April 19, 1960 R. P. FOX 2,933,197

CARGO CRANES

Filed May 10, 1956 3 Sheets-Sheet 1

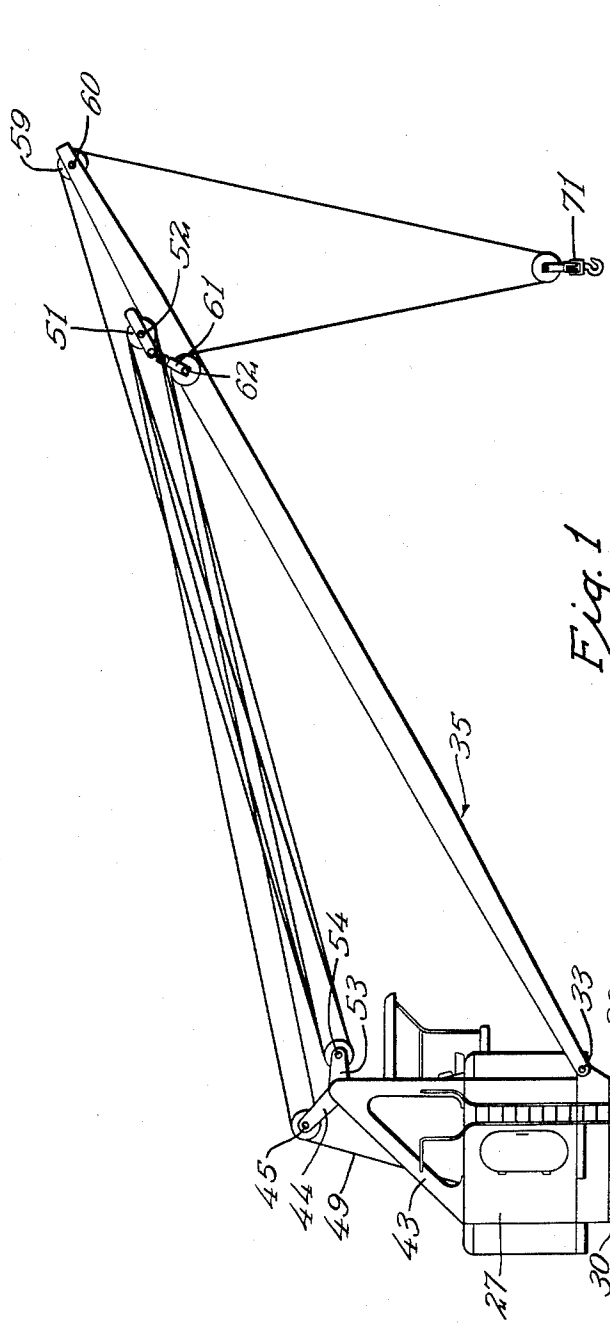


Fig. 1

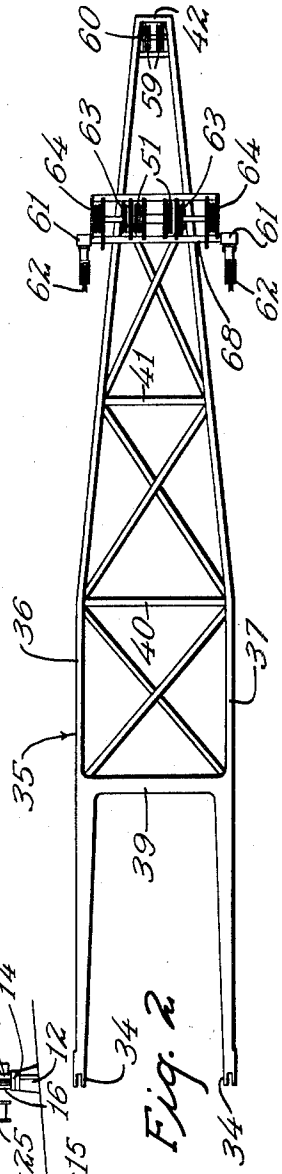


Fig. 2

INVENTOR
Robert P. Fox
BY Robert M. Dunning
ATTORNEY

April 19, 1960 R. P. FOX 2,933,197

CARGO CRANES

