

Nov. 9, 1943.

P. F. COOPER

2,333,705

STRAND FEEDING MECHANISM

Filed Aug. 1, 1942

2 Sheets-Sheet 1

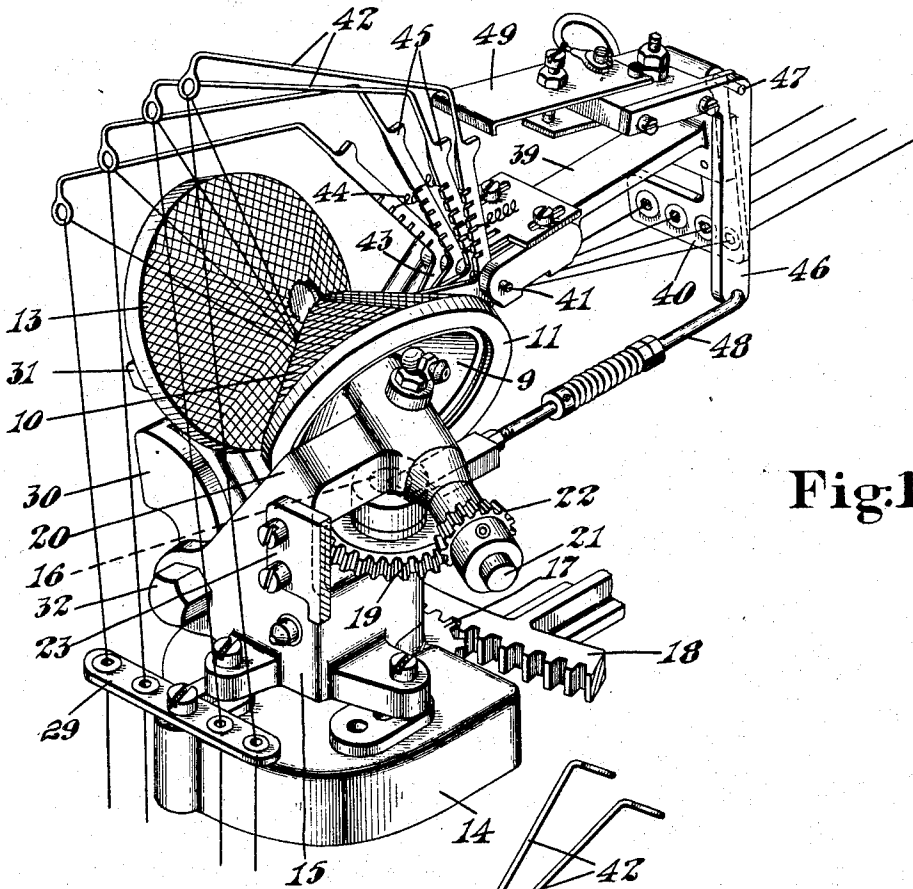


Fig. 1.

