March 4, 1969 M. M. BRYAN, JR., ET AL 3,430,426

MONITORING DEVICE FOR SPINNING FRAME

Filed April 18, 1967 Sheet 1 of 2

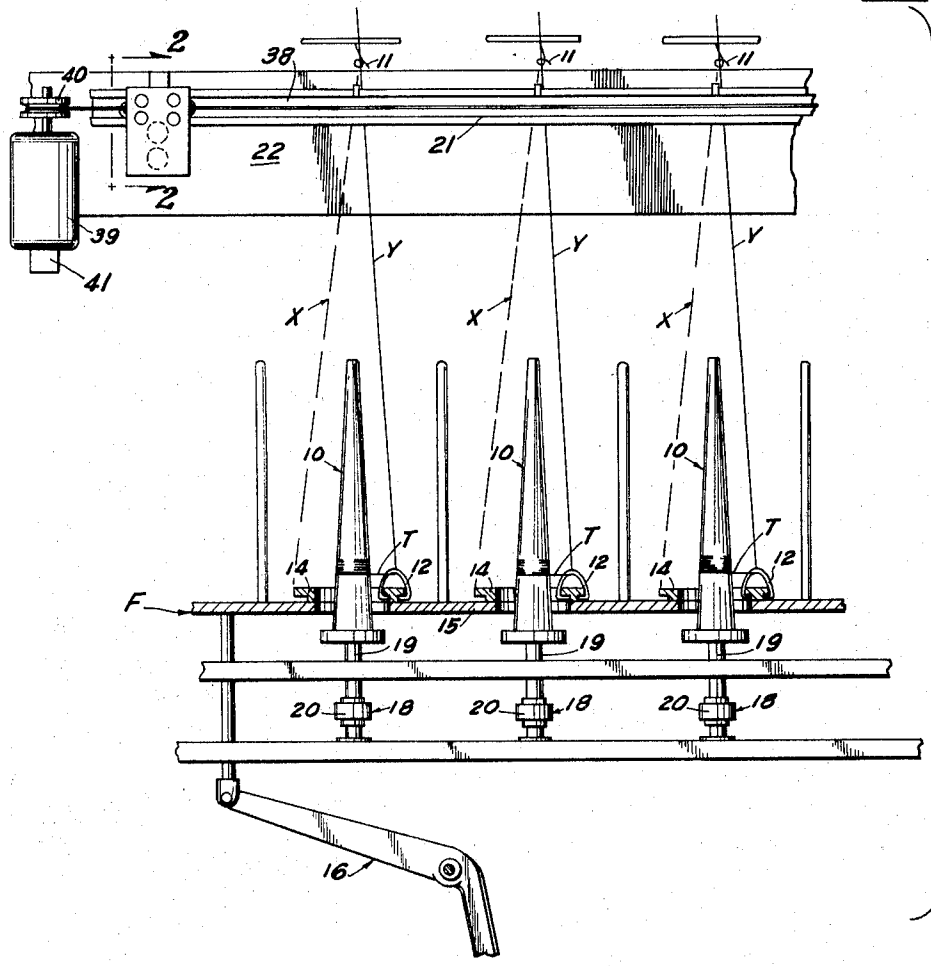



Fig. 1

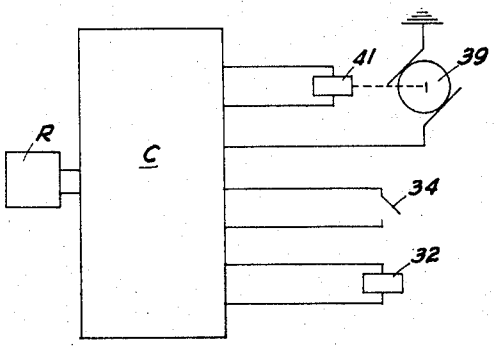



Fig. 5

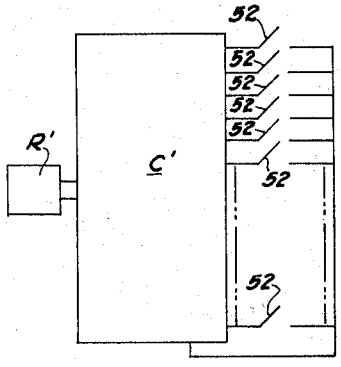



Fig. 6

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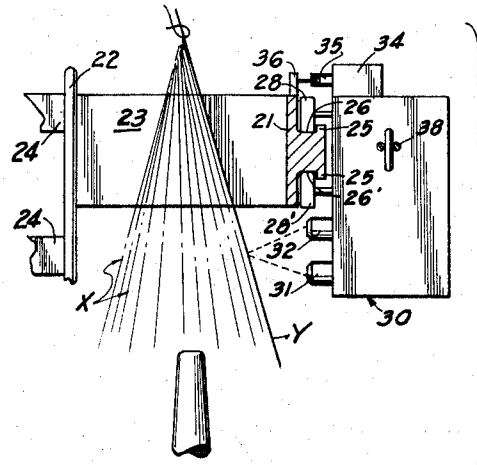



Fig. 2

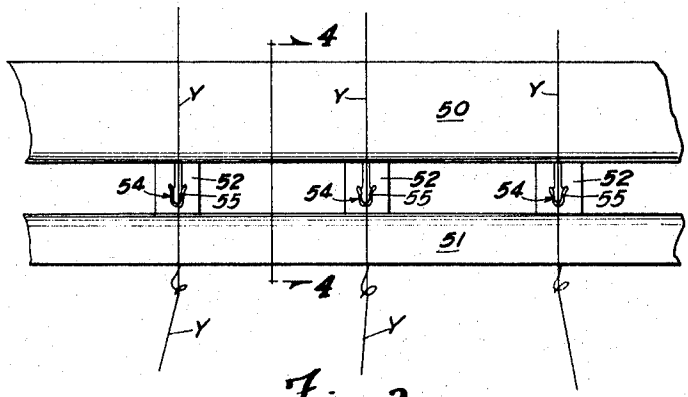



Fig. 3

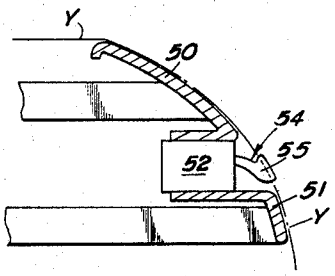



Fig. 4

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3,430,426

# MONITORING DEVICE FOR SPINNING FRAME

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Int. Cl. D01h *13/26, 13/16, 13/32*

## ABSTRACT OF THE DISCLOSURE

What is disclosed herein is a spinning frame which includes a monitoring means for monitoring the operating condition of each spindle assembly so as to provide an electrical output corresponding to the operating condition of each spindle assembly. The spinning frame is conventional in that yarn defines a substantially conical zone of motion as it passes to the rotating traveler of each spindle assembly and in one embodiment of the invention light reflected from yarn in a conical zone of motion is used to provide the electrical output corresponding to the operating condition of a spindle assembly. In another embodiment of the invention, the operation of a switch means in response to tension of yarn as it passes into a conical zone of motion is used to provide the electrical output corresponding to the operating condition of a spindle assembly. With either embodiment, the electrical outputs may be used to indicate that a spindle assembly is inoperative and may be accumulated by an accumulating means such as a conventional computer to indicate a pattern of operating difficulties indicative of a spindle assembly requiring corrective maintenance.

## BACKGROUND OF INVENTION

### *Field of invention*

This invention relates to textile machinery and more particularly to a spinning frame having improved operating efficiency and reliability because of the ease with which yarn breakage is identified for continuing operation at maximum efficiency and for the application of corrective maintenance procedures.

### *Prior art*

Spinning frames in which roving yarn is drafted and twisted into thread while being transferred from one bobbin to another are well known in the textile manufacturing art. A basic feature of these spinning frames is the ability to spin a plurality of threads simultaneously and wind each thread on a separate bobbin. It is because of this multiple spinning feature that these spinning frames are regarded in the textile industry as being generally efficient and reliable.

