United States Patent

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[54] **TEXTILE STRAND ENDS DOWN DETECTING APPARATUS WITH AUTOMATIC RESETTING MEANS**
12 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **57/81,** 57/56, 250/219
[51] **Int. Cl.** **D01h 13/26,** D01h 13/16, D01h 13/32
[50] **Field of Search** ..... 57/34, 52—56, 78, 81, 19; 250/219; 242/35.5, 35.6, 37; 15/312

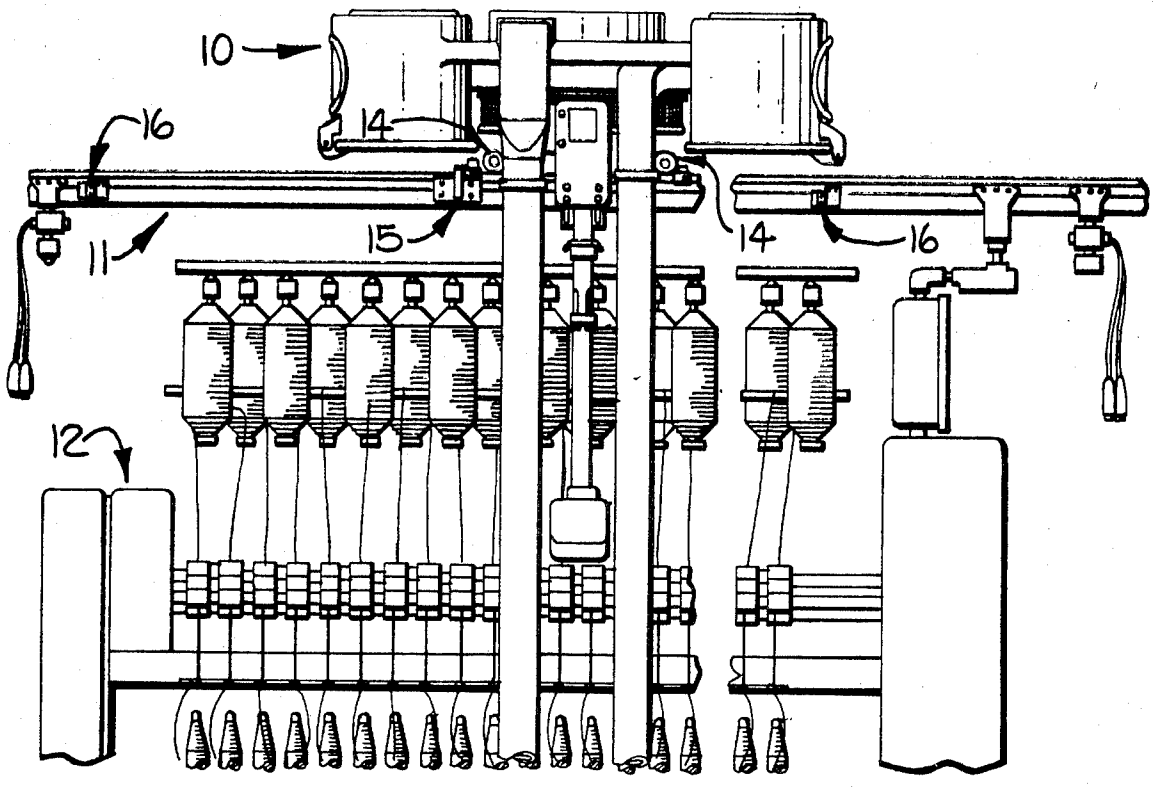
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ABSTRACT: Improved electrical circuitry for use in an apparatus which travels a detector along textile strand processing apparatus such as spinning frames for determining the absence of ends of yarn from locations therealong at which such ends are normally present and wherein the electrical circuitry establishes a lengthwise portion of a traversed textile machine in which an ends down condition is determined by resetting in response to signals generated as the detector travels along the textile apparatus. The resetting electrical circuitry disclosed herein incorporates, with first and second photosensitive detectors, first and second circuits responsive to signals originated from corresponding one of the photosensitive detectors, with one of the circuits comprising a resettable element and performing the function of distinguishing the absence and presence of ends of yarn at locations along a traversed textile apparatus and with the other circuit responding to signals from its corresponding photosensitive detectors by resetting the resettable element of the one circuit.