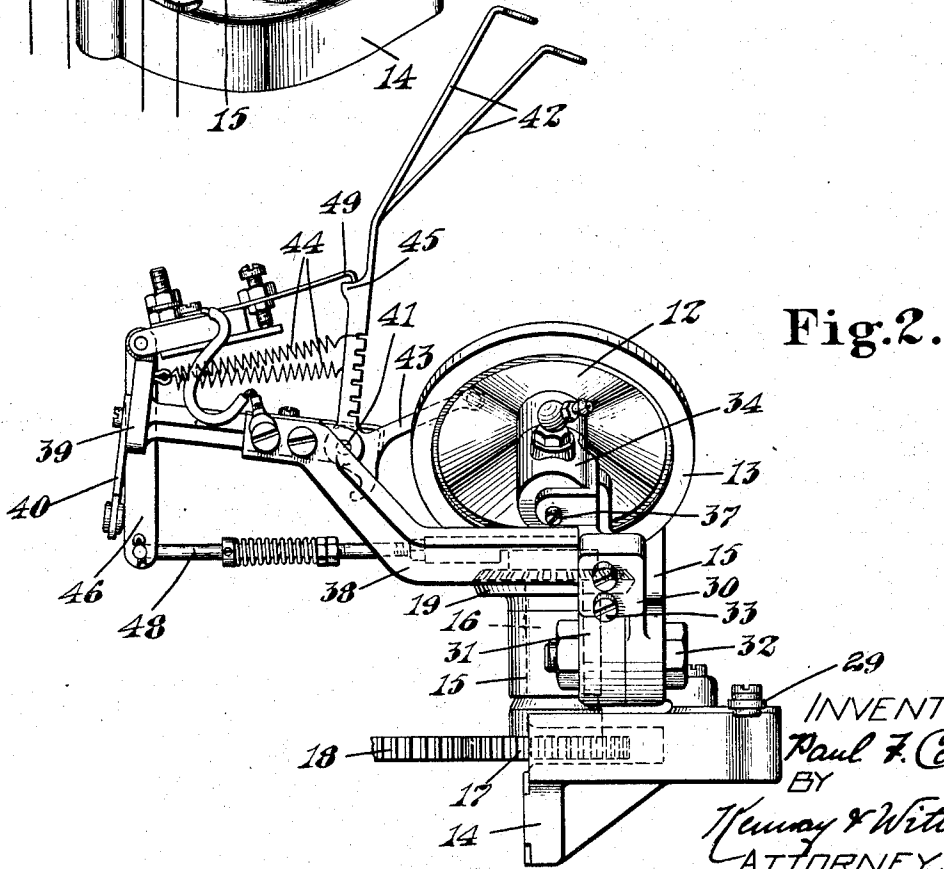


Fig. 2.

INVENTOR.
Paul F. Cooper.
BY
Henry & Witter.
ATTORNEYS.

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2 Sheets-Sheet 2

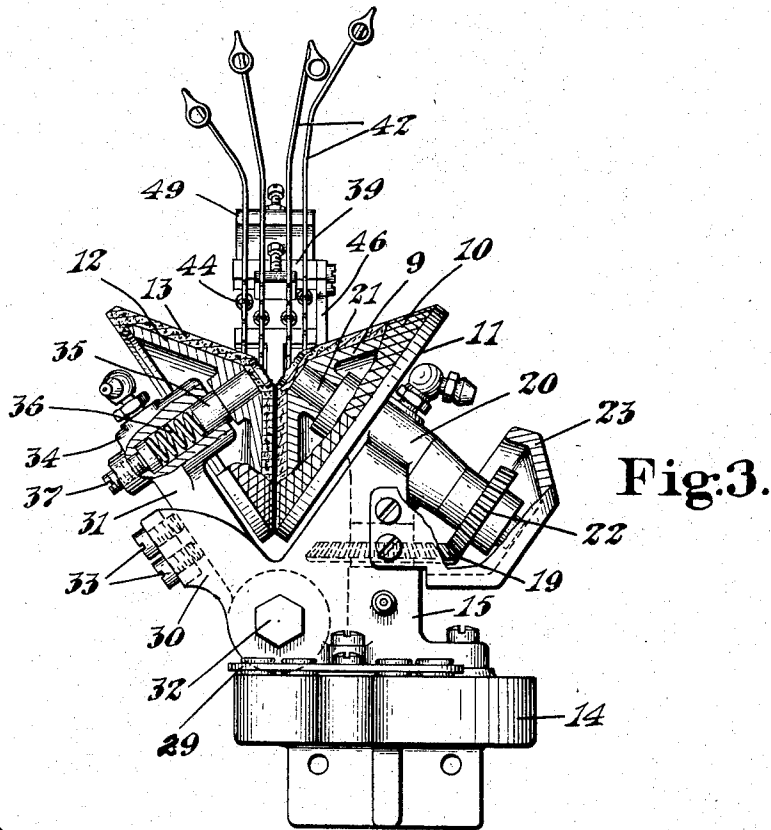


Fig. 3.

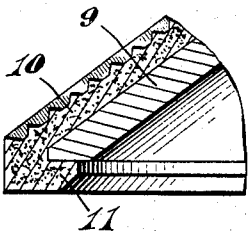


Fig. 5.

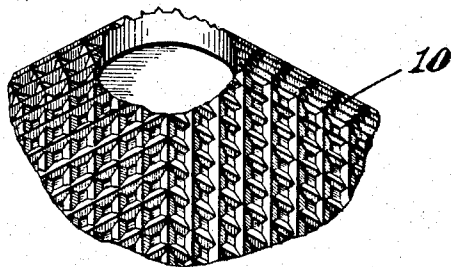


Fig. 4.

