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Merkle

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[54] **DEVICE FOR STOPPING A YARNWORKING MACHINE IN RESPONSE TO THREAD TENSION**

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[52] **U.S. Cl.** **200/61.18,** 57/81, 66/163

[51] **Int. Cl.** **B65h 25/14**

[58] **Field of Search** 200/61.13, 61.14, 200/61.18; 57/81; 66/163

[56] **References Cited**

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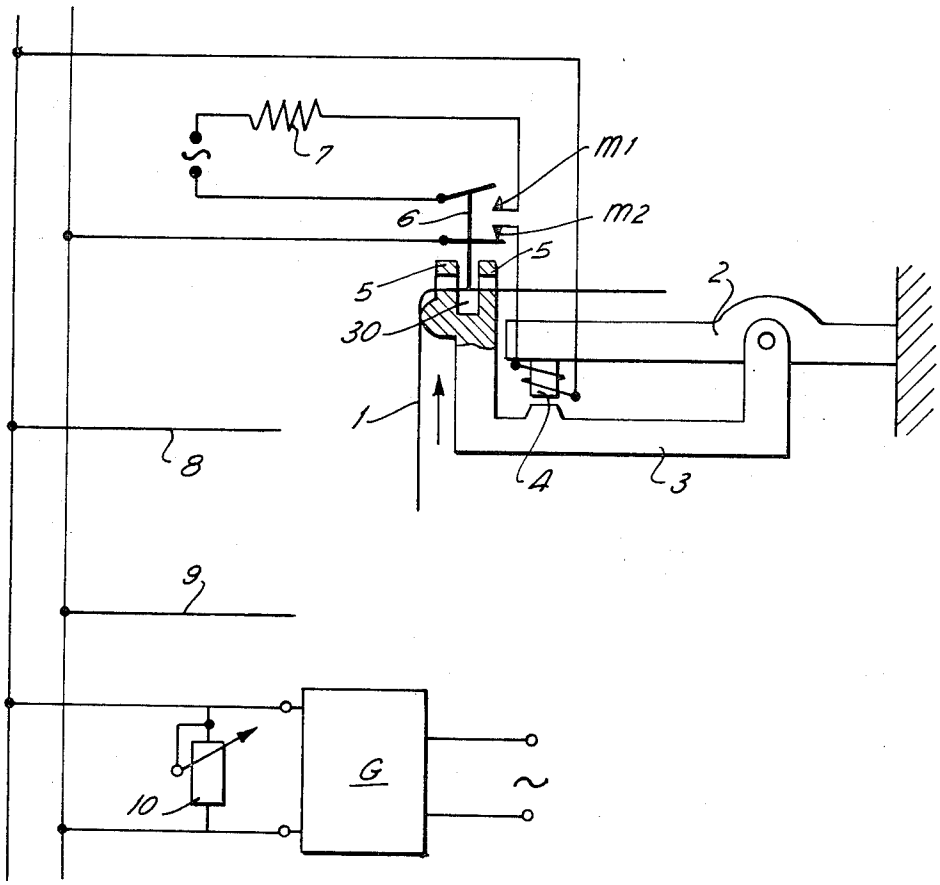
[57] **ABSTRACT**

A process and device for stopping a yarnworking machine is disclosed. The device comprises a thread holder which is maintained in operative position by holding means of predetermined force; switching means electrically coupled to the holding means such that thread being processed through the machine is conducted through the thread holder and maintained at a predetermined tension; the switching means being operative at the predetermined tension to maintain the yarnworking machine in operation.

