June 16, 1953 G. C. A. ALRIC 2,641,913

YARN FEEDING METHOD AND APPARATUS FOR KNITTING MACHINES

Filed Feb. 12, 1948 2 Sheets-Sheet 1

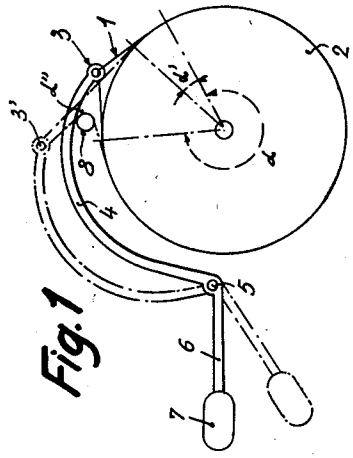


Fig. 1

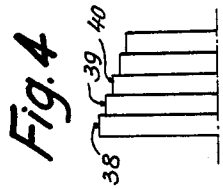


Fig. 4

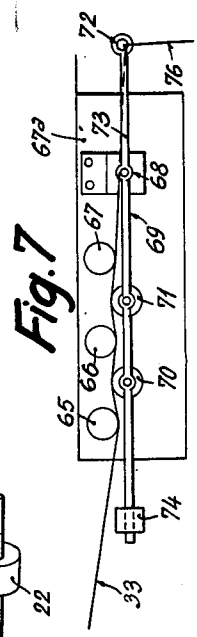


Fig. 7

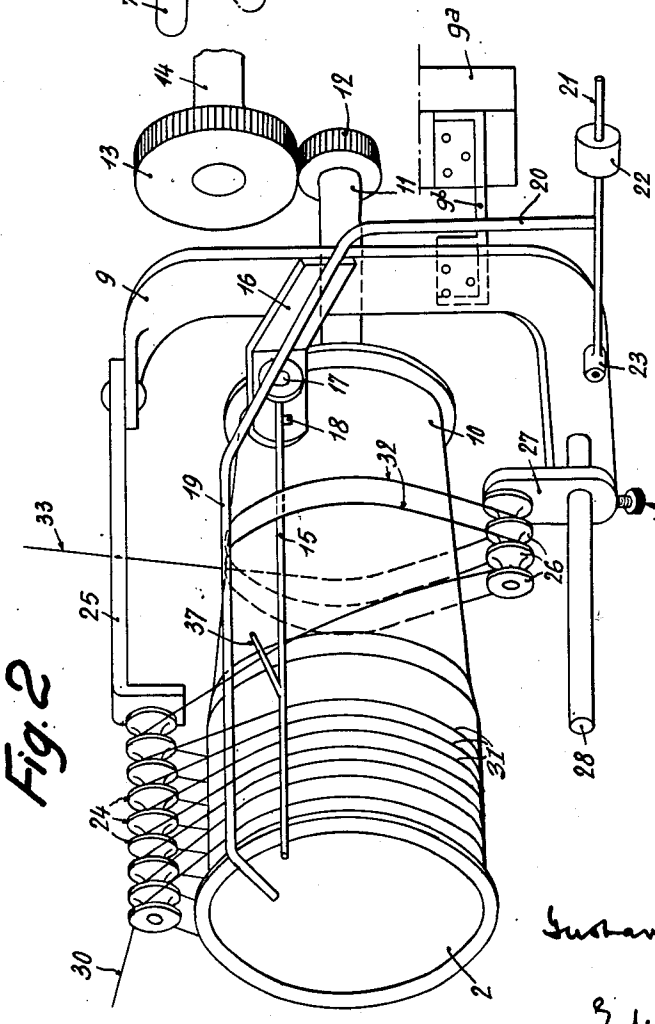


Fig. 2

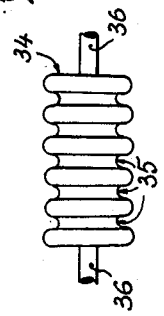


Fig. 3

Inventor
Gustave Charles Augustin Alric
By Mason, Fenwick & Lawrence
Attorneys

June 16, 1953 G. C. A. ALRIC 2,641,913

YARN FEEDING METHOD AND APPARATUS FOR KNITTING MACHINES

Filed Feb. 12, 1948 2 Sheets-Sheet 2

Fig.8

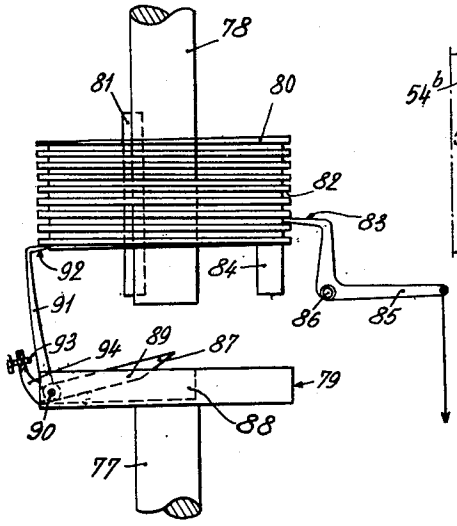


Fig.6

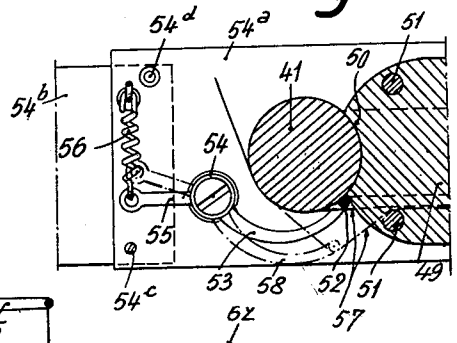


Fig.9

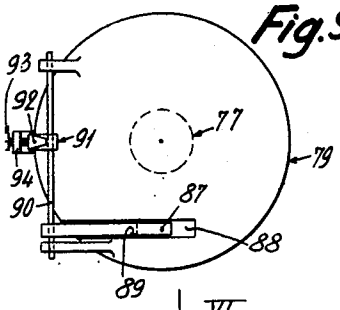
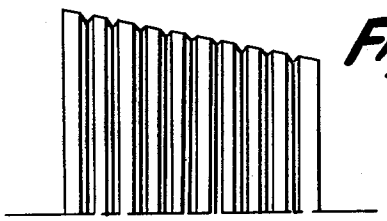


Fig.5

Fig.4a



Inventor
Gustave Charles Auguste Alric
by Rudolf Hoffmann
Atty

Patented June 16, 1953 2,641,913

UNITED STATES PATENT OFFICE

2,641,913

YARN FEEDING METHOD AND APPARATUS FOR KNITTING MACHINES

Gustave Charles Auguste Alric, Troyes, France, assignor to "Etablissements Poron," Troyes (Aube), France, a French limited liability company

Application February 12, 1948, Serial No. 7,838
In France April 15, 1947

23 Claims. (Cl. 66—132)

1

This invention is concerned with a method and an apparatus for feeding a yarn to a knitting machine. One of its objects is to provide a method and an apparatus whereby the yarn is accurately fed to the machine under a constant tension.

Another object of this invention is to provide a method and apparatus whereby the yarn is fed to the knitting machine at a constant, and advantageously adjustable output, so as to allow controlling in a simple manner the amount of yarn fed to said machine.

A further object is to positively remove the yarn from the source of supply by means of a rotary element so designed that the tension of the yarn at the exit of this element be of a constant and low value, thus eliminating the variations of tension caused by the resistances encountered by the yarn as it is unwound from said source.