INVENTOR
Paul F. Cooper.
BY
Henry & Witten.
ATTORNEYS.

UNITED STATES PATENT OFFICE

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STRAND FEEDING MECHANISM

Paul F. Cooper, Laconia, N. H., assignor to Scott & Williams, Inc., Laconia, N. H., a corporation of Massachusetts

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10 Claims. (Cl. 66—132)

This invention relates to furnishing or strand feeding mechanism for textile machines, particularly knitting and winding machines. Such machines require mechanism for supplying strands accurately, smoothly and at high speed under many different exacting conditions. For example, in knitting machines for fashioning garments the thread demand may be interrupted or varied in rate from time to time, or at regular intervals. The furnishing mechanism serving such machines must therefore be capable of feeding the strand or thread effectively at definite predetermined rates over a wide range of speeds, of permitting intervals of complete interruption with no thread being fed and of resuming feed smoothly and without appreciable lag after each such interruption of strand movement.

Important fields of use for my novel furnishing mechanism are in connection with circular underwear machines, which require thread feeding at uniform rate, at variable controlled rates with or without interruption periods when no thread is required (in these machines it may likewise be desired to handle elastic thread with or without a stretching device between the feeding mechanism and the needles); in circular hosiery machines with or without a stretching device in which the thread is required to be supplied at a controlled rate of feed broken by intervals of rest; and in flat hosiery or flat underwear machines in which the thread demand ceases at the end of each stroke and in which the thread is supplied either at a uniform rate or at a rate of feed varying in accordance with a selected predetermined cycle and with or without a stretching or tension device. My invention is herein disclosed as organized for use in these fields but is in no sense limited thereto.

I have discovered a novel structure for furnishing mechanisms that is completely satisfactory for carrying out all the functions above discussed. The mechanism comprises cooperating members of firm resilient rubber or rubber-like material shaped to present to each other conical contacting, strand-engaging faces of roughened configuration and arranged to be rotated about convergent axes under uniform pressure of engagement, in combination with a guide movable to direct a strand or a number of strands in paths at different distances from the small end of one of the said conical faces, or from the point where the axes of the conical surfaces intersect or most nearly intersect.

In addition to the useful characteristics above discussed, the novel mechanism of my invention

has other valuable and unpredictable advantages. In the first place, it operates with complete control of the yarn, that is to say, it delivers the yarn smoothly and at a uniform rate of speed and uniform light tension and it completely eliminates all jerking or catching of the yarn that may occur at the receiving or incoming side of the mechanism. For example, in being unwound from a cone the turns of the strand are bound to catch momentarily from time to time, or to require varying pull as the core diameter decreases. Such inequalities in the behavior of the incoming strand are absorbed by the resilient strand-engaging material presented in my improved mechanism, and cannot be detected in the strand itself as it is delivered from the conical strand-engaging faces. This improved result is probably due to the fact that all slip is eliminated between the strand and the feeding surfaces that engage it. This result may be due in part to a capacity for momentarily yielding of the resilient material of the feeding members which cushions and absorbs any irregularities occurring in the advancing movement of the strand at the point of initial engagement. Whatever the case may be the result is that the strand as delivered moves at the desired controlled rate of speed with a very light, uniform tension regardless of substantial and variable tension that might exist in the incoming strand running to the furnishing mechanism.

Another important and unpredictable result of my improved furnishing mechanism is that it practically eliminates the formation of lint or fluff from the yarn. In furnishing mechanisms as heretofore constructed a very objectionable characteristic has been the continual stripping from the strand of lint, fuzz or short fibres which in the continuous operation of the machine build up first into downy rolls and then into compact bodies or slugs that are likely to be picked up eventually and carried along by the strand causing breakage or an imperfection in the finished product. An objectionable formation of lint occurs in furnishing mechanism employing metal or other rigid strand-engaging faces or a single rigid strand-engaging face, or a toothed configuration of feeding surface. It has been discovered however, that by employing cooperating members of firm, resilient rubber-like material with roughened conical contacting strand-engaging faces, the formation of lint is practically eliminated and the mechanism may be run at high speed for hours without any objectionable formation of lint.

