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CONTROL FOR TEXTILE MACHINE

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Fig. 1

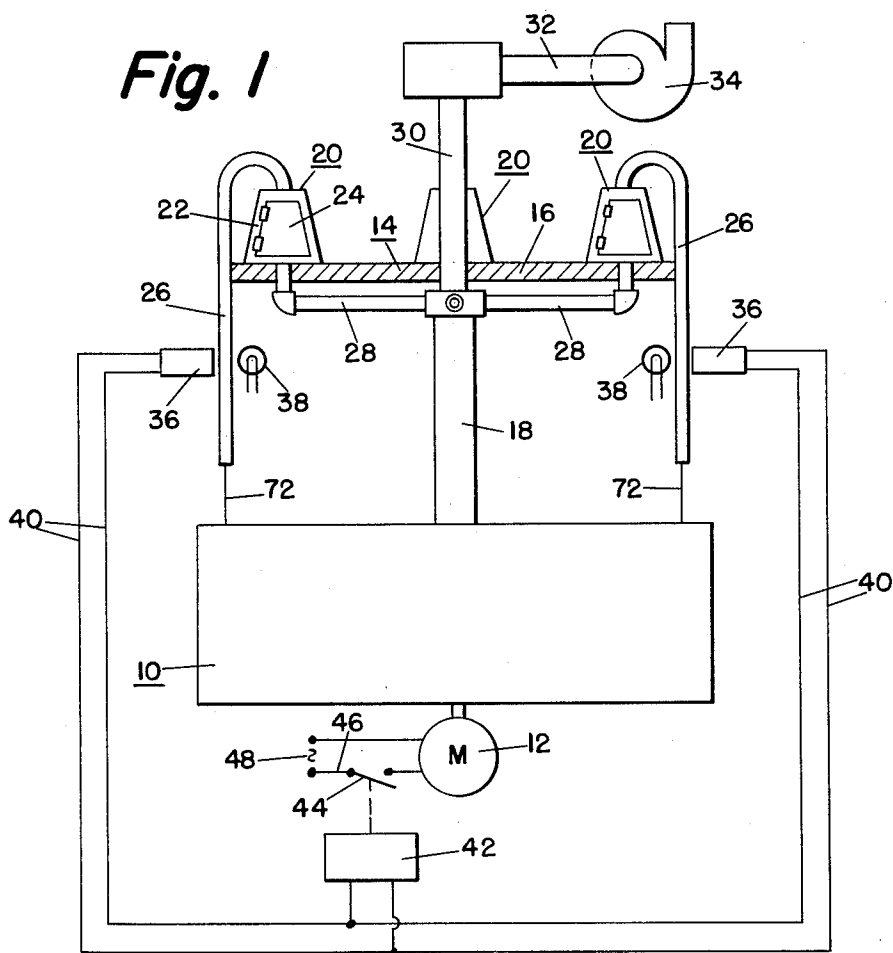


Fig. 2

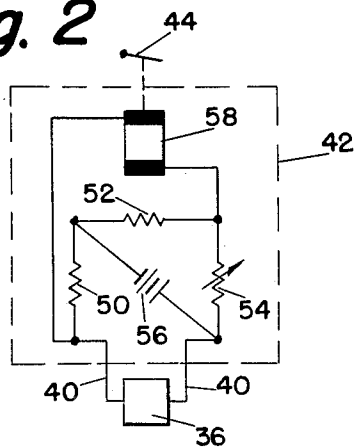
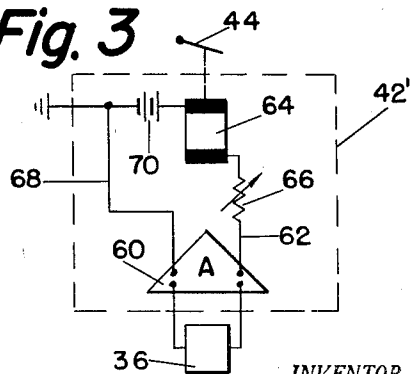


Fig. 3



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CONTROL FOR TEXTILE MACHINE

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5 Claims. (Cl. 28—51)

The present invention relates to a control for a textile machine, and more particularly to a control apparatus for stopping the operation of a textile machine in the event of either the breakage or the change in density of the thread or yarn being fed to the textile machine.

