Oct. 30, 1945. G. S. CARBONNEAU 2,388,121

TENSION CONTROL DEVICE

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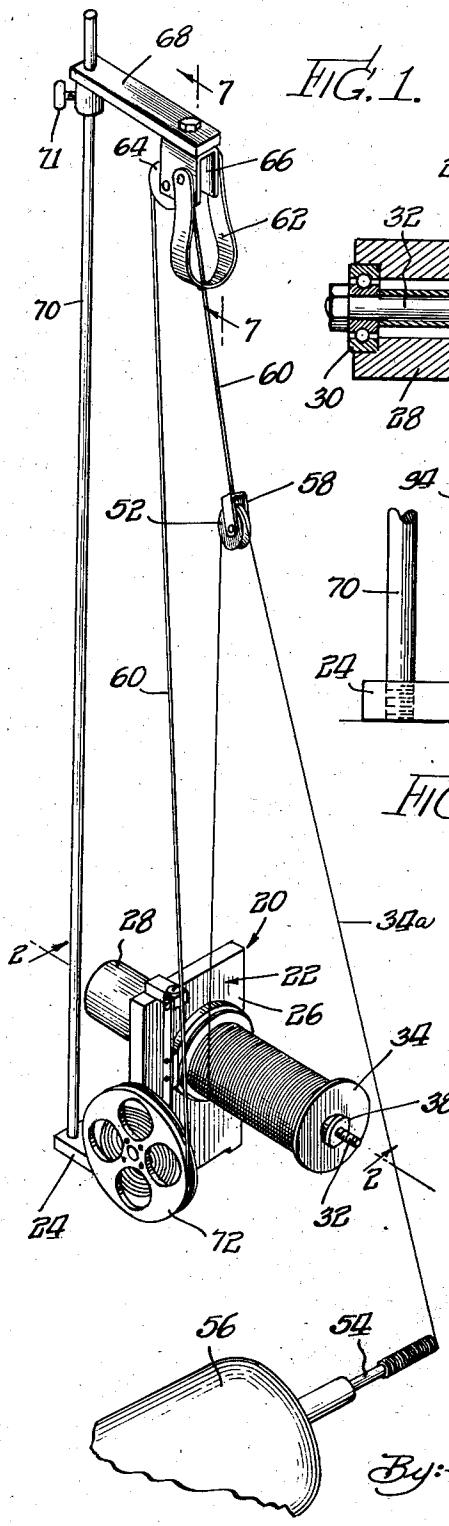


FIG. 1.

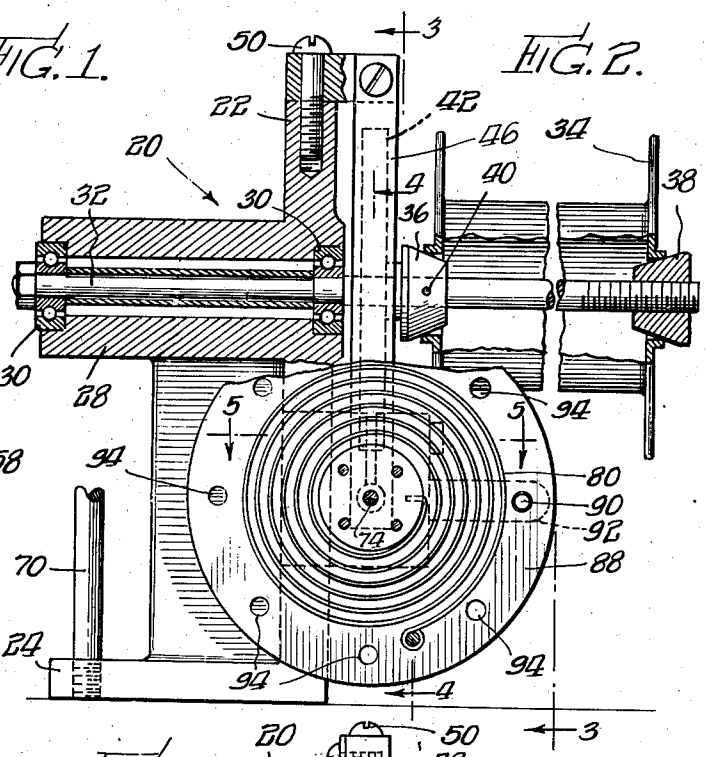


FIG. 2.

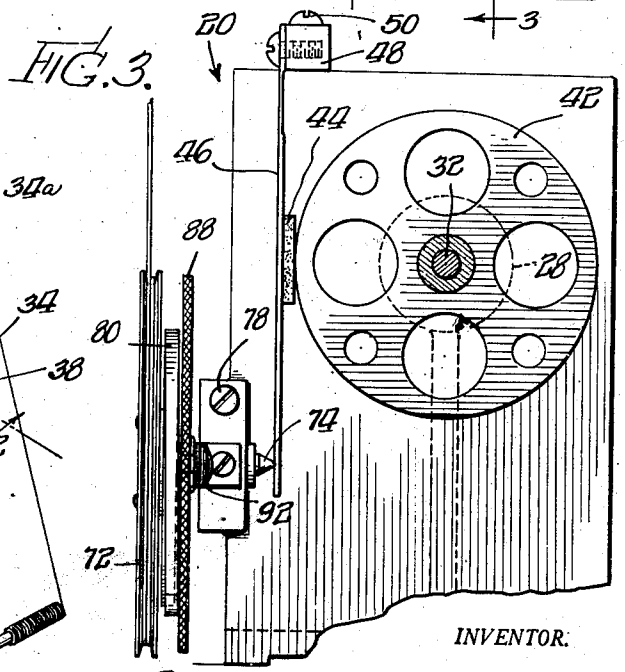


FIG. 3.

