

[54] **METHOD AND APPARATUS FOR
PROTECTING PRODUCTION OF
TEXTURED TEXTILE YARN**

[72] Inventor: **Patrick P. Carroll**, Shannon, Ireland
[73] Assignee: **Jonathan Logan, Inc.**, Spartanburg, S.C.
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57/78, 57/93, 57/157 TS
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57/77.3, 77.45, 78, 81, 88, 157 TS, 6, 16, 17, 18,
157 R, 100, 156

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Primary Examiner—John Petrakes
Attorney—Parrott, Bell, Seltzer, Park & Gibson

[57] **ABSTRACT**

Continued production of improperly processed textile yarn otherwise resulting from rotation of a spindle at an improper speed is protected against by a method and apparatus in which the rotational speed of the spindle is continually monitored and rotation thereof at an excessive differential in speed from a predetermined standard speed initiates a warning that improperly processed yarn is being produced.

22 Claims, 5 Drawing Figures

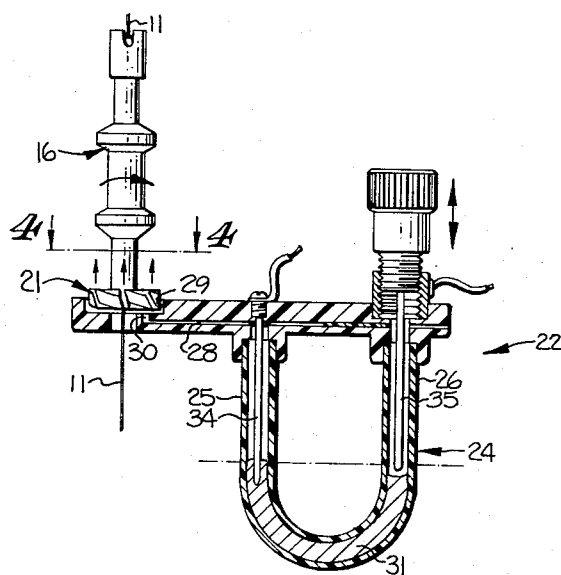


FIG-1

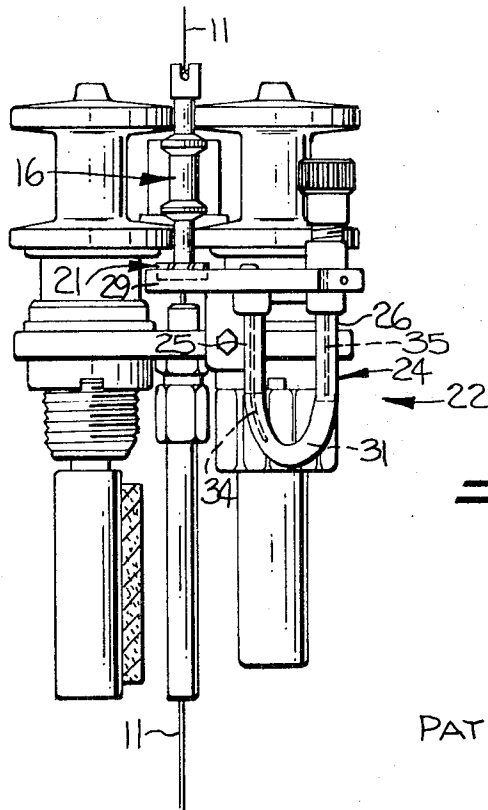
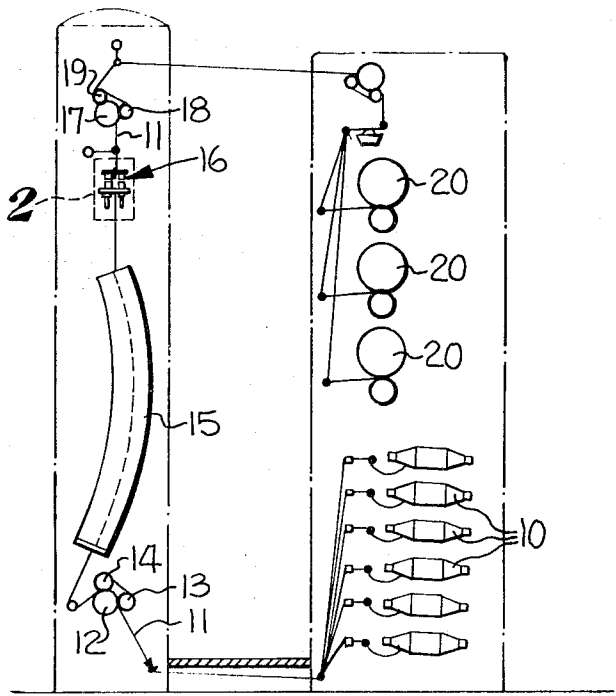
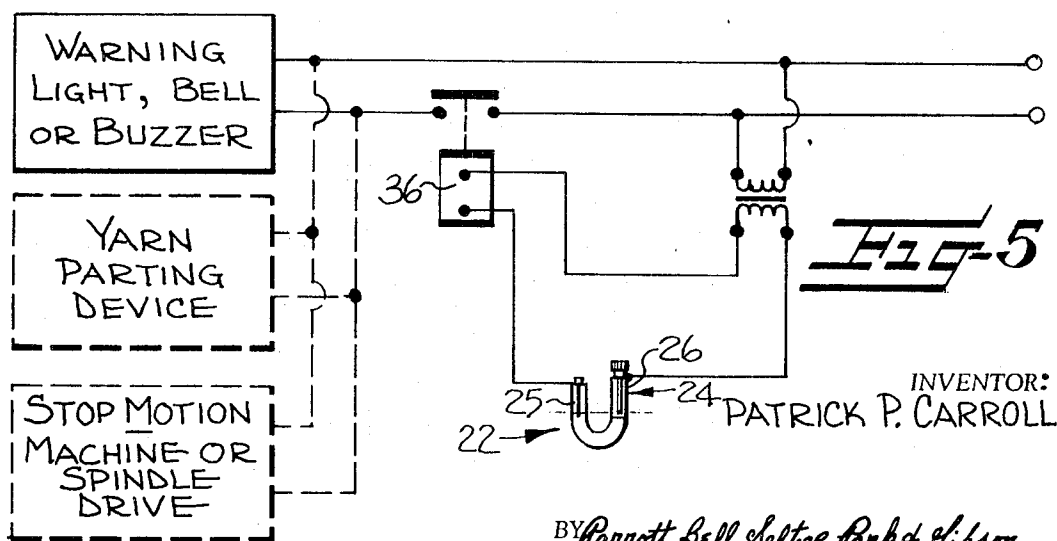
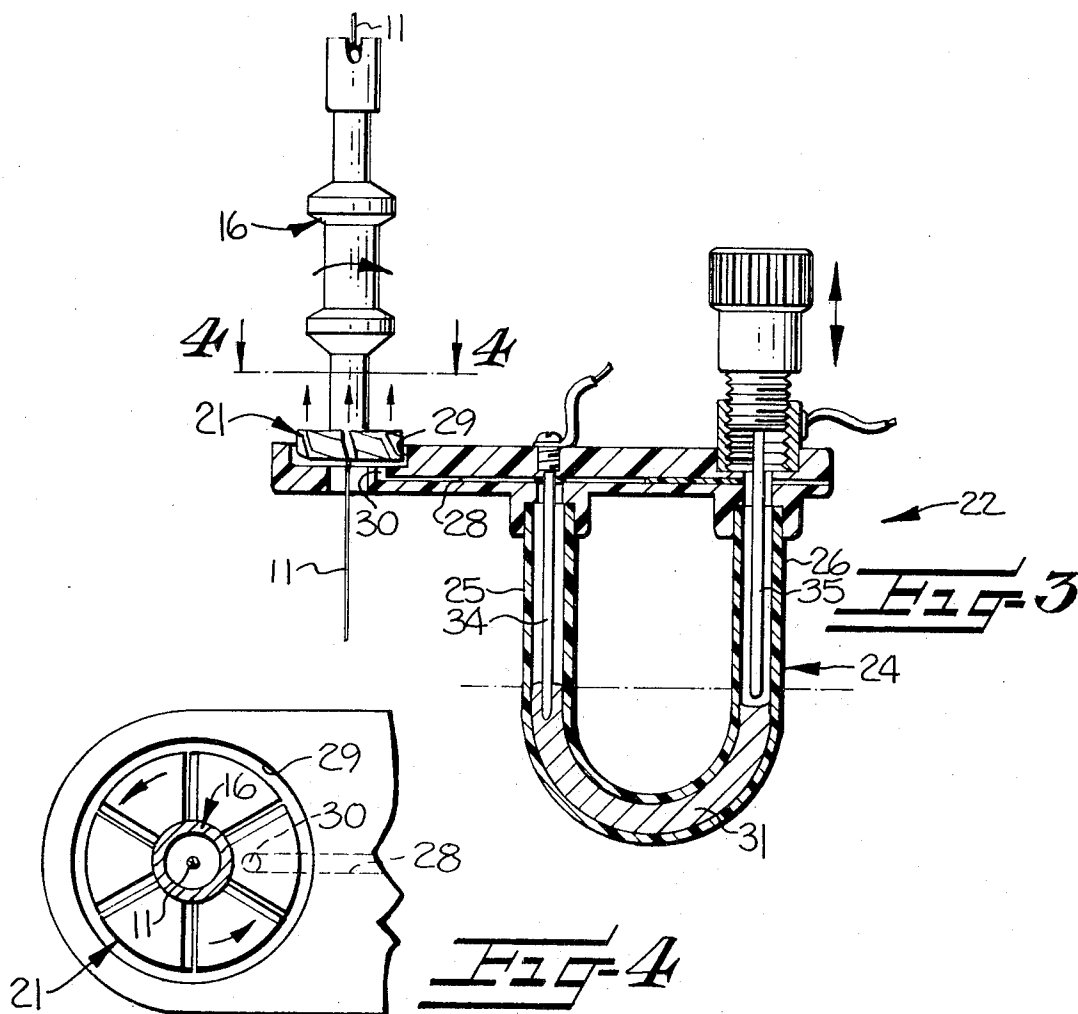


