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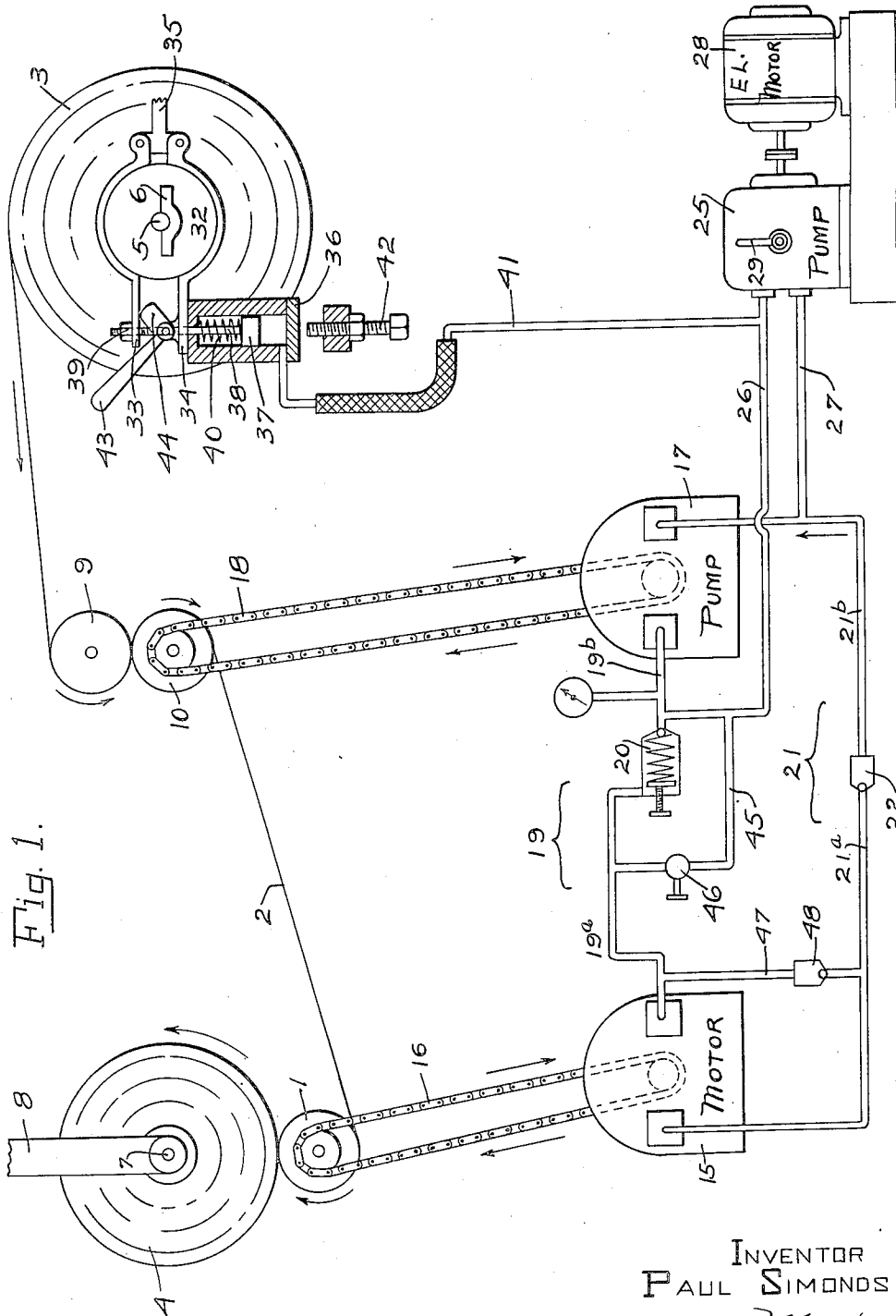
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2,164,596

