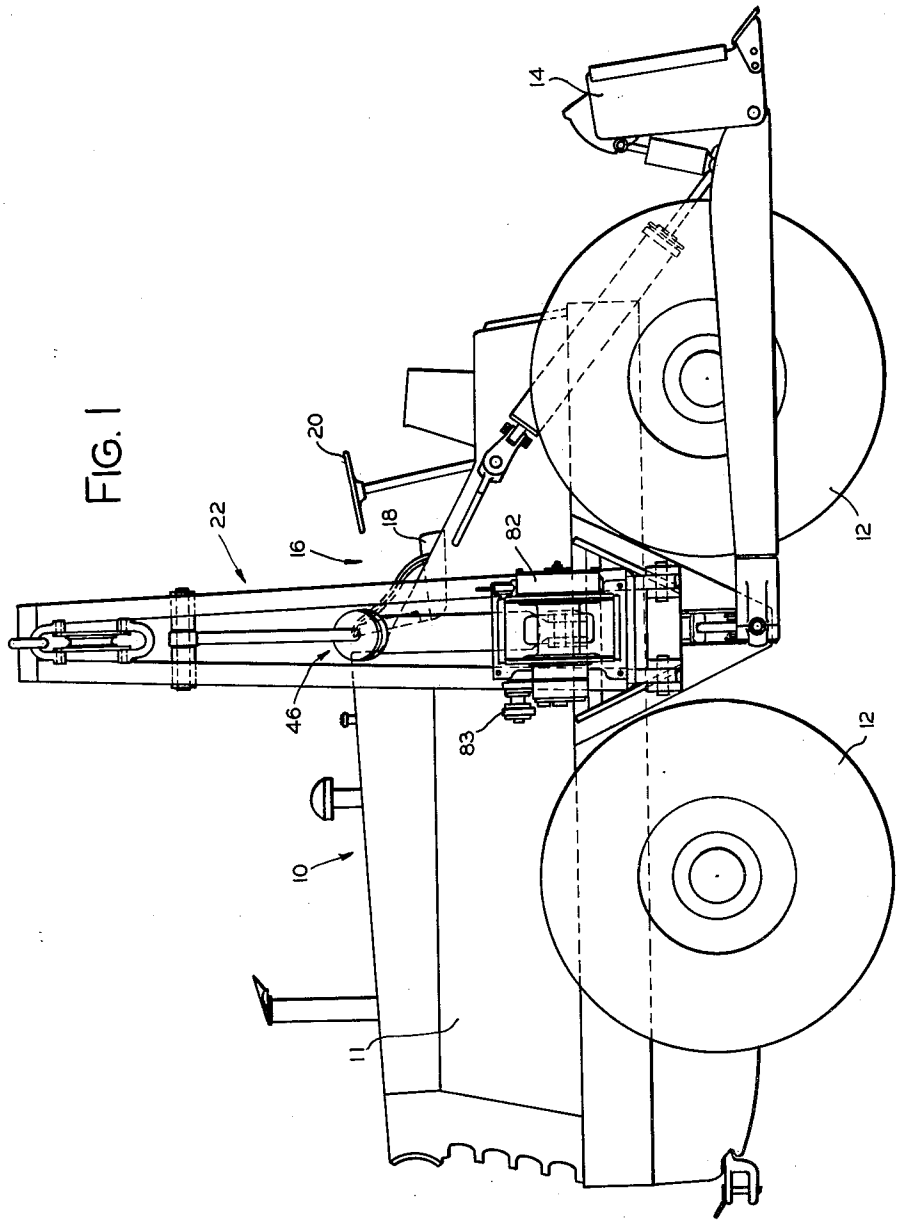
June 19, 1962 H. H. STILLEY 3,039,576

FLUID SYSTEM FOR A WINDLASS

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