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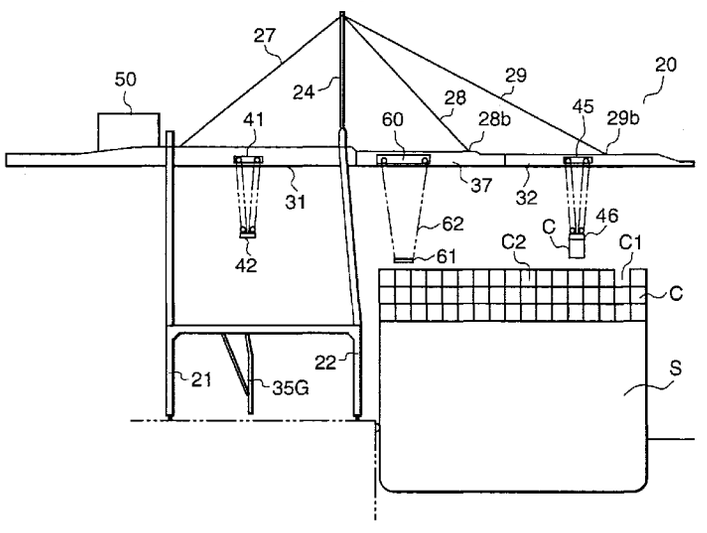
(54) Container crane

(57) In three trolleys for running girders 31 and 32, a central trolley 60 comprises a stage 61 which mounts a container from respective lifting devices 42 and 46 of both sides trolleys 41 and 45. The trolley 60 lifts down the stage 61 by ropes 62. In a case of a loading, the trolley 45 lifts up the container and mounts it on the stage 61. The container of the stage 61 is lifted up by the trolley 60 and is unloaded in a land side. A height position of the stage 61 is a height where under a condition where the container is lifted up, a minimum height where the trolley can run forms as a standard. In accompany with the proceeding of the loading, the height position of the stage 61 is descended gradually. In a case of ship loading, the stage is ascended gradually. An auxiliary beam 37 where the trolley 60 runs is positioned at the land side from a connection point between a tension bar 28 and a boom 32. A container crane 20 having a light weight structure can be obtained and a handling time for the container crane 20 can be shortened.

FIG.1



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Description

The present invention relates to a container crane and in particularly to a container crane for handling or loading and unloading a container.

Recently, an efficiency for handling a container is demanded strongly. For this demand, as shown in Japanese patent laid-open publication No. Hei 7-68,036, there is a container crane to which to one container crane two trolleys for lifting up a container and a trolley (a central trolley) for loading the container between the above stated two trolleys are installed. The above three trolleys run on a girder (in which a boom is included) of the container crane. The central trolley relays the container and a stage for receiving the container is lifted down from the central trolley.

The container is lifted up from a ship through a trolley at a side of sea, by running one or both of this trolley and a relay use trolley (the central trolley), a stage for receiving the relay use trolley is positioned at a lower portion of the container which is lifted down by the trolley and then the container is loaded on the stage.

Next, by running one of both the relay use trolley and a trolley at a side of land, the container of the relay use trolley is positioned at a lower portion of the land side trolley and the container is transferred to the land side trolley. The land side trolley gets the container off on the land.

In a conventional container crane technique shown in Japanese utility mode laid-open publication No. Sho 59-149,889, a stage for receiving a relay use trolley is provided to ascend and descend or lift freely. However, a structure (a steel frame) is stretched across between the stage and the relay use trolley. Further, in this conventional container crane technique a trolley at a side of land does not run.

In a conventional container crane technique shown in Japanese patent laid-open publication No. Hei 5-97,251, a second girder is provided and this second girder is positioned at a lower portion of a boom to which a trolley runs. The second girder has the same length to that of the boom and further in this second girder a vehicle or a carriage on which a container is loaded runs.

The container is lifted up by the trolley and is loaded on the vehicle. The vehicle runs at a side of leg of the container crane and the vehicle is transported at a side of the ground using a lifter. The second girder on which the vehicle runs is ascended and descended or is lifted up and down.

In a conventional container crane technique shown in Japanese utility model laid-open publication No. Sho 61-39,749, a second girder is provided and this second girder comprises a conveyor at a lower portion of a running range of two trolleys. This second girder is moved toward a running direction of the above two trolleys and is ascended and descended. A tip end of the second girder is positioned at an upper portion of a container on a ship.

The relay use trolley of the conventional container crane technique shown in Japanese patent publication No. Hei 7-68,036 and the above stated Japanese utility model laid-open publication No. Sho 59-149,889, between the stage for loading the container and the trolley which runs on the girder, is connected through the structure or the steel frame. There exist a comparative height and a comparative distance between the stage and the trolley. The container having several tons weight mass is loaded on the stage.

In particularly, since the relay use trolley runs by loading the container, the above stated structure or the above stated steel frame becomes a large size and also has a heavy weight construction. As a result, the trolley, the girder, the boom and the legs for supporting the structure (the steel frame) become large heavy weight constructions.

Further, a height position of the stage for receiving the relay use trolley of the conventional container crane technique shown in the above stated Japanese patent publication No. Hei 7-68,036 is a higher position from a height portion of the containers which are piled up on a deck of the ship. As a result, the relay use trolley can be positioned at an upper portion of the ship. However, since the stage is lifted down by the structure, a height of the stage can not alter or change.

The stage of the relay use trolley in the conventional container crane technique shown in the above stated Japanese utility model laid-open publication No. Sho 59-149,889 can ascend and descend, however the stage can not descend near to the deck of the ship. As a result, the landing processing proceeds, it is necessary to arise the lifting devices of the sea side trolley and the land side trolley toward the higher position, it takes a time for landing. A case for loading the container to the ship can be adopted similarly.

Since the length of the second girder of the conventional container crane technique shown in the above stated Japanese patent publication No. Hei 5-97,251 and the above stated Japanese utility model publication No. Sho 61-39,749 is long, the girder becomes a large scale size and also has a large heavy weight construction.

Since the lifting device of the sea side trolley of the conventional container crane technique shown in the above stated Japanese patent laid-open publication No. Hei 5-97,251 is ascended and descended by penetrating the second girder, it is necessary to prevent a collision of the lifting device with the running vehicle and further it is necessary to carry out a sufficient control to improve the handling efficiency or the loading and unloading efficiency.

Further, in the conventional container crane technique shown in the above stated Japanese utility model laid-open publication No. Sho 61-39,749, since the second girder moves toward a horizontal direction, the handling position or the loading and unloading position at the land side is limited.

Preferably, a first object of the present invention is to provide a container crane having a relay use trolley wherein the container crane having a light weight structure can be obtained.

Preferably, a second object of the present invention is to provide a container crane designed to have a relay use trolley wherein the container crane having a light weight structure can be obtained.

Preferably, a third object of the present invention is to provide a container crane designed to have a relay use trolley wherein a handling time or a loading and unloading time of a running container of the relay use trolley can be shortened.

Preferably, the first object can be attained by provision of a girder and a boom which have a first rail to which two both sides trolleys run and a second rail to which a central trolley runs, and in a condition where said central trolley is positioned at a tip end of a sea side of said second rail, said sea side tip end of said second rail is positioned where a respective lifting devices of said sea side trolley can be hoisting and lowering.

Preferably, the second object can be attained by a provision of a girder and a boom which have a first rail to which a first trolley can run and a second rail to which a second trolley can run, and a sea side tip end of said second rail is positioned at a land side from a sea side tip end of said first rail.

