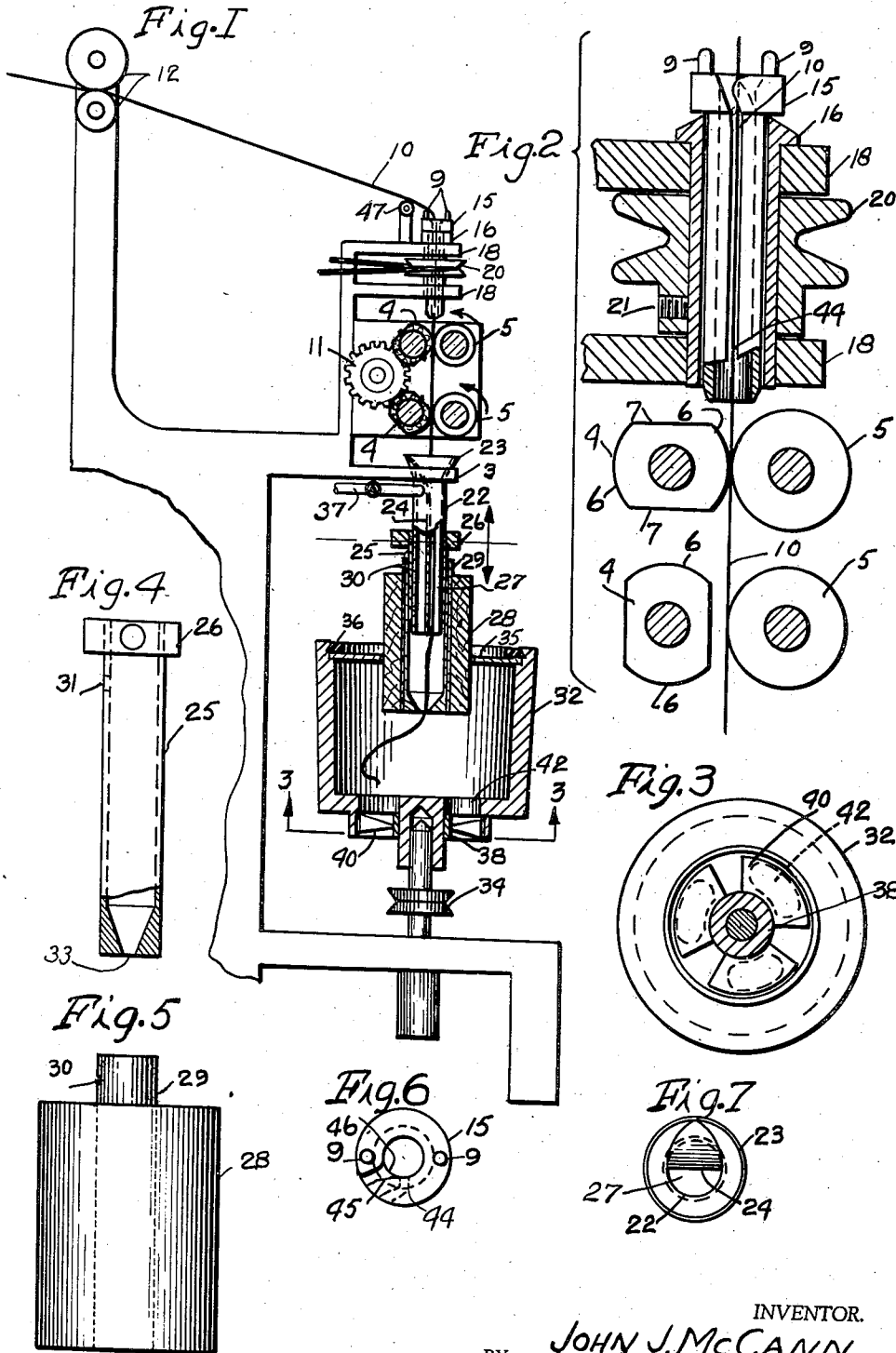


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METHOD OF SPINNING

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METHOD OF SPINNING

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This invention relates to a novel method of spinning a continuous strand of fibrous material into twisted yarn of superior quality and for conducting and winding the finished strand to and into suitable compact units. The invention also concerns a superior system of drafting and twisting and in cooperation therewith novel pot spinning and yarn guiding mechanism, all for the purpose of producing a superior product and increasing production.

