July 3, 1962 E. J. FAHEY ET AL 3,042,375

PORTABLE HOIST

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Fig. 1.

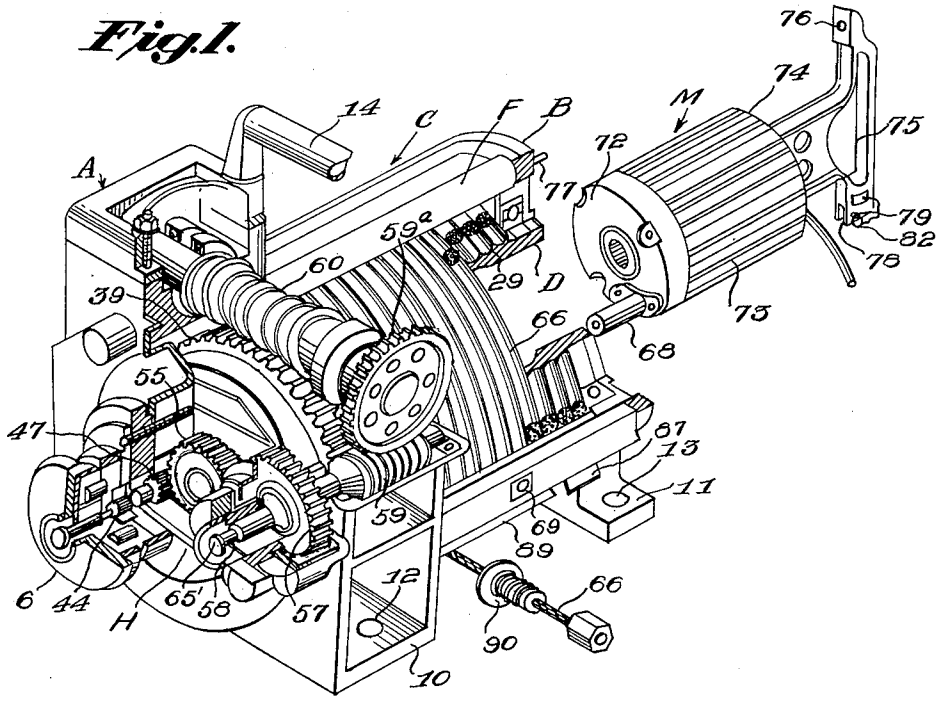
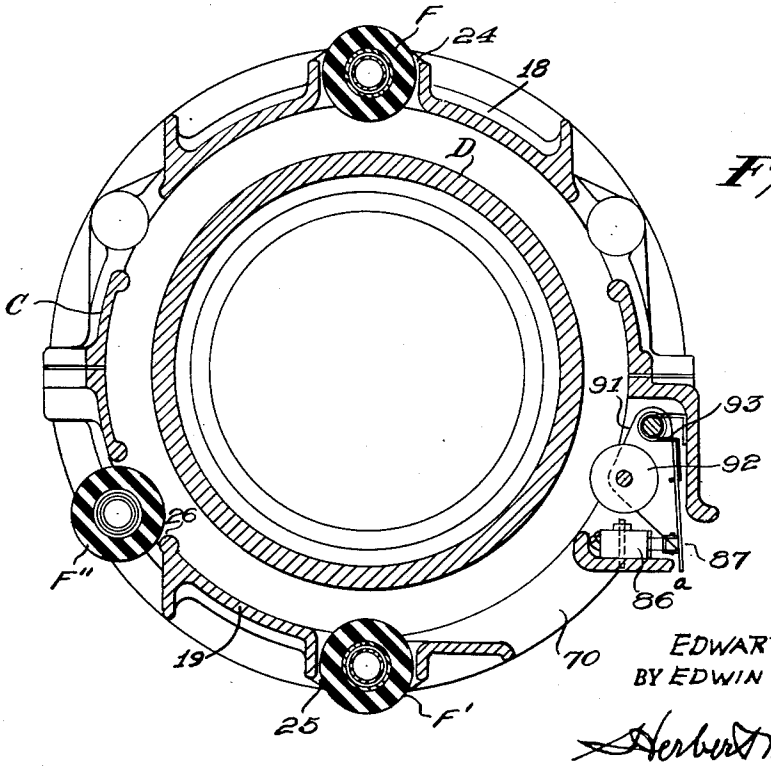


Fig. 4.