FIG. 1



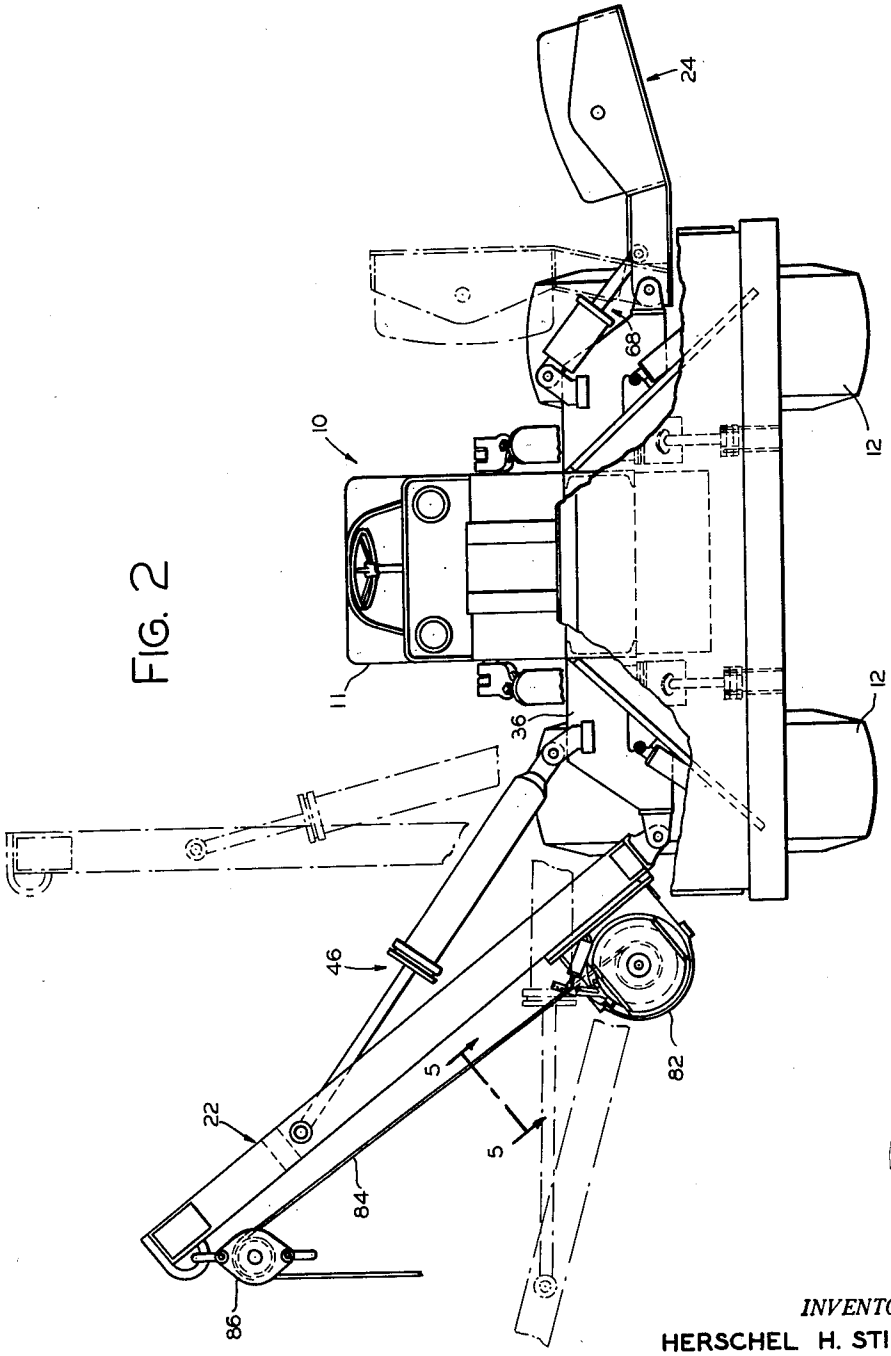
INVENTOR.
HERSCHEL H. STILLEY
BY Kenneth C. Witt
ATTORNEY

