

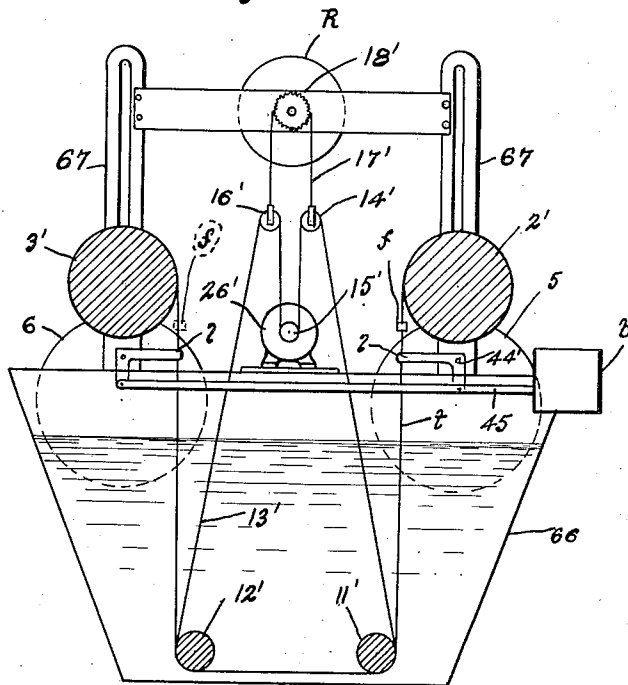
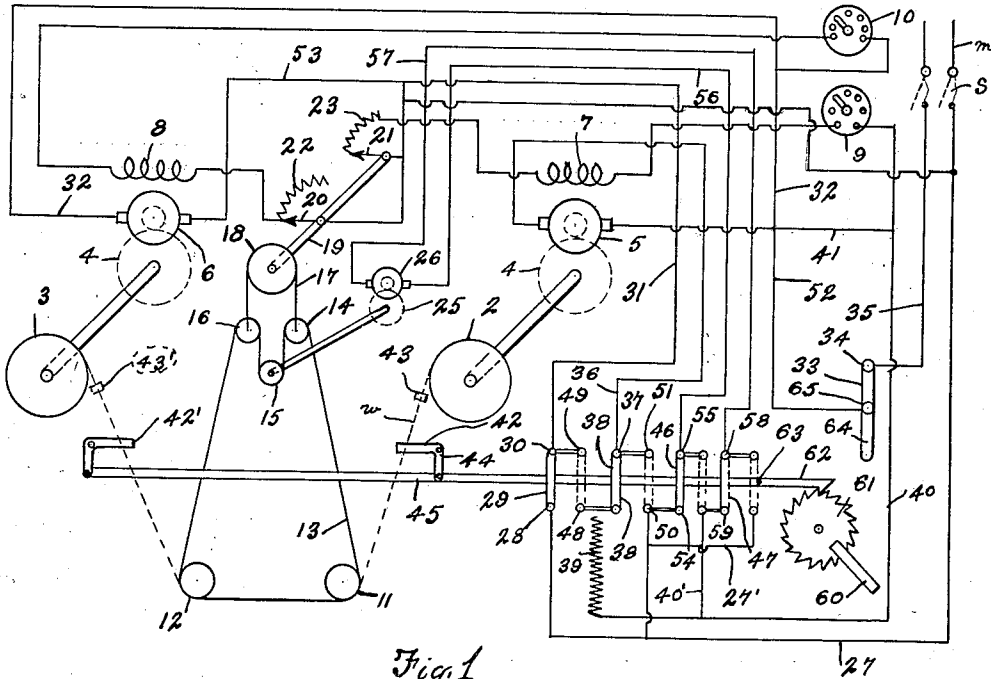
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ROLL DRIVE CONTROL

