June 26, 1962 R. PEEL 3,040,549

ELECTROTHERMAL YARN CUTTER AND YARN DRAG FOR KNITTING MACHINES

Filed April 17, 1957

FIG. 1.

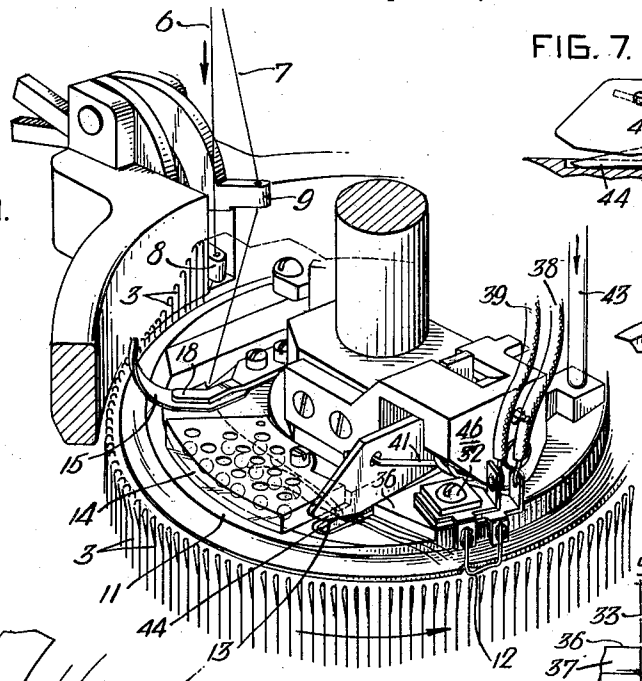


FIG. 7.

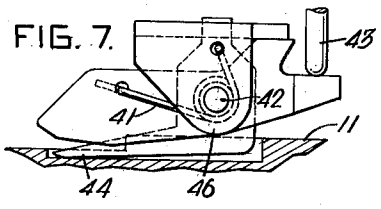


FIG. 6.

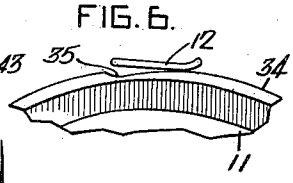


FIG. 4.

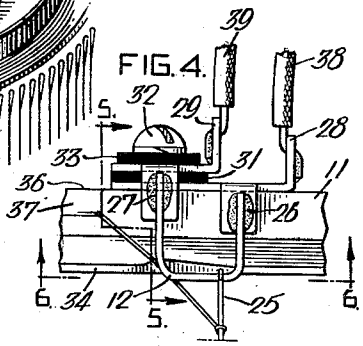


FIG. 2

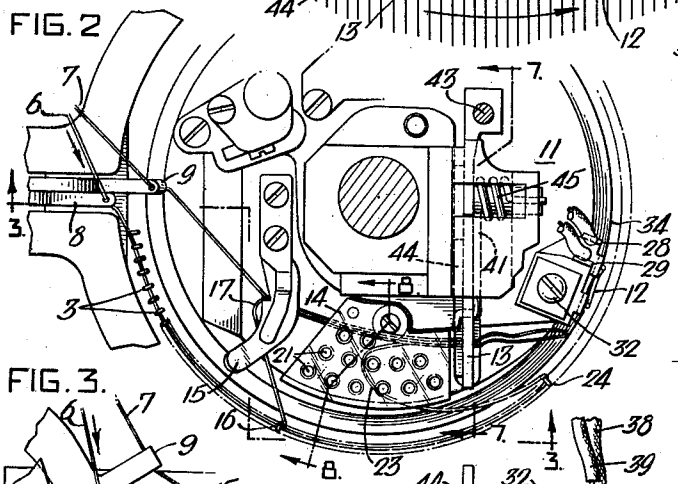


FIG. 5.

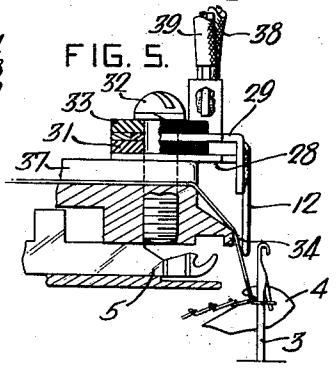


FIG. 3.

