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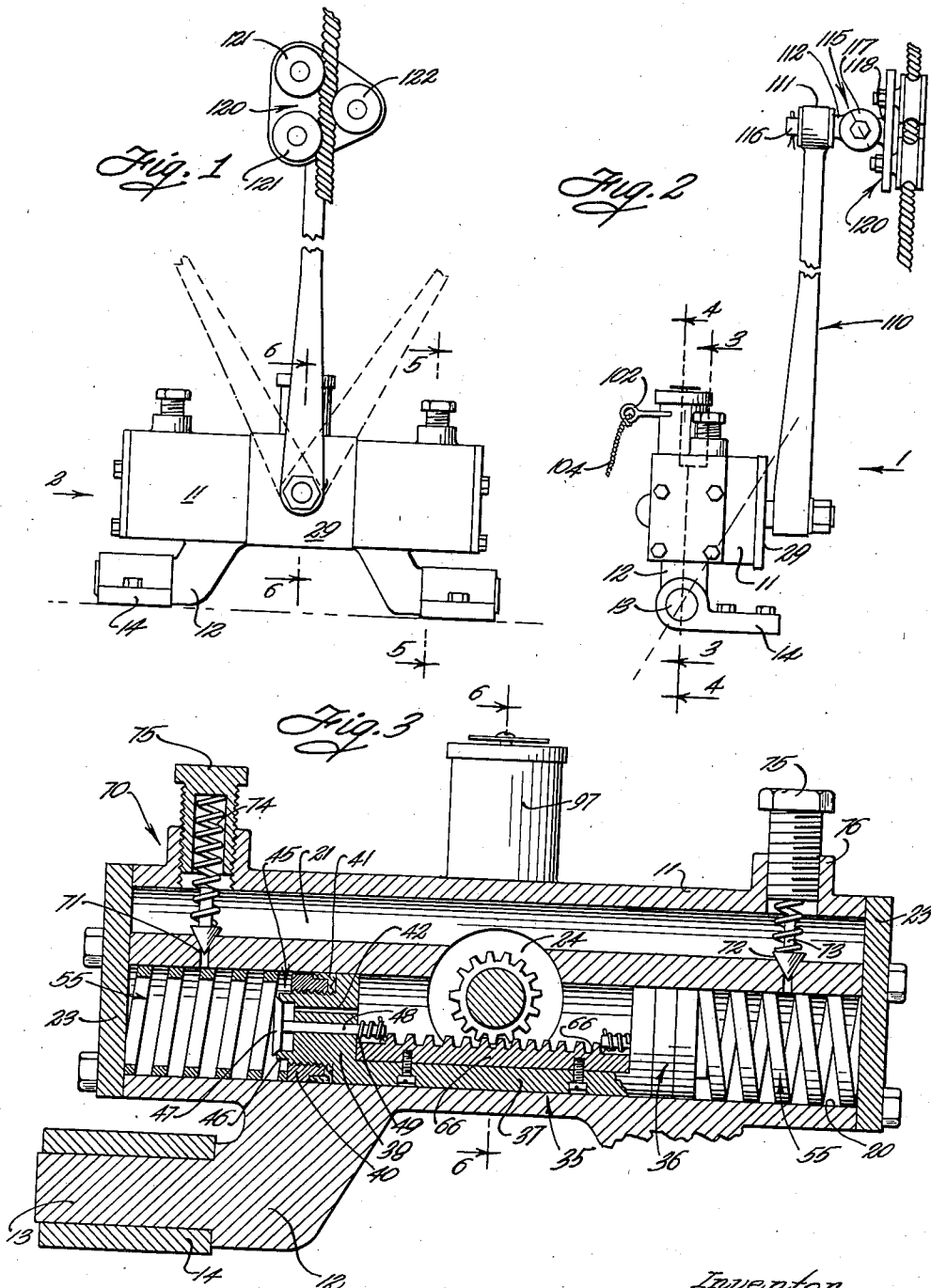
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HYDRAULIC LINE SPOOLER

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HYDRAULIC LINE SPOOLER

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12 Claims. (Cl. 242—157)

My invention relates to a hydraulic line spooler and may be considered as a further development and improvement over the patent to Spracher No. 2,016,755 and is a further development of my Hydraulic line spooler, Ser. No. 227,736, filed August 31, 1938, matured to Patent No. 2,192,201, issued March 5, 1940.