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TENSION CONTROL DEVICE

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FIG. 5.

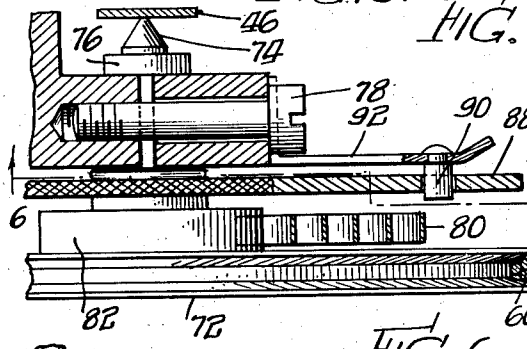


FIG. 4.

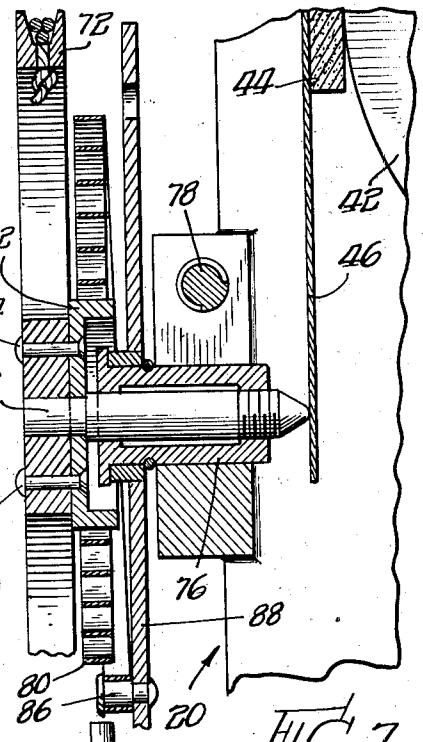


FIG. 6.

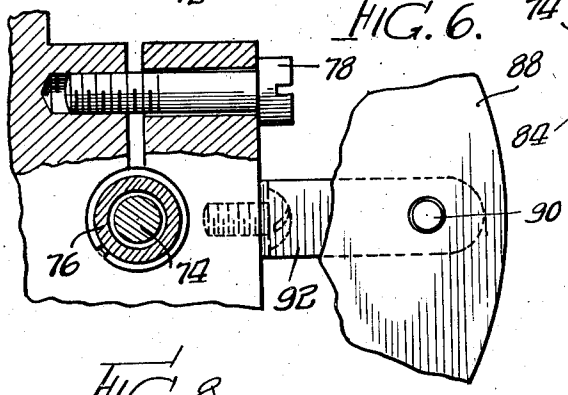


FIG. 8

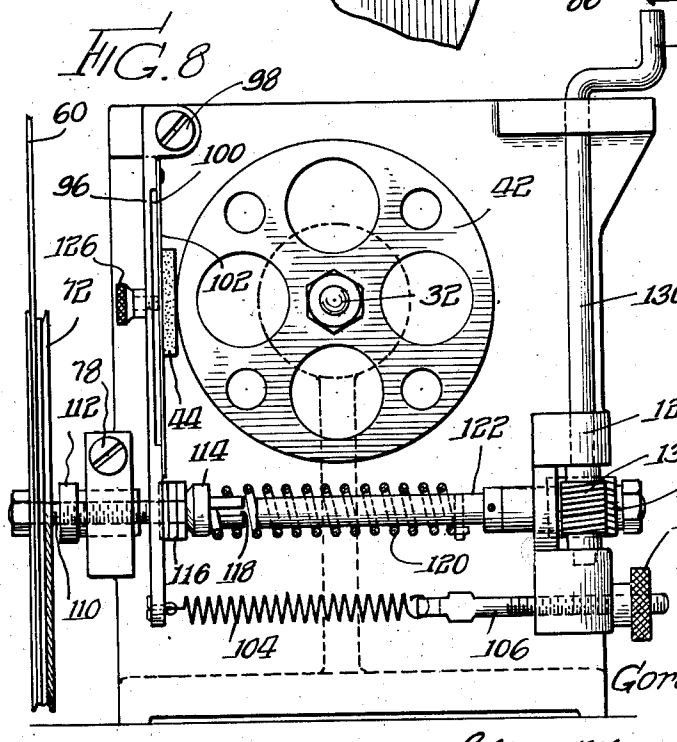
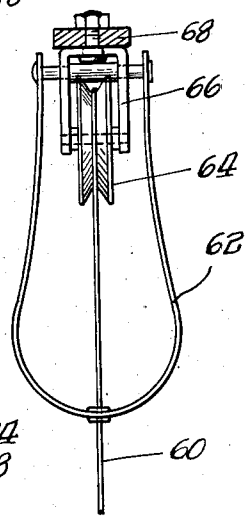


FIG. 7.



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Fig. 9.

