

12

EUROPEAN PATENT APPLICATION

21 Application number: **84112603.0**

51 Int. Cl.: **B 66 C 23/52, B 66 C 23/60**

22 Date of filing: **18.10.84**

30 Priority: **31.10.83 US 547215**

71 Applicant: **MASASUKE KAWASAKI, 1002 Michigan Avenue, Slidell Louisiana 70458 (US)**

43 Date of publication of application: **05.06.85**
Bulletin 85/23

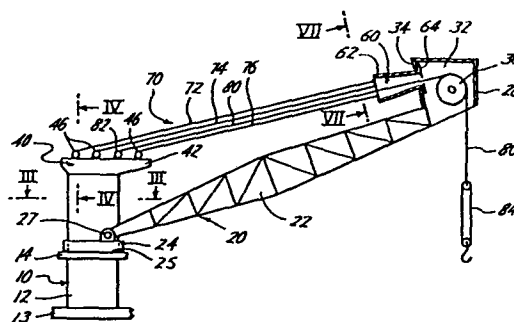
72 Inventor: **MASASUKE KAWASAKI, 1002 Michigan Avenue, Slidell Louisiana 70458 (US)**

84 Designated Contracting States: **BE DE FR GB IT NL**

74 Representative: **Patentanwälte Grünecker, Dr. Kinkeldey, Dr. Stockmair, Dr. Schumann, Jakob, Dr. Bezold, Meister, Hilgers, Dr. Meyer-Plath, Maximilianstrasse 58, D-8000 München 22 (DE)**

54 **Single post derrick with 360° swing.**

57 A derrick assembly for lifting and moving cargo is disclosed which includes a mast (12) adapted to be fixed to a supporting surface (13), the mast having a base and a top. A boom (22) having first and second ends is mounted along the length of the mast such that freedom of rotation of the boom about the mast is provided. A cable system (70) is operatively associated with the top of the mast and with the boom for selectively rotating the boom about the mast. In the most preferred embodiment, the cable means is adapted to provide movement of the boom about the fixed mast through 360° of rotation.



5

10

SINGLE POST DERRICK WITH 360° SWING

15 The present invention relates to an apparatus for
handling cargo on ships and, more specifically, the
present invention relates to a derrick suitable for
loading and unloading cargo within a limited area having a
boom which is adapted for 360° rotation about a mast.

20

 There exist numerous variations of derricks and
cranes for moving cargo. For example, a popular form of
crane is the revolving or pedestal crane. With this
crane, the base of the boom, including a winch, a control
25 cab and an A-frame mast are mounted on a revolving deck.
A set of driving pinions mesh with a bull gear to accom-
plish rotation of the unit through 360 degrees. While
this form of crane does provide full rotation, it suffers
the disadvantage for some applications of requiring an
30 exceptionally large deck area to permit full rotation when
mounted on a ship. It also lacks the structural rigidity
necessary for some marine operations.

 Another form of crane is the stiff leg derrick. In
35 the stiff leg derrick, a bull wheel at the base of the
mast swings the boom of the derrick around. Like the
pedestal crane, however, it has been found that for some
applications, the stiff leg derrick either requires

excessive deck space when mounted to a ship for full rotation or suffers limitations on its swing to less than 360 degrees.

5 An alternative form of derrick is the guy derrick. The guy derrick is so named because the head of the mast or derrick is supported by a plurality of guy wires extending radially outwardly from the derrick. Provided that the guy wires can be extended a sufficient distance
10 outwardly from the derrick, and provided that the movement of the boom of the derrick may be limited to passage under the extended guy wires, this form of derrick also allows the swinging of the boom through 360 degrees rotation. Once again, however, an exceptional amount of deck area is
15 required to adapt the derrick for full rotation, which makes this kind of derrick disadvantageous for many applications such as for service on a ship. Also, this form of derrick lacks adequate structural rigidity for some marine operations.

20 It should be noticed that for each of the above types of derricks, the mast and assembly supporting the boom rotate with the boom in use. Such a design avoids the tangling of vang and lines used in controlling the boom,
25 but it also requires a counterweight or counter support for the rotating mast. In turn, the need for the counter support is often what yields to excessive space requirements which are undesirable for some applications.