An object and feature of my present invention and certain of the problems solved thereby is in the construction of a much more compact line spooler than those above indicated, as it is disadvantageous to have moving structural elements extending beyond the necessary length of the cylinder or connected cylinders in which a hydraulic piston or pistons operate. Hence by the construction of this application, all of the moving parts which are operative to control the movement of the piston or pistons is confined within the housing structure and the cylinder or connected cylinders, therefore by my present invention the only moving exposed parts of the device are the main operating lever with the roller or pulley mount through which the cable is guided, the shifting of the cable thus oscillating the arm on its pivot.

It is sometimes desirable to have a differential pressure acting on the cable in guiding this for laying on a drum or winch. Such differential pressure is desirable in certain cases as the cable may lay with less resistance when being shifted in one direction than when being shifted in the opposite direction, therefore one of the objects and features of this present invention is a hydraulic control device or devices by which when the lever arm is moving in one direction of its oscillation there may be a materially greater or a lesser pressure resistance to such movement than when this same lever oscillates in the reverse direction of its complete cycle of movement. By this construction the flow of the fluid meets a greater resistance when traversing in one direction to allow the piston or pistons to move for instance in a first directional movement than the resistance encountered by the fluid when having another direction of flow. For this purpose I provide manually a controlled valve or valves through which the liquid or a portion thereof flows in the movement of the piston or pistons.

Another object and feature of my invention is to avoid a long path of traverse of the liquid when being transferred by a pressure action from one side of the piston to another, therefore in my invention I in reality incorporate two connected and aligned cylinders, each having its own piston, such pistons however are connected for simul-

taneous operation. The chamber between the pistons provides space for neutral pressure liquid, that is, the liquid in such neutral space has a pressure intermediate the pressure at the two ends of the aligned cylinders.

In the transfer of the fluid it is frequently desirable to change the hydraulic resistance to the movement of the line spooler and hence the lateral pressure required by the cable as this changes materially in the necessary pressures as to whether or no the cable is under a small or a large tension, that is, the weight being moved is light or heavy, therefore another feature of my invention is a by-pass control for the liquid operative as to each piston so that in a quick action changes may be made in the effective pressures operative in connection with the travel of the line spooler. In accordance with my invention this is further arranged for a remote control by means of a flexible cable within reach of an operator and a ratchet type actuated valve.

Another feature of the simplification of my invention relates to a construction for following the cable as the turns on the drum or winch increase or decrease in diameter. For this purpose the whole mounting of these cylinders with the lever arm rotate on a hinge or pivot and thus the arm may be tilted in a sense in a direction to or from the drum or winch. With this construction the carriage having the pulley guide for the cable is also mounted on a swivel at the upper end of the lever arm, this swivel having a plate on which is mounted preferably three rollers to engage the cable. Another detail feature for compact construction relates to a rack connection of the pistons and a pinion operated by the lever arm to reciprocate the rack and hence the pistons. A further simplification includes providing check valves in the pistons, these being operative in conjunction with the piston moving with the non-resistant portion of the liquid for transfer of liquid through the piston due to the opening of the check valve. Further detail construction includes the housing for the double or connecting cylinder having passages for the pressure flow of a portion of the liquid between the outside of a piston and the internal central space and also providing a space and location for a longitudinal shaft which opens or closes the pressure relief valves, such shaft being actuated by a gear construction manipulated by a ratchet device.

My invention is illustrated in conjunction with the accompanying drawings, in which:

Fig. 1 is a front elevation taken in the direction

of the arrow 1 of Fig. 2 with the lever and cable in the central position.

Fig. 2 is an end elevation taken in the direction of the arrow 2 of Fig. 1.

Fig. 3 is a vertical longitudinal section taken on the irregular line 3—3 of Figs. 2 or 5.

Fig. 4 is a similar longitudinal section taken on the irregular line 4—4 of Figs. 2 or 5 in the direction of the arrows omitting the pistons and the portions connected thereto.

Fig. 5 is a vertical section on the line 5—5 of Fig. 1 in the direction of the arrows.

Fig. 6 is a vertical section on the line 6—6 of Figs. 1 or 3 in the direction of the arrows.

In my invention I employ a main housing block 11 which is illustrated as substantially rectangular in transverse section. A pair of legs 12 extend downwardly from the bottom of the block and have hinged pintles 13 extending outwardly and parallel to the axis of the block and of the cylinders hereunder detailed. Hinged leaves 14 are fitted on the pintles and may be attached to a base or supporting structure by bolts or the like as indicated in Figs. 1 and 2. This allows the whole assembly to oscillate on the pintles as indicated by the full and the dotted line of Fig. 2.

