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R. N. CROSS
CABLE REELING SYSTEM

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Fig. 1.

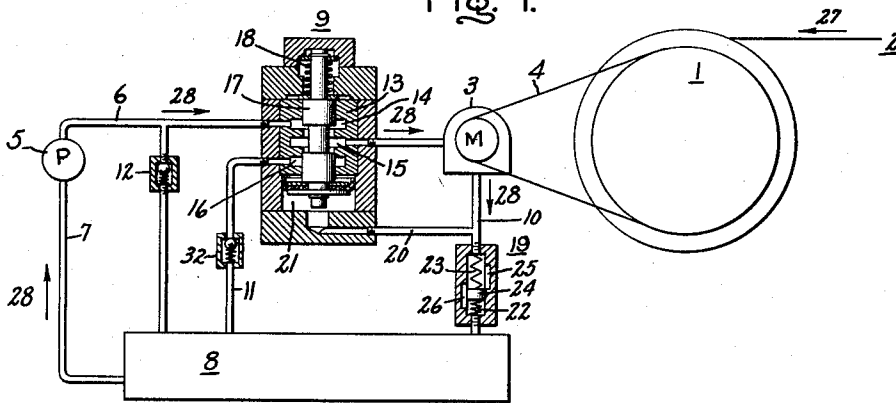
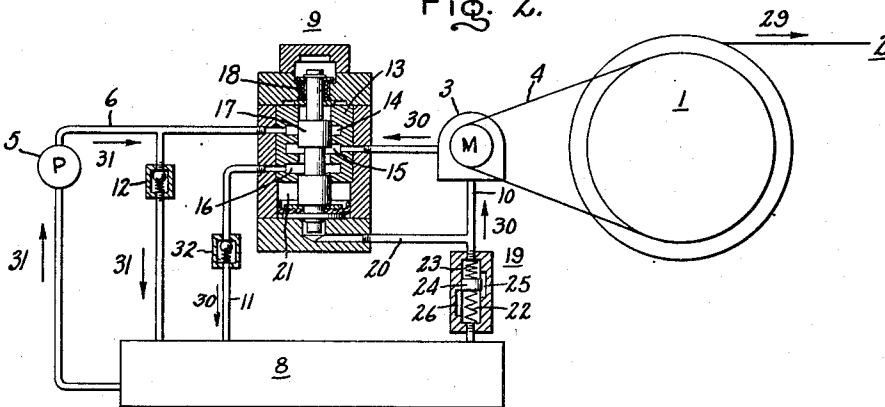


Fig. 2.



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CABLE REELING SYSTEM

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8 Claims. (Cl. 242-90)

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This invention relates to cable reeling systems particularly hydraulically operated cable reels for use with mine vehicles such as gathering locomotives and shuttle cars.

Mine locomotives of the gathering type and mine shuttle cars are conventionally supplied with electric power by means of an electric cable wound on a reel mounted on the vehicle. These cable reels have been electrically driven, however it has been found more desirable to provide a hydraulic motor drive. In the design of such hydraulically operated cable reeling systems, it is desirable to maintain constant tension on the cable during both reeling-in and paying-off, however this tension must not be sufficient to cause damage to the cable. It is further desirable to provide a system which will automatically switch from paying-out to reeling-in whenever the vehicle is stopped.

An object of this invention is to provide an improved cable reeling system.

Another object of this invention is to provide an improved cable reeling system of the hydraulic type wherein constant tension is maintained on the cable during both paying-out and reeling-in.

A further object of this invention is to provide an improved cable reeling system of the hydraulic type wherein the reel automatically shifts from paying-out into reeling-in position whenever the reel is at a standstill.

Yet another object of this invention is the provision of an improved cable reeling system of the hydraulic type characterized by its simplicity and small number of components.

