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C. C. BELL ET AL
WINDING MACHINE

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2 SHEETS--SHEET 1

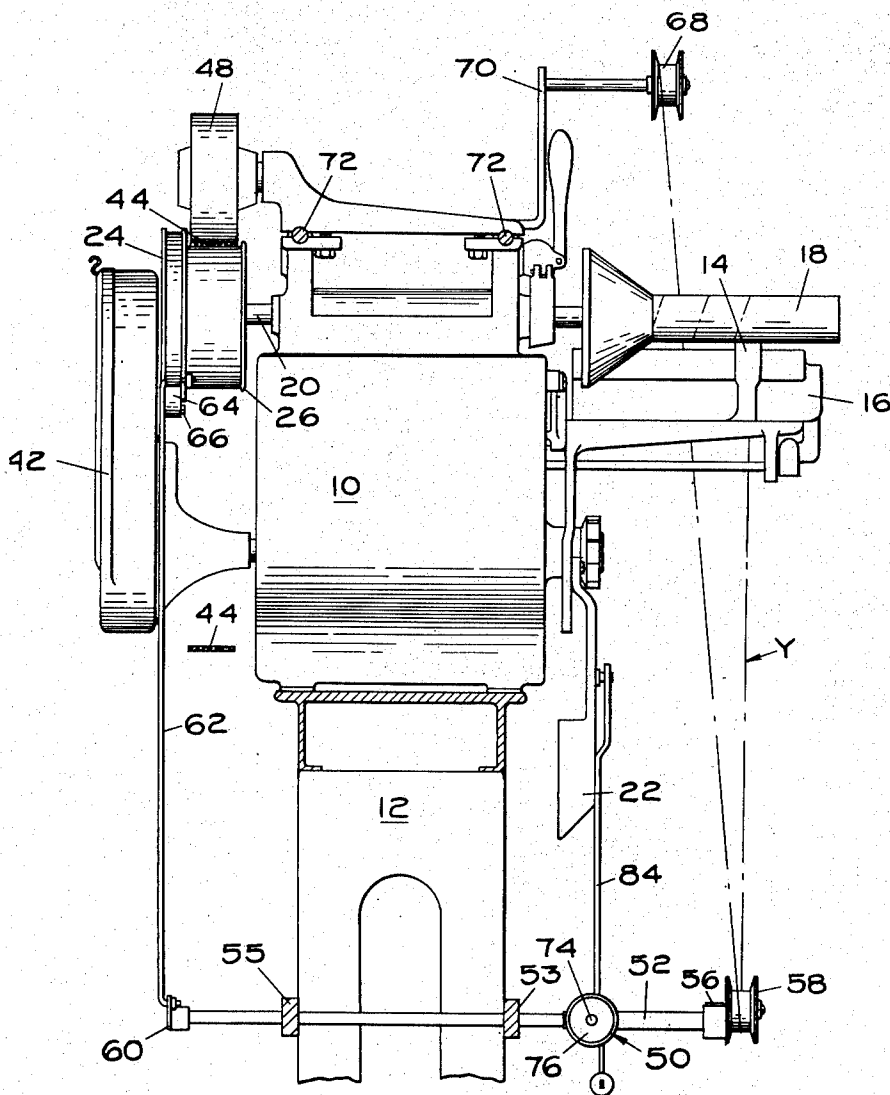
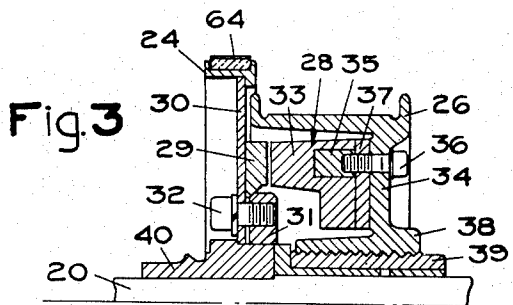