In the operation of a textile machine, such as a knitting, weaving, winding, twisting, or like machine, a problem is to stop the operation of the machine in the event that the thread or yarn being fed to the machine breaks. Heretofore, the devices used for this purpose required the thread or yarn to be under a relatively high tension so that any change in the tension of the thread or yarn operated the control device. However, there are textile machines in which the tension on the thread or yarn is relatively light so that the tension plate control device would not operate properly. Also, such tension control devices cannot detect variations in the thickness or density of the thread or yarn.

Some textile machines require the use of a thread or yarn of constant uniform thickness or density, and some textile machines use a multi-filament thread or yarn. For such machines it is desirable to have a control device which will not only detect breakages of the thread or yarn, but also variations in thickness or density, and even the breakage of a single filament of a multi-filament thread.

It is an object of the present invention to provide a novel control apparatus for a textile machine.

It is another object of the present invention to provide a novel control for stopping the operation of a textile machine upon the breakage of a thread or yarn being fed to the machine.

It is a further object of the present invention to provide a novel control for stopping the operation of a textile machine in the event of a variation of thickness or density of the thread or yarn being fed to the machine.

Other objects will appear hereinafter.

For the purpose of illustrating the invention there is shown in the drawings forms which are presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIGURE 1 is a diagrammatic view of a textile machine utilizing the control apparatus of the present invention.

FIGURE 2 is a circuit diagram of one type of switch which can be used in the control apparatus of the present invention.

FIGURE 3 is a circuit diagram of another type of switch which can be used in the control apparatus of the present invention.

Referring initially to FIGURE 1, the textile machine which utilizes the control apparatus of the present invention is generally designated as 10. The textile machine 10 may be any well-known type of knitting machine, weaving machine, winding machine, twisting machine, or the like types of machines. The textile machine 10 is operated by an electric motor 12.

A yarn rack, generally designated as 14 is mounted on the textile machine 10. The yarn rack 14 comprises a plate 16 supported on a post 18. A plurality of vacuum yarn feeding devices, generally designated as 20, are mounted on the plate 16. The vacuum yarn feeding devices 20 are described in detail in the copending patent

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application of John E. Malloy and John M. Ashe, Serial No. 806,297, filed April 14, 1959, now Patent No. 2,944,414, entitled "Vacuum Yarn Feeding Device," the disclosure of which is incorporated herein by reference.

In general, each of the vacuum yarn feeding devices 20 comprises an enclosed casing 22 of a transparent material, such as a plastic. The casing 22 has a door 24 hingedly mounted thereon to permit access to the interior of the casing 22. Within the casing 22 there is provided means for mounting a bobbin or spool of yarn or thread, not shown. A feed tube 26 extends upwardly from the top of the casing 22, and is curved downwardly to extend to the textile machine 10. Feed tube 26 is of a transparent material, such as a plastic. An exhaust tube 28 extends through the plate 16 and the bottom of the casing 22. The exhaust tubes 28 are connected through pipes 30 and 32 to a vacuum pump 34.

The control apparatus of the present invention comprises a separate photoelectric cell 36 mounted next to each of the feed tubes 26, with the photoelectric cell 36 being directed transversely across the feed tube 26. The photoelectric cells 36 may be either of the type which generates a voltage upon being exposed to light, or the type which changes in resistance when exposed to light. A separate source of light, such as a light bulb 38 is mounted next to each of the feed tubes 26, and diametrically across the feed tube 26 from the photoelectric cell 36 so as to direct its light across the feed tube 26 to the photoelectric cell 36. Each of the photoelectric cells 36 is connected by wires 40 to a switching mechanism, generally designated as 42. The switching mechanism 42 controls a switch 44 which is in the line 46 between the electric motor 12 and the source of electric current 48 for the motor 12. Thus, when the switch 44 is closed, the motor 12 will operate to operate the textile machine 10, and when the switch 44 is opened, the motor 12 is stopped to stop the operation of the textile machine 10.

Referring to FIGURE 2, there is shown one type of switching mechanism 42 for use with a photoelectric cell 36 of the type which changes in resistance when exposed to light. The switching mechanism 42 of the illustrated embodiment in FIGURE 2 comprises three electrical resistors 50, 52 and 54 connected in the form of a Wheatstone bridge with the photoelectric cell 36 forming one arm of the bridge. The resistor 54 is a variable resistor to permit balancing the bridge. A source of electrical current, such as a battery 56 is connected across two diagonally opposite corners of the bridge. A solenoid coil 58 is connected across the output corners of the bridge. The solenoid 58 is the coil of a relay which operates the switch 44.

