

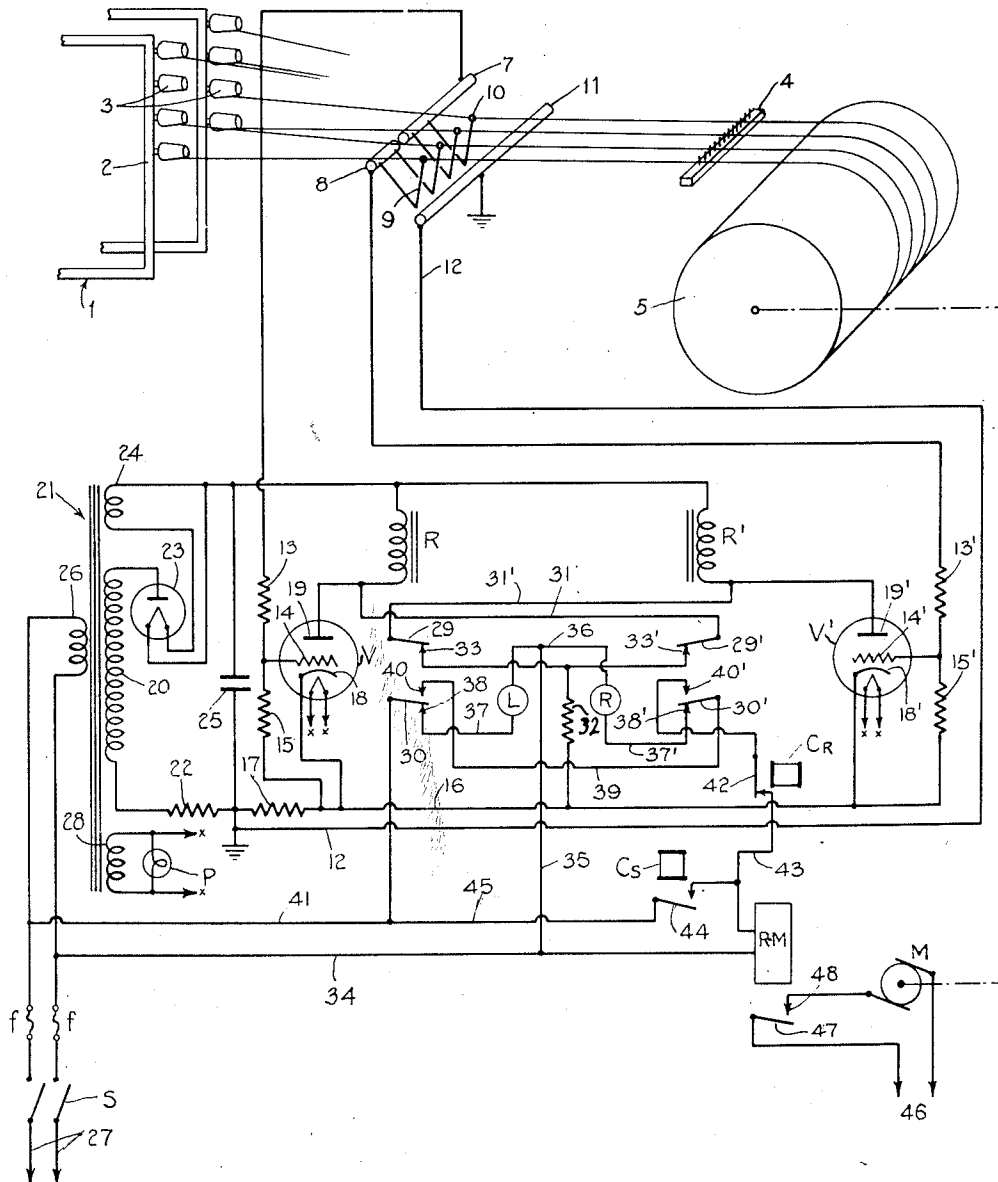
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ELECTRONIC TEXTILE CONTROL DEVICE

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## ELECTRONIC TEXTILE CONTROL DEVICE

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The present invention relates to a novel automatic stop-motion device for use in the textile industry and, more particularly, to an improved device for arresting progress of all threads in a textile machine upon the occurrence of relaxation or loss of tension in any thread and for providing a selective indication of such relaxation.