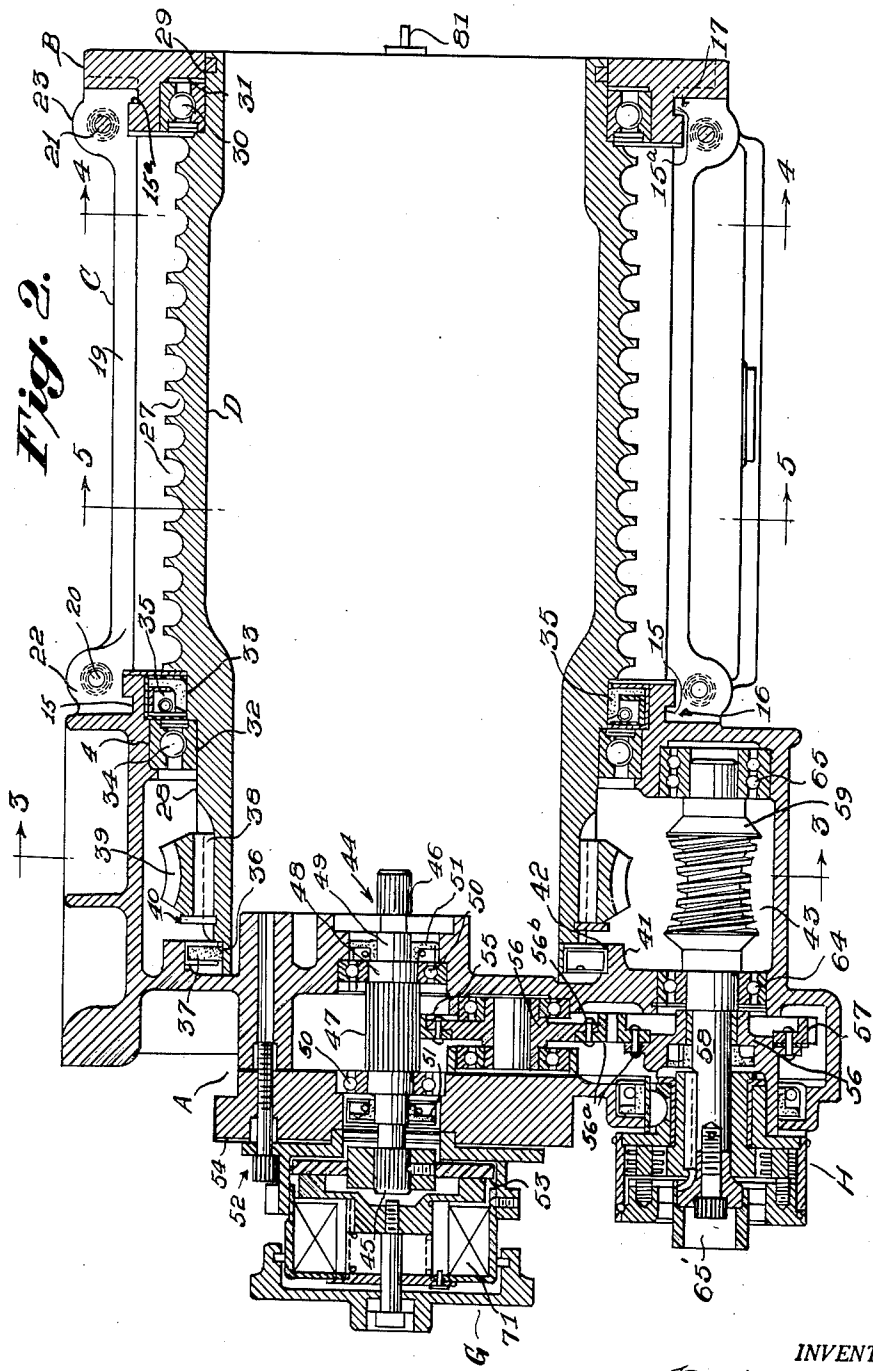
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Fig. 2.



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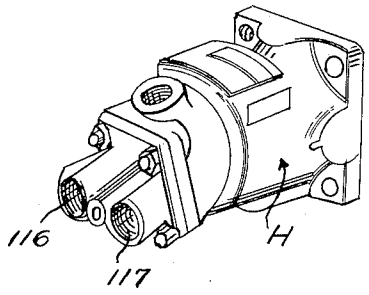


Fig. 8.

