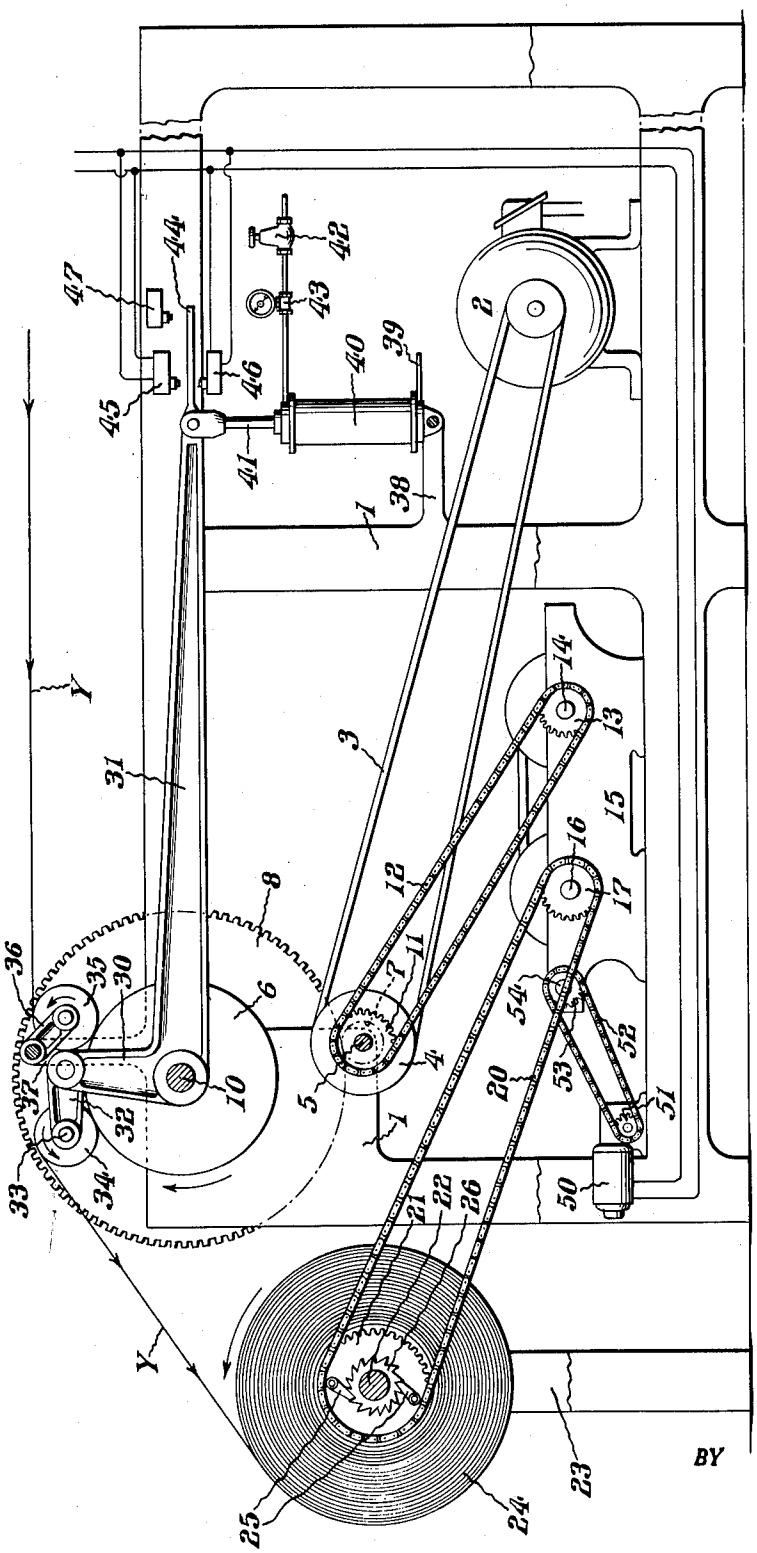
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VARIABLE SPEED DRIVE APPARATUS

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# VARIABLE SPEED DRIVE APPARATUS

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This invention relates to a control mechanism for a variable speed drive apparatus, and more particularly concerns a new and useful compensating drive mechanism for a yarn collecting beam for slashers or the like. More specifically the invention relates to a drive mechanism for a yarn collecting beam including means responsive to the yarn tension for regulating the speed at which the yarn collecting beam is driven.

