July 3, 1962 B. L. ANDERSEN ETAL 3,041,859

KNITTING MACHINE

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FIG.1

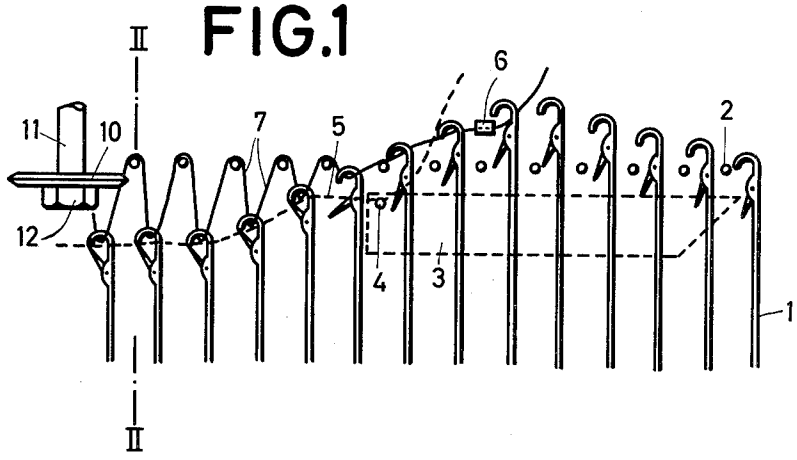


FIG.2

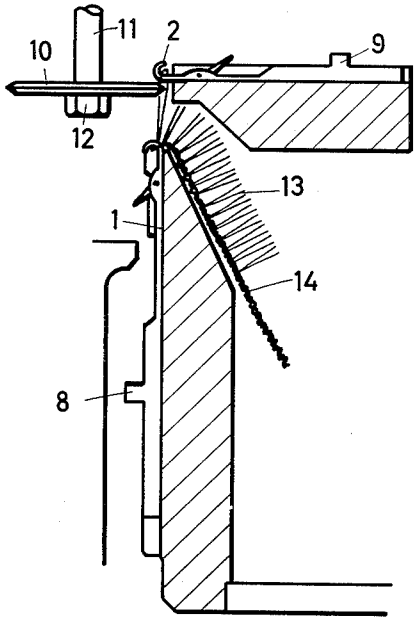
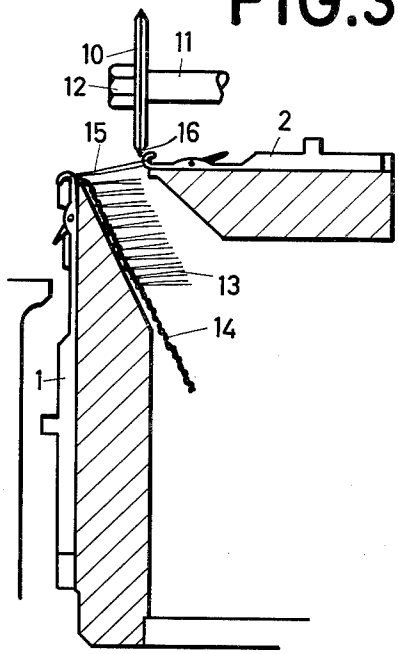


