Feb. 13, 1940. E. B. FEASTER 2,190,261

TENSION DEVICE

Filed Dec. 15, 1937 3 Sheets-Sheet 1

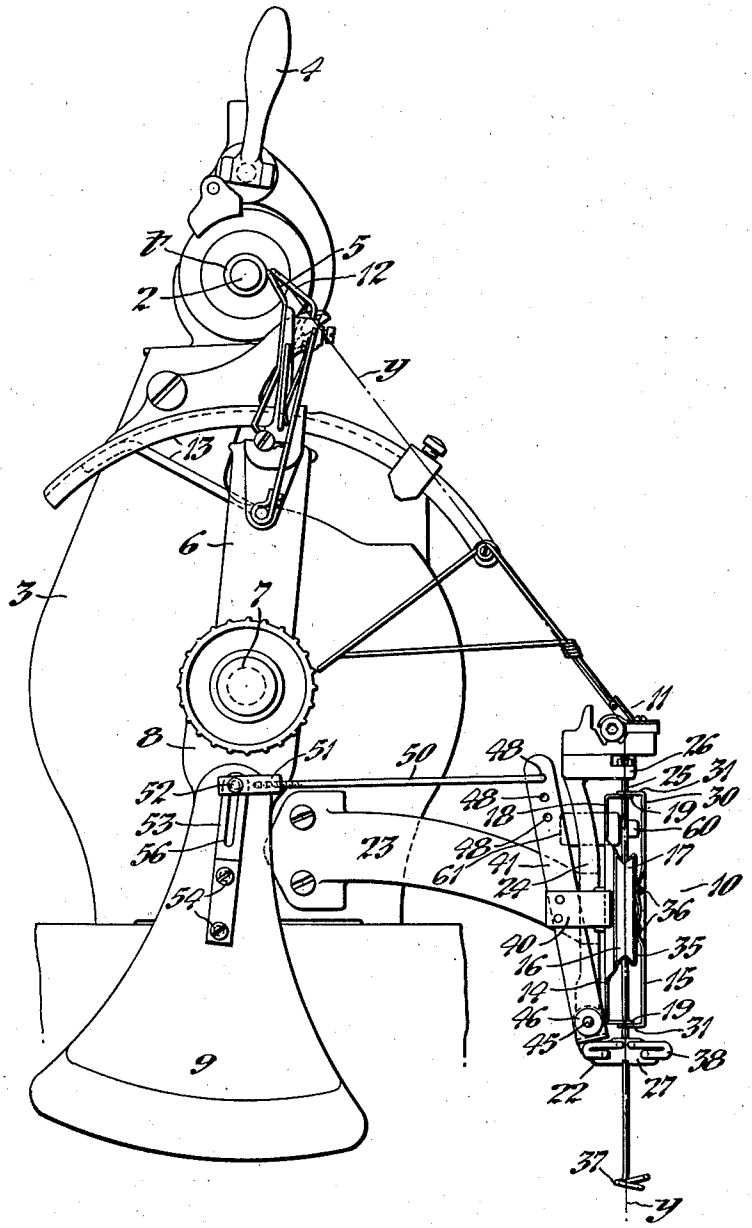


Fig. 1.

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Filed Dec. 15, 1937 3 Sheets-Sheet 2

