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(54) **A MOBILE CRANE**

MOBILKRAN

GRUE MOBILE

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US-A1- 2002 070 186
US-B1- 6 283 315
US-B1- 6 568 547

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Description

[0001] The present invention relates to a mobile crane, preferably a self-propelled mobile crane, of the type having a travelling base structure which allows for travel of said crane over a surface and furthermore having a revolving superstructure mounted on said base structure and rotatable about a vertical revolving axis with respect to the base structure. The present invention also relates to a method for operating such a mobile crane.

[0002] The crane further has a boom and a backmast, said boom and backmast each being hinged about an associated horizontal pivot axis to said superstructure. For lifting a load a main load hoisting means is associated with said boom for hoisting the load.

[0003] The crane also has a superstructure ballast and the superstructure is adapted for supporting said superstructure ballast thereon.

[0004] For performing so-called "superlifts" the crane has a superlift ballast. Associated connection means, commonly a multiple fall cable, serves to connect said superlift ballast to said backmast while said superlift ballast is resting on said surface and/or suspended from said backmast above said surface at a large distance from the base structure. Hereby the crane can resist very large overturning moments created by the load.

[0005] In practice the superlift ballast can weigh hundred or even several hundred metric tons. The ballast is usually composed of a stack of heavy steel plates.

[0006] Mobile cranes of this type are often employed for several lift jobs at a single construction site, e.g. of a chemical plant. This means that for each job the crane has to be moved, e.g. several tens or hundreds of meters, to a new location and prepared for the new job.

[0007] A disadvantage of prior art mobile cranes of the type described above relates to the practice described above, wherein the crane is moved from one location to the next. With most prior art cranes it is necessary to provide additional cranes and transport vehicles in order to move the superlift ballast to the new location. This is time consuming and poses additional safety hazards to personnel.

[0008] In DE - U - 297 24 688 it is proposed to mount the superlift ballast on a separate wheeled ballast car attached to the superstructure, having steerable wheels driven by associated drive means. This requires an extraordinary robust and expensive ballast car, which undesirably increases the costs of the crane.

[0009] In US 6 283 315 a mobile crane is disclosed having a ballast car attached to the superstructure by a telescopic beam. Also this car has steerable wheels, resulting in an undesirable complex and costly ballast arrangement.

[0010] The Demag CC 8800 crane has a superlift ballast car (max 600 ton) attached to the base structure via a telescopic beam. This crane further has a superstructure ballast mounted on the rear end of the superstructure. For further stabilizing this prior art crane a "central ballast" (max 100 ton) is provided on the chassis of the base structure. This is done by providing the front and rear beam of the base structure with a centrally arranged support platform on which metal ballast plates can be stacked.

[0011] A further prior art mobile crane is disclosed in US 6 568 547, wherein the crane is not provided with a superstructure ballast. This crane has a horizontal beam attached to the superstructure, which beam carries the superlift ballast.

[0012] The present invention aims to provide an improved mobile crane, having provisions for handling the superlift ballast which allow for a more efficient use of the crane at affordable costs.

[0013] The present invention provides a mobile crane according to the preamble of claim 1, which is characterized in that said travelling base structure is provided with superlift ballast support means which allow for supporting said superlift ballast on said base structure so that said superlift ballast is movable along with the mobile crane while being supported by said base structure.

[0014] The present invention thus proposes to use the travelling base of the crane itself, which is preferably self-propelled, as means to support and transport the superlift ballast when moving the crane from one job site to the next. This can result in a crane of lower costs than the complex prior art designs and/or a crane which can be operated far more efficiently.

[0015] The present invention also relates to a method for operating such a mobile crane.

[0016] Further preferred embodiments of the crane according to the invention, as well as methods for operating the crane, are disclosed in the claims and in the description which follows with reference to the accompanying drawings.

In the drawings:

Fig. 1 shows an example of a crawler crane according to the present invention in side view,

Fig. 2 the crane of figure 1 in a different set-up in a front view,

Fig. 3a-c in successive side views the positioning a superlift ballast part onto the base structure of the crane of figure 1,

Figs. 4a-f in successive plan views the positioning of both superlift ballast parts onto the base structure of the crane of figure 1,

Fig.5 in plan view the central chassis and the superlift ballast parts supported by said chassis of the crane of figure 1,

Figs. 6a,b in elevational cross-section two trays of a superlift ballast part of figure 5 in assembled and disassembled state respectively,

Fig. 7 a longitudinal cross-section of the ballast parts as in the view of figure 5, and

Fig. 8 a view from the front showing a ballast tray and superlift ballast plates stacked on said tray.

[0017] The figures 1 and 2 show in different set-ups for different lift jobs crawler crane 1 designed for lifting loads of several hundred metric tons, in a preferred embodiment up to 1200 metric tons or even more.

[0018] The crane 1 is a self-propelled crane and has a travelling base structure 2 which allows for travel of said crane over a surface. In manly cases said surface will be the ground, possibly reinforced by a suitable foundation, but it is also envisaged that the crane is used on a large pontoon or the like.

[0019] A revolving superstructure 3 is mounted on said base structure 2, so that the superstructure 3 can rotate about a vertical revolving axis with respect to the base structure 2.

[0020] The crane 1 further has a boom 4 and a backmast 5. The boom is hinged to the superstructure 3 so that the boom 4 pivots about horizontal pivot axis 6. The backmast 5 is also hinged to the superstructure 3 about a horizontal pivot axis 7.

[0021] In the embodiment show in figures 1 and 2 both the boom 4 and the backmast 5 have a lattice structure, which is preferably modular to allow for easy transport of the entire crane from one construction site to the next.

[0022] In figure 2 it is also shown that both the boom 4 has an A-frame design, with two elongated boom sections 4a, 4b separately connected to the superstructure and merging towards each other near the top of the boom 4.

[0023] The backmast 5 has a inverted Y-frame design with two lower backmast sections 5a, 5b pivoted to the superstructure 3 and merging into a single section 5c.