FIG.3 Modification



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KNITTING MACHINE

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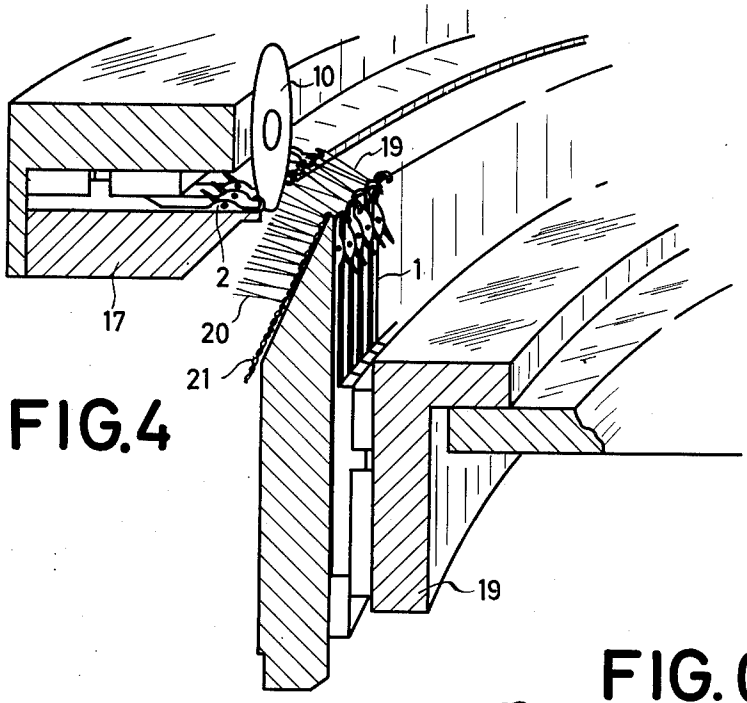
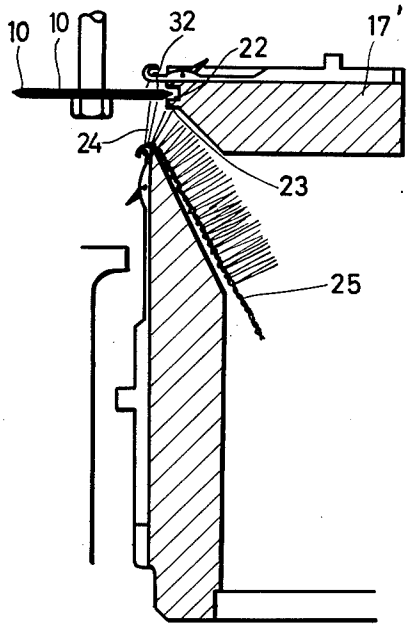