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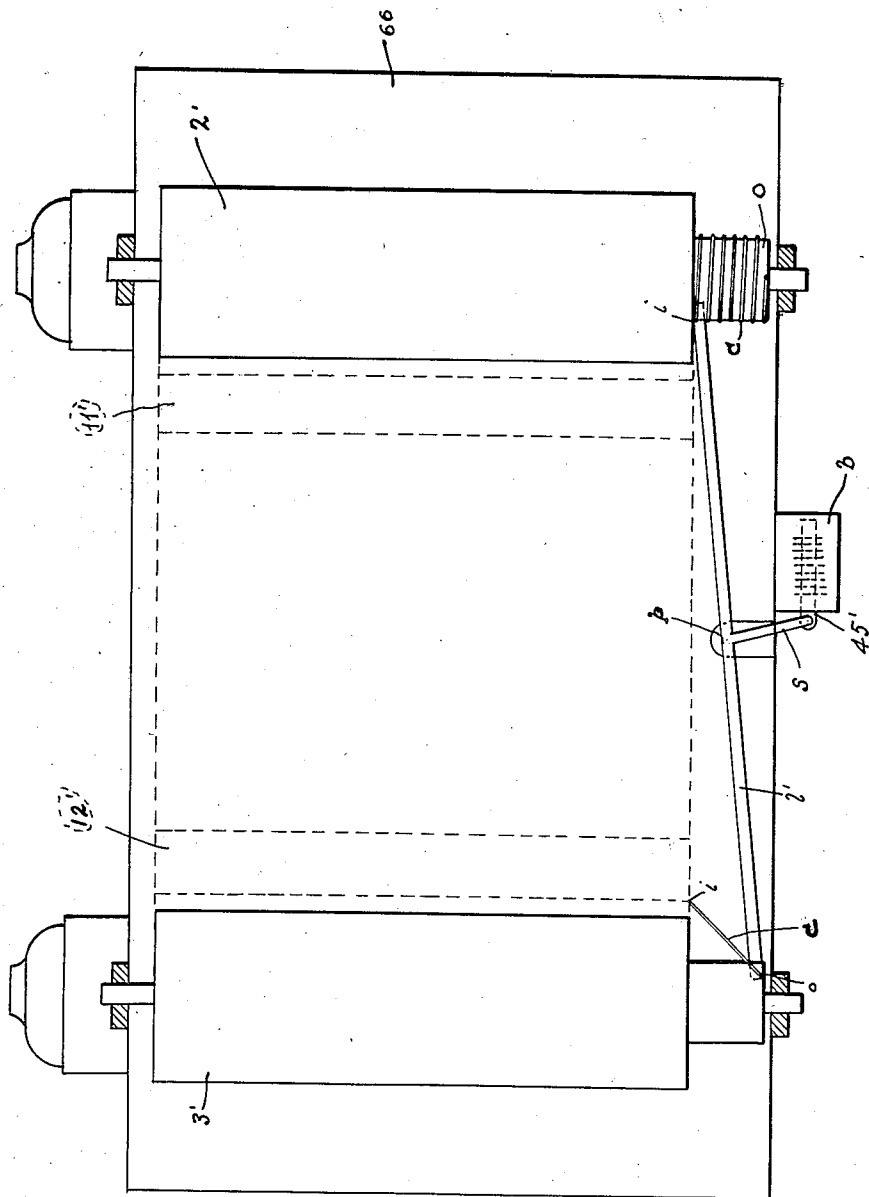


Fig. 3

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ROLL DRIVE CONTROL

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In the operation of rolls and the like upon which material is being wound, the latter progressively enlarges the virtual diameter of the roll and changes the rate of linear speed out of relation to the rotation rate. For instance, in the winding of web material, as paper, textiles, etc., this may introduce difficulties, and if the web is being drawn through some treating zone where the time rate of treatment is a factor, results are unsatisfactory. Again, when rolls are to be reversed at periodic times or be stopped after a given number of reversals, it is desirable that necessity for special supervision be reduced. And in all cases a drive capable of being controlled by the operation of the machine itself is of great importance.