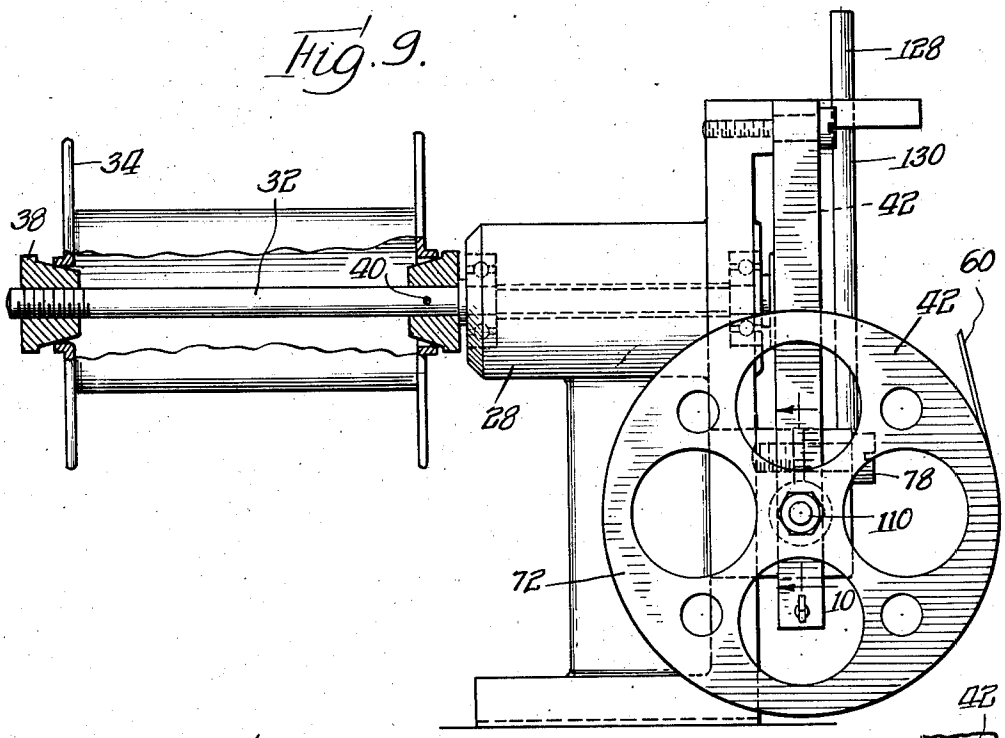


Fig. 11.

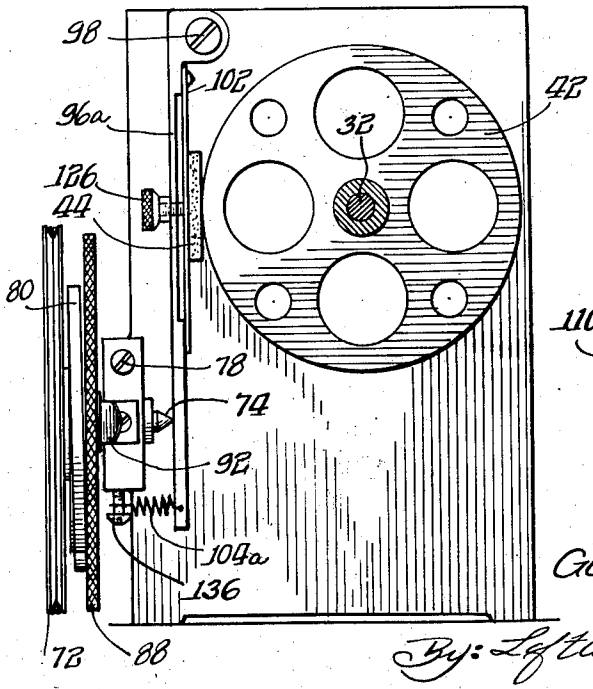
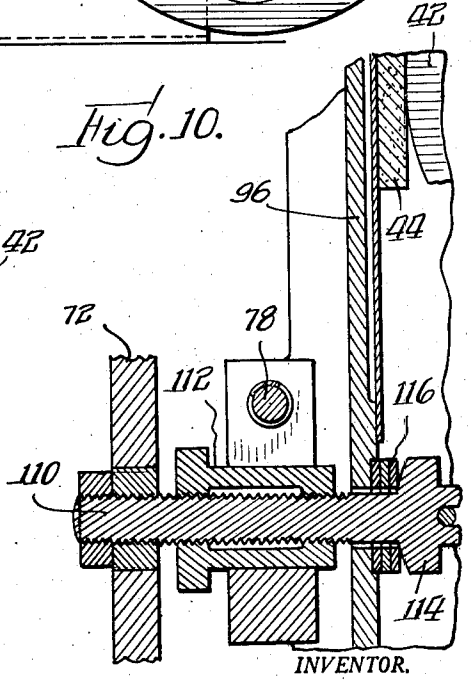


Fig. 10.



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UNITED STATES PATENT OFFICE

2,388,121

TENSION CONTROL DEVICE

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Application October 14, 1943, Serial No. 506,180

16 Claims. (Cl. 242—45)

This invention relates generally to tension control devices and more particularly to tension controls adaptable for use in winding relatively fine wires.

Wire breakage presents a serious problem, particularly in connection with the handling of light gauge stock. Considerable trouble has been experienced in the handling of fine wire such as copper wire, ranging in diameter from .0010 inch to .003 inch. Nichrome wire having a diameter as low as .00085 inch is employed in the manufacture of resistance windings and presents a serious breakage problem. One method heretofore employed in winding operations to reduce the possibility of wire breakage contemplates slow initial winding speeds. Such methods, however, reduce the speed at which the winding operations are completed and do not take into consideration problems incident to the winding of objects which are irregular as distinguished from circular in cross-section. Objects which are, for example, rectangular in cross-section continuously subject the wire to variations in tension due to the introduction of varying peripheral speeds of the surface upon which the wire is wound.

The ideal condition for winding a strand such as wire is to subject the wire to a uniform tension as it is fed from a supply spool to a rotating object. This tension must be such that it will not exceed the breaking point of the wire at any time and yet must be sufficient to insure a firm, close winding of the wire upon the periphery of the part which is being wound.

It is, therefore, an important object of the present invention to provide a tension controlling device which will enable relatively fine wires to be withdrawn from supply spools and wound on rotating objects at substantially uniform tension without breakage.

