This invention is directed to the provision of a motor driven cable winch apparatus. More particularly, this invention is directed to a winch apparatus that includes a housing, a motor that is mounted in the housing, a winch drum, and only two shafts together with associated drive connections for selectively powering the winch drum from the motor and disconnecting the power connection between the winch drum and the motor.

One of the objects of this invention is to provide new and novel winch apparatus of a construction to utilize interchangeable hydraulic motors for a variety of speeds and torque for different applications. A further object of this invention is to provide new and novel winch apparatus including a housing of a low profile which fits neatly into a truck bed so that the amount of un-sea-able platform space is kept to a minimum and so that it may be readily mounted on a truck bed that is slideably mounted on a truck frame. Another object of this invention is to provide new and novel winch apparatus that eliminates inefficient worm gears, castings and a separate idler shaft to permit the building of more power and speed in one compact unit at a reduced weight and cost per unit.

Other and further objects are enclosed inherent in the invention herein illustrated, described and claimed, and will be apparent as the description proceeds.

To the accomplishment of the foregoing and related ends, this invention then comprises the features hereinabove fully described and particularly pointed out in the claims, the following description setting forth in detail certain illustrative embodiments, these being indicative, however, of but a few of the various ways in which the principles of this invention may be employed.

The invention is illustrated with reference to the drawings wherein:

FIGURE 1 is a fragmentary perspective view of the rear portion of a truck with the tiltable bed in an inclined condition and the slideable bed moved rearwardly relative to the tiltable bed, said view showing winch apparatus of this invention mounted on the slideable bed;

FIGURE 2 is a plan view of the winch apparatus of this invention;

FIGURE 3 is a vertical elevational view, part in cross section, of the apparatus of this invention, said view being taken along the lines and in the direction of the arrows 3—3 of FIGURES 2 and 5 to illustrate the mounting of the motor and the structure mounted on the motor driven shaft;

FIGURE 4 is a vertical elevational view with the upper half in cross section, said view being taken along the lines and in the direction of arrows 4—4 of FIGURE 5, the cross sectional portion being taken along the line and in the direction of the arrows 4A—4A of FIGURE 2 and the lower part of said view being taken along the line and in the direction of the arrows 4—4 of FIGURE 2;

FIGURE 5 is a longitudinal vertical elevational view, part in cross section, generally taken along the line and in the direction of the arrows 5—5 of FIGURE 2 to illustrate the drive connection between the motor driven shaft and the clutch assembly on the winch mounting shaft; and

FIGURE 6 is an enlarged fragmentary cross sectional view of the clutch assembly and the clutch drive sprocket.

Referring to FIGURE 1 there is illustrated a rear portion of a truck having a tiltable bed 10 and a platform bed 11 slidably mounted on the tiltable bed by conventional structure. The winch apparatus, generally designated 15, is centrally mounted on the forward end portion of the slideable bed.

The winch apparatus 15 includes an upper top generally rectangular box shaped housing 16 of a low profile and a cover 17, there being provided nuts and bolts (not shown) for securing the outer perimeter flange portions 16c of the housing and cover together. The housing is provided with flanges 16f that are bolted to the frame of the slideable bed. The housing includes side walls 16a, 16b, a rear wall 16c, a bottom wall 16d and a front wall 16e joined together to form the rectangular box shaped housing.

An upright transverse partition 18 at one end is welded to housing side wall 16a and at the opposite end is welded to the adjacent end of a rearwardly extending longitudinal partition 19 which at its opposite end is welded to the rear wall 16c to form a motor compartment 24. An upright rear, longitudinally extending partition 20 is welded at the rear wall intermediate the partition 19 and the side wall 16e to be parallel thereto, the partition 20 being somewhat longer than the partition 19. A front upright partition 21 is at one edge welded to the front wall 16g and has its rear portion located intermediate and spaced from partitions 19 and 20. In longitudinal vertical cross section, the partition 21 overlaps partition 20. A top brace 22 is at its opposite ends welded to the overlapping portions of the partitions 20, 21.

