Feb. 14, 1967 E. C. SEWARD 3,304,061

HOISTING DEVICE

Filed July 23, 1965 2 Sheets-Sheet 1

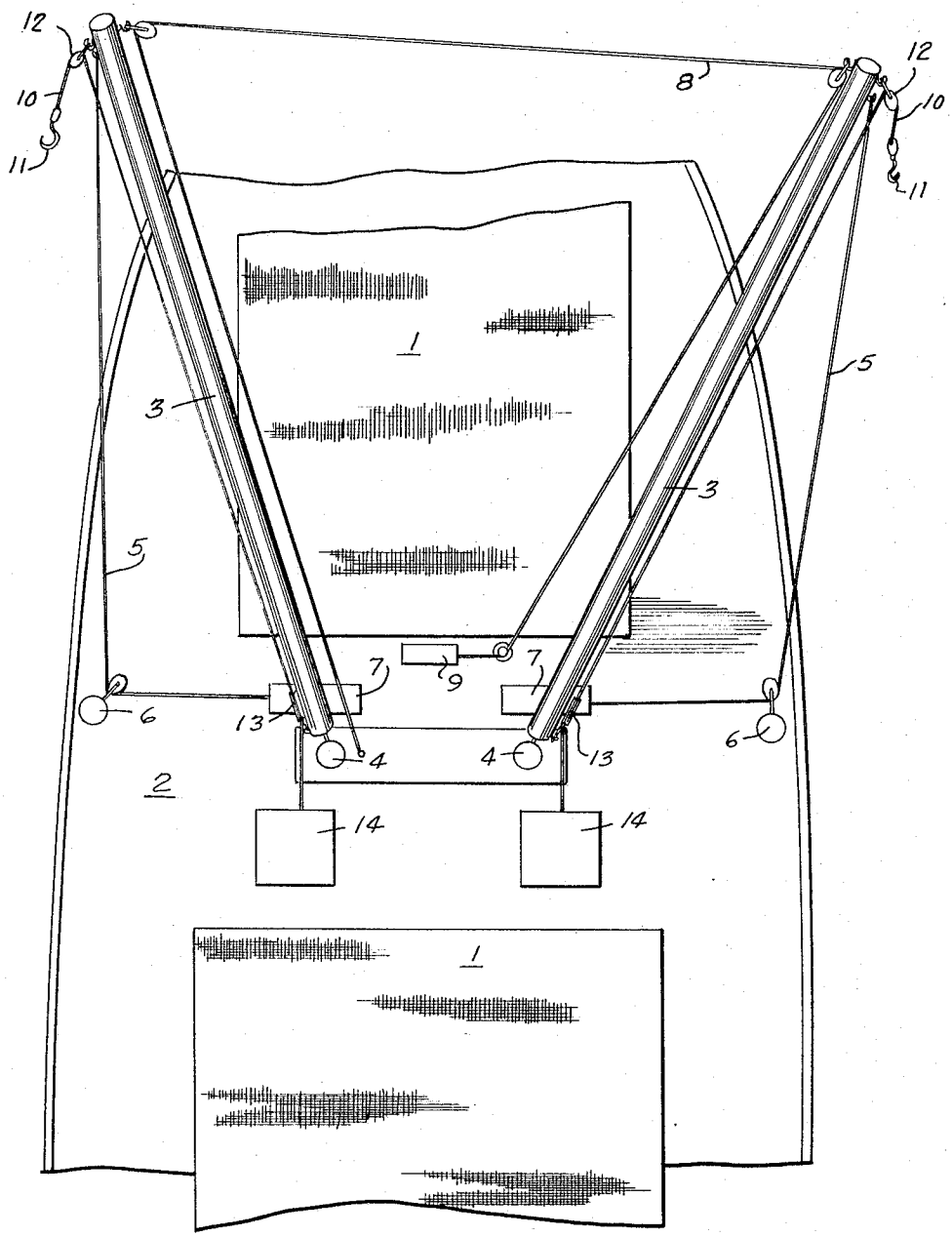


FIG. 1

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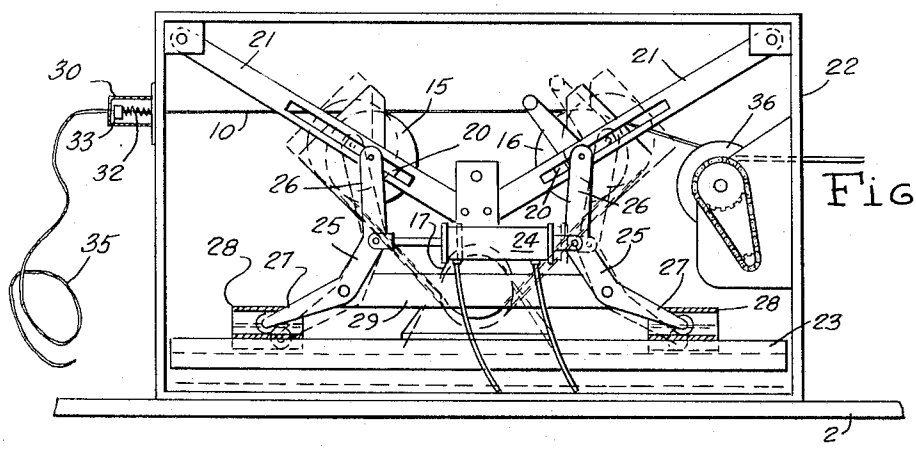


Fig. 2

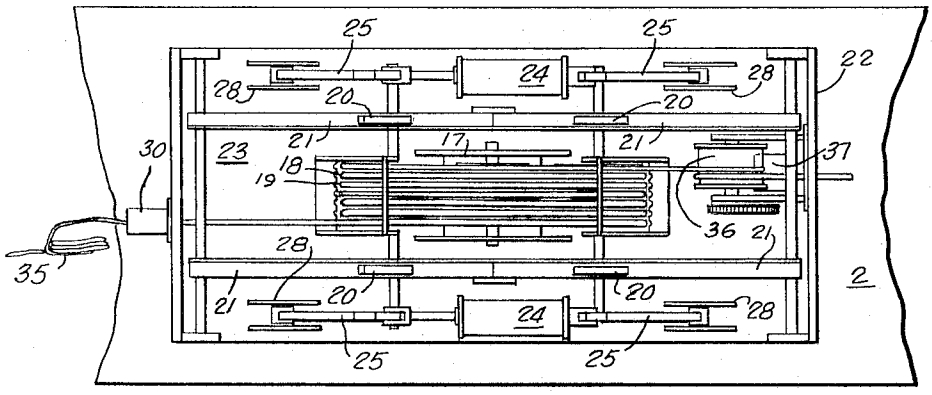


Fig. 3

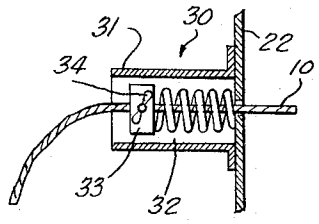


Fig. 4

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3,304,061

HOISTING DEVICE

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3 Claims. (Cl. 254—189)

This invention may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

This invention relates to a hoisting tackle and more particularly to a device which replaces the conventional winch in handling and lifting cargo or other materials.

Conventional winches have a drum upon which a wire or other rope is wound, one end of the rope being fastened to the drum and the other end to the cargo. There are several disadvantages inherent in the use of this type of winch. If the rope is wound while slack, the rope will be spooled loosely on some portions of the drum and tightly on other portions. When the loose windings come up during the unwinding process the cargo on the rope is dropped a distance which can vary from inches to feet. Such dropping puts severe strain on the hoisting equipment and can cause serious accidents. Another difficulty arises when the fleet angle and distance between the drum and heel block of the lifting boom are small. In this case, the rope will mound-up when being spooled under load. When the rope eventually slips off of the mound the load drops a short distance, again straining the equipment and increasing the dangers of operation.

The tight spooling of rope can be assured in many cases by placing a weighted ball on the cargo hook. The use of such a ball often slows down the operation, however, because the hook sometimes has to be hand-carried a substantial distance to the cargo. Moreover, the use of such a swinging weight in the confined area of a ship's hold is so dangerous that longshoremen will not work with it.

It is an object of this invention to provide a hoisting device which does not employ a conventional winch to raise or lower cargo and which consequently overcomes the disadvantages associated with the use of a conventional winch.

Another object is to provide a hoisting tackle employing a series of sheaves which can be hydraulically expanded and contracted horizontally and vertically to raise or lower cargo attached to a rope threaded around the sheaves, the travel distance and speed of the cargo runner and hook being a function of the distance the sheaves move and their rate of movement and the number of sheaves over which the rope is passed.

Another object is to provide a hoisting device employing a series of expandable sheaves to raise or lower cargo attached to a rope threaded around the sheaves, the fixed end of the rope being fastened to a shock absorber attached to a rigid frame.

Another object of the invention is to provide a motor in conjunction with an expandable-sheave hoisting tackle to draw the rope off of the sheaves when the sheaves are being contracted and the rope is not loaded, the motor being free wheeling when the rope is being drawn onto the sheaves and when the rope is loaded.

