July 15, 1969 S. R. MAKEHAM ET AL 3,455,095

SPINNING OF TEXTILE YARNS

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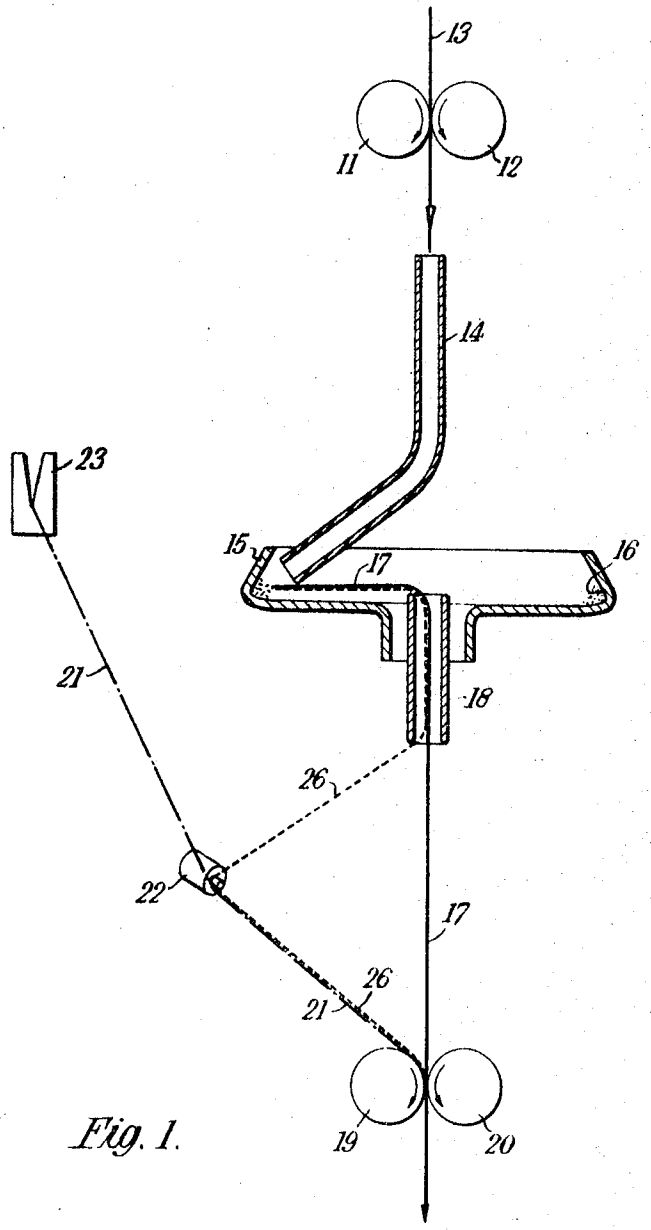


Fig. 1.

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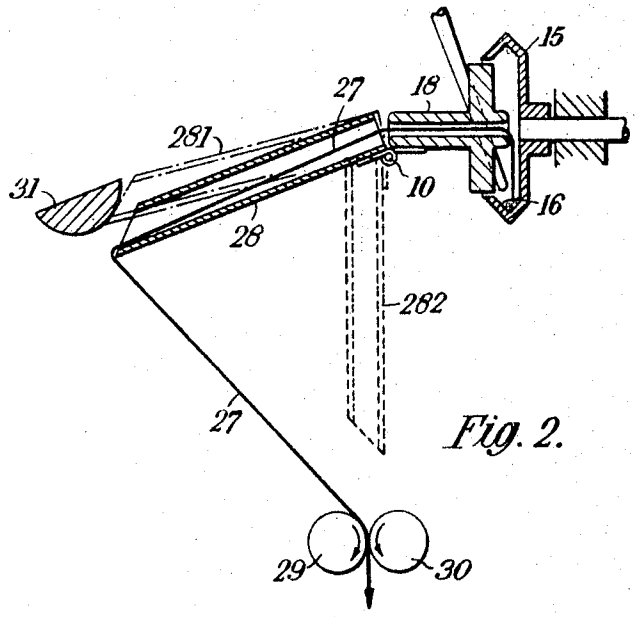


Fig. 2.

