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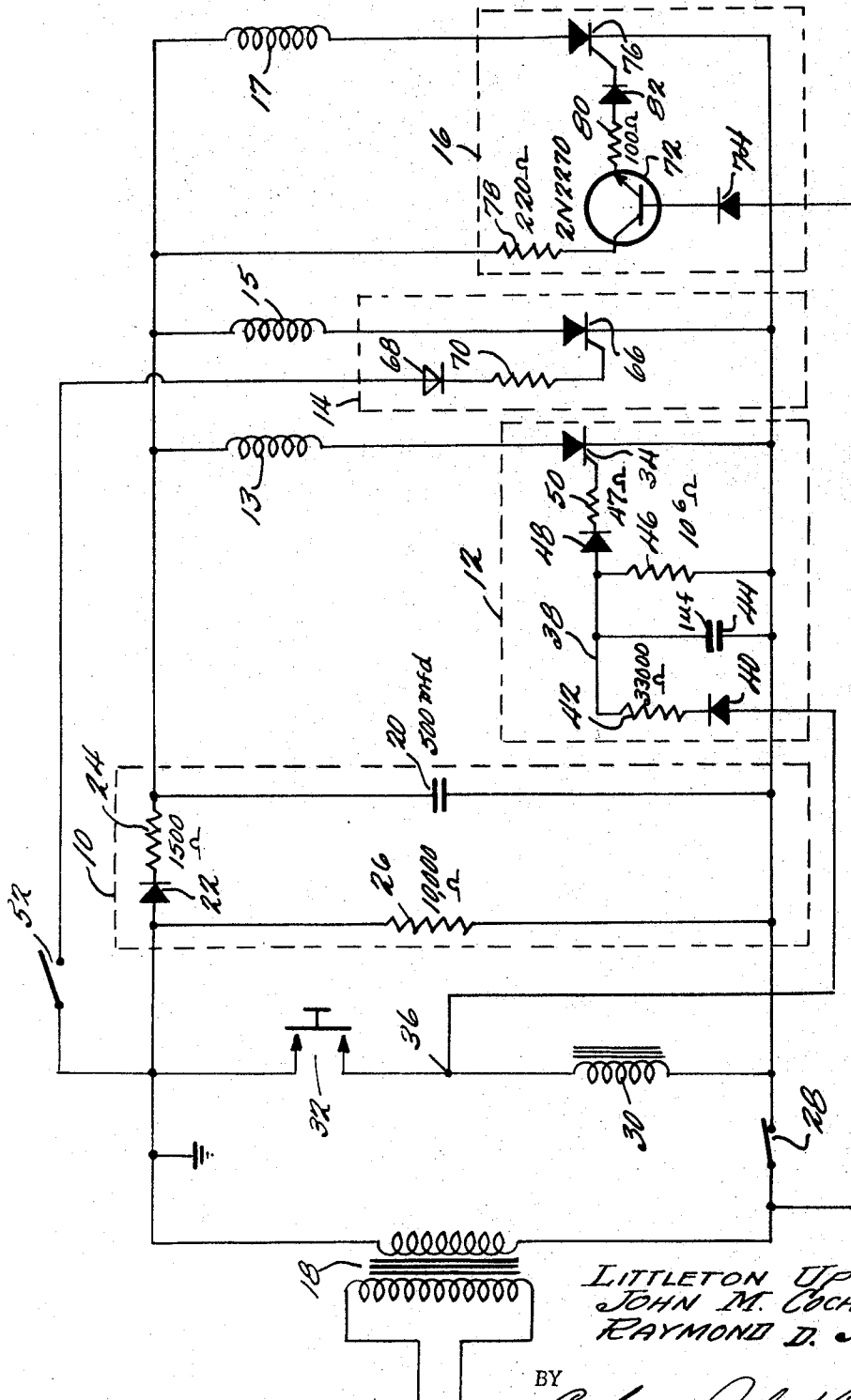
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3,437,799

