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APPARATUS FOR REGULATING THE OPERATION OF YARN SPINNING MACHINES

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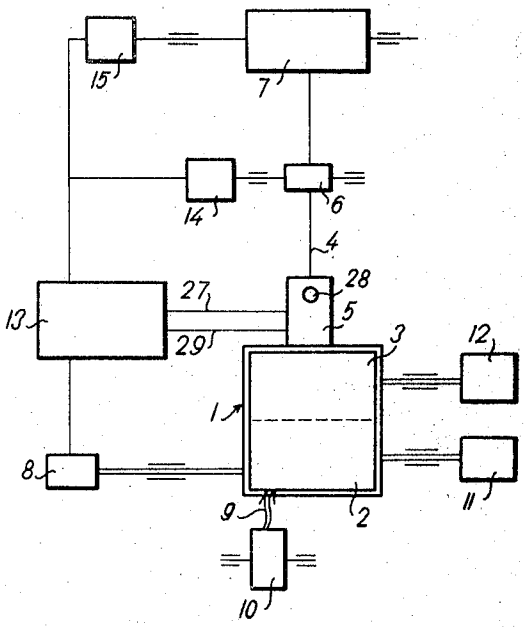
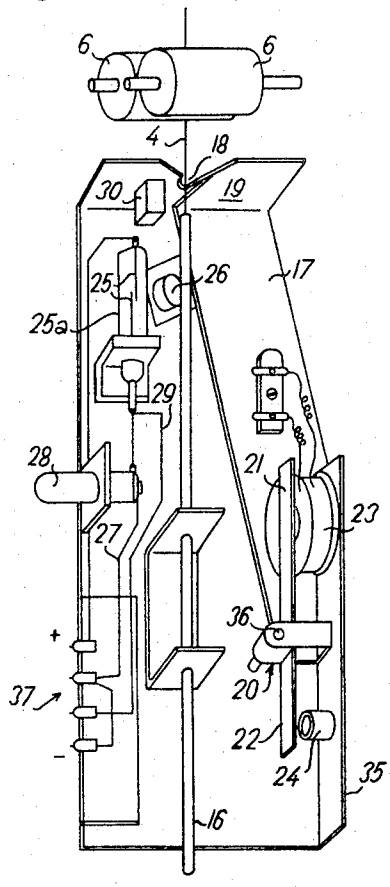


Fig. 1

Fig. 2



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APPARATUS FOR REGULATING THE OPERATION OF YARN SPINNING MACHINES

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ABSTRACT OF THE DISCLOSURE

A detector which bears against the travelling yarn is provided with a magnet which can close a normally open electric switch in response to yarn breakage whereby the switch terminates the advance of yarn. The switch is installed in an envelope which shields its parts from dust or other foreign matter.

A second magnet biases the detector against the yarn and rapidly displaces the detector to switch-closing position in response to yarn breakage. An electromagnet returns the detector to initial position with a delay following yarn breakage.

Background of the invention

The present invention relates to yarn spinning machines in general, and more particularly to improvements in an apparatus for regulating the operation of spinning machines. Still more particularly, the invention relates to an apparatus which can detect breakage of yarn in ringless and analogous spinning machines and which can interrupt the feed of yarn in response to detection of breakage.

It is already known to place a detector adjacent to the path of yarn in a spinning machine so that the detector can produce a signal when the yarn breaks. Such signal is utilized to start certain operations, such as arresting the yarn and connecting the trailing end of the yarn to the leading end of the next-following yarn. A serious drawback of presently known regulating apparatus which embody such detectors is that their operation can be affected by dust and/or other foreign matter which is normally present in a textile plant. The foreign matter can affect the operation of the regulating device irrespective of its design, i.e., whether mechanical, electrical or electrooptical, and improper operation of such regulating devices can cause substantial losses in output.

Accordingly, it is an important object of the present invention to provide an apparatus for regulating the operation of yarn spinning machines and to construct and assemble the apparatus in such a way that its operation is not affected by the presence of dust or other foreign matter or is affected less than the operation of presently known apparatus.

Another object of the invention is to provide a novel detector which can be used in the improved apparatus and to construct and assemble the detector in such a way that it can produce or initiate the generation of satisfactory signals whenever it detects a break in the yarn and irrespective of the presence and quantity of solid or other impurities in the surrounding atmosphere.