[0024] In the set-up of figure 1 a luffing fly jib arrangement 8, including jib 8a and stay beams 8b, 8c which are connected to the top of the boom 4.

[0025] A main load hoisting means is associated with the boom 4 for hoisting a load. In figure 1 a hoisting cable 11 is shown, which is guided over cable pulleys 12 mounted on the top of the backmast 5, on the stay beams 8b, 8c and on the top of the jib 8a. A crane hook 13 is suspended from the hoisting cable 11. A main load-hoisting winch 13a is mounted on the revolving superstructure 3.

[0026] A superstructure ballast 15 is provided, composed of a stack of steel ballast plates. The rear end of the superstructure 3 is adapted for supporting said superstructure ballast 15 thereon.

[0027] The crane 1 further has a superlift ballast 20 and associated connection means 30 serving to connect said superlift ballast 20 to the backmast 5 while the superlift ballast 20 is resting on the surface (as in figure 1) and/or suspended from said backmast 5 above said surface.

[0028] The connection means 30 are formed here by a superlift ballast cable 31 guided over a cable pulley 32 in the top of the backmast 5 and connected to a superlift ballast winch 33 mounted on the superstructure 3.

[0029] As will be explained in detail further below the travelling base structure 2 is provided with superlift ballast support means which allow for supporting said superlift ballast 20 on said base structure 2 so that said superlift ballast 20 is movable along with the crane 1 while being supported by said base structure 2.

[0030] The travelling base structure 2 comprises a central chassis 40 (shown in detail in figure 5) and a first and second carriage assembly 41, 42 on opposite lateral sides of the chassis 40. In this crane 1 the carriage assemblies are designed as crawler assemblies each having a track. Other designs are also envisaged such as wheeled carriage assemblies (for smaller cranes) or skid arrangements and the like.

[0031] As can be seen in particular in figures 4a-f the first and second crawler assemblies 41, 42 protrude forward and rearward with respect to the central chassis 40.

[0032] The travelling base structure 2, in this example the chassis 40 thereof, is provided with a first and a second superlift ballast support means 50, 55 located on opposite sides thereof, in this example to the front and to the rear of the chassis 40.

[0033] The superlift ballast 20 here comprises a first and a second superlift ballast part 20a, 20b, which are supportable on said first and second superlift ballast support means 50, 55 respectively.

[0034] As can be seen in figure 4 the first and second superlift ballast support means 50, 55 are adapted such that said first superlift ballast part 20a is supported essentially in front of the chassis 40 between the forward protruding carriage assembly parts and the second super lift ballast part 20b is supported essentially to the rear of the chassis 40 between the rearward protruding carriage assembly parts.

[0035] It is noted that the superlift ballast parts 20a, 20b are supported such on said travelling base structure 2 that unhindered revolving motion of the superstructure 3 is possible when the ballast parts are supported on the chassis.

[0036] As can be seen in figures 7 and 8 the first and second super lift ballast parts 20a, 20b here each include two interconnectable ballast trays 16 and multiple ballast plates 17 stackable on said each of said ballast trays 16. Each tray 16 has a bottom 16a and sidewalls 16b. The sidewalls 16b have a connection member 16c at one edge allowing for a sort of tongue-and-groove connection to the associated tray 16 and also to a corresponding vertical connection member 43 on the chassis 40.

[0037] In figures 7 and 8 it can be seen that the chassis 40 has two transverse beams 44, 45 extending between the crawler assemblies and two longitudinal beams 46, 47 interconnecting the transverse beams 44, 45. On top of said beam structure a slew ring 47a is mounted onto which a number of bogies 48 having rollers are supported. These bogies 48 support the superstructure 3 on the slew ring 47a in a rotatable manner (see e.g. fig. 2).

[0038] In figure 2 and in figure 7 hydraulic jacks 49 are visible on the chassis 40, near each of the carriage assemblies, which jacks serve to stabilise the crane 1 as it is stationary on the surface.

[0039] A preferred method for placing of the superlift

ballast parts 20a, 20b onto the base structure 2 will now be explained referring to figures 3 and 4.

[0040] In figure 3a and 4a the superlift ballast parts 20a, 20b are resting on the surface at a distance remote from the base structure 2.

[0041] First, as is shown in figures 3b and 4b, the entire super ballast 20 is brought closer to the base structure 2 by lifting the ballast 20 from the surface and topping the backmast 5. Then said ballast 20 is lowered onto the ground and the ballast parts 20a, 20b are disconnected from each other. The ballast lifting cable 31 is then connected only to the ballast part 20a, which is then lifted.

[0042] By slewing:the superstructure 3 the ballast part 20a is bought between the forward part of the crawler assemblies and then lowered so that this ballast part 20a comes to rest on the associated support means 50 of the chassis 40 (see figures 3c and 4c). The ballast lifting cable is then disconnected from the ballast part 20a.

[0043] Then the superstructure 3 is slewed back so that the cable can be attached to the other super lift ballast part 20b. This ballast part 20b is then lifted and by slewing the superstructure and topping the backmast 5, the ballast part 20b is brought between the rear end of the crawler assemblies. The ballast part 20b is then lowered onto the associated support means 55 of the chassis 40.

[0044] It will be apparent that alternative sequences for placing the ballast parts 20a, 20b on the structure 2 are also possible.

[0045] Now the mobile crane 1 can be moved to another job location and the superlift ballast 20 is taken along with the (self-propelled) crane 1.

[0046] It will be clear that the handling of the superlift ballast 20 in this manner is efficient and requires no additional cranes and transport vehicles when moving the crane from one job site to the next.

[0047] Of course the superlift ballast 20 could consist of one part only, which is then supported on a suitable location on the travelling base structure. It is however preferred to have multiple superlift ballast parts supported on opposite sides of the chassis.