Preferably, the third object can be attained by a provision of a stage hanged under the relay use trolley which is raised or lowered by ropes, and said ropes are inclined.

Brief Description of the Drawings:

Fig. 1 is a side view showing a container crane of one embodiment according to the present invention.

Fig. 2 is a side view showing a container crane of one embodiment according to the present invention and a view for explaining one loading manner;

Fig. 3 is a side view showing a container crane of one embodiment according to the present invention and a view for explaining another loading manner;

Fig. 4 is a longitudinal cross sectional view taking under from a side of a boom from a position of a girder shown in Fig. 1;

Fig. 5 is a plan view showing the boom shown in Fig. 1;

Fig. 6 is a side view showing a trolley shown in Fig. 1;

Fig. 7 is a side view showing a connection part between the girder and the boom shown in Fig. 1;

Fig. 8 is a plane view showing the connection part between the girder and the boom shown in Fig. 7; and

Fig. 9 is a longitudinal cross sectional view showing a container crane of another embodiment according to the present invention.

Description of Embodiment of the Invention:

One embodiment of a container crane according to the present invention will be explained by referring to from Fig. 1 to Fig. 8. In Fig. 1, a container crane 20 loads and unloads between a ship S and a vehicle (not shown in figure) etc. at a side of land. The container crane 20 installs horizontally a girder 31 at upper portion of four legs 21 and 22. At a side of sea of the girder 31, a boom 32 is installed and this boom 32 can be rotated toward an upper portion from a horizontal condition.

An upper end of a mast 24 which is installed at an upper portion of the leg 22 and the girder 31 at a side of the leg 21 are connected through a tension bar 27 each other. The upper end of the mast 24 and the boom 32 are connected by a tension bar 28 and a tension bar 29 each other. The respective tension bars 28 and 29 comprises a link member or a rope member. Further, a rope for rotating the boom 32 is installed on but this rope is shown in figure.

The container crane 20 has three trolleys 41, 45 and 60 which run on the girder 31 and the boom 32. The boom 32 is one kind of the girder 31. Further, the boom 32 is called as a beam. The trolley 41 is installed at a side of land and loads and unloads a container C between the land side and a stage 61 of the relay use trolley 60. The trolley 45 loads and unloads the container C between the ship S and the stage 61 of the relay use trolley 60. The trolley 45 runs from a tip end of the sea side of the boom 32 near to a tip end of the land side of the girder 31.

The trolley 41 can run with a range which is from a handling position or a loading and unloading position at the land side to a relay position of the relay use trolley 60. The handling position at the land side is between the land side leg 21 and the sea side leg 22 or is the land side position from the land side leg 21.

In this case, between the leg 21 and the leg 22 exists as the handling position and further a guide means 35G for guiding an ascent and a descent of a lifting device 42 and the container C is installed on. The above stated handing position has a range which is from between the leg 21 and the leg 22 to an upper portion (the position of the boom 32) of the ship S.

The trolley 45 runs mainly between the upper portion of the ship S (the position of the boom 32) and the relay use trolley 60. A range of the relay position of the trolley 45 and the relay use trolley 60 is between the leg 21 and the leg 22 and is a range of the upper portion of the ship S near to the position to the leg 22.

The trolleys 41 and 45 are lifted down the container C by the lifting devices 42 and 46 which attach and detach the container C through the rope. The respective lifting devices 42 and 46 is ascended and descended by a hoisting device (not shown in figure).

The relay use trolley 60 lifts down the stage 61 for loading the container C through a rope 62. The stage 61 can load the container C in a case where the con-

tainer C attaches a stocking cone at a lower face. The stage 61 can be ascended and descended. The stage 61 can be carried down on the ground under a consideration of a case of an exchange-over for the rope 62.

As shown in Fig. 4 and Fig. 5, the trolleys 41 and 45 can run on rails 47 which are installed at a side face of an inner side of the boom 32 and the girder 31.

The respective girder 31 and the respective boom 32 is comprised of two parallel members, respectively. The two members are connected with plural lateral beams 33 each other. Each of the lower portions of the side faces of the inner sides of the members has a rail 35 on which the trolley 41 and the trolley 45 can run.

At the side face of an outer side of the member of each of the girder 31 and the boom 32, an auxiliary beam 37 for supporting the relay use trolley 60 is fixed. At an upper face and a lower face of an outer side of the respective member of the auxiliary beam 37, rails 38 and 39 are installed.

Since the auxiliary beam 37 is formed integrally with the girder 31 and the boom 32, the auxiliary beam 37 can form as the girder 31 and also the auxiliary beam 37 can form as the boom 32, however in this case the auxiliary beam 37, the girder 31 and the boom 32 are called by dividing the respective elements for convenience' sake. Further, the auxiliary beam 37 is called by an inclusion in the girder 31 and the boom 32. The auxiliary beam 37 can be called simply as a beam.

The relay use trolley 60 installs at an outer side of the auxiliary beam 27 and is divided into toward a left side and a right side. The respective relay use trolley 60 runs on the rails 38 and 39. The respective relay use trolley 60 has a wheel which is mounted on an upper face of the rail 38, a wheel which contacts to the side face (a face of another relay use trolley 60 side) of an inner side of the rail 38, and a wheel which contacts to the side face of the rail 39 (each of the elements is not shown in figure).

With the container crane construction of the above stated construction, it is possible to prevent a fall down of the relay use trolley 60 and further the relay use trolley 60 can run. A frame of the relay use trolley 60 has a L shape longitudinal cross-section. The frame comprises a vertical piece 81 which has the wheel etc., a horizontal piece 82 which mounts a following running apparatus and a hoisting device 70, and a slantwise member 83 which connects the vertical piece 81 and the horizontal piece 82.

In other words, the above stated container crane construction can form a cantilever system. As a result, a large space can be obtained at an upper portion of the horizontal piece 82. Therefore, the machine and apparatus such as the hoisting device 70 etc. can be installed easily. Further, in a system where the machine and apparatus such as the hoisting device 70 etc. is installed in a machining room 50 (a rope trolley system and a semi-rope trolley system), the rope can be arranged easily by utilizing the upper portion large space.

The respective relay use trolley 60 has a running apparatus (in which an electric motor etc. is included) for running the relay use trolley 60 and the hoisting device 70 (in which an electric motor etc. is included) for ascending and descending the lifting device 61. A controlling apparatus of the relay use trolleys 60 and 60 is arranged at the machining room 50 which is installed on the girder 31, the running (a standstill is included) of the above stated two relay use trolleys 60 is synchronized and further the ascent and the descent or the lifting of the lifting device 61 is synchronized.

For the above, the relay use trolleys 60 and 60 installs various kinds of detectors. For example, such detectors are a rotation amount detector of the wheel, a running position detector and a rotation amount detector for the hoisting device 70 etc.. The relay use trolleys 60 and 60 and the machining room 50 are connected through a festoon cable (not shown in figure) similarly to those of the other trolleys 41 and 45.

When the relay use trolleys 60 and 60 are viewed taking from the running direction, an interval between ropes 62a and 62b of the one relay use trolley 60 and the ropes 62a and 62b of the another relay use trolley 60 is larger than a length of the respective lifting devices 42 and 46 and a length of the container C.

The two legs 22 and 22 are installed at outer sides of the ropes 62a and 62b. The end portions of the ropes 62a and 62b which are drawn out for the hoisting device 70 of the respective relay use trolley 60 are fixed on one point of a respective end portion of the stage 61 through sieves 63a and 63b.

