March 21, 1939. H. W. SHONNARD 2,151,338

LIFTING AND LOWERING MECHANISM

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Fig. 1.

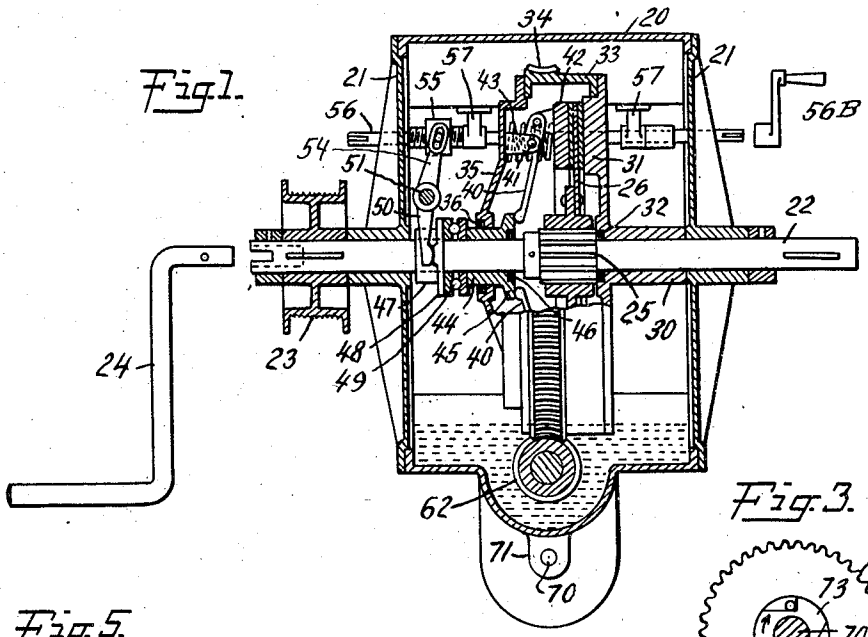



Fig. 3.

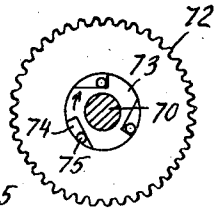



Fig. 5.

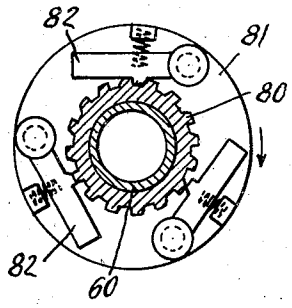



Fig. 2.




Fig. 6.

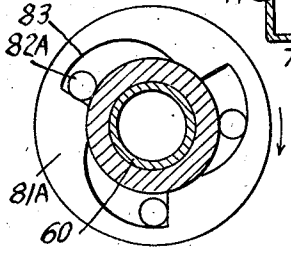
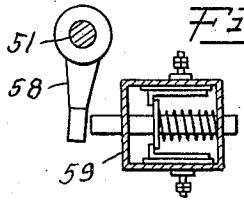



Fig. 4.




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LIFTING AND LOWERING MECHANISM

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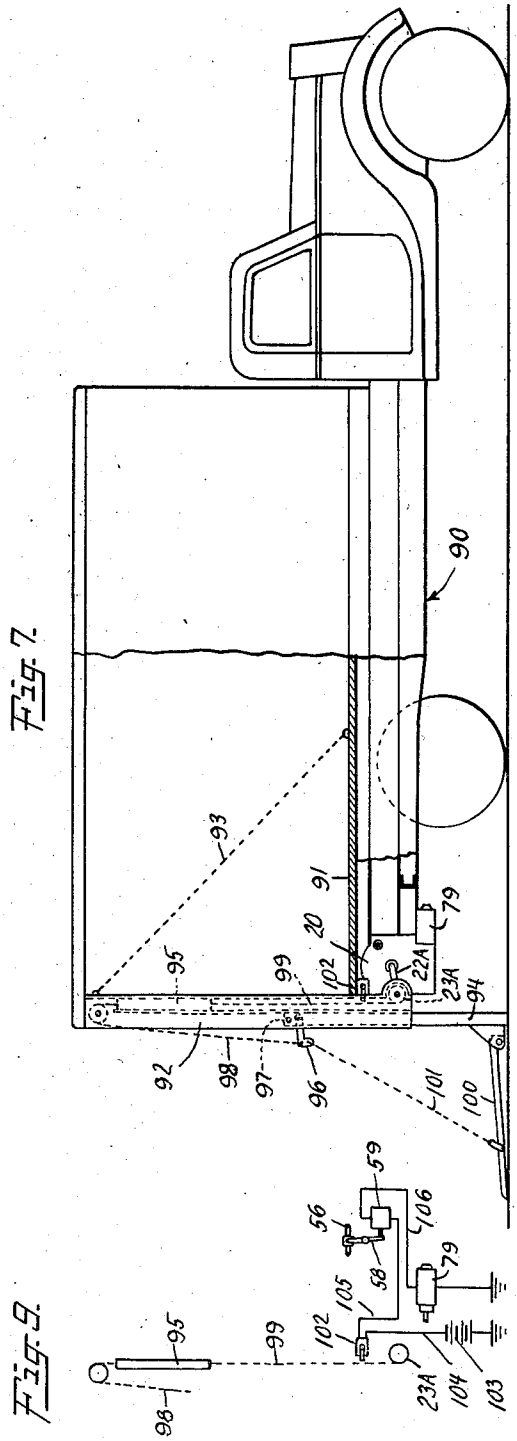