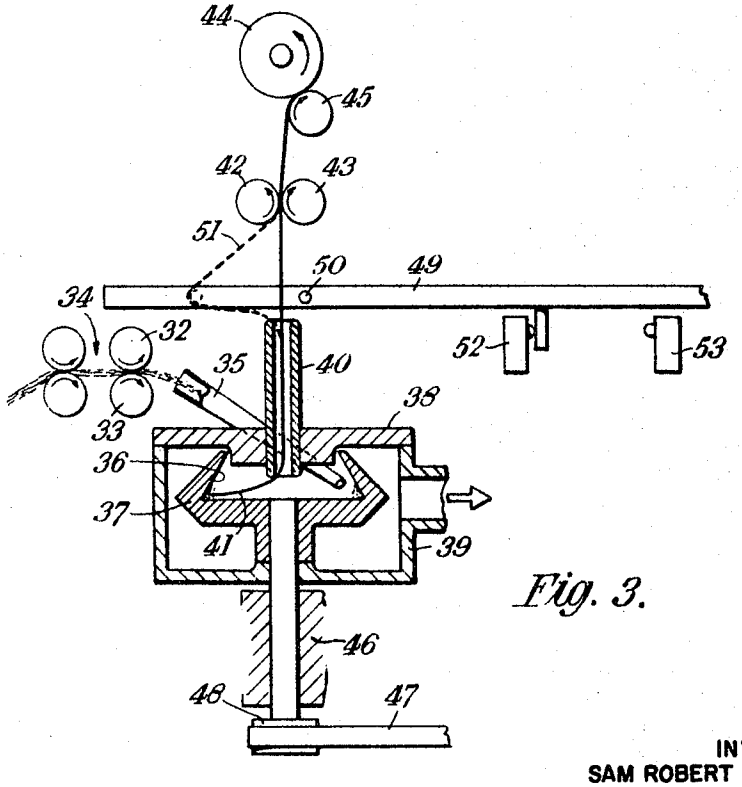


Fig. 3.

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SPINNING OF TEXTILE YARNS

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ABSTRACT OF THE DISCLOSURE

This invention is directed to a method and apparatus for piercing-up yarn end-breakages, as well as yarn ends resulting from the commencement of spinning operations, in the open-end spinning of textile yarns.

The present invention relates to open-end spinning and particularly to piecing up following thread breakage in open-end spinning. In this specification, by open-end spinning is meant the spinning of fibres into a twisted yarn by feeding the fibres in discrete manner to a fibre-collecting surface continuously removing them from the surface to form a twisted yarn and passing the twisted yarn to a take-up package.

Many systems of open-end spinning have been proposed but difficulty has been experienced with all of them when attempting to piece up following yarn breakage or when starting up the machine. In open-end spinning machines of the type employing a rotary fibre-collecting chamber, it is customary to use a seed yarn, that is to say, a length of yarn used in the threading operation but not forming part of the yarn wound on to the package. The seed yarn is introduced into the rotating chamber until the end picks up fibres from the collecting surface, and is then withdrawn. When the withdrawn yarn is sufficiently clear of the rotating chamber, the seed yarn is discarded and the newly formed yarn is passed through the delivery rollers to the take-up package where it must be knotted or otherwise secured to the yarn on the package. This operation has to be repeated each time there is a thread break and is found to be very time consuming.

An object of the present invention is to provide an improved method of piecing up in open-end spinning in which an end of yarn attached to the take-up package can be used to start or resume the spinning operation and in which the end of yarn pieced up is acceptable for delivery to the take-up package.

According to the present invention, there is provided a method of piecing up following an end breakage or upon starting spinning in the open-end spinning of textile yarns, comprising the steps of resuming or commencing the fibre feed, arranging for an end of spun yarn attached to the take-up means to follow an extended path between the fibre-collecting surface and the take-up means which can be shortened and for the end of yarn to terminate at a position in which it can be fed back by a self-threading movement to the fibre-collecting surface, shortening the extended path of said yarn to allow the end of yarn to contact and twist in fibres on the collecting surface, and drawing off the continuous length of yarn produced.

