This invention relates to mooring winches which are used for mooring a ship and also for other operations such as, for example, hauling a ship.

Such winches should be able to be arranged in a mooring position, wherein the tension in the mooring line is maintained substantially constant. This means that a ship which lies at the quay will also be held firmly against the quay-side when the water level changes, for example, at high and low tides, or in a lock canal due to emptying or filling of the lock.

In winches where this mode of operation is effected due to the reaction power, which acts in the driving system of the winch being counter-balanced by a driving power of almost constant magnitude and where the winch possesses a plurality of operative stages so as to be able to achieve higher speeds at lower loads, it is natural that one makes provision for changing over these stages separately in the mooring position so that the winch is set to the lowest speed stage in this position. Otherwise one easily gets overloading of the winch.

If one requires, however, a quicker pulling-in or letting-out of the line than one normally achieves in this mooring position, this will be difficult to undertake quickly, since the winch is set to the mooring position and the setting must be disconnected first of all.

An object of the invention is to provide a mooring winch of the above-mentioned type, in which it is unnecessary to alter the mooring setting in order to obtain quicker pulling-in than by the normal mooring operation, and where the winch will return to normal mooring operation with the same setting as before, after one has set it for quicker pulling-in and this operation has been concluded.

Accordingly, the present invention consists of a mooring winch in which the tension in the mooring line is maintained substantially constant as a result of the reaction power of this tension acting in the driving system of the winch being counter-balanced by a driving power of almost constant magnitude, the winch possessing a plurality of operative stages so that higher speeds can be obtained with lower loads, when the lowest speed range is engaged with the winch in the mooring position and wherein the manual control means of the winch is disposed in a position below the setting for the top speed in the mooring position and the movement of the manual control means in the direction of the top speed is arranged to engage a higher speed range independent of the mooring setting.

Conveniently, the control means of the winch is arranged to produce an increased rate of slackening-off in order that the invention can be more clearly understood, an embodiment thereof will now be described, by way of example, with reference to the accompanying drawings in which:

FIGURE 1 shows a control valve in a hydraulic mooring winch, with the associated parts, constructed in accordance with the invention, but with the motor and pipes represented schematically, the valves being shown in the positions for mooring.

FIGURE 2 shows a section which corresponds to FIGURE 1 but with the valves in the positions for usual use of the winch as a hauling winch or possibly as an unloading or cargo winch.

FIGURES 3 and 4 show the control means for setting of the mooring position as seen from above and shown respectively in the positions for mooring and hauling.

Referring to the drawings, the winch comprises a double pump 10, 11 with two pump chambers or cells 12, 13. In practice the cells lie side by side in the same housing 10 and are driven by a common shaft 14, but in the drawings they are shown side by side in different housings for the sake of clarity. Each cell contains a safety valve 15 and a back-pressure valve 16. The cells supply hydraulic fluid to individual feed conduits 17, 18. The fluid is received from a common discharge pipe 19, which branches off to each cell. From the discharge pipe a side pipe 29 branches off to a cooler 21. A main valve 22 between the feed and discharge of the side pipe together with two branch pipe valves 23, one in front and one behind the cooler, lead a part of the discharge fluid, in a suitable manner, through the cooler, should this appear desirable. Recording equipment (not shown), that is a thermometer and a manometer, make it possible to control the current through the cooler.

The feed pipe 17 from the first cell 12, extends to a manual control valve represented generally by the reference numeral 24. The valve corresponds substantially with the one described in U.S. Patent Nos. 2,736,170 and 2,822,668 and is, therefore, not described in great detail here. The valve will be described hereinafter only so far as is necessary for a comprehension of its use in the present invention. The valve includes a feed chamber 25 which is separated from another feed passage 26 by a check valve 27. The winch includes a main control slide member 28, the position of which is shifted from the outside by a control handle 29.

In the same manner as in the U.S. Patent 2,736,170 referred to above, the valve 24 controls a motor 30 provided with three chambers A, B and C. Two chambers A and B are directly controlled by the feed chamber 25, the third chamber is charged with fluid through a branch pipe via a pressure-responsive change-over valve 31. The said pressure-responsive valve is of the type which is described in U.S. Patent 3,013,577 except that the central passage, described therein, through the body of the valve is omitted and fluid is fed to the lower chamber 32 through a pipe 33 which will be referred to later on the description.

