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CONTROLLED FEED MECHANISM FOR YARN

Filed May 23, 1960

FIG. 1.

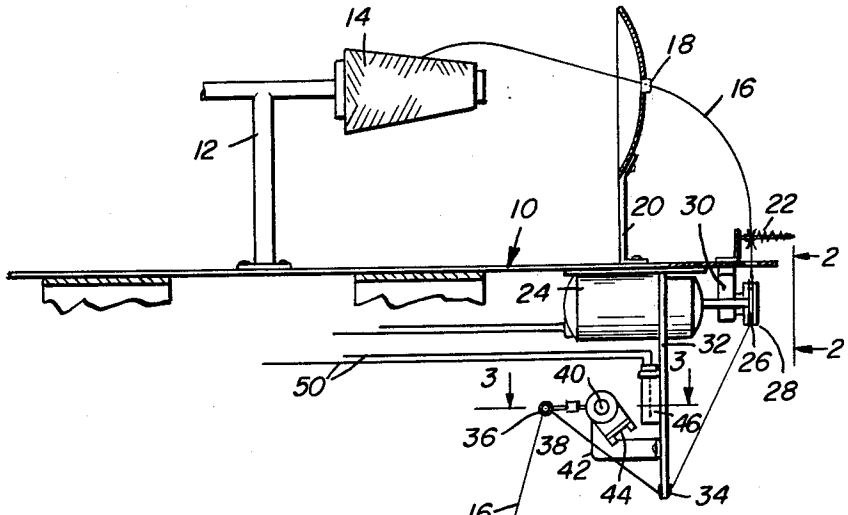


FIG. 2.

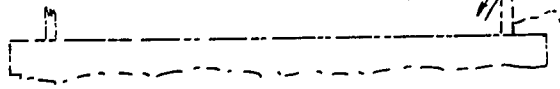
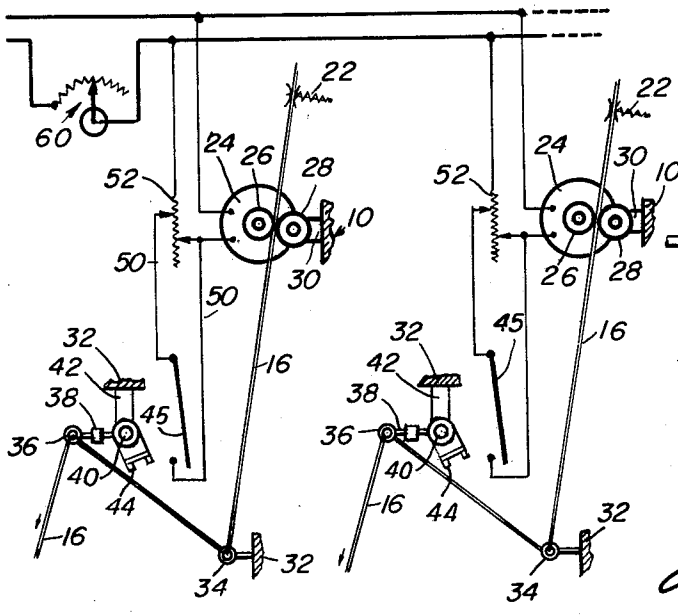


FIG. 4.



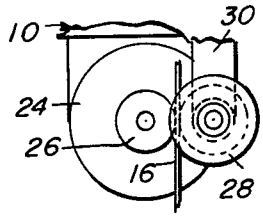
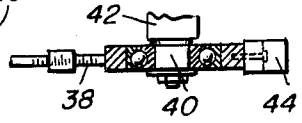


FIG. 3.



INVENTORS

HERBERT G. POST

WILLIAM L. CARROLL

BY

Albert G. Fike

ATTORNEY

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CONTROLLED FEED MECHANISM FOR YARN

Herbert G. Post, 5792 Crescent Ave., Buena Park, Calif., and William L. Carroll, 328 N. Newlin, Whittier, Calif.

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This invention relates to an improved controlled feed mechanism for yarn and has for one of its principal objects the provision of a device of the class described, which will automatically maintain a predetermined tension on a strand of yarn which is being fed off a bobbin to a knitting machine or the like.

One of the important objects of this invention is to provide a method and apparatus for feeding strands of yarn or thread, which are more or less elastic, at a uniform tension to the needles of a knitting machine or similar apparatus.

Another object of the invention is to provide a new and improved yarn feeding mechanism which will automatically vary the rate of feed of the yarn in accordance with the demand therefor by the knitting machine itself.

