Jan. 4, 1966 D. R. RICHARDS 3,227,190

LOOM STOCK MONITOR

Filed March 27, 1963

2 Sheets-Sheet 1

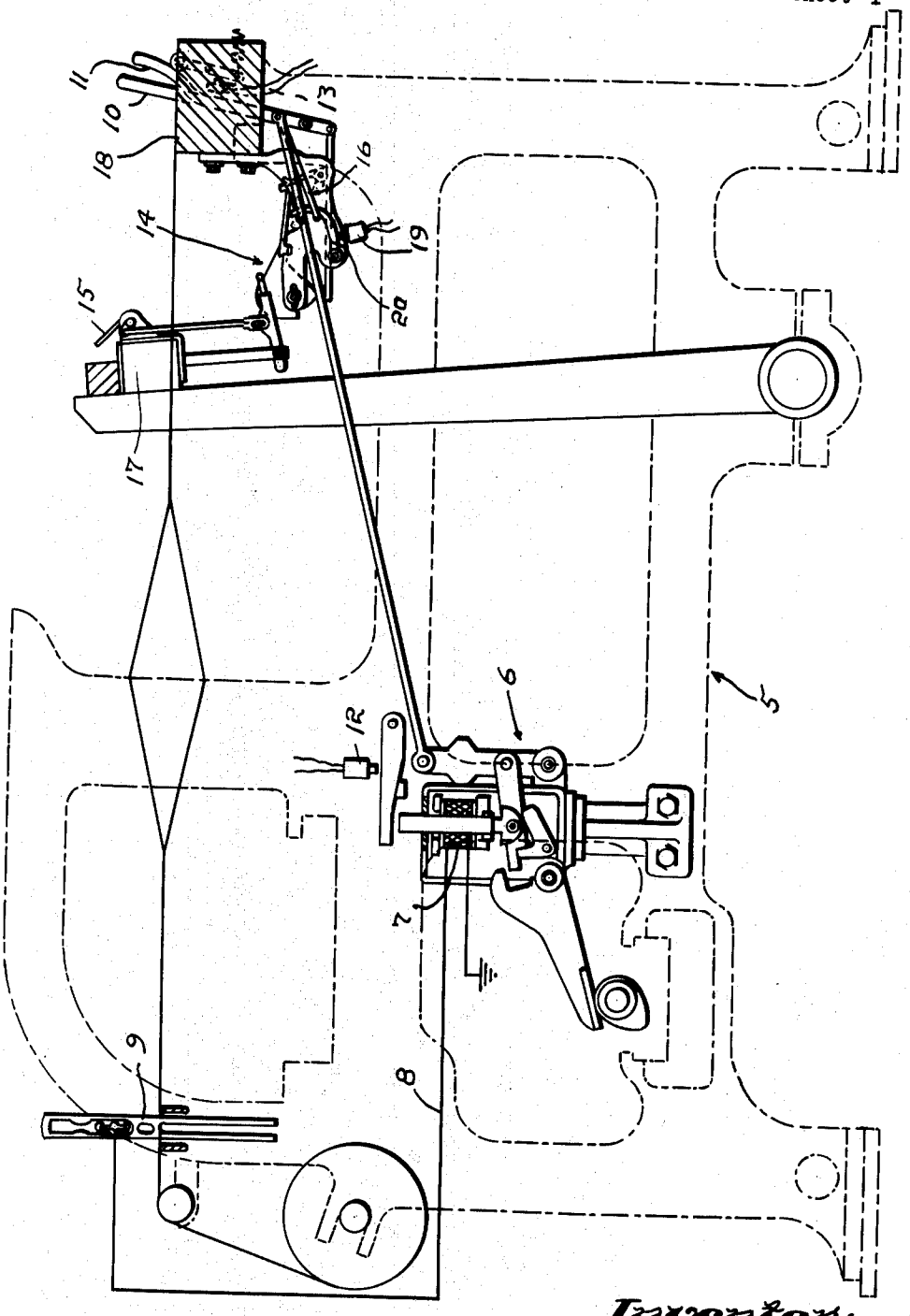


Fig. 1.