WINDER DRIVE

Filed Nov. 5, 1937

4 Sheets-Sheet 1



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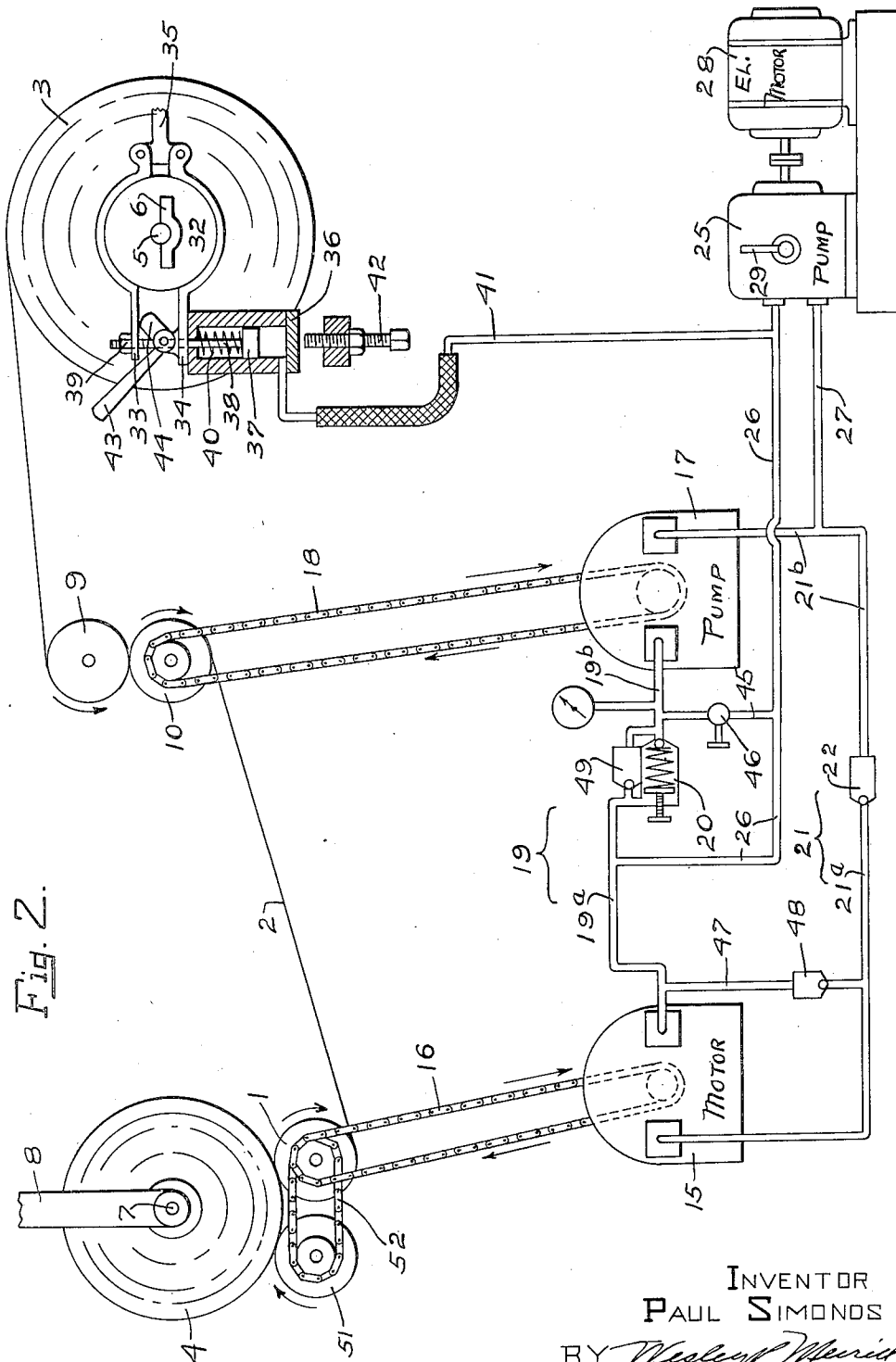
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WINDER DRIVE

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4 Sheets-Sheet 2



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WINDER DRIVE

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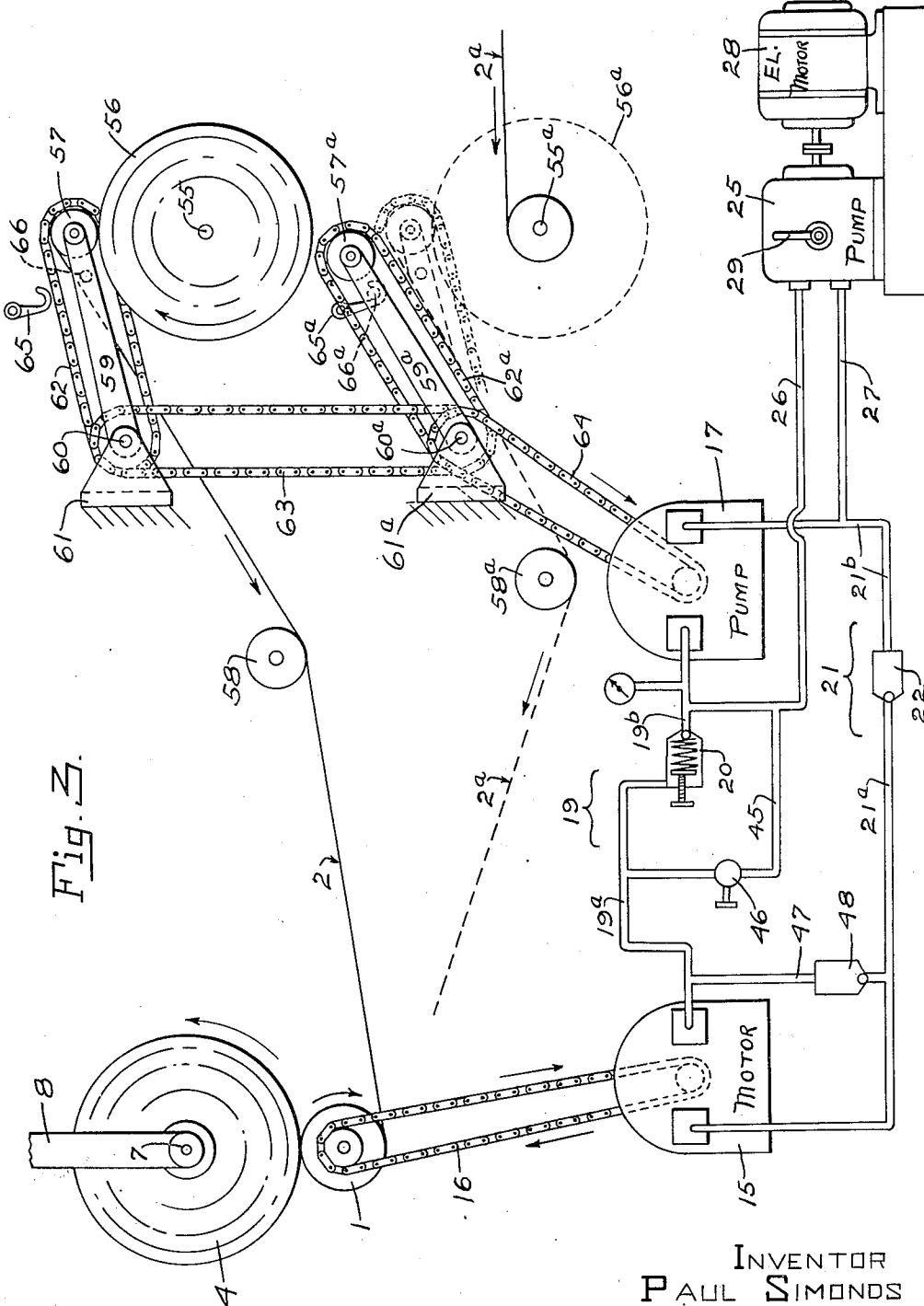


Fig. 3.

