United States Patent [19]

Felix

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[54] **METHOD OF AND APPARATUS FOR ASSESSING THE RUNNING BEHAVIOR OF TEXTILE MACHINES**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** ..... **235/92 PD;** 235/92 C; 235/92 CP

[51] **Int. Cl.** **G06m 3/02**

[58] **Field of Search** ..... 235/92 DD, 92 CP

[56] **References Cited**

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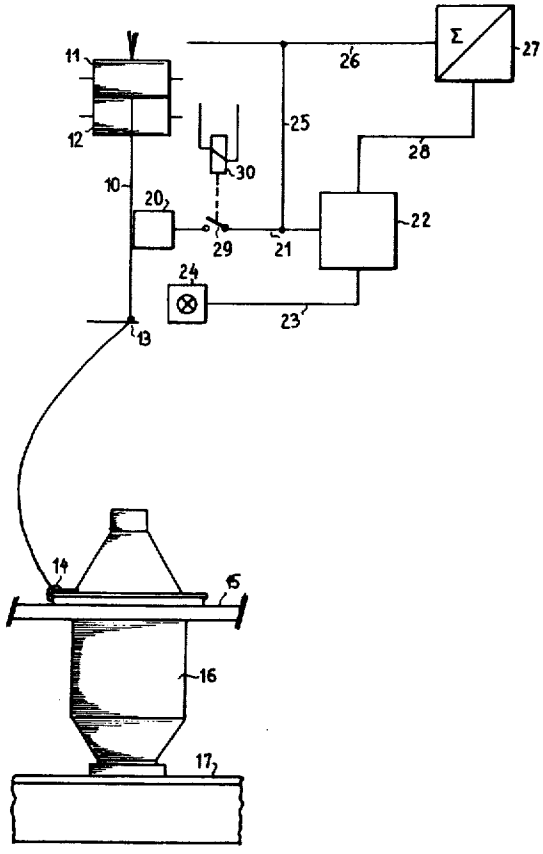
[57] **ABSTRACT**

A method and apparatus for assessing the running behavior of textile machines wherein a yarn monitor detects a characteristic at each spindle and a counter is provided at each spindle to count the number of occurrences at detection of the prescribed characteristic so that an evaluating unit receiving the indications from the counter can provide a signal indicating when a prescribed limit has been reached.

