June 19, 1923.

1,459,032

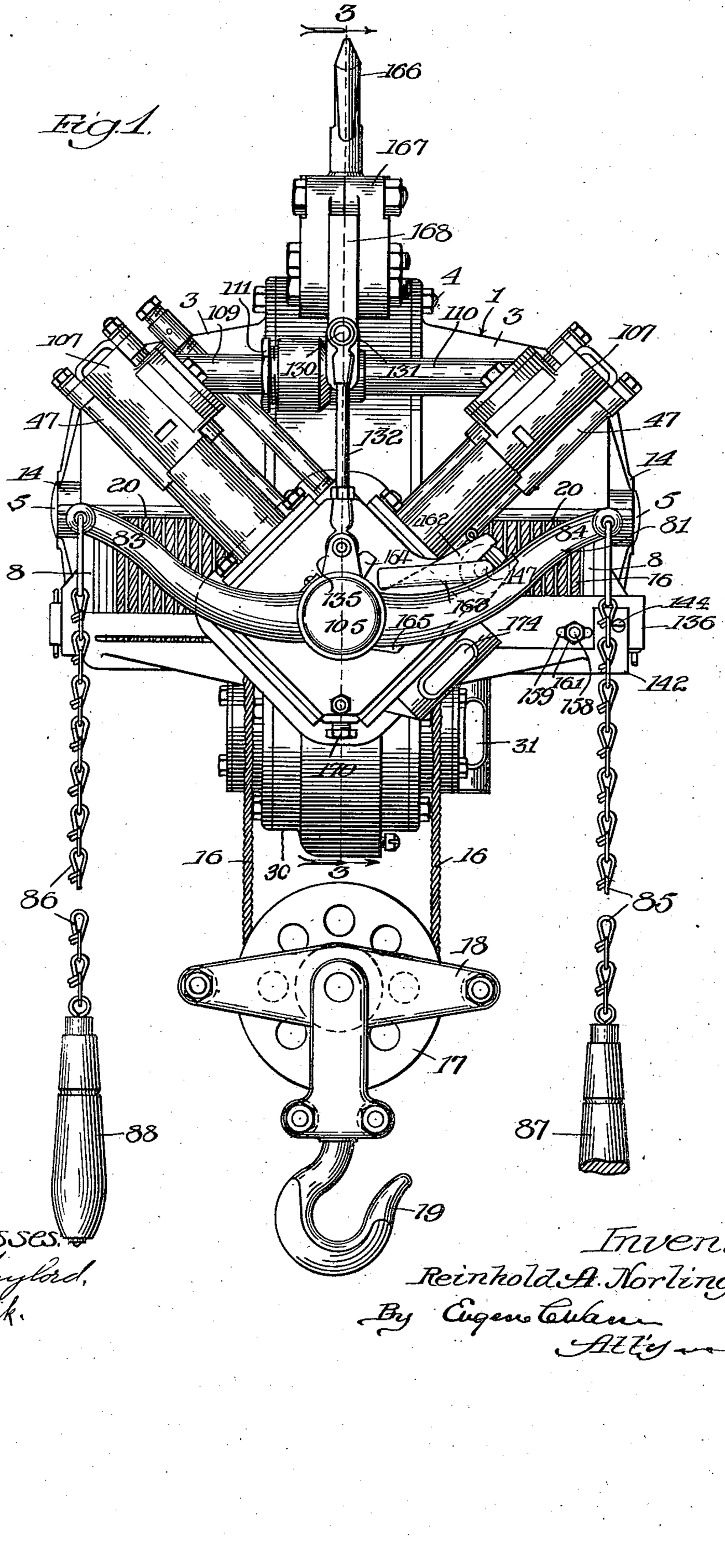
R. A. NORLING

PORTABLE POWER HOIST

Filed Aug. 11, 1919

6 Sheets-Sheet 1

Fig. 1.



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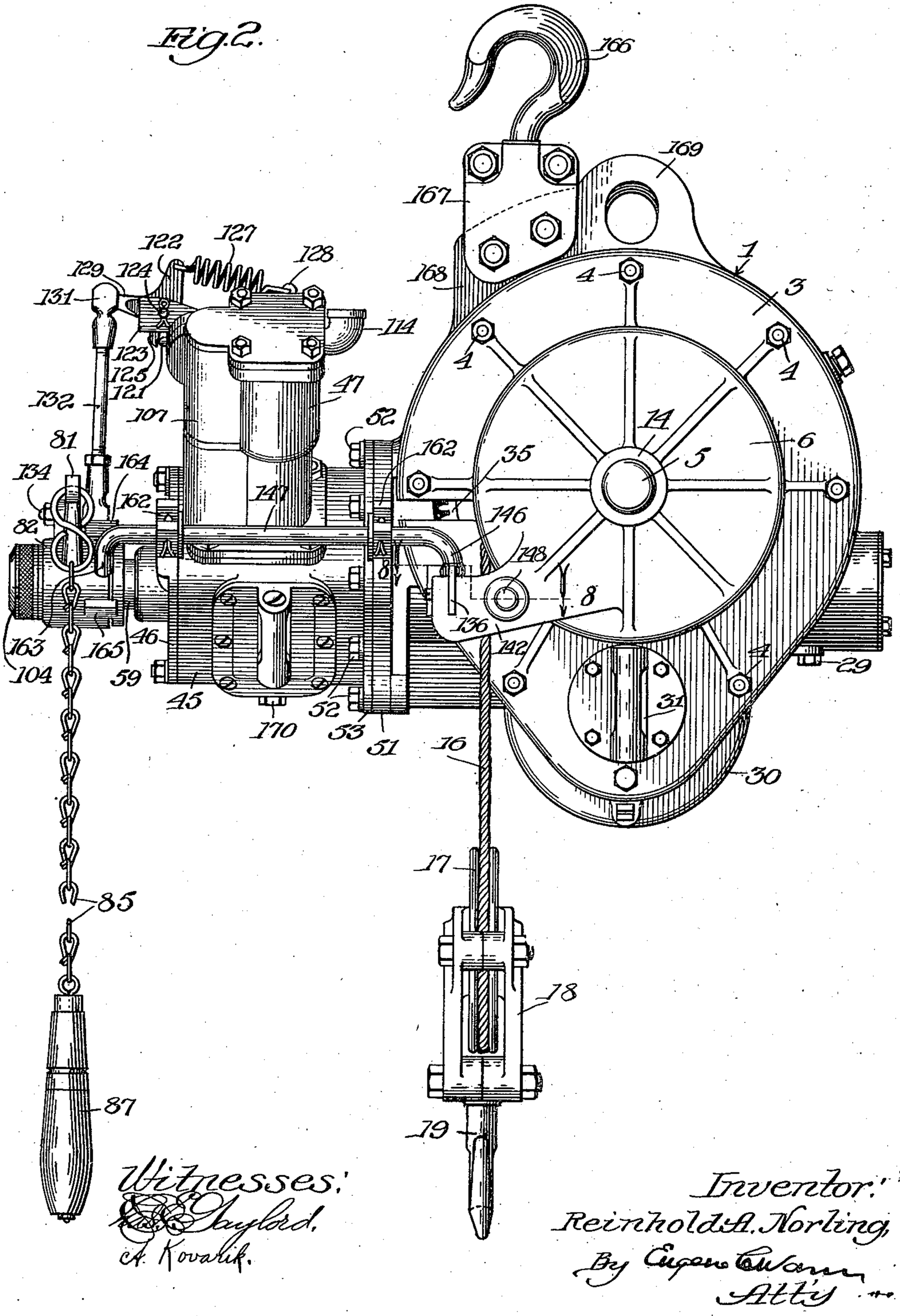
1,459,032

6 Sheets-Sheet 2

Fig. 2.



