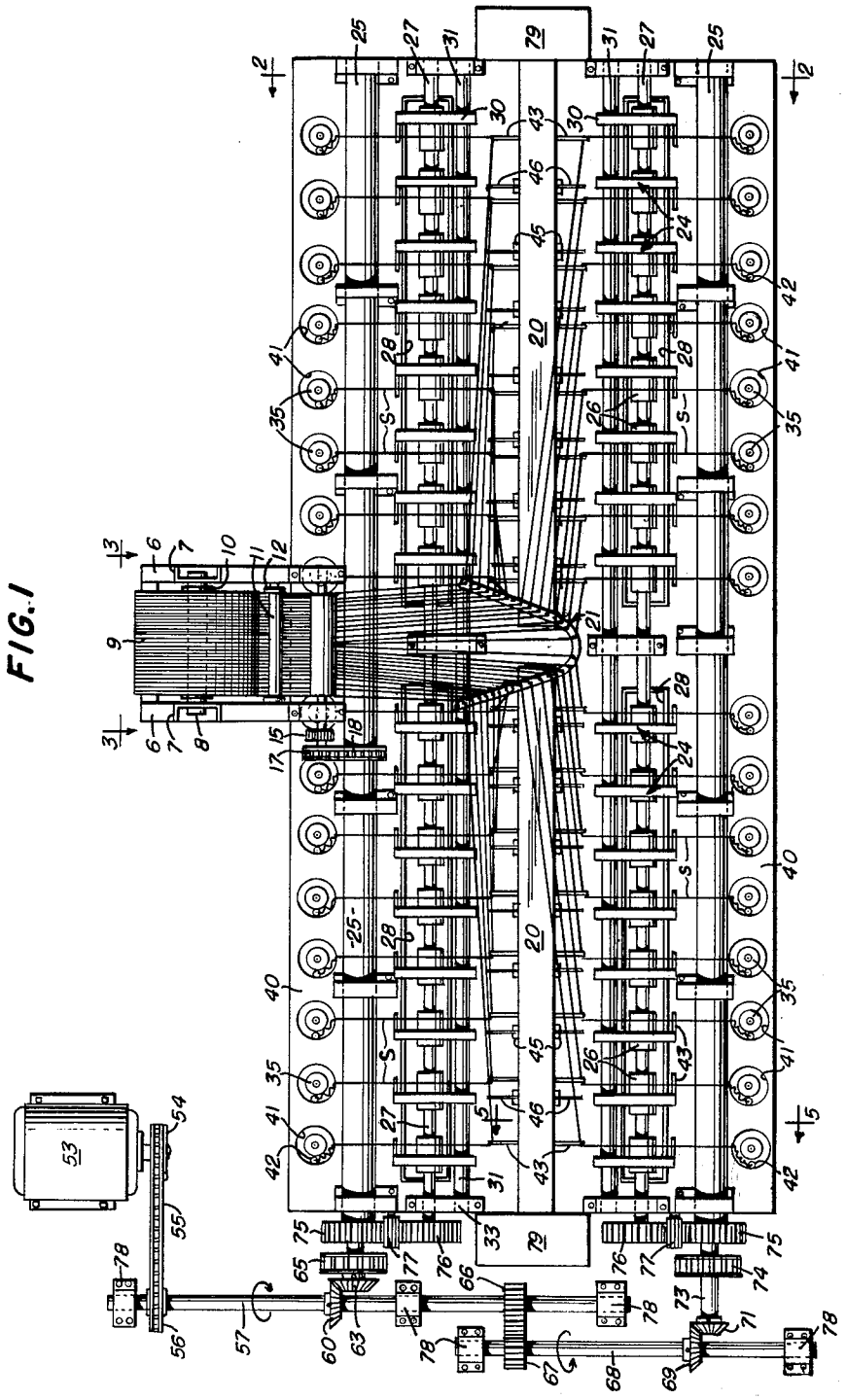
May 5, 1964 R. C. GOURLEY 3,131,527

MACHINE AND METHOD FOR MAKING PAPER YARN

Filed May 14, 1962 3 Sheets-Sheet 1

FIG. 1



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MACHINE AND METHOD FOR MAKING PAPER YARN

