Sept. 24, 1957 L. O. McLEAN 2,807,374

MULTIPLE REEVED LEVEL LUFFING SINGLE HOIST LINE FOR CRANES AND DERRICKS

Filed Sept. 22, 1953

2 Sheets-Sheet 1

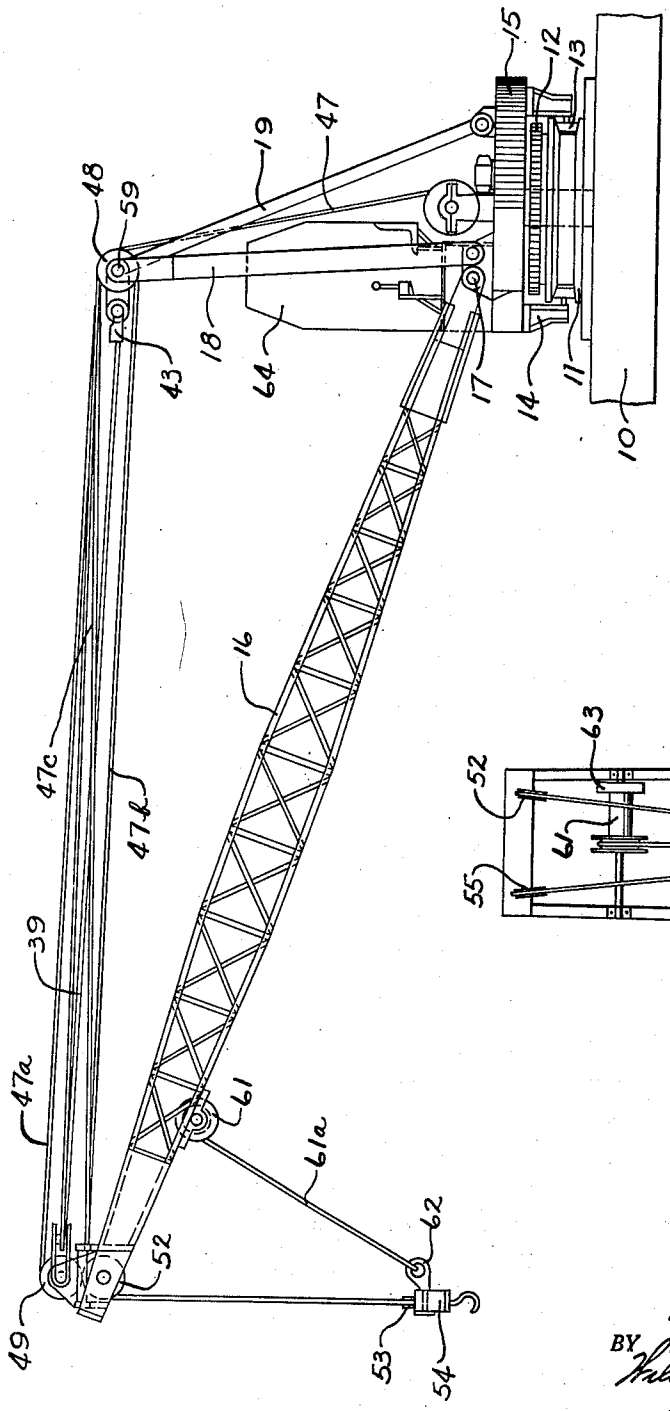


Fig. 1

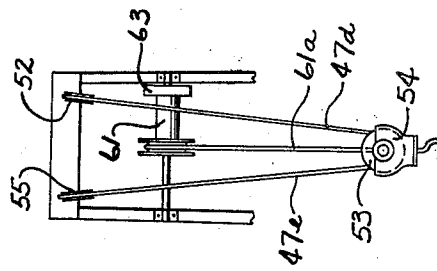


Fig. 4

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2 Sheets-Sheet 2

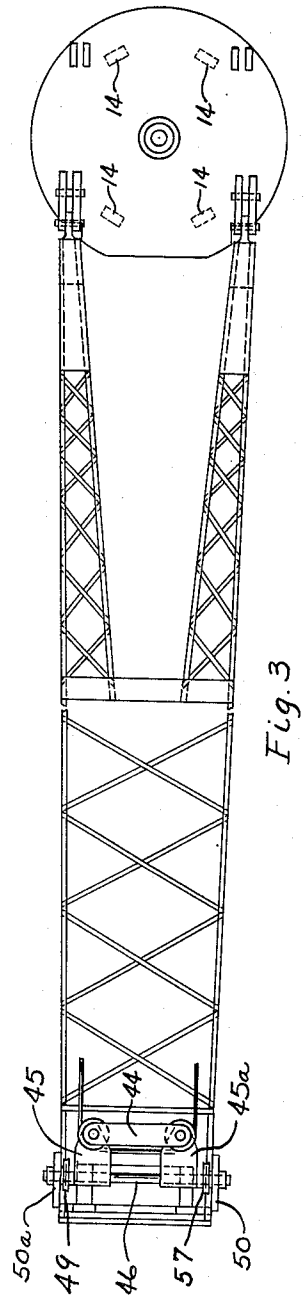


Fig. 3

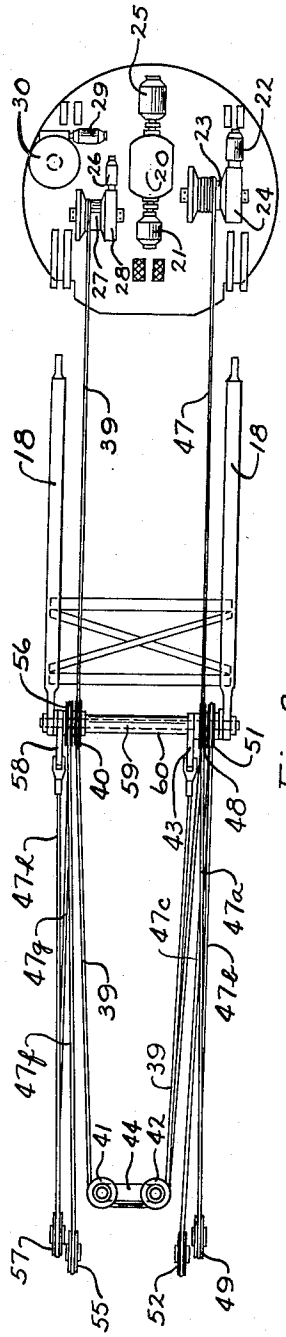


Fig. 2

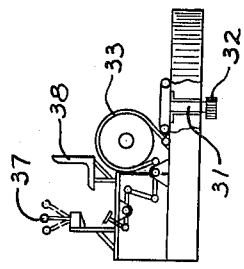


Fig. 6

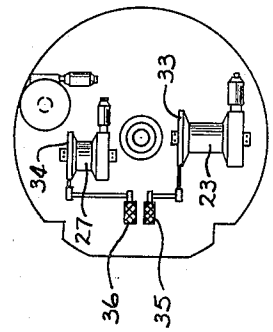


Fig. 5

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MULTIPLE REEVED LEVEL LUFFING SINGLE HOIST LINE FOR CRANES AND DERRICKS

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Application September 22, 1953, Serial No. 381,550

3 Claims. (Cl. 212—58)

This invention relates to a crane construction of a type which is particularly adaptable to handling cargo to or from ships, and which may therefore be termed a cargo crane.

While this crane may be mobile permitting it to be moved fore and aft or thwartship, as may be desired to reach particular handling operations, this invention is illustrated mounted in a fixed position upon the deck of a ship. Also cranes of this invention may be mounted upon mobile carriers or in a fixed position for material handling on wharves, docks or other land installations.

Most prior art cranes or derricks have employed a single hoist line leading over a boom point sheave, thence downwardly to load attaching means, which, when the boom is swung, results in a pendulum action of the suspended load known in the art as slewing. Slewing of the load is caused by sudden starting or stopping of the swinging boom. When the boom is raised or lowered, the load swings toward and away from the boom which is referred to in the art as luffing. Both of these pendulum actions are very objectionable.

To minimize pendulum action, cranes of the prior art have utilized independently controlled and spaced actuating load lines, converging from opposed directions and independently attached to the load. These lines are either spaced laterally above the converged ends in a single boom or run from two laterally spaced booms. An independently controlled winch is employed for each load line and the load on the independently controlled load lines is balanced by manual control. When the brakes are applied to the two load line winches to prevent any vertical movement of the load, pendulum action is actually induced by the listing of the ship and the load is shifted from one line to the other of the laterally spaced suspension points in the single boom point causing torsion in the boom which is objectionable. Pendulum action may be induced while the boom is not swinging by varying the brake application to the two winches that actuate the two load lines. This type of crane requires two hoist winches, two boom hoist winches, and four independent brake bands on the winches.

