

Oct. 6, 1953

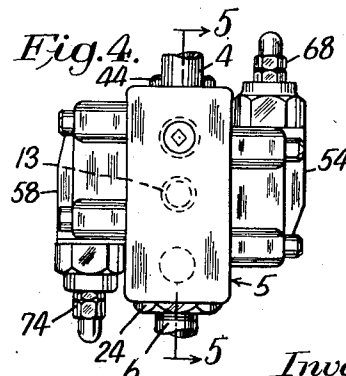
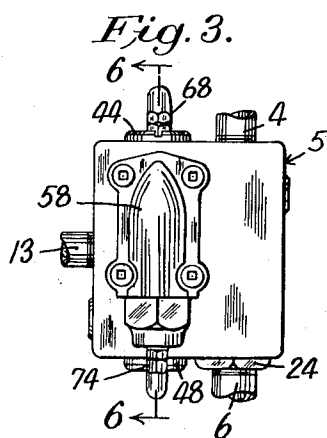
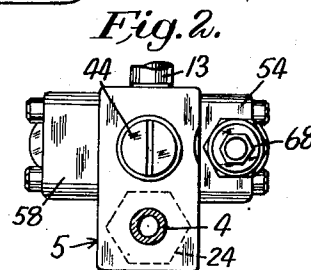
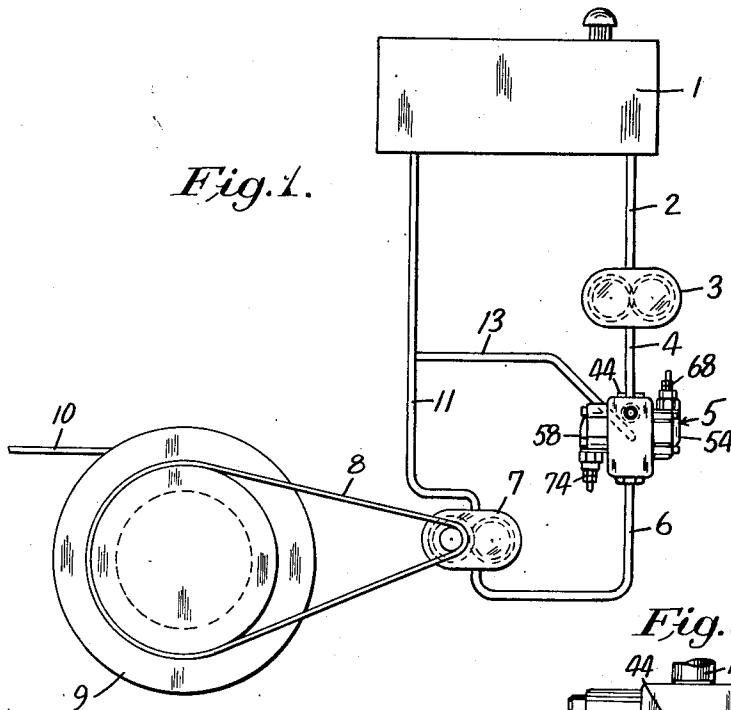
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2,654,548

CABLE REELING MECHANISM

Original Filed May 1, 1948

4 Sheets-Sheet 1



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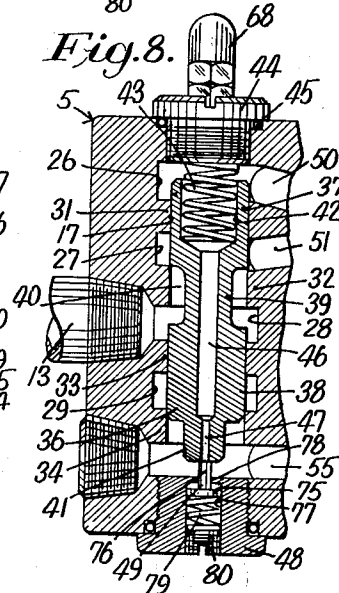
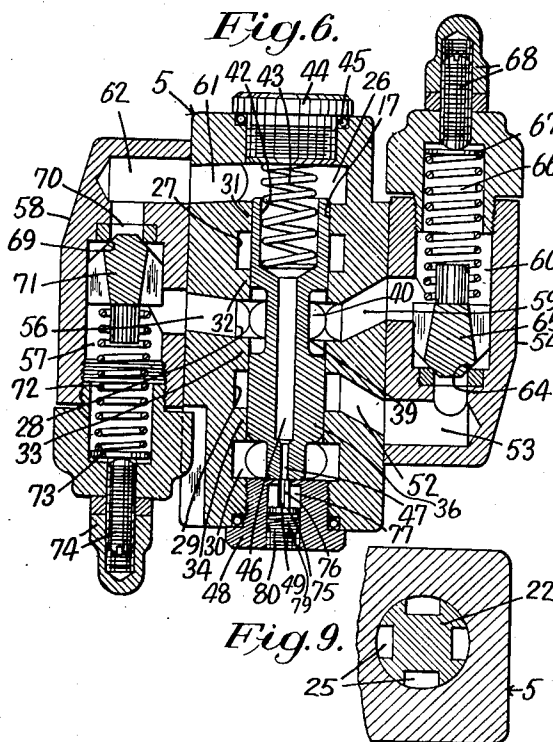
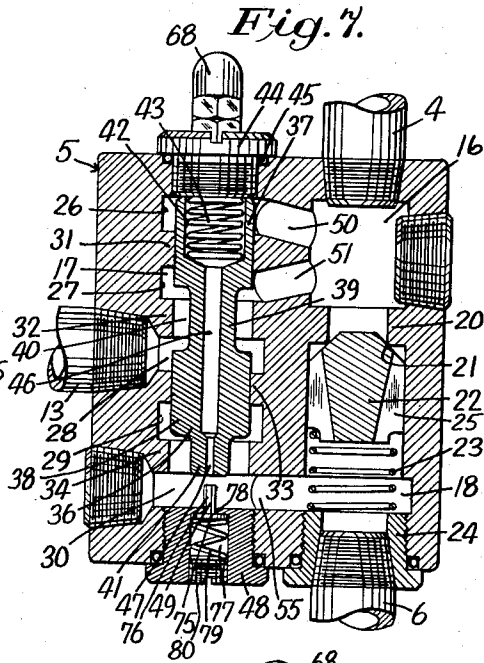
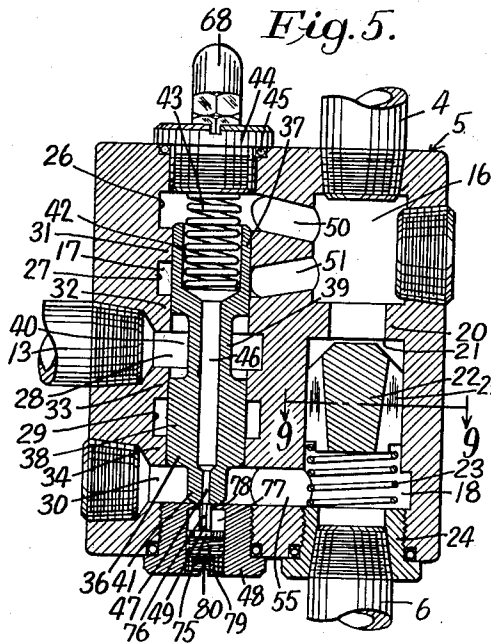
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CABLE REELING MECHANISM

