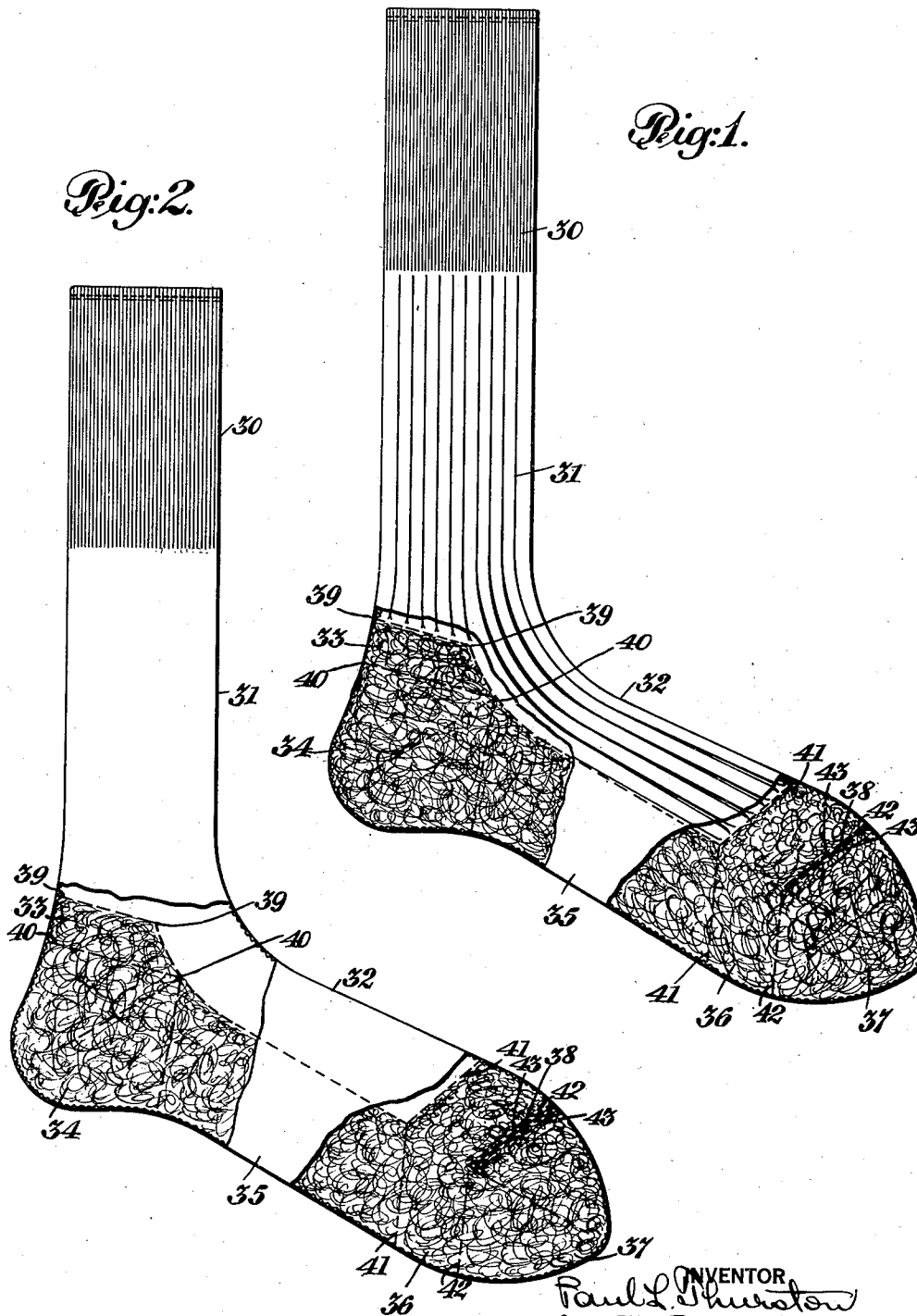


Feb. 11, 1941.

P. L. THURSTON
METHOD OF AND APPARATUS FOR KNITTING TERRY FABRIC
OR HOSIERY CONTAINING THE SAME
Filed May 13, 1939

2,231,399

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Fig. 3.

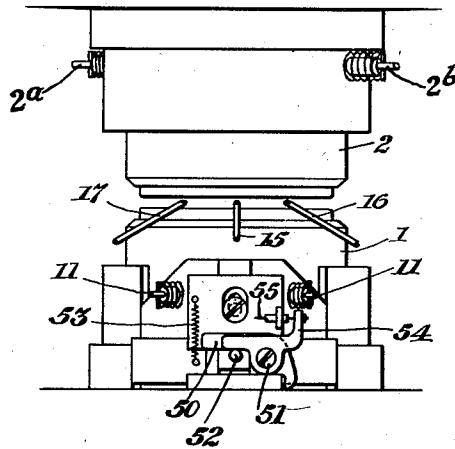


Fig. 4a.

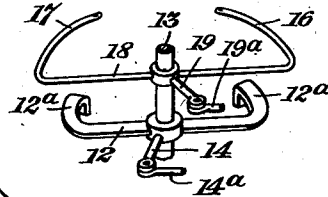
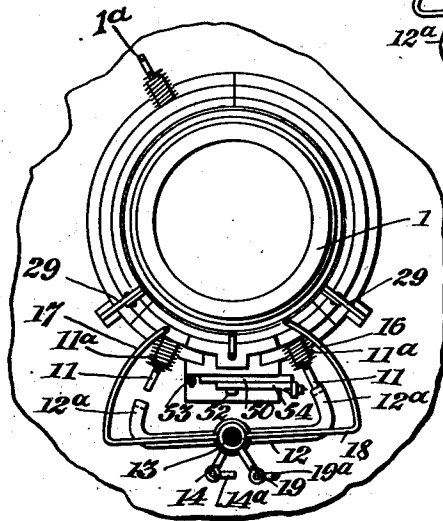


Fig. 4.



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Fig. 5.