To overcome objectionable features of such cranes, it has been discovered that it is only necessary to utilize a single load hoist line actuated by a single winch with an enclosed or non-corroding holding brake to prevent corrosion from salt air and water. The single load hoist line extends from the drum to the gantry and then is reeved over sheaves in three parts between the top of a gantry mounted vertically above the boom foot hinge pin, and one side of the laterally spaced apart suspension points at one corner of the wide boom point, thence downwardly under a sheave in the hookblock, continuing upwardly over sheaves on the opposite side of the boom point corner, thence it is reeved in three parts to the gantry and is attached to a dead end at the top of the gantry. The load hoist line pulleys are positioned on the gantry and the boom at distances of a ratio of two feet up the gantry for each seven feet along the boom length. A gantry

having sheaves mounted twelve feet in height requires a boom having the load hoist sleeves forty-two feet from the boom hinge to accomplish level luffing. When the hoist winch is held inactive and the boom raised or lowered, the load will travel in or out but will be maintained in a horizontal plane. This reeving of a single hoist line prevents a pendulum action of the load in a plane at a right angle to the boom when slewing. A pendulum action in and out when the boom is raised or lowered is reduced but can be prevented by a tagline mounted intermediate of the ends of the boom.

A further object of this invention is to provide a single winch with noncorrosive metal holding brake, to actuate a single boom hoist line reeved in two parts, to raise or lower only the weight of the boom regardless of the weight of the payload, as the entire weight of the payload is in compression within the boom.

Another object of this invention is to simplify the construction to the extent that the hoist machinery can be mounted within a ten foot circle upon a single deck, making it safer and less expensive to construct and maintain on account of its simplicity and the fact that at all times under all conditions the weight of the payload is equally divided upon each part of the two parts of the single hoist line suspending the load from the two opposite spaced apart boom point corners, preventing torsion of the boom.

Another object is the provision of new and useful improvements in material handling cranes whereby level luffing can be accomplished by utilizing a two part line instead of a single line or two single lines which is equal to a single line in force applied to lifting the load, thus enabling this invention to lift twice as much per available horsepower as prior art cranes which utilize a single load line or the equivalent of a single line.

Other objects and advantages appear hereinafter in the following description and claims:

Accompanying drawings show for the purpose of exemplification, without limiting the invention or claims thereto, certain practical embodiments illustrating the principles of the invention wherein:

Fig. 1 is a view in side elevation illustrating the structure of the crane.

Fig. 2 is a top disjointed plan view of the hoist winches and the reeving of the load hoist and boom hoist lines.

Fig. 3 is a top plan view of the boom.

Fig. 4 is a front view of the reeving of the load hoist line to the hookblock and spring tension tagline unit.

Fig. 5 is a top plan view of the winch brake mechanism.

Fig. 6 is a side view of the operator's station for operating the two winches, the slewing action and the winch brakes connecting means.

Referring to Fig. 1 of the drawings, the supporting means **10** for the hoist is illustrated as a rigid portion of the ship's structure. Various other types of supporting means may be employed, but generally it is desirable to mount a cargo crane upon the deck of the ship or above the level of the load to be handled by cranes embodying this invention. **11** is underframe attached to the deck of the ship and carries the circle gear **12**. A series of four rollers **13** is rotatably mounted on the hook roller brackets **14**.

The deck **15** is rotatably carried by the hook rollers **13** of the crane. The deck carries the motor, machinery, boom, gantry, controls and operator's station. The boom indicated at **16** is a box boom pivoted at **17** to the deck **15** and the gantry **18** is two-sevenths of the length of the boom and has the back legs **19**. A motor **20** is energized by a generator mounted within the structure of the ship through suitable wiring and collector rings. The electric motor drives the hydraulic pumps **21** and **25** which energize the hydraulic motors **22** and **26** through suitable

piping and a control valve at the operator's station, which in turn operates the load hoist winch **23** and the boom hoist winch **27** through the worm and wheels **24** and **28** respectively.

The hydraulic pumps also supply power through suitable piping and control valves at the operator's station to energize the hydraulic motor **29** to drive the swinging or slewing action through the worm and worm wheel **30** to which, as illustrated in Fig. 6, is fixed a vertical swing shaft **31** and pinion **32** and which meshes with circle gear **12**.

As shown in Fig. 6 the brake band **33** is made of non-corrosive metal as it is only a holding brake to prevent the load line from creeping due to leakage in the hydraulic motor after the motor has been stopped to stop the rotation of the winch **23** upon which the brake is applied. A similar boom hoist winch brake **34** is mounted on the boom hoist winch **27**. These brakes are not used to lower the load or the boom as they are lowered by reversing the hydraulic motors through use of the control valves at the operator's station.

The load hoist holding brake band **33** is applied by foot pedal **35** through conventional linkage and the boom hoist holding brake **34** is applied by pedal **36** through conventional linkage.

As shown in Fig. 6 a nest of hydraulic control valves with corresponding levers is indicated at **37** and the operator's seat is shown at **38**.

