The securing assembly **115** connects a top end of each of the stiles and portions of the support bar extend beyond a vertical plane running through a center of the stiles to form flanges for mounting the ladder to the hatchway **46**. The securing assembly can be fully assembled and then attached as a single unit to the two stiles or it can be attached to the stiles in separate pieces or subassemblies. Preferably, the securing assembly is permanently attached to the stiles by welding, soldering, brazing or other techniques well known to those of skill in the art. It is also contemplated that the securing assembly **115** can be removably attached to the stiles in the same manner used to connect stiles together as described above in reference to FIG. **5** for a multi-piece ladder assemblage.

The support bar **117** can have a variety of shapes in horizontal cross section such as a straight line, a curved line, a C-shape, a D-shape, an H-shape, an L-shape, a V-shape, circular, oval, polygonal, irregular, and sinusoidal. Polygonal shapes include triangular, square, rectangular, trapezoidal, pentagonal, hexagonal, heptagonal, and octagonal. In one preferred form of the invention, the support bar will have a circular shape in horizontal cross section. Additionally, in a preferred form of the invention, the support bar **117** will be arcuate in shape between opposed ends and will have a centrally disposed curved section **130**. The support bar has two sections that extend beyond the stiles located at opposed ends of the support bar to form mounting flanges **131**. The curved section also extends beyond the stiles and forms a third mounting flange **133**.

In a preferred form of the invention, the gussets **119** are generally triangular and more preferably right triangles and connect a bottom surface of the support bar **117** to an outer surface of the stiles. Preferably, each pair of the gussets **119** is permanently attached to the stiles and the bases of each pair of adjacent gussets are generally in alignment with one another.

The three pins **121** are connected to a bottom surface of the support bar **117** and extend perpendicularly therefrom. The three pins and are spaced from one another with two of the pins **121** being positioned at opposed distal ends of the support arm and the third pin is centrally located at the curved section **130** of the connector bar. The three pins **121** are generally cylindrical with the centrally located pin having a diameter larger than a diameter of the pins located at the distal ends of the support bar. In one preferred form of the invention, the central pin will have a diameter of 1 inch and the distal pins will have a diameter of ½ inch and all of the pins will be two inches in length. The three pins engage the hatchway **46** with the two smaller pins contacting an inner surface of the hatchway **46** and the larger pin engaging an outer surface of the hatchway.

The strap **123** has opposed ends connected to one of each of the stiles below the apexes of the gussets, on a front (FIG. **11-13**) or back side (FIGS. **7-10**) of the stiles and preferably the connection is permanent. The strap **123** is generally arcuate in shape from end to end. The strap **123** can have a variety of shapes in horizontal cross section such as a straight line, a curved line, a C-shape, a D-shape, an H-shape, an L-shape, a V-shape, circular, oval, polygonal, irregular, and sinusoidal. Polygonal shapes include triangular, square, rectangular, trapezoidal, pentagonal, hexagonal,

heptagonal, and octagonal. Most preferably, the strap will have a straight line cross sectional shape. The strap **123** is elongate having a length dimension greater than a width dimension and a depth dimension.

FIG. **10** shows another embodiment of a ladder **200** of the present invention that is the same as the ladder described with respect to FIGS. **7-9** but differs in that the ladder **200** can be assembled and disassembled without destroying the ladder. For example, the ladder can be assembled for use and then disassembled for storage. The ladder **200** has a top segment **202**, a middle segment **204** and a bottom segment **206**. FIG. **10** shows the ladder segments adjacent one another but not connected together. The top segment **202** is connected to the middle segment, for example, at a pair of joints **208**. Each of the two joints has a pair of holes, one of each on a stile, that are brought into alignment and a clevis pin is inserted through the holes to secure the segments together. A hairpin cotter is inserted through a bore at a distal end of the clevis pin to retain the clevis pin in place during use of the ladder. Preferably, the holes extend through the entire diameter of the stile. An opposed end of the middle segment **204** is similarly connected to the bottom segment **206**. Additional ladder segments are connected in the same fashion.