As clearly shown in Fig. 6, in the one relay use trolley 60, four ropes 62a, 62b and 62, 62b and four sieves 63a, 63b and 63a, 63b are installed. Further, the above "fixture at one point" is that when it is viewed taking from the running direction of the relay use trolley 60, however four actual fixture points exist. As shown in Fig. 6, the positions of the sieves 63a and 63b are the same positions, the fixture point of the ropes 62a and 62b to the stage 61 can form at the same position.

When the relay use trolleys 60 and 60 are viewed taking from the running direction, against a perpendicular line of the respective above stated fixture points, the ropes 62a and 62b are inclined symmetrically toward a left direction and a right direction.

Angles $\theta 1$ and $\theta 2$ of the respective ropes 62a and 62b for constituting the perpendicular line are the same. Accordingly, it is possible to restrain a sway of the stage 61 according to the wind from a longitudinal direction of the container C.

An apparatus for carrying out the running of the relay use trolley 60 and the ascent and the descent (the lifting) of the stage 61 is not provided on the relay use trolley 60 but it can be installed in the machining room 50. In this case, the fixture points of the ropes 62a and 62b do not exist on the stage 61.

The respective apparatus for carrying out the running of the trolley 41 and the trolley 45 and the lifting of

the lifting devices 62 and 66 can be installed on the trolley 41 and the trolley 45 and in the machining room 50 of the girder 31.

Fig. 6 is a view taking from a horizontal direction of the right angle direction toward the running direction of the trolley. The four ropes 62a, 62b and 62a, 62b which are sent out from the hoisting device 70 are fixed to the stage 61 through the sieves 63a, 63b and 63a, 63b.

In the running direction of the relay use trolley 60, an interval for hanging down the rope from the relay use trolley 60 is sufficiently larger than the interval (the interval for hanging up the stage 61) of the fixture points to the stage 61. The inclination angle $\theta 1$ to the respective rope toward the perpendicular line of the respective fixture points is the same. The reference numerals "62a, 62b" are expressed by "62" and the reference numerals "63a, 63b" are expressed by "63" case by case in the present specification. Further, the rope 62 can be replaced by the chain.

With the above stated container crane construction of this embodiment according to the present invention, the ropes 62a and 62b between the relay use trolley 60 and the stage 61 are inclined, the sway of the stage 61 due to the running of the relay use trolley 60 can be restrained easily. Further, since the ropes 62a and 62b are fixed to the stage 61, the sway of the stage 61 can be restrained easily.

Since the ropes 62a and 62b having two systems are provided, the sway of the stage 61 can be restrained easily. Further, the inclination angles $\theta 1$ of the respective ropes 62a and 62b are the same, the winding amount of the ropes 62a and 62b by a drum 71 can be formed the same.

As shown in Fig. 7 and Fig. 8, the girders 31, 37 and the booms 32, 37 are connected by a pin 30 each other. The bracket, which is projected from the girders 31 and 37 and the booms 32 and 37 to an upper portion, is connected by the pin 30. All of the rails 35, 38 and 39 are installed at a lower portion from the installation positions of the pin 30. Since the pin 30 is provided at an upper portion from the installation positions of the rails 35, 38 and 39, the bracket structure can be made simply.

Further, the respective connection part of the rails 35, 38 and 39 each other can be made vertically. In this case, the wheels of the relay use trolley 60 are mounted on the horizontal face of the upper surface of the rail 38, however the rail 38 can be inclined toward an inner side.

The pin 30 can be installed at the lower portion from the installation position of the rail 38. In this case, the connection part between the rail 31 of the girder 31 and the rail 38 of the boom 32 is installed at the side of the girder 31 from the pin 30 or the side of the boom 32 from the pin 60. The connection part is inclined toward the perpendicular line.

In a case where the connection part is installed at the side of the girder 31, an inclination surface of an end portion of the rail 38 at the side of the girder 31 is positioned at an upper portion from the inclination surface of an end portion of the rail at the side of the boom 32. In a case where the connection part is installed at the side of the boom 32, a relationship of the inclination is formed reversibly.

With the above stated container crane construction of this embodiment according to the present invention, it will be explained referring to the handling (the loading and unloading) of the container C in the ship S to the land side. The relay use trolley 60 is stopped between the position for the container C which is subjected to unload and the unloading position of the land side. The trolley 45 is ascended the lifting device 46 which has taken hold of the container C.

When the lower face of the container C is ascended at the height where the container C can be run directing for the relay use trolley 60, the ascent is made to stop. In this condition, the relay use trolley 60 begins to start the running directing for the relay use trolley 60. When the relay use trolley 60 is stopped at the position of the stopped relay use trolley 60, the lifting device 46 is descended to the stage 61 and the container C is unloaded. In a manner stated in above, the transportation of the container C from the ship S in the container crane 20 is carried out.

Next, the lifting device 46 is ascended a little, the trolley 45 is moved to the sea side directing for the position of a next container C. In a case where the trolley 45 carries out the lifting (the ascent and the descent) and the running at the same time, such operations will be allowed to carry out.

When the trolley 45 begins to start the movement toward the ship S side, the trolley 41 comes to move and is stopped at the position of the relay use trolley 60. The trolley 41 is run by holding the height of the lifting device 42 at the height of the upper surface of the container C which is mounted on the stage 61 and the trolley 41 is reached to the upper portion of the stage 61.

After that, the trolley 41 is descended the lifting device 42 and the lifting device takes hold of the container C of the stage 61. And by ascending and lifting up the container C, the trolley 41 is run directing for the land side. The trolley 41 is descended at the position of the guide means 35G and the container C is unloaded to the vehicle etc. of the ground.

In a case where the trolley 41 carries out the running and the descent of the lifting device 42 at the same time, such operations will be allowed to carry out. As stated in above, the transportation of the container C to the land side in the container crane 20 is carried out.

The standstill position of the relay use trolley 60 and the height position of the stage 61 are determined by making substantially the same the loading time of the trolley 45 from the ship S and the stage 61 and the unloading time of the trolley 41 from the stage 61 to the unloading position at the land side.

It is determined not to be large the waiting time for one of the trolley 41 and the trolley 45. So as to attain the above, the relay position between the trolley 45 and

the relay use trolley 60 becomes to position the upper portion of the ship S case by case.

In generally, in a case of the loading and the unloading (the handling) of the container C on the deck of the ship S, the relay use trolley 60 is positioned at the sea side near the leg 22. In a case of the handling of the container C in the hold of the ship S, the relay use trolley 60 is positioned at the upper portion of the ship S. The standstill position of the relay use trolley 60 is near the position where the lifting device 42 is ascended or descended to the hold of the ship S.

The standstill position of they relay use trolley 60 and the height position of the stage 61 are calculated and determined by the designation for the next container handling position from an operator of the relay use trolley 60. Or, they are determined successively by the handling schedule at the first time. The relay use trolley 60 is carried out automatically.

Next, the height position of the stage 61 of the relay use trolley 60 will be explained. The trolley 45 lifts up the container C and is ascended the container C to the height where the relay use trolley 60 can run directing for the stage 61. The running height is taken under the consideration about the minimum height as the standard.

Next, at the condition where the height of the lifting device 46 is maintained at that height, the relay use trolley 60 is run directing for the stage 61. The relay use trolley 60 is stopped at the upper portion of the trolley 45 and the lifting device 46 is descended. The height position of the stage 61 is the height where the trolley 45 can run at the condition where the container C is hang down and the height of the container C is not changed.

