Dec. 20, 1955 F. R. PAGE 2,727,374

KNITTING MACHINE

Filed Feb. 24, 1953 3 Sheets-Sheet 1

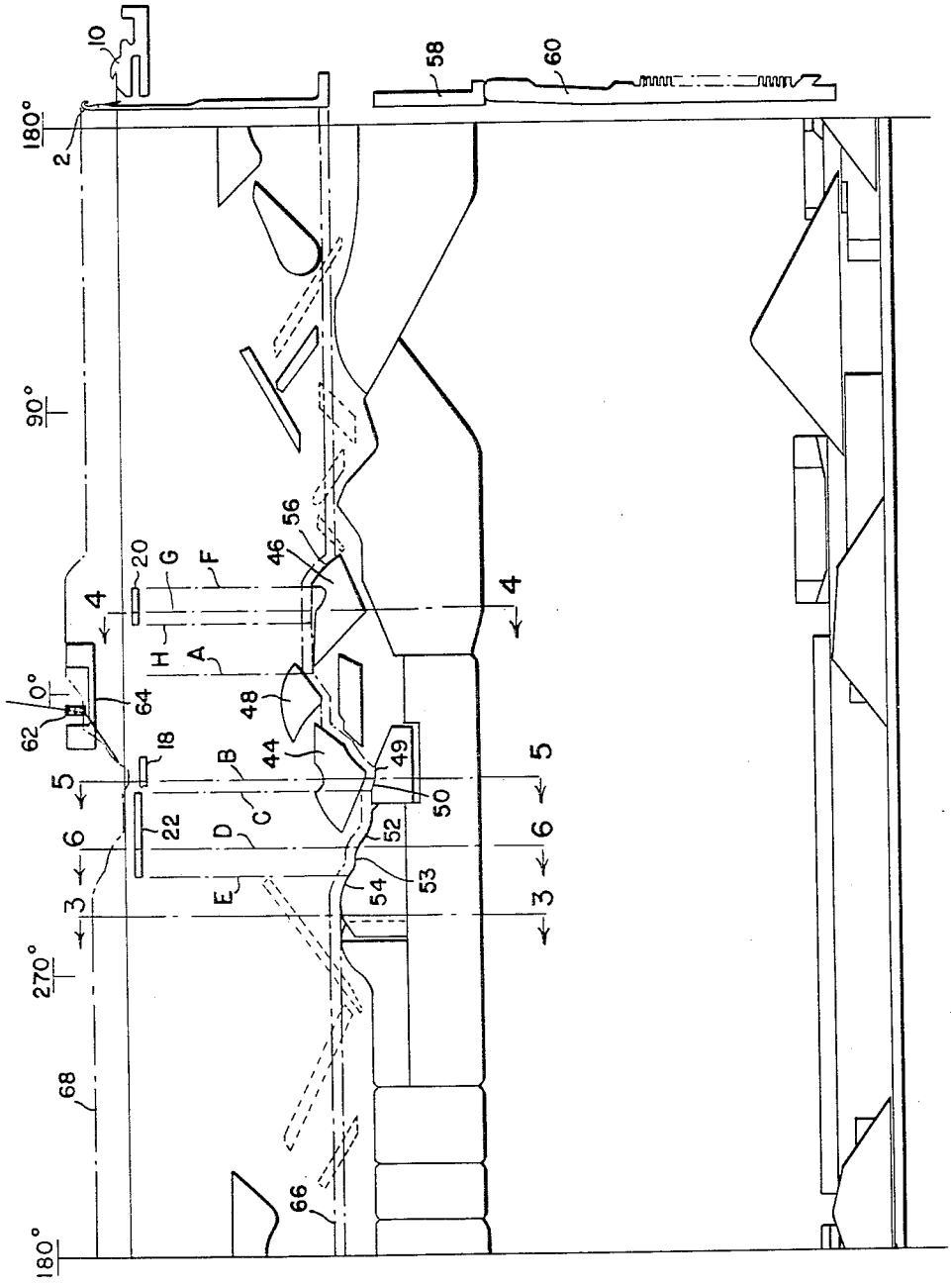


FIG. 1.

