United States Patent

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[45] Patented **Jan. 19, 1971**

[54] **BOOM RIGGING**
8 Claims, 8 Drawing Figs.

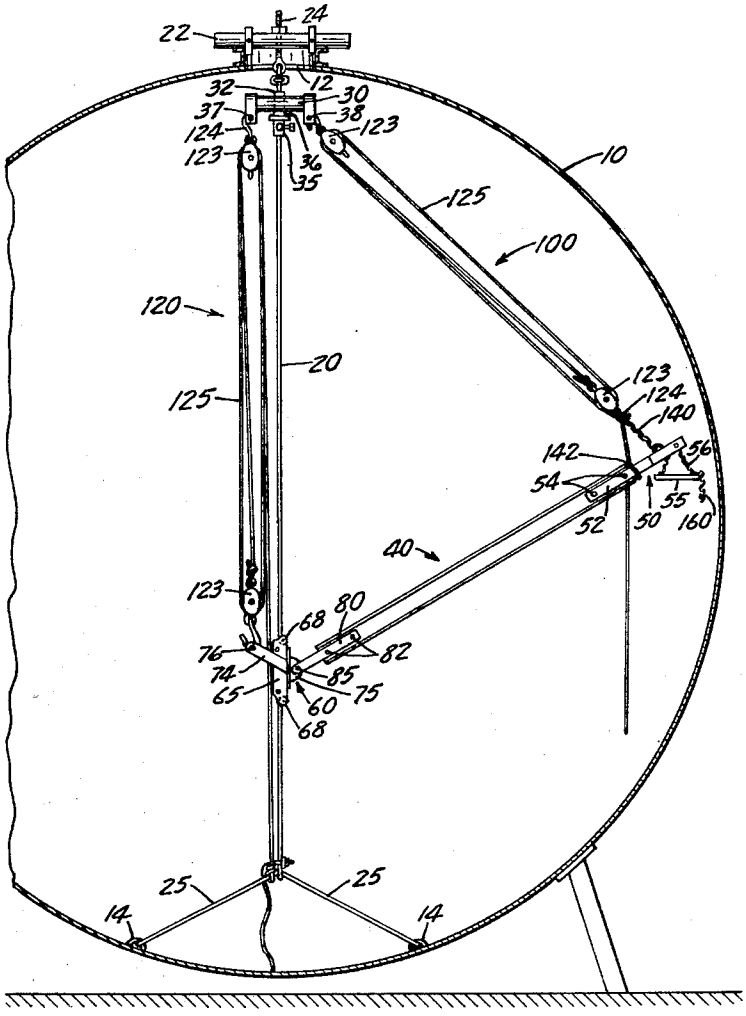
[52] **U.S. Cl.** **182/128,** 212/57
[51] **Int. Cl.** **E04g 1/36**
[50] **Field of Search** 212/57, 58, 59, 8, 19, 27; 182/2, 128

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ABSTRACT: A boom rigging for use in the maintenance of the interior of tanks. It includes a trolley mounted on the end of a boom and supported on a support cable positioned within the tank together with means raising and lowering each end of the boom relative to the support cable.