Continuous woolen yarn drafting is commonly practiced by placing a false and strengthening twist in the strand while drafting or stretching it, whereby to render the same more uniform, all of which false twist comes out of the strand before it is given the final twist and wound, as described in Patent No. 806,086. My invention contemplates the production of a superior yarn by so rotating or turning the strand on its axis as to effect a strengthening-sealing twist therein to seal the thin portions against further elongation in the drawfield, and thereafter twisting the strand while so supporting it that such twist follows along the strand to the said rotating or turning position in the drawfield where it unites with or blends into the strengthening-sealing twist effected by the said turning action. The production of a yarn resulting from these cooperating functions comprises one object of the invention.

The apparatus includes two or more relatively spaced drawing units for alternately or successively gripping and releasing the yarn as it passes from the twisting tube to the twisting and winding mechanism. These units permit the yarn twist to pass therethrough from the winding mechanism upwardly to the said sealing twist and permit the yarn with its resultant twist to pass downwardly therethrough to the twisting and winding mechanism where it is wound into suitable units, the sealing twist thereby not only being retained in the final product but being furthermore augmented by the cooperating twisting action of the twisting and winding mechanism. The tube illustrated is readily removable and it may be slotted for convenience in threading the yarn therethrough, and cooperating therewith is a thread guide for receiving and conducting the yarn as it passes from the drawing units.

An important feature of the invention relates to a novel method and mechanism for automatically threading and rethreading the yarn into a spinning pot by means of a current of air directed through the guiding channel and so confined as to draw the yarn into and through the channel when its leading end is introduced there-

into. The yarn passes through the channel into the spinning pot and, in a preferred form of the invention, the current of air is induced by a fan attached to the spinning pot. Also on and cooperating with the guide is a reciprocatory tube arranged removably to support a bobbin extending into the pot and serving to direct the yarn during the spinning operation and thereafter to receive the yarn cheese in collapsed form thereonto, the bobbin being removable and replaceable by an empty bobbin. The production of such an improved method and apparatus for the purpose described comprises a further object of the invention.

These and other features and advantages of my invention will be more readily understood and appreciated from the following description of a preferred embodiment thereof selected for purposes of illustration and shown in the accompanying drawing in which:

Fig. 1 is a fragmentary side elevation, partially in section, of an apparatus embodying my invention,

Fig. 2 is an enlarged sectional view through the twisting tube and drawing units,

Fig. 3 is a detail view taken on line 3—3 of Fig. 1,

Fig. 4 is a side elevation of a strand guiding tube which is mounted for longitudinal reciprocation,

Fig. 5 is a side elevation of a bobbin constructed to be carried by the guiding tube,

Fig. 6 is a top end view of the twisting tube, and

Fig. 7 is a top end view of the guiding tube.

The strand 10 to be spun into yarn passes from the delivery rolls 12 through a drawing field and to and through a twisting tube 15 loosely resting by gravity within an outer bushing 16 rotatably supported within bracket arms 18, a whirl 20 being secured to the bushing between the arms by a set screw 21. Beneath and in alignment with the tube are two relatively spaced strand feeding and drawing units each comprising a roll 5 with a continuous circular periphery and a cooperating roll 4 having two cooperating peripheral portions 6 and two slatted off portions 7. The strand 10 passes over a thread guide 47 into the tube 15 in position to be engaged and teetered by two pins 9 carried on the top end of the tube, these pins causing a rapid vibrating or trembling action on the strand and aiding the drafting thereof. This action by the pins is commonly called "teetering". After passing from the tube, which turns the strand on its axis and places

strengthening-sealing twist therein, the strand is gripped continuously by the drawing units, the units being driven synchronously by a gear 11 and each unit being adapted to grip the strand while the other unit is released therefrom. While I have herein illustrated two drawing units 4-5 operating alternately to grip and release the yarn strand, it will be apparent that more than two such units can be employed, the units being driven synchronously and being so constructed that the strand is never fully released but is gripped by one unit at all times.