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2 Sheets-Sheet 2

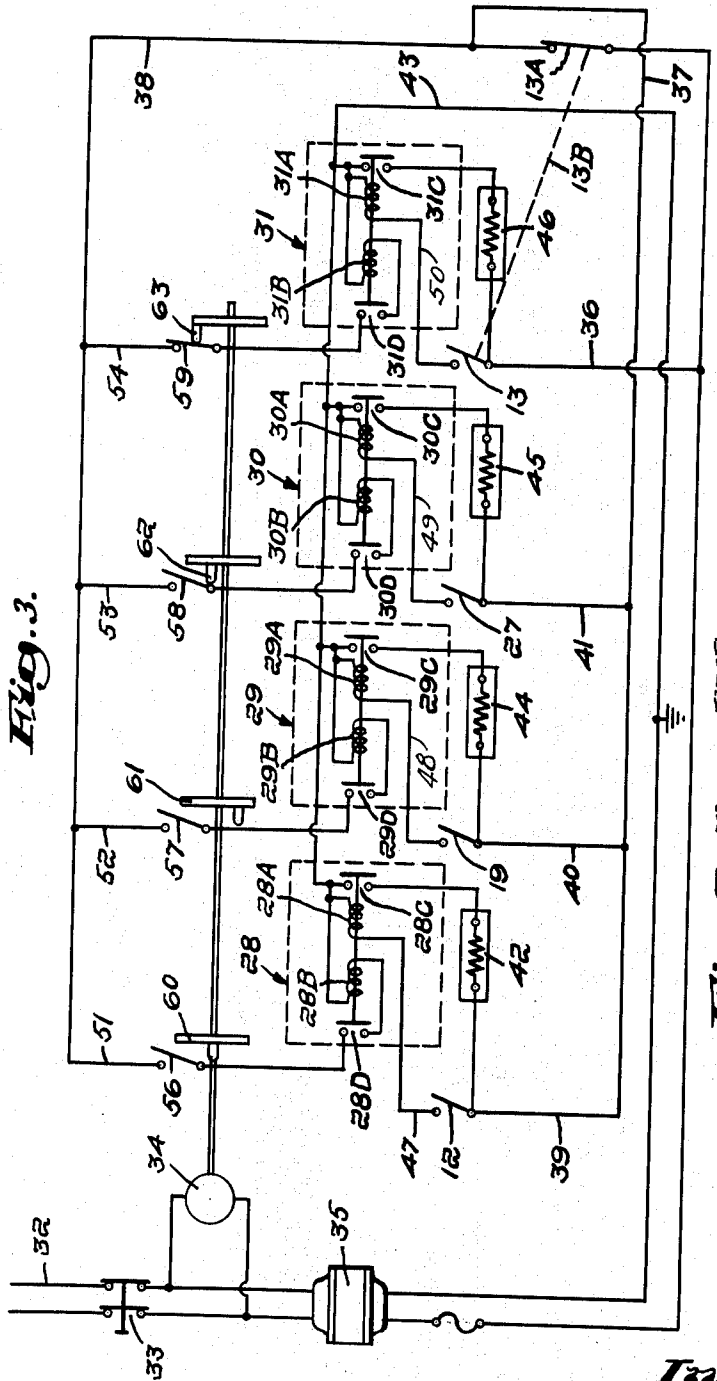


Fig. 3.

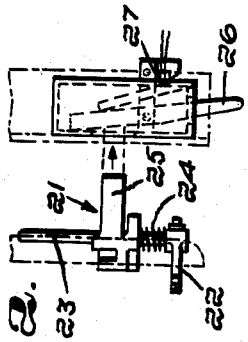


Fig. 2.

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United States Patent Office 3,227,190 Patented Jan. 4, 1966

3,227,190

LOOM STOCK MONITOR

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Filed Mar. 27, 1963, Ser. No. 268,221
7 Claims. (Cl. 139—336)

The present invention relates to monitors for loom stops to provide data as to the causes thereof.