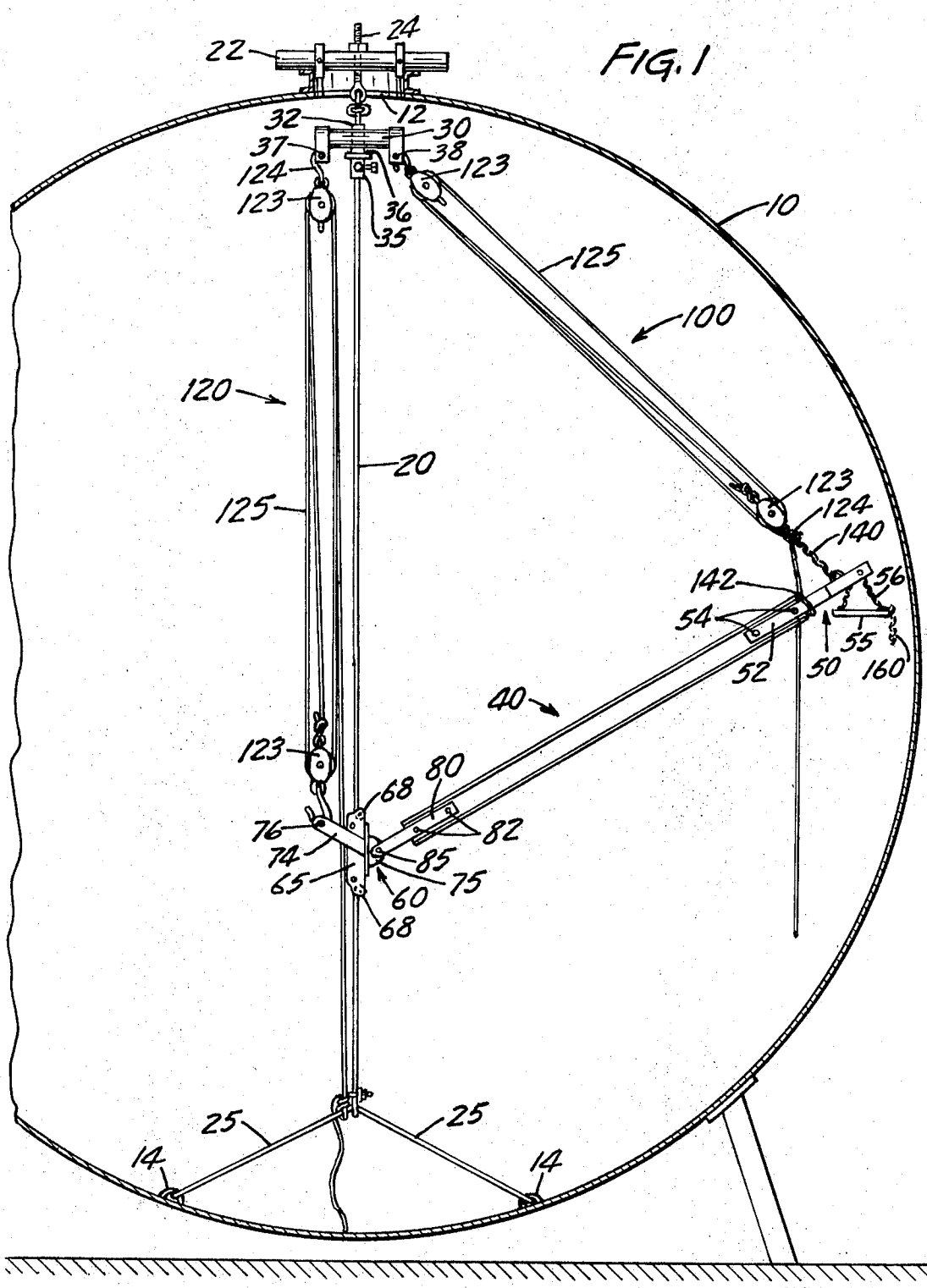


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SHEET 1 OF 2

FIG. 1



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FIG. 2

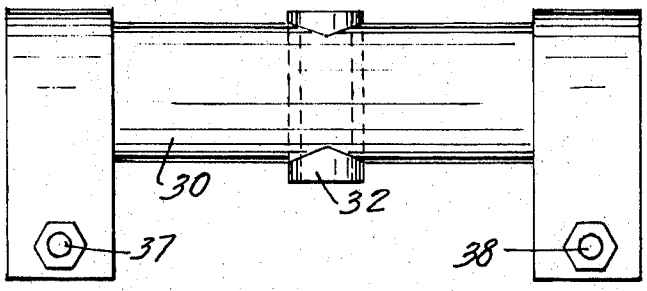


FIG. 3

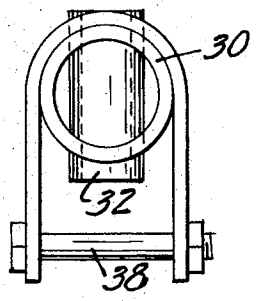


FIG. 4

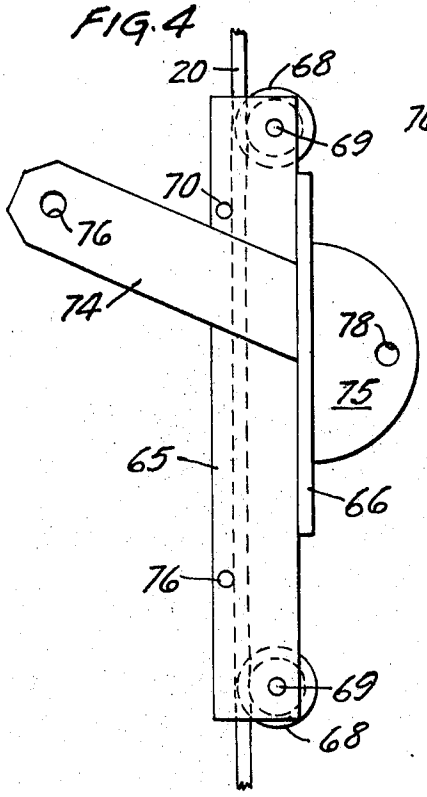


FIG. 6

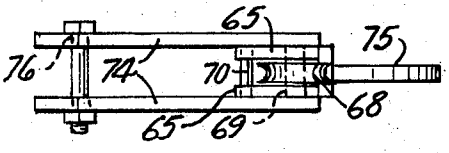


FIG. 6

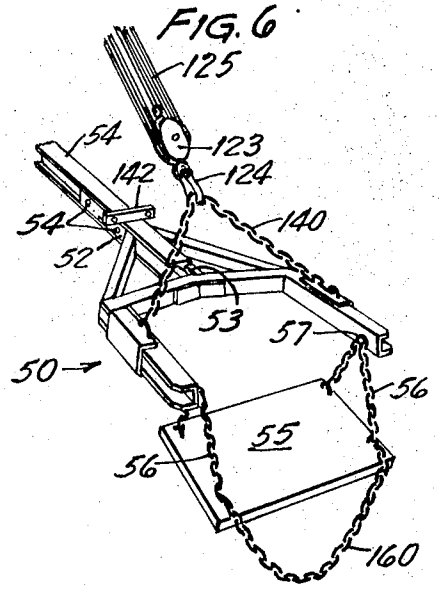


FIG. 5

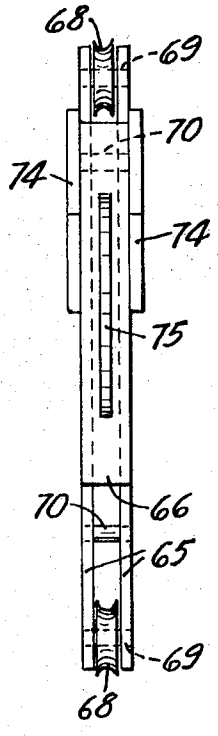


FIG. 8

