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PILE FABRIC KNITTING MACHINE

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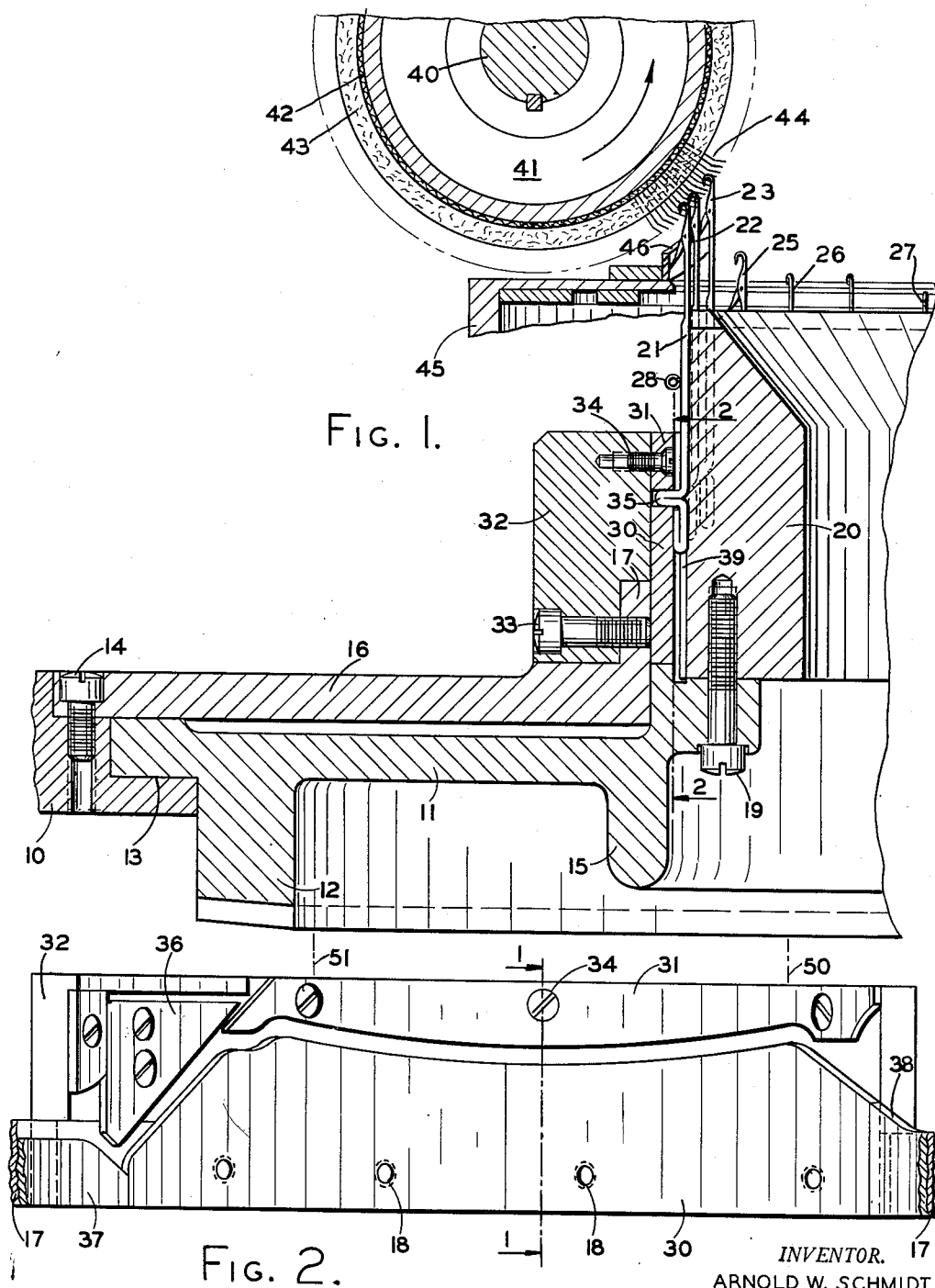


FIG. 1.

FIG. 2.

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PILE FABRIC KNITTING MACHINE

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5 Claims. (Cl. 66—9)

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The present invention relates in general to pile fabric knitting machines and the object of the invention is the production of a new and improved machine of this character.

A knitting machine such as referred to herein may be a circular latch needle machine manufactured by the Wildman Mfg. Co. of Norriston, Pa., having a 22 inch cylinder, for example and 10 needles per inch. This machine is equipped with a plurality of so-called carding heads which may be of the general type disclosed in the patent to Moore, No. 1,848,370, but are preferably of the improved type shown in the pending application of Brandt, Ser. No. 150,447, filed March 18, 1950. Each carding head takes on fibrous material, supplied in the form of a roving or sliver, and feeds the material to the needles of the knitting machine while the machine is knitting a base fabric, whereby the fibrous material is incorporated in the stitches of the base fabric and forms a pile on one side thereof.