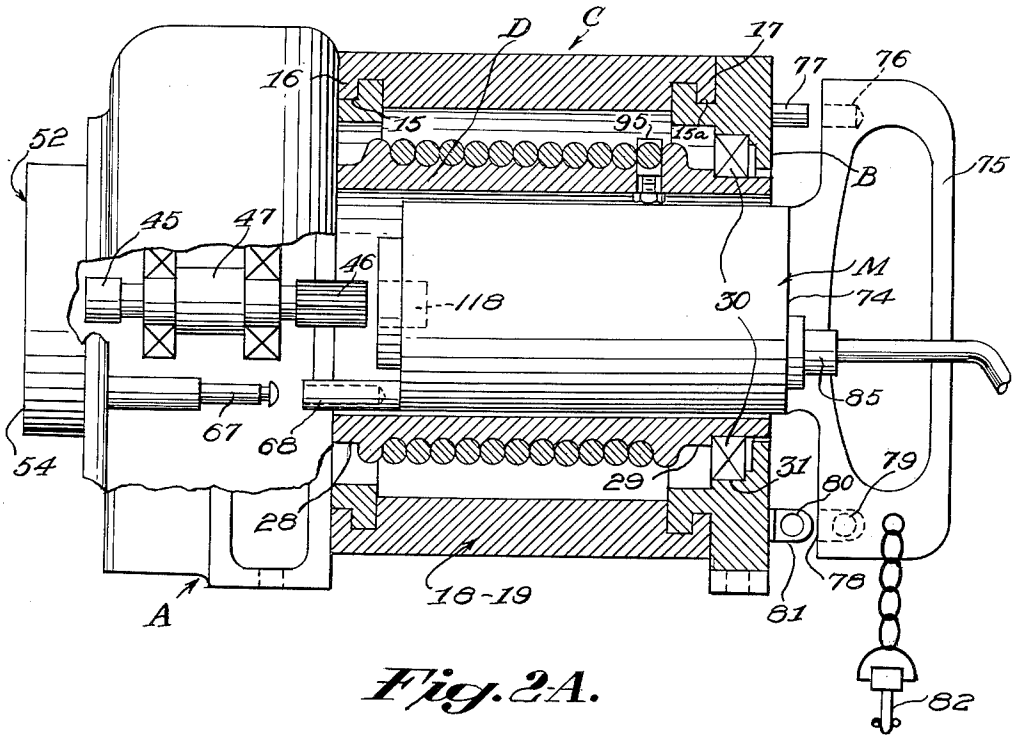


Fig. 2A.

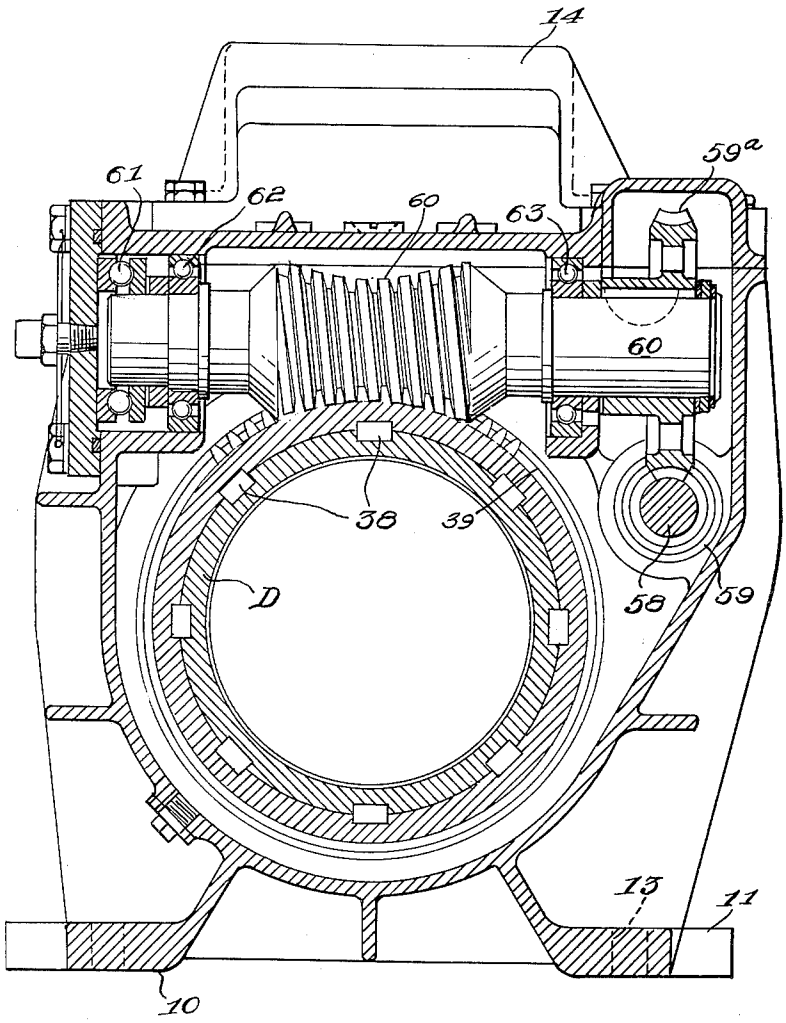
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PORTABLE HOIST

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Fig. 3.



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Fig. 5.

