Aug. 8, 1944. E. B. NICKLES 2,355,235

SHIP CRANE

Filed June 12, 1943 3 Sheets-Sheet 1

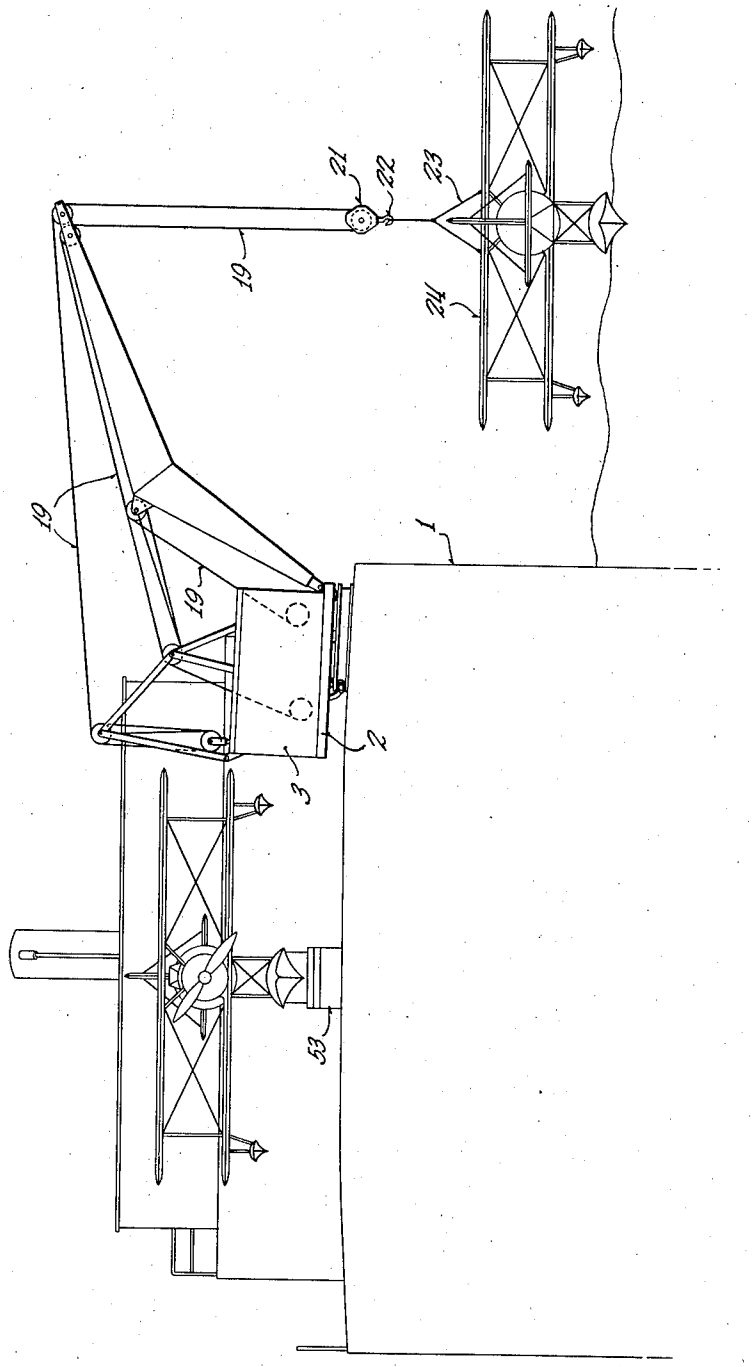


Fig. 1

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SHIP CRANE

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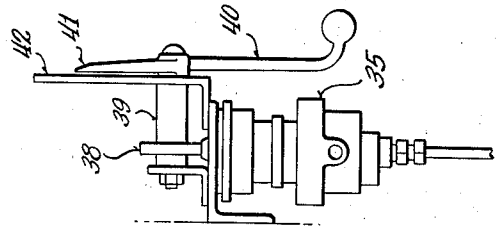