The carding head is mounted on the frame of the knitting machine with the feeding card disposed above and outside but overlapping the circular row of needles. The operation of transferring the fibrous material from the feeding card to the needles is carried out by raising the needles vertically as they approach the card, so that as the needles pass along the rotating card they penetrate into the card clothing and the fibrous material held thereon and become filled with fibers which catch on the hooks of the needles and are pulled out of the mass of fibers on the card. It will be appreciated that this is a critical operation, which requires a rapid and steady transfer of fibrous material to the needles, not only to insure the formation of a uniform pile but also to remove the fibrous material from the feeding card as fast as it is delivered thereto and thus avoid accumulation and matting of the material which would result in needle breakage and stopping of the machine.

The specific object of the invention is to improve the cooperation between the feeding card and the needles of the knitting machine to facilitate the rapid and uniform transfer of the fibrous material to the needles. This is accomplished by a novel design of the cams which control the elevation of the needles as they pass along the feeding card. Prior to my invention the needles were elevated by a cam having a horizontal contour opposite the feeding card, which maintained the needles at the same height as they passed along the card and caused the hooks to gradually penetrate into the card clothing and gradually leave it, the deepest penetration being attained at the

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center of the card. This was generally considered to be the best arrangement both from a theoretical and practical standpoint and was used to the exclusion of any other arrangement, so far as I am aware.

I have discovered, however, that greatly improved results are secured if the needles penetrate the card clothing to the same depth at all point. This is accomplished by designing the cams so that the needles are elevated sufficiently as they approach the feeding card to insure substantially the maximum penetration of the card clothing at the instant the needles enter it. This means that when a card of the usual length is used the needles will enter the card at the end thereof rather than at some point in its periphery. As the needles pass along the card they are gradually lowered and after passing the center of the card are gradually raised again so that they leave the end of the card at the same elevation they had when they entered it at the other end.

As previously indicated, the desired needle control is obtained by a novel and improved cam design according to which the cams are given an operative contour opposite the feeding card which corresponds substantially to the three dimensional curve defined by the intersection of the arc through which the needles move and the cylindrical surface of the feeding card. This results in a uniform penetration of the card clothing by the needles throughout the entire length of the card.

The invention will be described more in detail in the ensuing specification, reference being had to the accompanying drawing, in which—

Fig. 1 is a vertical section through one side of a machine embodying the invention, showing the feeding card of a carding head, the needle cylinder, and certain associated parts including the cams which control the movement of the needles; and

Fig. 2 is a partial section on the line 2—2 Fig. 1 and shows the operative contour of the cams.

Referring to Fig. 1, the reference character 10 indicates part of the so-called head ring which is an annular ring forming part of the frame of the circular knitting machine. This ring is supported above the floor by other parts of the frame (not shown) and in turn supports the gear ring 11 which is rotatable on the bearing 13. The gear ring carries on its lower side the crown gear 12 and is provided with the stiffening rib 15. The gear 12 is driven by pinions mounted on radially disposed shafts which are omitted from the drawing.

The needle cylinder is indicated at 20 and is

supported on the gear ring 11 to which it is secured by screws such as 19. The cylinder carries a circular row of latch needles, of which a few are shown in the drawing. There may be, for example, 10 needles per inch in the row but to avoid confusion most of them have been omitted. The first needle shown, needle 21, is on the section line and the others shown are the 14th, 21st, 31st, etc., counting around the row, every 10th needle being shown except that needle 22 is about the 14th as noted above. The needles are vertically slidable in grooves in the periphery of the needle cylinder 20, the groove for needle 21 being indicated at 39. The needles are retained in their grooves by the lower cam, shortly to be described, and by a coil spring 28 which extends around the cylinder.

The reference character 16 indicates the cam ring, which is supported on the head ring 10 and is secured thereto by means of screws such as 14. The cam ring has a vertical flange 17 on which a plurality of concave cam casings such as 32 are mounted by means of screws such as 33. There are eight of these cam casings, each subtending an arc of 45 degrees, in the particular machine described herein.

The lower cam 30 rests against the cam casing 32 and the flange 17 and is secured to the latter by means of countersunk screws such as 18, Fig. 2, which pass through holes in flange 17 and are threaded into tapped holes in the cam. These screws are accessible upon removal of the cam casing 32. For convenience in manufacture the cam 30 may be made in two parts, as indicated in Fig. 2 of the drawing. The upper cam 31 is mounted on the inside wall of the cam casing 32 and is secured thereto by screws such as 34. The upper and lower cams 31 and 30 are spaced apart and cooperate in forming a groove or track into which the abutments of the needles project as shown in Fig. 1 in the case of the abutment 35 of needle 21.