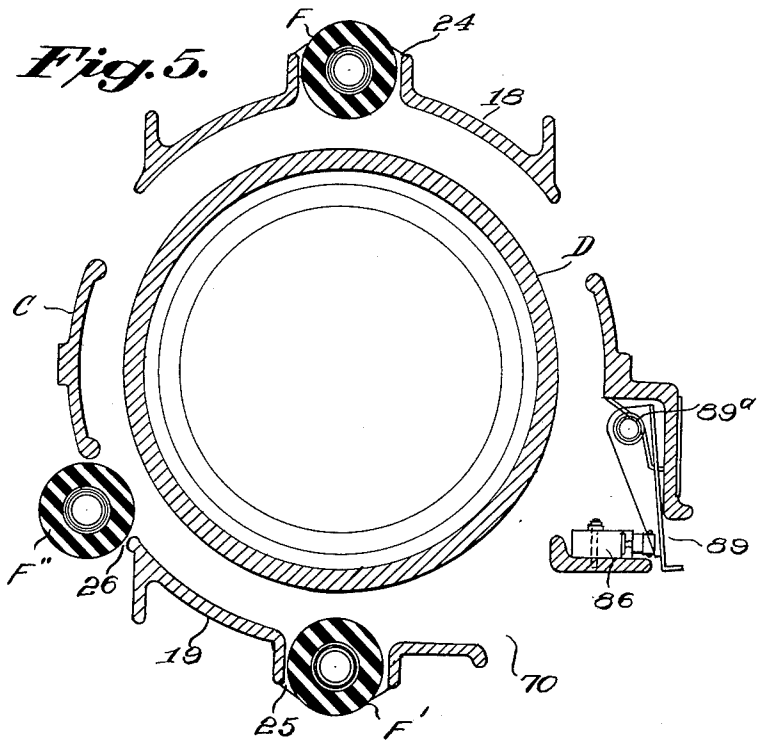
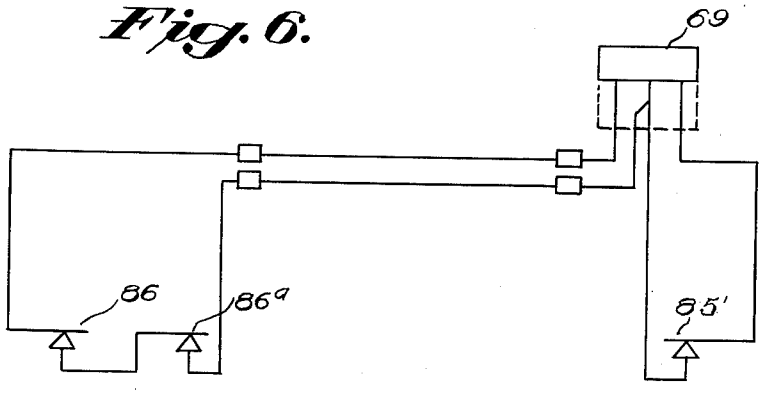


Fig. 6.



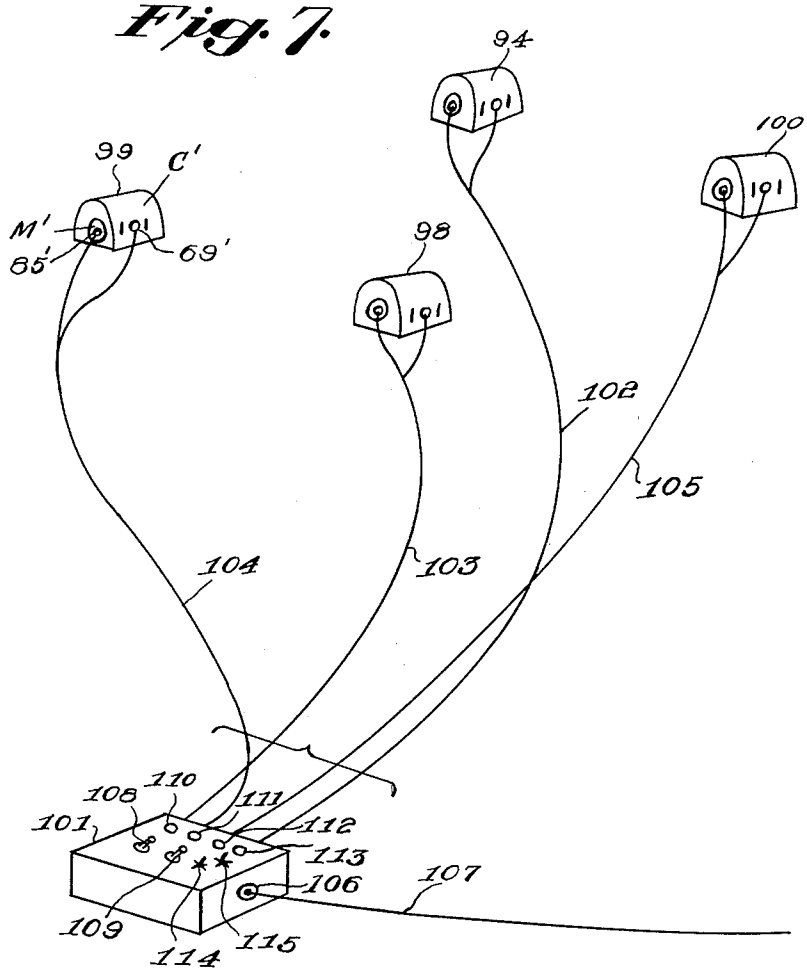
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Fig. 7.