In the operation of looms, devices are used to stop the looms automatically whenever the warp or the filling breaks or the shuttle jams. The frequency of warp and filling breaks normally varies with the strength of the yarns used and as each loom stop is an interruption of production, costs are affected thereby. The time intervals involved in tying warps and fillings and in freeing shuttles and in again starting the looms are standardized so that, with information as to the number of stops, production costs, as they vary with different yarns, can be determined. While the total number of stops is important, it is also important to have knowledge as to the number of stops for the principal causes.

Attempts have been made to provide stop counters but these have not proved satisfactory as not eliminating the recording of false indications of stops, whether deliberately caused by the weaver or occasioned by loom vibrations.

The principal objectives of the invention are to provide loom monitors that are reliable in operation in that the interval after a loom stop, in which the circuitry can be again closed to record another stop, is random in nature, that no additional count can be made until the loom starts at the end of such a random interval, and that are immune to loom vibrations.

In accordance with the invention these objectives are attained by providing a loom stop monitor for a loom having means to stop it including a control that is manually operable and also actuated by automatic controls, each responsive to a particular cause of loom malfunctioning. The loom monitor includes monitoring leads, each including a monitor unit for each such control and a normally open switch, a first control lead for each monitoring circuit and including a switch, mechanically operated by the control whose operation is being monitored, and means for closing the monitoring lead switch, and a second control lead for each monitoring lead, the second control lead being operative, when the first control lead is closed, to open the monitoring lead switch.

In practice, each of the second control leads has a switch that is operated by a cycler motor through a cam so that the interval between any loom stop, and the time that the loom may be restarted, is random in nature.

In practice, one monitor unit records a count each time the shipper is moved, whether manually or automatically, to stop the loom and the invention provides means for rendering the other monitor units operable until the shipper is again operated to start the loom.

In practice, the switch in each monitoring unit lead is part of a relay having first and second coils, the first coils being the switch closing means of the series of first control leads and the second coil being the switch opening means of the second control leads, each relay including a second switch closed by the first coil and opened by the second coil thereof.

In the accompanying drawings, there is shown an illustrative embodiment of the invention from which these and other of its objectives, novel features, and advantages will be readily apparent.

In the drawings:

FIGURE 1 is a somewhat schematic and partially sectioned side view of a loom provided with a monitor in accordance with the invention including devices operable on the breaking of the warp and filling as well as by manual movement of the shipper to stop the loom,

FIGURE 2 is a fragmentary view illustrating an additional switch to be actuated by a conventional protector motion device, and

FIGURE 3 is a schematic view illustrating the circuit of a monitor including the devices shown in both FIGURE 1 and FIGURE 2.

Reference is first made of FIGURE 1 wherein there is shown, on a somewhat schematic basis, a typical loom **5** provided with a conventional warp stop motion which is generally indicated at **6**. Because the stop motion **6** is conventional and its operation is well known, it is not herein detailed other than to note that its solenoid **7** is in a circuit **8** controlled by so-called "drop wire" switches, each held open by a warp end unless and until it breaks. One such switch is indicated at **9**. For detailed showings and descriptions of warp stop motions, reference is made to "Cotton Loomfixers' Manual" by Ivan Moberg; "Rayon Looms and Weaving" by Mauersberger, and U.S. Patent No. 1,873,465 dated August 23, 1932.

For the purposes of the present invention, it is important to note only that, when the solenoid **7** is energized, the stop motion **6** so actuates the shipper **10**, and with it the brake handle **11**, that the clutch is disengaged and the brake applied. Neither the brake nor the clutch is shown as they are conventional and form no part of the present invention in accordance with which a normally open switch **12** is located to be closed whenever the warp stop motion is actuated. The switch **12**, hereinafter sometimes called the "warp" switch is shown as being closed by the action of the solenoid **7**.

Whenever the shipper **10** is moved, manually or otherwise, it closes a normally open switch **13**, hereinafter sometimes referred to as the "shipper" switch. While both switches **12** and **13** are closed when the warp stop motion is actuated, only the switch **13** is closed when the shipper **10** is manually actuated.