To the accomplishment of the foregoing and related ends, the invention, then, consists of the features hereinafter fully described, and particularly pointed out in the claims, the following description and the annexed drawings setting forth in detail certain structures embodying the invention, these being illustrative however of but a few of the various ways in which the principle of the invention may be employed.

In said annexed drawings:—

Fig. 1 is a diagrammatic showing of one form of apparatus and wiring arrangement contemplated; Fig. 2 is a side elevation, partly in section, showing a dye-jig equipped with my improved control; and Fig. 3 is a plan view, obstructing upper parts being removed, showing a modification.

In its general aspects, the invention contemplates an electric motor drive for rolls, more especially winding and reeling rolls, and in association therewith, a self-controlled means for controlling the roll speed in accordance with the variation in its virtual diameter, including the layers of material thereon, so as to maintain a desired uniform linear speed; and at the same time capable of general adjustment. For some applications, reversal of the drive is also arranged to be accomplished automatically, together with a further control feature of automatic stopping if desired, after a predetermined number of reversals.

Referring to Fig. 1, there is shown a roll 2, and a roll 3, each driven through suitable reduction gearing 4 by a D. C. motor 5, 6, each such motor having a shunt field winding 7, 8, with a control rheostat 9, 10, whereby a general set for fundamental speed may be had. In the particular arrangement shown, the roll 3 is winding a web of material *w* from the roll 2, the web passing under idler rolls 11, 12 therebetween. Travelling also about the idler rolls, at their ends, is an endless belt 13 which takes over pulleys 14, 15 and 16. The pulleys 14 and 16 are connected by a chain 17 which takes over a pulley or sprocket 18, the shaft 19 from which carries rheostat arms 20, 21, each operating over an adjustable resistance or rheostat 22, 23. The pulley 15 with its shaft 24 is driven through suitable reduction gearing 25 by a D. C. constant speed motor 26.

With this arrangement, it will be seen that with current flowing from the mains *m* through the general cut-in switch *s* and through line 27, switch contact 28, switch arm 29, switch contact 30 and line 31, to the armature of the motor 6, and thence by line 32 to switch arm 33, contact 34 and line 35, the motor is supplied with current for drive. In order to prevent too free run of the idling motor drive of the roll 2 from which the material is being taken off, a braking action is provided, and while this may be accomplished by a mechanical brake on the shaft for instance, preferably I employ motors so wound as to be capable of functioning as motors when supplied with driving E. M. F., or on the other hand capable of acting as a generator when driven. For this, the motor 5, in the particular switching arrangement shown, is circuited through line 36, contact 37, switch arm 38, load resistance 39, line 40 and line 41. That is, while the motor 6 for the winding roll is on circuit to receive driving E. M. F., the motor 5 is being driven by the pull of the material, and is acting as a generator working into a resistance 39 or other desired load, thereby correspondingly braking the unwinding roll.

When the material has reached its end and it is desired to reverse the direction of drive, 100