Fig. 7.

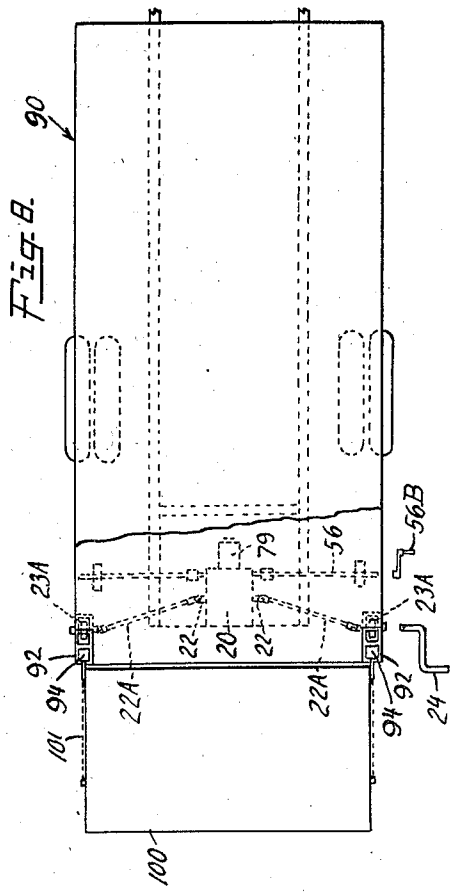



Fig. 8.




Fig. 9.

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Fig. 10.

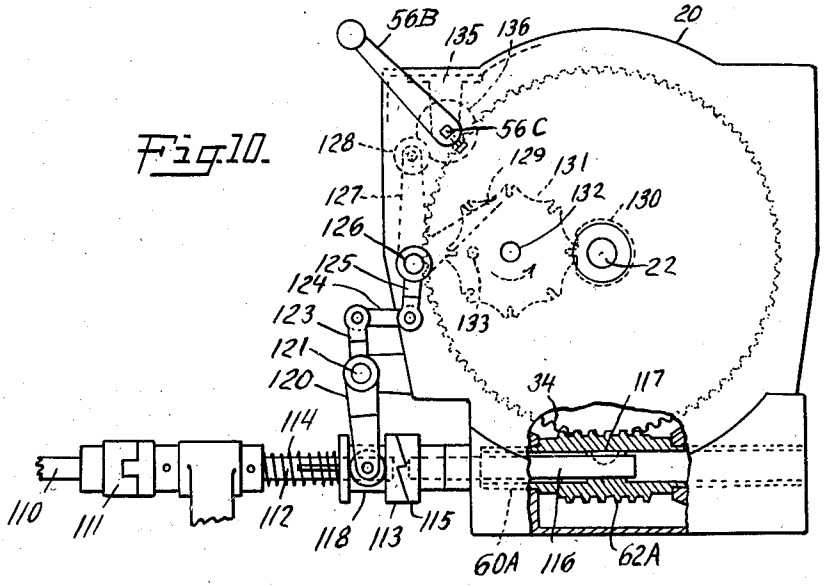
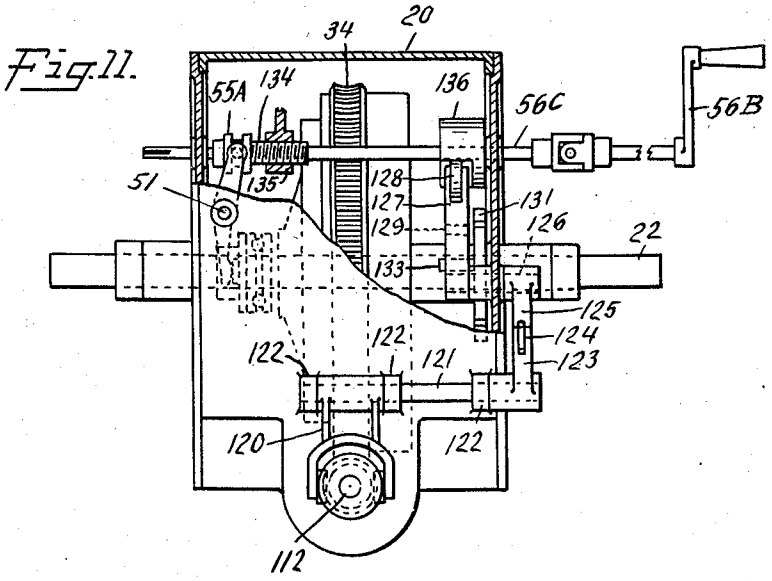



