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TENSION CONTROL FOR TEXTILE MACHINES

Filed Aug. 29, 1966

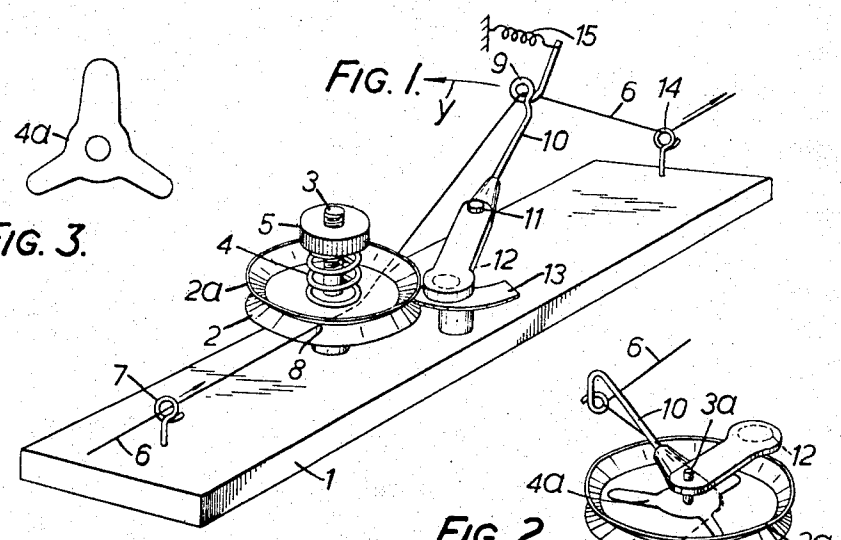


FIG. 1.

FIG. 3.

FIG 2

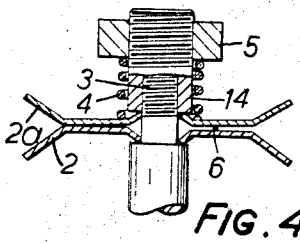


FIG. 4.

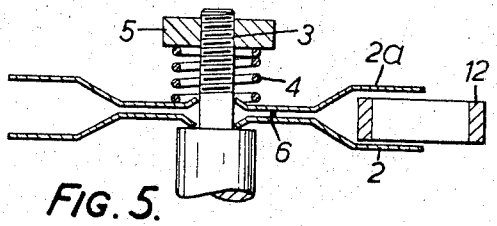


FIG. 5.

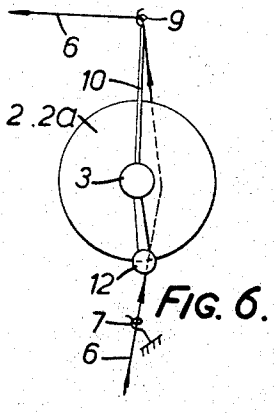


FIG. 6.

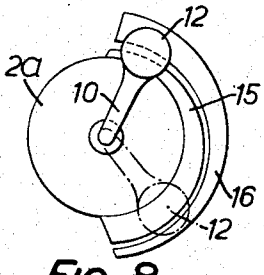


FIG 8

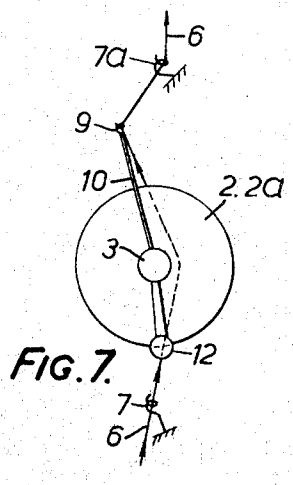


FIG. 7.

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TENSION CONTROL FOR TEXTILE MACHINES

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6 Claims. (Cl. 242—150)

This invention relates to thread tension-controlling mechanisms for textile machines, of the kind which serve to control the tension of the thread which runs through them so as to maintain the thread on the outlet side at a substantially constant tension, it being understood that such mechanisms can only increase the tension in thread delivered to them at a lower tension than that desired and are incapable of reducing the tension in a thread which is delivered to them at a tension in excess of that desired.

Many different forms of such mechanism have been proposed and employed, these forms of mechanism falling generally speaking into two distinct categories.

The first category are mechanisms employing a fixed friction surface over which the thread passes in close contact and a sensing lever or other sensing device on which a length of thread on the outlet side of the friction surface acts in one direction against the action of a elastic means applying a force to the sensing device in the opposite direction, the arrangement being such that the length of thread maintained in contact with the friction surface is increased or decreased by movement of a sensing device respectively to increase or decrease the amount of additional tension applied to the thread. In this category also fall mechanisms comprising single or multiple obstructions arranged to bear against the thread, the path of the thread when passing over the obstructions being varied by a tension sensitive device in accordance with the friction which is to be applied to the yarn to add tension thereto.