FIG-2

INVENTOR:
PATRICK P. CARROLL

BY *Barrott, Bell, Seltzer, Park & Libson*
ATTORNEYS



INVENTOR:
PATRICK P. CARROLL

BY *Parrott, Bell, Seltzer, Park & Libson*

ATTORNEYS

METHOD AND APPARATUS FOR PROTECTING PRODUCTION OF TEXTURED TEXTILE YARN

In the processing of certain types of textile yarns, as for example textured yarns and covered yarns, it is common practice to pass the yarns through or in engagement with a hollow, rotating spindle. Examples of machines of this type are false twist machines and rubber covering machines. While some variance in the speed of rotation of the spindles of these machines is permissible, excessive variations in such rotational speed will result in improperly processed yarn being produced. Such improperly processed yarn may not be readily apparent to an operator of the textile machine but the only ways heretofore available for determining improper spindle operating speeds were by visual detection of improperly processed yarn or by periodic checks using a suitable speed indicator, such as a strobe device.

Due to the difficulty in visually detecting improperly processed yarns and the other demands upon an operator's time and the time consuming, inefficient checking of spindle speeds by speed indicators, both prior quality control measures have been ineffective and considerable amounts of improperly processed yarn have been produced by improperly operating spindles before the improper operating condition has been determined by these prior methods. This problem has become particularly acute in view of the very high spindle speeds currently employed to provide ever increasing rates of production.

With the foregoing in mind, it is an object of the present invention to reduce the amount of improperly processed textile yarn produced by a textile machine utilizing a hollow, rotating spindle, and to thereby increase the amount of properly processed yarn produced thereby.