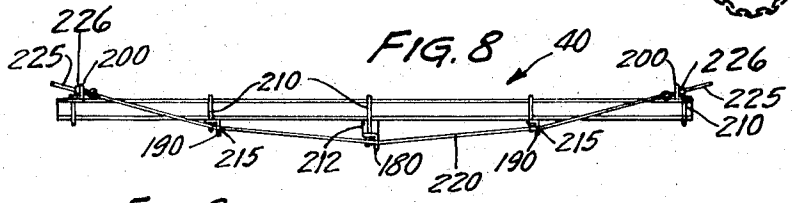
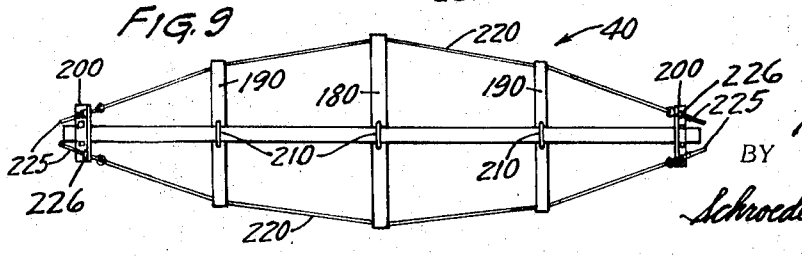


FIG. 9



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BOOM RIGGING

My invention relates to boom riggings used on the interior of tanks of various sizes and shapes to provide access to the interior surface thereon and more particularly to an improved rigging or tank stage which is applicable to various sizes and shapes of tanks and which may be readily inserted into and used therein.

