APPARATUS FOR MEASURING THE LENGTH OF YARN OR THE LIKE CONSUMED IN A PREDETERMINED NUMBER OF CYCLES OF A CYCLICALLY OPERATED MACHINE SUCH AS A TRICOT KNITTING MACHINE

Fig. 1.

Fig. 2.

INVENTOR.

LITTLETON UPSHUR

BY

ATTOURNEYS
APPARATUS FOR MEASURING THE LENGTH OF YARN OR THE LIKE CONSUMED IN A PREDETERMINED NUMBER OF CYCLES OF A CYCLICALLY OPERATED MACHINE SUCH AS A TRICOT KNITTING MACHINE

Littleton Upshur, Greensboro, N.C., assignor to Burlington Industries, Inc., Greensboro, N.C., a corporation of Delaware

Filed Feb. 16, 1967, Ser. No. 5,166

Int. Cl. G06m 3/08

13 Claims

ABSTRACT OF THE DISCLOSURE

An apparatus for measuring the length of yarn consumed in a predetermined number of operational cycles of a textile machine. For instance, if it is desired to measure the length of yarn consumed in knitting 960 courses of fabric on a tricot knitting machine and if 240 courses are knitted for each cycle of the machine, a stepping relay is provided in accordance with one aspect of the invention, whereby a counting device is connected to an appropriate source of electrical power by the stepping relay for four steps of the relay, the relay being stepped in response to each cycle of the machine. Thus, the counter will be connected to the electrical power source for a total of 960 courses. The length of yarn consumed in knitting 960 courses will be measured because of an impeller switch consisting of a pair of contact points which are closed by a cam driven by a pair of wheels of known diameter in friction contact with the yarn on the beam. The cam and wheel are arranged so that each one contact closure occurs for each inch of linear movement of the periphery of the wheel. Since the impeller switch assembly is connected in circuit with the counter and since electrical power is supplied to the counter through the impeller switch assembly for a period of time corresponding to the amount of time required to knit 950 courses of fabric, the counter will register the total length of yarn consumed in knitting 950 courses.

This invention relates to improved apparatus for measuring the length of yarn consumed in a predetermined number of cyclic operations of a textile machine; and in particular, the invention relates to improved apparatus for determining the length of yarn supplied from each beam which is fed into a given number of courses of fabric on a textile machine such as a knitting machine.

It is thus a primary object of this invention to provide improved apparatus for measuring the length of yarn consumed in a predetermined number of cyclic number of operations of a textile machine.

It is a further object of this invention for providing improved apparatus for sensing the length of yarn drawn from a rotating beam of yarn.

It is a further object of this invention to provide improved apparatus for determining the length of yarn consumed in a predetermined number of cyclic operations of a textile machine and for indicating the completion of the measurement.

It is a further object of the invention to provide improved apparatus for measuring the length of yarn drawn from a plurality of beams associated with a cyclically operating textile machine.

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

FIG. 1 is a schematic diagram of the circuitry employed in one illustrative embodiment of the invention;

FIG. 2 is a pictorial representation of an impulser switch assembly employed in conjunction with a beam of yarn to sense the length of yarn drawn from the beam;

and

FIG. 3 is a pictorial representation of a plurality of impulser switch assemblies when respectively employed with a plurality of beams.

Reference should now be made to FIG. 1 which schematically illustrates one embodiment of the invention, it being understood that the use of like reference numerals in the different figures of the drawings apply to like parts.

A source of electrical power 10 is connected to the primary winding of transformer 12. Typically, source 10 is the 24 volt AC power which is 200 supplied on a tricot knitting machine. The secondary winding of transformer 12 is connected across the stepping coil or stepping relay input 14 of stepping relay or multi-stable means 16 which has contacts or terminals 18, 20, 22, 24, 26, 28, 30, 32 and 34 where contacts 20-26 and 28-34 are respectively electrically connected together as shown in the figure. Reset coil 36 is provided to cause armature 38 of the stepping relay 16 to return to the initial position 18, the reset coil being energized upon the actuation of reset switch 42.