thereby to wind back for instance, a reverse control is provided, and this may take the form of a finger or projection, which at such time will travel out from the roll along with the web, and strike a trip lever 42. As a convenient arrangement, each roll may have its own lead strip or attachment strip of web, to which the material being wound may be secured in any suitable manner as by temporary stitching, and such web may carry a strip, as a thin metallic rod 43, which being normally wound in close to the roll rotates directly therewith, but which when the web is wound off to that point, will travel off from the roll with the web and strike the trip lever as aforementioned. The trip lever 42, in the form for instance of a bell crank lever is pivoted at fulcrum 44 and is thence pivotally connected to a switch rod 45 which carries the switch arms 29, 38, 46 and 47 these being fixed transversely of the rod 45 so that with the reciprocation of the rod, the arms are shoved back, and the arm 29 then bridges contacts 48, 49, as indicated in dotted line position in Fig. 1. At the same time, the switch arm 38 is shoved over onto the contacts 50, 51, and with this, motive E. M. F. is supplied from the line 27 through contact 50, switch arm, contact 51, line 36, armature 5, and line 52, switch 33, contact 34, and line 35, thereby energizing the motor 5 and driving the roll 2 in the wind-up direction. At the same time, the motor 6 of roll 3 is circuited through line 53, contact 49, switch arm 29, contact 48, resistance 39, line 40, line 41, and line 32, as a generator working into the resistance 39 or other desired load. The material is thus now being wound onto roll 2 and off of roll 3, against the braking action of the generator and load. When the material is unwound, a similar finger or trip-strip 43' carried in the attaching strip travels off from the roll with the web and strikes the trip lever 42' and draws the switch rod 45 with its arms back onto the other set of contacts. With the reversal of the main motor drive, a corresponding reversal of the constant speed control motor 26 is also had. For this, switch arms 46, 47, controlled by the same reversing mechanism, are arranged such for instance that arm 46 bridges contacts 54, 55, and in such position completes the circuit through line 27, line 56, motor 26, line 57, contact 58, and thence by switch arm 47 to contact 59, line 40, line 41, line 52, switch 33, contact 34, and line 35, to allow corresponding flow of driving E. M. F. With the reverse throw of the switch arms 46 and 47, the former will bridge lines 40' and 56 to the motor 26 and thence line 57 will be bridged by switch arm 47 to line 27', and line 27 will complete the circuit, and thus reversal of the constant speed motor 26 may be had.

When it is desired to stop the rolls en-

tirely after a predetermined number of reversals, a throw-out switch may be brought into operation by suitable means. One convenient form of this end may involve a settable trip arm 60, this being fixed for instance to a ratchet wheel 61, operated by a pawl 62, by a magnet, or by a direct pivoted attachment 63 for instance to the switch rod 45. With such arrangement, each right throw of the switch rod 45 will cause the pawl 62 to slide over and engage a fresh tooth on the ratchet, and with each left throw, the ratchet will be correspondingly turned up one tooth. Any number of teeth, in accordance with the requirements may be provided, and by having a number marked on each tooth starting with the trip lever 60, it is a simple matter for the operator to initially set the pawl 62 at the number corresponding to the number of reversals which he desires to run before the machine is stopped, and when that many teeth have been stepped up, the trip lever 60 will strike the projection 64 of the switch 33, it being pivoted for instance at 65, and the switch will thus be thrown off its contact 34, and the entire motor circuit be broken.

In the particular illustrative embodiment represented in Fig. 2, a dye-jig vat 66 for containing a dye bath in which textile material is to be treated, is provided with rolls 2', 3', these being mounted for instance in standards 67 and being driven through suitable reduction gearing by D. C. motors 5, 6, suitably mounted at the side of the vat. The web of cloth to be dyed travels between the rolls and under idler rolls 11', 12' in the bottom of the vat. An endless belt 13' likewise travelling over the idler rolls 11', 12', further leads over pulleys 14', 16' and 15' of a constant speed motor 26'. The pulleys 14', 16' are connected by a chain belt 17' which through sprocket 18' and associated shaft operates the double rheostat R containing resistances 22, 23 (see Fig. 1). As described foregoing, each roll 2', 3', may have a lead or attaching strip to which the web of cloth *t* is attached, temporarily, as by stitching or the like, and a finger or trip, for instance in the form of a thin metal strip *f* is positioned in the lead strip, such that when the web is all wound off the roll, the trip *f* travels off with the material and strikes the trip-lever *l*, which is fulcrumed at 44' and thus causes the switch rod 45 to correspondingly throw the switch arms on the contacts, arranged in any convenient fashion, in switch box *b*. The effect of this change of the switch is then to reverse the machine, supplying E. M. F. to the motor 5 which then becomes the wind-up side, and at the same time the motor 6 is switched into a load circuit and becomes a braking generator.

