Dec. 19, 1950 R. H. LAWSON 2,534,459

STRAND FEEDING MECHANISM

Filed April 23, 1945 2 Sheets-Sheet 1

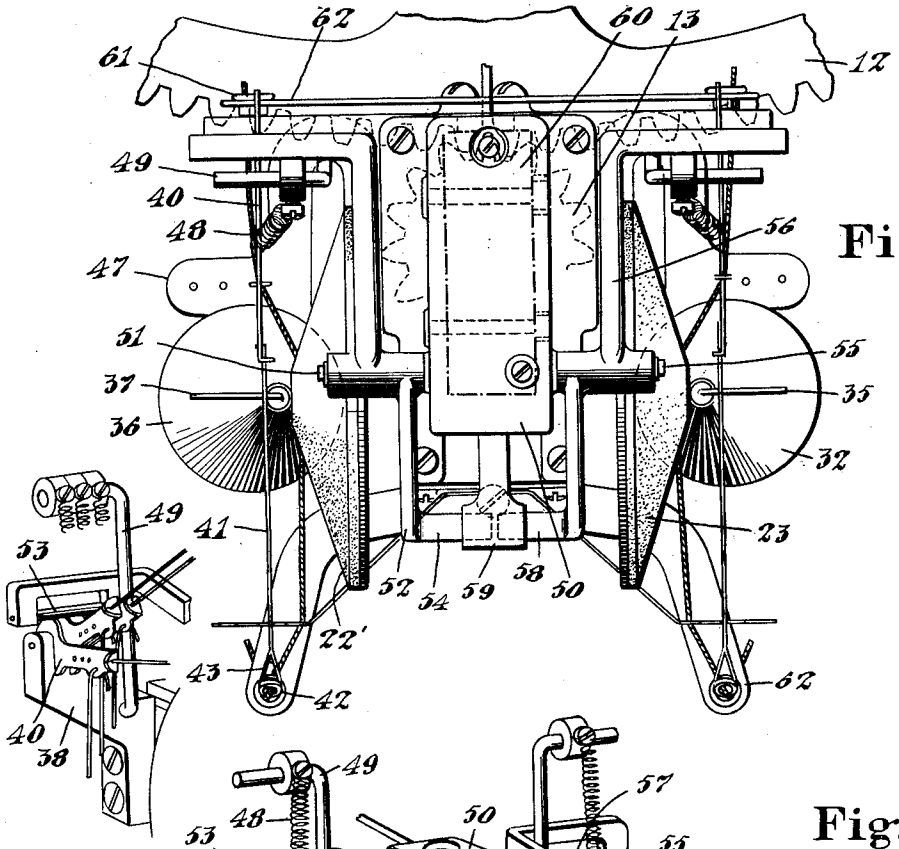

Fig.1.

Fig.6.