The block has a main cylinder or as may be considered two double cylinders 20 extending from end to end. There is also a fluid passage 21 extending from end to end of the block and a parallel passage 22, note Fig. 4, also from end to end of the block for the pressure relief valves and the operating rods therefor. The ends of the block are closed by closure heads 23 bolted in place. There is a neutral central transverse space 24 for a neutral pressure liquid in the block extending from the back wall 25 towards the front. This is cylindrical in the back portion and communicates with the cylinder 20 by intersecting the same, note Fig. 6. A threaded neck 27 is at the forward end of the opening or space 24 and in front of this is a suitable large recess 28, this being closed by a cover cap 29 on the front of the block at the central portion. The liquid occupying the space 24 and the hollow portions adjacent thereto is at a pressure intermediate the pressure at the opposite ends of the connected pistons and hence is designated as a neutral pressure liquid. The space filled by such liquid is designated a neutral space. The back of the block has a journal recess 30 being preferable to provide an enlarged boss in the back wall as shown to accommodate this journal, the purpose being defined hereunder.

The piston assembly designated by the numeral 35 includes two cylinder pistons 36 cylindrical as to their periphery and connected by a bar 37 sliding in the bottom of the main cylinder 20. Each piston is provided with a piston head 38 illustrated as integral with the bar 37 and having a screw threaded piston ring 40 attached therewith with cup leather or the like 41 therebetween. Each piston has one or more ports or ducts 42 therethrough communicating with the piston check valve 45, such valve being provided with a rim 46 engaged by a valve plug 47, such plug having a stem 48 extending through the piston head 38 with a coil compression spring 49 urging the valve plug against its seat, these being similar for both of the piston constructions. Two substantial compensating springs 55 bear against the end heads 23 and the pistons. These are for the purpose of substantially balancing the weight of the operating lever and the cable engaging carriage hereunder described in detail.

The reciprocating drive for the pistons designated by the assembly numeral 60 includes the shaft 61 to which is attached the lever arm. This shaft extends through a perforation in the cover plate 29, note Fig. 6, is journaled in a combined bushing 62 and a shaft packing, the bushing being threaded forming a closure of the central space 24 by the screw threaded connection 27. Suitable packing 63 makes a liquid tight joint at the shaft. The stub end 64 of the shaft is journaled in the recess journal 30 of the back wall 25 of the housing or block and intermediate the bearings there is a pinion 65 which meshes with a rack 66 bolted to the top of the bar 37. This engagement of the rack and pinion incidentally restricts the pistons from any tendency to rotation on their axis.

The individual hydraulic pressure control assembly 70 for the flow of the liquid from the one side of the pistons to the neutral central space 24 employs a valve port 71, note Fig. 3, at each end of the fluid passage 21, these being illustrated as having a tapered valve seat engaged by the adjustable cone type plug 72. Such plug is provided with a stem 73, a spring 74 reacting against the plug and a screw threaded adjustment cap 75, this being threaded into a threaded boss 76 on the upper side of the housing block. For convenience the adjusting cap is hollow, hence by adjusting the cap longitudinally the pressure on the spring 74 may be varied and thus the pressure retaining the valve plug 72 seated may also be varied. Such action is described hereunder.

The pressure relief valve equipment designated by the assembly numeral 80, note particularly Fig. 4, includes two rotary valves each indicated at 81. Each valve has a hollow or cup end 82 with diametrically opposite ports 83 leading to this cup. A shaft 84 is secured to the rotary valves as illustrated, to the base of the cup by means of a pin and the shaft extends longitudinally and centrally through the space 22 in the housing block. The main cylinder 20 has two ducts 85, note Figs. 4 and 5, which lead to the shaft passage 22 and align with the ports 83 of the rotary valves.

The operating mechanism and assembly 90 for the rotary valve assembly 80 includes a driven bevel gear 91 on the shaft 84 meshing with a complementary driving bevel gear 92, this being mounted on a drive shaft 93, note particularly Figs. 4 and 6. This drive shaft is journaled in a journal cup 94, such cup having a bushing 95 threaded therein with packing 96 confined below the bushing and the cup is threaded into the internal rim 96 of the housing tube 97. Secured to the vertical shaft 93 there is a lower ratchet disk 98, this being shown as having a threaded connection to the shaft, note Fig. 4, the periphery of the disk having upturned ratchet teeth. A complementary loose or driving ratchet 99 is loosely mounted on the extension stem 100 of the shaft 93, this being urged downwardly by the spring 101 which spring is also connected to the free disk 99 and to the wall or a stationary structure urging the disk 99 to its original position after a partial rotational movement. Such disk is rotated by being provided with an extension arm 102 attached to the top of the disk 99 and passing through a lateral slot 103 in the housing tube 97. A flexible cable 104 is connected to an eye or the like on the outer end of the arm 102. This cable leads to a place convenient to the operator of the winch or drum or some one in charge of the cable spooling operation. In order to determine the location of the rotary valves, the stem extension

