March 6, 1951 L. L. EAKIN 2,544,553

HOIST MECHANISM

Filed Dec. 19, 1947 2 Sheets-Sheet 1

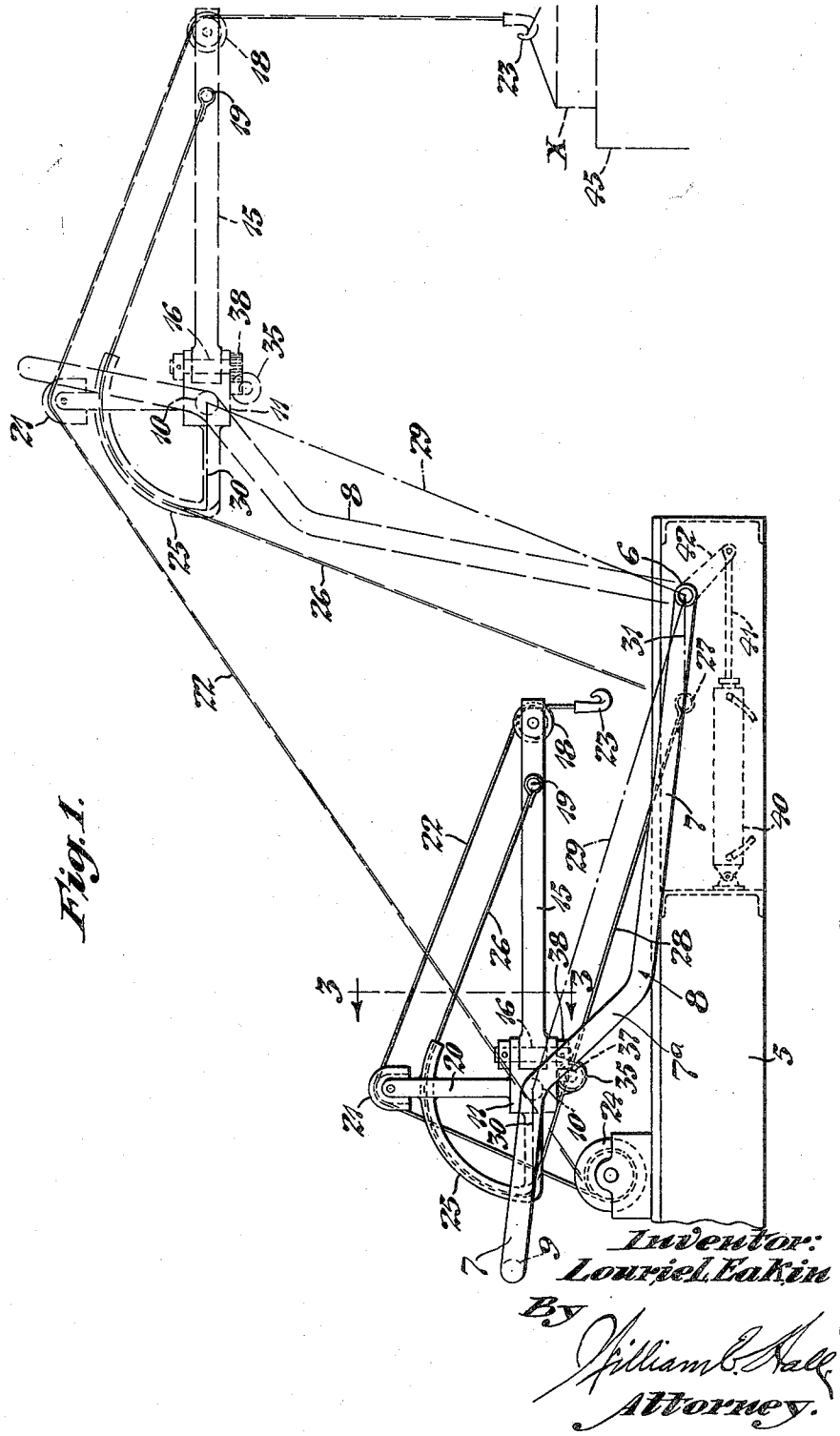

Fig. 1.