Claims

1. A mobile crane (1), preferably a self-propelled mobile crane, comprising:

- a travelling base structure (2) which allows for travel of said crane over a surface,
- a revolving superstructure (3) mounted on said base structure,
- a boom (4) and a backmast (5), said boom and backmast each being hinged about an associated horizontal pivot axis to said revolving superstructure (3),
- a main load hoisting means (11,13a) associated with said boom for hoisting a load,
- a superstructure ballast (15), said revolving superstructure (3) being adapted for supporting said superstructure ballast thereon,
- a superlift ballast (20,20a,20b) and associated connection means (30) serving to connect said superlift ballast to said backmast (5) while said superlift ballast is resting on said surface and/or suspended from said backmast above said surface,

characterized in that

said travelling base structure (2) is provided with superlift ballast support means (50,55) which allow for supporting said superlift ballast (20a,20b) on said base structure so that said superlift ballast is movable along with the mobile crane while being supported by said base structure (2).

2. Mobile crane according to claim 1, wherein said superlift ballast (20a,20b) is supported such on said travelling base structure (2) that unhindered revolving motion of the superstructure (3) is possible.

3. Mobile crane according to claim 1 or 2, wherein said travelling base structure (2) comprises a central chassis (40) and a first and second carriage assembly (41,42) on opposite lateral sides of the chassis.

4. Mobile crane according to any of claims 1 - 3, wherein said travelling base structure (2) is provided with a first and a second superlift ballast support means (50,55) located on opposite sides of said base structure (2), and wherein said superlift ballast at least comprises first and second superlift ballast parts (20a,20b), which are supportable on said first and second superlift ballast support means respectively.

5. Mobile crane according to claims 3 and 4, wherein first and second carriage assemblies (41,42) protrude forward and rearward with respect to the central chassis (40), and wherein the first and second superlift ballast support means (50,55) are adapter such that said first superlift ballast part (20a) is supported essentially in front of the chassis between the forward protruding carriage assembly parts and the second super lift ballast part (20b) is supported essentially to the rear of the chassis between the rearward protruding carriage assembly parts.

6. Mobile crane according to claim 4 or 5, wherein said first and second super lift ballast parts (20a,20b) each include a ballast tray (16) and multiple ballast plates (17) stackable on said ballast tray.

7. Mobile crane according to claim 6, wherein said ballast trays (16) are provided with interconnection means (16c) allowing for interconnecting said trays, so that said interconnected trays are usable during a lifting of a load by the mobile crane.

8. Mobile crane according to any of the preceding claims, wherein a superlift ballast hoist means (31,33) is associated with said backmast (5), so that said superlift ballast (20,20a,20b) is suspendable from said backmast, said backmast (5) being positionable so that said superlift ballast can be brought to support on said superlift ballast support means (50,55) of the mobile crane.

9. Mobile crane according to any of claims 2 - 8, wherein said carriage assemblies are crawler assemblies (41,42).

10. A method for operating a mobile crane according to one or more of the preceding claims, wherein the superlift ballast (20a,20b) is brought to rest on the superlift ballast support means (50,55) of the travelling base structure (2) so that said superlift ballast is moved along with the mobile crane while being supported by said base structure.

Patentansprüche

1. Mobilkran (1), vorzugsweise ein selbstfahrender Mobilkran, umfassend:

- eine verfahrbare Basisstruktur (2), die die Verfahrbarkeit auf einer Oberfläche ermöglicht,
- einen drehbaren Aufbau (3), der auf der Basisstruktur angebaut ist,
- einen Ausleger (4) und einen hinteren Mast (5), wobei der Ausleger und der hintere Mast jeweils schwenkbar um eine zugeordnete horizontale Schwenkachse mit dem drehbaren Aufbau (3) verbunden ist,
- ein Hauptlasthebemittel (11, 13a), das dem Ausleger zum Heben einer Last zugeordnet ist,
- einen Aufbauballast (15), wobei der drehbare Aufbau (3) für das Abstützen des Aufbauballastes darauf angepasst ist,
- einen Höchsthebeballast (20, 20a, 20b) und zugeordnete Verbindungsmittel (30), die dazu dienen, den Höchsthebeballast mit dem hinteren Mast (5) zu verbinden, während der Höchsthebeballast auf der Oberfläche ruht und/oder von dem hinteren Mast herab über der Oberfläche schwebend gehalten wird,

dadurch gekennzeichnet, dass
die verfahrbare Basisstruktur (2) mit Höchsthebeballast-Stützmitteln (50, 55) ausgestattet ist, die es ermöglichen, den Höchsthebeballast (20a, 20b) auf der Basisstruktur abzustützen, so dass der Höchsthebeballast, während er von der Basisstruktur (2) abgestützt wird, zusammen mit dem Mobilkran bewegbar ist.

2. Mobilkran nach Anspruch 1, wobei der Höchsthebeballast (20a, 20b) dermaßen auf der verfahrbaren Basisstruktur (2) abgestützt ist, dass eine ungehinderte Drehbewegung des Aufbau (3) möglich ist.

3. Mobilkran nach Anspruch 1 oder 2, wobei die die verfahrbare Basisstruktur (2) ein Hauptfahrgestell (40) und eine erste und eine zweite Laufwerksanordnung (41, 42) auf den gegenüberliegenden Lateralseiten des Fahrgestells umfasst.

4. Mobilkran nach einem der Ansprüche 1 bis 3, wobei die verfahrbare Basisstruktur (2) mit einem ersten und einem zweiten Höchsthebeballast-Stützmittel (50, 55) ausgestattet ist, die auf gegenüberliegenden Seiten der Basisstruktur (2) gelegen sind, und wobei der Höchsthebeballast zumindest erste und zweite Höchsthebeballast-Teile (20a, 20b) umfasst, die auf den ersten bzw. zweiten Höchsthebeballast-Stützmitteln abstützbar sind.