Carried by a bracket arm 3 beneath the units 4-5 is a tubular guide 22 having a funnel-like top end 23; a partition 24 being provided within the tube and dividing it into two channels, the top end of the partition 24 being tapered outwardly as shown in Fig. 7 to cooperate with the tapering portion 23 in guiding the strand into the channel. One channel 27 is open throughout the length of the tube for receiving and conducting the strand therethrough with a minimum of ballooning as the yarn passes through the tube. The plate 24 passes through the center of the tube which is also the center of the axis about which the yarn spins. Since the spinning yarn cannot pass beyond the plate toward the other channel, the ballooning tendency in that direction will be definitely eliminated and, since ballooning is restricted, the strand will remain substantially at the center of the spinning axis where there is a minimum of centrifugal action. Thus ballooning of the yarn within the tube is substantially eliminated while leaving the channel 27 fully open to the passage of the yarn and a conducting air current hereinafter described. Also cooperating with the partition to restrict yarn ballooning is a limited opening 33 at the bottom end of the tube 25. The other channel is closed at its top end by the top end of the partition (Figs. 1 and 7) and is adapted to receive a suitable pipe 37 therein and through which steam can be introduced into this closed channel. The steam is passed downwardly into the spinning pot 32 to condition the yarn therein whereby eliminating subsequent steaming operation to set the twist in the yarn, it being understood that ordinarily spinning and steaming are not performed simultaneously.

Telescoped over the bottom end portion of the guide 22 is a tube 25 having a head 26 attached to mechanism for reciprocating the tube longitudinally on the guide. The bottom end of the passage within the tube 25 is funnel shaped so that the exit opening 33 for the yarn is large enough to allow the yarn to be drawn through by an air current but is so restricted in size that ballooning of the yarn is limited to a minimum. This tube is adapted to receive and removably support a bobbin 28 affixed to a tube 29, the top end of the tube 29 projecting outwardly of the bobbin and having a detent 30 for engaging within a recess 31 of the tube 25 to hold the bobbin fixed thereto.

It may be explained that ballooning or whirling of the strand about a center causes tension on the strand due to air resistance and frictional resistance if the strand comes in contact with a wall or other surface that is not at or near its spinning axis. This resistance is very objectionable and particularly since (1) it causes the outer layers of fiber to be wrapped spirally about the strand whereby producing a poor and ragged yarn, and thus prevents the strand from being twisted around its own axis in a manner to pro-

duce a round, uniform and high-grade yarn and (2) since the air resistance increases approximately in proportion to the square of the velocity, the ballooning tension set up by the resistance limits the speed of twisting and results in breakage of fiber and of the strand itself. Confining of the strand to the central twisting axis of the yarn permits uniform twisting of the fibers about the yarn with a minimum of the objectionable results produced by ballooning and centrifugal force when the yarn is twisted without being thus confined.

Located beneath the guide 22 is a spinning pot 32 arranged to be rotated by a whirl 34. A cover 35 is secured to the pot by a ring 36 and has an opening therethrough for receiving the bobbin, the bobbin substantially filling the opening. The yarn strand passes downwardly through the guide 22, tube 25, and bobbin 28 and into the pot 32, and in order more effectively to direct and conduct the strand therealong I cause a current of air to pass therethrough in the direction of movement of the strand. This air current is efficiently and economically produced by a fan 38 attached to the bottom of the pot and having its blades 40 located in position to draw air downwardly and outwardly through the openings 42. The fixed guide 22 with its partition 24 ends short of the spinning pot 32 and that portion of the strand which extends from the end of the guide 22 into the spinning pot and is twisted simultaneously with and solely by the centrifugal winding of the strand by and within the pot.