In this first category of mechanisms it will be seen that it is the force which is applied by the thread to the sensing lever or other sensing device which determines the amount of friction to which the thread will be subject so as to obtain the appropriate tension on the outlet side of the mechanism.

In the second category are types of mechanism comprising sensing levers or other sensing devices which are sensitive to the tension of the thread on the outlet side of the mechanism by being acted upon in one direction by a length of thread on the outlet side of the mechanism and in the other direction by suitable elastic means, and one or more pairs of co-operating friction members along a determined path between which a length of thread passes in advance of the sensing device, these friction members being pressed towards one another by a force which is controlled by the tension sensitive device and thus itself controls the friction applied to the thread. In this category of mechanism, as at present in use, the sensing lever or other sensing device reacts mechanically on the friction members, usually so as to urge them away from one another against the pressure of a preset spring urging them towards one another but in some cases so as to urge them towards one another against the action of a pre-set spring in such a manner in each case, as to maintain a substantially constant tension in the thread on the outlet side of the friction members.

Various mechanical, electrical or electro-mechanical systems have also been devised by which the movements of the sensing lever or other sensing device are caused to vary the force urging the friction members towards one another. For example in some cases the sensing lever

is provided with a cam type transmission apparatus which acts to urge one or two disc-like friction members away from the other, the cam acting on a short rod which urges the movable disc axially away from the other disc while in other cases the cam may act to press two disc-like friction members towards one another by means of a simple follower.

In a still further form of apparatus recently developed the sensing lever is provided with a small flat and sharp finger which is forced in between two disc-like friction members with a wedge like action when the sensing lever moves in a direction indicating an increase in tension so as to urge the discs apart and thus reduce the tension.

The object of the present invention is to provide improved thread tension control mechanism for textile machines, the control mechanism being of the second general category referred to above, that is to say of the kind employing a tension-sensitive device on which the thread acts in one direction and elastic means act in the other direction, two friction members between which the thread passes along a suitable path and means by which movement of the sensing lever acts to vary the force with which the friction members are urged towards one another in a manner tending to maintain a substantially constant tension in the thread on the outlet side of the mechanism.

For convenience herein it will be assumed that there is a single fixed member and a single movable member although both such members may be movable and urged towards one another by the variable force and there may be two or more fixed members and two or more movable members.

Mechanism for controlling the tension of thread in textile machines according to the present invention comprises fixed and movable friction members between which the thread passes in a determined path, the movable friction member including at least a part formed of magnetic material, and means for applying a force to the movable friction member urging it towards the fixed friction member and for controlling that force, comprising spring means urging the movable friction member towards the fixed friction member, a pivoted tension sensing lever on which the thread acts after passing between the fixed and movable friction members and a permanent magnet connected to the pivoted lever and movable therewith in relation to the said part of magnetic material so as to modify by magnetic force the pressure applied by the movable friction member to the thread lying between it and the fixed friction member, the arrangement being such that during its movement with the pivoted lever the magnet travels continuously in parallel relationship to magnetic material whereby the magnetic flux between it and the magnetic material imposes on the magnet no force tending to cause pivotal movement of the pivoted lever but the magnet nevertheless imposes on the magnetic material included in the movable friction member a magnetic force which tends to move that member relatively to the fixed friction member and which varies with movement of the pivoted lever to vary the pressure applied to the thread between the movable and fixed friction members.

In one form of mechanism according to the invention the movable friction member is urged towards the fixed friction member by spring means to apply friction to the thread while the permanent magnet connected to the tension sensing lever is movable into and out of a position in which it acts magnetically on the said part of magnetic material included in the movable friction member in a direction tending to lift the movable friction member from the thread between the movable and fixed friction members, and a further fixed part of magnetic material is disposed adjacent to the magnetic material included in the

movable member and forms a substantially continuous body of magnetic material in parallel relationship to which the magnet moves, whereby the flux between the magnet and the magnetic material as a whole imposes no force on the magnet such as to tend to cause pivotal movement of the tension-sensing lever.

In an alternative arrangement according to the invention the thread passes in a predetermined path between the fixed and movable friction members and the magnet is arranged to move in a path parallel to part of the face of the movable friction member such that its position in relation to said pre-determined path varies to vary the pressure applied by the movable friction member to the thread passing along said path. Thus said path may lie to one side of the axis of fixed and movable friction members in the form of discs disposed co-axially with one another and the pivoted lever and magnet may be arranged to move about an axis co-axial with that of the discs.