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4 Sheets-Sheet 2



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CABLE REELING MECHANISM

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4 Sheets-Sheet 3

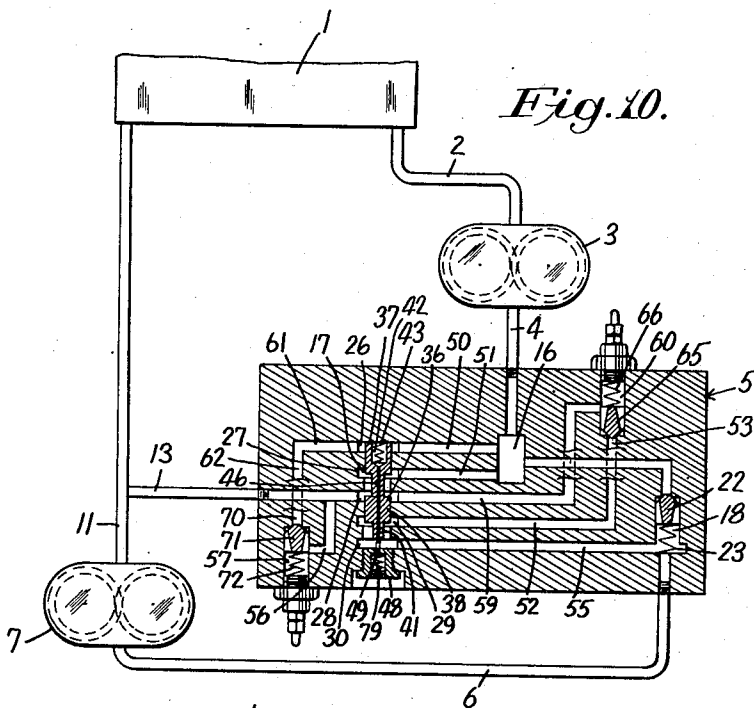


Fig. 10.

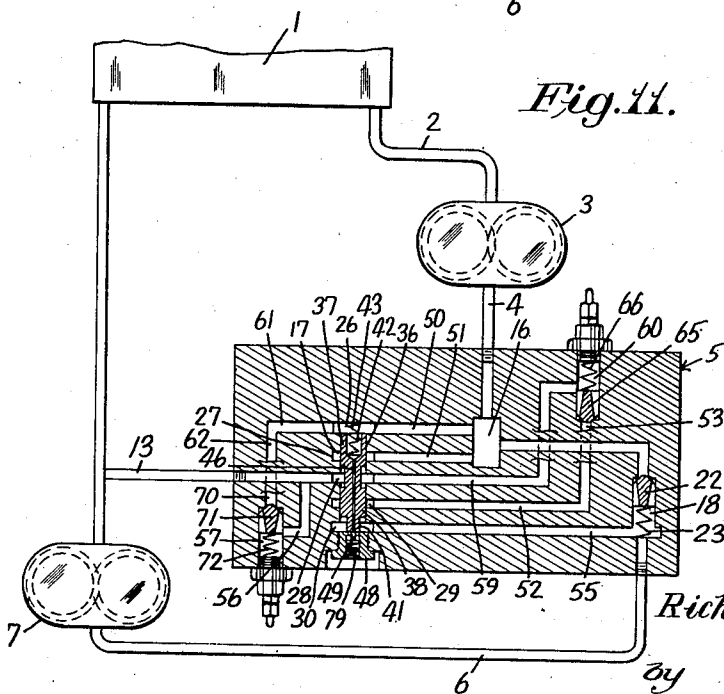


Fig. 11.

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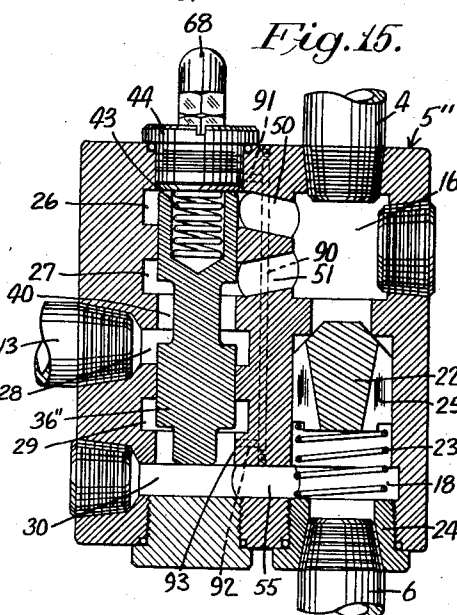
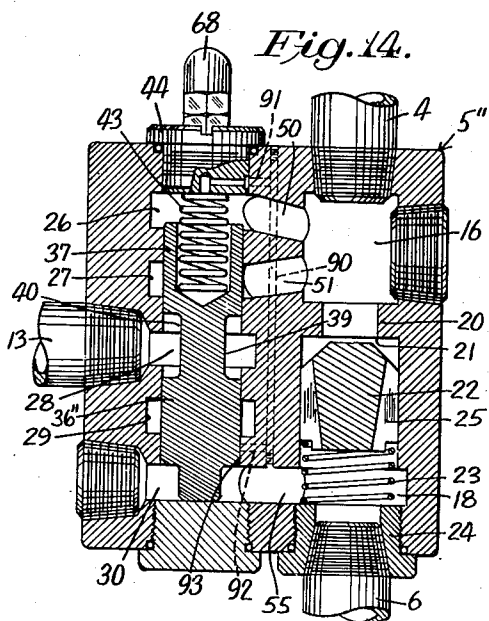
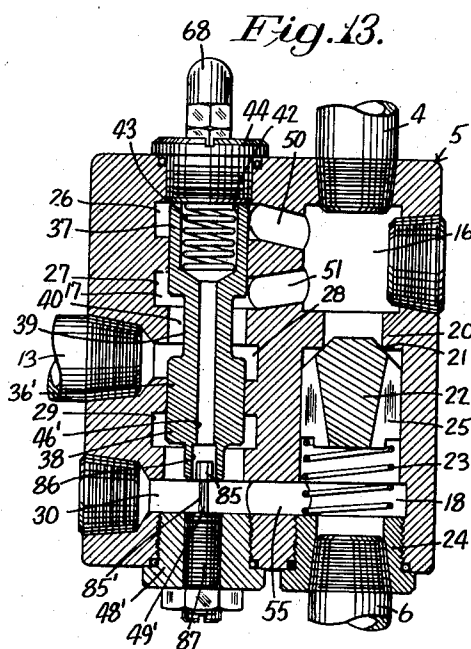
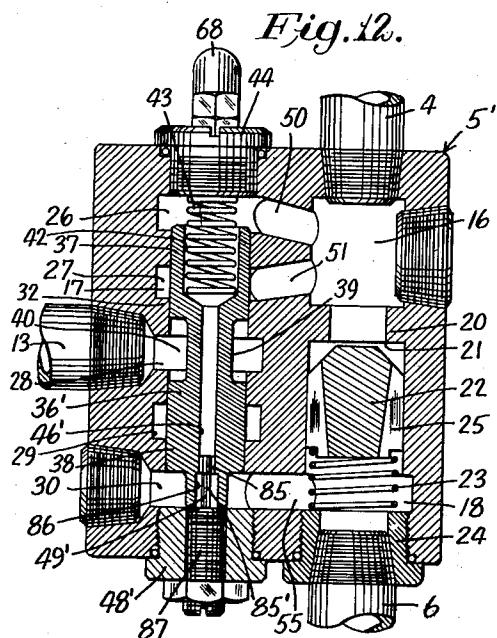
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CABLE REELING MECHANISM