It is a further object of the present invention to provide a tension controlling device as set forth above which will enable sudden high speed starting of the object to be wound without subjecting the wire to excessive tension, thereby reducing wire breakage to a minimum.

Still another object of the present invention is to provide a tension control arrangement which will enable winding wire upon the periphery of irregularly shaped objects at uniform tension.

More specifically, the present invention contemplates a control device which automatically controls the supply spool so that when wire is initially withdrawn therefrom the spool is free to rotate in an unwinding direction and after the inertia of the spool has been overcome a sensitively controlled braking action positively prevents overrunning of the spool and cooperates to maintain uniform tension in the wire as it is wound upon the rotating work piece.

In addition, the present invention contemplates a novel floating guide arrangement interposed between the supply spool and the rotating work piece which serves to materially reduce the tension to which the wire must be subjected in order to withdraw it from the supply spool.

The present invention contemplates the provision of braking means in combinatidn with the aforesaid floating guide or pulley, the effectiveness of said brake means being controlled in accordance with the position occupied by said guide.

The foregoing and other objects and advantages will be more apparent from the following detail description when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of a tension control device embodying the present invention, said device being shown in operative association with a rotatable work piece to which the wire is being applied;

Fig. 2 is an enlarged transverse sectional view of the supply spool and associated tension control mechanism, said view being taken substantially along the line 2—2 of Fig. 1, a portion of the tension setting wheel being shown in elevation;

Fig. 3 is a transverse sectional view taken substantially along the line 3—3 of Fig. 2;

Fig. 4 is a fragmentary detailed sectional view taken substantially along the line 4—4 of Fig. 2;

Fig. 5 is a horizontal detailed sectional view taken substantially along the line 5—5 of Fig. 2;

Fig. 6 is a sectional view taken substantially along the line 6—6 of Fig. 5, the major portion of the tension setting disc being broken away to disclose parts otherwise hidden;

Fig. 7 is an enlarged elevational view of the resilient bumper for the floating guide pulley;

Fig. 8 is an elevational view of a modified tension control mechanism, said view being taken similarly to the view shown in Fig. 3;

Fig. 9 is a side elevational view of the modified control mechanism as viewed from the left of Fig. 8;

Fig. 10 is a detailed sectional view of the modified control mechanism of Figs. 8 and 9 to more clearly illustrate the structural arrangement of the screw element and parts associated therewith; and

Fig. 11 is a view similar to Fig. 3 disclosing a further modified form wherein the brake arm of

Figs. 8 to 10, inclusive, is associated with the screw mechanism of Figs. 1 to 7, inclusive.

Referring now to the drawings more in detail wherein like numerals have been used to designate similar parts throughout the various figures, it will be seen that one embodiment of the invention illustrated in Figs. 1 to 7, inclusive, comprises a spool supporting and controlling device designated generally by the numeral 20. This device 20 includes a frame structure designated generally by the numeral 22 having a base section 24, an upright or vertical section 26 and a bearing section 28. As clearly illustrated in Fig. 2, the bearing section 28 carries suitably spaced anti-friction bearings 30 for supporting a spindle 32.

The spindle 32 projects beyond the vertical frame section 22 and this projecting portion of the spindle serves to accommodate a spool 34. In Fig. 2 an empty spool 34 is shown partly in section to illustrate the manner in which conical members 36 and 38 serve to maintain the spool concentrically clamped upon the spindle 32. The member 36 is secured to the shaft 32 by a suitable cross pin 40. The member 38 is internally threaded to cooperate with the outer threaded extremity of the spindle 32 in securing the spool as a rotative unit with the spindle. This is merely one form or method of mounting, and is shown for illustrative purposes only and not by way of limitation.

In the disclosed embodiment the conical members 36 and 38 are preferably formed of relatively light material such as Bakelite or other suitable plastic material. The member 36 is formed integral with a disc or brake wheel 42, the periphery of which provides a braking surface which cooperates with a brake shoe 44. This brake shoe 44 is carried intermediate the extremities of a vertically disposed leaf spring member 46, the upper extremity of the spring being secured to an arm 48 projecting beyond and secured to the upper extremity of the frame section 22 by means of a screw 50. The functioning of the brake shoe 44 is controlled by a mechanism about to be described but before describing said control mechanism it is well to note that wire to be unwound from the spool 34 is directed upwardly around a pulley 52 and thence downwardly to the work piece 54 which is rotated by an electric motor 56.

The pulley 52 is freely rotatable within a yoke 58 which is suspended from a flexible element 60. This flexible element 60 extends upwardly from the yoke 58 through a resilient buffer or bumper member 62 and thence over a pulley 64 rotatably supported by an inverted U-shaped member 66. This U-shaped member 66 serves as a pivotal support for the bumper 62 and is secured to the free extremity of a horizontal arm 68. This arm 68 is carried by the upper extremity of a vertical support rod 70 and is adjustably secured thereto by a clamping or set screw 71. The rod 70 extends upwardly from and is secured to the base section 24 of the frame 20.

It will be apparent from the foregoing that the wire 34a from the spool 34 is withdrawn from the spool due to the rotation of the work piece 54. The tension thus established in the wire will have a tendency to urge the pulley 52 downwardly. Any downward movement of the pulley 52 will cause the flexible element 60 to be pulled upwardly from a wheel or tension control member 72.