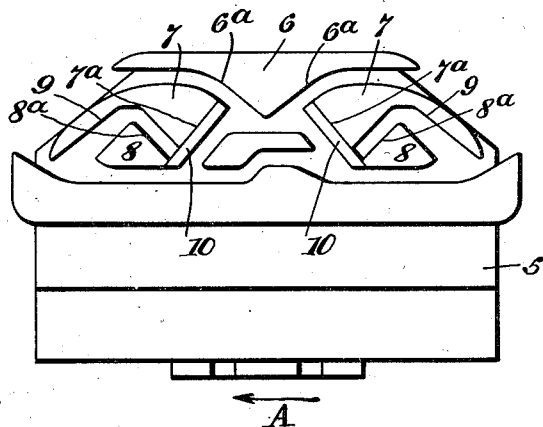


Fig. 6a

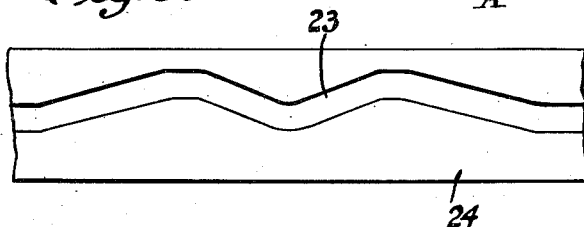


Fig. 7.

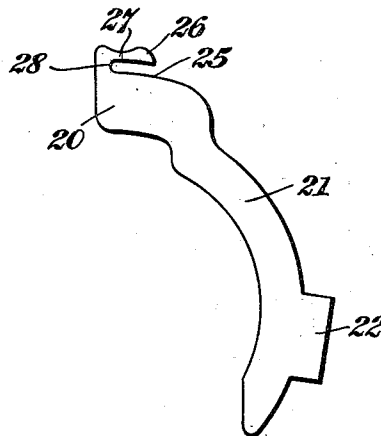
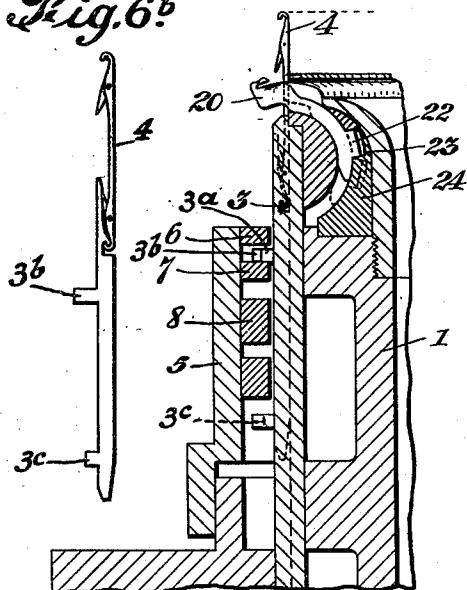


Fig. 6.

Fig. 6b



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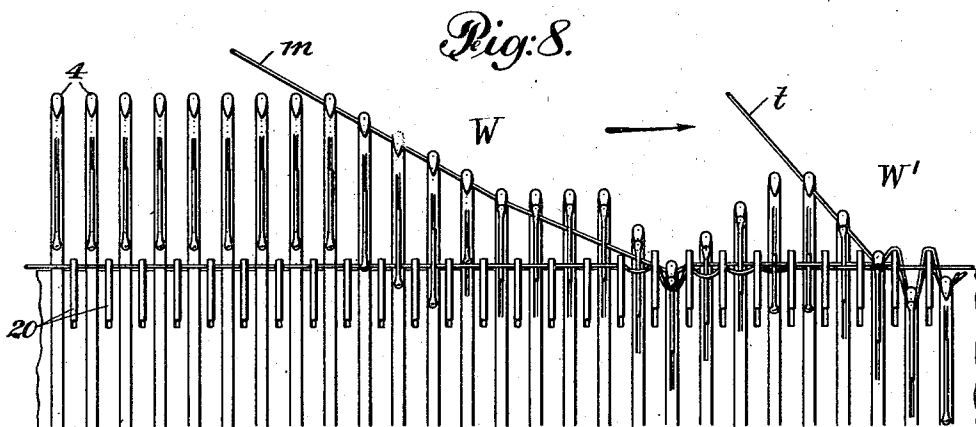


Fig. 9.

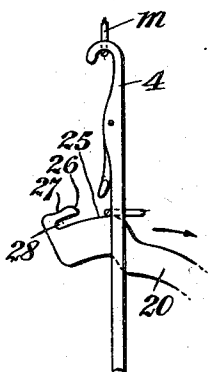


Fig. 10.

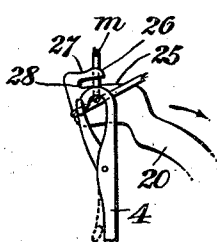


Fig. 11.

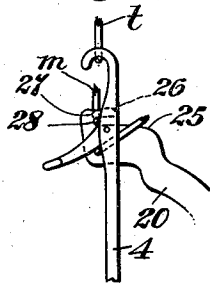


Fig. 12.

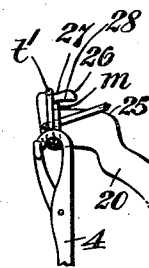


Fig. 13.

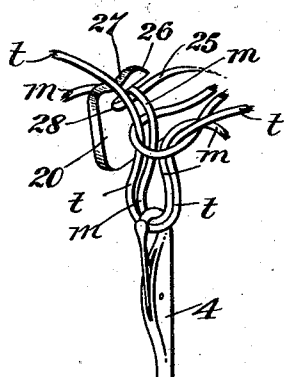
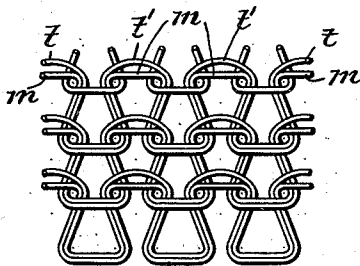


Fig. 14.

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UNITED STATES PATENT OFFICE

2,231,399

METHOD OF AND APPARATUS FOR KNITTING TERRY FABRIC OR HOSIERY CONTAINING THE SAME

Paul L. Thurston, Martinsburg, W. Va., assignor to Interwoven Stocking Company, New Brunswick, N. J., a corporation of New Jersey

Application May 13, 1939, Serial No. 273,434

31 Claims. (Cl. 66—14)

My invention consists in the novel features hereinafter described reference being had to the accompanying drawings which illustrate one embodiment of the same, selected by me for purposes of illustration, and the said invention is fully disclosed in the following description and claims.

My invention consists in a novel process and apparatus for the manufacture of hosiery having certain portions of its inner surface provided with sinker stitch loops formed of a separate thread and of greater length than the sinker loops of the main knitting thread, for the purpose of adding substance to the fabric and providing a soft interior cushioning surface therefor. Such additional sinker loops are frequently termed "terry loops" and they may or may not be combed or brushed so as to separate the exterior fibres of the terry loops and commingle them in a soft matted condition on the interior of the sock, ankle or stocking, to provide the soft or cushioning effect desired.