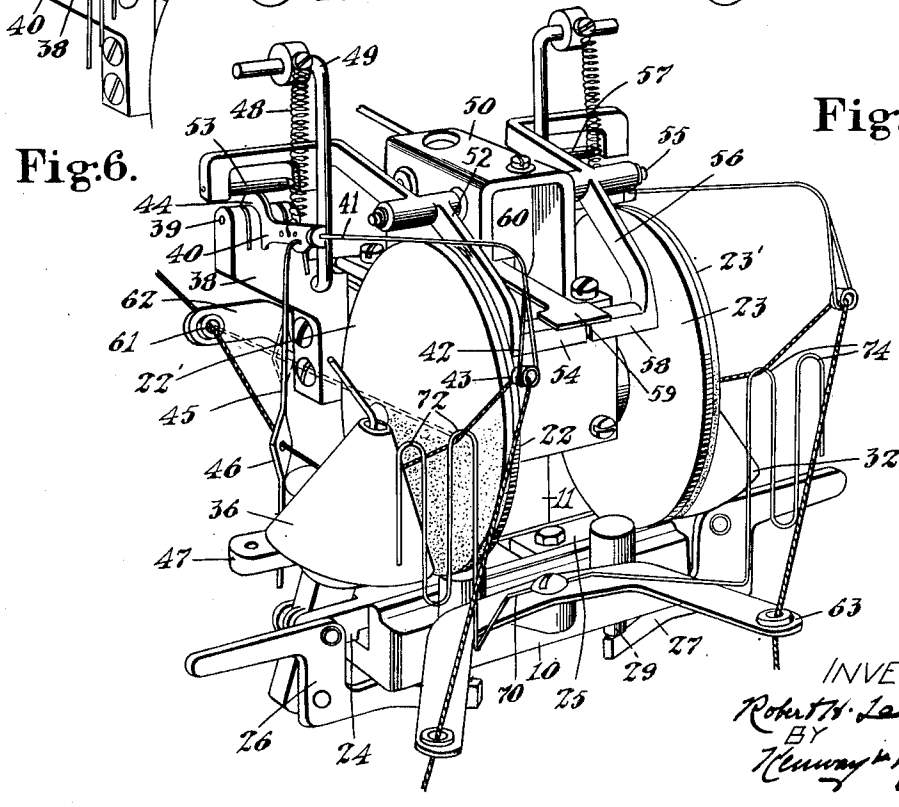

Fig.2.

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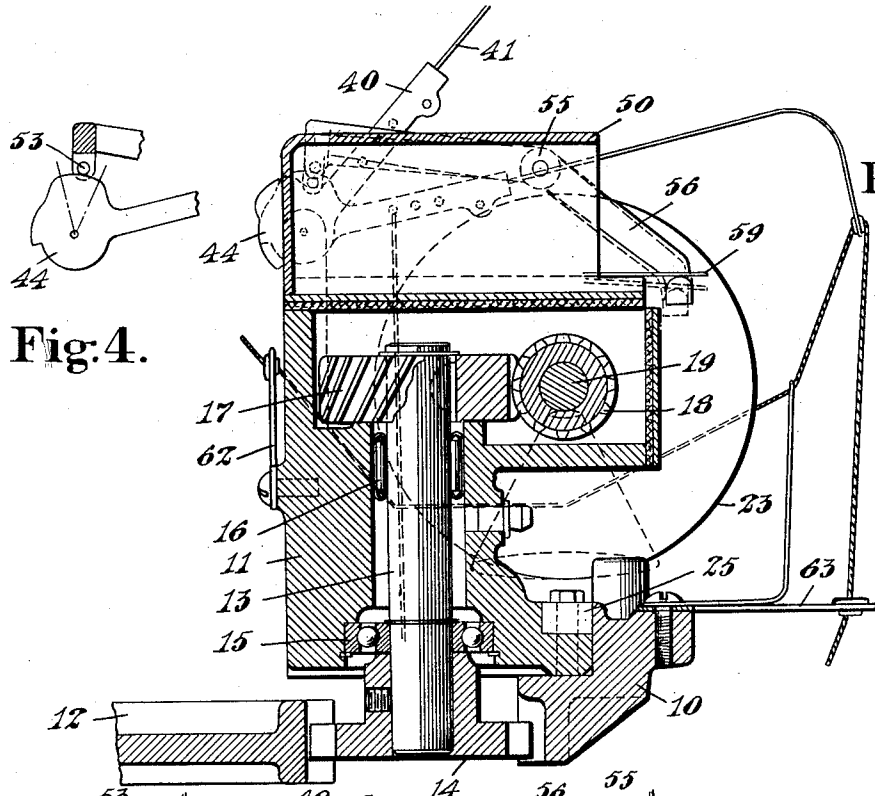

Fig:3.

Fig:4.