LOOM STOP COUNTER

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Sheet 1 of 2



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Sheet 2 of 2

Fig. 2

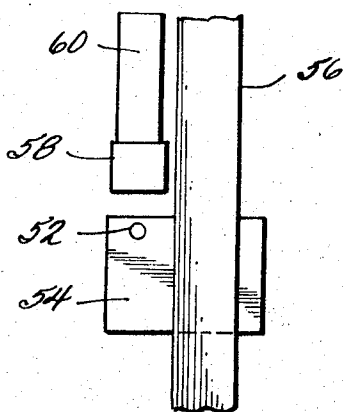
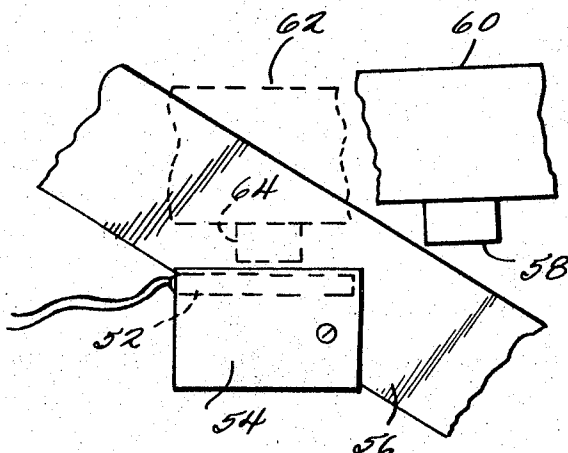


Fig. 3

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1

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LOOM STOP COUNTER

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11 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to circuitry for counting the number of times which a loom stops. In particular, the circuitry provides three counts which respectively correspond to warp, filling and mechanical stops. The three counters are actuated from a single charged capacitor. When the warp stop motion is actuated, the warp stop counter is not energized until an appropriate delay occurs to ensure that false counts are not registered whenever the warp stop motion is only momentarily actuated, which is often the case. Further, the invention employs an improved switch for actuating the filling stop counter whenever a filling stop is sensed. This switch comprises a metal-sheathed magnetic reed switch inserted into an aluminum block, mounted, for example, on the loom structure. This switch is actuated, whenever a filling stop is sensed, by the movement of a magnetic member to a position adjacent the switch to close the contacts thereof. Hence, accidental closure of this switch during maintenance of the loom is prevented. The mechanical stop counter section is so interrelated with the other two sections that whenever a loom stop occurs that is due neither to warp or filling stop motions, the mechanical stop counter is actuated.

This invention relates to an improved circuitry for counting loom stops; and, in particular, classifying such stops in terms of whether the stop is caused by warp, filling, or mechanical problems. This invention also relates to improved switching means for actuating a filling stop counter whenever a filling stop motion is sensed.

Numerous attempts have been made in the past to devise counters to register loom stops. The counters have failed to operate accurately over extended periods of time for a number of reasons. One of the most common weaknesses of these devices has been in the sensor to signal filling stops. Generally, such sensors have been snap-action switches, which must be positioned precisely in order to be closed by the movement of an appropriate loom part whenever a filling stop occurs. Such switches are readily susceptible to being displaced an amount sufficient to prevent closure. Commonly a few thousandths of an inch displacement (because of being bumped accidentally during maintenance of the loom) is sufficient. Further, they have been frequently placed so that the contacts are depressed by persons moving about the loom thereby causing the registration of false counts.

Thus it is a primary object of this invention to provide improved switching means for signalling a filling stop, the alignment of said switching means not being susceptible to displacement. Further, it is an object of this invention to provide such a switching means which is not subject to accidental actuation.

Many looms employ an electrical warp stop motion, in which a strip of metal, known as a drop wire, is suspended from each warp thread. When a warp thread breaks, the drop wire closes an electrical circuit to ground, actuating the loom stopping mechanism. This electrical signal has been used to actuate warp stop counters. How-

2

ever, during the normal operation of a loom, some of the drop wires make momentary contact with the electrodes. The duration of these contacts is too brief to actuate the loom stop motion, but may actuate a fast acting counter.

It is a further primary object of this invention to provide improved circuitry for counting the number of loom stops and for classifying such stops in accordance with whether the stop was caused by a warp, filling, or mechanical problem. It is a further object of this invention to provide such counting circuitry where the warp stop motion section of the counter includes circuitry to prevent the actuation of the counter until a reasonable amount of time has elapsed, thereby preventing pulse actuation of the warp stop counter due to momentary contact of the drop wire with an electrode during normal operation of the loom.

Since the counter mechanism of this invention employs three different counters respectively corresponding to the warp, filling, and mechanical problems, means are provided for preventing the registration of more than one count for a given loom stop. Thus it is a further primary object of this invention to provide an improved counter for counting loom stops and for classifying the various causes thereof, the counter including means ensuring that only one count is registered for a given loom stop.