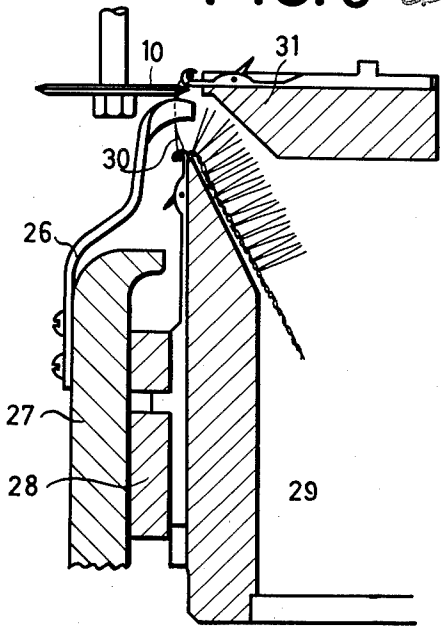
FIG.4

FIG.6 FURTHER MOD. OF CUTTER

MOD. OF CUTTER

FIG.5





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KNITTING MACHINE

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FIG.7

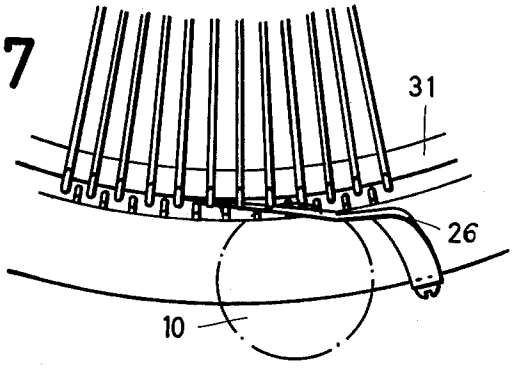


FIG.8

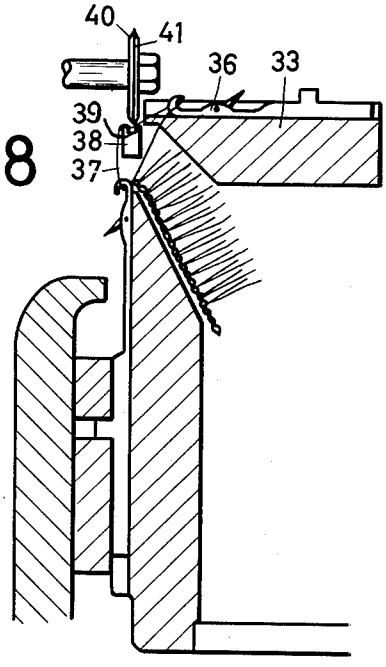
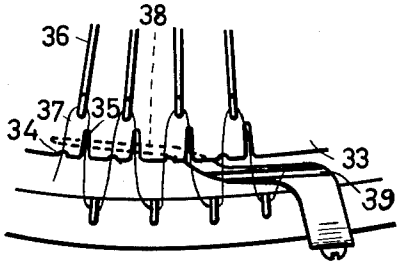


FIG.9



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United States Patent Office 3,041,859 Patented July 3, 1962

3,041,859

KNITTING MACHINE

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Filed Jan. 14, 1957, Ser. No. 633,957
Claims priority, application Norway Jan. 18, 1956
8 Claims. (Cl. 66—92)

The present invention relates to knitting machines, and concerns especially such machines adapted for knitting a fabric having free loops, or a fabric provided with pile which can be used for rugs or carpets, fur imitations, linings and for similar purposes.

Fur imitations have hitherto been produced by means of two separate machines, one of these machines being designed to knit a fabric similar to terry cloth and the other machine being employed for cutting the free loops, thereby obtaining a pile on the knitted fabric. Apart from the disadvantage that this process involves the use of two separate machines, the cutting machine cuts away as waste material a high percentage of the loops, thus producing a short pile. Fabric so produced on two machines is manifestly more expensive than it would be if one machine only could be used for the entire process.

It is also known to produce fur imitations by knitting in the usual way and subsequently introducing into the fabric a special kind of pile yarn, known as "tops," consisting merely of loose fibres which are neither spun nor twisted. This pile yarn, when secured to the knitted fabric (hereinafter referred to as the "backing") is later cut and electrically treated in order to raise the pile from the backing. This, however, is an expensive process necessitating the use of several machines.

In an attempt to produce such fur imitations or carpets in a conventional circular knitting machine of the cylinder and dial type, it has previously been proposed to replace the dial needles by hookless elements extending from the dial and adapted to form the loops on the backing; on the dial, above the said elements, was provided a roller which was pressed against the loop forming elements and intended to sever the loops in order to form a pile. However, such a method and machine have never been of any practical use, since the severing arrangements failed to ensure that all the loops were properly severed. Moreover, this particular method of severing the loops is quite unsuitable when dealing with certain synthetic yarns such as nylon, Orlon, Perlon and the like. A machine equipped with hookless elements is only suitable for knitting a very limited range of fabrics, since the hookless elements are unable to co-operate in the knitting process itself.

The object of the present invention is to provide a knitting machine which, although equipped with conventional needles, is nevertheless adapted to produce the above mentioned pile, such machine being thereby capable of knitting a variety of different designs.

Thus, for instance, on a circular knitting machine constructed according to the present invention and equipped with ordinary needles both in the cylinder and in the dial, many novel fabrics can be made such, for example, as fabric which is provided partly with pile and partly with elongated loops and has a plain knitted portion.

According to this invention, in a machine having two sets of needles, reciprocating at an angle to each other, a cutter is located between the said two sets of needles. Advantageously, the cutter is located as close as possible to the loop forming or loop elongating needles and is so disposed that when cutting the loops, the loose ends of each such loop will be of substantially the same length,

or, if merely cutting off the tops of the loops, the waste will be a minimum.

The cutter is preferably of a rotating type, such as a rotary knife.

A further object of the invention is to provide, in combination with a rotating cutter, means adapted to ensure that all of the loops will be securely and evenly cut.

This may be achieved by providing the machine with means designed either to guide the loops toward the cutting edge, or to co-operate with the cutting edge suchwise as to produce the effect of a pair of scissors.

The cutter can be either located horizontally or vertically, depending on the shape and construction of the co-operative cutting means, which may vary.