These and other features of the invention will be best understood and appreciated from the following description of preferred embodiments thereof, selected for purposes of illustration only and shown in the accompanying drawings in which:

Fig. 1 is a schematic cross sectional view illustrating the principle of the invention;

Fig. 2 is a perspective view of a first practical embodiment of the invention;

Figs. 3 and 4 are detailed views corresponding to Fig. 1;

Fig. 4*a* is a fragmentary view of a modified control cone.

Fig. 5 is an elevation view, of a second form of embodiment of the invention;

Fig. 6 is a partial cross section through VI—VI of Fig. 5;

Fig. 7 is a lateral view of an auxiliary device;

Fig. 8 is an elevation view of a clutch system for the device according to the invention;

Fig. 9 is a partial plan view of Fig. 8.

As illustrated in Fig. 1, the yarn 1 is caused to make a certain number of coils around a revolving element 2, each of these coils contacting this element 2 according to an angle α, where α is in radians. The length of total arc of contact between the yarn and the revolving element will therefore be $n\,\alpha$, n being the number of coils made by the yarn around this element.

The tension regulating effect is obtained by continuously varying the length of this total arc of contact in proportion to the actual tension of the yarn at the entrance of the apparatus. This is obtained by arranging a movable element or picker such as a rod 3 near the cylinder 2; a certain number of coils, preferably the last coils, are coiled simultaneously on the cylinder 2 and the element 3. The element 3 is mounted at the end of the small arm 4 of a curved rod pivoted at 5, which is counterbalanced by a weight 7 or a spring acting upon the second arm 6 of said curved rod.