A motor drive shaft 25 is journaled for rotation by a bearing 26 mounted in the central portion of each of the partitions 19 and 20, shaft 25 extending from adjacent end wall 16g to a location a substantial distance on the opposite side of partition 19. A rigid coupling element 27 at one end is keyed to the last mentioned end portion of the shaft (for example by a set screw not shown) and at the opposite end is keyed at 28a to the motor shaft 28h of a hydraulic motor 28 that has an inlet port 28b and an outlet port 28c. The inlet port and outlet port are connected to a supply of hydraulic fluid under pressure (not shown) through hydraulic lines 29, there being provided a control valve (not shown) in said lines that is operated by one of the levers located in the control box 30 which is mounted on the slideable bed 11 for movement therewith. Although any type of suitable motor can be used, advantageously a motor sold under the mark Char-Lynn Hydraulic Orbit Motor of the Char-Lynn Company of Minneapolis, Minnesota, is advantageously used.

The motor 28 is bolted to a longitudinally extending rectangular plate 32 by a plurality of nuts and bolts 33 to have the motor shaft extend thereafter. Plate 32 is of a longitudinal dimension to extend between the housing rear wall and the partition 18 and of a height to extend from the housing bottom plate 16d to the top edge of members 18, 16c. The plate is not in any way attached to the housing or the partition 18 but rather
is free to slide in the motor compartment 24. Further the motor 28 is secured to the plate such that it is held out of contact with the housing and the partition 18 such as illustrated in FIGURES 2 and 3 of the drawings. Since the motor compartment 24 is of substantially greater dimension that the motor and the plate 32 is attached to plate 28, merely by loosening the set screw 28d, the contact 28 and plate 32 may be removed from the compartment 24 so that another motor of different speed and torque characteristics may be substituted therefor.

A drive sprocket 34 is keyed to the drive shaft to be located between partition 20 and side wall 16b, there being a drive chain 35 extended around sprocket 34 and sprocket 36 which is mounted on the winch shaft 37 to rotate relative said winch shaft, there being provided a bearing 40 between the sprocket 36 and the shaft 37. The shaft 37 is stationarily mounted by bosses 39 in the side walls 16a, 16b.

Provided on the shaft 37 for rotation relative thereto through the provisions of bearings is the clutch assembly that includes a clutch member 41 having a maximum diameter annular flange 41a positioned adjacent the sprocket 36 and a reduced diameter hub portion 41b located between the sprocket 36 and partition 21. An annular flange 41a has a plurality of circumferentially spaced, transversely extending apertures into which clutch pins 42 are slidable extended, pins 42 being fixedly attached to the clutch shifter ring 43 which is axially slideable on the hub 41b. The apertures 41c are located to form continuations of sprocket apertures 36a when the sprocket 36 has been properly angularly positioned relative to clutch member 41. Thus by moving clutch member 43 in the direction of the arrows 44 from the FIGURE 6 position (when the sprocket 36 is properly angularly positioned relative clutch member 41), the clutch pins 42 are slidable extended into the aperture 36a. The pins 42 upon being extended into the aperture 36a will result in the clutch members 41, 43 being rotatably driven by the rotation of the sprocket 36.

In order to move the shifter ring 43 and in turn the clutch pins into and out of apertures 36a there is provided a shifter fork 48 having an arcuate portion extended into the circumferential annular groove 43a of shifter ring 43. Thus by translating the fork in the direction opposite arrow 44, the shifter ring 43 is moved from the FIGURE 4 position to the FIGURE 6 position, while translating the fork in the opposite direction moves the shifter ring 43 from the FIGURE 6 position to the FIGURE 4 position. Even though the fork axially moves the shifter ring 43, it does not interfere with the rotation thereof.