Moreover in such a construction the movable disc may be provided with a circumferentially extending flange part of progressively varying radial width while a fixed part of magnetic material extends around but is spaced by a radial gap from said flange part and constitutes with said flange part a body of magnetic material lying parallel to the path of movement of the magnet and provided a magnetic flux path having substantially the same characteristics irrespective of the pivotal position of the magnet relatively thereto.

In a still further arrangement according to the invention the movable and fixed friction members may be in the form of co-axial discs between which the thread passes in a path lying to one side of the axis of the discs and the discs may be provided with flange like rim parts between which the magnet lies and moves about an axis co-axial with that of the discs.

A number of forms of mechanism according to the invention for controlling thread tension in textile machines are shown by way of example in the accompanying drawings, in which:

FIGURE 1 is a perspective view of one construction of mechanism according to the invention,

FIGURE 2 is a perspective view of a second construction of mechanism according to the invention,

FIGURE 3 shows a form of a symmetrical spring which may be employed in the construction shown in FIGURE 2,

FIGURE 4 is a sectional side elevation showing an assembly of friction discs and associated parts which may be employed in constructions such as that shown in FIGURE 1 and designed to avoid excessive deflection,

FIGURE 5 is a sectional side elevation showing a still further arrangement of friction discs assembly and associated parts which may be employed in constructions according to the invention,

FIGURES 6 and 7 show diagrammatically how the mechanism such as that shown for example in FIGURE 2 operates to control tension, and

FIGURE 8 shows a still further modified construction of mechanism according to the invention.

In the construction shown in FIGURE 1 the mechanism is supported upon a mounting plate 1 and comprises two friction discs 2, 2*a* of magnetic material supported on a spindle 3 the lower end of which is rigidly secured to the mounting plate 1. The friction disc 2 lying near the mounting plate 1 is rigidly secured to the spindle 3 while the friction disc 2*a* is capable of limited movement relatively to the spindle 3 and is pressed towards the disc 2 by means of a spring 4 the force exerted by which on the disc 2*a* can be adjusted by means of an adjusting nut 5 engaging the screw threaded upper end of the spindle 3. The thread 6 in which a predetermined tension is to be maintained on the outlet side of the mechanism enters the mechanism through an entry guide 7 and then passes between the discs 2 and 2*a* by a predetermined path which lies, as shown at 8, to one side of the axis of the discs, after which the

thread passes through a guide 9 on the end of a sensing lever 10 which is pivoted to the mounting plate 1 at 11 and carries at its end remote from the guide 9 a permanent magnet 12. Also rigidly mounted on the mounting plate 1 is a body of magnetic material in the form of a strip 13 of accurate form, the arc representing part of a circle having the axis of the pivot 11 for centre, and the arrangement being such that the magnet 12 is spaced from but moves in parallel relationship to the upper face of the strip 13.

The thread 6 after passing through the guide 9 passes through a fixed exit guide 14 while elastic means, which may be mechanical, electrical or pneumatic and in the example shown are diagrammatically represented by a spring 15, urge the lever 10 about its pivot 11 in a direction opposite to that in which the part of the thread extending between the friction discs 2 and 2*a*, and through the guide 9 and the outlet guide 14 urges the lever by reason of the tension in this part of the thread.

It will be readily understood that when the thread 6 entering through the guide 7 has adequate tension, this tension alone will urge the sensing lever 10 in a direction opposite to that indicated by the arrow *y* with a force such that the magnet 12 will be maintained in its left hand position over the left hand end of the strip 13, i.e. above the adjacent edge of the disc 2*a* so that the disc 2*a* is attracted upwards by the magnetic flux so that it does not press upon the part of the thread 6 passing along the path indicated at 8. Therefore in these conditions no additional tension is added to the thread by reason of friction imposed upon it between the friction discs 2 and 2*a*. If however a thread entering through the guide 7 is inadequately tensioned, the sensing lever 10 will swing in the direction of the arrow *y* under the action of the spring 15 or other elastic means due to there being inadequate tension in the part of the thread passing through the guide 9 and the magnet 12 will swing to the right over the strip 13 and thus allow the action of the spring 4 to take full effect in pressing the disc 2*a* towards the disc 2. The required additional amount of tension will thus be imposed upon the thread by the additional friction applied to it between the discs 2 and 2*a*. In practice therefore, for any given force applied to the sensing lever 10 by the elastic means indicated at 15 with varying tension in the thread entering the mechanism through the guide 7, the lever 10 will at each instant take up a position such that the correct amount of friction will be applied to the thread passing between the discs 2 and 2*a* to maintain the part of the thread passing through the guides 9 and 14 at a constant tension.