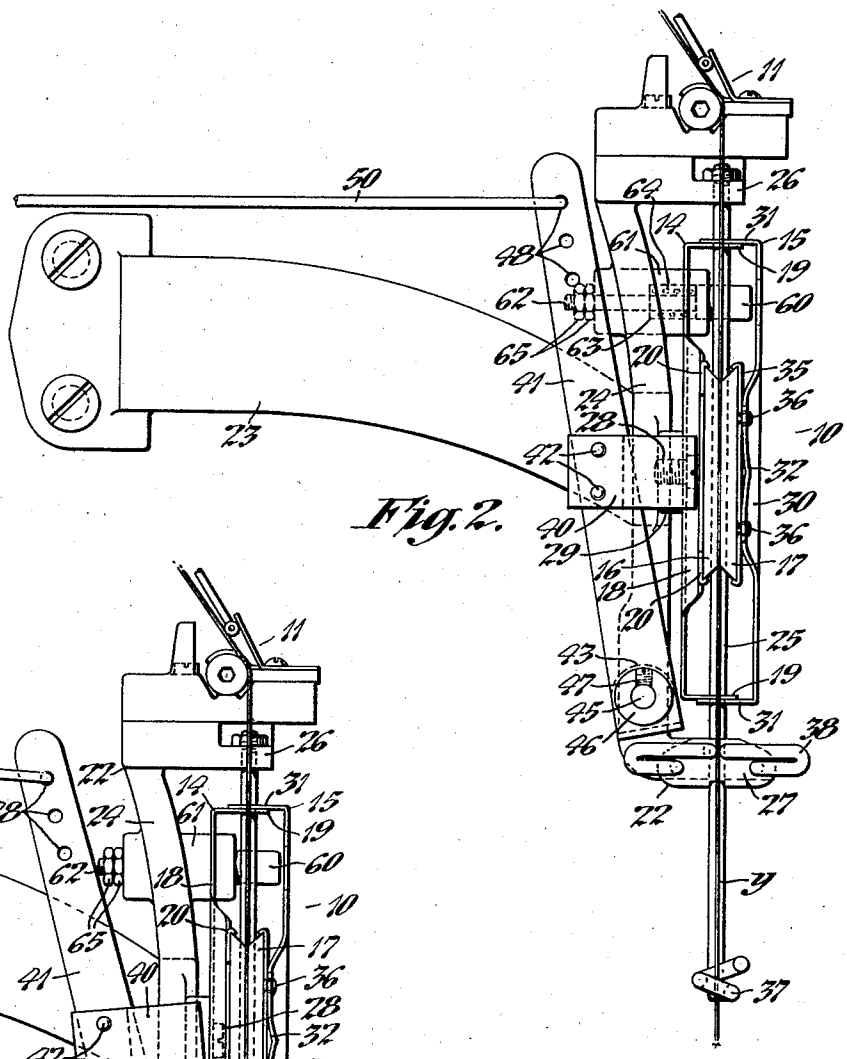


Fig. 2.

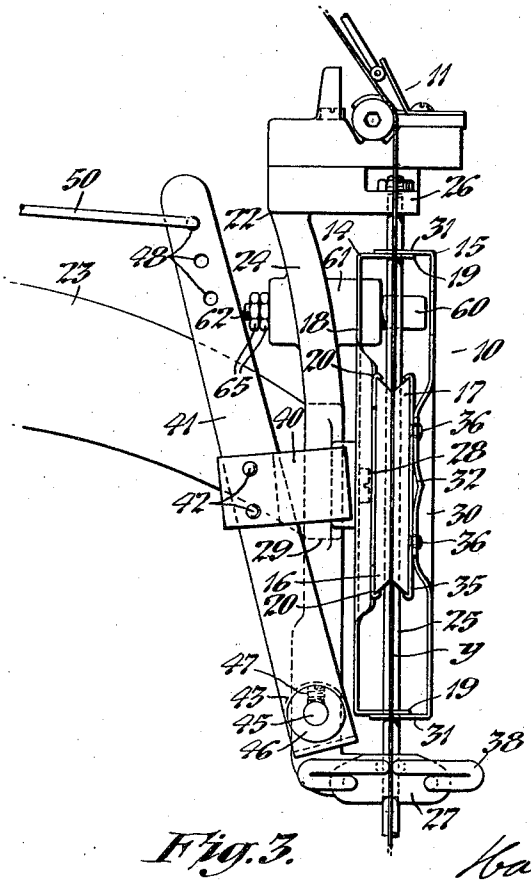


Fig. 3.