13 Claims, 7 Drawing Figures



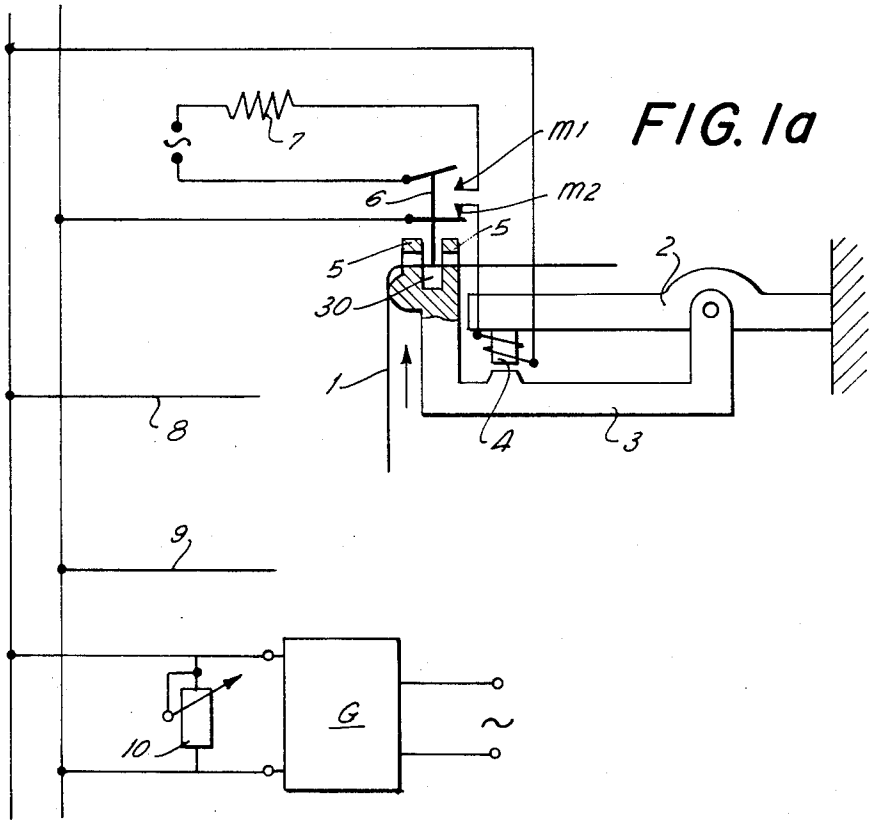


FIG. 1a

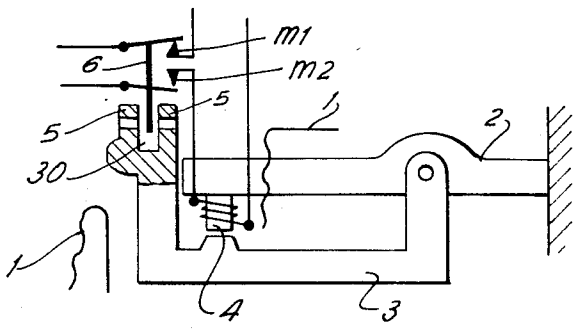


FIG. 1b

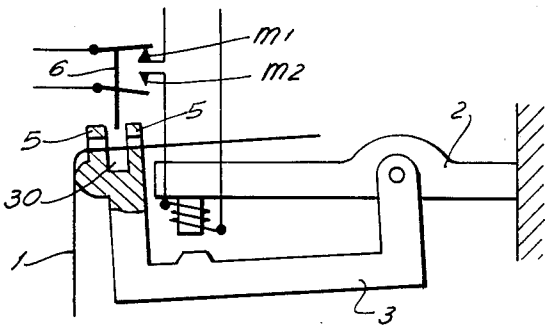


FIG. 1c

FIG. 2

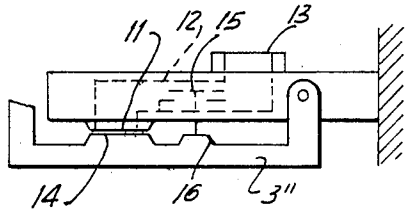
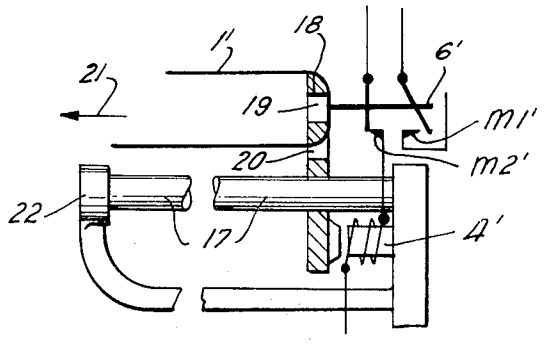


