July 10, 1951 K. H. ANDREN 2,560,204

AUTOMATIC STRAND FEED REGULATOR

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Fig. 2.

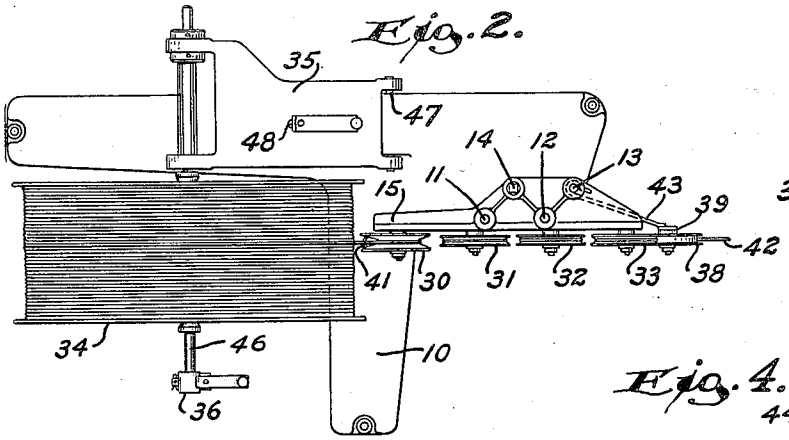


Fig. 4.

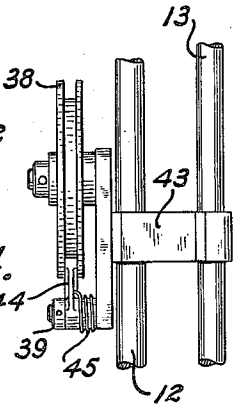


Fig. 1.

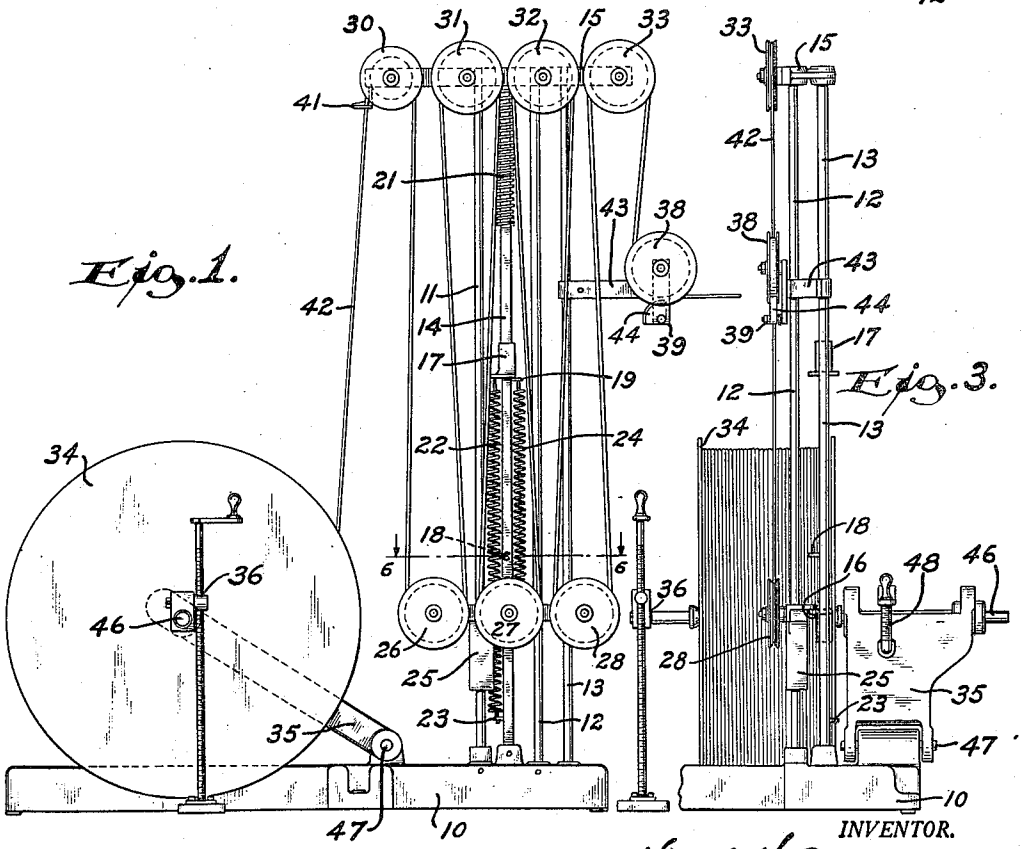


Fig. 3.