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 a schematic elevation view of a yarn texturing apparatus incorporating the present invention;

FIG. 2 is an elevation view of a spindle support and drive assembly such as is incorporated in an apparatus as schematically shown in FIG. 1 and incorporating certain structure of the present invention;

FIG. 3 is an enlarged elevation view of portions of the structure shown in FIG. 2, in partial section to more clearly show features of the present invention;

FIG. 4 is a plan view taken generally along the line 4—4 in FIG. 3; and

FIG. 5 is a schematic electrical wiring diagram showing certain features of the present invention.

Referring now more particularly to the drawings, the present invention is there illustrated as an improvement with textile yarn processing apparatus of a particular type and as an improved method of processing textile yarn practicable through the use of the apparatus. It is to be understood at the outset that the selection of a textile yarn texturing apparatus and method for disclosure herein as incorporating the improvements of the present invention is not intended to limit the application of the improvements herein disclosed to other textile yarn processing apparatus and methods of the general class with which this disclosure is concerned. For this reason, the disclosure made herein is to be taken as a broad teaching.

As schematically illustrated (FIG. 1), textile yarn to be texturized is supplied to an apparatus of the type with which the present invention is concerned in a wound supply package 10. Yarn 11 is drawn from the package, as by yarn supply feed rollers 12, 13, 14, and is directed therefrom to a yarn heating means such as an electrically heated plate or surface within a housing 15. While an electrical heater is here referred to, it is to be understood that apparatus with which the improvements of the present invention are useful are known to adopt a variety of other means for raising the temperature of the textile yarn 11 being textured or to use no heat where the yarn process is some other process such as twisting or covering.

From the yarn heating means, the yarn 11 passes in through a hollow rotating spindle generally indicated at 16, which twists the yarn in a manner well known to persons familiar with methods of texturizing textile yarn. The yarn 11 then passes from the spindle 16 through take-up drive rolls 17, 18, 19 and is formed into a take-up package 20 for subsequent removal from the apparatus and use in further textile manufacturing processes.

In operation of an apparatus of the general type schematically illustrated in FIG. 1 and briefly described above, the spindle 16 is driven in rotation at relatively high speeds, typically up into hundreds of thousands of revolutions per minute, while yarn is advanced from the supply package 10 to the take-up package 20 at a predetermined linear speed. On passing in engagement with the heater within the housing 15, the thermoplastic yarn is softened, and acquires the capability of taking a set. At the same time, the running length of yarn between the heater and the spindle 16 is being twisted by rotation of the spindle, so that the plastic yarn has twist imparted thereto. As the running length of yarn 11 passes in engagement with the spindle 16 and toward the take-up rolls 17, 18, 19 the yarn cools and is set in the twisted condition. Also, the yarn is untwisted and returns to a generally straight condition. However, the yarn has a characteristic texture imparted thereto by having been set in the twisted condition.

While the above disclosure of a texturizing apparatus and method has been included herein for clarity, persons familiar with the art of processing textile yarns will recognize that the details of the structure of the apparatus used and the particular parameters of the method steps followed may be varied over a significant range, as taught by the disclosures of previously granted patents and prior art practices.

The improved method and apparatus of the present invention stem from a recognition that, with the high rotational speeds of the spindle 16 of the present textile yarn texturing apparatus and the high linear speeds at which yarn 11 is passed through the apparatus, variation from a desired predetermined relationship in these speeds will result in production of enormous quantities of improperly textured textile yarn. The improved method and apparatus of this invention is directed to protecting against such continued production otherwise resulting from rotation of the spindle 16 at an improper speed. Due to the operational speeds of the spindle 16 and the effects of wear and the like thereon, a common cause for the production of improperly textured yarn is reduction of the speed of rotation of the spindle 16. Such a drop in the rotational speed of the spindle 16 typically results from bearing wear, frictional drag or improper drive adjustments. Periodic inspections in an effort to determine whether such effects are resulting in production of improperly textured textile yarn have proven unsatisfactory, due to the quantities of improperly textured yarn produced from the time that the rotational speed of the spindle reaches an excessive differential in speed from the predetermined standard speed and the time that spindle speeds are checked.