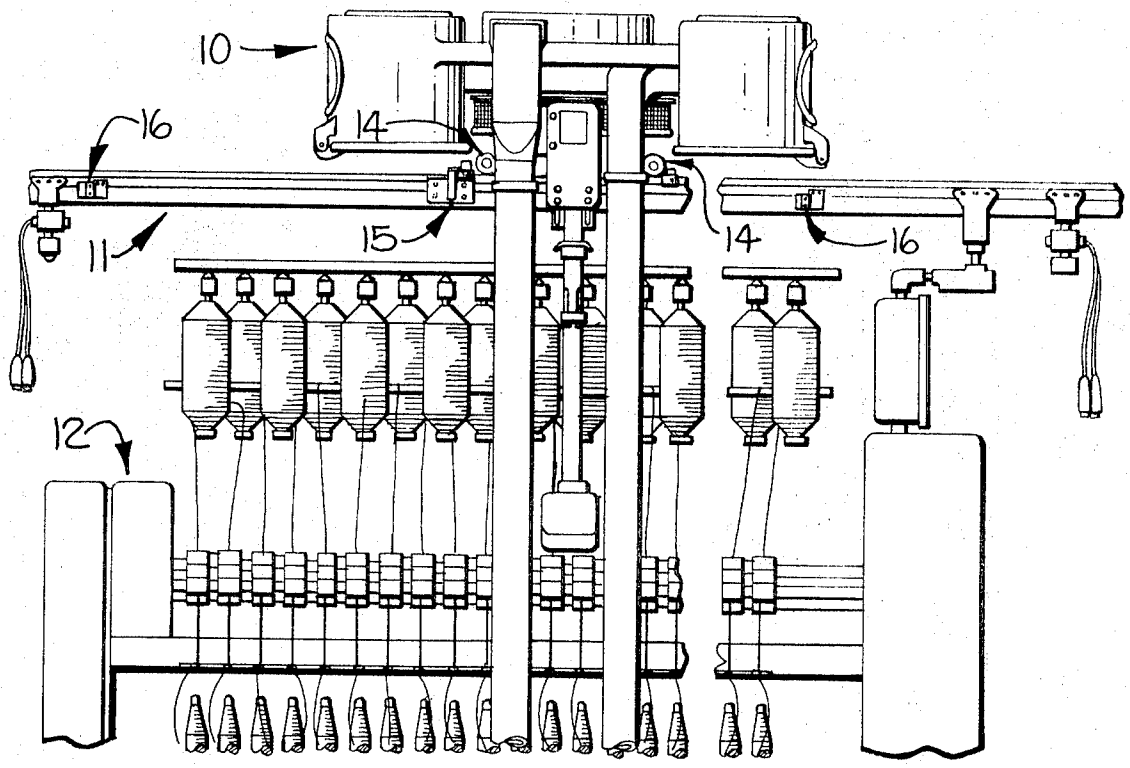


Fig-1

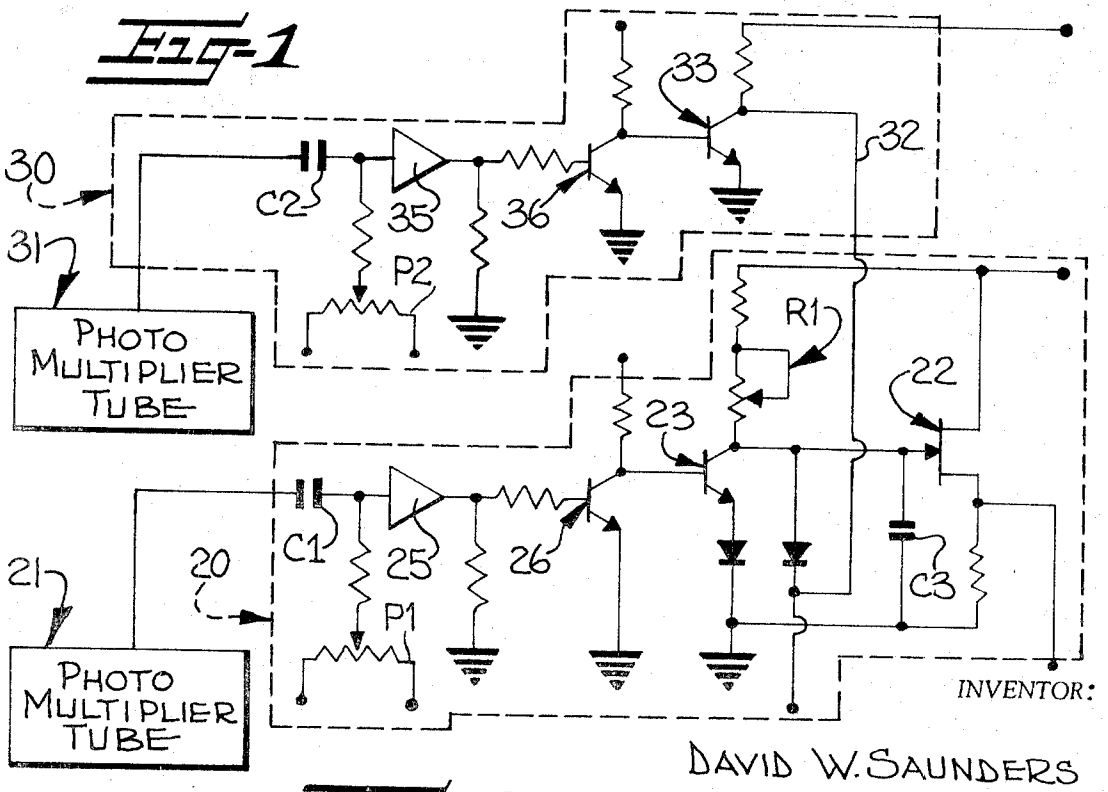


Fig-2

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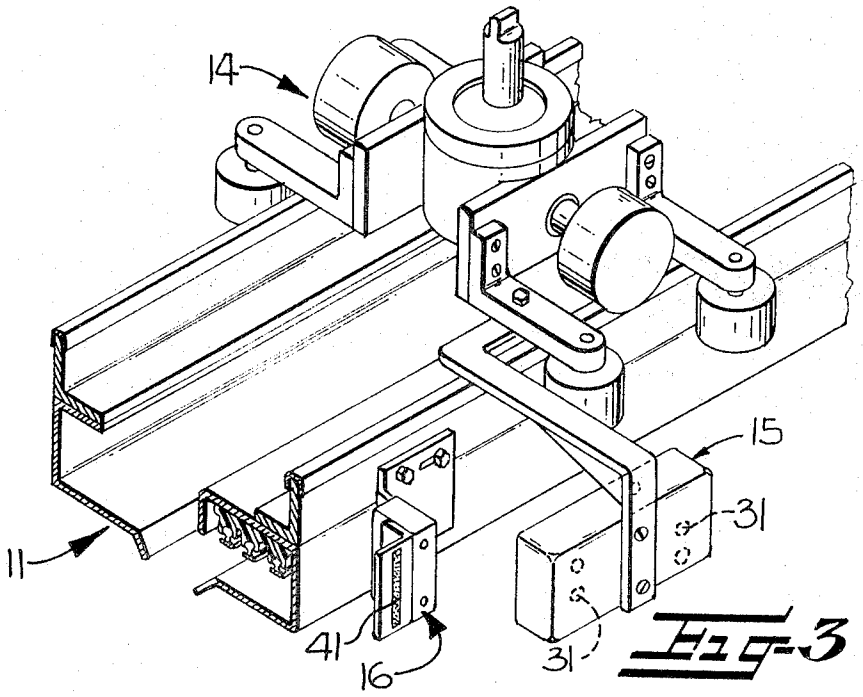


Fig-3

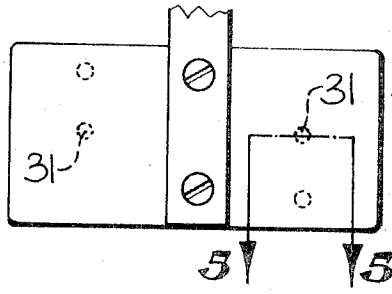


Fig-4

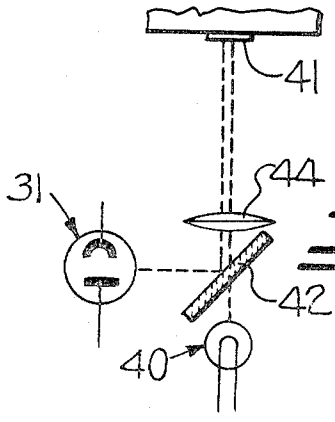


Fig-5

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TEXTILE STRAND ENDS DOWN DETECTING APPARATUS WITH AUTOMATIC RESETTING MEANS

It has heretofore been proposed that the efficiency of certain textile strand processing operations be improved by providing apparatus for detecting and reporting the ends down condition of textile yarn or thread-forming apparatus such as spinning and twisting machines. In accordance with certain of such proposals, apparatus is provided within a textile mill room, such as a spinning room, for moving detector means along textile apparatus such as spinning frames.

It is an object of the present invention to establish a lengthwise portion of a traversed textile apparatus in which an ends down condition is to be determined by ends down detecting apparatus of the general type mentioned above by providing electrical circuit means functioning without mechanical connection of the traveling portion of the ends down detecting apparatus to the stationary textile apparatus.

