United States Patent [19]

Van Tassel

[11] **3,866,382**

[45] **Feb. 18, 1975**

[54] **APPARATUS FOR SUPPORTING WORKMEN WITHIN AN OPEN-ENDED VESSEL AND CARRYING MATERIALS INTO AND OUT OF THE VESSEL, AND METHOD OF INSTALLING SUCH APPARATUS IN A VESSEL**

[75] Inventor: **Robert M. Van Tassel,** Franklin, Pa.

[73] Assignee: **United States Steel Corporation,** Pittsburgh, Pa.

[22] Filed: **Feb. 20, 1974**

[21] Appl. No.: **444,197**

[52] **U.S. Cl.** **52/741,** 52/749, 182/128

[51] **Int. Cl.** **E04b 1/35,** E04g 21/16

[58] **Field of Search** 52/741, 745, 747, 749, 52/30; 182/128, 141

[56] **References Cited**

UNITED STATES PATENTS

2,933,918	4/1960	Arnold	182/128 X
3,033,389	5/1962	Abardtin et al.	52/749 X
3,168,163	2/1965	Prosser	182/128 X
3,236,397	2/1966	Lakin	52/749 X
3,256,956	6/1966	Puhringer	182/128
3,259,208	7/1966	Behr	182/128
3,298,154	1/1967	Behr et al.	52/749
3,439,794	4/1969	Park et al.	52/749 X
3,517,771	6/1970	Mahringer et al.	182/128 X

Primary Examiner—Price C. Faw, Jr.
Attorney, Agent, or Firm—Walter P. Wood

[57] **ABSTRACT**

An apparatus which can be inserted into an open-ended vessel, such as a Q-BOP furnace, to support workmen within the vessel and carry materials into and out of the vessel, and a method of installing such apparatus in a vessel. The apparatus comprises a collar ring for attachment to the vessel surrounding an opening in the bottom, a tower supported from the collar ring for vertical movement, a turntable at the upper end of the tower, a collapsible platform carried by the turntable, an elevator cage movable vertically within the tower, a pair of upstanding guide-rail support posts, and rails attached to the posts for guiding the cage and safely stopping it in all emergencies. A single hoist, which is located above an opening in the top of the vessel, raises and lowers both the tower and the cage, eliminating need for multiple hoists. The apparatus breaks down into three relatively compact handling and storage sections, each only about twenty feet in height, which during installation are positioned sequentially under the opening in the bottom of the vessel and connected as they are installed.

20 Claims, 15 Drawing Figures

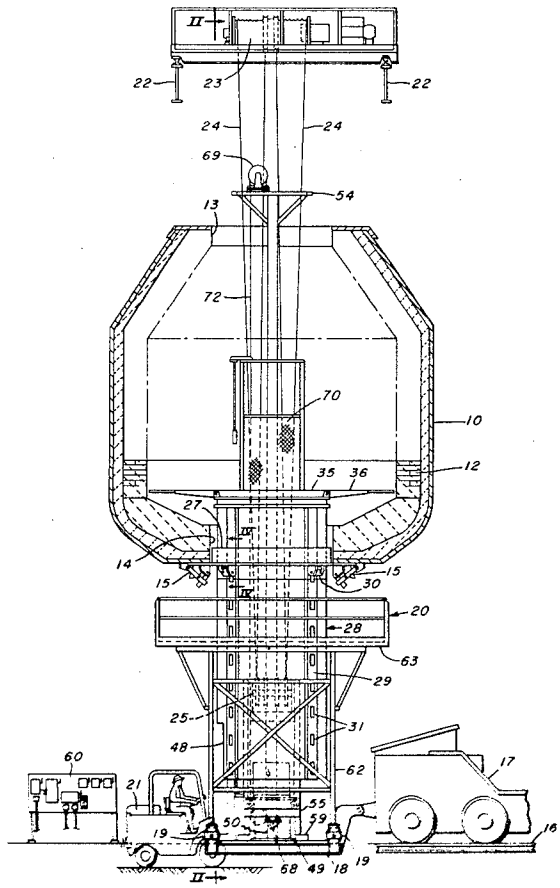


FIG. 1.

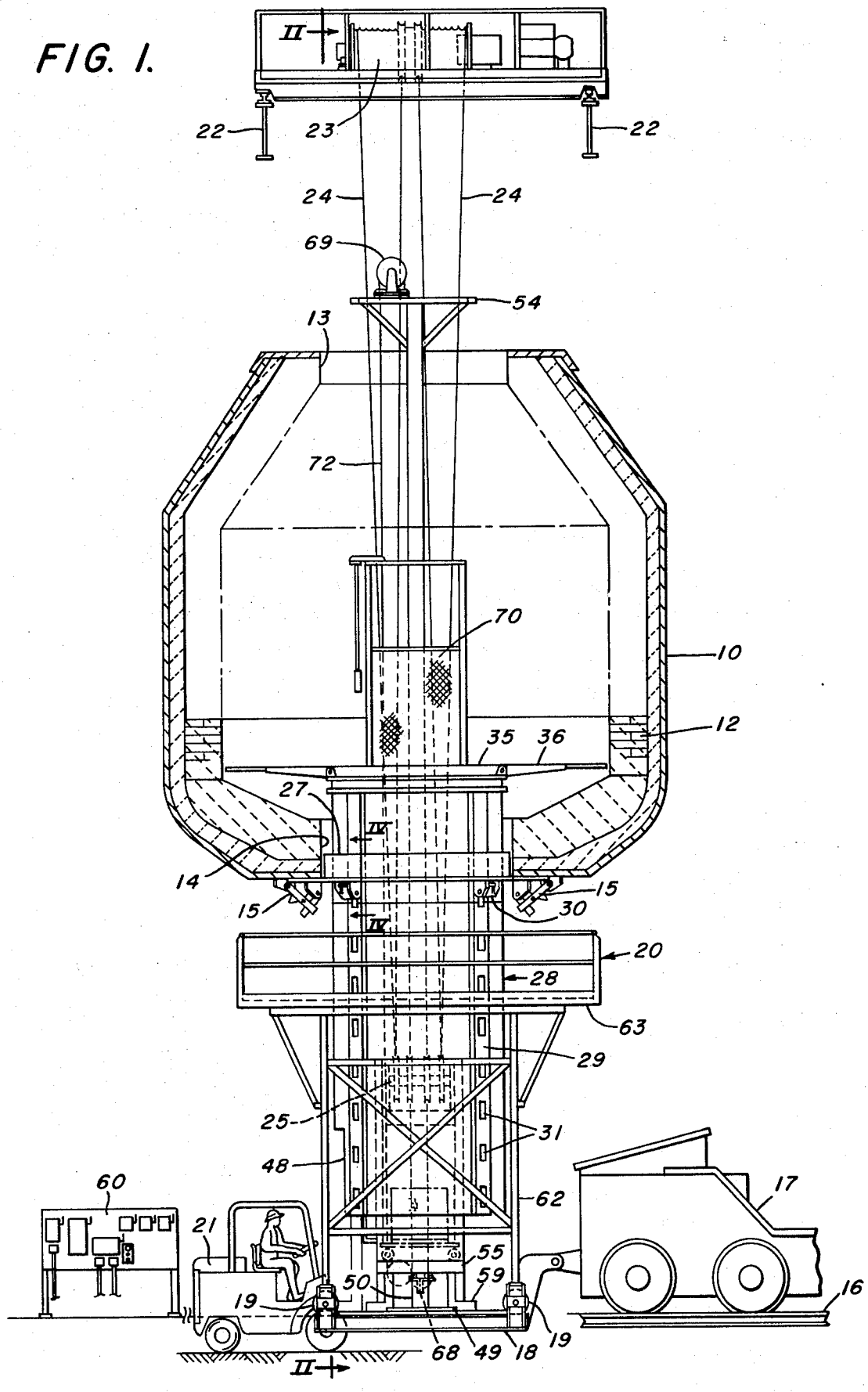

II
22
23
22
24
24
69
54
13
72
70
10
12
35
36
27
IV
14
15
15
30
IV
20
28
63
29
25
31
48
62
60
21
17
55
59
50
19
16
19
68
49
18
II

FIG. 2.