Fig. 11.




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Fig. 12.

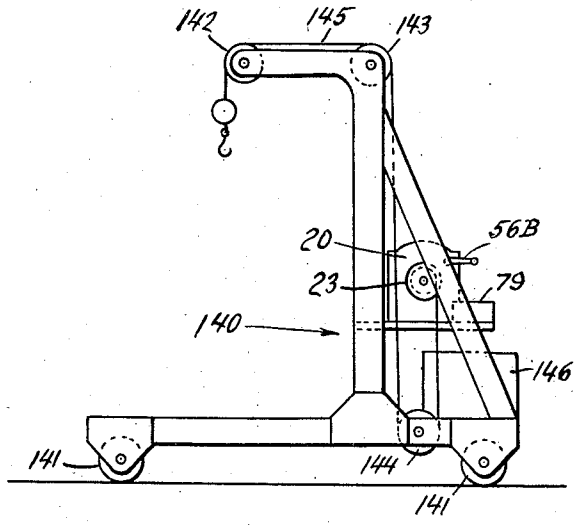



Fig. 13.

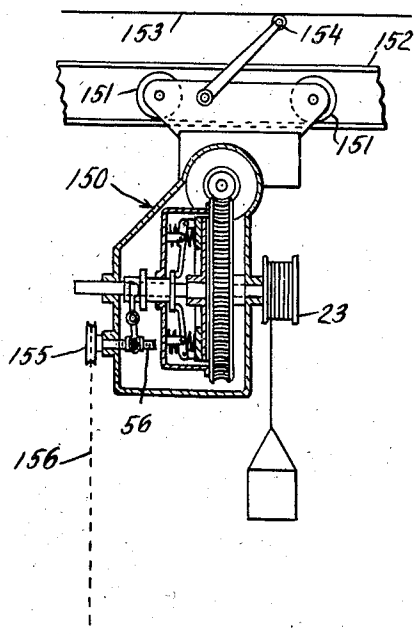
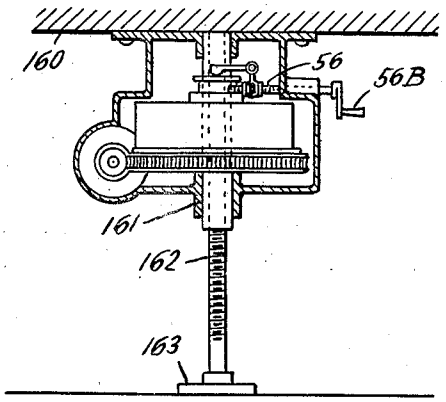



Fig. 14.




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# UNITED STATES PATENT OFFICE

2,151,338

## LIFTING AND LOWERING MECHANISM

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Application January 30, 1937, Serial No. 123,158

12 Claims. (Cl. 254—172)

This invention relates to improvements in lifting and lowering mechanism.

Its object is to provide a simple, compact, efficient and inexpensive apparatus for raising objects from one level to another and for retarding the descent of objects under variable speed control.

Another object is to provide an arrangement for connecting a driving shaft with a hoisting element, such as a cable drum, through a friction clutch for moving such element in one direction and to provide for use of the same clutch as a variable brake for controlling the rate of movement of the element in the opposite direction.

This invention is applicable to tail gate elevators for vehicles, but is in no sense limited to that specific use. Several applications of the mechanism will be illustrated and described to show its wide adaptability.