In order to translate the shifter ring in the aforementioned manner, there is provided a transversely extending rod 49 having one end attached to the boss 48a on the fork 48, and hence slidable extended through a boss 50 in partition 21 and outwardly through an aperture in wall 16a. An upright pin 51 is secured to the outer end of the rod 49 and in an aperture in the eccentric end portion of the operator arm 52. The operator arm may advantageously be connected by linkages (not shown) to an operating lever in the control box 30. A coil spring 53 is provided on the rod 49 and has one end secured to a boss 53a keyed to rod 49 adjacent the end wall 16a and the opposite end connected to the boss 50. A resiliently urging fork in the direction of arrow 44, i.e. to a position to move the clutch member 43 from the FIGURE 6 position to the FIGURE 4 position. Thus by releasing the operating force on the fork operating lever (moving it to the datum position), the shifter ring 43 is resiliently urged to the FIGURE 4 position. When the fork operating lever is operated at pivot arm 52 about pin 51 in the direction of arrow 67, the eccentric end portion of the arm 52 bears against the end wall 16a to in turn cause the rod 50 to be translated in the direction opposite arrow 44.

A sprocket 55 is rotatably mounted on a bearing 40 located in the shaft 37 such that said sprocket may rotate relative shaft 37. The sprocket 55 is welded or otherwise suitably secured to the clutch member 41b so that it is rotatably driven thereby, the sprocket 55 being located between partition 21 and end wall 16b. For example, as shown, hub portion 41b is welded to the hub of sprocket 55 and the clutch member 41 is rotatably mounted on and relative a hub portion of sprocket 36.

A chain 57 is extended around sprocket 55 and thence around the sprocket 56 that is mounted on the drive shaft 25 for rotation independent of the drive shaft, there being provided a bearing 59 mounted between partitions 19 and 20 and mounted for rotation independent of the rotation of the drive shaft 25 by a bearing 59. A double sprocket 62 is mounted on the shaft 37 for rotation independent thereof through the provision of a bearing 40, there being provided a pair of chains 66 extended around sprockets 61 and 62 such that the sprocket 62 is driven by the rotation of the shaft 37. The sprocket 61 is welded to the winch drum 63 which is mounted on the shaft 37 for rotation relative thereto by bearings 40. As may be noted from FIGURE 4, the winch drum and sprocket 62 are located intermediate side wall 16a and partition 21. One end of the winch cable 64 is secured to the sprocket 61, the other end of the winch cable 64 having tied or otherwise secured to the winch drum 63 by a U bolt and nuts 65, the cable 64 being wound around the drum and having an opposite free end portion 64a extendable over the slidable bed 11. Advantageously on the free end of the cable there may be provided a hook or other suitable attachment (not shown) for facilitating connecting the cable to a vehicle or other structure that is to be pulled up onto the slidable bed through operation of the winch apparatus of this invention. As may be noted from FIGURE 3, the cover 17 is provided with the cut out 17a through the end portion 64a of the cable may be extended, the cut out extending transversely the axial dimension of the winch drum.

The structure of this invention having been described, the operation thereof will now be set forth. For purposes of facilitating the description of the operation, it is to be assumed that all of the cable 64 other than the attachment at the free end thereof has been wound onto the drum 63 and that the FIGURE 6 position is in the direction of the FIGURE 4 position of FIGURE 4. Upon driving the truck to a location that the vehicle is to be loaded thereon, the controls are operated to tilt the bed 10 to the FIGURE 1 position and to roll the slidable bed 11 back to the position of said figure. Then the operator operates the fork control to pivot arm 52 in the direction of arrow 67 which moves the fork in a direction opposite arrow 44. This results in clutch member 43 being moved to the FIGURE 6 position. Now the operator grasps the free end of the cable and pulls it in the direction of the arrow 68. This results in the drum being rotated in the direction of the arrow 69 (FIGURE 2) which in turn rotates the double sprocket 62 in the same direction. This rotation of the double sprocket 62 results in the upper run of the chain 66 being moved in the direction of the arrow 75 to rotate sprockets 61, 56 about the shaft 25 in the direction of the arrow 70. The rotation of the sprocket 56 in the direction of the arrow 70 moves the upper run of the chain 57 in the direction of the arrows 69 to thereby rotate clutch members 41, 43 in the direction of the arrow 69. Since the clutch assembly is now being rotated relative to the clutch disengaged position, the rotation of the clutch members 41, 43 does not cause rotation of the sprocket 56. Further since the winch drum 63, double sprocket 62, double sprocket 61, sprockets 56 and 57 are mounted for rotation relative to the shafts on which they are mounted, the
cable may be relatively easily pulled out over the top of the slideable bed.