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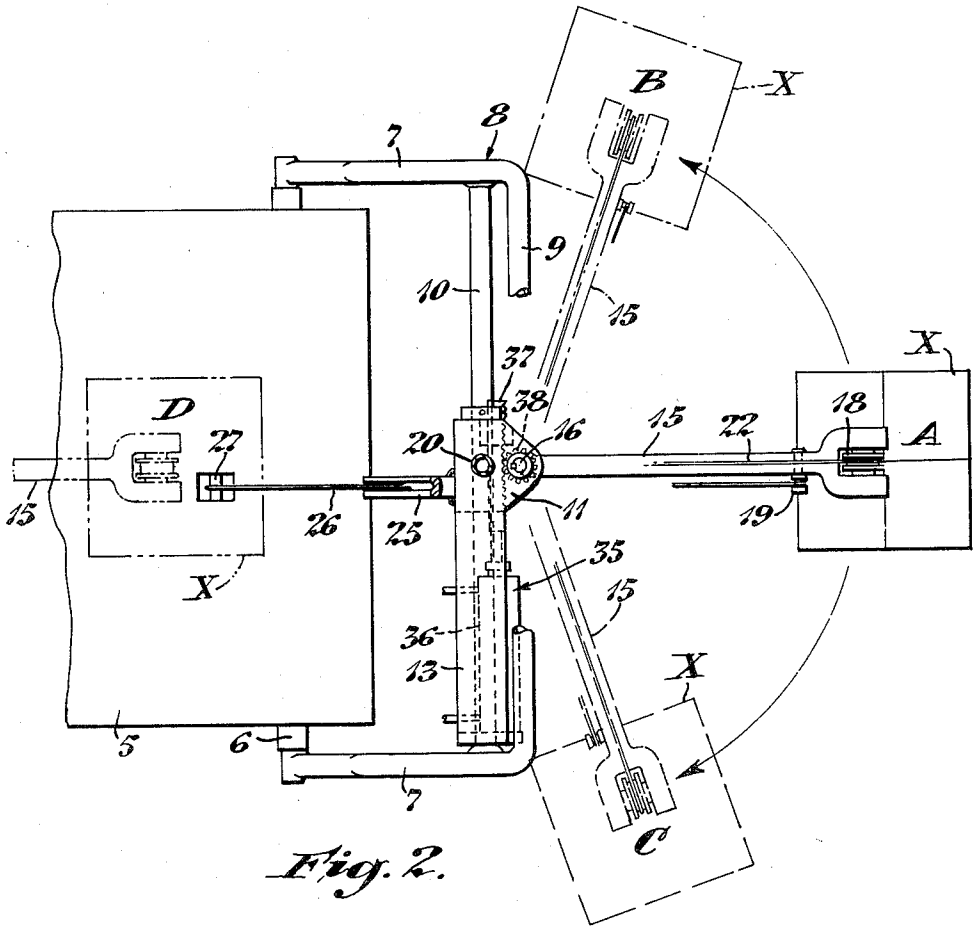

Fig. 2.

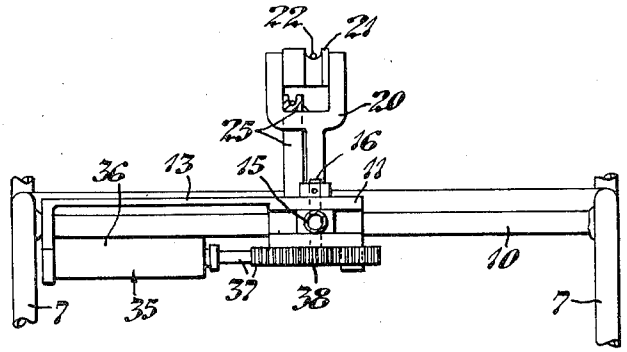

Fig. 3.

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Patented Mar. 6, 1951 2,544,553

UNITED STATES PATENT OFFICE

2,544,553

HOIST MECHANISM

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Application December 19, 1947, Serial No. 792,791

6 Claims. (Cl. 212—59)

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This invention relates to apparatus for handling various objects, and more particularly to an apparatus for lifting objects and transferring them to various locations.