With increasing material piling up on the winding roll, a differential effect begins to set in with the balanced pulleys. Since the pul-

ley 15' is running at a constant speed, any variation of the speed of pulleys 14' and 16' tends to change the pull on the balanced chain, depending upon the direction of travel, and whether the variation in speed is up or down. This increase in speed winds the belt 17' up on one side and plays it out on the other at a higher rate than the pilot motor 26', being constant speed, does. Correspondingly, with movement of the sprocket 18' in such slight differential motion, the rheostat R with its resistances as 22, 23 (Fig. 1) is adjusted to compensatively slow down the winding roll speed. The cloth is thus run through the dye bath at a constant rate of speed, and when wound out from one roll, the reversing mechanism throws the switches to wind it back in the opposite direction, and so the continued treatment proceeds. With each reversal, the control as represented in the ratchet 61 (Fig. 1) is progressively stepped up, until finally the arm 60 trips the switch 64 and breaks the circuit and stops the entire machine.

As shown in Fig. 3, the dye-jig vat 66 with the rolls 2', 3' and the drive as foregoing, is equipped with a control comprising a T-lever *l'* pivoted at *p*, its arms extending thence to points adjacent the ends of the rolls and its integral or rigidly connected stem *s* being pivotally connected to switch rod 45' which is reciprocably movable in the switch box *b*. A suitable cord *c* is fastened with one end to the end *o* of the roll and is wound with a few spiral turns inwardly to the cloth and its other end *i* is fastened to the edge of the cloth or leader-strip near the run-out point. A similar cord is applied to each roll. With the rolls turning, such cords merely turn therewith; but when the cloth winds off to the point of cord attachment the cord begins to unwind and travel down also. Such unwinding cord starts in at the inner side of the arm of lever *l'* and as the spiral turns unwind, the line-up position of the cord moves out, shoving the lever arm before it until it reaches the outer position as indicated at the left in Fig. 3. Such movement of the lever *l'* has also swung the stem-arm *s* through its arc, thereby pushing the switch rod 45' in the switch box *b* and reversing the connections, as already described. Roll 3' then winds the cloth, and when the point *i* at the end of the cloth on the unwinding roll 2' is reached, the cord *c* thereon unspirals and throws the adjacent end of the lever *l'* out, again reversing the switch.

It is thus seen that the advantages of the invention may be applied in varying extent, from a simple uniform speed control to a periodic reversal and more elaborate stoppage control on a predetermined number of reversals, all in accordance with the requirements of any particular installation. With such usages as dyeing and treating of tex-

tiles also, the invention lends itself especially well to a nicety of operation and exactness of control such as to occasion uniform results in the otherwise difficultly managed dye treatment. At the same time, necessity for skilled supervision is minimized.

Other modes of applying the principle of the invention may be employed, change being made as regards the details disclosed, provided the means stated in any of the following claims, or the equivalent of such, be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In apparatus of the character described, rolls for winding and rewinding a web of material therebetween, idler rolls upon which such material travels, a pair of idler pulleys, means for connecting said idler pulleys in normally balanced relation, a rheostat controlled by said connecting means, a constant speed pilot motor, a pulley connected thereto, and an endless belt travelling over said pulley and the aforesaid idler rolls and balanced pulleys and at the speed of the web of material.

2. In apparatus of the character described, winding and rewinding rolls, idler rolls on which a web of material may travel therebetween, a motor for driving each winding and rewinding roll, means whereby each said motor may act as a braking generator when its roll is unwinding, a constant speed pilot motor, an endless belt connecting said motor and the idler rolls over which the web of material travels, and a balanced differential mechanism operated by said endless belt for adjusting the speed of the winding motor to provide a uniform winding rate.

