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Bartling

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[54] **APPARATUS FOR TEMPORARILY STORING THREAD IN A SPINDLELESS SPINNING MACHINE**

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[52] **U.S. Cl.** ..... **57/34 R,** 57/58.89, 57/80

[51] **Int. Cl.** **D01h 13/16**

[58] **Field of Search** ..... 57/34 R, 56, 58.89–58.95, 57/78, 80, 83, 85, 86, 87

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Attorney, Agent, or Firm—Murray Schaffer

[57] **ABSTRACT**

Method and apparatus for rejoining broken thread in a spindleless spinning machine wherein the thread is formed in a turbine and withdrawn on to a spool. The breakage of the thread is sensed and in response thereto the spinning operation is stopped and the thread reversed into the spinning turbine. Upon the restarting of spinning, means are provided to temporarily store a loop of thread in order to compensate for the faster action of the spinning turbine than that of the withdrawing spool. The means comprise a hollow suction chamber located adjacent the path of the thread.

9 Claims, 2 Drawing Figures

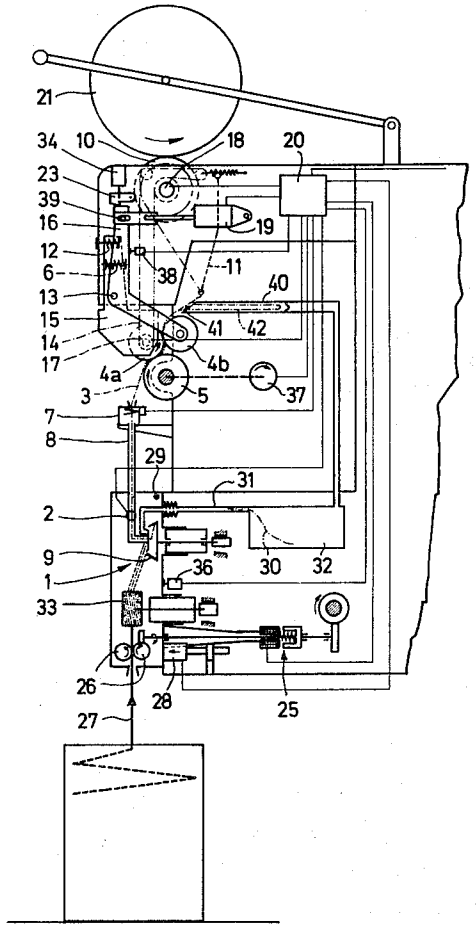
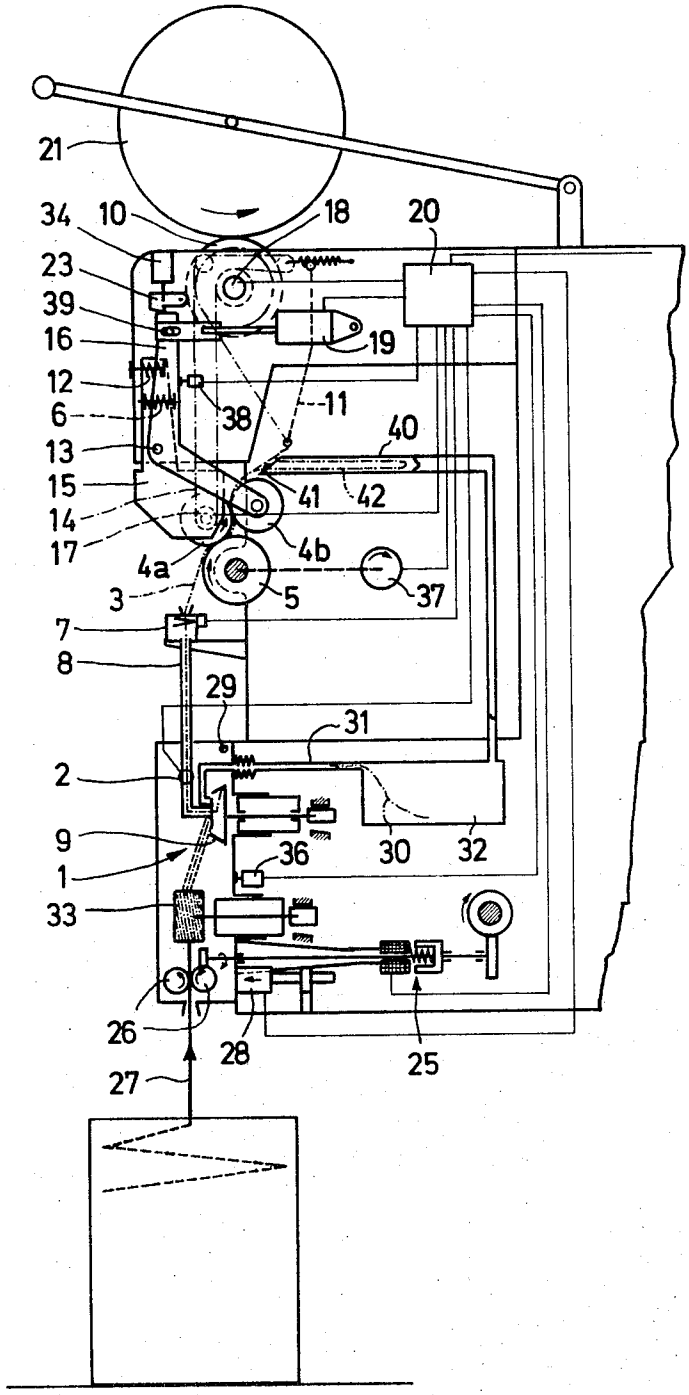


