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Strout et al.

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[54] **WINCH FOR VEHICLES**

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[52] **U.S. Cl.** **254/175.7**; 254/182

[51] **Int. Cl.** **B66d 5/04**

[58] **Field of Search** ..... 254/175.7, 170, 182, 187 R, 254/187 B

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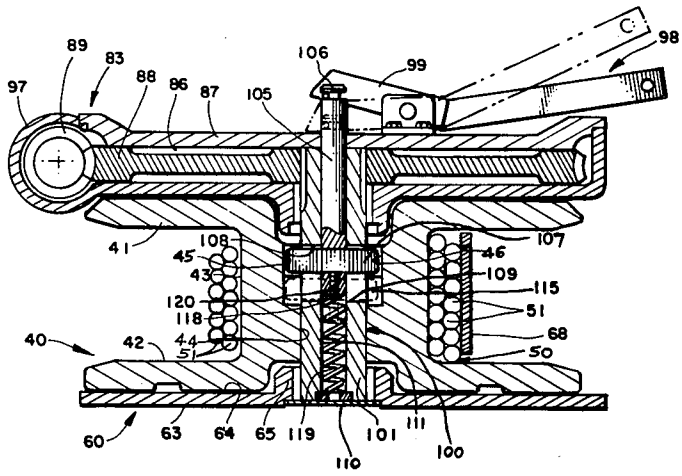
[57] **ABSTRACT**

An electrically driven winch has a cable drum with its axis aligned generally vertically and a cable packing device biased against the outermost cable coils to prevent the cable from becoming entangled and kinked while being rewound. The winch is structured for securement to a vehicle and includes a drive release that can be manipulated to disengage the cable drum and permit it to experience free spooling.