Fig. 3

Fig. 2

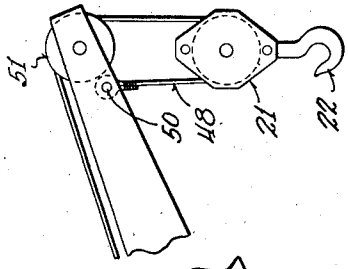
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SHIP CRANE

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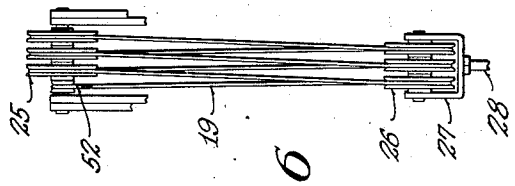


Fig. 6

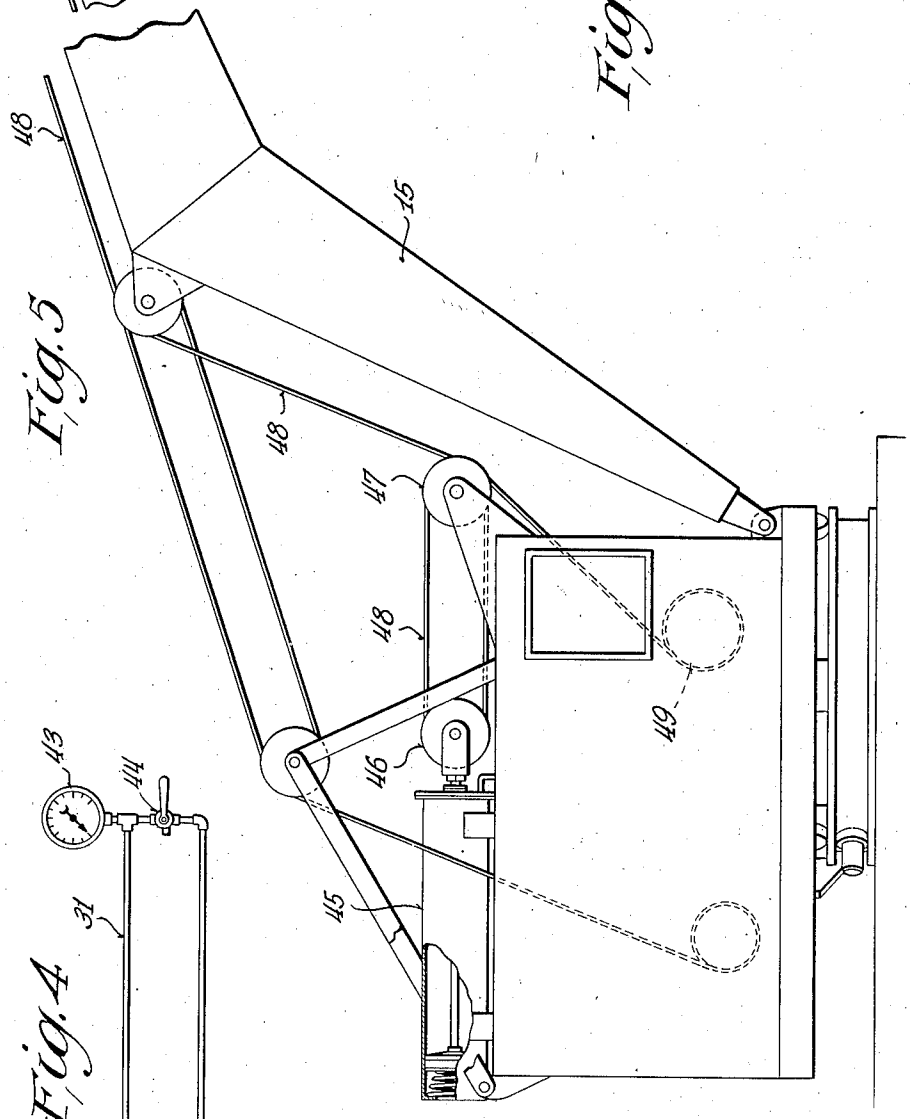


Fig. 5

Fig. 4

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UNITED STATES PATENT OFFICE

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SHIP CRANE

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Application June 12, 1943, Serial No. 490,585

4 Claims. (Cl. 212—3)

This invention relates to ship cranes.