Fig. 1



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2 SHEETS--SHEET 2

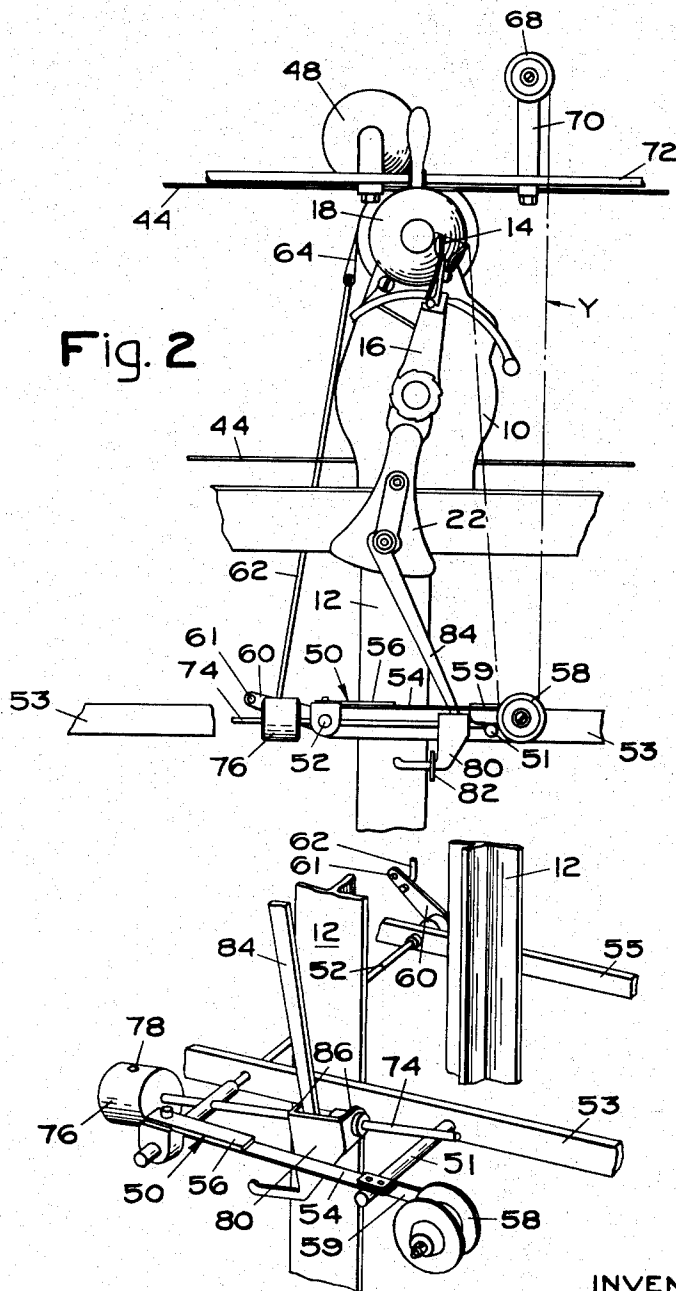


Fig. 4

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WINDING MACHINE

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16 Claims. (Cl. 242-45)

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This invention relates to improvements in winding machines for packaging yarn, thread, cord and other strand materials in cops, cones, and the like, and more particularly relates to such a winding machine wherein the tension of the said yarn, thread, cord or other strand material controls the speed at which it is wound into said cops, cones, and the like.

In the present specifications and claims, the term "yarn" is used in a general sense to indicate any type of attenuated material, and the work "package" is intended to designate the wound mass of yarn whatever its form or shape.

