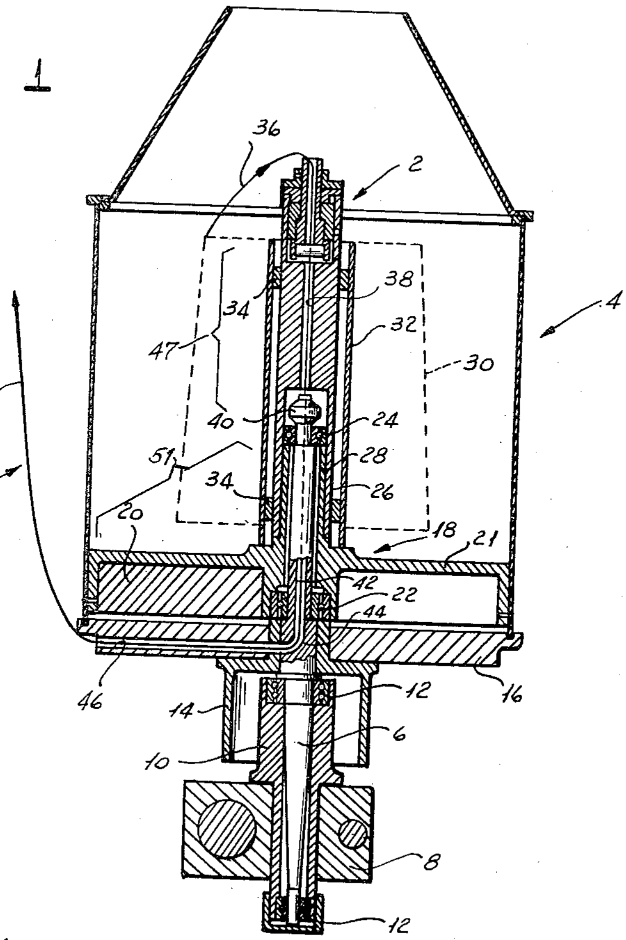
Jan. 26, 1954 H. C. UHLIG 2,667,029

TENSIONING DEVICE FOR ELONGATED FLEXIBLE MATERIAL

Filed Nov. 16, 1951 2 Sheets-Sheet 1

Fig 1



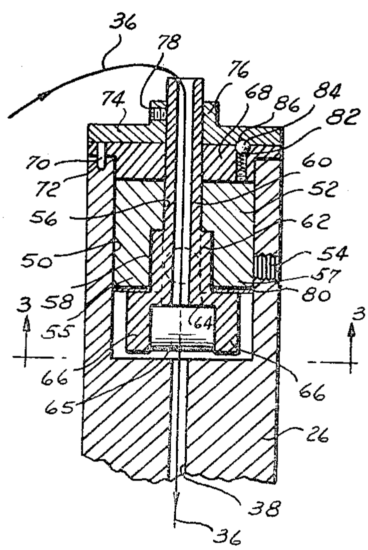


Fig 2

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Fig 3

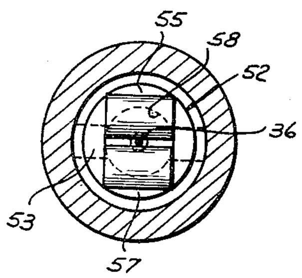


Fig 4

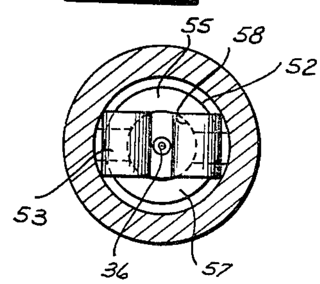
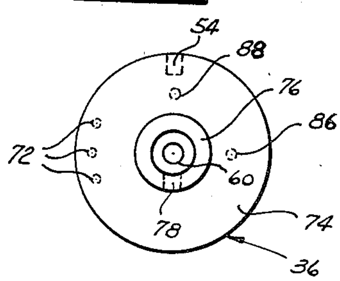