FIGURE 3 shows one type of switching mechanism 42' for use with a photoelectric cell 36 of the type which generates a voltage when exposed to light. The switching mechanism 42' comprises an amplifier 60 to which the photoelectric cells 36 are connected to increase the voltage generated by the photoelectric cells 36. One side of the output of the amplifier 60 is connected by line 62 to one end of the coil of a solenoid 64. The line 62 includes a variable resistor 66. The other side of the output of the amplifier 60 is connected by line 68 to ground. A source of electrical current, such as a battery 70 is connected between ground and the other end of the coil of the solenoid 64. The battery 70 is connected to the solenoid 64 so that the current from the battery 70 is of opposite polarity to the current from the photoelectric cells 36. Thus, the photoelectric cells 36 and the battery 70 are connected to the solenoid 64 in bucking relation. The solenoid 64 is part of a relay which operates the switch 44.

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The operation of the textile machine 10 using the control apparatus of the present invention is as follows:

The thread or filament of yarn 72 from the spool or bobbin within each of the casings 22 of the vacuum yarn feeding devices 20 is threaded through its respective feed tube 26 to the textile machine 10. The vacuum pump 34 is turned on to draw a vacuum in the casings 22, and draw air through the feed tubes 26 into the casings 22. As described in the copending application Serial No. 806,297, the air passing through the feed tubes 26 in the direction opposite to the movement of the threads 72 applies a slight tension to the threads 72.

The electric lights 38 are turned on to direct a beam of light across each of the feed tubes 26 to the photoelectric cells 36. Since a thread or filament of yarn 72 is passing through each of the feed tubes 26, part of all of the beam of light is blocked by the threads 72. The amount of light which reaches the photoelectric cells 36 depends on the size and density of the threads 72. Thus, with a particular thread 72 passing through the feed tube 26, each of the photoelectric cells 36 is exposed to an amount of light to provide each photoelectric cell 36 with a basic output characteristic. Such basic output characteristic will be either a certain electrical resistance or a certain output voltage according to the type of photoelectric cell 36 used. As will be explained later, the switching mechanism 42 is adjusted with respect to the basic output characteristic of the photoelectric cells 36 to permit the switch 44 to be closed. Thus, the electric motor 12 is provided with current so as to operate the textile machine 10.

During the operation of the textile machine 10, the threads 72 are drawn from the spools or bobbins within the casing 22 to the textile machine 10. Thus, the threads 72 are constantly moving across the photoelectric cells 36. If one of the threads 72 breaks, the flow of air through the feed tubes 26 will draw the broken end of the threads 72 back into the casing 22. When this happens, the photoelectric cell 36 for the broken thread 72 is exposed to a greater amount of the light from its light bulb 38, and the output characteristics of the photoelectric cell 36 is changed. The change in the output characteristics of the photoelectric cell 36 causes the switching mechanism 42 to operate to open the switch 44. The opening of the switch 44 stops the motor 12 and thereby stops the operation of the textile machine 10. In addition, if any thread 72 changes in thickness or density, the amount of light reaching the photoelectric cell 36 will change to change the output characteristic of the photoelectric cell 36. This change in the output characteristic of the photoelectric cell 36 operates the switching mechanism 42 to open the switch 44 and stop the operation of the textile machine 10. Also, if each thread 72 comprises a plurality of filaments bundled together, the breakage of any one filament will change the size and density of the strand, and thereby change the amount of light reaching the photoelectric cell 36. The output characteristic of the photoelectric cell 36 will be changed to operate the switching mechanism 42 and thereby stop the operation of the textile machine 10. Thus, the control apparatus of the present invention will stop the operation of the textile machine 10 either upon the breakage of a thread or upon the change in size or density of a thread.