Some of the more specific objects are to provide an arrangement for positively holding against reverse movement the driving parts which are used to raise a load.

A further object is to provide a single control lever for both lifting and lowering. I also provide an interlocking arrangement, which may be associated with the control lever to prevent release of the clutch for permitting and retarding the descent of a load while the driving force is connected with the hoisting gear and to insure the engagement of the clutch before the driving force can be connected with the hoisting gear.

A still further object is to provide for changing the ratio of driving gears while in mesh and in motion.

These and other objects of the invention will appear in the following specification in which certain embodiments of the invention will be shown and described and their novel features set forth in appended claims.

Referring to the drawings,

Fig. 1 is a sectional end elevation of a preferred embodiment of my invention, the section being taken on the line 1—1 of Fig. 2;

Fig. 2 is a side elevation partly in section of the parts shown in Fig. 1;

Fig. 3 is an end view of an over-running clutch arrangement shown in Fig. 2;

Fig. 4 is a side view of an electric switch and its control lever which are shown in Fig. 2;

Fig. 5 is an enlarged end elevation partly in section of a holding mechanism which is shown in Fig. 2, the section in this figure being taken on the line 5—5 of Fig. 2;

Fig. 6 is a sectional elevation of another form of holding mechanism;

Fig. 7 is a side elevation of a truck provided with a tail gate hoist and my novel actuating and controlling device;

Fig. 8 is a plan view of a part of the truck shown in Fig. 7, and of some of the devices which are mounted thereon;

Fig. 9 is a diagram of some of the parts of the raising and lowering mechanism and of the tail gate hoist and interconnecting electric circuits;

Fig. 10 is a side elevation with parts in section, of a modified arrangement of the control device. This figure shows a transmission shaft of a vehicle motor used to drive the hoisting gearing;

Fig. 11 is an end elevation partly in section of the arrangement shown in Fig. 10;

Fig. 12 is an illustration of another type of apparatus with which this invention may be used, in this particular case showing my raising and lowering mechanism applied to a movable crane;

Fig. 13 shows a similar mechanism applied to an overhead crane; and

Fig. 14 shows the mechanism used as a jack for a vehicle, such for example, as an automobile trailer.

20 designates a casing having removable ends 21 which form bearings for a load shaft 22. In Fig. 1, a cable drum 23 is shown keyed to one end of this shaft. The shaft projects from both of the sides 21, so that drum or other transmission element may be mounted on either of its ends. The ends of the shaft may be constructed to receive a hand crank 24. Intermediate its ends, the shaft 22 has a splined portion 25, on which is non-rotatively, but slidably mounted a friction disk 26.

30 is a hub freely mounted on the shaft 22 and carrying a circular plate 31. 32 is a packing between one end of the hub and the shaft 22. The plate 31 has an inner surface which cooperates with the friction disk 26. 33 is a rim secured to the plate 31, provided with external gear teeth 34. Another plate 35 is secured to the other side of the rim 33. The plates 31, 35 and the rim 33 form an oil-tight chamber within which the clutch mechanism which I am about to describe, is enclosed.

A series of radially disposed levers 40, one of which is shown, are pivotally supported at 41 on the plate 35. 42 is a pressure plate supported on the outer ends of the levers 40 and normally pressed by springs 43 against the friction disk 26. 44 is a collar freely mounted on the shaft 22. The plate 35 is rotatably supported on the outer

surface of this collar. 45 is a flange projecting from the inner end of the collar 44 and bearing against the inner ends of the levers 40. The plate 35 and the collar 44 are provided with oil sealing packings 36 and 46, respectively.

47 is another collar, freely supported on shaft 22 and having an outwardly projecting flange 48. 49 is an anti-friction thrust bearing interposed between the collars 44 and 47.

50 is a shifter which is forked, as shown in Fig. 2, to clear the collar 47, but to bear upon its flange 48. This shifter is affixed to a shaft 51 which is rotatable in stationary bearings 52, 53 in the casing. Another forked member 54 is affixed to shaft 51, spaced from the shifter 50, but within the casing. Between the ends of this forked member 54 is an internally threaded member 55 having pin and slot connections with the ends of member 54. This member 55 is mounted upon a threaded portion of a control shaft 56 which is parallel with shaft 22 outside of the gear teeth 34, but within the casing 20. This control shaft is supported in bearings 57 in the casing and projects through both of its sides 21 to receive a control handle 56B.

58 is another lever affixed to shaft 51 outside of the casing. This is arranged to open a normally closed electric switch 59, a side view of which is shown in Fig. 4.