June 19, 1962 H. H. STILLEY 3,039,576

FLUID SYSTEM FOR A WINDLASS

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FIG. 2



INVENTOR.
HERSCHEL H. STILLEY
BY Kenneth C. Witt
ATTORNEY

June 19, 1962 H. H. STILLEY 3,039,576

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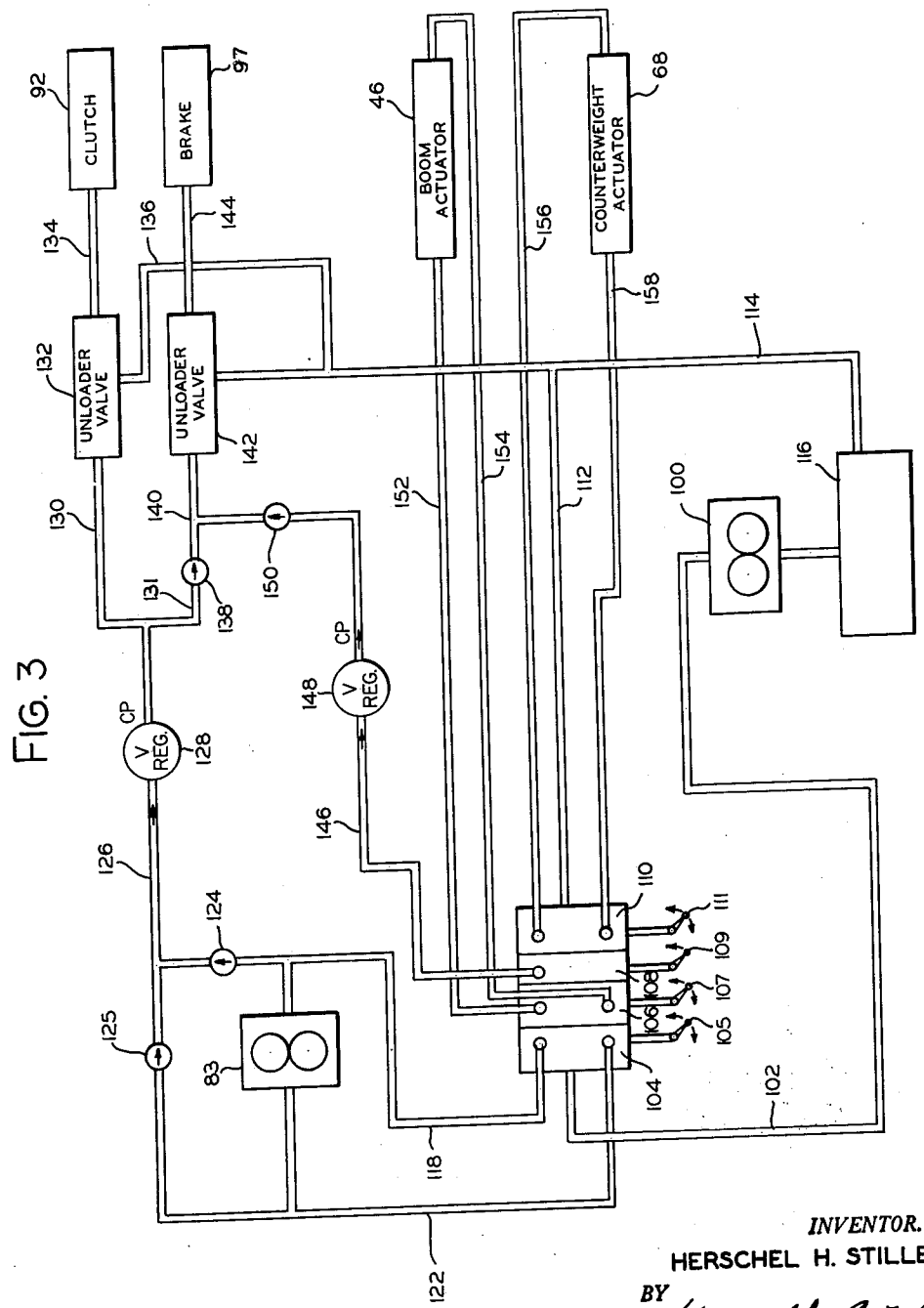