Large storage tanks, such as are used in refineries, chemical plants and the like, present a problem from the standpoint of maintenance, that is cleaning and painting, with respect to the interior surface thereof. Because of the variety of shapes and sizes of such tanks, riggings and tank stages of various types have been devised in order to position maintenance personnel in proximity with the surface upon which they are to work. In the past, such tank stages have taken a variety of forms, but these prior structures have had a common disadvantage of being extremely massive, difficult to set up on the interior of the tank, and difficult to use. This is particularly true where the tanks are spheroidal in configuration and the staging or rigging has to be inserted through relatively small manholes which are normally located at the top and/or bottom of such tanks. Further, such rigging or staging has to be readily adjustable or modified to fit varying sized tanks which range from a maximum diametrical dimension of 15 feet up to **60** feet and larger. A boom for supporting the occupant will have a length dimension of approximately one-half of this diametrical dimension and must be readily adjustable so that it may be pivoted with respect to a central point or shaft as well as rotated about the entire peripheral surface such that the user may effectively cover the interior surface of the tank. Where the rigging involves more than the boom as a continuance piece, the difficulty in inserting such a complex unwelding structure through a small manhole into the interior of a tank to set up the staging or rigging, is extremely difficult.

In my improved boom rigging, I have provided a universal structure which is applicable for varying sized tanks and in which the boom itself is the only principal continuous element which has to be inserted through the manhole in the tank. Once inserted, the remaining portion of this structure, including the trolley upon which the boom rides and which is of relative short length with respect to the boom, may be readily set up with a minimum of time and effort for usage. In my improved boom rigging, provision is made for substituting varying sizes or lengths of booms so that the structure may be utilized in any sized tank. This involves merely the replacement of the main boom element itself with a longer or shorter length boom piece which is readily connected to the personnel carrier and the trolley upon which it mounts for usage. My improved boom rigging utilizes a flexible support cable upon which the trolley rides with a minimum amount of friction so that the boom rigging may be easily used and adjusted within the tank to facilitate the positioning of the occupant carrier and the occupant in any position within the tank.

Therefore, it is the principal object of this invention to provide an improved boom rigging for use in the maintenance on the interior of varying sizes and shapes of tanks.

Another object of this invention is to provide in an improved boom rigging a simplified trolley member which supports the boom on a support cable in a relatively friction-free manner.

Another object of this invention is to provide an improved boom rigging in which the boom itself represents the only rigid element of any length which must be inserted through a manhole of a tank to set up the boom rigging within the tank.

A still further object of this invention is to provide an improved boom rigging which is simple in design, light in weight and easy to set up and use.

These and other objects of this invention will become apparent from a reading of the attached description together with the drawings wherein:

FIG. **1** is a diagrammatic view of the improved boom rigging installed in a tank;

FIG. **2** is a side elevation view of the head member of the improved boom rigging;

FIG. **3** is an end elevation view of the head member in FIG. **2** of the improved boom rigging;

FIG. **4** is a side elevation view of the trolley member of the improved boom rigging;

FIG. **5** is an end elevation view of the trolley member of FIG. **4** of the improved boom rigging;

FIG. **6** is a plan view of the trolley member of FIG. **4** of the improved boom rigging;

FIG. **7** is a perspective view of the personnel carrier on the end of the boom for the improved boom rigging;

FIG. **8** is a side elevation view of another embodiment of the boom for the improved boom rigging; and

FIG. **9** is a top view of the boom of FIG. **8** of the improved boom rigging.

My improved boom rigging is shown in FIG. **1** as applied to the generally spherical tank, indicated generally at **10**. Such tanks may be cylindrical, spheroidal, or spherical and may be located at ground level on supports, on elevated supports or atop other structures. The problem of maintenance of such tanks, that is cleaning, repairing or refinishing of the interior surface of the same is enhanced by the shape, the access opening thereto and relative position of the tank with respect to the ground. Such tanks may vary in shape from a diametrical dimension of 15 feet to shapes or configurations where the maximum diameter at certain points is as large as 50—60 feet. Such tanks are constructed with manholes or access openings, such as is indicated at **12**, which may be located at both the top and bottom of the tank or preferably at the top only with the bottom tank being closed except for fluid conduits. In addition, such tanks are constructed with suitable anchored cleats **14** positioned on the bottom surface thereof for the purpose of facilitating cleaning of the tanks or maintenance work therein. For simplicity purposes, the inlet and outlet conduits are omitted in the drawings.