FIG. 3a



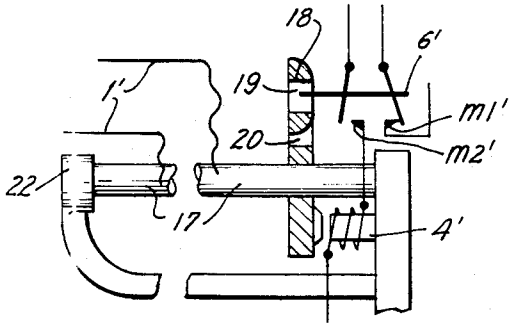


FIG. 3b

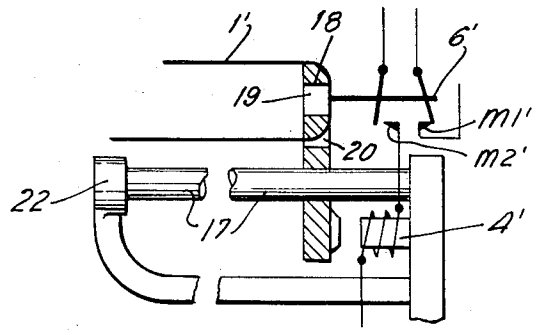


FIG. 3c

DEVICE FOR STOPPING A YARNWORKING MACHINE IN RESPONSE TO THREAD TENSION

BACKGROUND OF THE INVENTION

The invention relates to a method for stopping a yarn-working machine in response to thread tension, and to a device for practicing the method.

In yarnworking machines, thread tension which is too high will break the thread, and if operation is continued the product will be unusable. Even if the thread withstands the excessive tension, the quality of the product will be unsatisfactory. To overcome these defects, control means known in the trade as thread monitors are used, which will stop the yarnworking machine both in case of thread failure and if the maximum allowable thread tension is exceeded.

If known thread monitors, including those with electric contacts, a force derived from the thread tension is used to load or complete the loading of a reservoir in the form of a spring arrangement, and the criterion for the excess over maximum allowable thread tension that will trigger the stopping of the machine is determined by loading of the accumulator.

It is extremely difficult to set the loading into a motion which will permit the switching operations to be carried out. The spring arrangements of conventional type thread monitors effect changes in loading by changing the spring length. Thus, small changes in loading result in small length changes of the springs. Therefore, the desired spring tension must be accurately preset. This setting can be made only by skilled persons trained to set the desired spring tensions; such procedures require time and the settings must be made on the machine prior to use. The mechanism for setting the tension is located near the path of the thread and the adjusting mechanism is often inaccessible. The use of scales does not facilitate the work necessary to set the spring tension when equal and reproducible tensions must be obtained on a plurality of thread passages as, for example, in multi-system circular or flat knitting machines.

SUMMARY OF THE INVENTION

It is an object of the invention to eliminate the problems and disadvantages attendant when employing conventional type thread monitors for stopping a yarnworking machine. It is also an object of the invention to provide a device for stopping the machine by comparing a force provided by a source of energy independent of the thread tension with a force derived from the thread tension and varying proportionally with it. It is also a further object of the invention to provide a process for stopping the machine in response to thread tension by employing the device of the invention herein.

According to the invention, the maximum allowable thread tension is determined by a pull generating an effect of adhesion between two bodies in contact with each other without mechanical connection and diminishing with the distance between the, for example, the pull of a magnetic field.

The device for practicing the method according to the invention comprises a magnet, the pull of which keeps a thread holder, for example, a switch lever, in a neutral position permitting the machine to run, against a force acting upon it, derived from the thread tension and varying proportionally with it, and releases it to switch of its own accord into a position, stopping the machine as soon as the said force overcomes the pull of the magnet because the maximum allowable thread tension has been exceeded.