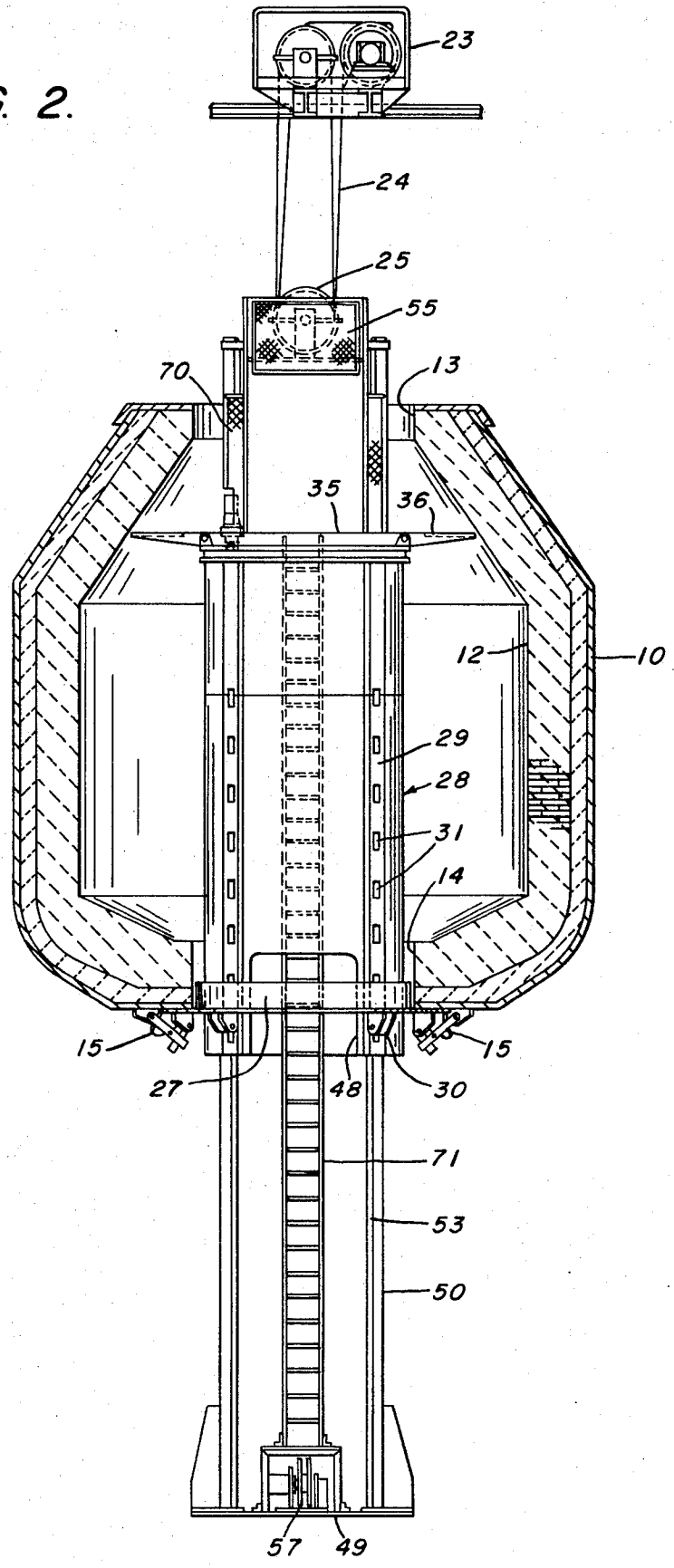


FIG. 13.

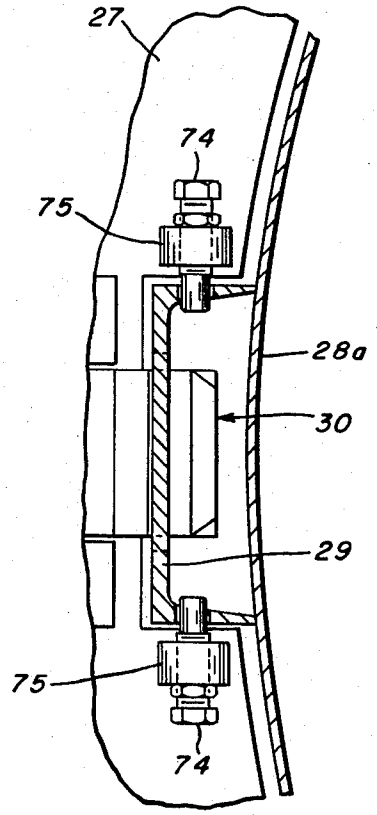


FIG. 3.

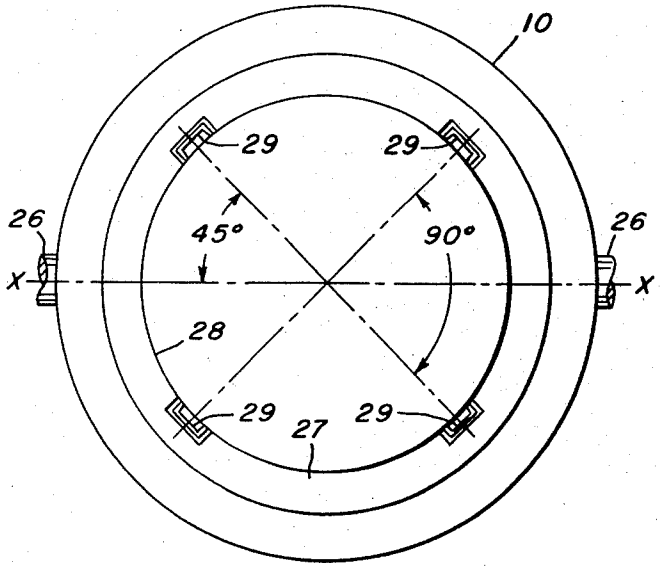


FIG. 4.

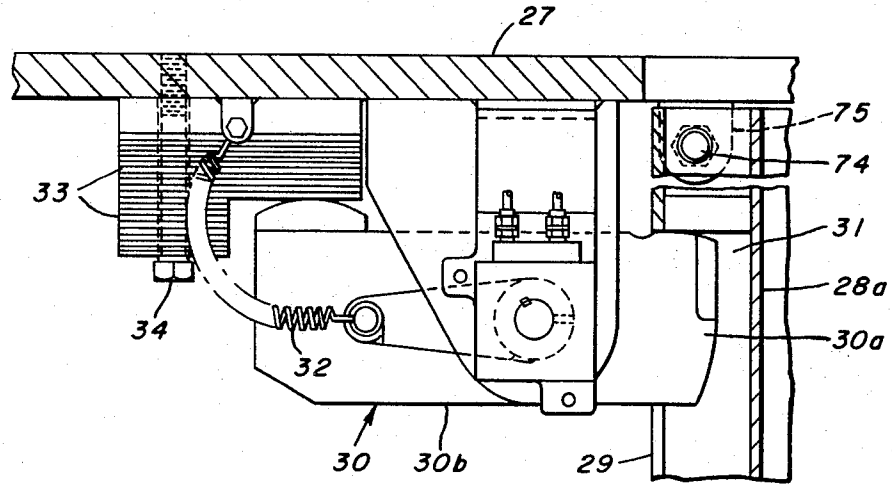


FIG. 5.

