United States Patent [19]

Lee, Jr. et al.

[11] **3,899,868**

[45] **Aug. 19, 1975**

[54] **CONTROL ARRANGEMENT FOR YARN PIECING APPARATUS**

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[73] Assignee: **Parks-Cramer Company,** Fitchburg, Mass.

[22] Filed: **July 17, 1974**

[21] Appl. No.: **489,432**

[52] **U.S. Cl.** ..... **57/34 R;** 57/81; 57/156

[51] **Int. Cl.** **D01h 15/00**

[58] **Field of Search** ..... 57/80, 81, 87, 34 R, 52, 57/53, 1 R, 156, 157 R

[56] **References Cited**

UNITED STATES PATENTS

3,486,319	12/1969	Lee, Jr. et al.	57/34 R
3,498,039	3/1970	Kent et al.	57/34 R
3,623,310	11/1971	Mulligan	57/34 R
3,626,680	12/1971	Whitney	57/81 X
3,638,412	2/1972	Rebsamen	57/52
3,659,409	5/1972	Saunders	57/34 R
3,672,143	6/1972	Whitney	57/53
3,726,072	4/1973	Ford et al.	57/34 R
3,754,992	8/1973	Lee, Jr.	57/34 R
3,841,076	10/1974	Ford et al.	57/87 X

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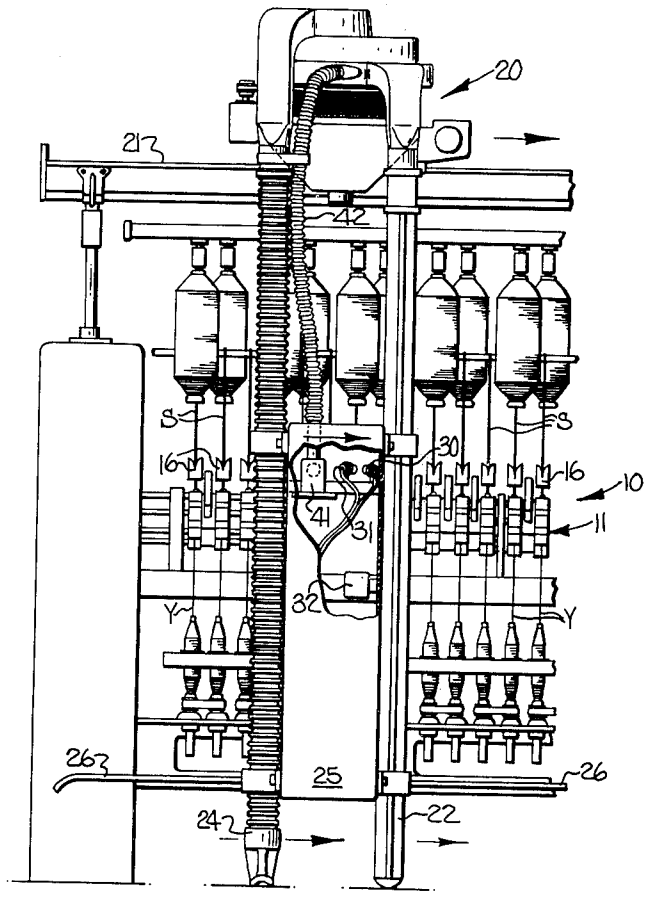
Attorney, Agent, or Firm—Parrott, Bell, Seltzer, Park & Gibson

[57] **ABSTRACT**

A traveling unit which has instrumentalities for reinstituting attenuated strand formation at drafting systems of a textile yarn forming machine and which traverses a textile yarn forming machine having a plurality of drafting systems is controlled by an arrangement which facilitates reduction in the number of ineffective attempts at reinstitution of strand formation. The control arrangement includes an active sonic detector for electrically signaling traversal of a drafting system location at which a stop member is in a retracted position and an attenuated strand detector responsive to electrostatic charges normally present at drafting system locations during attenuated strand formation. The control arrangement distinguishes among three possible circumstances and initiates operation of the instrumentalities for reinstituting strand formation only as required.