The loom **5** is also provided with a filling stop motion which is generally indicated at **14** and is not herein detailed as it is conventional. For a more complete description of the construction and operation of filling stop motions, reference is made to the above-referred-to "Cotton Loomfixers' Manual" and "Rayon Looms and Weaving" and U.S. Patent No. 1,369,517 dated February 22, 1921. For the purposes of the present invention, it is important to note only that the filling stop motion **14** has fork wires **15** normally held by the filling in a position preventing the actuation of the shipper knock off arm **16** by the filling stop motion as the lay **17** moves towards the breast beam **18**. In accordance with the invention, a normally open switch **19** is incorporated in the filling stop motion **14** to be closed when the filling breaks or runs out. As illustrative of the desired monitoring operation, the switch **19** is shown as closed by movement of the knockoff finger **20**. The switch **19** is sometimes hereinafter referred to as the "filling" switch.

It is also the common practice to provide a loom with a protector motion that is operative if a shuttle fails either to box or to box properly. Such motions are of various types and are conventional and for that reason, only those parts of a protector motion are shown that are essential to an understanding of the present invention. Reference is again made to the above cited "Cotton Loomfixers' Manual" or to "Rayon Looms and Weaving" for detailed descriptions of protector stop motions and their operation.

In FIGURE 2, parts of a generally indicated protector motion **21** are shown. These parts, which are at one side of the loom with corresponding parts being provided at the other side thereof, include a finger **22**, on a transverse rod **23**, disposed to be actuated whenever a shuttle boxes properly at that side. When the finger **22** is actuated, the rod **23** turns against the action of the spring **24**

so as to depress the dog 25 to cause it to pass under the knock-off lever 26 as the lay moves forward. The lever 26, if engaged, as it would be if the finger 22 were not so moved, would "knock off" the brake and shipper handles. In accordance with the invention, a normally open switch 27 is so mounted as to be closed when the lever 26 is actuated. The switch 27 is sometimes called the "protector" switch.

From the foregoing, it will be apparent that any conventional loom having mechanism operative to disengage the clutch and engage the brakes either manually or automatically as by warp stop motions and filling stop motions, or additionally, as by a protector motion, can readily have switches actuated by each such motion and by the shipper. With the arrangement as thus far described, the switch actuated by the shipper is operative not only when the shipper is manually moved but also when it is knocked-off by each of the other motions with which the loom is provided.

A loom stop monitor in accordance with the invention has a series of relays, one for the shipper 10 and one for each of the motions resulting in a loom stop that is to be recorded. In FIGURE 3, there are four such relays and these are generally indicated at 28, 29, 30 and 31. Each relay includes first and second coils distinguished from the general reference numeral for a relay by the suffix additions A and B, respectively. Each relay also includes first and second normally open switches which are also distinguished from the general reference numerals of the relays by the suffix additions C and D, respectively.

A circuit 32 has a control switch 33 and includes, in parallel, a cycler motor 34 and a transformer 35 with the transformer circuit having parallel leads 36, 37, and 38 with the leads 37 and 38 controlled by a switch 13A mechanically linked as at 13B to the shipper switch 13 to be normally closed when the loom is operating and open when the switch 13 is closed. The lead 37 has a series of monitoring leads 39, 40, and 41 and the lead 36 is also a monitoring lead.

The lead 39 includes a monitoring unit 42 and the normally open relay switch 28C by which it is connected to the ground 43 when the first relay coil 28A is energized. Similarly, the lead 40 includes a monitoring unit 44 and the normally open relay switch 29C, the lead 41 has a monitoring unit 45 and the normally open switch of the relay 30C, and the lead 36 has a monitoring unit 46 and the normally open relay switch 31C.

The monitoring units may be of various types and may be used by themselves or in conjunction with or as parts of recording systems or data storage systems for computors but are herein discussed as recorders of the counter type recording a single count each time it is energized, the count being either numerically or graphically recorded. Each monitor unit may be located on or adjacent its loom or it may be located remotely, in a control room in which data from other looms is also recorded in whatever form is desired and by whatever means best meet requirements. The simplest form of such a monitor is a pulse counter and as these are well known, they are not herein detailed.