The height of the stage 61 is lower a little than the lower surface of the lifted up container C. With the container crane construction stated in the this embodiment according to the present invention, in a case where the stage 61 is positioned on the container C of the deck of the ship S, the lower surface of the container C is higher than the height of the stage 61. When the trolley 45 is stopped at the upper portion of the stage 61, the lifting device 42 is descended.

A case of the loading of the container C which is mounted on the upper portion of the piled-up containers C will be explained. Fig. 1 shows an initial period condition of the loading, when the container C is loaded at a position of C1 and the container C at the C1 position is lifted up. The height position of the stage 61 is a little upper portion higher position than the upper surface of the highest portion container C at a position of C2 at the side of the stage 61 than the container C at the C1 position. The lower surface of the container C which has lifted up the lifting device 46 is higher than the stage 61. The height of the container C at the position C2 is a height where the running for the trolley 45 becomes obstacle.

In Fig. 1, when the container C at the side of the relay use trolley 60 does not exist from the container C at the C2 position, the height position of the stage 61 is the lower portion from the upper surface of the container C at the position C2. In this case, the trolley 46 is exceeded over the container C at the position C2, the running directing for the stage 61 and the descent of the lifting device 46 are carried out at the same time.

After the loading has proceeded, as shown in Fig. 2, the height of the pile of the containers C becomes low, and in a case where the container C at the C2 position is loaded, the height position of the stage 61 is a little upper portion higher position than the upper surface of the highest portion container C at a position of C4 at the side of the stage 61 than the container C at a position of C3. The height of the container C4 is a height where the running for the trolley 45 becomes obstacle. Fig. 2 shows the condition where the container C at the position C3 is lifted up.

After the loading has proceeded further, as shown in Fig. 3, the container C on the deck of the ship S is run out, and a case where the container C at a position of C5 in the hold of the ship S is loaded, the height where the lifted-up container C at the position C5 can be run is a height where the trolley can be run on the deck of the ship S.

As stated in the above, since the height position of the stage 61 is descended in response to the proceeding of the loading of the containers C, an operation for ascending the lifting device 46 of the trolley 45 becomes unnecessary and accordingly the handling time (the loading and unloading time) can be shortened.

Further, since the height position of the stage 61 is descended, also the height position of the lifting device 42 of the trolley 41 can be descended. As a result, the handling time (the loading and unloading time) using the trolley 41 can be shortened.

The height of the lifting device 42 of the trolley 41 is substantially the same to the height of the lifting device 46 of the trolley 45. However, the height of the lifting device 42 for taking hold the container C which is mounted on the stage 61 becomes to position at the lower portion in compliance with the taking hold manner.

For example, in the running direction of the trolley 41 and at the condition where a rear side flipper is projected toward the lower portion, then the trolley 41 is run directing for the stage 61 and the above stated flipper is contacted with the container C of the stage 61. In this case, the stage 61 may be swung but the sway can be restrained in accordance with the rope 62 which is stretched slantwise.

The height position of the stage 61 is higher at the upper portion than the lower surface of the container C where the trolley 45 runs, however it is unnecessary to form so. The height position of the stage 61 of the relay use trolley 60 during the handling time is a height in which the running height of the trolley 45 for lifting up the container C directing for the stage 61 is formed as the standard.

In a case where the running of the trolley 45 and the

descent of the lifting device 46 are carried out at the same time, the height position of the stage 61 may be sufficiently positioned at the lower portion than the lower surface of the container C which is loaded by the lifting device 46.

The trolley 41 for running directing for the stage 61 from the unloading position is ascended the lifting device 42 at the unloading position and such an ascent is stopped at a little upper portion of the height of the stage 61. Next, the running of the trolley 41 begins to start and the running is stopped at the upper portion of the stage 61 and the lifting device 42 is descended.

The trolley 41 for taking hold the container C which is mounted on the stage 61 is ascended a little and is run directing for the unloading position. At the unloading position, the running of the trolley 41 is stopped and then the lifting device 42 is descended.

The trolley 41 and the trolley 45 are operated manually or automatically. The trolley 41 and the trolley 45 can be carried out the running and the ascent and the descent (the lifting) at the same time. In a case where the running and the lifting of the trolley 41 and the trolley 45 are not carried out at the same time, the control for the sway checking of the lifting device 42 during the running can be carried out easily.

Further, since the height from the container C of the ship S to the stage 61 is low, an effect for carrying out the running and the ascent and the descent using the trolley 45 is small. However, there is a high possibility in which the trolley 41 carries out the running and the ascent and the descent at the same time. The relay use trolley 60 can be run automatically and also is ascended and descended automatically.

In the container crane construction of the above stated embodiment according to the present invention, the standstill position of the running direction of the relay use trolley 60 is varied or altered in accordance with the position in which the next container C is loaded from the ship S, however it can be set at a single running position against plural containers C. This is performed for the prevention of the sway of the stage 61. The standstill position of the ascent and the descent (the lifting) of the stage 61 can be carried out similarly.

Since the stage 61 is lifted down from the relay use trolley 60 using the rope 62, in comparison with the structure (the steel frame) it can be made the light weight and the small size structure.

In a case where the lifting devices 42 and 46 of the trolleys 41 and 45 are given and received the stage 61 and the container C, the stage 61 may be swung according to the sway etc. of the lifting devices 42 and 46. So as to prevent the above stated sway, the stretching angle of the rope 62 for lifting down the stage 61 is formed large.

The height position of the stage 61 of the relay use trolley 60 during the loading of the container C at the land side to the ship S, as understood from the above stated explanation, making the loading position at the ship S side as the standard, the height is formed with the running height of the trolley 45 which lifts up the container C from the stage 61 directing for the ship S is formed as the standard. The above stated running height is taken under the consideration about the minimum height. The stage 61 is ascended gradually.

In Fig. 1 and Fig. 5, the auxiliary beam 37 (the rails 38 and 39) of the boom 32 exists only at the side of the girder 31 from a vicinity of a connection point 28b between the boom 32 and the tension bar 28. However, the relay use trolley 60 can not run exceeding over the above stated connection point 28b.

Accordingly, the loads of the auxiliary beam 37 and the relay use trolley 60 are added on the tension bar 28, but they are not added on the tension bar 29. As a result, it is unnecessary to form large the tension bar 29 and therefore it is possible to form with a low cost.

Further, it is possible to form the boom 32 with the light weight. Also, it is possible to form the auxiliary beam 37 with the light weight. The relay use trolley 60 is desirable to run by exceeding over the connection point 28b between and the relay use trolley 60 and the tension bar 28. However, at the position of the connection point 28b the handling times of the trolleys 41 and 45 can be made substantially the same.

In the general container crane construction, the connection point 28b is positioned to make substantially the same the handling times of the trolley 41 and the trolley 45. Conversely, the position of the connection point 28b is selected to set substantially the same the handling times of the trolley 41 and the trolley 45.

Further, a range for burdening the load only on the tension bar 28 is that a central position of the running direction of the relay use trolley 60 is a position where an extension line of the tension bar 28 intersects with the rail 38.

The position of a tip end at the sea side of the auxiliary beam 37 (in which the rails 38 and 39 are included) is a position where, at the condition where the relay use trolley 60 is positioned at the above tip end, the lifting device 46 of the trolley 45 which is positioned at the sea side from the relay use trolley 60 can be ascended and descended.

It is necessary to position the position of the tip end at the land side of the auxiliary beam 37 (in which the rails 38 and 39 are included), namely the relay use trolley 60 is positioned at the land side from at least the leg 22 at the sea side. The auxiliary beam 37 does not exist at the land side from the leg 22 at the land side. Therefore, it can be lessened a possibility about falling down of the container crane 20.