As illustrated in the drawing, I prefer that the path of movement of the strand from the twister tube 15 to the winding position at the spinning pot shall be in a straight and substantially vertical line. Such arrangement utilizes gravity in the feeding of the strand through the drawing rolls and into and through the guiding tube and results in the most efficient handling of the strand and particularly facilitates free movement of the twist along the strand. My novel treatment of the strand to control ballooning thereof and conduct the strand, together with an air current, through the strand guiding channel and directly into the spinning pot makes this novel and efficient handling of the strand possible.

The operation of this mechanism is substantially as follows: The surface speed of the drawing units 4-5 is somewhat faster than the surface speed of the rolls 12 whereby stretching or drafting the strand therebetween, the pins 9 affecting a teetering action on the strand. The rotary tube 15 gives a strengthening-sealing twist to the strand in a drawfield between the gripped positions 12 and 4-5 whereby twisting and strengthening the strand at the weaker spots and causing elongation to take place at the thicker spots, this twist concentrating at the pins 9 and diminishing therefrom to the rolls 12.

If the spinning pot 32 is rotated in the same direction as the tube 15, the pot and tube place twist in the same direction in the strand up to the delivery rolls 12. In this case it is necessary that the rotary speed of the pot shall be substantially greater than the rotary speed of the tube whereby not only to prevent the tube from taking out of the strand such twist as passes from the pot upwardly through the rolls 4-5 but furthermore to secure a relatively greater concentration of the twist below the pins 9 than above such pins. The rotation of the tube continuously transfers twist upwardly from the greater twist concentration past the pins 9 from

whence it joins the twist in the strand above the pins. The pot spinning twist therefore travels up the strand and cooperates with the twisting action of the rotary tube to provide twist in the strand like and blending into that portion of the strengthening and sealing twist above the pins 9, the twist being permitted to pass through the units 4-5 when they are in the non-gripping position. When one unit 4-5 releases its grip on the strand, the twist in the strand passes through such unit to the other unit and, when the other unit releases its grip, this twist passes further therethrough along the strand.

If the spinning pot is rotated in a direction opposite to the tube 15, the strand is twisted up to the pins 9 in the same direction as the pot rotation, the pot spinning twist traveling up the strand and cooperating with the twisting action of the rotary tube to augment that portion of the strengthening and sealing twist effected by the tube and located below the pins 9. The twist above the pins 9 is in the opposite direction and is continuously reversed at the pins 9, the entire strand below the delivery rolls 12 being continuously under twist.

It will be apparent that in either case the passing of the pot spinning twist upwardly beyond the units 4-5 so reinforces the strengthening-sealing twist below the pins 9 that this portion of the strand remains more tightly twisted and results in most of the drafting or elongating of the yarn taking place between the pins 9 and the rolls 12, and this lower portion of the strengthening-sealing twist remains as permanent twist as the yarn passes through the apparatus. In continuous spinning operations heretofore known the strand is given a false twist which is effected by supporting the strand at two spaced points within a drawfield and twisting the strand intermediately of such points. This twisting is termed "false" for the reason that none of such twist passes into the strand beyond either of the points nor does any permanent twist pass into this field. In my apparatus one of these points comprises the units 4-5 which permit the passage of twist from the spinning pot into the drawfield whereby the strengthening and sealing twist therein becomes permanent twist due to the twisting cooperation of the spinning pot. The centrifugal and teetering action resulting from the twisting of the strand by the tube 15 causes the fibers of the yarn to project outwardly of the strand whereby producing a very desirable soft, bulky and wooly effect, and such effect is permanently retained in yarn produced by my method since the strengthening and sealing twist is not allowed to come out of the strand. In yarn produced by the "false" twisting method this desirable effect and these characteristics are lost since the "false" twist which holds these characteristics is allowed to go entirely out of the strand which is then re-formed by the subsequent permanent twisting operation thereon. It will be readily apparent that the permanent twist produced by my method adds materially to the quality of the product in making it more uniform and of substantially stronger texture.

