Sept. 18, 1945. J. C. BODANSKY ET AL 2,384,879

DRIVE CONTROL FOR TEXTILE MACHINERY

Filed May 26, 1944 5 Sheets-Sheet 1

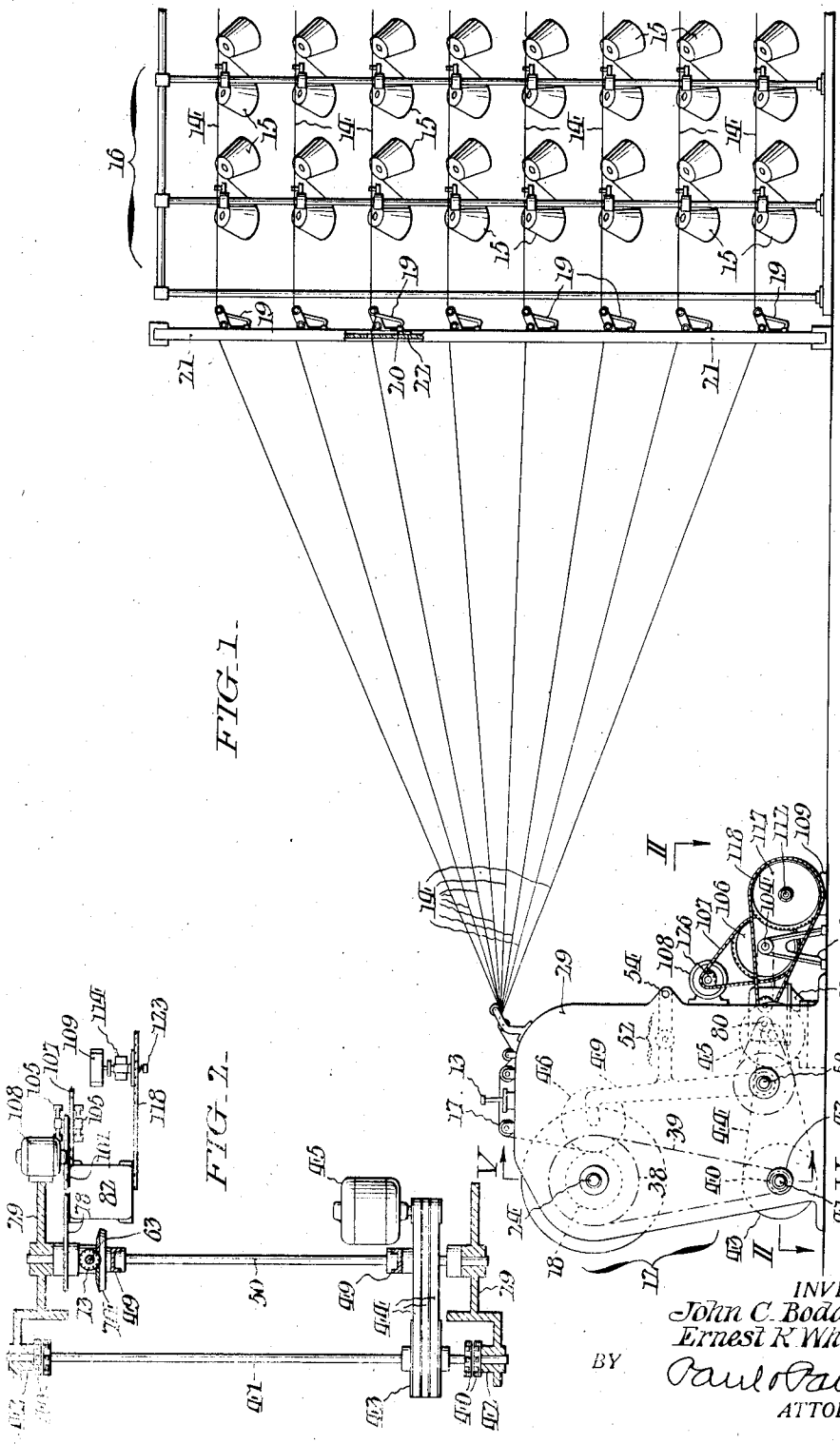


FIG. 1.

FIG. 2.

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DRIVE CONTROL FOR TEXTILE MACHINERY

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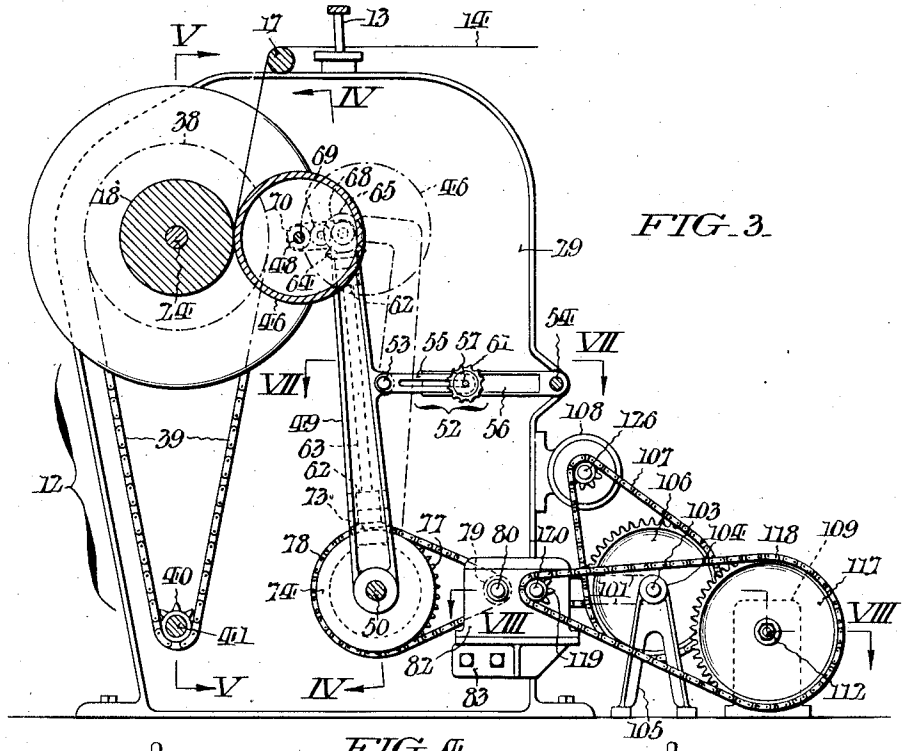


FIG. 3.