The shafts 51 and 56 may be located in the positions indicated in dotted lines and designated by 51A and 56A in Fig. 2, if it is desired to place the control shaft below the load shaft 22.

60 is a hollow shaft in bearings 61 in the casing 20. On it is a worm 62 in engagement with the gear 34. 63 is a gear and 64 a member of a spiral jawed clutch. This gear and clutch member are affixed to the shaft 60.

70 is a countershaft supported parallel with shaft 60 in bearings 71. 72 is a gear on shaft 70 which is in mesh with the gear 63. It is connected to be driven in one direction by the shaft 70, by the device shown in Fig. 3 which comprises a disk 73 keyed to shaft 70 on which disk gear 72 is rotatably supported. In this disk are angular pockets 74 in which are locking balls or rollers 75. These cause the gear to be driven by the disk when the latter is rotated in the direction of the arrow, but permit the gear to rotate freely on the disk in the same direction when the gear is driven at a higher rate of speed by another mechanism.

76 is another gear affixed to the countershaft 70, in mesh with a gear 77 affixed to the shaft 78 of an electric motor 79. The motor shaft 78 extends into the hollow worm shaft 60. Slidably but non-rotatively mounted on it is another spiral jawed clutch member 65 which may be moved into and out of engagement with clutch member 64 by a lever 66, pivoted at 67. As shown, the gear 77 is one-half the diameter of the gear 76, but the gears 63 and 72 are of equal diameter. Other gear ratios may be used as long as the gears 77, 76 drive the countershaft 70 at a lower speed than that of the motor shaft 68.

Secured to casing 20 and surrounding worm shaft 60 is a stationary ratchet wheel 80 (Fig. 5). 81 is a disk affixed to worm shaft 60 on which are pivoted a series of pawls 82. These move outwardly under the influence of centrifugal force when the disk 81 is rotated, to clear the teeth of the ratchet wheel, but when at rest at least one of the pawls engages the teeth of the ratchet wheel and holds the disk and worm shaft together, and consequently holds the plate 31 against reverse movement.

Another arrangement for accomplishing this result is shown in Fig. 6. In this case a stationary disk 80A having a cylindric outer surface is affixed to the casing and is surrounded by a disk 81A on the worm shaft. 82A designates locking balls or rollers in angular pockets 83. These permit disk 81A to rotate in the direction indicated by the arrow, but become jammed between the walls of pockets 83 and the outer surface of disk 80A to prevent rotation in the opposite direction. I prefer to make the pockets 83 of sufficient depth to permit the balls or rollers to move out entirely clear of disk 80A under the action of centrifugal force when the disk 81A is in motion.

Before describing further modifications and specific applications of the invention I will describe the operation of the mechanisms shown in Figs. 1–6.

When at rest the parts will be in the relative position in which they are shown, with the shaft 22 and side plate 31 held by one of the pawls 82 against rotation in one direction and the friction clutch engaged by the pressure of the friction disk 26 against plate 31. A load connected by a cable with the cable drum 23 will be held stationary. If it is desired to raise such a load the operator rotates the control shaft 56 in a direction to move member 55 to the right, as viewed in Figs. 1 and 4. This first effects a driving connection between the friction disk 26 and the plate 31, and continued movement of member 55 in the same direction removes lever 58 from the switch 59 and allows the latter to close the motor circuit. The motor will rotate the worm 62 through gears 77, 76 and 72, 63, the gear 34 and clutch plate 31. The friction disk 26 is held in engagement with plate 31 by the pressure plate 42 and moves with it to rotate the load shaft 22 and lift the load. This will continue until the motor circuit is opened when the parts will be held again to prevent descent of the load.

The gear ratio between the motor and the worm may be changed during this hoisting operation by moving lever 66 to move clutch member 65 into engagement with clutch member 64. Then worm shaft 60 will be connected to run in unison with motor shaft 78. The gear 72 will overrun the disk 73 which continues to rotate at the slower speed of the countershaft 70. This operation may be reversed at will.

When it is desired to lower the load, the operator turns control shaft 56 to move member 55 to the left, thus forcing shifter 50 against the flange 48 of collar 47 and moving collars 47 and 44 and the inner ends of levers 40 to the right (Fig. 1 position) and releasing the pressure of presser plate 42 from the friction clutch. This release is gradual and can be nicely adjusted to let the clutch slip as rapidly or as slowly as desired to control the rate of the descent of the load. An interlocking condition exists in that at the time the clutch is released to lower the load, the motor shaft 68 and the parts directly connected with it are held against reverse rotation and the switch 59 cannot be closed when the member 55 is in position to release the friction clutch.