Another and still further important object of the invention relates to the provision of a yarn tensioning device which will automatically feed the strands under uniform tension, irrespective of the speed at which the yarn being fed is taken up.

Yet another object of the invention resides in the provision of a simple, yet effective, means for automatically controlling and equalizing the tension on a plurality of strands of yarn or similar materials which are being fed into a processing machine, whereby undesirable and unsightly imperfections in the final product are avoided.

Other and further important objects of the invention will be apparent from the disclosures in the accompanying drawings and following specification.

The invention, in a preferred form, is illustrated in the drawings and hereinafter more fully described.

In the drawings:

FIGURE 1 is an illustration, somewhat diagrammatic, of the essential parts of the strand feed controlling mechanism of this invention.

FIGURE 2 is an enlarged detail view, taken on the plane of the line 2—2 of FIGURE 1, looking in the direction indicated by the arrows.

FIGURE 3 is an enlarged detail sectional view on the line 3—3 of FIGURE 1, looking in the direction indicated, and with certain parts broken away.

FIGURE 4 is a wiring diagram illustrating the action of two of the automatic yarn tension control devices of this invention.

As shown in the drawings:

The reference numerals **10** indicate generally the frame and bed which supports the tension controlled yarn feeding apparatus of this invention. A stand **12** is provided to support a bobbin **14** of yarn **16**.

The yarn **16** is preliminarily passed through an eyelet or guide **18** in a support **20** and then to a conventional tensioning device **22**. These elements are all mounted on the frame **10** in any desired or convenient manner.

A motor **24** is mounted beneath the frame **10**, and the shaft of this motor drives a yarn feed wheel **26**. This feed wheel contacts a juxtaposed wheel **28** (FIGURE 2) supported by a suitable bracket or the like **30** from the frame **10**, and any suitable means is provided for maintaining the two wheels in proper yarn-feeding relationship. In most cases, the wheel **28** is grooved, as shown in FIGURE 1, with the periphery of the wheel **26** being correspondingly rounded to fit in the groove of the wheel **28** and thereby provide a non-slipping grip upon the

strand **16** which is being fed between the wheels whenever the motor **24** is turning.

From an inspection of FIGURE 4, it will be evident that a plurality of motors **24** is employed in one complete knitting mechanism, and these are usually arranged in a circle about the knitting machine, whereby a suitable satisfactory feeding of the numerous strands of yarn is effected, and without any possibility of slippage at the feed wheels.

A bracket **32**, fastened to the underside of the frame **10**, supports an eyelet or guide **34** through which the strand **16** is possed, and another guide **36** is mounted on the end of an adjustable arm **38** pivoted at **40** to a supoprt **42** which is an extension of the bracket **32** (FIGURE 3).

A permanent magnet **44** is on the end of the arm **38**, and this is mounted in juxtaposition with a tiltable mercury switch **46** also on the bracket **32**. The tiltable portion of the mercury switch is indicated schematically by the switch blade **45**.

The switch is normally open, and a pair of wires **50** leads from the switch to a resistor or other motor speed control element **52**, as best shown in FIGURE 4.

From the guide or eyelet **36**, the strand **16** is then led either directly to the needle bed **54** or through an additional guide, if such becomes necessary.

The mercury switch **46** is either in or attached to a soft iron housing, not shown whereby counter-clockwise movement of the magnet **44** from the position illustrated in FIG. 4 to a position immediately adjacent the switch **46** will tilt the switch, causing the same to close, thereby momentarily speeding up the motor **24**, which is of the direct current type for this purpose.

In operation, each and every one of the plurality of motors **24**, which form part of the complete mechanism, is preliminarily set for a predetermined speed by means of a master control, as indicated more or less diagrammatically at **60** in FIGURE 4 and which is part of the circuit which controls all the motors and includes the respective mercury switches.

Yarns **16** from the numerous bobbins **14** are then brought through **18** to the conventional tensioners **22** and then to the respective yarn feed wheels **26**—**28** and finally through the guides **34** and **36** to the needle bed **54**.

All of the motors **24** are then synchronized to operate at the same speed of any desired or necessary revolutions per minute, thereby causing each and every one of the strands of yarn **16** to be fed at exactly the same speed to the needle bed.