In the U. S. patent to Whitener and Suggs No. 2,142,544, there is shown and described a successful drive control means for a slasher, wherein the speed of rotation of the yarn collecting beam may readily be controlled in response to the speed of operation of the slasher. This mechanism includes a mechanical differential type compensating device and also includes a disc friction clutch, which although entirely effective and satisfactory represent a substantial expense and require maintenance and adjustment.

It is accordingly one object of this invention to provide an apparatus having all of the advantages of the apparatus described in the aforementioned Whitener and Suggs patent with less initial cost and maintenance expense. It is a further object of this invention to provide a control mechanism for a yarn collecting beam which automatically controls the tension of the yarn as it builds up on the collecting beam.

Another object of this invention is to provide efficient means whereby yarn supplied at uniform speed may be started and automatically collected under constant tension on a yarn collecting beam.

Other objects and advantages of this invention, including the simplicity and economy of the same, and the ease with which the apparatus may be adjusted to provide different degrees of tension as well as the ease with which the device may be re-set to duplicate a degree of tension previously utilized, will be further apparent hereinafter, and in the drawing.

The drawing represents, in side elevation, one specific variable speed drive apparatus in accordance with this invention, certain of the parts being broken away and shown in section.

Turning now to the specific embodiment of the invention selected for illustration in the drawing, the number 1 designates the side frames of the apparatus, which may be a slasher for example. A driving motor 2 which is mounted on the side frame drives a belt 3 which is trained around a pulley 4 fixed on a jack shaft 5 which is journalled in the side frames 1. The jack shaft 5 drives a calendar roll 6 through spur gears 7, 8, the spur gear 8 being fixed on a calendar roll shaft 10 which is journalled in the side frames 1. Accordingly it will be apparent that the calendar roll 6 is driven at constant speed by the motor 2.

The jack shaft 5 also carries a sprocket 11 which meshes with chain 12 which is trained around a sprocket 13 fixed on the input shaft 14 of a variable speed transmission comprehensively designated by the number 15. The variable speed transmission 15 is of conventional design



and may if desired be substantially identical to the variable speed devices shown and described in the aforementioned Whitener and Suggs patent.

The output shaft 16 of variable speed transmission 15 carries a sprocket 17 meshed with drive chain 20. The chain 20 is trained around a sprocket 21 which is rotatable on a collecting beam spindle 22 journaled to a yoke 23. The yarn collecting beam 24 is fixed on the spindle 22. Pivotally mounted on the sprocket 21 are a pair of pawls 25 which are engageable with a ratchet 26 and thereby serve to drive the yarn collecting beam 24 in the direction indicated by the arrow adjacent thereto. Accordingly it will be apparent that the collecting beam 24 is driven at variable speed by the motor 2.

Pivoted to the calendar roll shaft 10 are two bell crank levers each having an upstanding arm 30 and a substantially horizontal arm 31. Pivoted to the end of each upstanding arm 30 is a link 32. A transverse shaft 33 is supported at the ends of the links 32 and carries a tension roll 34 which bears against the calendar roll 6 by reason of its own weight. A measuring roll 35 is connected by means of a pair of links 36 to a pair of upstanding projections 37 on the slasher frame 1. It bears against the calendar roll 6 by reason of its own weight. It will be appreciated that the yarn Y is fed over the measuring roll 35 and wraps around beneath the calendar roll 6 over the tension roll 34 for ultimate collection on the yarn collecting beam 24. The heights of projections 37 and their longitudinal positions with respect to the calendar roll shaft 10, as well as the lengths of links 36, are important since these elements give more yarn wrap-around to the calendar roll 6.