In the usual type of machines for winding yarn with a universal, precision or V-wind, the winding spindle is driven positively at a constant rate of speed to rotate the package, and the yarn is traversed lengthwise of the spindle with the rate of draft of the yarn increasing progressively as the package increases in diameter. In this type of winding machine, the traversing thread guide is reciprocated at a uniform rate, that is, in certain ratio of the speed of the winding spindle except for a slight increase therein to give an increment of motion to the guide whereby it will lay the yarn in helical coils with each coil in closely adjacent relation to the previously wound coil. With this type of precision winding, the package is built up with the turns or coils in all of the layers extending from end to end of the package in a predetermined number of convolutions and crossing each other with a symmetrical V-shaped pattern on the surface of the package. For most purposes the universal or precision wind is considered of advantage as producing a more stable and superior form of package with a maximum amount of yarn contained therein and capable of delivering with greater freedom under more constant tension. However, the usual types of machines employed for winding a universal or precision wound package are not suitable for certain purposes due to the positive and constant rate of speed of the winding spindle which, as above stated, causes the draft of the yarn being wound to increase progressively as the package increases in diameter. For example, this increase in speed makes it impossible to use the usual type of precision wider as a takeup for yarn being supplied at a constant speed, furthermore, the increase in the draft of the yarn being wound causes an increase in the tension of the yarn. It is, therefore, an object of the present invention to provide a machine for producing precision wound packages and maintaining the yarn at a constant tension or under a progressively decreasing tension.

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Another object of the present invention is to provide a machine capable of winding a precision wound package at a substantially constant yarn speed.

Another object of the present invention is to provide a winding machine for winding packages of yarn, or the like, and maintaining said yarn under a constant predetermined tension at all times during said winding.

Another object of the present invention is to provide a machine for winding yarn at a constant tension wherein any fluctuation in the tension of yarn being wound functions to restore the yarn tension to the predetermined desired value.

Another object of the present invention is to provide a machine for winding yarn at a predetermined decreasing tension wherein any fluctuation from said predetermined tension functions to restore the yarn tension to the predetermined desired value.

Another object of the present invention is to provide a machine for winding yarn wherein an excess of power is provided the winding spindle of said machine, and the tension of the yarn being wound controls a mechanism for dissipating a portion of said power in excess of that required to maintain said yarn under a predetermined tension.

Another object of the present invention is to provide a machine for winding yarn wherein the tension of the yarn being wound controls a braking member to regulate the effective torque applied to the winding spindle of said machine.

Another object of the present invention is to provide a machine for winding yarn wherein power is supplied the winding spindle of said machine through a slippable connection, and the tension of the yarn being wound controls the percentage of slip that takes place in said slippable connection.

Another object of the present invention is to provide a machine for winding yarn wherein power is supplied the winding spindle of said machine through a slip clutch member, and the tension of the yarn being wound controls the percentage of slip that takes place in said clutch.

Other objects of the present invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detail disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings wherein:

Figure 1 is a side elevation of a winding machine embodying the present invention;

Fig. 2 is a front elevation thereof;

Fig. 3 is a fragmentary sectional view of the driving pulley, brake drum and magnetic clutch; and

Fig. 4 is a fragmentary perspective view of the tension actuated compensating means.

The present invention comprises a machine for winding yarn wherein the tension of the yarn being wound and the speed at which said yarn is wound is controlled and maintained within predetermined limits by applying a predetermined substantially constant torque to the winding spindle of the machine through a connection capable of slipping, and applying a braking force, actuated by the tension of said yarn, to said spindle to remove therefrom that percentage of the constantly applied torque which is in excess of the torque required to wind said yarn at a predetermined tension.

The present drawings illustrate one unit of a gang machine comprising a plurality of winding units all substantially identical and embodying the present invention and adapted to be driven by a single motor. However, it should be understood that each unit can be individually driven if desired, and need not be gang mounted.