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KNITTING MACHINE

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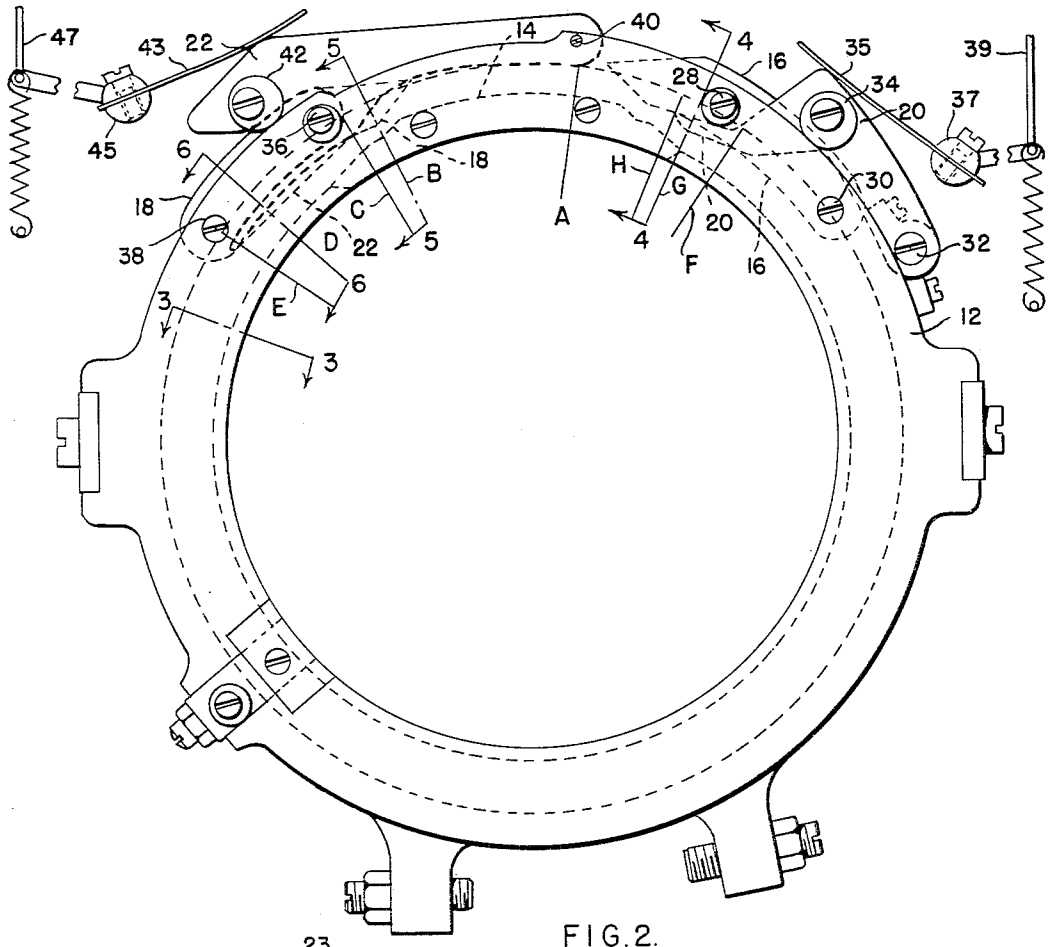


FIG. 2.

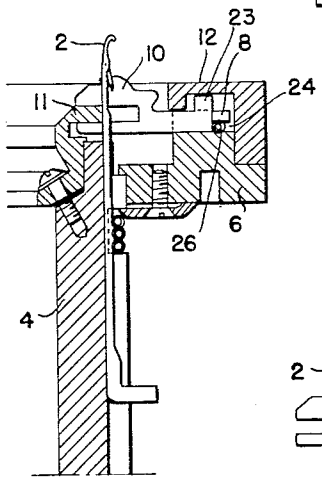


FIG. 3.

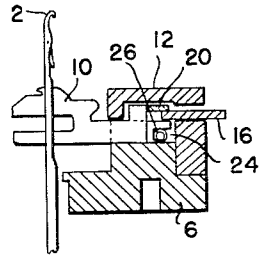


FIG. 4.

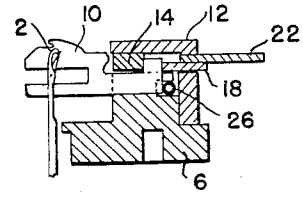


FIG. 5.

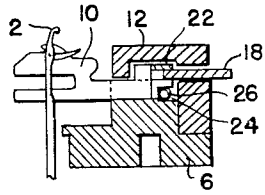


FIG. 6.

