YARN TRIMMING MECHANISMS

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The present invention relates to a trimming mechanism and more particularly to a yarn trimming mechanism especially adapted for trimming the ends of a reinforcing yarn in a circular hosiery knitting machine.

The objects of this invention is to provide a yarn trimming mechanism that is inexpensive and at the same time is dependable, durable, and efficient in operation, that is economical not only in that the power requirements are at a minimum but also in that the heat propagated thereby is at a minimum, that is sufficiently fast-acting to sever yarns in a circular hosiery knitting machine that is operating at normal speeds, and that is capable of being designed into such a machine in view of the space limitations thereof.

Having in mind the above and other objects that will be evident from an understanding of this disclosure, the invention comprises the devices, combinations and arrangements of parts as illustrated in the presently preferred embodiment of the invention which is hereinafter set forth in such detail as to enable those skilled in the art readily to understand the function, operation, construction and advantages of it when read in conjunction with the accompanying drawings in which:

FIG. 1 is a fragmentary sectional view of a knitting machine provided with a trimmer in accordance with this invention.

FIG. 2 is a top plan view of the trimmer of FIG. 1.

FIG. 3 is a vertical sectional view longitudinally of the trimmer of FIG. 1.

FIG. 4 is a transverse sectional view taken substantially on the line 4—4 of FIG. 1.

FIG. 5 is a detail view in perspective of the trimmer unit per se.

With reference to the drawings, there is illustrated a fragmentary portion of a circular knitting machine and particularly the rotary needle cylinder 1 having needle grooves 2 longitudinally in the periphery thereof in which the needles 3 are mounted for endwise sliding. Rotating with the needle cylinder 1 is a sinner ring 4 in which a plurality of sinkers 5 are mounted for sliding radially relative to the axis of the needle cylinder 1. To actuate the sinkers 5, there is provided a stationary sinner cap 6 having a cam groove that receives the bolts 7 of the sinkers. The needles 3 are adapted to be raised and lowered in the needle grooves 2 by a needle cam 9a cooperating with butt 35 of the needle. The trimmer in accordance with this invention is adapted to sever the knitting yarns at a point as closely adjacent to the needles as is practical.

The trimmer, which is generally indicated at 8, is mounted upon a post 9 upstanding from the frame of the machine. The means for mounting the trimmer on the post comprises a mounting plate 10 secured to the top of the post 9 by a screw 11 and having a laterally extending portion 12 upon which a pivot plate 13 is mounted by a screw 14. The pivot plate 13 has a pair of spaced upstanding lugs 15 between which is mounted the depending block portion 16, FIG. 4, of the body portion or frame 17 of the trimmer. A pivot pin 18 is secured in the lug 16, as by a set screw 19, and the ends thereof are pivotally mounted in the lugs 15. The pin 18 has a head 20 at one end thereof and a nut 21 threaded into the other end. The pin 18 and thus the entire trimmer is pivotally biased clockwise, as seen in FIGS. 1 and 3, by a torsion spring 22 coiled about the head 20 of the pin 18 and anchored at its opposite ends in a slot 23 in the end of the head 20 and in a hole in the pivot plate 15. The spring 22 biases the body portion 17 of the trimmer into a stop position as determined by adjustable stop screws 24 threaded through a portion of the body portion 17 and adapted to engage the top of the sinker cap 6, thereby positioning the trimmer vertically relatively to the needles 3.

Secured, for example as by brazing to the body portion 17 at the top thereof is an open-ended tube 25 which is disposed with the axis thereof, substantially normal to the axis of the pin 18 and in a plane radially of the needle cylinder 1. Mounted in the tube 25 is the trimmer unit 26 (shown per se in FIG. 5) which comprises an electromechanical transducer 27 and an acoustical transformer or amplifier 28 commonly called a horn. The transducer 27 is an electrically actuated generator of endwise oscillation or vibrations of high and preferably ultrasonic frequencies, and in the illustrated embodiment of the invention comprises a piezoelectric crystal 29 that is connected by wires 30 with a source of electric power of suitable frequency. A sleeve 31 of insulation surrounds the end of the crystal at the connection of the wires 30.