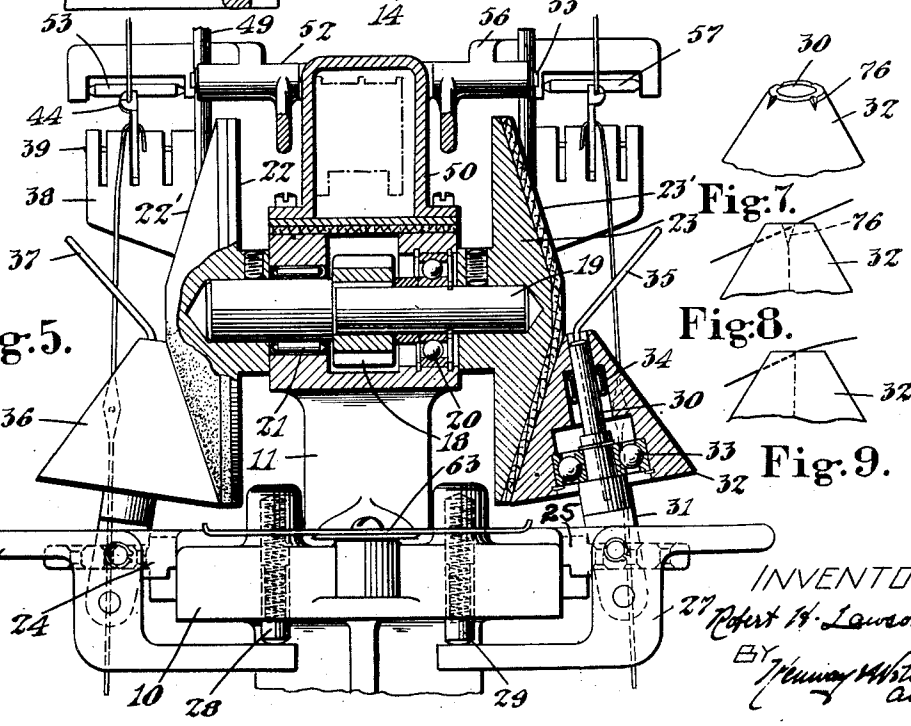

Fig:5.

Fig:7.

Fig:8.

Fig:9.

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STRAND FEEDING MECHANISM

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14 Claims. (Cl. 28—71.5)

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This invention relates to furnishing or strand feeding mechanism for textile machines such as knitting and winding machines. Such machines require mechanism for supplying strands accurately, smoothly, at high speed and with uniform tension under many different exacting conditions. For example, in knitting machines in fashioning garments, for example stockings, the thread demand may be interrupted or varied, while in making panel work on a rib body machine by leaving out needles the thread demand may be rapidly varied at regular intervals. The furnishing mechanism serving such machines must therefore be capable of feeding the strands or threads effectively at definite predetermined rates over a wide range of speeds, of permitting intervals of complete interruption when no thread is being fed, and of resuming feed smoothly and without appreciable lag after each such interruption of the feeding operation.

In one aspect the present invention consists in an improved furnishing device of the type employing cooperating feeding cones which are arranged to engage and advance a strand led between them at a rate which may be varied by shifting the path of the strand along the line of contact between the two cones and beyond their line of contact when it is desired to interrupt the strand feeding movement.

I have devised a novel structure for furnishing mechanisms that may be advantageously embodied in duplex form. This results in a compact organization in which a substantial number of strands may be taken care of in a limited space. Such devices are particularly useful in connection with circular machines where it is desired to feed multiple strands as for yarn change, plating, multi-feed, etc. The duplex furnishing device of my invention has a capacity for handling a plurality of strands in each of its pairs of cooperating feeding cones. In this connection an important feature of the invention comprises a single driving element operating independent pairs of cooperating strand feeding cones and independent strand guiding elements associated with each pair of cones.

Another feature of the invention consists in an improved yarn guide having a rectilinear movement and serving to direct the strand to the appropriate point in the line of contact in the feeding cones appropriate in each instance. By arranging the guide for rectilinear movement, a wide range of variation in the rate of strand feed, suitable for fancy effects by welt or other stitches on knitting machines and for winding, is conveniently secured and the entering angle of the thread maintained substantially constant so that accuracy and uniformity of feed is insured.

The duplex feature of my novel furnishing device also contributes to an improvement in stop motion mechanism whereby a single switch is controlled by either of the two furnisher elements and yarn changing may be effected without interfering with the machine's action or causing an unnecessary stop.

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Another feature of the invention consists in an improved take-up construction comprising a streamline thread arm terminating in an elongated triangular loop in which a thread guiding eye is smoothly enclosed, and a wire guide bent to provide loops which are located between the cones and the thread guiding eye. By this construction I have decreased the distance through which the thread arm must be depressed before the strand is entered between the cones and I have eliminated the annoyance of having the strand loop or catch upon the thread arm in yarn changing.

Another feature of the invention relates particularly to the yarn feeding cones and their associated parts. For example, I have found that the combination of a feeding cone having a yielding resilient cover with a feeding cone having an unyielding metallic face presents unexpected advantages in feeding yarn, particularly fine or elastic yarns which have been hitherto troublesome to handle. I have also found that by providing one of the cones with slashes or notches radiating from its apex that the operation of entering the yarn between the yarn feeding cones after an interval of interruption is facilitated and rendered more positive. The edges of such notches or slashes positively engage the yarn and whip it into feeding position without lag that might otherwise occur. I have also found it advisable to employ a yarn guide leading from the apex of one of the yarn feeding cones in such a direction as positively to prevent the yarn from reaching the outer surface of the cone but to insure that it is always entered in the line of contact between the two cones.