Referring now to Figs. 7 and 8, I will describe the application of this invention for actuating a tail gate hoist for vehicles. In these figures, 90 designates a truck having a floor 91. Vertical guides 92 are affixed to opposite sides of the rear end of the truck and braced to the truck body by cables 93. Each of these guides has two channels. Posts 94 slide in one of these channels and coun-

terweights 95 in the other. Links 96 are pivoted to these posts with their upward movement limited by stop pins 97. Chains 98 connect the outer end of these links with the upper end of counterweights. Chains 99 connect the lower ends of the counterweights with the cable drum 23A.

A load platform 100 is pivoted to the posts 94 in such a manner that it will assume a tilted position when the posts 94 rest on the ground. 101 are chains connecting the loading platform with the links 96. The platform is heavier than the counterweights so that it will pull the links away from their stop pins 97.

The cable drums 23A are connected with the power shaft 22 by cross-shafts 22A and flexible couplings. In Figs. 7 and 8 the change-gear arrangement interposed between the motor and casing 20 is omitted.

In this arrangement the ends of the control shaft 56 are extended to near the hoisting platform convenient to the operator. After a load has been placed on the platform 100 the latter can be raised, first to a horizontal position and then to the level of the truck floor 91, in the manner previously described. The rate of rise of the platform may be retarded by a manipulation of the control shaft 56 to permit the friction clutch to slip.

Loads of delicate merchandise may be lowered on the platform 100 as its rate of descent may be controlled to a nicety by the operator. In case of loss of power, the hand crank 24 may be used to lift posts 94 off the ground.

If desired to provide an automatic stop device for the platform, a self-closing limit switch 102 may be placed in the path of movement of the counterweight 95, or two such switches connected in series may be placed one under each counterweight. A diagram of such connections as may be used is shown in Fig. 9.

When the parts are in the positions shown in Fig. 9, the motor switch 59 is open and the limit switch 102 closed. One side of a battery 103 is grounded to the frame of the vehicle at A. The other side of the battery is connected to the limit switch by a conductor 104. 105 is a conductor from the limit switch to the motor switch 59. 106 is a conductor from the motor switch to the motor 79, the other side of which is grounded to the vehicle frame at B. Now, when motor switch 59 is closed by the rotation of control shaft 56, the motor will be energized to pull down the counterweight 95 and lift the load. This operation will continue until the counterweight 95 strikes the limit switch 102 to open it and stop the motor. The limit switch is positioned to be opened when the load platform reaches a desired predetermined level, such as the level of the truck floor 91.

Th motor 79 cannot be energized again until the limit switch is closed and the latter cannot be closed until the load platform is lowered, at least enough to raise the counterweight 95 from its engagement with the limit switch. Thus, an electrical interlocking arrangement is provided to prevent simultaneous actuation of the hoisting and the lowering connections of the mechanism.

In Figs. 10 and 11 which I will now describe, a mechanical interlocking arrangement is shown. In these figures, 110 is a take-off shaft from the vehicle motor, connected by a coupling 111 to drive a shaft 112. 113 is a spirally faced clutch member slidably, but non-rotatively mounted on shaft 112 and pressed by a spring 114 into engagement with another clutch member 115 on the end of a drive shaft 116. The drive shaft 116 extends into the worm shaft 60A with a loose fit. In this case the worm shaft is provided with one or more longitudinal key-ways, into one of which a key 117 on the drive shaft fits.

120 is a bifurcated shift lever which engages a groove 118 in the clutch member 113. It is affixed to a shaft 121 rotatable in bearings 122 in casing 20. 123 is a lever affixed to shaft 121. This is connected by a link 124 with a lever 125 affixed to a shaft 126 rotatable in the casing. 127 is an arm of another member affixed to shaft 126 within the casing and having an anti-friction roller 128 at its upper end. 129 is a cam arm integral with the arm 127.

130 is the driving member of an intermittent gear, affixed to the load shaft 22. This intermittently actuates a driven disk 131 pivoted at 132 to the casing and bearing a pin 133 which as it moves engages the cam arm 129. This disconnects clutch members 113, 115. It is to be noted that the movement of pin 133 is comparatively fast at the time it moves cam lever 129.