Referring to Figs. 1 and 2 of the drawings, the present machine comprises a housing member 10 adapted to be mounted on a table or base 12 and provided with suitable bearings for the various rotating elements. Housing member 10 contains a cam member, not shown herein because it may be of any usual construction well known to those versed in the art, for reciprocating a yarn guide 14 carried by traverse frame 16. Traverse frame 16 is pivotally mounted on housing member 10 in the manner common to precision winding machines whereby yarn guide 14 is adapted to reciprocate along the length of a package core 18, which is rotatably carried by spindle 20, to lay yarn Y on said package core in a precision wind, and to be moved away from said core 18 as the yarn Y builds up thereon. Traverse frame 16 carries a counterbalancing weight 22, on the opposite side of its pivotal connection to housing member 10, for the purpose of continuously urging yarn guide 14 against package core 18 or the periphery of the package being wound thereon. Spindle 20 is journaled in the upper end of housing member 10 and has one end extending from the front of said housing and provided with suitable means for removably securing package core 18 thereon. The other end of spindle 20 projects from the rear of housing member 10 and has brake drum 24 rigidly mounted thereon. Brake drum 24 is connected to pulley 26 by means of a magnetic clutch 28 (see Fig. 3) which is preferably housed inside of pulley 26.

Any convenient type of magnetic clutch may be employed. However, a preferred form is disclosed in Fig. 3 comprising a magnet ring 29 mounted on web 30 of brake drum 24 by means of clamping ring 31 and bolts 32. A second magnet ring 33 is mounted on the web 34 of pulley 26 by means of threaded inserts 35 and bolts 36. A spacing ring 37 may be located between magnet ring 33 and pulley web 34 to properly locate said

magnet ring 33 within said pulley. The hub 38 of pulley 26 is threadedly engaged with bushing 39 which in turn is rotatably carried by spindle 20. One end of bushing 39 bears against hub 40 of brake drum 24 to maintain magnet rings 29 and 33 spaced apart a predetermined distance. The spacing between magnet rings 29 and 33 can be varied to adjust the amount of torque transmitted by clutch 28 by screwing pulley 26 along bushing 39. When the proper setting is obtained, pulley 26 can be locked on bushing 39 by means of a suitable set screw, not shown.

A gear casing 42 contains suitable gears, not shown but of a type well known in the art, which provide a driving connection between the end of spindle 20, adjacent brake drum 24, and the cam, or other means, inside of housing member 10 that reciprocates yarn guide 14. Power is supplied to spindle 20 through pulley 26 by means of an endless belt 44 which passes over the top of pulley 26, and onto the top of an adjacent similar pulley, not shown, to drive another similar unit in the manner well known in the art. An idler or pressure applying pulley 48 is provided adjacent pulley 26 for the purpose of eliminating slip between belt 44 and pulley 26, or for limiting such slip to a predetermined value.

A tension controlling mechanism 50 is carried by table or base 12 beneath the above described winding mechanism. Tension controlling mechanism 50 comprises a shaft 52 rotatably carried in suitable bearings by rails 53 and 55 attached to the front and rear respectively of table or base 12. The ends of shaft 52 project beyond rails 53 and 55, and a generally horizontal arm 54, preferably made of a flexible spring-like material, is rigidly attached at one of its ends to the front end thereof. The end of arm 54 that is attached to shaft 52 is reinforced over approximately one-quarter of its length by a substantially rigid member 56 also rigidly attached to the end of shaft 52 and which extends over arm 54. Member 56 helps arm 54 resist bending in an upward direction but does not interfere with said arm 54 bending downwardly. The other or free end of arm 54 is provided with a yarn engaging wheel 58 mounted thereon by means of a suitable bracket 59. A stud or supporting pin 51 is suitably mounted on the front of rail 53 and projects beneath arm 54 to support it when the device is not in operation, and to provide a positive stop for clockwise rotation of said arm 54 when the device is in operation. The end of shaft 52 which projects beyond rail 55 is provided with a lever 60 rigidly attached thereto by any convenient means and which is provided with a plurality of adjustment holes 61 along its length. A brake operating rod 62 has one of its ends hooked to engage any one of the holes 61 in lever 60 and has its other end connected to one end of a brake band 64. Brake band 64 is wrapped around the upper half of brake drum 24 and is fixedly connected at its other end to a stud 66 projecting from gear casing 42.