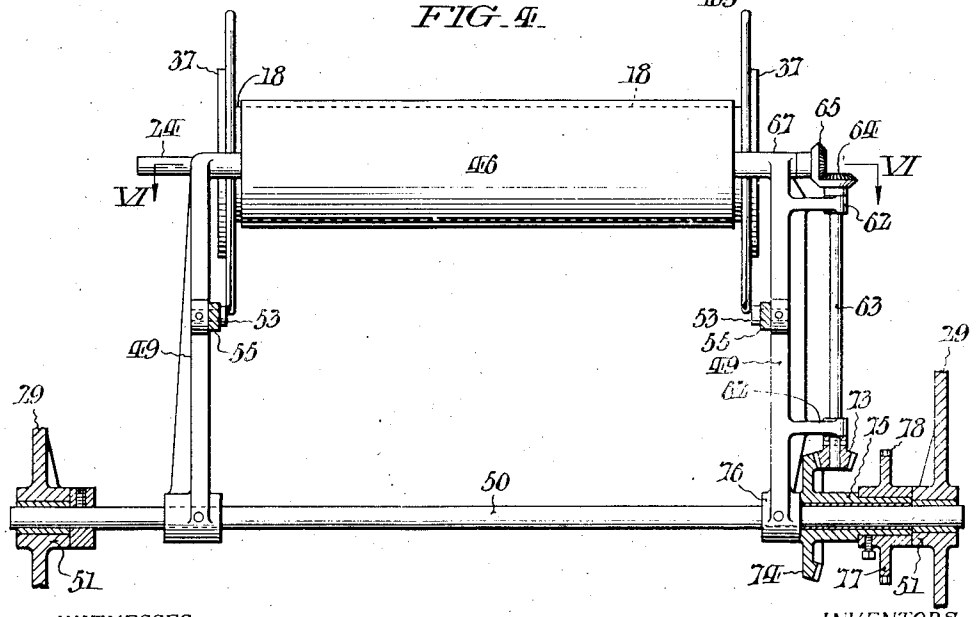


FIG. 4.

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DRIVE CONTROL FOR TEXTILE MACHINERY

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FIG. 5.

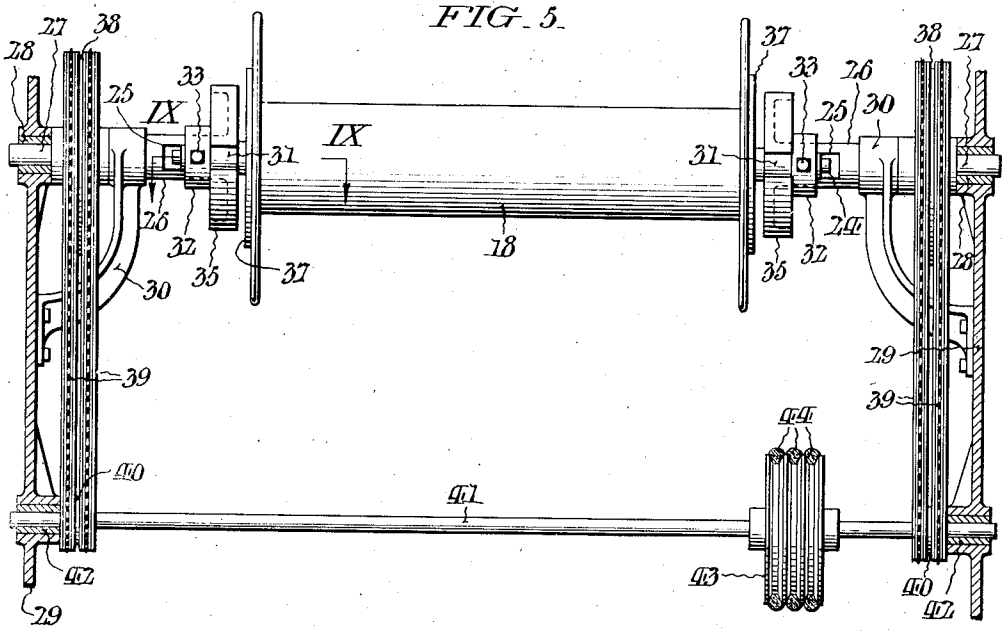


FIG. 6.