My improved boom rigging may be employed with a tank construction which includes a single manhole or access opening at the top and suitable cleats at the bottom or in one where access openings are located at the top or bottom of the tank. It employs basically a support cable, indicated at **20**, which is preferably made of a high tensile strength steel wire which can be secured, as indicated in FIG. **1** at the top of the manhole through a top brace structure **22** and suitable turnbuckle **24** for tightening the same with the opposite end of the support cable being anchored at the cleats or hook-type anchors in the base of the tank through a dual-link type connection, such as is indicated at **25**. Such a cable, when installed, will be drawn taut to prevent any significant sidewise movement and will be located at the geometrical center of the tank. Positioned on the support cable and near the manhole entrance at the top thereof is a swivel member **30**, which swivel member has a centrally located journal bearing **32** therein through which the support cable extends and with a suitable clamping structure **35** positioned on the cable and having a bearing surface **36** thereon meeting with the centrally located bearing **32** in the swivel member to provide a bearing surface to permit the swivel member to rotate about the cable. The ends of the swivel member, which extends transverse to the support cable, include a pair of hook-receiving loops **37,38** the purposes of which will be later noted. They are equally distantly spaced from the central bearing member and the entire structure is constructed of metal, such as steel or an equivalent material for load bearing purposes. The overall length of the swivel member is such that it may be readily inserted through a manhole or access opening in a tank. When installed, the swivel member **30** through the adjustable clamp **36** will be located near the access opening in the tank for the purpose of rotating the boom, as will be hereinafter described.

The boom, which is generally indicated at **40**, is also of metallic construction and is I-beam and preferably made of aluminum to be light in weight for ease in handling and installation. The boom may come in varying lengths depending upon the diametrical dimension of the tank and mounts a Y-shaped or bifurcated seat frame **50** at one extremity of the

beam. The neck or base portion of the seat frame **50**, indicated at **52**, has a notch **53** therein which slides on the central portion of the I-beam and is bolted and secured thereto through suitable means such as bolts **54**. As will be hereinafter defined, a personnel-carrying platform or seat **55** is attached to the arms of the bifurcated seat frame **50** through chains **56** to give a swinglike appearance with the chains being pivoted on the arms, such as at **57**, to maintain the seat level or horizontal as the boom is pivoted.

The opposite extremity of the boom mounts a trolley member **60** which in turn is mounted on the support cable **20** to roll thereon. The trolley member, whose length is approximately that of the swivel member for ease in installation of the manhole, is formed of a pair of side plates **65** and an end plate **66** with the top, bottom and one side of the extremities open. The plates are suitably secured to one another through means such as welding (not shown). To one side of the geometrical center of this generally rectangular form or frame of the trolley are positioned a pair of pulley wheels **68** which are pivotally mounted on journal pins **69** connected between the side plates **65** to define an axis of rotation of the pulley wheels which is parallel with the end plate of the trolley. The ends of the frame for the trolley member are open to pass the cable **20** therethrough and a pair of guide pins **70** are positioned inboard of the pulley wheels and aligned so that a line through their centers is equally spaced from the pulley wheels and parallel to a line through the journal pins for the same so that the support cable may be threaded through the trolley member engaging the grooved surface of the pulley wheels and bearing against the guide pins with a minimum of clearance therebetween. This will insure that the cable will slide over the surface of the guide pins and roll on the pulley members for a generally frictionless type support of the trolley member on the support cable to permit ease in raising and lowering the trolley member on the support cable. Thus, as shown in FIG. **4**, the peripheral surface of the pulleys at the support cable is spaced slightly from the contacted surface of the guide pins a distance slightly larger than the diametrical dimension of the support cable **20** to eliminate frictional drag on the pins but insure that the cable will be guided over the pulley surfaces at all times. The end and side plates **66, 65** respectively of the trolley member mount a pair of flange structures **74,75**. These are located at the same relative distance on the ends of the trolley members to give an overall balanced relationship and the flange structure **74** is formed of a pair of plates suitably welded to the side members and projecting away from the end plate **66**. These plates carry a mounting pin **76** extending therebetween for the purpose of receiving the hook of a block and tackle to be later described. The flange **75** on the opposite side is formed integral with plate **66** and is a semicircular shape plate with an aperture **78** therein which serves to mount the beam member for pivotal movement thereon. The beam member **40** is connected thereto through a pair of plates **80** positioned on the center section of the I-beam and bolted thereto through bolts **82** with the mounting pin **85** positioned through apertures in the opposite end of the plates **80** and through the aperture **78** in the flange **75** to securely mount the end of the boom thereon and permit pivotal movement of the boom relative to the trolley member.