Derricks having a pivoted boom are employed extensively for lifting objects, and such booms are commonly mounted to turn at their base so that the objects can be carried from one location to another position. Such booms are sometimes pivotally mounted on a rotary base or turntable to facilitate handling the material, and are quite successful in operation. However, such hoisting equipment is quite costly and cannot be readily installed on truck platforms, or in relatively small areas. The present hoisting apparatus was designed particularly for use on such vehicles, or in confined areas, and is especially suitable for use in unloading objects from a railway freight car onto a motor truck or onto a freight platform, or transferring objects from a truck or platform onto a flatcar, ship, or other conveyance.

One object of my invention is to provide an apparatus, of the character referred to, which consists of a boom pivoted on a fixed horizontal axis on a platform or other fixed support, a crane arm pivoted on a vertical axis on the boom to adapt it to pivot in a horizontal plane, flexible means connected between the support and the crane arm and operative to maintain the crane arm in horizontal position during all positions of angular adjustment of the boom, a cable passing over a pulley at the distal end of the crane arm for supporting an object to be lifted, a winch for winding the cable to lift the object, hydraulic means for pivoting the boom to different angular positions, and hydraulic means for turning the crane arm on its vertical position so as to swing the arm in a horizontal plane and carry the object to a new location where it can be deposited by paying out the cable. By this novel combination of parts, it is unnecessary to rotate the entire boom to swing the lifted object laterally to a location where it is to be deposited, the crane arm being employed solely for this purpose, and thus the structure is greatly simplified and made universal in operation. It will be apparent that such a hoisting apparatus can be mounted on a platform adjacent a railroad track to adapt it to lift objects from a railroad car and deposit them on the platform or upon a truck disposed adjacent the platform. Likewise, the apparatus can be installed on a ship and advantageously employed for loading objects onto or unloading them therefrom. As another example of its use, the apparatus can be conveniently mounted on the platform

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of a motor truck, since it occupies a minimum of space, and can be readily folded down in close proximity to the truck platform, when not in use, so that it will not interfere with the operation of the truck.

Another object is to provide an apparatus of the type indicated in which the boom and crane arm can be simultaneously pivoted by remotely controlled means so that an object can be lifted, moved forwardly or rearwardly and swung laterally at the same time, thereby expediting the loading or unloading operation and providing smooth operation of the apparatus.

Further objects of the invention are set forth in the following description which discloses a preferred embodiment of the apparatus, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is a side view of my improved apparatus;

Fig. 2 is a plan view thereof; and,

Fig. 3 is a cross-sectional view, taken on line 3—3 of Fig. 1.

Referring to the drawings in detail, I have therein shown the hoisting apparatus as mounted on a conventional support 5 which may be considered, for the purpose of illustration, as the platform of a motor truck, although it will be understood that the apparatus is adapted for use in conjunction with various other supports, either movable or stationary. Extending transversely of and rotatable on the support is a shaft or axle 6, to the projecting ends of which are connected the ends of the opposite legs or side members 7 of a substantially U-shaped boom 8 having a cross member 9 at its distal end. The boom 8 may be of the type disclosed in my prior applications, Serial Nos. 712,652 and 746,248, filed November 27, 1946, and May 6, 1947, respectively, and, as shown, its side members 7 may have offset portions 7a at their outer ends. Extending between the offset portions of the side members 7 is a transverse rod 10, hereinafter referred to as the second horizontal pivotal axis.

Pivotally mounted on the axis 10 is a holder 11 which, as shown in Figs. 2 and 3, may comprise a block having an extension 13. The block 11 is provided with a slot at one side for receiving an end of a crane arm 15, which is keyed to a pin or shaft 16 rotatable in holes in the upper and lower sides of the slot. The arm 15 carries a pulley or sheave 18 at its outer or forward end and an anchor pin 19 disposed rearwardly of the pulley. Projecting upwardly from the block 11 is a forked standard 20, at the upper end of

which is a cable guide element 21. A cable 22 passes over the guide element 21 and pulley 18 and has a hook 23 at one end adapted to support an object to be lifted. The other end of the cable may be connected to the wind-up drum of a winch 24 on the support 5.