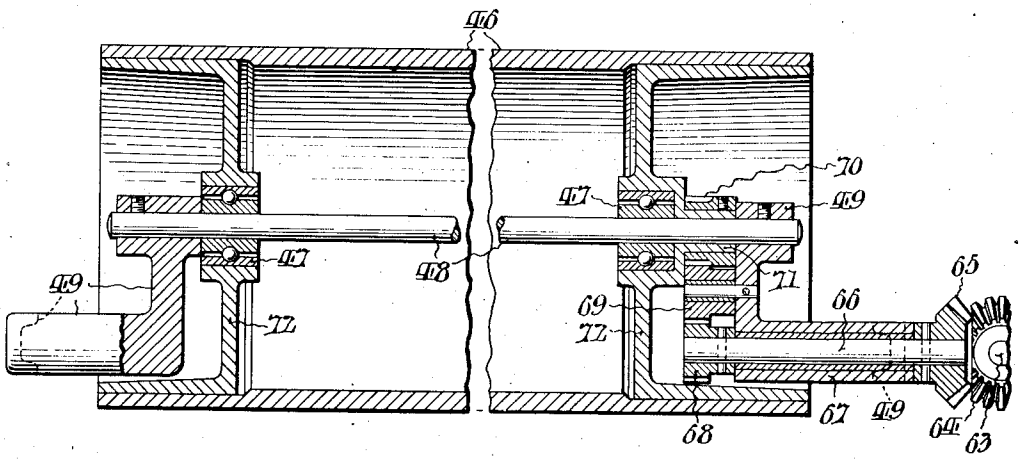
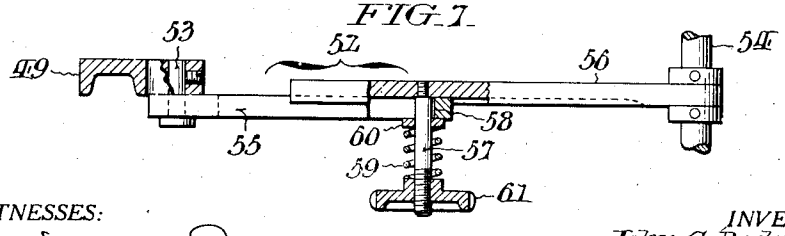


FIG. 7.



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DRIVE CONTROL FOR TEXTILE MACHINERY

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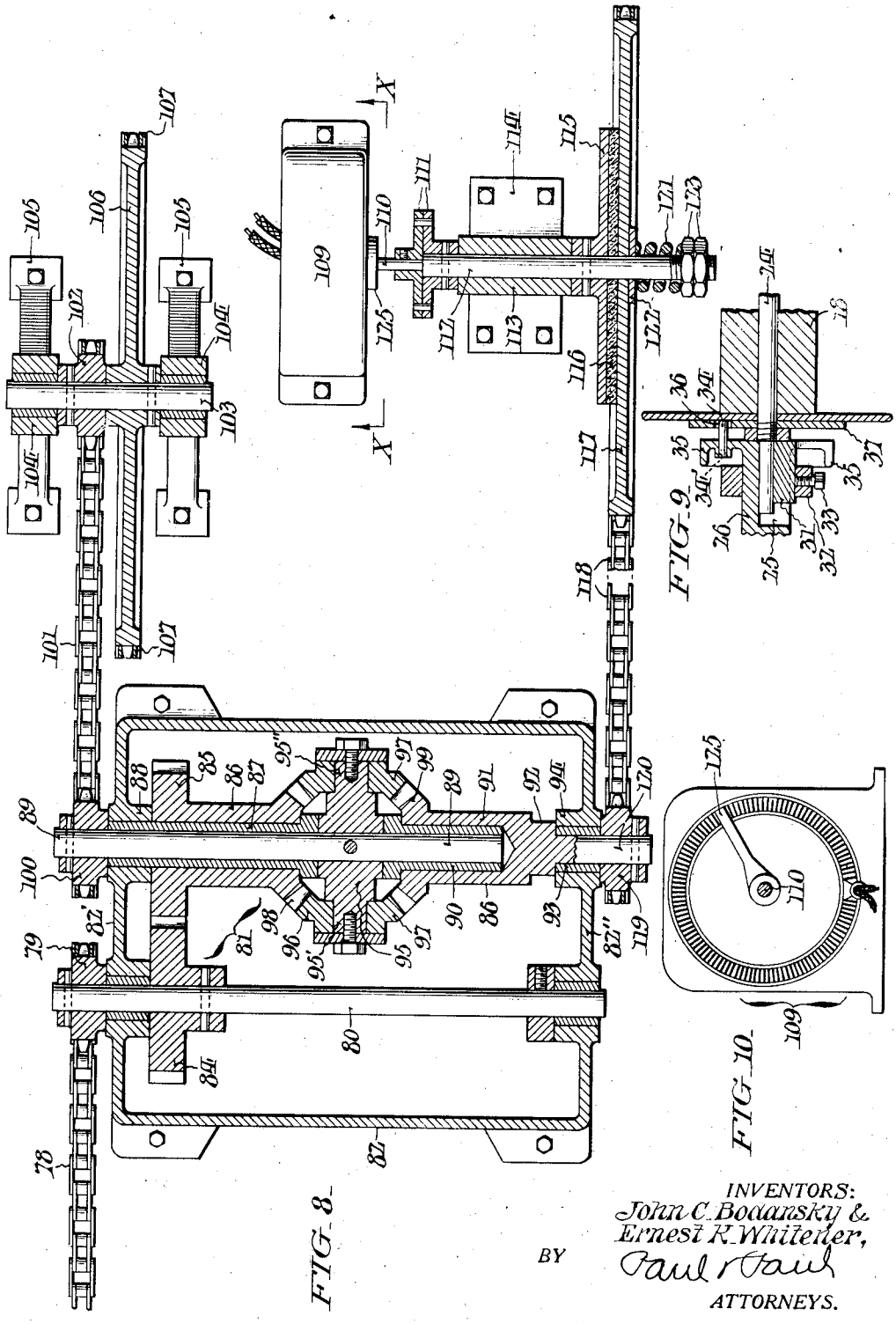


FIG. 8.

FIG. 10.

FIG. 9.