30 One type of derrick suitable for use on ships is the Stuelcken type of heavy-lift derrick. The Stuelcken derrick may be adapted to a single fixed mast such that it requires a minimum amount of deck space, but it is believed that the Stuelcken derrick has always been
35 limited in the degrees of rotation accommodated. This is because the control of the boom of a Stuelcken derrick is

typically provided by two vang's being attached to the top of the mast supporting the boom whereby full rotation of the boom would cause the tangling of the vang's. For extended movement of the boom, the vang's must often be
5 detached while the boom is being moved and then reconnected at a selected point of attachment. Even with this arrangement, it is often not possible to swing the boom "behind the mast".

10 Accordingly, it is desirable to provide a derrick which is suitable for use within a confined area, such as a small area of a deck or other surface, and yet which also offers a full 360 degrees of rotation in continuous operation.

15

Accordingly, the present invention provides a derrick assembly for lifting and moving cargo which requires a minimum of space for the derrick assembly and which provides for rotation of a boom about a fixed mast to the
20 full degree required.

More particularly, a derrick assembly for lifting and moving cargo is provided which includes a mast adopted to be fixed to a supporting surface, the mast having a base
25 and a top. A boom having first and second ends is mounted at its second end along the length of the fixed mast such that freedom of rotation of the boom about the fixed mast is provided. Cable means are then operatively associated with the top of the mast and with the boom for selectively
30 rotating the boom about the fixed mast. In a preferred form of the present invention, the cable means further provide a means for lifting and supporting the boom.

In a preferred aspect of the derrick assembly, the
35 boom is mounted along the length of the fixed mast and adapted for movement through 360 degrees rotation about a

longitudinal axis within the mast. The cable means for rotating the boom includes a vang sheave assembly secured to the top of the mast. The vang sheave assembly includes three sheave members positioned about the longitudinal axis such that the angular separation between any two adjacent sheave members in relation to a point of intersection of the longitudinal axis with the plane including the three sheave members is less than 180 degrees. Each sheave member is secured to the sheave assembly for rotation about a vertical axis and includes a sheave mounted to the sheave member for rotation about a horizontal axis in use. A vang spacer is rotatably secured to the boom proximate the head of the boom and three vangs are selectively secured at one end of each vang to the vang spacer in a spaced relationship about the end of the vang spacer. The vang spacer is, in turn, secured to the boom such that the vang spacer rotates in response to movement of the vangs. Each vang is further operatively associated with a sheave disposed on the vang sheave assembly and connected to a power means for selectively varying the length of the vangs. The rotation of the vang spacer upon the varying of the length of the vangs thereby precludes the tangling of the three vangs during the 360 degrees rotation of the boom.

25

In the most preferred embodiment of the present invention, the derrick assembly for lifting and moving the cargo includes a fixed mast fixable to a supporting surface, the mast having a base and a top. A bearing collar is disposed along the length of the mast and adapted for rotation about the mast whereby the rotation of the collar defines a longitudinal axis of rotation within the mast. A boom is secured to the collar such that rotation of the boom about the mast and the axis of rotation is accommodated. The assembly further includes three sheave members mounted to the mast and extending

35

proximate the top of the mast. The sheave members are disposed about the axis of rotation such that the angular separation between any two adjacent sheaves in relation to a point of intersection of the axis of rotation with a plane including the three sheaves is less than 180° . A vang spacing member is rotatably secured to the boom. The assembly further includes three vangs secured to the vang spacing member in a spaced relationship wherein each vang extends from the vang spacing member and is operatively associated with a sheave member. A means for selectively varying the length of the vangs such that rotation of the boom about the mast is accommodated is selectively secured to each vang.

In a preferred aspect of this embodiment, the boom includes an extension member mounted and disposed proximate the head of the boom. The extension member has a hollow bore directed relatively toward the top of the mast in relation to the boom and includes a first bearing surface surrounding the hollow bore. The vang spacer member comprises an elongated member having a hollow bore and a second bearing surface, the first bearing surface and the second bearing surface being configured complementary to each other such that the two mate to rotatably mount the vang spacer member to the extension member in such a manner that the hollow bore of the vang spacer member communicates with the hollow bore of the extension member and such that the hollow bore of the extension member is directed generally toward the top of the mast.

30

In a still more preferred aspect of the present invention, the boom includes a sheave positioned within the head of the boom and the mast includes a sheave mounted proximate the top of the mast and disposed proximate the axis of rotation of the boom. The derrick assembly then includes a hoist lead line extending between

35

the sheave at the top of the mast, through the hollow bore of the vang spacer and the hollow bore of the extension, to the sheave disposed in the head of the boom. A means for varying the length of the hoist lead line to lift and
5 deposit cargo is operatively associated with the lead line.