The transformer circuit also includes a series of first parallel control leads, 47, 48, 49, and 50, one control lead for each relay and shown as connected to the monitoring lead therefor in parallel with its monitoring unit. The control lead 47 is connected to the lead 39 by the normally open warp switch 12 and includes the first coil 28A of the relay 28 which, when energized, closes the switch 28C thus to energize the monitor unit 42 to register a stop due to warp breakage. The lead 48 is, similarly, connected to the lead 40 in parallel with the monitoring unit 44 by means oft he normally open filling switch 19 and it includes the first coil 29A of the relay 29 which, when energized, closes the switch 29C so that the monitor unit 44 registers a loom stop due to filling breakage. In a like manner, the lead 49 is connected to the lead 41 in parallel with the monitor unit 45 by the normally open protector switch 27. The lead 49 includes the first relay coil 30A which is operative to close the switch 30C enabling the monitor unit 45 to register a count of a loom stop as due to the failure of the shuttle to box properly. The control lead 50 is connected to the monitoring lead 36 in parallel with the monitor unit 46 by the normally open shipper switch 13 and it includes the first coil 31A of the relay 31. When the shipper switch 13 is closed, the relay coil 31A is operative to close the switch 31C whereby the monitor unit registers a loom stop as due to movement of the shipper 10, whether manually or automatically. As above stated, the closing of the switch 13 is attended by the opening of the switch 13A in control of its leads 37 and 38.

The lead 38 includes a series of second control leads 51, 52, 53, and 54.

The lead 51 has a switch 56, the second coil 28B and the second switch 28D of the relay 28. The switch 28D is closed when the first relay coil 28A is energized so that the second relay coil 28B then becomes energized whenever the switch 56 is closed provided that the switch 13A is also closed. When energized, the second coil 28B opens the relay switches 28C and 28D.

Similarly, the lead 52 includes a switch 57, the second coil 29B and the second switch 28D of the relay 28 enabling the second coil 28B to be energized, following the closing of the filling switch 19, to open the switches 29C and 29D provided the switch 57 and the switch 13A are both closed. The lead 53, likewise, includes a switch 58 and also includes the second coil 30B and the second switch 30D of the relay 30. The second coil 30B is energized whenever, following the closing of a protector switch 27, the switch 58 and the switch 13 are closed so that is then operative to open the relay switches 30C and 30D. The lead 53 includes a switch 59 and the second coil 31B and the second switch 31D of the relay 31 so that following the closing of the shipper switch 13 for any cause, the second coil 30B is energized to open the switches 31C and 31D.

The switches 56, 57, 58 and 59 are cycle switches and are operated by cams 60, 61, 62, and 63, respectively, driven by the cycler motor 34. Each cam is designed to open the appropriate cycler switch for a period usually representing about 2° of the cam cycle and it is preferred that the cams be arranged so that no two cycler switches are closed at any one time. The cams may be adjustable from 1% to 100% of their cycle.

From the foregoing, it will be appreciated that minitors in accordance with the invention are well adapted to meet the requirements of use since the period between any stop and after correction of the cause of the stop, and the restarting time of the loom is random. In addition, no new count can be made after a stop until the second coil of the actuated relay is reset and until the shipper 10 is moved to restart the loom. It will be appreciated, of course, that the counter associated with the relay 31 gives information as to total stops with the difference between that total and the total recorded on the other counters representing those for which the operator is responsible.

The information derived from a loom stop monitor in accordance with the invention can be used in various ways depending, in part, on the type of recording means used. In any event, the accurate data as to causes of loom stops is useful, both from the point of view of management as well as that of labor in improving the quality of work, the production per unit of labor, the distribution of work loads, and in anticipation of costs and production schedules.