Another advantage of the furnishing mechanism of my invention is that it has a wider range of utility than mechanisms heretofore known in that it capable of handling a greater variety of yarns than heretofore. In fact, by my invention, the range of the mechanism is increased in both directions, that is to say, it is capable of satisfactorily handling light single-strand yarns too delicate to be handled in furnishing mechanisms heretofore known, and it is capable of handling stiff wire-like strands of rayon or other thermoplastic yarns or mono-filament yarns, such as that sold under the trade name "Saran."

The furnishing mechanism of my invention has the further advantage that it will handle two or more strands of yarn at the same time even though the strands may run from time to time in overlapping or crossing paths. The different strands may be delivered by my novel mechanism independently at the required different rates without interfering with each other and this is true even though the different strands may be of different material such as wool or cotton.

Still another very important advantage in the furnishing mechanism of my invention is that its use overcomes the necessity for frequently adjusting the stitch of knitting machinery with which it is used. Heretofore it has been necessary every few hours in operating machines to make adjustments in the stitch forming mechanism to compensate for variations in length of stitch due to reduction in the size of the thread package as the thread is consumed. The necessity for this skilled supervision and delicate adjustment is eliminated by the furnishing mechanism of my invention, and machines serviced thereby may be operated continuously without any adjustment of the stitch due to variation in size of the thread package.

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 view in perspective of the complete mechanism,

Fig. 2 is a view in the side elevation,

Fig. 3 is a view in front elevation, with portions broken away, and

Figs. 4 and 5 are fragmentary views on an enlarged scale of one of the conical feeding members of the mechanism.

Without in any respect confining myself to the particular textile machine, which has been selected only by way of example, I will proceed to describe the illustrated mechanism as organized for feeding four strands of yarn from suitable sources of supply to the needles of a knitting machine.

The essential elements of the mechanism are cooperating cones or conical disk members 9 and 12 each having thereon a thick layer or facing 10 or 13 of molded rubber or rubber-like material and being arranged to rotate about intersecting axes with their conical surfaces in tangential rolling relation. The cones illustrated have metal bodies of the same size and shape, each being hollow and having a flat base angle of 25° or thereabout. The cones are both mounted upon a cast iron base 14 which is arranged to be bolted to the main frame of the knitting machine. To the base is rigidly but adjustably bolted an upright bracket 15 having bearings for a short vertical shaft 16 provided at its lower end with a pinion 17 arranged to be driven

by a large gear 18 constituting a part of the knitting machine and the only part herein shown. At its upper end the shaft is provided with a bevelled gear 19 and this is arranged to drive one of the conical feeding members as will presently be described.

The upright bracket 15 has integral upwardly diverging arms 20 and 30. The arm 20 is transversely extended and terminates in an elongated boss which provides bearings for a short inclined shaft 21 having at its lower or outer end a small bevelled gear 22 arranged to mesh with the bevelled gear 19 on the shaft 16 already mentioned. At its upper or inner end the shaft 21 is shouldered and fitted into the metal cone 9 so that this cone is positively driven for rotation with the shaft 21 from the large gear 18 of the knitting machine through the train of mechanism just described.

Adjustably mounted on the bracket 15 at the base of the stationary arm 30 is a bearing arm 31. This bearing arm is arranged for accurate adjustment about the axis of a pivot bolt 32 passing through the arm 30 and is supported in adjusted position by adjusting screws 33 which are threaded into the arm 30 and bear against the outer face of the arm 31. At its upper end the arm 31 is provided with an elongated boss 34 providing an inclined bearing for a short shaft 35, which is free to slide longitudinally and to rotate in the bearing. The shaft is shouldered at its upper end and fitted into the metal cone 12. At its lower end it is backed up by a compression spring 36 which in turn is adjustably supported by an abutment screw 37 threaded into a boss in line with the bearing in the arm 31. The screw 37 is set so as to maintain the conical rubber-covered surfaces of the two cones in yielding contact with just the desired degree of pressure. The cone 12 is rotated by its contact with the cone 9, both cones of course moving in the same direction at the common line of contact of their facings.