When using the switching mechanism 42 shown in FIGURE 2 for a photoelectric cell 36 of the type which changes in electrical resistance upon being exposed to light, the Wheatstone bridge is balanced by means of the variable resistor 54 to the basic output characteristic of the photoelectric cells 36. The photoelectric cells 36 may be connected across their arm of the bridge either in series or in parallel. When the Wheatstone bridge is balanced, there will be no current flowing through the solenoid coil 58 so that the switch 44 which is a part of the relay containing the solenoid 58 can be held closed by a spring. However, when the electrical resistance of any one of the photoelectric cells 36 is changed from its basic electrical

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resistance because of either a broken thread or a change in thickness or density of a thread, the Wheatstone bridge will become unbalanced. Thus, the Wheatstone bridge will provide an output current which will energize the solenoid 58 to open the switch 44.

When using the switching mechanism 42' shown in FIGURE 3 for a photoelectric cell 36 of the type which provides a voltage when exposed to light, the switching mechanism 42' is balanced with regard to the basic output characteristic of the photoelectric cells 36 by the variable resistor 66. The output of the photoelectric cells 36 is amplified by the amplifier 60, and flows through the solenoid 64 in the direction opposite to the flow of current from the battery 70. By adjusting the electrical resistor 66, the current from the photoelectric cells 36 may be made equal to the current flowing from the battery 70. Since the currents from the battery 70 and the photoelectric cells 36 are in bucking relation, the currents of equal magnitude will balance each other out so that no current will be flowing through the solenoid 64. Thus, the switch 44 can be held closed. However, if the current from the photoelectric cells increases due to a breakage of a thread 72, the current from the photoelectric cells 36 will be greater than the current from the battery 70 so that a current will flow across the solenoid 64 to energize the solenoid 64. This will cause the switch 44 to open, and thereby stop the operation of the textile machine 10. If the density or thickness of a thread 72 increases, less light will reach the photoelectric cell 36 so that the current from the photoelectric cell 36 will decrease. A decrease in the current from the photoelectric cells 36 will cause a flow of current through the solenoid 64 from the battery 70. This energizes the solenoid 64 to open the switch 44, and stop the operation of the textile machine 10.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims rather than to the foregoing specification as indicating the scope of the invention.

I claim:

1. In a textile machine, a tube of a translucent material extending from a source of a thread to the textile machine, a thread extending from said source of thread through said tube, a light sensitive device mounted next to said tube, said light sensitive device being an electrical device whose output characteristics vary with the amount of light to which the device is exposed due to changes in the characteristics of said thread within said tube, a source of light mounted next to said tube directly opposite to said light sensitive device, said source of light directing a beam of light through said tube to the light sensitive device, a switch for controlling the operation of the textile machine, and means connecting said light sensitive device to said switch so that a change in the output characteristics of said light sensitive device opens said switch to stop the operation of the said textile machine, and means connected to said tube for drawing a stream of air through said tube in the direction opposite to the movement of said thread through said tube.

2. In a textile machine, an enclosed casing, a bobbin of yarn in said casing, a tube of translucent material extending from said casing at a point above said bobbin to a machine, a thread extending from said bobbin through said tube, a light sensitive device mounted adjacent to said tube, said light sensitive device being an electrical device whose output characteristics vary with the amount of light to which the device is exposed due to changes in the characteristics of said thread within said tube, a source of light mounted next to said tube directly opposite to said light sensitive device, said source of light directing a beam of light through said tube to the light sensitive device, a switch for controlling the operation of the machine, means connecting said light sensitive device to said switch so that a change in the output characteristics

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of said light sensitive device opens said switch to stop the operation of said machine, and means connected to said casing below said bobbin for drawing a stream of air through said tube into said enclosed casing in a direction opposite to the movement of the thread through said tube.

3. In a textile machine in accordance with claim 2 wherein said enclosed casing is made of transparent material.

4. In a machine in accordance with claim 2 wherein said first mentioned means includes a Wheatstone bridge with said light sensitive device being one arm of said Wheatstone bridge, and a solenoid coil connected across output corners of said bridge for operating said switch to stop the machine.

5. In a machine in accordance with claim 2 wherein said first mentioned means includes an amplifier connected to the output of said light sensitive device, a first wire connecting said amplifier to a solenoid coil, said

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coil being operatively connected to said switch, a battery connected to said first wire between said coil and said amplifier, a second wire connected to said amplifier and said coil, a variable resistor in said second wire, whereby the output of said light sensitive device flows through the coil in a direction opposite to the direction of flow of current from the battery, thereby balancing each other, whereby increases and decreases in the output from said device activates said coil thereby operating said switch to stop the machine.

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