Accordingly, the present invention provides a derrick assembly having a single stationary mast which may be
10 fixed without the need of counterweights. The boom is adapted to the derrick mast for rotation about the mast. The motivating force for the rotation of the mast, in turn, is provided by three vangs, thereby obviating the need for the expensive gearing and motors included in
15 pedestal cranes and other designs.

More particularly, the present invention provides a derrick assembly which requires a minimum of deck space and provides a maximum of versatility through the provi-
20 sion of a boom rotatably connected to a fixed mast for rotation wherein the rotation is effected by a cable means associated with the top of the mast.

The invention will further be illustrated by refer-
25 ence to the appended drawings which illustrate a particular embodiment of the single post derrick having a 360° swing in accordance with this invention.

FIGURE 1 is a partial sectional side view of a
30 derrick of the present invention.

FIGURE 2 is a plan view of the derrick shown in
FIGURE 1.

FIGURE 3 is a sectional view of the mast taken along lines 3-3 illustrating the attachment of the boom collar and the boom of the present invention.

5 FIGURE 4 is a sectional view taken along lines 4-4 illustrating a sheave member positioned at the top of the mast of the present invention.

FIGURE 5 is a plan view of the sheave assembly shown
10 in FIGURE 4.

FIGURE 6 is a schematic view of the rotation of the boom and the loading of the vang caused by the rotation of the boom.

15

FIGURE 7 is a perspective view of the vang spacing member of the present invention illustrating the spacing of the vangs in the preferred embodiment.

20 The preferred embodiment is generally represented by a mast 10, a boom assembly 20 rotatably mounted to the mast 10, a vang sheave assembly 40 disposed at the top of the mast 10, a vang spacer 60 mounted proximate the head of the boom 20, and a plurality of vangs 70 extending
25 between the vang spacer 60 and the vang sheave assembly 40.

Referring to FIGURES 1 and 3, in the preferred embodiment, the mast assembly 10 includes a cylindrical
30 mast 12 which is secured to a deck 13 or other fixed reference point. The mast 12 is fixably secured to the deck 13 by welding or bolting the mast in place such that tilting of the mast 12 is precluded.

35 A collar support 14 is secured to the mast 12 along its length to provide a support base for a boom collar 24.

In the preferred embodiment, the collar support 14 is comprised of an annular member secured transverse to the mast 12 such that the collar support 14 extends radially outwardly from the mast to form an annular base of support for the boom collar 24. In the preferred embodiment, the annular support 14 may further be supported by bracing members (not shown) extending between the deck 13 and the support 14, or, alternatively, the mast may be sunk into the deck such that the annular support 14 is provided by the deck whereby a two level support system for the mast 12 is provided.

Referring now to FIGURES 1-3, the boom assembly 20 includes a boom 22 mounted along the length of the fixed mast 12 such that freedom of rotation of the boom 22 about the fixed mast 12 is provided. In the preferred embodiment, the boom assembly 20 includes a bearing collar 24 mounted along the length of the fixed mast 12 for rotation about the fixed mast 12. The bearing collar 24 includes a lower bearing surface 25 configured to mate with the annular support 14 to facilitate movement of the bearing collar 24 along the support surface 14, and an inner bearing surface 26 configured to mate with the outer configuration of the mast 12 to facilitate rotation of the bearing collar 24 about the mast 12.

The boom 22 is mounted to the collar 24 to accommodate rotation of the boom 22 about the mast 12. In the preferred embodiment, the boom 22 is pivotally mounted to the collar 24 by means of a pin joint 27 in order to provide vertical positioning of the boom 22 in use.

The boom 22 further includes a boom head 28 mounted at the end of the boom extending outwardly from the mast 12. The boom head 28 includes an upward extension member 32 secured to the top of the boom head 28. A sheave 30 is

mounted within the upward extension member 32 for rotation about a generally horizontal axis in use. The upward extension member 32 and boom head 28 each have a hollow bore extending therethrough to accommodate the passage of
5 a hoist lead line through the upward extension member 32 over the sheave 30 and down through the head of the boom 28 for the lifting and depositing of cargo.

