Feb. 6, 1962 H. N. KEENER 3,019,918

HOIST

Filed March 18, 1959 2 Sheets-Sheet 1

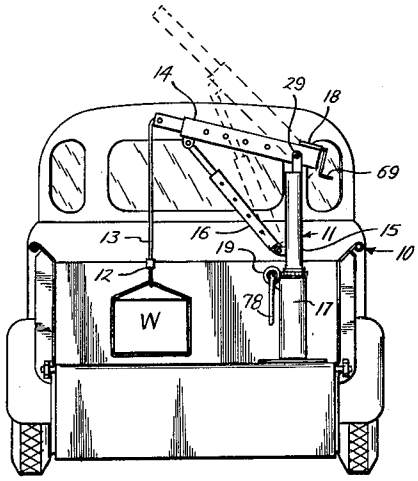
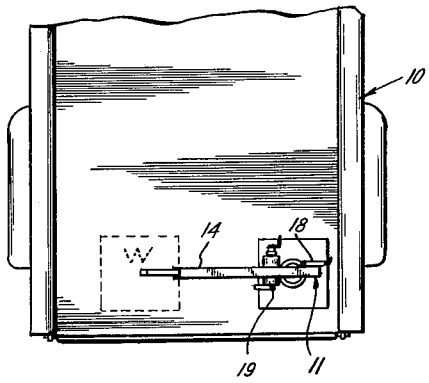


Fig. 1

Fig. 2



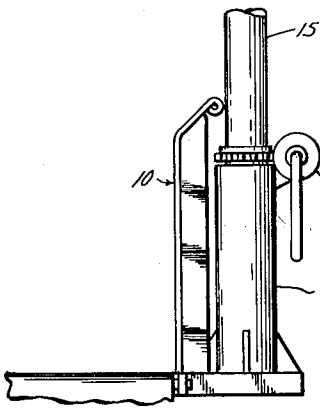


Fig. 3

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HOIST

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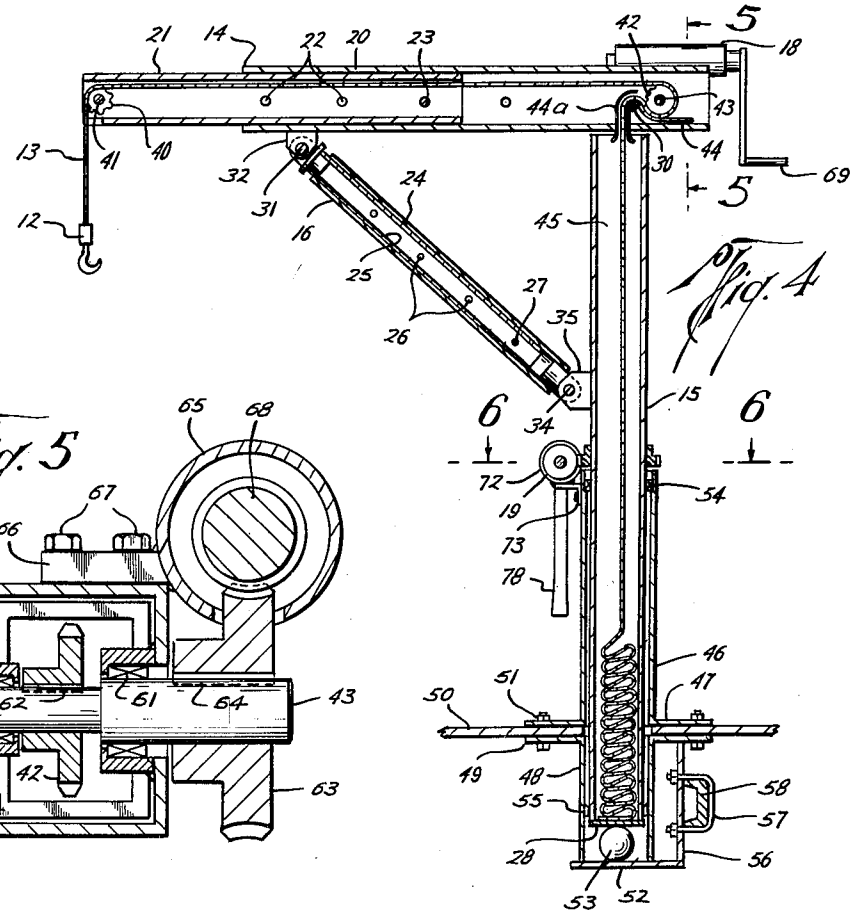