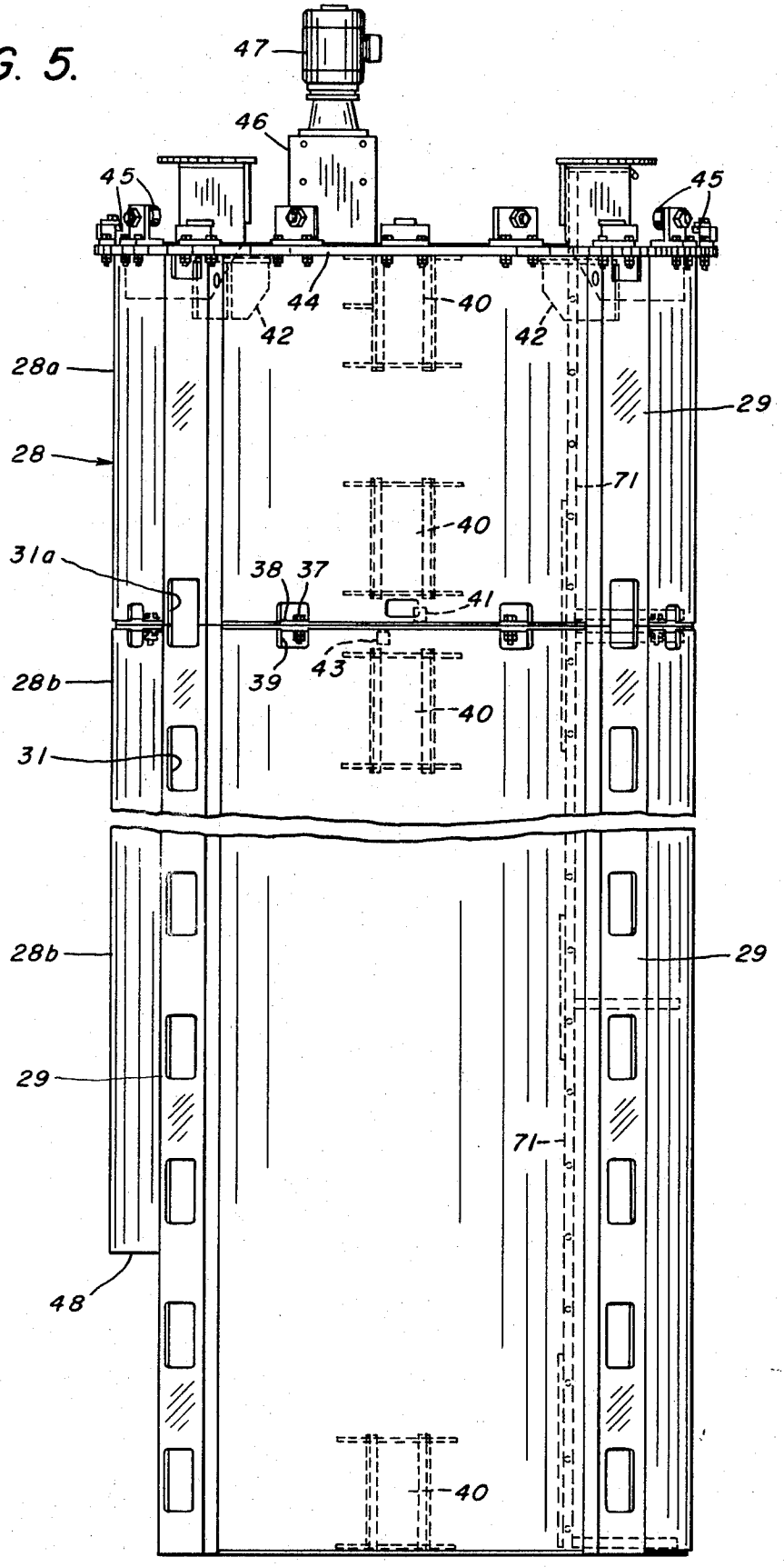

47
46
45
45
44
42
42
40
28a
29
28
71
40
31a
38
37
41
39
43
28b
40
31
28b
29
29
71
48
40

FIG. 6.

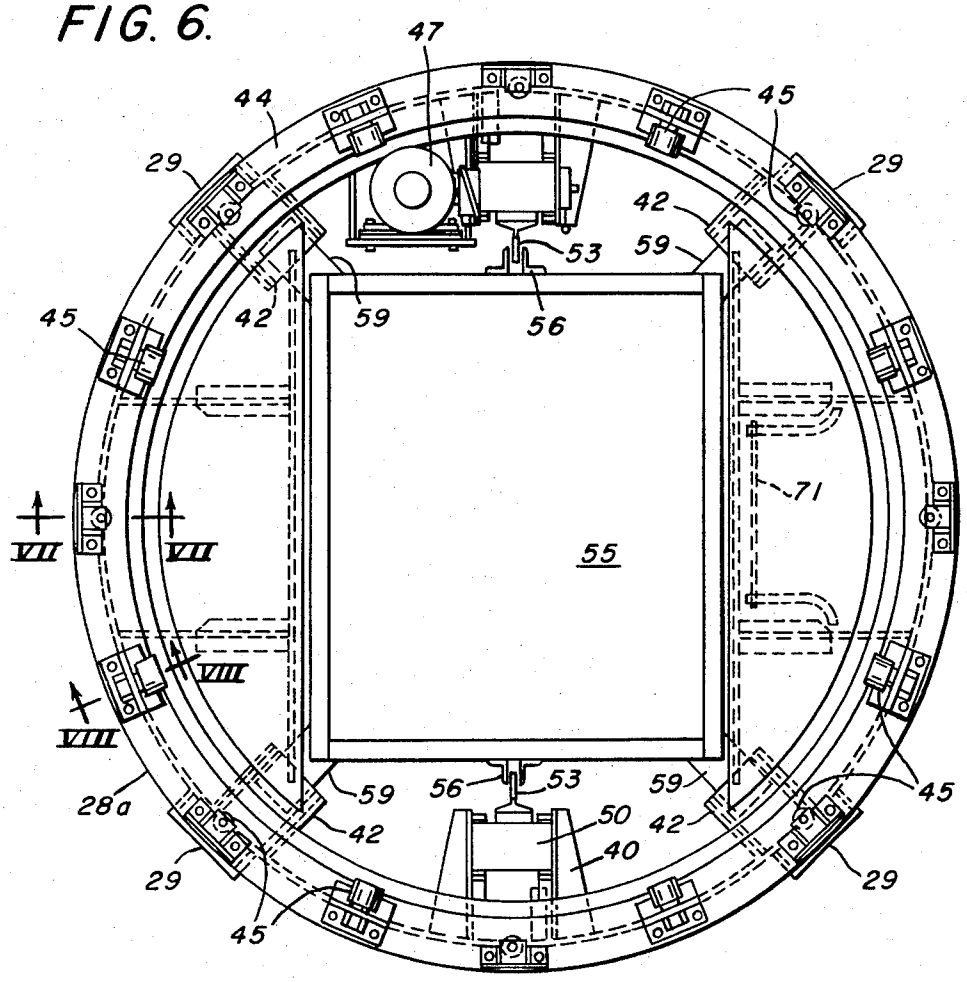


FIG. 7.

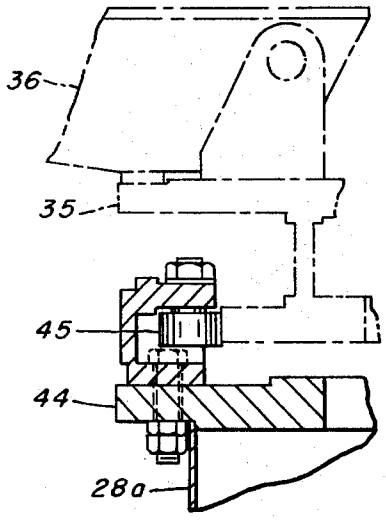


FIG. 8.

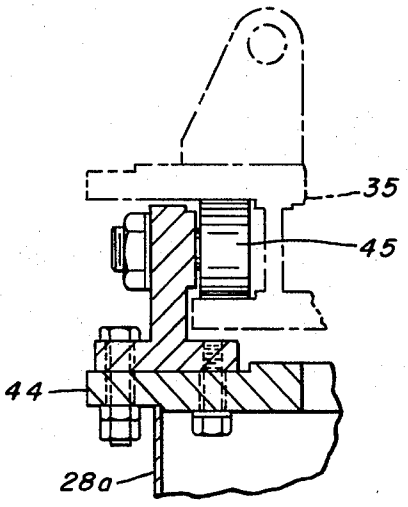


FIG. 9.

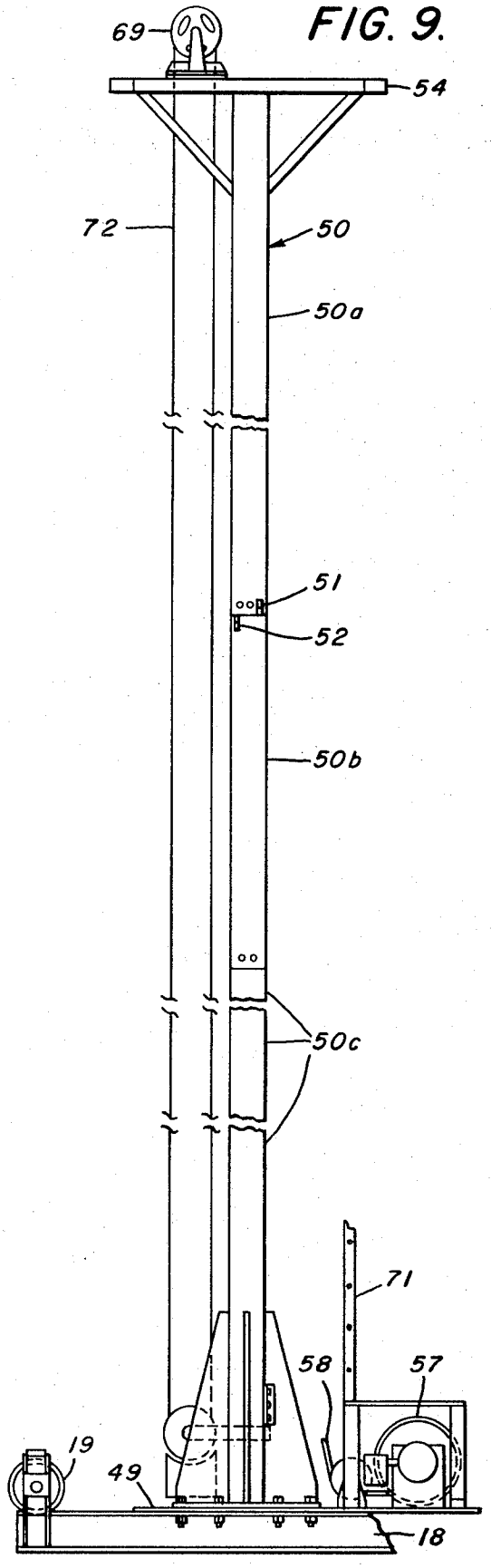

69
54
72
50
50a
51
52
50b
50c
71
58
57
19
49
18

FIG. 10.