Fig 5



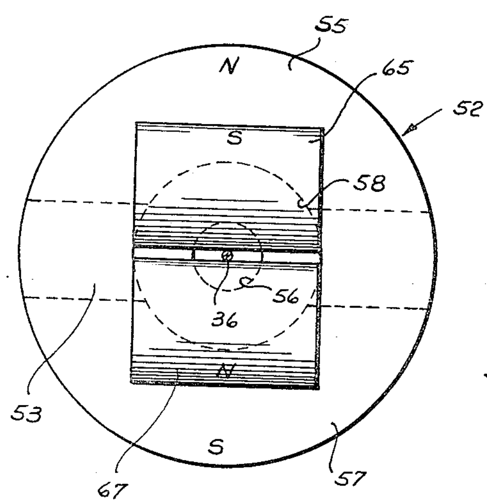


Fig 6

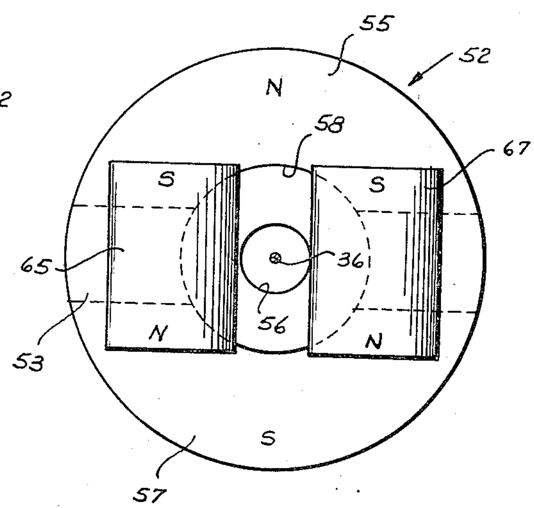


Fig 7

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TENSIONING DEVICE FOR ELONGATED FLEXIBLE MATERIAL

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Application November 16, 1951, Serial No. 256,751

11 Claims. (Cl. 57—58.86)

1

This invention relates to an improved tensioning device for flexible elongated members such as yarns, threads, and the like, the tensioning device being adapted to impose a predetermined tension upon the flexible elongated member as the latter travels therethrough.

The invention has among its objects the provision of a tensioning device of the character indicated of simple, rugged construction, such device being economical to make and easy to maintain, the device further being characterized by the uniformity of tension which it imposes upon the elongated flexible material in spite of vibration of the member or support in which it is mounted.

A still further object of the invention resides in the provision of a tension device of the character and for the purpose indicated in which the amount of tension imposed upon the elongated flexible member may be easily and quickly varied as desired.

The above and further objects of the invention will be more readily apparent in the following description of a preferred embodiment of the tensioning device of the invention.

Many operations upon elongated flexible members such as yarns, threads, fine wires and the like, require that a predetermined back tension shall be imposed upon such members during travel thereof. Typical of such operations are the winding of such flexible elongated members, the twisting of yarns to form threads, and the combining or doubling of threads to form cords. Requisites of a successful tensioning device for such operations are the maintenance of a substantially constant predetermined tension upon the member, the ability of the tensioning device to impose a high tension on the member without substantial injury thereto, and adjustability whereby the amount of tension imposed may be varied within appreciable limits. The tensioning device of the present invention is particularly characterized by possessing all three of the above characteristics, and also that of imposing symmetrical retarding forces upon the flexible member, plus simplicity and freedom from substantial wear of the tension imposing parts over long periods of operation.

The tensioning device of the invention is illustrated and described herein primarily in connection with the twisting of a flat yarn, made up of a plurality of continuous synthetic fibers, to form a thread. It is to be understood, however, and it has been indicated above, that the tensioning device of the invention is capable of use

2

to advantage in connection with other operations on elongated flexible members. It is to be understood that the elongated flexible members may be yarns made up of either natural or synthetic fibers, thread made from such yarns, or fine flexible wires and the like.