Original Filed May 1, 1948

4 Sheets-Sheet 4



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Att'y.

UNITED STATES PATENT OFFICE

2,654,548

CABLE REELING MECHANISM

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Continuation of application Serial No. 24,558;
May 1, 1948. This application February 25,
1953, Serial No. 338,790

15 Claims. (Cl. 242—90)

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This invention relates to improvements in cable reeling and paying out mechanisms particularly adapted for use on mine vehicles, and from this aspect relates especially to a fluid motor-pump drive and control apparatus for a cable reel on which there is wound the cable by which power is supplied to a self-propelled vehicle such as a shuttle car or mine locomotive of the gathering type. From another aspect, it relates to control valve mechanisms per se.

In a preferred embodiment of the invention from its reeling mechanism aspect, the same may comprise a source of hydraulic fluid, a pump whose drive is independent of the propulsion of the vehicle with which the mechanism may be used, a motor-pump device operatively connected to a cable reel so that neither can turn without the turning of the other, and an automatic valve mechanism including valves respectively operative to determine the pressure imposed on the motor-pump device when the cable is being wound in and operative to determine the back pressure imposed on the motor-pump device when the cable is being payed out, an automatic shifter valve controlled at least in part by the pressures built up by the motor-pump device when the same is acting as a pump for shifting connections in such a manner that, whereas during winding in of the cable, the relief device having a higher setting is in control, yet the relief device having the lower setting shall become operative when cable is pulled off of the reel, and that the main pump discharge shall be automatically relieved of substantially all back pressure, and means associated with the shifter valve for insuring the sharp throwing thereof.

From its control-valve aspect, the invention, in a preferred embodiment, may comprise a casing providing chambers having in them respectively a shifter valve, two relief valves, and a check valve, an external inlet connection having communication with one end of said shifter valve containing chamber and also with that chamber at a point between the ends of the latter and also with said check valve and with one of said relief valves, an external vent connection communicating with the chambers containing each of said relief valves and with said shifter valve-containing chamber at a different point between the ends of the latter, a connection between the other relief valve and said shifter valve-containing chamber at another point between the ends of the latter, a third external connection communicating with the other end of said shifter valve chamber and with said check valve containing chamber, and means for connecting together the opposite ends of said shifter valve containing chamber only when the shifter valve is at least a predetermined distance from the last mentioned end of its chamber.

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An object of the invention is to provide an improved reel driving and controlling apparatus. Another object of the invention is to provide an improved valve mechanism particularly adapted, but not limited, to the control of a hydraulic reel driving and control mechanism of the character hereinabove described. A further object of the invention is to provide an improved reel driving and control apparatus including a plurality of pressure relief valves, a hydraulically controlled shifter valve for rendering one or the other of the relief devices effective to control the pressures in a line between the pump and motor pump device, and means for providing a sharp and definite movement of the shifter valve regardless of the viscosity of the hydraulic fluid employed. A more specific object of the invention is to provide an improved reel driving and control apparatus including a plurality of differently set relief devices, a shifter valve constructed and arranged to render one or the other of said relief devices effective to control the pressure in a line between the pump and the motor-pump device, dependent upon the direction of rotation of the latter, and to provide an automatic establishment of control by the relief device having the higher setting promptly upon the coming to a stop of the motor-pump device, following a period of operation as a pump, and a control for the shifter valve providing an improved operation thereof. Other objects and advantages of the invention will hereinafter more fully appear.

Referring to the drawings in which a preferred embodiment and two modifications of my invention are shown,

Fig. 1 is a diagrammatic view illustrating a form of fluid circuit and elements associated therewith arranged in accordance with a preferred embodiment of my invention, for driving and controlling a motor-pump device operatively connected with a cable reel.

Fig. 2 is an enlarged end view of the relief and control valve mechanism shown in Fig. 1, the view being taken from what might be called the top, if the parts shown in Fig. 1 be considered to have the same relationship in space as is indicated on the first sheet of the drawings.

Fig. 3 is a side view of the relief and control valve mechanism of Fig. 2, the view being from the left hand side thereof with the mechanism in the position indicated in Fig. 1.

Fig. 4 is another side view of the relief and control valve mechanism, the position corresponding to that of Fig. 1, but the scale being larger.

Fig. 5 is an enlarged sectional view on the plane of the section line 5—5 of Fig. 4, through the relief and control valve mechanism.

Fig. 6 is an enlarged sectional view taken on the plane of the line 6—6 of Fig. 3.

Fig. 7 is a sectional view on the same plane

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and scale as Fig. 5, but with the parts shown in different relative positions.

Fig. 8 is a sectional view on the same plane as Figs. 5 and 7, showing the shifter valve in still another position, the right hand portion of the valve mechanism being broken away.

Fig. 9 is a fragmentary sectional view taken on the plane of the line 9—9 of Fig. 5.

Figs. 10 and 11 are views similar to Fig. 1, but showing the relief and bypass valve mechanism in a developed or schematic manner so that all of the passages therethrough and elements thereof may be noted in their working operations.

Fig. 12 is an enlarged sectional view on a plane corresponding to the plane of the section line 5—5 of Fig. 4, showing a modified relief and control valve mechanism.