FIG. 3

INVENTOR.
HERSCHEL H. STILLEY
BY Kenneth C. Witt
ATTORNEY

June 19, 1962 H. H. STILLEY 3,039,576

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FIG. 4

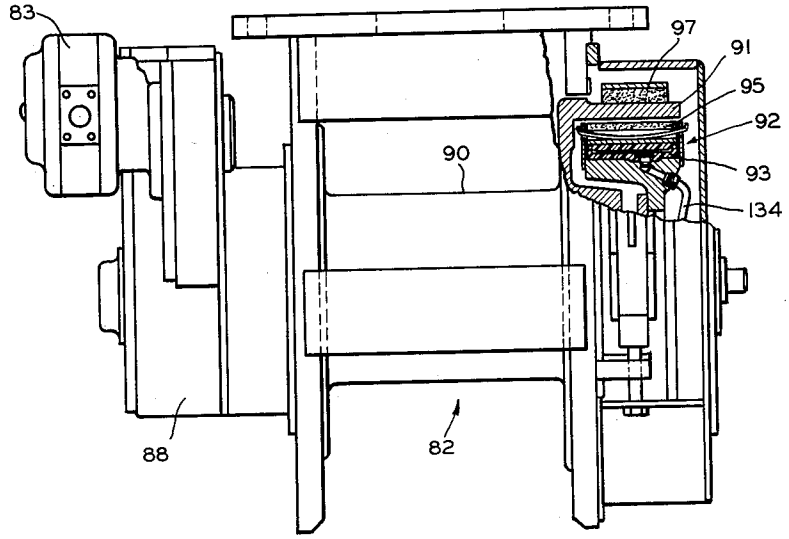
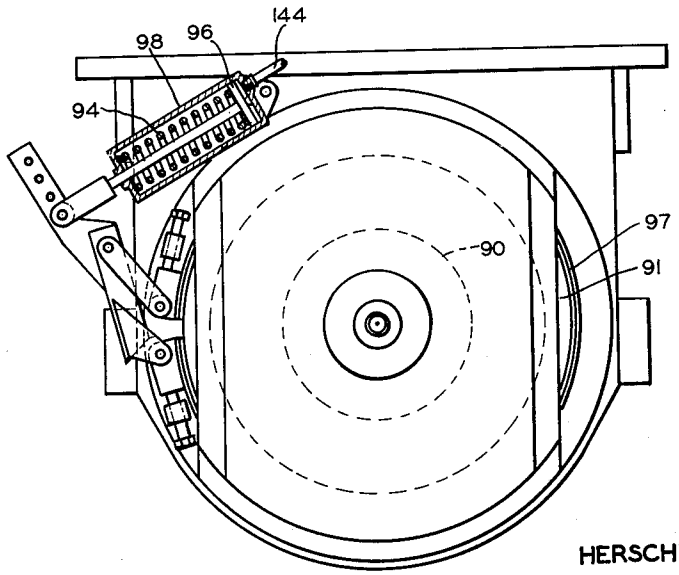


FIG. 5



INVENTOR.
HERSCHEL H. STILLEY
BY
Kenneth C. Witt
ATTORNEY

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3,039,576

FLUID SYSTEM FOR A WINDLASS

Herschel H. Stilley, St. Joseph, Mich., assignor to Clark Equipment Company, a corporation of Michigan

Filed Dec. 30, 1959, Ser. No. 862,913
4 Claims. (Cl. 192—.094)

This invention relates to mechanisms which are described generally as windlasses, and more particularly to operating and controlling systems for such mechanism.

The term windlass may be used to describe various machines employing a rotatable drum on which a rope or cable is wound or unwound to provide a force for hoisting, hauling or performing other work. Some well-known forms of windlasses are winches, hoists and capstans.

My invention is disclosed herein in a preferred form embodied in a mechanism which is commonly called a winch, but it should be understood that the disclosure does not limit the scope of the invention and that it is intended to be applicable to other windlass mechanisms also.

The object of the present invention is to provide a windlass mechanism which is powered and controlled by pressurized fluid, and more specifically it is an object of this invention to provide a fluid system for a windlass which provides a reliable and effective means for the operation and control thereof which is yet simpler and less expensive than previously known systems.

In carrying out my invention in one form I provide a winch which is operated by a fluid motor. A fluid actuated clutch is provided which connects the winch drum to the motor when rotation of the drum is desired. A brake normally holds the drum stationary but is released by fluid pressure when it is desired for the drum to rotate. A fluid system is provided having a valve for selectively admitting fluid to the motor for operating it, and conduit means are provided connected to the valve and including one-way valve means for admitting fluid to and operating the brake and clutch simultaneously with each operation of the motor.

