

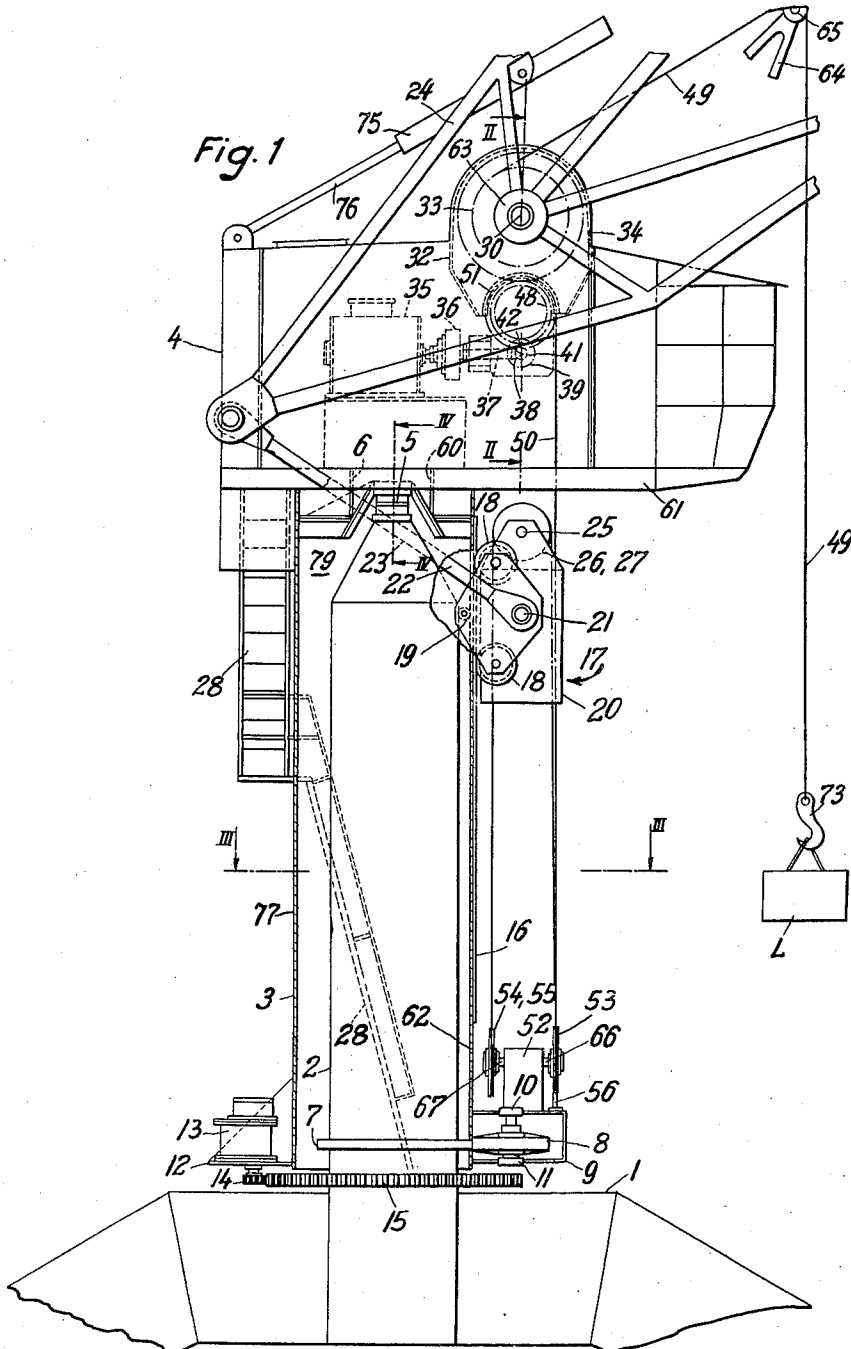
Nov. 10, 1959

H. LANGE
LUFFING CRANE

2,912,123

Filed April 6, 1956

4 Sheets-Sheet 1



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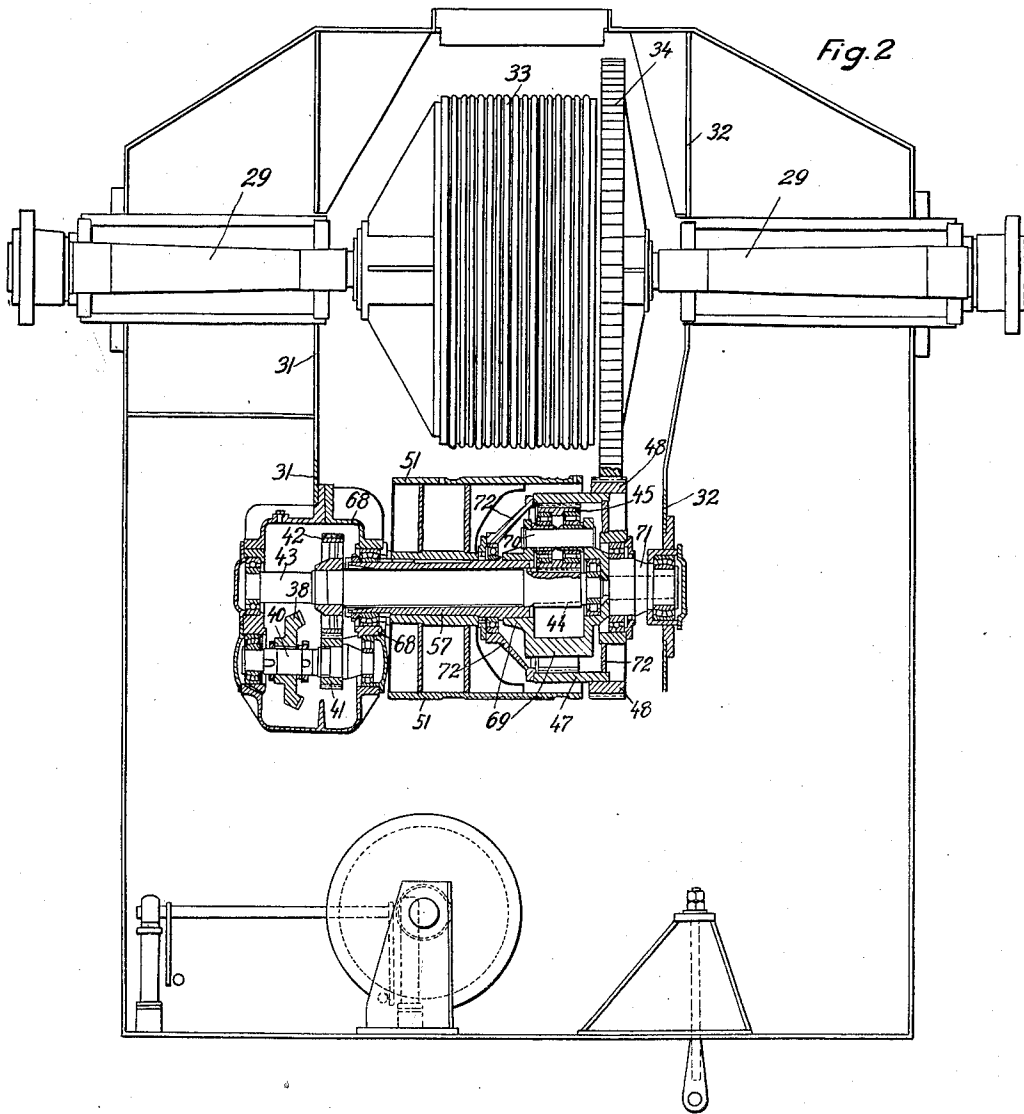