Other objects and advantages of this invention will become apparent upon reading the appended claims in conjunction with the following detailed description and the attached drawings, in which:

FIGURE 1 is a circuit diagram of an illustrative embodiment of the invention;

FIGURE 2 is a pictorial representation of an illustrative embodiment of switching means for signalling filling stops; and

FIGURE 3 is an end view of the switching means shown in FIGURE 2.

Referring to FIGURE 1, there is shown a circuit diagram of an illustrative embodiment of the invention. The counter circuitry of this invention comprises four sections, a capacitor section 10, a warp stop counter actuator section 12, a filling stop actuator section 14, and a mechanical stop actuator section 16. As can be seen in FIGURE 1, each of these sections is enclosed in dotted lines. The actuator circuits 12, 14 and 16 are respectively associated with warp stop counter 13, filling stop counter 15, and mechanical stop counter 17, where each of the counters is indicated by an appropriate coil. Counters 13, 15 and 17 are preferably conventional nonreset or manual reset electrically-actuated counters of 12 volts DC rating. They may be mounted in a remotely located panel or directly on the loom, in which case they are preferably shock mounted.

The counter circuitry is energized from a transformer 18, which is typically the standard low voltage transformer employed on a loom, which usually has a 12 volt secondary winding which supplies low voltage current for the warp stop motion and other circuits.

In the capacitor section 10, capacitor 20 stores a charge sufficient to operate the counters 13, 15, and 17. When the loom is started, capacitor 20 charges through diode 22 and resistor 24. The resistance of resistor 24 is chosen so that a period of several seconds is required to charge capacitor 20 to a value sufficient to actuate one of the counters. This delay is provided so that a count will not be registered if the loom stops immediately after being started. Resistor 26 performs a function in the operation of the mechanical stop section as described hereinafter, but is located in the capacitor section 10 for convenience in wiring.

Switch 28, usually a mercury switch, is typically attached to the shipper lever or other appropriate parts in

such a way that it is closed when the loom is running and open when the loom stops. The function of this switch is to remove power from the loom control circuits whenever the loom has stopped. This switch occurs during the actual stopping of the loom after a warp or filling stop motion has operated to initiate the stopping.

If the loom stop is due to the warp stop motion, the following circuitry is employed to actuate the warp stop counter. Solenoid 30 is the knock-off solenoid which causes the loom to stop. This solenoid is energized by contact of the drop wires, represented by switch 32, in the event of end breakage. The warp stop section 12 includes a silicon controlled rectifier (SCR) 34 and associated circuitry, generally indicated at 38, to trigger the operation thereof. The trigger circuitry 38 is connected to the junction 36 of the drop wires 32 and the knock-off solenoid 30. As long as the drop wires do not make contact, junction 36 is at the same potential as the cathode of SCR 34 and thus no current flows through the trigger circuit 38. Whenever the drop wires make contact, the junction 36 is raised to the transformer voltage above the cathode of SCR 34. Current then flows to the trigger circuit 28 which includes diode 40, resistor 42, capacitor 44, resistor 46, four-layer diode 48, and current limiting resistor 50. Thus, current flows through diode 40 and resistor 42 and initiates charging of capacitor 44. A four-layer diode 48 blocks the flow of current through the trigger circuit 38 until capacitor 44 has charged to a voltage equal to the breakdown of threshold voltage of diode 48. When this breakdown voltage is reached, diode 48 goes into a high conductance state and discharges capacitor 44 through SCR 34, turning the SCR on. With SCR 34 conducting, a circuit is completed between capacitor 20 and counter 13, thereby discharging capacitor 20 through the counter and causing the counter to register one count.

As can be seen, the trigger circuitry 38 for SCR 34 provides a time delay between the first contact of the drop wires 32 and the triggering of the SCR 34, this time delay corresponding to the amount of time required for capacitor 44 to charge through resistor 42 to the breakdown voltage of four-layer diode 48. This delay is necessary since, during the normal operation of a loom, the drop wires remain in substantial movement and occasionally make momentary contact. The duration of such accidental contacts is too brief to cause the knock-off solenoid 30 to pull in and stop the loom but it is sufficiently long to trigger an SCR into conduction in the absence of a time delay circuit. An appropriate time delay through the trigger circuitry 38 is 0.1 second. Typically, the breakdown voltage of four-layer diode 48 is approximately 10 volts.