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DRIVE CONTROL FOR TEXTILE MACHINERY

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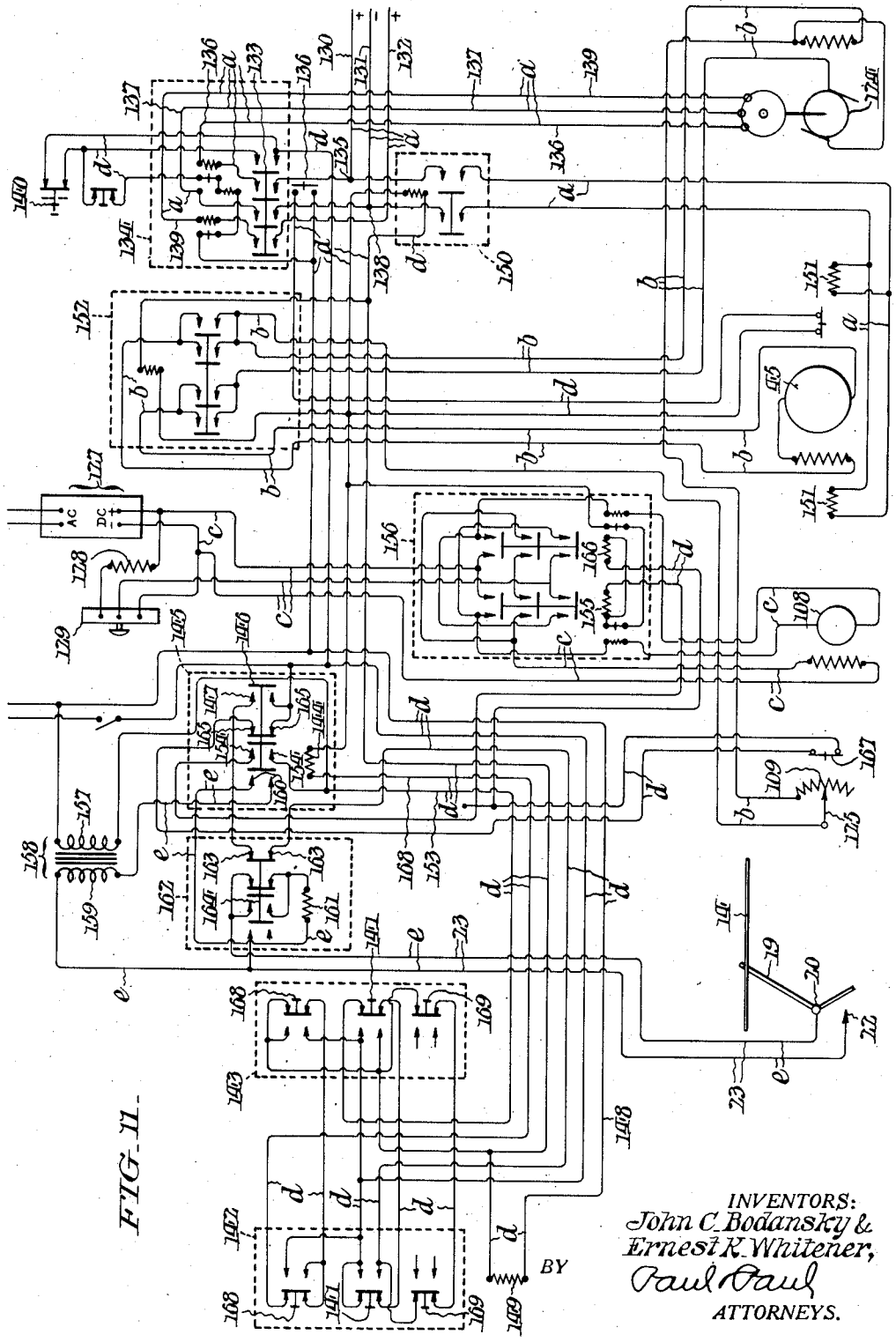


FIG. 11.

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2,384,879

DRIVE CONTROL FOR TEXTILE MACHINERY

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Application May 26, 1944, Serial No. 537,404

12 Claims. (Cl. 28—39)

This invention relates to drive controls for textile machinery and, more particularly, to winding apparatus or machinery such as beam warpers of the kind ordinarily employed in drawing multiple warp yarns from individual supply spools, or cones on a creel, and winding them in the form of a continuous sheet upon beams in readiness for weaving purposes. In beam warpers as ordinarily constructed heretofore, the beams are rotated through frictional contact with a cylinder which is driven at a constant speed. Thus as the diameter of the yarn accumulations on the beam increases the speed at which the yarn is drawn from the creel increases and the yarn is accordingly subjected to correspondingly increasing tension. As a consequence the density of the accumulations wound upon the beam varies and results in unevenness in the cloth woven from the warps.

The primary object of this invention is to overcome the above mentioned disadvantage, that is to say, to make it possible to automatically maintain a constant speed in the yarn notwithstanding the gradual increase in the diameter of the beam during the winding operation so that the yarn accumulation on said beam will be of uniform density throughout.

Another object is to provide an improved method and means for controlling the basic operating speed of textile machinery, and more particularly beam warpers, with associated electrical equipment whereby the yarn speed is kept constant throughout the winding operation, even though the beam itself be driven from the beam journals.

Other objects and features of advantage will be hereinafter disclosed, or become clearly apparent to those skilled in the art, from the following description of the accompanying drawings, in which,

Fig. 1 is a side elevation of a beam warper and creel-organization conveniently embodying this invention.

Fig. 2 is a plan section taken approximately as indicated by the angled arrows II—II in Fig. 1.

Fig. 3 is a larger scale vertical section through the beam-warper to better show the improved drive controlling mechanism of this invention.

Fig. 4 is a sectional view taken approximately on the plane designated by the angled arrows IV—IV in Fig. 3.

Fig. 5 is a vertical section on the plane indicated by the angled arrows V—V in Figs. 1 and 3.

Fig. 6 is a further, enlarged scale and broken, longitudinal section through the beam warper; said section being taken substantially as indicated by angled arrows VI—VI in Fig. 4.

Fig. 7 is a detail view mainly in plan, with parts in section, and taken as indicated by the angled arrows VII—VII in Fig. 3.