7 Claims, 5 Drawing Figures



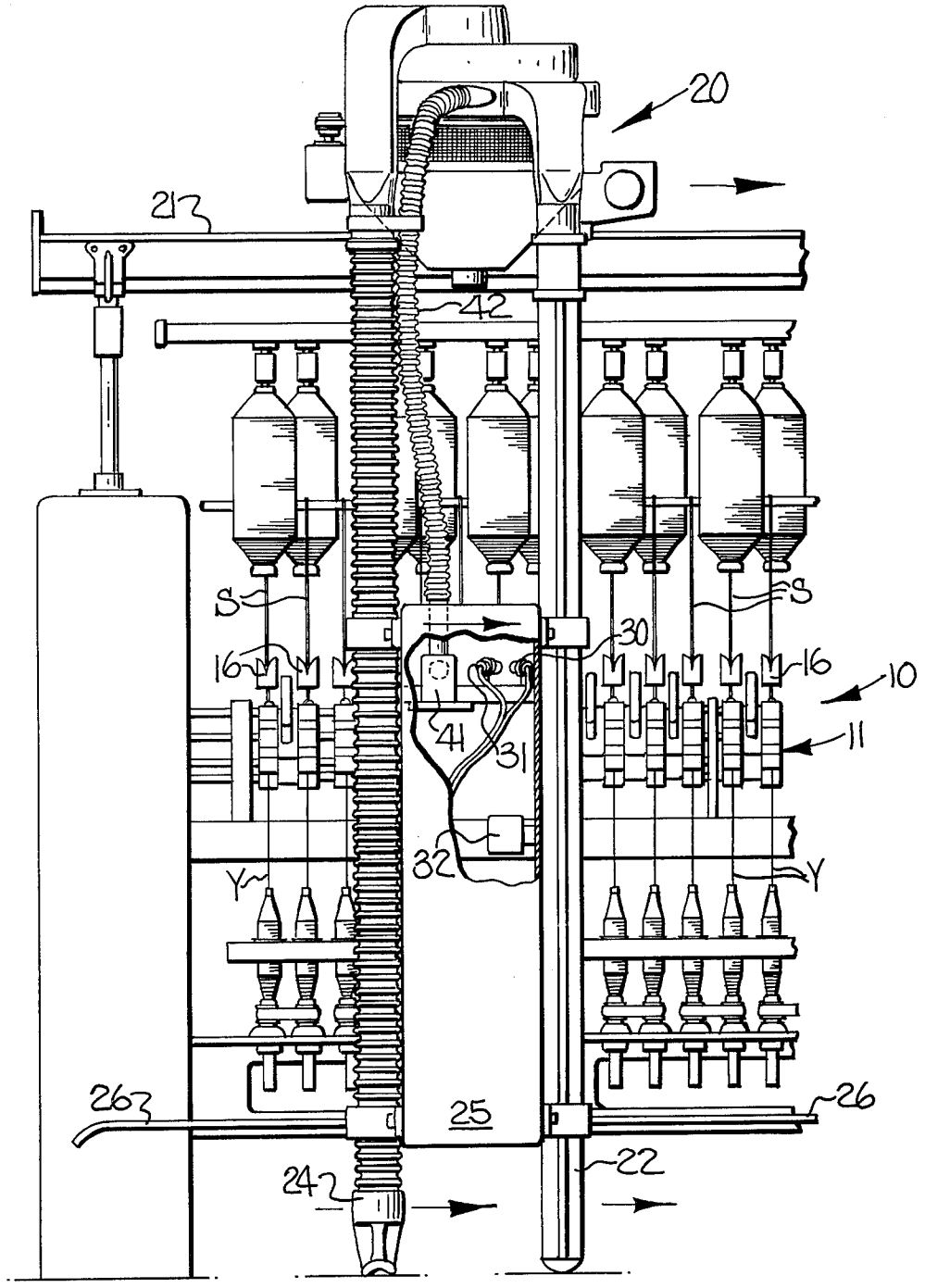


Fig-1

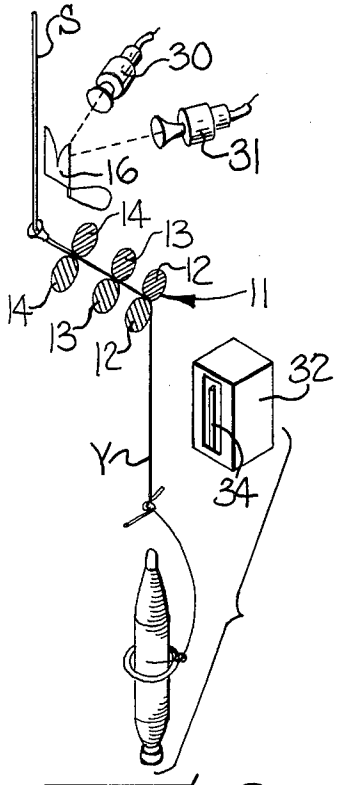


Fig-2

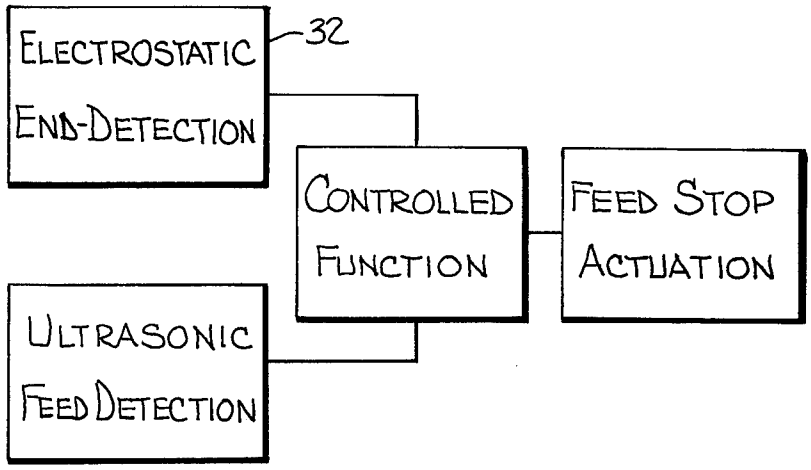


Fig-3

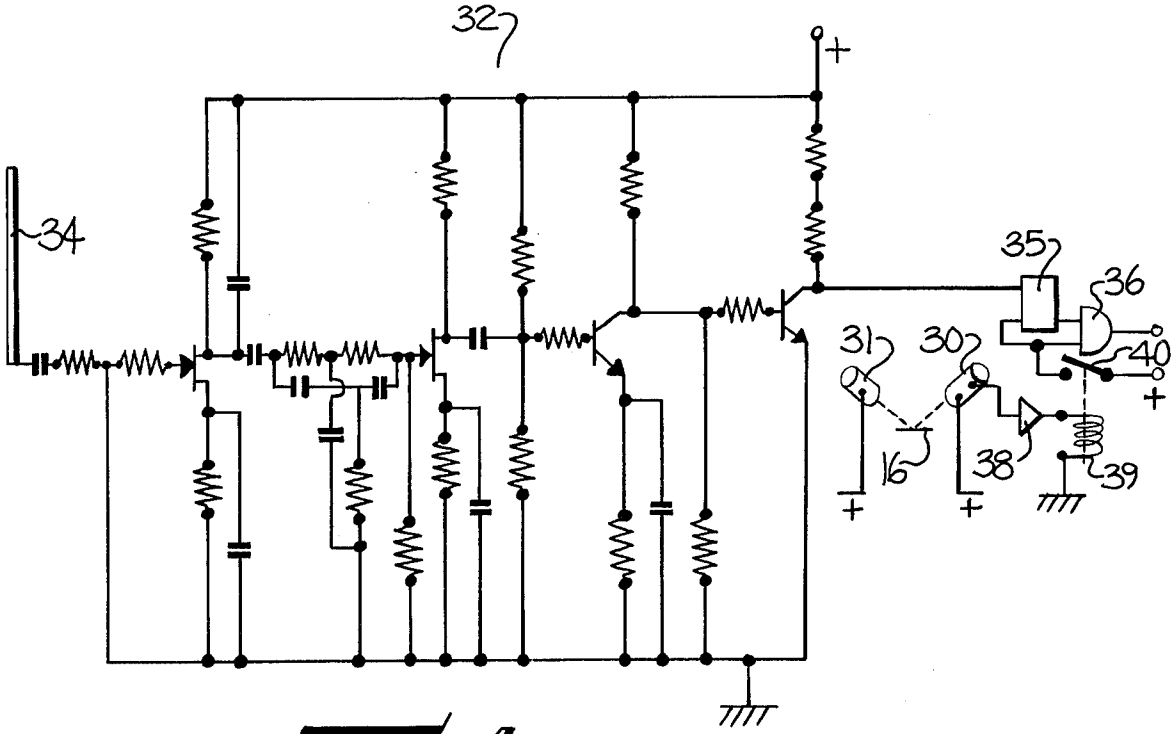


Fig-4

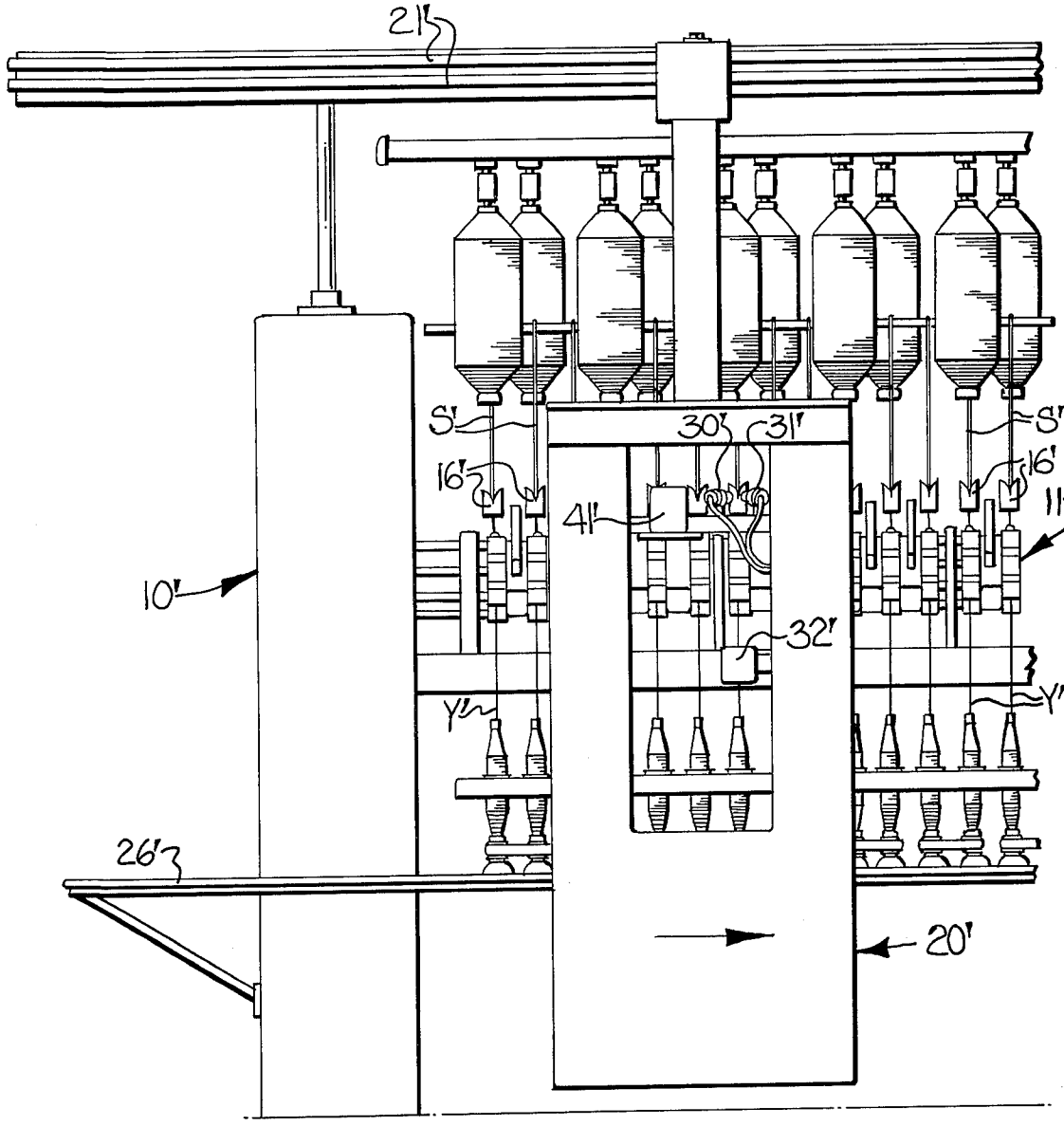


Fig-5

CONTROL ARRANGEMENT FOR YARN PIECING APPARATUS

One proposal made heretofore for improving the efficiency of operation of a textile yarn forming mill has been the use of apparatus for replacing the human spinner in reinstituting yarn formation. Such apparatus are known as automatic tenders or automatic piecing units and may function in a variety of different ways, as shown by issued patents known to persons skilled in the textile arts. One difficulty encountered with such proposals is the inability of the tender apparatus to distinguish among those locations along a yarn forming machine at which reinstitution of yarn formation is effective and those locations at which it is not effective. In connection with this problem, practical experience with apparatus of the type shown and described in previously granted patents has demonstrated that attempts at reinstitution of yarn formation are not uniformly successful.

The control arrangements heretofore used with certain tender apparatus have functioned by detecting any location along a traversed textile yarn forming machine at which normal yarn formation has been interrupted. With such detection, a cycle of operation intended to reinstitute yarn production is initiated. An attempt at reinstitution is made and, on completion of that attempt, the tender apparatus is moved from that location irrespective of success or failure in the institution of yarn production. Further, the tender apparatus is in no way responsive to a repeated interruption of yarn formation which may occur virtually immediately after reinstitution is successfully accomplished. Understandably, the number of ineffective attempts at reinstitution of strand formation can be quite high in view of these difficulties.