The stop motion device of the present invention, while of general application, is particularly adapted for use with a textile warper and will therefore be described with reference thereto.

An electronic warper stop motion which is now in commercial use and which has been found to give satisfaction in operation is one in which ungrounded drop wires associated with threads coming from one side of a creel are connected through a resistor to the control grid of a normally energized electronic tube to cause deenergization of the tube upon grounding of a drop wire resulting from breakage of an associated thread, deenergization of the tube causing a relay to open the circuit of the motor advancing the thread and causing a signal lamp to be lighted. Similarly, in the above mentioned device, the ungrounded drop wires associated with the threads coming from the other side of the creel are connected through a resistor to the control grid of a second normally energized electronic tube to cause deenergization of the tube upon grounding of a drop wire and opening of the circuit of the motor and lighting of a signal lamp, an interlocking circuit being provided to prevent the closure of the circuit of one lamp after that of the other has been completed.

The stop motion device of the present invention is generally similar to that above briefly described but is a decided improvement thereover in a number of important respects. The circuit of the new stop motion utilizes fewer elements and is so designed that the components thereof can operate well within their rated tolerances. The new device can be manufactured for about one-fourth of the cost of the earlier device.

The single figure of the drawing illustrates a schematic perspective view of the essential elements of a stop-motion device for use in association with a warper and includes a circuit diagram of the new electrical circuit of the invention.

In the drawing, a warper creel is indicated diagrammatically at 1 as composed of vertical bars 2, each carrying a plurality of cones of thread 3. The threads are drawn through a comb 4 to a warp beam 5, which is rotated by a motor M. The improved device of this invention provides two terminal bars 7 and 8, which are respectively

associated with the left side and right side of the creel, said bars being positioned transversely of the direction of travel of the threads. Each terminal bar has a multiplicity of drop wires 9 radially displaceable with respect to the bar and electrically connected thereto. These drop wires are upwardly bent, and each has a small aperture or eye 10 at the end remote from the connection to the terminal bar, said eye being adapted for passage therethrough of a thread. A metal contact bar 11 is positioned below and substantially parallel to the two terminal bars and at a distance therefrom such that the drop wires 9 make contact therewith when released by relaxation of the threads passing through the eyes 10 of these wires. The contact bar 11 is connected to a common ground circuit 12, and the terminal bars 7 and 8 are supported in suitable mountings (not shown) to insulate them from grounded elements of the machine.

The control circuit which is operated by the making of a contact between a drop wire 9 and ground bar 11 is made up of two similar networks one containing an electronic tube V responsive to such contact between the ground bar and a drop wire attached to the left-hand terminal bar 7 and associated with the left-hand section of the creel 1, and the other containing an electronic tube V' which is similarly responsive to closure of the circuit between the right-hand terminal bar 8 and the ground bar 11. The left-hand terminal bar 7 is connected through a circuit limiting resistor 13 to the control grid 14 of tube V. Control grid 14 is also connected through a grid resistor 15 to a line 16 which is connected to ground wire 12 through a resistor 17. The cathode 18 of tube V is connected directly to line 16. The plate 19 of tube V is connected through the energizing winding of relay R to a source of high potential comprising the rectified and filtered output from the secondary winding 20 of a step-up transformer 21. One end of winding 20 is connected to ground wire 12 through a resistor 22 and the other end is connected to the anode of a diode rectifier 23, the cathode of which is connected through relay R to the anode of tube V and through relay R' to the anode of tube V'. A separate winding 24 of transformer 21 serves for energization of the cathode of diode 23. One electrode of a condenser 25 is connected to the cathode of rectifier 23 and the other electrode is connected to ground wire 12. The primary winding 26 of transformer 21 is connected through suitable fuses 1 and a switch S to alternating current supply lines 27. A winding 28 on trans-

former 21 is provided to supply current to the cathode heaters of tubes V and V' through conductors 22 (not shown). A pilot lamp P is connected across the winding 28 to signify when power is on.

The connection from the right-hand terminal bar 8 of the warper to the tube V' and the circuit connections of this tube are substantially identical to those of tube V. In the drawing, each element of the circuit of tube V' corresponding to a similar element in the circuit of tube V is indicated by the same reference character but with a prime (') added thereto.