Fig. 13 is a sectional view on the same plane and scale as Fig. 12, with parts shown in different relative positions.

Fig. 14 is an enlarged sectional view of another modified form of relief and control valve mechanism, this view also being taken on a plane corresponding to the plane of section line 5—5 of Fig. 4.

Fig. 15 is a sectional view on the same plane and scale as Fig. 14, with parts shown in different relative positions.

Referring now to the drawings, and first to Figs. 1, 10 and 11, it will be noted that a reservoir or tank 1 constituting a source of hydraulic fluid is provided to contain the necessary quantity of such fluid for the driving and controlling of the reel. It may, of course, constitute a source of fluid for other purposes, but with that we are not here concerned. The reservoir 1 is connected by a suction line 2 with a main pump 3, which is driven from any suitable source of power, not shown, and which is desirably driven whenever power is being delivered to the vehicle (not shown) on which the reel is supported. The pump 3 delivers fluid under pressure to a line 4 which is connected with a relief and shifter valve mechanism generally designated 5, which has a connection 6 leading to a motor-pump device 7. This motor-pump device 7 is operatively connected as by a belt or chain 8 with a cable reel 9 upon which a power supply cable 10 is wound. While my invention is specifically described with reference to a cable reel carrying an electric cable for supplying current to electric motors, the invention is not limited to such systems, but includes within its contemplation reels for flexible conductors for other operating media. The motor-pump device 7 is connected with a conduit 11, which leads back to the reservoir or source 1, and a relief line 13 leads from the valve mechanism 5 to the line 11. The pump 3 is shown as the intermeshing gear type, as is also the motor-pump device 7. The specific details of the construction of the pump and motor-pump device, and even the types thereof, are not essential to the invention, and such devices are so well known per se that they are not more extensively illustrated.

The valve mechanism 5 provides a chamber 16 to which hydraulic fluid is delivered by the conduit 4. From the chamber 16 fluid may be delivered through a shifter valve chamber 17 to the connection 13 leading to the source 1, or, as will shortly be explained, to another chamber 18 which is connected with the conduit 6 leading to the motor-pump device 7 and which communicates also with the shifter valve chamber 17 as will later be described. Desirably, the cham-

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bers 16 and 18 may be arranged in line with each other, as shown in Figs. 5 and 7, and separated by a ported septum 20 which provides a valve seat 21 which a check valve 22 is adapted to engage and against which said check valve is adapted normally to be maintained by a spring 23 which at one end engages the check valve and at its other end rests upon a plug 24 with which the conduit 6 is threadedly or otherwise suitably connected. The chamber 16 communicates with the chamber 18, of course, when the check valve 22 is unseated. Fig. 9 will aid in the comprehension of the structure of the check valve 22, and from this figure it will be noted that the valve has a number of slots 25 in its periphery through which fluid may flow from the chamber 16 to the chamber 18 when the valve 22 is unseated.

The shifter valve receiving chamber 17 includes five annular chambers, each spaced from the next adjacent chamber by a ported partition. Starting from the top in Fig. 5, these annular chambers are successively numbered 26, 27, 28, 29 and 30. A ported partition 31 separates the chambers 26 and 27. A ported partition 32 separates the chambers 27 and 28. In like manner, ported partitions 33 and 34 respectively separate the chambers 28 and 29 and the chambers 29 and 30. Each of the ported partitions has the port therethrough of the same size as each of the others, said several ports being coaxially arranged so that their surrounding walls provide guidance for a two-spooled shifter valve 36 comprising an upper hollow spool 37, a lower spool 38 and a connecting portion 39 of reduced diameter, by reason of which an annular fluid conducting groove 40 is provided between the spools 37 and 38, and a ported stop projection 41. The spool 37 has a chamber or recess 42 in it, and a spring 43 extends into the recess and engages the lower end of the latter, the upper end of said spring 43 contacting an abutment plug 44 suitably packed at 45 to prevent leakage. A port 46, of relatively small diameter at its lower end 47 where it extends through the stop projection 41, connects the chamber 42 in certain positions of the shifter valve with the space surrounding the stop projection 41. In other words, it connects the chambers 26 and 30, when open. The stop projection 41 of the valve is adapted to cooperate with a suitable abutment plug 48 and with a yielding mounted valve 49, of which more will be said shortly. The abutment plug limits the downward movement of the shifter valve 36 and the valve 49 maintains closed the passage 46, 47 during its engagement with the projection 41.

The annular chamber 26 communicates with the chamber 16 through a port or cored opening 50. Similarly, the annular space 27 communicates through a port or cored opening 51 with the chamber 16. Annular chamber 28 communicates through the conduit 13 with the conduit 11 leading to the fluid source or reservoir 1. The annular chamber 29 communicates through a port or opening 52 with the chamber 53 in a relief valve casing 54 shown in the drawings as a separate element from the main body of the valve mechanism as a whole, but obviously formable with it as a unit if desired. The annular space 30 communicates through an opening 55 with the chamber 18. The annular chamber 28 also communicates through a port opening 56 with a chamber 57 in another relief valve housing 58. The annular chamber 28 further communicates

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through an opening 59 with a chamber 60 in the relief valve casing 54. The annular chamber 26 communicates through an opening 61 with a chamber 62 in the relief valve housing 58. The chamber 53 is separated from the chamber 60 by a ported valve seat 64 with which a spring pressed relief valve 65 is adapted to cooperate. A spring 72 having a follower 67 is adjustably loaded by an adjusting screw and nut mechanism 68, which controls the compression of the spring 72 and thus determines the pressure at which the valve 65 will lift from the seat 64. A valve seat 69 surrounding a port 70 extending between the chambers 57 and 62 is adapted to be engaged by a relief valve 71 pressed in a closing direction by a spring 72 which engages a follower 73 whose position may be adjusted by a suitable screw and nut mechanism 74. The valves 65 and 71 have flow-slots in the manner of valve 22. It will be observed that when the valve 36 is in top position, it does not prevent communication between the chamber 16 and the port 70. The normal compression of the spring 72 will be much higher than the normal compression of the spring 66, when their controlling valves have equal areas subjected to pressures tending to unseat such valves. For example, it may require a liquid pressure of 300 p. s. i. in chamber 62 to unseat valve 71, while for example a pressure of 100 p. s. i. in chamber 53 will suffice to unseat valve 65.