An alternate proposal for improving the efficiency of textile yarn forming operations has involved the use of stop members mounted on a textile yarn forming machine for interrupting feeding of supply strands to drafting systems in the event that formation of attenuated strands is found to have been interrupted. While it will be understood that operations in accordance with this proposal do not result in reinstitution of yarn formation, the interruption of supply strand feeding protects the textile yarn forming machine against risk of damage otherwise possibly occurring and permits reduction in or elimination of the need for attendance by a spinner. Such avoidance of human effort is obtained, however, at the cost of some reduction in production.

It is an object of this invention to improve upon the operation of a tender apparatus having instrumentalities for reinstituting attenuated strand formation by facilitating a reduction in the number of ineffective attempts at reduction of strand formation. In realizing this object of the invention the problems and deficiencies of such tender apparatus as briefly pointed out hereinabove are obviated and avoided. Desirably, this object of the present invention is accomplished by incorporating certain features of the stop members heretofore proposed as an alternative to traveling units which reinstitute attenuated strand formation, while further providing specific detector arrangements for cooperating with the various elements of the combination.

In those prior arrangements proposed in efforts to reduce ineffective attempts at reinstitution of strand formation, reliance has been placed on relatively sophisticated photoelectric or optical detectors. Such detectors have presented difficulties, primarily due to certain unavoidable limitations of the optical systems used and their adaptation to textile mill environments. Reliable photoelectric detection has been found to necessitate very accurate alignment and mounting of cooperating elements, due to depth of field and focus requirements.

Yet a further object of this invention is to detect the position of feed stop members through the use of an active sonic detector arrangement while detecting the presence or absence of attenuated strands normally formed along the textile machine by responding to electrostatic charges present during the normal strand formation, thereby obviating difficulties encountered with certain photoelectric or optical detectors. By distinguishing among various signaled conditions indicative of the operative state of a particular attenuated strand forming location, the arrangement of this invention accomplishes a particularly desirable control for a traveling unit of the type described.

Some of the objects of the invention having been stated, other objects 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 first combination in accordance with the present invention;

FIG. 2 is a schematic perspective view of certain detectors and textile yarn forming machine elements involved in the combination of this invention;

FIG. 3 is a block diagram of certain functions of a control arrangement of this invention;

FIG. 4 is a partially schematic drawing of certain electrical circuitry involved in the combination of this invention; and

FIG. 5 is a view similar to FIG. 1 of a second combination in accordance with this invention.

While this invention will be described hereinafter with more particular reference to the accompanying drawings, briefly described above, it is to be realized at the outset of this description that the present invention is contemplated as being of broad usefulness to persons skilled in those branches of the textile arts to which this invention pertains. Accordingly, the illustration and description of particular forms of the invention are not to be understood as being restrictive upon the scope of application of this invention, but are to be taken broadly as teachings of the best mode known at the time that the illustrations and description were prepared.

This invention is related to certain inventions described in previously granted patents which are owned in common. These patents include Lee, Jr. et al U.S. Pat. Nos. **3,486,319** granted Dec. **30, 1969;** Mulligan **3,623,310** granted Nov. **30, 1971;** Saunders **3,659,409** granted May **2, 1972;** Ford et al. **3,726,072** granted Apr. **3, 1973;** and Lee, Jr. **3,754,992** granted Aug. **28, 1973.** To the extent that the disclosures of these previously granted patents are necessary to a full understanding of the invention described here, those disclosures are hereby incorporated by reference into this description. In any event, interested readers are directed to those prior patents for further information concerning the art to which the present invention pertains.

FIG. 1 of the accompanying drawings shows a textile yarn forming machine, generally indicated at **10,** hav-

ing a plurality of drafting systems generally indicted at **11.** As is known, each of the drafting systems includes a series of pairs of rolls **12, 13, 14** (FIG. **2**) for normally receiving a supply strand S and normally delivering an attenuated strand Y. The machine **10** has a plurality of drafting systems arranged at a series of locations, so that the drafting systems receive a corresponding series of supply strands and deliver a corresponding series of attenuated strands or yarns.

A plurality of stop members **16** are provided for cooperation with the machine **10.** Each of the stop members **16** is mounted adjacent a corresponding one of the drafting systems **11** and is selectively actuable for movement between a retracted position (FIGS. **1** and **2**) spaced from a corresponding supply strand S and a strand interrupting position engaging and restraining the corresponding supply strand. When the stop member **16** is in the strand interrupting position, passage of the supply strand S into the corresponding drafting system **11** is interrupted, thereby precluding formation of an attenuated strand or reinstitution of attenuated strand formation.