The feed pipe 18 extends separately from the other cell 13 to the control valve 24 and into a side housing 34 disposed by the side of the feed chamber 25. In the side housing is located a rotary slide valve 35 and the feed pipe extends axially into a lower hollow space 36 in the interior of this rotary slide valve.

An overflow valve, represented generally by the reference numeral 37, is located coaxially of the rotary slide valve. Valve 37 is adapted for receiving an axially directed fluid pressure at its lower end. When the pressure exceeds a definite value in excess of the pressure of the fluid at upper casing of said value, that is in the upper space 38 in the slide valve 35, the valve opens and a quantity of fluid escapes such that the pressure against the lower end does not increase further. The pressure in the lower hollow space 36 will thereby be maintained at constant at this definite value.

The upper space 38 in the rotary slide valve 35 communicates through radially aligned openings 39 with the feed chamber 25.

The rotary slide valve 35 and the overflow valve 37 are firmly connected to each other. A spindle 40 acts on them both at their upper ends to be axially displaceable but
rotatably fixed to the rotary slide valve 35. The spindle extends outside the valve and then carries a wheel 41 for rotating the spine 40. During the first 90 degrees movement of the wheel the position of the slide valve is shown in FIGURE 2 to the position shown in FIGURE 1. The spindle is thereby screwed downwards, said spindle carrying at a position thereof external threads engaging with internal threads in the housing. This causes a pin 42 at the end of the overflow valve 37 to be seconded downwardly and basing against a control spring of the overflow valve (not shown) to subject same to an increased compression force. The pressure at which the overflow valve 37 opens is increased accordingly. It can be seen from FIGURE 3 and 4, that a stop piece 43 is secured to the wheel 41 which, at the same time, serves as a hand by its movement over a graduated scale 44. A fixed sector 45 limits the wheel movement so that it cannot extend beyond about 270 degrees, that is three quarters of a turn. There is at 46 a fixed position for hauling and a scale 47 for mooring. The numbers indicated on the scale correspond approximately to the tension in tons which is present in the hoisting line when the wheel is placed in the corresponding position.

The lower part of the rotary slide valve 35 includes a radially extending opening 48 which, in the mooring position, is turned towards a chamber 49 which is situated at the left of the rotary slide valve 28. From this chamber there extends a conduit 50 (shown in dotted lines) up to the upper conduit 27 above the back-pressure valve. A little above the chamber 49 a port 51 connected to the pipe 33 is situated.

Upon turning from the mooring position in FIGURE 1 to the hauling position in FIGURE 2, the opening 48 is rotated so that the space 55 is arranged in connection with the chamber 25, while connection with the chamber 49 is closed off.

The rotary slide valve 35 has a first recess 52a which causes the port or opening 51 to be connected with the upper chamber surrounding the rotary slide valve in the mooring position, said upper chamber being charged with fluid from the feed chamber 25. In addition there is a second recess 52b which causes the opening 51 to be connected with the lower chamber 49 in the hauling position. This communication is an alternating one, so that the opening 51 is in connection either with the one or other chamber, the unconnected chamber being closed off from the opening.

The mode of operation in the mooring position (see FIGURE 1) is now such that the two cells in the pump feed drive fluid independently of each other. In such mooring position the control valve 24 is in the stop position. The first cell then circulates the drive fluid in short circuit through the shortcircuiting conduit of the valve 24, practically without pressure. The other cell, on the other hand, feeds pressure fluid past the overflow valve 37, through the conduit 50 up to the conduit 26 at the upper side of the check valve 27 and from there to the motor cells A and B which are coupled in parallel. As a pipe 53 is branched off from the feed to the motor cell A via the pressure responsive valve 31 and from there to the cell C, it will depend on the position of the pressure responsive valve whether said motor cell C is charged with pressure fluid. However, the lower chamber in the pressure-responsive valve is connected in this position, via the pipe 33, to the feed chamber 25 for the rotary slide valve 35. This enables the pressure responsive valve to be changed over so that the motor cell C is also charged with pressure fluid, regardless of how low the pressure (mooring line tension) one sets the mooring valve to.

In the mooring position, therefore, the motor is driven with half the quantity of fluid from the pump and this quantity of fluid is distributed to all the motor cells.

If it is desirable to take in the slack in the mooring line rapidly, the control handle is moved over to the hoisting position, in this way, the shortcircuiting conduit of the control valve is closed to circulation and also the drive fluid of the first pump cell 12 is supplied to the winch. In the full-speed position the motor cell B, as is known, is then disconnected. At the same time, the pressure in the feed chamber 25 will be increased to the working pressure.