The invention will be more readily understood by reference to the accompanying drawings, which form a part of the specification, in which:

Fig. 1 is a view in axial section through a two-for-one twisting spindle incorporating a tensioning device made in accordance with a preferred embodiment of the invention, the guiding and twisting device on top of the driven shaft of the spindle being shown in side elevation;

Fig. 2 is an enlarged view in axial section through the top portion of the tensioning device of the invention shown in Fig. 1;

Fig. 3 is a view in section transverse to the axis of the spindle shaft and below the magnet system of the tensioning device, the section being taken along the line 3—3 in both Figs. 1 and 2, the retarding rollers being in operative, elongated flexible member engaging, position;

Fig. 4 is a view similar to Fig. 3 but with the tensioning rollers turned 90° relative to the magnet and with the rollers separated in inoperative, threading, position;

Fig. 5 is a view in plan of the tensioning device;

Fig. 6 is an enlarged, somewhat schematic, view of the magnet and rollers showing their relationship when the rollers are in operative, material engaging, position; and

Fig. 7 is an enlarged, somewhat schematic, view similar to Fig. 6 showing the relationship of the magnet and the rollers when the latter are in inoperative, threading, position.

The tensioning device of the invention in the embodiment shown has proved to be especially useful in twisting spindles although, of course, it is capable of many other uses. For purposes of illustration, the tensioning device is shown in Fig. 1 as being incorporated in a two-for-one twisting spindle such as that shown in Fig. 5 of my Patent No. 2,487,837, November 15, 1949. The tensioning device of the present invention is shown in Fig. 1 of the present application as substituted for the tensioning device **100** shown specifically in Figs. 7–11, inclusive, of my above patent.

The two-for-one twisting spindle, generally designated 4, operates, in this instance, upon flat yarn supplied from a bobbin or package, the yarn being given two twists for each revolution of the spindle as the yarn travels therethrough. By the term "flat yarn" there is meant a yarn in the form of a tape of generally rectangular cross section, the width of the tape materially exceeding its thickness. Such flat yarn form is that in which extruded synthetic fibers are usually gathered into a package. The spindle shown in Fig. 1 is supported on a machine frame, a portion of which is shown at 8, through the medium of a sleeve 10 mounted on the frame, the sleeve carrying at its upper and lower ends the ball bearings both designated 12. Journalled in such ball bearings is the generally upright driven shaft 6, to which is keyed the pulley 14 from which the shaft is rotated by a driving belt (not shown). Keyed to shaft 6 above the pulley is a disc flyer 16. Above such flyer, and floatingly mounted on the upper end of shaft 6, is a bobbin holder, generally designated by the reference character 18. Such bobbin holder has a lower flange portion 21 and a central sleeve portion 28, the latter surrounding and being spaced from the upper end of shaft 6. The ball bearing 24 at the upper end of sleeve 28 and the ball bearing 22 at the lower end of the bobbin support mount such support floatingly upon the driven shaft 6, so that the bobbin support may remain essentially non-rotative. The bobbin support is maintained in essentially fixed angular position by means of the weight 20 mounted beneath flange 21 at one zone thereof, the spindle in use being mounted with its axis at a small angle, such as 12°, to the vertical, as disclosed in my said patent.

The yarn to be twisted is contained in the wound package 30 which is provided with a core 32. The lower end of such core rests upon the upper surface of flange 21, the package being held centrally of the spindle by means of the sleeve 26, the lower end of which is telescoped snugly over the sleeve 28 centrally on the package support. Upper and lower annular spacer members 34, between the core of the package and the sleeve 26, retain the yarn package axially of the sleeve 26. The above described upper bearing 24 is positioned, as shown, between the upper end of shaft 6 and the upper end of the lower counterbore in sleeve 26.

The tensioning device of the invention, which is designated generally by the reference character 2, is supported in the upper end of sleeve 26, which is made of non-magnetic material such as stainless steel, aluminum, brass and the like. Tension device 2, to be more fully described hereinafter, comprises a plurality of magnetically responsive tension members adapted to bear against and to press therebetween the elongated flexible material, such members being, in the embodiment shown, identical cylindrical soft iron or steel rollers. The tensioning device further includes a magnet mounted adjacent such tension members so that such members lie within the magnetic field thereof with the axes of the rollers, under operating conditions, lying generally normal to the main lines of flux between the magnetic poles, so that under operating conditions the tension members are attracted to each other. The thus held tension members act to impose retarding tension upon the elongated flexible material by reason of their rotation in the magnetic field and thus their cutting of lines of force. To a markedly smaller degree the tensioning members are restrained from rotation by reason of their frictional engagement with the roll retaining member in which they are mounted.