In the container crane construction of the above stated embodiment according to the present invention, at the condition where the container C is mounted or loaded, the relay use trolley 60 does not run, however for the sake of the time shortening the relay use trolley 60 on which the container C is mounted may run. In this case, the trolley 41 at the land side can employ one in

which the trolley 41 is fixed, for example as disclosed in the above stated Japanese utility model laid-open publication No. Sho 59-149,889.

By establishing more a case of the installations of the trolley 41 and the relay use trolley 60 will be explained. The girder 31 and the boom 32 within the range where the trolley 41 and the relay use trolley 60 run are installed on the auxiliary beam 37 at a side face of an outer side of the horizontal direction using a welding manner or using bolts. The rails 38 and 39 are installed on the auxiliary beam 37.

The machining room 50 for operating the trolley 41 and the relay use trolley 60 is installed separately on the girder 31. Further, the auxiliary beam 37 is welded to the lower surface of the member, this member is welded to the upper surfaces of the girder 31 and the boom 32 and is projected outwardly. The auxiliary beam 37 is one kind of the girder 31 and the boom 32.

Further, in a first construction stage, the container crane where the second beam is installed (according to circumstances, the rails 38 and 39 of the relay use trolley 60 are installed) is delivered, then the handling is carried out one trolley. After that, at a time of a second construction stage where the handling amount increases, other two trolleys are added.

A further embodiment of a container crane according to the present invention will be explained referring to Fig. 9. As shown in Fig. 9, a relay use trolley 60 may employ as a boom supporting type. This boom supporting type relay use trolley 60b is lifted down from two rails of an auxiliary beam 37b. A lower portion of the auxiliary beam 37b is positioned at the lower portions from the lower portions of the girder 31 and the boom 32 and at this position the rails are installed on.

In the above stated embodiments of the container crane construction according to the present invention, on the assumption that the loading and the unloading (the handling) of the trolley 41 is carried out between the running road face of the container crane 20. However, in a case where at an upper portion from the running road face, for example, at between a machine and apparatus having an extent of the height of the deck of the ship S, the handling manner is carried out substantially similarly.

The technical range of the present invention is not limited within the wordings which are described in each claim of the what is claimed is item and the wordings which are described in the means for solving the problems item, but it can refer to a range where a man belonged to this technical field can replace easily the elements.

According to the container crane construction of the present invention, since the range for running the relay use trolley can be limited, the light weight structure can be obtained.

Further, since the stage is lifted down from the relay use trolley using the ropes, and since the ropes are inclined, the sway of the stage can be restrained due to the light weight structure, and further the handling time can be shortened.

Claims

1. A container crane comprising:

a girder;
a boom connected to a tip end portion of said girder and for rotating between a horizontal condition and a rising condition;
three trolleys for running on said girder and said boom;
in a running direction of said three trolleys, two trolleys positioned at both end portions and having a respective lifting devices for lifting a container; and
a trolley positioned at a center in said running direction and having a stage for loading said container from said respective lifting device of said two trolleys;

characterized in that

said girder and said boom have a first rail to which said two trolleys run and a second rail to which said central trolley runs;
a position of a tip end portion at a sea side of said second rail is a land side from a position of a tip end portion of a sea side of said first rail; and
in a condition where said central trolley is positioned at said position of said tip end portion of the sea side of said second rail, said position of said tip end portion of the sea side of said first rail is a position where said respective lifting device of said trolley at the sea side which is positioned at the sea side from said central trolley is positioned to ascend and descend toward an upper portion and toward a lower portion from a height position of said stand of said central trolley.

2. A container crane according to claim 1, characterized in that

said second rail is positioned at positions of both sides of an outer side in the horizontal direction from said first rail.

3. A container crane according to claim 1, characterized in that

said girder is supported by four legs; and
a tip end portion at the land side of said second rail is positioned between said legs at the sea side and said legs at the land side.

4. A container crane comprising:

a girder;
a boom connected to a tip end portion of said girder and for rotating between a horizontal condition and a rising condition; and
three trolleys for running on said girder and said boom;
in a running direction of said three trolleys, two trolleys positioned at both end portions and having a respective lifting devices for lifting a container; and
a trolley positioned at a center in said running direction and having a stage for loading said container from said respective lifting devices of said two trolleys;

characterized in that

said girder and said boom have a first beam to which said two trolleys run and a second beam to which said central trolley runs;
said second beam is installed on said first beam;
a position of a tip end portion at a sea side of said second beam is a land side from a position of a tip end portion of a sea side of said first beam; and
in a condition where said central trolley is positioned at said position of said tip end of the sea side of said second beam, said position of said tip end portion of the sea side of said first beam is a position where said respective lifting device of said trolley at the sea side which is positioned at the sea side from said central trolley is positioned to ascend and descend toward an upper portion and toward a lower portion from a height position of said stand of said central trolley.

5. A container crane according to claim 4, characterized in that

a side face of said second beam is fixed to both side faces in a horizontal direction of said first beam.

6. A container crane according to claim 4, characterized in that

said girder is supported by four legs; and
a tip end portion at the land side of said second beam is positioned between said legs at the sea side and said legs at the land side.

7. A container crane comprising:

a girder supported by four legs;
a boom connected to an end portion of said girder, at a use condition said boom is projected toward a horizontal direction;
a tension bar for connecting an upper end portion of a mast which is positioned at an upper portion of said leg to said boom;
three trolleys for running on said girder and said boom;
in a running direction of said three trolleys, two trolleys positioned at both end portions and having a respective lifting device for lifting a container;
in said running direction, a central trolley having a stage for loading said container from said respective lifting device of said two trolleys; and
said respective lifting devices of said two trolleys positioned at an upper portion of said stage;

characterized in that

said girder and said boom have a first rail to which said two trolleys run and a second rail to which said central trolley runs; and
a position of said tip end portion of a sea side of said second rail is a position where a connection point between said tension bar and said boom forms as a standard.

8. A container crane according to claim 7, characterized in that

said tension bar comprises a first tension bar and a second tension bar;
a connection point between said first tension bar and said boom is positioned at a land side from a connection point of said second tension bar and said boom, and
a position of a tip end portion at a sea side of said second rail is positioned at a position where said connection point between said first tension bar and said boom forms as a standard.

9. A container crane comprising:

a girder supported by four legs;
a boom connected to an end portion of said girder, at a use condition said boom is projected toward a horizontal direction;
a tension bar for connecting an upper end portion of a mast which is positioned at an upper portion of said leg to said boom;
three trolleys for running on said girder and said boom;
in a running direction of said three trolleys, two trolleys positioned at both end portions and having a respective lifting device for lifting a container;
in said running direction, a central trolley having

a stage for loading said container from said respective lifting device of said two trolleys; and said respective lifting devices of said two trolleys positioned at an upper portion of said stage;

characterized in that

said girder and said boom have a first beam to which said two trolleys run and a second beam to which said central trolley runs; and
a position of said tip end portion of a sea side of said second beam is a position where a connection point between said tension bar and said boom forms as a standard.

10. A container crane according to claim 9, characterized in that

said tension bar comprises a first tension bar and a second tension bar;
a connection point between said first tension bar and said boom is positioned at a land side from a connection point of said second tension bar and said boom, and
a position of a tip end portion at a sea side of said second beam is positioned at a position where said connection point between said first tension bar and said boom forms as a standard.