The transformer 28 is of a strong resilient metal, for example K-Monel, and comprises a first portion 32 secured at one end as by an epoxy resin directly to the end of transducer 27 and a second portion 33 extending from the opposite end thereof. The portions 32 and 33 are preferably cylindrical with the diameter of the first portion 32 being substantially equal to that of the crystal 27 and the diameter of the second portion being substantially less. The length of the first portion 32 is made equal to one-quarter of the wavelength of sound in the material of which the transformer 28 is formed at the frequency generated by the transducer 27. The length of the second portion 33 of the transformer is three times that of the first portion 32.

For mounting the trimmer unit 26 in the tube 25 for endwise sliding into and out of operative position with respect to the needles 3, there is provided a sleeve 35 secured as by brazing to the first portion 32 of the transformer at the end thereof adjacent to the second portion 33. This point, being spaced at a distance equal to one-quarter wave length from the end that is connected to the transducer 27 is at a node point and at this point there is no endwise vibration of the first portion 32 of the transformer. The sleeve 35 has an outside diameter such as to be snugly but slidably received within the tube 25. The trimmer unit 26 is supported at a second point within the tube 25 by a rubber O-ring 36 that surrounds the crystal 27.

The free end 37 of the second portion 33 of the transformer 28 is formed with a cutting edge 38 that is adapted to cooperate with the cutting edge 39 of anvil 40. The anvil 40 is carried by a collar 41 that is fixed on the second portion 33 of the transformer at a nodal plane thereof, which in the disclosed embodiment is at one-quarter wave length from the cutting edge 38. To bias the cutting edge 39 of the anvil 40 against the cutting edge 38, there is provided a relatively rigid bracket 42 carried by the collar 41 and into which is threaded the end of an adjusting screw 43.

The trimmer unit 26 is adapted to be advanced into and to be retracted from its operating position relative to the needles 3 by means of a cable 44 that is enclosed within a flexible but noncompressible sheath 45 which is connected at its end adjacent to the trimmer to a sleeve 46 that telescopically receives a stud 47 secured to a plate 48. The opposite end (not shown) of the sheath 45 is connected to a stationary point of the frame. The cable 44 extends freely through the sleeve 46, stud 47 and plate.
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48 and at its end is connected to the body 17 of the trimmer by a block 49 secured to the end of the cable and seated in a bore 50 in the body 17 and held therein by a retaining plate 50. Two rods 51 and 52 are connected to the plate 48 by screws 53 and extend normal therefrom and along and parallel to the tube 25. The rods 51 and 52 are mounted for endwise sliding in lugs 54 integral with the body 17, thereby serving to support the plate 48. At their ends the rods 51 and 52 are provided with blocks 55 secured on the reduced ends thereof as by set screws 56. The blocks have inwardly extending trunnions 57, FIG. 4, that extend through slots 58 in the tube 25 and into apertures 59 in the collar 35, thereby coupling the rods 51 and 52 to the trimmer unit 26. The slots 58 are elongated endwise of the tube 25 to permit motion of the trimmer unit 26 endwise thereof. The sleeve 46 is coupled to the plate 48 by a trip mechanism 60 whereby when the sleeve is urged forwardly, the plate 48 and thus the rods 51 and 52 and the trimmer unit 26 will be moved into trimming position. The cable 44 is adapted to be tensioned by the usual pattern cam of the machine. The sleeve 46 is urged forwardly by the sheath when tension is applied to the cable 44, thereby tending to straighten and to decrease the length of the path of the sheath. The rod 52 is provided with a collar 61 that is adapted to abut the end of the tube 25, thereby limiting the forward movement of the trimmer unit 26. When tension in the cable 44 is relaxed, the trimmer unit 26 is returned to its retraced position by a spring 62 that surrounds a rod 63 that is secured at one end to the plate 48 and at its other end telescopes into a bore 64 in the lug 16 of the body 17. The bore 64 is of sufficient depth to provide for relative motion between the body 17 and the rod 62 when the trip 60 is released. Tension is adapted to be applied to the cable 44 at the desired point in the knitting cycle by the usual master cam (not shown) of the machine.