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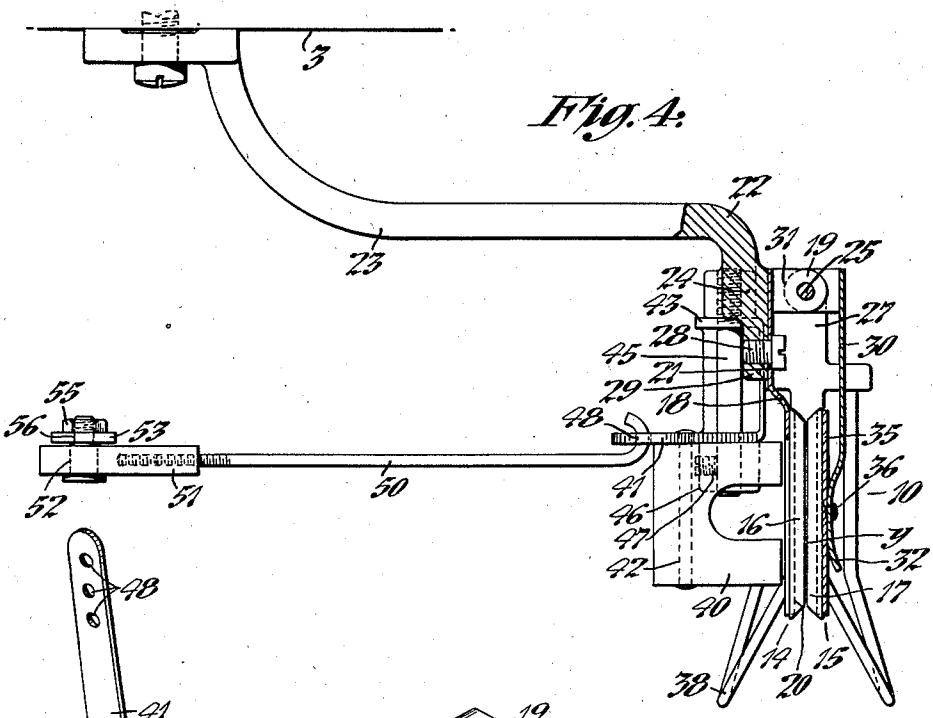


Fig. 4.

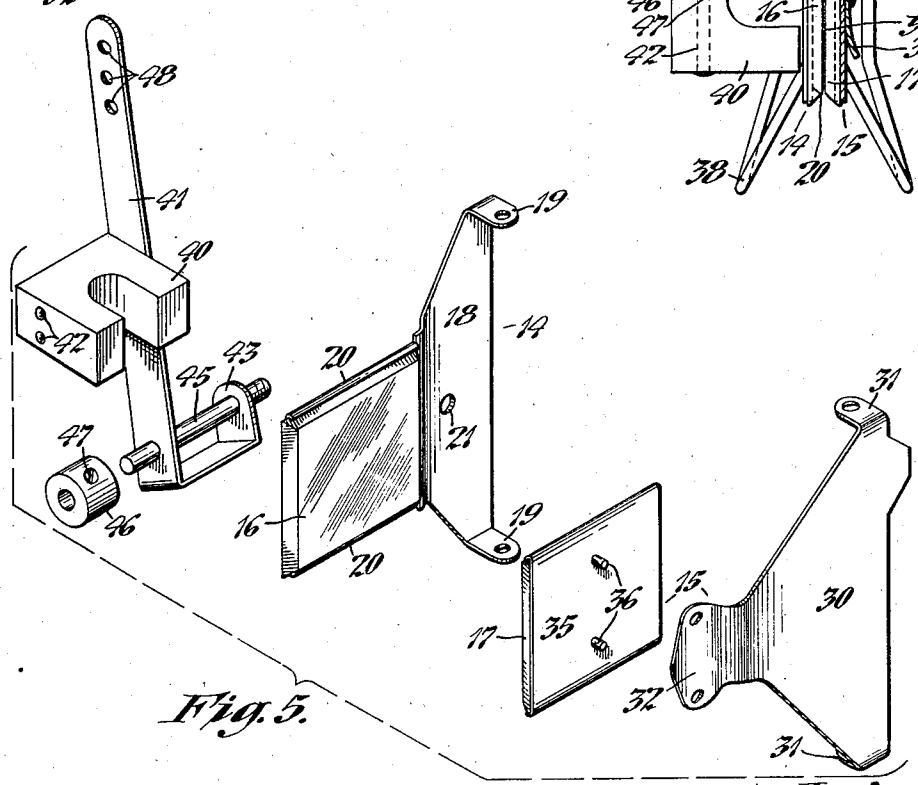


Fig. 5.

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UNITED STATES PATENT OFFICE

2,190,261

TENSION DEVICE

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Application December 15, 1937, Serial No. 180,021

12 Claims. (Cl. 242—45)

This invention relates to winding machines for winding cops, cones and other forms of packages of yarn, thread and like strand materials; and particularly to improved means for regulating the amount or degree of tension applied to the strand being wound in accordance with its linear speed or rate of draft.

