

Nov. 20, 1956

U. E. LEFFLER
HOISTS

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Fig. 1

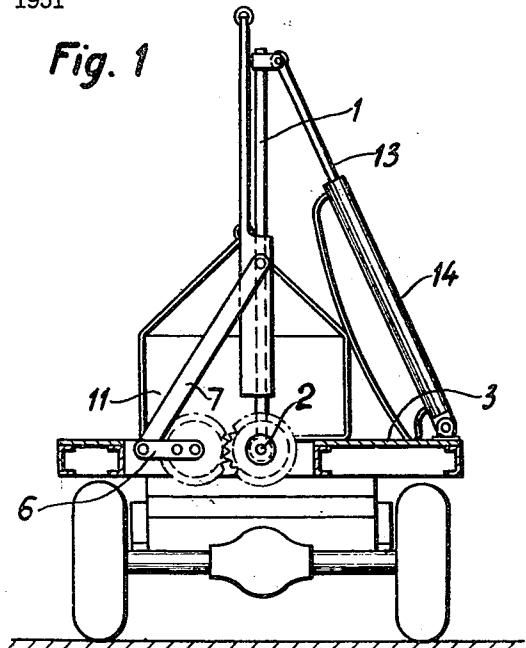


Fig. 2

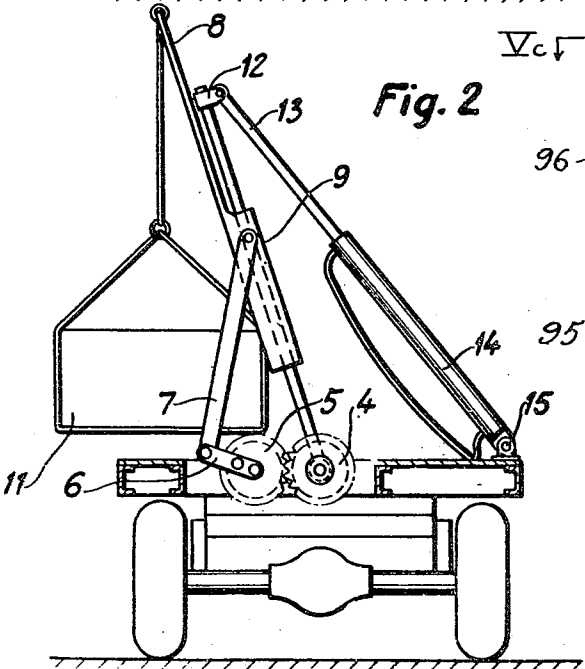


Fig. 5b

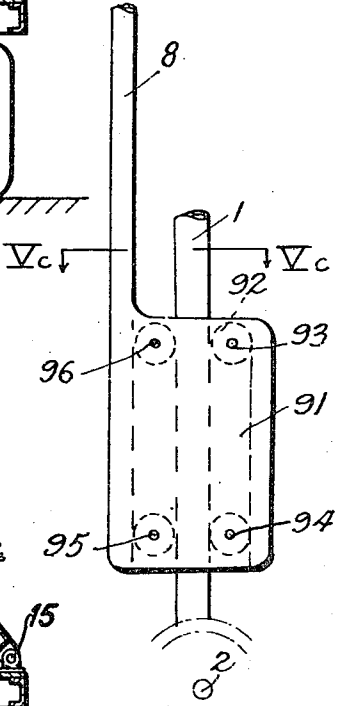
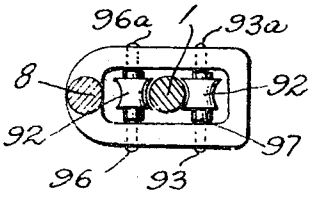