Fig. 4

Fig. 5

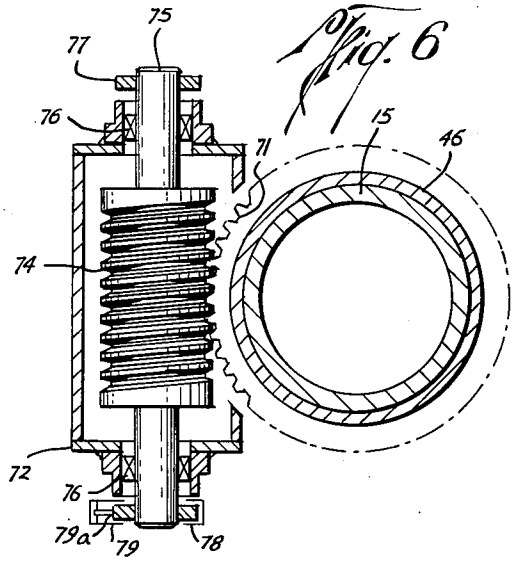


Fig. 6

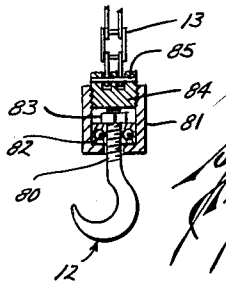


Fig. 7

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HOIST

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My present invention relates to a lifting and lowering hoist which is particularly adapted for use on a vehicle to accomplish loading and unloading thereof.

The problem of providing a hoist on a load-carrying vehicle such as a truck involves several design considerations. Initially, it is necessary that such device be relatively compact in order to accommodate itself within the outside dimensions of the truck body. In other words, the hoist should be of such size when not in use as not to rise above the cab height or extend beyond the outside of the vehicle and interfere with its passage through restricted openings.

Secondly, the height of the truck bed above the ground and the maximum size of the objects to be lifted necessitate a sufficient range of travel of the lifting means to permit its lowering to the ground and its raising to a sufficient height above the truck bed to allow the load to be swung inboard.

In addition to these basic considerations, there are a number of other features which are desirable for greater safety or ease of operation. Simple and rugged design, and mechanical means to aid in handling a load and swinging the boom are examples of such features.

A hoist which answers all of the foregoing needs is difficult to design, particularly for use on vehicles which are of relatively small dimension from the truck bed to the top of the cab, for example, a pick-up truck. The problem is further complicated by the limitations of conventional sources of power. A hydraulic hoist which effects lifting and lowering by means of pressure fluid directed to a cylinder and moving piston does not lend itself to the range of travel which is required. Further, experience has proven that it is virtually impossible to maintain a closed hydraulic system free of leakage over a period of time.

A winch driven cable assembly has been utilized for load handling purposes in a truck-mounted hoist, but it presents its own peculiar problems, in that a drum must be provided on which to store the excess cable, and the placement of this somewhat bulky item at a convenient location for proper operation and safety of the operator is difficult of accomplishment.

The foregoing discussion establishes the background which led to my invention, one of its primary objects being to provide a truck-mounted hoist which is of proper size to be conveniently accommodated on the work bed of a load-carrying vehicle and which may be adjusted to the proper configuration to accomplish any load handling assignment consistent with the capacity of the vehicle.

It is also an object of my invention to provide a hoist which is readily extensible both upwardly and outwardly to produce flexibility with regard to size of load and range of travel of the lifting and lowering means.