Filed May 10, 1956 3 Sheets-Sheet 2

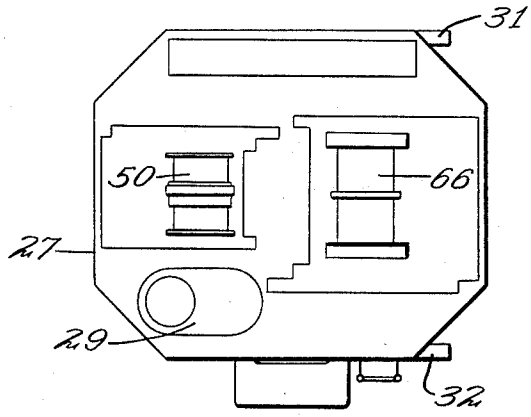


Fig. 3

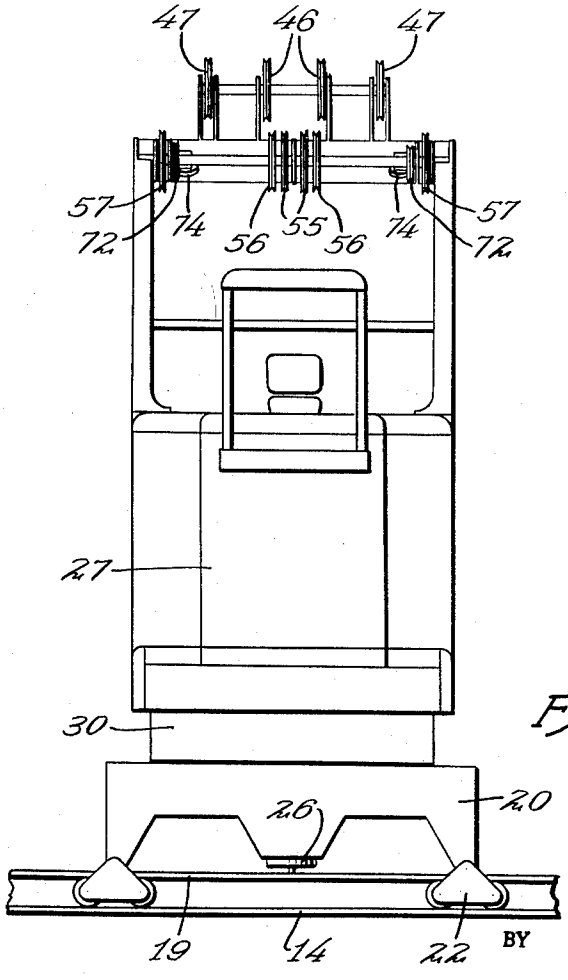


Fig. 4

INVENTOR
Robert P. Fox
Robert M. Dunning
BY
ATTORNEY

April 19, 1960 R. P. FOX 2,933,197

CARGO CRANES

Filed May 10, 1956 3 Sheets-Sheet 3

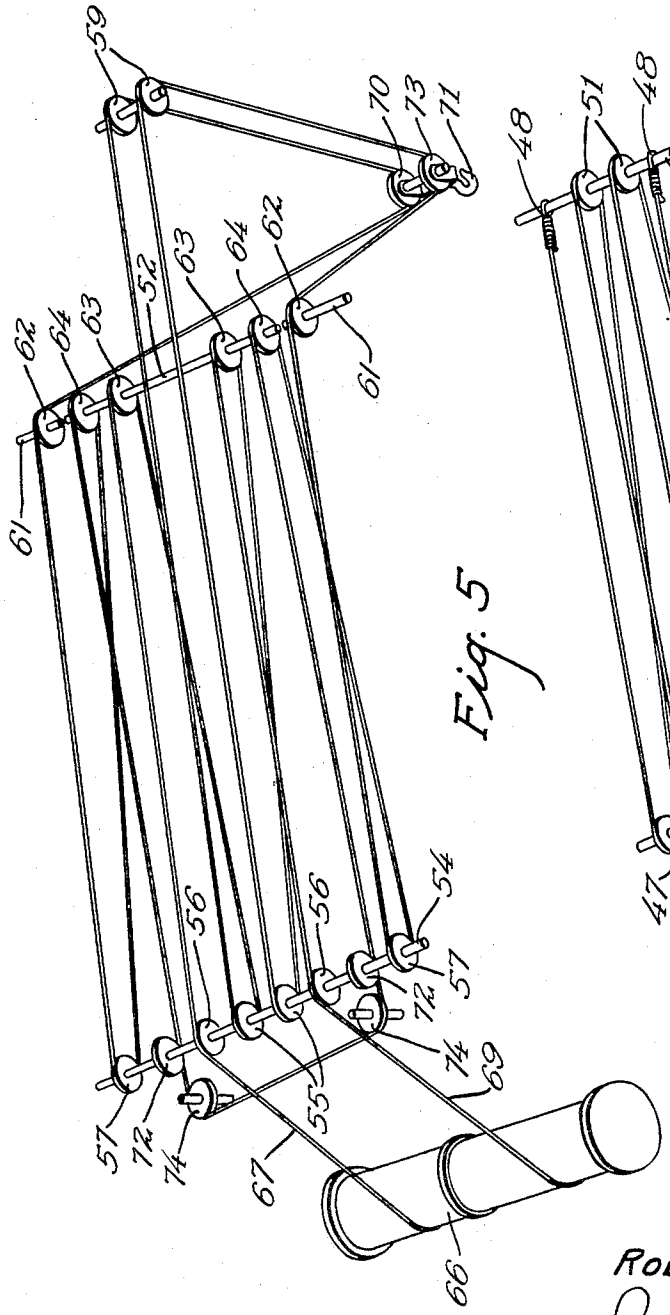


