CONTROL ARRANGEMENT FOR YARN PIECING APPARATUS

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

References Cited
UNITED STATES PATENTS
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
3,754,992 8/1973 Lee, Jr.......................... 57/34 R

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 re-institution 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 re-instituting strand formation only as required.

7 Claims, 5 Drawing Figures
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 for-

motion, 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 sonice 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 herein, 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-
3,899,868

ing a plurality of drafting systems generally indicated 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 reconstitution of attenuated strand formation.

A traveling unit generally indicated at 20 traverses the textile yarn forming machine 10 and has instrumentality (not shown in detail in the accompanying drawings) for reconstituting 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 instrumentality for reconstituting 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 instrumentality for reconstituting 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. 3,726,672 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 the 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) signalled traversal of a location at which the corresponding stop member 16 is in the retracted position and strand formation is occurring; (2) signalled 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 reestablishment 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 reestablish 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 reestablishment 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 reestablishment 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 reestablish 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 reestablishment 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 reestablishment 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 reestablishing 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 reestablishment 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 po-
sition,
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 dur-
ing attenuated strand formation for electrically sig-
naling traversal of a drafting system location at
which normal attenuated strand formation is oc-
curring,
logic circuit means electrically 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 posi-
tion and strand formation has been interrupted,
and traversal of a location at which said corre-
sponding member is in the strand interrupting posi-
tion, and
control means for responding to said logic circuit
means distinguishing signaled traversal of a loca-
tion at which said corresponding member is re-
tracted and strand formation has been interrupted
by stopping traversal of said machine by said trav-
eling unit and initiating operation of said instru-
mentalties for reinstituting attenuated strand for-
mation and for responding to said logic circuit dis-
tinguishing either of the other traversals of said machine by said traveling
unit.

2. Apparatus according to claim 1 wherein said con-
tral means for resetting said logic circuit means after
completion of operation of said instrumentalities for
ascertaining successful reinstition of attenuated
strand formation.

3. Apparatus according to claim 1 wherein said trav-
eling unit is a traveling pneumatic cleaner.

4. A method of operating a traveling unit which has
instrumentalities for reinstituting attenuated strand for-
mation at drafting systems of a textile yarn forming ma-
chine, the machine having a plurality of drafting sys-
tems arranged at a series of locations for normally re-
ceiving a corresponding series of supply strands and
normally delivering a corresponding series of attenu-
ated 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 corre-
sponding supply strand and a strand interrupting posi-
tion engaging and restraining the corresponding supply strand and thereby for interrupting passage of the re-
strained supply strand into the corresponding drafting
system, the method facilitating reduction in the number
of ineffective attempts at reinstition of strand forma-
tion and comprising the steps of:

traversing the drafting system locations with the trav-
eling unit while actively sonically detecting the dis-
position of stop members in the retracted position and
electrostatically detecting electrical charges nor-
manly present at drafting system locations dur-
ing attenuated strand formation,
electrarily signaling traversal of a drafting system lo-
cation at which the corresponding stop member is
in the retracted position,
electricaly signaling traversal of a drafting system lo-
cation 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 occurr-
ing, signaled traversal of a location at which said
corresponding stop member is in the retracted posi-
tion and strand formation has been interrupted,
and traversal of a location at which said corre-
sponding stop member is in the interrupting posi-
tion,
continuing traversal of the textile machine by the
traveling unit in response to distinguishing signaled
traversal of a location at which strand formation is
occurring and traversal of a location at which the
corresponding stop member is in the interrupting po-

5. A method according to claim 4 further comprises
the steps of electrically signaling successful reinsti-
tution of attenuated strand formation and repeating op-
eration 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 re-
tracted position and strand formation has been in-
terrupted.

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 blow-
ing the same from retracted position to strand inter-
rupting position, and said stop member actuation
means being operatively connected to said control
means and responsive thereto for emitting an actuating
air flow upon ascertaintment that an attempted reinsti-
tution 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