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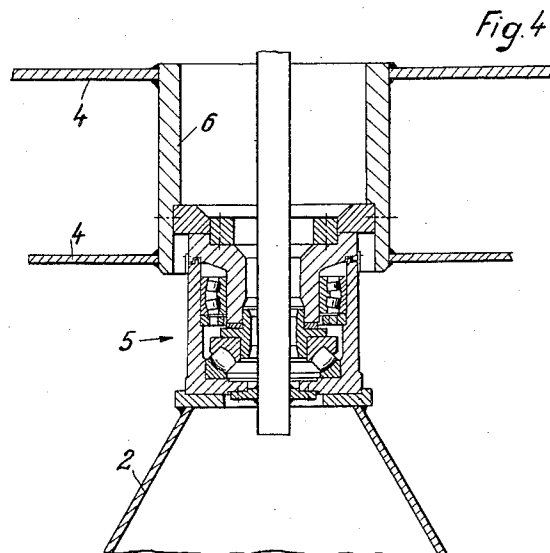
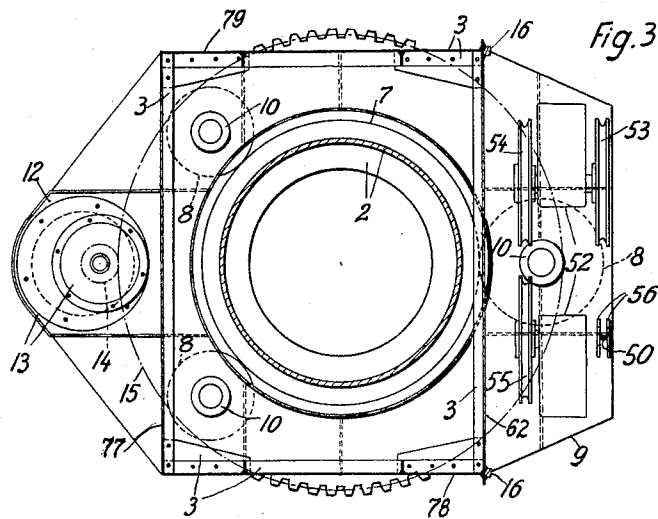
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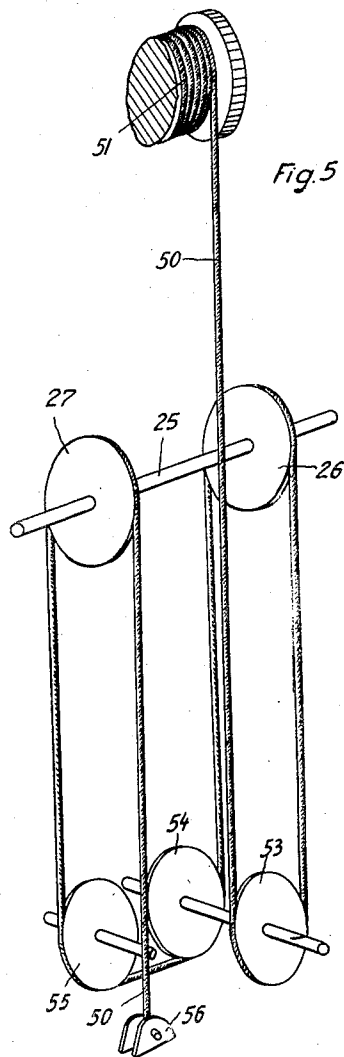