2

When the tension of the yarn decreases, weight 7 acts on the movable element 3 to move it away from the cylinder, when the mobile element 3 moves towards infinity.

These means allow varying directly the arc of contact of the yarn with the revolving element.

During this variation, the resisting arc constituted by the passage on the movable rod 3 varies also, when this movable element recedes, to add its slowing action to the decrease in drive due to the direct reduction of the angle α.

In practice, it is possible to increase this resisting variation without having large movement of the movable element by providing for a supplementary resisting arc on a fixed rod arranged appropriately, and in fact the regulation is obtained more by the variation of the resisting arcs than by the variation of the driving arc.

According to one advantageous form of embodiment of the invention, a stationary element 8 is used, located near the surface of the cylinder 2 and of the movable element 3; according to the position of the movable element 3, the yarn 1 comes, or not into contact with the said stationary element.

When the tension of the yarn decreases, the element 3 is moved away from the cylinder 2, for example in the position shown at 3', in dotted lines. Now and for each of the coils of yarn which pass on the movable element 3, the driving arc α is increased by an arc α', which is also a driving arc taken on cylinder 2, but it is diminished by a resisting arc α'' greater, taken on the fixed organ 8. It will be understood therefore that it is possible, in this manner, through relatively limited movements of the element 3 to obtain a relatively great variation of the total active arc α, taking account of the fact that the value of the arcs α' and α'' is multiplied by the number of coils of the yarn.

Fig. 2 illustrates, in perspective, one practical embodiment of the device which is schematically shown in Fig. 1. In this embodiment, the various elements acting on the yarn are mounted on a U-shaped support 9. This support is made integral with a fixed part 9*a* of the knitting machine by a support 9*b*. The revolving cylinder 2, and the revolving element 10 which acts as an output

controller, are here mounted on the same driving shaft 11.

It is advantageous to provide for adjusting the rotative speed of the cylinder 2 so that the peripheral speed of this cylinder is only slightly higher than the linear speed of the yarn at its surface. This result can be obtained by driving the shaft 11 at a variable speed; thus a speed variator can be interplaced between this shaft and the power source, or else a set of gears 12, 13, can be provided to transmit the rotation of the driving shaft 14 to the shaft 11. The shaft 14 is one of the shafts of the knitting machine. This set of gears may of course be interchangeable, in order to take account of the particular properties of the yarn used in each case.

A rod 15 mounted on a bracket 16 integral with the median part of the support 9 is arranged in a plane parallel to the axis of the cylinder 2; this rod can pivot in 17 on the said bracket and is stopped in its operating position by a tang 18.

Near the surface of the cylinder 2 and near the rod 15, a movable element 19 is arranged, this element being integral with one arm 20 of a bent rod the other arm 21 of which supports a counterweight 22. This counterweight 22 can be, or not, adjustable in position, for example by being frictionally displaceable along the rod 21. This bent rod is rotatable about an axle 23 integral with the median part of the lower branch of the support 9.

The yarn can be guided and supported onto the cylinder 2 by a revolving element 24 which will hereafter be described in detail. This element is mounted at the end of a bracket 25 integral with the upper branch of the support 9. A guide 26 is also provided, constituted in the same manner as the guide 24, which supports the coils of yarn which pass on the output control 10.

This output control 10 being cone shaped, it is advantageous, as already stated, to be able to move the coils of yarn which pass on its surface, this movement occurring in a plane parallel to the longitudinal axis of this output control. For this object, the guide 26 is mounted at the end of a movable part 27 adapted to slide along a rod 28 integral with the end of the lower branch of the support 9. A set screw 29 permits locking the part 27 in the selected position.

Due to the ratio of the peripheral speeds of the two revolving elements, this device is suitable for yarns which are not very extensible.

The displacement of the assembly 26, 27, 29 on the rod 28 permits, as it has been shown above, adjusting output of the yarn coming out of the device, said output being equal to the peripheral speed of the cone 10 at the place where the coils 32 are located. The yarn 30 coming from a reel makes a certain number of turns around the regulator 2, the inner coils of this yarn, as in 31, passing also on the mobile rod 19, then the said yarn makes a small number of coils, as in 32, around the output control 10 and it is possible to obtain, at 33, at the exit of the device, a yarn having a controlled output, this yarn being guided then towards the knitting machine.

The elements 24 and 26 supporting the yarn are each preferably constituted, as shown in Fig. 3, by a cylinder 34 provided with grooves as 35. In one preferred form of embodiment this cylinder 34 is mounted free on a shaft 36, but it can, of course, be controlled so as to have a peripheral speed equal to the speed of the yarn.