This wheel or disc member 72 is peripherally grooved so as to receive several turns of the flexible element 60, as clearly illustrated in Fig. 4, the extremity of the flexible element being suitably secured to the control wheel as indicated in Fig. 4. The control wheel 72 is secured to and rotatable with a spindle or micrometer screw 74, which spindle is rotatably supported within a bushing 76. This bushing 76 is secured against rotation upon the frame 20 by a split bearing construction clearly illustrated in Figs. 4 to 6, inclusive. By tightening a screw 78 the bushing is firmly clamped in position against rotation and axial displacement. Particular attention is directed to the fact that the right extremity of the spindle 74 as viewed in Fig. 4 is threaded and this threaded portion rotates within a complementary threaded section of the bushing 76. Hence rotation experienced by the control wheel 72 and consequently by the spindle or screw 74 causes said shaft or spindle to experience longitudinal movement. Rotation of the control wheel 72 in a counterclockwise direction, as viewed in Fig. 1, resulting from the upward movement of the portion of the flexible member 60 extending between the wheel 72 and the pulley 64, will cause the spindle or screw 74 to experience axial movement to the left as viewed in Fig. 4. The outer extremity of the spindle or screw 74 is conical so as to make a point contact with the lower extremity of the leaf spring 46. Thus, movement of the screw member to the left releases the pressure against the leaf spring and consequently relieves the braking action of the shoe against the periphery of the disc 42. Movement to the right of the screw 74 serves to urge the spring 46 to the right and thereby increases the braking action of the brake shoe 44 against the periphery of the brake wheel 42.

The screw 74 is constantly urged rotatably in a clockwise direction as viewed from the left of Figs. 3 and 4 by a clock spring 80. The inner extremity of the spring 80 is coupled with a drum 82 which is secured to the control disc 72 in any suitable manner as by means of rivets 84, as shown in Fig. 4. The opposite or outer extremity of the clock or spiral spring 80 is secured to a pin 86, which pin is carried by an adjusting plate or disc 88. This plate or disc 88 is rotatably mounted upon the bushing 76 and is secured against rotary movement by a locking pin 90 carried at the outer extremity of a resilient arm extending outwardly from the split bearing structure of the frame 20. By flexing the arm 92 so as to withdraw the pin 90 from registration with a companion aperture 94, the disc 88 may be rotated so as to impart greater or less tension to the clock spring 80.

From the foregoing it will be understood that when the pull exerted by the wire which is being withdrawn from the spool 34 causes the flexible element 60 to be unwound from the control wheel 72, the rotation of the wheel 72 is opposed by the clock spring 80. Likewise, when the tension of the wire 34a lessens and results in upward movement of the pulley 52 and consequent tendency for the flexible element 60 to slacken, the spring 80 functions to automatically take up the slack and simultaneously increase the braking action on the brake wheel 42.

A clearer understanding of the functioning of the above described control mechanism may be had by considering the action which takes place when the motor 56 is initially started to cause the winding of the wire 34a on the work piece 54. Assume that the free end of the wire 34a is brought into contact with the periphery of the

work piece 54 prior to the starting of the motor 56. The motor is now suddenly activated, thereby causing a very sudden pull on the wire 34a. The sudden pulling of the wire 34a causes a sudden or instantaneous rotation of the control wheel or disc 72 in a counterclockwise direction, as viewed in Fig. 1 and as viewed from the left of Figs. 3 and 4, thereby retracting the screw 74 and consequentlly relieving the braking action of the shoe 44. Thus, the sudden shock resulting from the fast starting of the motor is taken up in the downward movement of the pulley 52 and the rotary movement of the control wheel 72 against the action of the clock spring 80. By the time this shock resulting from the sudden starting of the winding motor is taken up the braking action upon the spool 34 has been released and the wire begins to unwind from the spool. Any slackening in the tension of the wire 34a during the winding operation results in an upward movement of the pulley 52 and in the consequent rotation of the wheel 72 in a clockwise direction due to the take-up action of the clock spring 80. This results in slightly increasing the braking effect upon the wheel 42, thereby positively preventing overrunning of the supply spool 34. Thus, throughout the entire coiling operation the braking action upon the rotating spool is so controlled that uniform tension of the wire 34a is constantly maintained and at no time is the wire subjected to a tension which exceeds its tensile strength and at no time is the supply spool permitted to overrun. In other words, the present invention contemplates a brake means as described which is operable in accordance with the pull exerted upon the wire by the rotating work piece. When the pull exerted upon the wire has a tendency to exceed a predetermined tension the braking action is automatically relieved and when the pull exerted upon the wire has a tendency to lessen, the braking action automatically increases in such a manner as to maintain uniformity or balance in tension.

The control may be so adjusted as to prevent the wire or strand from exceeding its elastic limit although in some instances it has been found possible and desirable to permit a uniform amount of wire elongation without exceeding the yield point.

The above described tension control mechanism also functions efficiently in instances where variation in tension of the withdrawn wire might result from the winding of an irregularly shaped work piece. In instances where the work piece is circular in cross-section, the peripheral speed of the work surface is constant but in instances where the work piece is, for example, rectangular in cross-section, the peripheral speed of a point located on the narrow surface of the work is considerably greater than the peripheral speed of a point on the wide surface of the work. In winding such an object the variation in peripheral speeds has a tendency to exert proportional variations in pull upon the wire and when the wire is of a relatively small gauge these variations are often sufficient to cause breakage. By employing the control device previously described, variations in peripheral speed will not impart proportional variations in tension or pull upon the wire. This is due to the fact that when the portion of the work having the greater peripheral speed is pulling on the wire the control wheel 72 functions to relieve the braking action just enough to counteract any tendency for increase in the tension of the wire. Likewise, as the wire or strand is being wound upon the surface having lower peripheral speed, any tendency for the wire to slacken is counteracted by automatic increasing of the braking action upon the spool due to the follow-up action of the clock spring 80.