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PORTABLE POWER HOIST

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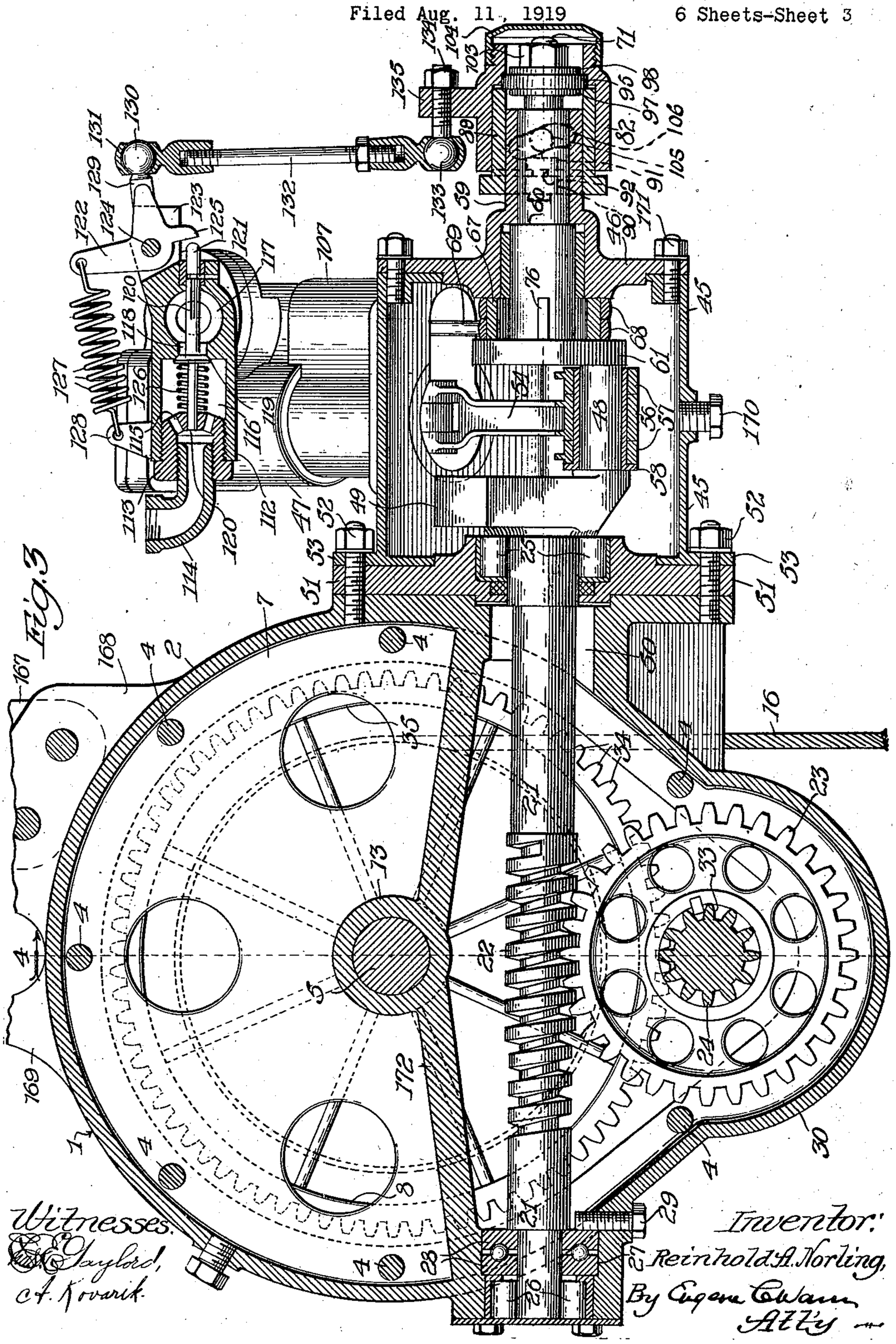

Fig. 3.

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PORTABLE POWER HOIST

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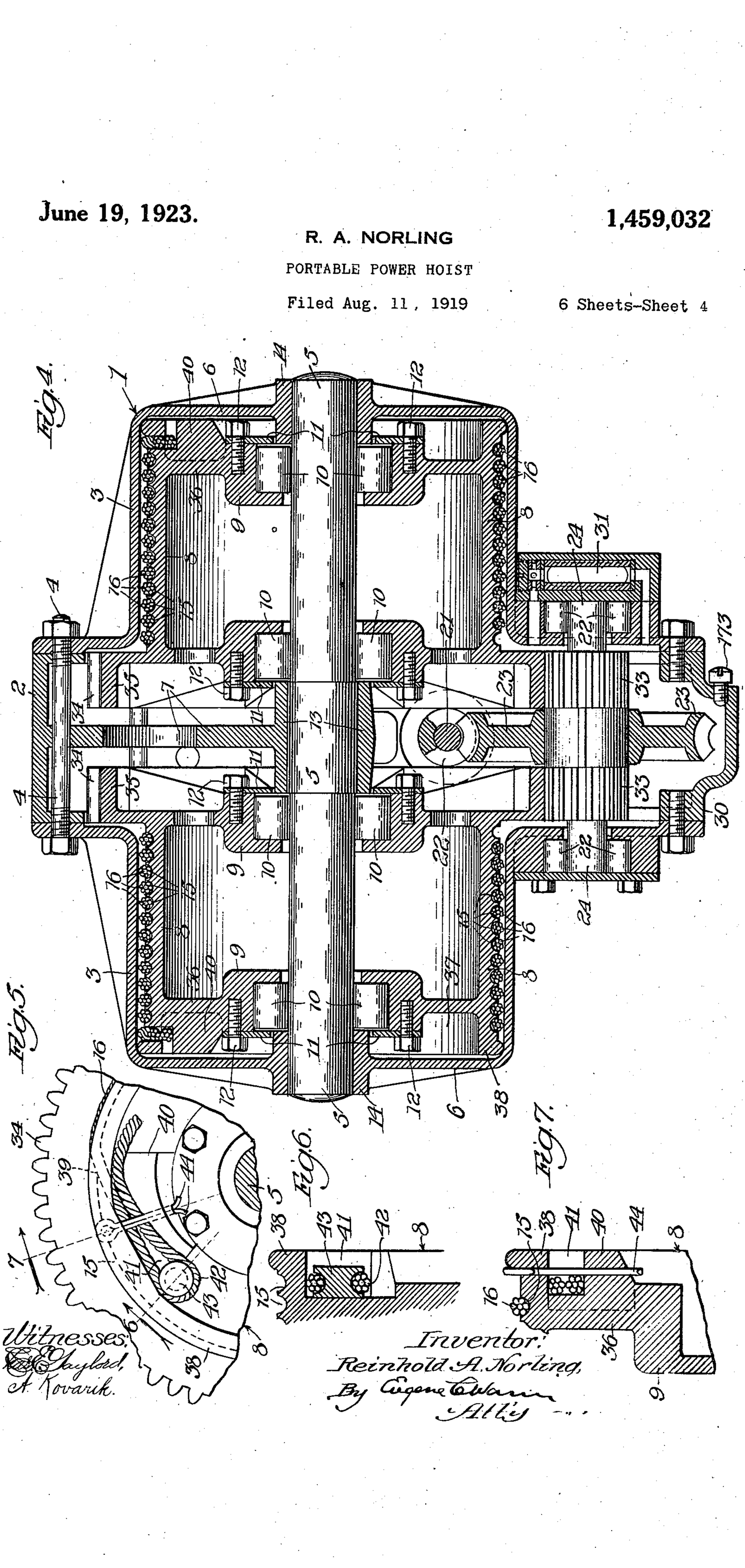
6 Sheets-Sheet 4



Witnesses:
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June 19, 1923. 1,459,032

R. A. NORLING

PORTABLE POWER HOIST

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Fig. 8.