The applicant has remarked that when the yarn is passed in fixed guiding devices, through notches or openings, puffs, dusts and the like accumulate in said notches or openings giving rise to supplementary undesired resistances and which in the most unfavorable cases, can partially shut off these openings and lead, if not to the abrasion of the yarn, at least to a troublesome overtension.

This drawback is avoided by utilising revolving supports as 34.

The yarn is placed on the apparatus by disengaging first the revolving elements. The rod 15 is pivoted by means of the finger 37, which first raises only the rod 15, pivoted at 17, which then, at the end of its course, raises also the rod 19 which passes over the rod 15. The regulator and the output control are then free and the yarn can be wound on them very easily. Then the rod 19 is lowered and a few more coils are made, these being passed on this rod; now the coils 32 are made and the rod 15 is lowered into working position. The device is now ready for operation.

First, it will be noted that whatever be the tension at 30, the number of coils 31, 32 remains always the same. If the tension at 30 goes higher, the yarn presses the rod 19 toward the cylinder 2, the driving arc a is automatically increased and the resisting arc a'' made on the rod 15 is lowered, if not suppressed. Thus the increase of tension at 30 is absorbed by the consequently increased driving friction on the cylinder. If the tension at 30 goes lower, the pressure of the yarn on the rod 19 is also lowered. The rod 19 is raised and automatically the arc a is reduced and the arc a'' is obtained on rod 15 or increased. In both cases, the tension of the yarn at the inlet of the cone 10 remains constant.

Of course, variations of tension occur at 33, by reason of the variations in the consumption of the yarn by the knitting machine. If, as indicated below, t_2 is the tension imposed on the yarn by the knitting machine and t_1 the tension of said yarn at the inlet of the cone 10, the following relation must be observed:

$$\frac{t_1}{t_2} < e^{fa}$$

where

a=total arc of contact between the yarn and the cone 10

f=coefficient of friction

e=base of Naperian logarithms.

This is the well known "belt formula."

If the condition is fulfilled no slippage occurs on the cone and the output remains constant. In practice, a, that is to say the number of coils, is chosen to take account of normal variations of tension, and no slippage occurs at 32.

If t_2 is too high, use is made of a device which will be described below, so as to lower t_2.

When no slippage occurs, it is quite evident that the yarn cannot leave the cone 10 at a linear speed greater than the peripheral speed of said cone at the point where the outlet coil is placed; so that a constant delivery is obtained.

In order that the output of the yarn coming out of the apparatus at 33 can actually be controlled, the coils 32 must not slip along the cone shaped surface of the output control 10 and occupy an undesired position. To this end, the surface of the cone 10 can be grooved as shown by Fig. 4a. It is also possible to constitute the surface of this cone 10 by a given number of elementary cylinders as 38, 39, 40, etc. (Fig. 4), these cylinders having decreasing diameters and being small in height. Due to this arrangement,

the coils 32 will not tend to leave the surface of the elementary cylinders on which they have been placed.

Figs. 5 and 6 illustrate another embodiment of the present invention, in which the tension limiter is constituted by two cylinders 41, 42, which are driven at the same rotative speed from the shaft 43 of the knitting machine. The latter bears for this object a gear 44, driving identical pinions 45 and 46 respectively integral with the cylinders 41, 42. The coils made by the yarn on the cylinders 41, 42 are guided by grooves 47, 48 made in the lateral faces of a fixed central block 49, located between the two cylinders where it covers one part of the surface, for example as in 50 (Fig. 6). In order to prevent the coils of yarns leaving the grooves 47, 48, rods such as 51 are advantageously provided, as shown in Fig. 5, on the two faces of the block 49.

In this embodiment, one of the rods 51 is used as a fixed element in the same manner as rod 15 of the first embodiment (Fig. 2). These rods are, of course, detachable, and are inserted into corresponding bores provided in the block 49, as shown in Figs. 5 and 6.

The movable element 52 is constituted by a a bent rod, the branch 52 of which is parallel to the cylinder 41, the other branch 53 being horizontal and mounted rotatively at 54 on the plate 54*a* supporting the assembly. It is part of a bell crank the second branch 55 of which is submitted to the action of an opposing spring 56 having a small power, this power being determined experimentally. As it is illustrated in Fig. 6, the yarn 57 passes on this movable element and, when the tension decreases, it can touch the rod 51, the movable element taking then the position shown by the dot and dash line 58 in Fig. 6. The mode of operation is identical to that of the device illustrated in Fig. 2.