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Fig. 6.

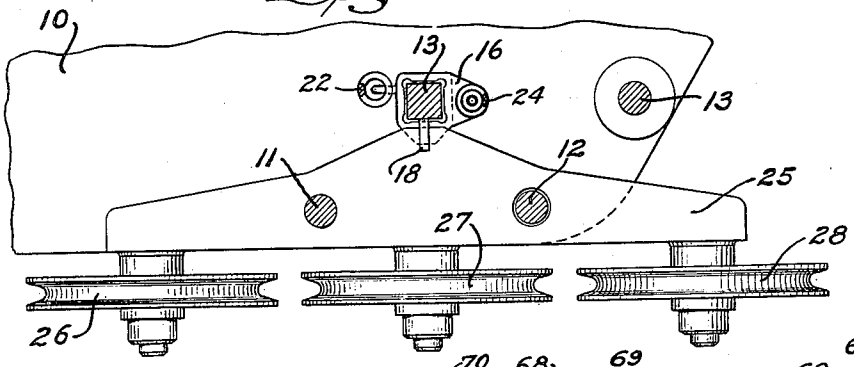
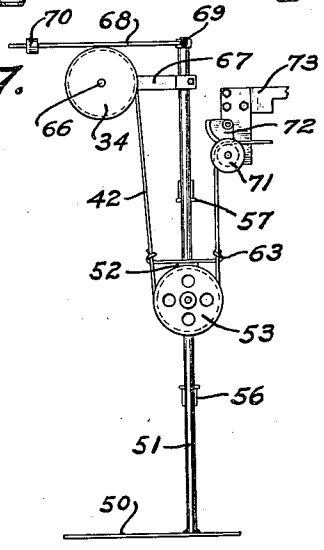


Fig. 7.



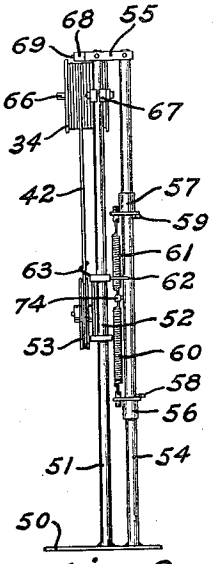


Fig. 8.

Fig. 5.

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UNITED STATES PATENT OFFICE

2,560,204

AUTOMATIC STRAND FEED REGULATOR

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Application June 17, 1947, Serial No. 755,093

8 Claims. (Cl. 242—45)

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This invention relates generally to improvements in the art of transferring strand-like material such as twisted or solid wire, cable, ribbon, tape or the like, from one locality to another; and relates more specifically to improvements in the construction and operation of automatically functioning mechanism for effecting regulated feeding of such materials.

The primary object of the present invention is to provide improved mechanism for regulating the delivery of continuous strand-like material from sources of supply to zones of utilization, while the elongated material is advancing either constantly or intermittently.

It is customary in many industries to withdraw various kinds of strand-like material such as wire, cable, tape or ribbon stock, from rotary supply reels or spools, by the continuous or intermittent draft or pulling action of a cutting, stripping, printing, or other device adapted to sever the stock into successive lengths or to otherwise utilize the material. Considerable difficulty has heretofore been encountered in obtaining uniform feed and proper tensioning of the strand-like stock under varying conditions of operation, especially in connection with the delivery of insulated electrical conductor stock or wire from a freely revolvable supply reel to the rapidly reciprocating feed mechanism of a wire cutting and stripping machine. Since the inertia of the supply reels when fully loaded is far greater than when the supply has been practically depleted, while the intermittent stock withdrawal action of the continuously operating wire utilizing machine remains substantially the same, any tensioning device which is interposed between the source of supply and the machine must necessarily function to automatically and uniformly tension the strand-like stock, and no reliable mechanism for insuring these results has heretofore been available.

It is therefore a more specific object of my present invention to provide an improved automatic strand feed regulator which is simple in construction, reliable and efficient in operation, and flexible in its adaptations.

Another specific object of this invention is to provide an improved wire feeding device which may be utilized as an automatic and effective pre-feeder for delivering wire stock from a rotating reel to various types of stock utilizing equipment, and which will retain its effectiveness regardless of variations in the quantity of stock contained on the supply reel and of varying wire withdrawal conditions.