Fig. 8 is a staggered plan section on an enlarged scale, taken approximately as indicated by the angled arrows VIII—VIII in Fig. 3.

Fig. 9 is a fragmentary plan section taken as indicated by the angled arrows IX—IX in Fig. 5.

Fig. 10 is a fragmentary elevation taken as indicated by the angled arrows X—X in Fig. 8; and,

Fig. 11 is a wiring diagram showing how the improved drive controlling mechanism of this invention is electrically governed.

In describing the form of this invention exemplified by the above mentioned drawings herewith, specific terms will be employed for the sake of clarity, but it is to be understood the scope of said invention is not thereby limited; each such term being intended to embrace all equivalents which perform the same function for an analogous purpose.

Referring first, more particularly, to Figs. 1–3 of the drawings, the numeral 12 comprehensively designates a beam warper which, as usual, is provided at the top with a reed 13 through which the warps 14 pass, more or less horizontally, en route from supply spools 15 on a creel 16 to a transverse guide-roller 17 and thence downwardly to the rotating beam 18 of the warper 12, on which beam they are collected. The creel 16 is of a well known commercial type provided with drop elements 19 which rest on the individual warps 14, and which are pivoted on a bus-bar or rod 20, in Figs. 1 and 11, while it will be understood that each row of such elements are similarly mounted across the stop board 21. In the event of warp breakage, or exhaust, the drop elements 19 fall into contact with another or paralleling contact element or bus-bar 22 and close a circuit 23, Fig. 11, to effect automatic stoppage of the beam warper 12, in a manner later on explained. The rotating beam 18 is removable from the warper 12, the protruding ends of its shaft 24, see Figs. 5 and 9 to best advantage, being inserted laterally into longitudinal recesses 25 in a head 26 at the inner ends of stub-shafts 27 which are freely rotatable in bearings 28 afforded by the spaced side frames 29 of the warper 12, said stub-shafts 27 also having journal supports in bearing brackets 30 extending inward from said side frames. After mounting of the beam 18, fillers 31, Fig. 9, are inserted into the recesses 25, of the shaft heads 26 to retain the reduced ends of the beam

shaft 24, in position, while slip collars 32 with clamp screws 33 are shifted over said fillers to secure them in place. Eccentrically disposed removable studs 34, Fig. 9, projecting inwardly from flanged enlargements 35 of the shaft heads 26 engage correspondingly allocated apertures 36 in the end elements 37 of the beam 18 so that the latter is obliged to rotate with the stub-shafts 27; while the studs 34 are each held in place, as by a set-screw 34', in an obvious manner. Sprocket wheels 38 affixed to the stub-shafts 27, between the bearings 28 and the brackets 30, are connected by chain drives 39 with similar pinions 40 on a cross-shaft 41 which is journaled in bearings 42, in the side frames 29, in the lower rear portion of the warper 12. Power is transmitted to a multi-groove pulley 43 on the shaft 41, preferably through V-belt drive 44, from a D. C. main motor 45, Figs. 1 and 2.

Cooperative with the rotating beam 18, during the winding of the warps 14 on the latter, is a hollow follower roll 46 which is mounted with interposition of ball bearings 47, Fig. 6, for free rotation about a shaft 48 whereof the opposite ends are fixed in a pair of angularly-movable arms 49. As shown the arms 49 are in turn affixed to a rock-shaft 50 journaled in bearings 51 on the side frames 29 of the warper 12, near the bottom and rearwardly relative to the cross-shaft 41. Also as shown to best advantage in Figs. 3 and 4, the follower roll 46 is maintained in pressure contact with the yarn accumulating on the beam 18, with capacity to yield as said accumulation grows in diameter, by a pair of links 52, Figs. 3 and 7, which are pivotally connected respectively to the arms 49 at 53, and to the side frames 29 of the warper 12 by a rod 54. Each of the links 52 comprises a pair of lapping components 55 and 56, see Fig. 7, one, 56 for example, having a laterally projecting stud 57 which passes through a longitudinal slot 58 in the other. The link components 55 and 56 are maintained in frictional contact with each other by a regulatable helical spring 59 in compression between a washer 60 on the stud 57, bearing against the component 55, and an adjuster nut-wheel 61 in threaded engagement on the outer end of said stud.

To adapt the beam warper 12, as described up to this point, to the present improvements one of the arms 49, the right-hand in Fig. 4 for example, is provided with spaced bearings 62 in which a shaft 63 is journaled. A miter pinion 64 at the upper end of the shaft 63 meshes with a companion pinion 65 at the outer end of a short shaft 66 which extends through a relatively elbowed bearing boss 67 on the arm 49. A spur component 68 on the inner end of the short shaft 66 receives motion through an idler 69 from a spur pinion 70 on the diametrically-reduced extension 71 of the hub of the adjoining head 72, of the follower roll 46. At its lower end the shaft 63 carries a beveled gear 73 which drives a crown-gear 74 with an integrally formed sleeve-like hub 75 mounted to rotate freely on the rock-shaft 50 between the fulcrum-boss 76 of the arm 49 and the bearing 51 of the warper side-frame 29. Affixed to a reduced part of the sleeve hub 75 is a sprocket-wheel 77 which through a chain drive 78 is connected to a sprocket-wheel 79 on the in-put shaft 80 of a differential gear-unit 81, Fig. 8, of which the casing 82 is supported by a bracket 83, Figs. 1 and 3, bolted to the side frame 29.