A second yarn engaging wheel 68 is suitably mounted by means of a bracket 70 above yarn engaging wheel 58. As illustrated in the drawings, Figs. 1 and 2, bracket 70 is carried by a frame made up of a plurality of rods 72, suitably mounted on top of housing member 10, and which in addition carry the idler pulleys 48, and support belt 44 at the end of its run in a manner not shown and not pertinent to the present invention.

Shaft 52 of tension controlling mechanism 50

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is provided between arm 54 and rail 53 with a balancing arm 74 which is generally parallel to arm 54. Balancing arm 74 passes through an opening provided in shaft 52, or may be otherwise suitably attached thereto, and has portions thereof extending on both sides of said shaft 52. The end of balancing arm 74 that is on the same side of shaft 52 as arm 54, is provided with a sliding differential tension adjusting member 80 adapted to receive balancing weights 82 for a purpose to be described more in detail hereinafter. The other end of arm 74, i. e. that portion diametrically opposed to arm 54, is provided with a counterbalancing weight 76 adapted to be positioned at any desired location on that end of arm 74 and secured thereto by means of a set screw 78 to compensate to any desired degree for the weight of arm 54, yarn engaging wheel 58, and tension adjusting member 80 and the weights 82. A differential tension actuating lever 84 is carried by counterweight 22 for movement thereby. The end of lever 84 engages between interturned arms 86 of differential tension adjusting member 80 to slide said member 80 and the balancing weights 82 carried thereby from right to left, as viewed in Figs. 2 and 4, as the package being wound on core 18 increases in diameter.

The apparatus of the present invention functions in the following manner: A strand of yarn Y is threaded from any convenient source of supply over yarn engaging wheel 68 downwardly therefrom around yarn engaging wheel 58 and upwardly therefrom over yarn guide 14 and onto package core 18. Package core 18 and spindle 20 are rotated by means of belt 44, rotating pulley 26 and through magnetic clutch 28, brake drum 24 attached to spindle 20. Yarn guide 14 is reciprocated by means of suitable cam means, contained in housing member 10, which in turn is driven from spindle 20 by suitable gears enclosed in gear casing 42. Counterbalancing weight 76 is positioned on balancing arm 74 so that the weight of arm 54, yarn engaging wheel 58 and differential tension adjusting member 80 and any balancing weights 82 carried thereby is overcome to such a degree that yarn engaging wheel 58 and arm 54 will be supported by yarn Y when the tension therein is a predetermined desired value. When the tension in yarn Y exceeds the predetermined desired value, the yarn will lift arm 54 causing it to rotate shaft 52 and lever 60 to cause brake operating rod 62 to draw brake band 64 against the periphery of brake drum 24, to slow down brake drum 24, spindle 20 and package core 18 by causing slippage to take place in magnetic clutch 28, thus reducing the tension on the yarn Y to the predetermined desired value. When the tension in yarn Y is less than the predetermined desired value, arm 54 drops downwardly, or rotates in a clockwise direction as seen in Figs. 2 and 4, rotating shaft 52 and lever 60 in a direction to cause brake operating rod 62 to release the pressure of brake band 64 on brake drum 24 permitting brake drum 24, spindle 20 and package core 18 to rotate at a higher speed and thus increase the tension in yarn Y. As the package being wound increases in diameter, lever 84 moves differential tension adjusting member 80 towards the fulcrum of arm 54, thus reducing the effective weight of wheel 58 on yarn Y with the result that a lower tension will actuate arm 54 and cause brake band 64 to be pressed against brake drum 24.

When yarn Y is being supplied from any convenient source at a constant speed, it will be

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apparent to those skilled in the art that the winding machine of the present invention will wind the yarn at a constant speed and at a predetermined tension. If it is desired to wind yarn Y at a constant tension, lever 84 can be removed from counterbalancing weight 22, or otherwise disconnected from differential tension adjusting member 80, so that arm 54 will respond to a constant tension throughout the winding of the package.