Fig. 5

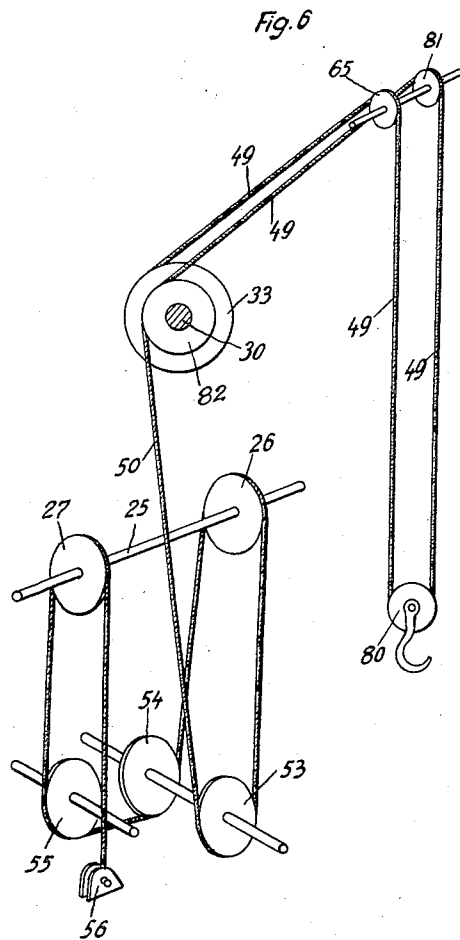


Fig. 6

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2,912,123

LUFFING CRANE

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Application April 6, 1956, Serial No. 576,625

7 Claims. (Cl. 212—58)

My invention relates to a luffing crane and, more particularly, to a crane of the type in which motion-compensating means are connected to the lifting cable and to the jib and are operable by the luffing motion of the latter to cause the cable to be pulled in or payed out in response to the luffing motion thereby causing the load to travel along a substantially horizontal path during the luffing motion.