Referring to Fig. 8 it will be noted that within the casing 82 of the differential gear-unit 81, which is preferably of the three shaft-type, that is to say, the in-put shaft 80 carries a spur gear 84 which meshes with a similar gear 85 integrally formed with a sleeve 86, at the outer end of the latter. As shown the sleeve 86 is mounted for free rotation on the bushing 87 of a bearing-boss 88, on the proximate side wall 82' of the casing 82. Rotative within the bushing 87 is a second in-put shaft 89 whereof an inner portion extends into a bushing 90 set axially into another sleeve 91 whereof the outer end is reduced as at 92 and journaled in the liner sleeve 93 of a bearing-boss 94, on the opposite side wall 82'' of the casing 82. Pinned to the shaft 89 is a collar 95 embodying diametral trunnions 95' and 95'' for bevel pinions 96 and 97 which mesh with bevel-gears 98 and 99 respectively and, preferably, formed integral with the contiguous ends of the sleeves 86 and 91. A sprocket wheel 100 fixed to the outer end of the shaft 89 is connected by a chain-drive 101 with a similar gear 102 on a transmission shaft 103, journaled in the bearing portions 104 of a pair of spaced standards 105. The transmission shaft 103 also carries a large sprocket wheel 106 which is driven through a chain 107 from a D. C. pilot-motor 108, rigidly attached to the proximately-related side frame 29, of the beam warper 12. At 109 is indicated a rheostat whereof the shaft 110 is aligned with and coupled at 111, to the aligned end of another transmission shaft 112, journaled in the bearing portion 113 of a standard 114. Affixed on the opposite end of the transmission shaft 112 is a disk 115 having a friction-material element 116 in contact with the contiguous face of a sprocket wheel 117, loose on said transmission shaft, and which is connected by a chain 118 with a sprocket pinion 119 fast on the protruding end of a trunnion or out-put stub-shaft 120, at the outer end of the sleeve 91 of the differential unit 81. A regulatable coil spring 121, in compression between a washer 122 in abutment with the outer face of the sprocket-wheel 117 and a pair of lock-nuts 123 engaged on the threaded end portion of the transmission shaft 112, serves to maintain said wheel in pressure contact with the friction facing 116 of the disk 115.

Referring now to Fig. 11 which diagrammatically illustrates conveniently associated electrical equipment, for controlling the mechanism above described, to maintain the speed of the yarns 14 constant throughout the length of the warp regardless of the diameter developing on the beam 18, even though said beam be directly driven from its journals, or the stub-shafts 27. It is to be observed that by the hereinbefore disclosed means, the driving means 38, 39 and 40, which rotate the beam 18 receive their motive power by way of the V-belt drive 41, 43, 44 from the D. C. main motor 45; and that said motor is energized from an A. C. motor generator 124.

The D. C. motor 45 is conveniently of 5 H. P., while its speed may be varied or controlled by the rheostat 109; however, in case the generator 124 and motor 45 should be series wound, such rheostat 109 is preferably placed in parallel with the series field of said generator, as indicated. The position of the contact arm 125 of the rheostat 109—Figs. 10 and 11—is determined by the output of the three-shaft differential unit 81; one in-put shaft 89 of said differential being connected through the sprocket-and-chain drive 79, 78, 77 and rock shaft 50, with the means 74, 73, 63, 64 and 65, to the shaft 48 of the hollow follower-roll 46, which is biased against the yarn accumu-

lating on the rotatable warp-beam 18: while said follower-roll 46 is rotated at the same peripheral speed as the surface speed of the yarns 14, of said beam 18. The other in-put shaft 89 of the differential 81 is connected by the sprocket-and-chain means 100, 101, 102, shaft 103, and similar mechanism 106, 107 to the shaft 126, of the small D. C. pilot-motor 108, which is preferably about one-eighth horse-power.

Now it will be readily apparent to those conversant with the art that, if the short-shaft 66, driven by the follower-roll 46 through the intermeshing spur-pinions 70, 69 and 68, and the transmission 103 driven by the pilot motor 108, turn in opposite directions at the same R. P. M.; the differential shaft-sleeve 91 and out-put trunnion 120, which is connected through the pinion 119, chain 118 and friction means 116, 115 to the shaft 112, carrying the contact arm 125 of the rheostat 109, said out-put trunnion 120 does not rotate, and the contact arm 125, as a result, will not move. On the other hand, if, for any reason, a difference should occur in the speed of one in-put shaft, 80 for example, relative to that of the other in-put shaft 89, the out-put shaft and trunnion means 91, 92 and 120 respectively, will jointly turn and consequently move the contact arm 125, of the rheostat 109, in such a way as to change the speed of the main or D. C. motor 45, until the R. P. M. of both in-put shafts 80, 89 are brought back to corresponding rotation. Thus it will be clearly evident that the speed of the D. C. pilot-motor 108 positively determines the peripheral speed of the warper beam 18.

The pilot-motor 108 is, preferably, operated from a suitable rectifier 127, or other appropriate source of direct current, having a rheostat 128 in series with its armature 129; and by provision of such rheostat the speed of the pilot-motor 108 may be varied, consequently the basic operating speed of the warper-beam 18 is correspondingly changed.

The sequence of operation of the improved drive controlling means hereinbefore disclosed is as follows:

Assuming that 130, 131 and 132, at the right-hand of Fig. 11, indicate feed lines for the supply of any desirable voltage of alternating current, to the electric equipment or system for activating the controlling means and primarily to the three-phase motor-generator 124, the latter becomes energized on shifting the multiple-contact 133 of the starting-switch 134 to the right-hand, as viewed in said figure, but without affecting the rest of the drive control, excepting that the interlock for said switch acts as an interlock for the remainder of the entire control. The D. C. pilot-motor 108, as well as the D. C. main motor 45, meanwhile remains motionless, while the rheostat 109 is in the position which will give lowest R. P. M. to said main motor 45 when it becomes energized. In other words, when the multiple-contact 133 is moved as aforesaid, current will flow—for example—from the feed line 130, splice 135 and second blade from the right-hand side of contact 133, via service line 136 to A. C. motor-generator 124, with return by the line 137—for instance—and the second blade from the left-hand side of the contact 133 to the splice 138 and line 131; or, vice versa, current may pass from feed line 132, outer left-hand blade of the multiple-contact 133 to service line 139 and motor-generator 124, with return by line 137, as aforesaid, without passage of current from said generator to any other part or parts of the control equipment hereinbefore described, until the motor-generator push-button 140 is moved from the dotted position in Fig. 11 to the full-line showing thereof; as readily apreciable by those conversant with the art.