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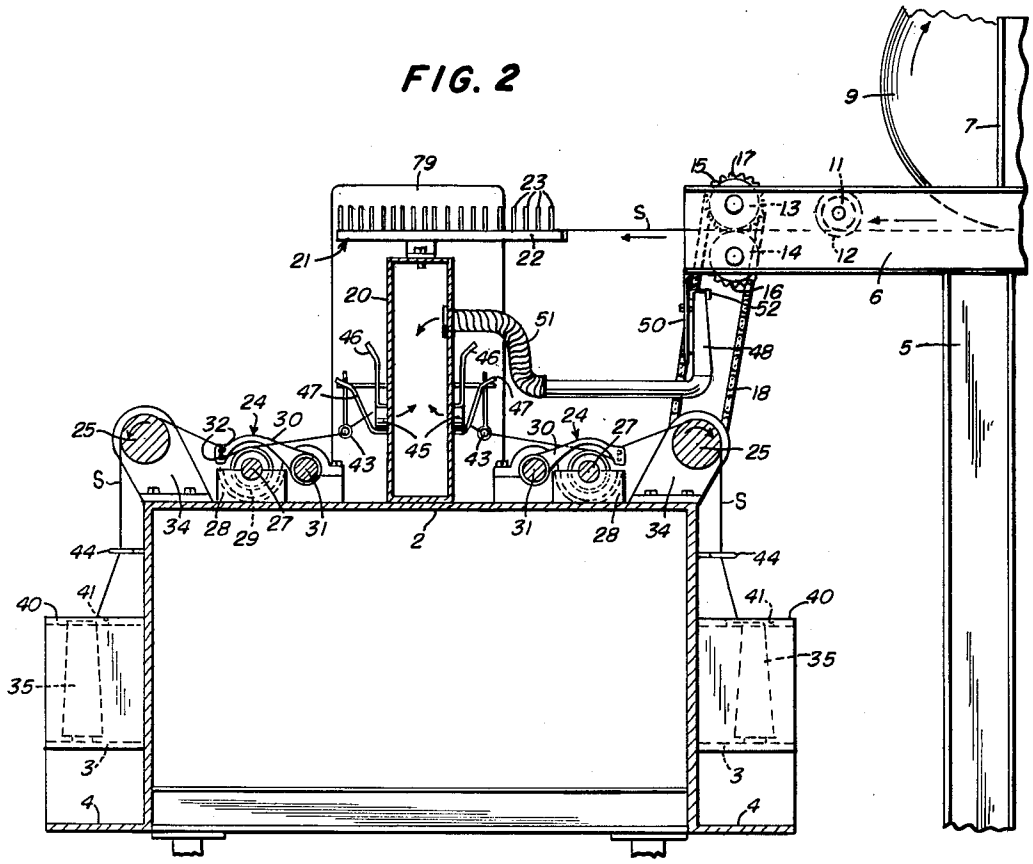
FIG. 2