The two cams described above control the movement of the needles as they pass the feeding card. There are other cams, including the knitting cams 35 and 37 which are mounted on the cam casing 32 and flange 17, respectively. Cam 38, which like cam 37 is only partly shown, is mounted on the flange 17 and has an operative contour at the left which merges into the lifting face of cam 30.

The feeding card 41 is mounted on the shaft 40 and is provided with card clothing comprising a strong cotton backing 42, a felt body 43, and resilient wire teeth 44 which are in the general form of staples or the legs of which pass through the cotton backing and the layer of felt and project from the latter as shown. The card clothing comes in the form of a long strip about $\frac{1}{4}$ inch wide, which is wound spirally around the body of the card and fastened at both ends with screws in known manner.

This feeding card is part of a carding head which preferably is similar to the carding head disclosed in application Serial No. 150,447 previously referred to. The carding head is mounted on the frame of the knitting machine with the card 41 disposed relative to the needle cylinder as shown in Fig. 1. In the machine shown, having a 22 inch needle cylinder, the card 41 is 4 inches long and has an outside diameter of approximately $3\frac{3}{4}$ inches.

The angular relation between the card 41 and the cams 30 and 31 is indicated by the dotted lines 50 and 51 in Fig. 2, line 50 indicating the po-

sition of one end of the card and line 51 the position of the other end.

The reference character 45 indicates the sinker cam ring which is supported in known manner on the frame of the knitting machine. The sinker dial and the sinkers which are supported on and rotate with the needle cylinder are not shown. These parts are all well known and the sinker cam ring is shown only because it supports the curved strip 46 which is provided to prevent the needle latches from closing accidentally while the needles are passing the feeding card. Latch guiding strips such as the strip 46 have been used before but according to the invention the strip 46 preferably is given a curvature which corresponds generally to the curvature of the groove between cams 30 and 31.

In the operation of the machine the needle cylinder 20 rotates in a counterclockwise direction as seen from above in Fig. 1, so that the needles sweep across the feeding card 41 from right to left as the card is observed from the right, or when looking across the needle cylinder toward the carding head. The card 41 rotates in the direction of the arrow and is continuously supplied with fibrous material by the preceding cards in the carding head in known manner.

In the machine shown the rotational speed of the needle cylinder is 18 R. P. M. and the peripheral speed at the needle row is approximately 105 ft. per minute. The peripheral speed of the card 41 is much higher and ranges from a minimum of about 400 ft. per minute to over 1400 ft. per minute. The card speed is adjustable for the best results on the particular pile fabrics being made.

When the needles leave the preceding knitting station the tops of the needles are a short distance above the top of the cylinder as indicated in the case of the needle 27. The height of the needles in this region is determined by a cam similar to cam 37. At a point some 3 or 4 inches from the card 41 the needles are raised to a somewhat greater height by the cam 38, as indicated in the case of needle 25. This preliminary elevation of the needles is for testing purposes and need not be discussed here since it is not concerned with the present invention.

As the needles approach the card 41 the abutments of the needles encounter the rise at the end of cam 38 and the continuation of this rise on cam 30 and the needles are rapidly raised to a position in which they will enter the teeth of card 41 at the desired depth. Needle 23 is shown in this position, while needle is just starting to rise. The needles are raised successively to the position of needle 23 and immediately thereafter they enter the teeth of the card clothing at the end of the card and begin their progress across the card from right to left. As soon as the needles enter the card clothing they are subjected to a strong upward pull due to engagement with the teeth of the card, which slip past the needles, and to the accumulation of fibrous material in the hooks of the needles which is pulled out of the accumulation on the card. Upward movement of the needles is prevented by the upper cam 31 which takes over control as soon as the needles enter the card clothing and gradually depresses them until they approach and pass the center of the card when they are allowed to gradually rise again until they emerge from the left hand end of the card at approximately the same elevation that they had when they entered it. Thus the needles traverse the

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card from end to end with a uniform penetration between the teeth and into the fibrous material carried thereby.

After the needles leave the card they are depressed somewhat by the upper cam 31 and then engage the knitting cam 36. The knitting operation performed under control of this cam and cam 37 in cooperation with the sinkers is well known and need not be discussed herein.

The depth to which the needles penetrate the card clothing of the feeding card as they pass along the card can be regulated by radial adjustment of the whole carding head with respect to the needle cylinder, as described in said application, Serial No. 150,447. The adjustment is carefully made to give the best results as regards the necessary loading of the needles and a minimum of interference by the rotating teeth of the card clothing with the progress of the needles along the card.

It is somewhat difficult to account for the greatly improved results achieved by the invention.