The valve 49 consists of a head portion 75 and a plunger portion 76; the head portion being slidably received in a chamber 77 formed in the abutment plug 48, and the plunger portion 76 extending through a reduced opening 78 coaxial with the chamber 77. A spring 79 engages the head portion at one end, and at its other end engages an adjustable threaded follower 80, and the pressure exerted by the spring 79 may be determined by the adjustment of its follower 80. Normally the spring 79 tends to maintain the plunger 76 in the position shown in Fig. 7, but the valve 49 may be depressed to the position shown in Figs. 5 and 6 and the plunger portion 76 is adapted to seal the opening 47 in the several positions of the shifter valve illustrated in Figs. 5, 6 and 8, but does not seal the opening 47 in the position of the shifter valve shown in Fig. 7. It may further be noted that sealing of the opening 47 by the plunger portion 76 will be discontinued as the shifter valve 36 moves upward, only, with the proportions shown, when the shifter valve reaches a position at which the flow of fluid through the port 51 and through the annular recess or groove 28 and the connection 13 has commenced. This means that the shifter valve will be sharply thrown, as the pressure at its upper end will drop when chamber 16 is connected with vent line 13. The mode of operation of the valve element 49 and its cooperation with the other parts of the mechanism will be more fully explained shortly.

The pump 3 may be considered, for the purposes of explaining the mode of operation of the invention, to be driven continuously while the vehicle is in use. Accordingly, it is taking liquid from the reservoir or source 1, through the conduit 2, and discharging it through the conduit 4 into the chamber 16, and the fluid that enters the chamber 16 must obviously go somewhere. Some of it can go through the conduit 6 after passing the check valve 22, and cause the motor-pump device 7 to operate as a motor and effect a winding in of the cable 10, and then pass back to the source 1 through the conduit 11, if the

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cable can be reeled in. However, the rate at which the cable can be wound in may and probably will be entirely insufficient to permit all of the fluid delivered by the pump 3 to pass through the motor-pump device 7 and, indeed, it is possible that the motor-pump device may be entirely incapable of winding in the cable at all, as when the vehicle is at a standstill. Therefore, some of the liquid delivered to the chamber 16 must go elsewhere, and this it will do, passing by way of the passage 50, the annular groove 26, the passage 61, the chamber 62, the port 70, past the relief valve 71, through the chamber 57, the port 56, the groove 28, and the conduit 13 into the return line 11 and back to the source or reservoir 1. The pressure of the spring 72 will be made sufficient to compel the desired pressure to be maintained in the chamber 16, and in the conduit 6. For example, a pressure of 300 p. s. i. may be maintained in the fluid supply connections to the motor-pump device 7 by the appropriate setting of the spring 72. In Figs. 10 and 11, it may be noted that in order to avoid overlapping ports, the connection of the conduit 13 with the chamber 28 is shown as made by way of a portion of the port 56 instead of opening into the chamber 28 separately from the port 56 and at right angles to the communication of that port with the chamber 28. Fig. 11, subject to the understanding just expressed, may be considered to show the normal position of the parts during the operation of the motor-pump device 7 as a motor to effect winding in of the cable 10; in other words, the mode of operation which takes place when the vehicle is moving in a direction to shorten the free length of the cable. At this time the shifter valve 36 occupies the position shown in Figs. 5 and 6 as well as Fig. 11 and is held in that position by reason of the facts (a) that the hydraulic pressure on its lower end is less than the hydraulic pressure on its upper end by the amount occasioned by the presence of the spring 23, and (b) that the spring 43 operates to hold the shifter valve 36 in the position mentioned.

If the vehicle is brought to a stop, the motor-pump device 7 will no longer drive the reel to wind in the cable, because the cable cannot then ordinarily be wound in; but there will be nothing which will occur in the controlling apparatus which would cause movement of the shifter valve 36 to reduce the pressure imposed on the motor-pump device 7 and so the cable will remain under undiminished tension while the vehicle is at a standstill. It will be noted that in the position of the shifter valve 36 shown in Figs. 5, 6 and 11, the lower end of the projecting portion 41 engages the top surface of the plug 48 and the plunger portion 76 of the valve 49 contacts the end of the projecting portion 41 and acts as a valve associated with the passage 47, and, because the spring 79 is strong enough to maintain this contact against the pressure for which the relief valve 71 is set, no flow through the passage 47 downwardly or upwardly will be possible until the shifter valve is moved up such a distance that contact between the plunger portion 76 of the valve 49 and the lower end of the projecting portion 41 of the shifter valve is interrupted.

Now suppose that the vehicle is caused to move in the direction which will necessitate the unwinding of the cable from the reel in order for such motion to take place. The tension of the cable will require the motor-pump device 7 to rotate in such a direction as to pump fluid taken in through the conduit 11 into the conduit

6. This fluid will pass into the chamber 18, but cannot pass the valve 22, and it also will be unable to pass the shifter valve 36 in the lower position of that valve. Accordingly there will be an instantaneous building up of pressure below the shifter valve 36 to a value in excess of the pressure existing on the top of that valve supplemented by the strength of the spring 43, and the shifter valve will start to move upward. The valve 49 will be moved upward by the spring 79 as long as there is no contact between the head portion 75 of the valve 49 and the portion of the plug 43 above the bore 77. Thus there can be no flow of fluid from the space below the shifter valve to the space above it, and the greater pressure below this valve will be maintained until the shifter valve gets well under way and preferably moves upward to such a point that the groove 40 can connect the port 51 with the annular chamber 28 and with the conduit 13 and thus permit a relief of the pressure at the upper end of the shifter valve. After this relief in pressure takes place, it will require no great pressure below the shifter valve to complete its travel and to maintain it in raised position, and when the shifter valve reaches top position the fluid pumped by the motor-pump 7 will be permitted to pass through the opening 52 and past the lower set relief valve 65 into the port 59 and through annular chamber 28 into the conduit 13, but it will be noted that the pressure acting to maintain the shifter valve in raised position will still exceed the pressure tending to force it down again by reason of the fact that the force produced by the spring 43 and the freely venting discharge of the pump 3 will not be equal to the pressure resulting from the presence of the relief valve 65 with its loading spring 66.

To repeat, the back pressure on the main pump is completely removed except for such resistance as friction of the liquid in the passages may involve, when the shifter valve is maintained in top position, and this shifter valve will be maintained in top position because of the greater pressure imposed on its lower end by reason of the presence of the relief valve 65 and its loading spring 66, this relief valve being adapted to maintain a pressure of, for example, 100 p. s. i. in the chamber 53. By reason of the structure described, the tension on the cable 10 will be substantially reduced, and the reel may be turned backward, driving the motor-pump device 7 as a pump, with a much lower pressure in the line 6 than during the operation of the motor-pump device as a motor.