Fig. 5

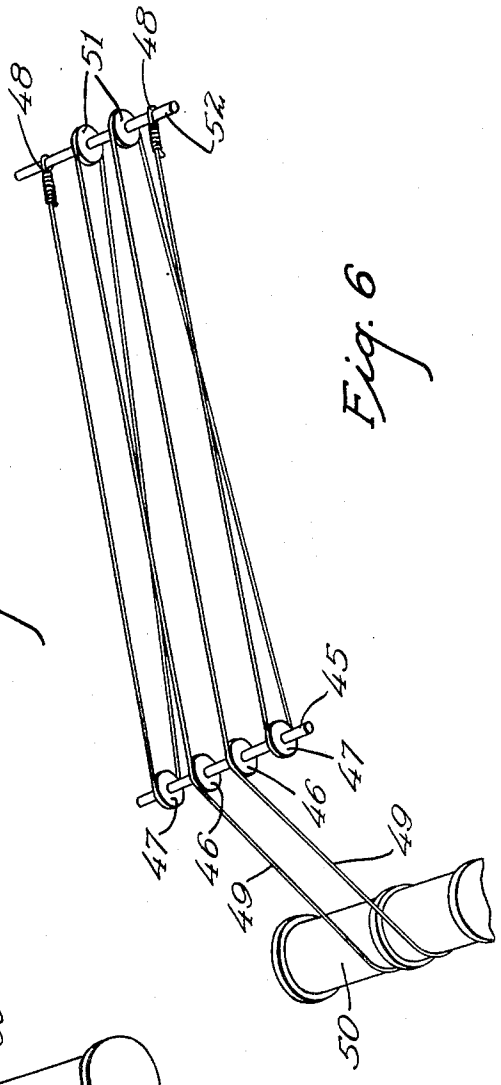


Fig. 6

INVENTOR

Robert P. Fox

BY Robert M. Dunning

ATTORNEY

United States Patent Office 2,933,197 Patented Apr. 19, 1960

2,933,197

CARGO CRANES

Robert P. Fox, Duluth, Minn., assignor to Clyde Iron Works, Inc., Duluth, Minn., a corporation of Minnesota