It is known, however, that the uniform penetration of the needles into the card clothing aids in maintaining a uniform depth of material along the card, which in turn helps to promote a more gradual transfer of material to the needles. Starting into the card at the maximum penetration the needles pass along the card at the same depth and skim off the material a little at a time, utilizing most of the length of the card to pick up material before they become filled to the required extent. The more gradual filling of the needles which is thus accomplished reduces the strain on the needles, since no large bunches of fibers are pulled off the card but only a few fibers at a time. It is also possible to adjust for a somewhat shallower penetration by the needles which reduces the wear and tear on the needles and the teeth of the card clothing.

The thickness of the pile depends on the thickness of the layer of fibrous material on the feeding card which in turn depends on the rate at which the material is supplied to the carding head and to the feeding card thereon. This rate cannot in any event exceed the rate at which the material can be taken off the feeding card by the needles, and as a practical matter the former rate must be the smaller by a certain factor of safety, the provision of which makes it impossible to supply material at a rate which will fill the needles to capacity. It is found that the invention accomplishes a more uniform and efficient cooperation between the carding head and the knitting machine which makes it possible to reduce the safety factor and more fully utilize the capacity of needles, thereby making it possible to knit a pile fabric having a thicker pile.

The invention having been described that which is believed to be new and for which the protection of Letters Patent is desired will be pointed out in the appended claims.

I claim:

1. In combination, a knitting machine having a circular row of needles supported on a rotatable needle cylinder for reciprocation in a direction parallel with the axis of the cylinder, means including a clothed cylindrical card for feeding fibrous material to the needles of said machine, means supporting said card in overlapping relation to the said row of needles whereby in the reciprocation of the needles they are projected into the card clothing, and cam means

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positioned to control the reciprocation of said needles, said cam means including a cam section adapted to move said needles sufficiently as they approach said card to cause the needles to enter said card at the end of the clothing, and also including a cam section shaped for interengagement with said needles and having a contour to hold the needles in a substantially constant depth of raking movement with respect to the card clothing as they move along the card.

2. In combination, a knitting machine having a circular row of needles supported on a rotatable needle cylinder, a cylindrical card for feeding fibrous material to said needles, means supporting said card in a position where it is accessible to said needles upon elevation thereof, a cam operative to elevate said needles sufficiently as they approach said card to cause the needles to enter the card clothing, and a cam controlling the elevation of said needles as they pass along said card, said last mentioned cam having an operative contour which substantially conforms to the curve defined by the intersection of the arcuate plane of the needles with the cylindrical surface of said card, whereby said needles penetrate the card clothing to substantially the same uniform depth at spaced points along the card.

3. In a pile fabric knitting machine comprising a circular row of abutmented and hooked needles supported on a needle cylinder rotatable about its axis and having grooves parallel with said axis for the reception of the needles in reciprocable relation to the cylinder, and a carding head adjacent said row of needles and provided with a clothed card accessible to said needles upon reciprocation thereof, said card being rotatable to deliver fibrous material to the hooks of said needles, and two cams in said machine supported in spaced relation to form a groove shaped to receive and guide the abutments of said needles during rotation of said cylinder, said groove having an operative contour for reciprocation of the needles opposite said card to progressively change the position of said needles as they pass the card whereby to maintain the hooks of the needles at a substantially uniform distance radially inside the outer circumference of the card clothing.

4. In a pile fabric knitting machine, a circular needle cylinder, a circular row of needles carried on said cylinder mounted upon a vertical axis, said needles being supported for vertical sliding movement, means including a card having card clothing for feeding fibrous material to said needles, said card being supported for movement in a path of movement in such overlapping relation to the row of needles that by raising the needles they may be caused to penetrate the card clothing to pick up fibrous material therefrom, a lower cam engaging said needles during rotation of said cylinder and contoured to raise the needles successively prior to reaching the end of said card, whereby said needles are caused to enter the card clothing at the end of the card and at the desired depth, and an upper cam having a curved operative contour adapted to engage said needles and regulate their height while the needles are passing along said card, the curvature of said upper cam being such that the needles penetrate the card clothing to substantially the same depth from one end of the card to the other.

5. In a knitting machine a card having card clothing positioned adjacent the path of movement of knitting needles, said machine being

provided with knitting needles to move in said path from one portion of a knitting operation to another, and having needle guiding means positioned for interengagement by the needles moving in said path, said guiding means being shaped to guide a card engaging portion of said needles in a raking operation through said card clothing, said needle guiding means being shaped to hold said portion of the needles in position to maintain the same degree of penetration of the card clothing throughout the raking engagement of a needle with the card.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
5 2,255,078	Moore	Sept. 9, 1941

FOREIGN PATENTS

Number	Country	Date
10 328,883	Germany	Nov. 8, 1920