Fig. 5c



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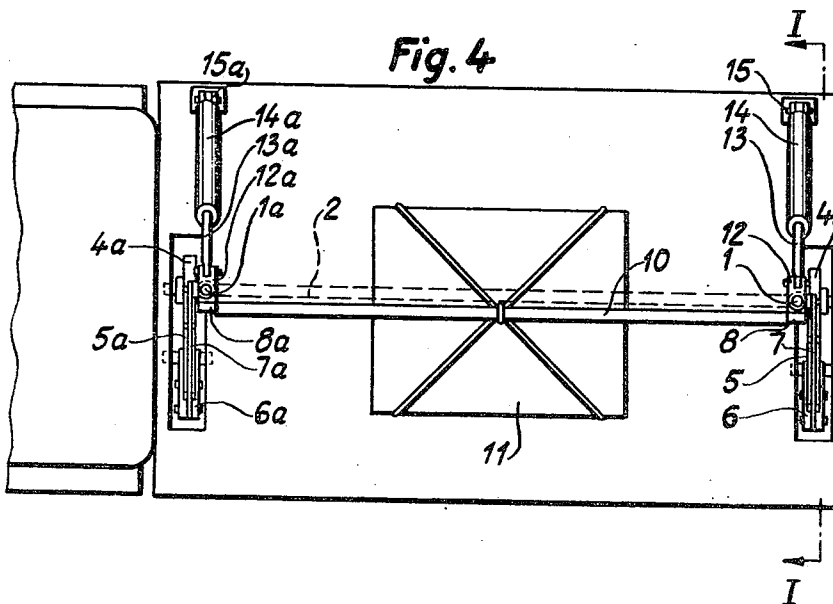
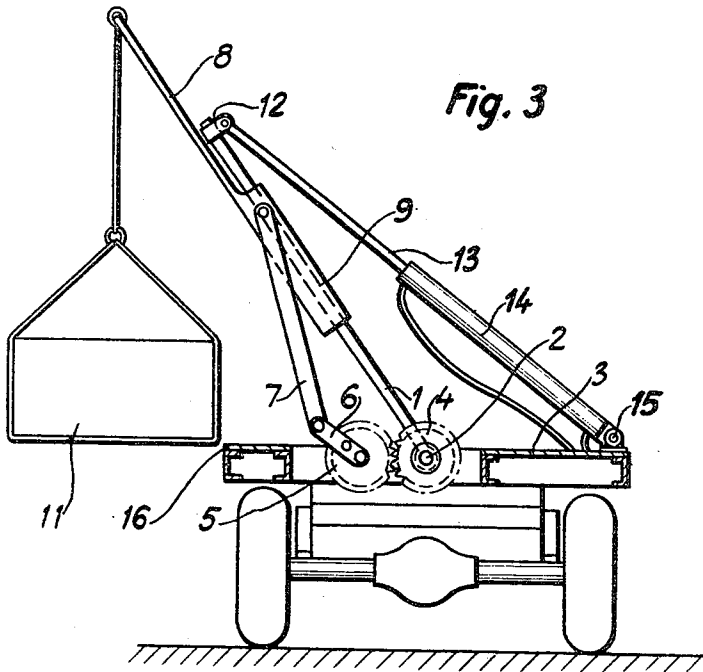
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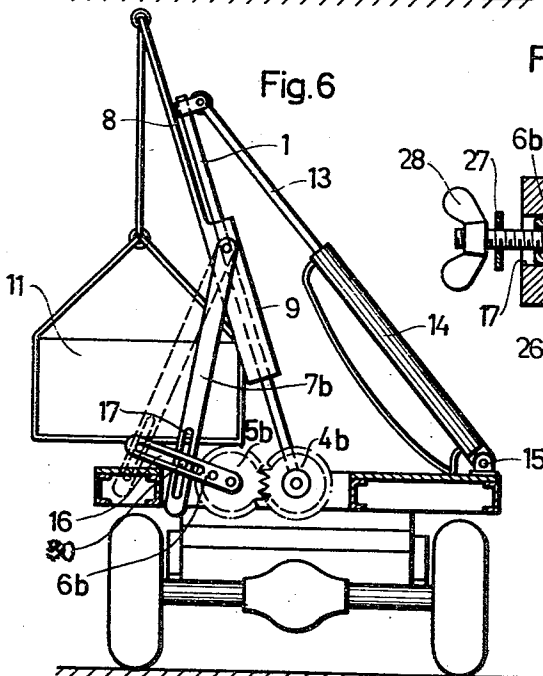
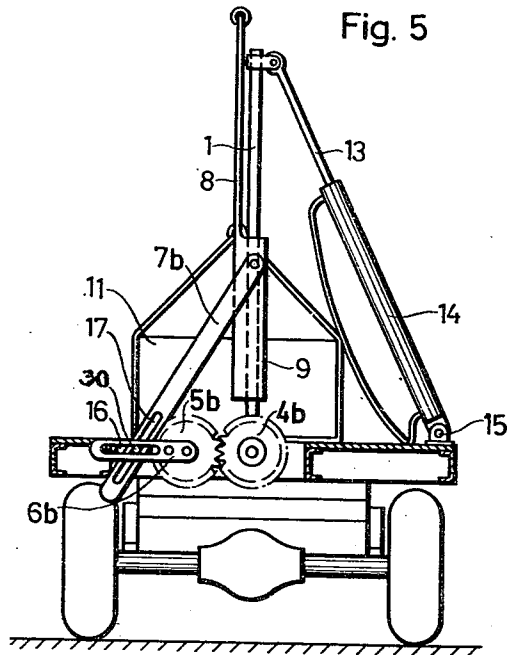
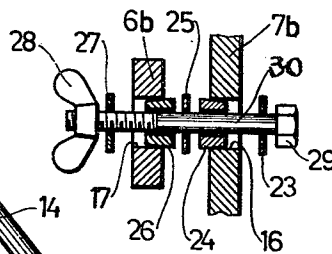