The structural features of the invention are illustrated in the accompanying drawings, in which:

FIG. 1 is a plan view of a typical shipboard cargo handling system incorporating the hoisting device of this invention;

FIG. 2 is an elevation view of the hoisting device, the solid lines showing the sheaves in an intermediate position and the phantom lines showing the sheaves in a more expanded position;

FIG. 3 is a plan view of the hoisting device showing the sheaves in the intermediate position of FIG. 2; and

FIG. 4 is a detailed sectional view of the rope shock absorber.

The shipboard cargo handling system is one of several types of material handling systems into which the hoisting device could be incorporated. The invention will be described within the shipboard system, although the invention has general application and could be used to replace conventional winches in any system requiring winches. Referring to FIG. 1, a typical shipboard system will be briefly described. To remove cargo from the hold **1** of a ship **2**, the ship is provided with one or more booms **3** pivotally fixed to the bases of masts **4** and movably connected with the upper parts of masts **4** by topping lines, not shown. Vang lines **5** run between the upper ends of booms **3** and the heels of vang posts **6**. Vang winches **7** play out or draw in lines **5** to swing boom **3**. A schooner guy **8** runs between booms **3**. Schooner guy winch **9** plays out or draws in the line for the schooner guy. Cargo runners **10** are the lines which are used to remove or place cargo. Runners **10**, having hooks **11** at one end, run over head pulleys **12** and heel pulleys **13** to cargo winches **14**. In the setting just descraibed, it is the cargo winches which have been replaced by the hoisting tackle of this invention. The hoisting tackle could be used to replace the vang and schooner guy winches if desired, however, just as it could be used to replace non-shipboard winches.

FIGS. 2–4 show the tackle system which constitutes the invention of this application. The preferred embodiment of the hoisting tackle system includes three sheaves **15**, **16** and **17**, made up of a series of pulleys such as shown at **18**, **19**. Sheaves **15** and **16** are rotatably mounted to blocks **20** which slidably engage inclined channels **21**. Channels **21** are rigidly mounted to frame **22**. Sheaves **17** is rotatably mounted to floating platform **23**. Hydraulic cylinders **24** are mounted outside of channels **21** between levers **25**. Levers **25** are preferably of the bell crank type, as shown. Levers **25** have upper portions **26** pivotally attached to sliding blocks **20** and lower portions **27** slidably or rotatably fixed within housings **28** mounted on platform **23**. Bars **29** connect the pivot points of levers **25**.

The fixed end of a cargo runner such as line **10** shown in FIG. 1 is attached to a shock absorber **30** on frame **22**. An embodiment of shock absorber **30** is shown in detail in FIG. 4. This shock absorber is a compression spring-loaded type, but it could also be operated by a tension spring or by hydraulic or air means. Referring to FIG. 4, the shock absorber consists of a housing **31** attached to frame **22** and containing a compression spring **32**. Line **10** is passed through the wall of frame **22** and through housing **31**, spring **32** and a bearing plate **33**. Line **10** is releasably clamped at the outside of plate **33** by any of several conventional means such as the grip and set screw **34** shown in FIG. 4. Line **10** may extend beyond grip **34** to form a coil **35** which may be wound on a spool for storage if desired. The use of coil **35** will be explained later.

From shock absorber **30**, line **10** is threaded about the pulleys of sheaves **15**, **16** and **17** in the conventional manner of a block and tackle. From sheaves **15**, line **10** is fed to and given several wraps around drum **36** to assure a frictional force sufficient to enable the drum to draw the line when rotated. Drum **36** is rotatably mounted to frame **22** and is driven by any conventional engagement with a free-wheeling motor **37**. Motor **37** is provided with a clutch or like conventional free-wheeling means so that drum **36** is freely rotated when line **10** is drawn into sheaves **15**, **16** and **17**. When line **10** is played out without load, motor **37** is required to turn drum **36** under power to draw the line off of sheaves **15**, **16**, and **17**. If

a weight could be added to the hook **11** of line **10** the line would draw itself off of the sheaves. As explained above, however, such a weight is not feasible on ships and in various other circumstances.