Application May 10, 1956, Serial No. 584,085

6 Claims. (Cl. 212—58)

This invention relates to an improvement in ship mounted level luffing cranes used in general cargo service. The purpose of this invention is to provide pendulum dampening for the load both radially and tangentially as related to the rotating center of the crane. Generally, pendulum action is caused by acceleration and deceleration of the crane swing, boom luffing, and ship's roll.

A feature of the present invention is to support the load in the bight of two cables that radiate from the load to the boom to form, in effect, an inverted tripod. The widely separated three points of suspension at the boom produce a pendulum dampening or stabilizing effect on the suspended load to resist horizontal motion in any direction.

A second feature of the present invention is made possible by the forward, double cable leg of the inverted tripod heretofore described. The forward cables, at close proximity, permit the use of a more conventional boom that tapers from a wide hinge to a narrow tip. This may be contrasted to other forms of load dampening devices that require heavy, wire ended booms for dampening in the radial direction only, as related to the rotating center of the crane.

A third feature of the present invention relates to the manner in which the load supporting cables are ultimately arranged to provide level luffing, and equalized to avoid slack lines or unevenly loaded lines. This feature virtually eliminates torsional effect in the boom, thereby permitting lightweight boom design and eliminating cable fouling.

An added feature of the present invention lies in the provision of a load suspension of an inverted tripod type in which the load supporting cables pass through sheaves on the load block. This arrangement permits the equalization of the load upon the lines in a novel and effective manner.

These and other objects and novel features of my invention will be more clearly and fully set forth in the following specification and claims.

In the drawings forming a part of the specification:

Figure 1 is a side elevational view of a cargo crane showing the general arrangement of parts therein;

Figure 2 is a top plan view of the crane boom showing the arrangement of sheaves thereupon;

Figure 3 is a diagrammatic view showing the location of the hoisting, luffing, and swinging devices in the crane cab;

Figure 4 is a front elevational view of the cab showing the arrangement of sheaves thereon; and

Figure 5 is a diagrammatic view of the load hoist lines showing the arrangement thereof;

Figure 6 is a diagrammatic view of the boom topping cable reeving.

The crane A is of the type used on ships and is designed for movement upon tracks supported on the deck of the ship. As an example, Figure 1 indicates the ship deck 10 having vertical supports 11 and 12 thereupon which support tracks 13 and 14 on which the crane is

mounted. Vertical spacers 15 and 16 are provided extending upwardly from the tracks 13 and 14 and support upper tracks 17 and 19, respectively. In other words, the tracks are channel-shaped in form including upper and lower rails between which the supporting wheels of the crane may run.

The crane A includes a base frame 20 having downwardly extending wheel supports 21 and 22 which serve as support and bearing for the wheels 23 and 24, respectively. The body of the crane normally rests upon these wheels 23 and 24 but the upper tracks 17 and 19 prevent the overturning of the crane during its operation. Spur gears 25 engage racks on the sides of the upper tracks 17 to drive the crane along the tracks. Spur gears 25 are driven by suitable motors such as 26 which may be operated in either direction to move the crane. The crane base 20 includes a suitable circular track which supports the crane cab 27. This arrangement is conventional. The means for rotating the cab 27 about a vertical axis on the base 20 is not illustrated in detail as such structure is also conventional. The means for rotating the crane about its vertical axis is not illustrated in detail but the apparatus may be described generally as including a swinger 29 shown in Figure 3 which rotates the cab about the vertical axis on tracks and wheels enclosed within the portion 30 of the apparatus as indicated in Figure 1.