The objects of my invention are to improve the mounting of the rotatable framework carrying the jib so as to simplify the structure and as to reduce the weight without impairing the strength thereof; to facilitate the assembly and disassembly of the aforementioned motion-compensating means and, more particularly, of a carriage forming part thereof; to facilitate the assembly and disassembly of a thrust bearing carrying the rotatable framework; to reduce the distance of the path described by the tail end of the jib from the vertical axis of rotation of the jib-supporting framework; and to simplify and reduce the number of parts of the aforementioned motion-compensating means to a minimum so as to save space in the cabin enclosing a substantial part of such compensating means.

Further objects of my invention will appear from a detailed description of a preferred embodiment of the present invention following hereinafter with reference to the drawings, it being understood that the terms and phrases used in such description have been chosen for the purpose of illustrating the invention rather than that of restricting or limiting the same, the features of novelty for which patent protection is sought being pointed out in the appended claims. In the drawings,

Fig. 1 is an elevation of the novel luffing crane embodying the present invention, part of the jib and of the base being shown broken away the housing surrounding the column being shown in section,

Fig. 2 is a more or less diagrammatical cross section taken through the cabin of the crane shown in Fig. 1 substantially along the line II—II of Fig. 1,

Fig. 3 is a horizontal section substantially taken along the line III—III of Fig. 1,

Fig. 4 is a vertical section taken along the line IV—IV of Fig. 1.

Fig. 5 is a perspective diagrammatic view of the compensating cable and of the sheaves and the cable drum associated therewith, and

Fig. 6 is a diagrammatic perspective view of a modification of reeving of the cable.

The novel luffing crane comprises a base 1 which may be a portal having legs provided with wheels running on rails in the conventional manner, a vertical column 2 of circular cross section firmly mounted in the base 1, a housing 3 carried by and surrounding the column, a framework 4 carried by the housing 3, and a jib 24 pivotally mounted on the framework 4 for luffing motion about a horizontal axis 30 located intermediate the ends of the jib. The housing 3 comprises a vertical front wall 62 and a rear wall 77, both extending from the frame-

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work 4 downwardly to a point closely above the base 1 substantially parallel to the axis 30, and parallel side walls 78 and 79, shown in section in Fig. 3, such walls being suitably re-inforced by angle bars.

Both the base 1 and the column 2 may be formed by hollow sheet metal elements. Preferably, the housing 3 has a rectangular cross section, as will appear from Fig. 3. The jib 24, the framework 4 and the housing 3 thus constitute a rotatable structure adapted to be rotated about the vertical axis of the column 2. The means for mounting the housing 3 for such rotation preferably comprises a thrust bearing 5 disposed at the top of the column 2, and a roller bearing disposed at the bottom of the housing 3. Preferably, the thrust bearing 5 is constituted by a pair of roller bearings capable of self-adjustment, same being readily accessible through an opening 60 provided in the floor 61 of a cabin constituted by the framework 4, such floor being rigidly connected with the bell 3 and disposed closely above the top of column 2. The roller bearing disposed at the bottom of housing 3 comprises three rollers 8 having trunnions rotatably mounted in bushings 10 and 11 carried by a box 9 welded to the outside of the front wall 62 of housing 3. The rollers 8 travel on a race ring 7 fixed to the column 2.

For the purpose of rotatably adjusting the jib about the axis of the column 2, a bracket 12 is welded to the rear wall of the housing 3 and carries a rotating mechanism 13 including an electric motor, a transmission and a pinion 14 driven thereby. The pinion engages a gear 15 fixed to the column 2 beneath the lower end of housing 3.

A ladder 28 is attached to the rear wall and a side wall of the housing 3 and terminates at a trap door provided in the platform 61 to afford the operator access from the portal 1 to the cabin 4.