Fig. 1


21
34
10
18
20
23
39
16
19
12
11
6
38
40
13
15
41
42
14
17
4a
4b
3
5
37
7
8
29
31
2
9
36
30
32
1
33
26
28
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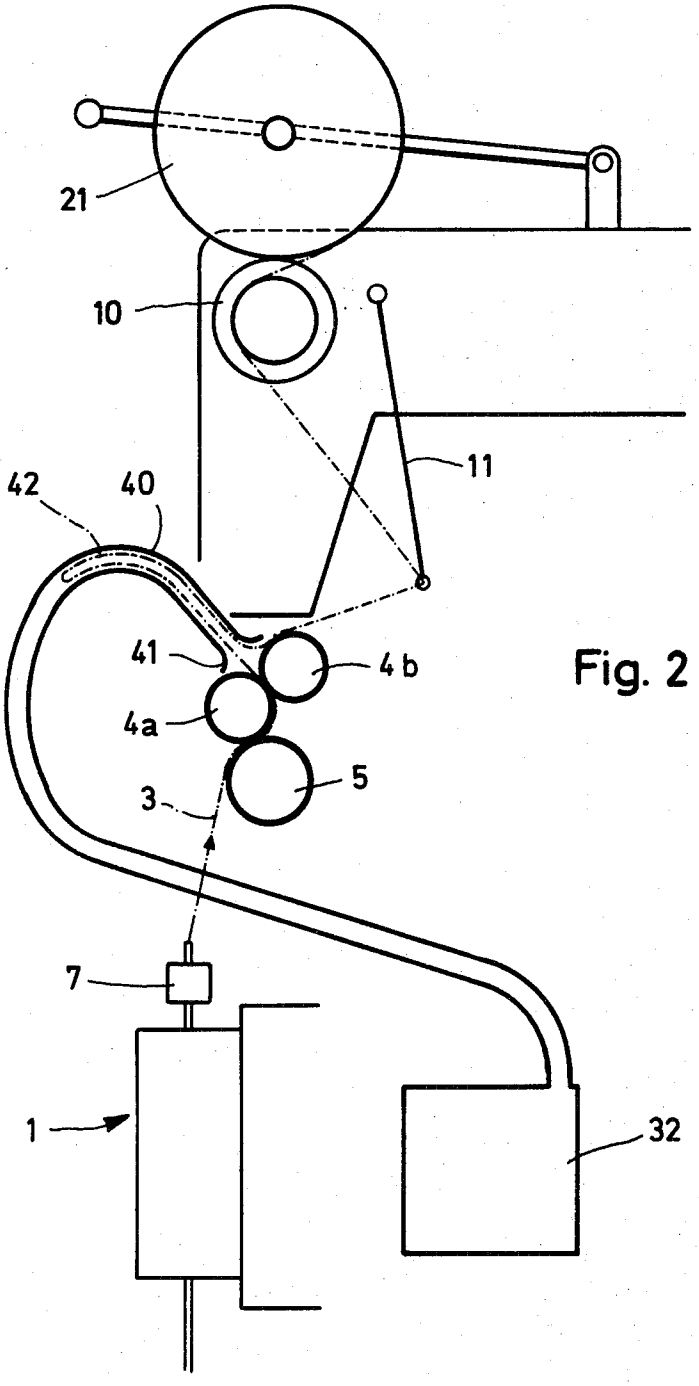