Now let it again be assumed that the vehicle stops. The motor-pump device 7 no longer acts as a pump and no longer delivers fluid through the conduit 6. Since the valve 49 is not sealing the passage 47, in the raised position of the shifter valve, the latter will move downwardly freely upon the cessation of the pumping of fluid into the chamber 18, until the lower end of the projecting portion 41 contacts the plunger portion 76 of the valve 49, and at the time the communication between the port 51 and the line 13 has, with a desirable proportioning of the parts, been interrupted, with the result that the pressure above the shifter valve will build up to the full amount called for by the setting of the relief valve 71. Thus, even though the shifter valve did not go all the way down to its position shown in Figs. 5 and 6, the pressure would build up to the setting of the relief valve 71 and the cable would be placed under tension, ready for imme-

diately winding in if the vehicle starts to move in a direction in which winding up of the cable will be requisite. If the passage 46, 47 were sealed off slightly before the communication between the passages 51 and 28 was completely interrupted, still, the throttling of the pump discharge could be counted on to cause a sufficient increase in the pressure above the valve 36 to cause the latter to move down to its bottom position.

It will be observed that the valve 49 prevents flow of fluid longitudinally through the valve 36—from the lower to the higher end thereof—until the valve has reached a position in which the groove 40 between its spools comes into communication with the passage 51, and it may further be noted that the strength of the spring 79 is sufficient to cause the plunger 76 to maintain contact with the lower end of the shifter valve and seal the passage through the latter so long as the shifter valve is within the range of movement of the valve 49. In passing it may be noted that fluid locking of the valve 49 is prevented by the provision of adequate clearances around its head 75 and plunger portion 76.

One important feature of the arrangement so far described is the provision of means which seals a passage through the shifter valve as long as the latter is below positions in which the passages 51 and 28 are not in communication with each other, and, more broadly, there is presented by the invention a shifter valve having chambers above and below it and with means provided for the interconnection, through a restricted passage, of such chambers in predetermined positions of the shifter valve, with said passage automatically sealed when the shifter valve is below positions in which communication between the grooves 27 and 28 exists. So viewed, it will be appreciated that in its broader aspects my invention is also present in the modification of Figs. 12 and 13, and also in the modification of Figs. 14 and 15, now to be described.

Referring first to the former figures (Figs. 12 and 13) it will be noted that the valve 49' has a head 85 which has a close sliding fit with the bore 46' extending through the shifter valve 36', except at the lower enlarged end 83 of such bore, where there is such an increase in diameter that when the head 85 lies wholly in the enlarged end 86, fluid can pass freely through the passage or bore 46' and the enlarged lower end thereof. The valve 49' may be made of uniform diameter, instead of having a head larger than its supporting stem 85'. The longitudinal extent of the enlarged bore 86 and the position of the upper end of the head 85 will be so determined that communication will be established between the chambers 26 and 30, desirably, just as connection is established between the grooves 27 and 28. The valve 49' is secured, in this embodiment, to a screw plug 87, threadedly secured in the bottom plug 48'. As may be seen from Fig. 12, there is no substantial passage of fluid from the chamber 30 to the chamber 26 when the shifter valve is in its lowermost position of Fig. 12, or before the passage 51 and the groove 28 are interconnected, but in the upper position of the shifter valve, the chambers 30 and 26 freely communicate with each other through the bore 46'.

In both of the forms of the invention so far described in some detail, ready adjustment of the positions of the valves, respectively, 49 and 49' is possible, and the passages which are adapted to connect the chambers 26 and 30 traverse the shifter valves. It is possible, however, as shown

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in Figs. 14 and 15, to make the shifter valve 36'' imperforate from end to end, and to provide a passage 90 in the body of the valve device 5'', and to connect this passage by transverse portions 91 and 92 respectively with the chamber 26 and with the shifter valve receiving bore just above the chamber 30; and, by the proper location of the point of opening of the transverse portion 92 through the cylindrical wall portion 93 of the bore which receives the shifter valve 36'', to seal communication between the chambers 26 and 30 when the shifter valve is in positions in which the passage 51 and the chamber 28 are not in communication with each other, and to provide communication through the passages 91, 90, 92 between said chambers 26 and 30 at other times.

From the foregoing description, it will be evident that my invention may be embodied in various forms, and that in all of the forms the operation will be positive and definite, and independent of the viscosity of the hydraulic fluid used, and that even if the oil gets very hot and there might otherwise be a tendency for it to flow so freely through the passage connecting the chamber 30 with the chamber 26 as to render the action of the shifter valve less positive than would be desirable, nevertheless, in each embodiment disclosed, the means for preventing flow between such chambers until the valve has gotten well started on its upward movement and connects the passage 51 with the chamber 28, will make certain and snappy the shifter valve control.

This application is a continuation of my application Serial No. 24,558, filed May 1, 1948, and now forfeited.

While there are in this application specifically described a preferred form, and two modifications, of my improved control valve, and a system of reel drive and control incorporating my invention from its more comprehensive aspect, it will be understood that this form and these modifications are shown for purposes of illustration and that the invention may be further modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim is:

1. In a cable reeling mechanism adapted to supply power to a moving vehicle, a winding reel adapted to have a cable wound upon it, a motor-pump device operable as a motor to drive said reel in a direction to wind cable thereon, a fluid pump, a pressure line connecting said pump to said motor-pump device, said motor-pump device being driven by said winding reel to cause the same to operate as a pump when cable is pulled off of the reel, and means for imposing on said motor-pump device a predetermined supply pressure when it is operating as a motor and a lower back pressure when it is being driven by the reel and acting as a pump and for connecting said fluid pump for substantially free discharge of the fluid which it pumps while said motor-pump device is being driven by the reel, including a valve element movable to different positions to effect said changes in pressure and actuated by fluid pumped by said motor-pump device when the latter is driven by the reel, said valve element having associated therewith means for permitting the passage of fluid from one end to the other thereof and means controlled by the movement of said valve for preventing fluid flow through said fluid passage permitting means in

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certain positions of said valve element intermediate said different positions.

2. In a cable reeling mechanism adapted to supply power to a moving vehicle, a winding reel adapted to have a cable wound upon it, a motor-pump device operable as a motor to drive said reel in a direction to wind cable thereon, a fluid pump, a pressure line connecting said pump to said motor-pump device, said motor-pump device being driven by said winding reel to cause the same to operate as a pump when cable is pulled off of the reel, means for imposing on said motor-pump device a predetermined supply pressure when it is operating as a motor and a lower back pressure when it is being driven by the reel and acting as a pump, including a valve element movable to different positions to effect said changes in pressure and actuated by fluid pumped by said motor-pump device when the latter is driven by the reel, and means also including said valve element for substantially wholly relieving the back pressure imposed on said fluid pump when cable is being pulled off of the reel, said valve element having associated therewith means for permitting the passage of fluid from one end to the other thereof and a separate valve relative to which said valve element is movable during at least a part of its own movement for preventing fluid flow through said fluid passage permitting means in certain positions of said valve element other than said different positions.