Fig. 5a



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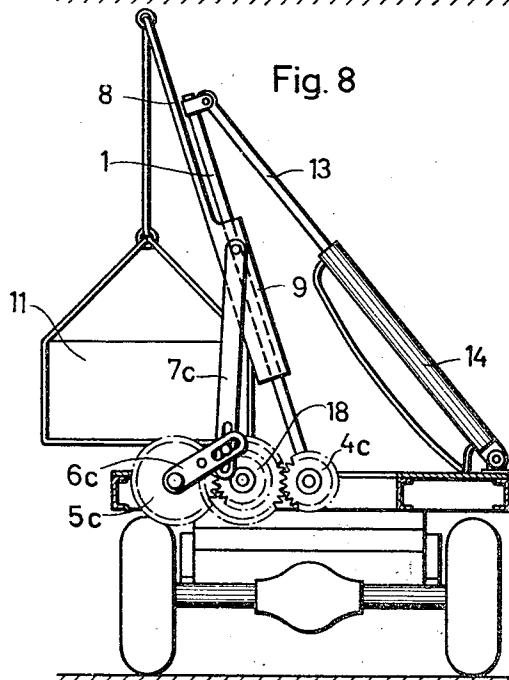
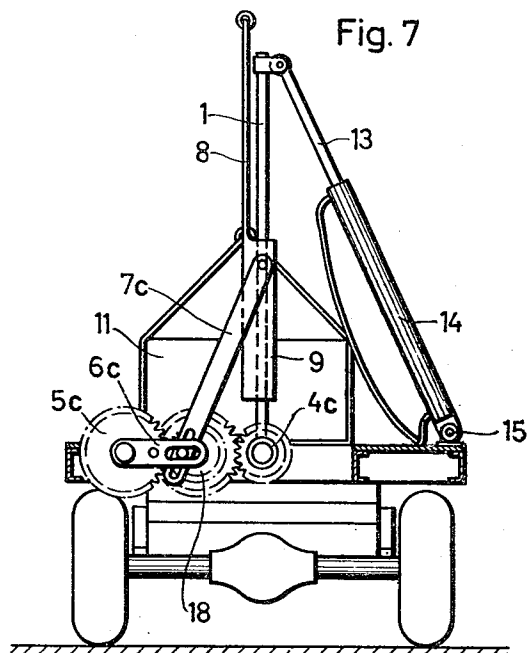
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HOISTS