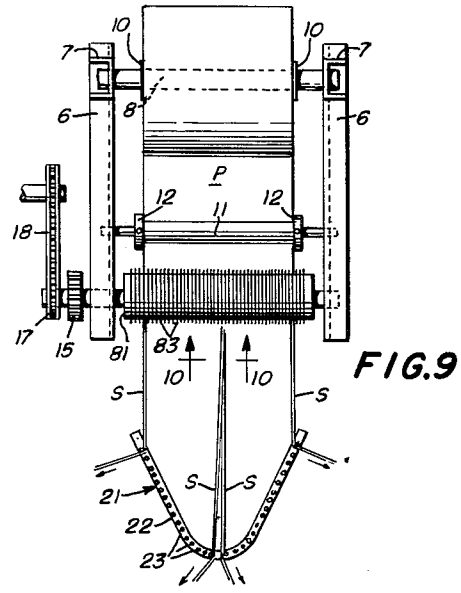


FIG. 9

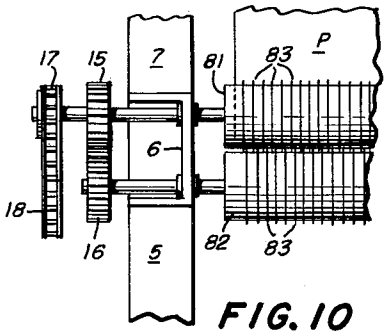


FIG. 10

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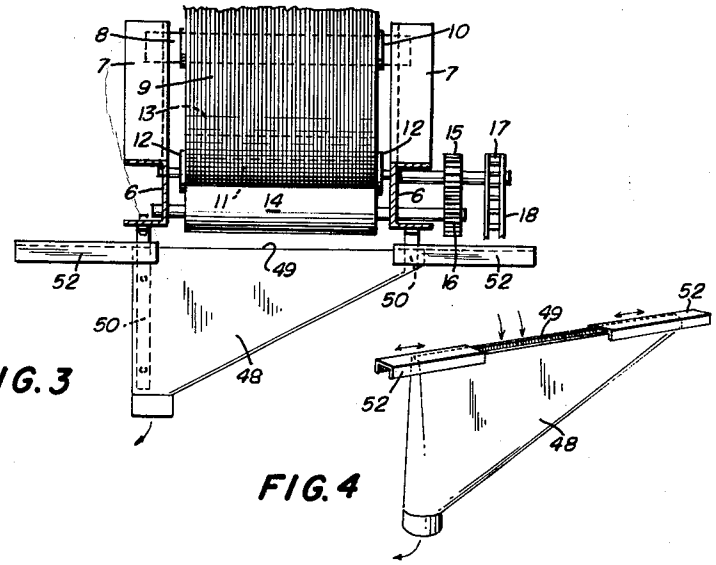

FIG. 3

FIG. 4

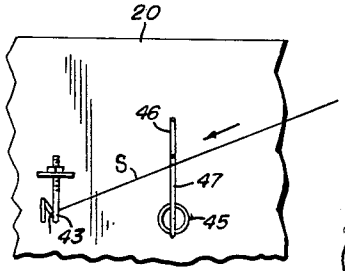

FIG. 6

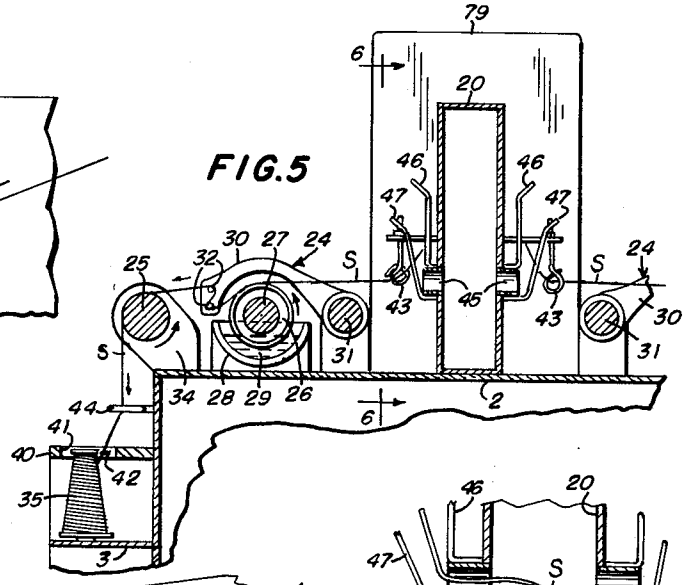

FIG. 5

FIG. 8

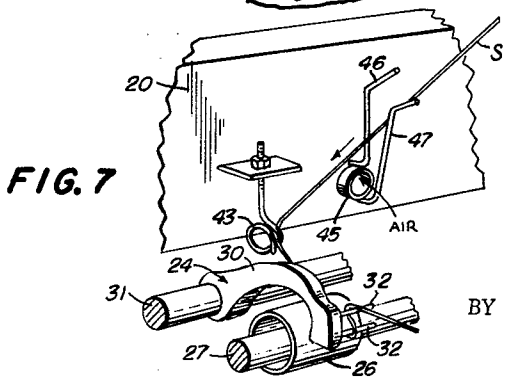

FIG. 7

INVENTOR

BY

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United States Patent Office 3,131,527 Patented May 5, 1964

3,131,527

MACHINE AND METHOD FOR MAKING PAPER YARN

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Filed May 14, 1962, Ser. No. 194,588
20 Claims. (Cl. 57—32)

This invention relates to machines and methods for converting lengths of paper into paper yarn by wet twisting, and also relates to an end collection system for textile machines.

Numerous machines and methods have heretofore been known for converting paper in strip form or wide web form into paper yarns suitable for use in making a variety of textile articles. These prior machines and methods were critically limited in the size of yarn which they were capable of producing and attempts to produce fine, light-weight paper yarns have heretofore met with failure or very limited success. For example, the finest and lightest weight paper yarn made by one previous machine and method was a number 5 yarn (jute count). One reason for these critical limitations on prior machines and methods is the low strength of paper strips when the width and thickness of said strips is reduced. As a result, the coarse paper yarns produced by the prior art are limited in use to the manufacture of articles wherein suppleness, soft hand, and lightness of weight are not important considerations.