After the cable end portion 64a has been pulled out sufficiently to be attached to the vehicle on the ground and is attached thereto, then the fork control lever in control box 30 is operated to a datum position and moves operating arm to the FIGURE 2 position. At this time spring 53 moves rod 49 in the direction of arrow 44 to pull the clutch pins are moved in sprocket apertures 36a. Thereafter the control valve (not shown) for motor 28 is operated so that the motor is driven to drive shaft 25 in the direction opposite arrow 70 and thereby sprocket 34 in the same direction. Rotatably driving sprocket 34 acts through chain 35 to drive sprocket 36 in the direction opposite arrow 69. Rotation of the sprocket 36 drives clutch members 41, 43 in the direction opposite arrows 69 and thence through sprocket 55, chain 57, sprocket 56, sprocket 61, chain 66, and sprocket 62 to drive the winch drum 63 in the direction opposite arrow 69.

Driving the winch drum in the direction opposite 69 results in the cable being wound on the winch drum and thereby pulls the vehicle in the direction opposite arrow 68 up onto the slideable bed. Once the load has been pulled up onto the slideable bed, the control for the motor 28 is returned to its rest position. After the appropriate controls have been operated, the tilttable bed and slideable bed are again moved to a travel position.

To be mention is that the sprockets 34 and 61 advantageously may be of the same diameter which is of a substantially smaller diameter than sprocket 56. The sprocket 56 in turn may be of the same or slightly larger diameter than sprocket 55 which is of a larger diameter than the sprockets 34, 61. However, the sprocket 56 is of a substantially smaller diameter than the diameter of the sprocket 62 and sprocket 36, sprocket 62 being a larger diameter than sprocket 36. Accordingly proper reduction in speed between the motor drive shaft and the rotation velocity of the winch drum 63 is obtained. Further by mounting all the sprockets other than sprocket 36 for rotation independent of their respective shafts, the aforementioned reduction is obtained in a relatively compact unit. Additionally no separate idler sprocket shaft and idler is required.

The winch shaft apparatus of this invention has speeds ranging from 16 feet per minute to 85 feet per minute and cable pull forces up to 15,000 pounds. Further, an extremely flexible unit is obtained through the use of interchangeable hydraulic motors for a variety of speeds and torque for different applications. For example, it may be used for hoisting, lowering and pulling loads at various speeds. Also, the apparatus of this invention has a forward and a reverse action. The capacities of the winch depend on the size of the motor installed.

As an example with one size motor and relative sizes of sprockets, the hydraulic motor, sprocket and chain reduction produces a 2,000 pound drag on the cable in the event of broken pressure lines (provided the clutch is in a clutch engaged position). Also with unbroken lines, the apparatus of this invention will lock the load in position as long as the control valve maintains a tight oil seal. Further by providing a one way oil restriction in the inlet port of the motor, with the clutch engaged, the unwinding speed is kept in safe limits.

Additionally the apparatus of this invention provides a housing of a relatively low profile which fits neatly into a truck platform and the platform bed form space is kept to a minimum and further only a small portion extends relatively a short distance above the platform bed. Additionally the housing extends beneath the slideable platform bed only a short distance and attached to the platform bed frame, and thereby does not interfere with or hinder engagement with the bed when the bed is tilted to the relative tilttable bed. That is, the winch apparatus of this invention provides both power and speed in one compact unit.