Resistor 46 acts as a bleeder resistor to ensure complete discharge of capacitor 44 and prevent the cumulative build up of charge on capacitor 44 due to a large number of accidental momentary contacts of the drop wires with the electrodes. Resistor 50 acts to limit the current to SCR 34.

Whenever the loom stop results from a filling stop, the following means are instrumental in implementing the registration of filling stop counter 15. First, refer to FIGURES 2 and 3 where there are respectively shown, front and end views of switching means for signalling the filling stop indication to counter 15. A metal-sheathed magnetic reed switch 52 is inserted into a hole in aluminum block 54. Block 54 is fastened to an appropriate stationary part of the filling stop mechanism or adjacent loom structure 56. A magnetic member 58 is attached to a movable member 60 of the filling stop motion. The filling stop motion is available in many well known embodiments and it is not necessary to disclose the details thereof. In the normal actuation of the filling stop mechanism, the movable member 60 moves to the position shown as 62, thereby moving the attached magnetic member 58 to position 64, which is adjacent or in close proximity to

reed switch 52. Thus the switch 52 closes. The appropriate positions for the block 54 and the magnetic member 58 are different for different makes and models of looms, but these positions will be obvious to those who are familiar with the operating mechanisms of looms. Further, filling stop mechanisms always include a member which corresponds to movable member 60. Thus, it would be obvious to those of ordinary skill in this art to appropriately provide for the physical location of the members 52, 54, 58 and 60 with respect to one another. The important feature of this aspect of the invention is the use of the magnetic reed switch 52, disposed in block 54. The block 54 and the magnetic member 58 are readily mounted on the loom in such a manner that they are not susceptible of being knocked out of alignment. Further, switch 52 is not subject to accidental actuation since only the magnet 58 can cause it to close.

Referring to FIGURE 1, switch 52 is shown connected to the gate terminal of SCR 66 which is disposed in the actuator section 14 for filling stop counter 15, the connection being made through diode 68 and resistor 70. Whenever switch 52 closes because of a filling stop, current flows through diode 68 and resistor 70 to the gate terminal of SCR 66, turning it on. This permits capacitor 20 to discharge through counter 15, registering one count.

Whenever the loom stop is caused by a mechanical stop, the following circuitry is implemented to actuate counter 17. A mechanical stop is by definition a loom stop which is initiated neither by the warp stop motion nor the filling stop motion. As stated hereinbefore, switch 28 is closed when the loom is running and opens when the loom stops. As long as switch 28 is closed, the base of transistor 72 is at the emitter potential and the transistor is cut off. When switch 28 is opened, the potential of the base of transistor 72 is effectively raised through diode 74 above the emitter potential, thereby forward biasing the base emitter junction thereof and turning it fully on. With transistor 72 turned on, current flows through the gate terminal of SCR 76, turning it on, the current flow through transistor 72 occurring through resistor 78, resistor 80 and diode 82. If capacitor 20 at this time is charged, it discharges through counter 17, registering one count.

If, however, the stopping of the loom has been initiated by either the drop wires of the warp stop motion or the filling stop mechanism, capacitor 20 will have already been discharged through counter 13 or counter 15, registering a warp stop or a filling stop, as the case may be. In such a case, when switch 28 opens as the loom stops, and SCR 76 is triggered, there is no charge on capacitor 20 and no count can be registered on counter 17. Hence, counter 17 will therefore register only those stops which are not initiated by either the warp or filling stop motions. As stated hereinbefore, these are by definition mechanical stops.

A preferred form of the electronic circuitry is an encapsulated modular form, wherein the capacitor section and each of the actuator sections is constructed as a separate module which is embedded in a conventional encapsulation material such as epoxy resin. In this form the circuits are protected from vibration and environmental influences. An advantage of the modular arrangement is that in case of electrical failure, a defective module can be removed and replaced easily by any electrician. The encapsulation makes impossible any type of repair; however, the cost of repair where the component is accessible would exceed in most cases the cost of a new module. Another advantage is that, if it is not desired to count all three classes of stops, only those modules which are required need be installed. Additionally, if only one of two classes of stops are initially counted, and it is desired at a later date to add the remaining ones, only the additional modules and counters need be added, without any change to the existing circuitry.