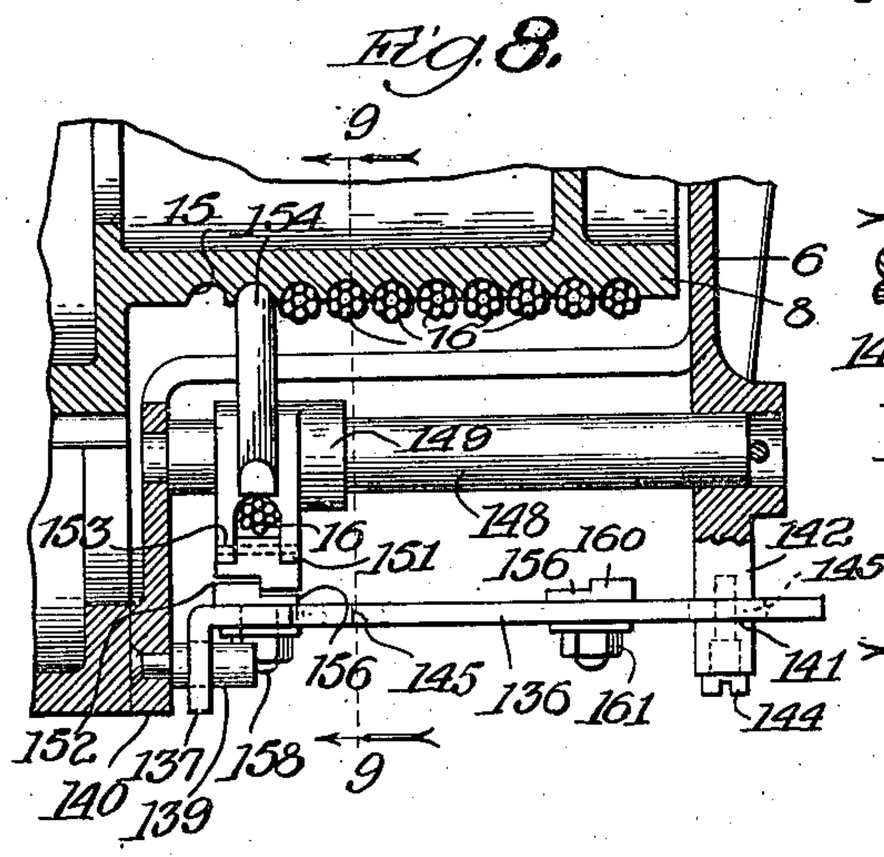


Fig. 9.

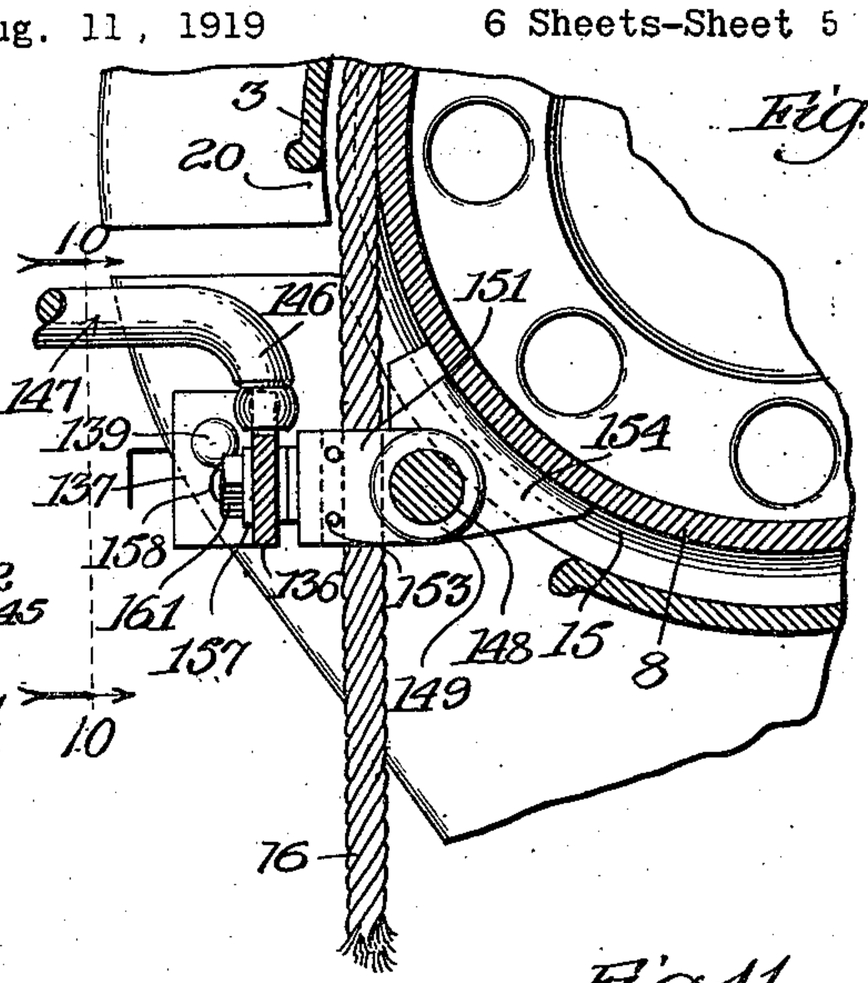


Fig. 10.

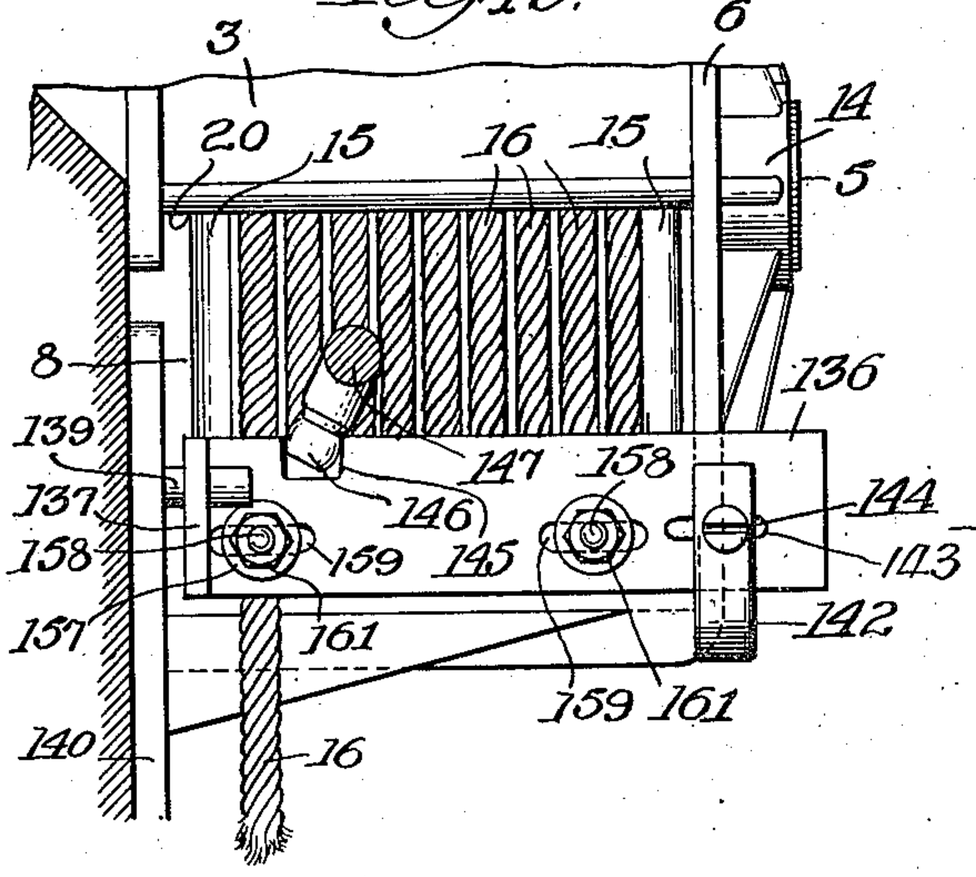


Fig. 11.

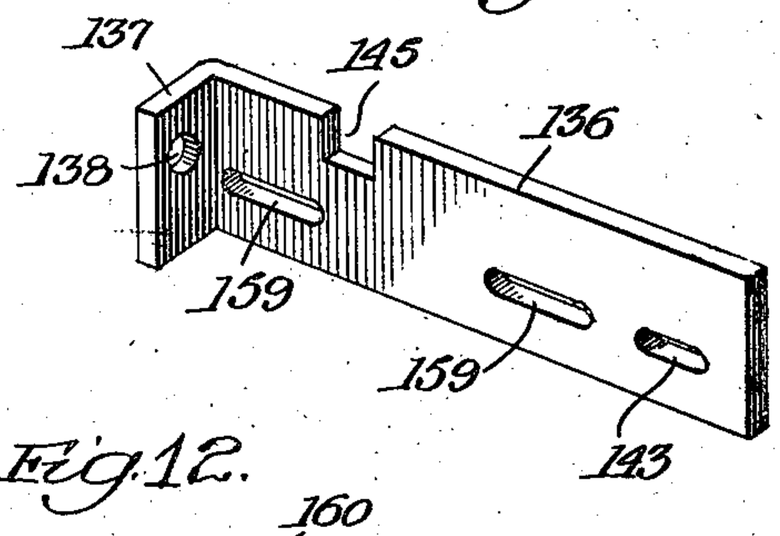


Fig. 12.