Further objects and advantages of this invention will become apparent and the invention will be better understood by reference to the following description and the accompanying drawing, and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

In accordance with this invention, there is provided a cable reel adapted to have an electric cable wound thereon and a hydraulic motor adapted to drive the reel for reeling-in the cable and to be driven by the reel as a pump when the cable is being reeled-out. A hydraulic pump is provided for supplying fluid to the hydraulic motor and a pressure line connects the motor and pump. A valve is arranged in the pressure line and a discharge line connects the valve and the fluid reservoir. The valve is normally biased so that the pressure line from the pump to the motor is open and the discharge line is closed. The

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valve is operable in response to a vacuum created by the motor when driven as a pump to close the pressure line isolating the pump from the motor and to open the discharge line connecting it to the motor. Thus, during the reeling-in operation, the pump supplies fluid to the motor through the pressure line and the normally open valve. However, when the direction of reeling is reversed, the reel motor is driven as a pump creating a vacuum which operates the valve to close the pressure line and open the discharge line. Thus, the motor draws fluid from the reservoir and discharges it through the valve and the discharge line thus providing a load on the reel so that the tension is maintained on the cable. When the reeling-out ceases and the reel and reel motor are at a standstill, the biasing means in the valve operates the valve to again open the pressure line and to close the discharge line. Thus, the motor automatically starts to reel-in responsive to a standstill condition of the reel.

In the drawing, Fig. 1 is a schematic view showing the improved cable reeling system of this invention in the reeling-in condition; and Fig. 2 is a similar view showing the system in the reeling-out condition.

Referring now to Fig. 1, there is shown a cable reel 1 adapted to have an electric cable 2 wound thereon. A hydraulic motor 3 of any suitable type is provided for driving the cable reel 1, as by a belt connection 4. A hydraulic pump 5 is provided driven in any suitable manner (not shown) for supplying fluid to the motor 3 through a pressure line 6. Line 7 connects the pump 5 and the fluid reservoir 8. A three-way vacuum pilot valve 9 is arranged in the pressure line 6 and another fluid line 10 connects the motor 3 and the fluid reservoir 8. A discharge line 11 connects the valve 9 and the reservoir 8 and a pressure relief valve 12 is interposed between the pressure line 6 and the reservoir 8.

The three-way vacuum pilot valve 9 comprises a valve chamber 13 having passages 14, 15 and 16 communicating respectively with the pressure line 6, the motor 3, and the discharge line 11. The internal spool 17 of the valve 9 is biased by spring 18 so that the passages 14 and 15 normally communicate and the passage 16 is closed. Thus, the pressure line 6 is open between the pump 5 and the motor 3 and the discharge line 11 is closed. A speed control valve 19 is arranged in the line 10 between the motor 3 and the reservoir 8 and a line 20 interconnects the line 10 intermediate the valve 19 and the motor 3, and

chamber 21 of the valve 9. The valve 19 is a two-way valve having springs 22 and 23 and piston 24. A predetermined amount of pressure or vacuum in either direction is thus required to operate the valve to expose ports 25 and 26.

In the reeling-in operation, as shown in Fig. 1, the cable is moving in the direction shown by the arrow 21 and the spring 18 of the valve 9 normally biases the spool 17 to open the pressure line 6 and close the discharge line 11. Thus, the pump 5 draws fluid from the reservoir 8 and supplies it to the motor 3 through the pressure line 6, the motor discharging the fluid to the reservoir through the line 10. The direction of flow of the fluid in this operation is shown by the arrows 28. In the reeling-in operation, the valve 19 serves to maintain back pressure on the motor 3 in order to maintain even tension on the cable 2. Since the motor 3 is discharging fluid into the line 10, the pressure will force the piston 24 of the valve 19 in the direction shown in Fig. 1 so that the ports 25 and 26 communicate to open the line 10 to the reservoir 8.