Therefore, an object of this invention is to provide novel machines and methods for producing fine, light-weight yarn which novel machines and methods are not characterized by the above-mentioned limitations of prior machines and methods.

A further object is the provision of novel machines and methods capable of producing paper yarns of a quality suitable for use in the manufacture of fabrics having greatly improved suppleness, considerably softer hand, and of much lighter weight than paper fabrics made from paper yarns produced by prior machines and methods.

Another object of this invention is the provision of novel machines and methods which are capable of producing paper yarns which are easily handled and more readily converted into fabrics by weaving, knitting or other means of fabrication.

A further object is the provision of novel machines and methods which are capable of producing fine, light-weight paper yarns useful for knitting into fabrics suitable for backing vinyl plastic film, conversion into wearing apparel, and other uses of similar character.

A further object is the provision of a novel end collection system for textile machines.

Further objects and advantages are apparent from the following detailed description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a plan view of the novel machine;

FIG. 2 is a sectional elevation on a somewhat enlarged scale taken on line 2—2 of FIG. 1;

FIG. 3 is a somewhat enlarged sectional view taken on line 3—3 of FIG. 1;

FIG. 4 is a perspective view of the suction device located adjacent the paper strip supply;

FIG. 5 is a somewhat enlarged sectional view taken on line 5—5 of FIG. 1;

FIG. 6 is a sectional view in partial cutaway on line 6—6 of FIG. 5;

FIG. 7 is an enlarged partial perspective view of the suction means, strip guide means, and moistening means of the machine of this invention;

FIG. 8 is an enlarged partial sectional view of the suction chamber, associated aperture, and guide wires of the

novel machine illustrating the disposition of a severed strip in relation thereto;

FIG. 9 is a partial plan view showing an alternate embodiment of supply means of the novel machine; and

FIG. 10 is a partial sectional view of the slitting mechanism taken on line 10—10 of FIG. 9.

The machine of the present invention comprises a supply means for continuously supplying long strips of paper; moistening means for applying liquid to each of said strips; suction means for applying suction to each of said strips as they extend from said supply means to said moistening means; and twisting means for individually twisting each strip into paper yarn. It is convenient to employ a twister which, in addition to twisting the paper strips into yarns, also winds said yarns on bobbins. Furthermore, it is preferred to employ a spreader between the supply means and the moistening means for the purpose of spreading said strips one from each other. A single drive source is also conveniently employed and is preferred in order to easily permit synchronization of function of the various components of the novel machine.

Referring now to FIGS. 1 and 2, there is shown a frame 1, comprising a long, inverted, U-shaped table 2, having horizontal shelves 3 and 4 extending outwardly along each lower side thereof and a pair of parallel, spaced upright members 5 laterally offset from said table at the center thereof and a pair of horizontal arms 6 connected at the upper end of said upright members and extending in a direction over the central portion of the table 2. A pair of standards 7 are mounted on the arms 6 and an axle 8 is rotatably mounted on the standards 7 and extends therebetween. A plurality of rolls 9 of thin strips S of paper are mounted on the axle 9 and are spaced from said standards 7 by washers 10. A guide roller 11 is rotatably mounted on the arms 6 between the standards 7 and the free ends of said arms and extends between said arms. Guide flanges 12 are fixed to the guide roller 11 adjacent the ends thereof to restrict lateral displacement of paper strips S as they come off the rolls 9 and pass to the spreader 21. At the free ends of arms 6 are rotatably mounted an upper feed roll 13 and a lower feed roll 14, the axes of said feed rolls being in spaced vertical relationship to each other. An upper feed roll drive gear 15 is keyed to one end of the upper feed roll 13 and a lower feed roll drive gear 16 is keyed to the corresponding end of the lower feed roll 14 and driveably engages with the upper feed roll drive gear 15. A sprocket wheel 17 is also keyed to the upper feed roll 13 at one end thereof and is driven by means of a chain and sprocket system 18. The feed rolls 13 and 14 are not critically necessary for the efficient operation of the machine of the present invention as illustrated in FIG. 1.