7 Claims, 3 Drawing Figures



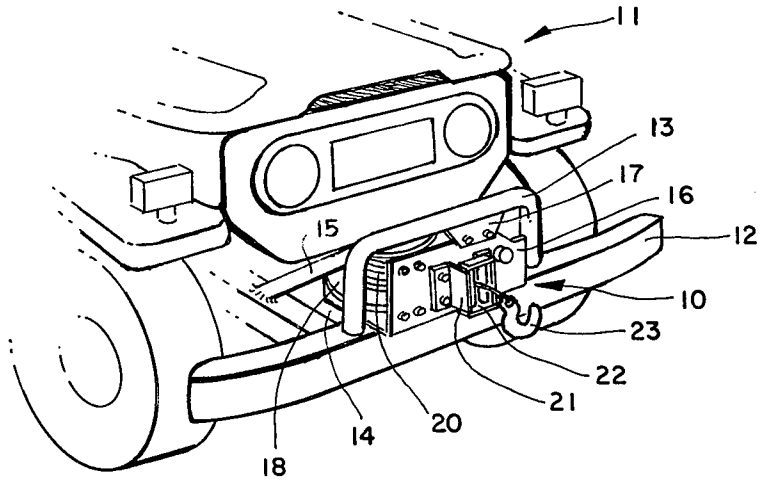

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FIG. 1

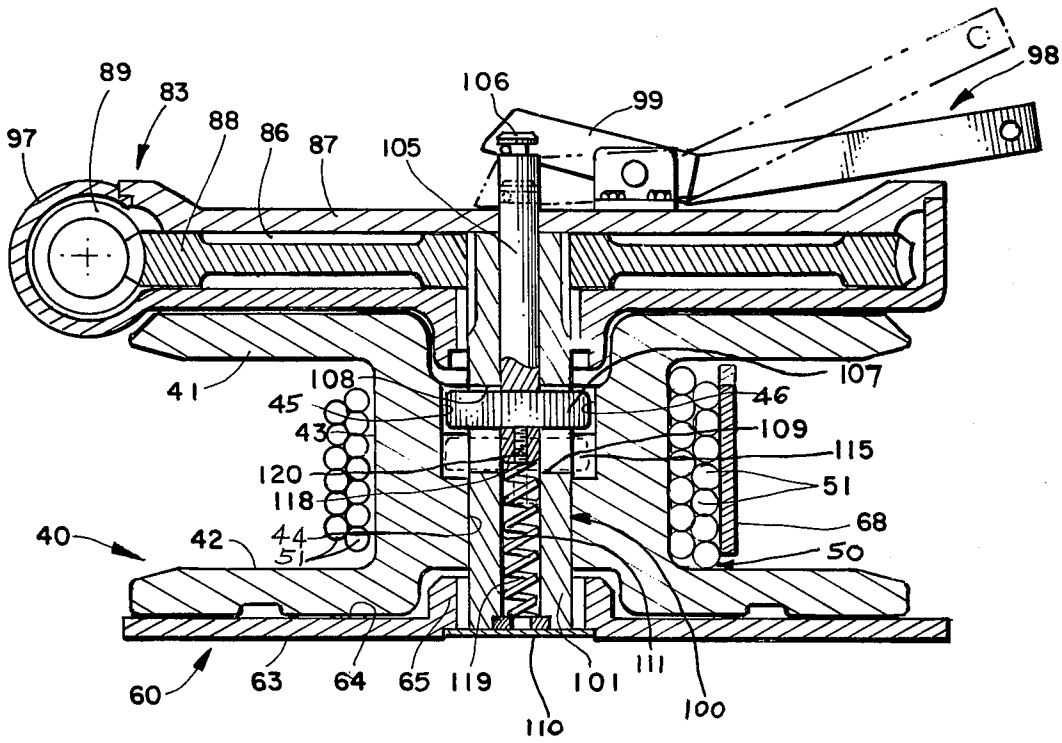
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FIG. 3

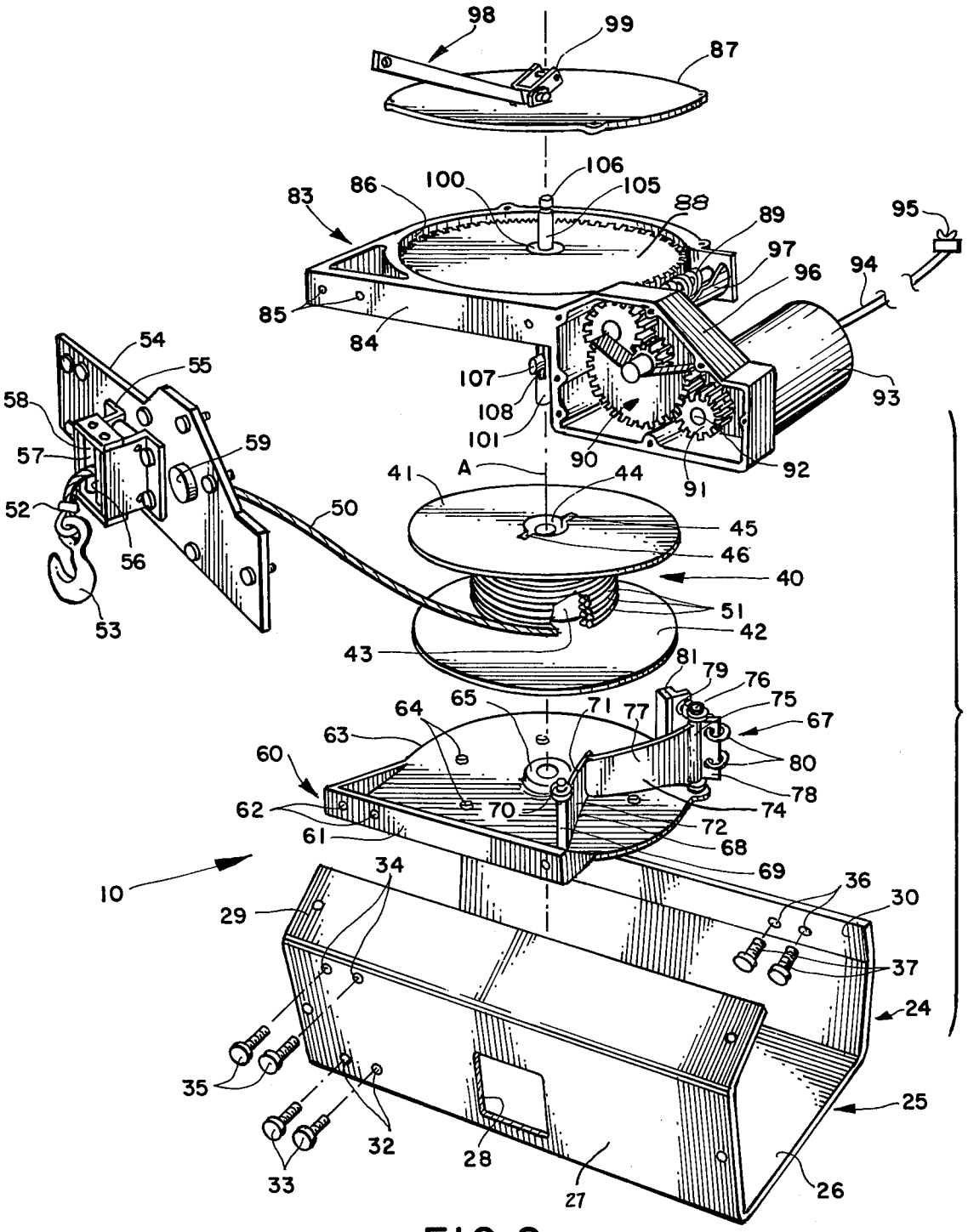
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FIG. 2