Still numerous other modifications of the invention will become apparent to one of ordinary skill in the art upon

5

6

reading the foregoing disclosure. During such a reading, it will be evident that this invention has provided unique counting circuitry for accomplishing the objects and advantages herein stated. Still other objects and advantages, and even further modifications will be apparent from this disclosure. It is to be understood, however, that the foregoing disclosure is to be considered exemplary and not limitative, the scope of the invention being defined by the following claims:

What is claimed is:

1. Loom stop counting circuitry for providing a plurality of counts respectively corresponding to a plurality of loom stop causes, said loom stop counting circuitry comprising:

a plurality of counter means each comprised of at least a single counter, for respectively registering the counts of said plurality of loom stop causes;

capacitive means connected to said plurality of counter means;

a plurality of counter actuating means each respectively associated with one of said plurality of counter means, each of said actuating means respectively responsive to one of said plurality of loom stop causes for connecting its associated counter means to said capacitive means so that upon the occurrence of a loom stop for a given cause, the said capacitive means will discharge through the counter means corresponding to said given cause registering one count, the registration of a count at all other counter means being prevented due to said discharge of said capacitive means; and

means for charging said capacitive means.

2. Loom stop counting circuitry as in claim 1, where said loom stop causes include warp stops, filling stops, and mechanical stops, and where said plurality of counters includes three counters respectively corresponding to said warp, filling, and mechanical stops.

3. A loom stop counting circuitry, as in claim 2 including means for delaying the connection of the capacitive means to said warp stop counter for a predetermined interval of time thereby preventing false actuation of the warp stop counter.

4. Loom stop counting circuitry, as in claim 2, where the actuating means associated with said filling stop counter includes (1) electrical switching contacts responsive to the presence of a magnetic field for the actuation thereof and (2) movable means for producing a magnetic field, said movable means being positioned adjacent said contacts in response to the detection of a filling stop to close said contacts and cause said capacitive means to discharge through said filling stop counter and cause one count to be registered.

5. Loom stop counting circuitry, as in claim 4, including a solid member having a hole therein for receiving said switching contacts, thereby preventing the accidental closure of said reed switch.

6. Loom stop counting circuitry, as in claim 2, where said mechanical stops include all stops due neither to warp stops nor filling stops, said loom including means for initiating the actuating means associated with said mechanical stop counter whenever said loom stops, the actuation of said mechanical stop counter occurring after the initiation of either a warp or filling stop.

7. Loom stop counting circuit as in claim 6 where said means for charging said capacitive means prevents said capacitive means from being charged to a value sufficient to actuate said counters until a predetermined interval of time has elapsed thereby insuring that a count will not be registered if the loom stops immediately after starting.

8. Loom stop counting circuitry, as in claim 1, where said capacitive and actuating means are respectively encapsulated to facilitate maintenance of said counting circuitry.

9. Apparatus for use with a textile machine which stops for a number of different causes for providing a plurality of counts, each said count reflecting the number of times which said machine has stopped for a given one of said number of different causes comprising:

a capacitor;

means for charging said capacitor when said machine is not stopped;

a plurality of counters each recording one of said counts, each electrically connectible to said capacitor to cause a discharge of said capacitor and each responsive when connected to said capacitor to the discharge of said capacitor to register a count of a machine stop for a given cause;

counter actuating means associated with said plurality of counters and responsive to said number of causes of stoppage for causing the counter recording the count reflecting the particular cause of stoppage to which said actuating means is responsive to be connected to said capacitor so that said capacitor is discharged to cause said counter recording the count reflecting the particular cause to register a count, and is thereby prevented from causing another of said counters from registering a count until said machine has been restarted and said capacitor recharged.

10. Apparatus as in claim 9 wherein said different causes include warp stops, filling stops and mechanical stops and means for delaying the connection of said capacitor to the counter recording the count reflecting the number of times which a warp stop has occurred.

11. Apparatus as in claim 10 wherein said actuating means includes switch means having an open and closed position and connecting the counter recording the count reflecting the number of mechanical stops to said capacitor, said switch means being in the open position while said machine is running and in the closed position while said machine is not running so that said capacitor, if charged, is discharged to cause said counter recording the count reflecting the number mechanical stops to register a count after said machine stops.

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