Attempts have heretofore been made to pick an airplane or other object from the water and hoist it upwardly and thereafter deposit it on the deck of a ship. These attempts have not been wholly successful for their success depends more or less upon the lack of rolling of the ship and relative smoothness of the water. An airplane, being a relatively delicate device, if subjected to suddenly applied violent stresses at the point where it is supported from the crane, as for example when the ship is rolling violently, will almost invariably be damaged as the entire weight of the plane is thrown more or less on a localized area when the ship suddenly rolls and lifts the airplane from the water, and again the plane is subjected to a relatively severe shock when the ship rolls in the other direction and suddenly drops the plane bodily into the water.

This invention is designed to overcome the above noted defects, and objects of this invention are to provide a ship crane which is so constructed that it will not subject the airplane or other object to severe suddenly applied shocks although the ship may be rolling violently, and although the water may be very rough, but which instead will cushion the shocks that would otherwise be applied to the airplane or other object, and which will maintain the supporting cable taut at all times and will gradually apply and relieve pressure from the localized portion of the airplane at which the hoisting sling or other device is attached.

Further objects are to provide a ship crane which may be used to raise an airplane or other object from the water and may thereafter be swung around and deposit the plane on the deck, or may be used, if desired, to lift the plane from the deck and swing around and deposit it in the water without shock to the plane in either case, irrespective of severe rolling of the ship or great roughness of the water.

Further objects are to provide means for a ship having limited deck space whereby a plane may be launched from the ship, as by means of a catapult, in combination with means whereby the plane may be lifted from the water in a manner to cushion substantially all shocks due to the lifting although the ship may be rolling severely.

Further objects are to provide a take-up device in combination with a ship crane which take-up device is so constructed that it has relatively little inertia and will quickly take up and respond to any change in tension on the lifting cable so as to prevent the formation of slack, on the one hand, and also to yieldingly and gently cushion the strains imposed on the airplane or other member being lifted from the water.

Further objects are to provide a construction in which the cushioning and take-up means may be quickly set for planes or other objects of different weights and, in one form of the invention, to provide means whereby this setting is automatically maintained.

Embodiments of the invention are shown in the accompanying drawings, in which:

Figure 1 shows the invention applied to the ship with the ship crane shown as lifting an airplane from the water and with a second airplane mounted in a catapult arrangement.

Figure 2 is a sectional fragmentary view through the ship crane.

Figure 3 is a detail showing an automatic air valve employed with the ship crane take-up.

Figure 4 shows a further form of valve arrangement.

Figure 5 shows a further form of ship crane.

Figure 6 is a view showing the multiple sheave arrangement of the take-up.

Referring to the drawings, particularly Figures 1 and 2, it will be seen that a vessel or ship has been indicated by the reference character 1. The ship crane may comprise a car body 2 which may carry a cab 3 and which carries the driving mechanism. This car body, as shown in Figure 2, is supported from a stationary circular base portion indicated generally at 4. It is preferable to provide a king pin 5 carried by the base 4 and extending into the car body. It is also preferable to provide a plurality of rollers 6 which travel on the upper portion of the base and form additional supporting means for the car body. In addition to this, it is preferable to provide underhanging rollers 7 which are positioned beneath a flange 8 formed on the base 4 to take a material part of the strain off of the king pin 5 when there is a tendency to tip the car body when the crane is lifting a load.

The crane may be provided with any suitable driving means. For example, it may be driven, as shown in Figure 2, by means of electric motors. One of the motors indicated at 9 is employed for driving a small pinion 10 through suitable reduction gearing, such pinion 10 meshing with an internal gear 11 formed in the base portion or support 4 to thereby enable the crane to turn about its king pin 5. Another motor 12 may be employed to drive the boom hoist drum 13 for raising and lowering the boom through the medium of the boom hoist line 14, such boom hoist line

being looped back and forth over suitable sheaves in the usual manner for raising and lowering the boom 15, such boom being pivoted to the car body in any suitable manner as indicated at 16. A third motor 17 may be employed for driving the hoist drum 18 for the hoist line 19.