The metal cones 9 and 12 are each provided with a facing or shoe 10 or 13 of firm resilient material such as natural or synthetic rubber of oil resisting composition. It is necessary that the coating should have this characteristic as many of the yarns which the mechanism must handle carry with them oil or paraffin. The facing is shown in Figs. 4 and 5 as comprising a complete self-contained unit shaped to be stretched over the metal cone of each feeding device and to maintain its position thereon without slipping or displacement. The conical wall of each rubber unit 10 or 13 is of substantial thickness and terminates in a shoulder bounded by a narrow cylindrical surface and having a flat inwardly extending annular flange 11. Between this flange and the conical inner surface of the unit is provided an annular channel in which is received the lower edge of the metal cone 9 or 12.

The outer surface of each facing unit 10 or 13 may be roughened in any desired pattern. As herein shown it is provided with intersecting ribs forming diamond shaped recesses of a conventional knurled pattern, and while this is a very satisfactory surface configuration, the particular design adopted is a matter of secondary importance only. The apex of each facing unit is truncated and presents a circular aperture having a wall made up in part by the projecting ends of the ribs which form the knurled pattern of its surface. These projections constitute

strand-engaging means which are effective in carrying the strands from neutral or non-feeding position to the bite of the feeding members after periods of interruption in the feeding movements of the strands. The knurled resilient surfaces of the two feed members are held in yielding contact by the action of the spring 36, as already explained, and in operation this resilient pressure is of an amount sufficient to cause a slight compression of the rubber of the facings along the common line of contact between the two feed members.

In Fig. 1 four strands are shown as being guided to and through the illustrated furnishing mechanism although a single strand may be handled with all of the advantages above described. The adjustable bearing arm 31 carries a rearward extension 38 in which is adjustably mounted a bracket 39 carrying a downwardly extending guide plate 40 having spaced eyes therein through which the respective strands are led to the furnishing mechanism from any suitable source of supply. The forward end of the bracket is forked and provided with a transverse pivot pin 41 upon which are pivotally mounted four spaced strand guides each having a long forwardly and upwardly extending arm 42 provided with a strand receiving loop at its forward end and a short arm 43 which when the mechanism is in operation, extends forwardly and downwardly below the point of intersection of the axes of the two conical feeding members. The strands pass through the eyes of the guide plate 40, through loops in the ends of the short arms 43, thence upwardly to the loops in the ends of the long arms 42 and finally downwardly through holes in a second guide plate 29, secured to the base 14, passing directly therefrom to the needles of the knitting machine. The portion of the strand passing between the two arms 42 and 43 of the strand guide may be moved from a neutral position of no feed, in space provided by truncation of the conical feeding members, downwardly into a position where it is engaged by the conical surfaces of the feeding member, and then progressively as the strand demand increases to positions further and further from the small ends of the cones to positions where the speed of feeding movement is progressively greater and greater.

Each strand guiding device is normally retained by a tension spring 44 in non-feeding position, but is drawn forwardly and downwardly against the action of its spring by tension in its own particular strand due to the instantaneous demand from the knitting machine. The greater the demand the further forward is the strand guide swung, and the faster feeding movement therefore imparted to its particular strand. As the demand slackens the guide is moved by its spring first toward a position of slower feeding speed, and then when the demand ceases to initial non-feeding position. Thus the strand is moved along the line of contact between the conical surfaces to provide the variation of strand feeding speed and it will be apparent that this movement precludes the wearing of any strand tracks in the surfaces and maintains the surfaces continuously uniform throughout. Attention is also directed to the fact that the two cooperating and like resilient surfaces, acting together against the strand, do not form lint and fluff from the yarn and thus is avoided the consequent breakage and imperfections in the product

which result from employing two unlike surfaces that act unequally on the yarn.

In order to complete the description of the illustrated mechanism it is necessary to refer to automatic means for detecting strand-breakage which is herein illustrated, but which forms no part of the present invention. The bracket 39 carries an L-shaped rocker member 46 pivotally mounted on a transverse shaft 47 and oscillated by an eccentric on the upper end of the vertical shaft 16 through an adjustable connecting rod 48. The forwardly extending arm of the rocker carries a horizontal sheet metal plate 49 having a downwardly extending flange at its forward end. Each of the strand guides is provided with a rearwardly extending shoulder 45 which in case of breakage is caused by the spring 44 to move rearwardly into the path of oscillation of the spring plate 49 but which is maintained slightly in advance of its path so long as the weight of a strand is carried by the long arm 42 of the strand guide. In each revolution of the shaft 16, the plate 49 is therefore oscillated so that it will engage any shoulder 45 which happens to be in its path. Electrical connections are made between the plate 49 and the respective strand guides. Accordingly if any strand breaks the shoulder 45 of the corresponding guide will be engaged by the flange of the plate 49 and an electrical circuit opened by which automatic stopping mechanism or any desired warning signal may be operated to indicate that the mechanism should be rethreaded. In Fig. 2, the strand guides are shown as engaged and held in inoperative position by the plate 49, this being the position in which they are held when the strand is broken and fallen from the loops of the arms 42.

