DEVICE FOR PREVENTING THE SWAYING OF THE SUSPENDING MEANS IN A CRANE

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1 Claim

ABSTRACT OF THE DISCLOSURE

In a crane comprising a trolley supported by and guided in its travel along the crane girder and a suspending means wound up and down by the lifting ropes from said trolley, a device for preventing the swaying of the said suspending means wherein the said ropes are reeved in such manner that in the pairs of the rope sheaves fixed to the front and back sides respectively of the said suspending means, the respective rope sheaves rotate in opposite direction when the suspending means is being wound up or down and in the same direction when swaying and by a restraining mechanism to restrain such rotation in the same direction.

DETAILED EXPLANATION OF THE INVENTION

The present invention relates to a device in a rope-trolley type crane for preventing the swaying of such suspending means as a spreader, a suspension beam, and a grab bucket, and of the loads pulled up by such means.

FIG. 1 is a front view showing an example of the conventional spreader device of the rope-trolley-type container crane, wherein 1 refers to a crane girder, 2 refers to the rail, 3 refers to a trolley which runs on the rail 2, 4 refers to a rope for the traction of the trolley, 5 a spreader installed below the trolley and 6 a container held by the spreader.

Container loading is chiefly effected by winding up and down the spreader 5 through the operation of the lifting ropes 9 which run through the four rope sheaves 8 held on the side of the spread from two pairs of the rope sheaves 7a, 7b fixed on the left and right ends of both front and rear sides of the trolley 3. The spreader 5 is wound up and down by the hoisting winch 16 which is attached on the crane girder. In addition, such container loading requires the running of the said trolley 3.

Such a conventional means as described above, however, has a disadvantage in that the suspended containers are caused to sway and that it is difficult to load down the containers precisely at a predetermined position in a hold or on a freight car or the like. Thus the above mentioned swaying causes a great difficulty in loading and unloading operation. The purpose of the present invention is to prevent the swaying of the suspending means and loads.

FIG. 2 is a perspective view showing the spreader device in an example of the present invention where the mechanical damping device is adopted. FIG. 3, a plan view of the embodiment in FIG. 2 along the line A−A, and FIG. 4 a plan view showing another embodiment of the present invention.

The spreader means adapted to the present invention is shown in FIG. 2, wherein 1 refers to the crane girder, 2 the rail, 3 the trolley, 5 the spreader, and 6 the container.

Four lifting ropes 9a, 9b, 9c and 9d are to be wound up and down by the winch (not shown in the figure) set up at one end of the running path of the trolley 3.

A pair of the lifting ropes 9a and 9b are reeved between the two pairs of rope sheaves 7a1, 7a2 and 7b1, 7b2 fixed on the right and left ends of the front side of the trolley 3 on one hand and the two rope sheaves 8a and 8b at the front corners of the spreader 5 on the other hand, and the other pair of the lifting ropes 9c and 9d are likewise reeved between the two pairs of rope sheaves 7c1, 7c2 and 7d1, 7d2 fixed on the right and left ends of the rear side of the trolley 3 on one hand and two rope sheaves 8c and 8d at the two rear corners of the spreader 5 on the other hand, so that the former pair of the lifting ropes are reeved in a manner that they cross each other on the front side and the latter pair on the rear side respectively to engage the rope sheaves fixed at the four corners of the said spreader 5. More particularly, the lifting rope 9a is reeved through the rope sheaves 7b1, 7b2, 7c2 in that order, to suspend the rope sheave 8b, and the rope 9b is reeved through the rope sheaves 7a2, 8a, 7d2 in that order, to suspend the rope sheave 8a. The rope 9c is reeved through the rope sheaves 7d1, 8d, 7c1 in that order, to suspend the rope sheave 8d, and the rope 9d is reeved through the rope sheaves 7c1, 8c, 7d1 in that order, to suspend the rope sheave 8c.

Thus the lifting ropes 9a and 9b, or 9c and 9d extend crossing each other between the trolley 3 and the spreader 5.

A pair of the said rope sheaves 8a and 8b or 8c and 8d which are facing each other are rotated in the opposite direction for winding up and down, and in the same direction in case of the swaying.

However, the ropes 9a, 9b, 9c, 9d may be reeved in a manner other than the one shown in the drawing, so long as the rope sheaves 8a, 8b, 8c, 8d are thereby caused to rotate in the direction mentioned above.

A damping device 10 is set up not only between the rope sheaves 8a and 8b but also between the rope sheaves 8c and 8d. The said damping device is intended to function only when the both rope sheaves rotate in the same direction. The purpose of this arrangement is to prevent the swaying of the container by stopping their rotation, taking advantage of the rotation in the same direction of the rope sheaves opposite to each other.