The yarn 36 delivered from package 30 runs upwardly, as shown, to the upper end of the tensioning device 2, thence downwardly therethrough, through passage 38 in sleeve 26, and into and through the twisting and guiding means 40 which is mounted on top of shaft 6 so as to rotate therewith, thence downwardly through the axial passage 42 in the upper end of shaft 6 and outwardly through the radial passage 46 in the flyer, passages 42 and 46 being connected by the curved passage 44 in shaft 6. The product emerges from the outer end of passage 46 as the double-twisted thread 49, such thread forming a balloon 48, thread 49 passing upwardly to a stationary guiding eye (not shown) positioned above and substantially coaxial with the upper end of the spindle. In that portion of its travel denoted 47 the yarn receives a first twist, by reason of the relative rotation of means 2 and 40. In the subsequent portion of its travel through the spindle, indicated at 51, the first twisted yarn receives a further twist by reason of the rotation of flyer 16.

As shown more clearly in Fig. 2, the upper end of sleeve 26 is provided with a counterbore 50 which receives the tension device 2 therewithin. Such tension device includes the magnet 52, generally in the form of a cylindrical tube, the magnet fitting snugly within the counterbore 50 and being held therein by the setscrew 54 threadedly received in the wall of the sleeve. The lower end of the magnet 52 is provided with a horizontal diametral slot 53 as indicated in Figs. 2, 3, and 4, thereby forming the two spaced depending portions 55 and 57 on the lower end of the magnet. The magnet is so magnetized that depending portion 55 forms one pole of the magnet, as for example the north pole as indicated in Figs. 6 and 7, and depending portion 57 forms the other pole of the magnet, as for instance the south pole as indicated in Figs. 6 and 7. Magnet 52 is preferably made of material having high permeability, as for example the magnetic alloy composed of 24–30% Ni, 9–13% Al, balance Fe, or the alloy composed of 24–30% Ni, 9–13% Al, 5–10% Co, balance Fe.

Magnet 52 is provided at its upper end with the axial bore 56, and at its lower end with the counterbore 58. Rotatably supported within such bore and counterbore in the magnet are the hollow stem portion 60 and the enlarged base portion 62, respectively, of the tensioning roll retaining means. Such roll retaining means is made of non-magnetic material such as stainless steel. The roll retaining means is provided at the bottom with a cross-arm 64 which extends at least partially across the poles of the magnet. From the outer ends of portion 64 there depend the spaced parallel roll retaining ears 66. The tensioning rolls 65 and 67 are positioned in confronting parallel relationship in the thus provided space in the bottom of the roll retaining means, the depending ears 66 being loosely in engagement with the opposite ends of the rolls. The roll retaining means has no device therein positively or mechanically to restrain the rolls from falling, nor does it have any provision for positively retaining the rolls from motion in a direction toward or away from each other. The magnetic field provided by the magnet, to be described, yieldingly retains the rolls both from falling out of the retaining means and also from undue sidewise motion even when they are placed in separated, inoperative, position. Further, of course, when the parts are mounted in operative relationship as shown in Figs. 1 and 2, the rollers are also restrained from undue movement either downward or sidewardly by reason of the bottom and side surfaces of the counterbore 50 in sleeve 26.

The tensioning device also includes means for holding the roll retaining means accurately in position in the desired angular relationship with respect to the magnet and its field and also with the desired spatial relationship of the rollers with respect to the magnet, both such relationships being adjustable so that the tension imposed upon the material travelling through the tensioning device may be varied. Such adjusting means includes the first, lower, disc 68 made of non-magnetic material, the central boss on which fits accurately within the upper end of the counterbore 50 in sleeve 26, and the radial flange of which lies upon the upper edge of the sleeve. Disc 68 is held in the desired angular relationship with respect to sleeve 26 and thus magnet 52 by means of the pin 70 which extends through a hole in the flange of disc 68 and into one of a plurality of angularly spaced holes 72 in the upper edge of sleeve 26. Overlying disc 68 is the second, upper, disc 74, likewise made of non-magnetic material. Disc 74 is provided with a central hollow boss 76, through the bore of which the upper end of the hollow stem 60 of the roll retainer extends. Setscrew 78 retains stem 60 at the desired angular relationship to disc 74.