Relay R has two armatures 29 and 30, the former of which over a back contact controls an alternative circuit for relay R' and the latter of which over a back contact controls the circuit for a signal light L and over a front contact controls the circuit of a motor controlling relay R—M. Similarly, relay R' has two armatures 29' and 30' controlling, respectively, an alternative circuit for relay R and the circuits of a signal lamp R and of the relay R—M. The alternative circuit for relay R comprises a lead 31 connecting the anode 19 of tube V with armature 29' of relay R' and a resistor 32, one end of which is connected to the back contacts 33 and 33' associated respectively with armatures 29 and 29' and the other end of which is connected to lead 18. The alternative circuit for relay R' comprises a lead 31' connecting the anode 19' of tube V' with armature 29 and resistor 32.

The circuit for signal lamp R may be traced as follows: from one power line 27 through switch S and a fuse f, through leads 34, 35 and 36 to lamp R, from lamp R through a lead 37' to back contact 38' of armature 30', armature 30', a lead 39 to a front contact 40 of armature 30, armature 30 and a lead 41 back to the other power line 27 through a fuse f and switch S. The circuit of signal lamp L comprises leads 34, 35 and 36, the lamp L, lead 37, back contact 38 of armature 30, armature 30 and lead 41.

The energizing coil of motor control relay R—M is connected across lead 34 and front contact 40' of armature 30'. It will be understood that commercial warpers use various different electrical systems to control the drive beam. Safety circuits to prevent over heating or the like, and "stop," "start" and "jog" switches are ordinarily provided. In order to indicate how the stop motion device of the present invention can be readily coupled with such other circuits a relay Cr is indicated in the drawing as controlling a switch 42 in the lead 43 connecting the front contact 40' of armature 30' with relay R—M and a relay Cs is indicated as controlling a switch 44 in a line 45 bridging the contacts controlled by relays R and R'. Relay Cr is intended to symbolize any relay of such safety system that is normally energized during operation of the warper and relay Cs one that is normally deenergized but is adapted to be energized during closure of "start" and "jog" switches. The motor M for driving the warp beam is connected across suitable supply lines 46 through the armature 47 of relay R—M and a front contact 48 associated therewith.

With the circuit arrangement just described, when switch S is closed, power is supplied to the cathode heaters of tubes V and V' from winding 28. At the same time the cathode of rectifier 23 is heated from winding 24 causing the rectifier to pass current on alternate half cycles of the impressed voltage wave. Operating potential is then impressed through the windings of relays R

and R' respectively upon the plates of tubes V and V'. Until the warp beam is started the threads from the creel will be slack and consequently the control grids of tubes V and V' will be grounded through the drop wires 9 and ground bar 11, biasing the tubes to cut-off. When, however, the beam is started by closure of the starting circuit including switch 44, the threads are brought under tension and the drop wires moved out of contact with the ground bar 11. Tubes V and V' will thereupon pass current and relays R and R' will become energized to pick up their armatures and complete the holding circuit for the motor controlling relay R—M which thus is maintained energized after opening of the starting circuit.

If now a thread breaks, for example, one coming from the left side of the creel, the associated drop wire 9 drops and makes contact with ground bar 11, grounding bar 1 and bringing the potential of grid 14 of tube V below that of the cathode 18. Tube V therefore becomes deenergized, deenergizing relay R. Relay R thereupon drops its armatures, closing the circuit of lamp L over the back contact of armature 30 and opening the circuit of relay R—M at the front contact of armature 30. The resulting deenergization of relay R—M opens the circuit of the beam motor M at contact 48. When the beam stops rotating, all threads are slacked and hence the control grid of tube V' will be grounded and that tube will also cease passing current. Relay R' will not, however, become deenergized as its alternative circuit through resistor 32 to lead 18 was closed at the back contact 33 of armature 29 when relay 30 became deenergized. Lamp R will not be lighted as its circuit will remain open at the back contact of armature 30'. Thus, upon stoppage of the warp beam due to a broken thread, the operator can tell by the lighting of light L that the broken thread is on the left side of the creel. Similarly when relay R—M is deenergized as a result of a thread break on the right side of the creel relay R' is deenergized upon deenergization of tube V', relay R is maintained energized over its alternative circuit including the back contact of armature 29', the circuit of light R is completed over the back contact of armature 30' and that of relay R—M is opened at the front contact of armature 30'. The lamp L will not light as its circuit is open at the back contact of armature 30.