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KNITTING MACHINE

Filed Feb. 24, 1953 3 Sheets-Sheet 3

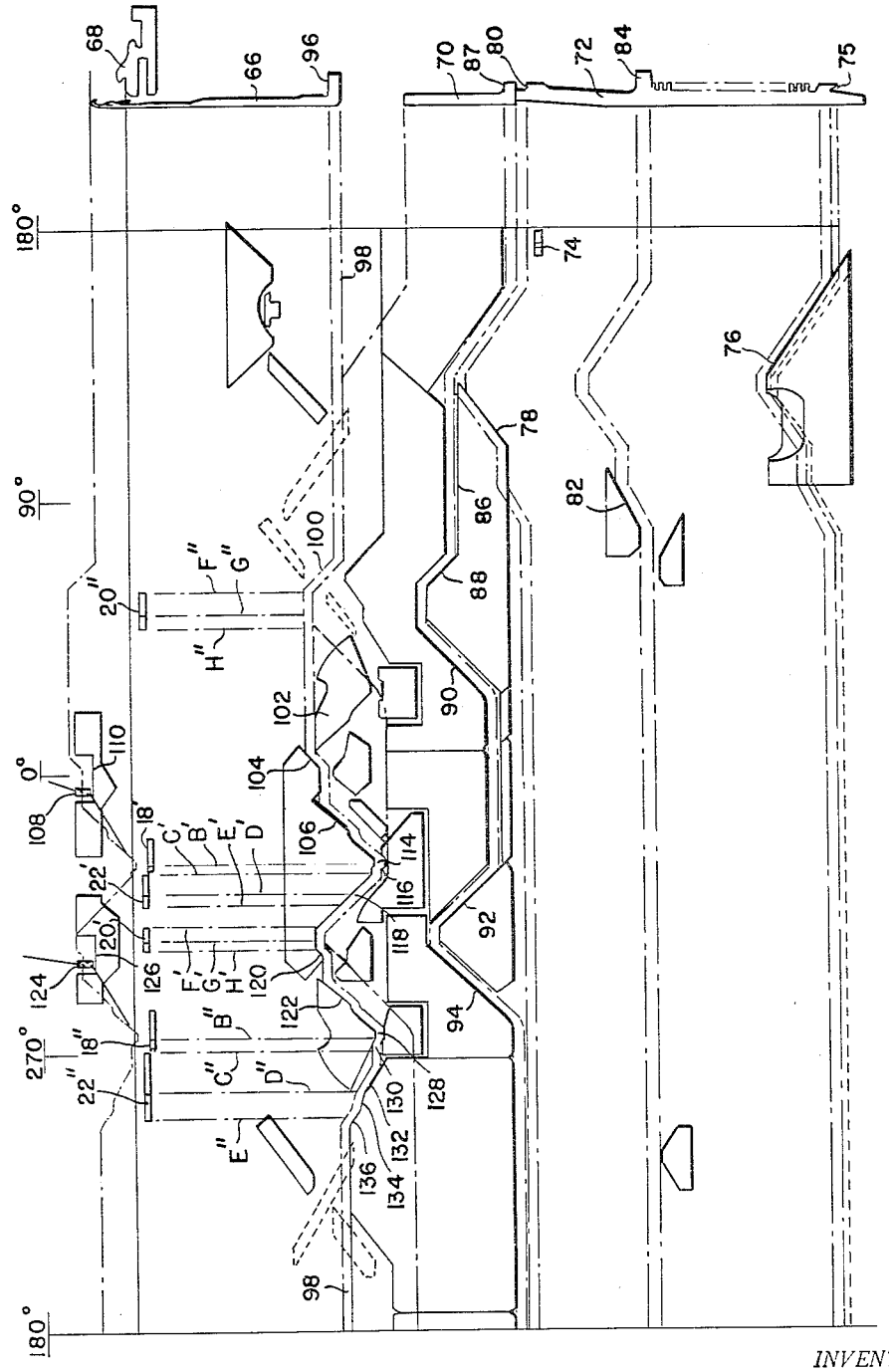


FIG. 7.

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2,727,374

KNITTING MACHINE

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Application February 24, 1953, Serial No. 338,329

8 Claims. (Cl. 66—108)

This invention relates to knitting machines and particularly to the knitting of welts in sheer ladies' stockings.