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A further specific object of the invention is to provide an improved insulated wire pre-feeder especially adapted for use in connection with wire stripping and/or cutting machines, which will maintain uniform and desirable feeding irrespective of the speed or rate of utilization of the wire.

Still another specific object of my invention is to provide improved automatic tensoining mechanism for longitudinally advancing strand-like stock, which will effectively compensate for differences in travel of the stock at the sources of supply and utilization, and which is adapted for diverse applications.

An additional specific object of the present invention is to provide a simple and reliable tensioning assemblage for wire feeds, wherein both gravity and the resilient action of springs are utilized to insure most efficient and automatic tensioning action upon the strand-like stock.

These and other specific objects and advantages of the invention will be apparent from the following detailed description.

A clear conception of the features constituting my present improvement, and of the construction and operation of several typical embodiments thereof, may be had by referring to the drawings accompanying and forming a part of this specification wherein like reference characters designate the same or similar parts in the various views.

Fig. 1 is a front elevation of a multiple loop type of my improved strand feed regulator adapted for relatively heavy duty;

Fig. 2 is a top view of the assemblage shown in Fig. 1;

Fig. 3 is a side elevation of the same mechanism, but with springs omitted;

Fig. 4 is an enlarged view similar to that of Fig. 3, but showing only the delivery wire retarder;

Fig. 5 is a rear elevation of the feed regulator shown in Figs. 1, 2 and 3;

Fig. 6 is an enlarged transverse section through the mechanism, taken along the line 6—6 of Fig. 1;

Fig. 7 is a front elevation of a single loop type of the improved strand feed regulator adapted for lighter use; and

Fig. 8 is a side view of the assemblage of Fig. 7.

While the invention has been shown and described herein as being advantageously applicable to insulated wire feed regulators associated with cutting and stripping machines, it is not my desire or intention to unnecesarily limit the utility of the improvement by virtue of this re-

stricted embodiment, and the term "strand-like" as used herein is intended to include any elongated or continuous relatively flexible stock.

Referring to Figs. 1 to 6 inclusive of the drawings, the multiple loop wire feed regulator shown therein, comprises in general a main support or base 10 having three upright cylindical rods 11, 12, 13 and an upright square post 14 firmly secured thereto and rigidly interconnected at their upper ends by a transverse stationary plate or bracket 15; lower and upper slides 16, 17 movably embracing the post 14 and being engageable respectively with fixed stops or pins 18, 19 secured to this post; a helical compression spring 21 surrounding the upper portion of the post 14 above the upper slide 17 and being suspended from the fixed bracket 15; a helical tension spring 22 connecting the upper slide 17 with a fixed stop or pin 23 secured to the lower portion of the post 14; a shorter helical tension spring 24 connecting the lower slide with the upper stop pin 19; a vertically movable bracket or transverse member 25 slidably engaging the cylindrical rod 11 and normally resting by gravity upon a laterally projecting integral ledge of the lower slide 16, the member 25 also being guided for translatory movement by the rod 12; a series of three sheaves 26, 27, 28 movable with and journalled for rotation about parallel axes upon the bracket member 25; another series of four sheaves 30, 31, 32, 33 journalled for rotation about parallel axes upon the fixed upper bracket 15; a wire supply reel 34 rotatably supported at one end upon the base 10 by a lever 35, and being provided at its opposite overhanging end with a weight relieving jack 36; and a wire delivery sheave 38 adjustably mounted upon the cylindrical rod 13 and having a wire retarder 39 associated therewith.

The main base 10 is preferably of relatively heavy and sturdy construction, and is of T-shaped formation as shown in Figs. 1 and 2 in order to provide for three-point contact and attachment to a floor or other suitable support, while permitting mounting of stock supply reels 34 of different diameters thereon. The parallel upright rods 11, 12, 13 and the post 14 may be rigidly but detachably secured at their lower extremities to bosses formed on the base 10, and the bracket 15 should be likewise secured to the upper extremities of the rods and post in any suitable manner, thereby providing a sturdy support for the various slides, springs and sheaves. The slides 16, 17 should be freely movable along the square post 14, and this post is formed square or otherwise polygonal in cross-section in order to prevent the slides from rotating about the post axis. The lower slide 16 is adapted to be engaged by the lower sheave carrying member 25 and is movable by this member and by the action of the spring 24, between the limits defined by the stop pins 18, 23 carried by the post 14; and the upper slide 17 is adapted to be moved by the member 25 between the limits defined by the upper stop pin 19 and the lower end of the compression spring 21, while its upward motion is restrained and retarded by the springs 21, 22, see Figs. 1 and 5.