Another feature of my invention consists in the combination of a flat yarn feeding cone with an acute cone or one having a sharp angle at its vertex. This combination renders the line of contact between the cones easily accessible for purposes of cleaning and ample space for presenting strands to feeding position and withdrawing them when the strand feeding operation is to be interrupted. Further it is a desirable feature in furnishing devices of the duplex type on account of its compactness.

These and other features of the invention will be best understood and appreciated from the following description of a preferred embodiment thereof, selected for purposes of illustration and shown in the accompanying drawings in which:

Fig. 1 is a plan view of furnishing device as seen from above;

Fig. 2 is a perspective view in elevation;

Fig. 3 is a view in vertical section;

Fig. 4 is a detail view showing a portion of a thread arm and associated parts;

Fig. 5 is a view in front elevation partly in section;

Fig. 6 is a fragmentary view showing portions of three thread arms;

Fig. 7 is a detail view of the cone structure;

Fig. 8 is a diagrammatic view illustrating a strand feeding operation with a cone structure similar to that shown in Fig. 7; and

Fig. 9 is another diagrammatic view.

Without in any respect confining myself to any particular textile machine, I will proceed to describe illustrated mechanism as organized in duplex form for feeding two strands of yard from suitable sources of supply to needles of a knitting machine. It will be understood that many features of the invention are not limited to a furnishing device of duplex form but may be usefully employed in furnishing devices having a single pair only of strand feeding cones.

Any desired number of the illustrated devices may be mounted as units in convenient location upon the frame of a knitting machine, for example upon the casing of the dial gear. Each device is a complete self-contained unit and may be driven at the required speed in any convenient manner. As herein shown the dial gear of the knitting machine is shown as making direct gear connection with the driving element of the furnishing device.

Each furnishing device comprises a frame which includes a horizontally disposed base portion 10 and an upright frame portion 11, shown in Fig. 3 as overhanging the dial gear 12 of the knitting machine. In the frame of the furnishing device is mounted a vertical shaft 13 having fast to its lower end a pinion 14 meshing with the dial gear 12. The shaft 13 is provided with ball bearings 15 at its lower end and with needle bearings 16 near its upper end where it is provided with a right angle spiral gear 17. This is arranged to mesh with a corresponding right angle spiral gear 18 fast to the middle of a horizontal shaft 19 disposed at right angles to the vertical shaft 13 and driven through the right angle spiral gears 17 and 18 at twice the speed of the driving shaft 13. As shown in Fig. 5, the horizontal shaft 19 is shouldered to receive the gear 18 and is journaled in the upright portion 11 of the frame by ball bearings 20 which support the reduced end of the shaft, and needle bearings 21 which support the larger end of the shaft. The upright frame portion 11 is forked at its upper end to receive with clearance the gear 18 which is keyed on the shaft 19 between a shoulder at one side and a collar that takes up the space between it and the ball bearing 20 on the other side.

Flat, wide-angle strand feeding cones 22 and 23 are secured by set screws to the opposite ends of the horizontal shaft 19 and rotated with it about a common horizontal axis in back-to-back relation with flat bases disposed concentrically with a substantial space between them. The cone 22 is provided with a thick resilient cover 22' of cork and rubber composition or the like, and the cone 23 is correspondingly provided with a resilient cover 23'.

The base portion 10 of the frame is provided with a transverse guide-way in which is adjustably retained a pair of oppositely extending carrier bars 24 and 25. Pivotally connected to the

outer end of the bar 24 is an angle bracket 26 and similarly connected to the outer end of the bar 25 is a similar angle bracket 27. Spring pressed plungers 28 and 29 housed in vertical casings upon the base 10 engage the inner arms of the brackets 26 and 27 and tend to rock them upwardly at their outer ends and to press the cooperating strand feeding cones carried thereby yieldingly against the surfaces of the flat cones 22 and 23. An upwardly extending shaft or spindle 30 having a flat shank portion 31 is connected to the angle bracket 27, as best shown in Fig. 5.