In knitting seamless ladies' stockings, one of the major problems, particularly since fine gauge fabric has become popular, has been to knit the welt loose enough to fit properly above the knee and still have all of the stitches retain uniform size and shape. In order that the ankle of the stocking may be sufficiently narrow to fit properly, a maximum number of needles are spaced about the cylinder and knit fairly tight stitches. However, since the required width of the welt fabric above the knee is approximately 50% greater than the ankle width, the stitches are necessarily much larger.

Due to these large stitches of relatively light or fine yarn, there is less of a locking condition present during their formation, and at times a stitch may be sufficiently distorted as various parts of the needle pass through it that it will fail to return to its proper shape and size at the end of its knitting cycle. This condition may be somewhat exaggerated when the yarn used is of a type such as nylon, which under certain conditions has a tendency to take and retain a set.

When distortion occurs in one stitch, a certain amount of robbing of yarn from adjacent stitches usually takes place which causes them also to be deformed to some extent and the result is an irregular cluster of stitches variously known in the trade as a draw stitch, crow foot, hen track, or the like. While the deformed stitches do not usually impair the wearing qualities of a stocking, they are unsightly and may result in the stocking being classed as a second and sold at a reduced price.

The distorted stitches are particularly troublesome in loose fabric of so-called turned welts in which the initial courses are taken from the needles and held by instruments in a dial during the knitting of a loop of fabric and then returned to the needles to join other stitches as shown in the patent to R. W. Scott No. 1,282,958. Due to the holding of the first courses, the stitches of the loop of fabric cannot be controlled by a takeup and several methods have been tried to apply tension, including the use of air blasts, but without marked success.

One of the reasons for knitting the welt exceptionally loose is due to shrinkage which takes place in nylon or yarns of similar type during finishing operations, and a method which permits the knitting of relatively smaller stitches by the use of preshrunk yarn is described in the patent to B. J. Faucette No. 2,396,166. While this method is satisfactory, it is desirable to secure satisfactory results, if possible, by mechanical means, and it is the general object of the present invention to provide such means, and in cases where welts of extreme width are required, to combine the method of using preshrunk yarn, as disclosed in Patent No. 2,396,166, with the mechanical means of the present invention.

After a stitch of the loose fabric is first drawn as the needle passes down the stitch cam, the needle is slightly raised to relieve the tension of the loop between the

hook and sinker platform. The next upward movement of the needle causes the newly formed loop to open the latch and slide over a wider part, or cheek, of the needle, which is the first place where distortion is likely to occur. The next upward movement of the needle from tuck to clearing height causes the loop to slide over the spoon of the open latch and from the narrowest part of the shank to a wider part where further distortion may take place.

It has been found that by properly moving the sinkers inwardly while the latch is being opened and the cheek of the needle is passing through the loop, it can be controlled so as to lessen the possibility of distortion, and by again moving in the sinkers after the needle has been raised from tuck to latch clearing height, where major distortion is likely to occur, an evening process takes place which equalizes the amount of yarn in successive loops so that when the sinkers cast off the loops after their associated needles have taken yarn and moved down the stitch cam, the newly formed stitches are of uniform size and shape.

While the shape of the so-called sinker presser cams may vary somewhat, it has been found that best results are obtained by the use of a contour that will gradually advance the sinkers and then permit them to be slowly withdrawn under the tension of the loops of yarn which they engage.

The presser cams are not required to be in action during knitting of parts of the stocking which are under control of a fabric take-up, nor are they required to be active when the stitches are small enough so that distortion does not occur, such as in the lower leg, ankle and foot.

The device will be generally described as applied to a single feed hosiery machine such as shown in the previously mentioned Scott patent for making a lady's stocking having a loose upper portion or welt, and will also be briefly described as applied to a similar machine having two feeds, but it will be equally effective in hosiery machines having more feeds, or in any knitting machine where large stitches of relatively light yarn are required and where the fabric being knit cannot be held under tension by means of a take-up.