On the upper portions of table 2, longitudinally along the center thereof, there are mounted, in end-to-end relationship, a pair of vacuum conduits or chambers 20, which will be more fully described hereinafter. On the top of the abutting end portions of the vacuum chambers 20 is mounted a comb or spreader 21 which has the shape of a horizontal V 22 having a rounded trough and comprises upright tines 23 fixedly mounted in spaced relationship on the upper face of the V 22 from one end thereof to the other. The strips S of paper pass from the rolls 8 over the V 22 with a single strip S between two adjacent tines 23 thereby separating the strips S one from the other.

Longitudinally along the upper face of table 2, two banks of moistening means 24 and strip contacting shafts 25 are mounted, on bank one each side of the vacuum chambers 20. Each moistening means 24 comprises a strip contacting drum 26 keyed to a drum shaft 27 for each bank. Liquid tanks 28 containing a liquid 29 are mounted on the upper surface of table 2 under the strip

contacting drums 26 and in sufficiently close proximity thereto that the lower portions of said strip contacting drums are immersed in the liquid 29 contained by the tanks 28. Each moistening means 24 also comprises a strip guide arm 30 which is pivotally mounted on a common guide arm shaft 31 for each bank, which shafts 31 are mounted on the upper surface of table 2. The outer ends of the guide arms 30 mount guide pins 32 around which the paper strips S are guided. Pins 32 also wipe the excess liquid from the paper strips. As many paper strips S are provided from the rolls 9 as there are sets of moistening means 24, each comprising a strip contacting drum 26; a strip guide arm 30; and associated guide pins 32. Each strip contacting shaft 25 and each drum shaft 27 are journaled at each end by suitable bearings 33 mounted at each end of the upper surface of table 2. Each strip contacting shaft 25 is rotatably supported by intermediate bearings 34 along the lengths thereof.

The frame 1 and the spindles 35 are normally a part of a conventional cotton twister having the usual ring twisting arrangement, bunch builder, tape drives, and the like.

Guide eyes 43 are mounted on the vacuum chambers 20 for guiding each strip S from the spreader 21 to the moistening means 24. Guide eyes 44 are mounted on the vertical sides of table 2 to guide each strip S from the strip contacting shaft 25 to the traveler 42.

The vacuum chambers 20 are provided with apertures 45 along each longitudinal side thereof. Adjacent the upper side of each aperture 45 there is mounted an upper guide wire 46 which extends upwardly and then outwardly from said aperture. Adjacent the lower end of said aperture is mounted a lower guide wire 47 extending outwardly and upwardly from said aperture.

A triangular-shaped vacuum box 48, having an open upper end 49, is mounted on brackets 50 fixed to the horizontal arms 6. The vacuum box 48 is connected at its lower end by means of a vacuum hose 51 to a vacuum chamber 20. Adjustable U-shaped channel members 52 are slideably mounted over the upper end 49 of the vacuum box 48. The channel members 52 determine the length of opening of said upper end 49 and are slideable inwardly toward each other to narrow said opening and are slideable away from each other to widen said opening. The vacuum box 48 is so mounted on the brackets 50 that the upper end 49 is positioned adjacent to and below the strips S as they move from the rolls 13 and 14 towards the spreader 21.

Although the particular construction and arrangement of vacuum chambers 20 and vacuum box 48 illustrated in the drawings has been found to be advantageous, any suitable suction or vacuum means for applying vacuum to the strips at one or more points between the supply means and the moistening means can be employed.

The drive means is normally within the confines of the twister frame but has been illustratively shown as comprising an electric motor 53 which turns a sprocket wheel 54 which operatively engages a chain 55 which in turn driveably engages sprocket wheel 56 keyed to a main drive shaft 57. The main drive shaft 57 has mounted thereon a bevel gear 60 which driveably engages a bevel gear 63 mounted on intermediate shaft 64 for said strip contacting shaft 25.

A gear 75 is keyed to each of the strip contacting shafts 25. A gear 76 is mounted on each of the drum shafts 27. Transfer gears 77 are rotatably mounted between each pair of gears 75 and 76 and driveably engage each gear of said pair to transfer rotation from strip contacting shaft 25 to drum shaft 27. All drive shafts are journaled in suitable bearings 78. The driving gears are of such a size as to provide substantially synchronous peripheral speed to the strip contacting shafts 25 and the drums 26.