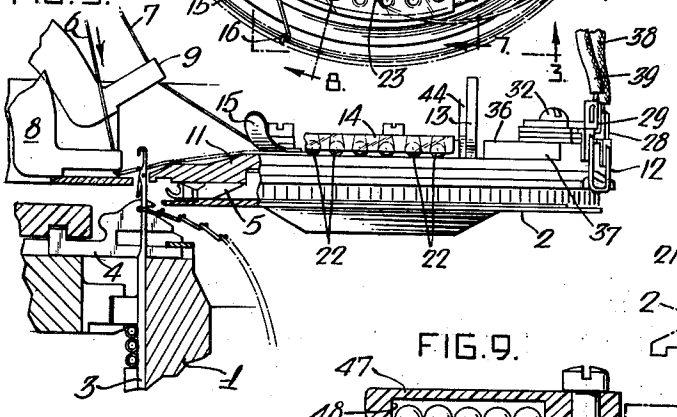


FIG. 8.

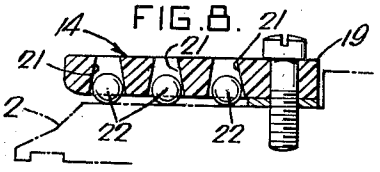
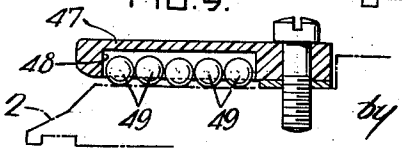


FIG. 9.



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United States Patent Office 3,040,549 Patented June 26, 1962

3,040,549

ELECTROTHERMAL YARN CUTTER AND YARN DRAG FOR KNITTING MACHINES

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Filed Apr. 17, 1957, Ser. No. 653,368
7 Claims. (Cl. 66—145)

This invention relates to improvements in circular knitting machines and relates more particularly to a novel and efficient yarn severing device for such machines.

A particular object of the invention is to reduce to a minimum the lengths of unknit loose ends of yarn in the knitting fabric produced in the course of laying a yarn to and lifting the yarn from the needle circle.

The invention comprehends also a novel form of yarn drag contributing materially to the efficient operation of the device.

In the attached drawings:

FIG. 1 is a fragmentary perspective view partly in section of the dial cap of a knitting machine showing also the yarn change fingers and the essential elements of the yarn severing device of this invention;

FIG. 2 is a top plan view of the machine parts shown in FIG. 1;

FIG. 3 is a fragmentary side elevational and partial sectional view on the line 3—3 of FIG. 2; of the dial and upper part of the needle cylinder;

FIG. 4 is a fragmentary elevational view of the dial showing details of the yarn parting element;

FIG. 5 is a sectional view on the line 5—5, FIG. 4;

FIG. 6 is a sectional view of the line 6—6, FIG. 4;

FIG. 7 is a sectional view on the line 7—7, FIG. 2;

FIG. 8 is a sectional view on the line 8—8, FIG. 2; and

FIG. 9 is a sectional view similar to FIG. 8 showing a modification within the scope of the invention.

With reference to the drawings, the numeral 1, FIG. 3, designates the needle cylinder, and 2 the dial of a knitting machine. The cylinder needles are indicated by the reference numeral 3. Sinkers 4 are carried at the upper end of the cylinder; and transfer bits 5 by the dial. Strands 6 and 7 of yarn are fed to the needles 3 by fingers 8 and 9 respectively, the fingers being adjustable between depressed and elevated positions to lay the yarn to and to lift it from the needle circle as desired. These are conventional parts of a hosiery knitting machine and their functions and modes of operation are well understood in the art.

The device of this invention is mounted on the dial cap 11. It comprises four mutually contributory elements designated respectively by the reference numerals 12, 13, 14 and 15. The element 12 is an electrically heated element which constitues the primary yarn parting element of the device, this element being heated to incandescence by electrical energy and operating to sever the yarn on contact. Element 13 is a clamp which functions to anchor the free ends of inactive yarn after the latter have been parted from the needle circle by the element 12. Element 14 places a drag on the yarn as hereinafter described to insure proper progression of the yarn by the needles to the severing element after insertion thereof by its feed finger into the needle circle; and the element 15 is a yarn guide and tensioning finger which insures accurate progression of the yarn to element 14.