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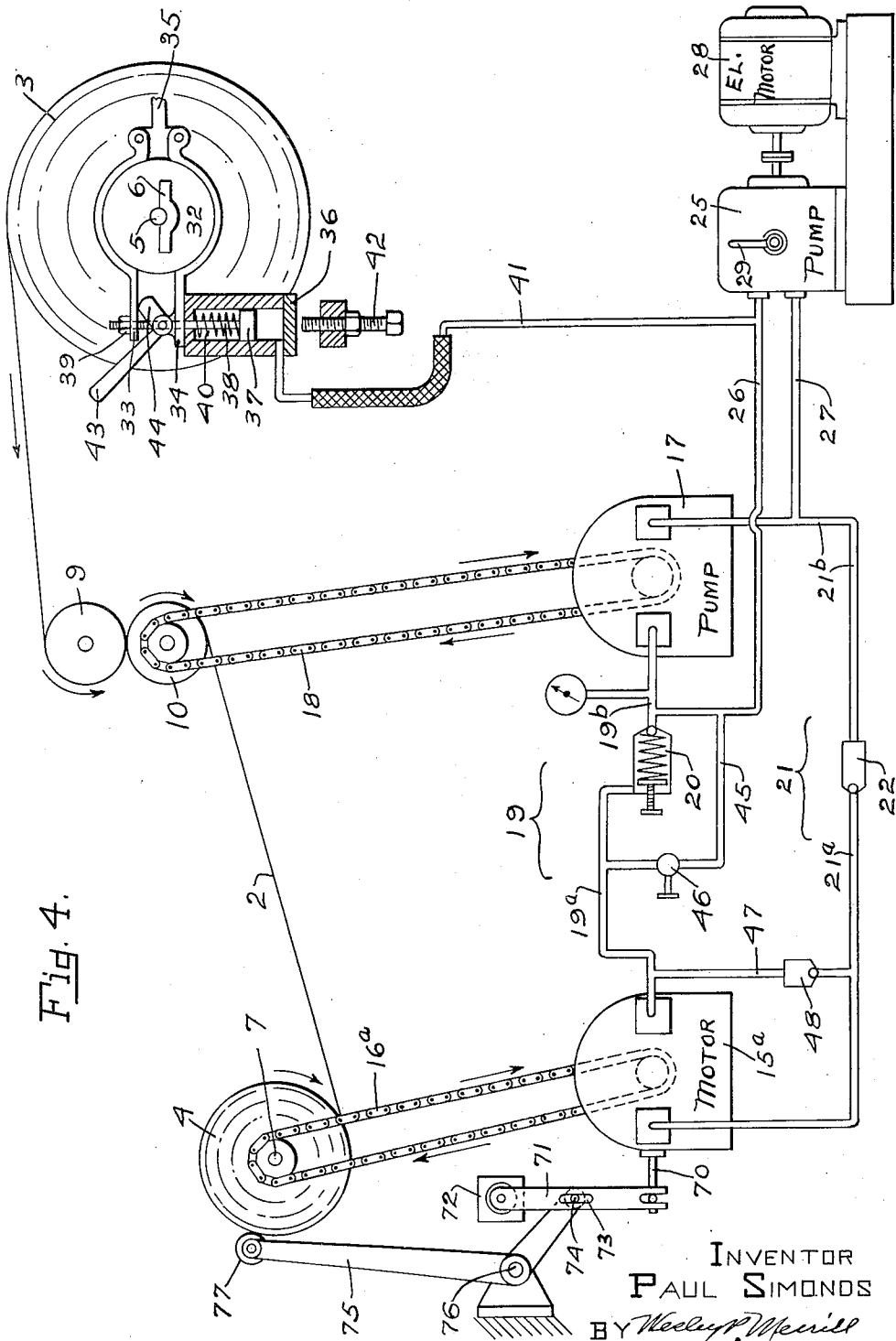
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WINDER DRIVE

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4 Sheets-Sheet 4



UNITED STATES PATENT OFFICE

2,164,596

WINDER DRIVE

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Application November 5, 1937, Serial No. 172,888

20 Claims. (Cl. 242-75)

This invention relates to rewinding machines of the type employed to wind web material into a finished roll after it has first been wound into a parent roll such, for example, as the parent roll into which paper is wound as it is delivered by a paper making machine. In order that the density of the rewound roll may be uniform, it is necessary to maintain a uniform tension upon the web as it is rewound into a new roll.

Tension has heretofore been maintained upon the web in various ways one of which is to fix the parent roll upon a shaft and to apply a brake load to the shaft. Since the parent roll decreases in diameter as the web is unwound therefrom and since at a given brake load the tension on the web is proportional to the radius of the roll, it is necessary to continually adjust the brake as the web is unwound from the parent roll. In addition to the expense of providing an attendant whose sole duty is to adjust the brake, there is a very large amount of power wasted at the brake. Also, the energy dissipated through the brake causes the brake to overheat and the brake lining to rapidly burn out even with cooling water flowing over or through the brake.

The present invention has as an object to provide a drive by means of which an idle rewinding machine may be gradually accelerated to high speed and gradually decelerated to a stop.

Another object is to provide a rewinding machine with a drive which will eliminate the above mentioned objectional characteristics.

Another object is to provide a drive which will enable a rewinding machine to wind web material into a roll of uniform density without undue waste of power.

Another object is to provide a rewinding machine with a drive which may be adjusted to unwind web from a parent roll and feed it to the rewind roller.

Another object is to provide a drive which will enable a rewinding machine to operate accurately and economically.