Referring now to FIGURES 1, 2, 4 and 5, the vang
10 sheave assembly 40 of the preferred embodiment is secured to the top of the mast 12 and includes a plurality of sheaves operatively mounted to the top of the mast 12 to facilitate variations in the length of the vangs 70 to position the boom. In the preferred embodiment, the vang
15 sheave assembly 40 includes an assembly frame 42 secured to the top of the mast 12. The frame 42 has a triangular outer configuration having approximately equal sides such that the frame 42 forms an equilateral triangle. A sheave member 44 is secured to the frame 42 in each of the three
20 corners of the frame 42, each sheave member 44 supporting a sheave 46 such that the sheave 46 rotates about a generally horizontal axis. In the preferred embodiment, the sheave member 44 includes an elongated cylindrical base member 48 connected at the upper end to a transverse
25 sheave support member 50. The frame 42 includes a vertical sleeve 52 having an inner aperture of diameter substantially equal to the outer diameter of the member 48 such that the member 48 fits snugly within the sleeve 52 for pivotal mounting of the sheave 46 in much the same
30 manner that a bed caster is mounted to a bed frame.

The base member 48 further includes a means for securing the member 48 within the sleeve 52 such that the sheave member 44 cannot be pulled out of the sleeve 52.
35 In the preferred embodiment, this means comprises a

locking nut 49 threadably secured to the base of the sleeve 52.

The sheave assembly 40 further includes a lower
5 sheave member 54 secured to the frame 42. The lower
sheave member 54 includes a sheave 56 mounted to it for
rotation about a generally horizontal axis in such a
manner that each sheave 56 aligns with a corresponding
10 sheaves down the inside of the mast 12. It will be
understood that additional guiding sheaves similar to the
sheave member 54 and sheave 56 may be incorporated inside
the mast to direct any vang or other cables to a conven-
tional cranking means or power means (not shown) for
15 varying the length of the vang or cable.

In the preferred embodiment, the vang sheave assembly
40 is generally represented by a triangularly shaped frame
42 including three sheave members 44, each sheave member
20 44 being spaced approximately 120° apart from the adjacent
sheave member 44. If the sheave members are to be fixed
in place, the inclusion of three sheaves is necessary to
insure that full rotation of the boom is accommodated.
More particularly, referring to FIGURE 6 and using the
25 axis of rotation 90 of the boom as a reference point, it
is necessary that the angular separation A, B or C between
any two adjacent sheaves is less than 180° . Stated dif-
ferently, the plurality of sheaves must be spaced around
the axis of rotation such that they do not all fall either
30 on a line or on one side of a line passing through the
axis of rotation. This can be accomplished only through
the use of at least three sheaves or through movably
mounting one of the sheaves such that it can occupy at
least two positions, which yields effectively to three
35 sheave positions. Conversely, if less than 180° rotation
is desired, it will be understood that as few as two vangs

may be utilized to swing the boom around between the two vangs.

5 Additionally, it should be understood that more than three vangs may be utilized and that various shapes for the vang sheave assembly frame 42 may be utilized so long as the positioning of the vang sheaves provides full rotation of the vang boom as described above.

10 Referring now to FIGURES 1 and 7, the vang spacer 60 is rotatably mounted to the head 28 of the boom 22 such that the spacer 60 rotates in response to forces exerted by the vangs 70 to keep the vangs 70 spaced and separated during rotation of the boom 22. In the preferred embodi-
15 ment, the vang spacer 60 includes a generally cylindrical member 62 having a hollow bore 66 passing therethrough. The cylindrical member 62 includes an outwardly extending annular bearing surface 64 which mates with an inwardly extending bearing surface 34 of the extended member 32
20 such that the two bearing surfaces 34, 64 rotatably support the vang spacer 60 within the extension member 32 with the bore 66 of the vang spacer 62 directed generally toward the top of the mast 12. The inner dimension of the bore 66 is not critical so long as it provides sufficient
25 room for passage of a hoist lead line 80 for all vertical positions of the boom 22.

 A plurality of vangs 70 extends from the vang spacer 62 to the sheaves 46 mounted to the sheave members 44 for
30 operation of the boom assembly 20. In the preferred embodiment, the derrick assembly 10 includes three vangs 72, 74 and 76, secured to the vang spacer 60 in a spaced relationship about the perimeter of the cylindrical member 62. Each vang 72, 74 and 76 extends to a separate sheave
35 member 44 where the respective vang is operatively asso-

ciated with a sheave 46 to facilitate movement of the vang to vary the length of the vang.