It is also an object of my invention to provide a truck-mounted hoist in which a sprocket driven roller chain is employed as the moving element for lifting and lowering loads, thereby overcoming the objectionable features of either hydraulic cylinders or winch and cable assemblies.

It is a further object of my invention to provide a truck-mounted hoist in which the roller chain is carried

within the hoist itself, that portion of the chain which is not in use at any given moment being stored therein, whereby the unit is made safe for the operator, simple in design, and convenient to operate.

It is a further object of my invention to provide a truck-mounted hoist which includes mechanical means for producing rotation thereof about a vertical axis whereby the hoist boom can be swung inboard or outboard.

It is a further object of my invention to provide a hoist which may be mounted readily at any location either in or adjacent to the load bed of a vehicle.

It is also an object of my invention to provide a truck-mounted hoist which is simple and economical in construction and sufficiently rugged to perform without malfunction under prolonged conditions of severe use.

The foregoing and other objects of my invention which shall become apparent are accomplished by means of a hoist unit comprising a stationary base on which is rotatably mounted a hollow vertical member. A longitudinally extensible boom is mounted atop the vertical member and is rotatable in a vertical plane about the pivot by which it is secured thereto. An extensible knee brace interconnects the vertical member and the boom and supports the boom in any of several predetermined angles relative to the horizontal as the boom is moved about its pivotal mounting. The moving element of the hoist which accomplishes the load handling function is a conventional roller chain having load attaching means such as a hook at one end thereof. The chain extends from the hook, over a free sprocket at the outboard end of the boom, within the boom to a worm and worm gear driven sprocket at the inboard end of the boom, and thence downward into the hollow interior of the vertical member where that portion of the chain which is not in use conveniently nests atop itself. An additional feature is provided by a worm mounted on the stationary base of the hoist which coacts with worm gear teeth affixed about the periphery of the vertical member to produce controlled rotation thereof about a vertical axis as the worm is driven by a crank handle attached thereto.

The presently preferred form of my invention is illustrated in the attached drawings in which:

FIG. 1 is an elevation of my hoist mounted on the bed of a pick-up truck;

FIG. 2 is a plan view of the installation shown in FIG. 1;

FIG. 3 is an elevation of an alternate installation;

FIG. 4 is an enlarged elevation of my hoist in partial section;

FIG. 5 is a section along line 5—5 of FIG. 4;

FIG. 6 is a section along line 6—6 of FIG. 4; and

FIG. 7 is a view in section of the load handling hook.

Referring now to FIGS. 1 and 2, reference number 10 designates the pick-up truck on which my hoist, indicated generally as 11, is mounted. A load W is suspended by the hook 12 on the terminal end of roller chain 13, and the path of travel of the chain is inward along the boom 14 and downward into vertical member 15. Knee brace 16 interconnects the two last named elements and the vertical member 15 is rotatably mounted on the base member 17. The hoist operating means for moving in and paying out the chain are shown as 18, and the boom swinging means connecting the base member 17 and the vertical member 15 is designated by the numeral 19.

In FIG. 3, the hoist is mounted outside the confines of the truck bed, but within the limits defined by the outermost extension of the truck fender. This installation is equally satisfactory and has the added advantage of pre-

serving the entire bed of the truck for pay load. It is apparent that in each of these installations, the base member 17 is attached to the frame of the truck in such manner as to react the loads on the hoist.

The dotted lines in FIG. 1 indicate an alternate configuration of the hoist in which the extensible features of the boom 14 and knee brace 16 are illustrated. The means of effecting such change shall be described in subsequent paragraphs.

FIGS. 4 through 7 illustrate the details of the design of the hoist. In FIG. 4, the boom 14 comprises an outer member 20 and an inner member 21 which is slidable therein to produce extension of the boom as desired. The outer and inner members are provided with matching transverse holes 22 to mark the predetermined increments of extension. In FIG. 4, the boom is in one of its intermediate positions, and the pin 23 extends through one set of holes to maintain such configuration.