If, for any reason, any one or more of the plurality of strands **16** is not being fed at a sufficient rate of speed to supply the demands of its respective needle, the slightest pull resulting from this increased tension will tilt the arm **38** about its anti-friction bearing pivot **40**, causing the magnet **44** to shift its position sufficiently to close the mercury switch **46**. This actuates the resistor **52** to immediately feed an increased supply of current to that particular motor **24**, speeding up the same to a sufficient degree to release the excess tension on the related strand **16**, whereupon the magnet **44** will move back into its original position, opening the switch **46** and accordingly moving the resistor **52** back to its original position, again reducing the motor speed to its original pre-set revolutions per minute and again presenting a normal feed speed.

The switch **46** need not be of the mercury type, as other switches with proper environmental operating means will perform satisfactorily. One type of mercury switch has a soft iron core built into its glass housing and this operates very satisfactorily. The element **60** comprises a rheostat, and this is employed to preliminarily adjust the feed motors **24** to a speed just below the

take-up speed at the needle bed **54**, and this is done in combination with the adjustable resistor **52** and with the magnetically operated switch **46** in open position.

The operator then checks to ascertain that the speed of the feed motor or motors **24** is above needle take-up speed when the switch **46** is closed. Closing of this switch shorts out the resistor **52** and accordingly raises the speed of that particular inter-connected feed motor. The feed motor fields may be separately excited for better regulation.

When the main motor or take-up is energized, the feed motors also start, and at this point, a slight over-feed of yarn or strand is initiated, both on the start or stop of the main motor. Then when, for any reason, the length of the yarn **16** is decreased between the feed wheels and the needle bed, the switch **46** is immediately actuated, causing a slight over-feed of that particular strand of yarn by increasing the speed of that individual motor **24**. This slight over-feed continues until the tension on the yarn **16** is lessened to a degree allowing the outer end **36** of the pivoted arm **38** to rise, opening the switch **46** and permitting the motor **24** to accordingly run at a slightly slower speed because of passage of current through resistor **52**. This action of alternate over-feeding and under-feeding is continued so long as the main motor or take-up continues to operate.

It will be evident that herein is provided a simple, yet efficient, apparatus and method of feeding and controlling yarn or similar material in the textile industry and which will automatically overcome all variables originating at the source of supply, such as a bobbin, and which will further then automatically deliver said yarn or other material to a take-up or similar apparatus at a controlled rate with no tension and regardless of the rate of delivery required by the take-up or similar equipment.

This will improve the quality of the final product, decrease undesirable stoppages, render maintenance more easy, facilitate rapid and accurate set-ups and change-overs and will generally increase over-all efficiency.

One of the real problems now existing in this industry has not been solved because of the lack of a suitable apparatus and method which this invention provides. Present-day methods allow the take-up or other apparatus to pull the yarn or other material directly from the source and usually through various tensioning and compensating devices in an effort to utilize variables at the source. Some of these variables are caused by under-winding, improper packaging, knots and variances in the distance from the source to the take-up. Present feeding mechanisms decrease the variables but do not eliminate them entirely because the compensators employed will not and cannot synchronize a multiple of strands between the plurality of sources and single take-up mechanism, particularly over any extended period of time. These compensating methods attempt to regulate the amount of material entering the take-up by physically moving the position of the strand or by over-feeding or under-feeding. Such methods which allow the take-up to move the compensator before it can assure a proper feeding will induce a variable in the strand, which will inevitably appear in the finished product by way of imperfections, and the main reason for this deficiency is slow reaction time in the various compensators now employed.

The apparatus of this invention will minutely and alternately over-feed and under-feed the yarn or other material to the take-up or other apparatus, as required, so there is never any appreciable change in the effective length of the strand being fed. The method and apparatus of this invention assures that any changes in strand length are always at an absolute predetermined minimum, and these will never change, regardless of any variables at the source or at the take-up. The monitoring device of this invention which, when once preliminarily adjusted and calibrated, will subsequently react immediately and properly determine over-feed and under-feed.

The feed wheels **26** and **28** are controlled and tuned very minutely, slightly under the natural demand of the take-up or other apparatus, whereby only a very small increase of speed by way of a fine tolerance is required for only a very short space of time. This is accomplished by the very low friction pivot **40** for the magnet arm **38** which activates the switch **46** through magnetic lines of flux and the complete absence of any mechanical connection.

Accordingly this invention presents an automatic control for the relatively high speed at which most circular knitting machines operate and will correspondingly increase the rate of feed of the yarn whenever the tension on any particular strand increases above optimum operating relationship. Also, as soon as the tension is lessened, the particular motor will be automatically returned to normal operating speed, which is equal to the demand of the take-up means while maintaining the yarn under uniform tension, although the demand may considerably vary the rate of travel of the yarn itself.