A segmental grooved element 25 is attached to the block 11 and standard 20 with its grooved portion arranged concentric with the axis 10. A cable 26 extends through the groove of the segmental element 25 and has one end fastened to the anchor pin 19. The other end of the cable 26 is joined to a transverse rod 27 on the support 5. It is to be noted that the distance between the axis 6 and the rod 27 is equal to the radius of the grooved element 25, so that the length 28 of the cable 26 extending between the element and the rod 27 is parallel to an imaginary line 29 extending between the two pivotal axes 6 and 10. In other words, the length 28 of the cable 26 and the line 29 form the opposite long sides of a parallelogram, the short sides of which are represented, respectively, by the radial line 30 and the line 31 in Fig. 1. It will be apparent that, due to the parallelogram arrangement of the parts, the crane arm 15 will remain parallel to the line 31, or, in other words, in a true horizontal position regardless of the angular position of the boom 8. The arm 15 may, however, pivot in a horizontal plane, as indicated in Fig. 2, under the action of a hydraulic actuator 35. The actuator 35 consists of a cylinder 36 mounted on the block 11 and having a piston rod 37 provided with rack teeth at its outer end adapted to mesh with the teeth of a small gear 38 carried by the pivot shaft 16. By this construction, when the piston rod 37 is moved, the shaft 16 and arm 15 are rotated, the direction of such rotation depending upon the direction of movement of the piston rod. The hydraulic actuator may be controlled by a suitable selector valve, not shown, located remotely therefrom.

The boom 8 may be pivoted on its axis 6 by power means, the present drawings showing a hydraulic actuator 40 for this purpose. The piston rod 41 of the hydraulic actuator 40 is connected to an arm 42 carried by the axle 6, so that when hydraulic fluid is introduced into either end of the actuator cylinder under pressure and the piston rod is accordingly slid, the axle 6 is turned and the boom 8 thus pivoted to desired angular positions. The hydraulic actuating means may be of the type disclosed in my pending application, Serial No. 746,248, filed May 6, 1947, and is therefore not described in detail herein.

Assuming that it is desired to unload an object X from the position A (Fig. 2) on a conveyance, such as the railroad flatcar 45, indicated in Fig. 1, and to deposit the object at a location D upon the support 5, the hydraulic actuator 40 is operated to pivot the boom 8 from the retracted position shown by full lines to the extended position indicated by the dash lines in Fig. 1. During this pivotal movement the crane arm 15 is carried forwardly by the boom 8, and, because the length 28 of the cable 26 remains parallel to the line 29, the crane arm remains in true horizontal position at all times so that the pulley 18 at its end is disposed above the object X to be lifted. When a selector valve (not shown) in the hydraulic circuit for the actuator 40 is operated to prevent escape of fluid from the ends of the hydraulic cylinder, the entire hoisting apparatus is locked against pivotal movement in either direction so that collapse is prevented.

The hook 23 of the cable 22 is next fastened to the object X and the winch 24 operated to wind up the cable and thereby raise the object. It will be noted that the cable 26, in addition to maintaining the crane arm 15 in horizontal position, also serves as a guy in strengthening the arm so that the arm is capable of supporting considerable weight at its end. With the object X thus suspended, the hydraulic actuator 40 is caused to pivot the boom 8 rearwardly toward the position shown by full lines in Fig. 1, the winch being simultaneously operated to wind the cable 22 to maintain the object at a desired height. After the object has been moved to a position above a selected location on the platform 5, as shown at D in Fig. 2, the actuator 40 is locked and the cable 22 unwound to permit the object to descend onto the support 5. If an object is to be transferred from position D to position A, the procedure explained above is reversed.

When it is desirable to transfer an object from position A to a location B or C disposed laterally thereof, the object is first lifted and the hydraulic jack 35 is thereafter energized to cause its piston rod 37 to move in the appropriate direction. Movement of the piston rod 37 and its rack teeth causes rotation of the gear 38 so that the crane arm 15 is pivoted on the vertical axis 16 to move its pulley 18 and the object to the selected position B or C, after which the actuator 35 is locked and the cable 22 paid out to cause the object to descend onto a motor truck, railroad car, or other conveyance, or upon a stationary platform at the location B or C.