The knee brace 16 is similar in design to the boom, having an outer member 24, an inner member 25, a series of holes 26, and a locking pin 27 to define its various positions. In FIG. 4, the knee brace is in a retracted for foreshortened position.

The vertical member 15 is a hollow cylinder which is closed at the bottom by plate 28. At its top are two upwardly extending lugs 29, shown in FIG. 1, between which the boom 14 is accommodated. Pin 30 interconnects the lugs 29 and the boom to provide a horizontal axis about which the boom rotates to any of several attitudes for more advantageous approach to load handling problems.

The knee brace 16 is connected to the outer member 20 of boom 14 by pin 31 which extends between matching lugs 32 on the bottom thereof and the end of inner member 24, and is similarly connected to the vertical member 15 by pin 34 extending between lugs 35 thereon and the end of outer member 25. When it is desired to lift the boom, the pin 27 is withdrawn from outer and inner members 24 and 25, and the knee brace is lengthened by sliding the inner member outwardly relative to the outer member, after which the pin 27 is repositioned through the appropriate hole 26 to lock the brace in its extended position. It is apparent that extension of the brace will rotate the boom about pin 30 into a new position, i.e., a greater vertical angle relative to the axis of the vertical member 15.

At the outboard end of inner member 21 of boom 14 is a sprocket 40 carried by the shaft 41 which is journaled into the walls of member 21 for rotation relative thereto. At the opposite or inboard end of boom 14 is the hoist operating means 18 comprising in part a driven sprocket 42 mounted on shaft 43 which is journaled within the walls of outer member 20. The details of this assembly shall be described in subsequent paragraphs.

Within the outer member 20 of boom 14 immediately above the upper end of vertical member 15 is the chain guide 44 and 44*a* which is adapted to direct the chain 13 about the sprocket 42 and downward into the hollow bore 45 of vertical member 15 which constitutes a chain storage chamber. The chain guide 44 is adapted to hold the chain 13 in position about the sprocket 42 over approximately five-sixths of its circumference.

The vertical member 15 is rotatably mounted within base member 17, a dual section assembly comprising an upper hollow cylinder 46 having an outturned flange 47 around the bottom thereof and a lower hollow cylinder 48 having an outturned flange 49 around the top thereof. Flanges 47 and 49 are substantially coextensive and bear against the top and bottom respectively of the bed 50 of the vehicle, in which position they are maintained by bolts 51 passing therethrough. The bed 50 is drilled to define a part of the continuous cylindrical bore through members 46 and 48 which surrounds the lower portion of vertical member 15.

The bottom of member 48 is closed by a plate 52 and

a ball 53 between plates 28 and 52 allows rotation of the vertical member 15 thereabout. The inside diameters of members 46 and 48 are somewhat greater than the outside diameter of the vertical member to accommodate a friction reducing bearing or bearing surface 54 within the upper part of member 46 and spacing lugs 55 within the lower part of member 48, the two last described elements serving to reduce rotational friction and maintain the vertical member 15 and base member 17 in coaxial relationship.

The lower section 48 of the base member is attached to the frame of the vehicle in any convenient manner, as for example, the bracket 56 held by U bolts 57 about the channel member 58 which forms a part of the chassis.

It is apparent that rotation of the vertical member swings the boom, and mechanical means 19 are provided to simplify this operation and eliminate danger to the operator in attempting to accomplish it by direct force on the load or boom. The details of the boom swinging means shall be described in subsequent paragraphs.

Referring now to FIG. 5, the shaft 43 extends through the outer member 20 of the boom 14 and bearings 60 and 61 allow rotation thereof. The sprocket 42 is secured to the shaft 43 by key 62 and a worm gear 63 is secured to the end of shaft 43 which extends outside the outer member 20 by a key 64. A housing 65 is mounted atop the outer member 20 by means of a lug 66 welded to the housing and bolts 67 which mate with tapped recesses in the outer member. Rotatably mounted within the housing is a worm 68 which engages the worm gear 63 to produce rotation thereof when the worm is driven. For such purpose a crank handle 69 is secured to the end of the worm as shown in FIGS. 1 and 4; however, it will be apparent that motor driven means could be substituted for the crank handle as desired.