Adjustment of the distance between the tensioning rollers and the magnet 52, axially of the latter, whereby the strength of the magnetic field to which the rollers are subjected may be varied, is effected by the provision of a plurality of non-magnetic thin washers or shims 80 between the upper surface of member 64 of the roll retaining means and the pole pieces of the magnet. The counterbore 58 in the magnet is made of such axial length relative to the enlarged portion 62 on the stem of the roll retaining means as to allow the reception of the latter by the former to its full length when no such shims 80 are employed. The roll retaining means is pulled upwardly snugly against the shims after which the setscrew 78 is tightened to retain the parts in position.

The described adjustment of the axial distance between the magnet and the tensioning rolls as a whole will allow the selection of a predetermined range of tensions within which the device will operate. The one particular tension chosen within such range is determined by the above described adjustment of the roll retaining means angularly with respect to the magnet by means of the pin 70 and the series of holes 72. Such angular adjustment of the roll retaining means relative to the magnet, as will be more readily apparent in the following discussion of Figs. 6 and 7, allows the selection of the force with which the two tensioning rollers attract each other.

The tensioning device of the invention is also provided with means whereby the axes of the tensioning rollers may be rotated relative to the magnet and its field, from the above described operative position, to an inoperative position wherein the magnetic field coacts with the two tensioning rollers so as to cause the latter to repel each other, thereby opening a marked gap between them so that the tensioning device may be threaded easily. Such last named means consists of a bullet catch positioned in disc 68 diametrically opposite pin 70, the spring pressed ball or detent 84 projecting upwardly therefrom as shown. The under side of the disc 74 is provided with two partially spherical depressions which receive the detent 84, the first of such depressions, designated 86, lying diametrically opposite the central hole 72 in the upper edge of sleeve 26. It will be apparent that, when the parts are positioned so that pin 70 projects into the central hole 72 and the detent 84 lies in depression 86, the rolls and magnet have the relationship to each other shown in Figs. 3 and 6, that is, the axial plane containing the interface between the rollers lies parallel to the slot 53 through the lower end of the magnet. The other detent receiving depression, designated 88, is positioned 90° removed from the first such depression. When it is desired to move the tensioning rolls apart, as for instance during threading of the device, the disc 74 is rotated 90° from the first described position so as to cause the detent 84 to seat within depression 88. When the parts are thus positioned relative to each other, the magnet and rolls have the relationship shown in Figs. 4 and 7. In such position of the parts, as will be apparent hereinafter, the rolls 65 and 67 are repelled from each other. The axes of such rolls now lie in vertical planes which are normal to the axis of the slot 53 through the magnet.

In Fig. 6 there is somewhat schematically shown the orientation of the yarn tensioning rollers and the magnet in the operative position of the former, whereas in Fig. 7 such orientation is shown when the rollers are in spaced apart, inoperative, position. When the rolls are in operative position, as shown in Fig. 6, a substantial part of one roll 65 lies beneath the north pole 55 of the magnet, the other roll 67 lying beneath the south pole 57 of the magnet. The position of the parts shown is that occupied by the rolls when the adjusting pin 70 is positioned in the central adjusting hole 72 of the sleeve. It will be apparent that under such conditions the rolls 65 and 67 will form a path through which the magnetic flux flows from pole 55 to pole 57, the roll 65, being opposite the north pole 55, will have an induced magnetism making it in effect a south pole, whereas roll 67, lying opposite the south pole of the magnet, will have a magnetism induced in it which in effect will make it a north pole. Since unlike poles of a magnet attract each other, the rolls 65 and 67 in the position shown in Fig. 6 will strongly attract each other, compressing the elongated flexible material therebetween as it travels downwardly through the tensioning device. When the roll retaining means is angularly positioned on one or the other side of the position shown in Fig. 6, as by placing the pin 70 in one of the side holes 72 in the sleeve, there will be a marked diminution of the number of lines of flux which pass from one pole of the magnet through the rolls and thence to the other pole of the magnet. Accordingly, the induced poles formed in the rolls are weaker, when their axes are thus turned, there is a weakening of the attraction of the rolls for each other, the rolls cut fewer lines of flux as they rotate, and their retarding effect upon the elongated flexible material passing therethrough is markedly decreased.