A traveling unit generally indicated at **20** traverses the textile yarn forming machine **10** and has instrumentalities (not shown in detail in the accompanying drawings) for reinstituting attenuated strand formation at a drafting system where an attenuated strand is absent. In the form illustrated in FIG. **1,** the traveling unit **20** is a traveling pneumatic cleaner supported upon the track **21** which extends over the textile machine **10** and having a blowing cleaning member **22** and a suction cleaning member **24** which depend to one side of the traveling cleaner **10.** The instrumentalities for reinstituting attenuated strand formation are mounted within a casing **25** disposed between the cleaning members **22, 24.** Additional support for the casing **25** is provided by an auxiliary lower rail **26** extending along the lower portion of the textile machine **10.** It will be understood by persons familiar with the textile art to which this invention pertains that the exact construction and operation of the instrumentalities for reinstituting attenuated strand formation may be in accordance with a number of known and available prior disclosures, including Lee, Jr. et al U.S. Pat. No. **3,486,319** and earlier patents referred to herein. It is for this reason that it is not deemed necessary to extend the present description by repetition of illustrations and description available elsewhere.

In accordance with the present invention, an active sonic detector means is mounted on the traveling unit **20** for movement therewith along the machine **10** and for electrically signaling traversal of a drafting system location at which the corresponding one of the stop members **16** is in the retracted position. In the form shown, the active sonic detector means comprises an ultrasonic transmitter **30** and an ultrasonic receiver **31.** By means of the ultrasonic transmitter **30,** a relatively tight beam of ultrasonic energy is emitted and is directed from the traveling unit **20** toward the textile machine **10.** Preferably, the active sonic detector means is mounted in the casing **25,** for projection of the beam of ultrasonic energy in a plane perpendicular to a generally planar surface of the stop members **16.** Reflection of the beam of sonic energy from a stop member **16** in the retracted position (FIG. **2**) results in reception of sonic energy by the receiver **31.** Where a stop member **16** is in the strand interrupting position, the tight beam of sonic energy does not impinge upon the stop member and is not reflected to the receiver **31.** Accordingly, no electrical signal is generated by the active sonic detection means upon traversal of a drafting system location at which the corresponding one of the stop members **16** has been actuated to move to the strand interrupting position. It will be understood that, as used in this description, reference to an "active" detector includes particularly those arrangements wherein a signal or energy beam is generated and emitted with the reflection or echo of that energy beam being received and detected. Further, it will be understood that reference to a "sonic" detector contemplates a detector which makes use of vibrating energy close to those frequencies detected by the human ear, although preferably the frequency range is in the range denominated as ultrasonic and at frequencies above the range of the human ear. These arrangements are distinct from detector arrangements which rely upon the use of a light and may be known as photoelectric, as experience has demonstrated that photoelectric detection systems may be subject to difficulties arising from depth of field and focus of optical systems which are not encountered with the use of active sonic detectors.

The traveling unit **20** also has mounted thereon for movement therewith along the machine **10** an attenuated strand detector generally indicated at **32** which is responsive to electrostatic charges normally present at drafting system locations during attenuated strand formation. The electrostatic detector **32** electrically signals traversal of a drafting system location at which normal attenuated strand formation is occurring. Preferably, the electrostatic detector **32** is mounted within the casing **25** at a location adjacent the path followed by attenuated strands Y in movement from the delivery rolls **12** of the drafting systems to bobbins on which the strands are wound.

The electrostatic detector **32** comprises an electrically floating detector rod **34** and circuitry (schematically shown in FIG. **4**) for responding to fluctuation in electrostatic charges near the rod **34,** all as described more fully hereinafter. The general cooperation between the electrostatic end detector **32** and the ultrasonic detector means may be understood from the block diagram of FIG. **3,** in which it is indicated that electrical signals generated by the detectors cooperate in initiating a controlled function (such as that accomplished by the mechanism illustrated in FIGS. **22, 23** of Lee, Jr., et al U.S. Pat. No. **3,486,319** and described in that patent with reference to those figures). The controlled function, as described more fully hereinafter, may additionally govern feed stop actuation (generally through use of an arrangement such as that of FIG. **11** of Ford et al U.S. Pat. No. **3,726,072** and as described in that patent with reference to that figure).

A more specific understanding of the manner in which the detector means cooperate may be gained from description with reference to FIG. **4.** As is there shown, fluctuation in electrostatic charges near the rod **34** are applied through FET and other transistors and associated resistors and capacitors to provide an electrical output to a bistable multivibrator or flip-flop **35** which, together with a gate device **36,** forms a logic circuit means. The logic circuit means is electrically connected with the receiver **31** of the active sonic detector and with the electrostatic detector **32** for distinguishing among three possible conditions.