25 Electrical power is applied to stepping coil 14 whenever switch 40 closes, this switch being under the control of a cam 44 on the tricot knitting machine 46, the cam making one revolution per 240 courses, for example, knitted. The cam 44 is provided with a short lobe 48 which causes switch 40 to close for a short time each revolution. The closing of switch 40 energizes or applies switching signals to the stepping coil 14, causing the armature 38 to step clockwise to the next contact of the stepping relay 16. Thus, for each 240 courses knitted by the machine 46 the armature 38 is moved to the next contact point. Indicator lamp 50 signals the completion of the measurement when armature 38 is stepped to contact 28.

Counter 52 is indicated by a coil and switch assembly 54 is representative of an impulse switch assembly which will be described in more detail hereinafter. Switch 54 closes every time a predetermined length, for example one inch, is drawn from the beam associated with counter 52 and switching assembly 54 and fed to the tricot knitting machine 46. When armature 38 is connected to one of the contacts 20-26, an electrical impulse is generated each time switch 54 closes, thereby pulsing counter 52.

The counters 52, shown in FIG. 1, are made for DC operation and therefore the bridge rectifier circuit 56 is employed.
Whenever more than one beam is associated with the tricot knitting machine 46 a plurality of counters such as counters 58-62 must also be provided, each of the counters corresponding to one of the beams associated with the tricot knitting machine 46. Thus, in FIG. 1 there are four beams associated with knitting machine 46 and thus the four counters 52, 58, 60 and 62 are respectively provided. Impulse switch assemblies 64-68 are respectively associated with counters 58-62.

Reference should now be made to FIG. 2 where the relation of the impulse switch assembly 54 with respect to a beam of yarn is pictorially shown. The impulse switch assembly consists of a switch 65 diagrammatically indicated in box 70, the contacts being closed by a cam 67 also diagrammatically indicated in box 70. The cam, in turn, is driven by one or both of the wheels 72 and 74 which are held in friction contact with the arm 76 on beam 78 by appropriate tension means or by the weight of impulse switch assembly. The impulse switch assembly is connected to the beam frame by rods 82 and 84 while the wire connection to the counter is shown at 86. Of course, various means for maintaining the wheels 72 and 74 in friction contact with the arm 76, which will be obvious to those having ordinary skill in the art.

The cam 67 and wheels 72 and 74 are arranged so that one contact closure of switch 65 occurs for each inch of linear movement of the periphery of the wheel 72 or 74. The impulse assembly is positioned so that the yarn beam 50, with the wheel resting on the yarn so that the revolving of the beam causes the impulse wheel to rotate at the same surface speed as a point on the surface of the yarn of the beam. Since the revolving of the beam is caused by yarn being pulled into the machine, the impulse switch assembly 54, which is in friction contact with the yarn so that electrical impulses are transmitted for each inch or other predetermined length of material drawn from the beam 78.

Reference should now be made to FIG. 3 which shows a plurality of beams 88 and 90, both of which feed the tricot knitting machine 46, shown in FIG. 1. As can be seen, impulse switch assemblies 96 and 98 are respectively associated with each of the beams 88 and 90.

The operation of the apparatus in accordance with this invention as an operating knitting machine will now be described. After the impulse switch assembly is first positioned on the yarn beam with the wheels resting on the yarn, the impulse switches close every inch of yarn and then the yarn which, in turn, is closed and reset switch 42, see FIG. 1, is also closed, thereby energizing reset coil 36 from the secondary winding of transformer 12. This resets the armature 38 of stepping relay 16 to contact 18. Not until lobe 48 momentarily contacts switch 40 is there any electrical power applied through stepping relay 16 to the counters 52, 58, 60 and 62. The remainder of the description of the operation will be with respect to counter 52 since the operation of counters 58-62 and their associated impulse switch assemblies 64-68 is the same as that for counter 52 and its associated impulse switch assembly 54.

Thus when lobe 48 of cam 44 contacts switch 40, armature 38 is stepped to contact 20 of stepping relay 16.

Since the impulse switch assembly 54 causes its contacts to momentarily close for every inch of yarn drawn from its associated beam, impulsive electrical power will be applied to counter 52 from the primary transformer 12 through stepping relay contact 20 and switch assembly 54 when the first inch of yarn is drawn from the beam. Thus, a first count will be registered for counter 52 which, of course, corresponds to the fact that one inch of yarn has been drawn from its associated beam. The total number of counts registered by counter 52 will correspond to the number of inches drawn from the beam.