However, the efficiency and reliability of these prior art spinning frames is dependent upon the prompt detection of broken yarn ends and prompt application of corrective maintenance procedures to insure both that yarn is being spun at all times and that the spindle assemblies carrying the bobbins are continuously operating. This is because broken yarn ends cause the particular bobbin upon which the yarn is being spun to become unproductive and because failure to promptly apply corrective maintenance procedures to a spindle assembly results in repeated failure of the spindle assembly.

With prior art spinning frames, breakage of the yarn being wound on a bobbin was detected by the operator as he walked up and down the sides of the spinning frame performing other assigned tasks. When he noted that one of the yarns had become broken so as to prevent the spinning thereof upon a bobbin carried by the spinning frame, he repaired this broken yarn and continued on his tasks. This process of detection of broken yarn ends was not only slow, but the irregularity with which the operator checked the bobbins for broken yarn ends frequently resulted in surveillance of each of the bobbins only after extended periods of time. Therefore, when a yarn became broken, it was usually an extended period of time before the broken end was detected and repaired so that the overall production efficiency of the spinning frame was reduced.

Moreover, since the operator simply repaired the broken yarn ends without noting the frequency with which a yarn end was broken on a particular spindle assembly, there was no way to obtain an indication that a particular spindle assembly was in need of corrective maintenance procedures unless a complete breakdown occurred. This also resulted in reducing the overall operating efficiency of the spinning frame as well as increasing the maintenance cost thereof.



## SUMMARY OF INVENTION

The invention disclosed herein overcomes these and other difficulties associated with the prior art spinning frames in that it provides a spinning frame which periodically and automatically surveys each of the plurality of spindle assemblies to detect whether any yarn being spun on the bobbins is broken and which provides an electrical output when a yarn is broken. This feature of the spinning frame frees the operator for other activities and serves to increase the overall operating efficiency of the spinning frame since each bobbin is surveyed at relatively short intervals of time and may be repaired with a minimum of down time. Moreover, since the frequency of yarn end breaks on each spindle assembly is readily provided by selectively accumulating electrical outputs over an interval of time, corrective maintenance procedures may be applied to the particular spindle assembly before a complete breakdown occurs.

These improvements in the spinning frame are provided by a spinning frame having integral monitoring means for monitoring the operating conditions of each of the spindle assemblies and for providing an electrical output related to the operating condition of each of the spindle assemblies. The resulting plurality of electrical outputs are fed to a conventional circuit arrangement such as that provided by a computer to permit the yarn breakage of any particular bobbin to be indicated at a central station so that a broken yarn end may be quickly and easily repaired. Moreover, when a conventional circuit arrangement such as a computer is arranged as an accumulating means for accumulating the electrical outputs from the monitoring means, the invention includes an accumulating means which indicates when corrective maintenance procedures must be applied to a spindle assembly by indicating the frequency of the yarn end breaks associated with the spindle assembly.

These and other features and advantages of the invention may be more clearly understood upon consideration of the following detailed description and accompanying drawings wherein like characters of reference designate corresponding parts throughout.

## DESCRIPTION OF DRAWINGS

FIG. 1 is a partial front elevational view of a spinning frame illustrating one embodiment of the invention;

FIG. 2 is a cross-sectional view of that embodiment of the invention illustrated in FIG. 1 taken in line 2—2 of FIG. 1;

FIG. 3 is a front elevational view of a second embodiment of the invention;

FIG. 4 is a cross-sectional view of the second embodiment of the invention illustrated in FIG. 3 taken in line 4—4 of FIG. 3;

FIG. 5 is a schematic wiring diagram for a conventional computer which may be used with that embodiment of the invention shown in FIGS. 1 and 2; and,

FIG. 6 is a schematic wiring diagram for a conventional computer which may be used with that embodiment of the invention shown in FIGS. 3 and 4.