Now, in order to activate the control system or equipment, shown and described, a starter button 141, at either of the switch stations 142, 143 must be shifted or pushed-in to energize the 110 v. coil 144 of the relay 145. In Fig. 11 the starter button 141 at the switch station 142 is assumed to have been moved for the just, previously stated, purpose; and it will be understood that energizing of the coil 144 will shift the multiple blade device 146, to bridge the contact gap 147 and put current into service conductor 148, thereby energizing a brake coil 149, shown at the left-hand of said figure, brake contactors 150 and 151, as well as shifting the starting switch 152 of the D. C. main motor 45. Brake coil 149 merely releases a brake on a warp carrier roll, not shown, while brake contactors 150, 151 release the brakes on the D. C. 5 H. P. main motor 45, all as readily understood by those conversant with the art. The starting switch 152 passes current from the generator 124 into the motor 45, whereupon said motor starts at its slowest speed inasmuch as the rheostat 109 is at its lowest position.

Release of the starter button 141 at either station 142 or 143 results in putting 110 v. A. C. current on service line 153, and since contacts 154 of relay 145, will also now be bridged, it follows that the coil 155 in the reversing switch 156 will be energized; while it also energizes the primary 157 of the transformer 158, the secondary 159 of said transformer already being closed across contacts 160 of relay 145.

As a result of all of the foregoing the warper 12 will be started slowly with the pilot-motor 108 standing still or inoperative, whereas the in-put shaft 80 of the differential unit 81 will be rotated by the follower-roll 46 through the drive 76, while the transmission shaft 103 which connects by the chain-drive 101 to the pilot-motor 108 will not. The out-put shaft means 91, 92, 120 of the differential unit 81, on the other hand, being connected to the rheostat 109 by the chain-drive 118 will turn slowly in such a direction as to tend to slow down the D. C. main motor 45, inasmuch as the shaft 110 of said rheostat has the slip-friction and stop means 115, 116, so that with the rheostat 109 at slowest position, the out-put shaft means 91, 92, 120 may continue to turn in the same direction.

When the starter button 141 is released and the coil 155 of reversing switch 156 energized, as aforesaid, the pilot-motor 108 starts driving the in-put shaft 89, with which it is coordinated through the chain-drive 101, in the opposite direction and at the speed for which said motor is "set." This speed being greater than that of the other in-put shaft 80 will cause the out-put shaft means 91, 92, 120 to reverse its direction and move the rheostat 109 in a direction to increase the speed of the main motor 45; while the speed of the beam 18 and, consequently, that of the follower-roll 46 will be correspondingly accelerated until the two in-put shafts 80, 89 of the differential 81 are rotating at exactly the same rate of speed. The out-put shaft means 99, 92, 120 will thereupon return to stationary status and leave the contact arm 125 of the rheostat 109 at proper, or the desired control location.

As the yarns 14 accumulate on the beam 18, with increase in its diameter, the surface speed

thereof tends to steadily increase, with resultant advance in the peripheral speed of R. P. M. of the in-put differential shaft 80. Since the input shaft 89, to which the pilot-motor 108 is operatively coordinated, runs at a constant speed, the out-put shaft means 91, 92, 120 will commence to move, but will only move the rheostat arm 125 angularly far enough to bring the surface speed of the yarns 14 on the beam 18 to that for which pilot-motor 108 has been set. When any yarn in the warps 14 breaks, the associated drop element 19, or elements, swings downwards to make electrical contact with the bus-bar 22 and thereby closes the 30 v. secondary 159 of the transformer 158 across the 24 v. coil 161 of a second relay 162 and thereby energizes said relay with separation of the contacts 163, by movement of the multiple-blade bar 164 to the left-hand of Fig. 11. Separation of the contacts 163, as aforesaid, breaks the circuit through the 110 v. coil 144, of the relay 145, whereby contacts 147 are opened and contacts 165 closed—as shown, such action also causing the starting switch 152 with brake contactors 150, 151 to open and apply the brakes, in an obvious manner, for stopping the beam warper 12.

Now it will be further apparent that when the relay 145 is de-energized, contacts 154 become unbridged, while contacts 165 are bridged, which interrupts current flow to the coil 155 of the reversing switch 156, and transfers said flow to the coil 166 with resultant reversal in the direction of rotation of the pilot-motor 108, whereby the beam warper 12 is brought to a stop, and said motor reversed. As a consequence of such action the rheostat arm 125, through the differential 81, is moved to the slow-speed position.

As the slow-speed position of the rheostat 109 is attained, an associated switch 167 breaks the circuit to the coil 166, of the reversing switch 156, and thereby stops the pilot-motor 108. Pushing-in of any one of the "jog," or "stop," buttons 168 and 169, respectively, accomplishes precisely the same actions as the opening of the contacts 147 of relay 145 by the "starter" buttons 141; while closing of the circuit 23 on breaking of a yarn 14 effects a corresponding result; whereas all over-load and protective devices are connected into the same circuit established upon pushing-in any stop-button 141, 168 or 169.

The "jog" buttons 168 are connected into the circuit in such a way that when any one is pressed the only result is that the D. C. motor starting switch 152 closes, causing the beam warper 12 to move at slow speed only; while no other relay or switch in the control system is closed. However, when the "jog" button 168 is released, the warper 12 stops again.