Conveniently, the co-operating cutting means may consist simply of a groove located underneath the loop elongating needles. Thus, for instance, in a circular knitting machine wherein the dial needles are the loop elongating needles and the cutter is in the form of a rotating knife the cutting edge of this knife would extend into the groove and one edge of the latter would then constitute one of two cutting edges between which the loops are cut.

Another way of performing the cutting is to arrange a stationary finger in front of the elongated loops and close to the rotating cutter, this finger being inclined and extending towards and underneath the loops so that with the finger secured in this position, the loops will slide along the finger and be pulled towards the cutting edge of the rotating knife and be cut between the finger and the said cutting edge.

If such a finger were itself to be provided with a cutting edge it would be sufficient to use this finger as the sole cutter, in which instance the rotating cutter could be dispensed with.

In the above described method of cutting by means of an inclined finger, each loop will be cut in two places, thereby wasting material. To avoid this waste, the finger can be so guided into each loop that the latter will be cut at one place only. In order to achieve this result, the loops are, according to the invention, individually turned so that they will spread out to form something like a shed, and the dial or other bed of the loop elongating needles is provided with grooves of different lengths or depths so that one loop, by retraction of the appropriate loop elongating needle, will sink into the grooves and form a shed. The inclined finger can then operate in the same way as above described, or it may be provided with a groove with which the rotating cutter extends.

The said finger can also be placed so that it will engage the elongated loops the moment these are formed. When the dial needles are retracted to form the elongated loops, one portion of each such loop will have an inclined disposition between the relevant dial needle and the corresponding cylinder needle, whilst another portion of the loop will be in a substantially vertical or less inclined position before the dial needle is retracted. In this way a shed is formed, and if the finger is placed in exactly the right position it can pick up the loops the moment they are formed.

In another embodiment of the invention the machine is built like a conventional circular knitting machine of the cylinder and dial type with the difference that the dial is located on the outside of the cylinder; that is to say, the dial in this case is in the form of a ring surrounding the cylinder.

In order that the invention may be more clearly understood and readily carried into practical effect, specific examples thereof as applied to a circular knitting machine of the cylinder and dial type will now be described with reference to the accompanying drawings, wherein,

FIGURE 1 diagrammatically depicts a few cylinder

and dial needles of such a machine and a rotating cutter set out to illustrate the general method of knitting according to the invention,

FIGURE 2 is a diagrammatic vertical sectional view of a portion of the head of the machine taken on the line II—II in FIGURE 1,

FIGURE 3 is a similar sectional view showing a modification of the method,

FIGURE 4 is a part-sectional perspective view depicting the case where the dial is in the form of a ring surrounding the cylinder,

FIGURE 5 is a vertical sectional view showing a modification of the cutter arrangement,

FIGURE 6 is a similar view depicting a further modification of the cutter arrangement,

FIGURE 7 is a detail plan view corresponding to FIGURE 6.

FIGURE 8 is another vertical sectional view illustrating a modification of the cutting arrangement shown in FIGURES 6 and 7, and

FIGURE 9 is a detail plan view corresponding to FIGURE 8.

In the drawings, the numeral **1** indicates the cylinder needles of a conventional circular knitting machine of cylinder and dial type and **2** are the so called dial or rib needles. **3** (FIGURE 1) represents the customary feeding plate of such a knitting machine, this plate being furnished with yarn guide **4** through which a base yarn **5** is fed in beneath the dial needles **2**. In addition to the yarn guide **4** there is provided a yarn guide **6** which is located above the dial needles, and is employed to feed in a pile yarn **7**.

The cylinder needles **1** are furnished with butts **8** which are engaged in a cam track provided between cams fitted in the customary cylinder cam box and by means of which cams the cylinder needles are reciprocated, i.e. advanced upwardly and retracted downwardly. Similarly, the dial needles **2** are provided with butts **9** arranged to be acted upon by cams in a dial cam cap (not shown), these cams serving to advance and retract the dial needles radially. When advanced, the cylinder needles **1** will receive into their hooks the pile yarn **7**. Thus, as each cylinder needle in turn is subsequently retracted it will pass between two dial needles and then engage the base yarn **5**. As a consequence, the portion of the pile yarn **7** drawn down by each cylinder needle will extend over and be supported by two dial needles. In this way each cylinder needle in the course of knitting draws an elongated loop of the pile yarn whilst simultaneously forming together therewith a conventional knitted loop of the base yarn. A rotating knife **10**, mounted on a shaft **11** and secured by means of a nut **12**, is located to cut the elongated loops underneath the dial needles, that is to say between the dial and the cylinder. More broadly considered, the elongated loops of the pile yarn **7** are cut at a location between the beds of the two sets of movable needles.