It will also be seen that by varying the elastic force applied to the lever 10 by the device indicated at 15, which might for example be a device of the kind forming the subject of the present applicant's United States patent application Ser. No. 534,729, the tension to be maintained in the thread can be varied to suit requirements.

By adjustment of the nut 5 it may also be possible to control to some degree the characteristics of the mechanism and more especially the maximum amount of tension which the mechanism can add to the thread.

It will be noted that the strip 13 is so formed and arranged that the magnetic flux between it and the magnet 12 sets up no force tending to move the magnet 12 laterally and therefore no force tending to cause pivotal movement of the sensing lever 10 about its pivot 11 either in the direction of the arrow *y* or in the opposite direction, the magnetic force applied to the magnet being at all times in a direction vertically downwards towards the strip 13, which will have no effect upon the sensitivity of the apparatus.

In the construction shown in FIGURE 2 the mechanism may be assumed to be mounted upon a mounting plate similar to the mounting plate 1 provided with fixed entry and exit guides 7 and 14, and comprises a spindle 3*a* rigidly mounted on the mounting plate and corresponding to the spindle 3 in FIGURE 1, the spindle 3*a* having rigidly mounted thereon a friction disc 2 and movably

mounted thereon a friction disc **2***a* corresponding respectively to the friction discs **2** and **2***a* in FIGURE 1. In the construction shown in FIGURE 2 instead of a coil spring **4** urging the friction disc **2***a* towards the friction disc **2**, an asymmetrical plate spring **4***a* the form of which is shown in FIGURE 3, serves this purpose, while a sensing lever **10** corresponding to the sensing lever **10** in FIGURE 1 is rotatably mounted upon the spindle **3***a* and connected to a permanent magnet **12**. In this construction as will be seen, the magnet **12** is so arranged that during pivotal movement of the lever **10**, it travels along an arcuate path in spaced parallel relationship to the rim of the disc **2***a* which is made of magnetic material. The asymmetrical form of the spring **4***a* provides that the part of the rim of the disc **2***a* adjacent to the path of the thread **6** between the discs will lift more readily than the part of the rim remote from that path when the magnet is passing over it and the arrangement is such, as shown, that a reduction in the tension in the part of the thread **6** on the outlet side of the friction discs **2**, **2***a* causes the magnet **12** to move away from the parts of the discs adjacent to the path of the thread between them, which parts are urged towards one another by the parts of the spring exerting the lesser force, and thereby allow these parts of the spring to press the discs more closely together where the thread passes between these discs.

It should be noted that the amount of actual movement of the disc **2***a* to achieve a change in the friction applied to the thread passing between the discs will be very small indeed and that it may be desirable possibly to limit this movement. For example in a construction otherwise similar to that shown in FIGURE 1, instead of a simple adjusting screw **5** being employed, an adjusting screw device as indicated in FIGURE 4 may be employed in which an adjustable stop member **14** is provided to provide a positive stop member limiting the upward movement of the disc **2***a*, and the adjusting nut **5** which acts on the spring **4** engages a screw thread on this stop member.

The modification shown in FIGURE 5, is to be assumed to be applied to a construction of the same general kind as that shown in FIGURE 2, that is to say to comprise a sensing lever **10** pivotally supported about the axis of the spindle **3** on which the friction discs **2** and **2***a* are supported. In this construction the discs, in addition to being urged towards one another by the adjustable spring **4** by a force dependent on the setting of the adjusting nut **5** are provided with spaced rim portions between which lies and moves freely the magnet **12**, which thus travels around the space between the rim portions of the discs **2** and **2***a* so as to occupy different circumferential positions relatively to the position of the path to one side of the axis of the spindles **3** along which thread **6** passes between the discs. In this case, therefore, the spring **4** urges the disc **2***a* towards the disc **2** with a force providing some minimum degree of added tension to the thread on the outlet side of the mechanism while the position of the magnet **12** at any moment determines what still further addition shall be made to the tension added to the thread by the mechanism.

FIGURES 6 and 7 show in plan and diagramatically two ways in which the sensing lever **10** can measure the tension in the thread leaving the mechanism. In FIGURE 6 the tension acts directly on the guide **9**, that is to say the thread is led from this guide in a direction substantially at right angles to the arm **10**, while in FIGURE 7 the tension acts indirectly on the guide **9** to the arrangement of the path of the thread from the discs **2**, **2***a* through a fixed outlet guide **7***a* so that the guide **9** acts laterally on the part of the thread extending between the discs **2**, **2***a* and the fixed outlet guide **7***a* as is also the case in the construction shown in FIGURE 1.