11. A container crane comprising:

a girder; and
a boom connected to a tip end portion of said girder and for rotating between a horizontal condition and a rising condition;

characterized in that

said girder and said boom comprises a first rail to which a trolley for lifting a container can run;
said girder and said boom comprises a second rail to which another trolley for lifting a container can run; and
a position of a tip end portion at a sea side of said second rail is a land side from a position of a tip end portion of a sea side of said first rail.

12. A container crane comprising:

a girder; and
a boom connected to a tip end portion of said girder and for rotating between a horizontal condition and a rising condition;

characterized in that

said girder and said boom comprises a first beam to which a trolley for lifting a container can run and a second beam which is installed on said first beam and to which another trolley for lifting a container can run; and
a position of a tip end portion at a sea side of said second beam is a land side from a position of a tip end portion of a sea side of said first beam.

13. A container crane according to claim 12, characterized in that

said second beam is fixed to both side faces of an outer side in a horizontal direction of said first beam.

14. A container crane according to claim 12, characterized in that

said first beam has a first rail to which said trolley can run; and
said second beam has a second rail to which said another trolley can run.

15. A container crane comprising:

a girder supported by four legs;
a boom connected to an end portion of said girder, at a use condition said boom is projected toward a horizontal direction;
a tension bar for connecting a mast which is positioned at an upper portion of said leg and said boom;

characterized in that

said girder and said boom comprise a first rail to which a trolley for lifting a container can run and a second rail to which another trolley for lifting a container can run; and
a position of said tip end portion of a sea side of said second rail is a position where a connection point between said tension bar and said boom forms as a standard.

16. A container crane according to claim 15, characterized in that

said tension bar comprises a first tension bar and a second tension bar;
a connection point between said first tension bar and said boom is positioned at a land side from a connection point of said second tension bar and said boom; and
a position of a tip end portion at a sea side of said second rail is positioned at a position where a connection point between said first tension bar and said boom forms as a standard.

17. A container crane comprising:

a girder supported by four legs;
a boom connected to an end portion of said girder, at a use condition said boom is projected toward a horizontal direction;
a tension bar for connecting a mast which is positioned at an upper end portion and said boom;

characterized in that

said girder and said boom comprise a first beam to which a trolley for lifting a container can run and a second beam which is installed on said first beam and to which another trolley for lifting a container can run;
a position of said tip end portion of a sea side of said second beam is a position where a connection point between said tension bar and said boom forms as a standard.

18. A container crane according to claim 17, characterized in that

said tension bar comprises a first tension bar and a second tension bar;
a connection point between said first tension bar and said boom is positioned at a land side from a connection point of said second tension bar and said boom; and
a position of a tip end portion at a sea side of said second beam is positioned at a position where a connection point between said first tension bar and said boom forms as a standard.

19. A container crane according to claim 18, characterized in that

said second beam is installed at both side faces of an outer side in a horizontal direction from said first beam.

20. A container crane comprising:

three trolleys for running on one substantially girder;
in a running direction of said three trolleys, two trolleys positioned at both sides and having a respective lifting devices for lifting up a container; and
in said running direction, a central trolley having a stage for loading said container from said respective lifting device of said two trolleys;

characterized in that

said central trolley lifts down said stage by plural ropes; and

said respective rope between said central trolley and said stage is inclined toward a perpendicular line.

21. A container crane according to claim 20, characterized in that

said respective rope between said central trolley and said stage is fixed to said stage; and
viewing from a horizontal direction of a right angle direction against a running direction of said central trolley, said respective rope between said central trolley and said stage is inclined toward a perpendicular line.

22. A container crane according to claim 20, characterized in that

viewing from said horizontal direction of said right angle direction toward said running direction of said central trolley, said respective rope between said central trolley and said stage are four and an angle of said respective ropes is the same toward said perpendicular line.

23. A container crane according to claim 22, characterized in that

said respective ropes between said central trolley and said stage is fixed to said stage; and
viewing from said running direction of said central trolley, said respective rope between said central trolley and said stage is inclined toward said perpendicular line.

24. A container crane according to claim 20, characterized in that

said respective rope between said central trolley and said stage is fixed to said stage; and
viewing from a horizontal direction of a running direction of said central trolley, said respective rope between said central trolley and said stage is inclined toward a perpendicular line.

25. A container crane comprising:

a girder;
a boom connected toa tip end portion of said girder and for rotating between a horizontal condition and a rising condition;
three trolleys for running on said girder and said boom;
in a running direction of said three trolleys, two trolleys positioned at both end portions and having a respective lifting device for lifting a container; and
a trolley positioned at a center in said running

direction and having a stage for loading said container from said respective lifting device of said two trolleys;

characterized in that

said central trolley lifts down said respective stage by ropes;
said girder and said boom have a first rail for said two trolleys and a second rail and a third rail for said central trolley;
said first rail, said second rail and said third rail are installed at a lower portion from a pin for connecting said girder and said boom;
said second rail is installed at an upper face on said girder and said boom and mounts said central trolley; and
said third rail is installed at a lower portion of a side face of said girder and said boom and contacts to a side face of a lower portion of said central trolley.

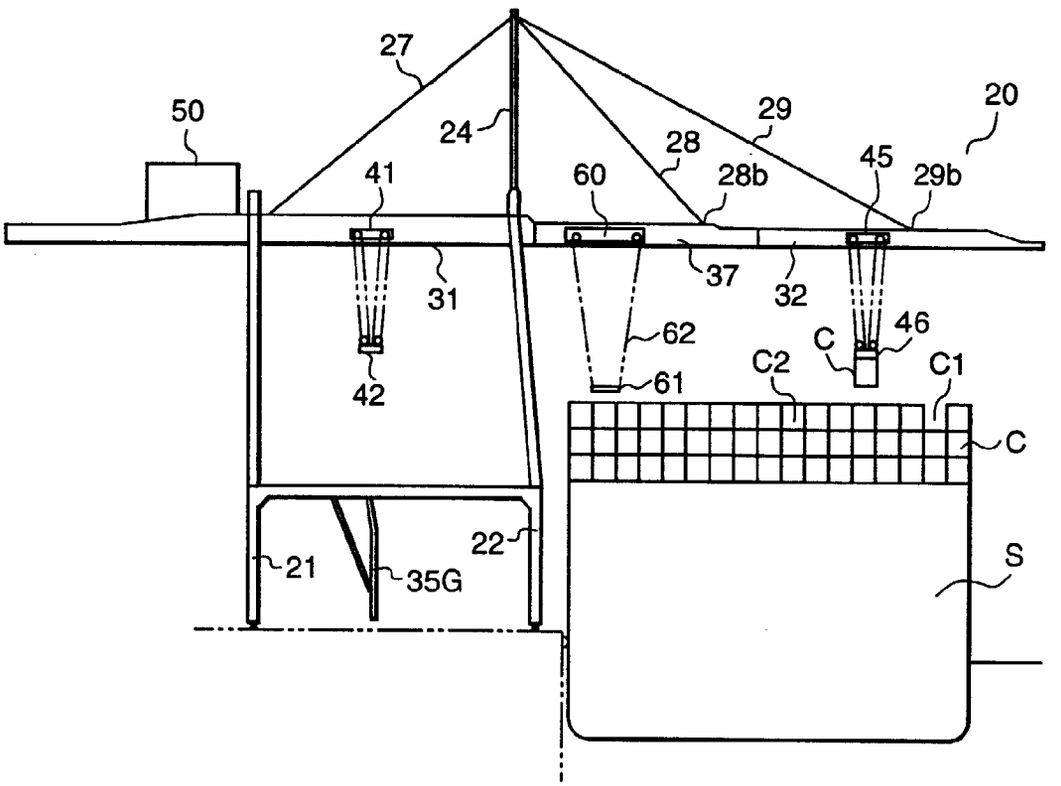
26. A container crane comprising:

three trolleys for running on one substantially girder;
in a running direction of said three trolleys, two trolleys positioned at both sides and having a respective lifting device for lifting up a container; and
in said running direction, a central trolley having a stage for loading said container from said respective lifting device of said two trolleys;

characterized in that

said central trolley lifts down said stage by ropes so as to descend said stage on the ground.