Other objects and advantages will appear from the description hereinafter given of winder drives in which the invention is embodied.

According to the invention in its general aspect, the winding roller of a rewinding machine is driven by a hydraulic motor and draws the web from the parent roll and winds it into a new roll, a pump is driven by the web and maintains tension thereon, the pump delivers liquid to the motor and thereby regenerates the power consumed in maintaining tension upon the web, the

rate at which the pump delivers liquid to the motor being less than the rate required by the motor to operate it, and a second pump delivers additional liquid to the motor to energize it.

The invention is exemplified by the winder drive shown schematically in the accompanying drawings in which the views are as follows:

Fig. 1 is a diagrammatic view illustrating one form of the invention.

Fig. 2 is a view similar to Fig. 1 but showing a slight modification of the hydraulic circuit.

Fig. 3 is a diagrammatic view illustrating another form of the invention.

Fig. 4 is a view similar to Fig. 1 but illustrating a modification of the drive disclosed therein.

A machine for unwinding paper from a parent roll and rewinding it into a new roll ordinarily includes means for trimming the edges of the paper and means for slitting the paper into strips the desired widths but, since the invention does not reside in the rewinding machine per se, only such parts thereof as are necessary to an explanation of the invention have been represented in the drawings.

Fig. 1

The winding machine shown in this figure is provided with a winding roller 1 which rotates upon a stationary axis and is adapted to draw a web 2 from a parent roll 3 and wind it into a roll 4. Parent roll 3 is fixed upon a shaft 5 which is journaled in stationary bearings 6. Rewound roll 4 rests upon winding roller 1 and is wound upon a suitable core or cores arranged upon a shaft 7 having each of its ends journaled in an arm 8 of a pressure control mechanism which has not been illustrated as it is of well known construction and forms no part of the present invention. It is deemed sufficient to state that the pressure control mechanism functions to maintain the pressure between roll 4 and winding roller 1 substantially constant.

As indicated by the arrows, web 2 passes from parent roll 3 around and between a pair of rotatably supported friction or pinch rollers 9 and 10 and then passes around winding roller 1 to roll 4 so that, when winding roller 1 is rotated, web 2 will be wound upon the cores on shaft 7 and form roll 4.

Winding roller 1 is connected to a hydraulic motor 15 as by means of a drive 16, and friction roller 10 is connected to a pump 17 as by means of a drive 18. The arrangement is such that, when motor 15 is energized, roller 1 will draw web 2 from roll 3 and wind it into roll 4, and web

2 in passing around roller 10 will cause it to rotate and drive pump 17.

Motor 15 has its inlet connected to the outlet of pump 17 by a channel 19 consisting of two sections 19^a and 19^b having a resistance valve 20 connected therebetween. The outlet of motor 15 is connected to the intake of pump 17 by a channel 21 consisting of two sections 21^a and 21^b having connected therebetween a check valve 22 which permits liquid to flow freely from motor 15 to pump 17 but prevents it from flowing in the opposite direction for a purpose to be presently explained. Channels 19 and 21 thus connect motor 15 and pump 17 into a substantially closed hydraulic circuit. That is, the arrangement is such that pump 17 when driven delivers its entire output to motor 15 and receives its entire supply of liquid therefrom.

Motor 15 and pump 17 and the drives therefor are so proportioned that the displacement of pump 17 per unit of time is less than that of motor 15. That is, pump 17 discharges liquid at a rate less than the rate required by motor 15. This may be accomplished by providing a pump having a smaller displacement per revolution than the motor and driving the pump at the same speed that the motor is driven. Ordinarily, however, motor 15 and pump 17 are substantially identical and have the same displacement per revolution, and drives 16 and 18 are so proportioned that the speed of pump 17 will be less than the speed of motor 15. For example, the drives may be so proportioned that pump 17 will be driven at 900 R. P. M. when motor 15 is operating at 1050 R. P. M.

Liquid for energizing motor 15 is supplied to the circuit by a pump 25 which has one of its ports connected to channel 19^b by a channel 26 and its other port connected to channel 21^b by a channel 27.

Pump 25 is driven from a suitable source of power, such as an electric motor 28, and is ordinarily of the reversible type so that it may deliver liquid in a direction and at a rate dependent upon the direction and distance its control lever 29 is shifted from a central or neutral position in which position of lever 29 pump 25 is at zero stroke and no liquid is discharged thereby.

Web 2 is ordinarily unwound from roll 3 and rewound into a new roll at a high rate of speed so that, if the rewinding machine is stopped for any reason such as at the completion of the rewind roll or to cut out defective parts of web 2, the momentum of parent roll 3 will cause it to continue to rotate and unwind web 2 therefrom.

In order to quickly decelerate roll 3, shaft 5 may be provided with a brake which is applied automatically in response to pump 25 ceasing to deliver liquid to motor 15. As shown, a brake drum 32 is fixed upon one end of shaft 5 and adapted to be engaged by two brake shoes 33 and 34, one end of each shoe being pivoted upon a stationary support 35.

Shoe 34 supports at its free end a brake cylinder 36 having a piston 37 fitted therein and provided with a rod 38 which extends through the free ends of both brake shoes and has an adjusting nut 39 threaded upon its upper end in contact with the free end of shoe 33.

The free ends of shoes 33 and 34 are urged toward each other to cause the shoes to engage drum 32 and apply a braking force to shaft 5 by a helical compression spring 40 which is arranged within cylinder 36 in contact with the upper end thereof and piston 37.

In order that the brake may be released when the rewinding machine is in operation, the lower end of cylinder 36 is connected by a channel 41 to channel 26 so that, when pump 25 delivers liquid to motor 15 to energize it, the pressure created by pump 25 will extend through channels 26 and 41 to cylinder 36 and move it downward in respect to piston 37, thereby compressing spring 40 and releasing the brake. The downward movement of cylinder 37 is limited by a stop 42 which prevents cylinder 37 and associated parts from causing the brake shoes to drag upon drum 32.