It will be apparent from the foregoing that, by the use of my improved apparatus, objects can be transferred from A to D, or vice versa, from A to B or from A to C, and vice versa, and from B to C, and vice versa, and to any position intermediate any of these locations. It is thus seen that the apparatus is universal in operation, and, because the crane arm 15 is pivoted intermediate the ends of the boom 8, it is unnecessary to provide means for pivoting the boom on a vertical axis to permit the objects to be swung to positions laterally of the base or support of the boom. It is obvious that the relative lengths of the boom 8 and crane arm 15 can be varied in accordance with the requirements, the apparatus herein disclosed being merely illustrative.

While I have herein shown and described the improved apparatus as embodied in a typical form of construction, by way of example, it will be apparent that the construction may be varied in certain respects, within the purview of my invention. Therefore, without limiting myself in this respect, I claim:

1. An apparatus for handling objects, comprising: a support; a boom pivotally mounted on a substantially horizontal axis on said support to adapt it for angular adjustment; a crane arm pivoted on a vertical axis on said boom to adapt it to pivot in a horizontal plane; and a cable of a length substantially equal to the distance between the pivotal mounting of the boom and the mounting of the crane arm on the boom, said cable being connected between said crane arm and said support for maintaining said arm in horizontal position during all positions of angular adjustment of said boom.

2. An apparatus for handling objects, comprising: a support; a substantially U-shaped boom

having its opposite side members pivoted on a horizontal axis on said support to adapt the boom to pivot to various positions of angular adjustment; a holder pivoted on a horizontal axis extending between said side members; a crane arm pivoted on a vertical axis on said holder to adapt the arm to pivot in a horizontal plane; and a cable of a length substantially equal to the distance between the pivotal mounting of the boom and the pivotal mounting of the holder thereon, said cable being spaced from the boom and connected between the holder and the support for maintaining said arm in horizontal position during all positions of angular adjustment of said boom.

3. An apparatus for handling objects, comprising: a support; a substantially U-shaped boom having its opposite side members pivoted on a horizontal axis on said support to adapt the boom to pivot to various positions of angular adjustment; a holder pivoted on a horizontal axis extending between said side members and provided with a segmental guide; a crane arm pivoted on a vertical axis on said holder to adapt the arm to pivot in a horizontal plane; and a cable having one end connected to the support and passing over said guide with its other end connected to said crane arm for supporting the latter, the radius of said guide being equal to the distance between said first mentioned horizontal axis and the point of connection of said one end of the cable on said support so that said crane arm is maintained in horizontal position during all positions of angular adjustment of said boom.

4. An apparatus for handling objects, comprising: a support; a substantially U-shaped boom having its opposite side members pivoted on a horizontal axis on said support to adapt the boom to pivot to various positions of angular adjustment; a holder pivoted on a horizontal axis extending between said side members and provided with a segmental guide; a crane arm pivoted on a vertical axis on said holder to adapt the arm to pivot in a horizontal plane; and a cable having one end connected to the support and passing over said guide with its other end

connected to said crane arm for supporting the latter, the arrangement being such that the length of cable extending between said guide and the point of connection of the cable on said support is maintained parallel to an imaginary line extending between said horizontal axes so that said crane arm is maintained in horizontal position at all times.

5. An apparatus for handling objects, comprising: a support; a substantially U-shaped boom having its opposite side members pivoted on a horizontal axis on said support to adapt the boom to pivot to various positions of angular adjustment; a holder pivoted on a horizontal axis extending between said side members; a crane arm pivoted on a vertical axis on said holder to adapt the arm to pivot in a horizontal plane; a cable of a length substantially equal to the distance between the pivotal mounting of the boom and the pivotal mounting of the holder thereon, said cable being spaced from the boom and connected between the holder and the support for maintaining said arm in horizontal position during all positions of angular adjustment of said boom; and means for pivoting said crane arm on said vertical axis.

6. An apparatus as defined in claim 2, and including a pulley at the distal end of said crane arm; a guide element on said holder; a hoisting cable passing over said guide element and said pulley and adapted to be connected to an object to be lifted; and a winch on said support for winding said hoisting cable to lift the object.

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