A further object of the invention is to provide a fully automatic regulating apparatus which can be installed in known ringless and other spinning machines and which requires no attention on the part of the operating personnel.

An additional object of our invention is to provide a regulating apparatus which occupies little room, which

comprises a relatively small number of simple and rugged components, which can restart a spinning machine when the break in the yarn is eliminated, and which consumes little energy.

Summary of the invention

Briefly outlined, one feature of our invention resides in the provision of an apparatus for regulating the operation of ringless and other yarn spinning machines. The apparatus comprises driven rolls or analogous advancing means for moving the yarn from the producing station lengthwise in a predetermined direction and in a predetermined path so that the yarn is maintained under tension, control means operative to terminate the movement of yarn in the predetermined direction and including switch contacts at least one of which is movable with reference to the other contact in response to placing into a suitable magnetic field to thereby trigger the operation of the control means, an envelope arranged to shield the contacts from foreign matter and to thus insure proper operation of the control means irrespective of the quantity of foreign matter in the surrounding atmosphere, detector means movable from a first position of engagement with the yarn in the aforementioned path when the yarn is under requisite tension to a second position when the tension is relaxed, for example, due to yarn breakage, and magnet means movable with the detector means and arranged to move the one contact with reference to the other contact in the second position of the detector means. The two contacts preferably form part of a normally open switch which closes automatically in response to movement of detector means to second position, and such switch then completes the circuit of a signal lamp or another device which is capable of producing a visible, audible or otherwise detectable signal.

The apparatus preferably further comprises an accelerating device which permanently urges the detector means to second position, i.e., which biases the detector means against the yarn. The control means preferably includes a resetting device which automatically returns the detector means to first position with a delay during which the machine eliminates the break.

The novel features which are considered as characteristic of the invention are set forth in particular in the appended claims. The improved regulating apparatus itself, however, both as to its construction and its mode of operation, together with additional features and advantages thereof, will be best understood upon perusal of the following detailed description of certain specific embodiments with reference to the accompanying drawing.

Brief description of the drawing

FIG. 1 is a diagram showing the component parts of a ringless spinning machine whose operation is regulated by the apparatus of our invention; and

FIG. 2 is a perspective view of the regulating apparatus.

Description of the preferred embodiments

Referring first to FIG. 1, there is shown a diagram of a ringless spinning machine which comprises a spinning unit **1** including a separating mechanism **2** and a yarn forming unit **3**. The yarn **4** is conveyed upwardly in a vertical path defined in part by a suction tube **16** (see FIG. 2) and its tension is tested by a detector unit **5** in a manner to be fully described in connection with FIG. 2. The means for advancing the yarn upwardly comprises a pair of advancing rolls **6** at least one of which is driven, and the yarn is taken up by a driven bobbin **7** located at a level above the rolls **6**.

The spinning unit **1** further comprises a series of drives including a drive **8** which feeds the sliver **9** from a source **10**, a drive **11** which operates the separating

mechanism 2, and a drive 12 for the yarn forming unit 3. The latter preferably comprises a conventional spinning chamber which is maintained at subatmospheric pressure, together with the interior of the tube 16. The operation of the drive 8 is regulated by a control unit 13 which receives signals from the detector unit 5. The control unit 13 further regulates the operation of a reversible drive 14 for the advancing rolls 6 and the operation of a reversible drive 15 for the bobbin 7.