The jib 24 mounted for pivotal luffing motion about the horizontal axis 30 is formed with a pair of spaced hub portions 63 rotatably mounted on a pair of spaced coaxial horizontal pins 29 forming part of and rigidly connected with the framework 4. The front end 64 of the jib diagrammatically indicated on a reduced scale in the upper right hand corner of Fig. 1 carries a head sheave 65. A lifting cable drum 33 is rotatably mounted on the inner ends of the pins 29 coaxially to the axis 30. The roof of the cabin has a dome portion which covers the cable drum 33. A lifting cable 49 is anchored to the lifting cable drum 33 to be wound thereon and extends therefrom through a slot of the cabin roof directly to and around the head sheave 65 to the load L to be lifted. The tail end of the jib 24 is bifurcated and straddles the framework or cabin 4. The ends of the bifurcations are connected by a pair of links 22, 23 to a carriage 17 having wheels 18 travelling on a vertical guideway 16 provided on the front wall 62 of the bell 3. As shown in Fig. 3, the guide-way 16 is formed by a pair of vertical rails disposed in the space between rearwardly projecting portions of the side walls of carriage 17, each of such portions carrying a wheel 19 travelling on the back of wall 62. In this manner, the wheels 18 are positively constrained to travel on the guideways 16 and cannot be lifted therefrom. Moreover, the carriage 17 is equipped with a counterweight 20 disposed between the side walls of the carriage and is provided with trunnions 21 on which the links 22, 23 are pivotally mounted. A bracket provided on top of weight 20 carries a horizontal shaft 25 which extends parallel to the jib axis 30 and carries a pair of pulleys 26, 27 (Fig. 5) forming part of the motion-compensating means and mounted for independent rotation.

The axis 30 and the axis of pin 21 are contained in a common vertical plane which is preferably spaced a sub-

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stantial distance from the vertical axis of column 2 in front of the latter to thereby reduce to a minimum the distance of the arcuate path described by the tail end of the jib from the axis of the column 2. This is desirable to permit the crane to be placed as close as possible to buildings that may be located rearwardly of the crane.

A bracket 52 is mounted on top of the box 9 and carries three horizontal pins extending at right angles to pin 21. One of the three pins denoted by 66 extends forwardly and carries a sheave 53. A second pin 67 extending rearwardly carries a sheave 54, and the third pin hidden from view by pin 67 carries a third sheave 55 which is hidden from view by sheave 54. A compensating cable 50 (Fig. 5) has one end anchored at 56 to the box 9 and extends from the anchoring point upwardly around the sheave 27, then downwardly around the sheave 55, then horizontally to and around the sheave 54, then upwardly to sheave 26 and around the same, then downwardly around sheave 53, and then upwardly to a drum 51 and has its other end anchored to such drum to be wound on the latter when the same rotates. The drum 51 is carried by and secured to a horizontal hollow shaft 57 (Fig. 2) disposed beneath the lifting cable drum 33 and extending parallel to the axis 30 thereof. One end of the hollow shaft 57 is journaled in a gear box 68 suspended from and fixed to a vertical plate 31 forming part of the framework 4 and carrying one of the pins 29. The other end of the hollow shaft 57 is provided with a casing 69 secured thereto for common rotation, carrying a plurality of bolts 70 and formed with a horizontal stud shaft 71 axially aligned with the hollow shaft 57. The shaft 71 is journaled in the lower end of a plate 32 which extends parallel to plate 31 and likewise forms part of the framework 4 carrying one of the pins 29. A shaft 43 is journaled within the hollow shaft 57 and has one end projecting into the hollow shaft 71 to be journaled therein, while its other end projects out of shaft 57 and carries a gear 42 meshing with a pinion 41 carried by a shaft 40 journaled in gear box 68. The shaft 40 is connected by a pair of meshing bevel gears 38 and 39 with a shaft 37 connected by a clutch 36 to an electric motor 35 mounted on a base carried by the platform 61. The lifting motor 35 is of a type equipped with an automatically controlled brake which prevents rotation of shaft 37 as long as the motor remains de-energized. Between the shafts 57 and 71 a sun gear 44 is provided on the shaft 43 and meshes with a plurality of planetary gears 45 rotatably mounted on the spacer bolts 70. The planetary gears 45 mesh with an internal gear 47 carried by a housing 72 which has hub portions rotatably mounted on shafts 57 and 71 and carries a spur gear 48 meshing with a spur gear 34 fixed to the lifting cable drum 33.

From this description it will appear that the driving couple produced by the electric motor 35 is transferred through the clutch 36, the shaft 37, the pair of bevel gears 38 and 39, the shaft 40, the pair of spur gears 41 and 42, and the shaft 43 to the sun gear 44. The couple is further transferred from the sun gear 44 via the planetary gears 45, the internal gear 47 and the meshing spur gears 48 and 34 to the drum 33 and by the latter to the lifting cable 49 which extends from the drum along a straight line to the head sheave 65 around the latter and to the load L. Therefore, the operator by controlling the electric motor 35 may lower and lift the load L. It will further appear that the frame members 31 and 32 forming part of the framework 4 carry the drum 33 and extend downwardly therefrom, and that the transmission encased in housing 68, the differential gearing encased in housing 72 and the drum 51 are suspended from the frame members 31 and 32.