From the foregoing description of one specific embodiment of the invention, it will be apparent that the new stop motion insures stopping of the warp beam upon breakage or slackness of a thread and provides a signal indicative of the location of the thread break which continues after all threads are slacked as a result of beam stoppage. The new circuit requires but few components, it is easy to install and to service and does not interfere with the operation of other safety circuits that may be in use with the particular warper to be controlled.

By way of illustration, but not of limitation, the circuit constants will now be given of one specific circuit which has been found particularly satisfactory with high speed warpers now in commercial use. In such circuit, tubes V and V' were halves of a double triode, a 6SN7, diode 23 was a 5Y3, resistors 13 and 13' were each 2.2 megohms, resistors 15 and 15' were each 1/2 megohm, resistors 17 and 22 were each 5 kilohms, resistor 32 was 13 kilohms, lines 27 were 110 volt, 60 cycle power lines, and condenser 25 had a capacity of 2

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microfarads. The voltages of windings 24 and 28 were 5 volts and 6.3 volts respectively and that of secondary 20 was 700 volts.

The invention has now been described with reference to one specific embodiment thereof. Obviously, various changes in the particular circuit illustrated and described could be made without departing from the spirit of the invention or the scope of the accompanying claims. For example, although the invention has been described with reference to the preferred embodiment of the invention wherein indications are given of a yarn break in but two divisions of the creel, either the right side or the left side, the system can be readily expanded to indicate a yarn break in more than two divisions as will be readily apparent to those skilled in the art. If indications of a yarn break in a third division, for example in the center of the creel, are desired, it is only necessary to provide a third circuit, comprising a series connected relay and tube connected across the power supply with the control grid of the tube connected through a resistor with drop wires associated with the threads of such third division and to provide a third indicator lamp controlled by such third relay. The motor control relay circuit would then be controlled over front contacts of all three relays and the alternative circuit for each relay would be controlled over back contacts of the other relays as in the illustrated embodiment of the invention.

Furthermore, although the bars supporting the the drop wires have been described as normally insulated from the ground, these bars could be grounded by connection to the ground wire of the circuit, in which case the contact bar would be divided into sections corresponding to the different parts of the creel and these sections connected respectively to the current limiting resistors in the grid circuits of the tubes. These and other variations and modifications are believed to be within the scope of the invention as described in the specifications and defined in the appended claims.

The following is claimed:

1. In a textile machine, the combination comprising means for advancing a plurality of threads under tension, guide means for each thread movable in response to reduction in tension of its associated thread, a pair of electrical contacts associated with each guide means and adapted to be closed upon movement of the associated guide means, a source of electrical energy, a plurality of circuits, each including an electronic tube and a relay connected in series across said source, a control circuit for each tube, each control circuit including a plurality of said pairs of electrical contacts and operating upon closure of any pair of contacts therein to deenergize the tube controlled thereby, means responsive to release of a relay consequent to deenergization of the tube in series therewith for stopping said first mentioned means and interlocking means preventing successive release of said relays.

2. The combination according to claim 1 including a signal associated with each relay, an energizing circuit for each signal, and means responsive to release of a relay for closing the energizing circuit of its associated signal.

3. The combination according to claim 1 wherein said interlocking means include a bridging circuit and contacts controlled by said relays, said bridging circuit being adapted to be connected by said relay controlled contacts across any of said tubes.

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4. In a textile machine the combination comprising means for advancing a plurality of threads under tension, guide means for each thread movable in response to reduction in tension of its associated thread, a source of electrical energy, a pair of circuits each including an electronic tube and a relay connected in series across said source, a control circuit for each tube, each control circuit including electrical contacts associated with a different group of said guide means and adapted to be closed upon movement of the associated guide means, the contacts in a control circuit when closed operating to deenergize the tube controlled by such circuit and thereby to release the relay in series with such tube, means responsive to release of either relay for stopping said first mentioned means and means operative upon release of either relay to maintain the other relay energized independently of the condition of the tube in series therewith.

5. The combination according to claim 4 including a pair of signals and energizing circuits therefor, means responsive to release of one of said relays for closing the energizing circuit of one of said signals and means responsive to release of the other of said relays for closing the energizing circuit of the other of said signals.