The boom **40** is pivoted on the trolley member through a suitable elevating mechanism, such as a block and tackle, indicated generally at **100**, and the trolley member itself is moved up and down the support cable through a similar block and tackle or equivalent structure, indicated generally at **120**. These may vary in form and incorporate multisheave pulleys **123** with hooked extremities **124** and suitable line or tackle **125** extending therebetween in a conventional manner to provide a conventional mechanical lifting system in which one extremity of a tackle or rope is secured to a pulley or a pulley mounting and with the tackle or rope extending over the grooved pulleys or sheaves of the pulley and extending back and forth between pairs of pulleys with the free extremity of the rope or tackle being positioned wherein it can be shortened or lengthened to vary the spacing between the pulleys and hence raise or lower the boom or the trolley member in a conventional manner employing the mechanical advantage of the number of turns of the tackle over the pulleys. The block and tackle **100** extending from one end of the swivel member **30** at the loop **38** thereon will be selectively and releasably hooked to the swivel member **30** at the hooked extremity of the upper pulley and with the lower pulley at its hook extremity connecting to a chain **140** secured at its extremities to the bifurcated arms of the seat frame on the end of the boom. The rope or tackle **125** for this pulley system will be directed to and terminate at a securing flange **142** positioned on the boom adjacent the seat so that the same may be operated by the person seated on the seat **55** of the boom rigging. The pulley or block and tackle system **120** which elevates the trolley member on the support cable, has one of the pulleys at its hook extremity connected to the pin **76** of the flange structure **74** and with the opposite pulley being connected over the loop **37** of the swivel member **30** so that the tackle and pulleys will be positioned to one side of the support cable **20**. The free extremity of the tackle is directed down to the base of the tank where a second operator or person will actuate the same to raise and lower the trolley member on the support cable for the purpose of positioning the chair end of the boom extremity relative to the surface of the interior of the tank. The occupant of the chair seat which pivots on the arms of the bifurcated seat frame has freedom of movement to work facing either direction relative to the frame. A suitable safety strap **160** connected to the seat can be placed around the occupant to prevent his falling out when facing forward or toward the tank wall. The seat frame itself will provide a similar support for the back of the occupant to prevent tipping in this direction.

The trolley member **60**, which is relatively short in length with respect to even the shortest boom section, is substantially the same length as the length of the swivel member so that it may be readily inserted into the tank. It has its flange structures positioned on opposite sides of the same to provide a general forced balance arrangement and minimize twisting of the trolley member on the cable. The occupant of the seat may rotate the entire boom and trolley relative to this cable and the interior of the tank causing rotation of the swivel member on the support cable as well as the supporting block and tackle merely by engaging his feet with the interior of the tank surface or hands and moving himself in this direction. This will insure coverage of the interior of the tank at the same elevation as the maintenance process proceeds.

My improved boom rigging utilizes boom elements which vary in length depending upon the particular size of tank to be worked. Thus, various length boom sections would be carried by the operator and installed for particular job applications. Whenever the boom length approaches 20 feet, it is advisable from a safety standpoint to strengthen the boom and protect against torsional strain on the same. Thus, as is shown in FIGS. **8** and **9**, the boom shown generally at **40**, will still utilize the I-beam aluminum construction in a single boom length but will employ cross support members **180, 190** and **200** connected thereto which members are of varying lengths and are constructed of an angle iron to be bolted or otherwise secured to the I-beam section through U-bolts, indicated generally at **210**. The central sections of the I-beam will have the braces **180, 190** positioned on the bottom side of the same with the brace **180** being extended down through a spacer block or plate **212** to be at a different vertical elevation from the cross support members **180** and **200**. Suitable notches **215** in the cross brace members permit threading of a cable **220** through the same with the cable extremities being connected to adjusting I-bolts **225** positioned through two apertures in the cross braces **200** and secured thereto by nuts **226** which, with the threaded I-bolts, may be used for tensioning and adjusting cable length so that the cables **220** form with the main portion of the I-beam a construction which is tensioned against torsional movement and supported against bending at the middle.

This entire structure, as shown in FIGS. 8 and 9 in side and plan views, will be mounted on the trolley member and mount the seat frame 52.