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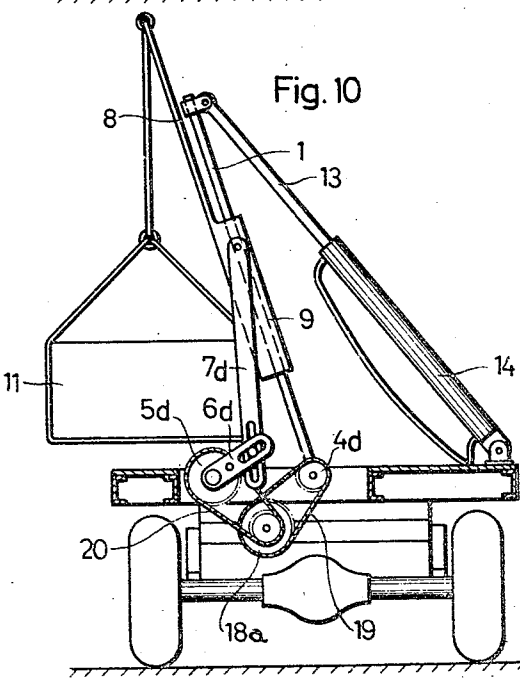
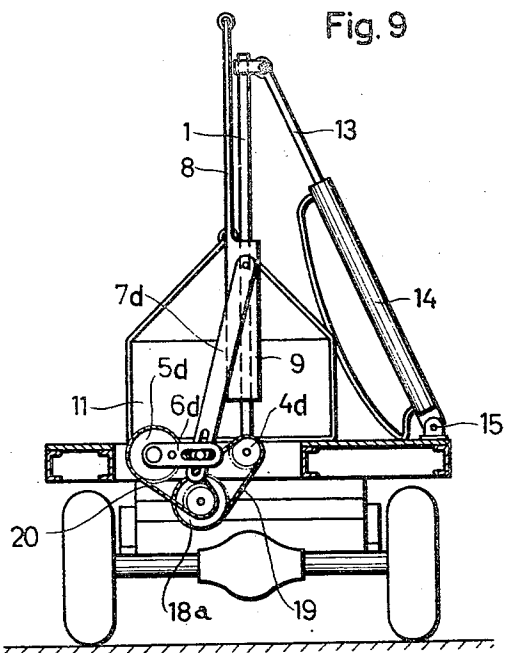
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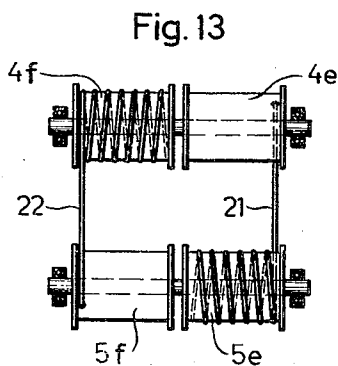
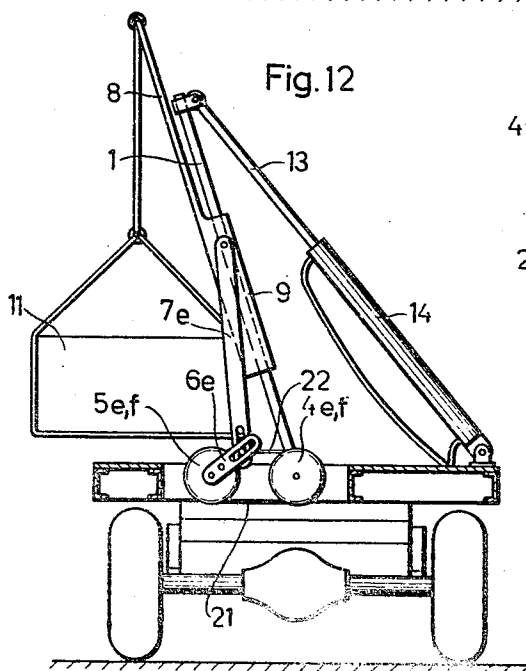
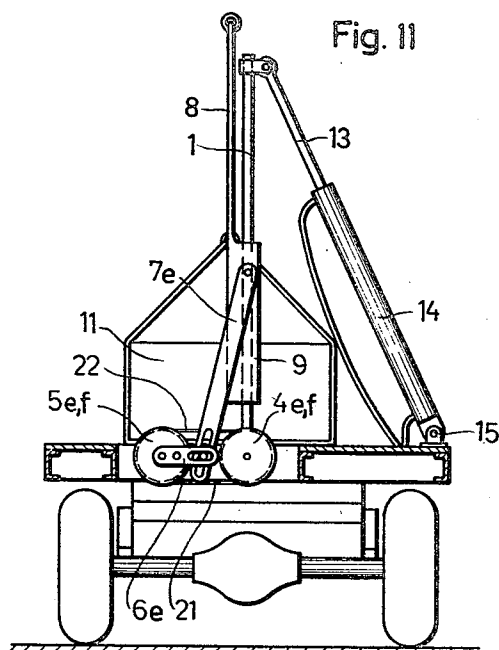
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HOISTS