The boom hoist winch **27** has spooled about it one end of the boom hoist line **39** as shown in Fig. 2. The boom hoist line **39** extends from the winch **27** up over the right hand or far gantry sheave **40**, thence forwardly around the two boom point suspension sheaves **41** and **42** back to dead end **43** at the opposite or left side at the top of the gantry. **44** indicates a spreader bar to properly space the sheaves **41** and **42** on their respective supporting brackets **45** and **45***a* which oscillate about the boom point shaft **46** shown in Fig. 3.

The load hoist line **47** leads from its spooling upon the winch **23**, being the left hand, up over the left gantry sheave **48**, thence forward as pass **47***a* and anticlockwise around the left hand or near boom point sheave **49**, thence rearwardly as shown in Fig. 2 as pass **47***b* to sheave **51** clockwise around this sheave and forwardly as pass **47***c* and anticlockwise over the left hand fair-lead **52** suspended in the boom point and down pass **47***d* and under hookblock sheave **53** journaled upon the axis in the hookblock **54**, thence upwardly as pass **47***e* clockwise over the right hand or far fair-lead **55**, thence rearwardly on pass **47***f* and anticlockwise around gantry sheave **56**, forwardly as pass **47***g* and anticlockwise around the right hand or far boom point sheave **57**, rearwardly as pass **47***h* to dead end **58** supported on shaft **59** at the top of gantry. **60** indicates a sleeve to stiffen shaft **59** and maintain proper spacing of gantry sheaves. The sheaves **49** and **57** are journaled on horizontal axis **46** between the brackets **50** and **50***a* mounted on the boom point.

As shown in Figs. 1 and 4, **61** indicates a conventional spring tension tagline mechanism with one end of a line **61***a* spooled about its drum and the other end attached to the eye **62** on the hookblock **54**. The purpose is to prevent twisting of the hookblock and to prevent pendulum action in and out of the load when boom is raised or lowered. A non-corroding holding brake **63** controls the tagline drum in a conventional manner from the operator's station.

64 indicates a cab enclosing the operator's station and operating controls as shown in Fig. 1.

The sheave shaft **59** on the gantry **18** is mounted just above the boom pivot **17**. As previously stated, the distance between the sheave shaft **59** and the boom pivot **17** is in the ratio of two-sevenths of the distance between the boom pivot **17** and the shaft **46** carrying the load, and the hoist line sheaves at the boom point. The purpose of this invention is to properly proportion these dimensions so that a suspended load will stay at the same elevation when the boom is raised and lowered. The load hoist line will work through the sheaves as the boom goes up or down but the length is not changed and the load stays in the same horizontal plane. The boom point approaches the suspended load when it moves out and moves away from the load as it raises to move the load in.

While for clarity of explanation certain embodiments of this invention have been shown and described, it is to be understood that this invention is capable of many modifications and changes in the construction and arrangement of parts and certain parts may be employed without the conjoint use of other parts without departing from the spirit and scope of this invention.

I claim:

1. A rotatably mounted crane comprising a foundation, a deck, a gantry mounted on the deck, a boom pivotally mounted on the deck, two pairs of sheaves laterally spaced apart journaled on a horizontal axis mounted in the top of the gantry directly above the boom pivotal connection to the deck at a distance equal to two-sevenths of the distance between the boom pivotal connection to the deck and the boom point mounted axis upon which two spaced apart sheaves are journaled, two spaced apart fair-leads suspended in the boom point, their axis being the same distance from the boom foot pivoted connection as the said axis of the boom point sheaves, two spaced apart sheaves journaled in a bridle pivotally attached to the boom point, two single winches, a hoist line having one end wound around one of said winches and having its intermediate portion reeved in three parts between one pair of the spaced apart pairs of gantry sheaves, and one of the spaced apart boom point sheaves and fair-lead, in two parts between the boom point fair-leads and the sheave of the load engaging means, and in three parts between the opposite boom point fair-lead and sheave and one of the opposite pairs of sheaves on the gantry and the dead end attached to the gantry, a boom hoist line having one end wound about the other of said winches and extending over a gantry sheave, thence around the said bridle sheaves to a dead end on the gantry, the said reeving of said hoist line about the said sheaves and fair-leads substantially providing for level luffing with two parts of a single hoist line reeved between boom point and load engaging means.

2. The structure of claim 1 characterized by the winches being held against drifting by means of non-corrosive holding brakes.

3. The structure of claim 1 characterized by a controllable spring tension tagline mounted intermediate of the ends of the boom with one end wound around the tagline drum and the other end attached to the load engaging means.

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