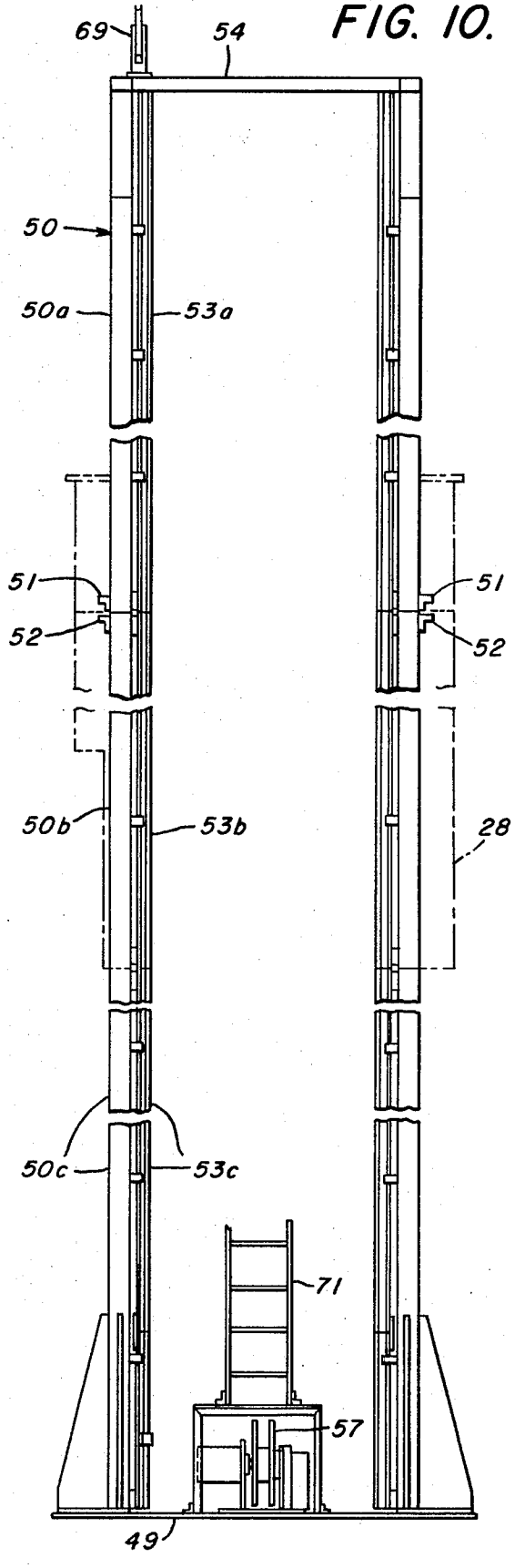

69
54
50
50a
53a
51
52
51
52
50b
53b
28
50c
53c
71
57
49

FIG. 11.

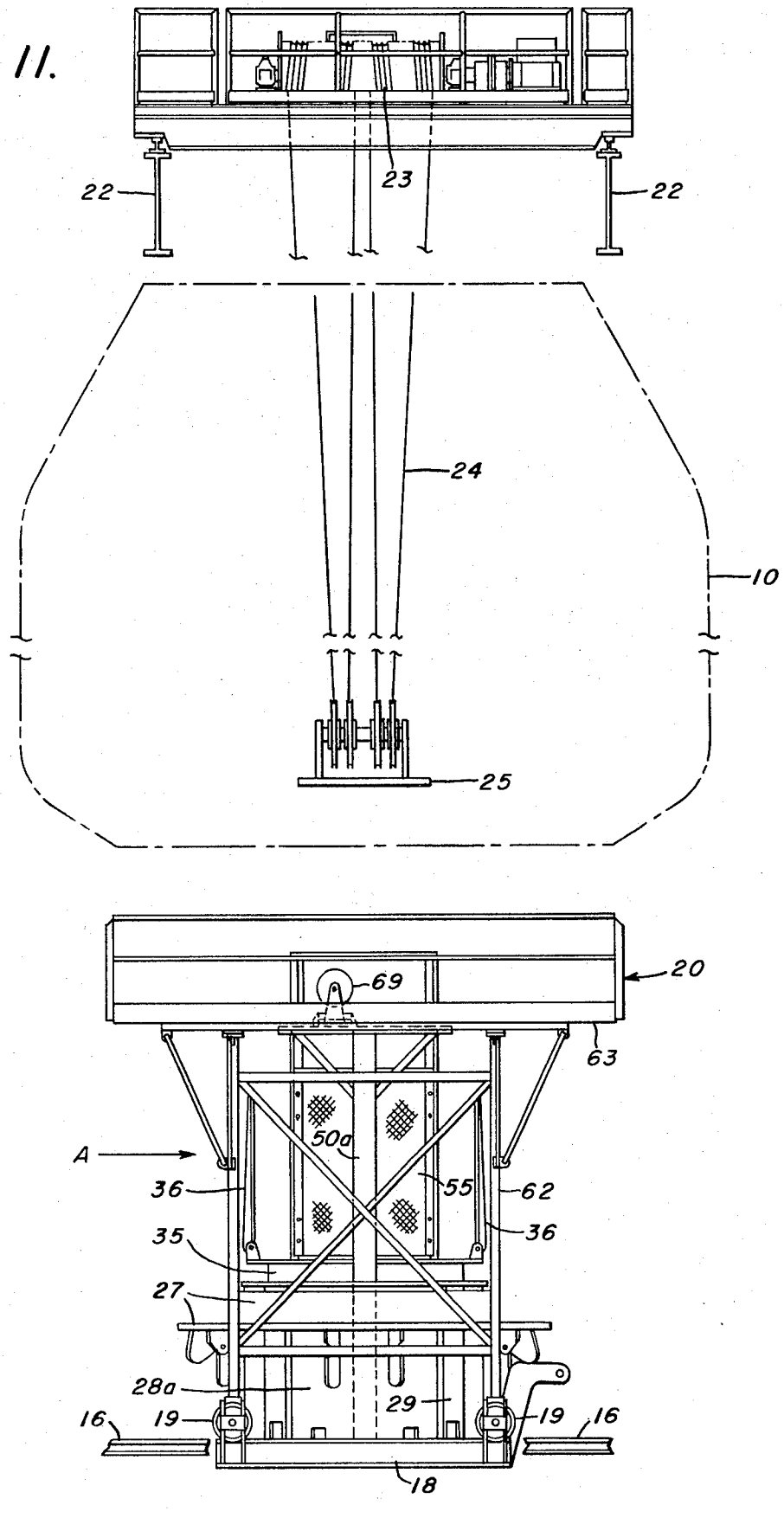


FIG. 12.