The springs 44 are so adjusted that when there is no tension upon the strand the respective strand guides are positioned to lead the strands through the space provided by the truncated ends of the feeding members or in non-feeding position. When tension is exerted on any of the strands by the demand of the knitting machine the arm 42 of the corresponding strand guide is pulled downwardly and accordingly the strand in passing from the lower arm 43 of the loop to the upper arm 42, is moved downwardly toward the bite of the feeding members. When it has been moved sufficiently to be engaged by the projecting ends of the ribs at the small end of the cones, it is immediately whipped into the bite of the feeding members. These projections act to expedite and facilitate the passage of the strand from non-feeding position to a position such as shown in Fig. 1 wherein the strand passes through the common line of contact between the conical surfaces.

The respective strands, when in feeding position, are engaged yieldingly and firmly by the resilient material of the facing units and advanced without any detectable slippage at a rate of feed determined by the rotation of the feeding members and the position of the strand between them. While the movement of the strands to the feeding members may be somewhat irregular for reasons already explained, these irregularities are removed and dissipated by the action of the feeding members. While all the reasons for these advantageous results are not entirely understood it is probable that the two resilient strand-engaging surfaces may instantaneously yield to any retraction of the entering strand and then, as the obstruction is overcome resume

their normal condition. However, in no instance is there any detectable slip or stripping of the strand and if an instantaneous distortion of the gripping material occurs it does not impart any noticeable irregularity to the strand as delivered by the feeding members. As the rate of strand demand increases the guides 42—43 are brought further and further forward and the strand is carried downwardly to positions in which the linear surface speed of the feeding members is increased to satisfy the increasing demand of the knitting machine. As the demand slackens the strand guides are swung upwardly by their springs 44 and when the demand ceases momentarily or for a longer period the guide of that particular strand moves the strand into non-feeding position out of range of the feeding members.

When a single strand guide is employed both of its arms are preferably located in the vertical tangential plane of the two feeding members. When two or more strand guides are employed they may be arranged with even transverse spacing, it being necessary only that the short lower arms 43 of the guides are brought close enough together at their outer ends to move freely into space between the conical surfaces 10 and 13 of the feeding members.

The preferred surface configuration of the feeding members is well illustrated in Figs. 4 and 5. It is a more or less conventional knurled pattern formed by intersecting ribs which start at the base of the conical facing unit, and run obliquely toward its apex defining between them diamond-shaped depressions disposed with their long axes coinciding with the elements of the conical surface. The ribs consequently present long narrow strand-engaging areas or lines, and thus momentary yielding of the limited strand-engaging areas is facilitated.

Further, corrugating or roughening the rubber facing causes the yarn to feed freely from the surface and keeps it from sticking to the cones, winding around them and breaking the strand of yarn. The two corrugated feeding surfaces moreover so grip the yarn that it is permitted to change from one position to another quickly and while thus handled the formation of lint is practically eliminated. This is due, at least in part, to the elimination of slippage of the strand between the feeding members, but may also be due to the incidental elimination of static electricity.

While I have shown and described the feeding members 9 and 12 as hollow metal cones with rubber-like resilient facings, it is understood that these cones could be of any other suitable material, such as plastics, wood or hard rubber and can either be hollow or solid. In some instances, a solid cone of the resilient material might be preferable to the metal cones herein shown.