Fig. 2

APPARATUS FOR TEMPORARILY STORING THREAD IN A SPINDLELESS SPINNING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for temporarily storing a surplus length of thread in a spinning machine and in particular for the storage of thread at the start up of a high speed open end spindleless spinning machine.

It is known to provide spinning machines, and in particular an open end spindleless spinning machine in which a turbine twists the fiber into an elongated thread or yarn, with a dancer roller and lever to create a reserve of thread yarn. The dancer roller and lever is generally located between two means of the machine which hold the yarn under tension after it is formed on the turbine. For example, the dancer roller and lever may be arranged between the take up nip rollers and the wind up spool. The dancer roller is adapted to pull the thread laterally of the straight line connection between these two means so that it may be more or less deflected from its general direction of run. In this manner by varying the pull and the angular velocity of the dancer roller the thread may be held at a more or less constant tension so that on the one hand the possibility of thread breakage is greatly reduced and on the other hand a desirable reserve length of thread can be obtained between the two means.

It is further known to provide in open end spindleless spinning machines means for producing a thread reserve of suitable length and for holding said thread reserve in a position at which the subsequently spun thread can be joined to it so that the subsequent thread can be pulled onto the wind up spool itself. Thus, after a thread breakage, the spinning machine can be automatically put into respinning operation and the newly spun yarn joined to the end of the previously spun yarn, without the need for the machine operator to manually withdraw the newly spun thread and tie it to the thread already wound on the winding spool. In this known apparatus the normal drive and operation of the spinning machine accomplishes this operation automatically. In general, this apparatus is quite satisfactory and provides suitable means by which a thread reserve can be created for the proper resumption of spinning. On the other hand, the resumption of spinning requires the wind up spool and the take up nip rollers to be brought up to their optimum operating speed over a period of time so that the proper tension is maintained on the thread. In general, however, the wind up spool requires a greater length of time to reach its normal speed than do the take up nip rollers. Thus, upon resumption of spinning after a break defect has been corrected, a surplus of thread is created which cannot be wound on the spool until the spool reaches its normal speed. The present machines such as those described above do not satisfy the condition and do not provide means for storing the surplus of thread upon the start up of spinning and thus constitute a disadvantage to the proper winding of the thread.

It is an object of the present invention to provide apparatus for spindleless spinning machines which remove the disadvantages of the known devices and in particular which provides apparatus for temporarily storing an excess of thread length created when the take up nip roller speed is higher than the speed of the winding spool and which stores the excess until the wind up spool reaches its normal drive of velocity.

It is a further object of the present invention to provide temporary storage means for accumulating excess length of thread, which continuously operates on the running thread which has only a slight but continuous effect on the thread so that the excess thread length can be constantly but slowly built and reduced in accordance with the operation of the machine and the tension on the thread.

The foregoing objects, other objects, as well as numerous advantages of the present invention will be seen from the following disclosure.