From the units 4-5 the yarn passes into and through the guide 22 and into the spinning pot, and the yarn is materially aided in this passage by the constant stream of air induced by the fan 38. While the partition 24 serves to confine the channel 27 to a relatively small and free passage and prevent objectionable ballooning of the yarn passing therethrough it has no ob-

structions which would restrict the passage of the yarn and air. The bobbin 28 substantially fills the opening in the pot cover whereby the incoming air must pass through the guide along with the yarn. During the spinning operation the tube 25 together with the bobbin is reciprocated vertically whereby building up a cheese of yarn within the rotating pot as will be understood. When the cheese has reached the desired size, the bobbin is lowered into the pot and the mechanism stopped. The cheese thereupon collapses onto the bobbin and is removed vertically from the pot, the pot cover and the guide 22 being mounted for convenient removal for permitting this operation. An empty bobbin is then applied to the tube 25 and the operation repeated. It will be understood that the bobbin can be any suitable tubular element adapted to receive the cheese.

The twisting tube 15 is rotated by its frictional engagement with the bushing 16 and may be freely removed therefrom. It will also be noted that the tube is slotted at 44 whereby to permit quick threading of the tube by passing the thread laterally through the slot. In Figs. 2 and 6 this slot 44 is shown as passing straight up the tube 15 until it reaches the flanged portion where it is cut at an angle at 45 whereby leaving an inner wall 46 which acts to prevent the yarn from passing outwardly through the slot, regardless of the direction of rotation. If a small end portion of the strand is allowed to protrude from the bottom end of the tube, when the tube is replaced after threading, the upper unit 4-5 will engage this end and pull the strand through the tube and, together with the aid of the air current, rethread the strand downwardly to and into the spinning pot.

A further and important feature of my invention relates to a novel and rapid threading of strands, resulting in the elimination of imperfections in the fabric and permitting operation of the machine at speeds substantially greater than has been heretofore possible. In spinning mechanism heretofore known it has been necessary to limit the operation to a speed at which broken strands could be pieced up without interrupting the operation of the machine and such pieced up ends have produced objectionable piecing and imperfections in the final product. The quick and semi-automatic threading permitted by my improved mechanism eliminates such necessity for speed limitation and thereby makes great increase of production possible. When a strand 10 breaks in my machine the operator drops the loose end of the strand by gravity into and through the tube 15 whereupon the upper unit 4-5 engages such end and together with the lower units 4-5 pulls it downwardly into the passage 27 wherein the current of air effected by the fan 38 threads and carries the strand downwardly through the passage and into the spinning pot. Thus rethreading is effected without requiring the uniting of the two broken ends and without limiting the speed of the machine, whereby producing the novel features above recited. This combination of centrifugal twisting pot and fan, an easy threading tube, the self threading rolls and thread guides, makes it unnecessary to join the yarn which would result in a faulty length of yarn at the joint and imperfections in the fabric.

Spinning by the use of centrifugal force in accordance with my invention enables the yarn to be spun with a light tensioning and a minimum of ballooning and produces a yarn having

permanently retained therein characteristics which were developed during the drafting. It will also be apparent that the combining of the drawing units 4-5 with the thread guide 47 and strengthening-sealing twisting tube 15, together with the twisting mechanism therebeneath, causes the twist in the yarn at the places it needs strengthening most during the drafting operation and finally results in a more even and uniform product.