Three embodiments of the invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a schematic diagram of apparatus for carrying out a method of piecing up in open-end spinning according to a first embodiment of the invention, with parts of the apparatus shown in section,

FIG. 2 is a schematic diagram of apparatus for carrying out a method of piecing up in open-end spinning according to a second embodiment of the invention, with parts of the apparatus shown in section, and

FIG. 3 is a schematic diagram of apparatus for carrying out a method of piecing up in open-end spinning according to a third embodiment of the invention, with parts of the apparatus shown in section.

With reference first to FIG. 1, feed rollers **11** and **12** are arranged to fed a sliver **13** of fibrous material through a feed tube **14** to a spinning rotor **15** having a fibre-collecting surface **16**, the fibres issuing from the feed tube **14** in more or less discrete fashion and being deposited on the fibre-collecting surface **16**.

Yarn is formed from twisted fibres picked up from the collecting surface **16** and passes, as shown by full line **17**, out of the spinning rotor **15** along an axial delivery tube **18** and in normal operation passes in a straight line to delivery rollers **19** and **20** from which it may be collected on a cheese or cone in well-known manner.

When an end breakage occurs the feed rollers **11** and **12** and delivery rollers **19** and **20** are stopped but the spinning rotor **15** continues to rotate at normal speed. The end of broken yarn **17** extending to the package is found and passed, as shown by chain-dot line **21**, from the delivery rollers **19** and **20** via a yarn guide **22** to a cutting device **23**, where it is cut, the cutting device **23** being so positioned as to cut the yarn to a predetermined length. The cut yarn is then passed further around the yarn guide **22**, which is offset from the axis of the delivery tube **18**, and introduced as shown by broken line **26** through the delivery tube **18** into the spinning rotor **15** so that the yarn follows an extended path between the fibre-collecting surface **16** and the delivery rollers **19** and **20**, with the end of the yarn lying adjacent to but not touching the fibre collecting surface **16**.

The operation of piecing is then automatically performed by starting the feed rollers **11** and **12** and the delivery rollers **19** and **20** so that fibres are delivered to the collecting surface **16** and the yarn released from the guide **22** by the pull exerted on it by the delivery rollers, the release of the yarn causing a reduction in the length of the yarn path and allowing the end of yarn first to be drawn back by suction in the rotor into contact with the fibres on the collecting surface **16**, and then to be withdrawn from the spinning rotor **15** by the delivery rollers **19** and **20** in a continuous manner, whereby yarn is again wound on to the package (not shown) without any knots or other piecing being necessary.

With reference now to FIG. 2, in the second embodiment of the invention provision is made for automatically restarting the spinning operation after yarn breakage, or when the machine has been stopped. When the yarn breaks, or is detached from the fibre-collecting surface due to machine stoppage, the yarn being formed is automatically held by any suitable gripping means to prevent further withdrawal thereof.

More specifically, the yarn **27** being formed in the spinning rotor **15** of FIG. 2 passes through the delivery tube **18** and then through a pivoted guide tube **28** arranged in end-to-end relation with the delivery tube and mounted at its end adjacent the delivery tube for pivotal movement on a pivot pin **10** extending at right angles to the axis of the delivery tube **18**. The yarn on leaving the guide tube **28** is taken up by a pair of take-up rollers **29** and **30** and the arrangement is such that in normal operation the yarn **27** is caused by the guide tube **28** to follow an extended path between the end of the delivery tube **18** and the take-up rollers **29** and **30**.

When the yarn 27 becomes detached from the fibre-collecting surface 16 of the rotor 15 by end breakage, the consequent reduction in tension is automatically detected by yarn tension detector means of known form, which in response to the reduction in tension automatically stops the take-up rollers 29 and 30 and causes the guide tube 28 to pivot to a position shown by chain-dot lines 281 to trap the yarn against a contacting surface of a stop 31 to prevent further withdrawal of the yarn 27.