The vertically movable bracket member 25 has an elongated depending hub bored for snug sliding engagement with the cylindrical upright rod 11, and is prevented from rotating about the axis of this rod 11 by virtue of its guiding coaction with the cylindrical rod 12, as clearly shown in Figs. 1, 2, 5 and 6. The lower sheaves 26, 27, 28 are journalled for rotation about parallel stub shafts secured to the bracket member 15, and the upper sheaves 30, 31, 32, 33 are likewise journalled for rotation about parallel stub shafts carried by the upper fixed bracket 15, while all of these sheaves have peripheral wire guiding grooves disposed in a common vertical plane. The initial wire receiving sheave 30 which is disposed nearest to the supply reel 34, has a wider peripheral groove than the others and is also provided with a wire guiding loop 41 as indicated in Figs. 1 and 2, for properly conducting the continuous wire 42 from the reel 34 to the tensioning mechanism. The final wire delivery reel 38 is journalled for rotation upon an arm 43 which is adjustably secured to the fixed cylindrical rod 13, so that this sheave 38 may be adjusted vertically or swung horizontally about the axis of this rod 13 in order to insure proper delivery of the wire 42 from the sheave 33 to the wire utilizing machine.

It is to be noted that the mounting of all of the sheaves on stub shafts pointing in the same direction away from their carrying elements, and the disposition of these sheaves in a common plane, combined with the spacing of the adjacent sheaves as shown, permits the wire 42 to be quickly and conveniently strung upon the successive sheave grooves in loop formation, and ready removal of a wire 42 may be effected by merely pulling on an end thereof. The wire retarder 39 which coacts with the final discharge sheave 38 is also suspended from the adjustable supporting arm 43 of this sheave, and comprises a pivotally mounted cam 44 urged toward the bottom of the peripheral wire guiding groove of the sheave 38 by a torsion spring 45, so as to frictionally engage the advancing wire 42 while travelling forwardly and to clamp the wire and to thereby prevent reverse motion thereof, see Figs. 1, 3 and 4. This cam 44 does not clamp the wire 42 sufficiently to prevent its withdrawal from the tensioning mechanism, but merely prevents reverse travel and retards the forwardly advancing wire sufficiently to maintain the outgoing strand taut at all times.

The wire supply reel 34 has the insulated wire 42 wound uniformly thereon as indicated in Fig. 2, and this reel is mounted for rotation upon a horizontal shaft 46 which is carried by the swinging end of the lever 35. The opposite end of the lever 35 is mounted upon a pivot pin 47 coacting with a lug formed integral with the main base 10; and the medial portion of this lever is provided with a jack screw 48 as shown in Figs. 2 and 5, for varying the angularity of the lever 35 so as to accommodate reels 34 of different diameters. Reels 34 of various capacities and diameters may thus be applied to the lever 35 and properly positioned to cooperate most effectively with the initial sheave 30 of the series; and in cases where the supply reel 34 is relatively heavy and bulky, a jack 36 may be applied to the outer overhanging end of the reel supporting shaft 46 as depicted in Figs. 1 and 2. The jack screw 48 and the jack 36 are independently adjustable but may be caused to cooperate so as to properly aline the shaft 46 and to insure relatively free rotation of the reels 34 applied to this shaft, and proper cooperation of these reels with the initial sheave 30.

When the heavy duty tensioning unit shown in Figs. 1 to 6 inclusive has been constructed and assembled as above described, with a reel 34 applied to the shaft 46 and the outlet end of the wire 42 connected to the wire utilizing machine, fresh wire stock may be withdrawn either con-

tinuously or intermittently from the reel 34 through the tensioning mechanism. During this withdrawal of wire 42 past the delivery sheave 38, the movable member 25 will normally float, that is, it will rise and drop by gravity between the slides 16, 17, thereby shortening or lengthening the wire loops formed by the lower and upper sheaves, and maintaining the wire 42 in taut condition. When the delivery end of the wire 42 is subjected to a sudden pull, the wire loops of the tensioning device will be shortened until the rotation of the reel 34 has been speeded up sufficiently to compensate for such sudden pull on the wire; and when the pull on the delivery end of the wire 42 is suddenly relaxed the inertia of the reel 34 will cause it to continue its rotation, thereby lengthening the loops sufficiently to compensate for the added wire stock fed into the tensioning mechanism.

If the pull or the relaxation at the delivery end of the wire 42 should become excessive or continue for a prolonged period of time, the range of gravity travel of the bracket member 25 and of the movable sheaves 26, 27, 28 carried thereby, may exceed the distance between the slides 16, 17 while the lower slide 16 is engaging the pin 18 and the upper slide 17 is contacting the upper pin 19. When the pull on the wire 42 thus becomes excessive or abnormal, the bracket member 25 will lift the upper slide 17 away from the pin 19 thus initially stretching the tension spring 22 and eventually engaging the lower end of the compression spring 21. The stretching of the spring 22 assists gravity acting upon the member 25 and on the elements carried thereby, in counteracting or balancing the excess pull; and when the compression spring 21 is brought into action, the excess pull on the wire is further resisted and balanced. In case of sudden or abnormal relaxation of the pull while the heavy reel 34 is revolving at relatively high speed, sufficient to cause the loops to elongate to such extent that the lower limit of mere gravity travel of the member 25 is exhausted, then the bracket member 25 will engage the lower slide 16 and the weight of the bracket and elements carried thereby will be lessened by the tension spring 24 to absorb or balance the abnormal relaxation or supply of excess stock. The improved unit thus automatically functions to counter-balance variations in either the pull or the relaxation exerted on the advancing wire 42, regardless of the degree of such variations.

It may sometimes be desirable to apply a braking effect to the supply reel in order to retard overrunning thereof, and while the heavy duty unit of Figs. 1 to 6 inclusive will effectively meet most operating conditions, the same automatic tensioning principle may also be applied to smaller units adapted for lighter work. Such a reel brake and simplified light duty tensioning device is illustrated in Figs. 7 and 8 wherein only one upright cylindrical rod 51 and an upright post 54 are utilized. The rod 51 and post 54 are disposed parallel to each other and have their lower ends rigidly attached to a base 50, while their upper extremities are firmly but detachably secured to an upper bracket 55. A movable bracket member 52 having a sheave 53 journalled for rotation thereon, slidably coacts with the cylindrical rod 51, and lower and upper slides 56, 57 likewise slidably coact with the post 54 and normally coact with lower and upper pins 58, 59 respectively, secured to this post. The slides 56, 57 are normally urged toward each other and

against the adjacent stop pins 58, 59 by means of alined lower and upper tension springs 60, 61, and the movable member which normally floats between the slides 56, 57 has an integral ledge 62 adapted to engage these slides and to move the same away from their respective stops. The adjacent ends of the tension springs 60, 61 are attached to a common pin 74 secured to the post 54, and the cross-section of the latter may be either circular or polygonal. The opposite legs of the single loop of wire 42 coacting with the sheave 53 are loosely embraced by a guide element 63 which is secured to the bracket member 52, and this guide element properly conducts the wire 42 to and from the tensioning sheave.

The wire supply reel of this simplified modification is journalled for free rotation on a shaft 66 carried by an arm 67 adjustably but normally fixedly secured to the rod 51, and a lever 68 which is swingably attached to the upper stationary bracket 55 by a pivot pin 69, bears against the periphery of the wire supply reel 34 and has a weight 70 adjustable therealong. This lever 68 and weight 70, serve to frictionally retard free rotation of the supply reel, and such a retarding device may also be readily applied to the heavy duty unit in an obvious manner. The weight 70 is adjustable along the lever 68 so as to vary the braking effect, and may be locked in adjustable position in any suitable manner. The modified assemblage is also provided with a wire delivery sheave 71 having a wire retarding cam 72 coacting therewith, and these delivery elements may be mounted upon the frame 73 of the wire utilizing machine, or otherwise supported so as to cause the wire 42 to be properly conducted from the movable sheave 53 to the place of utilization.