The cut loops produce a pile **13** retained in a base fabric **14**.

In the modification of this knitting process illustrated in FIGURE 3, each dial needle **2** is used to pull the pile yarn and thereby form an elongated loop **15** so that the relevant cylinder needle **2** will be in its retracted position when the said elongated loop is cut by the cutter edge **16**. In this way the pile **13** will from the outset assume a more natural condition since the loops **15** are drawn out nearly perpendicularly from the base fabric **14**.

In the machine shown in FIGURE 4 a dial **17** is in the form of an external ring surrounding a cylinder **18** equipped internally with the cylinder needles **1**. The dial or rib needles **2** in this case thus work in opposite directions as compared with the dial needles shown in FIGURES 2 and 3. The cutting knife **10** in this modification is mounted directly on the dial cap and functions to cut the elongated loops **19** to form a pile **20** on the base fabric **21**.

In FIGURE 5 is shown an arrangement wherein the needle dial **17'** is provided with a peripheral groove **22**, and the cutting edge **16** of the cutter **10** extends into this groove for co-operation with the edge **23** thereof. The co-operating edges **16** and **23** thus function after the manner of a pair of scissors to cut the elongated loops **24** and so form a pile on the base fabric **25**.

Another way of cutting the elongated loops by a knife action to provide a finger (see FIGURE 6) **26** which is mounted on the cylinder cam box **27** containing the cams **28** for actuating the needles **1** in the cylinder **29**. This finger **26** extends close up to the cutter **10** and is inclined so that it will pass in between the elongated loops **30** and the dial **31** and function to pull these loops **30** outwardly against the cutting edge of the cutter **10**. The finger **26** will thus co-operate with the cutter **10** in order to obtain a scissor-like effect or action. In FIGURE 7 is shown the manner in which the finger **26** extends from underneath the cutter **10** and in between the loops and the dial **31**.

By cutting the elongated loops in any of the ways illustrated in FIGURES 1–7, however, each of these loops is cut in two places, so that in respect of each loop there will be a small wastage **32** of yarn (FIGURE 5), and in order to avoid such waste, means may be provided to turn and spread the elongated loops suchwise as to form a shed.

Turning and spreading of elongated loops for this purpose may be effected by forming in the dial **33** (FIGURE 9), at respectively opposite sides of each dial needle **36** therein, a pair of grooves **34** and **35**, the groove **35** at one side of each dial needle extending deeper into the dial than the groove **34** at the opposite side of the said needle. When the stitch cam included in the dial cam system is appropriately adjusted to effect retraction of the needles **36** to a greater extent than in the various other examples herein described, the limbs of the elongated loops **37** will be engaged in the grooves **34** and **35**, so as to open out these loops in a transverse direction with respect to the circle of cylinder needles, thus enabling a finger **38** underneath the dial to be inserted into the opened out loops.

This finger **38** may be of the same form as the finger **26** and may also co-operate in the same way with a cutting knife **10**, such as shown in FIGURES 5 and 6. Alternatively, and as depicted in FIGURES 8 and 9, the finger **38** may be provided with a groove **39**, wherein the cutting edge **40** of a rotating knife **41** is located. In this way the same cutting effect as shown in FIGURE 6 is obtained with the difference that any waste of yarn is obviated.

Manifestly, the above described elements may be used not only in combination with a knitting machine of the circular cylinder and dial type, but can also be readily applied to other types of knitting machines, such for instance, as Interlock machines and machines equipped with Jacquard designing mechanism.