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PORTABLE HOIST

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Filed May 20, 1959, Ser. No. 814,605
5 Claims. (Cl. 254—174)

The present invention relates generally to a portable winch having utility in any industry where there is need for lifting and handling materials with a lightweight hoist.

An object of the present invention is to provide a hoist of extremely light weight, maximum compactness, and dependability in action having the built-in versatility of larger non-portable winches.

Another object is to provide for simple and ready interchangeability of parts without the requirement of any special tools.

Still another object is to provide a compact assembly with a quick-change electric motor and power connector arrangement.

A further object is to provide for manual operation of the hoist in case of power failure.

Yet another object is to provide automatic reel-in and reel-out limit switch control responsive to the hoist cable operation.

Still another object is to provide novel brake and slip clutch control of the hoist drum.

Another object is to provide a novel arrangement for using two or more of the present novel hoists or winch devices in combination.

With the foregoing and other objects in view, the invention consists of the novel construction, combination and arrangement of parts as hereinafter more specifically described, and illustrated in the accompanying drawings, wherein is shown an embodiment of the invention and several arrangements for using the same.

In the drawings, wherein like reference numerals denote corresponding parts throughout the several views;

FIG. 1 is a perspective view, partly in cross section, with the novel quick detachable motor separated from connection with the interior of the hoist drum;

FIG. 2 is a longitudinal horizontal cross section view of the hollow hoist drum, the end mountings for the drum, and the gearing interposed between the motor driven shaft and the drum, with the motor removed from within the hollow drum;

FIG. 2*a* is a partial longitudinal section view of the unit with the motor almost in operating position therein;

FIG. 3 is a transverse section taken on the line 3—3 of FIG. 2;

FIG. 4 is a transverse section taken on the line 4—4 of FIG. 2;

FIG. 5 is a transverse section taken on the line 5—5 of FIG. 2;

FIG. 6 is a schematic wiring diagram of the limit switch circuit arrangement;

FIG. 7 is a diagrammatic illustration of a plurality of electrically connected hoists combined for cooperative use from a single junction box; and

FIG. 8 is another type of motor that may be used in lieu of an electric motor.

Broadly, the hoist comprises a gear box A preferably of cast magnesium, a light end frame B, a hollow drum D, a slotted sectional drum cover C, and an interchangeable Motor M insertable within the hollow bore of the drum D.

Referring in detail to the drawings and first with particular reference to FIGS. 1 and 2, a gear box A and a light end frame B are each provided with a suitable supporting base **10** and **11** with fastener openings **12** and **13**. It is to be understood, however, that the hoist shall be designed for mounting in any attitude from any securing base with cable take-off from the drum D in any direction perpendicular within, for example, 5° to the axis of the drum. The hoist is made very light and a rigid handgrip **14** is mounted transverse the gear box A near the center of gravity of the hoist unit to provide for ease of manual transportation and installation by one man under difficult conditions, such as overhead installation from a ladder or like insecure base of operation.

The gear box A with a matched cover houses all the gearing of the hoist unit and likewise provides support for journalling one end of the drum D and for securing one end of the enclosing drum cover C. The opposite end of the drum D is rotatably supported by the light end frame B, which secures the opposite end of the enclosing drum cover C.

The gear box A and end frame B are each formed with annular grooves **15** and **15***a* in opposed longitudinally spaced relation, see FIG. 2. Each groove **14** and **15** is formed to mate or interfit with internal lips **16** and **17** at each end of the drum cover C.

This drum cover is preferably fabricated in two 180° segments or half-sections **18** and **19**, FIGURES 4 and 5, which are removable to permit access to the cable wrapped or reeved around the drum D. The sections **18** and **19** may be secured together by bolts **20** and **21** extended through apertured lugs **22** and **23**, see FIG. 2. Also, in FIG. 4, the sections **18** and **19** are formed with elongated slots **24**, **25**, and **26** through which extend the exterior surfaces of anti-fouling rollers F, F′, and F″. Each roller may be covered with a resilient yieldable material such as synthetic rubber of sufficient thickness to prevent fouling of the cable under no load reel-in or reel-out at maximum rates for the full usable length of the cable.

These rollers serve to maintain the cable in proper effective working position in the cable grooves **27** formed in the exterior surface of the drum D. The drum D is formed with smooth reduced annular bearing supporting surfaces **28** and **29** at each respective end thereof, see FIG. 2. The annular bearing end **29** is formed to mount 2 ball bearing unit **30**, thereon, which bearing is further secured in position by the annular land or shoulder **31** of the end frame B, which frame encircles the open end of the hollow drum D and into which telescopes the interchangeable motor cartridge or units M for connection to the gear box A, as described in detail hereinafter.

The reduced bearing end **28** of the drum D is extended in length and is formed with annular shoulders **32** and **33** for mounting a roller bearing unit **34** and an oil seal ring unit **35**, respectively, in the gear box A, as shown in FIGS. 1 and 2. From the shoulder **32**, the bearing surface **28** terminates into a reduced end or shoulder **36**, which supports a second oil seal ring unit **37**, while the surface intermediate the shoulder **36** and the shoulder **32** is formed with radial key members or splines **38** on which is mounted a ring gear **39**. This gear **39** is held on the key units **38** by a snap-on split ring **40**, see FIG. 2.

The gear box A is formed adjacent the end **28** of drum D with a bearing flange **41**, the oil seal ring unit **37** engaging the annular surface **42** of flange **41** and also an enlarged annular chamber or gear box portion **43**. This annular gear box portion **43** houses the drum mounted ring gear **39** and the gearing and pinion shaft **44** connected with the motor M to the drum. This gearing comprises the motor driven pinion gear shaft or take-off shaft **44** having splined ends **45** and **46** and an intermediate pinion gear **47**. The take-off shaft **44** is formed with smooth annular portions **48** and **49** at each respective end and these portions **48** and **49** are journalled at each end in bearings **50** and oil seal units **51** enclosed by a centrally positioned hub-like housing **52** formed from the gear box A. The take-off shaft **44** extends into and

through housing 52, so that the pinion gear 47 is enclosed thereby and the splined end 45 projects beyond the same for mounting a brake disk 53 on an electro-magnetic brake G connected to the end cap 54 of the hub-like housing 52 of gear box A. The gear 47 in hub housing 52 drives a gear train including gears 55, and 57, which impart a drive connection to a worm shaft 58 and a worm gear 59 drivably connected by a gear 59*a* mounted on the end of the second worm shaft 60 at right angles to worm shaft 58. It is clearly indicated in FIGURE 2 the gears 55 and 57 each include a hub portion 56 and a toothed ring 56*a* secured to the periphery thereof or by means of rivets 56*b*. The second worm shaft 60 is in drive connection with the ring gear 39 of the cable drum D, and has its respective ends journalled for rotation in bearings 61, 62, and 63, see FIGS. 1, 2, and 3.

The worm shaft 58 is journalled in bearings 64 and 65 at each end and extends beyond the bearing 64 to mount a part of a slip clutch H. The clutch H includes a socket or adaptor 65′ for a handcrank connection in case of power failure. This clutch may be a disk clutch of any suitable type and is factory pre-set to slip on loads heavier than a predetermined weight, for example, over 6,000 lbs., which allows a safety margin for a steel cable 66 of, for example, three-eighths inch.

As above stated, the cable 66 is prevented from jumping out of the grooves 27 of drum D by anti-fouling rollers F, F′, and F″ and also, for best performance, it should pay out from the drum axis through the cable cover slot 70 roughly within five degrees of perpendicular, see FIG. 1. The cover C is rotatable so that the slot 70 may be positioned in various pay out directions.

An electric power connection from the electric motor is made by a male jack 67 having wired connection to the brake solenoid winding 71. The jack extends toward the interior of the drum D from the gear box A, and is insertable into a female electric plug 68 on the end bell 72 of motor M. The female connector leads over to a side connector plug 69 mounted on the drum cover C and connectible in turn to a suitable electric power line, preferably the motor power circuit, and to reel-in and reel-out limit switches hereinafter described, see FIG. 2*a*.

The electric motor M may be of several types, such as 40 cycle A.C., 28 volt D.C., 60 cycle A.C., etc., and can be mechanically interchanged to suit available power sources. The motor comprises a casing 73 having the end bell 72 and an end bell 74 with a handle 75 mounted thereon. The end bell 74 of the motor M below the handle has an electrical plug 85 for connection with electric power and suitable controls. The handle is provided with a dowel socket 76 to fit over a dowel pin 77 projecting from the face of the end frame B, also the handle 75 is formed with a slot 78 having aligned opening 79 adapted to line-up with opening 80 in an eye-bolt 81 projecting from the diametrically opposite side of end frame B to receive a suitable fastener pin, such as a "pip-pin" or "ball-lock" pin 82, inserted through the handle slot openings 79 and the eye-bolt opening 80, after the motor power plug 85 has been connected to the electric motor power source and the male and female motor jacks 67 and 68 have been coupled together, to thereby connect the motor circuit to solenoid 71 of the magnetic brake G. Such connection since it is made through the electric solenoid circuit of the brake G, is a safety feature. For example, when the motor M is removed, the electrical connection with the brake solenoid is broken, and the brake is applied to hold the hoist drum D from turning due to pull or load on cable 66.

The motor M may be controlled by suitable master controls from the plug 85 on the motor bell 74 and also limit switches 86 and 86*a* may be provided in the motor circuit to control the same. These limit switches are both reel-in and reel-out switches and are mounted in the drum cover C adjacent the cable slot 70 therein and are connected to the motor power circuit by electric plug 69 at the side of the cover, for example, note FIG. 1 and the wiring diagram shown in FIG. 6. The reel-in switch 86 is actuated by a trip-bar 89 extending along the cable exit slot 70 in one of the drum cover sections. This bar is spring-biased away from the switch 86 by springs 89*a* and actuates the switch when contacted by a bumper 90 positioned at any predetermined point along the usable length of the cable 66, see FIG. 5.

The reel-out limit switch 86*a* is actuated by a spring-loaded bracket 91, which has a roller 92 biased by the spring 93 of bracket 91 against the cable 66 as it is wrapped around the drum D. This switch is actuated as the roller 92 senses departure of cable, that is, approximately two wraps from the end anchored to the drum D by cable clamp 95, see FIG. 4.

The general operation and many uses for the present novel lightweight hoist are believed to be apparent from the foregoing description, and to use the same all that is needed is to insert the lightweight electric motor M inside the winch drum D by hand into connection with the splined end of the gear train drive shaft extending from the inboard gear box A. The motor handle is then secured in place and the motor is ready to be started to drive the drum D.

The reel-out limit switch 86*a* may be actuated to cut-off motor power as the roller 92 of the switch senses departure of the cable 66 after power reel-out to approximately two wraps from the anchored end of the cable 66 and the reel-in limit switch 86 shall be actuated to cut-off motor power by the trip-bar 87 extending along the cable exit slot 70 in the drum cover C. This bar 87 is spring-loaded away from the switch 86 and will be forced into switch actuating contact by the bumper 90 located at any desired position on the cable 66.

Also, during operation of the winch by the motor hook-up, if load exceeds a predetermined amount, the clutch H will slip and relieve the load.

Then, also, the electro-magnetic brake G is normally released during the motor operation and it will automatically apply when the motor is stopped or when the same is removed from the drum bore.

In some instances, a hydraulic motor H, such as illustrated in FIG. 8 may be substituted for the electric motor M. This hydraulic motor connects by couplings 116 and 117 to a suitable source of fluid power and connects directly to the splined end 46 in the drum D, see FIG. 2*a*, by a splined socket 118.

The foregoing and many other advantages of this invention may be combined to provide a very desirable and efficient portable hoist, which can be flange, base or suspension mounted. Likewise, winches constructed according to this invention can be used in multiples, such as for tandem hoist operation from a single control or in multiples of four hoists 94, 98, 99 and 100, from a single junction box 101 as illustrated in FIG. 7, having leads 102, 103, 104, and 105 connected from plug 85′ to motor M′ and to the limit switch side plug 69′ on the motor cover C′.

The junction box 101 has a connector plug 106 and a lead 107 to an A.C. power source to a master switch, not shown at the power source. Generally, the junction box 101 shall contain two four-position switches 108 and 109, a push button switch 114, a reversing switch 115, and indicator lights 110, 111, 112, and 113, relays therein, terminal strips, etc., not shown, to provide the several following briefly described hoisting arrangements. The junction box 101 is portable and may be hand-held by the operator.

In arranging for harnessing four hoist assemblies, a rectangular pattern of hoisting locations, see FIG. 7, is established and may be labeled on the junction box at the selector switches 108 and 109 as "1-Front Port," "2-Front Starboard," "3-Rear Port," and "4-Rear Starboard." The numerals 1, 2, 3, and 4 shall be displayed at the base of the first selector switch 108 and 1—2, 2—3,

3—4, and 1—4, shall be displayed at the base of the second selector switch **109**. The center portion of each of the four-position switches is "neutral."

