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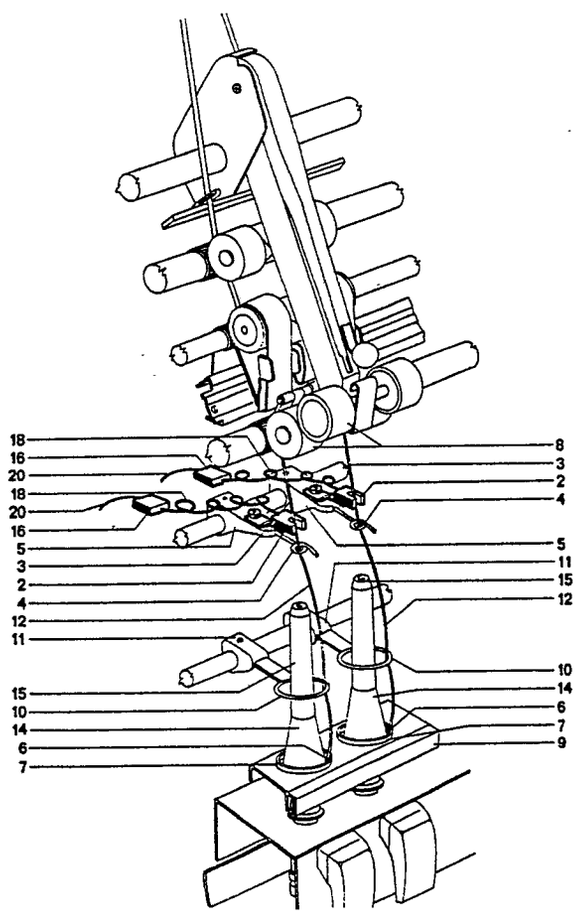
(54) Method and device for monitoring the path and quality of the yarn under formation in a ring spinning machine.

(57) A method for continuously monitoring a moving yarn under formation and collection on a package in a ring spinning machine, the method using a photoelectric or capacitive or piezoelectric transducer positioned between the last pair of drafting rollers and the underlying yarn guide element, or positioned to replace this latter, and a device for implementing this monitoring.



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METHOD AND DEVICE FOR MONITORING THE PATH AND QUALITY OF THE YARN UNDER FORMATION IN A RING SPINNING MACHINE

This invention relates to a method and device for continuously monitoring the path of yarn under formation, for its winding onto a package in a ring spinning machine.

Ring spinning machines are known, consisting of a plurality of spinning spindles arranged in adjacent progression.

Each spinning position comprises a ring-traveller pair, with the rotation of the traveller along the ring providing the real twist to the yarn under formation, and a drafting unit from which a sliver of textile fibres emerges, these being twisted together by the rotation of the spinning spindle as is well known to the expert of the art.

In such a ring spinning position there is the problem of continuously monitoring the presence and quality of the yarn which winds in the form of suitably distributed layers on the surface of the package under formation.

The purpose of this monitoring is to generate information, and initiate suitable measures if the yarn has broken or if the yarn which is present is not of the set quantity.

Sensors are currently used to a large extent for this purpose, these being of optical, inductive or any other type provided they are able to sense when the rotary travel of the traveller along the ring has stopped, to indicate the breakage of a yarn on a spinning spindle. Said sensors of the known art for sensing yarn breakage are either associated with mechanical units so that they are mobile for sensing purposes along the face or faces of the ring spinning machine, or are of fixed type applied to each spinning position.

These types of sensors for sensing yarn breakage on the spinning spindle in a ring spinning machine have proved to be too costly in terms of construction to enable them to be applied on a global scale, and are particularly limitative in that they do not provide information on the quality of the yarn under formation. Such yarn-monitoring warning means are therefore limited. In this respect, it should be noted that as spinning rates and market quality requirements increase, it becomes ever more important to provide suitable monitoring of the ring spinning operation, particularly with regard to the quality of the yarn under formation, but without substantially increasing the cost of the finished product. This is a very important current problem in that manufacturers are increasingly required to produce a perfect product. The need to contain working costs while producing higher quality has accentuated this problem, which has long existed in the ring spinning field. Yarn monitoring means are however known which are able to determine not only the presence of the yarn but also indicate the quality of the yarn under formation. However the known means of this type have further essential drawbacks which perhaps throw doubt on their practical usefulness in that they are of complicated construction while not always being dependable, so that their operation is both unreliable and unsatisfactory.