It will be apparent that the pulley 52 and its supporting yoke 58 move with great rapidity in response to the pulling action of the wire 34a and the consequent rotation experienced by the control disc 72. If the yoke 58 was suddenly brought into engagement with a fixed abutment such as the U-shaped member 66 (Fig. 1), it would have a tendency to dislodge the wire 34a from the pulley 52 and would also subject the parts to very severe operating conditions. To avoid clashing of the yoke 58 with a fixed abutment, the resilient bumper 62 in the form of a U-shaped spring member is employed. The flexible element 60 passes through an aperture provided in the center of the spring 62. The bumper 62 is pivotally supported upon the U-shaped bracket member 66 and thus enables the flexible element 60 to assume various degrees of angular displacement to the vertical. Thus, when the wire 34a is being withdrawn from the far end of the spool, as shown in Fig. 1, the portion of the flexible element 60 extending between the pulley 64 and the pulley 62 approximates the vertical, whereas when the wire from the spool 34 is being withdrawn from the near or outer end of the spool the flexible element 60 would be inclined to the vertical.

The bumper 62 also serves as an effective means for retaining the flexible element 60 in the groove of the pulley or sheave 64, as well as an efficient shock absorber for the pulley 52.

A slightly modified form of tension controlling device is shown in Fig. 8. The device of Fig. 8 differs principally in the form of take-up spring which functions in cooperation with the control disc 72 and in the structural details of the brake arm. It will be noted that the device shown in Fig. 8 incorporates a brake arm 96 which is non-resilient, as compared with the resilient leaf spring arm 46 previously described. The arm 96 is pivotally mounted at 98 and is formed with a longitudinally extending recess 100. Extending over this recess 100 and secured at its upper extremity only to the arm 96 is a leaf spring 102. This leaf spring 102 carries the brake arm 44. The lower extremity of the arm 96 is secured to one end of a coiled spring 104, the opposite extremity of this coiled spring being secured to an adjustable screw member 106. Adjustment of the screw member 106 is obtained by rotating the knurled nut 108. The spring 104 cooperates with the leaf spring 102 in causing the brake shoe 44 to bear resiliently against the periphery of the disc 42. The disc 42 is secured to and rotatable with the spool supporting spindle 32, Figs. 8 and 9.

The control wheel 72 of Fig. 8 is secured to a screw 110 which rotates in a bushing 112 in the same manner as the screw 74 is rotatable within the bushing 76 previously described. The bushing 112, like the bushing 76, is secured against rotation within the frame by means of the clamping screw 78. The inner extremity of the screw 110 passes through a recess in the arm 96 and is formed with an enlargement or head 114. Interposed between the head 114 and the brake arm 96 is a ball thrust bearing 116. Extending inwardly from the head 114 is a reduced section provided with an axially extending recess 118. One ex-

tremity of a coiled spring 120 is secured within the recess 118 and the opposite extremity of the coiled spring 120 is secured to a shaft 122. This shaft 122 is rotatably mounted in a bearing section 124, Fig. 8. The shaft 122 is coaxial with and terminates just short of the inner extremity of the screw member 110 and serves as a support for the coiled spring 120.

The coiled spring 120 like the clock or spiral spring 80 previously described serves to continuously urge the disc 72 in a clockwise direction as viewed in Fig. 9. In other words, any tendency for the wheel 72 to be rotated in a counterclockwise direction is opposed by the coiled spring 120. Rotation of the disc 72 in a counterclockwise direction as viewed in Fig. 9 causes the screw 110 and consequently the head 114 formed integral therewith to move to the left (Fig. 8), thereby swinging the brake arm 96 to the left, so as to reduce the braking effectiveness of the shoe 44 upon the periphery of the brake wheel 42. The control mechanism of Figs. 8 and 9 distinguishes from that disclosed in previously described figures in that when the screw member 110 moves inwardly it is not moved against the brake arm as is the screw member 74 (see Fig. 4) but in fact the head 114 is moved so as to permit the coiled spring 104 to act upon the arm 96 and thereby increase the braking action of the shoe 44. It will be noted that an adjustable screw member 126 is associated with the arm 96 and serves to control the degree of flexure of the leaf spring 102. In some instances, depending upon the sensitivity of control desired, the screw may be so positioned as to provide some space between the inner extremity of the screw and the adjacent surface of the leaf spring. Under such circumstances positive braking action of the shoe 44 does not take place until the leaf spring 102 has been flexed into engagement with the inner extremity of the screw or abutment 126. By adjusting the position of the screw 126 and the position of the screw 106, the braking action of the shoe 44 may be very sensitively controlled to meet the needs incident to its use. The tension of the take-up coiled spring 120 may be adjusted by rotating a handle 128 of a vertically disposed adjusting rod 130. The lower end of this rod 130 carries a worm 132 which meshes with a companion worm wheel 134 coupled with the shaft 122. Thus, the force or tension of the coiled spring 120 may be controlled by adjusting the vertical shaft 130, whereas the adjustment of the tension in the previously described clock spring 80 is obtained by disengaging the pin 90 from the disc 88 and moving the disc 88 until one of the other apertures 94 is brought into registration with the retracted pin 90.

A detailed description of the functioning of the control mechanism shown in Figs. 8 to 10, inclusive, in combination with the fixed pulley 64 and floating pulley 52 is not believed necessary. It will suffice to state that when the control mechanism of Figs. 8 to 10, inclusive, is employed, downward movement of the pulley 52 causes counterclockwise rotation of the control disc 72 as viewed in Fig. 9 and from the left of Fig. 8, thereby causing the screw 110 to rotate in a manner which relieves the braking action upon the brake wheel 42. The upward movement of the floating pulley 52 permits the coiled spring 120 to rotate the screw 110 so as to move the head 114 to the right, Fig. 8, thereby enabling the coiled spring 104 to act on the brake arm 96 so as to increase the braking action of the shoe 44 on the disc 42.