As many widely apparently different embodiments of this invention may be made without departing from the spirit and scope thereof, it is to be understood that we do not limit ourselves to the specific embodiments herein.

What we claim is:

1. Winch apparatus comprising a housing, a first shaft, a second shaft, means for rotatably mounting said first shaft in the housing and rotatably mounting said second shaft in the housing in parallel relationship to the first shaft, a motor, means for mounting said motor in the housing, said motor having a motor shaft, an annular coupling element keyed to said motor shaft and to said first shaft to form a rigid connection from the motor shaft to the first shaft, a winch drum rotatably mounted on the second shaft, a cable windably connected to said drum, a driven member mounted on the second shaft for rotation independent thereof, means drivenly connected to the first shaft for drivingly rotating said driven member when the first shaft is rotated, clutch means rotatably mounted on the second shaft for engaging the driven member to be drivenly rotated thereby and alternately being moved out of driven engagement therewith, means connected to the clutch means for selective operating said clutch means into and out of driven engagement with said driven member and intermediate means driven by the clutch means in driven engagement with the drivenly rotated member for drivingly rotating said winch drum, said intermediate means including a drive member mounted on the second shaft for rotation independent thereof and drivenly connected to the clutch means to be rotated thereby, a second driven member mounted on the first shaft for rotation independent thereof, a drive connection between said drive member and said second driven member to rotate the second driven member in response to the rotation of the drive member, and means drivenly connected to the second driven member for drivingly rotating the winch drum in an response to the rotation of the second driven member.

2. The apparatus of claim 1 further characterized in that said housing is of open top, rectangular box shape and includes a bottom wall and a pair of upright, right angularly extending walls, and that there is provided a pair of upright partitions mounted in said housing to in cooperation with said walls form a generally boxed shaped motor compartment, one of said partitions forming part of the means mounting said shafts, and that said motor mounting means includes an upright plate having edges respectively located closely adjacent one of said partitions and the bottom wall and free to move relative thereto, said motor being mounted on said plate out of contact with said walls.

3. Winch apparatus adapted for mounting on the bed of a vehicle such as a truck comprising an open topped, generally box shaped housing having a bottom wall, front wall, rear wall and side walls joined together, a first shaft having a first end portion, a second shaft, means for mounting said shafts in the housing in spaced relationship and parallel to one another and the first shaft for rotation, a motor mounted in said housing, said motor having a motor shaft, an annular coupling element keyed to said motor shaft and keying to said first shaft first end portion to form a rigid connection for rotating said first shaft, a winch drum in the housing and rotatably mounted on said second shaft, a winch cable connected to said drum, a first sprocket keyed to the first shaft to be rotated by the rotation of the first shaft, a clutch drive sprocket rotatably mounted on said second shaft, clutch means rotatably mounted on the second shaft for engaging the clutch drive sprocket to be drivenly rotated thereby and alternately being moved out of driven engagement therewith, means connected to the clutch means for selectively operating said clutch means into and out of driven engagement with said driven member and intermediate means for drivingly rotating said driven member.
mounted on the first shaft intermediate the motor and the first sprocket, said pair of sprockets being joined to rotate together, means for drivingly connecting said clutch means to one of said pair of sprockets, and a chain drivingly connecting the other of said pair of sprockets to said second sprocket.

References Cited by the Examiner

<table>
<thead>
<tr>
<th>UNITED STATES PATENTS</th>
<th>FOREIGN PATENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,425,792  8/1922  Pignani  254—187</td>
<td>12,767  1911  Great Britain.</td>
</tr>
<tr>
<td>1,530,492  3/1925  Haight  254—186</td>
<td></td>
</tr>
<tr>
<td>1,856,903  5/1932  Barrett  254—183 X</td>
<td></td>
</tr>
</tbody>
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