3. In apparatus of the character described, winding and rewinding rolls, idler rolls upon which a web of material may travel therebetween, a driving motor for each winding and rewinding roll, a constant speed pilot motor, idler pulleys, connecting means between said idler pulleys allowing bodily movement thereof, a rheostat pulley operated by said connecting means and an endless belt traveling over said idler rolls and said connected pulleys, and over a pulley connected with the pilot motor, said endless belt traveling at the speed of the web of material, and means controlled by the web of material for reversing the rolls.

4. In apparatus of the character described, winding and rewinding rolls, idler rolls upon which a web of material may travel therebetween, a driving motor for each winding and rewinding roll, a constant speed pilot motor, idler pulleys, connecting means between said idler pulleys allowing bodily movement thereof, a rheostat pulley operated by said connecting means, and an endless belt traveling over said idler rolls and said connected pulleys, and over a pulley connected

with the pilot motor, said endless belt traveling at the speed of the web of material, and means controlled by the web of material for reversing the rolls, said means comprising a projection carried with the web to travel off from the roll, a trip lever actuated by said projection, and switch arms operated by said trip lever to reverse said motors and switch the unwinding motor into a braking circuit.

5. In apparatus of the character described, winding and rewinding rolls, idler rolls upon which a web of material may travel therebetween, a driving motor for each winding and rewinding roll, a constant speed pilot motor, idler pulleys, connecting means between said idler pulleys allowing bodily movement thereof, a rheostat operated by said connecting means, an endless belt traveling over said idler rolls and said connected pulleys, and over a pulley connected with the pilot motor, and means controlled by the run-out of the web of material for reversing the rolls, said means comprising a trip lever, switch arms operated by said trip lever, and a cord adapted to be attached to the run-out end of the web of material and to the end of the roll whereby to unwind and form a linear projection against the trip lever to throw the same.

6. In apparatus of the character described, winding and rewinding rolls, motors therefor, idler rolls on which a web of material may travel therebetween, a pair of balanced pulleys, a flexible connection between said pulleys, a rheostat pulley operated by said flexible connection, a constant speed pilot motor having a pulley, an endless belt traveling over said pulley and over said idler rolls and said balanced pulleys, means for reversing the motors, said means including a projection carried with the web of material, a trip lever actuated by said projection, and switch arms operated by said lever, and means for stopping the machine on a predetermined number of reversals, said means including a settable ratchet carrying a trip, and a cut-out switch located in the path of said trip.

7. In apparatus of the character described, rolls for winding and rewinding a web of material with an expanse in exposure therebetween, drive means for said rolls, means for providing a uniform time-duration for the travel of the material between the rolls, said means including a pilot motor, means tending to run in relation with the web-material for reacting upon said pilot motor, and means actuated by said pilot motor for controlling said roll drive.

8. In apparatus of the character described, rolls for winding and rewinding a web of material with an expanse in exposure therebetween, drive motors for said rolls, means for providing a uniform time-duration for the travel of the material between the rolls, said means including a pilot motor, means

tending to run in relation with the web-material for reacting upon said pilot motor, and circuit-controlling means actuated by said pilot motor for controlling the current to said motor-drive.

9. In apparatus of the character described, rolls for winding and rewinding a web of material with an expanse in exposure therebetween, means for providing a uniform time-duration for the travel of the material between the rolls, said means including a constant-speed pilot motor, a pulley connected thereto, belt-means traveling over said pulley and in relation with the travel of the web-material, and circuit-control means actuated by said pilot motor for controlling the motor roll-drive.

10. In apparatus of the character described, rolls for winding and rewinding a web of material with an expanse in exposure therebetween, motor drive means for said rolls, means for providing a uniform time-duration for the travel of the material between the rolls, said means including a constant speed pilot motor, a pulley connected thereto, an endless belt traveling over said pulley and in relation with the web material, and rheostat means actuated by said pilot motor for controlling said motor roll-drive.

Signed by me this 29th day of August, 1929.

CHARLES E. ROBINSON, Jr.