A strand feeding cone 32, of relatively sharper pitch than the cone 22, is supported upon the spindle 30 by means of ball bearings 33 located in the base of the cone and needle bearings 34 located near the upper end of the shaft. The cone 32 is preferably of steel or other metal and presents a rigid strand driving face to the resilient strand driving cover 23' of the flat cone 23. Also cone 32 is so proportioned and so located in relation to cone 23 that at all contacting points the surface speed of one equals the surface speed of the other and this is achieved by having the extended axes of the two cones intersect at a common point. The strand fed by this pair of elements passes through the line of contact between the two cones and the rate of its linear feed depends on the position of the strand between the base and the apex of the cone 32. In entering the strand in feeding position, the strand is moved downwardly and inwardly between the two cones and this is facilitated by a wire guide 35 which is carried by the spindle 30 extending upwardly from the upper end of the spindle and then outwardly at an inclination of about 45°. The guide 35 not only directs the strands to the line of contact between the two cones, but positively prevents the strand from accidentally passing down to that portion of the cone 32 which slopes away from cone 23. A similar cone 36 and guide 37 are carried by the angle bracket 26 in cooperation with the flat disk 22.

With each pair of strand feeding cones there is associated one or more thread arms. These are identical in construction. For convenience, in Figs. 1 and 2 a single thread arm only is shown associated with each pair of strand feeding cones but provision is made for mounting three similar thread arms in association with each pair of strand feeding cones as shown in Fig. 6. However, since these are similar in construction and function, it will be sufficient for purposes of this disclosure to describe specifically only one thread arm. This is shown as carried by an angle bracket 38 fast to the left hand side of the upright frame portion 11, and as pivotally mounted on a horizontal shaft 39 in the bracket 38. The thread arm itself comprises a flat section 40 from which projects a wire extension 41. The outer end of this wire extension is turned downwardly and merges into an elongated triangular loop or sling 42 in which is enclosed a thread guiding eye 43 of porcelain or other wear-resisting material. The sling 42 provides a streamline enclosure for the eye 43, presenting no projection upon which this thread could catch and no configuration over which the thread might loop.

The rear end 44 of the flat section of the thread arm, as shown in Fig. 4, is shaped to present a concentric segmental cam surface which constitutes a part of the stopping mechanism to be presently described.

The arm 40 is provided with a series of holes and in one of these is hooked a downwardly ex-

tending wire 45 having a flattened section 46 in which is formed a thread guide. At its lower end the wire 45 is guided for vertical rectilinear movement in a hole formed in an arm 47 projecting laterally from the upright portion 11 of the frame. A long tension spring 48 is connected at its lower end to the arm 40 and at its upper end to an upstanding vertical supporting rod 49. The spring 48 exerts a pull on the thread arm 40 and thus maintains tension on the thread. The demand for the thread maintains the arm 40 in a normal working position. Variation in this demand causes the arm to swing up and down against the pull of the spring. The vertical wire 45 and the eye formed therein constitute an articulated thread guide having rectilinear movement in a path substantially at right angles to the path of the thread in passing to and between the strand feeding cones 22 and 36. Increasing demand of the knitting machine pulls the thread arm 40 downwardly and lowers the thread-guide wire 45 directing the thread more and more closely to the bases of the strand feeding cones and so increasing the rate of linear feed of the thread. On the other hand, when the thread demand of the knitting machine slackens, the arm 40 is lifted by the spring 48 and the thread guide wire 45 rises, directing the thread in a path nearer and nearer to the apex of the cones 36 and 22, thereby decreasing its rate of feed or even terminating its feeding movement by carrying the thread above or beyond the apices of the cones. In all these positions the thread approaches the line of contact between the cones in a direction at substantially right angles.

Located between the line of contact of the two cones 36 and 22 and the loop or sling 42 is a stationary wire guide 70 which may be secured to the machine at some convenient point such as the horizontal arm 63 (Fig. 2). The guide is formed with vertically extending loops 72 which are arranged to terminate at a level slightly above the point where the cones physically cease to intersect, as may be seen from an inspection of Fig. 2. The strand passes under one of the loops 72 instead of going directly to the eye 43 of the thread arm. As a result the strand is held out of action close to the apices of the cones so that the thread arm will be in approximately the same position when the strand is entered by means of guide 46 as it was when the thread went out from between the cones. By means of the loops 72 therefore it will be seen that the strand may be entered between the cones with the arm 40 being lowered a much shorter distance that would normally be the case without the loops. Thus any tendency for the guide 42 to overthrow and then rebounce is greatly reduced. The wire guide 70 preferably extends across the machine to provide a second set of loops 74, as shown at the right hand side of Fig. 2, which guides strands coming from the cones 23 and 32.