In order that the brake may be released when the rewinding machine is idle, a manual release may be provided. As shown, a lever 43 is pivoted to the free end of shoe 34 and provided with a cam 44 which will engage the free end of shoe 33 and release the brake when lever 43 is swung downward from the position shown.

Operation

Assuming that pump 25 is being driven and that a parent roll 3 has been fixed upon shaft 5, the apparatus will function as follows:

Lever 43 is swung downward to release the brake and then web 2 is unwound by hand from roll 3 and led around and between rollers 9 and 10.

Then, if desired, control lever 29 may be shifted to cause pump 25 to discharge through channel 27 into channel section 21^b. Since this liquid cannot flow to motor 15 due to check valve 22, it will flow through pump 17 and cause it to function as a motor and rotate roller 10, the liquid discharged by pump 17 returning to pump 25 through channels 19^b and 26.

Roller 10 upon being driven will cooperate with roller 9 and draw web 2 from roll 3 and feed it to winding roller 1. When enough web has been unwound from roll 3, lever 29 is swung to its neutral position, thereby stopping roller 10. The end of web 2 is then passed around roller 1 and fastened to the cores on shaft 7.

Lever 43 is then swung upward to permit the brake to operate and lever 29 is shifted in a direction to cause pump 25 to deliver liquid through channel 26 into channel section 19^b. Due to resistance valve 20 and to the mechanical advantage of drive 18 over drive 16, the liquid will at first enter pump 17 and cause it to function as a motor and rotate roller 10 in a direction opposite to that in which it rotated when unwinding web 2 from roll 3.

Roller 10 cooperating with roller 9 will move web 2 toward parent roll 3 until the slack has been taken up in the section of web between roller 1 and rollers 9 and 10. After the slack has been taken out of this section of web, rollers 9 and 10 will exert tension thereon and thereby cause the pressure in channel section 19^b to rise until it is sufficient to open resistance valve 20 which may be adjusted to vary the tension upon the section of web between roller 1 and rollers 9 and 10. Pressure also extends from channel 26 through channel 41 to cylinder 36 and releases the brake which is ordinarily so adjusted that it will be released by a pressure lower than the pressure required to open resistance valve 20.

When resistance valve 20 opens, the liquid discharged by pump 25 will flow therethrough and through channel 19^a to motor 15 and cause it to rotate roller 1 which will draw web 2 from roll 3 and wind it into a new roll 4. Web 2 in passing around and between rollers 9 and 10 will

drive pump 17 which will draw liquid from channel 21 and deliver it through channel 19 to motor 15. The liquid discharged by motor 15 will flow through channel 21 and will be in part consumed by pump 17 and in part returned to pump 25 through channel 21.

The arrangement is such that pump 25 supplies liquid to motor 15 only at a rate equal to the difference between the rate required to operate it at the desired speed and the rate at which pump 17 delivers liquid thereto. Also, since pump 17 in maintaining tension upon web 2 is driven thereby and delivers liquid to motor 15, the greater part of the energy expended in maintaining tension upon web 2 is regenerated. Consequently, a relatively small power pump 25 will suffice and only a small amount of power will be consumed.

After the machine has been started, the power required to cause pump 17 to raise the pressure of the liquid from the pressure prevailing in channel 21 to the pressure required to drive motor 15 may be sufficient to maintain the desired tension upon web 2, in which case channel 26 may be connected to channel section 19^a by a channel 45 having arranged therein a shut-off valve 46 which may be opened to bypass liquid around resistance valve 20.

When it is desired to stop the machine for any reason such as when roll 4 is completed or to remove a defective section from web 2, lever 29 is moved to its neutral position, thereby causing pump 25 to cease delivering liquid to motor 15 and the pressure in cylinder 36 to drop so that spring 40 can apply the brake.

The machine will not stop immediately due to the momentum of the moving parts. Roll 4 will continue to rotate and drive roller 1 which will continue to draw web from parent roll 3 and thereby rotate roller 10 until roll 3 is stopped by the brake. Motor 15 and pump 17 will be driven, respectively, by rollers 1 and 10 and circulate liquid through channels 19 and 21.

Since the displacement of motor 15 per unit of time is greater than that of pump 17, channel sections 19^a and 21^a are connected by a bypass channel 47 having arranged therein a check valve 48 which permits liquid to flow freely from channel section 21^a to channel section 19^a but prevents it from flowing in the opposite direction. The arrangement is such that, when motor 15 and pump 17 are driven by rollers 1 and 10, pump 17 may draw its supply of liquid from channel 21 and discharge through channel 19 to motor 15, and motor 15 may discharge into channel 21 and be supplied in part by the liquid discharged by pump 17 and in part by liquid drawn from channel 21 through channel 47 and check valve 48.

Fig. 2

The drive shown in this figure differs from the drive shown in Fig. 1 only in that channel 26 is connected to channel section 19^a instead of channel section 19^b, channel 45 connects channel 26 to channel 19^b instead of to channel section 19^a, and a check 49 is connected in parallel with resistance valve 20 and opens in a direction opposite to that in which resistance valve 20 opens. Consequently, corresponding parts are indicated by corresponding reference numerals and further description thereof is deemed unnecessary.

This figure also shows an additional roller 51 arranged alongside winding roller 1 to assist in

supporting roll 4 which is according to the usual practice for the reason that this arrangement avoids the necessity of providing means to restrain roll 4 from horizontal movement. Rollers 1 and 51 may be connected to each other by a drive 52 if desired.

Since it is immaterial insofar as the winder drive is concerned whether one or two rollers are employed to support roll 4, the additional roller has been omitted from the other views for the sake of simplicity in illustrating the described invention.