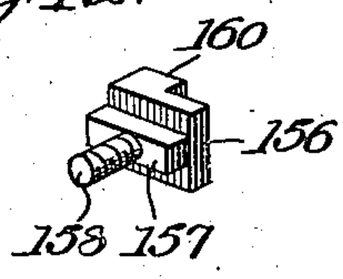
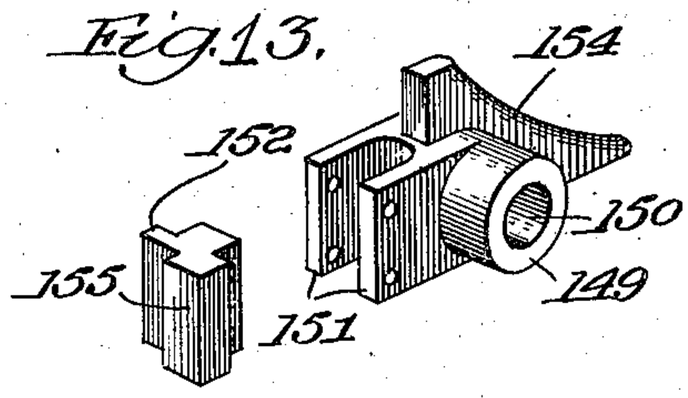


Fig. 13.



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Atty.

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R. A. NORLING

PORTABLE POWER HOIST

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Fig. 14.

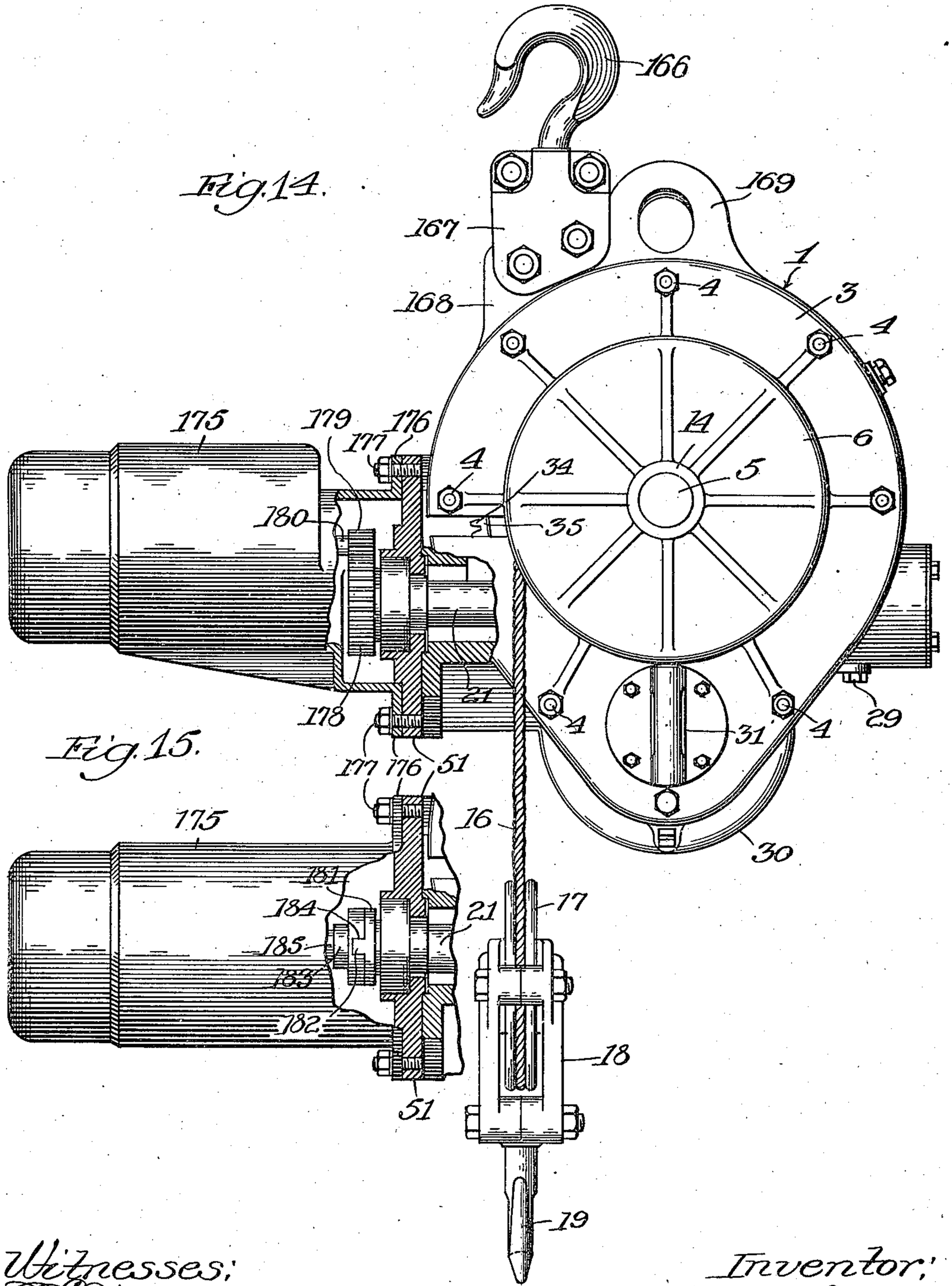

Fig. 15.

Witnesses:
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Atty.

Patented June 19, 1923. 1,459,032

UNITED STATES PATENT OFFICE.

REINHOLD A. NORLING, OF AURORA, ILLINOIS, ASSIGNOR TO INDEPENDENT PNEUMATIC TOOL COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

PORTABLE POWER HOIST.

Application filed August 11, 1919. Serial No. 316,794.

To all whom it may concern:

Be it known that I, REINHOLD A. NORLING, a citizen of the United States, residing at Aurora, in the county of Kane and State of Illinois, have invented new and useful Improvements in Portable Power Hoists, of which the following is a specification.

This invention relates to a portable power hoist.

The main objects of the invention are as follows: first, to locate the motor or prime mover which drives the rotary drums of the hoist proper on the outside of the drum casing, so that the motor may be readily accessible for repair, oiling, and other attention that it may require, without having any of the parts of the hoist proper interfere with or hinder ready access to the motor and its parts; second, to provide a connection between the crank shaft or like part of the motor and the main shaft of the hoist proper, so that the motor may be removed entirely from the hoist proper without disturbing any of the parts and connections of the hoisting structure, thereby permitting a replacement of a worn or injured motor by a new one; third, to provide means for automatically stopping the motor when the rope or cable has been wound upon or unwound from the drum to the extent required; fourth, to provide adjustable means for that purpose, that is, to permit the operator to adjust readily the parts for stopping the motor at any point between where the rope or cable is wound completely upon the drum and unwound completely therefrom; fifth, to provide two drums, with the driving mechanism between them, so as to gain a balanced construction and furthermore to require the use of a single cable or rope by having the ends of the rope attached to the respective drums, and thus permit the maximum length of cable with only one strand wrapped about each drum; sixth, to provide means whereby the parts which effect the reversing of the motor will be shifted or moved into their effective positions before the starting valve of the motor is opened; and seventh, to provide an efficient clamp for connecting the ends of the cable to the drums.

The invention consists further in the matters hereinafter described and more particularly pointed out in the appended claims.

In the accompanying drawings—

Figure 1 is a front elevational view of a portable power hoist constructed in accordance with my invention;

Figure 2 is a side view thereof;

Figure 3 is an enlarged vertical sectional view taken on line 3—3 of Fig. 1;

Figure 4 is a vertical sectional view taken on line 4—4 of Fig. 3;

Figure 5 is a fragmentary end elevational view of one of the drums and showing one end of the rope or cable clamped thereto by a rope clamp of my invention;

Figures 6 and 7 are enlarged sectional views taken on line 6— and line 7—, respectively, of Fig. 5;

Figure 8 is a fragmentary horizontal sectional view taken on the indirect line 8—8 of Fig. 2;

Figure 9 is a vertical sectional view taken on line 9—9 of Fig. 8;

Figure 10 is a view taken on line 10—10 of Fig. 9;

Figure 11 is a perspective view of the shift bar of the automatic stopping device;

Figure 12 is a perspective view of one of the adjustable stop members of such device;

Figure 13 is a perspective view of the rope or cable guide and shoe of such device and showing the two parts thereof separated;

Figure 14 is a side view of a hoist embodying the features of my invention, but showing an electric motor attached to the drum casing thereof instead of a pneumatic motor as shown in the preceding figures; and

Figure 15 shows a form of clutch for connecting the driving shaft of the hoist with the armature shaft of said electric motor when such shafts are in alignment.