8 Claims, 2 Drawing Figures



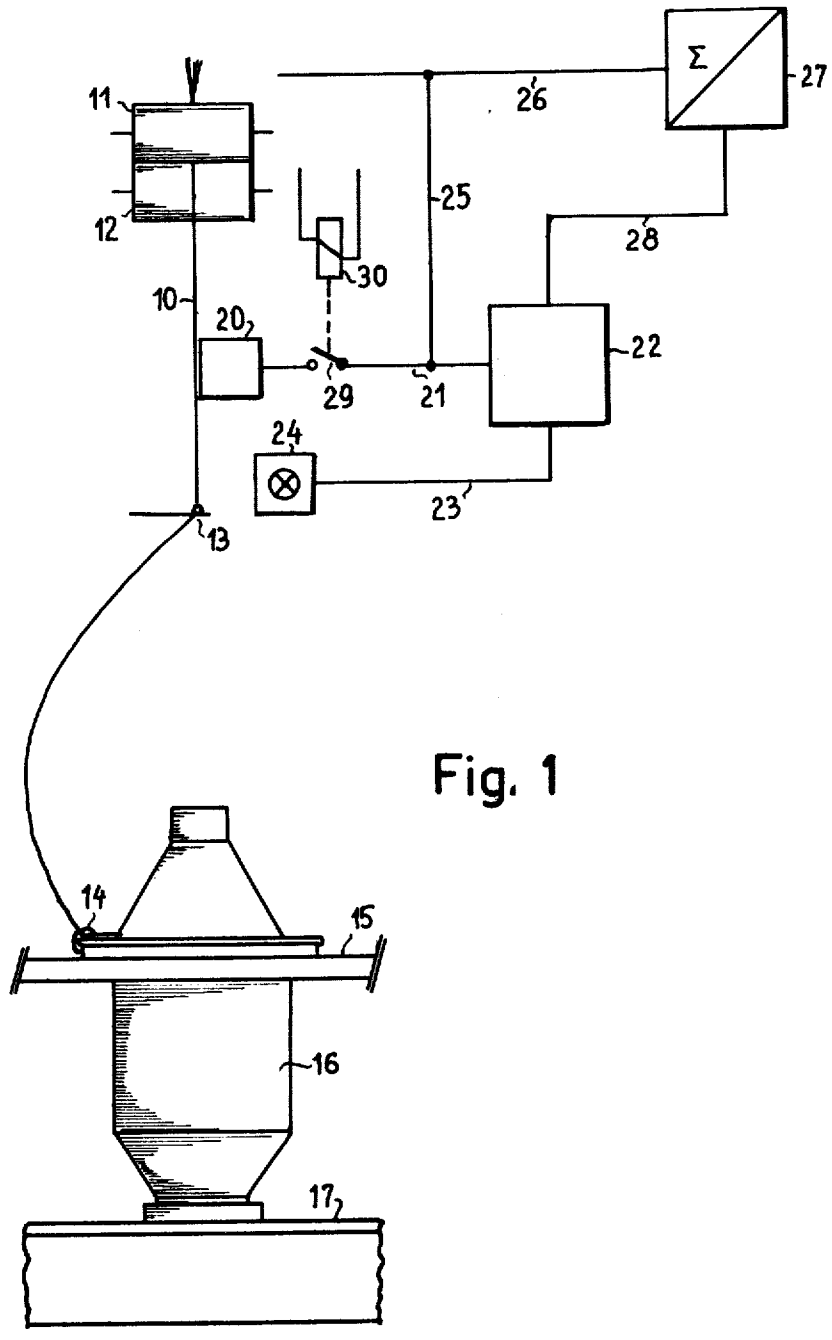


Fig. 1

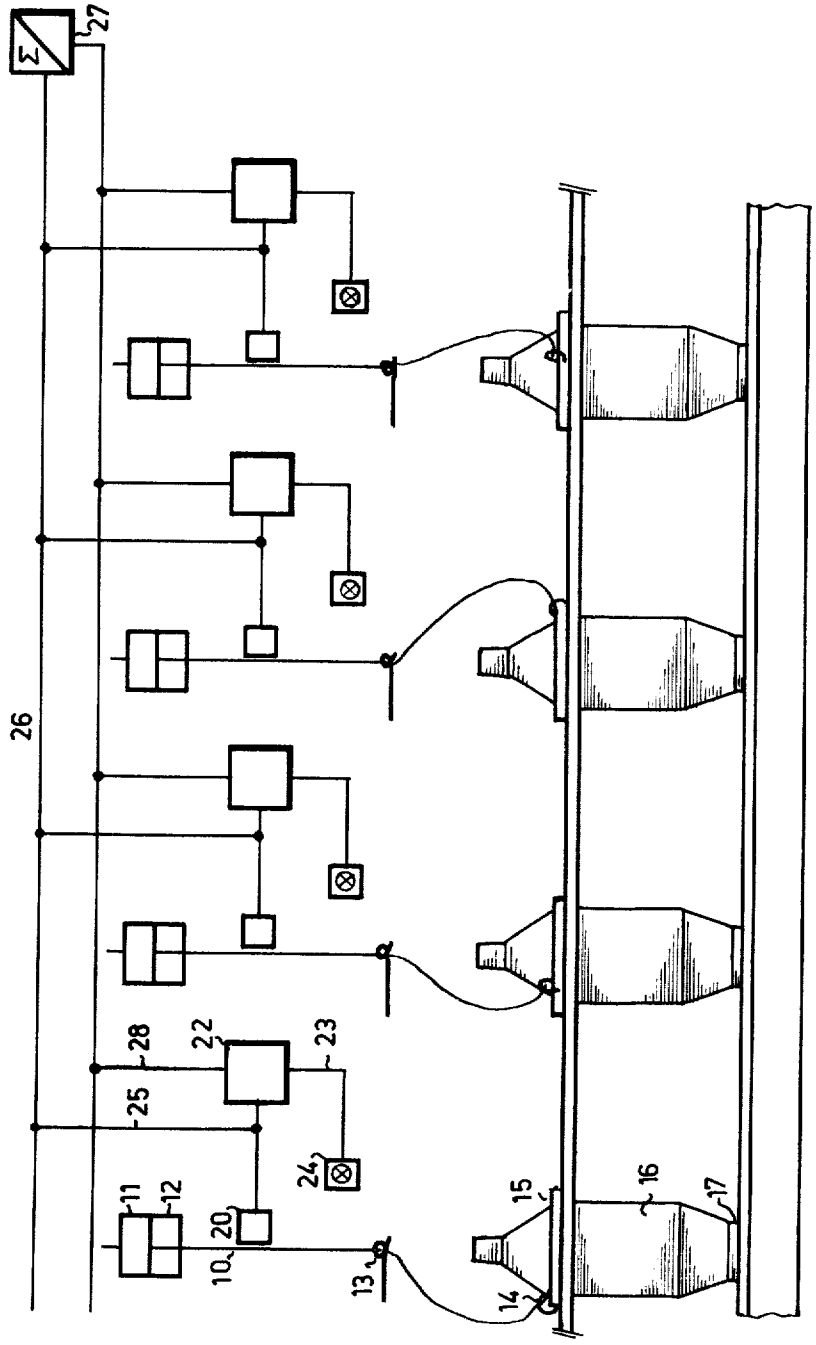


Fig. 2

METHOD OF AND APPARATUS FOR ASSESSING THE RUNNING BEHAVIOR OF TEXTILE MACHINES

This invention relates to a method of and an apparatus for assessing the running behavior of textile machines, and is particularly applicable to machines comprising a plurality of spindles working simultaneously alongside one another. Ring spinning machines represent one type of textile machine belonging to this category. Although it is the behavior of a ring spinning machine that is discussed below, the same considerations are also applicable to other textile machines.

One important factor in the cost of operating a ring spinning machine is the occurrence of stoppages caused by yarn breakages, whose elimination involves considerable difficulty. Although yarn breakages cannot be completely eliminated, their number should not exceed an acceptable limit.

Theoretically, the frequency with which yarn breakages occur at any particular individual spinning stations should comply with the laws of statistics. However, closer investigations have shown that certain individual spinning stations have a much higher yarn breakage frequency than might be expected from statistics. Some of the causes for the increased number of yarn breakages are known. However, it is extremely difficult to identify the spindles concerned and to determine the cause of the increased number of yarn breakages. Extra work has to be done in this regard, although this could be avoided either by directly eliminating the fault or by stopping the spindle affected until the fault has been eliminated. The operator cannot be expected to identify faulty spinning stations, because a single person has to attend thousands of spindles and it would be asking too much to expect this person to locate from memory a particular spindle which is giving rise to an increased number of yarn breakages.

It is of course possible to record and evaluate the number of yarn breakages by means of data processing systems. Unfortunately, systems of this kind are generally extremely expensive and are attended by the serious disadvantage that it would only be possible to obtain identification of a faulty spindle at a central unit. This is unsatisfactory so far as continuity of production is concerned, and conceals the danger of transmission errors.

An object of the invention is to remedy this situation by providing a method of assessing the running behavior of a textile machine comprising a plurality of spindles wherein operational characteristics are counted at each individual spindle, and a signal is generated in the immediate proximity of each spindle when the number or duration of the characteristics exceeds and/or does not reach a predetermined value.

This invention also provides an apparatus for assessing the running behavior of a textile machine having a plurality of spindles comprising a yarn monitor, a counter for recording impulses in consequence of a particular characteristic of each spindle, a nominal value pickup for determining the permitted number or duration of characteristics per spindle and a signal generator for indicating when the number or duration of the operational characteristics exceeds the predetermined nominal value and/or does not reach another predetermined value.

The predetermined nominal value can be calculated in accordance with the laws of statistics. It is of particular advantage to form the sum of all yarn breakages in the machine in question, in which case the sum and the probability for a certain number of characteristics in the operation of an individual spindle are in a direct mathematical relationship to one another.