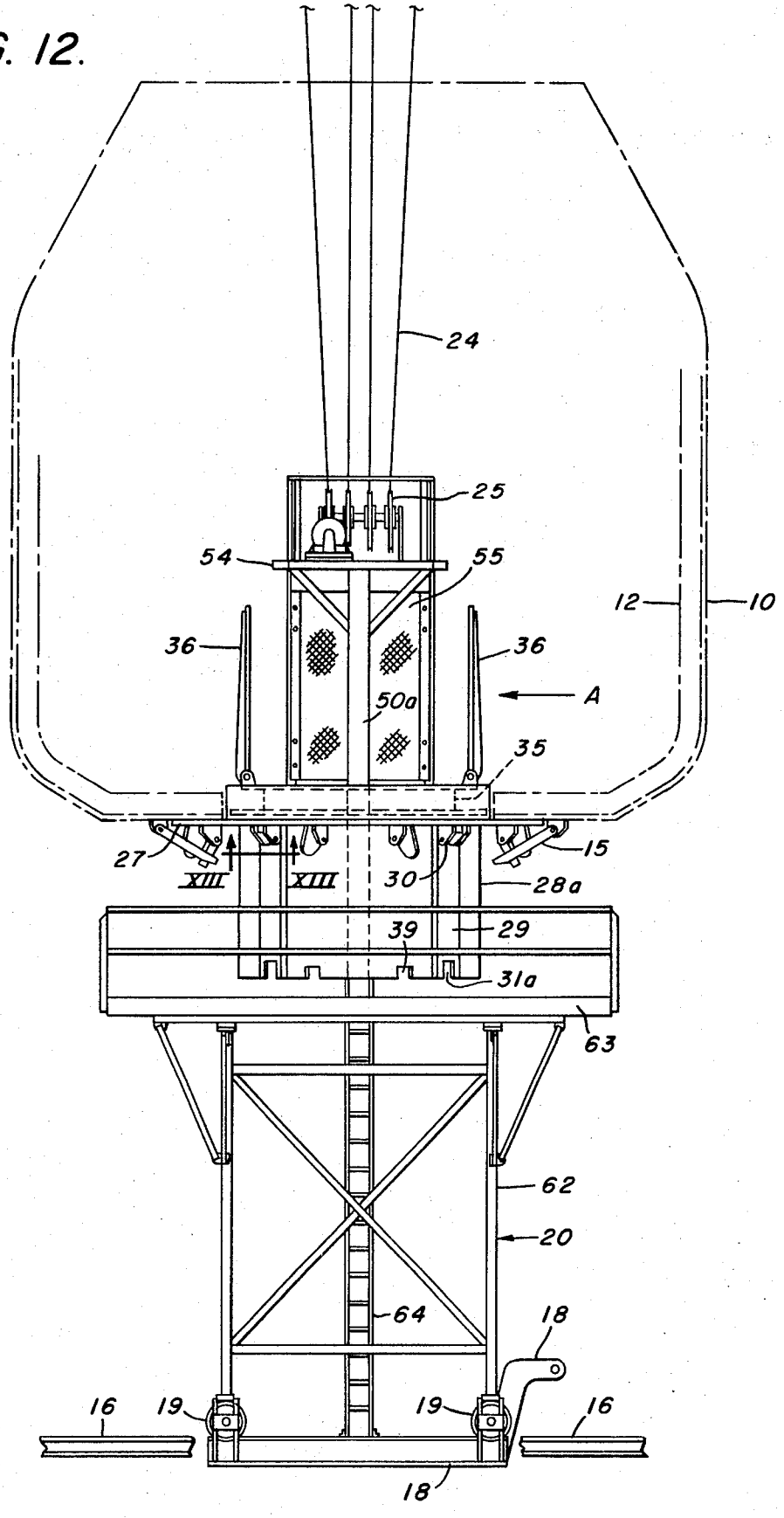

24
25
54
55
12
10
36
36
A
50a
35
27
XIII
XIII
30
15
28a
39
29
31a
63
62
20
64
18
16
19
19
16
18

FIG. 14.

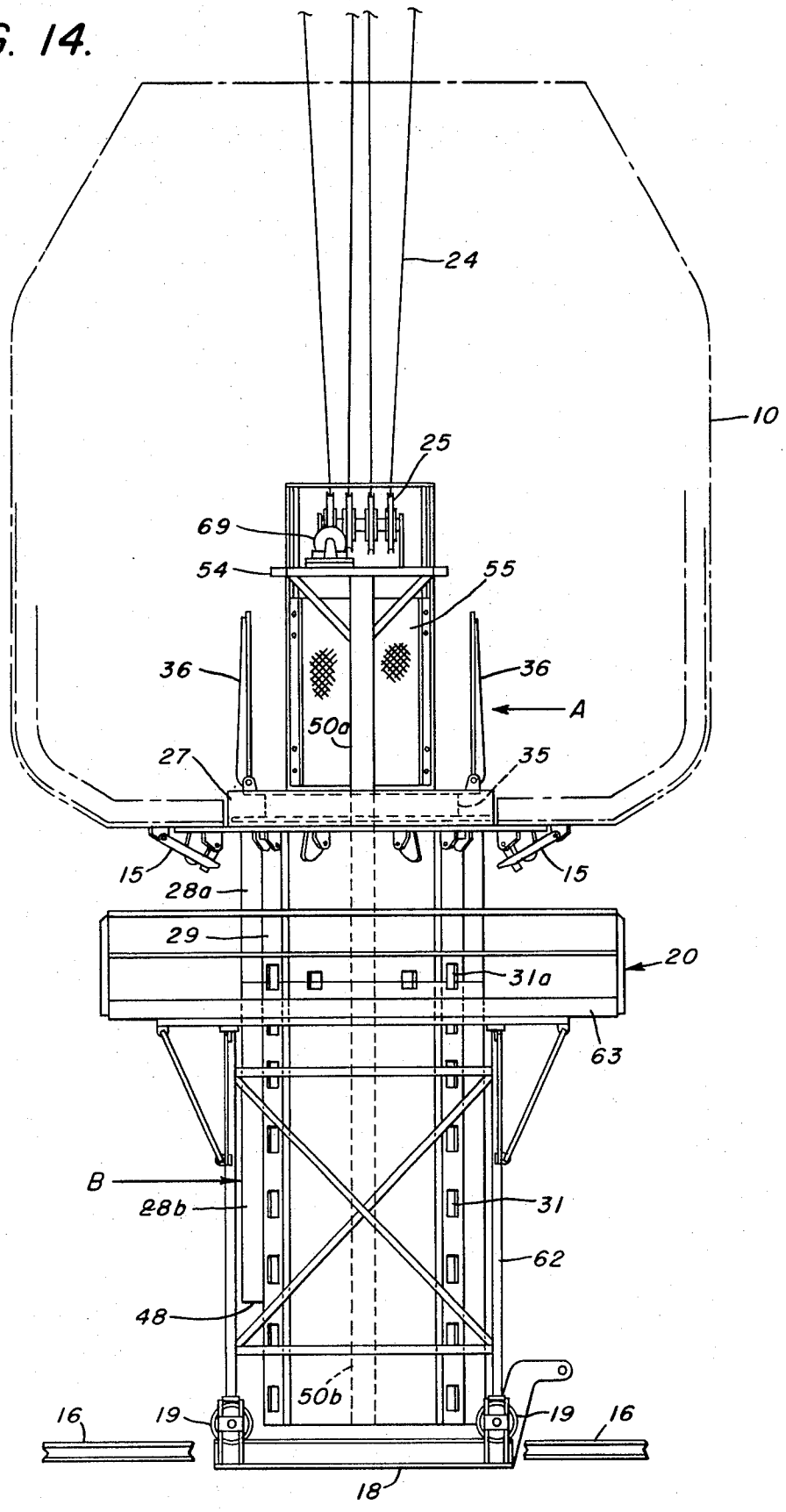
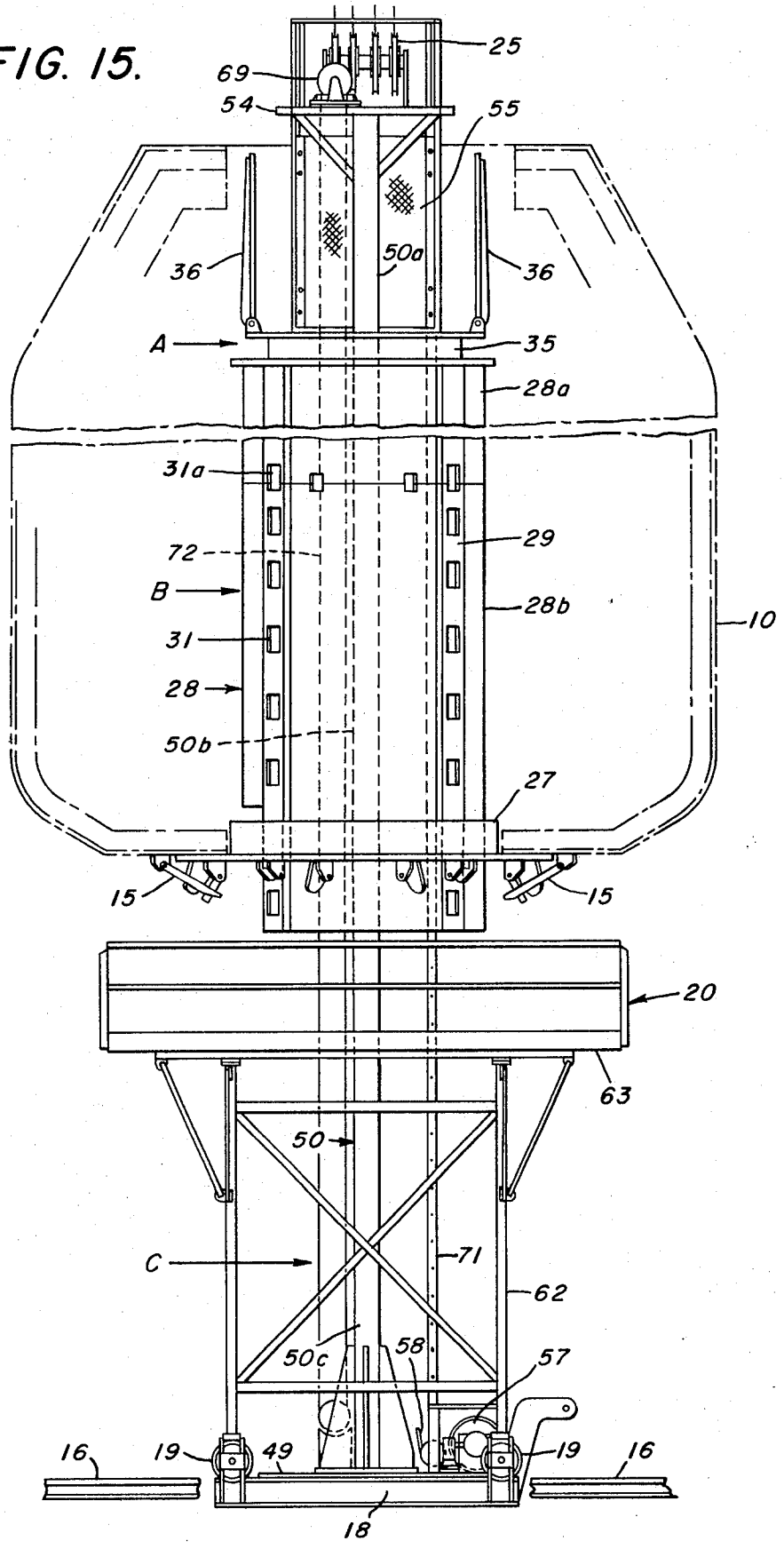