Whereas a magnetic clutch and a mechanical type brake have been specifically disclosed and described in connection with the present invention, it will be understood that it is not intended to limit the present invention to the use of these specific elements. For example, a friction type slippable clutch of any convenient design may be employed, or pulley 26 can be rigidly attached to brake drum 24 and idler pulley 48 so adjusted against belt 44 that said belt 44 can readily slip along the periphery of pulley 26 when brake band 64 is applied to brake drum 24. Also, other types of braking means can be employed in connection with any convenient type of slippable connection; as for example, a magnetic brake.

Since certain changes may be made in the above apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limited sense.

What is claimed is:

1. In a winding machine having a rotatable winding spindle and means for traversing a running strand of yarn across a predetermined length of said spindle, the combination comprising means for applying a predetermined substantially constant torque to said spindle, means adapted to engage said yarn prior to its being engaged by said traversing means and to be moved thereby when the tension therein exceeds a predetermined value, and means actuated by the movement of said last mentioned means and adapted when so actuated to subtract a percentage of said torque from said spindle.

2. In a winding machine having a rotatable winding spindle and means for traversing a running strand of yarn across a predetermined length of said spindle, the combination comprising means for applying a predetermined substantially constant torque to said spindle, means adapted to engage said yarn prior to its being engaged by said traversing means and to be moved thereby when the tension therein exceeds a predetermined value, and a brake actuated by the movement of said last mentioned means and adapted when so actuated to subtract a percentage of said torque from said spindle.

3. In a winding machine having a rotatable winding spindle and means for traversing a running strand of yarn across a predetermined length of said spindle, the combination comprising means for applying a predetermined substantially constant torque to said spindle, means adapted to engage said yarn prior to its being engaged by said traversing means and to be moved thereby when the tension therein exceeds a predetermined value, and a brake on said spindle actuated by the movement of said last mentioned means and adapted when so actuated to subtract a percentage of said torque from said spindle.

4. In a winding machine having a rotatable winding spindle and means for traversing a

running strand of yarn across a predetermined length of said spindle, the combination comprising a source of power for said spindle, a slippable connection between said source of power and said spindle adapted to apply a predetermined substantially constant torque to said spindle, means adapted to engage said yarn prior to its being engaged by said traversing means and to be moved thereby when the tension therein exceeds a predetermined value, and means actuated by the movement of said last mentioned means and adapted when so actuated to subtract from said spindle a percentage of the torque applied thereto through said slippable connection.

5. In a winding machine having a rotatable winding spindle and means for traversing a running strand of yarn across a predetermined length of said spindle, the combination comprising a source of power for said spindle, a slippable connection between said source of power and said spindle adapted to apply a predetermined substantially constant torque to said spindle, means adapted to engage said yarn prior to its being engaged by said traversing means and to be moved thereby when the tension therein exceeds a predetermined value, and a brake actuated by the movement of said last mentioned means and adapted when so actuated to subtract from said spindle a percentage of the torque applied thereto through said slippable connection.

6. In a winding machine having a rotatable winding spindle and means for traversing a running strand of yarn across a predetermined length of said spindle, the combination comprising a source of power for said spindle, a slippable connection between said source of power and said spindle adapted to apply a predetermined substantially constant torque to said spindle, means adapted to engage said yarn prior to its being engaged by said traversing means and to be moved thereby when the tension therein exceeds a predetermined value, and a brake on said spindle actuated by the movement of said last mentioned means and adapted when so actuated to subtract from said spindle a percentage of the torque applied thereto through said slippable connection.

7. A winding machine comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a clutch mounted on said spindle and adapted to transmit a predetermined substantially constant torque thereto, means adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, and means actuated by the movement of said last mentioned means and adapted when so actuated to subtract a percentage of said torque from said spindle.