The output control 59 is mounted directly on the end of the shaft 43, this output control, in this embodiment, being also cone-shaped. The device supporting the coils made by the yarn around the surface of the cone 59 is illustrated at 60 as a comb. This comb 60 has a threaded opening in which moves the axially fixed rotatable screw 61, operated by means of the knurled knob 62. The rotation of the screw 61 causes the comb 60 to move together with the coils. It is evident that the comb 60 could be replaced by the rotating cylinder illustrated in Fig. 3. This comb, moreover, is guided and is prevented from turning by means of a fixed rod 63 bearing smoothly in a corresponding opening made in the piece 64, on which the comb 60 is mounted. The yarn which leaves the tension limiter with an approximately constant tension is led onto the output controller by means of a guiding yarn ring 64*a*.

The plate supporting the feeding apparatus is mounted on a suitable fixed part 54*b* of the knitting machine by means of two bolts 54*c* and 54*d*.

The output controller is advantageously mounted in the immediate vicinity of the knitting machine. It is possible to do this by sectioning the supplier in two parts, the section acting as output controller being placed at the desired position.

It is also possible to constitute the feeding apparatus by joining, in a single apparatus, the limiter and output controller as it has been specified regarding Figs. 2 and 5. In this case, and when the tension t_2 imposed on the yarn by the knitting machine is greatly different from the tension t_1 of the yarn entering the said controller, this tension t_2 must be stepped down, for instance by means of a resisting winch, of a known type, that is to say of a fixed winch or one turning at a peripheral speed lower than the linear speed of the yarn.

Fig. 7 illustrates a particularly advantageous embodiment of a step down device for the tension t_2. The device illustrated is constituted by cylinders or cylindrical rods 65, 66, 67, which are mounted, perpendicularly to the path of the yarn and in the immediate vicinity of the knitting machine, on a fixed part 67*a* of the latter. This device comprises moreover a lever adapted to pivot around an axle 68 located between its ends and supported by the said part 67*a* and the branch 69 of which carries two cylinders or cylindrical rods 70 and 71. A ring 72 is provided at the other end of the lever, while a counter-weight 74 slidably mounted on the branch 69 can be used for balancing the assembly.

The yarn 33 leaving the controller 10 or 59 passes between the fixed cylinders 65, 66, 67 and the movable cylinders 70, 71, then reaches the knitting machine by passing through the ring 72. When the tension t_2 imposed on the yarn by the knitting machine, that is the tension of the yarn at 76, increases, the branch 73 is urged downwards and the cylinders 70, 71, rising, press on the yarn and impose to the latter retarding arcs of contact with the cylinders 65, 66, 67 on one hand, and 70, 71 on the other. Due to this arrangement, the said retarding arcs of contact with the cylinders depend directly upon the tension t_2 and the counter-weight 74 is so positioned that these arcs are of sufficient length to absorb said tension t_2; consequently, the tension of the yarn at the exit of the controller is not increased.

It is advantageous to provide a clutch between the shaft of the feeding apparatus and the driving shaft from the knitting machine, and to effect the engaging and the disengaging of the clutch with a certain lag. This result is obtained by means of the device illustrated in Figs. 8 and 9.

In this embodiment, the engagement of the driving shaft 77 belonging to the knitting machine, and the shaft 78 of the feeding apparatus is obtained by means of two plates 79 and 80; the first plate is integral with the shaft 77 and the second is mounted so as to slide on the shaft 78 by means of the key 81. The plate 80 revolves thus in unison with the shaft 78 and can consequently, eventually drive it.

The plate 80 comprises, on its outer surface, a threaded part 82, with which a finger 83 may co-operate or not, and is provided, perpendicularly to its lower surface, with a tooth 84. When the finger 83, mounted on the bent rod 85 connected at 86 on the frame of the apparatus or of the knitting machine, is not engaged with the thread 82, the plate 80 may descend, either by its own weight or by means of a spring, and the tooth 84 engages a tooth 87 borne by the plate 79; the shaft 78 is then driven rotatively, in a clockwise direction, the tooth 87 pressing on the tooth 84.

The disengagement of the clutch is made by raising the arm 85; the finger 83 comes then into engagement with the thread 82 to raise the plate 80; at a given time, depending on the vertical distance through which the teeth 84 and 87 co-operate, the latter cease to co-operate, and the

disengagement of the clutch is effective. This lag in the disengagement of the clutch can be adjusted for instance by varying the length of one of the teeth.

To this end, the tooth 87, partially located in a groove 88 made into the plate 79, is constituted by the bevelled end of a bent rod arm 89, which is movable around an axle 90 supported by bearings integral with the plate 79. The second arm 91 of this bent rod ends in a finger 92. When the clutch is disengaged, the preponderant weight of the arm 89 returns the arm 91 towards the shaft 78.