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Application August 3, 1951, Serial No. 240,169

9 Claims. (Cl. 212—8)

The present invention relates to a hoist having a lifting arm which is tiltably mounted on a substantially horizontal support, such as the platform of a truck, the deck of a vessel or the like, and which is adapted to bring a load suspended in a suspension member of the arm to move to and/or from the support above the edge thereof. In hitherto known devices of this kind it has been necessary to hoist the load in conjunction with the tilting of the arm, in order to prevent that the load being, for instance, a box suspended in ropes, a life boat or the like strikes against the edge of the support, such as the edge of the truck platform or the edge of the deck. In urgent cases this has involved a complication and a loss of time because the number of necessary manipulations has been increased. The present invention has for its purpose to facilitate the loading and unloading while using a single operating member and consists substantially therein that the suspension member is displaceable along the lifting arm under the influence of a gearing positively governed by the angular position of the lifting arm in such a manner that the distance between the point of suspension of the load and the axis of rotation of the arm is automatically increased in the tilting of the arm in a direction to bring the load outwards towards the edge of the support and is automatically reduced when the arm is raised in the opposite direction.

According to a preferred embodiment of the invention the bearing includes two toothed wheels the first one of which participates in the tilting movement of the arm and the second is rotatably mounted on the support and engages the first wheel and rotates in a direction opposite thereto and that a rigid link connects the suspension member with a point on the second wheel. It is then preferred to select the tooth engagement between the two toothed wheels in such a way that said distance has its maximum in a position of the arm in which the load is passing over the edge of the support.

The invention will be more closely described with reference to the accompanying drawings on which

Fig. 1 is a rear view of an embodiment of the invention and a partial section on line I—I in Fig. 4.

Fig. 2 is a similar view as that of Fig. 1 but having the lifting arm in a beginning tilting position.

Fig. 3 is a further similar view showing the tilting position when the load is passing the edge of the support.

Fig. 4 is a plan view corresponding to the positions of the parts indicated in Fig. 1.

Fig. 5 illustrates a modified form of the invention,

Fig. 5a is a detail view of the adjustable fastening means utilized in the device of Figures 5 and 6.

Figures 5b and 5c illustrate the possible provision of rollers to reduce or avoid sliding friction in the lifting device of the present invention.

Fig. 6 is a further view of the device of Fig. 5, but having the lifting arm in a tilting position.

Fig. 7 is a view, corresponding to that of Figure 1, and showing a further embodiment of the invention.

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Fig. 8 is a further view, corresponding to that of Figure 2, of the embodiment shown in Figure 7.

Fig. 9 is a view, corresponding to that of Figure 1, and showing still another embodiment of the invention.

Fig. 10 is a further view, corresponding to that of Figure 2, of the embodiment shown in Figure 9.

Fig. 11 is a view, corresponding to that of Figure 1, and showing a still further embodiment of the invention.

Fig. 12 is a further view, corresponding to that of Figure 2, of the embodiment shown in Figure 11, and

Fig. 13 is a detail view of the drum and cable configuration utilized in the embodiments of Figures 11 and 12.