On restarting the machine, the guide tube 28 is pivoted to a vertical position, shown by the broken line 282 in FIG. 2, which shortens the yarn path between the rotor delivery tube 18 and the take-up rollers 29 and 30, and the take-up rollers 29 and 30 are restarted, the arrangement being such that the end of the yarn 27 is first fed back into the spinnnig chamber 15 by the shortening of the yarn path so that the end contacts and picks up fibres from the fibre-collecting surface and is then withdrawn continuously by the take-up rollers 29 and 30. Spinning is thus resumed and whilst the yarn 27 is being drawn off by the take-up rollers 29 and 30 the guide tube 28 is gradually moved back to the normal spinning position shown in full line in FIG. 2, in which it causes the yarn to follow the extended path, thereby providing a reserve of yarn ready for use in a subsequent piecing operation.

In the third embodiment of the invention illustrated in FIG. 3, fibres from the delivery rollers 32 and 33 of a drafting system 34 are fed to the inlet end of a fibre feed tube 35 down which they are drawn in an airstream and deposited in the form of a ring of fibres under the action of centrifugal force on a fibre-collecting inner surface 36 of a hollow spinning rotor 37 arranged for rotation about a vertical axis. The rotor 37 has an open uppermost end which is partially closed by a cover plate 38 which also serves as a cover plate for a housing 39 within which the rotor 37 is mounted. The cover plate 38 is arranged to receive the fibre feed tube 35 which passes through it and which terminates at a position close to the fibre-collecting inner surface 36 of the rotor 37. The cover plate 38 is, in addition, formed with a central opening into which is fitted a vertically arranged yarn delivery tube 40 through which the formed yarn 41 from the rotor 37 is continuously passed upwardly and out of the rotor 37 and the housing 39. The yarn 41 is withdrawn from the yarn delivery tube 40 by a pair of yarn delivery rollers 42 and 43 mounted above the tube 40 and the yarn 41 is passed by these rollers to a yarn package 44 upon which it is wound with the aid of a take-up drum 45. The rotor 37 is carried by a shaft rotatably mounted in a bearing housing 46 and arranged to be driven by a belt drive comprising a driving belt 47 and a belt pulley 48.

A horizontally arranged longitudinally displaceable traverse bar 49 is provided behind the yarn 41 in its path from the upper end of the yarn delivery tube 40 to the yarn delivery rollers 42 and 43 and carries a forwardly projecting yarn-engaging pin 50 adapted to engage the yarn 41 when the traverse bar 49 is longitudinally displaced causing the yarn 41 between the yarn delivery tube 40 and the yarn delivery rollers 42 and 43 to follow an extended path, as shown by broken line 51, round the pin 50.

When the yarn 41 becomes detached from the fibre-collecting surface 36 of the rotor 37 by machine stoppage control means initiated by the machine stoppage causes the stopping almost instantaneously of the delivery rollers 32 and 33 of the drafting system 34, the yarn delivery rollers 42 and 43, the take-up drum 45 and the yarn package 44, machine brakes being employed if necessary. In addition, an electric motor (not shown) driving the spinning rotor 37 is switched off so that the spinning rotor slows down gradually. After a predetermined time delay, a secondary drive is started which causes longitudinal displacement of the traverse bar 49 causing the yarn engaging pin 50 to engage the yarn 41 between the yarn delivery tube 40 and the yarn delivery rollers 42 and 43 and displace it so that it follows the extended path round the pin 50. By increasing the yarn path, the tail-end of yarn 41 continues to be withdrawn from the rotor 37 at a reduced rate. This action, in conjunction with the rotation of the rotor 37 at the gradually reducing speed, enables the ring of fibres remaining in the rotor to be spun into the tail-end of yarn so that all the remaining fibres are taken off the collecting surface of the rotor. The length of traverse of the traverse bar 49 is so set that all the fibres are removed from the collecting surface whilst the final yarn end remains within the length of the yarn delivery tube 40 or is still protruding from the end of the tube but clear of the rotor.