The stopping mechanism will now be described. To the top of the upright frame portion 11 is secured a rectangular upstanding casing 50, extending into the space between the bases of the cones 22 and 23 and in which is enclosed a micro-switch controlling the service circuit to the knitting machine. This is arranged to be tripped whenever a strand passing through the furnishing device breaks or catches and so develops excessive tension. A horizontal stud 51 projects

from one side of the casing 50 and upon this is journaled a lever 52. The rear arm of this lever is bent at right angles and shaped to provide bearings for an elongated horizontally disposed roller 53 which normally rests upon the concentric surface of the cam 44 of the thread arm 40 and supports the lever 52. The forward end of the lever 52 extends downwardly and then inwardly in a horizontal extension 54. On the other side of the casing 50 is provided a similar stud 55 for a similar lever 56 carrying a roller 57 and having an inwardly extending extension 58 at its forward end. These two inturned extensions 54 and 58 underlie the forwardly extending operating arm 59 of the micro-switch 60. When either lever 52 or 56 is rocked upwardly at its forward end by having its rear end ride off the cam 44 of the thread arm, the operating arm 59 of the switch is lifted and the switch opened or closed as the case may be to cut off current to the knitting machine motor and instantly stop the machine or operate a suitable stop motion to stop the machine. The concentric surface of the cam 44 is of sufficient extent to give the thread arm adequate working range; that is to say, the thread arm may move from a lowered position of maximum strand feed to an elevated position of minimum strand feed without permitting the roller 53 to drop, but if the thread arm is moved for any cause beyond this normal working range, the roller 53 drops off the concentric cam surface, the lever 52 is rocked and the micro-switch 60 is tripped. Thus the machine is safeguarded against thread breakage or excessive thread tension, but at the same time yarn changing is permitted because only one thread arm is effective at a time and the thread arm controlling a strand which is not in use rocks upwardly to an inoperative position as shown in Fig. 3 in which its cam portion 44 clears the roller 53 and leaves it under control of the operative thread arm only.

As herein shown, thread is led to the furnishing device from any suitable source of supply, first through a thread eye 61 carried by the horizontal bar or strip 62 secured by screws to the back of the upright portion 11 of the frame. Thence it passes through the eye of the vertically moving thread guide 45 to the line of contact between the strand feeding cones. From there it passes through the thread eye 43 and then downwardly to the needles of the knitting machine through a thread eye supported in a horizontal arm 63 secured to the base 10. As the thread passes between the two cones it is positively advanced at a rate controlled by the position of the thread arm as already explained and the thread arm, in addition to its thread guiding function, constitutes the controlling element of the stopping mechanism.

The eye 61 preferably is located at the level of or just a little higher than the point where the cones cease to physically intersect (Fig. 2). A further desirable provision is that the eye 61 should be spaced away from the eye 46 an appreciable distance, such as for example a distance at least equal to one and one-half times the height of the line of contact of the cones. While the disposition of the eye 61 is not limited to the exact positioning described, I have found that such an arrangement does provide for highly satisfactory operation of the furnishing device. In particular, when any undue tension develops on the strand, the eye 61 in the position such

as noted does not prevent eye 46 from rising and it does tend to assist the strand in coming out from between the cones. Some latitude in the location of the eye 61 either above or below the preferred level referred to may be resorted to within those limits defined by development of undesirable tension effects in either instance.

A further point to be noted in connection with the location of eye 61 consists in the relative positioning of this element with respect to each of the several other guide members already described. Thus it should be observed that eye 43, eye 46 and eye 61 are arranged in alinement with one another along a line which intersects the guide arm 37 and falls at one side of the axis of cone 36, as may be more clearly seen from an inspection of Fig. 1. This results in a strand which is to be engaged between the cones always coming into positive engagement with the guide arm 37 from which the strand slides downwardly between the cones. Likewise as the strand emerges from the top of the cones it tends to straighten out and to slide upwardly on the guide arm 37. By this arrangement of the several guides one to another, there is provided a space between the disc 22 and the strand when said strand is not in a feeding position.