The detector unit 5 and certain parts of the control unit 13 are shown in greater detail in FIG. 2. The detector unit 5 comprises a main support or frame 35 which carries the aforementioned suction tube 16. The upper end of the tube 16 is spaced from a yarn guide 18 which is provided on the frame 35 and guides the yarn 4 at a level below the advancing rolls 6. The detector unit 5 further comprises a detector means or sensor 17 which resembles a lever and is rockable on a horizontal pivot pin 36. Its bent-over upper end portion 19 engages and bears against the yarn 4 between the upper end of the suction tube 16 and the guide 18. The end portion 19 of the sensor 17 is biased against the yarn 4 by an accelerating device including a permanent magnet 24 installed on the frame 35 and a magnetizable member 22 which is rigid with the sensor 17. The member 22 constitutes the lower arm of a two-armed lever 20 which is rockable on the pin 36 and whose upper arm 21 constitutes the armature of an electromagnet 23 affixed to the frame 35. The lever 20 consists of ferromagnetic material. When the electromagnet 23 is energized, it attracts the arm 21 and causes the sensor 17 to return to the normal or operative position of FIG. 2 in which its upper end portion 19 can engage the yarn 4 while the latter is under normal tension. The electromagnet 23 is stronger than the magnet 24 but the latter takes over as soon as the sensor 17 returns to the position of FIG. 2 and cooperates with the arm 22 to bias the sensor 17 to a second position in which the upper end portion 19 abuts against a suitable cushion 30, for example, a pad of rubber or like elastomeric material attached to the frame 35. The sensor 17 carries a permanent magnet 26 which serves as a means for closing an electric switch in response to movement of the sensor 17 to second position. The latter can assume such second position when the yarn 4 breaks or its tension decreases sufficiently so that the magnet 24 can rapidly attract the arm 22 and propels the end portion 19 toward and into abutment with the cushion 30.

The aforementioned switch forms part of an electric circuit in the control unit 13 and comprises two normally spaced electric contacts 25 at least one of which moves into current-conducting engagement with the other contact when placed into a magnetic field of requisite strength. Such field is produced by the permanent magnet 26 and its intensity is sufficient to close the switch when the end portion 19 of the sensor 17 abuts against the cushion 30, i.e, when the yarn 4 breaks.

In accordance with a feature of our invention, the contacts 25 are shielded by an envelope 25*a* of vitreous or other suitable material so that the closing and/or opening of the switch is not affected by the presence of dust or other foreign matter in the space surrounding the envelope 25*a*. All that counts is to move the magnet 26 sufficiently close to the envelope 25*a* to effect closing of the switch contacts 25 whereby the control unit 13 automatically arrests the drive 8 and reverses the drives 14, 15, i.e., the upward movement of broken yarn 4 is arrested and the rolls 6 begin to feed the yarn backwards. The arrangement is such that the trailing portion of the yarn is still located in the suction tube 16 when the sensor 17 assumes the second position in which the contacts 25 are closed. Since the interior of the tube 16 is maintained under subatmospheric pressure, the trailing end of the yarn is drawn back into the aforementioned spinning chamber and is placed onto a so-called collecting surface

of the yarn forming unit 3. Reopening of contacts 25 takes place when the yarn 4 is tensioned again and such opening causes the control unit 13 to restart the drive 8 and to reverse the operation of drives 14, 15 so that the tensioned yarn begins to travel upwardly.

Conductors 27, 29 connect the switch contacts 25 in circuit with a signal lamp 28 which lights up when the sensor 17 moves to second position. The lamp 28 can be replaced by a bell or another suitable signal generating device. A source of electrical energy for the control unit 13 is shown at 37.

The electromagnet 23 is connected in series with the switch contacts 25 so that it is energized in response to movement of the yarn-engaging portion 19 into abutment with the cushion 30. Energization of electromagnet 23 can be timed by a suitable time delay relay or the like to provide time for reversal of drives 14, 15 and return movement of yarn 4 toward the unit 3.

In normal operation of the spinning machine, the drive 8 advances sliver 9 from the source 10 and the drives 14, 15 are operative to cause upward movement of yarn 4, such yarn being taken up by the bobbin 7. The magnet 24 attracts the lower arm 22 of the lever 20 so that the upper end portion 19 of the sensor 17 bears against the yarn between the suction tube 16 and yarn guide 18 and the yarn is strong enough to withstand such bias and to prevent movement of the end portion 19 into abutment with the cushion 30.