A further object of this invention is to provide means responsive to radiant energy for establishing such a lengthwise portion independently of an end-detecting means incorporated in the traveling portion of the ends down detecting apparatus.

In accomplishing these objects of the present invention, mechanically actuated elements or mechanically moving elements are avoided in an environment where the operability of such actuation or movement may be impaired by lint or the like produced by the textile processes. More particularly, circuit means are provided which respond to electrical pulse signals from first and second photosensitive means for determining the presence and absence of ends of yarn from the response of one of the photosensitive means and for resetting an element of the circuit which makes such determination in response to the other photosensitive means. Stationary means positioned in predetermined spaced relation to the other photosensitive means and to a lengthwise portion of the textile apparatus traversed by the one photosensitive means cooperates by directing to the other photosensitive means light which gives rise to a resetting electrical pulse signal.

A further object of the present invention is the improvement of an apparatus of the general type described above wherein detector means travels with a pneumatic cleanser mounted on a track for movement above and along a plurality of yarn forming locations and wherein the compatibility of the traveling pneumatic cleaner functions and the ends down detecting function is enhanced.

Some of the objects and advantages of the invention having been stated, others will appear as the description proceeds, when taken in connection with the accompanying drawings, in which

FIG. 1 is an elevation view, partly broken away, of a textile strand forming apparatus and apparatus for detecting ends down thereon in accordance with the present invention;

FIG. 2 is a schematic wiring diagram of an electrical circuit means in accordance with this invention;

FIG. 3 is an enlarged perspective view of a portion of a traveling pneumatic cleaner and track therefor as shown in FIG. 1;

FIG. 4 is a enlarged elevation view of a transmitter means housing as shown in FIGS. 1 and 3; and

FIG. 5 is a schematic section view through a portion of the transmitter means housing of FIG. 4, taken generally as along line 5–5 in that FIG.

Referring now more particularly to the drawing, apparatus is there shown in which the movement of detector means along textile strand processing apparatus such as spinning frames for locating ends down thereon results from the combination of electrical circuit means with a traveling pneumatic cleaner as generally indicated at 10 in FIG. 1. The traveling pneumatic cleaner 10 is mounted on a track generally indicated at 11 for movement above and along a plurality of yarn forming locations on at least one textile strand processing

apparatus such as a spinning frame generally indicated at 12. For a more extensive discussion of the advantages and benefits which flow from such combination, attention is directed to copending application Ser. No. 794,880, filed Jan. 29, 1969, now U.S. Pat. No. 3,523,413, entitled "Apparatus and Method for Detecting and Reporting Ends Down on Textile Machines" and owned in common with this application. As the broad relationship of the traveling pneumatic cleaner of FIG. 1 to textile strand processing apparatus may be more fully understood from the disclosure in the aforementioned copending application and as reference is therein made to other and further pertinent patent disclosures, the present application shall not repeat at length such discussion and disclosure, but shall be directed more toward particular electrical circuit means for establishing a lengthwise portion of a traversed textile machine in which an ends-down condition is determined and which is operative in such an environment.

Apparatus of the type for which the present invention is an improvement comprises detector means such as a photosensitive means or other energy level sensing device which is moved along a portion of at least one textile strand processing apparatus in which ends of yarn normally are present during operation of the apparatus. Further, the ends-down detecting apparatus has logic circuit means responsive to the detector mean for determining from the response of the detector means the presence or absence of ends of yarn from location at which such ends normally are present. Typically, the logic circuit means moves with the detector means and includes an element generating pulse electrical signals upon determination of the absence of ends of yarn. While such specific details are of significance with regard to the present subject invention, this invention contemplates that the detector means and circuit means connected thereto may take forms such as are disclosed in the prior art, including pending applications owned in common with this application, and it is noted that electrical circuit means including detector means and logic circuit means are the subject of patent protection separate from the present invention.

In accordance with the present invention, the establishment of a lengthwise portion of a traversed textile apparatus in which an ends down condition is determined is accomplished by the response of an energy level responsive detector such as a photosensitive means, thereby avoiding direct physical engagement or mechanical actuation for serving this function. As a result, the present invention both minimizes the possibilities of mechanical malfunction and opens the possibility of more readily adapting preexisting textile strand processing apparatus to an ends down detecting apparatus of the general type discussed above.