When the axes of the rolls 65 and 67 are turned so that they lie in vertical planes normal to the gap 53 through the magnet, as shown in Fig. 7, as by turning disc 74 relative to disc 78 so that the detent 84 lies in the second depression 88, the rolls are repelled by each other so that they both retreat from the center line of the tension device, thereby allowing a threading tool to be passed easily between the rollers. Such repelling action of the rolls will be readily understood by a consideration of Fig. 7. As there shown, the upper end of each of rollers 65 and 67 now lies beneath the north pole 55 of the magnet, the lower ends of the rolls, as there shown, lying beneath the south pole 57 of the magnet. Accordingly, the upper ends of the rolls as they are shown in Fig. 7 now become south poles by induction and the lower ends of the rolls become north poles by induction. Thus, like poles in the rolls being opposite each other, the rolls repel each other when they are in such position relative to the magnet and its field.

Although the tension device of the invention is not limited to the particular orientation in space shown in the drawings, it displays its maximum advantages when the magnet lies above the rollers, as shown. In such position, frictional contact between the rollers and the roll retaining means during operation is minimized, since the yarn in travelling downwardly through the tensioning device tends to pull the rollers slightly downwardly free from the lower inner surface of the roll retaining means. Thus mechanical frictional wear upon the rollers by the retaining means is minimized. Furthermore, this action tends to free the rollers from substantial direct, vibration transmitting, contact with their support, so that the retarding tension imposed upon the material by such rollers does not vary materially even though the spindle or machine in which it is located may vibrate to a marked degree.

The tension device of the invention is also of advantage because of the fact that it acts upon the yarn or other flexible material in a symmetrical manner, that is, the yarn is retarded to the same extent and in exactly the same manner on both sides thereof by the two tensioning rollers. Thus the filaments making up the yarn are not stretched on one side any more than they are on the other, nor are they scuffed on one side, as by being engaged by a non-rotatable tensioning member such as a ball receiving seat. Finally, the device of the invention displays advantages over previously known tensioning devices in which one of the members was free to float, as for example a gravity or magnetically held ball, since with the parts of the tension device of the invention mounted in operative relationship, as shown, there is no possibility for either of the yarn tensioning rollers to jump out of place, as there is with a gravity or magnetically held ball especially when a knot or a snarled length of yarn must pass through the tensioning device. In contrast thereto, the tensioning rollers of the present tensioning device, while being free to float laterally, and while being substantially isolated from vibration transmitted to the tensioning device from the machine, will open readily to pass knots and snarled portions of the yarn therethrough while continuing to impose on the yarn a substantially uniform retarding tension.

Although I have described and illustrated a preferred embodiment of the tensioning device of the invention, it is to be understood that such embodiment is illustrative only since the device is capable of considerable variation as to details. The scope of the invention is therefore to be defined by the claims appended hereto.

I claim as new the following:

1. A tensioning device for elongated flexible material comprising two elongated magnetically responsive material engaging tension members, means mounting such members so that they may rotate on their longitudinal axes parallel to each

other in confronting relationship, such last named means being so constructed and arranged that the members may relatively approach or retreat from each other, a magnet mounted adjacent such members so that they are within its magnetic field, the tension members lying within the areas defined by projections of said poles on the plane containing the longitudinal axes of said members, and means providing for the turning of the axes of the tension members and the magnet relative to each other about an axis normal to the above mentioned plane to vary the degree of attraction between the tension members.

2. A tensioning device for elongated flexible material comprising two elongated magnetically responsive material engaging tension rolls, means mounting such rolls so that they may rotate on their longitudinal axes parallel to each other in confronting relationship, such last named means being so constructed and arranged that the rolls may relatively approach or retreat from each other, a magnet mounted adjacent such rolls so that they are within its magnetic field, the poles of the magnet both lying on the same side of the plane containing the longitudinal axes of the rolls, the rolls lying within the areas defined by projections of said poles or said plane, and means for turning the axes of the rolls and the magnet relative to each other about an axis normal to the above mentioned plane throughout an angle of substantially 90° to vary the degree of attraction between the rolls.