FIG. 2 and FIG. 3 show an embodiment of the mechanical method according to the present invention.

FIG. 3 shows the upper side of the spreader 5, wherein the damping device 10 comprises the horizontal shafts 12 positioned at a right angle to the shafts of the rope sheaves 8a, 8c by means of the bevel gear 11, the horizontal shafts 12' positioned at a right angle to the shafts of the sheaves 8b, 8d by means of the bevel gear 11' and the frictional coupling 13 which allow the reverse rotation of the shafts 12 and 12' under a load having a certain value or more, and connect these horizontal shafts 12 and 12'. Thus, in the coupling, the friction acting this way damps the reverse rotation of the shafts 12 and 12' caused by sideways swaying in a certain range of load, and decreases swaying of the spreader to a minimum.

Owing to this arrangement, the horizontal shafts 12 and 12' are rotated in the same direction for the lifting up and down of the spreader 5 since the facing rope sheaves are rotated in the opposite direction, and in case of swaying, the said horizontal shafts rotate in the opposite direction since the facing rope sheaves are rotated in the same direction and they mutually brake each other through the frictional coupling as a consequence.

However, since the purpose of the above mentioned damping device is to brake the rotation of the rope sheaves only when the said rope sheaves which are facing each other in the same direction, the same braking effect can also be obtained by the adoption of the oil pressure mechanism or the electric damping device.
In FIG. 4, an embodiment is shown where the oil pressure mechanism is adopted wherein, the oil pumps $15c$, $15b$, $15c$, $15d$ are connected to each of the rope sheaves $8a$, $8b$, $8c$, $8d$ through the couplings $14$ and the said pumps $15a$, $15b$ or $15c$, $15d$ are connected to each other, for the purpose of the braking effect described in the following.

Further, said pumps are connected to the tank through the oil pressure pipe system in which is located a device necessary for the oil pressure mechanism such as flow rate control valve, non-return valve, etc. Further, reduction gear, multiplying gear, etc. may be interposed between the rope sheaves and the pumps respectively.

Since the rope sheave revolves in the direction of dotted line in the figure when the trolley is running rightward or the container is being lifted up, the oil flows in the direction indicated by the arrow of the dotted line and circulates between the pumps $15a$ and $15b$ or $15c$ and $15d$ through the pipe system. Similarly, since the rope sheaves rotates in the direction opposite to that shown by the dotted line when the trolley is running leftward or the container is being pulled down, the oil flows in the direction opposite to that indicated by the dotted arrow and circulates between the pumps $15a$ and $15b$ or $15c$ and $15d$.

However, when the spreader $5$ holding containers sways leftward, both pumps $15a$ and $15b$ or $15c$ and $15d$ rotate in such a way that the oil flows in the reversed direction and stops their function and the rope sheaves $8a$, $8b$, $8c$, $8d$ are braked, for the said rope sheaves rotate in the direction indicated by the solid line. Similarly, when the spreader $5$ holding containers sways rightward, both pumps $15a$ and $15b$ or $15c$ and $15d$ rotate in such a way as the oil flows in the reversed direction and stops their function and the rope sheaves rotate in the direction opposite to that indicated by the solid line.

As has been described above, the swaying of the container can be almost prevented by the application of the present invention to the spreader means of the container crane, so that shipment, or the loading of the container into the freight can or the trailer can be easily carried out.

While the drawing shows by way of example the present invention as applied to the prevention of the swaying of the container, it is to be understood that the present invention of the device for prevention of swaying can be applied not only to spreader but also to other suspending means such as a suspension beam and a grab bucket.

What we claim is:

1. In a crane comprising a trolley supported by and guided in its travel along a crane girder, lifting ropes adapted to be wound up and down from the said trolley, and a suspending means hung from the trolley by said ropes, a device for preventing the swinging of the said suspending means characterized by the provision of sheaves on the suspending means, said ropes being arranged in pairs and reeved in such a manner that, in the pairs of the rope sheaves fixed to the front and back sides respectively of the said suspending means, the respective sheaves rotate in opposite directions when the suspending means is being wound up or down and in the same direction when swaying, and by the provision of a restraining mechanism interposed between the sheaves of each said pair adapted to restrain such rotation in the same direction and to permit free rotation thereof in said opposite directions, said restraining mechanism comprising horizontal shafts coupled at a right angle to the shafts of the rope sheaves by means of bevel gears, respectively, the shafts in each of said pairs of sheaves being directed one against the other and mutually coupled by a frictional coupling, thus permitting free rotation for opposite directions of said sheaves and braking the same when rotating in the same direction.

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