5. Mobilkran nach Anspruch 3 und 4, wobei erste und zweite Laufwerksanordnungen (41, 42) nach vorne und nach hinten in Bezug auf das Hauptfahrgestell (40) hinausragen und wobei das erste und das zweite Höchsthebeballast-Stützmittel (50, 55) derartig angepasst sind, dass das erste Höchsthebeballast-Teil (20a) im Wesentlichen im Vorderen des Fahrgestells zwischen den nach vorne hinausragenden Laufwerksanordnungs-Teilen abgestützt ist und das zweite Höchsthebeballast-Teil (20b) im Wesentlichen zum Hinteren des Fahrgestells hin zwischen den nach hinten hinausragenden Laufwerksanordnungs-Teilen abgestützt ist.

6. Mobilkran nach Anspruch 4 oder 5, wobei das erste und das zweite Höchsthebeballast-Teil (20a, 20b) jeweils eine Ballastablage (16) und mehrfache Ballastplatten (17), die auf der Ballastablage stapelbar sind, aufweisen.

7. Mobilkran nach Anspruch 6, wobei die Ballastablagen (16) mit Verbindungsmitteln (16c) ausgestattet sind, die es ermöglichen, die Ablagen miteinander zu verbinden, so dass die miteinander verbundenen Ablagen während des Hebens einer Last durch den Mobilkran verwendbar sind.

8. Mobilkran nach einem der vorhergehenden Ansprüche, wobei ein Höchsthebeballast-Hebemittel (31, 33) dem hinteren Mast (5) zugeordnet ist, so dass der Höchsthebeballast (20, 20a, 20b) von dem hinteren Mast herab schwebend haltbar ist, wobei der hintere Mast (5) positionierbar ist, so dass der Höchsthebeballast dazu gebracht werden kann, auf den Höchsthebeballast-Stützmitteln (50, 55) des Mobilkrans aufzuliegen.

9. Mobilkran nach einem der Ansprüche 2 bis 8, wobei die Laufwerksanordnungen Laufkettenanordnungen (41, 42) sind.

10. Verfahren zum Betreiben eines Mobilkrans nach einem oder mehreren der vorhergehenden Ansprüche, wobei der Höchsthebeballast (20a, 20b) dazu gebracht ist, auf den Höchsthebeballast-Stützmitteln (50, 55) der verfahrbaren Basisstruktur (2) zu ruhen, so dass der Höchsthebeballast, während er durch die Basisstruktur abgestützt wird, zusammen mit dem Mobilkran bewegt wird.

Revendications

1. Grue mobile (1), de préférence grue mobile automotrice, comprenant :

- une structure de base itinérante (2), qui permet de déplacer la grue sur une surface,
- une superstructure rotative (3) montée sur la structure de base,
- une flèche (4) et un mât arrière (5), la flèche et le mât arrière étant chacun articulé à la superstructure rotative (3) autour d'un axe formant pivot horizontal associé,
- des moyens de levage de charge principaux (11, 13a) associés à la flèche pour lever une charge,
- un lest de superstructure (15), la superstructure rotative (3) étant conçue pour supporter le lest de superstructure sur elle,
- un lest de super-levage (20, 20a, 20b) et des moyens de raccordement associés (30) servant à raccorder le lest de super-levage au mât arrière (5), tandis que le lest de super-levage repose sur la surface et/ou est suspendu au mât arrière au-dessus de la surface,

caractérisée en ce que
la structure de base itinérante (2) est pourvue de moyens de support de lest de super-levage (50, 55), qui permettent de supporter le lest de super-levage (20a, 20b) sur la structure de base de telle sorte que le lest de super-levage puisse être déplacé en même temps que la grue mobile tout en étant supporté par la structure de base (2).

2. Grue mobile selon la revendication 1, dans laquelle le lest de super-levage (20a, 20b) est supporté sur la structure de base mobile (2) de telle sorte que la superstructure (3) puisse tourner sans entrave.

3. Grue mobile selon la revendication 1 ou 2, dans laquelle la structure de base itinérante (2) comprend un châssis central (40), ainsi qu'un premier et un deuxième ensembles porteurs (41, 42) sur chaque côté latéral du châssis.

4. Grue mobile selon l'une quelconque des revendications 1 à 3, dans laquelle la structure de base itinérante (2) est pourvue de premiers et de deuxièmes moyens de support de lest de super-levage (50, 55) situés de chaque côté de la structure de base (2), et dans laquelle le lest de super-levage comprend au moins une première et une deuxième parties de lest de super-levage (20a, 20b), qui peuvent être supportées sur les premiers et deuxièmes moyens de support de lest de super-levage respectifs.

5. Grue mobile selon les revendications 3 et 4, dans laquelle les premier et deuxième ensembles porteurs (41, 42) dépassent vers l'avant et vers l'arrière par rapport au châssis central (40), et dans laquelle les premiers et deuxièmes moyens de support de lest de super-levage (50, 55) sont conçus de façon que la première partie de lest de super-levage (20a) soit supportée essentiellement à l'avant du châssis, entre les parties des ensembles porteurs dépassant vers l'avant, et que la deuxième partie de lest de super-levage (20b) soit supportée essentiellement à l'avant du châssis, entre les parties des ensembles porteurs dépassant vers l'arrière.

6. Grue mobile selon la revendication 4 ou 5, dans laquelle les première et deuxième parties de lest de super-levage (20a, 20b) comprennent chacune un plateau de lest (16) et plusieurs plaques de lest (17) pouvant être empilées sur le plateau de lest.

7. Grue mobile selon la revendication 6, dans laquelle les plateaux de lest (16) sont pourvus de moyens de raccordement (16c) permettant le raccordement mutuel des plateaux, de telle sorte que les plateaux raccordés puissent être utilisés pendant le levage d'une charge par la grue mobile.

8. Grue mobile selon l'une quelconque des revendications précédentes, dans laquelle des moyens de levage de lest de super-levage (31, 33) sont associés au mât arrière (5), de telle sorte que le lest de super-levage (20, 20a, 20b) puisse être suspendu au mât arrière, le mât arrière (5) pouvant être positionné de telle sorte que le lest de super-levage puisse être amené en support sur les moyens de support de lest de super-levage (50, 55) de la grue mobile.