The source of vacuum for the vacuum conduits or chambers 20 can be of any suitable type. In the embodiment of FIG. 1, the source of vacuum comprises two blowers 79 mounted at each outer end of the vacuum chambers 20. The intake of each blower 79 communicates with the corresponding vacuum chamber 20 to which it is attached such that air is withdrawn from said vacuum chamber by said blower. The blowers 79 are preferably driven independently from the motor 53 inasmuch as no speed synchronization of the blowers is necessary.

In operation, the paper strips S on rolls 9 are threaded under the guide roller 11 between the flanges 12, thence into the nip of feed rolls 13 and 14, and thence to the spreader 21 wherein not more than one strip passes between any single pair of tines 23. The strips S are spaced and separated in one or more directions and are individually threaded through a guide eye 43 in a manner to dispose said strip S between an upper guide wire 46 and a lower guide wire 47 associated with said guide eye 43. Each individual strip S is then passed from the guide eye 43 over its associated strip contacting drum 26 under the lower guide pin 32 and thence in a reverse direction upwardly around the upper portion of upper guide pin 32. The strip S is then passed over the strip contacting shaft 25 and thence downwardly through guide eye 44 to the spindle 35. The liquid tanks 28 are filled with a sufficient quantity of liquid 29, preferably a lubricating and/or sizing liquid, to immerse the lower portions of strip contacting drum 26. After all strips S of paper have been threaded as described above and ultimately fastened to a spindle 35, the blowers 79 are activated to provide a vacuum within chambers 20 and also within the vacuum box 48. The degree of vacuum within the chambers and box is not narrowly critical. Illustratively, pressures within the pressure chambers 20 can be maintained at 4 to 5 inches of water. The motor 53 is energized to drive the strip contacting shafts 25, the drum shafts 27, and the spindles 35. As the paper strips S come off of the rolls 9, they are spaced and separated by the spreader 21, individually guided over separate strip contacting drums 26 where they are individually moistened with liquid 29, then passed over strip contacting shaft 25 and individually through the separate travelers 42 which, in conjunction with its associated guide eye 44, its associated ring 41 on ring rails 40, and its associated spindle 35, twist the strip S into a paper yarn and wind the resulting yarn on the spindle 35 in a conventional twisting operation. In the event that a paper strip S is severed between the roll 9 and the wetting roll 26, the severed portion of the strip S will continue on to the spindle. The free end of the strip S still connected to the roll 9 will continue to be fed and sucked into the vacuum box 48. In the event that the strip S is severed from its roll 9 at any point after it is wet, the severed portion of the strip S will continue to the spindle 35 while the free end of the strip S remaining attached to the roll 9 will be sucked into aperture 45.

In most instances of strip breakage, the strip S breaks at a point between strip contacting shaft 25 and the spindle 35 because of the paper's low wet strength and the increased stresses put onto the strip S during the twisting and winding operation. In such cases, the strip S still remaining attached to the roll 9 is partially sucked into aperture 45 as best shown in FIG. 8 and prevented from falling by gravity or being entangled with other strips S or the associated mechanisms operating on said other strips. The strip S remaining intact with the roll 9 thus remains at least primarily in its original intended path. Sometimes the strip S becomes attached to the strip contacting shaft 25 which then winds it thereon as said strip is fed from the roll 9. In these instances, the chambers 20 serve as a delaying and holding means for holding the free end of a strip S which has been severed from the spindle 35 for a brief interval necessary for the strip contacting shaft 25 to begin the winding of said free end

thereon. As a practical matter, the increased diameter of the strip winding on the shaft 25 will eventually cause the strip to break, at which time the strip S will be collected in aperture 45 thereafter. In other instances, the chambers 20 and the vacuum box 48 serve as means for collecting the free ends of strips S remaining integral with their rolls 9. The guide wires 46 and 47 serve to guide the strip S within the area of vacuum effectiveness of the aperture 45 associated with said guide wires. The guide wires 46 and 47 are particularly effective when forces such as movement of air or the transmitted force resulting from breakage cause the strip S to stray from the area of vacuum effectiveness of the aperture 45.

As a result of the singular and/or combined actions of the vacuum chambers 20 and their apertures 45 and guide wires 46 and 47, and the vacuum box 48, the machine need not be shut down by reason of strips S being severed from the rolls 9 and thereby entangling with other strips S or the associated elements operating on said strips. Any severed strips S are passed from the point of severance to the spindles 35 through the remaining elements of the machine. The free ends still connected to the rolls 9 are kept from entangling with other strips S or other elements of the machine and are held until an operator has the opportunity to rethread said free end and attach it to a spindle 35 and continue manufacture of a paper yarn from the strip S associated with the free end.