A suitable luffing is provided to impart the luffing motion to the jib 24 about the axis 30. As such mechanism does not form part of the present invention and is well known in the art, it has been shown in the drawings

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diagrammatically only as comprising a cylinder 75 pivotally mounted on the jib 24 and a plunger 76 pivoted to the framework 4 and movable in the cylinder.

The operation is as follows:

When the operator wishes to move the load L in a direction away from the crane, i.e. to the right with reference to Fig. 1, he will so operate the luffing mechanism so as to rock the jib 24 about the axis 30 in clockwise direction with reference to Fig. 1. As a result, the links 22 and 23 are pulled upwardly and rearwardly causing the carriage 17 to travel upwardly on the guideway 16. As a result, the carriage 17 carries along the pulleys 26 and 27 whereby a pulling force is exerted on the compensating cable 50 causing the compensating drum 51 to be rotated in clockwise direction with reference to Fig. 1. This rotation is transferred by shaft 57 to the carrier 69, 70, 71 of the planetary gears 45, and the planetary gears impart rotation to the gear 48 and thus to the cable drum 33 in anti-clockwise direction with reference to Fig. 1. Therefore, the drum 33 winds up the lifting cable 49 to such an extent that the load L travels on a horizontal path notwithstanding the fact that the head sheave 65 is lowered during such luffing motion.

Inversely, when the operator wishes to move the load L towards the crane and causes the luffing mechanism (not shown) to swing the jib 24 anti-clockwise, the carriage 17 will be lowered paying out the compensating cable 50. The hook 73 carrying the load has such a weight as to cause the lifting cable 49 to exert on drum 33 a couple which is transferred through the gears 34, 48, 47, and 45 to the compensating drum 51, whereby the cable 50 is wound up and kept taut. As a result, the lifting cable 49 will be paid out to such an extent as to cause the load L to travel on a horizontal path notwithstanding the fact that the luffing motion will raise the head sheave 65.

The differential transmission encased by housing 72 permits the load L to be moved along an inclined path by the simultaneous operation of both the lifting motor 35 and the luffing mechanism. Both motions are added in the differential gearing and impart the appropriate motion to the winding drum 33.

From the foregoing description it appears that both the column 2 and the housing 3 are simple and effective elements of comparatively low weight which can be manufactured at low cost and permit simple assembly and disassembly of the carriage 17 as the latter is mounted in easily accessible position and sheltered from rain and snow by the cabin 4 disposed thereabove. Moreover, it will be noted that the thrust bearing 5 is readily accessible for assembly and disassembly and inspection and maintenance from the inside of the cabin. Owing to the disposition of axis 30 in spaced relationship forwardly of the axis of column 2, the rearward extension of the crane depending on the length of the bifurcated tail portion of the jib is a minimum. Another advantage of the present invention is the large distance between the thrust bearing 5 and the roller bearing composed of the rollers 8, whereby horizontal bearing forces that must be taken up by the bearings 5 and 8 are substantially reduced. Owing to the circular cross section of the column 2, the gear 15 may be accurately centered relative to the column thus ensuring an accurate mesh with the pinion 14. Owing to the suspension of the compensating drum 51, of the differential gearing in housing 72 and of the transmission in housing 68 beneath the lifting cable drum 33, the dimensions of these transmission means may be reduced to a minimum resulting in a very efficient operation and in an efficient utilization of the space available in the cabin 4.

In the embodiment described hereinabove with reference to Fig. 1, the cable 50 connecting the carriage 17 to the compensating drum 51 and the differential gearing connecting such compensating drum to the cable

drum to which the lifting cable 49 is anchored, constitute motion-transmitting means connecting the carriage 17 to the lifting cable 49 to pay out and pull in this cable in response to the luffing motion of the jib 24 thereby causing the load L to travel along a substantially horizontal path as long as the motor 35 remains deenergized.

The embodiment described, however, may be modified by mounting hook 73 on a sheave 80 (Fig. 6) and by disconnecting the end of cable 49 from the hook 73 and reeving it around such sheave and upwardly to a second head sheave 81 disposed coaxially to sheave 65 and around a pulley 82 disposed coaxially with the winding drum 33 and by fixing the end of cable 49 to the cable 50 which is disconnected from the drum 51, the latter being fixed in any suitable manner to the framework. In this event, the motion of cable 50 will be directly transferred to the one end of cable 49. In either embodiment, however, the pulleys 26, 27, 53, 54 and 55 and the cable 50 constitute a motion-transmitting means which connects the carriage 17 to the lifting cable 49 directly or indirectly.