9. Grue mobile selon l'une quelconque des revendications 2 à 8, dans laquelle les ensembles porteurs sont des ensembles à chenilles (41, 42).

10. Procédé d'actionnement d'une grue mobile selon une ou plusieurs des revendications précédentes, dans lequel le lest de super-levage (20a, 20b) est amené à reposer sur les moyens de support de lest

de super-levage (50, 55) de la structure de base itinérante (2), de telle sorte que le lest de super-levage soit déplacé en même temps que la grue mobile tout en étant supporté par la structure de base.

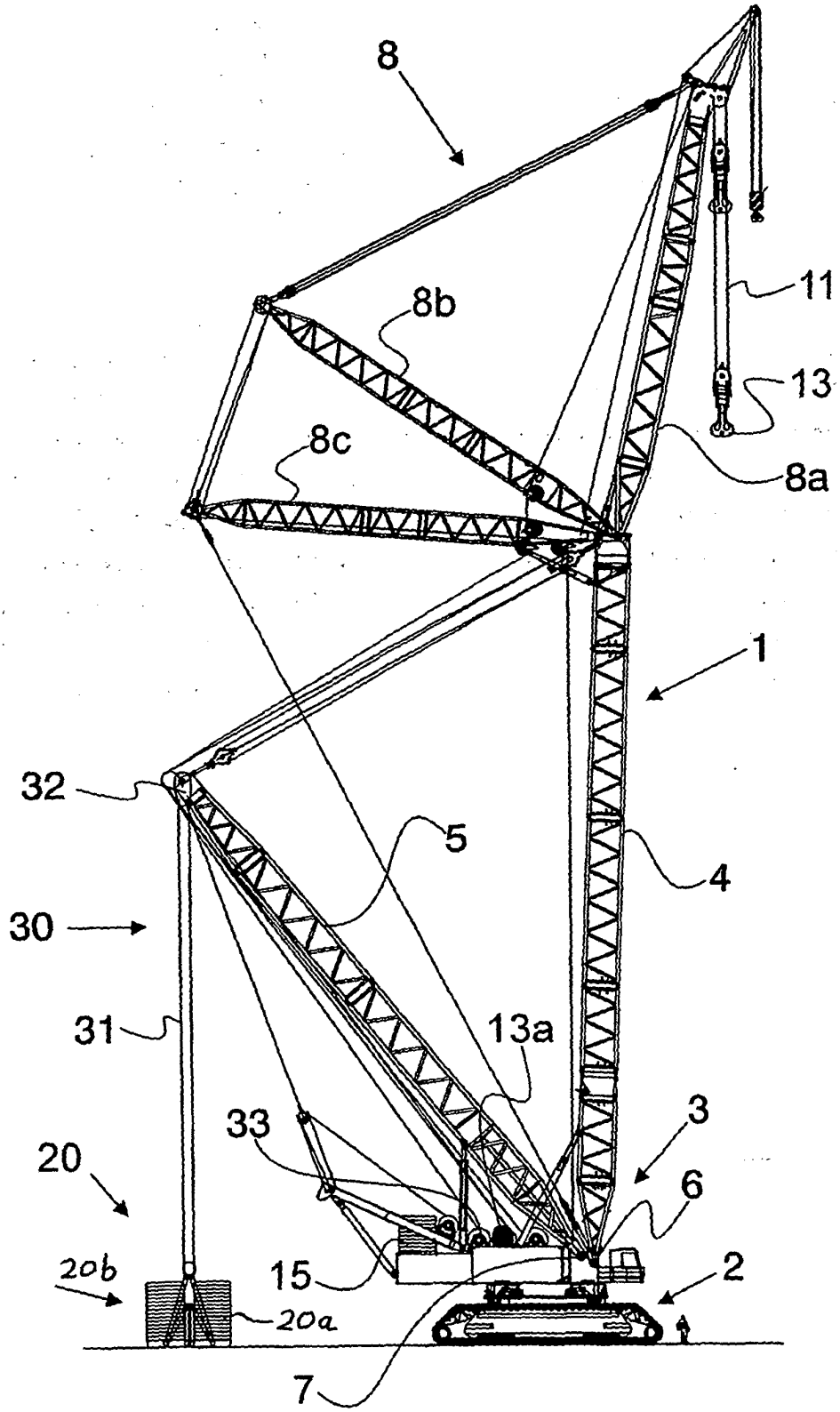

FIG 1

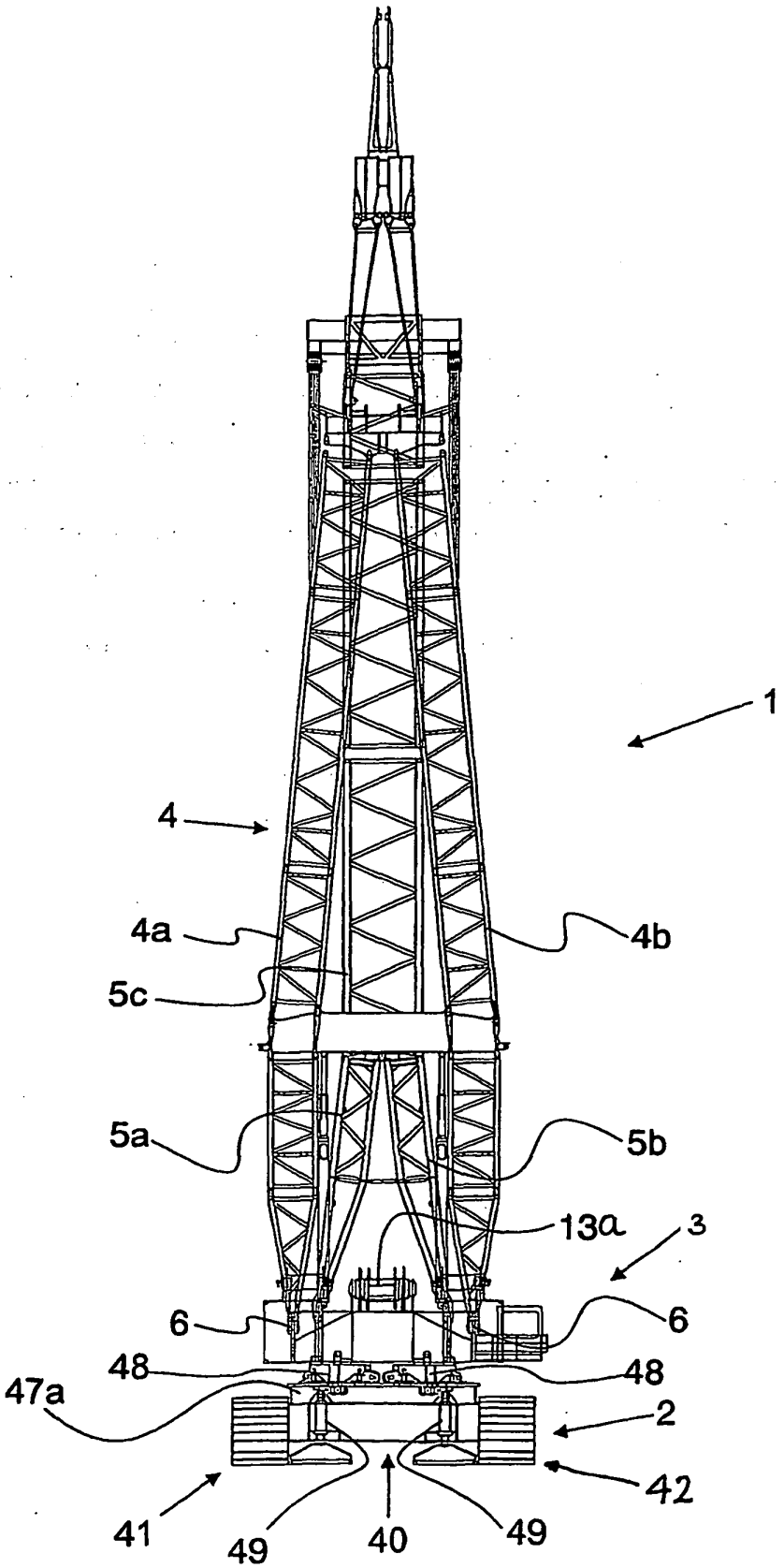