For a clearer and more complete understanding of my invention reference should be had to the accompanying drawing in which

FIGURE 1 is a side elevation of a tractor equipped with a side boom hoist including a winch embodying a preferred form of my invention,

FIGURE 2 is a front elevation of the vehicle of FIG. 1 with portions of it broken away,

FIGURE 3 is a schematic diagram of the fluid circuit of the invention,

FIGURE 4 is a view of the winch which is incorporated in the hoist mechanism on the vehicle, taken along the line 5—5 in FIG. 2, with a portion of the winch broken away, and

FIGURE 5 is an end view of the winch.

There is shown in the first two figures of the drawing a tractor vehicle indicated generally by the reference numeral **10** having a body portion **11** and four rubber-tired wheels **12** (only three of which are shown). The present invention is embodied in the boom hoist mechanism on this vehicle as explained in detail hereinafter. The tractor illustrated is provided with a bulldozer blade **14** at the front together with the mounting structure for same and the mechanism necessary for raising, lowering and tilting the bulldozer blade. The vehicle **10** is provided also with an operator's station indicated generally by the numeral **16** which includes a seat **18** and an operator's steering wheel **20**. Included at the operator's station but not shown on the drawing are the pedals and levers necessary for operating the vehicle and the bulldozer blade.

The machine **10** has a pivotable boom structure **22** mounted on the right side (facing in the direction the operator faces) and a pivotable counterweight structure **24** mounted on the left side.

The boom **22** is pivotable in a vertically disposed plane between an approximately vertical position and a position approaching horizontal as illustrated by the dot-dash lines in FIG. 2 by means of a piston and cylinder type hydraulic actuator **46** which is pivotally connected between boom **22** and machine **10**.

The counterweight **24** on the opposite side of the machine is pivotally connected thereto and movable between the extended position illustrated in solid lines in FIGURE 2 and the retracted position illustrated by the dash-dot lines by means of a cylinder and piston type hydraulic actuator **68** which is pivotally connected between counterweight **24** and the machine **10**.

The tractor **10** includes a winch **82** preferably attached to boom **22** and driven by an hydraulic motor for operating a cable **84** in and out over a sheave **86** on the outer end of boom **22** to provide for hoisting and other operations. The hydraulic motor **83** is inside the portion of the winch housing indicated by the numeral **88** (see FIG. 4). Through a gear train in the portion of the winch indicated by a numeral **88** and through a shaft extending through the drum **90** of the winch the motor **83** drives the drum **90** whenever the motor is operated and a clutch **92** is actuated to connect the motor and gear train to the drum. As illustrated the clutch **92** is the type which employs an expandable tube **93** in circular arrangement with friction blocks **95** installed on the outside of the tube, which friction blocks engage a flange portion **91** on the drum and thereby accomplish engagement of the clutch when the tube is expanded by internal fluid pressure. It will be appreciated however that the present invention is not limited to this particular type of clutch and that other equivalent clutches such as shoe type or multiple disc clutches for example may be employed, if desired.

The winch **82** also includes a brake comprising a band **97** surrounding the flange **91**. This band is automatically tightened and the brake applied by means of a spring **94** (see FIG. 5) in the absence of fluid pressure acting on piston **96** in cylinder **98**. When fluid under suitable pressure is admitted to cylinder **98** the spring is compressed and the band released permitting the drum **90** to turn.

The motor **83** may be rotated in either direction and the direction of rotation of the motor determines the direction of operation of the drum **90**. It will be understood that cable **84** is wound on drum **90** in one direction of rotation and unwound in the other direction of rotation. By such operation the boom hoist drum on the tractor vehicle may be utilized for raising a load, lowering it and other operations normally performed with a mechanism of this type. It is desirable also to provide free spooling operation in which the cable **84** may be payed out without resistance by exerting a pull at the end of the cable **84** or by securing the end of the cable **84** to a fixed object and then moving the tractor. The fluid circuit described hereinbelow provides for such operation.

FIG. 3 illustrates schematically the fluid circuit for the winch **82**. In order to simplify the drawing it has not been attempted to show all of the actual hydraulic lines on the vehicle **10**. It will be readily appreciated by those skilled in the art that such connections are provided in a known manner by using rigid and flexible tubing as necessary. FIG. 3 shows schematically the hydraulic connections and it is explained in connection with the schematic diagram how the various devices involved are connected into the fluid circuit.