SUMMARY OF INVENTION

According to the present invention temporary storage means for storing excess length of thread formed on the turbine of an open ended spindleless spinning machine is provided comprising a hollow chamber located between the turbine and the wind up spool of the machine. The hollow chamber has an opening located adjacent the path of the thread and is connected to a source of suction. The magnitude of the suction being selected such that when the tension on the thread falls below a predetermined value the thread is caused to be drawn as a loop into the hollow chamber. Preferably the chamber is formed as a tube open at both of its ends. One end of the tube is connected to the source of vacuum, such as compressor pump reservoir, etc. The other end of the tube is provided with a suction nozzle which preferably is formed integrally with the tube itself.

It is most advantageous to arrange the nozzle of the tube adjacent the line of thread movement between the take up nip rollers and the winding spool so that the suction constantly acts on the thread. It is further advantageous to utilize the source of vacuum already existing for the spinning machine which supplies the spinning turbine and spinning chamber with its own vacuum to withdraw the waste thread and waste fibers. Spinning machines are normally provided and exist with suitable source of vacuum.

Full details of the present invention are given in the following description and are shown in the attached drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a schematic side view of a spindleless spinning machine showing the apparatus of the present invention combined therewith, and

FIG. **2** is an enlarged schematic view of a further embodiment of the present invention.

DESCRIPTION OF INVENTION

As seen in FIG. **1**, a spindleless spinning assembly, generally depicted by the numeral **1**, of the type shown and described in copending application Ser. No. 264,527 filed on June 20, 1972, comprises a rotating spinning turbine **9** mounted within the chamber of an enclosed housing. The assembly produces in the known manner a thread **3** which pulled through an outlet channel or tube **8**. In accordance with the present invention an electrical sensor, such as a photo-electric cell **2** cooperating with a light source, or similar device is mounted on the tube **8** to sense the continuity of the thread **3**. The thread **3**, in normal operation (FIG. **1**),

is withdrawn from the spinning turbine **9** by a pair of take up nip rollers **4***a* and **4***b* which are biased by a spring **6** to press against each other. The rollers **4***a* and **4***b* have a smooth outer circumference and are driven by a continuously clockwise rotating wheel or roller **5** which extends across and in contact with each of similar nip rollers employed along the spindle bank of a multiple spinning assembly machine. The roller **4***a* is mounted at the end of a lever **15** which is biased by a spring **12** to pivot about a point **13** into normal operating engagement with the drive roller **5.** The roller **4***b* is mounted at the end of a bell crank **16** also pivoted at the point **13** and biased by a spring **6** to press the roller **4***b* against the surface of roller **4***a* for conjoint swinging and rolling.

The thread **3** passes over a dancer roller and arm **11** which is adapted to oscillate and resiliently accumulate a length of thread in reserve during the operation of the apparatus. The thread **3** then passes over a grooved drum **10** on which a reel or wind up spool **21** rests for free rotation. The grooved drum **10** rotates the spool **21** and acts to apply the thread in an even manner across it. The drum **10** and therefore the spool **21** abutting against it is driven by the common drive by the roller **4***a* abutting against roller **5** via a transmission such as a chain or belt **14** arranged on the axle or shaft for roller **4***a*.