Hosiery of this type has ordinarily been made heretofore largely, if not entirely for athletic use and has been formed as a more or less coarse fabric. According to my invention it is possible to produce the soft interior cushioning effect at the parts of the sock or stocking desired, and at the same time to knit the exterior fabric either as a plain or a rib knit fabric of higher class yarns, so as to produce hosiery which may be worn for normal purposes where a soft interior surface or a cushioning effect, or a sock of greater warmth, is desired.

In the manufacture of the terry portions of the fabric it has heretofore been customary to feed simultaneously to each of the needles the main knitting thread and the separate or terry thread in connection with the usual knitting wave, causing the needles to simultaneously draw stitches containing both threads, and to provide the sinkers with portions adapted to pass between the said threads and having sinker shoulders at different elevations for measuring or determining the length of sinker loops of each thread, said sinker shoulders being disposed either vertically or horizontally so that the needle, while drawing both threads downwardly to the same extent, will produce sinker loops of the additional thread of greater size than the normal sinker loops of the main knitting thread. These enlarged sinker loops of the additional or terry thread will therefore project on the inner face of the fabric. It will be obvious that the sinkers must be moved radially with great rapidity the distance required to bring the sinker shoulders into operative rela-

tion with the portions of the separate threads extending from each needle taking the same, to the respective thread feed finger therefor, and the slightest variation in the relative position of the threads, or either of them with respect to the sinkers, due to slight variations in tension, vibration of the threads, or otherwise, will result in the failure of a sinker to properly engage and support the separate threads, thus producing inferior knitting. As a matter of fact, this very frequently happens, with the result that a very considerable number of seconds are produced even with fairly coarse knitting and terry threads, and this result would be aggravated in knitting with finer threads and larger numbers of needles and finer needles. The production of this type of hosiery has therefore been practically limited, as before stated, to the more or less coarse fabrics used mainly for athletic purposes.

It has also been found to be difficult in reciprocating work, as at the toes and heels, to form the terry loops during the reverse reciprocations of the needle cylinders of the knitting machines, and it has been customary, therefore, to knit the terry loops only in the alternate courses of the heels and toes during which the needle cylinder is moving in the same direction that it moves during circular work. This of course results in the formation of less cushioning loops in the heels and toes where the greatest wear comes and where such cushioning is particularly needed.

According to my present invention, I provide the knitting cylinder with knitting cam mechanism having a main drawdown cam operable in both directions of the needle cylinder, so designed as to draw down all the needles in a main knitting wave adjacent to which they have taken the main knitting thread, to a less extent than that required to cast off the loop or stitch of the preceding course, the main knitting thread engaging a main shoulder of the sinkers to draw the normal stitch, and to provide on opposite sides of the main knitting cam, auxiliary cams for acting upon the needles which knit the portion of the stocking at which terry loops are desired. These auxiliary cams raise the needles to receive the secondary, or auxiliary, or terry thread, after which they are again drawn down a secondary knitting wave, sufficiently to cast off the preceding loop or loops, retaining a loop of the main knitting thread and a loop of the terry thread thereon. Between the feeding of the main thread and the feeding of the terry thread, however, the sinkers are moved radially so as to bring a higher auxiliary shoulder beneath the terry

thread and form a larger sinker loop thereof than the sinker loop formed by the main knitting thread.

Each of the auxiliary cams is also preferably provided with a switch cam capable of being maintained in one of three positions, it being understood that when one of these switch cams is in operative position, the other will be in inoperative position. When the switch cams are all the way out, they have no effect on the needles and terry stitches, as well as stitches of the main thread, are formed on all of the needles, both the long butt, which knit the front of the leg and instep, and the short butt needles, which knit the back of the leg, the high splice portion and sole of the foot during circular work, and the heel and toe pockets during reciprocating work. When the switch cams are halfway in, they engage only the long butt needles, which are thereby caused to pass the auxiliary knitting cam, and are drawn down far enough to cast the stitches of the previous course, so that terry stitches are only formed on the short butt needles, and when the switch cams are all the way in, all the needles of the entire circular series will be carried down past the auxiliary cams and no terry stitches will be formed at any point around the portion of the stocking being knit. In conjunction with this cam mechanism, I also provide suitable mechanism under the control of the pattern mechanism of the machine for moving the switch cams respectively into and out of each of their aforesaid positions, and holding one or both of said cams in inoperative position, and I also provide an auxiliary thread feed finger for terry thread on each side of the main thread feed finger, which auxiliary thread feed fingers are moved by said pattern mechanism, respectively, the one into and the other out of operative position, according to the direction in which the cylinder is moving during circular or reciprocating work.

It will therefore be seen that by providing two successive knitting waves, which must be traversed by the needles forming the terry loops before the stitches of the preceding course are cast off, and feeding the main and terry threads separately, one adjacent to each of said knitting waves, a wide separation is brought about between the points where the separate threads engage the needles, a separation which may be of any desired extent. This affords a time element for the operation of the sinker from the position in which its main sinker shoulder is brought into operative position by the first knitting wave to engage the main knitting thread, and determine the length of the sinker loop thereof, to the position in which the secondary sinker shoulder is brought into operative position to engage the secondary or terry thread, and determine the greater length of the sinker loop formed thereof. This results in an easier operation of the sinker actuating cam, and insures the efficient and accurate operation of the sinkers in producing the said sinker loops of terry thread on the inner face of the fabric, even with the use of the finer grades of main knitting thread, both as to quality and diameter, and the use of the finer and more numerous needles in the knitting means.

According to my present invention, therefore, I am able to produce the interior terry effect of the high splice above the heel, at the back of the leg, in every course of the heel and toe, and throughout the sole of the stocking, and throughout a circular portion at the end of the foot of the stocking adjacent to the toe, which is ordinarily

termed the toe band. I am also enabled to form the leg and instep portions of the stocking of relatively fine thread, and either by plain knitting or rib knitting, as may be found desirable.

My improved process may be carried into effect by, and embodied in many different kinds of circular knitting machines, and the socks or stockings produced thereby may be provided with any type of ornamentation desired, such as wrap stripe, reverse plating or float stitch ornamentation, and also in split foot knitting machines which make the entire foot of the sock by reciprocating knitting, also circular knitting machines provided with vertical superposed coaxial knitting cylinders having double ended needles capable of being transferred from one cylinder to the other and operated in either by the means of sliders carrying the necessary knitting butts and transfer butts, in which case the leg of the stocking and instep or top of the foot may be made of plain knitting, or any desired type of rib knitting, such as 1 x 1 rib, 6 x 3 rib, etc. In the accompanying drawings and in the following description, I have set forth my invention as carried out by means of the last mentioned type of knitting machine, although I wish it clearly understood that my invention is in no wise limited thereto.

Referring to the accompanying drawings,

Fig. 1 is a side elevation of a 6 x 3 rib sock, portions of which are broken away to show the terry loops on the inner face of portions thereof.

Fig. 2 is a similar view of a plain knit sock.

Fig. 3 is a side elevation of portions of a knitting machine having superposed coaxial needle cylinders constructed and arranged for carrying out my improved process, portions of the apparatus being removed and the thread feed fingers being broken away.

Fig. 4 is a top plan view of the lower cylinder of the machine illustrated in Fig. 3, showing the means for operating the switch cams and terry thread feed fingers.

Fig. 4a is a perspective view of the mechanism shown for operating the switch cams and terry thread feed fingers.

Fig. 5 is an elevation of the inner face of the cam block carrying the main and auxiliary knitting cams drawn to an enlarged scale.

Fig. 6 represents a partial sectional view of the lower cylinder of the machine, showing the sinker mechanism.

Fig. 6a is a detail view showing the partial development of the sinker operating cam shown in Fig. 6.

Fig. 6b is a detail view of one of the needles and the slider therefor, located in the lower cylinder.

Fig. 7 is an enlarged detail view of one of the sinkers.

Fig. 8 is a diagrammatic view showing the main and auxiliary knitting waves and the manner in which the main and terry threads are fed to the needles and separately drawn over different portions of the sinkers to produce larger sinker loops of the terry thread than those of the main knitting thread.

Fig. 9 is a detail view showing one of the needles holding a stitch of the preceding course thereon and receiving the main or body thread, and one of the sinkers in position to cooperate with the needle in drawing a loop over the main shoulder of the sinker.

Fig. 10 is a similar view showing the needle after it has drawn the loop of body thread over the main shoulder of the sinker without casting off the previous stitch.

Fig. 11 is a similar view showing the needle raised by the auxiliary elevating cam to receive the loop of terry thread and the sinker moved into position to bring the auxiliary shoulder adjacent to the needle.

Fig. 12 is a similar view, showing the needle drawn down to cast off the previous stitch, and holding the separate loops of main thread and terry thread.

Fig. 13 is a perspective view of the parts illustrated in Fig. 12.

Fig. 14 is a diagrammatic view of a section of the fabric showing the stitches composed of main and terry thread in several courses.

In carrying my invention into effect, I may employ a plain circular knitting machine for knitting plain fabric and forming heels and toes in the usual and well known manner, or I may employ a knitting machine capable of producing both plain knit and rib knit fabric, and therefore capable of knitting a stocking with the leg and instep portions of rib knitting, and the heel, toe and sole portions of plain knitting. I prefer, however, to employ a machine of the type in which superimposed coaxial knitting cylinders are provided with needles having hooks at both ends, suitable transfer mechanism being also provided for shifting the needles from one cylinder to the other in a well known way, whereby all of the needles may be assembled in the lower cylinder for the production of circular knitting, or alternate needles or groups of needles may be transferred from the lower cylinder to the upper cylinder during the knitting of an entire circular course, or a portion thereof, as preferred. Such a machine is the Komet machine, manufactured by the Bentley Engineering Company of Leicester, England, and I have shown my invention embodied in and carried into effect by a Komet machine, in connection with certain additions thereto and changes therein, which are hereinafter fully described.

Referring to Fig. 3, 1 represents the lower cylinder of a Komet machine, modified as herein-after described, and 2 the upper cylinder, it being understood that the cylinders are each provided with sliders, one of which is indicated at 3, in Fig. 6b, and with a circular series of needles 4, in this instance having hooks and latches at each end, in the usual manner in Komet machines, and adapted to be transferred in the usual manner from the sliders of one cylinder to those of the other, under the control of the usual pattern mechanism. The needles have associated therewith knitting butts to engage the knitting cam mechanism hereinbefore described, the knitting butts for the needles which knit the heel and toe pockets by reciprocating work and narrowing and widening being short butts, indicated at 3a in Fig. 6, and the knitting butts for remaining needles being long butts, indicated at 3b in said figure. Where my invention is carried out by the use of a machine of the Komet type having double ended needles, the knitting butts 3a, 3b, will be provided on the sliders for the needles, one of which is shown in Fig. 6b, and the sliders for the needles which are to be transferred from the lower cylinder to the upper cylinder are also provided with transfer butts, one of which is illustrated at 3c in Figs. 6 and 6b.

It will be understood, however, that where my invention is carried out by means of a knitting machine having a single cylinder and a single series of needles having hooks at one end only, the shanks of the needles will be provided with the

appropriate long and short knitting butts and the transfer butts will be omitted.

In the following description and in the claims, where I have referred to the needles having associated therewith long and short butts, it is to be understood that the butts may be as above indicated, either directly attached to and forming part of the needles, or to a slider operatively connected herewith.

In Fig. 5 I have shown a form of cam block for the lower knitting cylinder. The block in its entirety is indicated at 5 and is shown as it would appear if straightened out in a single plane. The cam block is provided with main knitting cam mechanism comprising the centrally located drawdown cam 6, having the drawdown cam grades 6a disposed oppositely for reciprocating work, and cooperating with the additional drawdown cams 7, having drawdown cam grades 7a, 7a, cooperating with the grades 6a, 6a, to produce a main knitting wave in either direction of the cylinder. Each of the cams 7 is cut away, as shown, to receive an auxiliary elevating cam 8 provided with an elevating cam grade 8a, and an auxiliary drawdown cam grade 9 is provided beyond each of the auxiliary elevating cams 8, formed in this instance integral with the additional cam 7, although this is not essential. Obviously the auxiliary drawdown cam grades 9 will each produce a secondary knitting wave. The lowest point of the additional drawdown cams 7 will draw the needles down to a point (see Fig. 10) in which they will draw a stitch of the main thread, but will not cast off the stitch or stitches of the preceding course, while the auxiliary drawdown cam grades 9 terminate at points sufficiently lower than the ends of the cams 7 to cast off the previously held stitch or stitches (see Fig. 12).

In conjunction with each of the auxiliary cam mechanisms there is provided a switch cam, indicated at 10, 10, movable radially through slots in the cam block 5 and extending from the upper end of the drawdown cam grade 7a to the lower edge of the auxiliary cams 8. These switch cams are preferably carried by plungers 11 mounted in bearings in the cam block, in a well known way, and provided in this instance with springs 11a, normally holding the switch cams in their outermost or inoperative positions. The sliders in the lower cylinder (or the shanks of the needles in an ordinary stocking knitter) are provided, as usual, with long and short butts, the needles operated by the short butts knitting the rear half of the leg of the stocking, including the high splice above the heel, the heels and toes, and the sole of the foot, the remaining needles operated by the long butts knitting the front of the leg and instep portions. When the switch cams are in their inoperative or outermost positions they will not come in contact with any of the knitting butts. By moving them to an intermediate position, they will engage the long butts and force the needles controlled thereby to pass downward below the auxiliary riser cams 8, thus completing the casting off of the previously formed stitch, as will be readily understood with reference to Fig. 5, while the short butts will engage the auxiliary elevating cam 8 and be raised into operative position to receive the terry thread, and will follow down the secondary knitting wave in engagement with the cam grade 9. If, on the other hand, the switch cams are pushed all the way in, all of the needles will be carried downward on the main knitting wave, past the auxiliary elevating cam 8, and caused to cast off the preceding stitch.

The object of having two sets of auxiliary cams 8 and switch cams 10, is primarily to enable the terry stitches to be formed in every course of the heel and toe, as will be readily understood. Obviously when the cylinder is being rotated in one direction only, only one of the auxiliary elevating cams and its adjacent switch cam will be operative. I provide automatic means for operating the switch cams, which consists in this instance of a rocking lever 12, mounted on a stud 13 supported from the main frame and provided at its opposite ends with arms 12a, 12a, to engage one or other of the plungers 11 and push in the corresponding switch cam to the required extent, according to the work to be accomplished. The rocking lever 12 is provided with an actuating arm 14 operatively connected, as by a link 14a, with mechanism under the control of the pattern mechanism of the machine (not herein shown), the operation of which will be clearly understood.

The main knitting thread is fed by means of a centrally located stationary thread feeding finger 15, to the needles previous to or during the main knitting wave, and the terry thread is fed from separate spools by one or other of two auxiliary thread feeding fingers 16 and 17 according to the direction in which the cylinder is rotating, the construction being such that the needles receive first the main knitting thread in connection with the main knitting wave, and draw a stitch loop thereof, and thereafter those needles which are to knit the terry stitches are raised by one or other of the auxiliary knitting cams 8 and receive the terry thread from one or other of the thread feeding fingers 16, 17, according to the direction in which the cylinder is moving, after which the needles are drawn down by the adjacent auxiliary drawdown cam 9 which produces the secondary knitting wave. The auxiliary thread feed fingers 16 and 17 are conveniently secured to or formed integral with a rocking lever 18 also mounted on the stud 13 and provided with an actuating arm 19 which is connected, as by link 19a, with suitable operating devices under the control of the pattern mechanism of the machine (not shown).

In conjunction with the needle actuating mechanism above described, I provide radially movable sinkers 20, which in the Komet machine are formed, as best shown in Figs. 6 and 7. Each of these sinkers is provided in this instance with a curved body portion 21 having an actuating butt 22, to engage a cam groove 23 in a sinker actuating cam 24, in this instance located within the cylinder 1, so that the upper end of the sinker will be given radial movement toward and from the center of the cylinder. Fig. 6a illustrates a development in a single plane of the sinker cam 24 shown in Fig. 6. Each sinker is provided with a normal shoulder 25 over which the normal stitch of the main knitting thread is drawn, and above this shoulder the sinker is provided with an inwardly extending projection 26 having its upper surface concave, or inwardly curved, as indicated at 27, forming an auxiliary shoulder to receive the terry thread, and providing a slot 28 between the projection 26 and the normal shoulder 25.

The formation of the terry fabric at the desired portions of the stocking is best illustrated in Figs. 8 to 14. Assuming that the cylinder is being rotated continuously in the same direction as it would be in knitting circular work, and that the parts of the machine are constructed and operating substantially as previously described, and assuming that there is a stitch on each of the needles, which may be, for example, a stitch of the last

course of the top portion of sock, ankle or stocking, each of the needles will receive the main knitting thread *m* in its hook from the main thread feed finger, 15, at the top of the main knitting wave, which is indicated at *W* in Fig. 8, the sinkers being in their outermost positions, all as indicated in Fig. 9. All of the needles will be drawn down by one of the main drawdown cam grades 6a, the one at the right of the center in Fig. 5, in which the direction of rotation of the cylinder is indicated by the arrow *A*. Let it be also assumed that the switch cam 10 at the left of the center of the cam mechanism is in its intermediate position, that is to say in position to engage only the long butts of the sliders or needles. As the needle butts, all of which engage the main cam grade 6a, pass therefrom the long butts will engage the switch cam 10, which will produce a continuation of the main knitting wave and cause said needles to cast their previously held stitches, in the usual manner, and pass on below the auxiliary elevating cam 8, at the left in Fig. 5, drawing the usual or normal stitch loops and sinker loops over the normal shoulder 25 of the adjacent sinkers. The needles controlled by the short butts will, however, engage the auxiliary elevating cam grade 8a, and will therefore not cast the previously formed stitch, as clearly indicated in Fig. 10, but will draw the main knitting thread over the normal shoulder 25 of the adjacent sinkers which are moved gradually inwardly in the direction of the arrows, Figs. 9 and 10, and thereby bring the projections 26 of the adjacent sinkers over the main thread, as shown in Fig. 11.

The needles controlled by the short butts will rise, following the elevating cam grade 8a, and adjacent to their highest point they receive the terry thread, indicated at *t*, after which they encounter the adjacent auxiliary drawdown cam 9, following down the secondary knitting wave, indicated at *W'* in Fig. 8. As the needles controlled by the short butts descend through the secondary knitting wave, a loop of terry thread will be drawn over the concave surface of the auxiliary shoulders 27 of the adjacent sinkers, as clearly shown in Fig. 12, the previously formed stitch will be cast off, leaving in the hooks of the needles a normal stitch of the main thread *m*, and the loop or stitch of the terry thread *t*, having the longer sinker loop *t'*, as clearly shown in Figs. 12 and 14.

Assuming that it is desired to knit a stocking such as that shown in Fig. 1, for example, of the accompanying drawings, in which the main body of the leg and instep are formed of 6 x 3 rib, the method of knitting will preferably be carried out substantially as follows. In this figure 30 represents the top of the stocking, 31 the leg, 32 the instep, 33 the high splice above the heel, 34 the heel, 35 the sole, 36 the toe band, 37 the toe and 38 the looped joining of the upper portion of the foot with the toe. The top 30 may be knit by plain knitting with all the needles in the lower cylinder of the Komet machine, and with or without the insertion of an elastic thread, or the top may be knit of 1 x 1 rib, with or without an elastic thread, or of 6 x 3 like the leg, as may be preferred, by transferring the necessary alternate needles or alternate groups of needles to the upper cylinder, the particular formation of the top forming no part of my present invention. It will be understood that the upper and lower cylinders will be provided with the usual transfer cams for engaging the transfer butts of the sliders and transferring the needles from the sliders of one cylinder

to the sliders of the other cylinder under the control of suitable pattern mechanism. I have not herein particularly illustrated the duties of this transfer mechanism as it is well known. The transfer cams of both cylinders are ordinarily mounted on radial plungers so that the transfer cams may be moved into and out of operative relation with the butts of the sliders of both the upper and lower cylinders when desired. In Fig. 3 the operating plungers for the transfer cams of the upper cylinder are indicated at 2a, 2b and in Fig. 4 the plunger operatively connected with the transfer cam of the lower cylinder is indicated at 1a. The operation of these cams is exactly as usual in the Komet machine. In knitting the 6 x 3 leg 31, obviously alternate groups of three needles separated by groups of six needles will be transferred to the upper cylinder in the usual manner, and the switch cam 10 on the left side of the main drawdown cam (Fig. 5) will be placed in its innermost position, so that all of the needles of the lower cylinder will receive the main knitting thread only, pass down the main knitting wave, continue down the switch cam 10, and cast off their previously formed stitches at the conclusion of the main knitting wave W, as augmented by the switch cam 10, the needles of the upper cylinder forming the inwardly extending wales of the fabric, in the usual manner. This form of knitting will proceed down to the point indicated by the dotted line 39, 39, which indicates the upper edge of the high splice portion 33, at the rear of the leg. Beginning at this point, if it is desired to provide the high splice portion 33 with a terry lining, the transfer cams with which the machine is ordinarily provided, operating in their usual manner, are adjusted by the pattern mechanism of the machine so as to transfer all of the needles controlled by the short knitting butts which are in the upper cylinder, to the lower cylinder, and the switch cam 10, at the left in Fig. 5, is withdrawn to its intermediate position so as to engage only the long knitting butts, while the short knitting butts pass upward over the auxiliary elevating cam 8, without casting off the stitches of the previous course, and receive the terry thread t, from the appropriate auxiliary feed finger 16, drawing a longer sinker loop as the short butts are drawn down the auxiliary knitting wave W', in the manner previously described, until the last short butt needle has cast off, when the finger 16 is moved to its inoperative position and the terry thread is clamped and severed by a clamp and cutter 29, one of which is provided at each side of the cam block 5, as shown in Fig. 4. As the knitting proceeds the long butt needles, part of which are in the upper cylinder, will take only the main knitting thread and will continue the knitting of 6 x 3 rib work on the front portion of the leg, to complete the course. Successive courses are knit in this manner, thus knitting the high splice portion 33 of the sock by plain knitting with the additional and longer terry sinker loops, as previously described, while the front of the corresponding portion of the leg will be knit as 6 x 3 rib with the main knitting thread only, in the usual manner.

After the completion of the high splice, the point indicated by the dotted line 40—40 Fig. 1 is reached, where the heel is to be knit. The heel is produced by reciprocating work on the short butt needles and narrowing and widening, in the usual manner, while the long butt needles hold their stitches. During the knitting of the heel, the respective switch cams 10 and their adjacent auxiliary thread feed fingers 16 and 17 are alternately

brought into operation, so as to feed a terry thread by one or other of said feed fingers 16 and 17, according to the direction of movement of the cylinder in each course of the heel, each of the terry threads being cut and bound by one or other of the cutting and binding mechanisms 29, at the end of the course. This produces a full terry lining on the inner face of the heel pocket, with terry loops at all the stitches of each course, a most desirable feature of my invention.

When the heel is completed, circular knitting is resumed in the same manner as in knitting the high splice portion of the leg, the long butt needles producing 6 x 3 rib on the top of the foot, and the short butt needles producing plain knitting with the main and terry threads in each course of the sole of the foot, the terry thread being cut and bound in each course, as previously described, by one of the cutting and binding mechanisms, 29, and being reintroduced after the knitting of the 6 x 3 rib stitches in each course.

When the point indicated by the dotted line 41—41 is reached, just before the toe pocket, it is desirable to knit a number of complete courses forming what is generally referred to as the toe band by plain knitting. At this point the transfer mechanism of the Komet machine is actuated to transfer the remaining long butt needles from the upper cylinder to the lower cylinder, so as to knit continuous courses of plain knitting, and the switch cam 10, at left in Fig. 5, which is operating in connection with the short butt needles, is actuated by the pattern mechanism so as to withdraw it to its inoperative position, thus causing all of the circular series, both long and short butt needles, to be elevated by the adjacent auxiliary cam 8 without casting off the stitches of the preceding course, to enable them each to receive the terry thread and to be drawn down the auxiliary knitting wave W', as before described, so as to form a plurality of complete circular courses of stitches of the main knitting thread and the terry thread, and produce the toe band, indicated at 36 in Fig. 1, extending entirely around the foot with the terry lining, as therein shown. The knitting in this manner continues until the point indicated by the dotted line 42—42 is reached.

The toe pocket, indicated at 37 in Fig. 1, is then knit in the same manner as hereinbefore described with reference to the heel pocket by reciprocating work, the needles having the long butts holding the stitches of the last course of the top of the foot. When the toe pocket is completed, circular knitting will be resumed and the switch cam 10, at the left in Fig. 5, is moved inwardly to its innermost position to enable a plurality of courses of plain knitting with the main knitting thread only, say about twelve courses, to be knit before beginning the top of the next sock or stocking. After the stocking is separated from the succeeding stocking, by severing through these circular courses of plain knitting (or by the use of a pull thread in the usual manner) the remaining plain courses at the toe joining are raveled back one or two of said courses, being preferably left to facilitate the joining of the top of the foot and toe in the usual manner by looping. These courses of plain knitting at the toe joining are indicated between the dotted lines 38 and 43 in Fig. 1.

The stocking may now be turned inside out and the terry sinker loops of the high splice, heel, sole, toe band and toe may be brushed or combed in a well known way to produce a soft, matted

fibre lining for those portions of the stocking, sock or ankle.

It will be understood that instead of 6 x 3 rib portions 31 and 32 of the sock, any other form of rib may be employed by suitably adjusting the machine to provide for such different distribution of the needles between the upper and lower cylinders. It will also be understood that these portions of the sock, to wit, the leg and top of the foot may be knit on this machine by plain knitting, in which case all of the needles will remain in the lower cylinder at all times. The character of these portions of the stocking does not affect the operation of the devices which produce the terry lining. I have shown such a sock in Fig. 2, in which the parts corresponding with those shown in Fig. 1 are given the same reference numerals.

I wish it to be understood that my invention can be carried out to produce a stocking such as indicated in Fig. 2, having the plain knit leg and top of the foot on any ordinary knitting machine capable of knitting a plain knit stocking, by providing the machine with the cam mechanism and radially movable sinker mechanism having main and auxiliary shoulders, operating in the manner previously described, and my invention can also be carried out to produce such a sock provided with any desired type of ornamentation, such as wrap stripe, reverse plating or floats, such for example, where the machines are adapted to produce such ornamental effects. In the use of such a knitting machine, or any other knitting machines, the construction of which will permit the terry thread to be carried halfway around the cylinder from the last stitch in which it occurs, a single thread guide could be employed, and the clamps and cutters eliminated, the terry thread being in such case floated across the cylinder and subsequently cut out in a well known way. In the knitting of the heel and toe, however, it would be necessary to move such single terry thread feed finger from one side to the opposite side of the main thread feed finger at the end of each course of reciprocating work.

I wish it also to be understood that my invention may be carried out to produce the stockings hereinbefore described on a split foot machine, which makes the entire foot of the stocking by reciprocating work in a well known way. In such case it will be necessary to withdraw the terry yarn before the suture seam is reached at each reciprocation during the formation of the foot, as the main knitting yarns in both the instep and sole would be fed to the hooks of the suture needles which could not ordinarily accommodate the terry yarn in addition thereto. This could readily be accomplished by adjusting the pattern mechanism so as to withdraw the terry thread feed finger in operation at the proper point in the course and the introduction of the terry thread in the next reciprocating course in the opposite direction, either by a separate terry thread feed finger, as shown herein; or by shifting a single terry thread finger to the opposite side of the main thread feed finger, as the overthrow of the yarn in its reciprocations would readily permit the same.

It will be understood that the main knitting thread may be of any desired character and of any desired fineness, and that the terry thread will ordinarily be a coarser thread, and preferably of a character which will facilitate the combing of the terry sinker loops, as hereinbefore described, for the production of a matted surface of combed fibres, although in some instances the combing

of the terry sinker loops may be omitted if found desirable.

It will be understood that the cam block shown in Figs. 3, 4 and 5 may be raised and lowered as usual in knitting machines, and as ordinarily constructed in the Komet machine, for the purpose of regulating the size of the stitch loops formed by the main knitting thread. In Fig. 3, for example, there is shown a lever 50 pivoted on a stud 51 and engaging a pin 52 for depressing the cam block 5, the cam block being normally held in its highest position by means of a spring 53. Obviously where the terry loops are formed, it will be desirable to increase the size of the stitches in that portion of the fabric containing the terry loops without interfering with the size of the stitches of the other portions of the stocking, as the front of the leg and instep or top of the foot. To this end I have shown a second stitch regulating lever 54, which may also be mounted on the stud 51 in position to engage the pin 52 and which is connected in this instance by a Bowden wire, indicated at 55 with suitable mechanism operated under the control of the pattern mechanism (not herein shown) for depressing the cam block during that portion of the revolution of the cylinder during which the terry stitches are formed, and thereby increasing the size of the loops of main knitting thread and regulating the size of the terry loops in conformity therewith, so that the production of the terry lining within such portions of the fabric will not decrease the interior diameter of the sock, ankle or stocking. In fact, it is desirable that such portions of the sock, ankle or stocking should be, if anything, more roomy than the other portions. Thus it will be seen that during the knitting of the high splice, the heel, the sole and toe, the lever 54 will be operated to depress the cam block during the operation of the short butt needles, so as to make those portions of the sock with larger stitches, while the spring 53 will return the block to its normal position during the knitting with the long butt needles, the size of the stitches formed thereby remaining unchanged. Of course where the toe band 36 is knit the cam block will be held depressed during the entire revolution of the cylinder, and the operation of both the long and short butt needles in order to increase the size of the main and terry loops throughout that portion of the sock, ankle or stocking.

It will be understood that where reference is made in the preceding specification, and in the claims, to "long butt needles" and to "short butt needles," these expressions apply to needles provided respectively with long or short knitting butts, or needles controlled by jacks or sliders having long or short knitting butts, according to the type of knitting machine in which my present invention is embodied.

While I prefer to provide on each side of the main knitting cam 6 a switch cam 10 in connection with the elevating cam 8, and auxiliary draw-down cam 7, as shown in Fig. 5, the switch cam 10, at the right in Fig. 5, might be omitted in some instances where only the short butt needles could possibly be engaged by the auxiliary elevating cam 8 at that side. I prefer, however, to construct the cam mechanism as shown in Fig. 5, as its use would be essential if the over movement of the cylinder in reciprocating knitting, for example, was sufficient to bring the long butt needles into position where they would otherwise engage the adjacent elevating cam at the right of the cam 6, or for example in case it was desired to provide the

terry sinker rib lining in the heel but not in the toe, or for other reasons its use would be not only desirable or essential.

What I claim and desire to secure by Letters Patent is:

1. Steps in the production of knit fabric provided with terry loops on its inner surface, which comprise causing a plurality of consecutive needles of a circular knitting machine to travel down two successive knitting waves before casting off the stitches of the preceding course and raising the said needles between said knitting waves, feeding a main knitting thread to the needles, in connection with the first knitting wave, and feeding a terry thread to the needles in connection with the second knitting wave, and causing the other consecutive needles to travel down the first knitting wave, taking the main knitting thread and to continue therein, and cast off the stitches of the preceding course without taking the terry thread.