3. In combination, a winding reel having a cable thereon adapted to be wound in or payed off, a motor connected to said reel to drive the latter to wind in the cable when supplied with operating medium and to be driven backwards by the reel when cable is pulled off of the reel, means for supplying operating medium to said motor to drive the same to effect winding in of said cable, said operating medium supply means having in communication therewith a valve, having a fluid passage therethrough and opposed surfaces from one to the other of which said fluid passage extends, and movable into different positions appropriate respectively to winding in and pulling off of cable, and operative in the latter position to reduce the force required to drive the motor backwards to less than the force exerted by the motor when driving the reel, means for subjecting one of said opposed surfaces on said valve, to effect movement thereof to said latter position, to the pressure of the operating medium discharged by said motor when the same is driven backwards including a connection with the then exhaust of said motor, and means for preventing escape of operating medium through said fluid passage during a substantial portion of the first, but not the last, portion of such movement of said valve.

4. In combination, a winding reel having a cable thereon adapted to be wound in or payed off, a motor connected to said reel to drive the latter to wind in the cable when supplied with operating medium and to be driven backwards by the reel when cable is pulled off of the reel, means for supplying operating medium to said motor to drive the same to effect winding in of said cable, said operating medium supply means including a device having a fluid passage extending longitudinally therethrough and movable to reduce the force required to drive the motor backwards as compared with the force exerted by the motor when driving the reel, and means for subjecting opposed surfaces on said device to operating medium delivered respectively by said means for supplying operating medium and by said motor

when the latter is driven backwards, to control movements thereof, said device having associated therewith a valve for controlling the fluid passage which extends longitudinally therethrough and obstructing said passage during certain intermediate portions of the movements of said device.

5. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off of the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a one-way connection for the flow of fluid from said pump to said motor-pump device, means for conducting fluid after it has done work in said motor-pump device back to said source, a relief connection between said one-way connection and said source having a relief valve therein set to open upon the attainment of a relatively high pressure in said one-way connection, another relief connection arranged between said one-way connection and said source and having a relief valve therein set to open upon subjection to a relatively lower pressure, and means for preventing flow from said one-way connection to said second relief connection when said motor-pump device is driving said reel including a longitudinally bored valve device movable by the discharge pressure of said motor-pump device when the same is acting as a pump and having a controlling valve, relative to which it is movable, for rendering the bore through said valve device inoperative to affect its movements in predetermined portions of its path including portions intermediate the ends of the latter.

6. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off of the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a check valved one-way connection for the flow of fluid from said pump to said motor-pump device, means for conducting fluid after it has done work in said motor-pump device back to said source, a relief connection between said one-way connection and said source having a relief valve therein set to open upon the attainment of a relatively high pressure in said one-way connection, another relief connection arranged between said one-way connection and said source and having a relief valve therein set to open upon subjection to a relatively lower pressure, and means for preventing flow from said one-way connection to said second relief connection when said motor-pump device is driving said reel including a valve device traversed by an axial passage and having oppositely facing areas in continuous communication with said one-way connection at opposite sides of the check valve therein, said valve device traversed by an axial passage having as-

sociated with it, for controlling, said axial passage, a valve relative to which said valve device is movable and which valve projects into the path of movement of said valve device and has an inner end between and spaced from the end limits of said path.

7. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off of the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a conduit to which said pump discharges, a conduit connected to said motor-pump device and alternatively operative to conduct fluid received from said first conduit to said motor-pump device to drive the latter as a motor and to serve as a discharge line from said motor-pump device when the latter is driven by said reel and acts as a pump, a conduit connecting said motor-pump device with said source and alternatively serving as an exhaust line when said motor-pump device drives said reel and at least in part as a suction line when said motor-pump device is driven by said reel, a conduit connecting said first and second conduits, conduit means for connecting said first conduit to said source having a relief valve therein set at a relatively high relief pressure, a conduit means for connecting said first conduit to said source having between its ends a valve shiftable to open and close the same, and conduit means for connecting said second conduit to said source having a relief valve therein set at a relatively low relief pressure and also controlled by said shiftable valve, said shiftable valve being perforate from end to end and having associated with it, to control flow between its ends, a valve relative to which it is movable to control such flow and which valve projects into the path of movement of said shiftable valve and has an inner end spaced from the end limits of such path.

8. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off of the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a conduit to which said pump discharges, a conduit connected to said motor-pump device and alternatively operative to conduct fluid received from said first conduit to said motor-pump device to drive the latter as a motor and to serve as a discharge line from said motor-pump device when the latter is driven by said reel and acts as a pump, a conduit connecting said motor-pump device with said source and alternatively serving as an exhaust line when said motor-pump device drives said reel and at least in part as a suction line when said motor-pump device is driven by said reel, a conduit connecting said first and second conduits and having a valve associated therewith for preventing flow,

therethrough from the second conduit to the first, conduit means for connecting said first conduit to said source having a relief valve therein set at a relatively high relief pressure, conduit means for connecting said first conduit to said source having between its ends a valve shiftable to open and close the same, and conduit means for connecting said second conduit to said source having a relief valve therein set at a relatively low relief pressure and also controlled by said shiftable valve, said shiftable valve having oppositely facing surfaces continuously connected in communication, one with said first conduit, and the other with said second conduit and connected in communication with each other when, but only substantially as, said valve attains to a position to open said conduit means for connecting said first conduit with said source.

9. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a conduit to which said pump discharges, a conduit connected to said motor-pump device and alternatively operative to conduct fluid received from said first conduit to said motor-pump device to drive the latter as a motor and to serve as a discharge line from said motor-pump device when the latter is driven by said reel and acts as a pump, a conduit connecting said motor-pump device with said source and alternatively serving as an exhaust line when said motor-pump device drives said reel and at least in part as a suction line when said motor-pump device is driven by said reel, a conduit connecting said first and second conduits and having a valve associated therewith for preventing flow therethrough from the second conduit to the first, conduit means for connecting said first conduit to said source having a relief valve therein set at a relatively high relief pressure, conduit means for connecting said first conduit to said source having between its ends a valve shiftable to open and close the same, and conduit means for connecting said second conduit to said source having a relief valve therein set at a relatively low relief pressure and also controlled by said shiftable valve, said shiftable valve having oppositely facing surfaces continuously connected in communication, one with said first conduit, and the other with said second conduit and having associated therewith means for providing a restricted communication between said surfaces, a spring for biasing said valve in the direction in which the surface subjected to the pressure in said second conduit faces, and means for cutting off the restricted communication between said surfaces so long as said shiftable valve is cutting off communication between said first conduit and said source.