The object of the invention is therefore to provide a control method involving monitoring without contact with the yarn under formation so as not to obstruct the distribution of twist through it, and a device for implementing this monitoring which is space-saving, of simple construction and easy to mount on any ring spinning spindle.

This object is attained according to the invention by providing an optoelectric yarn monitor which enables both the path of the moving yarn under formation to be monitored and the yarn quality to be checked against the set quality, by analyzing the frequency of defects and activating acoustic or light signals either at the spindle or at the head of the machine each time the yarn breaks and each time there is an indication of a defective spindle which is giving rise to an abnormal number of defects.

The characteristics and principle of operation of the sensing light beam of said optoelectric or capacitive or piezoelectric yarn monitor are already known in detail in the art. According to a preferred embodiment the optoelectric yarn monitor is in the form of an optical monitor of single-path, reflection or other known type. In the case of a single-path optical monitor the photoemitter and photoreceiver face each other, whereas in the case of the reflection optical monitor the photoemitter and photoreceiver are placed side by side facing a reflector positioned a certain distance away. The purpose therefore of the present invention is to obviate the aforesaid drawbacks by using an optoelectric monitor positioned at each spinning spindle and above or as a replacement for the first yarn guide after the last pair of drafting rollers, to monitor the path of the yarn and check that its quality confirms to the set quality. This monitoring is done by a light beam with the result that even very thin and delicate yarns can be monitored without damage. The optoelectric device which implements the method of the present invention also has the following advantages:

- it is insensitive to machine vibration because it uses a light emitting diode as the light source;
- it is insensitive to external light sources because

of the use of modulated light for the monitoring light beam
- it is of small dimensions and therefore easily installed on already operating spinning spindles;
- it is positioned above or in the position of the first yarn guide element under the drafting unit.

This latter operating advantage can be further clarified as follows. The textile fibres which leave the drafting unit in the form of a sliver are twisted by the twist which rapidly rises by the effect of the rotation of the traveller along the ring, said rotation being generated by the high-speed rotation of the spinning spindle in known manner. Between the traveller and the first yarn guide element under the drafting unit the moving yarn assumes its well known balloon rotation which is determined by the centrifugal force of the yarn before its deposition on the package under formation. In the section between the first yarn guide element located below the drafting unit and the last pair of drafting rollers the yarn is fairly stable transversely, ie does not oscillate transversely by any significant amount. In addition in this latter section and in proximity to or in correspondence with said first yarn guide element the yarn has already assumed most of its twist, so that an observation of its quality at this point is a sufficiently accurate indication of that of the yarn being wound on the package under formation.

The present invention therefore provides an optoelectric device positioned in an optimum point or section. These and further advantages are attained by the method of the present invention and the device for its implementation, for the continuous monitoring of a forming yarn moving towards its collection as a package on a spinning spindle of a ring spinning machine, said continuous monitoring being exercised on the yarn in an intermediate position between the last pair of drafting rollers and the first underlying yarn guide element by an optoelectric transducer. A further method of the present invention comprises the continuous monitoring of a forming yarn moving towards its collection as a package on a spinning spindle of a ring spinning machine, said continuous monitoring being exercised on the yarn in the position of the first yarn guide element below the last pair of drafting rollers by an optoelectric transducer which acts as and replaces said yarn guide element.

A preferred embodiment of the device of the present invention is described hereinafter by way of non-limiting example with reference to the single accompanying drawing.

This is a schematic isometric perspective view of the optoelectric yarn monitor positioned along the path of the yarn under formation in a ring spinning machine between the last pair of drafting rollers and the underlying first yarn guide element, or as a replacement for this latter.

In the accompanying figure, equal elements carry equal reference numerals. Further in the figure, for reasons of overall clarity those parts not necessary for an understanding of the invention are omitted, or are indicated in an overall manner by virtue of being known.

In said accompanying figure:
8 is the drafting roller pair positioned at the end of the drafting unit from which a sliver of textile fibres leaves to be twisted to form the yarn; 3 is the yarn under formation, which acquires twist by the rotation of the traveller 6; 4 is the first yarn guide below the drafting roller pair 8, it being in the form of a loop to facilitate the introduction of the yarn 3. Said yarn guide 4 represents the vertex of the balloon 12. In this respect, the shape of the balloon 12 is determined by the centrifugal force of the yarn between the yarn guide 4 and the traveller 6, as is well known to the expert of the art. The yarn 3 under formation travels downwards within the loop of the yarn guide 4 with negligible transverse oscillation; 5 is the support for the yarn guide 4 and can be tilted to facilitate doffing, and in addition is adjustable; 2 is the photoelectric or capacitive or piezoelectric transducer for monitoring the moving yarn 3 under formation, said photoelectric transducer 2 being positioned between the drafting roller pair 8 and the yarn guide element 4. Advantageously, said photoelectric transducer 2 is positioned in proximity to the yarn guide 4, or replaces said yarn guide 4; 14 is the package under formation; 9 is the ring support bench which is moved with vertical reciprocating movement to wind the yarn in superposed concentric layers to form the known spinning package 14; 6 is the traveller rotated by the rotational speed of the spindles, the revolutions of said traveller 6 creating the real twist acquired by the yarn 3 under formation; 7 is the ring which is fixed on the bench 9 to form the guide and rotation track for the traveller 6; 15 is the wound yarn support tube for forming the package 14; 10 is the antiballoon yarn guide or balloon control ring, with its aperture curved to allow and facilitate introduction of the yarn; 11 is the support for the ring 10, and can be raised and tilted for doffing purposes, and is also adjustable. The operation of the device for monitoring a moving yarn under formation and collection as a package in a ring spinning machine as shown on the accompanying drawing is apparent. In said drawing, those parts not essential for understanding the invention have been omitted for clarity.

The textile fibre sliver leaves the pair of drafting rollers 8 at constant speed. Twist rises from the traveller 6 to bind the textile fibres together in cylindrical form to form the yarn 3, which travels downwards and continues to assume twist, to then

deposit on the surface of the forming package 14 by the action of the ring-traveller pair. During the movement which terminates in its collection on the package 14, the presence of the yarn 3 and its quality are monitored by the optoelectric transducer 2 which, as a device for investigating presence and quality, is constructed advantageously in the form of a hollow yarn guide so as to correctly retain the yarn 3 in position. Said optoelectric transducer 2 is designed to provide at its output electrical signals which are advantageously amplified. Said electrical signals are fed through the cable 18 to the control card 16, they being either of oscillating and hence variable value or of constant value. An oscillating value indicates that the yarn 3 is being collected whereas a constant value indicates that the yarn is absent (accidental yarn breakage). In this respect, it should be noted that a yarn moving through an optoelectric transducer produces an incident light of variable luminosity on the photoreceiver because, as is well known, the diameter of the forming yarn 3 slightly oscillates about an average value (count), and in addition the yarn vibrates slightly during its travel. The light from the photoemitter encounters the moving yarn and strikes the photoreceiver with variable luminosity to produce a variation in electrical conditions in the optoelectric transducer, so resulting in oscillating electrical signals. These latter reach the control card 16 to confirm that the forming yarn 3 is under movement and that the linear regularity of the yarn 3 is within a predetermined range, with the result that said card 16 does not produce a signal at the spinning spindle or in any other advantageous position.