In this case the control shaft 56C has a threaded portion 134 in an internally threaded stationary member 135 so that a longitudinal movement is imparted to the shaft when it is rotated and to the member 55A which is affixed to it. A cam drum 136 is also affixed to control shaft 56C against which the roller 128 is pressed by the spring 114. This drum has a depressed portion which permits the roller 128 to move toward the control shaft to the position in which it is shown in Fig. 10. This occurs when the control shaft is rotated in the direction to effect hoisting and causes the clutch members 113, 115 to engage each other, and connect shaft 110 operatively with worm 62A.

Rotation of load shaft 22 will continue through a predetermined number of revolutions when the intermittent gear members 130, 131 will move pin 133 under cam arm 129 to raise it and disconnect clutch members 113, 115, thus stopping the hoisting movement automatically.

The parts are now so held that no further hoisting connections can be made until the cable drum and its shaft 22 have been reversed to lower a load or the load platform. When the drive shaft is thus disconnected, control shaft 56C may be rotated in the direction to permit the friction clutch to slip to effect lowering. Such rotation of the control shaft brings the larger part of cam drum 136 under roller 128 and holds it out to prevent reconnection of clutch members 113, 115 during the operation of lowering.

The cam drum 136 is so proportioned that the control shaft can be rotated to cause parts of the friction clutch to become firmly engaged to prevent further lowering of the load before roller 128 reaches the depression in the cam drum.

In Figs. 12, 13 and 14 other applications of the invention are shown. In Fig. 12, 140 is a portable crane mounted on rollers 141. On the frame of the crane are pulleys 142, 143, 144, over which runs a cable 145 to the cable drum 23. 146 designates a storage battery.

150 (Fig. 13) is an overhead crane supported on rollers 151 running on a track 152. Power for the motor (not shown) is taken from a wire 153 and a trolley 154. 155 is a pulley affixed to control shaft 56. Over it runs a hand chain 156. The operation of these devices is obvious.

In Fig. 14 the parts of the mechanism are somewhat modified to adapt them to be used as a jack for the front end of a vehicle trailer 160. Instead

of a solid power shaft 22, such as shown in the other figures, a hollow internally threaded shaft 161 is provided. Into this fits a threaded post 162, the lower end of which forms a base 163 for resting on the ground. The rotation of shaft 161 when driven for hoisting will raise the trailer. The latter may be lowered at any rate desired by the operator by permitting the friction clutch to slip more or less.

Several modifications and adaptations of this invention have been illustrated and described in order to show that many changes in the construction and arrangement of the parts may be made within its spirit and scope, and I intend no limitations other than those imposed by the appended claims.

What I claim is:

1. A shaft, means for connecting a load therewith, a friction member connected to rotate with the shaft, a driving member freely supported on the shaft, associated with the friction member, means for rotating the driving member in one direction only, and means for operatively connecting the friction member with the driving member to rotate the shaft in one direction and for gradually releasing the connection between said members to permit the shaft to be rotated in the opposite direction under the influence of a load thereon and to control the rate of said movements in both directions.

2. A shaft, means for connecting a load therewith, a friction member connected to rotate with the shaft, a driving member freely supported on the shaft, associated with the friction member, means for rotating the driving member in one direction, means for holding the driving member against rotation in the opposite direction, and means for operatively connecting the friction member with the driving member to rotate the shaft in one direction and to prevent relative rotation between said members and for gradually releasing said connection to permit the shaft to be rotated at a desired rate under the influence of a load thereon, in the direction opposite to that of the driving member.

3. A load shaft, means for connecting a load therewith, a friction member connected to rotate with the load shaft, a driving member freely supported on the load shaft associated with the friction member, a power shaft and gearing between the power shaft and the driving member whereby the driving member may be rotated in one direction, means associated with the power shaft for holding the driving member against rotation in the opposite direction, and means for operatively connecting the friction member with the driving member to rotate the load shaft in one direction and to prevent relative rotation between said members and for gradually releasing said connection to permit the load shaft to be rotated at a desired rate under the influence of a load thereon, in the direction opposite to that of the driving member.

4. A load shaft, means for connecting a load therewith, a friction member connected to rotate with the load shaft, a driving member freely supported on the load shaft associated with the friction member, a power shaft and gearing between the power shaft and the driving member whereby the driving member may be rotated in one direction, means actuated by the rotation of the load shaft in the load raising direction, for automatically stopping the rotation of the power shaft, means associated with the power shaft for holding the driving member against rotation in the opposite direction, and means for operatively connecting the friction member with the driving member to rotate the load shaft in one direction and to prevent relative rotation between said members and for gradually releasing said connection to permit the load shaft to be rotated at a desired rate under the influence of a load thereon, in the direction opposite to that of the driving member.