Even a device using a natural magnetic is advantageous for monitoring thread tension, for the variation of its pull by means of an air gap varied in width through an adjustment between it and the movable part acted upon by its pull is a very simple matter compared to adjustment of the spring arrangement heretofore used. But the disadvantage that the adjusting members are confined to the location of the monitoring means remains. To overcome this, especially where the pull of a plurality of magnets arranged in different locations must be adjustable to corresponding values, according to the invention an electromagnet with continuously variable field strength is provided, and a central control means for continuously regulating the field strength of the devices according to the invention arranged at a plurality of thread passages.

The use of an electromagnet to regulate the thread passage has distinct advantages. When a multi-system circular or flat knitting machine is to be converted to working a different kind of yarn whose maximum allowable tension differs from that of the kind previously worked, the spring arrangement of the monitors used must be adjusted individually to the maximum that will apply after conversion. The time required for this represents an extraordinary burden of cost, counting the loss of time during which the machine is out of operation. Through the central adjustability of the field strength of all electromagnets of the thread tension monitoring devices arranged on a plurality of thread passages, according to the invention, this loss of time is reduced to a minimum.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawing shows several embodiments of the device for practicing the method of the invention by way of example, the function of which device is to monitor the thread tension and stop the machine, not shown, when the thread tension is too high or too low.

FIG. 1*a* illustrates schematically the normal operating position of a device according to the invention in which the thread holder is a pivoted switch lever and the force to be compared with the thread tension emanates from the field of an electromagnet.

FIG. 1*b* illustrates the embodiment in accordance with FIG. 1a in a non-operative position, after the yarn has broken.

FIG. 1*c* illustrates the embodiment of FIG. 1*a* in a non-operative position, when the tension of the yarn has exeeded a predetermined value.

FIG. 2 illustrates a modification of the switch lever of FIG. 1*a* in which an air suction device provides the comparison force generated by the electromagnet of FIG. 1*a*.

FIG. 3*a* is a modification of the device of FIG. 1*a* in which the switch lever and thread holder is slidable along a rod and is illustrated in a normal operation position.

FIG. 3*b* illustrates the embodiment of FIG. 3*a* in a non-operative position, after the yarn has broken.

FIG. 3*c* illustrates the embodiment of FIG. 3*a* in a non-operative position when the tension in the yarn has exceeded a predetermined value.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The device of FIGS. 1*a* through 1*c* has a member 2 attached to a suitable part of the frame of the machine, to which member a lever 3 is linked so as to be able to swing in the plane of the drawing. This lever has a forked head whose prongs 5 have lateral holes in line with each other for passage of the thread 1. The thread, coming off the spool, passes over a boss on the head of the lever 3 and through the holes either by way of a conventional feeder or directly to the thread guide at the point of operation in question. The feeler 6 is carried by the segment of thread, taut during operation, traversing the space in the forked head 5 of the lever 3 in such position that, as shown in FIG. 1*a*, it holds the active contact of microswitch *m*1 open and the passive contact of microswitch *m*2 closed. FIG. 1*a* contact m1 which in the normal operative position is open, and which, when closed, provides current to the field magnet of the clutch mechanism 7, which serves to disengage the driving motor for driving the yarnworking machine from the same, see FIGS. 1*b* and 1*c* for the conditions when the tension applied to the yarn has exceeded a predetermined force or is broken. As illustrated in FIG. 1*a* the yarnworking machine is in its operating position with microswitch *m*1 in an open position and microswitch *m*2 in a closed position and the force being generated by electromagnet 4 is controlled by regulator or control means 10 while clutch 7 is in a non-operative position which permits the yarnworking machine to continue operation. By way of the passive contact of *m*2, the electromagnet 4 arranged under the member 2 receives direct current from the output of bridge rectifier G to generate the magnetic field, whose strength is continuously variable by means of the regulator 10. The winding of relay 7 in working position closes the circuit of an electromagnet, not shown, which releases the clutch between the yarnworking machine and its power source. The taut thread loads the lever 3 with a counterclockwise torque, while the electromagnet 4 holds it fixed in the neutral position shown so long as the torque acting on lever 3 in the opposite direction emanating from the thread tension is weaker or at all events no stronger than that exerted on lever 3 by the field of the electromagnet 4. If the thread tension increases further, the pull of the electromagnet will no longer suffice to hold the lever, and the lever 3 will swing down counterclockwise as illustrated in FIG. 1*c*. The feeler 6 will move down in direction toward lever 3, microswitch *m*2 will open and, at the same time, microswitch m1 will close, the winding 7 of the relay energizes the clutch mechanism between the machine and its source of power, the clutch is released and the machine stops.