In accordance with the present invention, methods of texturing textile yarn such as discussed generally above are improved by continually monitoring the rotational speed of spindle 16 while distinguishing between rotation thereof within a predetermined differential in speed from a predetermined standard speed and rotation thereof at an excessive differential in speed from the predetermined standard speed. In response to a determination that the spindle is rotating at an excessive differential in speed, a warning is automatically given that improperly textured yarn is being produced. Such a warning protects against continued production of improperly textured textile yarn by at least attracting the attention of an operator of the apparatus and assuring that corrective maintenance steps are taken. Typically, inasmuch as the apparatus failures which result in rotation of the spindle at an excessive differential in speed are related to wear and the like slowing the spindle, the monitoring and response to the rotational speed of the spindle are operative when the spindle rotational speed drops below a predetermined speed range.

To the end of accomplishing this improved method, the textile texturing apparatus in accordance with the present invention is improved by addition of a fluid impeller means 21 (FIGS. 2 and 3) operatively connected to the spindle 16 for inducing a fluid flow upon rotation of the spindle 16 and thereby for effecting a fluid pressure differential indicative of spindle rotational speed. With the particular form of spindle 16 illustrated, the fluid impeller means has a form generally similar to an axial flow fan impeller. Desirably, the impeller means 21 is constructed and arranged to draw a flow of air from a point adjacent the lower end of the spindle 16 upwardly across the spindle 16, to provide an additional function of cleaning the spindle 16 of dust or the like otherwise collecting thereon from the textile yarn 11 being textured, the yarn having been previously subjected to a treatment leaving a residue thereupon.

Fluid pressure responsive electrical switching means generally indicated at 22 operatively communicates with the impeller means 21 for sensing the fluid pressure differential effected thereby and for changing the conductive state of an electrical circuit in response to a fluid pressure differential indicative of rotation of the spindle. In the particular form illustrated, the pressure responsive means 22 comprises a U-tube 24 having one leg 25 thereof operatively communicating with the fluid impeller means 22. The other leg 26 of the U-tube 24 communicates with the ambient atmosphere, as by being open. Operative communication of the one leg 25 with the impeller means 21 is established by a fluid flow conduit 28 passing from the one leg 25 to an impeller housing 29 shrouding at least a portion of the periphery of the impeller means 21. By means of a passageway 30 extending through the housing 29 to a point adjacent the impeller means 21, the conduit 28 and one leg 25 of the U-tube 24 are opened to the lower fluid pressures induced by rotation of the impeller means 21.

As will be understood, the flow of fluid induced by the impeller means 21 effects a differential between the pressure in the one leg 25, conduit 28 and passageway 30 and ambient atmospheric pressure. As such a pressure differential is applied to the one leg 25 of the U-tube 24, the pressure differential acts on a body 31 of electrically conductive liquid therewithin, preferably being a body of mercury. With the reduction of the pressure present in the one leg 25, the body 31 of mercury within the U-tube 24 is displaced within the legs thereof, being drawn upwardly into the one leg 25 until the differential in heights of the column of mercury balances with the pressure differential. Thus, the generated fluid pressure differential which is indicative of rotational speed of the spindle 21 is balanced against a pressure force established by displacement of the body 31 of mercury. In accordance with the present invention, the body 31 of mercury is also used as a moving element in an electrical switching means. As is generally well known to persons working with electrical switching means, the conductive state of an electrical circuit may be changed by movement of a pool of electrically conductive liquid such as mercury into and out of a position wherein electrically conductive liquid contacts electrical conductors which are included in an electrical circuit. On contacting such electrical conductors, electrical current may flow through the body of mercury and change the conductive state of the electrical circuit including the conductors.