6. The combination according to claim 4 wherein said last mentioned means includes a circuit adapted to be connected in series with either of said relays across said source, and a set of contacts associated with each relay, each set being adapted to be closed upon release of its associated relay and when closed connecting said last mentioned circuit in series with the other relay to maintain the same energized.

7. In a textile machine the combination comprising means for advancing a plurality of threads under tension, a guide means associated with each thread adapted to be moved when its associated thread is slackened, a pair of contacts associated with each guide means, means grounding one only of each pair of contacts, a pair of electronic tubes each having a cathode, a control grid and an anode, a resistor connected at one end to the control grid of one of said tubes and at its other end to the ungrounded one of certain of said pairs of contacts, a resistor connected at one end to the control grid of the other of said tubes and at its other end to the ungrounded one of certain other of said pairs of contacts, a source of energy, a pair of relays, the anode of each tube being connected to the high potential end of said source through one of said relays, grid leak resistors for said tubes, means connecting the cathodes of said tubes with the low potential end of said source for operation at above ground potential, whereby said tubes and relays are all energized when the threads are under tension but upon slackness of any one of the threads and consequent grounding of the control grid connected to the contact of the pair of contacts associated with the guide means for such thread the tube controlled thereby is deenergized and breaks the circuit of the relay connected thereto, means responsive to release of either relay for stopping said first mentioned means and means operative upon release of either relay to maintain the other relay energized.

8. The combination according to claim 7 wherein said last mentioned means include a pair of contacts controlled by each relay and

adapted to be closed upon release of the controlling relay, one contact of each pair of relay controlled contacts being connected to the low potential end of the relay controlling the other pair of relay controlled contacts, and a resistor connected at one end to the cathodes of said tubes and at its other end to the other one of each pair of relay controlled contacts.

9. The combination according to claim 7 including a pair of signals and energizing circuits therefor, means responsive to deenergization of one of said relays for closing the energizing circuit of one of said signals and means responsive to deenergization of the other of said relays for closing the energizing circuit of the other of said signals.

10. In an electronic warper stop motion of the type employing drop wires adapted upon slackness of an associated thread to close a ground connection for the control grid of one or another of a pair of normally energized electronic tubes depending upon the location of the slacked thread, the improvement which comprises a pair of normally energized relays, each adapted upon deenergization to stop the warper and to signal thread breakage, a normal circuit for each relay including one of the normally energized tubes and a common alternate normally open relay circuit for by-passing either tube, and means responsive to deenergization of either relay for connecting the alternate circuit to the other relay.

11. The improvement according to claim 10 wherein said alternate circuit includes a resistor connected at one end to the cathodes of the tubes and the last mentioned means of said claim comprises a pair of contacts controlled by each relay and adapted to be closed upon deenergization of the controlling relay, one contact of each pair being connected to the anode of the tube in the normal circuit of the other relay and the other contact of each pair being connected to the other end of said resistor.

12. An electronic circuit for a warper stop motion having drop wires adapted to be grounded upon slackness of associated threads, comprising a pair of like electronic tubes each having a control grid, a cathode and an anode, a pair of

relays each controlling a pair of contacts, one end of the energizing winding of one relay being connected to the anode of one tube and to one of the pair of contacts controlled by the other relay, said pairs of contacts being adapted to be closed upon deenergization of the relay controlling the same, a resistor connected at one end to the cathodes of said tubes and at its other end to the other one of each of said pair of contacts, a source of operating energy for said relays and tubes having its high potential end connected to the other ends of said relays and its low potential end grounded, a resistor connected between the cathodes of said tubes and ground, grid leak resistors for said tubes, the control grid of one tube being connected to a group of drop wires and the control grid of the other tube being connected to another group of drop wires, and means responsive to deenergization of either relay for stopping the warper.

13. The circuit according to claim 12 including a pair of signal lamps, energizing circuits for the lamps, means responsive to deenergization of one relay for closing the energizing circuit for one lamp and means responsive to deenergization of the other relay for closing the energizing circuit of the other lamp.

14. The circuit according to claim 12 wherein said source comprises a step-up transformer, the primary winding of which is adapted to be connected to power lines and the secondary of which is connected at one end through a resistor to ground and at its other end to the anode of a diode rectifier, the cathode of which provides the positive end of said source, and a condenser connected between the cathode of said diode and ground.

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