As illustrated in the drawings, a portable power hoist embodying the features of my invention comprises two main parts, the hoist proper and the prime mover or motor. The hoist proper comprises a hollow casing 1 having a mid-frame 2, and drum covers 3, 3 on opposite sides thereof, the parts being secured thereto by clamp bolts 4, as shown. Through the casing 1 extends a stationary drum shaft 5 having its ends supported in the end webs 6 of the drum covers, as shown in Fig. 4. The central portion of said shaft 5 is mounted in a supporting web 7 made part of the mid-frame 2. Located in the cas-

ing 1 are two rotatable rope or cable drums 8, 8, both made alike with one on each side of the web 7 and surrounding the stationary shaft 5. Each drum 8 is provided at the ends thereof with hubs 9, 9, made to have race-ways for roller bearings 10 bearing against the stationary shaft 5. The rollers 10 are kept in place by collars 11 secured to the hubs 9 by screws 12, 12. The shaft 5 is pressed into the web 7 through a fixed bushing 13 extending between the roller bearings 10 at the inner ends of the drums 8, and thus serves to prevent the drums from moving into contact with the central web 7. The end webs 6 are also provided with fixed bushings 14 extending inward toward the roller bearings 10 at the outer ends of the drums and serve to hold the latter from movement into contact with the drum covers 3. In short, the bushings 13 and 14 prevent the drums from movement along the stationary shaft 5, but do not interfere with the rotation of the drums about said shaft. Each drum 8 is provided in its outer surface with a continuous spiral groove 15 extending about the drum from the inner to the outer end thereof and of a size to receive a rope or cable 16. With said hoist a single cable 16 is employed, one portion of which wraps in a single layer around one drum and the other portion wraps in a single layer around the other drum, with the loop at the mid-portion of the cable trained about a grooved pulley or sheave 17 outside of the casing 1 and journaled for rotation on a frame 18 carrying a swiveled hoisting hook 19. The looped portion of the cable 16 passes out of the drum casing 1 through a suitable opening 20 extending across the front of the casing, as shown in Fig. 1.

Located in the casing 1 and extending between the drums 8, 8 below the bushing 13 is a shaft 21 arranged transverse to the drum shaft 5 and provided between its ends with a worm 22 in mesh with a worm gear 23, keyed or otherwise fixed to a shaft 24 arranged at right-angles to and below the shaft 21, as shown in Figs. 3 and 4. Said shaft 21 is supported at its ends in the casing 1 by roller bearings 25, 26 and an end thrust bearing 27 adjacent the latter, as shown in Fig. 3. Said thrust bearing has two ball races 28 loosely mounted both in the casing 1 and on the shaft 21, so that said worm shaft 21 may be pulled out of the drum casing after the motor has been removed therefrom, without removing or disconnecting any of the other parts of the hoist. The screw 29 holds the end thrust bearing in place. The mid-frame 2 has its lower portion 30 curved downward about the worm gear 23 to provide an oil chamber so that said worm gear may be immersed in oil approximately up to its center, the oil sight 31 of Fig. 4 being for the purpose of showing the level of oil in the casing. The shaft 24 extends through the oil chamber 30 and has its ends journaled in the end webs 6 of the drum covers on roller bearings 32, 32, as shown in Fig. 4. The worm gear 23 is centrally located on the shaft 24, the portions of the shaft on each side thereof having gear pinions 33 fixed thereto or cut integral with the shaft if desired. Said gear pinions 33 are alike and mesh with gear teeth 34 on the inner ends of the drums 8, which as shown are cut in annular flanges 35 on said drums. But suitable gear wheels may be attached to the drums in preference to cutting the gear teeth thereon. The gear ratio between the worm gear 23 and the drums 8 may be changed by changing the diameter of the gear pinions 33 on the shaft 24 and the diameter of the gears 35 on the drums 8, with the result that the speed and power for lifting weights will be changed. The worm 22 has such a pitch that it will hold a load on the cable 16 suspended when the motor is stopped or shut off or removed entirely from the casing 1.

One end of the cable 16 is secured to one of the drums 8 and the other end of the cable is secured to the other drum. In Figs. 4, 5, 6, and 7, I have shown a method of fastening the ends of the cable to the drums. The outer hub 9 of each drum is connected with the cylindric body portion of the drum by a radial web 36 spaced a distance inward from the outer edge of the drum, thereby providing an annular channel 37 having an overhanging flange 38. Extending through said flange is an inclined slot or passage 39 opening at one end into the channel 37 and at the other end through the outer face of the drum. Beneath said flange 38 at the passage 39 is a wedge-shaped lug 40, preferably formed integral with the web 36. The outer surface of said lug 40 is inclined from the flange 38 downward to provide between such parts a wedge-shaped groove 41 with the passage 39 opening into the narrowest end thereof. One end of the cable 16 is inserted through the passage 39 into the groove 41 and doubled upon itself to form a loop 42, in which is placed a spool or collar 43, causing the diameter of the loop to be slightly greater than the larger end of the groove 41. The strands of the cable are laid in the groove 41 and the cable drawn tight, wedging itself and the spool into the groove 41. To prevent the loop from working out of the open side of the groove 41, I provide a retaining member 44 in the form of a cotter pin extending through the flange 38 and the lug 40 on the outside of the loop, as shown in Fig. 7. The other end of the cable is connected with the other drum 8 in the same manner. By having the ends of the cable secured to the drums 8 at the outer ends thereof, it fol-

lows that the upper ends of the cable will be farthest apart when the distance between the hoist and the load is the greatest and will prevent the cable from twisting. The cable is wound on the drums, the latter rotating in the same direction at the same speed, only one layer of cable covering each drum, the layers of cable fitting in the spiral grooves 15, in this way preserving the cable and exerting the same power and speed on the same at all times.

For rotating the drums 8, 8, I provide a prime mover secured to the drum casing 1 on the outside thereof, and in the device illustrated the prime mover is in the form of a pneumatic motor having a crank case 45, a crank case cover 46, and double acting cylinders 47, 47 arranged V-shaped. as shown in Fig. 1. The crank consists of a single stud 48 formed integral with a counterweight 49 on the worm shaft 21. Said shaft 21 extends outward from the front of the drum casing 1 through an opening 50 closed by a plate 51 carrying the roller bearings 25, heretofore mentioned. Said plate 51 is secured to the drum casing 1 by fastening members 52, which also pass through a flange 53 on the crank case 45 for attaching the motor to the drum casing. In the cylinders 47 are pistons (not shown) having connecting rods, only one 54, being shown in Fig. 3, extending to the crank pin 48 and provided with straps 56, 57, respectively, engaging about the crank pin 48 with a bushing 58 interposed between such parts. The crank case cover 46 is provided with a tubular extension 59 extending outward therefrom in alignment with the worm shaft 21 and in which is mounted a hollow shaft 60 having at its inner end a disk or flange 61. This is located in the crank case 45 and has removable connection with the crank pin 48 in the manner shown and described in my co-pending application filed November 3, 1921, Serial No. 512,503, and which application is a division of the present one. Applied about the portion of the shaft 60 in the crank case 45 between the cover 46 and the disk 61 is an eccentric 67 surrounded by two eccentric straps 68, 68 connected with valve rods 69, which have pivotal connection at their upper ends with reciprocating valves (not shown) of the engine cylinders, as shown in Fig. 13, so as to control the inlet and exhaust of motive fluid to and from said cylinders. The eccentric 67 has an internal diameter greater than the shaft 60, while its outer diameter is made eccentric to the internal diameter thereof. The eccentric 67 is shifted for reversing the operation of the motor. Thus, when the eccentric is shifted to one position, the motor will run forward and wind the cable on the drums; while, if shifted to the opposite position, the motor will reverse and unwind the cable from the drums. To effect the shifting of the eccentric for such purposes, I provide the construction shown and described in detail in my said co-pending application. Generally, this construction includes an eccentric shifter 71 slidably mounted in the hollow shaft 60, and a rack bar 76 extending across the shaft 60 within the eccentric 67. This bar 76 extends through slots in the shaft 60 and engages the eccentric on the inside and supports it. The connection between the shifter 71 and the rack bar 76 is such that the latter is moved across the shaft 60 when the shifter is moved, thus changing the eccentricity of the parts and effecting a reversal of the motor.