In the embodiment as illustrated there are two lifting arms 1 and 1a which below are rigidly interconnected by means of a shaft 2. This is rotatably mounted on a truck platform 3 so that its axis of rotation is substantially horizontal. To the shaft 2 there are further fixed two gear wheels 4 and 4a which are intermeshing each with one corresponding gear wheel 5 and 5a respectively. These are rotatably mounted in the frame of the truck platform 3 and are each provided with one connecting arm 6 and 6a respectively rigidly secured thereto. A rigid link 7, 7a is articulately connected to said arm, if desired, at a point thereof the radial distance of which from the axis of rotation of the wheel 5, 5a is adjustable. Such an adjustable fastening configuration is shown in Figures 5, 5a, and 6. The opposite upper end of the link 7, 7a is jointly connected to the suspension member which is shaped as an extension 8, 8a displaceable and guided along the lifting arm 1 and 1a respectively, so as to move in parallel therewith. In certain of the appended claims this displaceable mounting of the suspension member 8, 8a on lifting arm 1, 1a will be termed a "slidable" displacement. It must be emphasized that this terminology refers to the fact that the relative displacement between members 8, 8a and arms 1, 1a is in translation, and that the said elements 8, 8a and 1, 1a are so guided and restricted relative to one another that they remain substantially parallel throughout the said translation. It should further be noted that the terminology is meant to encompass configurations wherein means such as rollers are interposed between members 8 and 1 to reduce or avoid sliding friction, such expedients being well known to those skilled in the art. Such rollers could be provided as indicated in Figures 5b and 5c. Four rollers 92 having a concave running surface are provided in the sleeve 91. They are provided with shafts 97 and pins 93, 93a of smaller diameter and rotatable in holes in the sleeve 91, as indicated at 93, 93a, 94, 95, 96 and 96a. The rollers bear against opposite sides of the lifting arm 1 but are free from contact with the insides of the sleeve 91. In this way the sleeve 91 and suspension member 8 are firmly guided in being displaced with parallel motion, and with a much reduced friction along the arm 1. The restrictive guiding referred to above, and providing the defined "slidable displacement," is effected in the shown example by a sleeve 9, 9a enclosing the lifting arm 1 and on which the link 7, 7a is pivotally mounted. The upper ends of the extensions 8, 8a are interconnected by means of a transversal carrying rod 10 on which the load 11 is suspended. The lifting arms 1 and 1a are above provided with a coupling piece 12, 12a on which an operating rod 13 and 13a respectively is jointly connected. The opposite end of the operating rod 13, 13a is secured to a piston not shown on the drawing and reciprocable in a cylinder 14, 14a to which pressure oil is supplied. Said cylinders are swingably mounted at 15, 15a on the platform of the truck.

The arrangement operates as follows, reference being had only to those parts which are at the rear part of the platform for the sake of simplicity. In the starting

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position shown in Figs. 1 and 4 the load 11 is assumed to rest on the platform 3 the lifting arm 1 being then about vertically. If now the cylinder 14 is fed with pressure oil underneath the piston movable therein the operating rod 13 will be forced out and force in turn the lifting arm 1 to tilt to the left, for instance, to the position shown in Fig. 2. Hereby the toothed wheel 4 is rotated anticlockwise over an angle and forces the toothed wheel 5 to rotate clockwise a corresponding angle. Hereby the arm 6 is raised so that the link 7 forces the sleeve 9 and the arm 3 to slide upwards so that the load 11 is raised according to Fig. 2.

If the operating rod 13 is pushed out further from the cylinder 14, the process is continued so that the sleeve 9 is pushed upwards further along the lifting arm 1 so that the load 11 will clear the outermost edge 16 of the platform as shown in Fig. 3.

The gearing ratio between the wheels 4 and 5 and 4a and 5a respectively as well as the point of coupling of the link 7, 7a on the toothed wheels 5, 5a may be so selected that the load 11 in question will clear the edge 16 of the support in a corresponding position and will rest on the support 3 when the arm 1, 1a according to Fig. 1 is nearly vertical in a corresponding other position. Then the gearing ratio may be so selected that the toothed wheels 5, 5a rotate less than 180° when the lifting arm 1, 1a swings from a vertical position according to Fig. 1 to the position for the bringing of the load beyond the edge of the support according to Fig. 3. In the shown example this angle is only about 45°. As an extreme case the gearing ratio and the tooth engagement may be so selected that when the lifting arm 1, 1a takes up a vertical position the radius between the point of connection of the link 7, 7a on the toothed wheel 5, 5a and the center of rotation thereof is parallel with the link 7, 7a and directed from the suspension member 8, 9 whereas when the lifting arm 1, 1a takes up its position corresponding to the bringing of the load past the edge 16 said radius is parallel with the link 7, 7a but directed towards the suspension member 8, 9. In this way the hoisting ability of the gearing is utilized in tilting as far as possible.