Arranging the path of movement of the strand from the pins 9 in the drawfield to the strand exit 33 within the spinning pot in a straight and substantially vertical line permits the pot spinning twist to pass directly and uninterruptedly up the strand to the nip of the lower rolls 4-5 without touching any guide or element which would obstruct such action. It is apparent that such action can take place only by the employment of a spinning pot as the twisting and winding unit. The substitution of ring or cap spinning would generally require the employment of a centrally disposed guide or eyelet above the winding and twisting unit and such guide would seriously impede the upward passage of the twist along the strand as will be clearly apparent. The employment of a spinning pot in this combination is therefore essential to the full enjoyment of my invention. Attention is furthermore called to the fact that the employment of a spinning pot and the straight line path of movement of the strand makes the automatic threading of the strand possible. This arrangement and the automatic threading also provides for the rapid piecing up of the strands which in turn makes high speed operation of the front rolls 4-5 possible.

It may be desirable to twist the strand without drafting and/or with limited or no teetering action. This can be accomplished by running without draft and/or with limited or no action of the twister tube 15 on the strand. In cases where no action by the twister tube 15 is desired, the strand will be fed vertically through the center of the tube without rotating the tube or the tube may be removed, spinning or twisting being performed wholly by the rotary action of the pot spinner 32. The twist given to the strand by the pot spinner travels up through the units 4-5. However, in some cases, it is not necessary that the winding twist shall pass upwardly through the units and in these cases any well known type of feed rolls can be substituted for the units 4-5. This twisting action places and leaves the desired twist in the yarn as it is wound by centrifugal force within the pot. It should also be noted that the reduction of the opening through the tube 25 at 33, together with the plate 24, has enabled me to more than double the rotary speed of the pot 32, this result being due to the fact that such construction very substantially reduces ballooning of the yarn. In mechanism which I have constructed and operated in accordance with the invention as herein disclosed, I have rotated the tube 15 at approximately 2,700 R. P. M. and the pot spinner 32 at approximately 6,000 R. P. M.

Should the continuous delivery of the strand to the pot spinner 32 be stopped, the rotation of the pot would wind the yarn therein around the bobbin and form an obstruction on the bobbin preventing its upward movement through the cover 35. In such emergency, the detent 34 will permit the bobbin to pull free from the tube 25 and thereby prevent damage to the apparatus. 75

Having thus described my invention what I claim as new and desire to secure by Letters Patent of the United States is:

1. A method of spinning a continuous strand of fibrous material, which consists in moving the strand longitudinally along a predetermined path, teetering and turning on its own axis a portion of the moving strand at an intermediate point in said path while holding the strand substantially above the intermediate point and holding the strand by successively gripping and releasing it at a plurality of relatively spaced points below said intermediate point in such sequence that the strand is always gripped at one of said relatively spaced points, and simultaneously therewith twisting the strand below and extending upwardly into said turned portion of the strand.

2. The method defined in claim 1 in which the twisting of the strand below said gripped points is in a direction corresponding to and at a speed substantially in excess of the turning speed at said intermediate point and wherein the strand is wound into a unit simultaneously with the twisting.

3. A method of twisting a continuous strand of fibrous material into a cheese collapsed onto a bobbin, which consists in passing the strand longitudinally through the bobbin, twisting the strand by the action of centrifugal force into a cheese outside the axial position of the bobbin as the strand emerges from the bobbin, disposing the bobbin into receiving position within the cheese, and thereafter stopping the centrifugal action whereupon the cheese collapses onto the bobbin, the bobbin and cheese forming a removable unit.

4. A method of spinning a continuous strand of fibrous material, which consists in moving the strand longitudinally along a predetermined path, gripping the strand at relatively spaced strand feeding and delivering portions of the path, drafting the strand between said portions while subjecting it to a teetering action, turning the strand on its axis by force applied thereto intermediately of said portions, twisting the strand and winding it into a cheese simultaneously by subjecting the strand to centrifugal action after it leaves the turning position, and confining the strand against ballooning along a portion of its path beyond the turning position.