24
10
25
69
54
55
36
36
A
50a
27
35
15
15
28a
29
20
31a
63
B
28b
31
62
48
50b
16
19
19
16
18

FIG. 15.


25
69
54
55
36
50a
36
A
35
28a
31a
72
29
B
28b
10
31
28
50b
27
15
15
20
63
50
C
71
62
50c
58
57
16
19
49
19
16
18

APPARATUS FOR SUPPORTING WORKMEN WITHIN AN OPEN-ENDED VESSEL AND CARRYING MATERIALS INTO AND OUT OF THE VESSEL, AND METHOD OF INSTALLING SUCH APPARATUS IN A VESSEL

This invention relates to an improved apparatus for supporting workmen within a large open-ended vessel and carrying materials into and out of the vessel, and to a method of installing such apparatus in a vessel.

Although use of my invention is not thus limited, the apparatus is particularly useful in lining or re-lining bottomblown oxygen steelmaking furnaces, commonly known as Q-BOP furnaces. The usual Q-BOP furnace includes a large open-top vessel of circular cross section lined with refractory brickwork. The vessel has a removable bottom wall section in which tuyeres are mounted, whereby the bottom also is open when this section is removed. A practice followed heretofore in re-lining the vessels of top-blown oxygen steelmaking furnaces, which are open only at the top, is to lower a tower-like apparatus into the vessel through the open top. The apparatus includes a turntable and collapsible platform on which workmen may stand, and an elevator for carrying materials in and out. Reference can be made to Abarotin et al U.S. Pat. No. 3,033,389, of common ownership, for a showing of one example of an apparatus of this type. A similar practice may be followed in re-lining a Q-BOP furnace if there is sufficient headroom, but advantageously the apparatus may be inserted into a Q-BOP vessel from beneath. Reference can be made to Smith U.S. application Ser. No. 253,217, filed May 15, 1972, also of common ownership, for a showing of one example of an apparatus designed for insertion through the open bottom of a Q-BOP vessel or the like. Other examples are shown in Puhringer U.S. Pat. No. 3,256,956, Behr U.S. Pat. No. 3,259,208, Behr et al. U.S. Pat. No. 3,298,154 and Mahringer et al. U.S. Pat. No. 3,517,771.

An object of my invention is to provide an improved apparatus of the foregoing type which may be inserted through the open bottom of a large open-ended vessel and is of simplified construction, more easily handled and stored, and safer for workmen than previous such apparatus.

A further object is to provide an improved apparatus of the foregoing type which can be expeditiously inserted and installed into a vessel through the open bottom, and expeditiously removed and dismantled when work within the vessel has been completed.

A further object is to provide an improved apparatus of the foregoing type which breaks down into three relatively compact handling and storage sections when not in use.

A further object is to provide an improved apparatus of the foregoing type which comprises a vertically movable tower and a vertically movable elevator cage within the tower both raised and lowered with the same hoist, eliminating the need for multiple hoists used heretofore.

A further object is to provide an improved apparatus which attains the last-mentioned object and in which both tower and cage are positively guided as they are raised and lowered.

A further object is to provide an improved method of installing a tower and cage apparatus in an open-end vessel in which parts of the apparatus, broken down into handling and storage sections of convenient size, are sequentially positioned beneath the vessel, and hoisted into the vessel and interconnected.

IN THE DRAWINGS

FIG. **1** is a partly diagrammatic vertical sectional view of a vessel in which an apparatus constructed in accordance with my invention is installed;

FIG. **2** is a partly diagrammatic vertically sectional view on line II—II of FIG. **1**, but showing parts of the apparatus in different positions and omitting the transport car and scaffold used with the apparatus;

FIG. **3** is a diagrammatic bottom plan view illustrating the relation between the trunnion axis of the vessel and the supports for the tower embodied in the apparatus;

FIG. **4** is a vertical section on a larger scale on line IV—IV of FIG. **1**;

FIG. **5** is a side elevational view of the tower omitting the turntable and collapsible platform;

FIG. **6** is a top plan view of the tower and cage;

FIG. **7** is a section on line VII—VII of FIG. **6**;

FIG. **8** is a section on line VIII—VIII of FIG. **6**;

FIG. **9** is a side elevational view of the guide-rail support posts embodied in the apparatus taken from the same side as FIG. **1**;

FIG. **10** is a side elevational view of the posts and guide rails taken from the same side as FIG. **2**;

FIG. **11** is a diagrammatic side elevational view showing the first handling and storage section of the apparatus positioned beneath the vessel prior to installation;

FIG. **12** is a diagrammatic side elevational view showing the first handling and storage section hoisted into the vessel;

FIG. **13** is a horizontal section on a larger scale on line XIII—XIII of FIG. **12**;

FIG. **14** is a diagrammatic side elevational view showing the first handling and storage section installed in the vessel and the second positioned beneath the vessel prior to installation; and

FIG. **15** is a diagrammatic side elevational view showing the first and second handling and storage sections hoisted into the vessel, and the third handling and storage section positioned beneath.

FIGS. **1** and **2** show diagrammatically a portion of a Q-BOP furnace of known construction, the vessel of which includes a metal shell **10** and a lining **12** of refractory brickwork. The vessel has openings **13** and **14** circular in outline in its top and bottom respectively. A plurality of clamps **15** are pivoted to the underside of the vessel for holding a bottom wall section (not shown) within the opening **14** when the furnace is operating. The floor beneath the vessel carries rails **16** on which a conventional ladle car **17** runs. A trailer or transport car **18** is coupled to the ladle car, but can be removed except when needed for use with my apparatus. The transport car has wheels **19** which likewise run on rails **16** and it carries a scaffold **20** hereinafter described. FIG. **1** shows rail **16** broken away beneath the vessel, but it is to be understood that the rail in reality is continuous beneath the vessel to support the transport car. A conventional fork-lift truck **21** operates on the floor for bringing loads to or from the apparatus. Beams **22** are located above the vessel. Before installing my apparatus in the vessel, I mount a hoist **23** on the beams **22.** As best shown in FIG. **11,** the hoist has ropes **24** reeved around its sheaves, which ropes are

reeved also around the sheaves of a sheave block **25** and thus support the latter for vertical movement. Ropes **24** can remain permanently reeved around the sheaves of both the hoist **23** and sheave block **25.** In most instances the vessel is supported on trunnions which are shown diagrammatically at **26** in FIG. **3** and permit the vessel to tilt about a horizontal axis x—x.