The foregoing general object of the invention and subsidiary objects particularly relating to details of construction and operation will become apparent from the following description read in conjunction with the accompanying drawings in which:

Figure 1 is a development of the knitting cams of a machine embodying the invention, the development being viewed looking outwardly from the axis of the needle cylinder;

Figure 2 is a plan view of the sinker cam ring of the knitting machine as viewed from above showing the regular cams as well as those which are specially provided in accordance with the invention;

Figure 3 is a fragmentary section taken on the plane the trace of which is indicated at 3—3 in Figures 1 and 2, this section showing the needle cylinder, cylinder top, sinker ring, and sinker cam ring, together with a needle and sinker at their approximate relative positions during the time the needle remains at tuck height;

Figure 4 is a similar fragmentary section taken on the plane the trace of which is indicated at 4—4 in Figures 1 and 2 and showing the position of a sinker in relation to a needle when the sinker has been moved fully inwardly by a presser cam after the needle has reached its extreme latch-clearing height;

Figure 5 is a similar fragmentary section taken on the plane the trace of which is indicated at 5—5 in Figures 1 and 2 and showing a needle and sinker at the time the sinker cam has just moved the sinker into position to cast a stitch from the needle;

Figure 6 is a similar fragmentary view taken on the

plane the trace of which is indicated at 6—6 in Figures 1 and 2 and showing a needle and sinker at the time when the latch is being opened by a stitch as the needle is being raised; and

Figure 7 is a view generally similar to Figure 1 but showing a development of the jack and knitting cams of a two-feed machine as viewed looking outwardly from the axis of the needle cylinder.

Referring first to Figures 1 to 6, inclusive, there are shown therein certain parts of a single feed machine as are particularly involved in the accomplishment of the ends of the present invention. For further details of such machine reference may be made to the Scott patent referred to above.

The machine comprises latch needles 2 carried by a needle cylinder 4. A sinker ring 6 is slotted as indicated at 8 to mount sinkers 10 for radial sliding movements, the inner portions of the sinkers being guided in conventional fashion by the cylinder top 11. A sinker cam ring indicated at 12 is provided with a cam 14 which serves to move sinkers outwardly, and with the usual cams 16 and 18 which serve to move the sinkers inwardly. Additionally, there are provided the cams 20 and 22 in accordance with the present invention serving for the additional control of the sinkers. All of these cams act upon the sinker butts 23. The sinker ring is grooved at 24 to receive a spring band 26 which serves to urge the sinkers inwardly in yielding fashion. As will hereafter appear, the action of this spring band is limited by the inner bounding surface of the groove 24: i. e. the inward motion of the spring is thus limited and when the sinkers move correspondingly further inwardly they are no longer under control by the spring band.

The cam 16 is secured to the sinker cam ring by the screws 28 and 30, while the cam 18 is secured to the sinker cam ring by the screws 36 and 38. These cams are consequently immovable with respect to the sinker cam ring during operation of the machine.

Pressure cam 20 is pivoted on a screw stud 32 carried by the sinker cam ring and has its inward movement adjustably limited by engagement of an eccentric stop 34 carried by the cam with the outer edge of the sinker cam ring. Cam 22 is similarly pivoted to the sinker cam ring on a screw stud 40 and is provided with an adjustable eccentric stop 42 which limits its inward movement by engagement with the edge of the sinker cam ring. The cams are respectively urged inwardly by the leaf springs 35 and 43 carried by upright shafts 37 and 45 which are subject to control from cams on the main drum of the machine, the springs acting on the cams to urge them inwardly during welt formation, though the cams may be so urged thereafter until tighter stitches are being knit for fashioning in the leg portion of a stocking.

Referring now to Figure 1, the cams provided for action on needle butts comprise the forward and reverse stitch cams 44 and 46, the center cam 48, the raising cams 50, 52, 53 and 54, and the clearing cam provided at 56 on the reverse stitch cam. Various other cams which take part in phase of the knitting not of concern herein are illustrated and it will, of course, be understood that the machine is provided with the usual pickers for the formation of heels and toes, these not being shown. Associated with the needles in their slots in the needle cylinder are intermediate jacks 58 and pattern jacks 60 which, however, take no part in the phases of operation to which the present invention is directed, and accordingly these jacks and their operations are not detailed. Yarns are fed to the needles from the usual feeding fingers of which one is indicated at 62, the yarns being fed to the needles from a conventional throat plate indicated at 64. During the formation of a stocking welt, the needle butts follow the path indicated at 66 in Figure 1, the hook ends of the needles following the corresponding path 68.