Pivoted to a pair of projections 38 on the frame 1 are a pair of air cylinders 40 each having a piston 41 the upper end of which is pivotally connected to the end of horizontal arm 31 of the bell crank lever. Other reactive means, such as springs or cylinders utilizing fluids other than air, for example, may be substituted for the air cylinders 40. In the apparatus shown in the drawing, air is conducted to the air cylinders 40 through a valve 42, the pressure being indicated by a gauge 43. Air may also be introduced through conduit 39 to provide reverse pressure in cylinder 40. The tension of yarn Y as it approaches the collecting beam 24 tends to rock the bell crank lever arm 31 upwardly, and the air in cylinder 40 opposes this tension and balances the bell crank lever on its pivot. Fixed on the end of the horizontal arm 31 is a switch actuator member 44 which has capacity to swing up and down between a normaliy-open upper travel limit switch 45 and a normally-open lower travel limit switch 46, both of which are supported in fixed position but adjustable up and down relative to the frame 1. The switch actuator member 44 has capacity to contact and actuate each of the aforementioned switches 45, 46. The switches 45, 46 are suitably mounted on the frame 1 by any conventional means for adjustment up and down along the path of tilting movement of the bell crank lever arm 31. The position of the tension roll 34 relative to the yarn collecting beam 24 is thereby adjusted. The number 47 designates a safety switch which is disposed in fixed position in the path of movement of the switch actuator 44, slightly above the switch 45. It serves to shut down the apparatus should the switch 45 fail. Other safety switches may be provided at suitable places to stop the machine when the actuator 44 travels past the limits permitted by switches 45, 46. The travel limit switches 45, 46 are connected electrically to a reversible gear motor 50 which, through sprocket 15, chain 52 and sprocket 53 drives the adjusting screw shaft 54 of the variable speed transmission 15. The ratio of input speed to output speed of the transmission 15 is thereby varied. The electrical connections, which are con-

ventional and thereby not further described in detail, are so arranged that closure of the actuator switch **45** serves to drive the gear motor **50** in one direction while closure of the actuator switch **46** serves to drive the gear motor 50 in the opposite direction. Thus the adjusting screw **54** is regulated in response to the switches 45, 46 to change the output speed of the variable speed device 15 and thereby either to increase or decrease the speed of rotation of the yarn collecting beam **24**. As described herein, this speed of rotation is increased in response to closure of switch 46, and decreased in response to closure of switch 45.

*Operation*

In starting up the device for operation, it will be assumed that an empty yarn collecting beam **24** is to be placed upon the yoke **23** and the winding of the yarn is to be started thereon while the yarn is supplied at constant speed from the calendar roll **6**. When the new collecting beam **24** is started, the apparatus is driven at low speed. The spindle **22** is driven too slowly to wind the yarn on the collecting beam **24** as fast as it is being delivered by the calendar roll **6**. Accordingly, the yarn collecting beam is preferably turned, by hand or other convenient means, at a rotary speed greater than that of the spindle **22**. This is permitted by the action of the pawls 25 which trip over the teeth of ratchet **26**. The tension of yarn Y between the collecting beam and calendar roll will be negligible at this time, and the actuator 44 on one of the bell crank arms **31** will be in contact with the travel limit switch **46**. This immediately causes the variable speed transmission **15** to increase its output speed and it thereby increases the speed of the spindle 22 to a value necessary to run the collecting beam at a proper speed to provide the necessary yarn tension. The pawls 25 then engage the teeth of ratchet **26**, the yarn tension balances the bell crank levers, and the apparatus is readily brought up to normal running speed.

As the yarn Y moves continuously over the measuring roll 35, around the calendar roll **6** and over the tension roll 34, it is continuously wound around the yarn collecting beam 24. As the yarn on the collecting beam increases in diameter, the tension of the yarn between the collecting beam 24 and the calendar roll **6** has a tendency to increase. This tends to tilt or rock the tension roll 34 counterclockwise (as viewed in the drawing) about the calendar roll shaft 10. The free end of the bell crank arm 31 tends to rise against the resistance of the compressed fluid in the cylinder 40. When the yarn tension reaches a predetermined increased value, the switch actuator member 44 contacts the travel limit switch 45 and thereby energizes the reversible gear motor **50** which drives the adjusting screw shaft **54** and thereby decreases the output speed of the variable speed transmission **15**. The speed of rotation of yarn collecting beam **24** is thereby decreased which in turn decreases the tension of the yarn Y to such an extent that the switch actuator member 44 moves away from the switch **45** and permits it to de-energize the gear motor **50**. Should the speed of the collecting beam be reduced excessively, the yarn tension decreases to such an extent that the air cylinder 40 draws the switch actuator member **44** downwardly into contact with the travel limit switch **46**. This energizes the gear motor **50** which turns in the opposite direction thereby moving the adjusting screw shaft **54** in reverse, thereby increasing the output speed of variable speed transmission 15 and correspondingly increasing the speed of rotation of yarn collecting beam **24**. The operation of the device is thus continued with the switch actuator member 44 moving between the switches 45, 46 and gradually decreasing the speed of rotation of the collecting beam until the collecting beam is filled with yarn. At this point its speed of rotation is at a minimum.