FIG 2

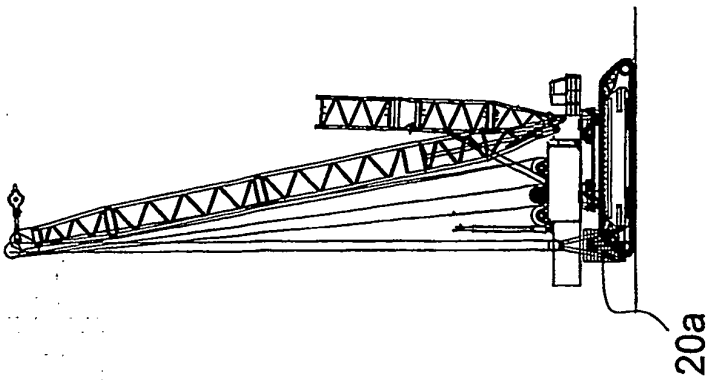

FIG 3c

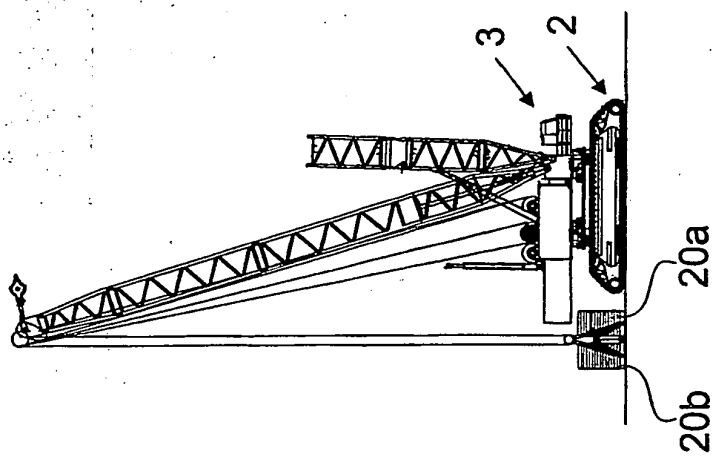

FIG 3b

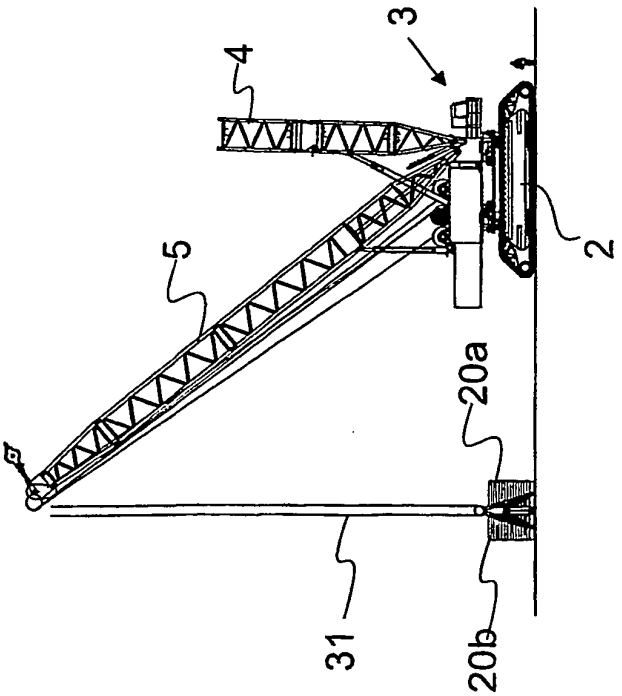

FIG 3a

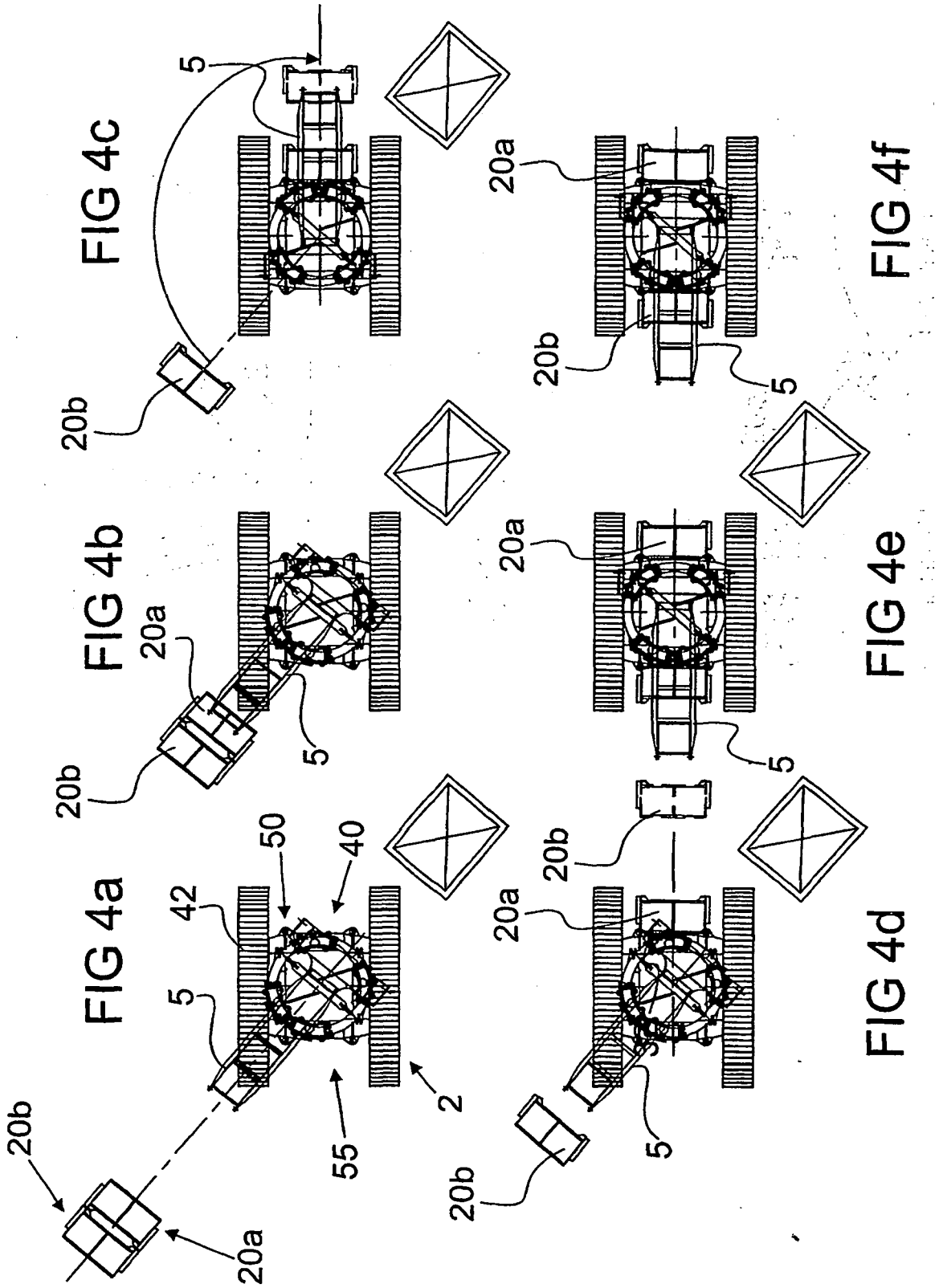
FIG 4a
20b
20a
55
2
5
42
50
40
FIG 4b
20b
5
20a
FIG 4c
20b
5
FIG 4d
20b
5
20a
FIG 4e
5
20a
FIG 4f
20b
5
20a