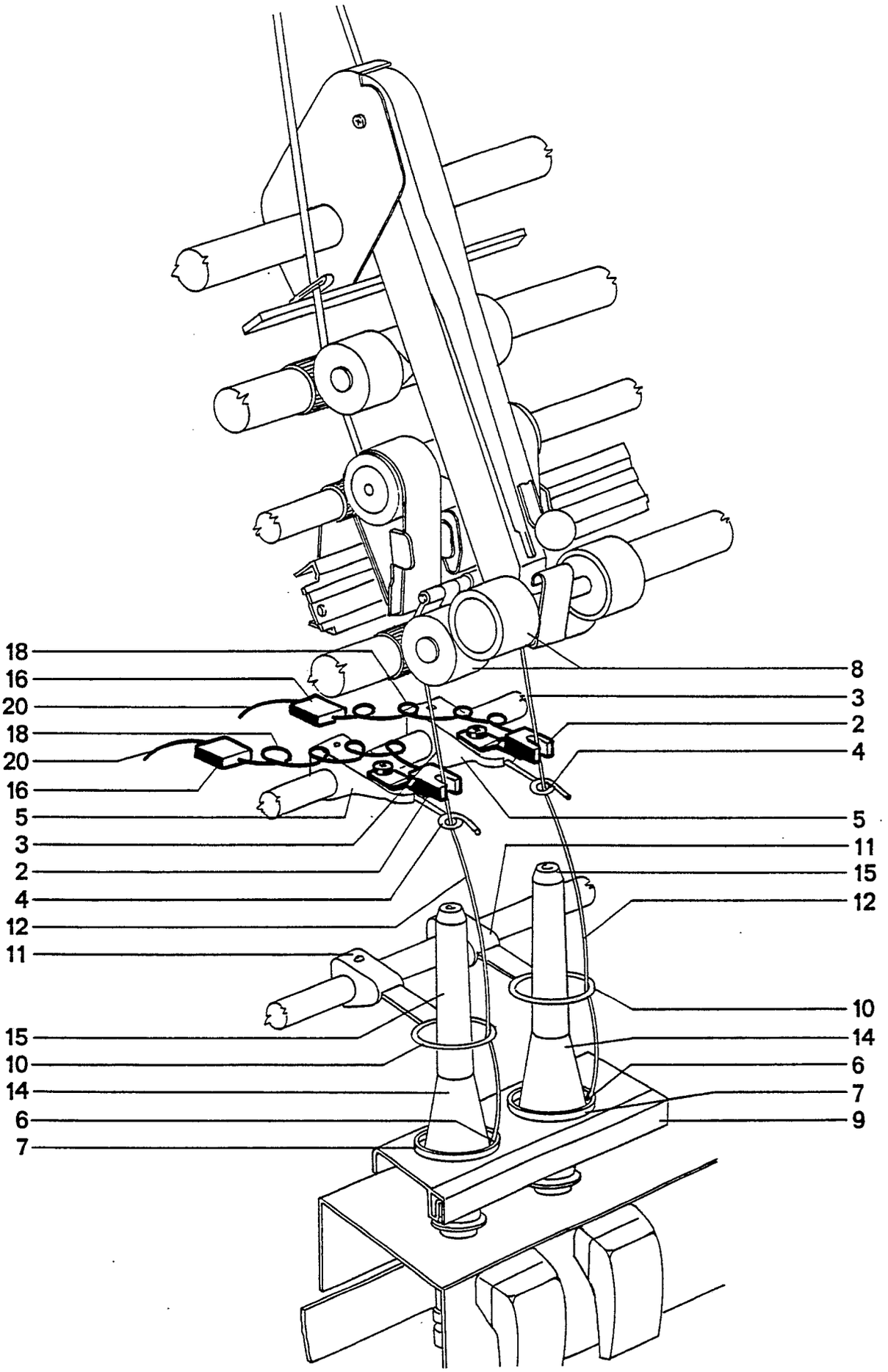
In contrast, if the light from the photoemitter does not encounter the yarn 3 (yarn broken) thus striking the photoreceiver with constant luminosity, or if it does encounter yarn but strikes the photoreceiver with a variable luminosity such that it falls outside the regular predetermined variation, it produces in the optoelectric transducer electrical signals which are either constant with time (lack of yarn) or are of such values as to indicate linear irregularity in the yarn under formation. These electrical signals reach the control card 16 which immediately produces signals at the spinning spindle, or feeds them to the head of the machine so as to call the attention of the service personnel, who are thus made aware of the breakage of the yarn 3 or of the linear irregularity defects in the yarn 3 being wound on the forming package 14.

Claims

1. A method for continuously monitoring a moving yarn under formation and collection on a package in a spinning position of a ring spinning machine, said spinning position comprising a ring-traveller pair and a drafting unit with interposed guide elements, characterised in that the continuous monitoring is exercised on the moving yarn under formation, in an intermediate position between the last pair of drafting rollers and the underlying yarn guide element which is positioned above and in proximity to the tip of the vertical tube which supports the deposition of the yarn during its winding, said continuous monitoring being implemented by an optoelectric or capacitive or piezoelectric transducer.

2. A method for continuously monitoring a moving yarn under formation and collection on a package in a spinning position of a ring spinning machine as claimed in claim 1, characterised in that the continuous monitoring is exercised on the moving yarn under formation, in the position of the yarn guide element which is positioned below the last pair of drafting rollers and above and in proximity to the tip of the vertical tube about which the yarn winds, by means of an optoelectric or capacitive or piezoelectric transducer which acts as and replaces said yarn guide element.

3. A device for continuously monitoring the moving yarn under formation and collection on a package in a ring spinning position comprising the ring-traveller pair and the drafting unit with guide elements interposed between the two, characterised by further comprising an optoelectric or capacitive or piezoelectric transducer positioned between the yarn guide element situated above the yarn winding tube and the last pair of drafting rollers of said drafting unit, or positioned in the position of and therefore as a replacement for said yarn guide element.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