The conveying airstream in the fibre feed tube 35 is generated by connecting a suction pump to the rotor housing 39 and in bringing the machine to rest the pump is finally switched off after a predetermined time interval when the spinning rotor 37 also comes to rest or is automatically braked.

It will usually be found that the drive to the spinning rotor 37 may be switched off at the same time as the other parts of the machine as the residual rotation of the rotor 37 due to its momentum will usually be sufficient to twist up the remaining fibres into the tail end of yarn.

When restarting the machine the suction pump is first switched on and the spinning rotor 37 then restarted. The delivery rollers 32 and 33 of the drafting system which feed fibres to the inlet to the fibre feed tube 35 are then restarted and either at the same time or after a predetermined time delay the traverse bar 49 is caused to commence its return stroke. As the traverse bar 49 returns, the yarn path between the yarn delivery tube 40 and the yarn delivery rollers 42 and 43 shortens and as a result the tail end of yarn lying in the delivery tube 40 is fed back into the spinning rotor 37 and comes into contact with the newly formed fibre ring on the fiber-collecting surface 36 of the rotor 37. As soon as the traverse bar 49 reaches the end of its return stroke, the yarn delivery rollers 42 and 43, take-up drum 45 and yarn package 44 are restarted and the spinning of new yarn commenced. The movement of the traverse bar 49 may be employed to control the operation of parts of the machine and in the embodiment of the invention shown in FIG. 3 as the bar 49 commences its return stroke it operates a microswitch 52 which causes the delivery rollers 32 and 33 of the drafting system to start up and upon completion of the return stroke operates a second microswitch 53 for starting up the yarn delivery rollers 42 and 43, the take-up drum 45 and take-up package 44. In addition, the switches 52 and 53 are employed to control the extent of traverse movement of the traverse bar 49.

The delivery rollers 32 and 33 of the drafting system are operated at high speed and it may be preferable to arrange for these rollers to start up before the traverse bar 49 commences its return stroke.

We claim:

1. A method for piecing-up yarn end-breakages and yarn ends resulting from the commencement of spinning in the open-end spinning of textile yarns, which comprises effecting continuous feeding of a fibre to a fiber-collecting surface, passing spun yarn formed from twisted fibres on said fiber-collecting surface to a yarn take-up position, passing an end of spun yarn from said yarn take-up position upon arrestment of the same along an extended yarn path towards said fibre-collecting surface, cutting said ended yarn in its extended yarn path to a predetermined length to provide for termination of the same at a point spaced adjacent to said fibre-collecting surface, shortening the extended path of said cut yarn to permit the same to contact and twist in the fibres carried on said fibre-collecting surface, and drawing off the continuous length of yarn produced.

2. A method for piecing-up yarn end-breakages and yarn ends resulting from the commencement of spinning in the open-end spinning of textile yarns, which comprises

effecting continuous feeding of a fibre to a fiber-collecting surface, passing spun yarn formed from twisted fibres on said fibre-collecting surface to a yarn take-up position, arresting the fibre feed at said yarn take-up position while continuing the production and withdrawal of yarn at said fibre-collecting surface, passing an end of spun yarn form said yarn take-up position upon arrestment of the same along an extended yarn path towards said fibre-collecting surface, cutting said ended yarn in its extended yarn path to a predetermined length to provide for termination of the same at a point spaced adjacent to said fibre-collecting surface, shortening the extended path of said cut yarn to permit self-threading feed-back of the same to said fibre-collecting surface, and drawing off the continuous length of yarn produced.

3. The method as claimed in claim 2, wherein the yarn extending between the fibre-collecting surface and the take-up position is caused gradually to take-up said extended yarn path during normal spinning, and further including the step of trapping said end of yarn upon arrest of said take-up position so that said end of yarn remains in a position in which it can be fed back by said self-threading movement to the fibre-collecting surface.