The drive functions in the previously described manner except that, after web 2 has been attached to the cores on shaft 7 and pump 25 has been adjusted to deliver liquid through channel 26, the liquid delivered by pump 25 will at first flow through channel 26, channel section 19^a, check valve 49 and channel section 19^b to pump 17 and cause it to function as a motor and take up the slack in the section of web between roller 1 and rollers 9 and 10.

After the slack has been taken up and tension exerted upon web 2, resistance valve 20 will open and then the apparatus will operate in the previously described manner.

Fig. 3

The rewinding machine shown in this figure is intended to be applied directly to a machine which processes web material and winds it into parent rolls upon two or more shafts successively such, for example, as a paper making machine of which, since it forms no part of the present invention, only two winding shafts 55 and 55^a have been shown. For the purpose of illustration, let it be assumed that a parent roll 56 of web 2 has been wound upon shaft 55 and that a web 2^a is being wound upon shaft 55^a to form a roll 56^a.

It is to be understood that the rewinding machine unwinds the web from the parent roll on one winding shaft and winds it into a new roll or rolls faster than the processing machine delivers web to the other winding shaft so that the one parent roll will be exhausted and the winding shaft upon which it is wound will be ready to receive web from the processing machine before the parent roll on the other winding shaft is completed.

Except for the modifications necessary to adapt the winding machine to a web processing machine, the winder drive is the same as the winder drive shown in Fig. 1. Consequently, like parts have been indicated by like reference numerals and further description thereof is deemed unnecessary.

Web may be unwound from either parent roll and wound into a new roll by a winding roller 1 driven by a motor 15 as previously explained. When being unwound from parent roll 56 on shaft 55, the web passes around a friction roller 57 which at that time rests upon parent roll 56, it then passes under a deflector roller 58 and then around winding roller 1 to be wound into a roll 4. When being unwound from parent roll 56^a on shaft 55^a, the web passes around a friction roller 57^a which at that time rests upon parent roll 56^a, it then passes under a deflector roller 58^a and then around winding roller 1 to be wound into a roll 4.

Friction roller 57 has its axle journaled in the free ends of a pair of arms 59 having the other ends thereof journaled upon a shaft 60 which is carried by a stationary bearing bracket 61 and

connected to roller 57 by a suitable drive such as a chain drive 62. Friction roller 57^a has its axle journaled in the free ends of a pair of arms 59^a having the other ends thereof journaled upon a shaft 60^a which is carried by a stationary bearing bracket 61^a and connected to roller 57^a by a suitable drive such as a chain drive 62^a. Shaft 60^a is connected to shaft 60 and to pump 17 by suitable drives such as a chain drive 63 connecting it to shaft 60 and a chain drive 64 connecting it to pump 17.

The arrangement is such that, when friction roller 57 is driven by web 2 being unwound from parent roll 56, drive 62 will rotate shaft 60 which will cause drive 63 to rotate shaft 60^a and thereby cause drive 64 to drive pump 17. Likewise, when friction roller 57^a is driven by web 2^a being unwound from parent roll 56^a, drive 62^a will rotate shaft 60^a which will cause drive 64 to drive pump 17.

Since drives 62, 62^a, 63 and 64 are interconnected, rotating one friction roller will cause the other friction roller to rotate. Therefore, when one friction roller is being rotated by web being unwound from the parent roll on one winding shaft, it is necessary to hold the other friction roller out of contact with the parent roll being wound upon the other winding shaft. For the purpose of illustration, two latches 65 and 65^a have been shown arranged above rollers 57 and 57^a, respectively, to engage pins 66 and 66^a fixed, respectively, in arms 59 and 59^a.

Assuming that pump 25 is running, that friction roller 57 is in contact with parent roll 56 and that friction rollers 57^a is being held out of contact with the parent roll being wound upon winding shaft 55^a, the apparatus will function as follows:

Web 2 may at first be unwound by hand or, if desired, the end of web 2 may be led around roller 57 and then control lever 29 may be shifted to cause pump 25 to discharge liquid through channel 27 into channel section 21^b. Since this liquid cannot flow to motor 15 due to check valve 22, it will flow through pump 17 and cause it to function as a motor and rotate roller 57 which will rotate roll 56 to unwind the web therefrom. The web may then be led around rollers 58 and 1 and be attached to the cores on shaft 7.

Lever 29 may then be shifted to cause pump 25 to deliver liquid through channels 26 and 19^b to pump 17 which will at first function as a motor and drive roller 57 to cause it to rotate parent roll 56 in the opposite direction, thereby taking the slack out of the section of web 2 between it and roller 1.

After the slack has been taken out of this section of web, roller 57 will exert tension thereon and thereby cause the pressure in channel section 19^b to rise until it is sufficient to open resistance valve 20 and then liquid discharged by pump 25 will flow therethrough and through channel 19 to motor 15 and cause it to rotate winding roller 1 which will draw web 2 from roll 56 and wind it into a new roll 4.

Web 2 in unwinding from roll 56 rotates roller 57 and thereby drives pump 17 and causes it to deliver liquid to motor 15, it being understood that drives 16 and 64 or the displacement per revolution of motor 15 and pump 17 are so proportioned in respect to each other that pump 17 discharges liquid at a rate less than the rate required to drive motor 15 and that the additional liquid required to drive motor 15 is supplied by pump 25 as previously explained.

The winder drive otherwise functions in sub-

stantially the same manner as the drive in Fig. 1 except that a brake on the parent roll is unnecessary due to the fact that, when pump 25 ceases to deliver liquid to motor 15, pump 17 resists rotation of roller 57 and thereby causes it to quickly decelerate parent roll 56.

When parent roll 56 is exhausted, roller 57 is latched in its upper position, roller 57^a is lowered into contact with parent roll 56^a, and web 2^a is unwound therefrom, passed around roller 58^a and winding roller 1 and attached to the cores on shaft 7. The apparatus will then function as above described.