WINCH FOR VEHICLES

BACKGROUND OF THE INVENTION

This invention generally relates to winches and more specifically to winches mounted on vehicles such as four wheel drive trucks.

Basic winches are used in numerous situations to exert a pulling force, customarily to haul or hoist a load from one location to another. Automatic electrically operated winches are well known.

Automatic winches carried by vehicles should, under optimum circumstances, be compact for packaging in a relatively small space and also be conveniently mounted near the front or rear of the vehicle for easy access and efficient operation.

Most conventional automatic winches are customarily bulky, weighty and constructed for general use - and so are not readily adaptable for mounting on a vehicle. Conventional cable drums or spools for example, are oriented with their axes aligned horizontally and this creates space limitation problems.

Another significant drawback with conventional winches is that as the cable or line is being rewound on the cable drum, the coils of the cable often become knotted, kinked and entangled with one another. When this occurs, then the cable must either be totally replaced which is costly or at least straightened out, which is time consuming and annoying.

SUMMARY OF THE INVENTION

Briefly stated, the winch of this invention is compact, easily operated and especially practical and efficient for use in connection with a vehicle.

In its broader structural aspects, the winch of this invention has a housing with a top part, a base part and attachment elements for connection to a vehicle. Mounted between the housing top and base parts is a cable drum constituted by a pair of flanges and an intermediate core whose axis is aligned generally vertically. A cable is wound on the drum which may be hooked or secured to some object prior to energizing the motor to exert a pulling force.

A drive spindle is operatively engaged with the cable drum. Drive means interconnects the power take-off shaft of the motor and the drive spindle. A drive release means is arranged to selectively disengage the drive spindle from the cable in order to allow free spooling by the cable drum.

A cable packer means is biased radially inwardly towards the drum core and into frictional engagement against the outermost coils of the cable. The cable packer means is coupled to the housing and is arranged to substantially evenly distribute the cable coils across the drum core as the cable is being rewound. In this manner, the cable coils will be maintained at an approximately constant depth and the problem of kinking and entangling in the cable will be prevented.

The cable packer means preferably includes a paddle pivotally coupled between the housing top and base parts and structurally arranged so that it progressively and intermittently moves toward and away from the drum core as the depth of cable is being caused to decreas and increase respectively. A lever pivotally coupled by an intermediate section between the housing top and base parts has one end attached to a spring and the other end biased in sliding engagement against the paddle to exert a constant force against the paddle.

The cable drum has a central bore of circular cross section. The bore periphery forms an annular recess and at least one locking notch. The drive spindle has a central passage and a longitudinally aligned slot extending entirely through the spindle wall.

The drive release means preferably includes a rod slidably positioned in the spindle central passage and the rod further carries a locking element. A handle may be manipulated in order to shift the rod within the spindle central passage and selectively position the locking element in either the annular recess or the locking notch. When the rod is shifted so that the locking element is positioned in the locking notch then the spindle and drum are drivingly engaged with one another. Conversely when the rod is shifted so that the locking element is positioned in the annular recess and hence allowed to free wheel then the spindle and drum are mutually disengaged for permitting the drum to experience a free spooling motion.