For moving the shifter 71 endwise from the exterior of the motor, I provide on the outside thereof a control lever 81 having the shape shown in Fig. 1 and provided at its center with a hub 82, from opposite sides of which extend the arms 83, 84. To the outer ends of said arms are connected depending chains 85, 86, having handles 87, 88 at their lower ends, as shown in Fig. 1. By pulling down on the chain 85, the motor will run forward and wind the cable on the drums 8, whereas by pulling down on the chain 86 the motor will run reverse and unwind the cable from the drums. To effect this, the control lever 81 is connected with the shifter 71 by the following construction, which causes endwise movement to be given to the shifter 71 upon the actuation of said control lever. The hub 82 of said control lever is rotatably mounted on the extension 59 of the crank case, there being a bushing 89 inserted between such parts, as shown in Fig. 3. The bushing and hub are connected together so as to turn in unison, this being accomplished in the specific form of construction shown by providing such parts at their inner ends with flanges 90, 91, respectively, connected together by fastening members 92, 92. The hub 82 extends beyond the outer end of the tubular extension 59 to provide a space into which extends the outer end of the shifter 71. Mounted on the reduced outer end of said shifter is an annular collar 95 bearing against the outer end of the bushing 89, as shown in Fig. 3. The outer side of said collar 95 bears against a shoulder formed on the hub 82. By such construction the collar 95 is clamped between the hub 82 and bushing 89, and moves endwise with such parts in the shifting of the member 71. On opposite sides of the collar 95 are collars 97, 98, keyed to the shifter 71. The outer end 101 of the shifter 71 is threaded to receive a clamp nut 103, which holds the collars 95, 97, and 98 in place. The outer end of the hub 82 is also threaded to receive a cap member 104 to close the opening in the hub. For moving the shifter 71 endwise when the control lever 81 is operated, I pro-

vide a means for accomplishing such purpose, one form of which includes a stud 105, shown in dotted lines in Fig. 3. Said stud 105 is held in a fixed or stationary position by being screwed into the tubular extension 59 of the crank case, and has its outer end projecting into a slot 106 formed in the bushing 89. Said slot 106 is milled spiral in the center and straight at its ends so that upon the rotation of the bushing by the control lever 81 the shifter 71 will be moved endwise during the path of movement of the stud 105 through the spiral portion of the slot 106 and thus effect the shifting of the eccentric 67 for reversing the motor. The ends of the slot are made straight in order that the hub 82 may have a partial rotation without moving the member 71 endwise and thus permit the shifting of the eccentric to be completed before the starting valve of the motor is opened and the motor started.

The starting valve is constructed as follows. The starting valve is located between the valve cylinders 107, 107 (Fig. 1) and includes pipes 109, 110, which are coupled together at their meeting ends by a coupling member 111. Such end of the pipe 110 is provided with a tubular extension 112 arranged at right-angles to said pipe, as shown in Fig. 3. Screwed into the open end of the extension 112 is a plug 113, which carries a nipple 114, to which is connected an air supply hose or pipe (not shown). The plug 113 is provided at its inner e
a wall having passages 115, which open into a chamber 116 formed in the extension 112. Said chamber communicates with a chamber 117 in the pipe 110 through a port 118, which is normally closed by a valve 119. Said valve has a stem 120 slidably mounted at its inner end in the plug 113 and at its outer end in the casing 112 and is there provided with an outwardly projecting part 121. For operating the valve, I provide a trigger 122 mounted between ears 123 on the valve casing and connected therewith by a pivot pin 124. Said trigger 122 is provided with a depending lug 125, which operates against the outer end of the valve stem 120 for moving the valve into open position to permit motive fluid to enter the chamber 117 and thence flow into the power cylinders of the motor through the pipes 109, 110. The valve 119 is normally held in a closed position by a spring 126, located in the chamber 116, as shown. The trigger 122 is normally maintained in position with its lug 125 out of contact with the outer end 121 of the valve stem by a spring 127, one end being connected with a lug 128 fixed on the valve casing 112 and the other end connected with the trigger 122. One of the arms 129 of the trigger is provided at its outer end with a ball 130 retained in a socket 131 secured to the upper end of a rod 132 which extends downward towards the hub 82. The lower end of said rod is provided with a ball 133 on the inner end of a bolt 134 clamped to an upright lug 135 formed integral with the hub 82. The spring 127 is made strong enough not only to maintain the trigger 122 in its inoperative position, such as shown in full lines in Figs. 1 to 3, but also to hold the rod 132 in a vertical position and thus maintain the control lever 81 in its neutral position, such as shown in full lines in Fig. 1. Thus, when either end of said lever is pulled downward by an operator grasping either one of the handles 87 or 88, the hub 82 is partially rotated, carrying therewith the lug 135 and causing a downward pull to be exerted on the rod 132, which operates the trigger for opening the valve 119 and then starts the motor. When the parts are thus moved, the rod 132 assumes a position at an angle to the vertical, the spring 127 always tending to restore the rod and the control lever 81 to their normal or neutral position, so that, when the operator releases his hold on the handle grasped by him, said spring will act to return the parts to the position referred to and stop the motor by allowing the valve 119 to close.

For automatically stopping the motor when the cable or rope has been wound in one layer on each drum and thus prevent damaging the cable by winding it in two layers on the drums in opposite directions, and further prevent the load being pulled up against the hoist casing with a likelihood of injuring the same, should the operator fail to stop the motor before that happens, and also to stop the motor before the cable is unwound from the drums to its fullest extent and thus prevent the load or hook 19 from striking the surface beneath the hoist, as well as to stop the motor at any point between such extremes, I provide a construction for accomplishing such purposes, one form of which is as follows and is illustrated in Figs. 8 to 13. Located in front of the casing 1 and to one side of the motor is a shift bar 136 having its inner end 137 arranged at right-angles thereto and extending outward therefrom. Said end 137 is provided with a hole 138, through which extends a guide lug 139 fixed to a web 140 on one of the drum covers 3, as shown in Fig. 8. The opposite end of the bar 136 is received in a vertically arranged slot 141 opening upward through a bracket 142 extending outward from the end web 6 of the right-hand drum cover 3. As shown in Fig. 11, said bar 136 is provided adjacent its outer end with an elongated slot 143, through which extends a set screw 144 screwed into the bracket 142 through the slot 141 therein. Said bar 136 is provided in