3. A tensioning device for elongated flexible material comprising two elongated magnetically responsive material engaging tension rolls, means mounting such rolls so that they may rotate on their longitudinal axes parallel to each other in confronting relationship, such last named means being so constructed and arranged that the rolls may relatively approach or retreat from each other, a U shaped magnet mounted adacent such rolls so that they are within its magnetic field, the pole pieces of the magnet both lying on the same side of the plane containing the axes of the rolls and the axis of the magnet lying normal to such plane, and means for turning the axes of the rolls and the magnet relative to each other about the axis of the magnet to vary the degree of attraction between the rolls.

4. A tensioning device for elongated flexible material comprising two elongated magnetically responsive tension members which engage opposite sides of the material and compress it between them, means mounting such members parallel to each other in confronting relationship, such last named means being so constructed and arranged that the members may relatively approach or retreat from each other and so that the members are mechanically free to drop vertically, means providing spaced magnetic poles above the members, the last named means being mounted adjacent the members and subjecting such members to its magnetic field so that such members are attracted to each other and are impelled toward the magnetic poles whereby the members are floatingly mounted in a vertical direction, and means for retaining the axes of the members at a predetermined angle relative to the direction of the magnetic field between the poles.

5. A tensioning device for elongated flexible material comprising two elongated magnetically responsive tension rolls which engage opposite sides of the material and compress it between them, means mounting such rolls so that they may rotate on their longitudinal axes parallel to

each other in confronting relationship, such last named means being so constructed and arranged that the rolls may relatively approach or retreat from each other and so that the rolls are mechanically free to drop vertically, means providing spaced magnetic poles above the rolls, the last named means being mounted adjacent the rolls and subjecting such rolls to its magnetic field so that such rolls are attracted to each other and are impelled toward the magnetic poles whereby the rolls are floatingly mounted in a vertical direction, and means for retaining the axes of the rolls at a predetermined angle relative to the direction of the magnetic field between the poles.

6. A tensioning device for elongated flexible material comprising a main body having a passage therethrough, the main body having a counterbore at one end thereof, a magnet having a bore therethrough secured in the counterbore coaxially thereof, the lower end of the magnet being provided with diametrically opposite poles, a tension member retaining means having a hollow material conducting stem and a lower cross-arm, the stem extending through the bore in the magnet and the cross-arm lying interiorly of the counterbore beneath the magnet, a pair of magnetically responsive tension members mounted on the cross-arm in parallel confronting relationship with the plane containing the axes of such members disposed transverse to the axis of the magnet, the tension member retaining means having means restraining the rotation of the axes of the members relative to the cross-arm of the retaining means, and adjustable means for securing the retaining means to the main body at a selected angle about the axis of such main body.

7. A tensioning device for elongated flexible material comprising an elongated main body having a passage longitudinally therethrough, the main body having a counterbore at one end thereof, a magnet having a bore therethrough secured in the counterbore coaxially thereof, the lower end of the magnet being provided with diametrically opposite poles, a tension member retaining means having a hollow material conducting stem and a lower cross-arm, the stem extending through the bore in the magnet and the cross-arm lying interiorly of the counterbore beneath the magnet, a pair of magnetically responsive tension members floatingly mounted on the cross-arm in parallel confronting relationship with the plane containing the axes of such members disposed transverse to the axis of the magnet, the tension member retaining means having means restraining the rotation of the axes of the members relative to the cross-arm of the retaining means, a disc member overlying the upper end of the magnet and secured to the stem of the retaining means, the disc being rotatable with respect to the main body, and means releasably selectively to retain the disc and the members in two angular positions which are 90° apart about the axis of the main body, in one of said positions the axes of the members lying parallel to a straight line between the magnetic poles.