As applied in the present apparatus, dip wires 34, 35 extend into the U-tube 24 for contacting the body 31 of mercury as the body moves within the U-tube 24. In particular, the dip wires 34, 35 are arranged so that an electrical circuit therebetween is completed through the body 31 of mercury upon the fluid pressure differential applied to the one leg 25 varying by an excessive amount from a standard range of pressure differential. That is, the dip wires 34, 35 are so positioned relative to the body 31 of mercury that the body, when drawn upwardly into the one leg 25 of the U-tube 24, moves out of electrical contact with at least one of the dip wires. Then, should the rotational speed of the spindle 16 drop to below a predetermined range of rotational speeds, the fluid flow drawn by the impeller means 21 will be so reduced as to decrease the

fluid pressure differential present in the one leg 25, permitting the body 31 of mercury to shift within the U-tube 24, engage both of the dip wires 34, 35 and render an electrical circuit therethrough electrically conductive.

In the particular form illustrated and described to this point, the dip wires 34, 35 are electrically connected to an electrically actuating warning means such as a warning lamp indicated in block diagram form in FIG. 5 and controlled by a relay 36. The warning lamp is energized in response to a change in conductive state of the circuit established through the dip wires 34, 35 and becomes illuminated for advising an operator of the texturing apparatus that improperly textured textile yarn is being produced. An operator noting the warning lamp to be energized should promptly take the indicated spindle 16 out of production, and take such steps as may be required to correct the operating deficiency of the texturing apparatus.

Further, it is contemplated that the warning means may comprise means operatively connected to the texturing apparatus for interrupting production of textured yarn in response to detection of a spindle 16 operating at an improper speed, and thereby minimize the quantity of improperly textured yarn produced. Such minimization of production of yarn may be accomplished by providing yarn cutting means for severing the yarn passing in engagement with the spindle 16, or may comprise stop motion means for stopping rotation of the spindle 16 and passage of yarn in engagement therewith such as by stopping the main drive motor of the texturing apparatus (FIG. 5).

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 is claimed is:

1. In a textile yarn processing apparatus having a hollow rotatable spindle, means for driving the spindle in rotation for twisting textile yarn being processed on the apparatus and means for passing the textile yarn through the hollow spindle at a predetermined linear speed, the improvement therewith of means for protecting against continued production of improperly processed textile yarn otherwise resulting from rotation of the spindle at an improper speed and comprising:

speed sensing means operatively associated with the spindle and directly responsive to the rotational speed thereof for sensing rotation of the spindle at an excessive differential in speed from a predetermined standard speed, and warning means operatively associated with said speed sensing means and responsive to determination thereby that the spindle is rotating at an excessive differential in speed from the predetermined standard speed for automatically warning that improperly processed textile yarn is being produced.

2. Apparatus according to claim 1 wherein said speed sensing means comprises signal generating means operatively connected to the spindle for generating a signal indicative of the rotational speed thereof and signal comparing means operatively connected to said signal generating means for receiving signals therefrom and distinguishing between a signal indicative of spindle rotation within a predetermined differential in speed and a signal indicative of spindle rotation at an excessive differential in speed.

3. Apparatus according to claim 2 wherein said signal generating means comprises fluid flow inducing means mounted on said spindle for rotation therewith and for effecting a fluid pressure differential as the speed indicative signal.

4. Apparatus according to claim 3 wherein said signal comparing means comprises fluid pressure sensitive means for balancing the fluid pressure differential effected by the fluid flow inducing means against a standard pressure force.

5. Apparatus according to claim 2 wherein said signal comparing means comprises signal balancing electrical switching means for balancing the speed indicative signal against an opposing standard signal of like kind and for changing the con-

ductive state of an electrical circuit in response to a determination that spindle rotation is at an excessive differential in speed.

6. Apparatus according to claim 1 wherein said warning means comprises an annunciator means positioned for ready observation by an operator of the apparatus and actuable in response to said speed sensing means to advise the operator that improperly processed yarn is being produced.

7. Apparatus according to claim 1 wherein said warning means comprises means operatively connected to the apparatus for interrupting production of textile yarn in response to said speed sensing means and thereby minimizing the quantity of improperly processed yarn produced.

8. Apparatus according to claim 7 wherein said production interrupting means comprises yarn cutting means for severing the yarn passing through the spindle.