Referring now to FIG. 2, the present subject invention includes electric circuit means as there schematically illustrated. A first circuit means, enclosed by a dash line and indicated generally at 20, is electrically connected to end detector means, preferably a photosensitive means such as a photomultiplier indicated generally at 21, and is responsive to pulse signals for distinguishing between the absence and pressure of ends of yarns at locations along a traversed textile machine and in accordance with an operation described more fully hereinafter. A second circuit means enclosed within a dash line and generally identified by the reference character 30 is electrically connected to a resetting detector means, preferably a second photosensitive means such as a photomultiplier generally indicated at 31, and operates in a particular manner described more fully hereinafter to apply electrical pulse signals to the first circuit means 20.

Each of the first and second circuit means 20, 30 is electrically coupled to a corresponding one of the first and second photosensitive means 21, 31 through a corresponding one of two coupling capacitors C1, C2 and includes a set point potentiometer P1, P2. By the inclusion of the coupling capacitors C1, C2, the first and second circuit means 20, 30 are rendered responsive to the rate of change of light incident on the photosensitive means 21, 31 from within a predetermined

field of view thereof which is moved relative to the spinning frame **12** with movement of the traveling pneumatic cleaner **10** along the track **11**. That is, electrical signals from the photosensitive means **21**, **31** which are indicative of only a slow change in the level of illumination directed thereto, and which usually are present as variations in direct current voltage level, are not applied through the coupling capacitors C1, C2 to the first and second circuit means **20**, **30**. A pulse signal passing through the corresponding coupling capacitor is amplified by amplifiers **25** and **35** in the respective first and second circuit means, where the amplitude of the incoming signal is sufficient to overcome a saturating input normally applied through the potentiometers P1 and P2, as is known in the application of operational amplifiers.

The photosensitive means **21** is mounted as a portion of a detector means which also includes a light source illuminating the field of view of the photosensitive means **21** and which is arranged for movement of the field of view along a portion of the spinning frame **12** at which ends of yarn normally are present, such as between the delivery rolls of the drawing systems of the spinning frame **12** and the pigtail or other stationary guide. Such a detector means structural arrangement is more fully disclosed in the aforementioned copending application owned in common with this application, and attention is directed thereto for the disclosure in full detail. As an end of yarn passes through the field of view of the photosensitive means **21** and is illuminated by a light source moving therewith, light is reflected from the end of yarn to the photosensitive means **21**. The relatively rapid movement of the yarn through the field of view results in rapid fluctuation in the level of illumination applied to the photosensitive means **21** and generates a pulse signal capable of passing through the coupling capacitor C1 to the first circuit mean **20**. Other forms of end detector means are known to be useful with apparatus of the type to which this invention relates, and the use in this disclosure of the photosensitive means **21** as an example is not intended to preclude use of such other forms.

The first circuit means **20** incorporates a resettable element, preferably in the form of a resettable oscillator functioning as a logic circuit means and comprising a unijunction transistor **22**, a timing capacitor C3, a triggering transistor **23** and a timing resistor R1. By adjustment of the resistance value by the resistor R1, the time within which the voltage present across the capacitor C3 rises to a predetermined level can be established. On the voltage across the capacitor C3 reaching a predetermined level, the unijunction timing transistor **22** becomes conductive and an output pulse is generated by the logic circuit means.

Generation of an output pulse from the unijunction transistor **22** is avoided where the voltage buildup on the timing capacitor C3 is discharged to ground at predetermined intervals of shorter duration than the time established by the values of the timing capacitor C3 and the timing resistor R1. Such discharge of voltage across the timing capacitor C3 to ground is accomplished on the triggering transistor **23** becoming conductive. This change in the conductive state of the triggering transistor **23** occurs in response to a pulse signal originating in the first photosensitive means **21**, passing through the coupling capacitor C1 into the first circuit means **20**, ad being amplified and shaped by an amplifier **25** and signal conditioning transistor **26**. The operation of the logic circuit means just described relies upon the traveling cleaner **10** moving along and above the spinning frame **12** at a known linear speed and further upon the spacing of ends of yarn along the spinning frame **12** being known. During normal movement of the first photosensitive means **21** adjacent a portion of the spinning frame **12** at which ends of yarn are present, periodic pulsing of the triggering transistor **23** at intervals established by movement of the field of view of the first photosensitive means **21** across ends of yarn precludes such voltage buildup across the timing capacitor C3 as to result in firing of the unijunction timing transistor **22**. Otherwise, the resettable oscillator will normally generate output pulse electrical signals at a time interval slightly greater than the interval at which the field of view of the photosensitive means normally traverses location at which ends of yarn are normally present. In the absence of an end of yarn, the timing capacitor C3 is not discharged to ground and the unijunction timing transistor is fired to distinguish the absence of an end of yarn from a location at which such an end is normally present.