For clarity, the positions of the sinker operating cams are indicated at 18, 20 and 22, there being indicated only the active portion of the first of these cams. Sinker operating cam 16 is omitted since, as will appear, when the cam 20 is present and operating the cam 16 has no effect.

The operation of the described mechanism is as follows:

Considering first the movements imparted to the needles, the cycle may be considered as beginning at the position indicated at A in Figures 1 and 2. At this position the needle butts are just beginning their movement down center cam 48, whereby each needle is caused to take yarn and draw it to a measured loop over the platforms of adjacent sinkers as it is lowered by stitch cam 44. The lower end of stitch cam 44 provides a close raceway in association with the level portion 49 of the cam therebelow, and this arrangement causes the needle to draw a definite amount of yarn and to hold it accurately against robbing by succeeding needles as they draw their loops and until the previous stitches have been cast from the needles. The lowermost position of the needle thus achieved at B is illustrated in Figure 5. The needle is then raised slightly by cam rise 50 to the position indicated at C to relieve the tension on the new loop. The needle then rises over the next cam which includes the relatively rapid rises 52 and 54 and a slight rise at 53 between the positions indicated at D and E. The first rise at 52 to the position approximately indicated by D brings the needle to the level indicated in Figure 6 where the loop begins to open the latch. Immediately following this is the gentle rise over the cam portion 53 which completes opening of the latch. Then the needle rises at 54, position E, and winds up at tuck level where it remains, as indicated in Figure 3, until it reaches the rise 56 on the reverse stitch cam by which it is raised to latch clearing height at position F. The needle then passes positions indicated at G and H to approach the center cam 48 and complete the described cycle. The position of the needle between F and A is that illustrated in Figure 4 which is a section taken at the position G.

The needle movements which have just been described are conventional, and the present invention is particularly concerned with the sinker movements which accompany the needle cycle.

At the beginning of the cycle at A, the sinkers have been withdrawn by the sinker cam 14 to permit the yarn to be drawn by the needle hook past the sinker neb and over the platforms of adjacent sinkers.

At position B a close raceway is formed between the cams 14 and 18 to prevent possible overthrow of the sinkers or chatter which might tend to cause stitches to vary in size. At position B the sinker has been moved inwardly by knock-over cam 18 to a position which will cause the completed stitch to pass in back of the rising needle. The position attained by the sinker is that illustrated in Figure 5.

Following position B, the sinker is held substantially in a constant radial position until it reaches the position C. At this point the contour of the sinker presser cam 22 crosses that of cam 18 and the sinker is gently moved inwardly until it reaches the position D when it is located as illustrated in Figure 6. Cam 22 acts as an unyielding cam, having its position fixed by the setting of stop 42, even though it is held inwardly by spring 43, the spring being a strong one capable of resisting any outward forces exerted by the sinkers. The contour of cam 22 then recedes, and under the tension of the stitch the sinker is gradually moved outwardly until it reaches the location E. Referring particularly to Figure 6, it will be noted that the sinker in this figure has been moved inwardly by cam 22 clear of the spring band 26 which is itself restrained from inward movement by engagement with the inner wall of the spring groove 24. As the sinker moves outwardly under the tension of the stitch and by reason of the recession of cam 22, it ultimately

reaches a position in which it engages the spring band 26. Further outward movement is then prevented by the spring band which, in effect, acts as though it is unyielding, and the sinker then retains beyond position E the location which is illustrated in Figure 3.

This position is then normally maintained by the sinker until it reaches the location F. At this location it begins to move gradually inwardly under the action of sinker presser cam 20 (which like cam 22 is essentially unyielding) until the location G is reached where the parts assume the positions illustrated in Figure 4, the sinker again being located radially inward of the position which would be maintained by spring band 26, which again is ineffective because of its limiting by the inner wall of the groove 24.

Beyond location G and to location H the sinker is again released by the sinker pressing cam 20 and may move outwardly under the tension of the yarn until it engages the spring band. Beyond position H it engages the cam 14 whereby it is withdrawn to the position mentioned at the beginning of the cycle, the spring band yielding under the positive action of cam 14.

The foregoing provides extremely accurate control of the pressure applied to the loops by the sinkers as follows:

The radial position of a sinker at location B is definitely fixed by cams 18 and 14, so that the previously completed loop is carried inwardly to permit the rising hook end of the needle to pass in front of it.

Cam 22 definitely determines the radial position of the sinker to control the loop on the needle at the time it is opening the latch at position D and as illustrated in Figure 6.