During normal operation of the modified strand tensioning unit, the bracket member 52 which is slidable along the rod 51 is normally freely movable within the limits defined by the slides 56, 57 while coacting with the stop pins 58, 59, and tensions the single loop of wire 42 by gravity alone. However, if the pull on the wire delivered from the sheave 71 becomes excessive and abnormally prolonged or rapid, the member 52 and the sheave 53 will be elevated sufficiently to cause the ledge 62 to engage the upper slide 57 and to move the latter away from the stop pin 59, thereby causing the upper tension spring 61 to stretch and to aid gravity in balancing the excess pull. If the revolving wire supply reel should pick up excessive speed, or if the pull at the delivery end of the wire 42 is suddenly or abnormally diminished, the member 52 and its sheave 53 may drop sufficiently to cause the ledge 62 to engage the lower slide 56 and to move this slide away from its stop pin 58, thereby stretching the lower tension spring 60 and causing this spring to diminish the wire tension and cause the supply reel to slow down. The modified device thus also functions to automatically properly tension the wire 42, and with the braking effect afforded by the lever 68 and weight 70, definitely regulates the speed and the starting and stopping of the wire supply reel 34.

It is to be noted that in both assemblages illustrated, the aggregate weight of the movable sheaves and their carrying member, modified by the springs as conditions require, provide variable tension in the wire 42 which causes turning of the reel 34 to overcome variable resistance, or to pay out wire so as to meet varying speed demand. The reaction to this tension, is supplied by the wire utilizing device while pulling on the wire, or by the reverse motion preventing cam when the

demand for wire has momentarily ceased or has permanently stopped, and the motive power is thus furnished by the wire utilizer. The weight induced pull on the wire may be automatically augmented by one of the springs as for instance the spring **22**, and eventually also by a spring **21**, or this pull may be gradually diminished toward zero by another spring as by the spring **24**, depending upon the demand. In this manner the normal pull required to rotate the reel **34** will remain constant and this reel will turn uniformly while the wire utilizing device removes wire either constantly or intermittently, and minor variation in the resistance to withdrawal of wire from the supply reel will merely reflect itself in similar variations in the amount of wire stored, but a considerable length of wire will always remain in the festoon or loops coacting with the sheaves.

However, if the resistance to withdrawal of wire from the reel **34** increases due to irregular or improper winding, or for any other reason, or if the wire utilizing device speeds up and demands more wire, then the spring **22** will be gradually brought into action and the pull on the wire **42** will gradually increase so as to overcome the increased resistance or to cause faster paying out of wire, and the wire utilizer will in the meantime draw some of the stored wire until equilibrium is restored. If on the other hand the resistance to paying out is reduced to less than normal, or if the demand for wire ceases or is momentarily checked, then the spring **24** will gradually pull excess wire from the reel **34** into the festoon of loops, and when the demand ceases the reel will ultimately stop. When the wire utilizing device again starts after complete stoppage, it will draw wire first from the over supplied festoons before rotating the reel, thus gradually and gently applying a uniform tension or pull on the wire and subsequently gradually revolving the supply reel, and the latter will thus be gently started, accelerated, decelerated, and stopped. This functioning applies to both type of the improved reel pay out units, and the multiple loop device merely provides for greater storage of wire in the festoon.

From the foregoing detailed description of the construction and operation of the tensioning mechanism, it will be apparent that my present invention provides a simple but reliable unit adapted to automatically maintain proper tautness in the advancing wire **42** under varying conditions of supply and delivery of the stock. In each of the embodiments disclosed, the wire under normal conditions is properly tensioned merely by gravity acting upon the lower sheave carrying member or movable weight which is rollably suspended in the bottom of each depending loop; and in each case excessive or abnormal pull or push on the elongated stock is effectively compensated for by the action of resilient means such as a spring working in conjunction with the gravity action. While the single loop unit of Figs. 7 and 8 is well adapted to meet a considerable range of applications, the multiple loop device will take care of greater variations in operating conditions since a pull of considerable magnitude applied to the delivery end of the wire **42** will result in far less travel of the movable member **25**, than a pull of the same magnitude would produce when applied to the single sheave carriage or member **52**. The multiple loop tensioning mechanism therefore has a wider range of application than the single loop device, and the improved reel brake shown in Figs. 7 and 8 may be readily applied to both embodiments of the invention. The mechanism is obviously constructed to permit rapid application of the wire loops to the sheaves, and all parts thereof may be easily adjusted, assembled or dismantled; and the resiliently restrained upper and lower stops afforded by the slides, definitely limit the free rise and fall of the weighted tensioning sheaves. The improved jack **36** also facilitates adjustment and supporting of heavily laden reels **34**, and various kinds of wire **42** or other strand-like stock may be conveniently applied to the tensioner. The improved mechanism has gone into successful commercial use as applied to insulated wire tensioners for cutting and stripping machines, but is more generally applicable to diverse other equipment involving similar conditions of operation.