100 is provided at its top with a pointer 105 which operates over the closure cap 106 and thus indicates the position of the rotary valve assembly and the relation of the valve ports 83 and 85. The device is so arranged that on a single arcuate pull and turn of the arm 102 rotating the free ratchet disk 99, the equipment is rotated and due to the bevel drive the cylindrical valves 81 are rotated one-quarter of a turn, this shifting them from a full open to a closed position and from a closed to an open position. The pointer 105 clearly indicates whether these valves are in their open or their closed position.

The cable actuated lever arm 110, note Figs. 1, 2 and 6, has its lower end keyed or otherwise secured to the shaft 61 and its upper end is provided with an eye 11. This forms a mounting for a universal joint assembly 115 which includes a stub shaft 116 journaled in the eye 111. A transverse journal 117 is mounted on the end of the stub shaft and in this is a second short shaft 118 having the carriage plate 120 thereon. Such carriage plate supports the rollers, the plate is shown as triangular having two stationary rollers 121 attached thereto by axle bolts and a single adjustable roller 122 having a slot and an adjustable axle bolt mounting, hence the rollers are readily adjustable to the diameter of the cable and to the pressure contact desired with the cable.

From the above construction it will be seen that as the cable builds up in succeeding layers on a winch or drum or is wound off of the winch or drum decreasing the effective diameter, the whole housing block 11 with the equipment contained therein and the main lever arm oscillate in a front to rear direction on the hinge pintles 13, the movement being indicated by the dash and the dotted lines of Fig. 2 through the pintles 13. As each layer of cable is wound on the drum or unwound therefrom, the lever arm 110 is caused to oscillate in a lateral direction as indicated by the full and dotted lines of Fig. 1. In view of the fact that the lever arm is keyed to the shaft 61 which has a bearing in the journal recess 30 and in the journal bushing 62, manifestly the pinion 65 is rotated first in one direction and then in another direction, thence as the pinion meshes with the rack 66 such rack and hence the two pistons are reciprocated in the common and divided cylinder 20. As above mentioned, the compression springs 55 are mainly for the purpose of counter-balancing the lever 110 and the parts such as the carriage 120 associated therewith.

In the normal action of the equipment and presuming there is a considerable weight on the cable or the cable is otherwise subjected to a considerable tension, the valve assembly 80 has its ports closed, that is, the ports 83 in the rotary valve element 81 are out of registry with the ducts 85 communicating with the cylinder 20 at each end, hence no liquid can travel in the by-pass passage 22 from one side of the pistons to the other.

Presuming therefore the lever 110 is undergoing a movement in one direction laterally, this causes one of the pistons 36 to approach one of the closure heads 23 and the other piston to recede from the opposite closure head. The piston which is advancing therefore compresses the confined liquid between such piston causing a seating of the plug valve 47 and preventing any passage of the liquid from the pressure side of the piston through the port or duct 42 to the central recess. The liquid displaced therefore by

the compression piston is forced through the valve port 71 to relieve the liquid under pressure. This action raises the cone valve plug 72 against the action of the compression spring 74 which is coiled around the stem 73 of the plug. The opposite piston being moved towards the central and neutral space allows opening of its valve plug 47 by the slight pressure developed on the neutral liquid, such liquid flowing from the central space through the port 42 and past the valve plug 47 into the increased space in the cylinder caused by the receding piston. The entire flow of liquid to fill the space of the piston receding from one of the closure heads 23 thus flows through the check valve system of the piston. The cone valve or plug 72 is maintained firmly seated so that no liquid passes into the end of the cylinder. This applies to both directions of movement. In other words, the valve plugs 72 only yield upwardly due to pressure of the confined liquid at the end of the main cylinder 20.