Referring now to Fig. 2 in which like parts are indicated by like reference numerals the cable 2 is shown as reeling-out in the direction shown by the arrow 29. The motor 3 is thus reversed due to the pull on the cable reel 1 making the motor act as a pump. A vacuum will thus be created between the speed control valve 19 and the motor 3 and, since the line 20 interconnects the line 10 and the cavity 21 of the valve 19, this vacuum shifts the spool 17 to close the passage 14 and the pressure line 6 and to open the passage 16 so that it communicates with the passage 15. Thus, the pressure line 6 is closed and the discharge line 11 is opened and connected to the motor 3 responsive to a vacuum created by the motor when it is driven as a pump. In the reeling-out operation therefore, the motor 3, driven as a pump, draws fluid from the tank 8 through the line 10 and discharges through the valve 9 and the discharge line 11 to the reservoir 8 as shown by the arrows 30. The pump 5 is still operating however and draws fluid from the reservoir 8 and discharges the fluid back to the reservoir through the pressure relief valve 12 as shown by the arrows 31. When the cable reel is unreeling and the vehicle makes a sudden stop, there may be a tendency for the reel to rotate several revolutions due to inertia. Relief valve 32 in discharge line 11 places back pressure in the motor 3 when it is to be driven as a pump during the reeling-out operation. This back pressure prevents the cable reel from spinning when the vehicle is brought to a sudden stop. Relief valve 32 in no way affects the reeling-in operation and may only be necessary under certain conditions for reeling-out. When the cable reel 1 slows to a standstill from the reeling-out condition, the vacuum in the line 20 will leak off through the speed control valve 19 and the spring 18 will return the spool 17 to the normal position with the pressure line 6 open and the discharge line 11 closed. Thus, the motor 3 is again operable as a motor and will automatically start to operate in the other direction to reel-in the cable 2.

It will now be readily apparent that this invention provides a hydraulically operated cable reeling system wherein tension is provided on the cable in both the reeling-out and reeling-in conditions, the tension in the reeling-out condition being merely sufficient to take up the slack in the cable and not enough to damage the cable. Furthermore, this system provides for automati-

cally shifting from the reeling-out into the reeling-in position responsive to the cable reel being at a standstill.

While I have illustrated and described a particular embodiment of this invention, further modifications and improvements will occur to those skilled in the art. I desire it to be understood therefore that this invention is not limited to the particular embodiment shown and I intend in the appended claims to cover all modifications within the spirit and scope of this invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, and valve means arranged in said pressure line and having a vacuum actuated movable element arranged to open said pressure line in a first position and to close said pressure line in a second position, said valve means having a vacuum line connecting said movable element and said motor whereby the vacuum created by said motor when driven as a pump moves said element into said second position to close said pressure line isolating said pump from said motor.

2. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, and valve means arranged in said pressure line and having a vacuum actuated movable element arranged to open said pressure line in a first position and to close said pressure line in a second position, said movable element being normally biased to said first position, said valve means having a vacuum line connecting said movable element and said motor whereby the vacuum created by said motor when driven as a pump moves said movable element into said second position to close said pressure line isolating said pump from said motor.

3. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, valve means arranged in said pressure line, and a discharge line connected to said valve means, said valve means having a vacuum actuated movable element arranged to open said pressure line in a first position and to close said pressure line in a second position, said movable element being normally biased to said first position, said valve means having a vacuum line connecting said motor and said movable element whereby the vacuum created by said motor when driven as a pump moves said movable element to said second position to close said pressure line isolating said pump

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from said motor and to open said discharge line so that said motor is connected thereto.

4. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, a fluid reservoir, a line connecting said pump to said reservoir, another line connecting said motor to said reservoir for discharging fluid from said motor during reeling-in and for supplying fluid to said motor when driven as a pump during reeling-out, valve means arranged in said pressure line, a discharge line connecting said valve means and said reservoir, said valve means having a vacuum actuated movable element arranged to open said pressure line and close said discharge line in a first position and to close said pressure line and open said discharge line in a second position, said movable element being normally biased to said first position whereby said pump draws fluid from said reservoir and supplies said fluid to said motor which discharges said fluid to said reservoir through said other line, said valve means having a vacuum line connecting said motor and said movable element whereby the vacuum created by said motor when driven as a pump moves said movable element to said second position to close said pressure line isolating said pump from said motor and to open said discharge line connecting said motor thereto whereby said motor draws fluid from said reservoir through said other line and discharges said fluid to said reservoir through said discharge line.

5. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, a fluid reservoir, a line connecting said pump to said reservoir, another line connecting said motor to said reservoir for discharging fluid from said motor during reeling-in and for supplying fluid to said motor when driven as a pump during reeling-out, valve means arranged in said pressure line, a discharge line connecting said valve means and said reservoir, said valve means having a vacuum actuated movable element arranged to open said pressure line and to close said discharge line in a first position and to close said pressure line and open said discharge line in a second position, said movable element being normally biased to said first position whereby said pump draws fluid from said reservoir and supplies said fluid to said motor which discharges said fluid to said reservoir through said other line, means in said other line for creating a vacuum therein responsive to operation of said motor as a pump, and a vacuum line connecting said other line and said valve means for introducing said vacuum to said movable element so that said movable element is moved to said second position to close said pressure line isolating said pump from said motor and to open said discharge line connecting said motor thereto whereby said motor draws fluid from said reservoir through said other line and discharges said fluid to said reservoir through said discharge line.