This will then cause the change-over of the pressure responsive valve 31 and also the disconnection of the motor cell C. There is, consequently, pure fluid fed, as in the normal mooring position and this quantity of fluid is led to only one motor cell. One obtains, in other words, six times the hauling-in speed.

In a corresponding manner, one can set to such a large circulation that the winch lets out the line without resistance.

As soon as the unnormal conditions have passed, which made it desirable to haul-in or let-out the line quickly, the operating handle is moved back to the stop position and is locked in this position.

On the other hand, moving the wheel to the hauling position converts the winch to the usual hauling winch wherein both the pump cells, 12, 13 feed pressure fluid to the feed chamber 25, whilst the lower chamber in the pressure responsive control valve 31 is charged with pressure fluid from the upper side of the check valve 27 via the pipe 33.

This will cause the pressure responsive control valve 31 to be automatically changed-over in the usual way when the pressure in the system increases above the valve where it is desirable to also connect the third motor cell C. As the pressure fluid is charged to the lower side of the pressure responsive valve 31 from a position which is situated on the upper side of the check valve 27, that is with a pressure which is identical with the reaction pressure of the load, one prefers the valve 31 being changed over by lower loads when the control valve is moved to the stop position. This would otherwise happen if the feed to the pipe 33 was taken from a point below or in front of the check valve 27.

The mode of operation in the hauling position will then be precisely the same as for the usual cargo winch according to the U.S. Patents 2,736,170 and 2,822,668 equipped with a pressure responsive control valve according to the U.S. Patent 3,013,577.

If the wheel 41 is moved unintendedly to the mooring position during use of the winch as a cargo or hauling winch, when the control handle is moved to the stop position, the winch does not stop. Against the load, the winch will either haul-in or let-out the line. In order to avoid such an unintended movement to the mooring position, the wheel can be equipped with a lock (not shown) which secures it to the hauling position and which must be unlocked before one can set it for mooring.

Preferably, the control valve is equipped with an automatic return mechanism (not shown) to the stop position. This can be of the type which is shown and described in U.S. Patent 2,981,239.

Even if, in the previous description, one has foreseen that different constructions of valves, approaching those disclosed, can be used in the winch, namely with reference to the constructions which are illustrated and described in the aforementioned patents, it must be emphasized that other valve constructions can be used which are able to fulfill the same general functions, without falling outside the scope of the invention. Also the invention can be varied in other ways by a person skilled in the art within the protection of the following claims.

What I claim is:

1. A hydraulic transmission system for a winch, comprising a substantially constant pressure fluid pump, having first and second pump cells, a first manually adjustable control valve, a first supply line leading from said first pump cell to the first manually adjustable control valve, a motor circuit, a feed conduit from said control valve to said motor circuit, a discharge conduit from said motor circuit to the control valve and a return line from said
control valve back to said pump cells, said first supply line comprising a first branch conduit and a second branch conduit leading from a common junction to individual ports in said control valve, said first branch conduit leading to a port selectively connected with said feed conduit in hoisting and stop positions of the control valve while the port of the second branch conduit is selectively connected to said return line in varying speed position and stop position of the control valve, a check valve opening for fluid flow towards the motor circuits and situated at a location intermediate said junction and said port of the first branch conduit, a second manually adjustable control valve, and a second supply line leading from said second pump cell to the second manually adjustable control valve, said second control valve being adjustable to a first position in which the fluid from said second supply line is conducted to said first branch conduit and to a second position in which the fluid from said second supply line is conducted to said second branch conduit ahead of said check valve.

2. A hydraulic transmission system according to claim 1, further comprising a conduit leading from said second supply line to said first supply line for supplying fluid thereto independent of the position of said second control valve, and pressure responsive control valve means in the last said conduit for allowing fluid to flow from said second supply line to said first supply line with said second manually adjustable control valve in said first position when the fluid pressure in said second supply line exceeds a predetermined value.

3. A hydraulic transmission system according to claim 2, further comprising means for adjusting the pressure at which said pressure responsive control valve means opens, said means for adjusting the pressure being operatively associated with the manually operable means for adjusting said second control valve such that said means for adjusting the pressure can only be adjusted when the second manually adjustable control is in the first position thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

2,736,170 Huse ------------------- Feb. 28, 1956