In the following specification and claims the term "yarn" is employed in a general sense to apply to all forms of strand material, either textile or otherwise, and the designation "package" is intended to indicate the product of the machine whatever its form.

One object of the present invention is to provide a differential tension device adapted to operate automatically to maintain an ultimate uniform tension on the yarn as the linear speed of the latter is varied.

Another object of the invention is to provide a device of the type specified which is controlled by the growth of the package being wound to reduce the applied tension on the strand as the speed of draft of the latter increases whereof to maintain the ultimate tension uniform throughout the winding.

Another object of the invention is to provide a tension device of the type indicated comprising magnetic means for applying pressure to the tension-members which act against the strand to apply tension thereto.

Another object of the invention is to provide a tension device of the type indicated having magnetic means for applying the force to cause the tension-members to bear against the strand and automatically-operated means for varying the effect of the magnetic force to adjust the amount of tension applied to the strand.

Another object of the invention is to provide in a winding machine, a magnetically-operated tension device with means actuated automatically during the growth of the package being wound to shift the magnetic means to vary the amount of tension applied to the running strand in accordance with the variation in its linear speed.

Another object of the invention is to provide a differential tension device of the type indicated comprising a minimum number of parts of simple construction adapted to operate without undue wear and durable in use over long periods of time.

Further objects of the improvement are set forth in the following specification which describes a preferred embodiment of the invention, by way of example, as illustrated by the accompanying drawings. In the drawings:

Fig. 1 is an elevational view of a winding machine showing the essential elements of the winding mechanism and illustrating the present improved tension device as applied to use therewith;

Fig. 2 is an enlarged elevational view of the tension device showing the tension-members bearing against a strand feeding therebetween with the magnetic means applying the maximum pressure thereto;

Fig. 3 is a similar view showing the magnetic means displaced in position to reduce the force applied to press the tension-members against the strand;

Fig. 4 is a part-sectional plan view of the tension-device with the parts shown in the same position as in Fig. 2; and

Fig. 5 is a perspective view showing the various parts of the tension device in disassembled relationship.

The present invention is concerned more particularly with a tension device for use on winding machines in which the package being wound is rotated at a constant rate of speed. As well known to those skilled in the art, winding machines of this type operate in such manner that as the winding progresses and the package increases in circumference the yarn feeds thereto at an accelerated rate and, consequently, unless the applied tension on the yarn is relieved the tension at the package will be augmented so as to have a deleterious effect on the winding. It has heretofore been proposed to provide means for gradually relieving or reducing the tension applied to the yarn during the increase in its linear speed and the present invention consists in an improved device employing magnetic means to apply the tension and automatically regulate the amount thereof during the winding.

The invention is herein shown as applied to use on a winding machine of conventional type having a positively driven winding-spindle on which the package is wound and a reciprocating thread-guide which traverses the yarn longitudinally of the spindle. Referring to Fig. 1 of the drawings, the winding-spindle 2 is journaled in bearings at the top of a box-like frame 3 and driven from a pulley or other suitable means, not herein shown. The thread-guide 5 is slidably mounted in a traverse-frame 6 and connected to be reciprocated by a helical cam, not shown, which is rotated by a shaft 7, also journaled in bearings in the frame 3 and con-

nected to be driven with the winding-spindle 2. A starting lever or handle 4 at the top of the frame 3 is connected to the driving mechanism of the machine in the usual manner to control the operation of the machine. The traverse-frame 6 is pivoted on the cam-shaft 7 and below the latter it is counterbalanced by an arm 8 terminating in a weight 9 at its lower end.

The strand of yarn *y* or other material feeds through a tension device, represented generally by the reference character 10, thence draws up through a slub-detector 11 of known construction, and passing over a wire-bail 12 on the traverse-frame 6, draws through a notch in the thread-guide 5 to direct it onto a suitable tube or carrier *t* mounted on the spindle 2. As the yarn builds up on the tube or carrier *t* the thread-guide 5 is forced radially outward from the axis of the winding-spindle 2 with the traverse-frame 6 pivoting on the shaft 7 to accommodate such movement of the guide. The thread-guide 5 is maintained bearing on the winding at all times by the pressure of the counterweight 9 and in some cases a differential pressure device cooperates with the traverse-frame to gradually reduce the pressure of the thread-guide on the package during the growth in the winding. A dogging device of well-known construction, indicated generally at 13 in Fig. 1, is usually provided to control the outward movement of the traverse-frame 6 whereby to prevent the thread-guide 5 from vibratory movement during the winding. Suffice it to state herein that the swinging movement of the traverse-frame 6 is employed for varying the pressure of the tension-members on the running strand to reduce the applied tension whereof to maintain a substantially constant yarn tension as the package increases in diameter.