A still further modification is disclosed in Fig. 11 wherein the control mechanism of Figs. 1 to 7, inclusive, incorporates the brake arm 96 of Fig. 8. In Fig. 8 the coiled spring 104 functions to increase the braking action of the shoe 44 whereas in Fig. 11 a coiled spring 104a continuously urges the arm 96a to the left so as to maintain contact between said arm and the screw 74. The arm 96a is recessed similarly to the arm 96 and also employs the leaf spring 102 which carries the brake shoe 44. The adjustable abutment screw 126 may also be carried by the arm 96a to control the degree of flexure experienced by the spring 102. In all other respects the control mechanism shown in Fig. 11 is structurally identical with that disclosed in Figs. 1 to 7, inclusive.

From the foregoing it will be apparent that this invention contemplates an improved, efficiently operable means for controlling the tension in strands such as wire, thread and the like during the withdrawal thereof from a supply spool. The micrometer adjustment screw in association with the take-up spring, floating pulley, et cetera, provides a cushioning action which precludes the possibility of excessive tension in the strand as it is being withdrawn from the spool. As previously pointed out, excessive tension normally experienced in conventional mechanisms for withdrawing wire from spools is positively avoided. In devices constructed in accordance with the present invention which have been in successful commercial use, a take-up of as much as 36 inches of wire has been obtained at the start of the winding operation, thereby preventing the wire from being subjected to excessive tension conditions. By employing the floating pulley 52 the aforesaid take-up of 36 inches is accomplished by subjecting said pulley to vertical displacement of only 18 inches. The arm 68 may be positioned along the vertical rod 70 in an adjusted position prior to the starting of the unwinding operation, thereby affording the pulley 52 greater or less degree of vertical shifting. Also, before winding the work piece, the take-up spring such as the clock spring 80 or the coiled spring 120 may be adjusted to resiliently impart greater or less turning force to its respective control wheel 72. With the view of reducing to a minimum the inertia which must be overcome in moving the floating pulley 52 downwardly as a result of the pulling action of the wire 34a, rotating parts such as the wheel 72, the brake wheel 42, and even the pulleys 52 and 64 are preferably made of light weight material such as Bakelite. By employing the floating pulley 52 over which the wire must pass from the supply spool 34 to the work piece 54, a tackle or pulley block arrangement is presented which reduces to a satisfactory minimum the tension to which the wire 34a must be subjected in order to render the tension control mechanism associated with the control wheel 72 functionally operable. In addition, the sensitivity of the take-up springs 80 and 120 associated with the control wheels coupled with the mechanical advantage afforded by the aforesaid tackle or pulley block arrangement assures balanced, substantially uniform tension conditions which enables very fine wires to be firmly wound upon a work piece without the slightest possibility of breakage. That is to say, despite the smallness in the gauge of the wire, the sensitivity in operation of the control mechanism is such as to maintain a predetermined uniform tension in the wire.

It will also be noted that the floating pulley 52 withdraws the wire from the spool 34 at substantially the same angle at all times. Also the flexi-

ble element 60 is tangentially withdrawn from the wheel 72 at the same radial distance at all times. That is to say, the pull of the flexible element 60 is always exerted at the same point, the same distance from the center of the wheel, and tangentially in the same direction. This materially contributes to the uniformity in function of the tension control device.

It has been previously pointed out that the micrometer mechanism of the brake control means is automatically responsive to variations in the pulling force exerted upon the wire or strand during the withdrawal thereof to correspondingly control the operative effectiveness of the brake means and thus maintain balanced tension conditions. In this connection, it should also be understood that variations in pulling force frequently result from irregularity in the speed of the electric motor which rotates the work piece. The present invention is designed to prevent deleterious increases in wire tension from irregularities in the speed of the motor. The sensitivity of the aforementioned micrometer or screw mechanism, and parts associated therewith, is such that it may be adjusted to permit some or to entirely prevent any elongation in the wire. Wires of extremely small cross section may be subjected to some elongation without breakage providing accurate control of the tension experienced by the wire is maintained in accordance with the teachings of the present invention. The brake means or shoe previously described is preferably maintained in continuous contact with the brake wheel 42. In other words, it is preferable to prevent the brake wheel 42 from running free at any time except at the instant of starting. The construction of the brake arms disclosed herein is such that when increase in braking action is initiated, such action is of a yieldable or cushioning nature due to the fact that the brake shoes are mounted directly upon spring members. In one instance this constitutes the leaf spring 46 and in the other instance the leaf spring 102, each of which is free at one extremity to facilitate the flexing thereof.

The micrometer adjustment or screw mechanism previously described makes it possible to apply substantial braking force although the force available to effect such braking action is relatively small. That is to say, the turning force applied to the control disc 72 in one direction by the pulling of the flexible element 60, and in the other direction by the resilient action of the take-up springs (clock spring 80 or coil spring 120), is of relatively small magnitude as compared with the force of the screw member acting upon the brake arm. Thus, the lesser force available to bring about automatic responsiveness of the control disc to variations in pulling force upon the wire acts through the micrometer adjustment or screw mechanism in making available a greater force for operating the brake means.