9. Apparatus according to claim 7 wherein said production interrupting means comprises stop motion means for stopping rotation of the spindle and passage of yarn in engagement therewith.

10. In a textile yarn texturing apparatus having a yarn twisting spindle, means for driving the spindle in rotation for twisting textile yarn being processed on the apparatus and means for setting the textile yarn in twisted condition, the improvement therewith of means for protecting against continued production of improperly textured textile yarn otherwise resulting from rotation of the spindle at an improper speed and comprising:

fluid impeller means operatively connected to the spindle for inducing a fluid flow upon rotation thereof and thereby for effecting a fluid pressure differential indicative of the spindle rotational speed,

fluid pressure responsive electrical switching means operatively communicating with said fluid impeller means for sensing the fluid pressure differential effected thereby and for changing the conductive state of an electrical circuit in response to a fluid pressure differential indicative of rotation of the spindle at an excessive differential in speed from a predetermined standard speed, and

electrically actuated warning means electrically connected to said fluid pressure responsive means and operative in response to a change in conductive state of the circuit thereby established for warning that improperly textured textile yarn is being produced.

11. Apparatus according to claim 10 wherein said fluid pressure responsive means comprises a U-tube having one leg thereof operatively communicating with said fluid impeller means, a body of electrically conductive liquid in said U-tube and movable relative thereto in response to a balance of fluid pressures imposed thereon, and electrical contact means arranged relative to said U-tube and said body of liquid for completion of an electrical circuit through said body of liquid in response to variations in fluid pressure effected by said fluid impeller means.

12. Apparatus according to claim 11 wherein said electrical contact means are arranged relative to said U-tube and said body of liquid for completion of an electrical circuit upon a rise in fluid pressure applied to said one leg from said fluid impeller means, such fluid pressure rise being indicative of a drop in spindle rotational speed.

13. In a method of processing textile yarn which includes passing the yarn through a hollow rotating spindle, the improvement which comprises:

continually monitoring directly from the spindle the rotational speed thereof while sensing excessive variations in the rotational speed of the spindle from a predetermined standard rotational speed, and

automatically warning that improperly processed yarn is being produced in response to a sensing of an excessive variation in the rotational speed of the spindle to protect against continued production of improperly processed yarn due to improper spindle speed.

14. A method according to claim 13 wherein the step of automatically warning that improperly processed yarn is being produced comprises electrically energizing an annunciator positioned to advise an operator of the yarn texturing process of the unsatisfactory condition thereof.

15. A method according to claim 13 wherein the step of automatically warning that improperly processed yarn is being produced comprises interrupting production of such yarn to thereby minimize the quantity of improperly processed yarn produced.

16. A method according to claim 15 wherein the step of interrupting production of yarn comprises severing the yarn passing through the spindle.

17. A method according to claim 15 wherein the step of interrupting production of yarn comprises stopping rotation of the spindle and passage of yarn therethrough.

18. In a method of texturing textile yarn by passing the yarn in engagement with a rotating spindle to twist the yarn, and setting the yarn in twisted condition, the improvement which comprises:

continually monitoring directly from the spindle the rotational speed thereof while sensing excessive variations in the spindle speed of rotation from a predetermined standard speed, and

automatically warning that improperly textured yarn is being produced in response to a sensing of an excessive variation in the rotational speed of the spindle to protect against continued production of improperly textured yarn due to improper spindle speed.

19. A method according to claim 18 wherein the step of continually monitoring the rotational speed of the spindle comprises generating a signal indicative of the rotational speed thereof and comparing the generated signal to a standard indicative of a predetermined rotational speed of the spindle.

20. A method according to claim 19 wherein the step of generating a signal comprises inducing flow of fluid in response to rotation of the spindle and thereby effecting a fluid pressure differential as the signal.

21. A method according to claim 20 wherein the step of comparing the generated signal to a standard comprises balancing the generated fluid pressure differential against a standard pressure force.

22. A method according to claim 19 wherein the step of comparing the generated signal to a standard comprises balancing the generated signal against an opposing standard signal of like kind.

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