The motors are individually controlled by means of the controllers indicated generally at 20 in Figure 2 so that the operator located within the cab may operate the motors either simultaneously or individually as required, suitable windows being provided in the cab for the operator.

The boom hoist line 19 is looped over a sheave 21 which is provided with a hook or other means indicated at 22 by which it engages a sling or other attaching means 23 which is attached to the airplane 24 or to any other object that it is desired to handle.

One end of the boom hoist line 19 is attached to the hoisting drum 18 and the other end of the boom hoist line 19 is looped back and forth over a plurality of stationary sheaves 25 and a plurality of movable sheaves 26, the latter being carried by a head 27 attached to a plunger rod 28.

This arrangement provides means for multiplying the motion of the take-up device so that a considerable length of cable will be drawn in or let out for a relatively small movement of the take-up device.

The movable sheaves 26 are, as stated, attached to the plunger rod 28 which in turn is attached to the piston 29, such piston working within an elongated cylinder 30 which may be vertical, as shown in Figure 2, or horizontal, as shown in Figure 5, or which may be set at any desired angle, depending on the arrangement of other parts of the mechanism. The cylinder 30 is closed at its upper end and communication therewith is provided through the medium of a pipe 31. The lower end of the cylinder is open as indicated at 32 and a spring 33 is carried in the lower end of the cylinder so as to prevent a sudden blow being struck the bottom of the cylinder by means of the piston 29 even if the piston should be inadvertently suddenly driven down to the bottom of the cylinder.

It is intended that the piston 29 and cylinder 30 shall constitute a cushioning device for the hoist line, which will yieldingly and increasingly cushion any shock that may be applied to the airplane due to rolling of the ship or due to high waves or other conditions of this order. For example, if the crane is arranged to lift an airplane from the water and the ship suddenly rolls away from the airplane, the load of the airplane will be suddenly imposed on the hoist line and consequently a very high localized strain will be imposed on the airplane. However, this is prevented as the piston 29 will immediately move upwardly and will gradually cushion this load or shock as it will increase the compression of air in the upper portion of the cylinder 30, and consequently will offer a gradually increasing yielding cushioning effect so that sudden strains are not imposed on the airplane. In addition to this, the piston, cylinder, and movable sheaves 26 cooperating with the stationary sheaves 25, constitute a take-up device which will keep the hoist line taut at all times.

The pressure in the upper portion of the cylinder 30 is adjusted so that when the plane is fully supported by the hoist line, the piston is approximately half way up the cylinder. This air pressure is supplied from a compressed air tank 34 which is in turn supplied from an air pump as indicated, such air pump being driven from a motor or in any other suitable manner. The pressure of the air within the tank 34 is considerably greater than that normally maintained within the cylinder 30 for any given weight of planes. A well known automatic air valve indicated at 35 is employed which automatically maintains a given pressure for any given setting and which will discharge the air if the pressure exceeds a given value. However, after the air pressure is set at a certain definite value within the cylinder 30 for a given weight of plane, the automatic valve 35, which would normally discharge air if the pressure in the cylinder 30 exceeded the value for which the automatic valve is set, is prevented from discharging by means of a check valve 36 interposed between the pipe 31 and the automatic valve 35. However, if the air should slowly leak from the cylinder 30, the automatic valve 35 will maintain the minimum given air pressure.

If a heavier plane is to be handled, the automatic valve 35 is set for a higher initial pressure so that when the plane is supported by the hoist line, the piston 29 is about midway of the cylinder 30.

If a lighter plane has to be lifted, the automatic air valve 35 is set for a lower pressure. However, the check valve will prevent discharge of air from the line 31 through the automatic valve 35. In order to provide for this condition, a by-pass hand valve 37 is provided which when it is desired to lower the air pressure, is opened to by-pass the check valve 36. When the pressure in the line 31 has arrived at the desired lower pressure, the by-pass valve 37 is closed and this lower minimum pressure is maintained by the automatic air valve 35.