In many instances, it is convenient to employ a roll of paper width and to slit said paper width as it is unrolled from said roll rather than provide rolls of narrow paper strips as described above. In the embodiment shown in FIGS. 9 and 10, there is illustrated a roll 80 of paper P in web form mounted on the axle 8 between washers 10. Instead of feed rolls 13 and 14, cooperating slitting rolls 81 and 82, respectively, are mounted on the arms 6. Each slitting roll has mounted thereon a series of rotary knives 83. As best shown in FIG. 10, each rotary knife 83 of the upper slitting roll 81 cooperates in cutting action with an opposed cutting knife 83 of the lower slitting roll 82. The upper slitting roll 81 has a gear 15 connected to one end thereof and also a sprocket wheel 17 connected to said end. The lower slitting roll 82 has a gear 16 connected to one end thereof, which gear driveably engages with gear 15. The sprocket wheel 17 is driveably connected through a chain and sprocket system to the strip contacting shaft 25 such that rotary motion is transmitted from shaft 25 to both slitting rolls 81 and 82.

In operation of the embodiment shown in FIGS. 9 and 10, the paper P is threaded under guide roller 11 between guide flanges 12 and thence into the nip of the slitter rolls 81 and 82. The motor 53 is put into operation. The slitting rolls 81 and 82 are thus rotated to slit the paper P into a plurality of strips S which are then threaded through the spreader and the remaining components of the machine in the manner described above. After threading has been completed and the blower 79 and motor 53 are actuated, the strips S are conducted through the machine and wound into paper yarns in the manner described above. Severed strips and the resulting free ends of strips still connected to the roll 80 are also handled in the manner described above.

Inasmuch as many changes can be made in the above-described machines and methods without departing from the scope of the invention, all subject matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. Machine for converting lengths of paper into paper yarns comprising common supply means for continuously supplying a plurality of long strips of paper; moistening means for applying a liquid to each of said strips; suction means for applying suction to each of said strips at a point between said supply means and said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; and twisting means for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply means to said twisting means.

2. Machine as claimed in claim 1 wherein said supply means comprises a plurality of rolls of said long strips of paper.

3. Machine as claimed in claim 1 wherein said suction means applies suction to each of said strips at a point adjacent said supply means.

4. Machine as claimed in claim 1 wherein said suction means applies suction to each of said strips at a point adjacent said moistening means.

5. Machine as claimed in claim 1 wherein said suction means applies suction to each of said strips at a point adjacent said supply means and at a point adjacent said moistening means.

6. Machine as claimed in claim 1 wherein said suction means comprises a chamber maintained at a pressure below that of the atmosphere of said machine, said chamber having a plurality of apertures, one adjacent each of said strips as it passes from said supply means to said moistening means.

7. Machine as claimed in claim 1 wherein said twisting means also includes means for winding said paper yarns on bobbins.

8. In a machine for continuously converting a plurality of paper strips from a common supply into paper yarns, said machine having moistening means for applying a liquid to each of said strips, and twisting means for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply to said twisting means, the improvement comprising suction means for applying suction to each of said strips at a point between said supply and said moistening means for continuously collecting and holding a broken strip being fed from said supply until an operator rethreads said broken strip while said machine continues to operate.

9. Machine for converting lengths of paper into paper yarns comprising a frame; common supply means mounted in said frame for continuously supplying a plurality of long strips of paper; moistening means mounted in said frame for applying a liquid to each of said strips; suction means mounted in said frame for applying suction to each of said strips at a point between said supply means and said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; twisting means mounted in said frame for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply means to said twisting means; and guide means for guiding each of said strips into the area of suction effectiveness of said suction means upon detachment of said strip from said twisting means.

10. Machine for converting lengths of paper into paper yarns comprising a frame; common supply means mounted in said frame for continuously supplying a plurality of long strips of paper; moistening means mounted in said frame for applying a liquid to each of said strips; a suction chamber mounted in said frame, the internal pressure of said chamber being less than the pressure of the atmosphere of said machine, said chamber having a plurality of apertures each mounted adjacent one of said strips as it passes from said supply means to said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; twisting means mounted in said frame for individually twisting said mositened strips to form paper yarns, said strips of paper extending and

traveling from said supply means to said twisting means; and guide means mounted on said chamber for guiding each of said strips into the area of suction effectiveness adjacent one of said apertures upon detachment of said strip from said twisting means.