5. A method of spinning a continuous strand of material, which consists in passing the strand through a drawfield to a winding position, imposing a strengthening-sealing twist and teetering action on the strand in the drawfield, and imposing a further twisting action on the strand beyond and extending into the drawfield and co-operating with the said strengthening-sealing twist.

6. The method defined in claim 5 plus the step of winding the strand into a cheese by centrifugal action as the strand leaves the drawfield, aiding movement of the strand from the drawfield to the winding position by a current of air confined with the strand within a limited channel, and effecting said further twisting action simultaneously and in cooperation with said winding of the strand.

7. A method of twisting a continuous strand and winding it into a cheese which consists in subjecting the forward end portion of the strand to rotary centrifugal action at the winding position whereby to twist the strand along its path of movement to such position and to wind the strand into a cheese, and simultaneously there-

with assisting the passage of the strand to such position by confining it within a relatively small passage in said path and directing a current of air through the passage toward said position.

8. The method defined in claim 5 plus the step of so confining the strand within a channel between the drafting and the winding positions that ballooning of the strand therein is restricted, and aiding movement of the strand along and within the confined channel by forcing a current of air therethrough toward the winding position.

9. A method of spinning a continuous strand of fibrous material, which consists in passing the strand through a predetermined channel to a strand winding position, twisting the strand, passing a current of air independently of liquid through the channel in the direction of movement of the strand, and confining the strand and air to an area within the channel preventing substantial ballooning of the strand and causing the air to conduct the strand through the channel.

10. A method of threading a strand through a strand receiving channel and into a spinning pot, which consists in confining the exit end of the channel within the spinning pot to a relatively small passage, forcing through the passage and into and through the spinning pot a current of air of such intensity as will carry a strand through the passage and into the spinning pot, and introducing the leading end of the strand into the entrance end of the passage.

11. A method of threading a strand through a strand receiving channel and into a spinning pot, which consists in confining the channel to a relatively small passage therethrough and therealong, drawing a current of air through the passage to a point beyond the exit end of the passage and through the spinning pot, the current of air being of such intensity as will draw a strand through the passage, and introducing the leading end of the strand into the entrance end of the passage.

12. A method of spinning a continuous strand of fibrous material, which consists in moving the strand longitudinally through a drawfield, turning the strand on its axis by force applied there-

to between the ends of the drawfield, effecting a teetering action thereon in the drawfield, passing the strand from the drawfield through a confined channel to a winding position, twisting the strand at the winding position while so holding the strand that such twist passes upwardly into the drawfield.

13. A method of pot spinning a continuous strand of fibrous material by centrifugal force to effect the twisting of the strand fibers around the yarn axis and produce a cheese of substantially round and uniform yarn, which consists in centrifugally winding the strand and effecting twisting thereof in a channel of substantial length, and simultaneously therewith preventing lateral movement of the strand in one direction beyond the central axis of the twist and throughout a substantial length of the channel while leaving the strand free to move laterally in the opposite direction and through the channel and the twist thereof to pass freely along the strand through the channel.

14. The method defined in claim 13 in which the strand is initially fed into said channel and simultaneously therewith guided laterally thereof toward and to the said central axis of the twist as the strand enters said substantial length of the channel in which the strand is prevented from said lateral movement, and in which the portion of the strand extending therefrom to the winding position is twisted simultaneously with and solely by the centrifugal winding of the strand.

15. A method of spinning a continuous strand of fibrous material, which consists in moving the strand longitudinally through a drawfield, turning the strand on its axis by force applied therebetween the ends of the drawfield, effecting a teetering action thereon in the drawfield, passing the strand from the drawfield to a winding position, and twisting the strand at the winding position while so holding the strand that such twist passes upwardly into the drawfield, the path of movement of the strand from the drawfield to the winding position being in a straight and substantially vertical line.

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