From the above discussion of the operation of the first circuit means **20**, it is to be understood that the timing of the intervals established by the timing capacitor C3 and timing resistor R1 must begin in predetermined relation to a lengthwise portion of a traversed textile machine in which an ends down condition is to be determined by the first circuit means **20**. As used in relation to the particular first circuit means disclosed above, the terms **37** reset" and "unreset" relate to such establishment and initiation of the timing cycle in relation to the lengthwise portion of a spinning frame in which end down are to be determined. Resetting of the resettable element of the first circuit means **20** is accomplished by grounding both sides of the timing capacitor C3 independently of any change in conductive state of the triggering transistor **23** or unijunction **22**.

More particularly, the resetting detector means, herein disclosed as the second photosensitive means **31**, and second circuit means **30** are operatively connected to the resettable element of the first circuit means **20**, through a conductor **32** extending between portions of the first circuit means **20** and a control transistor **33** of the second circuit means **30**. The control transistor **33** receives pulse signals which pass to the second circuit means **30** through the coupling capacitor C2 after having originated from the second photosensitive means **31** and which are amplified and shaped by an amplifier **35** and a signal conditioning transistor **36**. Upon the second photosensitive means **31** generating an output pulse, a pulse reaching the control transistor **33** renders the transistor conductive and grounds the timing capacitor C3 of the first circuit means **20**. Such grounding discharges any voltage charge built up on the timing capacitor C3 and initiates the timing cycle which in the disclosed arrangement enables the logic circuit means to distinguish between the presence and absence of ends of yarn at locations along the traversed textile machine.

It is recognized that the logic circuit means used in an ends down detecting apparatus may be other than a resettable oscillator as described above with reference to FIG. **2**. However, it is typical of all logic circuit means presently known to me that proper operation of the ends down detecting apparatus involves establishment of a lengthwise portion of a traversed textile apparatus in which the absence of ends is determined. Thus, the use of a resettable oscillator in this disclosure as an example is not intended to preclude use of other logic circuit means in conjunction with a two channel resetting electrical circuit means as herein disclosed. Further, the advantages contemplated by the present disclosure and realized through the use of a photosensitive means as the resetting detector means are foreseen as obtainable with the use of other known radiant energy responsive detector means. Accordingly, the disclosure herein of a photosensitive means as the resetting detector means is not intended to preclude use of other radiant energy responsive detector means for generating resetting signals.

In order to cooperate with the first and second photosensitive means **21**, **31** and with the first and second circuit means **20**, **30** in the operation described immediately above, the present invention further contemplates the provision of means stationarily positioned relative to a traversed textile machine and to the path traveled by the field of view by the second photosensitive means **31** for directing radiant energy in the form of light to the second photosensitive means at predetermined locations and thereby establishing a lengthwise portion of the traversed textile machine in which an ends down condition is determined by the first photosensitive means and first circuit means. As illustrated more fully in FIGS. **3**—**5**, the second photosensitive means **31** preferably is arranged with a

light source 40 to cooperate with at least one highly reflective member 41 mounted adjacent to the track. 11 above the spinning frame 12 in predetermined spaced relation to the location at which the ends of yarn normally are present on the spinning frame 12 to function as a means stationarily positioned relative thereto. As disclosed more fully in copending application Ser. No. 866,266 filed on even date herewith, entitled "Information Transmitting Means for Textile Strand End Detecting Apparatus," and owned in common herewith, the traveling pneumatic cleaner 10 includes a tractor carriage generally indicated by the reference character 14. Mounted from the tractor carriage 14 for movement adjacent the track 11 is a transmitter means housing 15 which cooperates with a receiver housing 16 and other elements not herein described in transferring data from the pneumatic cleaner 10 to a stationary annunciator system in accordance with the disclosure and teaching of the aforementioned copending application. In accordance with the present invention, the transmitter means housing 15 additionally encloses the second photosensitive means 31 and a light source 40 associated therewith, and so arranges the second photosensitive means 31 that the field of view thereof is directed toward the track 11 and is moved therealong with movement of the tractor carriage 14. A highly reflective surface 41 is mounted on the receiver means housing means 16, to function as the reflective member mentioned heretofore which cooperates with the second photosensitive means and second circuit means in establishing a lengthwise portion of the traversed textile machine in which an ends down condition is determined.