Throughout the specification and in the claims reference is made to the present invention as being adaptable for controlling the tension in strands. The term "strand" is used in its broadest sense to include either a single filament, wire, et cetera, or a plurality of filaments, wires, et cetera. In other words, in referring to the invention as a mechanism for controlling the tension in a strand, the term "strand" is used in its generic sense to include wire, thread, or similar materials, either in the form of single or multiple filaments. It should also be noted that the present invention is not limited to the control of tension in strands as they are being applied to the peripheral surface of a rotating object, but is adapted to be employed in any instance where a strand must be withdrawn from a source of supply and as it is withdrawn the tension thereof must be uniformly maintained in order to prevent breakage as well as undesirable stretching or elongation.

While for purposes of illustration certain structural embodiments of the invention have been disclosed herein, it should be understood that the invention is not limited to the specific disclosures and structural details, but is capable of other modifications and changes without departing from the spirit and scope of the appended claims.

The invention is hereby claimed as follows:

1. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a work piece including a free support for a coiled strand, shiftable brake means for governing the force exerted by the strand to withdraw the strand from said support and brake control means including micrometer mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means.

2. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a work piece including a free support for a coiled strand adapted to be rotated in response to the pull experienced by the strand as it is being withdrawn therefrom, shiftable brake means for governing the force required to rotate said support, and brake control means including micrometer mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means.

3. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a work piece including a free support for a coiled strand adapted to be rotated in response to the pull experienced by the strand as it is being withdrawn therefrom, shiftable brake means for governing the force required to rotate said support, and brake control means including rotatable screw mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means.

4. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a work piece including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the strand from said support, brake control means including micrometer mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means, resilient slack take-up means cooperatively associated with said micrometer mechanism, and resilient means interposed between said brake means and said brake control means.

5. Mechanism for controlling the tension in a strand as it is being withdrawn from a source

of supply including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the supported strand, and brake control means including a rotatable screw member for effecting movement of said brake means, said screw member being automatically responsive in rotation to variations in the pulling force above a predetermined value exerted upon the strand during the withdrawal thereof.

6. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the supported strand, brake control means including a micrometer mechanism automatically responsive to variations in pulling force exerted upon the strand during the withdrawal thereof, shiftable strand guiding means, and a flexible element coupling said shiftable strand guiding means with said brake control means whereby variations in pull exerted upon the strand will be transmitted to said brake control means.

7. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the supported strand, brake control means including a rotatable screw member automatically responsive to variations in pulling force exerted upon the strand during the withdrawal thereof, shiftable strand guiding means, and a flexible element coupling said shiftable strand guiding means with said brake control means whereby variations in pull exerted upon the strand will be transmitted to said brake control means.

8. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the supported strand, brake control means automatically responsive to variations in pulling force exerted upon the strand during the withdrawal thereof for effecting movement of said brake means, shiftable strand guiding means, a flexible element coupling said shiftable strand guiding means with said brake control means whereby movement of said shiftable strand guiding means will correspondingly effect said brake control means, a fixed guide means for said flexible element interposed between said shiftable strand guiding means and said brake control means, and means for securing said fixed guide means in various fixed positions with respect to said brake control means.

9. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the supported strand, brake control means including a rotatable wheel member for effecting movement of said brake means, a flexible element operatively associated at one extremity with said rotatable wheel member and adapted to impart rotation to said member when pulled in at least one direction, and strand guiding means coupled with the opposite extremity of said flexible element whereby variations in pull experienced by the strand will be transmitted to said brake control means.

10. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the supported strand, brake control means automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof, said brake control means including a rotary control member, a flexible actuating element having one extremity peripherally associated with said rotary member, a shiftable strand guiding member coupled with the opposite extremity of said flexible element, a guiding member for said flexible element positioned above said rotary member and said strand guiding member, and a bumper means interposed between the guide means for the flexible element and said strand guiding means.

11. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a work piece which may be non-cylindrical including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the strand from said support, flexible brake control means including micrometer mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means, resilient slack take-up means cooperatively associated with said micrometer mechanism, and means for adjusting the tension in said resilient slack take-up means.

12. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a polygonally shaped work piece including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the strand from said support, flexible brake control means including micrometer mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means, and resilient slack take-up means including a spiral spring device cooperatively associated with said micrometer mechanism.

13. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply and applied to a rotating non-cylindrical work piece including a support for a coiled strand, shiftable brake means for governing the force required to withdraw the strand from said support, flexible brake control means including micrometer mechanism cooperatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly control the operative effectiveness of said brake means, and resilient slack take-up means including a coiled spring cooperatively associated with said micrometer mechanism.

14. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply, means adapted to be rotated in response to the withdrawing of the strand, shiftable brake means for governing the force required to cause rotation of said first-mentioned means during the withdrawal of the strand, and flexible brake control means including micrometer mechanism operatively associated with said brake means and automatically responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof to correspondingly

control the operative effectiveness of said brake means.

15. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply, means adapted to be rotated in response to the withdrawing of the strand, brake means operatively associated with said first-mentioned rotatable means for governing the force required to withdraw the strand, said brake means including a brake wheel and a shiftable brake member peripherally associated therewith, brake control means including mechanism automatically responsive to variations in pulling force exerted upon the strand during the withdrawal thereof, said brake control means comprising a rotary wheel member, shiftable strand guiding means, and a flexible element coupling said shiftable strand guiding means with the wheel of said brake control means whereby variations in pull exerted upon said strand will control the operative effectiveness of said shiftable brake arm.

16. Mechanism for controlling the tension in a strand as it is being withdrawn from a source of supply including a support for a coil strand, shiftable brake means for governing the force required to withdraw the supported strand, brake control means responsive to variations in the pulling force exerted upon the strand during the withdrawal thereof, said brake control means including a rotary control member, a flexible actuating element having one extremity operatively associated with said rotary member, a shiftable strand guiding member associated with the opposite extremity of said flexible element, and a bumper means interposed between said shiftable strand guiding member and said rotary control member.

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