The fluid circuit includes a pump **100** which preferably is operated in the usual manner by the engine of the vehicle. This pump is connected by a conduit **102** to

supply a bank of four open-center type valves which are indicated respectively by the numerals 104, 106, 108 and 110. It will be appreciated by those familiar with valves that if all four valves are in the neutral position the fluid from the pump merely recirculates through the valve bank and back through conduit 112 and conduit 114 to a sump or reservoir 116 from which it is again recirculated by the pump. When one or more of the valves are operated pressurized fluid is directed to the respective devices to which the individual valves are connected.

Each of the valves 104, 106, 108 and 110 is operated by a lever and these levers are indicated respectively by the numbers 105, 107, 109 and 111. The operating levers preferably are located near the operator's seat 18 on the vehicle. Valve 104 is a bidirectional valve and if the lever 105 is operated in one direction from the neutral position, fluid under pressure from pump 100 is admitted through conduit 118 to operate hydraulic motor 83 in one direction which is referred to hereinafter as the winding direction, and returns through conduit 122 to the valve 104 from whence it returns through conduits 112 and 114 to the sump. If lever 105 is operated in the other direction the direction of flow of pressurized fluid through conduit 122, the motor 83 and the conduit 118 is reversed and the motor 83 operates in the other direction and operates the winch in the opposite or unwind direction. An exemplary multiple valve mechanism suitable for this purpose is disclosed in U.S. Patent No. 2,247,141.

When the motor 83 is operated in the winding direction pressurized fluid also flows through one-way valve 124, through conduit 126 and through a pressure regulator 128. It will be appreciated that pressure regulator 128 is not an essential part of the invention but in the typical fluid circuit described and illustrated herein it was found expedient to operate the winch motor 83 at 1500 lbs. per sq. in. pressure and then reduce the fluid pressure by means of pressure regulator 128 to a lower value of 400 lbs. per sq. in. for the operation of the clutch and brake as described in the subsequent paragraph.

After passing through regulator 128 and in this particular case being reduced in pressure to 400 lbs. per sq. in., pressurized fluid flows simultaneously through two conduits indicated respectively by the numerals 130 and 131. From conduit 130 the pressurized fluid passes through a valve 132 which is termed herein an unloader valve and thence through conduit 134 to the clutch 92. As long as fluid pressure is maintained in conduit 130 the unloader valve 132 maintains pressure in the clutch 92. When pressure is released in conduit 130 the unloader valve 132 drains fluid from the clutch 92 through conduit 136 back to conduit 114 and thence back to the reservoir 116.

Simultaneously with the operation of the clutch 92, fluid entering conduit 131 flows through a one-way valve 138 and thence through conduit 140 and another unloader valve 142 to the brake 97 for releasing the latter. As long as pressure is maintained by the pump on the unloader valve 142 the brake is maintained released. As soon as valve 104 is operated to cut off fluid pressure to the motor 83 and the clutch and brake, unloader valve 142 permits fluid to drain from the brake into drain line 114 and back to the reservoir thus allowing the spring 94 to apply the brake again. An unloader valve having the characteristics above mentioned and which is suitable for use in the system of the present invention as either valve 128 or 142 is commercially available and is manufactured by Waterman Engineering Co., Chicago, Illinois, under their model number E 151.

It will be apparent that the operator merely by pushing one lever to operate the single valve 104 thereby automatically starts the winch motor, engages the clutch and releases the brake. The direction of operation depends upon which way the lever 105 is moved. One-way valve 125 passes pressurized fluid for the operation of the clutch and brake when motor 83 is energized for unwinding operation, the same as one-way valve 124 does for winding operation. As soon as the lever 105 is restored to neutral again operation ceases and the mechanism is restored to its initial position.

If free spooling operation is desired, that is, if it is desired to merely release the drum so that the cable may be payed out without restriction, lever 109 is moved to operate unidirectional valve 108. This admits pressurized fluid through a conduit 146, pressure regulator 148 and a one-way valve 150 to conduit 140, and thence through unloader valve 142 and conduit 144 to the brake 97 to release the latter. One-way valve 138 prevents fluid from passing it and operating the motor or the clutch. When valve 108 is restored to neutral the brake is again applied through the action of the unloader valve in draining fluid from the brake actuator.