A front portion of the housing carries a guide frame in which is mounted a pair of vertically aligned and spaced rollers. The rollers are arranged in general alignment with the cable drum and define an access space through which the cable travels while being unwound from and rewound upon the cable drum.

The drive means may include a ring gear or spur gear aligned with and fixed to the drive spindle and a worm gear drivingly interengaged with the ring gear. Gear reduction means are provided to reduce the rotational speed of the drive spindle relative to the rotational speed of the power take-off shaft. The motor is a reversible and electrically operated motor that can be activated from within the vehicle by a remote control electrical switch.

BRIEF DESCRIPTION OF THE DRAWINGS

The numerous benefits and unique aspects of the present invention will be fully understood when the following detailed description is studied in conjunction with the drawings in which:

FIG. **1** is a perspective view showing a winch constructed in accordance with this invention mounted to the front end of a four wheel drive vehicle; and,

FIG. **2** is a perspective exploded view showing the basic components of a winch constructed in accordance with this invention; and,

FIG. **3** is a longitudinal sectional view taken generally through the center of the cable drum, drive spindle and drive release device components of the winch.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now primarily to FIG. **1** of the drawings, a winch **10** is shown situated in an operational environment, i.e., mounted to a front central section of a four wheel drive vehicle **11** having a bumper **12.**

For ease in the installation of winch **10,** a winch mounting kit is provided that includes a U-shaped cross bar **13** that generally spans across the winch **10,** a pair of diagonally oriented support bars **15** secured to cross bar **13** and a mounting platform **14.** The winch **10** has a general packaging frame or housing **16** which, in this embodiment, is shown secured to a depending mounting bracket **17** which is another part of the winch mounting kit.

A cable drum **18** aligned with its axis in a general vertical direction holds a pull cable **20** shown spirally

wound around the cable drum **18.** A front face of housing **16** mounts a guide frame **21** which defines an access space **22.** A cable hook **23** attached to the free end of cable **20** is shown partly retracted and projecting through the access space **22.**

For purposes of illustration, the vehicle **11** may be a Bronco, a Toyota Land Cruiser, a Ford Pickup, a Jeep or the like. The size, shape and construction of housing **16** is made to accommodate the available or selected mounting space of the particular vehicle. The winch mount shown in FIG. **1** may be for a Toyota Land Cruiser, while the winch mount shown with more detail in FIG. **2** may be for a Ford Bronco or a Jeep. The exact winch mount will vary depending upon a number of factors dictated by the particular vehicle on which the winch **10** is to be mounted.

Referring now primarily to FIG. **2,** a housing **24** has a skid plate **25** integrally formed with a bottom face **26,** a front face **27** and an insert opening **28** through the front face **27.** The skid plate **25** also is formed with a front face extension **29** and a rear face **30.** Bolt openings **32** are formed through front face **27** for accommodating bolts **33.** In a similar manner, bolt openings **34** are formed in the upper region of front face **27** to accommodate **35.** At various locations in the housing **24,** attachment openings are formed to accommodate attachment elements for rigidly securing the winch **10** to some suitable mounting surface of the vehicle and/or the winch mounting kit previously described. For example, the skid plate rear face **30** has bolt openings for receiving bolts **37** which, in order to mount the winch **10** to some vehicle support surface, would extend through registering openings in the vehicle support surface.

A cable drum **40** has an upper flange **41** and a lower flange **42** which are separated and interconnected by an intermediate core **43.** A bore **44** is formed through the center of cable drum **40** whose axis A is aligned generally vertically. An upper portion of the periphery of bore **44** defines a pair of diametrically opposed locking notches **45** and **46** that shall subsequently be described in more detail.

Spirally wound about the core **43** of the cable drum **40** is a heavy duty, high tensile strength cable **50** with winds or coils **51** between the flanges **41** and **42.** The free end **52** of cable **50** is connected to a claw or slip hook **53.**

A front plate **54** structured for attachment on the inside of skid plate front face **27** is formed with an outwardly projecting guide frame **55** shaped for placement within the insert opening **28.** The guide frame **55** rotatably mounts a pair of vertically aligned surfaces **56** and **57** which are spaced laterally apart to define a relatively long and narrow access space **58.** These surfaces **56** and **57** may be stationary and generally convex or rollers to assist in guiding the cable **50** back and forth. When the winch **10** is fully assembled for operation, the guide surfaces **56** and **57** will be arranged in general alignment with the cable drum **40** to facilitate passage of cable **50** through the access space **58** as the cable **50** is unwound from and rewound upon the core **43.** A recessed bearing **59** is provided on the inner wall of front plate **54** to journal a shaft in the gear train of the winch drive mechanism.

A base part **60** of the housing **24** includes an attachment bar **61** having a series of bolt holes **62** arranged to register with bolt holes **32** for receiving the bolts **33.** A generally circular bearing plate **63** has a plurality of upwardly projecting thrust washers **64** upon which cable drum flange **42** rests. A central positioning ring **65** is provided to assist in centering and locating the cable drum **40.**

A cable packer **67** operates in conjunction with the cable drum **40** to guide the coils **51** across the drum core **43** as the cable **50** is being wound up. The cable packer **67** has a paddle **68** fixed to a hinge **69** that is mounted on a pivot pin **70** whose opposing ends are journalled within housing base part **60** and a housing top part **83.** An inner face **71** of the paddle **68** is constantly biased against the coils **51** of cable **50** and an outer or striking face **72** of paddle **68** is constantly frictionally engaged by a lever **74.**

The lever **74** is integrally formed with a hinge **75** at an intermediate location between its ends and hinge **75** contains a pivot pin **76** likewise journaled within housing base part **60** and housing top part **83.** The lever **74** is formed with a pusher arm **77** on one side of hinge **75** and the pusher arm is arranged in constant engagement, sometimes sliding engagement, with paddle **68.** On the other or radially outward side of hinge **75** the lever **74** is formed with a connector arm **78** connected to a plurality of springs **79** having hooks or other attachment elements **80.** In the arrangement of cable packer **67** shown the springs would be under compression so as to urge leber **74** against paddle **68.** The opposite ends of the spring **79** are fixed to a stationary part of the winch **10,** shown in the form of an anchoring post **81.** If the anchoring post **81** were on the other side of lever **74,** and still mounted to the housing **24,** then the springs would be under tension to achieve the desired biasing effect.

The top part **83** of housing **24** has an attachment bar **84** formed with bolt holes **85** positioned to align with bolt holes **34** to receive the bolts **35.** The housing top part **83** defines a circular gear chamber **86** and includes a removable cover **87** that together confine a ring gear **88.** The ring gear **88** is interengaged with another component of the drive means, i.e., a worm gear **89.**

The drive means includes a gear reudction means **90** in the form of a plurality of gears shown that include a spur gear **91** fixed to the power take-off shaft **92** of an electrical motor **93.**

Electrical motor **93** is a reversible motor which can be energized through an electrical wire **94** leading to a remote control point where a person may use a switch **95** to rotate the cable drum **40** in one direction, in the reverse direction or turn off the motor **93.**

The housing top part **83** in addition includes a gear box **96** for some of the drive means gears and a cylindrical casing **97** that surrounds and protects the worm gear **89.**

A drive release means is provided and includes a manually operated lever in the form of a crank **98** which is pivotally mounted on the top of removable cover **87.** The lower end **99** of crank **98** rotatably mounts a swivel head **106** formed by the top of a rod **105.**

Splined or otherwise fixed to the center of ring gear **88** is a drive spindle **100** having a lower concealed portion **101** that is positioned in the cable drum bore **44.** A locking element in the form of a locking key **107** carried by the rod **105** extends transversely through a pair of longitudinally directed slots **108** in the walls of the drive spindle **100,** as best seen in FIG. **3.**

Referring now specifically to FIG. 3, the drive spindle 100 has a pair of longitudinally aligned slots 108 and 109 formed through diametrically opposed portions of the side walls of spindle gear 100. The top section of spindle gear 100 is fixed by splines or the like to the center of ring gear 88 while a bottom and generally concealed portion 101 is journaled within a bearing 110 of the housing base part 60. A smooth central passage 111 extends from end to end through drive spindle 100.