The position of the sinker between locations E and F, while the needle is at tuck height, is determined by the inner wall of the groove 24 containing the spring band 26. The sinker is then held by the spring band as illustrated in Figure 3.

Cam 20 determines the position of each sinker as illustrated in Figure 4 to apply uniform tension to succeeding loops as they pass the location G, in order that those which have become distorted during the stitch forming cycle will be reformed, and when released from their needles will be uniform in size and shape. There is thus provided an "evening out" of the stitches.

The overall results of the foregoing are such as to maintain the loops under definite controls throughout those portions of the cycle where, as noted above, distortions and irregularities of the loops might otherwise occur. The positions of the cams 20 and 22 may be accurately adjusted by adjustment of the stops 34 and 42 to secure the desired uniformity of stitches.

As previously indicated, the foregoing applies to the formation of the relatively loose stitches in the welt. If the cams 20 and 22 are to be active only during welt formation, the springs 35 and 43 are thereafter withdrawn and the cams are moved outwardly to inactive positions by the sinkers and/or centrifugal force. However, in a machine not equipped with a takeup it may be desirable to keep the cams in action until the stitches begin to tighten at the beginning of the fashioning process.

Figure 7 illustrates the application of the invention to a two-feed hosiery machine. The general arrangement of the cams is similar to that shown in the patent to J. J. McDonough No. 2,576,962, except that the needles are shown as being raised from tuck to clear height at one feed, and from just beyond the bottom of the central stitch cam to clearing height at the other feed by intermediate jacks rather than by needle butts.

The latch needles 66 are associated with sinkers 68 in an arrangement which is substantially identical with that illustrated in Figures 3 to 6, inclusive, and accordingly specific reference to these elements and their mountings will not be repeated. Intermediate jacks 70 and pattern jacks 72 are provided the latter being of tilting type as used in machines of this character. Referring first to the control of the pattern jacks, these jacks have their lower ends tilted outwardly, as they enter the cams from the right of Figure 7, by a cam 74 pressing on their upper ends. The tilting action serves to cause the notch 75 of each jack to engage and ride upwardly over cam 76. Cam 78 then engages and depresses the shoulder 80 of each pattern jack, and the jacks are further lowered by the action of a cam 82 on their butts 84 bringing them to the level at which they enter the right of Figure 7.

The intermediate jacks 70 are provided with butts 87. Through the action of the pattern jacks they are raised at the location of cam 76 to a level above the cam 86 and are raised by the rise 88 of this cam, being then lowered by cam 90. Cam 92 again raises the intermediate jacks and they are depressed by cam 94 to their initial level.

The butts 96 of the needles 66 enter the cams at tuck level along the path 98. As the intermediate jacks rise over cam 88, the needles are pushed upwardly as indicated at 100 to clearing height and pass at this height over the reverse stitch cam 102 at the first feed. They are then depressed by the cam 104 and then by the first feed forward stitch cam 106 to take yarn fed by the finger 108 and passing from the throat plate 110. The stitch cam 106 moves the butts 96 to their lowermost level 114 whereupon they are raised slightly by cam 116 to relative tension on their stitches. They are then raised to clearing height at 118 by the rise of the intermediate jacks over cam 92, are slightly depressed by cam 120 and then engage and are lowered by the second feed stitch cam 122 taking yarn fed by a finger 124 and from a throat plate 126. After reaching their lowermost position under the lower end 128 of stitch cam 122, they are slightly raised at 130 and are then further raised by the successive slopes 132, 134 and 136 of a raising cam, finally arriving at tuck level in the path 98.

It will be evident from the foregoing brief description of the needle path that the needles, in the case of this two-feed machine, pass twice in a single revolution of the needle cylinder through phases corresponding to those involved in the single feed machine and illustrated in Figure 1. Since the duplicated needle movements are essentially the same as those involved in the single feed machine they will not be further described.