The electric sensor **2** is connected to a control circuit schematically shown by the numeral **20.** The control circuit may employ one or more relays, solid state amplifier circuits, timing devices, etc. The photoelectric sensor suggested is of conventional construction producing an electric signal output on sensing the presence or absence of a given object in line with it. In the present situation should the normal operation of the spinning assembly be disturbed by a break in the thread **3,** the sensor **2** produces a signal passing to the control circuit **20.** Operatively connected to the control circuit are a pair of brake means **17** and **18** which are mounted respectively to stop the rotation of either or both of the rollers **4***a* and **4***b* and the groove drum **10** on command of the control circuit on receipt of a signal indicating a break in the thread. A two stage actuator **19** such as a double winding solenoid with magnet core is mounted generally perpendicular to the long arm of the bell crank **16** and is connected to it by a bolt and pin **39.** The actuator is adapted to move the lever **16** and to hold it securely against the roller **4a** so that both the rollers **4***a* and **4***b* come free of the driving roller **5** simultaneously. Both rollers **4***a* and **4***b* are stopped by braking means **17.** This stops the movement of the thread **3** and maintains a length of the thread hanging below the rollers **4***a* and **4***b*. The movement of the lever **16** by the actuator **19** is limited by a micro-switch **38** or the like arranged at a predetermined distance from the edge of the lever **16.** In stopping the rollers and the grooved drum **10** the dancer roller and arm **11** acts to maintain a sufficient length of thread in reserve.

Simultaneously with the stopping of the thread movement, the control circuit **20** causes a normally closed resiliently biased clutch or coupling **25** to open by energizing its solenoid coil **24.** The clutch **25** normally operates the paired feed rollers **26** by which the raw fiber band **27** is fed to the spinning chamber. After a predetermined time delay, the control circuit **20** activates a cutting element **7** which is arranged between the spinning assembly **1** and the rollers **4***a* and **4***b*. The cutting element **7** is mounted at the end of the tube **8** in axial alignment with the thread and may be of conventional construction known to those skilled in the art. The spinning turbine **9** is maintained under vacuum via a conduit **31** extending from a source of vacuum **32** such as a reservoir or air pump. The piece of thread **30** cut by the cutter **7** is thus carried away together with the other fiber particles, pulp, etc. formed in the spinning chamber.

The spinning assembly housing is pivoted at one end **29** and is swung from its other end by a second solenoid or similar actuator **28.** The drive whorls for the spinning turbine **9** and the fiber picker and loosening rollers, generally depicted by the numerals **26** and **33,** extend out of the housing solenoid **28** actuated by a signal from the control circuit **20** so that the housing is pivoted simultaneously with the application of brakes **17** and **18** and the actuation of the first solenoid **19** so that the spinning turbine **9** and the fiber pickers **33** are also disengaged from their drive means.

As soon as the housing pivots under action of actuator **28,** it releases a second micro-switch **36** which causes the control circuit **20** to further activate the actuator **19** to pull the upper arm of bell crank **16** further to the right. This latter movement causes the roller **4***b*, which is of the same diameter as its companion roller **4***a*, to engage the surface of the drive roller **5.** On reaching this position a latch **23** falls behind the upper arm of the lever **16** overcoming the effect of spring **12** and holding the lever **16** in the position where roller **4***b* is rotated by the continuously rotating drive roller **5.** The brakes **17** and **18** are simultaneously released. The rotation of the roller **4***b* is thus reversed and counter to its normal operating direction, i.e.: when roller **4***a* is in contact with the roller **5,** thus causing the completed thread **3** to be pulled downwardly off the spool **21.** This causes the spool **21** to also reverse direction. The slot **39** is of a length that after a latch **23** engages the lever, the actuator **28** may be returned to its forward or original position.

Through the aforedescribed switching process, the thread **3** with its end is moved backwardly through the tube **8** into the spinning chamber without actual reversal of any of the drive means or special operation of the other parts. At the instant the backwardly moving thread **3** passes the photo sensor **2,** a new impulse signal is sent to the control circuit. The control circuit **20** in turn causes the coupling **25** to close, and the solenoid actuator **28** to release the housing all of which places the fiber feed rollers **26,** the picker **33** and the spinning turbine back into action, even while the thread continues to reverse. Simultaneously, an adjustable impulse generator **37** which is driven by the common drive **5** closes and begins producing a series of impulses.