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6. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, a fluid reservoir, a line connecting said pump to said reservoir, another line connecting said motor to said reservoir for discharging fluid from said motor during reeling-in and for supplying fluid to said motor when driven as a pump during reeling-out, valve means arranged in said pressure line, a discharge line connecting said valve means and said reservoir, said valve means having a vacuum actuated movable element arranged to open said pressure line and to close said discharge line in a first position and to close said pressure line and open said discharge line in a second position, said movable element being normally biased to said first position whereby said pump draws fluid from said reservoir and supplies said fluid to said motor which discharges said fluid to said reservoir through said other line, a valve in said other line operable to open said other line responsive to a predetermined pressure or vacuum, said last-named valve causing a vacuum to be created in said other line responsive to operation of said motor as a pump, and a vacuum line connecting said other line and said valve means for introducing said vacuum to said movable element so that said movable element is moved to said second position to close said pressure line isolating said pump from said motor and to open said discharge line connecting said motor thereto whereby said motor draws fluid from said reservoir through said other line and discharges said fluid to said reservoir through said discharge line.

7. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeled-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, a fluid reservoir, a line connecting said pump to said reservoir, another line connecting said motor to said reservoir for discharging fluid from said motor during reeling-in and for supplying fluid to said motor when driven as a pump during reeling-out, valve means arranged in said pressure line, a discharge line connecting said valve means and said reservoir, said valve means having a vacuum actuated movable element arranged to open said pressure line and to close said discharge line in the first position and to close said pressure line and open said discharge line in a second position, means for normally biasing said movable element to said first position whereby said pump draws fluid from said reservoir and supplies said fluid to said motor which discharges said fluid to said reservoir through said other line, a valve in said other line operable to open said other line responsive to a predetermined pressure or vacuum, said other valve causing a vacuum to be created in said other line responsive to operation of said motor as a pump, and a vacuum line connecting said other line and said valve means for introducing said vacuum to said movable element so that said movable element is moved to said second position to close said pressure line isolat-

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ing said pump from said motor and to open said discharge line connecting said motor thereto whereby said motor draws fluid from said reservoir to said other line and discharges said fluid to said reservoir through said discharge line, said biasing means returning said movable element to said first position responsive to said reel returning from reeling-out to standstill whereby said motor automatically starts reeling-in.

8. A cable reeling system comprising a cable reel adapted to have a cable wound thereon, a hydraulic motor adapted to drive said reel for reeling-in said cable and to be driven by said reel as a pump when said cable is reeling-out for providing a load on said reel so that tension is maintained on said cable, a hydraulic pump for furnishing fluid to said motor, a pressure line connecting said motor and said pump, a fluid reservoir, a line connecting said pump to said reservoir, another line connecting said motor to said reservoir for discharging fluid from said motor during reeling-in and for supplying fluid to said motor when driven as a pump during reeling-out, valve means arranged in said pressure line, a discharge line connecting said valve means and said reservoir, said valve means having a vacuum actuated movable element arranged to open said pressure line and to close said discharge line in a first position and to close said pressure line and open said discharge line in a second position, means for normally biasing said movable element so that said pressure line is open and

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said discharge line is closed whereby said pump draws fluid from said reservoir and supplies said fluid to said motor which discharges said fluid to said reservoir through said other line, means in said other line for creating a vacuum therein responsive to operation of said motor as a pump, and a vacuum line connecting said other line and said valve means for introducing said vacuum to said movable element so that said valve is moved to said second position to close said pressure line isolating said pump from said motor and to open said discharge line connecting said motor thereto whereby said motor draws said fluid from said reservoir through said other line and discharges said fluid to said reservoir through said discharge line, said biasing means returning said movable element to said first position responsive to said reel returning from reeling-out to standstill whereby said motor automatically starts reeling-in.

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