We claim:

1. In the knitting of pile fabric using cooperating cylinder needles and dial elements to draw relatively elongated loops of pile yarn retained extended by the dial elements until completion of pile loop holding stitches by the cylinder needles; the method of forming cut pile including the step of, while the loops are retained in the drawn condition by the dial elements, severing the bight ends of the drawn loops against the dial to sever the loops to form the cut pile.

2. A knitting machine comprising two beds at an angle to each other and spaced slightly from each other and each having a needle mounting surface, two sets of needles, a set reciprocally mounted in a surface on each of said beds for reciprocation toward a line formed by the intersection of the surfaces in which said sets of needles are mounted, the needles in one of said sets being adapted to knit a base yarn and a pile yarn to form a

base fabric and the other of said sets of needles cooperating with said first set of needles to form pile loops of said pile yarn, and a cutter mounted adjacent said line and having a cutting edge projecting toward one of said beds from the side of the surface of said other bed in which the needles are mounted which is remote from said one bed, said cutter being adapted to cut the pile loops of said pile yarn adjacent said other set of needles.

3. A knitting machine as claimed in claim 2, in which said cutter is a circular rotating knife.

4. A knitting machine as claimed in claim 2, in which said cutter comprises, in combination, a rotating knife and a guide finger adjacent the edge of the knife and extending into the space between said beds from the side of the surface in which said one set of needles lies opposite the other set of needles for engaging loops of said pile yarn and guiding them against said rotating knife.

5. A knitting machine as claimed in claim 4, in which said finger has a cutting edge thereon.

6. A knitting machine comprising two beds at an angle to each other and spaced slightly from each other and each having a needle mounting surface, two sets of needles, a set reciprocally mounted in a surface on each of said beds for reciprocation toward a line formed by the intersection of the surfaces in which said sets of needles are mounted, the needles in one of said sets being adapted to knit a base yarn and a pile yarn to form a base fabric and the other of said sets of needles cooperating with said first set of needles to form pile loops of said pile yarn, and a cutter mounted adjacent said line and having a cutting edge projecting toward the bed having the other of said sets of needles, said cutter being adapted to cut the pile loops of said pile yarn adjacent said other set of needles, the said bed having a groove therein into which said cutting edge projects.

7. A knitting machine comprising two beds at an angle to each other and spaced slightly from each other and each having a needle mounting surface, two sets of needles, a set reciprocally mounted in a surface on each of said beds for reciprocation toward a line formed by the intersection of the surfaces in which said sets of needles are mounted, the needles in one of said sets being adapted to knit a base yarn and a pile yarn to form a base fabric and the other of said sets of needles cooperating with said first set of needles to form pile loops of said pile yarn, and a cutter mounted adjacent said line and having a cutting edge projecting toward the bed having the other of said sets of needles reciprocally mounted therein, said cutter being adapted to cut the pile loops of said pile yarn adjacent said other set of needles, said bed having the other of said sets of needles therein also having a plurality of pairs of grooves therein, one groove in each pair being deeper than the other groove in each pair and being on one side of a needle in the said other set of needles, and the other groove in each pair being on the other side of a needle in said other set of needles.

8. A knitting machine comprising two beds at an angle to each other and spaced slightly from each other and each having a needle mounting surface, two sets of needles, a set reciprocally mounted in a surface on each of said beds for reciprocation toward a line formed by the intersection of the surfaces in which said sets of needles are mounted, the needles in one of said sets being adapted to knit a base yarn and a pile yarn to form a base fabric and the other of said sets of needles cooperating with said first set of needles to form pile loops of said pile yarn, and a cutter mounted adjacent said line and having a cutting edge projecting toward the bed having the other of said sets of needles reciprocally mounted therein, said cutter being adapted to cut the pile loops of said pile yarn adjacent said other set of needles, said bed having the other of said sets of needles therein also having a plurality of pairs of grooves therein, one groove in each pair being deeper than the other groove in each pair and being on one side of a needle in the said other set of needles, and the other groove in each pair being on the other side of a needle in said other set of needles, and a grooved finger adjacent the edge of said bed having said grooves therein, the groove in said grooved finger extending parallel to the edge of said bed and receiving the cutting edge of said cutter therein.

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