The fiber subsequently fed from the feed rollers **26** is spun, in conventional manner by centrifugal action against the inner wall of the spinning turbine **9,** and is drawn off from the so-called binding or splicing point which is fixed within the general limits on the face of the spinning wall. The constant path and distance over which thread **3** must be returned between the thread sensor **2** and the binding point of the spinning turbine can be derived as a ratio of or a multiple of impulses generated by the impulse generator **37,** which multiple can be predetermined. Thus, after a predetermined number of pulses indicative of the time necessary for

the thread to come back to the binding point and automatically splice itself, the control circuit is caused to energize a magnet **34** which lifts the latch **23** releasing the lever **16,** which for all the preceding time was holding roller **4***b* against the drive roller **5.** On release of lever **16** roller **4***b* is freed allowing the roller **4***a* to return into contact with the drive **5,** thus placing the entire apparatus back into its normal production position. During this entire rebinding or splicing operation, the take up roller **21** slips in reverse direction over the grooved drum **10,** on action of the downwardly moving thread, permitting the dancer arm **11** to pull and maintain adequate reserve yarn.

The operation of the aforementioned device can be further ascertained by reference to Ser. No. 264,527. The device functions in the same manner as was earlier discussed in the introduction to this specification. The disadvantage earlier disclosed exists in that when knitting is initiated or resumed after the removal of the cause of the thread breakage, the wind up spool **21** because of its previous reversal of rotation first slides and then only after the elapse of a period of time reaches its full rotational speed, while simultaneously the take up rollers **4***a* and **4***b* reach their full operating speed practically at once. This condition cannot, however, be eliminated since it is essential in order to arrive at the desired quality of the newly spun thread especially the desired thickness thereof which, of course, depends from the speed of rollers **4***a* and **4***b*. In this manner, during the time it takes for the wind up spool to reach its operating speed, the take up nip rollers **4**a and **4**b produce an excess of thread which is fed somewhere between the take up rollers **4***a* and **4***b* on the one hand and the wind up spool **21** on the other hand. This excess thread may become so large that it is only partially taken up and compensated for by the action of the dancer roller reserve lever **11** so that unless additional steps are taken the thread becomes so long that the tension on it falls below the proper and necessary level in order to have correct reeling of the thread on the spool.

In order to overcome this disadvantage the present invention is provided which is shown in the drawings by way of example. As seen in FIG. **1** a hollow chamber **40** is located between the take up nip rollers **4**a and **4**b and the wind up spool **21.** The hollow chamber **40** extends horizontally and is connected by suitable conduit means to the same source of suction **32** used to evacuate the spinning chamber **9.** If desired the hollow chamber **40** can be connected to an independent and remote source of suction. The front end of the tube **40** is cut at an angle so as to lie substantially parallel to the moving thread **3** and forms a mouth **41.** The mouth **41** is preferably extended so as to be close to the thread and therefore the suction would have a continuous influence upon the moving thread **3.** Thus, as the tension on the running thread **3** falls below a predetermined level determined by the degree of suction in the hollow tube **40,** the excess thread would be sucked into the tube **40** in the form of a continuous loop **42.** The decreased tension on the thread would of course occur during the time after resumption of spinning and before the wind up spool reaches its full operating speed. When, however, the wind up spool **21** reaches its full operating speed which as noted earlier is only slightly higher than that of the take up nip rollers **4***a* and **4***b*, which withdraw the thread **3** from the spinning chamber, this slightly higher speed leads to a slightly increased tension which is sufficient to slowly but continuously withdraw the loop **42** and the excess length of thread from the hollow chamber **40** thus allowing the excess length temporarily stored in the chamber **40** to be slowly reeled onto the spool **21.** The length of the loop **42** is continuously reduced over the period of time until the thread **3** is again withdrawn in a straight line between the rollers **4***a* and **4***b* and the dancer roll **11.** Similarly, the existence of the continuous suction in the chamber **40** permits the thread to be drawn into the loop **42** over a continuous period of time thus building the loop **42** slowly, avoiding any ravelling or knotting of the thread.