Having thus disclosed my invention and described it in the best form now known to me, I claim as new and desire to secure by Letters Patent:

1. Furnishing mechanism including in its structure two cooperating rotatable members of firm resilient rubber-like material shaped and arranged to present to each other along a line contact disposed between the rotary axes of the members conical contacting strand-engaging faces of roughened configuration, means for rotating said members in the same direction at their common line of contact and under uniform pressure at said line, and a guide movable

in accordance with machine demand to direct a strand in paths along said line at different distances from the smaller end of the said conical faces, said faces being adapted resiliently and frictionally to engage the strand along said line and feed the strand longitudinally at speeds corresponding to the rotary surface speeds of the surfaces engaging the strand.

2. Furnishing mechanism including in its structure a pair of cooperating rotatable members of firm resilient rubber-like material shaped and arranged to present to each other along a line contact disposed between the rotary axes of the members conical faces roughened to present raised contacting strand-engaging areas, means for rotating said members in the same direction at their common line of contact and under uniform pressure of engagement at said line, and a guide movable in accordance with machine demand to direct a strand in paths along said line at different distances from the smaller end of said conical faces and beyond their range of feeding action, said faces being adapted resiliently and frictionally to engage the strand along said line and feed the strand longitudinally at speeds corresponding to the rotary surface speeds of the surfaces engaging the strand.

3. Furnishing mechanism including in its structure cooperating rotary strand-feeding members each having a conical body and a conical rubber-like facing thereon presenting a roughened and resilient strand-engaging surface, said members being arranged to rotate in tangential relation along a line contact and about converging axes with limited and yielding pressure of engagement, and strand guiding means for movably directing a strand in accordance with machine demand in different paths along said line between said members and beyond their range of feeding action, said faces being adapted resiliently and frictionally to engage the strand along said line and feed the strand longitudinally at speeds corresponding to the rotary surface speeds of the surfaces engaging the strand.

4. Furnishing mechanism including in its structure cooperating strand-feeding members, each comprising a rigid core having a substantial covering layer of rubber-like material, the said members presenting conical surfaces to each other and being rotatable in tangential relation along a line contact, both surfaces having a bas-relief pattern therein providing projecting portions adapted to engage an interposed strand, impart a feeding movement thereto and be free to yield instantaneously to momentary retardation of the incoming strand and immediately to reassure their normal condition when such retardation terminates, and means for holding and directing a strand laterally along said line in accordance with machine demand.

5. Furnishing mechanism including in its structure cooperating strand-feeding members, each comprising a rigid cone having a substantial covering layer of rubber-like material, the said members presenting conical surfaces to each other and being rotatable about converging axes in tangential relation along a line contact between said axes, both surfaces being recessed in a knurled pattern providing limited outstanding strand-engaging areas capable of being displaced momentarily by irregular retardation of a strand fed between them, and having the capacity of immediately reassuming their normal position when such retardation terminates, and means

for holding and directing a strand laterally along said line in accordance with machine demand.

6. For a furnishing mechanism, a strand-feeding member comprising a hollow truncated cone having a conical facing unit of rubber-like material provided with an annular base flange extending inwardly from the conical wall of the unit and embracing the lower edge of the said metal cone.

7. For a furnishing mechanism having a strand feeding member, a cooperating strand-feeding member comprising a cone having a substantial layer of rubber-like facing material thereon presenting a conical surface configuration consisting of intersecting ribs extending upwardly from the base of the cone and defining between them diamond shaped depressions, the ribs providing narrow upstanding strand engaging areas and said conical surface being adapted to cooperate with the first named member to feed a strand.

8. For a furnishing mechanism having a strand feeding member, a facing for a strand-feeding member comprising a conical unit of rubber-like material provided with an annular

base flange extending inwardly to embrace its support, said facing being adapted to cooperate with the first named member to feed a strand.

9. For a furnishing mechanism having a strand feeding member, a facing for a strand-feeding member comprising a conical unit of rubber-like material having an outer surface configuration consisting of intersecting ribs extending upwardly from the base of the cone and defining between them diamond-shaped depressions, the ribs providing narrow upstanding strand-engaging areas and said facing being adapted to cooperate with the first named member to feed a strand.

10. Furnishing mechanism including in its structure cooperating strand-feeding members rotatable about converging axes and presenting to each other roughened conical faces of resilient rubber-like material, and a plurality of strand-guides having short arms movable in adjacent paths in the space between the diverging conical surfaces of said members and long arms arranged with substantially greater lateral spacing for movement above said members.

PAUL F. COOPER.