Yarn monitors, advantageously of the kind which function without contact, are used on the spindles for detecting the occurrence of a yarn breakage, releasing a different signal to indicate that the yarn is or is not traveling, depending upon the circuitry used. These signal changes indicate clearly the occurence of yarn breakages. In order to count the yarn breakages, it is of particular advantage for counting impulses to be released for example in the event of yarn breakage (change from traveling yarn to stationary yarn) or during application of the new yarn (change from stationary yarn to traveling yarn). However, measures have to be taken to ensure that, when the machine is taken out of operation, counting of the yarn breakages is also interrupted because otherwise changes from a traveling yarn to a stationary yarn will occur in the absence of a yarn breakage.

Since the number of spindles per machine is generally extremely large, it is important to keep the cost of equipping each spindle with a yarn monitor, of counting and/or indicating means as low as possible. Yarn monitors are available in suitable form, the expensive part generally being the counter. However, it is possible to use relatively small counters, i.e., counters with a small number of possible values providing the apparatus is designed in such a way that counting impulses are only recorded until they have exceeded a predetermined value, subsequently actuating the indicating means. This is because it does not contribute very much more to the information if, in addition to detection of the predetermined nominal value being exceeded, the extent to which it is exceeded is also indicated. In this case, it is sufficient to use a signal lamp as the indicating means on each spindle.

Embodiments of the invention are described below by way of example with reference to the accompanying drawings, wherein:

FIG. **1** diagrammatically illustrates a spinning station with the elements associated with it; and

FIG. **2** shows several spinning stations of the kind shown in FIG. **1** arranged adjacent one another.

FIG. **1** shows in simplified form part of a ring spinning machine. Untwisted yarn **10** leaves a drawing zone, diagrammatically indicated by a pair of front cylinders **11** and **12**, and passes through a yarn guide **13**. The twist required for the strength of the yarn is then imparted to the yarn by means of a traveler **14** in known manner, i.e., by the bobbin **16** rotating on its mounting **17** and by the traveler **14** traveling around the ring **15**. The bottom **16** is uniformly wound with the spun yarns, through reciprocating vertical travel of the ring rail **18**.

A yarn monitor in the form of a detector **20** of known construction is arranged, for example, in the zone between the front cylinders **11** and **12** and the yarn guide **13**, its function being to transmit different signals along a line **21** to a counter **22**, depending upon whether the yarn **10** is traveling or stationary.

The yarn breakages can be derived from this signal and their number stored in counters. When the yarn

monitor releases an electrical signal to indicate whether the yarn is traveling or stationary, it is of particular advantage to use electrical stores, which are known in various different forms, as the counters. In the case of a ring-spinning machine, it is possible for example to use a counter **22** (bistable multivibrators with which it is possible to count up to **3**). The corresponding circuit has to be such that, when the third yarn break occurs at the spindle in question, a signal lamp **24** is illuminated and, through internal connections, it is ensured that no further counting impulses reach the input of the counter because, on the arrival of the next impulse, the counter would be set back to zero. Another advantage of electrical counters is that they can be set back to zero from a central unit with the result that an evaluation period can begin at the same time for all the bobbins.

For calculating statistical probability, with which the yarn breakages occur at any one of the spindles, it is of advantage to determine the total number of yarn breakages in a machine containing, for example, 200 spindles, during a predetermined time interval. By means of a busbar **26** to which the counter **22** is connected by means of a line **25**, it is possible to determine the sums of the yarn breakages of all the spindles **16** in a central evaluating unit **27**, which may typically include a summing circuit for summing the signals received on bus **26** and a level detector for determining when the value in the summing circuit reaches a given level. When these sums are reached, it is possible for example to suppress all further counting, for example by means of a signal transmitted from the central evaluation unit **27** through a connecting line **28** to the counter **22.** This prevents three yarn breakages (where a two-stage counter in the form of a flip-flop is used) on one spindle from becoming too probable. The storage capacity of the counter or store need not, of course, be confined to three, but can be increased to larger values by providing in place of the two-stage counter a plural stage counting chain of any desired length. However, a two-stage counter formed by flip-flop stages with a counting capacity of three represents an extremely economical solution.