8. A winding machine comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a clutch mounted on said spindle and adapted to transmit a predetermined substantially constant torque thereto, means adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, and a brake actuated by the movement of said last mentioned means and adapted when so actuated to subtract a percentage of said torque from said spindle.

9. A winding machine comprising in combination a winding spindle, a yarn guide adapted to

traverse a running strand of yarn across a predetermined length of said spindle, a clutch mounted on said spindle and adapted to transmit a predetermined substantially constant torque thereto, means adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, and a brake on said spindle actuated by the movement of said last mentioned means and adapted when so actuated to subtract a percentage of said torque from said spindle.

10. A winding machine comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a magnetic clutch mounted on said spindle and adapted to transmit a predetermined substantially constant torque thereto, means adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, and means actuated by the movement of said last mentioned means and adapted when so actuated to cause said magnetic clutch to slip to subtract a percentage of said torque from said spindle.

11. A winding machine comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a magnetic clutch mounted on said spindle and adapted to transmit a predetermined substantially constant torque thereto, means adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, and a brake actuated by the movement of said last mentioned means and adapted when so actuated to cause said magnetic clutch to slip to subtract a percentage of said torque from said spindle.

12. A machine for winding a package of yarn comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, means for applying a predetermined substantially constant torque to said spindle, means adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, a tension adjusting member associated with said last mentioned means and adapted to be adjusted relative thereto to decrease said predetermined value as said package increases in diameter, and means actuated by the movement of said yarn engaging means and adapted when so actuated to subtract a percentage of said torque from said spindle.

13. A machine for winding a package of yarn comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, means for applying a predetermined substantially constant torque to said spindle, an arm adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, a balancing arm associated with said first mentioned arm, movable means on said balancing arm adapted to carry balancing weights, means associated with said yarn guide and adapted to move said movable means on said balancing arm as said package increases in diameter whereby said predetermined value decreases progressively as said package increases in diameter, and means actuated by the movement of said first mentioned arm and adapted when so actuated to subtract a percentage of said torque from said spindle.

14. A machine for winding a package of yarn comprising in combination a winding spindle, a

yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a source of power for said spindle, a slippable connection between said source of power and said spindle, an arm adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, a balancing arm associated with said first mentioned arm, movable means on said balancing arm adapted to carry balancing weights, means associated with said yarn guide and adapted to move said movable means on said balancing arm as said package increases in diameter whereby said predetermined value decreases progressively as said package increases in diameter, and means actuated by the movement of said first mentioned arm and adapted when so actuated to subtract from said spindle a percentage of the torque applied thereto through said slippable connection.

15. A machine for winding a package of yarn comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a clutch mounted on said spindle and adapted to transmit torque thereto, an arm adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, a balancing arm associated with said first mentioned arm, movable means on said balancing arm adapted to carry balancing weights, means associated with said yarn guide and adapted to move said movable means on said balancing arm as said package increases in diameter whereby said predetermined value decreases progressively as said package increases in diameter, and means actuated by the movement of said first mentioned arm and adapted when so

actuated to subtract from said spindle a percentage of said torque.

16. A machine for winding a package of yarn comprising in combination a winding spindle, a yarn guide adapted to traverse a running strand of yarn across a predetermined length of said spindle, a clutch mounted on said spindle and adapted to transmit torque thereto, an arm adapted to engage said yarn and to be moved thereby when the tension therein exceeds a predetermined value, a balancing arm associated with said first mentioned arm, movable means on said balancing arm adapted to carry balancing weights, means associated with said yarn guide and adapted to move said movable means on said balancing arm as said package increases in diameter whereby said predetermined value decreases progressively as said package increases in diameter, and a brake actuated by the movement of said first mentioned arm and adapted when so actuated to cause said clutch to slip to subtract a percentage of said torque from said spindle.

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