In FIG. **2** a modification of the apparatus is shown in somewhat more schematic form although the same reference numerals are used for the apparatus as are shown in FIG. **1.** It will be seen from FIG. **2** that the hollow chamber is positioned opposite to the take up rollers **4***a* and **4***b* along the contact line of these rollers and is provided with a flaring outwardly directed funnel-shaped mouth **41.** Otherwise the apparatus acts and operates in a similar manner to that as described with regard to FIG. **1.**

Preferably, the chamber **40** in either case is formed of a tubular member which may extend to the source of suction **32** or it may be connected at its rearmost end with suitable conduit means connected thereto. The nozzle **41** at the front end of the tube is preferably made integrally with the tube although it may be formed of a separate member connected to it. The source of suction is provided with suitable valve means to control the speed of the air in the tube so that the suction at the mouth **41** will cause deflection of the thread **3** into the chamber **40** only when the tension of the thread **3** falls below a certain level. The valve means may be provided along the tube since the vacuum provided by the source of suction normally is predetermined by other requirements of the spinning machine. The air speed in the tube and especially at the nozzle **41** thereof is adjusted so that with a given material for the thread and with predetermined other properties thereof, e.g. the thickness, the degree of twisting etc., the air speed is always high enough to tautly retain the loop in the tube as long as the normal working tension of the thread between the take up rollers and the wind up spool **21** has not yet been reached. During this period any curling of the loop must be prevented. Alternatively instead of valve means there might be used interchangable tubes in order to meet the specific requirements encountered with various types of threads. Suitable air speeds are higher than 5 meters per sec and preferably higher than 25 meters per sec.

It will be seen from the foregoing that the present invention provides suitable and very effective means for temporarily storing excess thread upon the initiational resumption of spinning in a spindleless spinning machine. Various changes and modifications will be obvious to those skilled in the art and accordingly the present disclosure is intended to be illustrative only of the present invention and not limiting of it.

Preferably the valve means are designed such that any air stream through the tube may be blocked off during normal operation of the spinning machine. This is also valid in cases where interchangable tubes are used. In this latter case separate valve means may be

provided for blocking off the air suction in the tube when no air stream is required.

What is claimed:

1. Apparatus for temporarily storing excess lengths of thread formed on the turbine of a spindleless spinning machine for subsequent winding on a spool, comprising a hollow chamber located between the turbine and the spool having an opening located adjacent the path of the thread, a source of suction connected to said chamber, the magnitude of said suction being selected so that when the tension on said thread falls below a predetermined value, the thread is caused to be drawn as a loop into said chamber.

2. The apparatus according to claim **1** wherein the hollow chamber comprises an open end tube connected at one end to the source of suction and having a nozzle at its other end located adjacent the thread.

3. The apparatus according to claim **2** wherein the nozzle is formed integrally with said tube.

4. The apparatus according to claim **1** including take up means arranged to withdraw the thread from said turbine and wherein said nozzle is located between said take up means and said winding spool.

5. The apparatus according to claim **4** wherein said take up means comprises a pair of contacting nip rollers, said nozzle being arranged facing said rollers and lying along the line of contact thereof.

6. The apparatus according to claim **1** wherein said source of suction is identical with the source of suction for evacuating the turbine of said spinning machine.

7. The apparatus according to claim **2** wherein between the source of suction and the nozzle of the tube there are provided valve means for adjusting the suction and the air speed in the tube in compliance with the characteristics of the thread spun.

8. The apparatus according to claim **2** wherein at least one of the tube and the nozzle are exchangable for adjusting the suction and the air speed in the tube in compliance with the characteristics of the thread spun.

9. The apparatus according to claim **8,** characterized in that valve means are provided for completely disconnecting the tube from the source of suction during normal operation of the spinning machine.

* * * * *

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 3,842,579

DATED : October 22, 1974

INVENTOR(S) : GERHARD BARTLING

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

On the cover sheet should be inserted --

FOREIGN APPLICATION PRIORITY DATA

April 29, 1972 Germany P 22 21 316.7-26 --.

Signed and Sealed this

second Day of *September 1975*

[SEAL]

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents and Trademarks