As indicated in Figure 3, the cab 27 is provided with boom anchor members 31 and 32 which, as indicated in Figure 1, have axially aligned pivots 33 extending therethrough. These pivots 33 extend through the boom anchors 31 and 32 and through the bifurcated ends 34 of the boom 35. These pivots 33 are arranged on a generally horizontal plane and permit the raising and lowering of the boom 35. The boom itself is relatively wide at its base including spaced boom sides 36 and 37 connected at intervals with cross connections such as 39, 40 and 41. The boom gradually tapers in width and is relatively narrow at the cross section 42 at the boom point. Cross bracing is employed to strengthen the boom as is conventional in structures of this type.

As indicated diagrammatically in Figure 1, a frame 43 extends upwardly from the cab 27 and acts as a support for transverse shafts which guide the various operating lines. A bracket 44 on the frame 43 supports a transverse shaft 45 upon which is mounted two pairs of sheaves 46 and 47. The boom topping or peaking lines 49 are shown in Figure 6 to extend from the boom hoist drum 50 over one pair of sheaves 46 to a pair of sheaves 51 mounted on the boom 35 near the point thereof. The lines 49 then return over the second pair of sheaves 47 on the shaft 45 and are dead ended to the boom at 48. In other words, parallel boom topping lines extend from sheaves on the shaft 45 to sheaves 51 on a shaft 52 near the point of the boom to produce the desired boom lifting action. The topping lines and sheaves are omitted in Figure 5 to simplify the illustration.

The frame 43 (Figure 1), also supports another bracket 53 which supports a transverse shaft 54. As shown in Figure 5, the shaft 54 supports three pairs of sheaves which are indicated by the numerals 55, 56 and 57. A pair of sheaves 59 are mounted upon a transverse shaft 60 at the boom point, the sheaves 59 being in side by side relation. A pair of pulley blocks 61 are mounted upon transverse frame 68 at a point substantially spaced from the boom point. These blocks 61 include pulley sheaves 62. The transverse frame 68 also supports the transverse shaft 52 which supports the sheaves 51 as well as two additional pairs of sheaves 63 and 64. The purpose of this arrangement will be further described.

With reference now to Figures 3 and 5 of the drawings,

it will be noted that a load hoisting drum **66** is provided which is shown only diagrammatically in Figure 5 but which simultaneously exerts a pull on two load lines **67** and **69**. Tracing the load line **67**, it will be noted that from the drum **66**, the line passes over a sheave **56** on the shaft **54** and extends to a sheave **63** on the shaft **52**. From the sheave **63** the line extends over a sheave **55** and from there over a sheave **59** at the boom point. The line then extends downwardly over a sheave **70** forming a part of the load block **71**. The line then diverges upwardly and outwardly to extend over the sheave **62** forming a part of the pulley block **61**. The line **67** then successively passes about the sheave **57**, sheave **64** and under sheave **72**. The line then passes about sheave 74 and becomes a part of the second load line.

The second load line operates in a similar manner. The line **69** extends from the drum **66** over a sheave **56** to a sheave **63** on the shaft **52**. It then extends over the second sheave **55** on the frame of the apparatus and extends to the second sheave **59** at the boom point. The line then extends parallel to the line **67** to pass over a second sheave **73** forming a part of the load block **71**. It then diverges upwardly and outwardly over the sheave **62** and successively passes over the second sheave **57**, the second sheave **64** and beneath the sheave **72**. The line then passes about a sheave **74** and becomes a part of the first described load line **67**. In other words, the lines **67** and **69** are in effect integral, so that the pull on the two lines is equalized.

The shaft **54** is properly located to produce a substantially level luffing action on the load as the boom is raised or lowered. In other words, as the load is raised, the distance between the shafts **54** and **52** decreases in amount sufficient to hold the load at a substantially constant level. If the boom is lower, the reverse action takes place and the portion of the load line supported between the shafts **52** and **54** increases sufficiently to hold the load at an approximately even level. Therefore, the crane possesses level luffing features which have been considered highly desirable from an operation standpoint.