When it is desired to engage the clutch, the finger 83 is withdrawn and the plate 80 rests on the finger 92. Owing to the rotation of the plate 79, the finger 92 penetrates in the threaded part 82, this ensuring the progressive lowering of the plate 80. When the teeth 84 and 87 are in mesh, the latter rises, due to its inclined position, this resulting in spacing the finger 92 from the threaded part.

The amount by which the tooth 87 raises may be limited by an adjustable tang 93, constituted for instance by a screw screwed in an arm 94 integral with the plate 79. This enables to adjust the cooperating length of the teeth 84 and 87 and consequently the lag of the clutch, as the driving is effective as soon as the teeth can cooperate.

What I claim is:

1. A method for feeding yarn to a knitting machine with constant tension comprising the steps of coiling said yarn a fixed number of turns around a revolving element having a peripheral speed greater at all points than the linear speed of said yarn; and altering the driving force on said yarn by continuously varying the length of the arc of contact of at least part of said turns with said revolving element in proportion to the actual tension of said yarn coiled on said revolving element and by passing said yarn over a fixed rod to provide a variable additional resisting arc.

2. A method for feeding yarn to a knitting machine with automatically constant output and tension comprising the steps of coiling said yarn a fixed number of turns around a revolving element having a peripheral speed greater at all points than the linear speed of said yarn; automatically altering the driving force on said yarn by automatically and continuously varying the length of the arc of contact of at least part of said turns with said revolving element in proportion to the actual tension of said yarn coiled on said revolving element; then coiling said yarn, which at this moment is at a constant tension, on a revolving cone; and varying the output of said yarn by moving said coils, as a whole, on the surface of this cone.

3. A yarn feeder which comprises in combination, at least one revolving tension regulator on which the yarn is coiled; means to rotate said regulator with a peripheral speed greater at all points than the linear speed of said yarn; a supporting member to support a fixed number of coils of said yarn around said regulator; a movably mounted elongated element over which at least part of the coils of said yarn pass, said movably mounted element having its axis parallel to the axis of rotation of said regulator; means to move said movably mounted element in parallel relation to the axis of rotation of said regulator in proportion to the actual tension of said yarn coiled on said regulator; a second revolving element controlling the output of said yarn, said yarn having a given number of coils on said control element; means to rotate said control element with a peripheral speed equal to the speed which said yarn is to have at the entrance to said control element; and an adjustably mounted member supporting said coils of said yarn around said control element.

4. A yarn feeder according to claim 3 in which said regulator and said control element constitute a single assembly.

5. A yarn feeder according to claim 3 in which said regulator and said control element are spaced from each other.

6. A yarn feeder according to claim 3 for feeding the yarn to a knitting machine in which said control element is located in the immediate vicinity of the knitting machine.

7. A yarn feeder which comprises in combination, at least one revolving tension regulator having the yarn coiled thereon; means for rotating said regulator with a peripheral speed higher at all points than the linear speed of said yarn; a supporting member located adjacent to said regulator to support a fixed number of coils of said yarn around said regulator; a movably mounted elongated element over which at least one part of said coils of yarn pass, said movably mounted element having its axis parallel to the axis of rotation of said regulator; a fixedly mounted element located adjacent to said regulator and said movably mounted element; and means continuously to move said movably mounted element in proportion to the actual tension of said yarn coiled on said regulator and in parallel relation to said axis of rotation of said regulator, said movement causing said coils of said yarn passing over said movably mounted element to come in contact with said fixed element.

8. A yarn feeder which comprises in combination, at least one revolving tension regulator having the yarn coiled thereon, said regulator comprising a cylinder; means for rotating said regulator with a peripheral speed higher at all points than the linear speed of said yarn; a supporting member located adjacent to said regulator to support a fixed number of coils of said yarn around said regulator; a movably mounted elongated element over which at least one part of said coils of yarn pass, said movably mounted element having its axis parallel to the axis of rotation of said regulator; means for continuously moving said movably mounted element in parallel relation to the axis of rotation of said regulator in proportion to the actual tension of said yarn coiled on said regulator; an output controlling cone over which said yarn passes in a given number of coils, said cone being connected to said cylinder at the base of said cone, whereby said cone rotates with said cylinder, the diameter of said surface of said cone over which said yarn passes being less than the diameter of said cylinder whereby the periphtral speed of said surface of said cone is less than that of said cylinder and equal to the speed which said yarn is to have as it enters said control cone; and a member located adjacent to said control cone for supporting the coils of said yarn around said control cone.