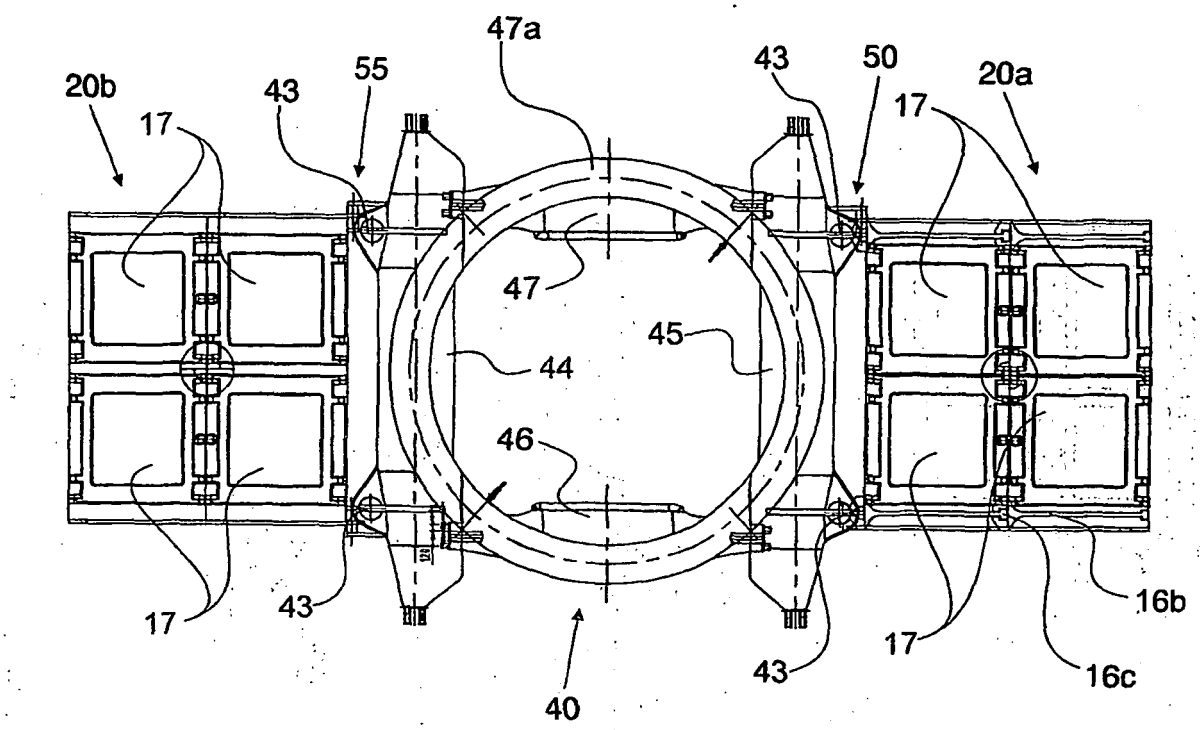

FIG 5

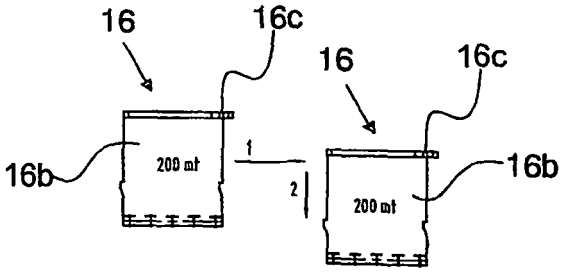

FIG 6b

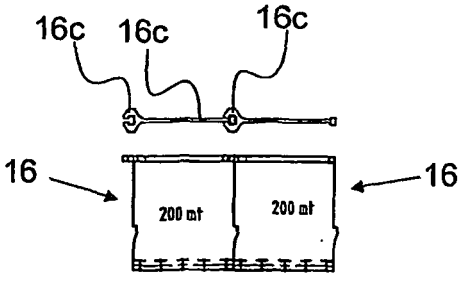

FIG 6a

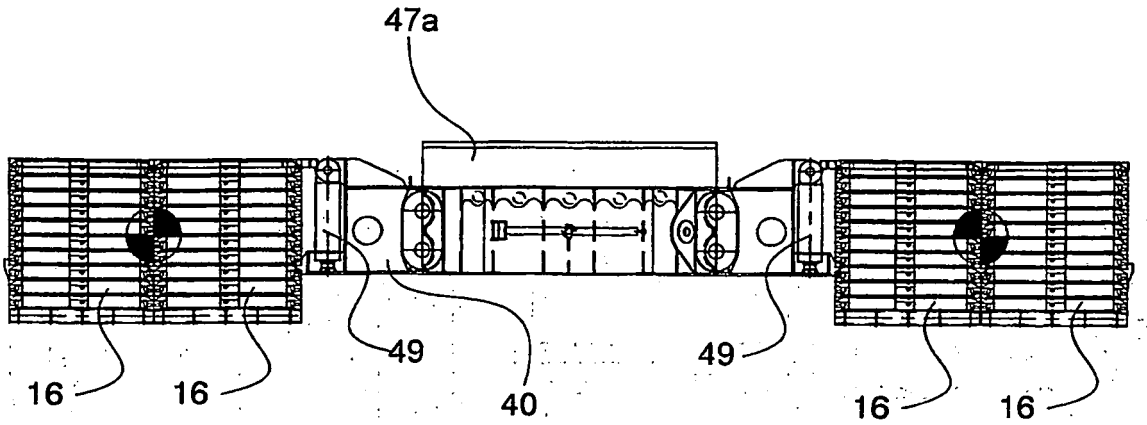

FIG 7

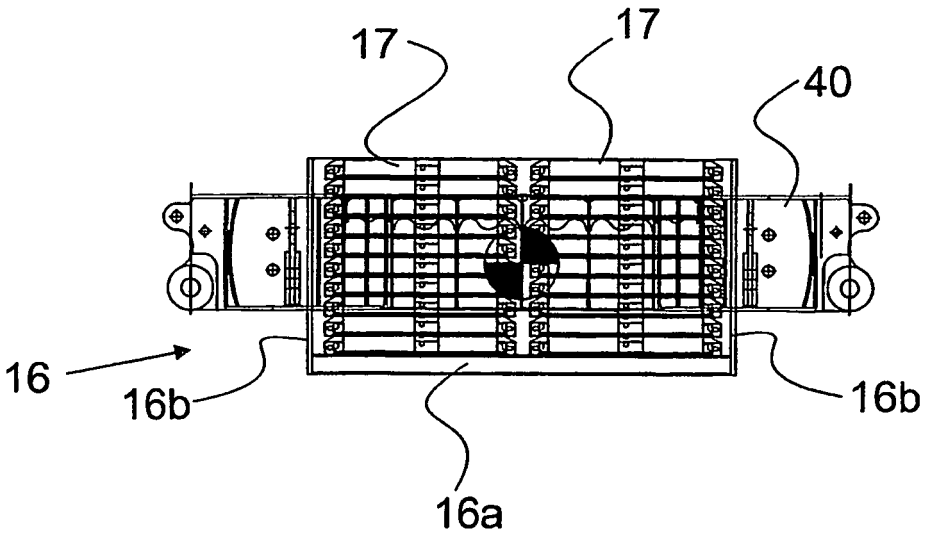

FIG 8

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- US 6283315 A **[0009]**
- US 6568547 B **[0011]**