5. A load shaft, means for connecting a load therewith, a friction member connected to rotate with said load shaft, a driving member freely supported on the load shaft having a friction surface, an oil-tight casing surrounding the friction member, means within the casing for pressing the friction member into engagement wtih the friction surface of the driving member, a power shaft geared to drive said driving member, and an adjusting device outside of the casing for controlling the pressure between said members.

6. A load shaft, means for connecting a load therewith, a friction member connected to rotate with said load shaft, a driving member in the form of an oil-tight casing surrounding the friction member, freely supported on the load shaft, having an internal friction surface on one side of the friction member and supporting a presser plate on the other side of the friction member, a power shaft geared to driving said casing, and a control device outside of said casing for adjusting the pressure between said members and the presser plate.

7. A load shaft, means for connecting a load therewith, a friction member connected to rotate with said load shaft, a driving member freely supported on the load shaft having a friction surface, an oil-tight casing surrounding the friction member, means within the casing for pressing the friction member into engagement with the friction surface of the driving member, a power shaft geared to drive said driving member, means for holding the power shaft against rotation in the opposite direction, and an adjusting device outside of the casing for controlling the pressure between said members.

8. A load shaft, means for connecting a load therewith, a friction member connected to rotate with said load shaft, a driving member in the form of an oil-tight casing surrounding the friction member, freely supported on the load shaft, having an internal friction surface on one side of the friction member and supporting a presser plate on the other side of the friction member, a power shaft rotatable in one direction, geared to drive said casing, means for holding the power shaft against rotation in the opposite direction, and a control device outside of said casing for adjusting the pressure between said members and the presser plate.

9. An outer casing, a load shaft supported thereby, means for connecting a load therewith, a friction member on a part of said load shaft within the outer casing connected to rotate with the load shaft, a driving member freely supported on the load shaft, having a friction surface, an inner oil-tight casing surrounding the friction member, a gear outside of said inner casing, a power shaft, a gear thereon within the outer casing in mesh with the gear outside of the inner casing, arranged to drive the driving member in one direction, means for holding the power shaft against rotation in the opposite direction, and a control device outside of said inner casing for adjusting the pressure between said members.

10. An outer casing, a load shaft supported

thereby, means for connecting a load therewith, a friction member on a part of said load shaft within the outer casing connected to rotate with the load shaft, a driving member in the form of an inner oil-tight casing surrounding the friction member, freely supported on the load shaft, having an internal friction surface on one side of the friction member, a gear outside of said inner casing, a power shaft, a gear thereon within the outer casing in mesh with the gear outside of the inner casing, arranged to drive the inner casing in one direction, means for holding the power shaft against rotation in the opposite direction, a control shaft in the outer casing parallel with the load shaft, extending through said outer casing, and a control member on the control shaft for adjusting the pressure between said members.

11. An outer casing, a load shaft extending through and beyond both sides thereof, a friction member on an intermediate part of said load shaft connected to rotate therewith, a driving member in the form of an inner casing surrounding the friction member, freely supported on the load shaft, having an internal friction surface on one side of the friction member, supporting a presser plate on the other side of the friction member and supporting springs acting on the presser plate to force the friction member into driving engagement with said friction surface, gear teeth on the outside of said inner casing, a power shaft, a gear thereon in mesh with the gear teeth on the inner casing in the lower part of the outer casing, arranged to drive the inner casing in one direction, means for holding the power shaft against rotation in the opposite direction, and a control device outside of said inner casing for adjustably counteracting the effect of said springs.

12. An outer casing, a load shaft extending through and beyond both sides thereof, a friction member on an intermediate part of said load shaft connected to rotate therewith, a driving member in the form of an inner casing surrounding the friction member, freely supported on the load shaft, having an internal friction surface on one side of the friction member, supporting a presser plate on the other side of the friction member and supporting springs acting on the presser plate to force the friction member into driving engagement with said friction surface, gear teeth on the ontside of said inner casing, a power shaft, a gear thereon in mesh with the gear teeth on the inner casing in the lower part of the outer casing, arranged to drive the inner casing in one direction, means for holding the power shaft against rotation in the opposite direction, a control shaft in the outer casing parallel with the load shaft, extending through and beyond both sides of said outer casing, a control member on the control shaft, and connections between said control member and the presser plate whereby the effect of said springs may be counteracted by rotation of the control shaft.

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