Referring now more particularly to Figs. 2 to 5, inclusive, the present improved tension device comprises a fixed element or member 14 and a movable member 15 adapted to press against the strand *y* as it draws upwardly therebetween. In the present improved form of construction the yarn-contacting members of the tension device are preferably constructed of glass or other vitreous material in the form of flat plates 16 and 17 having their edges beveled on four sides as shown most clearly in Fig. 5. The tension-plate 16 is mounted on a sheet-metal frame or support 18 of substantially triangular shape in main outline and having ears 19 bent at right-angles at its upper and lower ends. Projecting from the forward edge of the main portion of the frame 18 are two parallel arms 20 with the metal folded or curled over to provide grooves for receiving the beveled edges of the plate 16. The fixed tension-member 14 is rigidly supported on a tension-bracket 22 comprising an arm 23 bolted to the frame 3 of the winding machine and carrying an offset upright cross-arm 24 of slightly bowed conformation. The upright or cross-arm 24 supports the slub-detector 11 at its upper end and also mounts a vertical rod 25 held in bores in lugs 26 and 27 projecting laterally from the top and bottom of the arm. The ears 19 on the frame 18 are bored to receive the rod 25 and a screw 28 passing through a hole 21 in the frame is screwed into a lug 29 on the central portion of the cross-arm 24 to secure the tension-member 14 in stationary position.

The movable tension-member 15 is pivotally mounted on the rod 25 to swing about the axis of the rod. The member 15 comprises a triangularly-shaped frame or support 30 having ears 31 at its top and bottom bored to receive the rod 25 and a narrowed arcuately-bent extension 32 at its center. The tension-plate 17 is mounted in a holder 35 comprising a sheet-metal element of rectangular outline having its top and bottom edges bent over to engage the beveled edges of the plate. A pair of pins 36 project from the back of the plate-holder 35 through holes in the extension 32 of the frame 30 and are headed over at their ends to secure the plate-holder to the frame with a loose connection. Preferably, the pins 36 are somewhat smaller than the holes in the frame 30 so that the holder 35 is free to rock laterally to a slight extent on the frame for a purpose as later explained. When the frame members 18 and 30 are mounted on the vertical rod 25 with the member 18 secured fast to the upright 24 of the bracket 22 the ears 31 on the frame 30 overlap the ears 19 on the frame 18 so that both tension-members are held from vertical movement.

It will be observed that with the above-described form of mounting the tension-member 14 is held fixed, while the member 15 is adapted to swing with respect thereto and to assume a position with the two faces of the plates 16 and 17 in opposite parallel relationship as shown most clearly in Fig. 4 of the drawings. The strand of yarn *y* is supplied to the machine from a cop or bobbin arranged below, but not herein shown. The strand feeds upwardly through a pigtail guide 37, formed at the terminal of the wire rod 25, and thence through the crotch of a second wire guide 38 to direct it between the tension-members 14 and 15 at a point rearwardly from their forward edges, see Fig. 4. From the tension-members 14 and 15 the yarn feeds through the slub-detector 11 and thence to the winding in the manner as before explained.

As previously indicated, the means for applying pressure to the movable tension-member 15 to cause it to press against the yarn drawing between the plates 16 and 17 comprises a magnet 40 which is preferably of the horseshoe type as illustrated in Figs. 4 and 5. The magnet 40 may be constructed of any suitable metal properly magnetized, and to adapt it to be shifted in position with respect to the movable tension-member 15 it is mounted on a pivoted arm or lever 41 as by means of rivets 42.

The lever 41 may be conveniently constructed of sheet-metal bent into L-shape at its lower end to provide an upright ear 43 extending parallel to its main arm and formed with a hole registering with a corresponding hole in the arm which serve as bearings for a pivot-pin or rod 45. The pivot-rod 45 is screwed into the lower end of the cross-arm 24 on the bracket 22 with the magnet-supporting lever 41 pivoted thereon and held in place by a collar 46 secured to the end of the rod by a set-screw 47.