If it is desired to pivot the boom up or down the lever 107 is operated to move bidirectional valve 106 in the desired direction to admit pressurized fluid through conduit 152 for operating the actuator in one direction, in which case fluid from the opposite end of the actuator is returned through conduit 154. The operation of valve 106 in the opposite direction admits fluid through conduit 154 while fluid is discharged through conduit 152 and the boom actuator moves in the opposite direction.

The counterweight is operated in a similar manner to the boom actuator by the operation of lever 111 to move bidirectional valve 110 in the desired direction to admit fluid through either 156 or conduit 158, with the other conduit serving as a discharge line in each case.

Thus it will be apparent that my invention provides a simple and reliable fluid circuit for a windlass which is readily assembled and is very easy for an operator to master and use.

While I have described and illustrated herein a preferred embodiment of my invention, it will be appreciated that modifications may be made by those skilled in the art. It should be understood therefore that I intend to cover by the appended claims all such modifications which fall within the true spirit and scope of my invention.

I claim:

1. A fluid system for a windless having a fluid operated reversible motor, a normally applied fluid pressure released brake and a fluid pressure engaged clutch, the fluid system comprising a pump for supplying pressurized fluid, bidirectional valve means operatively connected between said pump and motor for selectively admitting pressurized fluid to the motor for operating it in the desired direction, and conduit means connected between the said bidirectional valve means and the brake and clutch, said conduit means including one-way valve means therein for admitting pressurized fluid to and operating the brake and clutch simultaneously with each operation of the motor.

2. A fluid system for a windlass having a fluid operated motor, a normally applied fluid pressure released brake and a fluid pressure engaged clutch, the fluid system comprising connections to a source of pressurized fluid, valve means connected to said connections for selectively admitting fluid to the motor for driving the winch, and conduit means connected to the said valve means and including one-way valve means therein for admitting fluid to the brake and clutch simultaneously with each operation of the motor.

3. A fluid system for a windlass having a fluid operated reversible drive motor, a normally applied fluid pressure released brake and a fluid pressure engaged clutch, the fluid system comprising a pump for supplying pressurized fluid, bidirectional valve means operatively connected to said pump for selectively admitting pressurized fluid to the motor for operating it in the desired direction, conduit means connected to the said bidirectional valve means and including one-way valve means therein for admitting pressurized fluid to and operating the brake and clutch simultaneously with each operation

of the motor, unidirectional valve means operatively connected to said pump for admitting pressurized fluid to and operating the brake, and additional one-way valve means in said conduit and associated with the said unidirectional valve means providing for operation of the brake without operating the drive motor and clutch.

4. A fluid system for a windlass having a fluid operated reversible motor, a fluid pressure released spring applied brake and a fluid pressure engaged clutch, the fluid system comprising a pump for supplying pressurized fluid, bidirectional valve means connected to the said pump for selectively admitting pressurized fluid to the motor for operating it in the desired direction, a first conduit connected to the said bidirectional valve and including a first one-way valve therein for conducting pressurized fluid when the motor is operating in one direction, a second conduit connected to the said bidirectional valve and including a second one-way valve therein for conducting fluid when the motor is operated in the opposite direction, the said first and second conduits being connected to a third common conduit for selectively directing pressurized fluid thereto, a fourth conduit connected between the said third common conduit and the clutch for transmitting pressurized fluid to the clutch and including an unloader valve therein, the said unloader valve discharging fluid from the clutch in the absence of

fluid pressure in the said fourth conduit, a fifth conduit including a second unloader valve therein for supplying pressurized fluid from the said third common conduit to the brake for releasing the brake, said second unloader valve discharging fluid from the said brake and allowing it to engage again in the absence of fluid pressure in the said fifth conduit, a unidirectional valve connected to the said pump, a sixth conduit connected between the said unidirectional valve and the said fifth conduit ahead of the said second unloader valve and including a third one-way valve therein for admitting pressurized fluid through the second unloader valve to the brake for releasing the brake upon actuation of the said unidirectional valve, and a fourth one-way valve connected in the said fifth conduit between the junction of the said third common conduit with the said fifth conduit and the junction of the said fifth and sixth conduits for preventing the flow of pressurized fluid from the said sixth conduit into the said third or fourth conduits.

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