4. Apparatus for piecing-up yarn end-breakages and yarn ends resulting from the commencement of spinning in the open-end spinning of textile yarns, which comprises a rotating fibre-collecting surface adapted to receive fibres and to pass spun yarn formed from twisted fibres thereon, a source of fibres and means for supplying fibres therefrom on a continuous basis to said fibre-collecting surface, a movable yarn take-up mechanism mounted to receive spun yarn from said fibre-collecting surface, a yarn guide mounted at a point offset from the path of movement of said yarn from said fibre-collecting surface to said yarn take-up mechanism during normal spinning, means for arresting movement of said yarn take-up mechanism upon interruption of the yarn feed, a cutting device mounted adjacent to said yarn take-up mechanism and operative to cut said yarn to a predetermined length upon arrestment of said yarn take-up mechanism, and feed means mounted on said fibre-collecting surface operative upon arrestment of said take-up mechanism and operation of said cutting device for feeding a cut end of yarn in an extended path around said yarn guide and back towards said fibre-collecting surface to a point spaced adjacent to said fibre-collecting surface.

5. Apparatus for piecing-up yarn end-breakages and yarn ends resulting from the commencement of spinning in the open-end spinning of textile yarns, which comprises a rotating fibre-collecting surface adapted to receive fibres and to pass spun yarn formed from twisted fibres thereon, a source of fibres and means for supplying fibres therefrom on a continuous basis to said fibre-collecting surface, a movable yarn take-up mechanism mounted to receive spun yarn from said fibre-collecting surface, an elongated yarn guide mounted at a point offset from the path of movement of said yarn from said fibre-collecting surface to said yarn take-up mechanism during normal spinning, said yarn guide being movable between a first position in which said yarn follows an extended path to said take-up mechanism and a second position in which said yarn follows a shortened path to said take-up mechanism, means for arresting movement of said yarn take-up mechanism upon an end-breakage of said yarn, said yarn guide being operative upon arrested movement of said take-up mechanism to take up a third position, and an element cooperating with said yarn guide upon arrest of said take-up mechanism to trap the yarn and prevent further withdrawal of the same from said fibre-collecting surface.

6. The apparatus as claimed in claim 4 wherein said yarn guide is mounted in a position in relation to said yarn take-up means to support the end of yarn in its extended path such that when operation of the yarn take-up mechanism is resumed the pull exerted on said yarn causes release of said yarn from said yarn guide and shortening of said extended yarn path to said yarn take-up mechanism.

7. The apparatus as claimed in claim 6, wherein said yarn guide is mounted in a position in relation to said cutting device such that the end of yarn being cut to said predetermined length by said cutting device is passed in contact with said yarn guide, thereby facilitating the subsequent passage of said yarn around said guide and into said fibre-collecting surface.

8. The apparatus as claimed in claim 5, wherein said elongated yarn guide comprises a tube through which said yarn passes, said tube being pivotally mounted at the yarn entry end thereof.

9. The apparatus as claimed in claim 4, that further comprises yarn diverting means mounted behind the yarn in its path from the fibre-collecting surface to the yarn take-up mechanism for diverting the yarn in its passage from the fibre-collecting surface to the yarn take-up mechanism so that said yarn follows said extended path, and control means initiated on machine stoppage to stop said fibre feed to said fibre-collecting surface, to arrest the yarn take-up mechanism and to actuate said yarn diverting means such that fibres in said fibre-collecting surface are spun into the tail end of yarn and removed from said fibre collecting surface, while the final yarn end remains at a position permitting it to be fed back by a self-threading movement to said fibre-collecting surface.

10. The apparatus as claimed in claim 9, wherein said yarn diverting means comprises a longitudinally displaceable traverse bar positioned behind the yarn in its path from the fibre-collecting surface to the yarn take-up mechanism and provided with a yarn-engaging member adapted to engage the yarn when the traverse bar is longitudinally displaced to cause the yarn between said fibre-collecting surface and said yarn take-up mechanism to follow an extended path around said yarn-engaging member.

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