In an embodiment where the securing assembly **115** is releasably attached to the top segment **202**, the securing assembly has two connector tubes (not shown) attached to a bottom surface of the support bar and extend in a perpendicular direction away from the bar. The gussets connect the connector tubes to the support arm instead of to the stiles. A hole at a distal end of each connector tube is brought into alignment with respective holes on a top end of each of the stiles and the parts are releasably connected together using the clevis pin assemblies in the same fashion as the ladder segments are connected as discussed above.

The dimensions of the ladder can vary based on the need and application. Typically, the ladder will have sufficient height to extend from a top of a tank to a bottom surface of a tank to provide safe access by a person using the ladder. The ladder can be stowed, for example, on a tanker truck, service vehicle or in a garage or other storage area.

In a preferred form of the invention, the stiles, arms and rungs will be made from a material suitable for use as a ladder and capable of supporting the weight of an adult person of, for example, 250 pounds, and can include, metal, fiberglass, composite materials, wood, polymeric materials and combinations of the same. Suitable metals include aluminum and steel, and preferably is aluminum. The parts can be manufactured by any suitable method such as extrusion and molding or other technique well known to those of ordinary skill in the art. In one preferred form of the invention, the rungs will have traction enhancing modifications such as a textured surface, knurls **220** and or non-slip paint. FIGS. **8** and **10** show knurls **220** extending along the length of the rungs.

While the present invention is described in connection with what is presently considered to be the most practical and preferred embodiments, it should be appreciated that the invention is not limited to the disclosed embodiments, and is intended to cover various modifications and equivalent arrangements included within the spirit and scope of the claims. Modifications and variations in the present invention may be made without departing from the novel aspects of the invention as defined in the claims. The appended claims should be construed broadly and in a manner consistent with the spirit and the scope of the invention herein.

We claim:

1. A portable ladder comprising:

a pair of elongate stiles spaced from one another and each having a first end and a second end, a topmost surface at the first ends, and the pair of elongate stiles extending in a first direction;

a plurality of rungs each extending between the elongate stiles transverse to the first direction and having opposed ends one of each attached to each of the elongate stiles and each of the plurality of rungs being spaced from one another along the first direction, the rungs being arcuate in shape between the opposed ends; and

a securing assembly fixedly attached to the topmost surfaces and comprising first and second support bar sections and a centrally disposed curved portion extending from and between the first and second support bar sections; each support bar section having a distal end extending from and spaced in a direction transverse to the first direction outward from the pair of elongate stiles,

said curved portion extending rearward of the stiles and the support bar sections extending forward of the stiles; and each support bar comprising a stop projecting from the distal end, the respective stops extending along the first direction and spaced from one another and the stiles.

2. The ladder of claim **1** wherein the stiles have an outer surface and a central portion of each of the plurality of rungs extends in a direction transverse to the first direction outward beyond the outer surface.

3. The ladder of claim **1** wherein the stiles have a cross-sectional shape selected from the group consisting of a straight line, a curved line, a C-shape, a D-shape, an H-shape, a T-shape, an L-shape, a V-shape, circular, oval, polygonal, and sinusoidal.

4. The ladder of claim **3** wherein the polygonal shapes include triangular, square, rectangular, trapezoidal, pentagonal, hexagonal, heptagonal, and octagonal.

5. The ladder of claim **1** wherein the securing assembly is fixedly attached to both of the stiles.

6. The ladder of claim **5** wherein the securing assembly, further comprising a third stop depending from the curved portion and extending along the first direction.

7. The ladder of claim **6** wherein a distance between the respective stops of the support bars and the third stop of the curved portion defines a gap.

8. The ladder of claim **7** wherein the respective stops of the support bars are spaced from each other, to define a wall receiving structure.

9. The ladder of claim **5** further comprising an arcuate strap spaced from the securing assembly and connected at opposed ends to the stiles.

10. The ladder of claim **9** further comprising a pair of gussets, one of each gusset connecting the securing assembly to one of the stiles.

11. The ladder of claim **1** wherein the respective stops of each support bar is generally cylindrical.

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