The trip mechanism 60 is designed to prevent a smash-up of the needles 3 by retracting the trimmer unit 26 from its operative position in the event that a needle 3 is not properly lowered, as when the butt thereof is broken. The trip mechanism comprises a lever arm 65 pivotally mounted intermediate its ends on the plate 48 by a pivot pin 66, FIG. 1, the lever arm 65 being biased about the pin 66 in a clockwise direction as seen in FIG. 2 by a spring 67. On the one end of the lever arm 65 is a roller 68, FIG. 2, that engages the end of the sleeve 46 and against which the end is held by the spring 62. The opposite end of the lever arm 65 is provided with an upstanding pin 69. The pin 69 is adapted to be engaged by an arm 70 that is carried by a bar 71 which in turn is carried by a rod 72 that is pivotally mounted by means of a block 73 on a pin 74 extending through an elongated slot 75 in the tube 25 and threaded into an aperture 76 in the sleeve 46. The rod 72 has a needle engaging end 77 that extends toward and, with the trimmer unit 26 advanced to its operative position, is disposed closely adjacent to the path of the ends of the needles immediately in front of the trimmer unit at the cutting edge 38. Thus, the end 77 is adapted to be engaged by a needle which is not properly withdrawn and when engaged, pivots the rods 72 and thus the arm 70 to engage the pin 69 and thus to pivot the lever arm 65 and to release the roller from engagement with the end of the sleeve 46. When so released, the spring 62 forces the plate 48 outwardly toward the sleeve 46, thereby effecting throw-out of the trimmer unit 26.

Numerous alterations of the structure herein disclosed will suggest themselves to those skilled in the art. However, it is to be understood that the present disclosure relates to a preferred embodiment of my invention which is for purposes of illustration only and not to be construed as a limitation of the invention. All such modifications which do not depart from the spirit of the invention are intended to be included within the scope of the appended claims.

What is claimed is:
1. A trimming mechanism including a trimmer unit comprising an electromechanical transducer adapted to generate endwise oscillations of high frequency, an acoustical transformer secured to said transducer for receiving endwise oscillations therefrom and for amplifying such oscillations, said transformer having a free end formed as a cutting edge, an anvil having a cutting edge and means for mounting said anvil on said trimmer at a node point with the cutting edge thereof cooperating with the cutting edge at the free end of said transformer for severing yarns between said cutting edges.
2. A trimming mechanism in accordance with claim 1 in which the means for mounting said anvil on said transformer comprises a collar secured to said trimmer at a node point, and there is provided means for adjusting the cutting edge of said anvil relatively to the cutting edge at the end of said transformer comprising a bracket carried by said collar and an adjusting screw cooperating with said bracket and anvil.

3. A yarn trimming mechanism for a knitting machine comprising a body adapted to be mounted on the machine, a trimmer unit, and means for mounting said trimmer unit on said body for movement into and out of an operative position with respect to the needles of the machine, said trimming unit comprising an electromechanical transducer adapted to generate endwise oscillations of high frequency, an acoustical transformer secured to said transducer for receiving endwise oscillations therefrom and for amplifying such oscillations, said transformer having a free end formed as a cutting edge, an anvil having a cutting edge, and means for mounting said anvil on said trimmer at a node point with the cutting edge thereof cooperating with the cutting edge at the free end of said trimmer for severing yarns between said cutting edges.
4. A yarn trimmer mechanism in accordance with claim 3 in which said means for mounting said trimmer unit on said body comprises a tube on said body and receiving said trimmer unit, longitudinally thereof, and a collar slidably mounted in said tube and secured to said trimmer unit at a node point of said trimmer thereof.

5. A yarn trimming mechanism in accordance with claim 4 in which said trimming unit comprises two portions each of which are uniform in cross-section with the cross-section of the one section adjacent to the transducer being substantially larger than the cross-section of the other section, and there being two different node points along said transformer with said collar for mounting the trimmer unit in said tube being secured thereto at the node point nearer to said transducer and the means for mounting the anvil on said transformer being disposed at the other one of said two node points.

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