FIG.1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C
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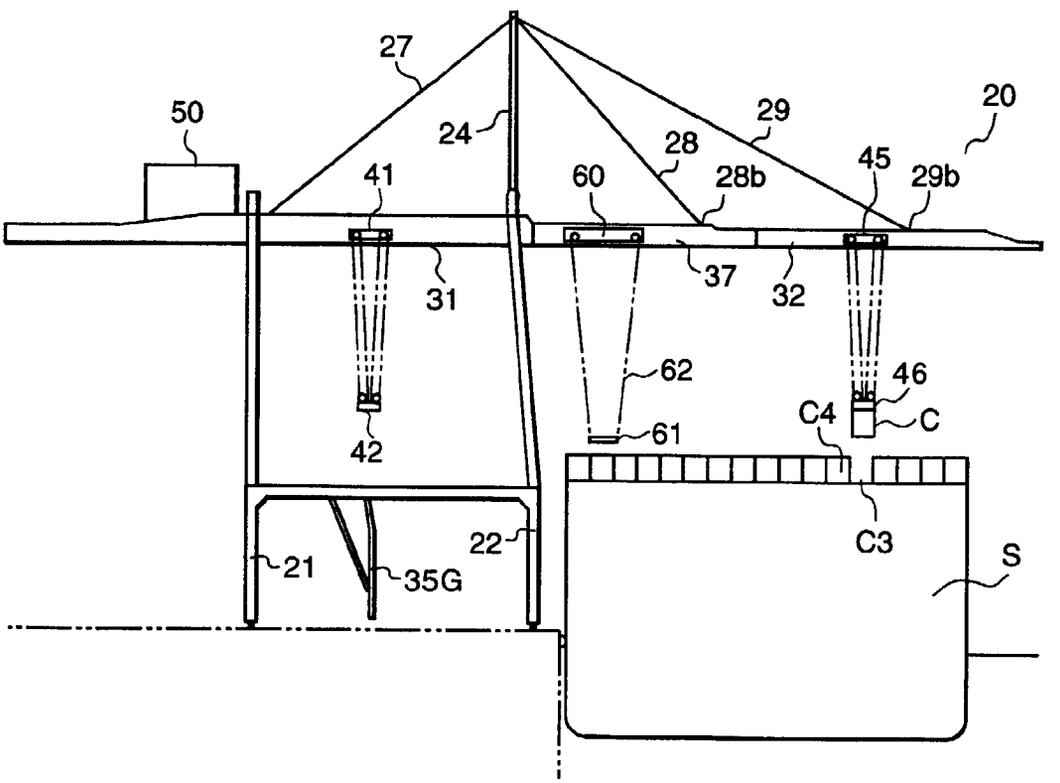
C2
C1
C
22
21
35G
S

FIG.2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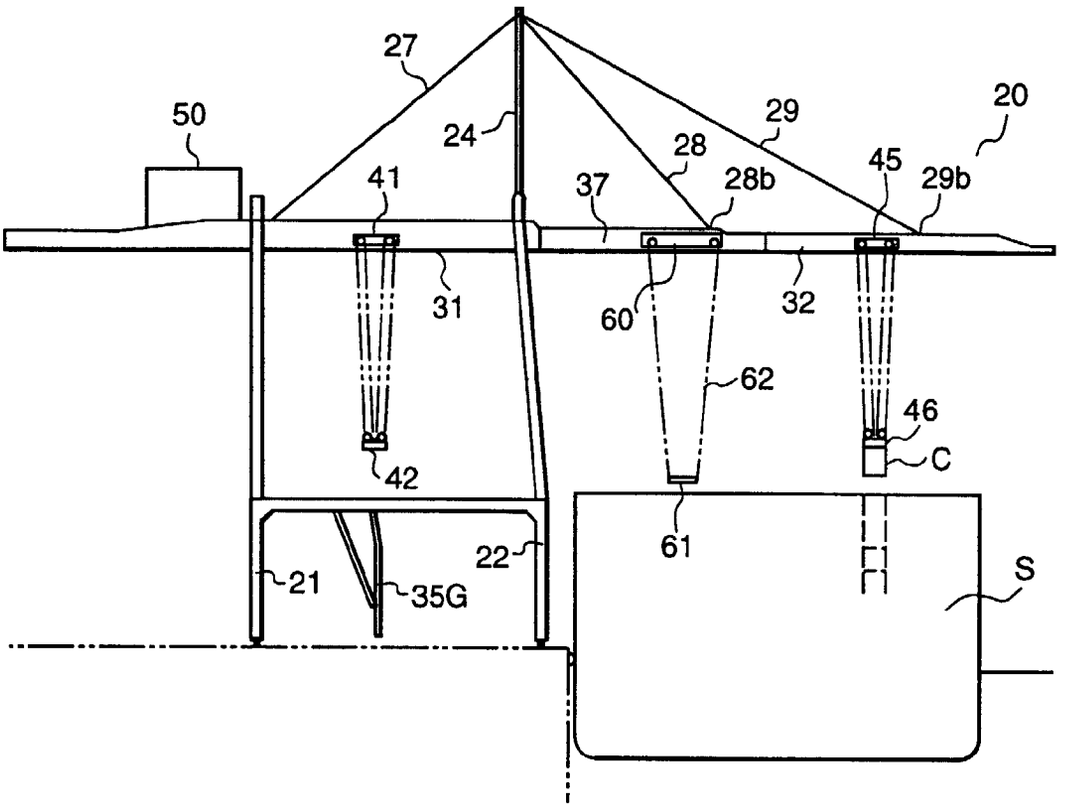
C3
22
21
35G
S

FIG.3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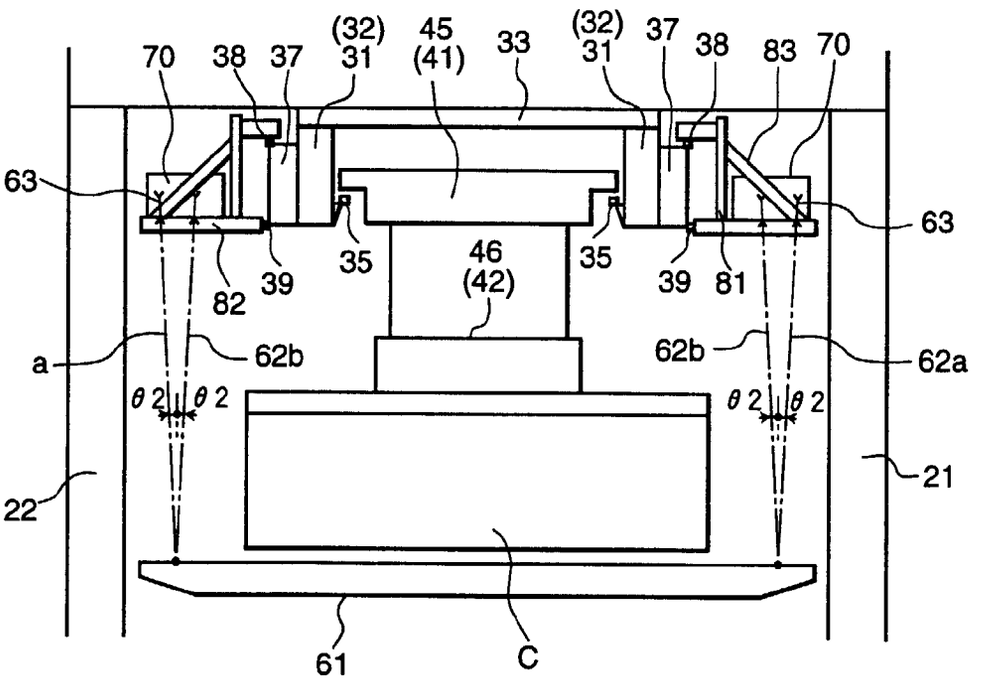
35G
S