The nature of these elements and the manner in which they function to the desired end is as follows. As illustrated in the drawings, the finger 9 is elevated holding its yarn 7 above the needles, and the loose end of this yarn lies under finger 15, drag element 14, and clamp 13, and terminates in proximity to the element 12. The

end is held securely in this position by the clamp and also by the less positive actions of elements 14 and 15. This is the position that the yarn end might occupy at start of the knitting operation or after the finger during the knitting operation had been elevated to withdraw the yarn from the needles. The finger 8 is depressed and the yarn 6 is being fed to the needles.

It may be assumed that the knitting operation has just been initiated by depression of finger 8 and that the first needle to pick up the yarn 6 has progressed to the point 16 in FIG. 2, the numeral being used to identify both needle and position. As illustrated, the loose end of this yarn lies together with the end of yarn 7, under the elements 15, 14, and 13 and is clamped by the latter element. The pressure of spring finger 15 tends to hold the yarn at point of contact so that the needle movement forms a loop the bright 17 of which lies under the said finger. This finger is made of very light and resilient spring steel and backed at the top by an element 18 which limits movement of the finger away from the upper surface of the dial cap 11. As the needle 16 progresses the end of the yarn adjoining the needle 16 passes under element 14. This element consists of a plate 19 which may suitably be made of transparent plastic and which has, see FIGS. 2 and 8, a system of holes 21 forming retainers for metallic or other spheres 22 which seat on the dial cap as shown best in FIG. 8. The spheres 22 have sufficient weight to exert a drag on the loop 17 which, as the needle 16 continues to advance, is withdrawn from under finger 15 and then progressively under the plate 19. The position and condition of the loop as it moves under the plate is shown in FIG. 2 wherein it is indicated by reference numeral 23. This loop position corresponds to the position of needle 16 indicated at 24. The drag element 14 serves to keep the loop of yarn after leaving finger 15 under confined control until the needle 16 has advanced to the parting element 12 and precludes interference of the loop with the normal needle action in the area between the feed finger 8 and the cut off 12.

As the needle 16 moves toward the element 12 the proximate end of the loop passes under the forward end of the clamp 13 which is now elevated so that when the needle has reached the position shown at 25 in FIG. 4 the yarn end will have been drawn downwardly over the edge of the dial cap, see also FIG. 5, and into contact with the parting element 12 at a point closely adjoining the needle path which at this point in the circle is in close proximity to the lower end of the said element. Simultaneously with the parting of the yarn, the clamping element 13 moves down to clamp the severed end as well as the other end of the loop 17 so that the latter is held securely away from the needle path.

The physical nature of element 12 is best shown in FIGS. 4 and 5. It consists in the present instance of a U-shaped Nichrome V wire the ends of which are welded or otherwise attached at 26 and 27 respectively to terminal strips 28 and 29. This strip 28 seats on the top surface of the dial cap. The strip 29 is superimposed upon strip 28 with an intervening insulator 31. A screw 32 threaded into the cap 11 and insulated at 33 from strip 29 retains the strips and insulators in place and thereby anchors the element 12 in position. The element 12 extends downwardly into close proximity to the peripheral edge 34 of the dial cap which is recessed at 35 to increase the gap between the wire and the cap to an extent inhibiting excessive withdrawal of heat from the wire by the metal cap, particularly from the side of the wire against which the yarn is drawn as described above. The clearance provided by recess 35 is also of advantage in preventing accumulation of particles of yarn, dried oil or other materials adversely affecting operation of the device. The dial cap upper surface is elevated at the cut off position as indi-

cated at 36, and this elevation forms a shoulder 37 against which the yarn is drawn by the needle as shown in FIGS. 4 and 5 and thence downwardly and against the near side of wire 12. As previously set forth, the wire is connected, through the leads 38 and 39 with a source of electrical energy which maintains the wire at a temperature sufficiently high to part the yarns on contact. Should initial contact not part the yarn, the latter will be drawn by the advancing needle downwardly along the near side and then along the bottom reach of the wire so as to prolong contact and insure parting. The severed end of yarn will be retained by the clamp 13, as described, and the ends thus accumulating may be periodically removed by manual or other means.