The magnet-carrying arm or lever 41 is formed with a series of holes 48 at its upper end and engaging one of these is the hooked end of a wire link or connecting rod 50. The opposite end of the link 50 is screwed into a member 51 which has a transverse hole for receiving a stud 52 which connects it with the lower arm 8 of the traverse-frame 6. As herein shown, the stud 52 is slidable in a slot 56 in the offset upper portion of a member 53 fastened to the arm 8 at 54. A nut 55 is screwed onto the threaded end of the stud 52 to bind its shouldered portion against the member 53, see Fig. 4. By loosening the nut 55 the stud 52 can be slid in the slot 56 to adjust the connec-

tion of the link 50 with the arm 8 to vary its position with respect to the pivot of the traverse-frame 6 whereof to regulate the amount of motion transmitted through the link 50 to the magnet-lever 41 during the movement of the thread-guide 5. As a further means for regulating the extent of motion transmitted to the magnet-lever 41 and the initial position of the magnet 40 the link 50 may be shifted in the holes 48 in the upper end of the lever. To secure a fine adjustment of the position of the magnet 40 with respect to the movable tension-member 15 the link 50 may be screwed into or unscrewed partly from its connecting member 51. It should be stated that the lever 41 is preferably constructed of brass to render it non-magnetic and, likewise, the frame 18 which holds the tension-plate 16 is preferably made of copper or brass for the same reason. The holder 35 and frame 30, however, are constructed of steel in order to adapt them to be influenced by the force of the magnet 40.

The tension-member 15 may be swung open to receive the yarn and means in the form of a plunger 60 is provided on the tension-bracket 22 for thereafter automatically swinging the member into operative position to be influenced by the magnet 40. Normally, the end of the plunger 60 is clear of the frame 30 when the tension-plates 16 and 17 are bearing against the yarn *y* to apply tension thereto, but when the frame 30 is swung open manually to admit the yarn between the tension-plates in threading up the device the plunger will act against the rearward portion of the frame to return the latter into operative position. In other words, the plunger 60 functions merely to close the tension-members after they have been opened manually. As shown most clearly in Fig. 2, the upright or cross-arm 24 of the bracket 22 is formed with a hub 61 bored to receive the reduced shank 62 of the plunger 60. The head of the plunger 60 slides in an enlarged counterbore 63 in the hub 61 with a spring 64 coiled around its shank and normally tending to project the plunger outwardly from the end of the hub. A pair of nuts 65 on the threaded end of the shank 62 of the plunger serve to limit the outward movement of the plunger under the action of the spring 64, the nuts providing means to adjust the plunger in position with clearance between its end and the side of the frame 30 of the tension-member 15 when the latter is in normal operative position. The plunger 60 is initially adjusted to provide the clearance between its end and the side of the frame 30 and remains in this relationship so that it has no contact with the frame while the tension-device is operating on the yarn.

Having now described a preferred form of construction of the present invention the method of operation of the tension-device during the winding of a package will next be explained.

To prepare the winding machine for operation the strand of yarn *y* is led up from its source of supply through the guides 37 and 38 and between the plates 16 and 17 of the tension-members 14 and 15. Thence it is passed through the slub-detector 11, drawn over the wire-bail 12 on the traverse-frame 6 and through the notch in the thread-guide 5, and its end suitably attached to the cop-tube or carrier *t*. The traverse-frame 6 is placed in position with the guide 5 bearing against the periphery of the tube *t*, this operation being performed by releasing the dogging device 13 which, as before stated, is usually provided for preventing the guide from retrogressive movement toward the winding-spindle 2. The operation of the machine is started by rocking the hand-lever 4 and as the winding-spindle 2 is rotated and the thread-guide 5 traversed longitudinally thereof the yarn is laid on the tube *t* in helical coils to build up a package by what is known as the Wardwell or Figi wind.