9. A yarn feeder which comprises in combination, at least one revolving tension regulator having the yarn coiled thereon, said regulator comprising a cylinder; means for rotating said regulator with a peripheral speed higher at all points than the linear speed of said yarn coiled

thereon; a supporting member located adjacent to said regulator to support a fixed number of coils of said yarn around said regulator; an elongated movably mounted element over which at least one part of said coils of yarn pass, said movably mounted element having its axis parallel to the axis of rotation of said regulator; means for continuously moving said movably mounted element in parallel relation to said axis of rotation of said regulator in proportion to the actual tension of said yarn coiled on said regulator; a second revolving element for controlling the output of said yarn comprising a cone over which said yarn has a given number of coils, said cone being connected to said cylinder at the base of the cone; a shaft integral with said cylinder; a power transmission means interconnected between said shaft and a power source; and a supporting member located adjacent to said cone for supporting said coils of yarn around said control cone.

10. A yarn feeder which comprises in combination, at least one revolving tension regulator having the yarn coiled thereon, said regulator comprising a cylinder; means for rotating said regulator with a peripheral speed higher at all points than the linear speed of said yarn coiled thereon; a supporting member located adjacent to said regulator for supporting a fixed number of coils of said yarn around said regulator; a movably mounted elongated element over which at least one part of said coils of yarn pass, said movably mounted element having an axis parallel to the axis of rotation of said regulator; means for continously moving said movably mounted element in parallel relation to said axis of rotation of said regulator in proportion to the actual tension of the yarn coiled on said regulator; a second revolving output controlling element comprising a cone over which said yarn has a given number of coils, said cone being connected to said cylinder at the base of said cone; a shaft integral with said cylinder; a power transmission means interconnected between said shaft and a power source; and a supporting member located adjacent to said cone for supporting the coils of said yarn around said control cone, said supporting means being movably mounted so as to be displaceable along an axis parallel to the longitudinal axis of said control cone.

11. A yarn feeder as claimed in claim 10, in which the surface of said control cone is grooved.

12. A yarn feeder as claimed in claim 10, in which said cone-shaped controller comprises a plurality of coaxially connected cylinders of successively decreasing diameters.

13. A yarn feeder which comprises in combination, a cylinder over which the yarn to be fed is caused to make a fixed number of coils; a cone connected to said cylinder at the base of said cone; a driving shaft integral with said cone and supporting said cone and cylinder; a frame for the feeder; a rod connected to said frame, said rod being movably mounted so as to be movable in parallel relation to the axis of said cylinder; a part of said coils of yarn passing over said rod; a fixed rod arranged in parallel relation to the axis of said cylinder and adjacent to said cylinder and said movably mounted rod; a supporting element located adjacent to said cylinder for supporting said coils of said yarn around said cylinder, said supporting element being freely mounted on said frame; and a second supporting element for coils of said yarn passing over said cone, said second supporting element being movably mounted so as to be displaceable along an axis parallel to the axis of said cone.

14. A yarn feeder which comprises in combination, a cylinder on which the yarn to be fed is caused to make a fixed number of coils; a cone connected with said cylinder at the base of said cone; a driving shaft integral with said cone and supporting said cone and cylinder; a frame for said feeder; a rod connected to said frame, said rod being movably mounted so as to move in a parallel relation to the axis of said cylinder, a part of said coils of yarn passing over said rod; a fixed rod supported in a position parallel to said axis of said cylinder and adjacent to said cylinder and said movably mounted rod; a supporting member for said coils of yarn around said cylinder, said supporting member comprising a grooved cylinder freely mounted on said frame; and a second supporting means for coils of said yarn around said cone, said second supporting means being movably mounted so as to be displaceable along an axis parallel to the axis of the cone.

15. A yarn feeder which comprises in combination, a cylinder on which the yarn to be fed is caused to make a fixed number of coils; a cone connected to said cylinder at the base of said cone; a driving shaft integral with said cone and supporting said cone and said cylinder; a frame for the feeder; a rod connected to said frame, said rod being movably mounted so as to move in parallel relation to the axis of said cylinder, a part of said coils of yarn passing over said rod; a second rod fixedly mounted in parallel relation to said axis of said cylinder adjacent to said cylinder and said movably mounted rod; a supporting means for said coils of yarn around said cylinder, said supporting means comprising a grooved cylinder freely mounted on said frame; a second supporting means for coils made by a grooved cylinder freely mounted on a member which is slidably mounted on a rod integral with said frame; and means to lock said slidably mounted member on said rod integral with said frame in a selected position.