The derrick assembly 10 further includes a hoist lead
5 line 80 extending from a sheave member 82 mounted in the top of the vang sheave assembly 40 proximate the axis of rotation to the boom sheave 30 and downwardly at one end to connect with a suitable hoist block 84 for lifting
10 cargo. The opposing end of the hoist lead line 80 extends down the interior of the mast 12 to a conventional cranking means (not shown) for varying the length of the hoist lead line 80 as desired.

Referring now to FIGURES 1, 2 and 7, when the derrick
15 of the present invention is utilized, rotation of the boom may be effected by selectively varying the lengths of the vangs 72, 74 and 76. As shown in FIGURE 2, if it is desired to rotate the boom in a counterclockwise manner, then vang 74 is shortened and vang 72 and 76 are proportionally lengthened. As shown in FIGURE 7, once vang 74
20 is shortened, the vang spacer cylinder 62 will tend to rotate in a counterclockwise rotation such that the three vangs 72, 74 and 76 will remain separated during the movement and rotation of the boom 22. In turn, the hoist lead
25 line 80, which is supported between the boom sheave 30 and the hoist lead line sheave 82 will remain centered within the vang spacer 62, also separated from the three vangs 72, 74 and 76.

30 It will be apparent from the above description that reversing the lengthening and shortening of the vangs will cause the boom to rotate in a clockwise manner, as well as causing the vang spacer to rotate in a clockwise manner such that the vangs and hoist lead line again remain
35 disentangled.

Referring now to FIGURE 6, a schematic diagram of the loading of the vangs in the three-vang embodiment of the present invention is shown. As illustrated in FIGURE 6, as the boom swings about the stationary mast, two of the
5 vangs may be designated to carry the bulk of the load. That is, in the regions designated (72-74), the vangs 72 and 74 may be adapted to support the bulk of the load. The remaining vang is kept taut, but is subjected to heavy loading only when needed to assist the other two vangs.
10 Alternatively, all three vangs may carry approximately an equal share of the load with suitable controls to so distribute the load.

Hence, the present invention provides a derrick which
15 may be operated from a single mast and which is fully operated by a simple system of cables operatively associated with the top of the mast and with the boom. The present invention may be adapted to either provide full rotation of the boom about the mast, or it may be adapted
20 to provide a lesser degree of rotation with a corresponding drop in the number of required vangs. Because of the adaptation of the vang spacer to rotate with the movement of the boom, the number of the vangs utilized may be varied to almost any desired number to increase the
25 degree of support and control of the boom as desired.

In an alternative design of the present derrick one of the sheave members 44 may be movably secured within the vang sheave assembly such that it moves along a track
30 between a plurality of selected positions in the sheave assembly. The single sheave member then effectively acts as a plurality of sheave members. The possibility of such modification is apparent in view of the above disclosure is believed to be within the spirit and scope of the
35 present invention.

The instant invention has been disclosed in connection with a specific embodiment. However it will be apparent to those skilled in the art that variations from the illustrated embodiment may be undertaken without
5 departing from the spirit and scope of the invention. For example, the boom collar 24 may be elongated to form a sleeve to which support cables could be attached between the boom and the sleeve. The vang cables could then be used solely to rotate the boom. Additionally, the mast 12
10 could take a plurality of shapes or structures so long as it was adapted to support the collar means for supporting the boom along the length of the mast and the vang sheaves at the top of the mast. These and other variations will be apparent to those skilled in the art and are within the
15 spirit and scope of the invention.

CLAIMS:

1. A derrick assembly for lifting and moving cargo, characterized in that it comprises:

5

(a) a mast adapted to be fixed to a supporting surface, the mast having a base and a top;

10

(b) a boom having first and second ends, the second end of the boom being mounted along the length of the fixed mast such that freedom of rotation of the boom about the fixed mast is provided; and

15

(c) cable means operatively associated with the top of the mast and with the boom for selectively rotating the boom about the fixed mast.

20

2. The assembly of claim 1, characterized in that the cable means further comprises a means for supporting the boom.

25

3. The derrick assembly of claim 1 or claim 2, characterized in that the boom is mounted along the length of the fixed mast and adapted for movement through 360° rotation about a longitudinal axis within the mast, and

30

characterized in that the cable means comprises:

(a) a vang sheave assembly secured to the top of the mast, the sheave assembly including three sheaves positioned about the longitu-

5 dinal axis such that the angular separation
between any two of the three sheaves in
relation to the point of intersection of
the longitudinal axis with a plane includ-
ing the three sheaves is less than 180°;

10 (b) a vang spacing member rotatably secured to
the boom proximate the first end of the
boom;

15 (c) at least three vangs selectively secured at
one end to the vang spacing member in a
spaced relationship, the vang spacing mem-
ber being rotatably secured to the boom
such that the vang spacing member rotates
in response to movement of the vangs, the
vangs further each being operatively asso-
ciated with a sheave disposed on the vang
sheave assembly; and

20 (d) winch means associated with an opposing end
of each vang for selectively varying the
length of the vangs.