While the invention has been described in connection with a preferred embodiment thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as fall within the scope of the invention or the limits of the appended claims.

What I claim is:

1. A luffing crane comprising a base, a column carried thereby, a housing carried by and surrounding said column and forming a guideway substantially parallel thereto, means for mounting said housing for rotation about the axis of said column, a framework carried by said column above said guideway, a jib pivotally mounted on said framework for luffing motion about a horizontal axis located intermediate the ends of said jib, the tail end of said jib being bifurcated, a carriage mounted for up-and-down travel on said guideway, a pair of links connecting said carriage to the bifurcations of the tail end of said jib, a lifting cable drum mounted for rotation on said framework coaxially to said horizontal axis, a head sheave mounted on the front end of said jib, a lifting cable connected to said lifting cable drum to be wound thereon and extending therefrom around said head sheave to the load to be lifted, motion-transmitting means connecting said carriage to said lifting cable to pay out and pull in said cable in response to the luffing motion of said jib thereby causing the load to travel along a substantially horizontal path, a lifting motor carried by said framework, and a transmission connecting said lifting motor with said drum, said framework constituting a cabin enclosing said drum, said lifting motor and said transmission and being disposed between said links and between said bifurcations of said tail end of said jib.

2. A luffing crane as claimed in claim 1 in which said means for mounting said housing comprises a thrust bearing disposed at the top of said column and a roller bearing disposed at the bottom of said housing.

3. A luffing crane as claimed in claim 1 further comprising a gear fixed on said column beneath the lower end of said housing, a pinion engaging said gear and rotatably mounted on said housing, and a motor for driving said pinion mounted on said housing.

4. A luffing crane as claimed in claim 1 in which said horizontal axis of said jib is spaced a substantial distance from the vertical axis of said column.

5. A luffing crane comprising a base, a column carried thereby, a housing carried by and surrounding said column, means for mounting said housing on said column for rotation about the axis thereof, a framework carried by and fixed to said housing, a jib mounted on said framework for luffing motion about a horizontal axis, a lifting cable drum mounted for rotation on said framework coaxially to said axis, said framework including frame members carrying said drum and extending downwardly therefrom, a head sheave mounted on the front end of said jib spaced from said axis, a lifting cable connected to said lifting cable drum to be wound thereon and extending therefrom around said head sheave to the load to be lifted, motion-compensating means which include a differential gearing suspended from said frame members and are connected to said lifting cable and to said jib and are operable by the luffing motion of the latter to cause said cable to be payed out or pulled in in response to the luffing motion of said jib thereby causing the load to travel along a substantially horizontal path during the luffing motion, a lifting motor carried by said framework, and a transmission suspended from said frame members and connecting said lifting motor with said drum.

6. A luffing crane comprising a base, a column rigidly connected therewith, a housing carried by and surrounding said column and forming a guide-way substantially parallel thereto, means for mounting said housing on said column for rotation about the axis of the latter, a framework fixed to said housing, a jib mounted on the framework for pivotal movement about a horizontal axis spaced a substantial distance from the vertical axis of said column, a carriage mounted for up-and-down travel on said guide-way, a counterweight fixed to said carriage, and means connecting said carriage with said jib to balance the latter by said counterweight in any position of said jib, the point of connection of said means with said carriage being spaced the same distance from said column as said substantial distance.

7. A luffing crane comprising a base, a column rigidly connected therewith, a housing carried by and surrounding said column and forming a guide-way substantially parallel thereto, means for mounting said housing on said column for rotation about the axis of the latter, a framework fixed to said housing, a jib mounted on said framework for pivotal motion about a horizontal axis spaced a substantial distance from the vertical axis of said column, a lifting cable carried and guided by said jib, a lifting cable drum connected with said lifting cable for winding up and paying out said cable, a carriage mounted for up-and-down travel on said guide-way, means connecting said jib with said carriage to move the latter in response to said pivotal motion, and motion-transmitting means connecting said carriage to said lifting cable to pay out and pull in said cable in response to said pivotal motion, thereby causing the load to travel along a substantially horizontal path, the point of connection of said means with said carriage being spaced the same distance from said column as said substantial distance.

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