FIG. **1** also shows a switch **29** in the connecting line **21** through which, when the machine as a whole is stopped, the counting impulses are also interrupted by actuating a contactor **30.** Stoppage of the yarn as detected by the yarn monitor **20** because of stoppage of the machine should not, of course, be evaluated as a yarn break.

The foregoing description has dealt mainly with the example of yarn breaks. However, the invention is also applicable to other operational characteristics. Prolonged stoppages are another example of operational characteristics. They reduce efficiency and, for this reason, should also be identified. In order to obtain the required indicating signal at the spindle, it is possible for example to adopt the following procedure. Conventional yarn monitors are used to indicate whether or not the yarn is traveling. An impulse is then released from a clock signal in the evaluation unit **27** at certain time intervals, for example every minute. These impulses are then counted by a second counter at those spindles where the yarn has stopped. This is easily accomplished by applying the clock signals to the second counter only when the output of the yarn monitor **20** indicates stopping of the yarn, for example by way of a switch. If a spindle remains stationary for example for 30 minutes, it follows that thirty impulses are counted by the second counter. The installation can be such that the indicating instrument at the individual spindles responds on reaching a certain number of impulses. Flip-flops can again be used as the second counters. If for example six flip-flops are used, it is possible to count up to $63 = (2^6 - 1)$. It is of particular advantage to fix the counting value at which the indicating instrument responds, and to vary the time interval between the impulses. So far as the present example is concerned, the indicating instrument would therefore respond after 63 minutes with an interval between impulses of one minute. If the interval between impulses is 2 minutes, a total stoppage time of 126 minutes would elapse before indication.

The cut count of electronic yarn cleaners is another example of operational characteristics. An electronic yarn cleaner normally has a certain average cut count at a certain spindle. Excessive or inadequate impulse counts can be obtained both as a result of disturbances affecting the machine and also as a result of incorrect sensitivity of the yarn cleaner. In this case, it is advisable both to indicate when a certain impulse count has been exceeded and also to indicate if a certain cut count has not been reached after a certain time. These two indications can, of course, be combined into a single indication.

What is claimed is:

1. A method of assessing the running behavior of a textile machine including a plurality of spindles comprising the steps of detecting operational characteristics at each individual spindle, counting the detected operational characteristics at each spindle, summing the detected operational characteristics from all of said spindles and generating a signal in the immediate proximity of each spindle when the number or duration of the characteristics detected at the given spindle reaches a predetermined value in excess of the average number of detected operational characteristics of the plural spindles prior to detection of a predetermined total number of operational characteristics from all of said spindles.

2. A method as claimed in claim **1** wherein the step of counting is only continued until the said signal is generated.

3. An apparatus for assessing the running behavior of a textile machine having a plurality of spindles comprising yarn monitor means for providing an impulse upon detecting a particular characteristic of the running behavior at each spindle, a counter connected to receive the output of said yarn monitor means at each spindle for counting said impulses representing the occurrences of the detected characteristic at the respective spindle, evaluating means connected to the output of each counter for resetting said counters upon detection of a predetermined total of detected occurrences of the particular characteristic at all of said spindles and signal generator means at each spindle responsive to said counter for indicating when the counter reaches a predetermined count.

4. An apparatus as defined in claim **3** wherein said counter includes a bistable multivibrator.

5. An apparatus as defined in claim **3** wherein said yarn monitor means includes at least one yarn detector which tests the yarn for travel without contact therewith.

6. An apparatus as defined in claim 3 wherein said yarn monitor means is provided in the form of a yarn cleaner.

7. An apparatus as defined in claim 3 wherein said yarn monitor means includes a yarn detector at each spindle having its output connected to a respective counter, the outputs of all of said counters being connected to said evaluating means via a common busbar.

8. An apparatus as defined in claim 3, further comprising relay means for disconnecting said counter from said yarn monitor means upon deactivation of said textile machine.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,890,489 Dated June 17, 1975

Inventor(s) Ernst Felix

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Priority Data (cover page, section [30]) incorrect. Should read:

--Jan. 24, 1972 Switzerland 973/72--

Signed and Sealed this

thirtieth Day of *September 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

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Commissioner of Patents and Trademarks