The apparatus of my invention comprises first a collar ring **27** and a cylindrical tower **28.** The collar ring is circular in outline and is attached to the bottom of the vessel surrounding the opening **14.** I use some or all of the clamps **15,** normally used to attach the bottom wall section to the vessel, to attach the collar ring. Tower **28** extends through the collar ring into the vessel and is vertically movable. The tower includes a plurality of circumferentially spaced vertically extending channels **29** welded to the outside of its cylindrical body. A corresponding plurality of latches **30** are pivoted to the underside of the collar ring for engagement with vertically spaced latch-receiving openings **31,** arranged in rows in the webs of channels **29,** whereby the collar ring supports the tower, as well as guiding the tower as it moves vertically.

As FIG. **4** shows, each latch **30** is a lever of the first class balanced to gravitate to a position in which its shorter arm **30***a* enters a latch-receiving opening **31.** A spring **32** assists gravitational forces in assuring that the shorter arm enters the opening. The longer arm **30***b* of the latch bears against a stack of shims **33** pivoted to the bottom of the collar ring **27** on a bolt **34.** Thus the latches act as ratchets; that is, they pivot out of the way against the action of gravitational forces and spring **32** when the tower is raised with respect to the collar ring, but automatically enter the openings to prevent unintended lowering of the tower. The purpose of the shims **33** is to assure that the axis of the tower is vertical even though the vessel may be slightly tilted. As FIG. **3** shows diagrammatically, preferably there are four channels **29** spaced 90° apart, and spaced 45° from the trunnion axis x—x. I adjust the angle of the tower axis with respect to the vessel by moving a selected number of shims **33** into a position to be engaged by each latch arm **30***b*. The latches can be retracted manually to lower the tower, but preferably the underside of the collar ring carries hydraulic motors or equivalent (not shown) operatively connected with the latches for this purpose.

The upper end of the tower carries a turntable **35,** and the turntable carries a collapsible platform **36** for supporting workmen within the vessel. The turntable and platform can be of known construction (for example as shown in the aforementioned Smith application) and hence are not shown in detail.

As best shown in FIGS. **5** and **6,** I construct tower **28** of separable upper and lower sections **28***a* and **28***b*. I detachably join the two sections with bolts **37** which extend through mating internal flanges **38.** The walls of the sections have hand holes **39** through which bolts **37** are accessible from the exterior of the tower. The uppermost latch-receiving openings **31***a* of each vertical row lie partially within the upper section **28***a*. The other latch-receiving openings **31** lie wholly within the lower section **28***b*, which is substantially the longer of the two sections. The tower walls carry diametrically opposed internal guide brackets **40,** illustrated as located near each end of each section. The walls of the upper section also carry a pair of diametrically opposed internal lugs **41** at their lower edges and four angularly spaced internal stops **42** at their upper edges. The walls of the lower section also carry a pair of diametrically opposed internal lugs **43** at their upper edges angularly offset from lugs **41** of the upper section. The upper end of the upper section has a flange **44** which carries roller bearings **45** for supporting and guiding the turntable **35** (FIGS. **7** and **8**). A stand **46** is fixed to the upper section and carries a drive motor **47** for the turntable. The lower edge of the lower section **28***b* has a cutout **48.** The purpose of the guide brackets **40,** lugs **41** and **43,** stops **42** and cutout **48** is explained hereinafter.

The apparatus comprises next a base **49** which rests on the transport car **18** beneath the vessel. As best shown in FIGS. **9** and **10,** base **49** carries a pair of opposed upstanding guide-rail-support posts **50** which I construct of separable upper, middle and lower sections **50***a*, **50***b*, and **50***c*. The two lower sections **50***c* are fixed to opposite sides of the base **49,** and the three sections of each post are detachably bolted to one another end-to-end. The lower ends of the upper sections **50***a* and the upper ends of the middle sections **50***b* carry outwardly projecting lugs **51** and **52** respectively, the purpose of which is explained hereinafter. The main purpose of the posts is to carry vertically extending guide rails **53** likewise constructed of sections **53***a*, **53***b* and **53***c* fixed to the inside faces of the respective post sections. As best shown in FIG. **6,** the aforementioned guide brackets **40** on tower **28** receive the posts **50,** whereby the tower can ride up and down on the posts, which assist also in guiding the tower. The upper ends of the posts **50** carry a safety governor support bracket **54** fixed to the upper sections **50***a*. The bracket **54** is in the form of an open rectangular frame and serves also to brace the upper ends of the posts.

I point out that in practice I do not normally assemble the two tower sections **28***a* and **28***b* by themselves as FIG. **5** shows, nor the three post sections **50***a*, **50***b*, and **50***c* by themselves as FIGS. **9** and **10** show. Nevertheless I have presented these figures for the purpose of illustrating more clearly the relation of these parts in the apparatus when it is fully installed in a vessel.

Next the apparatus comprises an elevator cage **55** which rides up and down between the posts **50** and through the tower **28.** The side walls of the cage carry guideways **56** which receive the guide rails **53** for positively guiding the cage as it moves up and down (FIG. **6**). The sheave block **25** is detachably fixed to the top of the cage, whereby the hoist **23** can raise and lower the cage. In its lowered position shown in FIG. **1** the cage rests on base **49** where it can receive materials from the fork lift truck **21** or deliver materials thereto. Base **49** carries a reel **57** for an electric cable **58** which leads to the cage **55** for lights and controls (FIGS. **9** and **10**). The aforementioned cutout **48** in the tower permits access to the cage when the tower is in a low position, as FIG. **1** shows. When the cage is raised, materials may be transferred between it and the platform **36** at the top of the tower. An important feature of the invention is that the underside of the cage carries four outwardly projecting feet **59** which are engageable with the aforementioned stops **42** at the top of tower **28** (FIGS. **1** and **6**). When I wish to raise the tower, I operate the hoist **23** to raise the cage until the feet **59** abut the stops **42** and then continue to operate the hoist. Thus both the cage and tower move upwardly, usually to a level such that the latches **30** enter the next lower

set of latch-receiving openings **31.** In this manner I raise the platform **36** in steps from a position near the vessel bottom, as shown in FIG. **1,** to a position near the top, as shown in FIG. **2,** as work progresses within the vessel. I use a single hoist **23** to move both cage and tower, thus eliminating the multiple hoists shown in the aforementioned Smith application. I control the hoist at a panel **60** located at floor level.

As mentioned hereinbefore, the transport car **18** carries a scaffold **20** for use in conjunction with my apparatus. As shown in FIGS. **1, 11, 12, 14** and **15,** the scaffold includes a framework **62** which surrounds the lower portion of the apparatus beneath the vessel. The framework carries a platform **63** spaced a convenient distance below the vessel bottom for workmen to perform such operations as engaging or disengaging the clamps **15,** connecting and disconnecting the sections of the tower **28,** posts **50** and guide rails **53,** and releasing latches **30.** The framework **62** also carries a ladder **64** for access to the platform **63** (FIG. **12**).

Preferably the apparatus embodies several safety features, among which I point out elevator instantaneous safety gripping devices **68** on the underside of cage **55** (FIG. **1**), a governor **69** on the support bracket **54** (FIGS. **1** and **9**), an enclosure **70** for the cage at the top of the tower (FIGS. **1** and **2**), and a sectional ladder **71** (FIG. **2**). The gripping devices **68** per se are of a known construction and serve to grip the rails **53** instantly and stop the cage in the event the ropes **24** break or the hoists **23** gives way. The governor **69** is connected to the cage through an endless rope **72** and serves to stop the hoist motor and cage in the event the cage travels too fast. The enclosure **70** prevents personnel from falling through the tower **28** when the cage is lowered. The ladder **71** furnishes access to the top of the tower independently of the cage.