10. In a cable reeling mechanism adapted to supply power to a moving vehicle, a winding reel adapted to have a cable wound upon it, a motor-pump device operable as a motor to drive said reel in a direction to wind cable thereon, a fluid pump, a pressure line connecting said pump to said motor-pump device, said motor-pump device being drivable by said winding reel to cause the

same to operate as a pump when cable is pulled off of the reel, means for imposing on said motor-pump device a predetermined supply pressure when it is operating as a motor and a lower back pressure when it is being driven by the reel and acting as a pump, including a valve element movable to different positions to effect said changes in pressure and actuated by fluid pumped by said motor-pump device when the latter is driven by the reel, and means also including said valve element for substantially wholly relieving the back pressure imposed on said fluid pump when cable is being pulled off of the reel, said valve element having associated therewith means for permitting the passage of fluid from one end to the other thereof and a separate valve relative to which said valve element is movable during at least a part of its own movement for preventing fluid flow through said fluid passage permitting means in certain positions of said valve element other than said different positions, said separate valve having means for yieldingly supporting it for movement through a distance less than the range of movement of said valve element.

11. In a cable reeling mechanism adapted to supply power to a moving vehicle, a winding reel adapted to have a cable wound upon it, a motor-pump device operable as a motor to drive said reel in a direction to wind cable thereon, a fluid pump, a pressure line connecting said pump to said motor-pump device, said motor-pump device being drivable by said winding reel to cause the same to operate as a pump when cable is pulled off of the reel, means for imposing on said motor-pump device a predetermined supply pressure when it is operating as a motor and a lower back pressure when it is being driven by the reel and acting as a pump, including a valve element movable to different positions to effect said changes in pressure and actuated by fluid pumped by said motor-pump device when the latter is driven by the reel, and means also including said valve element for substantially wholly relieving the back pressure imposed on said fluid pump when cable is being pulled off of the reel, said valve element having associated therewith means for permitting the passage of fluid from one end to the other thereof and a separate valve relative to which said valve element is movable during at least a part of its own movement for preventing fluid flow through said fluid passage permitting means in certain positions of said valve element other than said different positions, said separate valve having a portion receivable, in certain positions of said valve element, in said means for permitting the passage of fluid from one end to the other of said valve element, to prevent flow through said means.

12. In a cable reeling mechanism adapted to supply power to a moving vehicle, a winding reel adapted to have a cable wound upon it, a motor-pump device operable as a motor to drive said reel in a direction to wind cable thereon, a fluid pump, a pressure line connecting said pump to said motor-pump device, said motor-pump device being drivable by said winding reel to cause the same to operate as a pump when cable is pulled off of the reel, means for imposing on said motor-pump device a predetermined supply pressure when it is operating as a motor and a lower back pressure when it is being driven by the reel and acting as a pump, including a valve element movable to different positions to effect said changes in pressure and actuated by fluid pumped

by said motor-pump device when the latter is driven by the reel, and means also including said valve element for substantially wholly relieving the back pressure imposed on said fluid pump when cable is being pulled off of the reel, said valve element having associated therewith means for permitting the passage of fluid from one end to the other thereof and a separate valve relative to which said valve element is movable during at least a part of its own movement for preventing fluid flow through said fluid passage permitting means in certain positions of said valve element other than said different positions, said valve element and separate valve having portions coacting with each other in certain positions only of said valve element to cut off fluid flow through said means for permitting the passage of fluid.

13. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off of the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a check valved one-way connection for the flow of fluid from said pump to said motor-pump device, means for conducting fluid after it has done work in said motor-pump device back to said source, a relief connection between said one-way connection and said source having a relief valve therein set to open upon the attainment of a relatively high pressure in said one-way connection, another relief connection arranged between said one-way connection and said source and having a relief valve therein set to open upon subjection to a relatively lower pressure, and means for preventing flow from said one-way connection to said second relief connection when said motor-pump device is driving said reel including a valve device traversed by an axial passage and having oppositely facing areas in continuous communication with said one-way connection at opposite sides of the check valve therein and having further a valve associated with it, projecting into its path from one end of the latter and relative to which it is movable, for controlling said axial passage, and maintaining it closed until said valve device has moved a substantial distance away from said one end of said path.

14. In combination, a winding reel mounted upon a vehicle for movement therewith and adapted to have a cable wound thereon and to wind in said cable or to have the same drawn off of said reel depending upon the direction of vehicle movement, a motor-pump device connected to said reel to drive the latter to effect winding of said cable and to be driven by said reel as cable is pulled off of the latter, a source of hydraulic fluid, a pump connected to said source to draw fluid therefrom and to supply fluid to drive said motor-pump device as a motor to effect reel drive, a first conduit to which said pump discharges, a second conduit connected to said motor-pump device and alternatively operative to conduct fluid received from said first conduit to said motor-pump device to drive the

latter as a motor and to serve as a discharge line from said motor-pump device when the latter is driven by said reel and acts as a pump, a conduit connecting said motor-pump device with said source and alternatively serving as an exhaust line when said motor-pump device drives said reel and at least in part as a suction line when said motor-pump device is driven by said reel, a conduit connecting said first and second conduits, conduit means for connecting said first conduit to said source having a relief valve therein set at a relatively high relief pressure, conduit means for connecting said first conduit to said source having between its ends a valve shiftable to open and close the same, and conduit means for connecting said second conduit to said source having a relief valve therein set at a relatively low relief pressure and also controlled by said shiftable valve, said shiftable valve being perforate from end to end and having associated with it a valve projecting into its path from one end of the latter and relative to which it is movable to control flow between its ends and to preclude such flow until said shiftable valve has moved a predetermined distance from said one end.

15. In a cable reeling mechanism adapted to supply power to a moving vehicle, a winding reel adapted to have a cable wound upon it, a motor-pump device operable as a motor to drive said reel in a direction to wind cable thereon, a fluid pump, a pressure line connecting said pump to said motor-pump device, said motor-pump device being rotatable by said winding reel to cause the same to operate as a pump when cable is pulled off of the reel, means for imposing on said motor-pump device a predetermined supply pressure when it is operating as a motor and a lower back pressure when it is being driven by the reel and acting as a pump, including a valve element movable to different positions to effect said changes in pressure and actuated by fluid pumped by said motor-pump device when the latter is driven by the reel, and means also including said valve element for substantially wholly relieving the back pressure imposed on said fluid pump when cable is being pulled off of the reel, said valve element having associated therewith means for permitting the passage of fluid from one end to the other thereof and a separate valve relative to which said valve element is movable during at least a part of its own movement for preventing fluid flow through said fluid passage permitting means in certain positions of said valve element other than said different positions, said separate valve projecting into the path of said valve element from one end of said path and precluding flow through said means for permitting the passage of fluid from one end to the other of said valve element save when said valve element has moved a substantial distance from said end of its path.

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