Let it be assumed now that the knitting operation with yarn 6 is to be terminated. The finger 8 will then be elevated, assuming a position corresponding to that of finger 9 as illustrated. The last needle engaging the yarn 6 will draw that yarn from the elevated finger first under the tension element 15, then under drag 14 and clamp 13, which latter is now again elevated to receive the yarn and finally against the cut off wire 12 which parts the yarn as described above. Simultaneously the element 13 will move down to clamp the now free end of yarn as described below, the yarn end occupying a position corresponding to the yarn 7 in FIGS. 1 and 2.

The clamping element or finger 13 is normally held down in the clamping position by a spring 41 and is elevated about its pivot 42, see FIG. 7, by pressure on the rear end exerted by an actuating rod 43. The rod itself may be actuated from the pattern mechanism of the machine in timed relation with the yarn fingers 8 and 9 in manner well known in the art. The finger cooperates with a second and relatively fixed finger 44, the fingers 13 and 44 having the same general relation as the blades of a shear except that they lack the sharp cutting edges of such blades. The fingers are held resiliently in face-to-face relation by the coiled body 45 of spring 41 which is carried by pivot 42 and is confined under compression between a face of finger 13 and the wall of housing 46. When finger 13 is depressed after introduction of a yarn in the nip, the fingers grip the yarn but without tendency to cut or abrade.

The drag 14, as illustrated in FIGS. 2 and 8, provides a separate pocket or retainer 21 for each of the spheres 22. In the modified drag shown in FIG. 9 the plate 47 has an extended recess 48 in the underside thereof common to all of the spheres 49 so that the latter are in relatively close assembly. There may be other modifications within the scope of the invention as defined in the appended claims.

The severing of the yarn as described by means of the heated element may be effected in a number of ways.

The element may be connected to the electrical energy source continuously during the whole of the period the machine is running. This avoids necessity for cam actuated switches or other current interrupting means and the complications arising therefrom. If the machine is fitted with a pneumatic stocking tensioning device the slight cooling effect of such device will nullify any effect the heat of the element might have upon the mechanism of the knitting machine. If the blower unit of the said tensioning device and the heat severing device are controlled by the same switch, so that when the blower stops the heat cutter is deenergized and the drive to the machine is tripped, complete safety in the machine is assured.

Alternatively the heat severing device may be normally deenergized and may be brought into action by means of a switch operated from the pattern mechanism in well known manner each time a yarn change takes place. This makes the device more readily applicable to machines which do not use a pneumatic tensioning device. Also it permits a higher temperature to be used momentarily where necessary for heavy yarns not so susceptible to separation by heat. It tends also to reduce possible long term undesirable effects such as the drying or baking of lubricating oil yarn residue on the parts of the machine adjacent to the heated element.

Both methods have their relative merits and are envisaged in the broad scope of the invention.

I claim:

1. In a circular knitting machine, the combination with a rotary needle circle and means cooperating with the needles of said circle to knit fabric from yarn fed thereto, of means to lay a yarn end to the circle at a point on said yarn remote from the terminal end thereof to initiate the knitting of the yarn by the needles, said laying operation thereby leaving an unknit tail end of yarn attached to the circle, the movement of the circle then traversing the said tail end over a path adjoining the circle, a yarn severing element in close proximity to said circle to sever the yarn and supported in said path of traverse so as to intercept and sever the said tail end of yarn, and yarn drag means intermediate the severing element and the said laying means for retarding the movement in said paths of the portions of the said tail end, said drag means comprising opposed relatively-spaced superimposed surfaces, and a plurality of drag elements projecting loosely from one of said surfaces and contacting the other surface.

2. A circular knitting machine according to claim 1 wherein the said drag elements project from the upper surface and seat on the lower surface.

3. A circular knitting machine according to claim 2 wherein the drag elements take the form of spheres of substantial weight.

4. In a yarn drag of the character described, a flat traverse surface over which a loop of the yarn may be displaced, a plurality of elements bearing on said surface and free to be displaced away from said surface by passage of the loop between said elements and said surface, and means for confining the elements laterally to their respective bearing points on said surface.

5. A yarn drag according to claim 4 wherein the said elements are spherical.

6. A yarn drag according to claim 5 wherein the elements are free to roll in the confining means.

7. A yarn drag according to claim 4 wherein the confining means comprises a member supported in spaced relation to the said traverse surface and having element-retaining recesses therein affording displacement of said elements away from said surface.

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