This particular device can be readily adapted for use with various types of knitting machines, even though the same vary in speed requirements over a relatively wide range. The unit is obviously of very light construction and extremely sensitive to even the slightest variations in tension so that a uniform supply of yarn is fed to the knitting machine itself at all times and a much better final product will inevitably result.

We are aware that many changes may be made and numerous details of construction varied throughout a wide range without departing from the principles of this invention; and we, therefore, do not propose limiting the patent granted hereon otherwise than as necessitated by the prior art.

We claim as our invention:

1. In a device for controlling the feed tension of a strand of yarn at the needle bed of a knitting machine, the combination of: a pair of yarn feding wheels; a motor for driving said yarn feeding wheels; guide means for a strand of yarn interposed between said feeding wheels and said needle bed, said guide means including a pivoted arm supporting one of said guide means and mounted for pivotal movement in response to changes in yarn tension at said needle bed; an electrical control circuit for said motor actuatable by said pivoted arm, said control circuit including a normally open magentically energized switch operable by said pivoted arm; and a resistor adapted to be shorted by said switch to momentarily increase the speed of said motor when said pivoted arm is deflected to energize said magnetic switch.

2. In a device for controlling the feed tension of a strand of yarn at the needle bed of a knitting machine, the combination of: yarn feeding means; a motor for driving said yarn feeding means; guide means for a strand of yarn interposed between said feeding means and said needle bed, said guide means including a pivoted arm supporting one of said guide means and mounted for pivotal movement in response to charges in yarn tension at said needle bed; an electrical control circuit for said motor actuatable by said pivoted arm, said control circuit including a normally open magnetically energized switch operable by said pivoted arm; and a resistor adapted to be shorted by said switch to momentarily increase the speed of said motor when said pivoted arm is deflected to energize said magnetic switch.

3. In a device for controlling the feed tension of a strand of yarn at the needle bed of a knitting machine, the combination of: yarn feeding means; a motor connected to said yarn feeding means for driving the same; guide means interposed between said yarn feeding means and said needle bed, said guide means including an elongated pivoted arm having a portion engaging said yarn strand, said portion being mounted for pivotal movement in response to changes in yarn tension at said needle bed; and an electric control circuit interposed between said

motor and said pivoted arm, said electrical control circuit including a rheostat for initially setting the speed of rotation of said motor, a normally open magnetic switch operable by said pivoted arm and a resistor connected in said circuit and adapted to be shorted out when said switch is closed by the action of said pivoted arm.

4. In a device for controlling the feed tension of a strand of yarn at the needle bed of a knitting machine, the combination of: a pair of yarn feeding wheels; a motor connected to said yarn feeding wheels for driving the same; guide means interposed between said yarn feeding wheels and said knitting machine, said guide means including an elongated pivoted arm having a portion engaging said yarn strand, said portion being mounted for pivotal movement in response to changes in yarn tension at said needle bed; and an electric control circuit interposed between said motor and said pivoted arm, said electrical control circuit including a rheostat for initially setting the speed of rotation of said motor, a normally open magnetic switch operable by said pivoted arm and a resistor connected in said circuit and adapted to be shorted out when said switch is closed by the action of said pivoted arm.

5. In a device for controlling the tension of a strand of yarn at the needle bed of a knitting machine, the combination of: positive feeding means engageable with said strand; a motor connected to said positive feeding means to drive the same; movable guide means engageable with said strand and mounted for movement in response to changes in yarn tension at said needle bed; and an electrical control circuit interposed between said motor and actuable by said movable guide means, said electrical control circuit including a normally open switch actuatable by said movable guide means and motor speed control means in said circuit adapted to be operated by said switch to alter the speed of said motor when said switch is closed by said movable guide means.

6. In a device for controlling the tension of a strand of yarn at the needle bed of a knitting machine, the combination of: positive feeding means engageable with said strand; a motor connected to said positive feeding means to drive the same; movable guide means engageable with said strand and mounted for movement in response to changes in yarn tension at said needle bed; and an electrical control circuit interposed between said motor and actuatable by said movable guide means, said electrical control circuit including a normally open switch actuatable by said movable guide means and a resistor in said circuit adapted to be shorted out by said switch when said switch is closed by said movable guide means, said circuit including a rheostat which will permit the speed of said motor to be pre-set prior to the energization of said device.

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