its upper edge near its inner end with an upwardly opening slot or recess 145 to receive the lower end 146 of a rockably mounted arm 147, by means of which the bar is given endwise movement in both directions in a manner to be described. Located between the drum casing 1 and the bar 136 is a stationary shaft 148 extending between the web 140 and the bracket 142, as shown in Fig. 8. Said shaft 148 is cylindric and has slidably mounted thereon a guide member 149 provided with a hole 150, through which said shaft extends. Said guide member is provided at one side with outwardly extending webs 151, 151 laterally spaced apart to provide a fork shaped member, through which passes the cable 16, as shown in Figs. 8 and 9. The outer end of the opening between the webs 151 is closed by a cap 152 secured in place by fastenings 153. By the construction described, the cable is guided so that no matter how it is pulled sideways below the hoist it does not affect the part of the cable above the guide 149, thus making it impossible for the cable to climb on top of the layer already on the drums or get out of the spiral grooves 15 therein. The guide 149 is provided on the opposite or rear side thereof with a curved shoe 154 shaped to fit into the spiral groove 15 of the associated drum 8, so that the guide member 149 will travel across the face of the drum 8 from one side thereof to the other along the stationary shaft 148 in the rotation of the drum. The cap 152 is provided with an outwardly extending lug 155 designed to contact with stop members 156 adjustably secured to the bar 136. There are two of such stop members 156, one adjacent each end of the bar 136, and as both are alike only one will be described in detail. As shown in Fig. 12, the stop member is provided at one side thereof with a rib 157, from which projects a screw-threaded stud 158, to be extended outward from an elongated slot 159 in the bar 136, the rib 157 being received in said slot and holding the stop member from turning. Said stop member is provided on the opposite side thereof with an outwardly extending lug 160 in the path of movement of the lug 155 on the cable guide 149. On the threaded stem 158 of each stop member is applied a nut 161 for clamping the stop member to the bar 136. By having the stop member 156 adjustable lengthwise of the bar 136, the distance between the stop members may be varied so as to vary the extent of movement allowed the cable guide 149 and thus effect the stopping of the motor at any point desired between the place where the cable is wound completely on the drums and unwound completely therefrom, so that the operator if he wishes the motor to stop after the load has been raised to a predetermined distance less than that allowed by the cable being wound completely on the drums, may set the innermost stop member 156 accordingly; whereas, should it be desired to limit the distance that the load or lifting hook 19 be allowed to descend, the operator may fix the outermost stop member accordingly, and thus prevent the hook from striking the ground or floor, as the case may be, should the hoist not be supported a sufficient distance above the same to prevent the hook from touching the floor if the cable were unwound from the drums to the fullest extent. For stopping the motor through the bar 136, I provide the rockable rod 147. Said rod is arranged to extend outward from the drum casing along the side of the motor, and is retained in fork-like supports or lugs 162 extending outward from the casing of the motor, as shown in Figs. 1 and 2. The outer end 163 of said rod is bent downward toward the hub 82 of the control lever 81, as shown in said figures, and occupies a position in the path of movement of radial lugs 164, 165 on said hub 82. When the parts occupy the position shown in full lines in Fig. 1, the cable or rope 16 is wound completely on the drums with the lifting hook 19 raised in close proximity to the casing of the hoist, and the arm 147 having its outer end 163 substantially in contact with the lug 164, and the shoe 154 of the rope guide is at the inner end of the spiral groove in the right-hand drum 8. To unwind the cable from the drums, the operator pulls downward on the left-hand chain 86 by grasping the handle 88, thereby moving the arm 83 of the control lever 81 downward and the opposite arm 84 upward, carrying therewith both lugs 164, 165 so as to bring the lowermost one 165 into position closely adjacent the end 163 of the rod 147. The motor starts by the opening of the starting valve 119 and to keep the motor in operation the operator maintains his grasp on the handle 88 and keeps the left-hand end 83 of the control lever in its fully lowered position, for otherwise the valve 119 would close by the action of its spring 126 and the motor be stopped and the parts returned to their neutral positions by the spring 127, should the operator release his hold on the chain 86. As the cable unwinds, the shoe 154 travels across the face of the right-hand drum 8 toward the outer end thereof until it comes in contact with the outermost stop member 156, whereupon the bar 136 will be moved endwise outward, rocking the rod 147 in a direction to move its outer end 163 into contact with the lowermost lug 165 and acting against it to move the control lever 81 back to its neutral or central position, as shown in Fig. 1, with the result of stopping the motor. Such action is of course strong enough to pull the handle 88 upward and out of the hand of the oper-

ator. To wind the cable on the drums, the other chain 85 is pulled downward by the operator grasping the handle 87 and holding it depressed, thereby moving the arm 84 of the control lever 81 downward and the opposite end 83 upward, at the same time bringing the uppermost lug 164 into position to be engaged by the outer end 163 of the rod 147. When the shoe 154 reaches the inner end of the spiral groove, it moves the plate 136 endwise by contacting with the innermost stop member 156, thus moving the control lever 81 back to its neutral or central position and again stopping the motor. It is of course understood that the operation of the motor first in one direction to unwind the cable and then in the opposite direction to wind the cable is effected by the shifting mechanism heretofore described, which is brought into operation upon the movement of the control lever 81.

The drum casing 1 is provided at its upper end with a swivel hook 166 for suspending the hoist from an overhead support, said hook being provided with clamp plates 167, whereby the same may be connected with an upright web 168 formed on the casing. Said web is provided with a loop 169, to which a rope or chain may be attached for pulling the hoist up when being installed. The crank case 45 is provided with a screw plug 170, which when removed permits the same to be drained of the oil therein, while the cover plate 46 is fastened to the crank case by suitable fastening members 171, as shown in Fig. 3. The web 7 of the mid-frame 2 of the drum casing is cut away at its lower end to provide room for the worm shaft 21 and parts arranged therebelow, said web being provided at such end with a transverse strengthening web 172. The reservoir 30, in which the worm gear 23 is mounted, is provided with a screw plug 173, which when removed permits draining of the same. The crank case 45 is made to receive a quantity of oil for lubricating the crank shaft and connected parts, and is provided with an oil sight 174, as shown in Fig. 1.

Having the motor located on the outside of the drum casing 1 and being removably connected therewith, as shown in Fig. 3, it is possible to remove and attach the motor to the hoist proper without affecting or changing the construction of the parts in the hoist casing. This, therefore, permits the use of any type of prime mover desired for operating the drums 8, whether it be in the form of a pneumatic motor, as shown in Fig. 3, or in the form of an electric motor 175, as shown in Figs. 14 and 15. When an electric motor is applied, its outer casing is provided with a flange 176, through which is extended the fastening members 177 in the same manner as the fastening members 52. With such construction, however, it is necessary that the worm shaft 21 terminate on the outside of the plate 51 and there be provided with a spur gear 178, which meshes with a gear pinion 179 on the armature shaft 180, in case the latter is out of alignment with the worm shaft 21. Should the armature shaft be in alignment with the worm shaft 21, then a flexible connection is made between the two shafts, as shown in Fig. 15. In such case, the outer end of the worm shaft is provided with a disk 181 having a rib 182 received in a complementary shaped slot 183 in a disk or face plate 184 in the armature shaft 185. Whatever type of prime mover is employed, it will be noted that the same, being located on the outside of the hoist casing, may be connected therewith little difficulty and thus be readily accessible for the purpose of repair or removal without interfering with the driving connection of the drums of the hoist proper.

By providing two drums 8, 8 arranged opposite each other in the manner shown, the driving mechanism for the drums may be placed between the same, thereby not only producing a balanced construction, but also enabling the drums to be rotated in the same direction and at the same rate of speed, with the result that the action on each of the two strands of the rope or cable 16 extending downward below the hoist will be uniform on each and the load on the hoisting hook 19 raised and lowered properly and without twisting the cable. Moreover, by the use of two drums, one layer of cable may be wrapped upon each drum, thereby preventing injury to the cable by avoiding the necessity of having layers of the cable wound one upon the other. The automatic stopping mechanism has the advantages already noted, but it may be well to state that by such mechanism the motor will be stopped without any action on the part of the operator to that end, and thus prevent damage being done to the parts or the load being handled by the hoist, should the attention of the operator be absorbed in something other than attending to his duties of operating the hoist. Other and further advantages arising out of my invention will be apparent to those skilled in the art to which my invention relates.

While I have shown and described herein in detail one form of portable power hoist embodying the features of my invention, it is of course understood that the details of construction and arrangement of parts shown may be variously changed and modified without departing from the spirit and scope of my invention.

I claim as my invention:

1. A portable power hoist, comprising a casing, two drums therein and spaced apart endwise, means in said casing for supporting both drums and having the same loosely

mounted thereon, a single rope or cable for said drums and having its ends secured thereto with the looped portion of said cable extending out of said casing, a shaft in said casing between the spaced ends of said drums, a motor carried by said casing and connected with said shaft for rotating the same, and power transmitting means in said casing connecting said shaft with both drums for rotating the same in unison.

2. A portable power hoist, comprising a casing having a mid-section and drum covers on opposite sides thereof, said covers having end webs, a stationary shaft supported by said mid-section and the end webs of said drum covers, two drums loosely mounted on said shaft, one in each drum cover and completely enclosed thereby, a single rope or cable for said drums and having its ends secured thereto with the looped portion of said cable extending out of said casing through slots in said drum covers, a second shaft arranged transversely to the first and journaled in said mid-section between said drums, a motor secured to the mid-section on the outside thereof and connected with said second shaft for rotating the same, and power transmitting means in said mid-section below said second shaft and connecting the same with both drums for rotating them in unison.