The logic circuit means distinguishes among; (1) signaled traversal of a location at which the corresponding stop member **16** is in the retracted position and strand formation is occurring; (2) signaled traversal of a location at which the stop member **16** is in the retracted position and strand formation has been interrupted (as in an "end down" condition); and (3) traversal of a location at which the stop member **16** is in the strand interrupting position. The logic circuit means preferably is arranged to provide an output only in instances of the second of the listed conditions. More particularly, reflection of ultrasonic energy from a stop member **16** to the receiver **31** (FIG. 4) generates an electrical signal which, when passed through an amplifier **38,** is effective to energize coil **39** of a relay. The relay coil **39,** when energized, closes an associated contact **40** which applies an electrical signal to the multivibrator **35** and gate device **36.** Thus, the multivibrator device is set to a first condition and is prepared to receive a signal through the electrostatic detector **32** in the event that normal attenuated yarn formation is proceeding. In the event that normal attenuated yarn formation is proceeding, an electrical signal derived from the exposure of the rod **34** to electrostatic charges pass to the multivibrator **35,** resetting the multivibrator to an alternate condition and removing from the gate device the signal which would otherwise be passed through the multivibrator **35.** The gate device **36** is selected to be of a type which passes an output signal only in the instances that two signals are applied thereto (an "and" gate).

In the event that normal attenuated strand formation has been interrupted, no signal passes from the electrostatic detector **32** to the multivibrator **35,** and thus two signals continue to be applied to the gate device **36** and an output signal is provided. This output signal may then be used to actuate control arrangements as referred to hereinabove.

In the event that the corresponding stop member **16** has been pivoted to the actuated or feed stop position, no sonic energy is reflected to receiver **31,** the relay contacts **40** are not closed, and no signals are applied to the multivibrator **35** or gate device **36.**

This invention contemplates that the electrostatic detector **32** may be employed to check proper reinstitution of yarn formation prior to release of the traveling unit **20** for continuing traversal of the textile machine **10.** In such an arrangement, the control for the instrumentalities which reinstitute yarn formation would be arranged to reset the detectors and logic circuit on completion of a cycle of operation of the instrumentalities. With resetting of the detectors, while the stop member **16** continues in the retracted position, the presence of electrostatic charges following successful reinstitution of yarn formation would preclude passage of a signal through the logic circuit means and would release the traveling unit **20** for continued traversal of the textile machine **10.** In the event of an unsuccessful attempt at reinstitution of yarn formation, electrostatic charges indicative of attenuated strand formation would be absent, and a successive cycle of operation of the instrumentalities could be initiated.

Following one or more repetition of cycles of operation of the instrumentalities, with continuing failure to successfully reinstitute attenuated strand formation, it is contemplated that the control arrangement would pass a signal to a feed stop actuation device **41,** supplied with air under pressure through a conduit **42** communicating with a fan portion of the traveling cleaner **20** as briefly indicated above by reference to related U.S. Pat. No. **3,726,072.** Thus, an "air bullet" would be directed against the stop member **16,** pivoting the stop member to the strand interrupting position. With movement of the member **16** to strand interrupting position, the corresponding drafting system location would be assured of falling into the third of the distinguished conditions described hereinabove and no further attempts at reinstitution of yarn formation at that drafting system location would be made until such time as an operator attending the machine corrected the difficulty which caused the traveling unit to fail. It is in this manner that the number of ineffective attempts at reinstitution of strand formation is reduced in accordance with this invention.

It is contemplated that the advantages of this invention are equally applicable to traveling units of a type different from that described to this point. Accordingly, a different variety of traveling unit, indicated generally at **20′**, has been illustrated in FIG. **5.** Prime notation has been used to identify portions of the combination illustrated in FIG. 5 corresponding with portions described with reference to FIGS. **1–4,** in order to aid understanding of the application of this invention to such an alternative traveling unit **20′**. As will be recognized, the traveling unit **20′** is supported by upper and lower rails **21′, 26′** and is provided with an active sonic detector means having a transmitter **30′** and a receiver **31′** and with an attenuated strand detector means **32′**. Additionally, the traveling unit **20′** is equipped with an appropriate means **41′** for remotely actuating feed stop members **16′** as necessary in accordance with this invention.

In the drawings and specification, there has been set forth a preferred embodiment 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.