To operate four hoisting assemblies, a suitable master switch is turned on for power and the operator may call on a single hoisting assembly operation by selecting 1, 2, 3, or 4 at the first selector switch or adjacent pairs of hoisting assemblies may be called on by selecting 1—2, 2—3, 3—4, or 1—4 at the second four-position switch. All four hoisting assemblies may be called on by depressing the single push button switch **114**.

The reversing switch **115** selects reel-in or reel-out of the cable.

The indicator lights **110—113** indicate which hoisting assemblies are in operation when the selector switches are adjusted.

Thus, the various combinations of hoisting assemblies may be used by selecting the desired assembly of hoists at the two four-position switches, and the direction of reeling is selected by the reversing switch **115**. Likewise, two or three hoisting assemblies may be selected by the two four-position switches or all four hoists may be controlled by the single push button switch **114**.

Having set forth our invention in accordance with certain specific structural embodiments thereof, what we claim and desire to secure by United States Letters Patent is:

We claim:

1. A winch comprising a drum with a hollow bore open at one end, said drum having an exterior surface, said surface being formed with annular grooves, a cable reeved around said drum in said grooves, end supports for each end of said drum, said supports having bearing units for rotatably mounting each end of said drum, an electric motor detachably mounted completely within the bore of the drum, said motor having a rotor with an internally splined socket and a stator, a female electric socket, with lead connections from said stator to said female electric socket, a gear train mounted in one of said end supports, a power take-off shaft coupled to said internally splined rotor socket, said shaft having a pinion in driving connection through said gear train with said drum, an electromagnetic brake having a solenoid and a male electric coupling jack connectable with said female electric socket, electric circuit for said motor, said circuit when closed maintaining said brake solenoid energized to hold said brake released when said female socket and male jack are connected and said brake applying to hold said drum from rotation when said motor is removed from said open end of the drum.

2. A lightweight portable winch comprising a cast magnesium gear box having a gear train mounted therein and formed with a bearing opening, a bearing in said opening, a light end frame spaced from said gear box with a bearing opening oppositely aligned to said gear box, a bearing in said end frame bearing opening, a hollow cable drum having each end thereof journalled in said respective bearings, a gear around an end of said drum, said gear being drivably connected to said gear train, a drum cover with an elongated slot around said drum having internal lips at each end thereof, annular grooves concentrically positioned around said bearing of the gear box bearing opening and the said end frame bearing opening, said lips and said grooves interfitting to mount said cover, a cable reeved on said drum, a cable end anchor clamp on an end thereof, said cable paying off the drum through said cover slot, and an electric motor mountable within said drum and detachably connectable with the gear train of the gear box for imparting rotation to said drum through said gear train and its connection to said gear on the drum.

3. The structure according to claim 2 including a reel-in limit switch mounted on the drum cover adjacent the said elongated cable slot and switch actuating means mounted on said cable, said switch actuating means cooperating with said limit switch for controlling said electric motor.

4. A winch comprising a drum with a hollow bore and an exterior annular surface with grooves therein, a cable reeved around said drum in said grooves, end supports for each end of said drum, said supports having bearing units for rotatably mounting each end of said drum, a cover around said drum with a cable exit slot, an electric motor detachably mounted completely within the bore of the drum, an electric circuit for said motor, said motor having a rotor with an internally splined socket and a stator with a female electric socket, a gear train mounted in one of said end supports, a power take-off shaft coupled to said internally splined rotor socket, said shaft having a pinion in driving connection through said gear train with said drum, an electro-magnetic brake having a solenoid and a male electric jack connectable with said female connector socket, current from said motor circuit when closed maintaining said brake solenoid energized to hold said brake released when said female socket and male jack are connected and said brake applying to hold said drum from rotation when said motor is removed from said drum, and a plurality of elongated cable antifouling rollers having yieldably resilient surfaces journalled in said cover and in engagement with said cable in said grooves.

5. A lightweight portable winch comprising a cast magnesium gear box having a gear train mounted therein formed with a bearing opening, a bearing in said opening, a light end frame spaced from said gear box with a bearing opening oppositely aligned to said gear box, a bearing in said end frame bearing opening, a hollow cable drum having each end thereof journalled in said respective bearings, a gear around an end of said drum, said gear being drivably connected to said gear train, a drum cover with an elongated slot around said drum having internal lips at each end thereof, annular grooves concentrically positioned around said bearing of the gear box bearing opening and the said end frame bearing opening, said lips and said grooves interfitting to mount said cover, a cable reeved on said drum, a cable end anchor clamp on an end thereof, said cable paying off the drum through said cover slot, and an electric motor mountable within said drum and detachably connectable with the gear train of the gear box for imparting rotation to said drum, said cover being rotatable in said mounting grooves and permitting said cover slot to be turned to various angular cable pay-out positions, said drum being rotatable through said gear train connection with said gear around the end of said drum.

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