16. A yarn feeder according to claim 15, comprising in addition an adjustable counter-weight connected to said movably mounted rod to balance said movably mounted rod.

17. Yarn feeder which comprises in combination, a tension regulating device, constituted by two parallel cylinders around which the yarn to be fed makes a fixed number of coils; means for driving these cylinders rotatively at the same peripheral speed, higher at all points than the linear speed of the yarn; a supporting element for supporting the coils made by the yarn around this regulator; an elongated element movable in a plane parallel to the axis of the cylinders on which passes at least one part of the said coils; a cone-shaped revolving output controller on which the yarn coming out of the regulator makes a given number of coils; means for driving this controller with a peripheral speed equal to the speed which the same yarn is to have as it enters said controller; and means for supporting the coils made by the yarn around this controller.

18. Yarn feeder which comprises in combination, two parallel cylinders around which the yarn to be fed makes a fixed number of coils; a pinion integral with each of the cylinders, these pinions having the same number of teeth; a driving shaft; a pinion clamped on this shaft and in mesh simultaneously with each of these

two pinions; means for supporting the coils of yarn; a cone integral with the end of this driving shaft on which the yarn, having left the cylinder, makes a given number of coils; means for moving at will these coils along the cone; and an elongated element movable in a plane parallel to the axis of the cylinders and on which passes at least a part of the coils of yarn coiled around these cylinders.

19. Yarn feeder which comprises in combination, two parallel cylinders around which the yarn to be fed makes a fixed number of coils; a pinion integral with each cylinder, these pinions having the same number of teeth; a driving shaft; a pinion clamped on this shaft and in mesh simultaneously with each of these two pinions; a fixed block arranged between the two cylinders and provided with grooves supporting the yarn; at least one fixed rod keeping these coils in these grooves; an elongated element movable in a plane parallel to the axis of the cylinders, disposed near one of the two cylinders between the said fixed rod and the said cylinder and on which passes at least a part of the coils of yarn coiled on these cylinders; a cone integral with the end of this driving shaft on which the yarn having left the cylinder makes a given number of coils; and means for moving at will these coils along the cone.

20. Yarn feeder according to claim 19, in which the elongated element movable in a plane parallel to the axis of the cylinder is submitted to the action of a spring having a small power which tends to space it away from the corresponding cylinder.

21. Yarn feeder for feeding yarn to a knitting machine which comprises in combination, at least one revolving tension regulator; means for driving this regulator rotatively with a peripheral speed higher at all points than the linear speed of the yarn to be fed; supporting means for supporting the coils made by the yarn around this regulator; a movable element on which passes at least part of the coils of yarn; means for continuously moving this movable element in parallel relation to the axis of this regulator depending on the actual tension of the yarn; a revolving output controller on which the yarn thereafter makes a given number of coils; means for driving this controller with a peripheral speed equal to the linear speed which the yarn is to have as it enters this controller; means supporting the coils made by the yarn around this controller; and a resisting device constituted by a given number of fixed rods between which are disposed mobile rods borne by a lever the second arm of which is submitted to the action of the yarn placed between these fixed rods and these mobile rods.

22. Yarn feeder which comprises, in combination, at least one revolving tension regulating device; means for driving this regulator rotatively with a peripheral speed higher at all points than the linear speed of the yarn to be fed; means for supporting the coils made by the yarn around this regulator; an elongated movable element, on which passes at least part of the coils of yarn; means for continuously moving this elongated element in parallel relation to the axis of this regulator, depending on the actual tension of the yarn; a revolving output controller on which the yarn thereafter makes a given number of coils; means for driving this controller with a peripheral speed equal to the speed which the yarn is to have as it enters the said controller; means supporting the coils made by the yarn around this controller; and a time delayed or temporized control for the starting and the stoppage of the yarn feeder, interposed between the latter and the driving shaft.

23. Yarn feeder according to claim 22, in which this control is constituted by at least one finger which penetrates, at the beginning of the operation, in the threads of at least one screw located appropriately and the starting or the stoppage of the yarn feeding device is effective only when this finger has run over a suitable and adjustable length of the threads of the screw.

GUSTAVE CHARLES AUGUSTE ALRIC.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,977,686	Mayer	Oct. 23, 1934
2,109,863	Lawson	Mar. 1, 1938
2,217,225	Lawson	Oct. 8, 1940
2,333,705	Cooper	Nov. 9, 1943
2,399,403	St. Pierre	Apr. 30, 1946
2,441,118	Boncrant	May 4, 1948
2,471,362	Vin	May 24, 1949