By changing the gearing ratio, the length of the connection arm 6 and the position of the tooth engagement in relation to the two wheels one is apparently able to vary within wide limits that curve which the point of suspension of the load is intended to describe in loading and unloading.

In certain cases it may be preferable to provide more than two intermeshing toothed wheels, such as is shown in Figures 7 and 8 and/or to interconnect the toothed wheels in pairs by means of chains instead of by means of a direct tooth engagement, such as is shown in Figures 9 and 10 care then being taken to select properly the direction of rotation.

As is shown in Figures 11, 12 and 13, the toothed wheels 4, 5 and 4a, 5a respectively may be replaced by rope or cable drums having two rope or cable parts crossing one another and being fixed on their corresponding drums which parts are provided in a manner known per se so that in operation the one part is wound on the first drum and wound off the second drum while at the same time the other part is wound on the second drum and wound off the first drum.

Examining the foregoing modifications of the present invention in somewhat greater detail, Figures 5, 5a, and 6 disclose one possible arrangement by which the position of the point of articulation of arm 6, 6a and link 7, 7a may be varied. The arrangement is substantially the same as that disclosed in Figures 1 and 2, except that the gears 4 and 5 have now been designated 4b and 5b, the modified link 7 is now termed 7b, and the modified arm 6 is designated as 6b. Arm 6b has an elongated slot 16 defined adjacent one end thereof and link 7b, in turn, has a further elongated slot 17 therein. Passing

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through slots 16 and 17 is an elongated bolt 30 having a head 29 at one end thereof and a nut 28 at the other end. Washers 23-27 inclusive are also spaced on said bolt as shown in detail in Figure 5a, the washers 24 and 26 being preferably tapered in cross-section somewhat so that, upon the tightening of wing nut 28, they will tend to become wedged in slots 16 and 17 respectively thereby aiding in the firmness of the connection. It should be noted that when the wing nut is so tightened, the elements 7b and 24 are disposed between and bear upon washers 23 and 25 while the elements 6b and 26 are disposed between and bear upon washers 25 and 27. The forces imposed by washers 25 and 27 upon the elements 6b and 26 as well as the forces imposed by the washers 23 and 25 upon the elements 24 and 7b are not sufficient to rigidly bind arm 6b and link 7b on the bolt 30, however, and the elements 6b and 7b may be rotated relative to one another with their corresponding washers 26 and 24 on the elongated bolt 30. The point of connection between arm 6b and link 7b may be readily varied by loosening wing nut 28, manually varying the relative positions of slots 16 and 17, and then retightening wing nut 28.

Figures 7 and 8 show another embodiment of the present invention, in which more than two intermeshing toothed wheels are utilized. In this latter embodiment, link 7 has been redesignated 7c, arm 6 is termed 6c, and gear wheels 4 and 5 are termed 4c and 5c. As is shown in Figures 7 and 8, gear wheels 4c and 5c have been spaced apart, and a further toothed wheel 18 has been interposed therebetween. Because of this further wheel 18, it will be noted that the direction of rotation of gear wheel 5c, for a given lifting operation, is opposite to that of wheel 5 in Figures 1 and 2. Care must therefore be taken to assure that the direct of rotation is properly considered in the linkage interconnection and, in the embodiment of Figures 7 and 8, this is done by directing arm 6c in a direction opposite to that of arm 6 in Figures 1 and 2. The operational interplay of gears 4c, 5c, and 18 and of the linkages 6c-7c, will be readily apparent from the foregoing discussion in respect to the embodiment of Figures 1 and 2.