Assuming that 240 courses of fabric are knitted by machine 46 for each revolution of the cam 44, the lobe 48 will cause the switch 40 to again momentarily close when 240 courses have been knitted thereby energizing stepping coil 14 from the secondary winding of transformer 12. Hence, the armature 38 will move to contact 22. Since contact 22 is also connected to the counter 52 through impulse switch assembly 54, the measurement of the length of yarn drawn from the beam continues. Since contacts 24 and 26 are also connected to counter 52, the counter continues to register the length of yarn drawn for two further revolutions of the cam or for a total of 960 courses of fabric knitted by machine 46.

When a further revolution of the cam causes the armature 38 to move to contact 28, power is removed from the counter 52. As this occurs precisely at the end of four complete revolutions of the cam, the counter ceases to count when 960 courses have been knitted. At the same time, power is applied to indicator light 50, which indicates completion of the measuring operation. Unless the power switch is turned off, the armature continues to step to subsequent contacts with each rotation of the cam, until a mechanical stop is reached, said mechanical stop being a standard feature of the stepping relay. Indicator lamp continues to burn, since all contacts following contact 28.

This measurement or count remains displayed to be read at any subsequent time. Further, indicator lamp 50 shows that the measurement has been completed and is ready to be read, lamp 50 being energized through any one of the contacts 28-34 of stepping relay 16, as shown in FIG. 1. Although in the operation described above, the circuitry is arranged to register the number of inches consumed in 960 courses of fabric, it will of course be obvious that a simple change in the connection of the contact points 20-34 of stepping relay 16 can be made to cause the circuit to count any multiple of 240 courses. Thus, if it were desired to measure the number of inches consumed, in knitting 1440 courses of fabric, contacts 20-30 would be electrically connected together and separated from contacts 32 and 34 which would also be connected together.

Transformer 12 is employed in the circuit of FIG. 1 because stepping relays are generally available for 115 volt AC operation and, thus transformer 12 steps up the 24 volt AC power available on the tricot machine to the 115 volts required for stepping relay 16. However, in some applications it may be feasible to supply the circuit in FIG. 1 with 115 volts power. In this situation, the transformer 12 would be eliminated. The counters 52, 58, 60 and 62 would, of course, also be suitably selected for 115 volt operation, thereby eliminating any need for two power sources.

The counters 52, 58, 60 and 62 run from DC power, as shown in FIG. 1. Where several counters are in parallel, as shown in FIG. 1, it is preferable to use a rectifier circuit for each counter as this permits the impulse switches to carry AC current, thereby eliminating arcing problems which may arise if these switches were operated with DC current.

As would be obvious to those having ordinary skill in this art, the circuits and apparatus described hereinbefore may be adapted to other types of cyclically operated machinery where it is desirable to measure the length of yarn or other material fed thereto for a predetermined number of cycles of operation of the machinery. It is only necessary to obtain a suitable arrangement for obtaining
a momentary closure of switch 40. Each time one of the cycles of the machinery occurs. Still numerous other modifications of the invention will become apparent to one of ordinary skill in the art upon reading the foregoing disclosure. During such a reading, it will be evident that this invention has provided a unique apparatus and 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 limiting, the scope of the invention being defined by the following claims.

What is claimed is:

1. Apparatus for measuring the length of material consumed in a predetermined number of cycles of a cyclically operated machine such as a tricot knitting machine, said apparatus comprising:
   multiple state means capable of existing in a multiple number of stable states, said multi-stable means being successively switched to each of its stable states in response to sequential switching signals being applied thereto, each of said stable states having associated therewith an output terminal and said multi-stable means having an input terminal,
   means for generating one of said switching signals each time said machine executes one of said cycles,
   counting means responsive to said impulses for registering a count corresponding to the measurement of the said length of material,
   means for generating one of said impulses each time a predetermined length of material is fed to said machine and for transmitting said impulse signal to said counter when said multi-stable means is in one of a plurality of stable states less than all of said stable states, said plurality not including the first of said stable states,
   indicating means responsive to at least one of said states which is not said first state and not in said plurality of states so that, when said multi-stable means is switched to said output terminal associated with said one state, said indicating means will signal the completion of said measurement, and
   means for resetting said multi-stable means to said first state after the completion of said measurement.