In operation, the spreading or contracting of sheaves **15, 16** and **17** replaces the winding or unwinding of a line on a conventional winch drum to raise or lower the movable end of the line and consequently to raise or lower cargo. The sheaves are shown in two positions in FIG. 2. In the expanded position, the cargo hook is at its full height on boom **3**. If it is desired to lower the hook or cargo, hydraulic cylinders **24** are contracted. This contraction works through levers **25** to move sheaves **15** and **16** down channels **21** toward one another. At the same time, levers **25** raise platform **23** and sheave **17** closer to sheaves **15** and **16**. As the sheaves are moved closer together, line **10** is drawn off of the sheaves, thereby lowering the cargo. If there is no cargo on line **10**, the line must be drawn off the sheaves by drum **36** and motor **37**. The operation is reversed to raise cargo; cylinders **24** are expanded, the sheaves move apart, and line **10** is drawn onto the sheaves thereby raising cargo. During this operation and when the line is being drawn off under load, motor **37** and drum **36** are free-wheeling. By providing three sheaves in the configuration shown, a large travel of hook **11** can be obtained from a small relative displacement of the sheaves. Sheaves **17** shortens the horizontal distance the sheaves must be moved and thereby conserves space and makes possible the use of a shorter stroke of the pistons of cylinders **24**. The travel distance of hook **11** per foot of separation of sheaves **15, 16** and **17** can be varied by varying the number or size of pulleys **18, 19**.

In a conventional winch, in which the line is wound on a drum, the fixed end of the line is attached to the drum. Consequently, no provision can be made for a shock absorber to ease the strain on the hoist caused, for example, by the heaving of the load against the line resulting from the rolling of a ship at anchor. A shock absorber such as **30** can be used in the tackle system of this invention. If the cargo being raised shifts or if the ship rolls before the load is in the air, the jolt to the line passes over free-wheeling drum **36** and sheaves **15–17** and is transmitted to spring **32** or similar energy absorbing means, thereby reducing the strain on the hoist system.

The cargo runner **10** is shown in FIG. 1 to be a single line passing over the boom head pulley to the cargo. It is often desirable to "double up" the line when hoisting cargo. To double up a line a pulley is added just above the cargo hook and the line is run over the boom head pulley and around the hook pulley and back up to the boom head, where it is fixed to the boom. Obviously the conversion to a doubled-up cargo runner requires more line. This is the purpose of the line coil **35**. To obtain the line needed to double up, grip **34** is loosened and line **10** is drawn through shock absorber **30**, over sheaves **15–17** and out over drum **36**. When the line has been sufficiently extended grip **34** is again tightened.

It will be understood that the tackle system of this invention may be modified in various ways without departing from the scope of the invention.

I claim:

1. In a material handling system including a boom, a material handling line having a free end and a fixed end, said line being movably attached to and depending from said boom, and hoisting means for drawing in and letting out said line with respect to said boom to raise or lower material attached to said line, an improvement in said hoisting means wherein said hoisting means comprises:

(a) a frame, the fixed end of said material handling line being fixed to said frame;

(b) a plurality of sheaves mounted on said frame, said material handling line being threaded about said sheaves and said sheaves being movable with respect to one another in both the horizontal and vertical directions;

(c) means for moving said sheaves with respect to one another, the free end of said line being drawn toward and away from said hoisting means as said sheaves are moved further apart and closer together;

(d) shock absorber means between the fixed end of said material handling line and said frame; and

(e) means for drawing said material handling line off of said sheaves when the line is not in a cargo loaded state so as to draw itself from the sheaves as the sheaves are moved closer together.

2. The hoisting device described in claim **1** wherein the number of sheaves is three, triangularly disposed, one of said sheaves being movable vertically and two of said sheaves being movable both vertically and horizontally.

3. In a material handling system including a boom, a material handling line having a free end and a fixed end, said line being movably attached to and depending from said boom, and hoisting means for drawing in and letting out said line with respect to said boom to raise or lower material attached to said line, an improvement in said hoisting means wherein said hoisting means comprises:

(a) a frame, the fixed end of said material handling line being fixed to said frame;

(b) a plurality of sheaves rotatably mounted on said frame, said material handling line being threaded about said sheaves and said sheaves being angularly disposed with respect to one another;

(c) means for moving said sheaves with respect to one another, the free end of said line being drawn toward and away from said hoisting means as said sheaves are moved further apart and closer together; and

(d) shock absorber means comprising a housing attached to said frame and spring mounted within said housing, said material handling line being releasably fixed to said spring to permit additional length of line to be drawn through said shock absorber means onto said sheaves; and means for drawing said material handling line off of said sheaves, said means for drawing said material handling line off of said sheaves comprises a rotatable drum mounted on said frame and having several wraps of the material handling line around it and a free-wheeling motor and clutch to rotate said drum under power to draw the line from said sheaves when the line is not in a cargo loaded state so as to draw itself from the sheaves as the sheaves are moved closer together.

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