Figures 9 and 10 show a still further modification of the device of Figures 7 and 8, in which chains are utilized to interconnect the several toothed wheels rather than relying upon direct tooth engagement therebetween. Arm 6 and link 7 have been retermed 6d and 7d, respectively, while toothed wheels 4 and 5 are now designated 4d and 5d. To provide for chain interconnections, the intermediate toothed wheel 18a is displaced downwardly and chain loops 19 and 20 are passed about toothed wheels 4d-18a and 5d-18a, respectively. The various gear wheel and linkage movements of this embodiment are substantially the same as those of Figures 7 and 8.

In the final embodiment shown in Figures 11, 12, and 13, the toothed wheels 4, 4a and 5, 5a are replaced, respectively, by cable drums 4e-4f and 5e-5f. Arm 6 and link 7 have been retermed 6e and 7e, respectively, in this particular embodiment. As is seen more clearly in Figure 13, a cable portion 21 is wound between drums 4e and 5e and a further cable portion 22 is wound onto drum 5f and off drum 4f. In the particular embodiment illustrated, cable portions 21 and 22 extend, between the drums, parallel to one another; the arm 6e accordingly extends to the right from drum 5e, f to assure proper operation of the system. In the event, however, that the cables are so wound that portions 21 and 22 are made to cross one another, the arm 6e should extend to the left from drum 5e, f.

I claim:

1. A hoist comprising a platform, an elongated lifting arm tiltably mounted at one of its ends on said platform, a first rotatable member connected to said lifting arm adjacent said platform, said first rotatable member be-

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ing movable with said lifting arm whereby the angular position of said first member varies with variations in the tilt position of said lifting arm, a second rotatable member mounted on said platform adjacent said first member and operatively interconnected with said first rotatable member whereby the angle of rotation of said second member is dependent upon the angle of rotation of said first rotatable member, a first rigid link radially connected to said second rotatable member, a load suspension member slidably displaceable along said lifting arm, a second rigid link pivotally connected at one of its ends to said suspension member and pivotally connected at the other of its ends to said first rigid link at a pivot point displaced from the center of rotation of said second member, and means for selectively tilting said lifting arm whereby said suspension member is automatically variably displaced along said lifting arm by said first and second links upon tilting of said lifting arm and upon corresponding rotation of said first and second rotatable members.

2. The hoist of claim 1 wherein said first and second rotatable members are interconnected through a third rotatable member whereby said first and second members rotate in like directions for any given hoist operation.

3. The hoist of claim 1 in which said first and second rotatable members comprise cable drums, said members being interconnected by cables fastened, at their ends, to said drums.

4. The hoist of claim 1 wherein said first and second rotatable members comprise wheels having toothed peripheries, said members being interconnected by a chain passing around said toothed peripheries.

5. A hoist comprising a substantially horizontal support, a first shaft mounted substantially parallel to said support for rotation thereon, a lifting arm attached to said first shaft for tiltable movement on said support upon rotation of said first shaft, a second shaft rotatably mounted on said support, gear means interposed between

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said first and second shafts whereby rotation of said first shaft effects rotation of said second shaft, a suspension member displaceable along the said lifting arm, guide means restricting the displacement of said lifting arm to directions substantially parallel to said lifting arm, and a linkage interconnecting said rotatable second shaft and said suspension member whereby the distance between said suspension member and said first shaft along said lifting arm is automatically changed as said first shaft is rotated to tiltable move said lifting arm.

6. A hoist as claimed in claim 5 in which the said guide means comprises a substantially tubular sleeve attached to said suspension member and surrounding said lifting arm.

7. A hoist as claimed in claim 6, in which the said gearing comprises two intermeshing toothed wheels, one of said wheels being positively coupled to said first shaft thereby to rotate with tilting movement of the lifting arm, the second of said wheels being positively coupled to said second shaft and rotating in a direction opposite to that of the first toothed wheel.

8. The hoist of claim 7 wherein said linkage comprises a first arm rigidly coupled to the second of said toothed wheels, and a second arm jointedly connecting said first arm and said tubular sleeve.

9. The hoist of claim 8 including adjustable means connecting said first arm and said second arm whereby the radial distance between said second shaft and the point of connection of said first and second arms may be adjusted.

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