25 4. The derrick assembly of claim 3 characterized in that
it further comprises a bearing collar secured along the
length of the mast and adapted for rotation about the mast
wherein the boom is secured to the bearing collar to pro-
vide freedom of rotation of the boom about the mast.

5. The derrick assembly of claim 3 or claim 4 character-
ized in that the boom includes an extension member dis-

posed proximate the first end of the boom, the extension member having a hollow bore directed relatively toward the top of the mast in relation to the boom and including a first bearing surface, and characterized in that the vang
5 spacing member comprises an elongated member having a hollow bore and a second bearing surface in which the first bearing surface and second bearing surface are configured to mate such that the vang spacing member is rotatably mounted to the extension member with the hollow
10 bore of vang spacing member communicating with the hollow bore of the extension member and with the hollow bore of the vang spacing member directed generally toward the top of the mast.

15

6. The derrick assembly of claim 5 characterized in that the boom includes a sheave rotatably secured within the extension member of the first end of the boom for rotation about a generally horizontal axis in use and in that the
20 mast includes a sheave pivotally secured at the top of the mast proximate the axis of rotation of the boom, and in that it further comprises a hoist lead line extending between the sheave at the top of the mast, through the hollow bore of the vang spacing member and the hollow bore
25 of the extension member, and the sheave disposed in the extension member of the first end of the boom.