Experience has indicated that in certain installations it may be desirable to provide positive locking means on the hoist operating means 18 to prevent reverse operation when a load is suspended from the hoist. This can be accomplished readily with a ratchet wheel on worm 68 and a locking pawl on the housing 65, outer member 20 of the boom 14, or lug 66. Such ratchet and pawl obviously would be adapted to allow rotation of the worm in a direction tending to reel in the chain and to prevent rotation in the opposite direction. When the services of the locking means are not required, the pawl can be rotated out of the engagement with the ratchet wheel as is customary in an arrangement of this type.

FIG. 6 illustrates the arrangement of the boom swinging means 19. A circle of worm gear teeth 71 are attached about the periphery of vertical member 15 immediately above the point at which it emerges from the cylinder 46. Housing 72 is secured to the cylinder 46 by bracket 73, and the worm 74 within the housing engages the teeth 70. Worm 74 is attached to shaft 75 which is rotatably mounted within the housing 72 by bearings 76. Crank handle 77 and ratchet arm 78 are attached to shaft 74 to produce rotation thereof. The handle and arm are shown at opposite ends of the shaft 75, but it is apparent that both could be mounted at the same end and serve equally well. Rotation of the worm 74 by means of either of these members will rotate the vertical member within the base member to swing the boom.

The provision of dual means for driving the worm is for the purpose of facilitating operation of the boom swinging means. The relatively short crank handle 77 may be used when there is no load on the hoist, at which time its lesser mechanical advantage would not pose a problem. Under load, the resistance of the boom to rotation might be increased to a point where the crank handle could not readily perform its task. Under such circumstances the long ratchet arm 78 would be employed, it being understood that a conventional ratchet assembly, well-known in the art, is incorporated into the arm at its

point of attachment to the shaft **75** so that in a selected direction of rotation, the ratchet pawl **79** will engage the ratchet teeth **79***a* on the shaft and drive it whereas when the arm is moved in the opposite direction, the pawl will fail to engage the teeth and thus the arm will rotate relative to the shaft into position for a new driving stroke.

The conventional roller chain employed in my winch cannot be rotated about its own axis to any great extent without damage. Thus the hook **12** is provided with a swivel mounting whereby it may rotate above the axis of the chain. This arrangement is best shown in FIG. 7 in which the shank **80** of the hook extends into the lower portion of the swivel housing **81**, through the ball thrust bearing **82**. A nut **83** is attached about the threads on the terminal end of the shank **80** and bears against the upper portion of the bearing **82**. The chain receiving lug **84** is threadably engaged within the upper portion of the housing **81**, and the endmost link of the chain **13** is received within the apertures of the chain receiving lug and secured by pin **85**. Thus the hook **13** may rotate relative to the housing **81** on thrust bearing **82** and the chain is free to flex in a normal way about the pin **85**.

The foregoing description relates to the presently preferred embodiment of my invention. However, it will be obvious to one skilled in the art that it could be modified in several particulars without departing from its spirit. Thus, I desire to protect by Letters Patent all forms of the invention falling within the scope of the following claims:

1. A hoist comprising a base member, a vertical member rotatably mounted on said base member, a chain storage chamber within said vertical member, a longitudinally extensible boom member pivotally mounted atop said vertical member for rotation about a horizontal axis, said boom member having an inboard and an outboard end and a sprocket chamber within said inboard end, boom locking means on said boom to maintain said boom member in the desired predetermined position of extension, a longitudinally extensible brace member interconnecting said vertical member and said boom member at points intermediate their ends, brace locking means on said brace member to maintain said brace member at various predetermined lengths to position said boom member at various desired angles relative to said vertical member, a first sprocket rotatably mounted at the outboard end of said boom member, a second sprocket rotatably mounted within said sprocket chamber at said inboard end of said boom member, a worm and worm gear mounted on said boom and connected to said second sprocket to produce rotation thereof, a roller chain extending from said first sprocket along said boom member around said second sprocket and downward into said chain storage chamber within said vertical member, and chain guide means mounted within said sprocket chamber of said boom member adjacent said second sprocket and projecting into said chain storage chamber to hold said chain against said second sprocket over a substantial portion of the circumference thereof and guide said chain into said storage chamber.