In installation, my improved boom rigging, because of its light weight and single piece construction, may be readily inserted through an access or manhole 12 in a tank 10 and be utilized with a minimum of installation time and problems. Thus, after insertion of the boom with the trolley member attached thereto into the tank, the operator need merely secure the support cable and position it taut against movement. With the trolley positioned thereon, the only remaining requirement for installation is the positioning of the swivel member, which would have the support cable positioned through the same, in an elevated position mounted to the top of the tank so that the block and tackle pulleys could be connected thereto. The swivel member is positioned to a desired elevation and the clamp providing the bearing support for the same is secured in this position. Thereafter, the block and tackle will be connected at the ends of the swivel member and to the boom and trolley member respectively. In this position, the operator on the chair seat may elevate his portion of the boom relative to the trolley member and the operator within the tank and the base of the same may elevate the trolley member to position the occupant of the chair seat in any position relative to the tank. Rotative movement of the trolley end boom relative to the tank accomplished by the operator engaging the wall surface and applying force thereto so that the entire boom will pivot on the support cable. This improved structure is extremely lightweight, is readily adaptable for use in any tank and does not require any buildup of parts or any massive structure to be inserted into a tank.

Therefore, in considering this invention it should be remembered that the present disclosure is illustrative only and the scope of the invention may be determined by the appended claims.

I claim:

1. A boom rigging, comprising:

a. a swivel support having a central opening therein with a bearing surface surrounding the same and a pair of hook support members at the extremities of the same;

b. a support cable positioned through the central opening in the swivel support and adapted to be secured taut at the top and bottom of the tank in which the boom rigging is to be placed;

c. a bearing lock means adjustably positioned on the support cable and near one extremity of the same and supporting the swivel support on the cable for rotational movement;

d. a trolley member positioned on the support cable and having roller guide means positioned around the cable to guide the trolley member on the support cable, said trolley member having flanges on opposite sides of the same intermediate the roller guide means, said trolley member including an enclosed sheave with pulley wheels at the open extremities of the same and aligned guide pins spaced intermediate the pulley members and from a line of the axes of the pulley wheels to define a path substantially equal in width to the diametrical dimension of the support cable;

e. a boom pivotally mounted on one of the flanges of the trolley member and including a pivotally mounted chair support positioned at the extremity of the same, said pulley wheels at the ends of the trolley member being spaced apart a distance which bears the ratio with the length of the boom of no greater than 1—7;

f. means connected between the other of the flanges on the trolley member and one of the pair of hook support members on the swivel support and disposed to one side of the support cable extending parallel thereto for moving the trolley member on the support cable; and

g. means connected between the other of the hook support members on the swivel member and the unpivoted extremity of the boom adjacent the chair support and operated from the chair support for pivoting the boom on the trolley member.

2. The boom rigging of claim 1 in which the means connected between the hook support members on the swivel member and the flange and boom respectively are pulley members with tackle extending between the respective pulley members and adapted to be lengthened and shortened to raise the trolley member and the boom on the support cable.

3. The boom rigging of claim 2 in which the flanges on opposite sides of the trolley member are positioned intermediate the pulleys and pins therein to substantially balance the forces applied thereto.

4.

The boom rigging of claim 2 in which the chair support is comprised of a bifurcated frame with a seat member pivotally mounted at the ends of the bifurcated frame.

5. The boom rigging of claim 4 in which the boom is an I-beam member having a first pair of plates mounted to the central portion of the I-beam and positioned around the flange to pivot the boom on the trolley member and in which the bifurcated frame has a slot therein fitting over the opposite extremity of the central portion of the I-beam and secured thereto for mounting the chair support on the boom.

6. The boom rigging of claim 2 in which the pulley wheels are rotationally mounted in the end enclosed sheave of the trolley member to one side of the cable adjacent the flange mounting the boom and in which the guide pins are disposed intermediate the pulley wheels and spaced adjacent the flange mounting the means for moving the trolley member on the cable support.

7. The boom rigging of claim 4 in which the means connected between the other of the hooks on the swivel member and the unpivoted extremity of the boom include a chain member secured to the bifurcated frame and mounting a pulley forming a part of said means, and including a flange plate mounted on the boom adjacent the bifurcated frame to secure the free extremity of the tackle of the means for pivoting the boom on the trolley member.

8. The boom rigging of claim 7 and including tension rods connected between flange members secured to the extremities of the boom adjustably positioned thereon to prevent torsional movement of the boom.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,556,252 Dated January 19, 1971

Inventor(s) Milo E. Atkins

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 6, Line 2, before "enclosed sheave", delete "end".

Signed and sealed this 20th day of April 1971.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

WILLIAM E. SCHUYLER,
Commissioner of Paten