FIG.4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(32)
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31
(41)
33
31
37
38
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70
63
63
35
46
35
39
82
39
(42)
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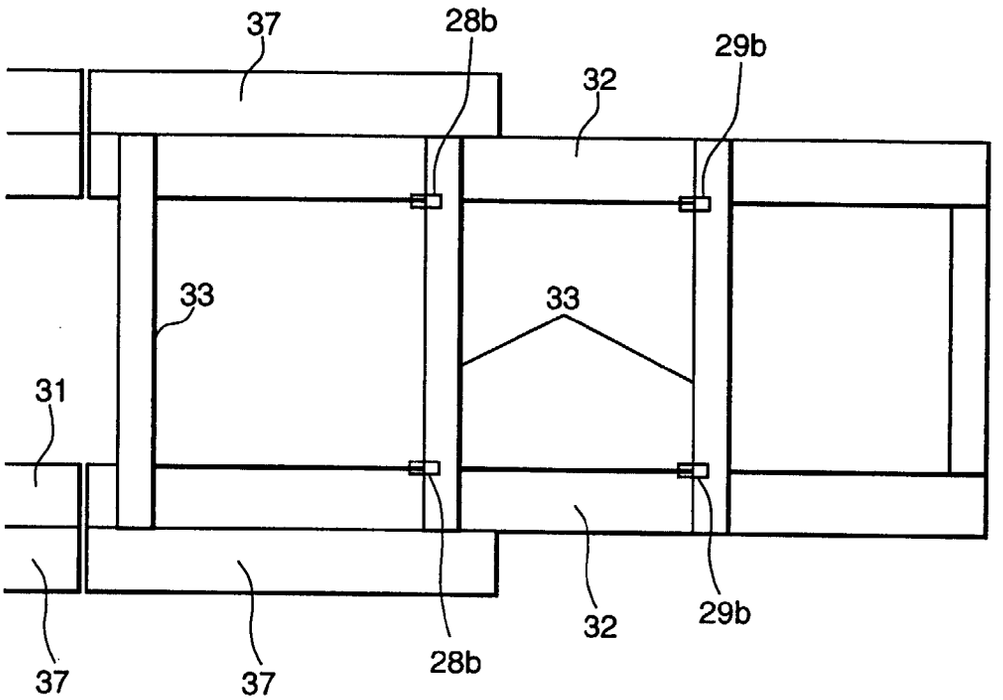
62b
62a
θ2
θ2
θ2
θ2
22
21
61
C

FIG.5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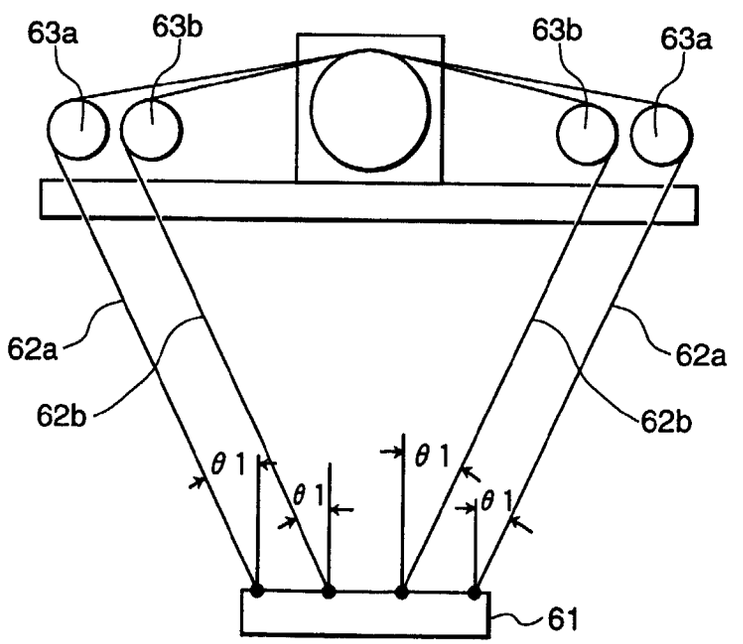
29b
32
33
33
31
37
37
28b
32
29b

FIG.6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62b
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θ1
θ1
θ1
61

FIG.7

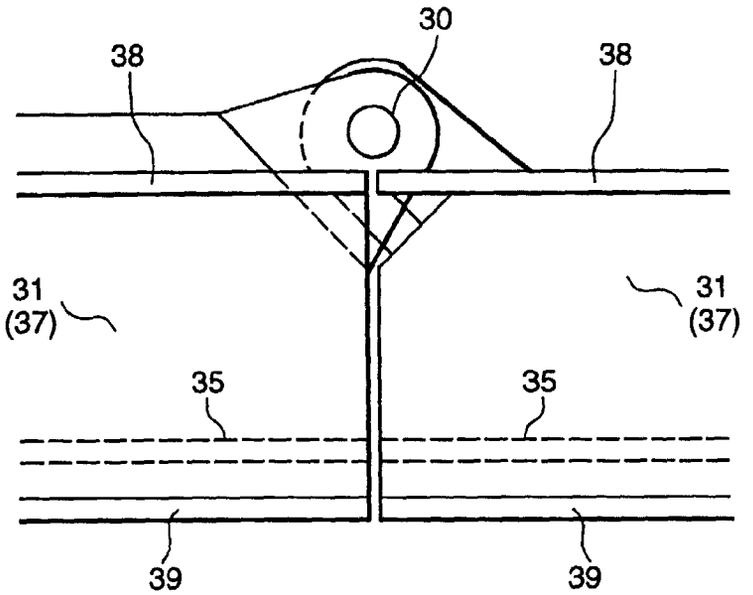

FIG.8

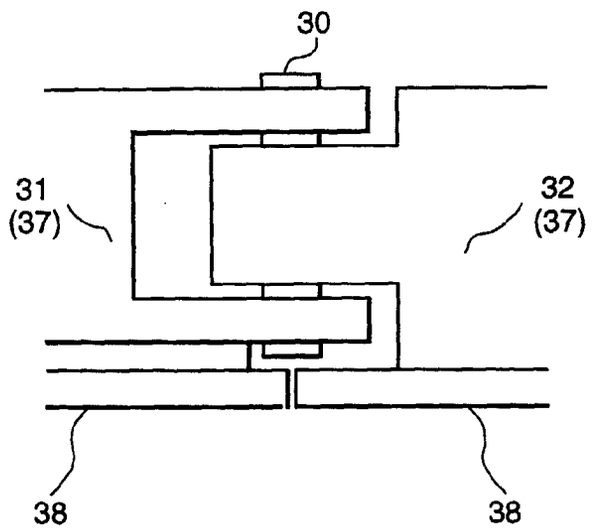

FIG.9