These figures and the following detailed description disclose embodiments of the invention, however, the invention is not limited thereto since it may be embodied in other equivalent forms.

## ILLUSTRATIVE EMBODIMENTS

Referring to FIG. 1 it will be seen that the invention is used in conjunction with a conventional spinning frame F which utilizes ring travelers **12** to spin yarn Y into thread T and wind thread T upon each of the bobbins **10**. In the particular spinning frame F shown, it will be understood that yarn Y is received from drafting rolls (not shown) and passes through pigtail guides **11** and thence through the travelers **12** which move around horizontally positioned spinning rings **14** mounted on a vertically movable ring support **15**. The ring support **15** is selectively movable up and down with respect to the bobbins **10** by an elevating assembly **16** so that thread T wound on the bobbins **10** can be evenly distributed between the bottom and the top of the bobbins **10**. A spindle assembly **18** mounts each bobbin **10** so that the bobbin **10** is rotated by a belt **20** driven from a common drive shaft (not shown).

As will be well understood by those skilled in the art, yarn Y passes through the pigtail guides **11** and the travelers **12** while being twisted and spun into thread and wound onto the bobbins **10** by rotation of the bobbins. During its travel from each pigtail guide **11** to a corresponding traveler **12**, the yarn Y circumscribes a substantially conical zone of motion X due to the revolving motion of the traveler **12** about the ring **14**.

A first embodiment of the invention is shown in FIGS. 1 and 2 and includes a stationary track **21** fixedly mounted by supports **23** to a background board **22** carried by the frame of the spinning frame F through supports **24**. The track **21**, a cross-section of which is shown in FIG. 2, is positioned in front of the yarn Y by supports **23** extending from the background board **22** between spindle assemblies **18** so as not to interfere with the movement of the yarn Y from the pigtail guides **11** to the travelers **12** of the spindle assemblies **18**. The track **21** is a substantially T-shaped member with flanges **25** at the base thereof to form runways **26** and **26'**. These runways receive guide rolls **28** and **28'** respectively, for guiding and supporting a monitoring means such as a monitoring mechanism **30** as it is moved along the track **21**.

The monitoring mechanism **30** is positioned or passes in front of the yarn Y in each conical zone of motion X and includes a conventional photoelectric transmitter **31** and a conventional photoelectric receiver **32** extending below the track **21**. Both the transmitter **31** and the receiver **32** are focused on the zone of motion X being defined by motion of yarn Y as it passes from a pigtail guide **11** to a traveler **12**.

In operation of the monitoring mechanism **30**, light is emitted from the transmitter **31** and reflected back to the receiver **32** by the yarn Y as the monitoring mechanism **30** moves past each spindle assembly **18**. The light reflected from the yarn Y to the receiver **32** when the yarn Y is moving in a cone of motion X is sufficient to cause an electrical output to be generated. In the absence of yarn Y moving in a cone of motion X as when the yarn Y is broken, the light reflected from the yarn Y is not sufficient to cause an electrical output to be generated.

The monitoring mechanism **30** is moved progressively along track **21** with a cable **38** attached to the monitoring mechanism **30** and to a pulley **40** driven by a motor **39**. Carried by the monitoring mechanism **30** is a microswitch **34** having an actuator arm **35** extending outwardly to engage a switch actuator **36** mounted on the track **21** at each spindle assembly **18**. The switch **34** is operatively connected to the motor **39** so that when the switch **34** is activated at each station, the monitoring mechanism **30** will be stopped for a short period of time to allow the monitoring mechanism **30** to scan the cone of motion X defined by yarn Y. The background board **22** is preferably a black body so that it reflects very little light. This prevents inadvertent activation of the receiver **32** by light reflected from the background board **22**.



Referring more particularly to FIG. 5, one circuit arrangement for this embodiment of the invention is shown. From FIG. 5, it will be seen that the motor **39** is driven through an output signal from a conventional computer C which is programmed so that the motor **39** may be selectively operated in response to actuation of the switch **34** through the switch actuators **36**. A counter **41** is mechanically connected to the motor **39** and in response to revolutions of the motor **39** provides a signature output to the computer C that is representative of the position along the track **21** at which the monitoring mechanism **30** is located at any particular instance. This allows the computer C to distinguish the particular spindle assembly **18** on the spinning frame F at which light is being reflected into the receiver **32**.

Moreover, it will be understood that the signature output from the counter **41** may also be used with the computer C in place of the switches **34** to stop the monitoring mechanism **30** at each spindle assembly **18** for a short period of time. This is because the computer C provides a convenient circuit for starting and stopping the motor **39** when the computer C is programmed in conventional manner. In addition, it will be understood that the monitoring mechanism **30** may be moved continuously past the plurality of spindle stations **18** rather than stopped at each spindle station **18** and still be responsive to light reflected into the receiver **32** at each spindle station **18**. Regardless of the manner in which the monitoring mechanism **30** is positioned along the track **21**, output of the receiver **32** at each spindle assembly **18** is fed to the computer C as a condition output which indicates whether a yarn Y is being spun onto a bobbin **10** at a particular spindle assembly **18**.

A computer C has been chosen to illustrate a circuit arrangement because, as will be understood by those skilled in the art, a computer C inherently provides a convenient means for providing control signals and for receiving and accumulating a plurality of electrical outputs. It also provides a convenient means for providing an appropriate impulse to a read-out device R which identifies the operating condition at each spindle assembly by a visual signal and which provides an accumulative record of the performance of each particular spindle assembly **18**. The readout device R may be any conventional device of its type and serves to tell an operator whether any yarn Y is broken and when a predetermined number of yarn breakages have occurred at a particular spindle assembly **18** so that corrective maintenance procedures may be applied to the spindle assembly **18** to correct any mechanical malfunction that may be present therein.

Referring to FIGS. 3 and 4, it will be seen that a second embodiment of the invention comprises a first slide plate **50** and a second slide plate **51** positioned below the first slide plate **50**. The slide plates **50** and **51** provide a smooth continuous surface over which the yarn Y passes at it moves from the drafting rolls (not shown) to the pigtail guides **11** on the spinning frame F.

A microswitch **52** is positioned between the upper guide **50** and the lower guide **51** corresponding with each spinning position on the frame F and has a smooth-surfaced actuator arm **54** with guide flanges **55** thereon for directing the yarn Y thereover as it moves over the slide plates

50 and 51. The actuator arm 54 is responsive to the yarn tension and as long as the yarn Y is being passed over the slide plates 50 and 51 under tension, the contacts of the microswitch 52 will be open so that no signal is provided to a computer C' or other circuit means for providing an accumulating means in cooperation with a read-out device R' as seen in FIG. 6. However, when a yarn Y is broken and yarn tension is released, the contacts of a microswitch 52 are closed and an electrical output is provided to the computer C'. It will be understood that with appropriate arrangement and programming of the computer C' in conventional manner, this electrical output serves as both a signature output which is characteristic of a particular spindle assembly 18 and a condition output which is indicative of the condition of yarn Y at the spindle assembly 18.

As with the readout device R in the first embodiment described above, the readout device R' serves to visibly indicate when a particular yarn Y is broken as well as to indicate the accumulated yarn breakages at each spindle assembly 18. As a result, a broken yarn Y can be quickly repaired and after a predetermined accumulated number of broken yarn ends occur with respect to a particular spindle assembly 18, proper corrective maintenance procedures may be applied to the spindle assembly 18 to correct any mechanical malfunction that may be present.

## OPERATION

In the operation of the first embodiment of the invention, yarn Y is secured to each bobbin 10 after passing through a guide 11 and a traveler 12 and the spinning operation is started. The computer C serves as a control circuit to activate the motor 39 to move the monitoring mechanism 30 along the track 21 and may be programmed to move and stop the monitoring mechanism 30 in response to the output of the counter 41. However, in the embodiment of the invention described above and which is arranged to stop the monitoring mechanism 30 at each spindle station 18, the actuator arm 35 of the switch 34 engages the actuator 36 at the first station of the spinning frame F and a holding signal is sent to the computer C.

This causes the computer C to stop the motor 39 for a predetermined period of time while the monitoring mechanism 30 scans the cone of motion X by emitting light from the transmitter 31 and receiving light reflected by yarn Y with the receiver 32. The computer C utilizes the output signal from the counter 41 as a signature output to indicate at which particular spindle assembly 18 yarn Y is being scanned and combines this with the condition output from the receiver 32 to provide an output to the read-out device R indicative of whether the yarn Y at the particular spindle assembly 18 is broken.

After stopping the movement of the monitoring mechanism 30 for a predetermined period of time, the computer C then causes the motor 39 to move the mechanism 30 to the next spindle assembly 18 whereupon the switch 34 causes the motor 39 to again stop the movement of the monitoring mechanism 30. The scanning operation is again performed by the monitoring mechanism 30 and the operation is repeated until the yarn Y at all spindle assemblies 18 has been scanned by motion of the monitoring mechanism 30 along the track 21. After the yarn Y at all of the spindle assemblies 18 has been scanned, the computer C causes the motor 39 to reverse and return the monitoring mechanism 30 to its starting position to immediately repeat the scanning operation. As already indicated above, this scanning operation may involve the stopping of the monitoring mechanism 30 at each spindle station 18 as described or may simply involve moving the monitoring mechanism 30 continuously along the track 21.

The computer C and readout device R are arranged to make an accumulative record of the yarn breaks at each spindle assembly 18 so that reference to this record will indicate when the particular spindle assembly 18, as evidenced by the number of yarn breaks, is in need of corrective maintenance procedures. The readout device R may be appropriately constructed to emit an audible or visual signal when a predetermined number of yarn breaks has occurred at a particular spindle assembly 18.

In the operation of the second embodiment of the invention, it will be seen that the spinning operation is started in the same manner as with the first embodiment of the invention. The computer C' is programmed to either intermittently or constantly interrogate the spindle assemblies 18 through the micro-switches 52 and to provide an output to the readout device R' similar to that provided by the computer C.

It will be obvious to those skilled in the art that many variations may be made in the embodiments chosen for the purpose of illustrating the invention without departing from the scope thereof as defined by the appended claims.

We claim:

1. Yarn twisting apparatus comprising a series of spaced spindle assemblies each constructed to receive a bobbin, a spinning frame including a series of spaced spinning rings, each spinning ring positioned so as to surround the bobbin received on a spindle assembly, a traveler connected to each spinning ring and arranged to pass freely about its spinning ring, frame moving means for reciprocating said spinning frame in a vertical direction, a series of yarn supply means each constructed to feed yarn at a predetermined rate to a bobbin from a position disposed above a spindle assembly through the traveler of the spindle assembly and to the bobbin received on the spindle assembly, means for rotating each of said spindle assemblies at a predetermined angular velocity whereby the travelers are each moved about their respective spinning ring and move the yarn in a varying spiral path about a bobbin which path is continually shortened and lengthened by the reciprocation of said spinning frame to form a series of conical zones of motion above each spindle assembly, a background board positioned on one side of the series of conical zones of motion, a series of support means extending from said background board between the conical zones of motion, a track member supported by said series of support means on the other side of the series of conical zones of motion, sensing means movable along said track member for detecting the movement of yarn in each of said conical zones of motion and generating an electrical output in response to the absence of yarn movement in any of the conical zones of motion, and accumulating means for separately accumulating the electrical outputs from said sensing means.

2. The invention of claim 1 wherein said sensing means comprises a light emitter directed toward said background board and positioned to illuminate the conical zones of motion, and light receiving means also directed toward said background board and positioned to receive light reflected by the yarn in the conical zones from said light emitter.

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U.S. Cl. X.R.

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