As illustrated, the highly reflective member preferably is a retroreflective surface. As herein used, the term "retroreflective surface" refers to a surface having a characteristic of reflecting light directly backward along the line of incidence along which light impinges on the surface. Advantage is taken of this characteristic of the reflective surface 41 by the particular arrangement of the second photosensitive means 31 and the light source 40 in the transmitter means housing 15. As more fully illustrated in FIGS. 4 and 5, an optical system is provided in association with the second photosensitive means 31 and the light source 40 which includes a partially reflective member 42 arranged at a suitable angle to the second photosensitive means 31 and the light source 40. Light from the light source 40 passes through the reflective member 42 and is directed outwardly of the transmitter means housing, through an appropriate optical system such as a lens 44, toward the track 11. Should light thus emitted from the transmitter means housing 15 impinge on the reflective surface 41, light is strongly reflected backward toward the transmitter means housing 15, to pass through the lens 44 and be reflected from the partially reflective member 42 and reach the photosensitive means 31. Thus, the light source and second photosensitive means are arranged for coaxial and codirectional illumination and viewing of a field of view and a strong transient response is obtained from the photosensitive means 31 on passage of the traveling cleaner 10 adjacent a position at which a reflective surface 41 is positioned.

As best illustrated in FIG. 1, receiver housings 16 bearing reflective surfaces 41 are spaced from the closest adjacent spindle location of the spinning frame by a distance generally the same as the gauge of the spinning frame. That is, the distance between the retroreflective surface and the next adjacent end of yarn is substantially the same as the distance between adjacent pairs of ends of yarn. In order to accommodate movement of the traveling cleaner 10 in either direction relative to the traversed spinning frame, retroreflective surfaces are provided at both ends of the spinning frame 12.

In the drawings and specification, there have been set forth preferred embodiments of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

What I claim is:

1. In an apparatus which travels along textile strand processing apparatus such as spinning frames for locating ends down thereon, means for establishing a lengthwise portion of a traversed textile apparatus in which the absence of ends is determined comprising:

end detector means mounted for movement along a portion of at least one textile apparatus where ends of yarn normally are present and responsive to ends of yarn during movement across locations at which such ends are disposed for generating pulse electrical signals indicative of the presence of an end of yarn,

first circuit means comprising a resettable element and electrically connected to said end detector means for responding to pulse signals generated thereby during normal traversal of locations at which ends are disposed, for distinguishing between the absence and presence of ends of yarn while said resettable element remains unreset, and for registering an ends down condition thus sensed and determined,

resetting detector means mounted relative to said end detector means for coordinated movement thereof along a traversed textile apparatus and for responding to radiant energy directed thereto for generating pulse electrical signals,

second circuit means electrically connected to said resetting detector means and to said resettable element of said first circuit means for responding to pulse signals generated by said resetting detector means and for resetting said resettable element, and

means stationarily positioned relative to a traversed textile apparatus and to the path traveled by said resetting detector means for directing radiant energy to said resetting detector means in predetermined coordination to said end detector means traversal of a lengthwise portion of a textile apparatus and thereby for establishing a lengthwise portion of a traversed textile apparatus in which an ends down condition is determined by said first circuit means.

2. Apparatus according to claim 1 wherein said first circuit means comprising a pulse shaping means electrically connected to said end detector means for receiving pulse signals therefrom and for shaping the characteristics of received pulse signals and logic means electrically connected to said pulse shaping means for receiving shaped pulse signals therefrom and responsive to normal traversal of said end detector means for distinguishing between absence and presence of ends of yarn on a traversed textile apparatus and for generating an output pulse electrical signal upon an end of yarn being absent from a location at which the same normally is present.

3. Apparatus according to claim 2 wherein said pulse shaping means comprises an amplifier for shaping to a substantially uniform shaped pulse characteristic pulse signals originating from said end detector means with varying pulse characteristics and aid logic means comprises a resettable, free-running oscillator functioning as said resettable element and normally generating output pulse electrical signals at a predetermined time interval coordinated to normal traversal of said end detector means and responsive to receipt of a shaped pulse signal from said pulse shaping circuit means for initiating timing of said predetermined interval, said predetermined time interval being slightly greater than the interval at which said end detector means normally traverses locations at which ends of yarn are normally present, so that cadenced resetting of said oscillator by a shaped pulse signal indicative of an end of yarn being present at a traversed location inhibits generation of an output pulse signal by said oscillator.

4. Apparatus according to claim 1 wherein said second circuit means comprises a pulse shaping means for shaping the characteristics of pulse signals generated by said resetting detector means.

5. Apparatus according to claim 4 wherein said second circuit means comprises an amplifier for shaping to a substantially uniform shaped pulse characteristic pulse signals originating from said resetting detector means with varying pulse characteristics.