Where it is desired to have equal pressure or resistance to the lever 110 in both directions of oscillation, the adjustment caps 75 are used to regulate the pressure or compression on the springs 74, thus giving an equal seating pressure of the plugs 72 on the respective seats, however if it is desired to have a greater resistance to the movement of the lever when traversing in one direction as for instance from left to right, one of the springs 74 is adjusted to permit opening of its valve plug 72 at greater or lesser pressure than the other valve. By this procedure a differential resistance to the movement of the piston assembly is developed or its movement in one direction over its return movement in a reverse direction. Such action of a differential resistance is highly desirable in some cases of spooling a cable on a drum or winch and also in certain cases in reference to the unwinding.

The purpose of the rotary valve 30 which as above mentioned, is normally closed when the cable is under considerable weight or tension is to give a release and a by-pass, therefore, presuming a cable is somewhat suddenly released from tension or weight due for instance to a baler being brought near to the surface, then by manipulating the pull cable 104, the valve assembly 80 may be rotated to an open valve position. Such action therefore causes the passage 22 to operate as a by-pass and substantially none of the fluid is required to open the plug valve 72 but flows from the end of the cylinder where the liquid is being compressed by an advancing piston to the central neutral space and from the central neutral space to the other end of the cylinder where the volume is increased by the receding piston. As above mentioned a single pull on the cable 104 is sufficient to rotate the cylinder valves 81 one-quarter of a turn as shown in the present design, that is, from an open to a closed position or from a closed to an open position. Of course it is apparent by this design of the ratchet assemblies on the disks 98 and 99 and by having a greater number of ports 83, that this action can be effected with a lesser angular turn.

The universal joint assembly 115 for the carriage plate 120 is sufficient to allow the carriage to follow the cable in the oscillating lateral movement as indicated by the dotted lines in Fig. 1 and also the front to rear movement due to the change of diameter of the drum or winch when the assembly oscillates on the pintles 113.

Various changes may be made in the details of

the construction without departing from the spirit or scope of the invention as defined by the appended claims.

I claim:

1. In a hydraulic line spooler, the combination of a cylinder, a double piston reciprocating therein, the cylinder having a neutral space for neutral pressure liquid between the pistons, means operated by the spooling action on a cable to reciprocate the pistons in the cylinder, means to develop a pressure resistance of the liquid in the cylinder to a reciprocating movement of the piston, a hydraulic pressure release assembly including a by-pass passage with control valves therein communicating between the cylinder and the neutral space and adjacent the ends of the cylinder beyond the position of movement of the pistons and means to open or close the said control valves, such valves when open forming a passage through the by-pass for a substantially free flow of the liquid and when closed forcing the liquid transfer through the pressure resistance means.
2. In a hydraulic line spooler provided with a cylinder and a piston assembly reciprocated therein during the spooling of a cable, the combination of the cylinder having a neutral space for neutral pressure liquid, the piston assembly having two pistons, means connecting the pistons for simultaneous movement in the same direction, there being a passage with a port from each end section of the cylinder to the neutral space, a spring actuated valve seated at each port, a manual means to adjust the spring pressure, a check valve means for flow of liquid between the neutral space and a cylinder end subject to a suction stroke only whereby equal or differential pressures may be developed resistant to the movement of the piston in its reciprocation.
3. In a hydraulic line spooler, the combination of a cylinder, two connected pistons, means actuated by the shifting movement of a cable in spooling on or off a drum to reciprocate the pistons in the cylinder, each piston having a pressure actuated check valve operative to close in the piston exerting a compression stroke and to open in the other piston operating on a suction stroke, the cylinder having a neutral space for neutral pressure liquid, a passage having two regulating valves for flow of liquid from the end of the cylinder having the pressure stroke to the neutral space whereby an adjustment of the said valves to release at different pressures develops a differential hydraulic pressure on the movement of the pistons in one direction relative to their movement in the opposite direction.
4. In a hydraulic line spooler in which a piston assembly is moved reciprocally against hydraulic pressure through the action of spooling a cable on a drum or the like, the combination of means constructed and adapted to exert a differential hydraulic pressure opposing the movement of the piston assembly in one direction relative to that opposing its movement in the opposite direction.
5. In a hydraulic line spooler in which a piston assembly is moved reciprocally against hydraulic pressure through the action of spooling a cable on a drum or the like, the combination of means constructed and adapted to exert a differential hydraulic pressure opposing the movement of the piston assembly in one direction relative to that opposing its movement in the opposite direction, the differential pressure means including a passage for the flow of the hydraulic fluid from one side of the piston assembly to the other and a manually adjustable valve controlling the flow through such passage.
6. In a hydraulic line spooler in which a piston assembly is moved reciprocally against hydraulic pressure through the action of spooling a cable on a drum or the like, the combination of means constructed and adapted to exert a differential hydraulic pressure opposing movement of the piston assembly in one direction relative to that opposing its movement in the opposite direction, a by-pass for the liquid from one side of the piston assembly to the other and a controlled valve to open and close the by-pass and thereby maintain the desired pressure opposing reciprocation of the piston when the by-pass is closed and relieve the pressure when the by-pass is opened.
7. In a hydraulic line spooler in which a cylinder is provided with a piston assembly reciprocated against hydraulic pressure in the cylinder through the action of spooling a cable on a drum or the like, the combination of means to transfer liquid from the pressure to the suction side of the piston assembly including adjustable valves whereby a differential hydraulic pressure may be developed opposing the movement of the piston assembly in one direction relative to that opposing its movement in the opposite direction, a hydraulic pressure release including a by-pass for the flow of liquid from one side of the piston assembly to the other with a controlled valve in said by-pass shiftable to open or closed position whereby in the closed position of said controlled valve the reciprocation of the piston is regulated by the differential control valve and when in the open position a free passage of liquid develops through the by-pass.
8. In a hydraulic line spooler in which a cylinder is provided with a piston assembly reciprocated in the action of spooling a cable on a drum or the like, the combination of the piston being double headed with a spring controlled check valve in each piston head for transference of liquid from a pressure to a non-pressure side, the cylinder having a neutral space for neutral pressure liquid between the piston heads, two regulating valve means each communicating from an end of the cylinder beyond the extreme movement of the piston to the neutral space, the two regulating valves being independently adjustable, each regulating valve being operative to open in only one direction of liquid flow to thereby develop a differential pressure to the movement of the piston assemblies in one direction relative to the reverse movement.
9. In a hydraulic line spooler in which a cylinder is provided with a piston assembly reciprocated in the action of spooling a cable on a drum or the like, the combination of the piston being double headed with a spring controlled check valve in each piston head for transference of liquid from a pressure to a non-pressure side, the cylinder having a neutral space for neutral pressure liquid between the piston heads, two regulating valve means each communicating from an end of the cylinder beyond the extreme movement of the piston to the neutral space, the two regulating valves being independently adjustable, each regulating valve being operative to open in only one direction of liquid flow to thereby develop a differential pressure to the movement of the piston assemblies in one direction relative to the reverse movement, a by-pass passage between the cylinder ends and the said neutral space, with a control valve communicating