While I have described the limit switches **45**, **46** as normally open switches which serve to energize the gear motor only when a speed adjustment is required, it will be appreciated that these limit switches may also be wired in such manner that, once the limit switch **45** is actuated the gear motor **50** continues to run until such time as the limit switch **46** is actuated, thereby stopping the gear motor **50**. Other suitable electric connections and arrangements may be substituted for the specific connections and arrangements disclosed herein without departing from the scope of this invention. In any event the bell crank lever arms **30**, **31** constitute balancing means which are responsive to the tension of the yarn Y as it approaches the collecting beam **24**, and have capacity to tilt or rock in a predetermined path to move the tension roll **34** bodily toward and away from the yarn collecting beam **24**. They are also effective to actuate the switches 45, 46 to control the output speed of transmission **15**, all in response to differential changes of yarn tension.

While I have described my invention with respect to one specific embodiment thereof, it will be apparent to those skilled in the art that various changes other than those referred to above may be made in the form of the device, that equivalent elements may be substituted for those specifically illustrated in the drawing, and that certain features of the invention may be used to advantage independently of the use of other features, all within the scope and spirit of the invention as defined in the appended claims.

Having thus described my invention, I claim:

1. In a driving mechanism for a textile machine, the combination comprising a motor, variable speed drive means driven by said motor, a yarn collecting beam, connecting means for driving said yarn collecting beam from said variable speed drive means, and compensative control means including a balancing means responsive to yarn tension and a fluid pressure means connected to the balancing means in opposition to said yarn tension, said control means being operative to regulate the output speed of said variable speed drive means in response to the tension of yarn as it approaches said collecting beam, said connecting means including normally interconnected driving and driven elements wherein the driven element has capacity to move faster than and independently of the driving element when the rotary speed of the yarn collecting beam is increased beyond its normal driven speed corresponding to the output speed of the drive means, whereby an empty yarn collecting beam can be started by rotating the yarn collecting beam at a speed in excess of its normal driven speed to build up yarn tension thereby actuating said compensative control means and causing said variable speed drive means to speed up and automatically establish normal drive connection with said yarn collecting beam.

2. The combination defined in claim 1 wherein the driving element is a pawl and the driven element is a ratchet.

3. In a driving mechanism for a textile machine having a yarn collecting beam, the combination comprising variable speed drive means connected to rotate said beam, adjusting means including a reversible electric actuator for changing the output speed of said variable speed drive means, a tension roll over which the yarn is fed as it passes to said collecting beam, balancing lever means upon which said tension roll is supported, said balancing lever means being tiltable to move said tension roll means toward and away from said yarn collecting beam, a plurality of electric limit switches disposed in the path of tilting movement of said balancing lever means, and electric conductors connecting said switches to said reversible electric actuator, whereby the output speed of said drive means is automatically regulated in response to yarn tension.

4. The combination defined in claim 3, wherein a safety switch is placed in the path of tilting movement

of said balancing lever means beyond the limits defined by said limit switches.

5. The combination defined in claim 3, wherein the electric limit switches are adjustable along the path of tilting movement of said balancing lever means for regulating the position of the tension roll relative to the yarn collecting beam.

6. In a driving mechanism for a textile machine having a yarn collecting beam, the combination comprising drive means, a variable speed transmission driven from said drive means, said transmission being connected to rotate said yarn collecting beam, adjusting means for varying the output speed of said transmission, a tension roll over which the yarn is fed as it passes to said collecting beam, balancing lever means upon which said tension roll is supported, said balancing lever means being constructed and arranged to move said tension roll means toward and away from said yarn collecting beam, yarn tension opposing means including pneumatic pressure means connected to said balancing lever means and continuously urging said lever means to move said tension roll away from said yarn collecting beam, said opposing means including fluid pressure means together with valve means



and gauge means for varying and re-setting the amount of fluid pressure, control means operative in response to the movement of said balancing lever means to change the output speed of said variable speed transmission and thereby vary the speed of rotation of said yarn collecting beam, and means for reversing the pressure of the fluid pressure means and thereby facilitating the doffing of a full yarn collecting beam.

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