Since the criterion for stopping the machine in case of thread failure, which eliminates the thread tension without any swinging movement on the part of the lever, is opposite to the one when the maximum allowable thread tension is exceeded, a second microswitch *m*2 is required, which switches off the energizing current for the electromagnet when the feeler 6 moves down as illustrated in FIG. 1*b*. Such movement of the feeler 6 independently of that of the lever 3 is possible because the feeler, unhindered by the segment of thread, now slack, that supported it, can drop into a groove located beneath the space between the fork prongs 5. The swing of lever 3 owing to disconnection of the energizing current for the winding of electromagnet 4, which takes place only after the feeler has already responded, has no effect on the functioning of the device according to the invention.

To indicate that several devices according to the invention, associated with all the individual thread passages of a multi-system circular or flat knitting machine, may have their electromagnets connected in parallel to a common line supplied from the bridge rectifier G, line 8 and 9 branching off from this common line are shown, supplying current to energize another electromagnet 4. Similarly, still more electromagnets may be connected to the common line. The regulating means 10, being in parallel with the aid common line, thus permits centralized continuous control of all energizing currents of electromagnets 4 to corresponding values, so that the thread tensions to which the devices according to the invention respond will be equal at all thread passages.

The embodiment of the device according to the invention as shown in FIG. 2 is connected by a suction line at 13 to a source of air suction not shown. The outgoing mouth of line 12 is surrounded by a sealing surface 11 fitting snuggly on the sealing surface 14 of lever 3'' when in the position of the drawing, in which it is held by the suction prevailing in line 12. The head, not shown, of lever 3'' is similar to that of lever 3 in FIG. 1*a*. A member corresponding to the feeler 6 in FIG. 1*a* and likewise not shown actuates only one microswitch, having the functions of the one designated *m*1 in FIG. 1*a* (stopping the machine at unduly high thread tensions). The valve 15 (FIG. 2) serves much the same purpose as the microswitch *m*2 in FIG. 1*a*. It is held open by a cam on lever 3'' as long as it is in the position of the drawing, allowing the suction of line 12 to act on surface 14. If the unduly increased thread tension overcomes the suction acting on the lever 3'', so that the latter swings downward, the valve 15, no longer supported by cam 16, closes under the suction of the air, so that further access of air through the mouth of line 12 is cut off.

The embodiment of the device according to the invention in FIGS. 3*a* through 3*c* differs from that of FIGS. 1*a* through 1*c* in the form of thread holder, which here becomes a member 18 supported by and slidable on the rod 17, and shown sectionally in the drawing. The thread 1' passes over the member 18, is turned 90°, spans the opening 19, and after making another 90° turn, leaves the bore 20 of the member in the same direction in which it had come out of the member. It thus forms a loop that tends to pull the member in the direction of the arrow 21 under the thread tension. This pull is opposed by the field of magnet 4'. As illustrated in FIG. 3*c* if owing to excessive thread tension the pull acting in the direction of arrow 21 overcomes that of the magnetic field, the member 18 is moved out of the neutral position shown and slides to the left along rod 17, possibly as far as the stop 22. Whether it will reach the stop depends on what length of yarn the machine will work from the time of disengagement of its power until its stops. If the maximum path of member 18 from neutral position to stop 22 is one meter, then another two meters of thread can be worked in that length of time. This length is sufficient even if the yarnworking machine is equipped with so-

called spool frames. Such is the advantage of this design of the device according to the invention.

In case of thread failure as illustrated in FIG. 3*b*, the member **18** remains in neutral position, but feeler **6'**, held by a light spring, not shown, against the segment of thread spanning the opening **19**, enters the opening, taking the slackened segment of thread with it, and switches microswitches *m*1' and *m*2' just as when the member **18** is shifted out of neutral position, where the segment of thread stretched over opening **19** gave way to the end of feeler **6'** in contact with it.