In Fig. 7 is illustrated a feature of construction which consists in providing one of the strand-feeding cones, for example the cone 32, with notches or slashes 76 extending in divergent relation from the vertex of the cone. Such notches or slashes present definite edges which act positively to engage the yarn and whip it into feeding position when the yarn is to be moved into position between the cones after an interval of interrupted feed. This entering action is best shown in Fig. 8 where the notches 76 are shown as having allowed the strand to freely enter between the cones so that it will be grabbed by them as the full surface of cone 32 comes to the line of contact, thus starting the feeding of the strand smoothly and at once. A contrast to this condition is shown in Fig. 9 where the strand is trying to enter between cones not supplied with the notches. The pressure of the contacting surfaces is usually great and the thread must catch by pure friction so as to force its way between the cones, which means separating them to the extent of the draw of the thread. Under the conditions as shown in Fig. 9, thread may at times refuse to enter between the cones and under any circumstances its time of entry is uncertain, thus preventing a smooth starting action of the strand from a non-feeding to a feeding position, such as is essential in yarn changing on a knitting machine and highly desirable when starting other machines, such as winders. The above applies in cases where smooth surfaces are used on the cones. These smooth surfaces are especially desirable when feeding yarns at high speeds since vibration is thus eliminated or reduced. For best results, the length of the notches 76 should be limited to avoid the occurrence of any undesirable interruption in smooth feeding. Thus a configuration extending for a distance of one-sixteenth of an inch gives satisfactory results.

Under some conditions, as high-speed operation, a better furnishing action can be obtained by the use of cones which are characterized by smooth faces. The use of smooth surfaces may however offer a less desirable means of initially engaging the strand between the cones. The notches 76 are especially effective in overcoming any possible lag in the actual entering of the strand between smooth surfaces as rolls of this character.

Having thus disclosed my invention and described in detail an illustrative embodiment thereof, I claim as new and desire to secure by Letters Patent:

1. A duplex furnishing device comprising separate pairs of strand-feeding cones, an oscillatory thread arm associated with each pair of cones, a rocking lever engaged and held at rest by each thread arm while the arm occupies a normal working position, and a single stop switch arranged to be thrown by the movement of either one of said rocking levers when the said rocking lever is released by movement of the corresponding thread arm beyond its working range.

2. A furnishing device including strand-feeding cones, an oscillatory thread arm associated therewith and having a concentric cam surface of predetermined length, a rocking lever normally locked in stationary position by engagement with said cam surface, and a stop switch arranged to be thrown by said rocking lever when the thread arm is moved sufficiently in either direction to carry its said cam surface to releasing position.

3. A duplex furnishing device comprising a driving shaft, a shaft driven thereby at an intermediate point, wide-angle cones fast to each end of said driven shaft in back-to-back relation, an angle bracket pivotally mounted adjacent to each of said wide-angle cones, an acute-angle cone carried by each bracket, spring means operating upon the brackets for pressing the latter cones against the wide angle cones, and a movable thread arm associated with each pair of cones.

4. A duplex furnishing device comprising a frame having a vertically disposed driving shaft journaled therein, a horizontal shaft driven thereby at a higher rate of speed, wide angle cones fast to both ends of said driven shaft and rotatable therewith about a common axis in back-to-back relation, independently adjustable carrier bars mounted in said frame beneath the driven shaft, an upstanding spindle mounted for pivotal movement on each bar and carrying a freely rotatable acute-angle cone, independent spring means tending at all times to swing the spindles toward the wide angle cones, and strand controlling means associated with both pairs of cones.

5. A duplex furnishing device comprising a pair of wide-angle cones rotatable about a common axis and spaced from each other in back-to-back relation with their bases disposed concentrically, an acute angle cone in rolling contact with each wide angle cone, a pivotally mounted thread arm associated with each pair of cones, being movable in accordance with thread demand and having a concentric supporting portion, a tripping lever resting on the supporting portion of each thread arm and arranged to be held at rest thereby throughout the working range of thread demand, a stop switch located between the wide-angle cones, and an operating arm for the switch located in the path of both tripping levers.