Drum cable 40 has a pair of locking notches 45 and 46 formed in diametrically opposed portions of the periphery defined by the longitudinally extending bore 44. Disposed immediately beneath the pair of locking notches 45 and 46 is a ring shaped space or annulus 115 which fully surrounds the drive spindle 100 and rod 105. For purposes of illustration two layers of coils 51 of cable 50 are shown pressed against one side of the cable drum core 43 by the paddle 68 associated with the cable packer mechanism.

The rod 105 carries a locking key 107 which extends transversely through the rod 105 and the diametrically opposed slots 108 and 109 in the drive spindle 100. The opposing ends of locking key 107 project radially outwardly by a sufficient distance to fit within either the locking notches 45 and 46 or the adjacent annulus 115. In FIG. 3 for purposes of illustration the opposing ends of locking key 107 are shown disposed within the locking notches 45 and 46.

The locking key 107 is oriented and fixed in place by a set screw 120 extending upwardly through the rod base end 118. A spring or biasing element 119 positioned within the lower part of drive spindle central passage 111 is arranged to bear against the rod base 118 and urge rod 105 normally upwardly to maintain the cable drum 40 and drive spindle 100 in their driving engagement position. This position is further indicated by the solid lines of the drive release means 98.

When the drive release means 98 is shifted to its phantom line position, then the rod 105 will be thrust downwardly causing the locking pin 107 to enter the annulus 115 - thereby disengaging cable drum 40 from the drive spindle 100.

The cable drum 40 for example has 120 feet to 150 feet of 5/6-inch steel cable packed within the space between flanges 41 and 42. The tensile strength or pull rating of the cable 50 is at least 9,000 pounds. The motor 93 is a series wound, reversible, DC motor which transmits torque to the cable drum 40 through gear reduction units. The gear train is protected with lubrication contained for example in gear chamber 86, gear casing 97 and the general gear box 96.

OPERATION

Keeping the above construction in mind, it can be understood how many of the previously described disadvantages of conventional vehicle winches are overcome or substantially eliminated by this invention.

The winch 10 may be used to exert a pulling force on some external object or device in order to move that object or device from one place to another. Alternatively, the winch 10 may be operated to exert a pulling force on the vehicle to which it is mounted - in order to extricate the vehicle when it is stuck in mud or snow, for example. This could be done with the aid of external pulleys, guidelines and other conventional mechanical devices.

Assuming that the winch 10 is mounted satisfactorily to the front or rear central portion of a vehicle - it is now ready for being operated as particular and varying needs arise. If the vehicle becomes stuck in mud of generally immobilized in a ravine or down an embankment, for example, the winch 10 may be quickly and effectively used to handle the predicament.

The drive release means 98 is shifted to thrust the locking key 107 into the annulus 115 so that the cable drum 40 will be capable of free spooling action. Under these conditions, the person may grasp slip hook 53 and freely pull the cable 50 through the guide surfaces 56 and 57 as the cable drum 40 freely rotates about its verticle axis A. When a sufficient length of cable 50 has been drawn from the cable drum 40 and the slip hook 53 has been looped around some stationary object and hooked to itself or otherwise secured to the stationary object - then the operator may manipulate the drive release means 98 to again drivingly engage the drive spindle 100 and the cable drum 40.

The switch 95 is used to activate the motor 93 which in turn commences to drive the drive spindle 100 through the gear train and gear reduction mechanism 90. As the force in cable 50 is caused to gradually and progressively pull the vehicle, the portion of cable 50 being simultaneously rewound on the cable drum 40 is being laid evenly by the cable packer means 67.

The constant biasing force of paddle 68 against the outermost cable coils 51 cause them to be laid flatly and evenly so they are incapable of becoming kinked or entangled with one another. The paddle 68 exerts a force radially inwardly towards the axis of the cable drum 43 with the result that the coils of the farthest radially outward layer are driven and distributed inwardly.

At any point the motor 93 associated with the winch 10 can be stopped by controlling the switch 95 and turning it to an OFF position.

From the foregoing it will be evident that the present invention has provided a winch in which all of the various advantages are fully realized.