Fig. 4

The winder drive shown in this figure differs from the drive shown in Fig. 1 in that winding roller 1 is omitted and the shaft 7 upon which web 2 is to be wound into a new roll is connected directly to and driven by a hydraulic motor 15^a as by means of a drive 16^a. Since the winder drive is otherwise exactly the same as the drive shown in Fig. 1, like parts have been indicated by like reference numerals and no further description thereof will be given.

Since roll 4 is driven directly by motor 15^a and increases in diameter as web 2 is wound thereon, it is necessary to drive it at a progressively decreasing speed as it increases in diameter in order to unwind web 2 from parent roll 3 at a substantially uniform speed and thereby drive pump 17 at a substantially uniform speed. This may be accomplished by employing a variable displacement motor instead of the constant displacement motor employed in the previously described drive and increasing the displacement of the motor as roll 4 increases in diameter.

Motor 15^a may be of the type in which the displacement member or slide block is shifted hydraulically in response to operation of a follow-up valve. Since this type of pump and motor control is well known and in extensive commercial use and since its mechanism is ordinarily arranged inside a casing, it has been represented solely by a follow-up valve stem 70 which extends from the casing of motor 15^a.

As shown, valve stem 70 is adapted to be operated by a lever 71 which has one of its ends pivoted to stem 70 and its other end pivoted upon a stationary support 72. Lever 71 is provided intermediate its ends with a slot 73 to receive a pin 74 fixed to one arm of a bell crank lever 75 which is pivoted upon a stationary pin 76 and has a roller 77 arranged upon the end of its other arm and in contact with the periphery of roll 4.

The arrangement is such that roller 77 swings bell crank lever 75 upon pin 76 and causes it to swing lever 71 which shifts valve stem 70 to effect an increase in the displacement of motor 15^a as roll 4 increases in diameter, thereby causing motor 15^a to rotate roll 4 at a progressively decreasing speed as roll 4 increases in diameter. Otherwise, the drive operates in the same manner that the drive shown in Fig. 1 operates.

The winder drive herein set forth may be modified in various other ways without departing from the scope of the invention as hereafter claimed.

The invention is hereby claimed as follows:

1. The combination, with a web of material, of means including a hydraulic motor for moving said web, means for resisting movement of said web including a first pump driven by motion imparted thereto from said web and delivering liquid to said motor, said pump having a smaller displacement per unit of time than said motor, a

first channel connecting the outlet of said pump to the inlet of said motor, a second channel connecting the outlet of said motor to the intake of said pump, and a power driven pump for delivering additional liquid to said motor to energize the same.

2. The combination, with a web of material, of means including a hydraulic motor for moving said web, means for resisting movement of said web including a first pump driven by motion imparted thereto from said web and delivering liquid to said motor, said pump having a smaller displacement per unit of time than said motor, a first channel connecting the outlet of said pump to the inlet of said motor, a second channel connecting the outlet of said motor to the intake of said pump, a power driven pump for delivering additional liquid to said motor to energize the same, and a resistance valve connected into said first channel for resisting the delivery of liquid from said first pump to said motor.

3. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means and delivering liquid to said motor at a rate less than the rate required by said motor, a second pump for supplying liquid to said motor to energize the same, and means for driving said second pump.

4. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means and delivering liquid to said motor at a rate less than the rate required by said motor, a second pump for supplying liquid to said motor to energize the same, means for driving said second pump, and means offering a low resistance to the delivery of liquid from said first pump to said motor.

5. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means and delivering liquid to said motor at a rate less than the rate required by said motor, a second pump for supplying liquid to said motor to energize the same, means for driving said second pump, a brake for resisting rotation of said parent roll, and means responsive to variations in the pressure created by said second pump for operating said brake.

6. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and wind-

ing it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means and delivering liquid to said motor at a rate less than the rate required by said motor, a second pump for supplying liquid to said motor to energize the same, means for driving said second pump, a brake for resisting rotation of said parent roll, spring means for applying said brake, a piston and a cylinder for releasing said brake against the action of said spring, and means connecting said cylinder to the outlet of said second pump to cause said brake to be released upon said second pump energizing said motor.

7. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, pinch rollers arranged between said parent roll and said rewind roller to have said web passed therearound and therebetween, a first pump driven by motion imparted thereto from said pinch rollers and enabling said pinch rollers to maintain tension upon that part of the web between said pinch rollers and said rewind roller, said pump delivering liquid to said motor at a rate less than the rate required by said motor, a second pump for supplying additional liquid to said motor to energize the same, and means for driving said second pump.

8. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, pinch rollers arranged between said parent roll and said rewind roller to have said web passed therearound and therebetween, a first pump driven by motion imparted thereto from said pinch rollers and enabling said pinch rollers to maintain tension upon that part of the web between said pinch rollers and said rewind roller, said pump delivering liquid to said motor at a rate less than the rate required by said motor, a second pump for supplying additional liquid to said motor to energize the same, means for driving said second pump, and a resistance valve connected between said first pump and said motor to resist the delivery of liquid from said pump to said motor.

9. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, a first pump driven by motion imparted thereto from said web to maintain tension upon said web, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a second pump connected between said channels and normally adapted to deliver additional liquid into said first channel to energize said motor, means for driving said second pump, and means

for reversing said second pump to thereby cause said first pump to function as a motor.

10. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, a first pump driven by motion imparted thereto from said web to maintain tension upon said web, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump connected between said channels and normally adapted to deliver additional liquid into said first channel to energize said motor, means for driving said second pump, and means for reversing said second pump to thereby cause said first pump to function as a motor.

11. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means and delivering liquid to said motor, the displacement of said pump per unit of time being less than that of said motor, a first channel and a second channel connecting said pump and said motor in series with each other and forming therewith a hydraulic circuit, a second pump for delivering additional liquid to said motor to energize the same, means for driving said second pump, a third channel connecting said first and second channels to each other to permit liquid to circulate in said circuit upon said second pump ceasing to deliver liquid thereto, and a check valve arranged in said third channel for preventing liquid from flowing from said first channel to said second channel.

12. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between said first pump and said resistance valve and its other port connected to said second channel, and means for driving said

second pump to enable it to deliver liquid into said first channel whereby upon starting said machine the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor.

13. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between said first pump and said resistance valve and its other port connected to said second channel, means for driving said second pump to enable it to deliver liquid into said first channel whereby upon starting said machine the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor, a check valve arranged in said second channel to prevent liquid passing there-through to said motor, and means for reversing said second pump to thereby cause said first pump to function as a motor and rotate said roll means to unwind said web from said parent roll.

14. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between said first pump and said resistance valve and its other port connected to said second channel, means for driving said second pump to enable it to deliver liquid into said first channel whereby upon starting said machine the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor, a brake normally resisting rotation of said par-

ent roll, and means for releasing said brake in response to pressure created by said second pump in energizing said motor.

15. In a winding machine having means for rotatably supporting a length of web material wound into a parent roll and a rewind roller for drawing said web from said parent roll and winding it into a new roll, the combination of a hydraulic motor for driving said rewind roller, roller means for engaging said web to be rotated thereby as said web is drawn from said parent roll by said rewind roller, a first pump driven by motion imparted thereto from said roller means, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between said first pump and said resistance valve and its other port connected to said second channel, means for driving said second pump to enable it to deliver liquid into said first channel whereby upon starting said machine the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor, a check valve arranged in said second channel to prevent liquid passing therethrough to said motor, means for reversing said second pump to thereby cause said first pump to function as a motor and rotate said roll means to unwind said web from said parent roll, a brake normally resisting rotation of said parent roll, means for releasing said brake in response to pressure created by said second pump in energizing said motor, and means for holding said brake in released position.

16. The combination, with a winding drum adapted to have a web of material wound into a parent roll thereon and a rewind roller for unwinding said web from said parent roll, of a hydraulic motor for driving said rewind roller, a friction roller adapted to be moved into contact with said parent roll and to be rotated by said web during the unwinding thereof from said parent roll, a first pump driven by motion imparted thereto from said friction roller, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a second pump for delivering additional liquid to said motor to energize the same, and means for driving said second pump.

17. The combination, with a winding drum adapted to have a web of material wound into a parent roll thereon and a rewind roller for unwinding said web from said parent roll, of a hydraulic motor for driving said rewind roller, a friction roller adapted to be moved into contact with said parent roll and to be rotated by said web during the unwinding thereof from said parent roll, a first pump driven by motion imparted thereto from said friction roller, a first channel connecting the outlet of said pump to

the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between said first pump and said resistance valve and its other port connected to said second channel, and means for driving said second pump to enable it to deliver liquid into said first channel whereby the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor.

18. The combination, with a winding drum adapted to have a web of material wound into a parent roll thereon and a rewind roller for unwinding said web from said parent roll, of a hydraulic motor for driving said rewind roller, a friction roller adapted to be moved into contact with said parent roll and to be rotated by said web during the unwinding thereof from said parent roll, a first pump driven by motion imparted thereto from said friction roller, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, the displacement of said pump per unit of time being less than that of said motor, a resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between said first pump and said resistance valve and its other port connected to said second channel, means for driving said second pump to enable it to deliver liquid into said first channel whereby the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor, a check valve arranged in said second channel to prevent liquid passing therethrough to said motor, and means for reversing said second pump to thereby cause said first pump to function as a motor and rotate said roll means to unwind said web from said parent roll.

19. A rewind drive, comprising a rewind roller for winding into a finished roll a web of material drawn from a parent roll formed upon any one of a plurality of winding drums, a hydraulic motor for driving said rewind roller, a friction roller associated with each of said drums and adapted to be moved into contact with the parent roll thereon and to be rotated by said web during the unwinding thereof from that parent roll, a first pump, driving means connecting said pump to each of said friction rollers whereby said pump is driven by said web as it is drawn by said rewind roller from the parent roll on any of said winding drums, a first channel connecting the outlet of said pump to the inlet of said motor and a second channel connecting the outlet of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, said pump when driven by said web delivering liquid to said motor at a

rate less than the rate required by said motor, a second pump for delivering additional liquid to said motor to energize the same, and means for driving said second pump.

- 5 20. A rewind drive, comprising a rewind roller for winding into a finished roll a web of material drawn from a parent roll formed upon any one of a plurality of winding drums, a hydraulic motor for driving said rewind roller, a friction roller
10 associated with each of said drums and adapted to be moved into contact with the parent roll thereon and to be rotated by said web during the unwinding thereof from that parent roll, a
15 first pump, driving means connecting said pump to each of said friction rollers whereby said pump is driven by said web as it is drawn by said rewind roller from the parent roll on any of said winding drums, a first channel connecting the outlet of said pump to the inlet of said
20 motor and a second channel connecting the outlet

of said motor to the intake of said pump to enable said pump to deliver liquid to said motor and to receive liquid therefrom, said pump when driven by said web delivering liquid to said motor at a rate less than the rate required by said motor, a
5 resistance valve connected into said first channel to resist the delivery of liquid from said pump to said motor, a second pump having one of its ports connected to said first channel between
10 said first pump and said resistance valve and its other port connected to said second channel, and means for driving said second pump to enable it to deliver liquid into said first channel where-
15 by the liquid delivered by said second pump will at first drive said first pump as a motor and cause it to draw the slack out of said web and then said liquid will pass through said resistance valve and energize said motor.

PAUL SIMONDS.