I claim:

1. Apparatus for stopping a yarnworking machine when the thread tension in the yarn exceeds a predetermined value or when the yarn breaks, comprising:

a thread holder assembly including a movable yarn carrying member for guiding said yarn in a predetermined path when in a first position, said member being movable to a second position in response to a force exerted thereon by the thread tension;

force generating means associated with the thread holder assembly for exerting a predetermined force on the yarn carrying member, said force being opposite the force exerted by the thread tension and sufficient to hold the yarn carrying member in the first position against the force exerted by the predetermined thread tension; and

switch means operatively connected to the yarnworking machine and the force generating means and responsive to the presence of yarn in the predetermined path for maintaining the machine in an operating condition and for energizing said force generating means, so that the switch means is responsive to the absence of yarn in the predetermined path and the machine is stopped when the yarn breaks or the thread tension exceeds the predetermined value causing the force of the force generating means to be overcome and the yarn carrying member to move to the second position.

2. The apparatus of claim **1** wherein the force generating means is an electromagnet.

3. The apparatus of claim **2** wherein the force generating means is also provided with means for continuously varying the field strength.

4. The device of claim **1** wherein the thread holder assembly is slidably mounted on a rod.

5. The apparatus of claim **4** wherein the force generating means is an electromagnet.

6. The apparatus of claim **1** wherein said movable yarn carrying member is pivoted at one end and having a forked head portion formed at the other end; said forked head portion having an opening therein for passing the yarn therethrough along said predetermined path.

7. The apparatus of claim **1** wherein the switch moves from a first operating position to a second position to stop the machine off in response to the absence of yarn in the predetermined path.

8. The apparatus of claim **7** wherein said switch means is electrically connected to the force generating means so that when the yarn breaks or the thread holder assembly moves in the direction of the force exerted on it by the yarn, the switch means will move from the first operating position and open a circuit for deenergizing the force generating means and the yarnworking machine.

9. An apparatus for stopping a yarnworking machine when the thread tension in the yarn exceeds a predetermined value or when the yarn breaks, comprising:

a thread holder assembly including a movably yarn carrying member for guiding said yarn in a predetermined path when in a first position, said member being movable to a second position in response to a force exerted thereon by the thread tension;

suction means constructed and arranged with the thread holder assembly for exerting a predetermined force on the yarn carrying member, the direction of said force being opposite to the force exerted by the thread tension and sufficient to hold the yarn carrying member in the first position against the force exerted by the predetermined thread tension; and

switch means operatively connected to the yarnworking machine and the force generating means and being responsive to the presence of yarn in the predetermined path for maintaining the machine in an operating condition and for energizing said force generating means, so that the switch means is responsive to the absence of yarn in the predetermined path and the machine is stopped when the yarn breaks or the thread tension exceeds the predetermined value causing the force maintained by the force generating means to be overcome and the yarn carrying member to move to the second position.

10. An apparatus for stopping a yarnworking machine, if the thread tension in the yarn exceeds a predetermined value or if the yarn breaks, comprising:

a thread holder assembly including a movable yarn carrying member for carrying the yarn along a predetermined path;

an electromagnet means constructed and arranged with the thread holder assembly for exerting a predetermined force on the yarn carrying member, the direction of said force being opposite to the force exerted by the thread tension and sufficient to hold the yarn carrying member in a first position against the force exerted by the predetermined thread tension; and

switch means including a feeler which feels the position of the yarn on the yarn carrying member whereby when the position of the yarn is changed along the predetermined path the switch operates from its first position to a second position to stop the machine.

11. The apparatus of claim **10** wherein the feeler also effects a deenergization of the electromagnet.

12. The device of claim **10** wherein the yarn carrying member is slidably positioned on a rod to slide in the direction of the force exerted on it by the yarn.

13. The apparatus of claim **10** wherein the yarn carrying member includes a recess over which the yarn is passed and in which said feeler rests on the yarn to determine the position of the yarn as it is moving along said predetermined path.

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