3. A portable power hoist, comprising a casing having a mid-section and drum covers on opposite sides thereof, said covers having end webs, a stationary shaft supported by said mid-section and the end webs of said drum covers, two drums loosely mounted on said shaft, one in each drum cover and completely enclosed thereby, a single rope or cable for said drums and having its ends secured thereto with the looped portion of said cable extending out of said casing through slots in said drum covers, a second shaft arranged transverse to the first and journaled in said mid-section between said drums, a motor secured to said mid-section on the outside thereof and connected with said shaft for rotating the same, a third shaft below the second shaft and arranged parallel to the first shaft below said second shaft and having its ends journaled in the adjacent portions of said drum covers, and a gear train connecting the second shaft with both drums through the third shaft for rotating said drums in unison.

4. A portable power hoist, comprising a casing, two hoisting drums rotatably mounted in said casing and spaced apart endwise, each drum having gear teeth at its inner end, a worm shaft mounted in said casing and extending between the ends of said drums, a second shaft arranged transverse to said worm shaft, a worm gear secured to said second shaft and meshing with the worm on said worm shaft, said second shaft being provided with gear teeth meshing with the gear teeth on said drums, and a motor for rotating said worm shaft.

5. A portable power hoist, comprising a casing, a stationary shaft mounted therein, two hoisting drums rotatably mounted on said shaft and spaced apart endwise, each drum having gear teeth at its inner end, a worm shaft mounted in said casing and extending between the ends of said drums and arranged transverse to said stationary shaft, a third shaft mounted in said casing and arranged transverse to said worm shaft, a worm gear on said third shaft and meshing with the worm on said worm shaft, said third shaft being provided with gear teeth meshing with the gear teeth on said drums, and a motor for rotating said worm shaft.

6. A portable power hoist, comprising a hollow casing having a mid-section and drum covers secured thereto on opposite sides thereof, a stationary shaft located in said casing and being supported by said mid-section and said drum covers, two hoisting drums rotatably mounted on said shaft and spaced apart endwise, each drum having an annular flange at the inner end thereof, said flange having gear teeth thereon, a worm shaft mounted in said casing below said stationary shaft and arranged transverse thereto, a third shaft journaled in said mid-section beneath said worm shaft and arranged transverse thereto, a worm gear secured to said third shaft and meshing with the worm on said worm shaft, said third shaft having gear teeth on opposite sides of the worm gear thereon and meshing with the gear teeth on said drums, and a motor for rotating said worm shaft, said motor being secured to and located on the outside of said casing.

7. A portable power hoist, comprising a casing, hoisting drums rotatably mounted therein and having a cable to be wound upon and unwound therefrom, a motor secured to said casing for operating said drums, a member engaging said cable and having connection with one of said drums so as to be moved endwise thereof upon the rotation of said drum, and means interposed between said member and said motor for stopping the same when the cable has been wound upon or unwound from said drums to a predetermined extent.

8. A portable power hoist, comprising a casing, two hoisting drums rotatably mounted therein and having spiral grooves to receive strands of cable connected with said drums, a motor for operating said drums and connected with said casing, an endwise movable plate mounted on said casing, a member engaging said cable and having a shoe extending into the spiral groove of one of said drums, stop members adjustably

connected with said plate and adapted to be engaged by said member for moving said plate endwise, and means interposed between said plate and said motor for stopping the same when said member moves said plate.

9. A portable power hoist, comprising a casing, two hoisting drums rotatably mounted therein and having spiral grooves to receive strands of cable connected with said drums, a motor for operating said drums and connected with said casing, a manually operable control lever carried by the casing of said motor for starting the same, a cable guide engaging said cable and having a shoe extending into the spiral groove of one of said drums, an endwise movable plate mounted on said casing, stop members adjustably connected with said plate and adapted to be engaged by said cable guide for moving said plate, a rod rockably mounted on the motor casing and having one end engaging said plate and the other end adapted to engage said control lever for stopping the motor when said cable guide moves said plate.

10. A portable power hoist, comprising a casing, two hoisting drums rotatably mounted therein and having spiral grooves to receive strands of cable connected with said drums, a motor for rotating said drums and secured to and located on the outside of said casing, a manually operable control lever carried by the casing of said motor for starting the same, a cable guide engaging said cable and having a shoe extending into the spiral groove on one of said drums, an endwise movable plate mounted on said casing, stop members adjustably connected with said plate and adapted to be engaged by said cable guide for moving said plate endwise, a rod rockably mounted on the casing of said motor and having one end engaging said plate and the other end extending between lugs on said control lever for moving the same into position stopping said motor upon the movement of said plate by said cable guide, and a spring connected with said lever for returning the same to and normally holding it in its inoperative position.

11. A portable hoist having a rotatable hoisting drum, a cable adapted to be wound upon and unwound from said drum, and means for connecting the end of said cable to said drum, comprising a hole extending through a flange at one end of said drum, a lug secured to said drum beneath said flange and having the outer surface thereof inclined to provide a wedge shaped recess between the same and said flange to receive a loop provided at the end of said cable, and a member insertible in the loop at the end of said cable for permitting the loop of the same to be drawn tightly in said wedge shaped recess, and means for holding the loop of said cable in said recess.

12. A portable power hoist, comprising a casing having a mid-section and drum covers secured thereto on opposite sides thereof, said mid-section having a portion extending below said drum covers and forming a chamber, said drum covers having end webs and parts closing the sides of said chamber, a stationary shaft extending through said mid-section and having its ends supported by the end webs of said drum covers, two drums loosely mounted on said shaft, one in each drum cover and completely enclosed thereby, a single rope or cable for both drums and having its ends secured thereto with the looped portion extending out of said casing through slots in said drum covers, a second shaft journaled in said mid-section transverse to said first shaft and extending between said drums, a motor secured to said mid-section and connected with said second shaft for rotating the same, a third shaft in said chamber parallel with said first shaft and having its ends journaled in the parts of the drum covers at the sides of said chamber, and a gear train connecting said second shaft with both drums through said third shaft for rotating said drums.

13. A portable power hoist, comprising a casing having a mid-section and drum covers secured thereto on opposite sides thereof, said mid-section having a center web with a fixed sleeve, said drum covers having end webs, each having a fixed sleeve aligned with the sleeve of the mid-section, a stationary shaft extending through the sleeve of the mid-section and having its ends in the sleeves of said drum covers, two drums loosely mounted on said shaft, one in each drum cover and completely enclosed thereby, antifriction bearings carried by said drums and engaging said shaft inside of said sleeves, the latter preventing the drums moving into contact with the webs of said mid-section and drum covers, a single cable for said drums and having its ends secured thereto with its looped portion extending out of said casing through slots in said drum covers, a shaft journaled in said mid-section between said drums, a motor secured to said mid-section on the outside thereof and connected with said shaft for rotating the same, and power transmitting means connecting said shaft with both drums for rotating the same in unison.

14. A portable power hoist, comprising a casing having a mid-section and drum covers with end webs, said covers being secured to said mid-section on opposite sides thereof, a stationary shaft extending through said mid-section and having its ends supported by the end webs of said drum covers, two drums with spiral grooves loosely mounted on said shaft with a drum in each drum

cover, a single rope or cable for both drums and extending out of said casing through slots in said drum covers, said cable having its ends secured to said drums, said covers completely enclosing said drums and closely surrounding the same to permit only a single layer of cable being wound thereon, a second shaft in said casing between said drums, a motor secured to said mid-section on the outside thereof and connected with said shaft for rotating the same, and power transmitting means in said casing and connecting said second shaft with both drums for rotating the same in unison.

15. A portable power hoist, comprising a hoisting drum, a cable therefor, a supporting structure for said drum, a motor for operating said drum and carried by said supporting structure, and means including a member engaging both cable and drum and moved endwise of the latter upon rotation thereof for automatically stopping said motor after the cable has been taken up or played out to a predetermined extent.

16. A portable power hoist, comprising a hoisting drum, a cable therefor, a supporting structure for said drum, a motor for operating said drum and carried by said supporting structure, and means including a member engaging both cable and drum and moved endwise of the latter upon rotation thereof for automatically stopping said motor after the cable has been taken up or played out to a predetermined extent, said stopping means being adjustable for varying the extent of take up and play out of said cable.

In testimony that I claim the foregoing as my invention, I affix my signature, this 9th day of August, A. D. 1919.

REINHOLD A. NORLING.