It is to be understood that when the piston 29 has moved approximately half way up the cylinder when the plane is supported on the hoist line, the pressure within the upper portion of the cylinder 30 is considerably greater than the minimum pressure maintained by the automatic air valve 35. However, the check valve 36 prevents discharge of air from the pipe 31 and consequently full cushioning action is obtained.

The automatic valve 35 is indicated in side elevation in Figure 3. It is a conventional type of automatic air valve in which the setting is controlled by means of a cam 38 carried by a shaft 39 operated from a manually movable handle 40. The setting is indicated by means of a pointer 41 and a calibrated scale 42, the air valve being suitably supported within the cab 3.

In place of the automatic valve 35, the by-pass valve 37 and the check valve 36, the arrangement shown in Figure 4 could be employed. In this arrangement the pressure in the pipe 31 is indicated by a pressure gauge 43 and a manually operable three-way valve 44 is provided between the supply of compressed air and the pipe 31. This valve is operated so as to bring the pressure within the cylinder 30 to the desired point and thereafter is closed. If a higher pressure is desired, this higher pressure is easily obtained by letting more compressed air flow into the pipe 31 and consequently into the cylinder 30 of Figure 2 and is thereafter again closed. If a lower pressure is desired, the three-way valve is turned so as to discharge air from the pipe 31 to the atmosphere until the pressure indicated by the gauge 43 arrives at the desired point.

In the form of the invention shown in Figure 5, the cushioning cylinder indicated at **45** is positioned horizontally. It is of the same construction as that previously described and carries the movable multiple sheaves **46** between which and the stationary sheaves **47** the hoist line **48** is looped.

Figure 5 also differs from that shown in Figure 2 in that one end of the hoist line **48** is attached to the hoisting drum **49** and the other end of the hoist line is attached, as indicated at **50**, adjacent the outer sheaves **51** of the boom **15**, the hoist line **48** being looped over the lifting sheave **21** as indicated. The looped portion of the hoist line between the fixed sheaves **47** and the movable sheaves **46** is only an intermediate portion of the hoist line. In Figure 2 one end of the hoist line is attached to the hoisting drum **18** and the other end of the hoist line is attached, as indicated at **52** in Figure 6, that is, adjacent the stationary sheaves **25**. Either arrangement could be employed with either the horizontally or vertically arranged take-up and cushioning cylinder.

It is to be understood that the actual hoisting of the plane is controlled by the operation of the hoisting motor **17** under the manual control of the operator within the cab. For example, if a plane approaches the ship and it is desired to lift the plane from the water to the ship, the plane is attached to the hook or other member **22**, see Figure 1, and thereafter the operator starts the hoisting drum **18**, the minimum pressure within the cushioning cylinder being previously established as has been described hereinabove. Thereafter as the hoist line tightens, the piston within the cylinder moves upwardly and arrives at approximately its mid position as the plane is lifted from the water and the full load of the plane comes on the hoist line. If during this interval the ship should suddenly roll away from the plane and the full load of the plane should suddenly be imposed on the hoist line, no appreciable shock would be applied to the plane or to the cable as the cushioning mechanism would immediately come into play and gradually cushion this shock so that the full weight of the plane would gradually be applied to the hoist line in a manner that would not damage the plane or any other part of the apparatus. On the other hand, if the ship should suddenly roll towards the plane after the plane has been lifted from the water and the plane again suddenly set down in the water, there would still be no appreciable shock either to the plane or other parts of the device as the cushioning device would relieve the pressure on the hoist line in a gradual manner to the requisite extent while keeping the hoist line from becoming slack at any time. A sufficient number of stationary and movable sheaves are employed and a sufficient stroke of the piston is provided so as to take up any amount of slack required.

After the plane has been hoisted from the water, it may be swung into position and lowered on to the deck of the ship **1**.