2. A hoist for use on the bed of a load carrying vehicle to accomplish loading and unloading thereof comprising a base member; a vertical bore extending into said base member; a vertical member carried within said bore and extending upwardly therefrom; a chain storage chamber within said vertical member; a longitudinally extensible boom member pivotally mounted atop said vertical member for rotation about a horizontal axis, said boom member comprising an outer member, an inner member carried within and longitudinally slidable relative to said outer member, a spaced series of mating transverse bores through said outer and inner members, and a pin removably insertable through said bores; a longitudinally extensible brace interconnecting said outer member of said boom and said vertical member, said brace member comprising an outer member, an inner member carried within and longitudinally slidable relative to said outer member, a spaced series of mating transverse bores through said outer and inner members, and a pin removably insertable through said bores; a first sprocket rotatably mounted at the outboard end of said inner member of said boom member; a second sprocket rotatably mounted at the inboard end of said outer member of said boom member; a rotatable worm mounted on said boom member at said inboard end; a worm gear attached to said second sprocket and in operative engagement with said worm; a crank handle attached to said worm to produce rotation thereof; a roller chain extending from a free end at the outboard end of said boom member, around said first sprocket, within said boom member, around said second sprocket, and downward into said chain storage chamber within said vertical member; a chain guide within said inboard end of said boom member projecting into said chain storage chamber to hold said chain in engagement with a substantial portion of the circumference of said second sprocket and guide it into said chain storage chamber; load handling means attached to said free end of said roller chain and axially rotatable relative thereto; and boom swinging means comprising a worm rotatably mounted on said base member, worm gear teeth secured about the periphery of said vertical member in operative engagement with said worm, and a handle attached to said worm to produce rotation thereof.

3. The combination of claim 2 and a ratchet arm attached to said worm of said boom swinging means to produce consecutive increments of rotary movement thereof responsive to reciprocating rotation of said ratchet arm through a limited arc.

4. A hoist comprising a vertical member having a chain storage chamber therewithin, a hollow boom member mounted atop and extending outwardly from said vertical member, a brace member interconnecting said vertical member and said boom member, a first rotatable sprocket mounted at the outboard end of said boom member, a second rotatable sprocket mounted within said boom member above said vertical member, driving means connected to said second sprocket to produce rotation thereof, chain guide means adjacent said second sprocket and opening into said chain storage chamber, and a roller chain extending from said first sprocket within said boom member around said second sprocket and through said chain guide means into said chain storage chamber.

5. The combination of claim 4 in which said driving means comprises a worm and worm gear in operating relationship mounted on said boom member, and a handle attached to said worm to produce rotation thereof.

6. A hoist comprising a base member, a vertical member rotatably mounted on said base member, said vertical member having a chain storage chamber therewithin, a hollow boom member mounted atop and extending outwardly from said vertical member, a brace member interconnecting said vertical member and said boom member, a first rotatable sprocket mounted at the outboard end of said boom member, a second rotatable sprocket mounted within said boom member above said vertical member, driving means connected to said second sprocket to produce rotation thereof, chain guide means mounted within said boom member and projecting into said chain storage chamber, a roller chain extending from said first sprocket along said boom member around said second sprocket and through said chain guide means into said chain storage chamber, and boom swinging means interconnecting said base member and said vertical member to rotate the latter about its own axis.

7. The combination of claim 6 in which said boom swinging means comprises a worm rotatably mounted on said base member, matching worm gear teeth about the periphery of said vertical member, and means attached to said worm to produce rotation thereof.

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