What is claimed is:

1. A winch capable of being mounted to the front portion of a four-wheel drive vehicle, comprising:
   a. a housing having a top part, a base part and attachment elements for connection to a vehicle;
   b. a cable drum mounted for rotation between the housing top and base parts and having a pair of flanges with an intermediate core whose axis is aligned generally vertically - the cable drum having a central bore of circular cross section, an annular recess formed in the bore periphery, and, a locking notch formed by the bore periphery adjacent the annular recess;
   c. a cable wound on the drum;
   d. a drive spindle operatively engaged with the cable drum and being formed with a central passage and a longitudinally aligned slot extending entirely through the spindle wall;
   e. a motor with a power take-off shaft, connected to the housing;
   f. drive means interconnecting the power take-off shaft and the drive spindle;
   g. drive release means arranged to disengage the drive spindle from the cable drum and allow free spooling by the cable drum - the drive release means including a broad slidably positioned in

the spindle central passage, a locking element carried by the rod, and, a handle for manually shifting the rod within the spindle central passage to selectively position the locking element in either the annular recess or the locking notch;

h. a guide frame connected to a front portion of the housing;

i. a pair of vertically aligned surfaces within the guide frame and spaced to define an access space, the surfaces being arranged in general alignment with the cable drum to facilitate passage of the cable as it is travelling through the access space while being extended or rewound; and,

j. cable packer means including a paddle biased radially inwardly towards the drum core and into frictional engagement against the outermost coils of the cable, the paddle extending at least halfway between the drum flanges,

wherein the cable packer means and paddle are arranged to substantially evenly distribute the cable coils across the drum core as the cable is being rewound in order to maintain an approximately constant cable depth and prevent entangling and kinking in the cable,

wherein in addition when the rod is shifted so the locking element is positioned in the locking notch then the spindle and drum are drivingly engaged, and, when the rod is shifted so the locking element is positioned in the annular recess then the spindle and drum are disengaged for allowing free spooling motion by the drum.

2. The structure according to claim **1** wherein the cable packer means includes:

a spring anchored by one end to a stationary part of the winch; and,

a lever pivotally coupled by an intermediate section between the housing top and base parts, one end of the lever being connected to the other end of said spring and the other end of the lever being biased in sliding engagement against the paddle to constantly force the paddle against the cable.

3. The structure according to claim **1** wherein:

a biasing element is positioned in a lower portion of the spindle central passage and arranged to urge the rod upwardly;

a pair of locking notches are formed in diametrically opposed sides of the bore periphery and are located above the annular recess;

a pair of slots extend through diametrically opposed walls of the spindle;

the locking element is a key extending transversely through the rod and entirely through the spindle slots, the ends of the key projecting outwardly for locking engagement with the pair of locking notches; and,

the handle is a crank pivotally connected by an intermediate section to the housing top part and an upper portion of the rod is rotatably coupled to the crank.

4. The structure according to claim **1** wherein the drive means includes:

a ring gear coaxially aligned with and fixed to the drive spindle;

a worm gear drivingly interengaged with the ring gear; and,

gear reduction means to reduce the rotational speed of the drive spindle relative to the rotational speed of the power take-off shaft.

5. The structure according to claim **4** wherein the housing top part includes;

a gear chamber and removable cover that generally surround and protect the ring gear; and,

a cylindrical casing that generally surrounds and protects the worm gear.

6. The structure according to claim **1** wherein:

the winch is mounted to the front part of a four-wheel drive vehicle;

the motor is a reversible and electrically operated motor; and,

a switch is provided for energizing the motor and causing the power take-off shaft to rotate in one direction and selectively in the opposite direction.

7. The structure according to claim **1** wherein:

the cable packer means includes a spring anchored by one end to a stationary part of the winch, and, a lever pivotally coupled by an intermediate section between the housing top and base parts - one end of the lever being connected to the other end of said spring and the other end of the lever being biased in sliding engagement against the paddle to constantly force the paddle against the cable;

a biasing element is positioned in a lower portion of the single central passage and arranged to urge the rod upwardly;

a pair of locking notches are formed in diametrically opposed sides of the bore periphery and are located above the annular recess;

a pair of slots extend through diametrically opposed walls of the spindle;

the locking element is a key extending transversely through the rod and entirely through the spindle slots, the ends of the key projecting outwardly for locking engagement with the pair of locking notches; and,

the handle is a crank pivotally connected by an intermediate section to the housing top part and an upper portion of the rod is rotatably coupled to the crank.

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