I claim:

1. In a loom stop monitor for a loom of the type having devices, each actuated by a loom stop the cause of which is different from the cause of any other loom stop, a series of monitoring circuits, each including an electrically operated monitoring unit for each device and a unit

operating switch, a first series of control circuits, one for each unit and including a normally open switch connected to an appropriate one of said devices to be closed thereby and means to close the unit operating switch in the circuit including that unit, a second series of control circuits, one for each unit and including means to open the unit operating switch in the circuit including that unit and a switch, and means continuously operating to effect the opening and closing of said last named switch at regular intervals thereby to provide a random interval between the elimination of a cause of a stop and the re-starting of the loom.

2. The monitor of claim 1 in which each last named switch is adjustable for a period amounting to approximately 2° of the cycle.

3. In a loom stop monitor for a loom of the type having devices, each actuated by a loom stop the cause of which is different from the cause of any other loom stop, a series of monitoring circuits, each including an electrically operated monitoring unit for each device and a unit operating switch, a first series of control circuits, one for each unit and including a normally open switch connected to an appropriate one of said devices to be closed thereby and means to close the unit operating switch in the circuit including that unit, a second series of control circuits, one for each unit and including means to open the unit operating switch in the circuit including that unit and a switch, and means continuously operating to effect the opening and closing of all of said last named switches at regular intervals thereby to provide a random interval between the elimination of a cause of a stop and the re-starting of the loom.

4. The monitor of claim 3 in which the last named switches are closed one after the other and without overlap.

5. In a loom stop monitor for a loom of the type having devices, one actuated by a loom stop the cause of which is warp breakage, another actuated by a loom stop the cause of which is filling breakage, another actuated by a loom stop the cause of which is mechanical, and a device actuated whenever the loom stops for any cause, a series of four monitoring circuits, each including an electrically operated monitoring unit for each device and a unit operating switch, a first series of four control circuits, one for each unit and including a normally open switch connected to an appropriate one of said devices to be closed thereby and means to close the unit operating switch in the circuit including that unit, a second series of four control circuits, one for each unit and including means to open the unit operating switch in the circuit including that unit, said second series including a common lead having a switch which is opened by the device that is actuated whenever the loom is stopped regardless of cause and which is closed when the unit operating switch of the circuit of the first series for said last named device is open, each of said second series of control circuits also having a switch and means continuously operating to effect the opening and closing of said last named switches at regular intervals thereby to provide a random interval between the elimination of a cause of a stop and the re-starting of the loom.

6. In a loom stop monitor for a loom of the type having devices, each actuated by a loom stop the cause of which is different from the cause of any other loom stop, a series of relays, one for each such device, each relay being of the type including first and second coils and first and second normally open switches closed when the first coil is energized and opened when the second coil is energized, a series of monitoring circuits, one for each relay and including an electrically operated monitoring unit and the first switch of said relay, a series of first control circuits, one for each relay and including the first coil thereof and a normally open switch connected to an appropriate one of said devices to be operated thereby, a second series of control circuits, one for each relay and including the second coil and the second switch thereof and a switch, and means continuously operating to effect the opening and closing of said switches at regular intervals thereby to provide a random interval between the elimination of a cause of a stop and the re-starting of the loom with no two of said last named switches being closed at any time.

7. In a loom stop monitor for a loom of the type having devices, each actuated by a loom stop the cause of which is different from the cause of any other loom stop and a device actuated whenever the loom stops for any cause, a series of relays, one for each such device, each relay being of the type including first and second coils and first and second normally open switches closed when the first coil is energized and opened when the second coil is energized, a series of monitoring circuits, one for each relay and including an electrically operated monitoring unit and the first switch of said relay, a series of first control circuits, one for each relay and including the first coil thereof and a normally open switch connected to an appropriate one of said devices to be operated thereby, a second series of control circuits, one for each relay and including the second coil and the second switch thereof and a control switch, a lead common to said second series of circuits, said common lead including a switch which is opened by the device that is actuated whenever the loom is stopped regardless of cause and closed whenever the unit operating switch of the circuit of the first series for that device is opened, and means continuously operating at regular intervals to effect the opening and closing of said control switches thereby to provide a random interval between the elimination of a cause of a stop and the re-starting of the loom.

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