with the cylinder ends and a remote operative means to actuate the said control valves to an open or closed position whereby in the open position a substantially free passage for liquid is afforded through the by-pass to and from each end of the reciprocating piston assembly.

10. In a hydraulic line spooler in which a piston assembly has means for reciprocation in a cylinder against a pressure resistance to the flow of liquid through a control valve by the medium of a cable winding on and off a drum, the combination of a by-pass means including two rotatable valves distinct from the control valve each connecting to the end of the cylinder beyond the travel of the piston assembly, a shaft connecting the valves and a remote control means to rotate the shaft and thereby open or close the valves, the said valves when open developing a substantially pressure free by-pass for transfer of liquid from the opposite ends of the cylinder in the reciprocating motion of the piston.

11. In a hydraulic line spooler in which a piston assembly is moved reciprocally against hydraulic pressure through the action of spooling a cable on a drum or the like, the combination of means constructed and adapted to exert a differential hydraulic pressure opposing the movement of the piston assembly in one direction relative to that opposing its movement in the opposite direction, the differential pressure means

and the piston assembly including two connected pistons spaced apart and operative in a cylinder, there being a neutral space for neutral pressure liquid in the cylinder located between the two pistons, a liquid passage connected with the neutral space, two valves operatively connected from the liquid passage and to the cylinder beyond the travel of the pistons and means to manually adjust the valves to regulate the differential hydraulic pressure during reciprocation of the pistons.

12. In a line spooler a housing structure having a cylinder therein with ports and passages in the housing communicating with the said ports, a hinged mounting for the housing having a hinge pintle parallel to the axis of the cylinder, a lever arm pivoted to the housing on a pivot at right angles to the hinge pintle, pistons operating in the cylinders with valve means for transference of fluid, a drive connection between the pivot of the lever and the pistons, the lever arm having a guide means on the end for a cable winding on a drum whereby the lever arm is oscillated on its pivot in the traversal of the cable from one end to another of a drum and the housing and lever arm turns on the pintle of the hinge as the cable builds up in diameter or decreases in diameter on the drum.

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