6. In an apparatus which moves along textile strand processing machines such as spinning frames for locating ends down thereon, means for establishing a lengthwise portion of a traversed textile machine in which the absence of ends is determined comprising;

detector means comprising first photosensitive means having a predetermined field of view and being mounted for movement of said field of view along a portion of at least one textile machine where ends of yarn normally are present, said first photosensitive means being responsive to light reflected thereto from ends of yarn during movement of said field of view across positions at which such ends are disposed for generating pulse electrical signals indicative of the presence of an end of yarn,

first circuit means comprising a resettable element and electrically connected to said first photosensitive means for responding to pulse signals generated thereby during normal traversal of said first photosensitive means field of view, for distinguishing between the absence and presence of ends of yarn at locations along a traversed textile machine while said resettable element remains unreset and at which ends of yarn normally are present and for registering an ends down condition thus sensed and determined,

second photosensitive means having a predetermined field of view and being mounted relative to said first photosensitive means for coordinated movement of said fields of view thereof along a traversed textile machine, said second photosensitive means being responsive to light directed thereto for generating pulse electrical signals,

second circuit means electrically connected to said second photosensitive means and to said resettable element of said first circuit means for responding t pulse signals generated by said second photosensitive means and for resetting said resettable element, and

means stationarily positioned relative to a traversed textile machine and to the path traveled b said second photosensitive means field of view for directing light to said second photosensitive means in predetermined coordination to traversal by said first photosensitive means of a lengthwise portion of a textile machine and thereby for establishing a lengthwise portion of a traversed textile machine in which an ends down condition is determine by said first circuit means.

7. Apparatus according to claim 6 further comprising a light source mounted for illuminating said second photosensitive means field of view and for movement therewith along a traversed textile machine, said second photosensitive means being responsive to reflection of light emanating from said light source.

8. Apparatus according to claim 7 wherein said means for directing of light to said second photosensitive means comprises at least one highly reflective element mounted on said traversed textile machine in predetermined relation to locations at which ends of yarn normally are present.

9. Apparatus according to claim 8 wherein said highly reflective member comprises a retroreflective surface and said light source and second photosensitive means are arranged for coaxial and codirectional illumination and viewing of said field of view.

10. In an apparatus which travels a pneumatic cleaner along textile strand processing apparatus such as spinning frames for removing lint and the like and including ends down detecting means for locating ends down thereon, means for establishing a lengthwise portion of a traversed textile machine in which the absence of ends is determined comprising;

end detector means mounted for movement with a traveling pneumatic cleaner along a portion of at least one textile apparatus where ends of yarn normally are present and responsive to ends of yarn during movement across locations at which such ends are disposed for generating pulse electrical signals indicative of the presence of an end of yarn,

first circuit means comprising a resettable element and electrically connected to said end detector means for responding to pulse signals generated thereby during normal traversal of said end detector means, for distinguishing between the absence and presence of ends of yarn at locations along a traversed textile apparatus while said resettable element remains unreset and at which ends of yarn normally are present and for registering an ends down condition thus sensed and determined,

resetting detector means comprising photosensitive means having a predetermined field of view and being mounted relative to said end detector means for coordinated movement thereof along a traversed textile apparatus, said photosensitive means being responsive to light directed thereto for generating pulse electrical signals,

second circuit means electrically connected to said photosensitive means and to said resettable element of said first circuit means for responding to pulse signals generated by said photosensitive means and for resetting said resettable element, a

means stationarily positioned relative to a traversed textile machine and to the path traveled by said photosensitive means field of view for directing light to said photosensitive means in predetermined coordination to said end detector means traversal of a lengthwise portion of a textile machine and thereby for establishing a lengthwise portion of a traversed textile machine in which an ends down condition is determined by said first circuit means.

11. In an ends-down detector, which travels along a textile strand processing apparatus such as a spinning frame having a series of ends of yarn being formed thereon for detecting the absence of any ends of yarn, the ends down detector including an electrical circuit having a resettable element for controlling proper cyclic operation thereof and adapted to be reset in advance of the ends down detector traveling along a series of ends of yarn; the improvement therewith of the ends down detector including energy level sensing means for generating electrical pulse signals, the intact running ends of yarn cooperating with said energy level sensing means to effect generation of electrical pulse signals denoting the presence of ends of yarn, and means positioned in advance of the series of yarns and cooperating with said energy level sensing means to effect generation of electrical pulse signals, said energy level sensing means cooperating with said resettable element for effecting resetting thereof in response to an electrical pulse signal generated by cooperation with said last named means.

12. Apparatus according to claim 11 wherein said energy level sensing means comprises at least one photosensitive means for generating electrical pulse signals in response to variations in levels of light incident thereon and further wherein said means positioned in advance of the series of yarns comprises a light reflective surface for reflecting light to said photosensitive means.