It should be understood that it is not desired to limit this invention to the exact details of construction or to the precise mode or method of operation, herein shown and described, for various modifications within the scope of the appended claims may occur to persons skilled in the art; and it is also intended that specific descriptive terms employed herein be given the broadest possible interpretation consistent with the disclosure.

I claim:

1. In an automatic strand tensioner, a series of spaced strand guiding sheaves coacting with successive portions of advancing stock to produce a succession of depending loops between the sheaves, a series of interconnected vertically movable sheaves rollably suspended in the bottoms of said loops, upper and lower vertically movable slides normally defining the limits of free upward movement of said movable sheave series, a fixed stop for limiting the downward movement of each slide, and independent springs coacting with said upper and lower slides to resiliently restrain the movement thereof by said movable sheave series.

2. In an automatic strand tensioner, a base having an upright rod and an upright post, strand guiding sheaves supported from said base and producing a loop depending from said sheaves adjacent to said rod, a vertically movable sheave slidable along said rod and resting in the bottom of said loop, upper and lower slides movable along said post and coacting with said movable sheave to limit the free upward movement thereof, and a fixed stop coacting with each of said slides for limiting the downward movement thereof.

3. In an automatic strand tensioner, a base having an upright rod and an upright post, strand guiding sheaves supported from said base and producing a loop depending from said sheaves adjacent to said rod, a vertically movable sheave slidable along said rod and resting in the bottom of said loop, upper and lower slides movable along said post and coacting with said movable sheave to limit the free upward movement thereof, and a fixed stop carried by said post beneath each of said slides for limiting the downward movement thereof.

4. In an automatic strand tensioner, a base having an upright rod and an upright post, strand guiding sheaves supported from said base and producing a loop depending from said sheaves adjacent to said rod, a vertically movable sheave slidable along said rod and resting in the bottom of said loop, upper and lower slides

movable along said post and coacting with said movable sheave to limit the free upward movement thereof, a fixed stop coacting with each of said slides for limiting the downward movement thereof, and independent springs coacting with said upper and lower slides to resiliently restrain the movement of the slides by said movable sheaves.

5. In an automatic strand tensioner, a series of strand guiding sheaves coacting with successive portions of advancing stock to produce a succession of depending loops lying in a common plane, a series of interconnected vertically movable sheaves rollably suspended in the bottoms of said loops, upper and lower vertically movable slides defining the limits of free vertical movement of said movable sheaves, a fixed stop coacting with each of said slides for limiting the downward movement thereof, and springs resiliently restraining the movement of said slides.

6. In an automatic strand tensioner, a series of strand guiding sheaves coacting with successive portions of advancing stock to produce a succession of depending loops lying in a common plane, a series of interconnected vertically movable sheaves rollably suspended in the bottoms of said loops, upper and lower vertically movable slides defining the limits of free vertical movement of said movable sheaves, and a fixed stop for limiting the downward movement of each slide.

7. In an automatic strand tensioner, a series of strand guiding sheaves coacting with successive portions of advancing stock to produce a succession of depending loops lying in a common plane, a series of interconnected vertically movable sheaves rollably suspended in the bottoms of said loops, upper and lower vertically movable

slides defining the limits of free vertical movement of said movable sheaves, a fixed stop for limiting the downward movement of each slide, and a spring for resiliently restraining the upward movement of the upper slide.

8. In an automatic strand tensioner, a series of upper strand guiding sheaves rotatable about fixed parallel axes and coacting with successive portions of continuously advancing strand stock to produce a succession of depending loops, a series of lower vertically movable sheaves rollably suspended in the bottoms of the successive loops, upper and lower vertically movable slides defining the limits of free vertical movement of said lower sheaves, a fixed stop for limiting the downward movement of each of said slides, and another fixed stop for also limiting the upward movement of said lower slide.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
798,641	Varley	Sept. 5, 1905
911,698	Carder	May 9, 1911
1,351,867	Oakes	Sept. 7, 1920
1,384,153	Roos	July 12, 1921
1,417,484	Baker	May 30, 1922
1,940,701	Shope	Dec. 26, 1933
1,940,702	Shope	Dec. 26, 1933
2,193,044	Sibley	Mar. 12, 1940
2,249,947	Doe	July 22, 1941
2,357,389	Ferm	Sept. 5, 1944
2,380,951	Decker, Jr., et al.	Aug. 7, 1945