2. Apparatus, as in claim 1, where said multi-stable means is a stepping relay.

3. Apparatus, as in claim 1, where said means for generating said switching signals includes an electrical power source and means for momentarily connecting said electrical power source to said multi-stable means each time said machine executes one of said cycles.

4. Apparatus, as in claim 3, where said means for momentarily connecting said electrical power source to said multi-stable means includes a switch and a cam driven by said machine, said cam having a short lobe thereon so that said switch is closed each time said machine executes one of said cycles.

5. Apparatus, as in claim 4, where said means for generating said impulse signals includes means for momentarily connecting said electrical power source to said counter means through at least one of the output terminals of said multi-stable means each time a predetermined length of said material is fed to said machine.

6. Apparatus, as in claim 4, where said means for momentarily connecting said electrical power source to said counter means each time a predetermined length of material is consumed by said machine includes at least one wheel in friction contact with the material on said beam whereby a point of said material moves at the same speed as a point on the wheel, so that a pair of electrical contacts between said electrical power source and said counting means are closed each time said predetermined length of material is drawn from the beam and consumed by the machine.

7. Apparatus for measuring the length of material consumed in a predetermined number of cycles of a cyclically operated machine such as a tricot knitting machine, said apparatus comprising:
   a source of electrical power,
   multiple state means capable of existing in a multiple number of stable states, said multi-stable means being successively switched to each of its stable states in response to sequential switching signals being applied thereto, each of said stable states having associated therewith an output terminal and said multi-stable means having an input responsive to said electrical power source,
   means responsive to said machine for momentarily connecting said electrical power source to said multi-stable means input and thereby generating one of said switching signals each time said machine executes one of said cycles,
   counting means connected in circuit with multi-stable means, said means for momentarily connecting said electrical power source to said counter means through at least one of the output terminals which is not the first of said stable states of said multi-state means each time a predetermined length of said yarn is fed to said machine and
   means for resetting said multi-stable means to said first state after the completion of said measurement.

8. Apparatus, as in claim 7, where at least one of the output terminals of said multi-stable means is not connected in circuit with said counting means so that, when said multi-stable means is switched to the stable state corresponding to said last-mentioned one output terminal, the counting means will no longer register the said measurement of the yarn.

9. Apparatus, as in claim 8, including means responsive to said last-mentioned one output terminal for indicating the completion of said measurement of yarn.

10. Apparatus, as in claim 8, where said multi-stable means is a stepping relay and where the stepping coil therefor is connected in series circuit with said means for temporarily closing the connection between said electrical power source and said multi-stable means for each cycle of said machine.

11. Apparatus, as in claim 7, where said counting means includes a plurality of counters and a respective plurality of means for momentarily connecting the counter means to said electrical power source, said plurality of counters being connected in series with its associated means for momentarily connecting the counter to said electrical power source for each predetermined length of yarn consumed by the machine.

12. Apparatus, as in claim 7, where said means for momentarily connection said electrical power source to said counter means each time a predetermined length of yarn is consumed by said machine includes at least one wheel in friction contact with the material on said beam whereby a point of said material moves at the same speed as a point on the wheel, so that a pair of electrical contacts between said electrical power source and said counting means are closed each time said predetermined length of material is drawn from the beam and consumed by the machine.

13. A method of measuring the length of material consumed in a predetermined number of cycles of a cyclically operated machine such as a tricot knitting machine comprising the steps of,
   generating a switching signal each time said machine executes one of said cycles,
   applying said switching signal to multi-stable means having a plurality of stable states each having associated therewith an output terminal so that said multi-
tiple state means is successively switched to each of said stable states, generating an impulsive signal each time a predetermined length of material is fed to said machine and transmitting that impulsive signal to a counter when said multiple state means is in one of a plurality of said multiple states less than all of said states, said plurality not including the first of said states, indicating when said multiple state means is in a state which is not said first state or in said plurality of states to signal the completion of said measurement, and resetting said multiple state means to said first state after the completion of said measurement.

References Cited
UNITED STATES PATENTS
2,828,468 3/1958 Ball et al. -------------- 324—78
2,851,596 9/1958 Hilton ---------------- 250—27
3,171,953 3/1965 Young ---------------- 235—92

MAYNARD R. WILBUR, Primary Examiner
J. M. THESZ, Assistant Examiner
U.S. Cl. X.R.