If the yarn 4 breaks in the unit 3 or its tension decreases for another reason, the lower arm 22 of the lever 20 is accelerated by the magnet 24 and propels the upper end portion 19 of the sensor 17 against the cushion 30 even before the trailing end of the yarn leaves the suction tube 16. The magnet 26 closes the switch contacts 25 because the sensor 17 has assumed its second position and the signal lamp 28 lights up. The end portion 19 urges the yarn against the cushion 30 to arrest its forward movement. Closing of switch contacts 25 produces a signal which causes the control unit 13 to arrest the drive 8 and to reverse the drives 14, 15. The electromagnet 23 is energized and attracts the upper arm 21 of the lever 20 against the opposition of the permanent magnet 24 so that the end portion 19 of the sensor 17 releases the yarn 4 and such yarn can travel downwardly. The operation of the drive 12 is not dependent on the position of the contacts 25, i.e., the interior of the tube 16 remains under suction and the yarn is drawn back into the unit 3 and its trailing end is placed onto the aforementioned collecting surface of the unit 3. The collecting surface then attracts the yarn. The contacts 25 are opened when the collecting surface already holds the trailing end of the yarn, and such opening of contacts 25 causes the control unit 13 to start the drive 8 and to reverse the drives 14, 15. The drive 11 operates continuously. The yarn 4 is tensioned as soon as the rolls 6 begin to rotate in a sense to move the yarn toward the bobbin 7.

When the spinning machine is arrested, the magnet 24 attracts the arm 22 and the end portion 19 of the sensor presses an intermediate portion of the yarn 4 against the cushion 30. A portion of the yarn remains in the tube 16. The yarn can be released in response to short-lasting energization of the electromagnet 23. The duration of such energization is determined by a time-delay relay in the circuit of the control unit 13. The purpose of clamping the yarn against the cushion 30 when the spinning machine is idle is to prevent complete extraction of yarn from the tube 16 and to permit for automatic splicing of yarn on restarting of the machine. Manual threading of yarn through the tube 16 and into the unit 3 is a time-consuming operation.

The signal lamp 28 is of particular importance if the machine is not provided with the aforedescribed automatic splicing or spinning-in assembly. The lamp 28 warns the persons in charge that the yarn has developed a break.

The source **37** is preferably independent of the main source of electrical energy for the spinning machine. This insures that the yarn **4** will be properly held in response to stoppage which is due to interruption of the main power supply. For example, the source **37** may include a set of batteries or accumulators.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can, by applying current knowledge, readily adapt it for various applications without omitting features which fairly constitute essential characteristics of the generic and specific aspec s of our contribution to the art and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. Apparatus for regulating the operation of yarn spinning machines, comprising advancing means for moving the yarn under tension lengthwise in a predetermined direction and along a predetermined path; control means operative to terminate the movement of yarn in said direction and including switch contacts at least one of which is movable with reference to the other in response to placing into a magnetic field to thereby trigger the operation of said control means; detector means movable from a first position of enagement with the yarn in said path when the yarn is under tension to a second position when the tension is relaxed due to yarn breakage; magnet means movable with said detector means and arranged to move said one contact with reference to said other contact in the second position of said detector means; means for accelerating the movement of said detector means to second position; and resetting means for returning said de ector means to first position in automatic response to movement of said detector means to second position.

2. Apparatus as defined in claim **1**, wherein said one contact is arranged to move into current-conducting engagement with said other contact to thereby complete an electric circuit in said control means in response to movement of said detector means to second position, and further comprising means for shielding said contacts from foreign matter including an envelope of vitreous material, said magnet means comprising a permanent magnet affixed to said detector means.

3. Apparatus as defined in claim **1**, further comprising a tube defining a portion of said path and a yarn guide spaced from one end of said tube, said detector means having a yarn-engaging portion located between said tube and said yarn guide.

4. Apparatus as defined in claim **1**, wherein said accelerating means comprises a magnetizable member and a magnet member positioned to attract said magnetizable member, one of said members being fixed and the other of said members being connected for movement with said de ector means and said other member being free to move toward said one member in response to yarn breakage to thereby move said detector means to second position.

5. Apparatus as defined in claim **1**, further comprising cushioning means for arresting the detector means in said second position.

6. Apparatus as defined in claim **1**, wherein said reset ing means comprises an electromagnet and said detector means comprises a portion constituting the armature of said electromagnet, said control means further comprising means for energizing said electromagnet on movement of said detector means to second position.

7. Apparatus as defined in claim **6**, wherein said detector means comprises a two-armed lever one arm of which constitutes said armature and the other arm of which consists of magnetizable material, said lever being rockable about a fixed axis in response to movement of said detector means between first and second positions, said accelerating means comprising a permanent magnet adjacent to and arranged to attract said other arm to thereby accelerate the detector means during movement from the first to second position.

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