8. A tensioning device for elongated flexible material comprising an elongated main body having a passage longitudinally therethrough, the main body having a counterbore at one end thereof, a tubular magnet secured in the counterbore coaxially thereof, the lower end of the magnet being provided with diametrically opposite depending poles, a tension member retaining means having a hollow material conducting stem and a lower cross-arm, the stem extending through the bore in the magnet and the cross-arm lying interiorly of the counterbore beneath the magnet, a pair of magnetically responsive tension rolls floatingly and rotatably mounted on the cross-arm in parallel confronting relationship with the plane containing the roll axes disposed transverse to the axis of the magnet, means mounted on the cross-arm restraining the rotation of the axes of the rolls relative to the cross-arm of the retaining means, a first, lower, disc member overlying the upper end of the magnet through which the stem of the retaining means protrudes, adjustable means for securing the first disc to the main body at a selected angle about the axis of such main body, a second, upper, disc member overlying the first disc, means securing the stem of the retaining means to such second disc, the second disc being rotatable with respect to the first disc and the main body, and means coacting between the first and second discs releasably selectively to retain the second disc and the rolls in two angular positions which are 90° apart about the axis of the main body, in one of said positions the axes of the rolls lying parallel to a straight line between the magnetic poles.

9. In a twisting spindle for elongated flexible material, said spindle having an elongated sleeve for holding a bobbin from which the material is withdrawn, said sleeve having an axial, material conducting, passage therethrough, said sleeve having a counterbore at its upper, material receiving, end, the improved material tensioning device which comprises a magnet having a bore therethrough secured in the counterbore coaxially thereof, the lower end of the magnet being provided with diametrically opposite poles, a tension member retaining means having a hollow material conducting stem and a lower cross-arm, the stem extending through the bore in the magnet and the cross-arm lying interiorly of the counterbore beneath the magnet, a pair of magnetically responsive tension members mounted on the cross-arm in parallel confronting relationship with the plane containing the axes of the members disposed transverse to the axis of the magnet, means restraining the rotation of the axes of the members relative to the cross-arm of the retaining means, and adjustable means for securing the retaining means to the sleeve at a selected angle about the axis of such sleeve.

10. In a twisting spindle for elongated flexible material, said spindle having an elongated sleeve for holding a bobbin from which the material is withdrawn, said sleeve having an axial, material conducting, passage therethrough, said sleeve having a counterbore at its upper, material receiving, end, the improved material tensioning device which comprises a magnet having a bore therethrough secured in the counterbore coaxially thereof, the lower end of the magnet being provided with diametrically opposite poles, a tension member retaining means having a hollow material conducting stem and a lower cross-arm, the stem extending through the bore in the magnet and the cross-arm lying interiorly of the counterbore beneath the magnet, a pair of magnetically responsive tension members floatingly mounted on the cross-arm in parallel confronting relationship with the plane containing the axes of such members disposed transverse to the axis of the magnet, means restraining the rotation of the axes of the members relative to the cross-arm of the retaining means, a disc member overlying the

upper end of the magnet and secured to the stem of the retaining means, the disc being rotatable with respect to the sleeve, and means releasably selectively to retain the disc and the members in two positions which are 90° apart about the axis of the sleeve, in one of said positions the axes of the members lying parallel to a straight line between the magnetic poles.

11. In a twisting spindle for elongated flexible material, said spindle having an elongated sleeve for holding a bobbin from which the material is withdrawn, said sleeve having an axial, material conducting, passage therethrough, said sleeve having a counterbore at its upper, material receiving, end, the improved material tensioning device which comprises a tubular magnet secured in the counterbore coaxially thereof, the lower end of the magnet being provided with diametrically opposite depending poles, a tension member retaining means having a hollow material conducting stem and a lower cross-arm, the stem extending through the bore in the magnet and the cross-arm lying interiorly of the counterbore beneath the magnet, a pair of magnetically responsive tension rolls floatingly and rotatably mounted on the cross-arm in parallel confronting relationship with the plane containing the roll axes disposed transverse to the axis of the magnet, means mounted on the cross-arm restraining the rotation of the axes of the rolls relative to the

cross-arm of the retaining means, a first, lower, disc member overlying the upper end of the magnet through which the stem of the retaining means protrudes, adjustable means for securing the first disc to the sleeve at a selected angle about the axis of such sleeve, a second, upper, disc member overlying the first disc, means securing the stem of the retaining means to such second disc, the second disc being rotatable with respect to the first disc and the sleeve, and means coacting between the first and second discs releasably selectively to retain the second disc and the rolls in two positions which are 90° apart about the axis of the sleeve, in one of said positions the axes of the rolls lying parallel to a straight line between the magnetic poles.

HENRY C. UHLIG.

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