11. Machine as claimed in claim 10 wherein said guide means comprises at least one guide wire mounted on said chamber adjacent each said aperture.

12. Machine for converting lengths of paper into paper yarns comprising a frame; common supply means mounted in said frame for continuously supplying a plurality of long strips of paper; moistening means mounted in said frame for applying a liquid to each of said strips; spreading means mounted in said frame between said supply means and said moistening means for spreading said strips of paper one from each other; suction means mounted in said frame for applying suction to each of said strips at a point between said supply means and said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; and twisting means mounted in said frame for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply means to said twisting means.

13. Machine for converting lengths of paper into paper yarns comprising a frame; common supply means mounted in said frame for continuously supplying a plurality of long strips of paper; moistening means mounted in said frame for applying a liquid to each of said strips; suction means mounted in said frame for applying suction to each of said strips at a point between said supply means and said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; twisting means mounted in said frame for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply means to said twisting means; and drive means for driving said supply means, said moistening means, and said twisting means.

14. A method for converting lengths of paper into paper yarns comprising, continuously supplying a plurality of long strips of paper from a common supply of a machine; applying suction to an area adjacent each of said strips which area will be crossed by a broken strip forthwith upon breaking for continuously collecting and holding a broken strip being fed from said supply until an operator rethreads said broken strip while said machine continues to operate; thereafter moistening each of said strips; and individually twisting each of said moistened strips to form paper yarns.

15. A method for converting lengths of paper into paper yarns comprising, continuously supplying a plurality of long strips of paper from a common supply of a machine; spreading said strips one from each other; applying suction to an area adjacent each of said strips which area will be crossed by a broken strip forthwith upon breaking for continuously collecting and holding a broken strip being fed from said supply until an operator rethreads said broken strip while said machine continues to operate; thereafter moistening each of said strips; and individually twisting each of said moistened strips to form paper yarns.

16. A method for converting lengths of paper into paper yarns comprising, continuously supplying a plurality of long strips of paper from a common supply of a machine; applying suction to an area adjacent each of said strips which area will be crossed by a broken strip forthwith upon breaking for continuously collecting and holding a broken strip being fed from said supply until an operator rethreads said broken strip while said machine continues to operate; thereafter moistening each of said strips; individually twisting said moistened strips to form paper yarns; and individually winding said yarns on bobbins.

17. A method for converting lengths of paper into paper yarns comprising, continuously supplying a plurality of long strips of paper from a common supply of a machine; spreading said strips one from each other; applying suction to an area adjacent each of said strips which area will be crossed by a broken strip forthwith upon breaking for continuously collecting and holding a broken strip being fed from said supply until an operator rethreads said broken strip while said machine continues to operate; thereafter moistening each of said strips; individually twisting each of said moistened strips to form paper yarns; and individually winding said yarns on bobbins.

18. A method for converting lengths of paper into paper yarns comprising, continuously supplying a plurality of long strips of paper from a common supply of a machine; spreading said strips one from each other; moistening each of said strips; guiding strips severed from said supply prior to moistening into a suction zone for continuously collecting and holding a broken strip being fed from said supply until an operator rethreads said broken strip while said machine continues to operate; and individually twisting said moistened strips to form paper yarns.

19. Machine for converting lengths of paper into paper yarns, comprising a frame; common supply means mounted in said frame for continuously supplying a plurality of long strips of paper; moistening means mounted in said frame for applying a liquid to each of said strips; suction means mounted in said frame for applying suction to each of said strips at a point between said supply means and said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; twisting means mounted in said frame for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply means to said twisting means; and rotating means contacting said strips of paper as they travel from said moistening means to said twisting means.

20. Machine for converting lengths of paper into paper yarns, comprising a frame; common supply means mounted in said frame for continuously supplying a plurality of long strips of paper; moistening means mounted in said frame for applying a liquid to each of said strips; suction means mounted in said frame for applying suction to each of said strips at a point between said supply means and said moistening means for continuously collecting and holding a broken strip being fed from said supply means until an operator rethreads said broken strip while said machine continues to operate; twisting means mounted in said frame for individually twisting said moistened strips to form paper yarns, said strips of paper extending and traveling from said supply means to said twisting means; and rotating means contacting said strips of paper as they travel from said moistening means to said twisting means.

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