That which is claimed is:

1. In combination with

a textile yarn forming machine having a plurality of drafting systems arranged at a series of locations for normally receiving a corresponding series of supply strands and normally delivering a corresponding series of attenuated strands and a plurality of stop members, each mounted adjacent a corresponding one of said drafting systems and selectively actuable for movement between a retracted position spaced from a corresponding supply strand and a strand interrupting position engaging and restraining the corresponding supply strand and thereby for interrupting passage of the restrained supply strand into the corresponding drafting system, and

a traveling unit traversing the machine and having instrumentalities for reinstituting attenuated strand formation at a drafting system where an attenuated strand is absent,

an arrangement for facilitating reduction in the number of ineffective attempts at reinstitution of strand formation and comprising:

active sonic detector means mounted on said traveling unit for movement therewith along said machine and for electrically signaling traversal of a drafting system location at which the correspond-

ing one of said stop members is in the retracted position,

attenuated strand detector means mounted on said traveling unit for movement therewith along said machine and responsive to electrostatic charges normally present at drafting system locations during attenuated strand formation for electrically signaling traversal of a drafting system location at which normal attenuated strand formation is occurring,

logic circuit means electricallly connected with said sonic detector means and said strand detector means for distinguishing among signaled traversal of a location at which said corresponding member is in the retracted position and strand formation is occurring, signaled traversal of a location at which said corresponding member is in the retracted position and strand formation has been interrupted, and traversal of a location at which said corresponding member is in the strand interrupting position, and

control means for responding to said logic circuit means distinguishing signaled traversal of a location at which said corresponding member is retracted and strand formation has been interrupted by stopping traversal of said machine by said traveling unit and initiating operation of said instrumentalities for reinstituting attenuated strand formation and for responding to said logic circuit distinguishing either of the other traversals by continuing traversal of said machine by said traveling unit.

2. Apparatus according to claim **1** wherein said control means for resetting said logic circuit means after completion of operation of said instrumentalities for ascertaining successful reinstitution of attenuated strand formation.

3. Apparatus according to claim **1** wherein said traveling unit is a traveling pneumatic cleaner.

4. A method of operating a traveling unit which has instrumentalities for reinstituting attenuated strand formation at drafting systems of a textile yarn forming machine, the machine having a plurality of drafting systems arranged at a series of locations for normally receiving a corresponding series of supply strands and normally delivering a corresponding series of attenuated strands and having a plurality of stop members each mounted adjacent a corresponding one of said drafting systems and selectively actuable for movement between a retracted position spaced from the corresponding supply strand and a strand interrupting position engaging and restraining the corresponding supply strand and thereby for interrupting passage of the restrained supply strand into the corresponding drafting system, the method facilitating reduction in the number of ineffective attempts at reinstitution of strand formation and comprising the steps of:

traversing the drafting system locations with the traveling unit while actively sonically detecting the disposition of stop members in the retracted position and electrostatically detecting electrical charges normally present at drafting system locations during attenuated strand formation,

electrically signaling traversal of a drafting system location at which the corresponding stop member is in the retracted position,

electrically signaling traversal of a drafing system location where normal attenuated strand production is occurring,

distinguishing among signaled traversal of a location at which said corresponding stop member is in the retracted position and strand formation is occurring, signaled traversal of a location at which said corresponding stop member is in the retracted position and strand formation has been interrupted, and traversal of a location at which said corresponding stop member is in the interrupting position,

continuing traversal of the textile machine by the traveling unit in response to distinguishing signaled traversal of a location at which strand formation is occuring and traversal of a location at which the corresponding stop member is in the interrupting position, and

interrupting traversal of the traveling unit and initiating operation of the instrumentalities for reinstituting formation of attenuated strands in response to distinguishing the signaled traversal of a location at which said corresponding stop member is in the retracted position and strand formation has been interrupted.

5. A method according to claim **4** further comprises the steps of electrically signaling successful reinstitution of attenuated strand formation and repeating operation of the instrumentalities for reinstituting formation of attenuated strands in the event of failure to successfully reinstitute strand formation.

6. Apparatus according to claim **2** further comprising stop member actuation means for directing a flow of air against a stop member and thereby for selectively blowing the same from retracted position to strand interrupting position, and said stop member actuation means being operatively connected to said control means and responsive thereto for emitting an actuating air flow upon ascertainment that an attempted reinstitution of attenuated strand formation failed.

7. A method according to claim **5** further comprising the steps of emitting an actuating air flow in the event of failure to successfully reinstitute strand formation and directing the air flow against the corresponding stop for selectively blowing the same from retracted position to strand interrupting position.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,899,868

DATED : August 19, 1975

INVENTOR(S) : Charles D. Lee, Jr., et al

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

Column 3, Line 45, "herein" should be --therein--;
Column 5, Line 24, "pass" should be -- passes--;
Column 7, Line 34, before "for" insert --comprises means--;
Column 8, Line 36, "comprises" should be --comprising--;
Column 8, Line 46, delete "and".

Signed and Sealed this

second Day of *December 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks