Dec. 7, 1954 A. W. SWARTZ 2,696,034

MECHANICAL DEVICE FOR CRIMPING NYLON OR OTHER YARN

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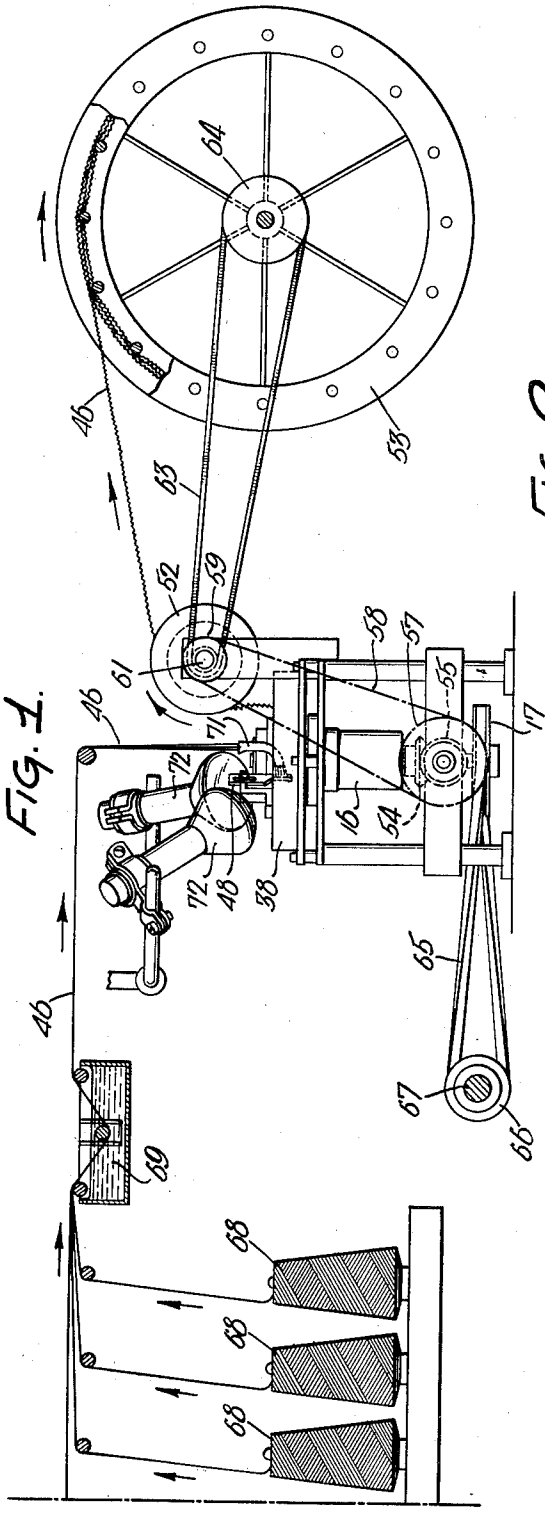


FIG. 1.

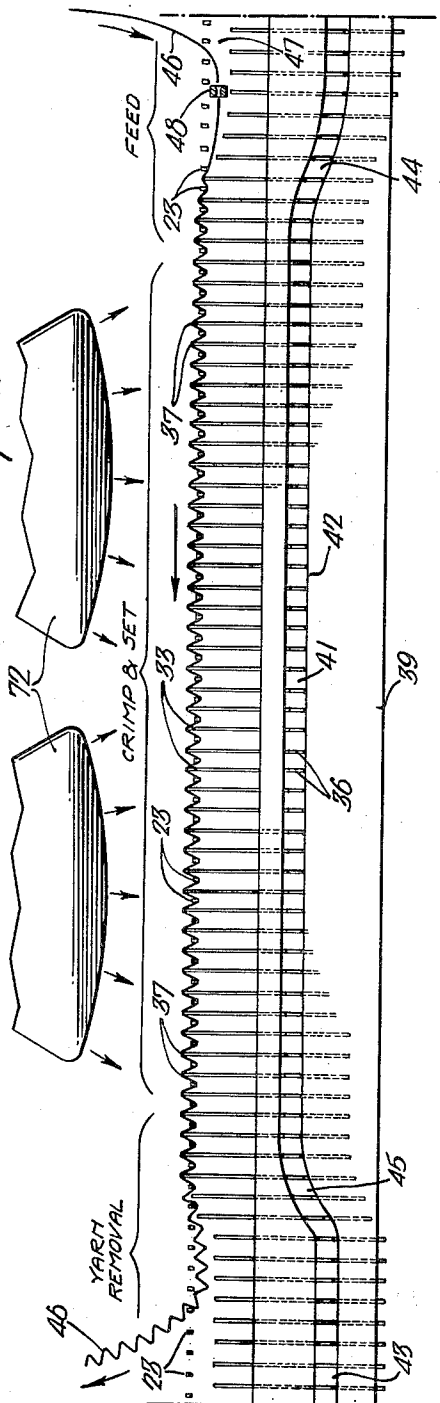


FIG. 2.

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FIG. 5.

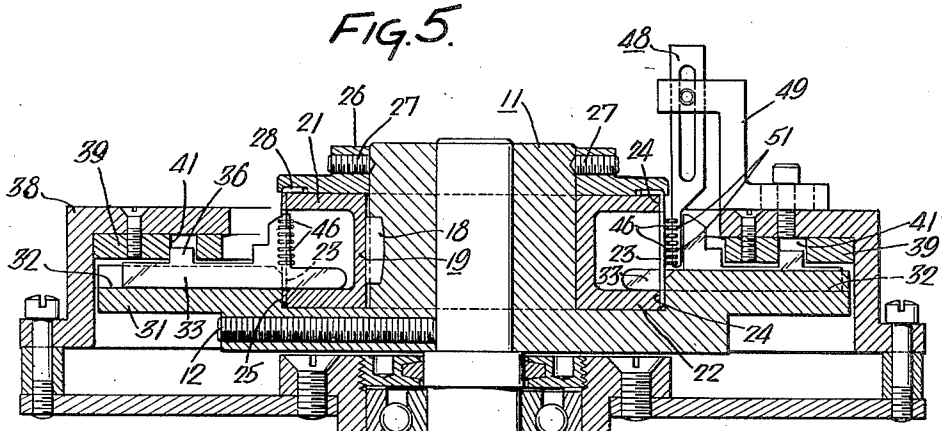


FIG. 6.

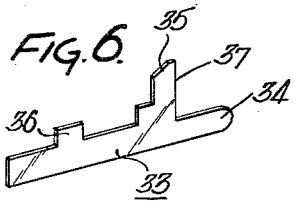


FIG. 7.

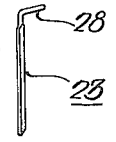


FIG. 4.

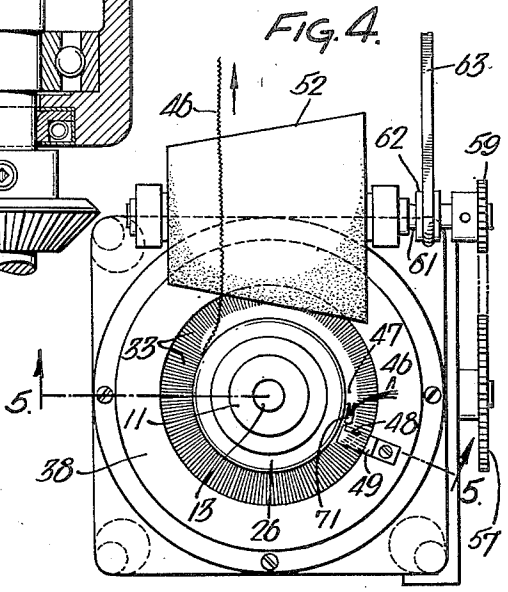
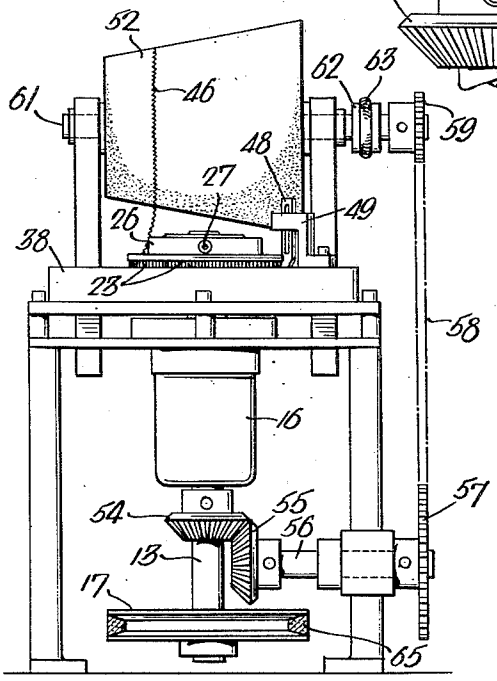


FIG. 3.



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MECHANICAL DEVICE FOR CRIMPING NYLON OR OTHER YARN

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Application February 3, 1953, Serial No. 334,891

13 Claims. (Cl. 28—1)

Various methods have been proposed for crinkling or crimping nylon and like yarns as a means for affording textile fabrics produced therefrom a more desirable appearance; for the concealment of slight imperfections appearing in the sheerer fabrics; and for reducing the sometimes undesirable glossy appearance of the conventional nylon product. Attempts to crimp the yarn by mechanical means have proved generally impracticable because of a tendency of the prior crimping machines to damage the fine threads or filaments with obvious undesirable effects upon the textile product. It has been proposed also to obtain the crimp by first knitting the yarn into a fabric, setting the yarn in the fabric, and subsequently unraveling the fabric, the recovered crimped yarn being then used in conventional manner in the production of the finished article. Such a process is disclosed in U. S. Patent 2,601,451 dated June 24, 1952. It is evident that a method of this character necessarily materially increases the cost of the finished textile product due to the requirement for the original fabric, the backwinding operations for recovery of the crimped yarn, and the slowness of the crimping operation as a whole.

I have discovered a simple and practical means for treatment of nylon and other yarns by mechanical means to produce the desirable crinkled or crimped formation in the yarn, the method and mechanism employed each being of a character to insure against damage of the yarn irrespective of its gauge, and being characterized by high productive capacity greatly exceeding the capacity of the practical methods and machines of the prior art.

The invention will be more readily understood by reference to the attached drawings wherein:

Figure 1 is a semi-diagrammatic side elevational view of a crimping machine made in accordance with the invention;

Figure 2 is a diagrammatic development of the crimping elements of the rotary crimping head of the machine and of the element actuating cam;

Figure3 is an end elevational view of the machine;

Figure 4 is a fragmentary top plan view of the machine;

Figure 5 is an enlarged sectional view on the line 5—5, Figure 4, and,

Figures 6 and 7 are views in perspective of two of the complementary crimping elements.

With reference more particularly to Figure 5 of the drawings the crimping machine therein illustrated comprises a rotary head 11 which is secured by a set screw 12 to the upper end of a vertical shaft 13. This shaft is journaled in anti-friction bearings 14 and 15 in the fixed frame 16 of the machine and has attached to its lower end, see Figure 3, a pulley 17 by means of which the shaft 13 and the head 11 may be rotated. The head 11 has keyed thereto, as indicated at 18, an annular member 19 which comprises at top and bottom respectively thereof two relatively spaced radially projecting flanges 21 and 22. These flanges form a support for an annular series of needle like elements 23 which are mounted in the outer peripheral portions of the flanges 21 and 22 and which form a closely set cylindrical series extending around the member 19 coaxially with the shaft 13. The elements 23 are mounted in the present instance in radial slots 24 in the outer edges of the flanges 21 and 22 and are held in place within the slots by a shoulder 25 in the head 11 and by a collar 26 which is secured to the head by set screws 27 at the top of the member 19. In the present instance each of the elements 23 has an

offset upper end 28 which seats upon the upper surface of the flange 21 and supports the elements 23 on the latter. The elements 23 are, by means of the structure just described, arranged side by side and in spaced relation and constitute one set of crimping elements.

The head 11 is extended in its lower part in the form of a radial flange 31 and this flange is provided in its upper surface with a series of radial slots 32 which extends continuously around the entire circumference of the head. These upright radial slots 32 correspond in number to the elements 23 and are arranged with respect to the latter so that each of the slots is in alignment with and passes through the space between an adjoining pair of the elements 23. Each of the slots 32 slidably supports a flat finger 33, see Figure 6, the rounded terminal end 34 of which lies in the inner end of the slot and within the space between the flanges 21 and 22 of the member 19. Adjoining the end 34 is an upwardly extending narrow flange 35 which in assembly lies in proximity to the elements 23 and is adapted to pass between the latter. The height of the flange 35 corresponds to the length of the elements 23 exposed between the flanges 21 and 22 and above the upper edge of the terminal end 34 of the finger 33. Outwardly of the flange 34 and spaced from the latter is an upwardly extending portion 36, the function of which will be hereinafter described. The fingers 33 are by means of the structure just described, arranged side by side and in spaced relation and constitute a second set of crimping elements, the arrangement being such that each set of crimping elements comprises a spaced linear series with the elements of one set in proximate confronting relation to the elements of the other set, with the elements of the respective sets in alignment with the inter spaces defined by the adjacent elements of the other set.

The head 11 with the attached member 19 corresponds closely to the rotary needle cylinder of a knitting machine and the elements 23 correspond in form and arrangement to the cylinder needles of such machine. The elements 23 may for example have the form and cross sectional dimensions of the stems of such needles with the same typical smooth surfaces, rounded corners and absence of undesirable sharp edges. The elements 23 may also correspond in number and relative positions to the cylinder needles of a conventional knitting machine. Similarly the elements 33 correspond generally in form and dimensions to the sinkers of a knitting machine and bear the same relation to the elements 23 as do the sinkers of the conventional machine to the cylinder needles. Like the sinkers of the knitting machine the elements 33 are designed for reciprocation in the slots 32 in the radial direction and with respect to the elements 23, with the inner edge 37 of the upward extension 35 moving between a retracted position radially outward from the elements 23 and an advanced position inwardly of the outer edges of the latter elements. Hence, the direction of movement of each of the elements 33 as said element moves into and out of the inter space between the proximate confronting elements 23, is in a substantially fixed plane common to the moving element and to the inter space between said proximate confronting elements 23.

To effect reciprocation of the elements 33 as described above, a flanged member 38 is provided on the frame 16 which embraces the outer edge of the flange 31 of the head and extends inwardly over said flange, as best illustrated in Figure 5. Secured at the inside of the member 38 is an annular cam member 39 having a cam groove 41 which receives the projections 36 of the elements 33. As the head 11 rotates with the elements 33, the cam 39 functions to reciprocate the said elements longitudinally in their respective grooves 32. The shape of the cam groove is illustrated in the diagrammatic development view of Figure 2. As therein shown the cam during a portion of one full revolution of the head 11 holds the fingers 33 in an advanced position with respect to the elements 23 in which position the edge 37 of the extension 35 of the finger lies inwardly of the cylinder defined by the outer edges of the elements 23. During the remaining part of the 360° movement of the head 11 the cam 41 functions to retain the fingers 33 in an outwardly retracted position with respect to the elements 23, wherein

the said edge 37 of the finger is spaced radially outward from the aforesaid cylinder. As shown in Figure 2 the portion 42 of the cam groove, wherein the fingers 33 are in the advanced position, is connected to the other portion 43 of the cam groove, wherein fingers 33 occupy the retracted position, by smoothly merging portions 44 and 45 which function respectively to advance and retract the fingers 33 with respect to the elements 23.

The direction of rotation of the head to accomplish the aforesaid results is indicated by the arrow in Figure 2, and in accordance with the invention means is provided for guiding the yarn to be crimped into the space between the extensions 35 of the fingers 33 and the elements 23 which space exists when the said fingers are in the retracted position. The yarn thus directed between the fingers and the elements 23 passes around the outer periphery of the cylinder defined by the latter elements and is subsequently withdrawn from the open space between the finger extensions 35 and the elements 23 after the said fingers have been retracted by action of the inclined portion 45 of the cam groove 41. As the yarn is guided between the fingers 33 and the elements 23, as described, the inclined portion 44 of the cam advances the fingers 33 with result that the yarn is crimped between the respective adjoining pairs of elements 23 and the inner edge 37 of the extension 35 of the fingers 33 as best illustrated in Figure 2 wherein the yarn is indicated by the reference numeral 46.

The means by which the yarn is guided to the outer surface of the cylindrical assembly of the elements 23 is shown in Figure 5. It consists essentially of an arm 48 which is adjustably secured to and depends from a bracket 49 secured to the top of the member 38 on the fixed frame 16 of the machine. The lower relatively narrow end of the arm 48 projects downwardly into the space 47 in a position, illustrated in Figures 5 and 2, immediately adjoining the point where the fingers 33 begin their advance movement under the action of the inclined cam groove section 44. The terminal portion of the arm 48 which extends into the space 47 is provided with a plurality of small yarn guide apertures 51 arranged in vertical series extending over the entire height of the yarn engaging edge of the finger 33. It will be apparent that a plurality of ends of yarn corresponding in number to the apertures 51 may be guided into position for crimping between the edges 37 of the fingers 33 and the elements 23 and will be carried in the crimped state with the rotating head 11 to the point where the yarn is released by retraction of the fingers 33. The yarn may then be withdrawn from the space 47. In passing from the space 47 the yarn moves over the surface of a suitable feed roll 52 and thence, in the present instance, to a take-up reel 53. In the present instance the feed roll 52 and the reel 53 are driven from the shaft 13 through the medium of a bevel gear 54 on the said shaft, an intermeshing bevel gear 55 on a jack shaft 56 suitably journaled on the fixed frame of the machine, a sprocket 57 on the outer end of the shaft 56, a chain 58 which connects the sprocket 57 with a sprocket 59 on a shaft 61 which shaft is suitably journaled on the fixed frame and to which the roll 52 is secured. The shaft 61 carries a pulley 62 which is connected through a belt 63 with a pulley 64 on the reel 53. By this means the rotary movements of the crimping head 11, of the guide roll 52, and of the reel 53 are synchronized. In the present instance the shaft 13 of the crimping head is connected through the pulley 17 and a belt 65 with a pulley 66 on a shaft 67 which is connected with a suitable source of power not shown.

The operation of the machine will be more readily understood by reference to Figure 1 of the drawings. As therein illustrated the ends of yarn to be crimped, consisting for example of nylon, are drawn from cones 68, the yarn ends passing from these cones through a water bath, or other bath, 69. The dampened yarn then passes to a guide 71 associated with the arm 48 previously described which directs the yarn ends to the apertures 51 of the said arm. The yarn ends then pass around the periphery of the cylinder defined by the elements 23 and are acted upon by the fingers 33 as described above which press the yarn ends between the adjoining elements 23 to effect the desired crimp formation. In this crimped form the yarn ends are carried around the crimping head to the extent of the portion 42 of the cam groove 41, approximately 180° in the present instance, and in this movement are exposed to heat from any suitable source, the source in the present instance consisting of infra-red lamps 72 mounted above the crimping head as well shown in Figure 1. This heat sets the yarn in the crimped state so that when the fingers 33 are retracted by the cam groove 41, as shown at the left end of Figure 2, the yarn 46 will retain the crimped formation. As previously stated the crimped yarn withdrawn from the crimping head passes over the roll 52 to the reel 53.

It is apparent that the amplitude of the crimp and the number of crimps to the unit of yarn length is a function of the number of the elements 23 in the cylindrical assembly and the extent to which the fingers 33 pass inwardly between the elements 23. An important characteristic of the device resides in the fact that the action of the crimping fingers and elements upon the yarn ends does not subject the yarn to any pressure or strain of a damaging nature, and more particularly to the excessive tensional strains and abrading pressures which are characteristic of prior mechanical crimping devices. Such strains and pressures have been eliminated by employment of knitting machine principles and the adaptation of conventional knitting machine parts in the crimping operation.

I claim:

1. In a yarn crimping machine, a set of crimping elements arranged side by side in relatively spaced linear series, a second set of elements similarly arranged and in proximate confronting relation to the elements of the other set with the elements of one of said sets in alignment with the inter spaces between the side by side elements of the other of said sets, means for relatively advancing the elements of at least one of said sets to bring the elements of the two sets into intermeshing relation and to subsequently retract the elements from said relation, the direction of movement of each moving element as it moves into and out of said intermeshing relation being in a plane common to the moving element and to the inter space between the proximate confronting elements of the other set, means for introducing yarn between the two sets of elements for conversion to crimped condition, said yarn being between said elements when the latter advances into said intermeshing relation, and means for subsequently withdrawing the yarn from between said sets of elements in the form of the crimped end product.

2. A yarn crimping machine according to claim 1 including means for effecting said advance and retractive movements of the elements in linear progression so that the yarn is pressed progressively into the spaces between the adjoining elements of the respective sets.

3. A yarn crimping machine according to claim 1 wherein the crimping elements of each linear set defines an annulus, one said annulus embracing the other.

4. A yarn crimping machine according to claim 3 wherein the two annular series of crimping elements are coaxial and are mounted for simultaneous rotation about the common axis, wherein means is provided for effecting said rotation, and wherein further the means for relatively advancing and retracting the elements is responsive to the said simultaneous rotation of the two annular series of crimping elements.

5. A yarn crimping machine according to claim 4 including a rotary head forming a mount for the crimping elements, means for rotating the head, and relatively fixed cam means in operative engagement with the elements of at least one set for effecting the said advancing and retracting movements of said elements.

6. A yarn crimping machine according to claim 5 wherein the cam means is formed to advance the respective elements of one set of elements with respect to the elements of the other set at one point in each 360° rotational movement of the head and to retract the elements of said one set at another point in said movement, whereby the elements of the two sets remain in the intermeshed relation during a substantial part of each full rotation of the head.

7. A yarn crimping machine according to claim 6 including means for guiding the yarn to the crimping elements and for subsequently withdrawing the yarn from said elements at opposite ends respectively of that portion of the full rotation of the head wherein the elements of the two sets are in intermeshed relation.

8. A yarn crimping machine according to claim 7 wherein each crimping element has a yarn engaging edge portion extended in a direction substantially transverse to

the direction of movement of said movable element so as to accommodate on said extended edge a plurality of individual yarn ends in a single pass through the machine.

9. A yarn crimping machine according to claim 8 wherein the said edge portions and the adjoining side surfaces of the crimping elements are smoothly contoured and wherein the clearances between the adjoining elements when intermeshed are sufficiently great to avoid direct surface contact between the intermeshed elements so as to avoid injury to the yarn.

10. A yarn crimping machine according to claim 1 including means operative on the yarn while the latter is held in the crimped condition between the sets of elements for setting the yarn in the crimped condition.

11. A yarn crimping machine according to claim 10 wherein the setting means comprises a source of heat.

12. In a yarn crimping machine, a rotary head, an annular series of relatively spaced elongated crimping elements mounted on the head and forming a cylinder coaxial with the axis of the head, a complementary series of crimping fingers mounted for radial reciprocation in the head in alignment with the interspaces of the cylindrical assembly of crimping elements so as to be movable into and out of intermeshed relation with the latter elements, means for rotating the said head, relatively fixed cam means in operative connection with the said fingers for moving the latter successively into the said intermeshed relation with the crimping elements and for subsequently retracting said fingers, means for guiding yarn into the space between the crimping elements and fingers afforded by said retraction and into position for displacement by the fingers into the spaces between the crimping elements when the fingers are advanced, and means for withdrawing the crimped yarn from the head when subsequently released by retraction of the fingers.

13. A crimping machine according to claim 12 wherein each of the crimping fingers has a longitudinally extending portion in permanent intersecting relation with the cylinder defined by the crimping elements and a transversely extending yarn-engaging portion movable into and out of the intersecting relation.

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