It will be seen that the load block **71** is supported by four portions of the load line. Two of these portions extend in substantially parallel relation from the sheaves **59** at the boom point to suitable sheaves **70** and **73** on the load block. From the load block the load lines diverge upwardly and outwardly over the widely spaced sheaves **62**. As a result the load will be suspended by a three point suspension. Because of this fact rotation of the boom about its vertical axis will not create the same pendulum effect as if the sheaves **62** were the same distance apart as the sheaves **59**. At the same time the load is suspended between points substantially spaced longitudinally of the boom. As a result the effect of centrifugal force is greatly dampened. In other words, the outward pendulum effect of the load due to centrifugal force is dampened as well as the lateral pendulum effect.

It will be seen that with this arrangement the boom may be of a generally conventional type which is wide at its hinged end and tapers to a narrow width at the point. By employing a transversely extending frame at a point spaced from the boom point, the proper lateral positioning of the sheaves to produce the pendulum dampening effect is provided. Not only will the lateral swinging of the load be dampened but also the outward swinging of the load is substantially dampened.

In accordance with the patent statutes, I have described the principles of construction and operation of my cargo crane, and while I have endeavored to set forth the best embodiment thereof, I desire to have it understood that changes may be made within the scope of the following

claims without departing from the spirit of my invention.

I claim:

1. A cargo crane including a crane body, means rotatably supporting said body, a boom hingedly secured on a horizontal pivot to said body, the pivotal end of said boom being relatively wide, a pair of closely spaced sheaves supported centrally with respect to the longitudinal axis of the boom adjacent the boom point, a load block, a pair of sheaves supported by said load block and spaced apart a distance substantially equal to the spacing of said sheaves at the boom point, a pair of widely spaced sheaves supported by said boom at a point substantially spaced from the point of the boom, and hoist lines extending over said closely spaced sheaves at the boom point, extending in parallel relation to said load block, extending about the sheaves of said load block, and over said widely spaced sheaves on said boom, said load lines being connected to equalize the load thereupon.

2. The structure described in claim 1 and in which a three part line between said boom and said point above said crane body is interposed between said widely spaced sheaves and said dead ends of said lines.

3. A substantially level luffing cargo crane including a crane body having a super structure thereupon, means rotatably supporting said body, a boom having a relatively wide end, means pivotally connecting said relatively wide end to said crane body on a substantially horizontal pivot, a pair of closely spaced sheaves at said boom point, a pair of similarly spaced sheaves, a load block connected to said similarly spaced sheaves, a pair of widely spaced sheaves on said boom at points substantially spaced from the boom point, a series of sheaves on said boom at a point spaced from the boom point, and a series of spaced sheaves on said super structure, a pair of load lines extending from said crane body over sheaves on said super structure and cooperable sheaves on said boom to provide three part lines therebetween, one part of one three part line extending over said sheaves at said boom point and about said sheaves connected to said pulley block, said load lines extending over said widely spaced sheaves on said boom and over cooperable sheaves on said super structure and on said boom to form three part lines, the final line of each three part line being connected at said super structure.

4. The construction described in claim 3 and in which the spacing between said sheaves on said super structure and on said boom are properly located so that elevation or lowering of said boom will hold said load block at a substantially horizontal level.

5. The structure described in claim 4 and in which said boom tapers from said relatively wide hinged end to a relatively narrow extremity.

6. The construction described in claim 4 and including a transverse frame secured to said boom to extend laterally thereof, and means on said frame supporting said widely spaced sheaves.

References Cited in the file of this patent

UNITED STATES PATENTS

899,005	Brown	Sept. 15, 1908
1,111,102	Sawyer	Sept. 22, 1914
2,014,544	Wilsing	Sept. 17, 1935
2,627,984	Senn et al.	Feb. 10, 1953
2,709,526	Hansen	May 31, 1955
2,805,781	Senn	Sept. 10, 1957
2,807,374	McLean	Sept. 24, 1957

FOREIGN PATENTS

992,069	France	June 27, 1951