There are illustrated in Figure 7 the various sinker operating cams which have the same functions as those in Figure 1, and may be similarly mounted and controlled, but are duplicated at the two feeds. At the first feed the cams 18', 22' and 20' correspond, respectively, to the cams 18, 20 and 22 of Figure 1. At the second feed cams 18'', 22'' and 20'' correspond, respectively, to the cams 18, 22 and 20 of Figure 1. Additionally, there are indicated in Figure 7, in association with the first feed, the locations B', C', D', E', F', G' and H' corresponding to the respective unprimed lettered positions indicated in Figure 1 while in association with the second feed there are indicated the positions B'', C'', D'', E'', F'', G'' and H'' which also correspond, respectively, to the unprimed lettered locations of Figure 1. Without going into detailed discussion of these locations, it may be stated that respectively thereat there occur the same relationships of the sinkers and needles as were described in detail in connection with the single feed machine, and the sectional views Figures 3 to 6, inclusive, would serve to illustrate the sinker operations involved at each of the two feeds in Figure 7. It will accordingly be evident that the same controls of stitch formation are involved in the two-feed machine as in the single feed machine. The sole difference which may be noted is that the rise to clearing height along path 118 following the lowering of the needles by stitch cam 106 is accomplished in a continuous movement rather than in stepped movements as in the case of the second feed in Figure 7 and in the case of the single feed in

Figure 1. While this continuous rise of the needles occurs, the sinker actions in control of the stitches are substantially identical.

It will also be evident that the invention is applicable to machines involving more than two feeds, there being provided in association with each of the feeds the same types of sinker controls. In all cases the stitches are properly controlled and formed with the elimination of the objectionable distortions discussed above.

What is claimed is:

1. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, a spring band for urging the sinkers inwardly, cams for imparting a knitting wave to said needles, means for advancing sinkers to a radial position to move loops which have been cast off beyond the hooks of rising needles, means for further advancing sinkers to exert controlling action on stitch loops as the needles rise and latch opening occurs, and means restraining said spring band from urging said sinkers inwardly as far as they are advanced by the last mentioned means.

2. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, a spring band for urging the sinkers inwardly, cams for imparting a knitting wave to said needles, means for advancing sinkers to a radial position to move loops which have been cast off beyond the hooks of rising needles, means for further advancing sinkers to exert controlling action on stitch loops as the needles rise and the stitch loops rest upon open needle latches, and means restraining said spring band from urging said sinkers inwardly as far as they are advanced by the last mentioned means.

3. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, a spring band for urging the sinkers inwardly, cams for imparting a knitting wave to said needles, means for advancing sinkers to a radial position to move loops which have been cast off beyond the hooks of rising needles and for retaining said sinkers temporarily in said radial position, means for thereafter further advancing sinkers to exert controlling action on stitch loops as the needles rise and latch opening occurs, and means restraining said spring band from urging said sinkers inwardly as far as they are advanced by the last mentioned means.

4. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, a spring band for urging the sinkers inwardly, cams for imparting a knitting wave to said needles, means for advancing sinkers to a radial position to move loops which have been cast off beyond the hooks of rising needles and for retaining said sinkers temporarily in said radial position, means for thereafter further advancing sinkers to exert controlling action on stitch loops as the needles rise and the stitch loops rest upon open needle latches, and means restraining said spring band from urging said sinkers inwardly as far as they are advanced by the last mentioned means.

5. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, cams for imparting a knitting wave to said needles, means for advancing sinkers to a radial position to move loops which have been cast off beyond the hooks of rising needles, means for further advancing sinkers to exert controlling action on stitch loops as the needles rise and latch opening occurs, and means for advancing sinkers after loops have cleared the latches of needles to restore the size and shape of distorted stitches.

6. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, cams for imparting a knitting wave to said needles, means for advancing sinkers to a radial position to move loops which have been cast off beyond the hooks of rising needles, means for further advancing sinkers to exert controlling action on stitch loops as the needles rise and the stitch loops rest upon open needle latches, and means for advancing sinkers after loops have cleared the latches of needles to restore the size and shape of distorted stitches.

7. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, a spring band for urging the sinkers inwardly, cams for imparting a knitting wave to said needles, means for advancing sinkers after loops have cleared the latches of needles to restore the size and shape of distorted stitches, and means restraining said spring band from urging said sinkers inwardly as far as they are advanced by the last mentioned means.

8. A knitting machine comprising a needle bed, latch needles movable therein, sinkers associated with said needles, a spring band for urging the sinkers inwardly, cams for imparting a knitting wave to said needles, means for advancing sinkers after loops have cleared the latches of needles to even out the stitches on adjacent needles, and means restraining said spring band from urging said sinkers inwardly as far as they are advanced by the last mentioned means.

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