FIGURE 8 shows a modification which may be employed in a construction which might be otherwise similar to that shown in FIGURE 2, in which modification the

rim of the friction disc **2***a* is provided with a part **15** also of magnetic material the radial width of which increases progressively in the circumferential direction, this part **15** being surrounded by a fixed part **16** of magnetic material the radial width of which varies progressively in a manner such that the total radial width of the parts **15** and **16** taken together remains approximately the same at all circumferential points. In this case, therefore, the total magnetic flux between the magnet **12** and the parts **15** and **16** together remains substantially unaffected by pivotal movement of the magnet with the sensing lever **10** but the amount of that flux which exerts magnetic force on the part **15** and hence on the disc **2***a* varies with pivotal movement of the magnet. The arrangement thus has some relationship to the arrangement shown in FIGURE 1, the part **16** having something the same effect in FIGURE 8 as the part **13** has in FIGURE 1.

What I claim as my invention and desire to secure by Letters Patent is:

1. Mechanism for controlling the tension of thread in textile machines, comprising fixed and movable friction members between which the thread passes, the movable friction member including at least a part formed of magnetic material, and means for applying a force to the movable member urging it towards the fixed friction member and for controlling that force, comprising spring means urging the movable friction member towards the fixed friction member, a pivoted tension-sensing lever on which the thread acts after passing between the fixed and movable friction members, and a permanent magnet connected to the pivoted lever and movable therewith in relation to the said part of magnetic material so as to modify by magnetic force the pressure applied by the movable friction member to the thread lying between it and the fixed friction members wherein, during its movement with the pivoted lever the magnet travels continuously in parallel relationship to the said part of magnetic material so that the magnetic flux between said magnet and the magnetic material imposes on the magnet no force tending to cause pivotal movement of the pivoted lever but the magnet nevertheless imposes on the magnetic material included in the movable friction member a magnetic force which tends to move that member relatively to the fixed friction member and which varies with movement of the pivoted lever to vary the pressure applied to the thread between the movable and fixed friction members.

2. Mechanism for controlling the tension of thread in textile machines comprising fixed and movable friction members between which the yarn passes, spring means urging the movable friction member towards the fixed friction member to apply friction to the thread, the movable friction member including a part of magnetic material, a pivoted tension-sensing lever on which the yarn acts after passing between the fixed and movable friction members, means urging the pivoted lever against the action of the thread thereon, a permanent magnet connected to the tension-sensing lever and movable therewith into and out of a position in which it acts on said part of magnetic material in a direction tending to lift the movable friction member from the thread between the movable and fixed friction members and a further fixed part of magnetic material disposed adjacent to the magnetic material included in the movable friction member and forming a substantially continuous body of magnetic material in parallel relationship to which the magnet moves, whereby the flux between the magnet and the magnetic material as a whole imposes no force on the magnet tending to cause pivotal movement of the tension-sensing lever.

3. Mechanism for controlling the tenseion of thread in textile machines as claimed in claim **1**, in which the thread passes in a predetermined path between the fixed and movable friction members and the magnet is arranged to move in a path parallel to part of the face of the movable friction member such that its position in relation to the

predetermined path varies to vary the pressure applied by the movable friction member to the thread passing along said path.

4. Mechanism for controlling the tension of thread in textile machines as claimed in claim 3, in which the fixed and movable friction members are in the form of discs disposed co-axially, the thread passes between said fixed and movable friction discs in a path which lies to one side of the axis of such discs, and the pivoted lever and magnet move about an axis co-axial with that of the discs.

5. Mechanism for controlling the tension of thread in textile machines as claimed in claim 4, in which the movable disc is provided with a circumferentially extending flange part of progressively varying radial width while a fixed part of magnetic material of progressively varying radial width extends around but is spaced by a radial gap from said flange part and constitutes with said flange part a body of magnetic material lying parallel to the path of movement of the magnet and providing a magnetic flux path having substantially the same total radial width at all circumferential points.

6. Mechanism for controlling the tension of thread in textile machines as claimed in claim 4 in which the friction discs are provided with flange-like rim parts between which the magnet lies and moves.

References Cited

UNITED STATES PATENTS

2,554,286	5/1951	Wilson	242—150
2,554,493	5/1951	Heizer	242—150
2,745,610	5/1956	Vila Reyes	242—150

FOREIGN PATENTS

1,224,657	2/1960	France.
1,315,921	12/1962	France.
1,334,203	6/1963	France.

OTHER REFERENCES

Japanese printed application No. 37–7,375.
Japanese printed application No. 38–4,726.

STANLEY N. GILREATH, *Primary Examiner.*