6. A furnishing device including thread-feeding cones in rolling contact with each other, stationary thread guides at either side of the line of contact of the cones, both positioned at a level above the smaller ends of the cones, an articulated thread guide mounted between one of said stationary thread guides and the entering side of the cones and being movable in a substantially straight line path always at right angles to the

line of the thread passing to the cones, a thread arm cooperating with the articulated thread guide and movable itself in accordance with variations in the thread demand, the stationary guides initially supporting the thread above the cones at either side thereof.

7. A furnishing device comprising thread-feeding cones mounted for rotation about converging axes and having their surfaces rolling in contact with one another, guides for directing a strand in a path between the conical sides of said cones, one of said guides being stationary and arranged at a level above the smaller ends of the cones, the other of said guides being movable in a substantially straight line path always at right angles to the path of the thread in passing to said cones and being located between the stationary guide and the entering side of the cones and adapted to assume a position below said stationary guide when a strand is entered, a thread arm operatively connected with the said movable guide, extending above the cones and being responsive to thread demand, and a second stationary guide interposed between the thread arm and the cones and located above the level of the smaller ends of the cones.

8. A furnishing device comprising contiguous strand-feeding cones, a stationary strand-feeding guide eye located at a level above the smaller ends of the cones, a thread arm mounted for oscillation under thread demand, spring means controlling such oscillation, a movable guide eye responsive to oscillations of the thread arm, said movable guide eye being arranged between the strand-feeding guide eye and the entering side of the cones and being restricted to movement in a substantially straight line path at right angles to the path of the strand in passing to the cones, and a second stationary guide member mounted between the thread arm and the cones, said guide member being arranged at a level above the smaller ends of the cones for the purpose of directing the strand in a path closely adjacent to the cones independently of the thread arm.

9. A duplex furnishing mechanism comprising a pair of strand-feeding cones disposed concentrically for rotation about a common axis with their smaller ends oppositely directed, a common shaft carrying said cones and positively driving them at equal speed, separate rotary strand-feeding cones respectively pressed yieldingly toward the two driven cones and cooperating therewith to advance different strands at independent rates of linear feed depending on the point of contact therewith of the particular strand.

10. A duplex furnishing mechanism comprising a pair of similar strand-feeding cones disposed concentrically for rotation about a common axis with their smaller ends outwardly directed, a common shaft carrying said cones and positively driving them at equal speed, a cooperating strand-feeding cone yieldingly pressed toward each of said driven cones and rotated by contact therewith, and strand-guiding means associated with each pair of cones and operating independently to direct strands in different paths between the cones and thus to advance the strands at variable rates of linear feed.

11. A duplex furnishing mechanism comprising a base, a vertical shaft journaled therein and having a gear at its upper end, a transverse shaft

shouldered and reduced throughout a portion of its length, a gear fast on said reduced portion and supported by the shoulder, a wide angle strand-feeding cone fast to each end of the transverse shaft, separate brackets pivotally mounted on the base, a narrow angle strand-feeding cone carried by each bracket, and spring operated means acting on the brackets for pressing the narrow angle cones toward the wide angle cones.

12. A duplex furnishing mechanism comprising a base having an upright portion forked at its upper end, a transverse shaft shouldered and reduced throughout a portion of its length, a gear keyed to the reduced portion of the shaft and supported by the shoulder therein, the said transverse shaft extending outwardly at both ends beyond the forks of the said upstanding base portion, wide angle cones fast to both ends of the shaft with their smaller ends directed outwardly, and narrow angle cones pivotally mounted in opposite sides of the base and yieldingly urged inwardly into rolling contact with the wide angle cones.

13. A duplex furnishing mechanism comprising a base carrying a horizontal shaft, a pair of wide angle strand-feeding cones mounted upon opposite ends of the shaft with their bases spaced apart and providing an intermediate open space, a narrow angle cone engaged with the outer face of each wide angle cone, a thread guide movable in response to the passage of a strand between each pair of cones, and an automatic stopping device located in the space between the wide angle cones and having operating connections with both the said thread guides.

14. A duplex furnishing mechanism comprising a pair of strand-feeding cones having truncated smaller ends oppositely directed and disposed concentrically with respect to a common axis, separate rotary strand-feeding truncated cones in yielding contact with the oppositely directed cones and cooperating to advance different strands at independent rates of linear feed, depending on the point of contact therewith of the particular strand, while one cone of each pair is positively driven at the same speed.

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