At the start of the winding operation with the thread-guide 5 bearing against the cop-tube *t* on the winding-spindle 2 and the traverse-frame 6 in the position shown in Fig. 1 of the drawings the magnet-carrying lever 41 will be in the position illustrated in Fig. 2 with the poles of the magnet 40 closely adjacent the rearward side of the fixed tension-member 14. In this position of the parts the lines of magnetic force pass from one pole of the magnet 40 through the glass-plates 16 and 17 to the other pole of the magnet and are thus caused to attract the steel parts of the tension-member 15 to draw it toward the member 14. In this way the tension-plate 17 is caused to press the strand of yarn *y* against the opposed face of the plate 16 to apply resistance to the draft of the strand as it draws between the tension-plate. The amount of pressure thus applied to the strand may be regulated by adjusting the position of the lever 41 to initially locate the magnet 40 nearer to or farther from the movable tension-member, this adjustment being effected by shifting the link 50 in the different holes 48 at the upper end of the lever and/or by turning the link in the connecting member 51 in the manner of a turnbuckle. In the present drawings, the link 50 is shown connected with the upper hole 48 which locates the magnet 40 in a position to exert a maximum attractive force on the movable tension-member 15, but with the link 50 engaged with a lower hole 48 or screwed farther into the member 51 the magnet will be initially positioned farther away from the tension-member 15 to diminish its attractive force.

As the winding proceeds the yarn is built up on the cop-tube *t* in overlying layers and the thread-guide 5 is forced outwardly from the spindle 2, thereby swinging the traverse-frame 6 with it while the lower arm of the frame swings in the opposite direction. As the arm 8 recedes from the tension-device 10 the link 50 will rock the lever 41 in the same direction to shift the magnet 40 away from the movable tension-member 15 as indicated in Fig. 3. During this continuous receding movement of the magnet 40 from the tension device 10 the magnetic force applied to attract the movable tension-member 15 is diminished to gradually lessen the pressure of the tension-plate 17 on the running strand of yarn *y*. Stated briefly, as the package increases in diameter and the linear speed of the yarn is proportionately increased due to the growing diameter of the winding the lever 11 will be moved by the traverse-frame 6 to gradually lessen the attraction of the magnet 40 for the movable member 15. In this way the tension applied to the yarn is progressively reduced and, consequently, the ultimate tension on the strand as it winds into the package is maintained substantially constant.

By adjusting the connection of the link 50 on the arm 8 of the traverse-frame 6 to alter its position with respect to the axis on which the frame swings the relative movement of the magnet-carrying arm 41 may be regulated in relation to the movement of the thread-guide 5 so as to provide the proper variation in the amount of tension applied to the yarn in conformity with

its changing rate of speed as it delivers to the winding.

It has been stated that the tension-plate 17 is mounted on the movable member 15 with a loose connection between the rivets 36 and the holes in the extension 32 of the member 30. Through this construction the tension-plate 17 is permitted to rock slightly in both horizontal and vertical planes to allow the passage of slubs or enlargements on the yarn without causing the movable tension-member to be swung away from the fixed member. This provision prevents chattering and vibration of the movable tension-member which would tend to cause an uneven tension on the strand.

It will be observed from the foregoing that the present invention provides an improved differential tension-device which is operated automatically during the progress of the winding to relieve the applied tension on the running strand to compensate for the increase in its linear speed whereby to maintain a substantially constant tension as the yarn winds into the package. In this way excessive tension on the strand is avoided so that the cop or package may be wound with the proper degree of tension to prevent the yarn from being strained or the package being deformed by bulging at its ends. The machine is thus adapted to produce perfect packages wound from either fine or coarse yarn without strain on the material and without malformation of the package.

It will further be observed that the present tension-controlling means is of great simplicity as requiring but one moving element, the magnet, in addition to the standard parts of the machine. Moreover, the action of the magnetic force on the movable tension-member is much steadier and under better control than with the usual arrangement of weighted levers employed to adjust the tension, thus avoiding chattering and vibration of the movable tension-member and insuring a more uniform application of tension to the strand.

The present improved device is further of such construction as to render it less liable of becoming deranged or getting out of order and wear is reduced to a minimum due to the simplification of the mechanism for controlling the action of the movable tension-member.

While the improved device is herein shown and described as embodied in a preferred form of construction, it is to be understood that various modifications may be made in the structure and arrangement of its parts without departing from the spirit or scope of the invention. It is also to be understood that the magnetic means may be employed to apply a fixed degree of tension to the strand without varying its force on the tension-device by shifting the magnet. Therefore, without limiting myself in this respect, I claim:

1. In a tension device, the combination of a magnetic-responsive tension-element movable to adapt it to bear against a feeding strand to apply resistance to its draft, a magnet mounted adjacent said magnetic-responsive element for attracting it to cause it to bear against the strand, and means for adjusting the position of said magnet with respect to the magnetic-responsive element to vary the effect of said magnet on said element whereby to vary the tension applied to the feeding strand.