As mentioned hereinbefore, the apparatus breaks down into first, second, and third relatively compact handling and storage sections A, B and C. Essentially the first of these sections A includes the collar ring **27,** the upper section **28***a* of the tower, the turntable **35,** the collapsible platform **36,** the upper sections **50***a* and **53***a* of the posts and rails, and the cage **55.** When the apparatus is disassembled, all parts of the first handling and storage section can be supported on the transport car **18** nested within the scaffold **20,** as FIG. **11** shows. The aforementioned lugs **51** on the upper post sections **50***a* rest on the aforementioned lugs **41** on the tower section **28***a* to prevent the post sections from dropping from the tower section. The collar ring **27** is temporarily attached to the upper end of the tower section. The temporary attachment means includes bolts **74** which are threadedly engaged with tapped lugs **75** on the underside of the collar ring **27** and extend into holes in the flanges of channels **29,** as FIG. **13** shows. Essentially the second handling and storage section B includes the lower tower section **28***b* and the middle sections **50***b* and **53***b* of the posts and rails. The aforementioned lugs **52** on the post sections **50***b* rest on the aforementioned lugs **43** on the tower section **28***b* to prevent the post sections from dropping from the tower section. The various lugs of course do not interfere with movement of the tower downwardly relative to the posts. The angular offset of lugs **41** on the upper tower section **28***a* from the lugs **52** on the middle post sections **50***b* prevents any interference. Essentially the third handling and storage section C includes the base **49,** the lower sections **50***c* and **53***c* of the posts and rails, and the reel **57.**

According to the installing method of my invention, I load the first handling and storage section A on the transport car **18** and use the car to position the section under the opening **14** in the vessel bottom, as FIG. **11** shows. At this stage the rope **72** which operates the governor is bundled compactly within the tower section **28***a*. I operate the previously installed hoist **23** to lower the sheave block **25** to the cage **55** and I attach the block to the top of the cage. The ropes **24** and block **25** clear the bracket **54.** Next I operate hoist **23** to lift the cage into the vessel. The feet **59** on the cage abut the stops **42** in the upper tower section **28***a* and thus also lift this section and the collar ring **27** temporarily attached to its outside with bolts **74.** I stop the hoist when the collar ring reaches the bottom of the vessel, as FIG. **12** shows. Workmen on the platform **63** of scaffold **20** detach the collar ring from the upper tower section and attach the collar ring to the vessel with clamps **15.** Next I again operate the hoist **23** to lift the cage and upper tower section to a level such that the latches **30** enter the uppermost latch-receiving openings **31***a*, which are partially in the upper section. I adjust the shims **33** to assure that the axis of the tower section is vertical. Thus the collar ring supports the upper tower section. I unfurl the rope **72.**

Next I load the second handling and storage section B on the transport car **18** within the scaffold **20,** and position this section under section A, as FIG. **14** shows. Workmen on the platform **63** bolt the mating flanges **38** together to connect the two sections, and bolt the upper and middle sections **50***a* and **50***b* of the posts together. I operate the hoist to lift the parts to a height such that they clear the third section C. Next I load the third handling and storage section C on the transport car again within the scaffold, and position this section under section B, as FIG. **15** shows. Workmen on the scaffold bolt the middle and lower sections **50***b* and **50***c* of the posts together. Thereafter I make the necessary hydraulic and electric connections and connect items such as the governor **69.** I open the collapsible platform **36.** If the vessel is to be re-lined I lower the tower **28** to a position such that the platform **36** is near the bottom to start the re-lining operation. I follow similar steps in reverse order in dismantling the apparatus when it is no longer needed.

From the foregoing description, it is seen that my invention affords an apparatus which is of simple construction for supporting workmen within a large vessel and carrying materials to and from the vessel. The apparatus utilizes only a single hoist both to raise and lower the cage which carries the materials, as well as to raise and lower the tower which supports workmen. The apparatus breaks down into relatively compact handling and storage sections for easy installation, dismantling and storage. All hydraulics and electrical lines are self-contained in the three sections for convenient connection. The apparatus is fully equipped with safety features, and both the cage and tower are positively guided as they move vertically for maximum safety.

I claim:

1. In an apparatus for supporting workmen within an open-ended vessel and carrying materials into and out of the vessel, which apparatus comprises:

a vertically movable tower adapted to extend through the open bottom of the vessel;

supporting means for workmen carried by said tower adjacent its upper end;

tower-supporting means for attachment to the vessel adjacent its open bottom;

an elevator cage vertically movable within said tower; and

means on said cage for engagement by a hoist above the open top of the vessel for raising and lowering the cage;

the improvement comprising:

ratchet means on said tower-supporting means engageable with said tower to prevent downward movement thereof but permitting upward movement; and

interengageable means on said tower and said cage for raising said tower with respect to said tower-supporting means.

2. An apparatus as defined in claim **1** in which said tower-supporting means includes a collar ring, and said ratchet means includes a plurality of latches pivoted to said collar ring, said tower having a corresponding plurality of rows of vertically spaced latch-receiving openings.

3. An apparatus as defined in claim **2** comprising in addition means carried by said collar ring and cooperating with said latches for adjusting the position of said tower so that its axis is vertical.

4. An apparatus as defined in claim **1** in which said interengageable means includes stops on said tower adjacent its upper end and cooperating outwardly projecting feet carried by said cage.

5. An apparatus as defined in claim **1** in which said improvement further comprises means positively guiding said cage as it moves vertically.

6. An apparatus as defined in claim **5** in which the means positively guiding said cage includes a base adapted to be positioned under the open bottom of the vessel, opposed posts carried by said base, guide brackets carried by said tower and receiving said posts, guide rails carried by said posts, and guideways carried by said cage and receiving said rails.

7. An apparatus as defined in claim **6** in which said tower, said posts, and said rails are formed in a plurality of sections to facilitate installation of the apparatus in a vessel and removal therefrom.

8. An apparatus as defined in claim **5** in which said improvement further comprises means for breaking down the apparatus into first, second and third relatively compact handling and storage sections.

9. An apparatus as defined in claim **8** in which the first handling and storage section includes an upper section of said tower, said tower-supporting means, upper sections of guiding means, and said cage, in which the second handling and storage section includes a lower section of said tower and middle sections of said guiding means, and in which the third handling and storage section includes a base plate and lower sections of said guiding means upstanding from said base plate.

10. The combination, with an apparatus constructed as defined in claim **1**, of a transport car movable to a position under the open bottom of the vessel and adapted to carry the apparatus to a position for installation in the vessel.

11. The combination, with an apparatus constructed as defined in claim **1**, of a transport car movable to a position under the open bottom of the vessel and adapted to carry the apparatus to a position for installation in the vessel, and a scaffold carried by said car and surrounding the apparatus, said scaffold affording a support for workmen immediately below the vessel.

12. In an apparatus for supporting workmen within an open-ended vessel and carrying material into and out of the vessel, which apparatus includes a vertically movable tower adapted to extend through the open bottom of the vessel, tower-supporting means for attachment to the vessel adjacent its open bottom, an elevator cage vertically movable in said tower, and guide means for said cage, the improvement in which said tower, said tower-supporting means, said cage, and said guide means break down into first, second and third relatively compact handling and storage sections capable of installation sequentially in the vessel.

13. An apparatus as defined in claim **12** in which said first handling and storage section includes an upper section of said tower, said tower-supporting means temporarily attached to the upper section of said tower, upper sections of said guide means, and said cage nested in the upper section of said tower.

14. An apparatus as defined in claim **13** in which said second handling and storage section includes a lower section of said tower adapted to be attached to the upper section of said tower, and middle sections of said guide means adapted to be attached to the upper sections of said guide means.

15. An apparatus as defined in claim **14** in which said third handling and storage section includes a base plate and lower sections of said guide means adapted to be attached to the middle sections of said guide means.

16. The combination, with an apparatus as defined in claim **13**, of a transport car and a scaffold mounted on said car, said handling and storage sections being individually supportable on said car within said scaffold.

17. A method of installing an apparatus in an openended vessel, which apparatus provides support for workmen within the vessel and means for carrying materials into and out of the vessel, said method comprising:

positioning under the open bottom of the vessel a first handling and storage section which includes an upper tower section, tower-supporting means temporarily attached to said upper tower section, upper sections of guide means, and an elevator cage;

hoisting said first handling and storage section through the open bottom to a position in which tower-supporting means is at a level to be attached to the vessel adjacent the open bottom;

attaching said tower-supporting means to the vessel, whereafter said tower-supporting means engages and supports said upper tower section;

positioning under said first handling and storage section a second handling and storage section which includes a lower tower section, and middle sections of guide means;

joining said upper and lower tower sections;

joining the upper and middle sections of said guide means;

positioning under said second handling and storage section a third handling and storage section which includes a base plate and lower sections of guide means upstanding from said base plate; and

joining the middle and lower sections of said guide means.

18. A method as defined in claim 17 in which means on said cage abuts means on said upper tower section to hoist said upper tower section as said cage is hoisted.

19. A method as defined in claim 17 in which said handling and storage sections are loaded in sequence on a transport car which carries them under the vessel.

20. A method as defined in claim 17 including the further step of adjusting said tower sections to a position in which their axis is vertical even though the vessel may be tilted.

* * * * *