In order to facilitate a clearer understanding of all the explanation relating to the operation of the illustrated embodiment of this invention and referring to Fig. 11, the main circuits are respectively designated as follows: The letter *a* indicates the A. C. motor voltage circuit going to the A. C. end of the motor generator 124: the letter *b* points out the D. C. motor circuit connecting from the motor generator 124 to the D. C. main electric motor 45, rheostat 109 and starting switch 152: the letter *c* designates the circuit connecting-in the pilot-motor 108 through the switch 155: the lines *d* indicate the 110 v. A. C. control circuits: and the lines *e* the low voltage or 32 v. stop motion circuit.

From the foregoing it will be seen that when the warper 12 stops, regardless of the cause, the improved drive and control hereinbefore disclosed is positively returned to the slow- speed setting; and, as a result, said warper cannot be started at full speed and, due to the use of the differential-controlled rheostat 109, will gradually build-up to the operating speed; whereby sudden starting, which causes "skidding" of the follower-roll 46 is effectively prevented. Furthermore, the yarn speed, remains constant regardless of the diameter of the beam 18, but may be changed by simply adjusting the rheostat 128 and thereby varying the speed of the pilot-motor 108.

Obviously, corresponding results to those above described can be accomplished by using a shunt wound generator and a shunt wound D. C. motor; the only difference to be encountered being that two rheostats would have to be used in place of the single rheostat 109, one of such rheostats being in series with the motor and the other in series with the field of the generator, to ensure variable voltage and field weakening control.

Having thus described our invention, we claim:

1. In textile winding machines including a source for supply of a multiplicity of individual yarns to a rotary collector with an associated follower roll, and electrically-activated control equipment, the combination of a motor-generator, a motor operative by current supplied from said generator, a differential-unit operative by the follower roll, and an associated rheostat set for a definite slow-speed position, said rheostat having means movable by the differential unit to accelerate or decelerate the speed of said motor, whereby sudden starting-up of the winding machine is positively prevented.

2. In textile winding machines including a source for supply of individual yarns to a rotary collector, a follower-roll cooperative with said collector, and associated electrically-activated equipment; the combination of a current-convertor; a motor, operative by current from said convertor, with drive means coordinated to the collector; a rheostat in circuit with the motor and set to control its basic operating speed; and a differential-device, actuable from the follower-roll, for friction drive-and-release connection to the rheostat, whereby the speed of the yarns is maintained constant throughout the winding operation.

3. In textile winding machines including a source for supply of individual yarns to a rotary collector-beam, a follower-roll cooperative with said beam, and associated electrically-activated equipment; the combination of a current-convertor; a motor, operative by current from said convertor, with drive means coordinated to the collector-beam; a rheostat in circuit with the motor and set to control its basic operating speed; a mechanical-differential, actuable from the follower-roll, for friction drive-and-release by the rheostat; and a pilot-motor with a suitable rectifier, also in circuit with the motor aforesaid, under operative control by the differential, whereby the speed of the yarn peripherally collected on the beam is maintained constant throughout the winding operation.

4. In a winding machine including a source for supply of individual yarns to a rotary collector-beam, and a follower-roll cooperative with said beam; the combination of an electric system including a current-convertor; a main driving motor served by current from the convertor, and means operatively coordinating the collector-beam with said motor; a rheostat in the electric

system set to control a basic operating speed for the driving motor, when the latter is activated; a mechanical differential, operable by the follower-roll, with an automatically variable connection to the rheostat; a pilot-motor, served by current from a current rectifier in the electric system, and operatively controlled from the mechanical-differential; and means for advancing the R. P. M. of the main driving motor, from its basic operating speed, concurrently with increasing accumulation of yarn on the collector-beam, whereby the peripheral speed of said yarn is maintained constant throughout the winding operation.

5. The combination of claim 4 wherein the current-convertor is in the form of a three-phase motor-generator; the main driving motor is of the five horse-power direct-current type; and the pilot-motor is of the one-eighth horse-power direct-current species.

6. The combination of claim 4 wherein the mechanical differential is of the three-shaft type with one in-put shaft operatively coordinated to, and driven by, the follower-roll, and the other in-put shaft similarly connected to the main driving motor; and the out-put shaft is coordinated to the pilot-motor and the speed controlling rheostat with interposition of a friction drive-and-release means, whereby the speed of said pilot-motor positively determines the speed of the collector-beam.

7. The combination of claim 4 wherein the follower-roll is supported between spaced arms on a common rock-shaft, associated yieldable links bias said arms into pressure contact with the collector-beam, and mechanism, carried by one of the arms aforesaid, and operatively coordinated with the follower roll serves to drive the mechanical differential.

8. The combination of claim 4 wherein the electric system includes an automatic starting switch for the main driving motor, and associated brake contactor means.

9. The combination of claim 4 wherein the electric system includes a reversing switch for the pilot-motor, a current rectifier and rheostat serve current for operating said pilot-motor, and means are provided for adjusting said rheostat to vary the basic operating speed of the collector beam.

10. The combination of claim 4 wherein the electric system further includes means controlling all necessary over-load and protective devices.

11. In a yarn winding apparatus of the character described, an electric driven motor, a follower roll maintained in peripheral contact with a beam upon which the threads are wound; a differential gear unit influenced by speed changes in the follower roll as the diameter of the beam increases; and regulatable resistance means in circuit with the drive motor and actuated from the differential gear unit to vary the speed of the motor for maintenance of a uniform line of travel of the yarns during the winding.

12. In a yarn winding machine, a main electric driven motor; a follower roll maintained in peripheral contact with a rotating beam upon which the yarns are wound; a differential gear unit driven by a constant speed pilot motor and influenced by speed changes in the follower roll, as the diameter of the beam increases; and adjustable resistance means in circuit with the main motor actuated from the differential gear unit to vary the speed of the pilot motor for maintenance of uniform travel of the yarns during the winding.

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