2. In a tension device, the combination of a pivoted tension-element movable to adapt it to bear against a feeding strand to apply resistance to its draft, said tension-element being responsive to magnetic force, a magnet mounted adjacent said magnetic-responsive tension-element for attracting it to cause it to bear against the strand, and means for adjusting the position of said magnet with respect to the magnetic-responsive element to vary the effect of said magnet on said element.

3. In a tension device, the combination of a magnetic-responsive tension-element movable to adapt it to bear against a feeding strand to apply resistance to its draft, a magnet mounted adjacent said magnetic-responsive element for attracting it to cause it to bear against the strand, and means to progressively shift the magnet relatively of said magnetic-responsive element to vary the effect of said magnet on said element.

4. In a tension device, the combination of tension-members adapted to bear against a strand feeding therebetween, one of said tension members being responsive to magnetic force, a magnet mounted adjacent said magnetic-responsive member to attract it and cause it to press the strand against the opposite member, and means to progressively shift the magnet relatively of said magnetic-responsive member to vary the strength of the magnetic force.

5. In a tension device, the combination of a relatively stationary tension-member, a second magnetic-responsive member movable toward the stationary member, a magnet mounted adjacent the magnetic-responsive member for attracting it to press it against the yarn feeding between said members, and means for adjusting the magnet away from the movable tension-member to diminish the effect of its force thereon.

6. In a winding machine, the combination of a tension-device for applying tension to a strand feeding to the machine, means for winding a package from said strand, magnetic means for operating the tension device, and means actuated during the growth of the package being wound on the machine to progressively reduce the force of the magnetic means to reduce the tension applied to the strand as the linear speed of the latter increases.

7. In a winding machine, the combination of a rotary winding-spindle, means for traversing yarn to wind a package on said spindle, a tension-device for applying resistance to the draft of the yarn as it feeds to the winding, magnetic means for actuating the tension-device, and means operated during the increase in diameter of the package to vary the force of said magnetic means to reduce the amount of tension applied to the yarn.

8. In a winding machine, the combination of a rotary winding-spindle, means for traversing yarn on the spindle to wind a package, said spindle and traversing means being caused to separate as the package increases in size, means for applying tension to the yarn feeding to the package, magnetic means for operating said tension-means, and means actuated by the separation of the winding-spindle and traversing means to vary the force of the magnetic means to progressively reduce the amount of tension applied to the yarn throughout the winding of the package.

9. In a winding machine, the combination of a rotary winding-spindle, means for traversing yarn on the spindle to wind a package, said winding-spindle and traversing means being caused to separate as the package increases in diameter, a

tension device for applying resistance to the draft of the yarn as it feeds to the package, a magnet for actuating the tension device, and means operated by the separation of the winding-spindle and traversing means to shift the magnet to vary its force on the tension device to progressively reduce the tension applied to the yarn throughout the winding of the package.

10. In a winding machine, the combination of a rotary winding-spindle, means for traversing yarn on the spindle to wind a package, a tension device comprising means adapted to press against the yarn to apply resistance to its draft as it feeds to the package, a magnet for actuating said tension device, and means influenced by the growth in diameter of the package to move the magnet to diminish its force on the tension device to progressively reduce the tension applied to the yarn during the winding of the package.

11. In a winding machine, the combination of a rotary winding-spindle, a thread-guide for traversing yarn on the spindle to wind a package, means for mounting the thread-guide to adapt it to separate from the winding-spindle during the growth in the winding, a tension device for applying resistance to the draft of the yarn as it feeds to the winding, a magnet for actuating the tension device, and means operated by the movement of the thread-guide to shift the magnet to diminish the effect of its force on the tension device to reduce the tension on the yarn progressively throughout the winding of the package.

12. In a winding machine, the combination of a rotary winding-spindle, a reciprocatory thread-guide for traversing yarn on the spindle to wind a package, a traverse-frame for supporting the thread-guide to adapt it to move away from the spindle as the winding increases in diameter, a tension device for applying resistance to the draft of the yarn as it feeds to the winding, a magnet for actuating the tension device, and means connecting the traverse-frame to shift the magnet to reduce its force on the tension device to relieve the tension on the yarn progressively throughout the winding of the package.

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