This invention also contemplates the combination of means for lifting the plane from the water without shock or placing the plane in the water without shock and catapult means which are indicated very generally at **53** in Figure 1 for projecting a plane outwardly from the deck of the ship. Thus this invention in its broadest aspects contemplates means for launching a plane from the ship without damage to the plane in combination with means for lifting a plane from the water and depositing it on the ship without shock to the plane. This invention, therefore, provides means whereby a plane may be launched from a relatively limited deck area and may be again placed on this relatively limited deck area without damaging shock to the plane.

It will be seen that this invention provides novel means whereby a ship with limited deck area nevertheless can launch and retrieve a plane even in rough water when the ship is rolling, due to the combination of the catapult arrangement for launching the airplane and the strain removing cushioning means and slack take-up ship crane arrangement. These two devices act in conjunction with each other so that the launching and retrieving of an airplane may be accomplished even under very adverse conditions and although a very limited deck area is available.

In addition to this the ship crane itself provides means whereby a plane may be deposited in the water or may be lifted from the water without damaging shock to the plane. Obviously the ship crane can be used for the handling of other objects than planes if it is desired.

In both forms of the invention it will be seen that an intermediate portion of the hoist line is looped back and forth several times over the movable and stationary sheaves so that the pneumatic take-up device can work independently of the hoisting drum.

It is to be noted also that the action of the pneumatic take-up and slack preventing device is very quick as it has very little inertia and immediately moves to the desired position as required.

Although this invention has been described in considerable detail, it is to be understood that such description is intended as illustrative rather than limiting as the invention may be variously embodied and is to be interpreted as claimed.

I claim:

1. A ship crane comprising a power driven hoist drum, a hoisting cable operated by said drum, a hoisting member supported from said hoisting cable for attachment to the object to be hoisted, a plurality of stationary sheaves and a plurality of movable sheaves around which an intermediate part of said cable is looped, a cylinder, a piston within said cylinder operatively connected to said movable sheaves, said piston being moved by said movable sheaves when a load is imposed on said hoisting cable and compressing air within said cylinder to cushion any suddenly applied load, and means for maintaining a predetermined initial air pressure within said cylinder when there is no load on the hoisting cable.

2. In a ship crane, a hoisting cable, a hoist drum for said cable, power means for operating said hoist drum, a hoisting member supported from said hoisting cable for attachment to the object to be hoisted, a pneumatic cable take-up and shock cushioning means for said cable comprising a cylinder, a piston in said cylinder, said cylinder having an open and a closed end, movable sheave means around which said cable is passed, and means operatively connecting said piston and said movable sheave means, said pneumatic cable take-up and shock cushioning means being arranged to compress air in the closed end of said cylinder when a load is placed on said hoisting cable, and cushioning means between said cylinder and said piston for stopping said piston adjacent the open end of said cylinder.

3. A ship crane comprising a power driven hoist drum, a hoisting cable operated by said drum, a hoisting member supported from said hoisting

cable for attachment to the object to be hoisted, stationary sheave means and movable sheave means around which a part of said cable is looped, a cylinder, a piston within said cylinder operatively connected to said movable sheave means, said piston being moved by said movable sheave means when a load is imposed on said hoisting cable and compressing air within said cylinder to cushion any suddenly applied load, a source of compressed air, and an automatic adjustable valve connected between said source of compressed air and said cylinder for establishing a predetermined initial air pressure within said cylinder when there is no load on said hoisting cable.

4. A ship crane comprising a power driven hoist drum, a hoisting cable operated by said drum, a hoisting member supported from said hoisting cable for attachment to the object to be hoisted, stationary sheave means and movable sheave means around which a part of said cable is looped, a cylinder, a piston within said cylinder operatively connected to said movable sheave means, said piston being moved by said movable sheave means when a load is imposed on said hoisting cable and compressing air within said cylinder to cushion any suddenly applied load, a source of compressed air, an automatic adjustable valve connected between said source of compressed air and said cylinder for establishing a predetermined initial air pressure within said cylinder when there is no load on said hoisting cable, a check valve between said automatic valve and said cylinder, and a normally closed by-pass valve connected in parallel with said check valve.

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