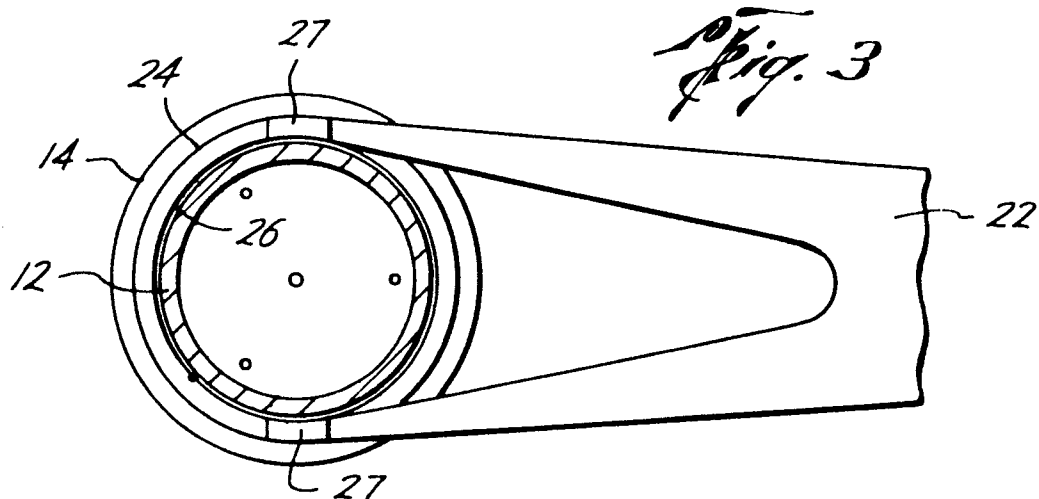
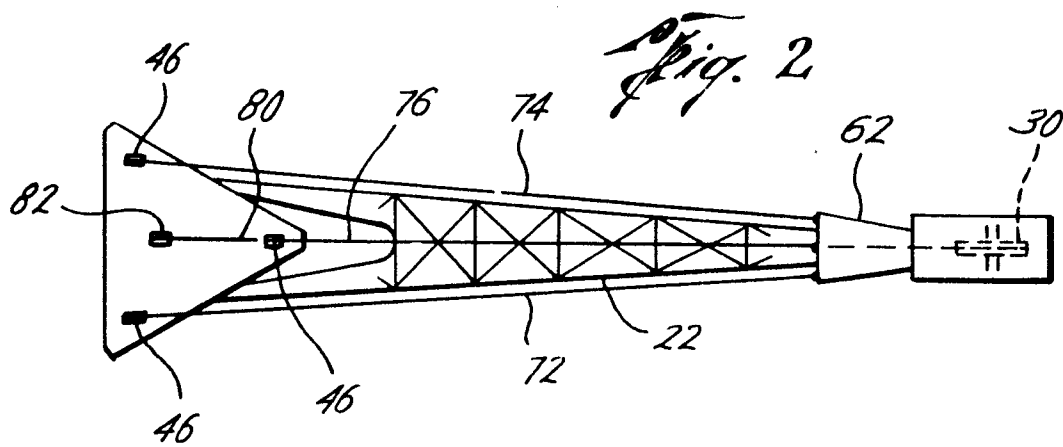
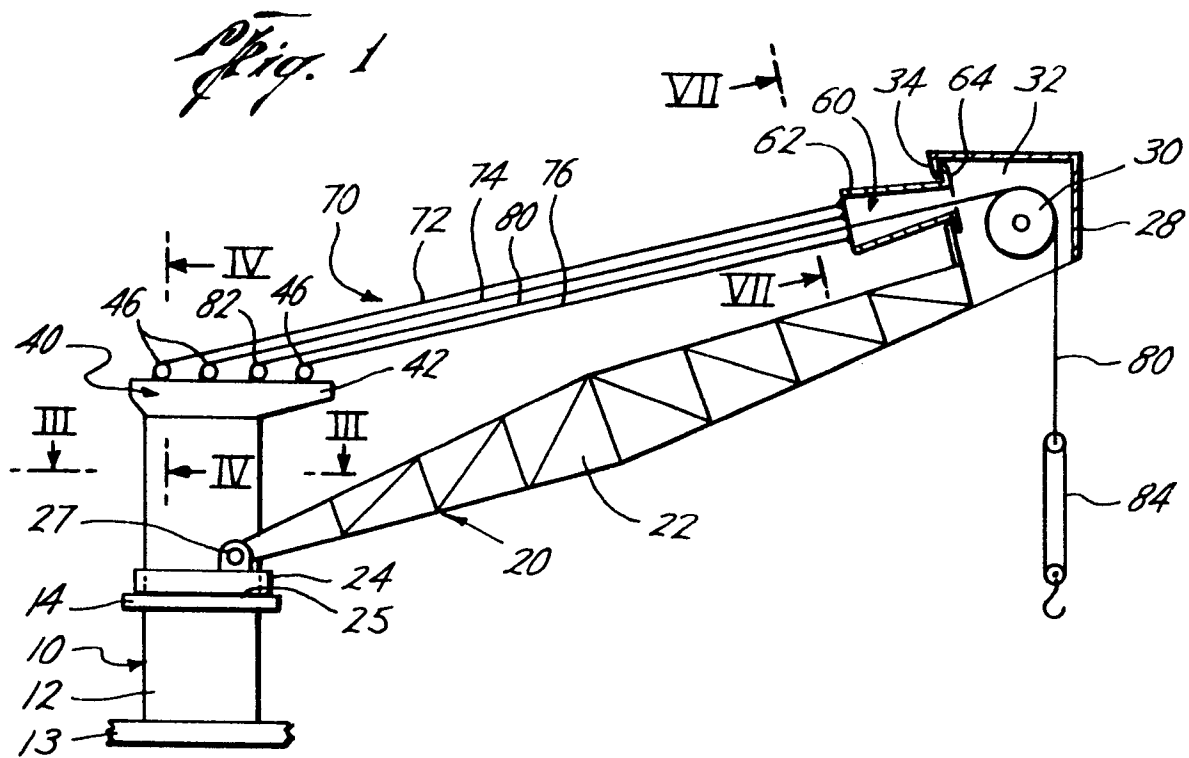
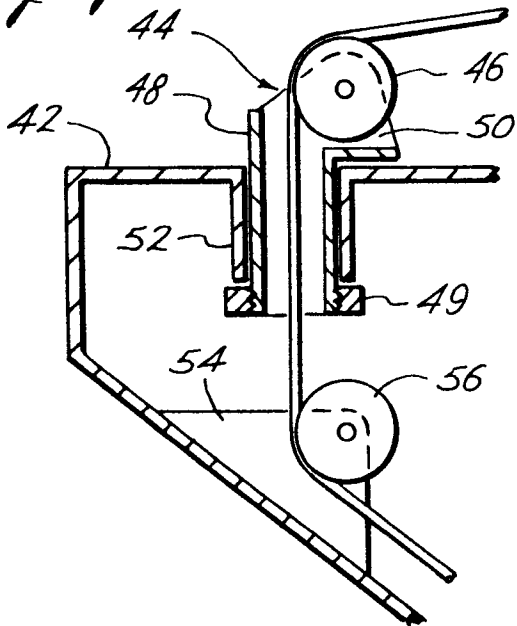
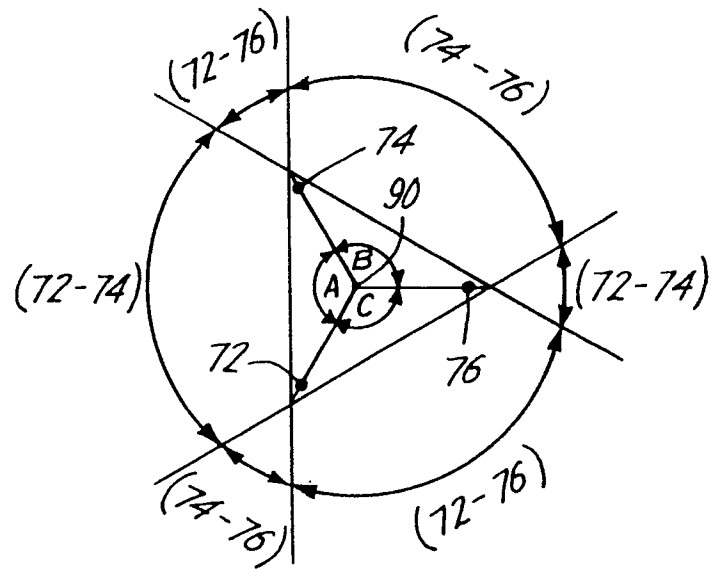
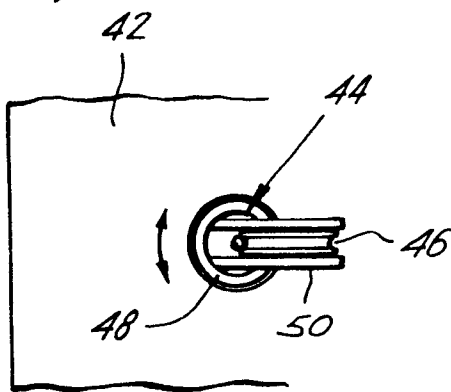
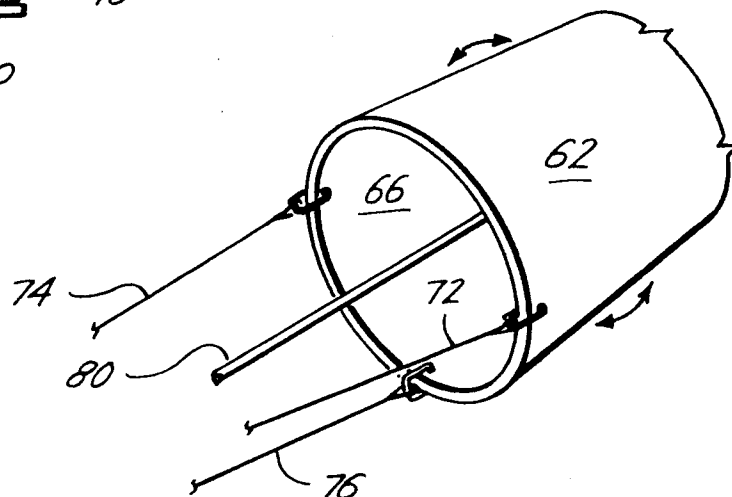


Fig. 4*Fig. 6**Fig. 5**Fig. 7*



European Patent
Office

EUROPEAN SEARCH REPORT

0143316
Application number

EP 84 11 2603

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-2 001 025 (SPEEDCRANES) * Whole document *	1-6	B 66 C 23/52 B 66 C 23/60
X	NL-A-81 04 269 (ITREC) * Whole document *	1-4	
X	GB-A-1 248 410 (TESTING ASSOCIATES) * Whole document *	1-4	
A	FR-A-2 496 073 (BLOHM & VOSS) * Whole document *	1-3,5	
A	DE-B-1 094 617 (STÜLCKEN SOHN)		TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 66 C B 63 B
A	GB-A-2 028 264 (KAWASAKI)		
A	US-A-3 375 937 (BRADSHAW)		
A	GB-A- 990 204 (BUCKLAND)		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 12-02-1985	Examiner VAN DEN BERGHE
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			