2. Steps in the production of knit fabric provided with terry loops on its inner surface, which comprises causing a plurality of consecutive needles of a circular knitting machine to travel down two successive knitting waves before casting off the stitches of the preceding course and raising the said needles between said knitting waves, feeding a main knitting thread to the needles, in connection with the first knitting wave, and feeding a terry thread to the needles in connection with the second knitting wave, and causing the other consecutive needles to travel down the first knitting wave, taking the main knitting thread and to continue therein, and cast off the stitches of the preceding course without taking the terry thread, and causing the first mentioned needles which draw stitch loops of the main and terry threads, to draw larger sinker loops of the terry thread than the sinker loops of the main thread.

3. Steps in the production of knit fabric provided with terry loops on its inner surface, which comprise causing a plurality of consecutive needles of a circular knitting machine to travel down two successive knitting waves before casting off the stitches of the preceding course and raising the said needles between said knitting waves, feeding a main knitting thread to the needles, in connection with the first knitting wave, and feeding a terry thread to the needles in connection with the second knitting wave, and causing the other consecutive needles to travel down the first knitting wave, taking the main knitting thread and to continue therein, and cast off the stitches of the preceding course without taking the terry thread, and severing the terry thread at the end of each partial course containing the same.

4. Steps in the production of knit fabric provided with terry loops on its inner face by reciprocating work on a circular knitting machine, which comprise feeding a main knitting thread to a plurality of consecutive needles in each reciprocating course and causing the needles to pass down two successive knitting waves in each direction of travel before casting off the stitches of the preceding course, and raising the said needles between said knitting waves, and feeding thereto a terry thread in each direction of travel of the needles, in connection with the second knitting wave, and drawing sinker loops of the terry thread of greater size than the stitch loops formed by the main knitting thread, in both directions of travel of said needles.

5. Steps in the production of knit fabric provided with terry loops on its inner face by recip-

rocating work on a circular knitting machine, which comprises causing a plurality of consecutive needles to travel down two successive knitting waves in each direction of travel, before casting off the stitches of the preceding course and raising the said needles between said knitting waves in each direction of their reciprocating movement, and in each direction of movement feeding a main knitting thread to said needles in connection with the first knitting wave, feeding a terry thread to the needles in connection with the second knitting wave, supporting the main knitting thread adjacent to each needle, and supporting the terry thread at a higher level adjacent to each needle to produce sinker loops of the terry thread of greater size than those of the main knitting thread in each course of said reciprocating work.

6. Steps in the production of knit fabric, provided with terry loops on its inner face by reciprocating work on a circular knitting machine, which comprises causing a plurality of consecutive needles to travel down two successive knitting waves in each direction of travel, before casting off the stitches of the preceding course and raising the said needles between said knitting waves in each direction of their reciprocating movement, and in each said direction of movement feeding a main knitting thread to said needles in connection with the first knitting wave, feeding a terry thread to the needles in connection with the second knitting wave, in one direction, and feeding a separate terry thread to the needles in connection with the second knitting wave during the travel of the needles in the opposite direction of their reciprocating movement, and in both directions of travel of the needles during their reciprocating movements, and supporting the main knitting thread adjacent to each needle, and supporting the terry thread at a higher level adjacent to each needle to produce sinker loops of the terry thread of greater size than those of the main knitting thread.

7. In a process of knitting a stocking having the inner surfaces of portions thereof provided with terry loops, knitting the leg by circular knitting, causing all of the needles of a circular knitting machine to travel down a main knitting wave, feeding a main knitting thread thereto, and drawing the stitches over main sinker shoulders, knitting other portions of the stocking, raising a plurality of consecutive needles in each course before they cast off the stitches of the preceding course, feeding a terry thread thereto, and causing them to travel down a second knitting wave and to draw stitch loops of the terry thread over higher sinker shoulders to produce longer sinker loops of the terry thread than those of the main thread, causing other consecutive needles in each course to travel down the main knitting wave only without taking the terry thread, and forming the heels and toes of the stocking by reciprocating work and narrowing and widening.

8. In a process of knitting a stocking having the inner surfaces of portions thereof provided with terry loops, knitting the leg by circular knitting, causing all of the needles of a circular knitting machine to travel down a main knitting wave, feeding a main knitting thread thereto, and drawing the stitches over main sinker shoulders, knitting other tubular portions of the stocking by raising a plurality of consecutive needles in each course before they cast off the stitches of the preceding course, feeding a terry

thread thereto, and causing them to travel down a second knitting wave and to draw stitch loops of the terry thread over higher sinker shoulders to produce longer sinker loops of terry thread than those of the main thread, causing other consecutive needles in each course to travel down the main knitting wave only without taking the terry thread, and forming the heels and toes of the stocking by reciprocating work and narrowing and widening on said terry loop forming needles, and causing said needles to travel down said main and secondary knitting waves before casting off and feeding both the main and terry threads thereto, and drawing said longer sinker loops of the terry thread in both directions of travel of said needles during reciprocating work.

9. In a process of knitting a stocking having the inner surfaces of portions thereof provided with terry loops, knitting the leg by circular knitting, causing all of the needles of a circular knitting machine to travel down a main knitting wave, feeding a main knitting thread thereto, and drawing the stitches over main sinker shoulders, knitting other tubular portions of the stocking by raising a plurality of consecutive needles in each course before they cast off the stitches of the preceding course, feeding a terry thread thereto, and causing them to travel down a second knitting wave and to draw stitch loops of the terry thread over higher sinker shoulders to produce longer sinker loops of terry thread than those of the main thread, causing other consecutive needles in each course to travel down the main knitting wave only without taking the terry thread, and adjacent to the toe of the sock causing all of the circular series of needles to travel down said main and secondary knitting waves before casting off and feeding the main and terry threads to each needle in each course, in conjunction with said main and second knitting waves respectively, and drawing said longer sinker loops of terry thread to form a toe band, and knitting the heels and toes by reciprocating work and narrowing and widening, on said terry forming needles, and causing said needles to travel down said main and secondary knitting waves before casting off, and feeding both the main and terry threads thereto, and drawing said longer sinker loops of the terry thread in both directions of travel of said needles during reciprocating work.

10. The process of knitting a stocking having portions of its inner surface provided with terry loops, by means of a knitting machine having opposed coaxial cylinders and needles provided with hooks at opposite ends, which consists in assembling portions of the needles in the upper cylinder and the remaining needles in the lower cylinder, and knitting a rib leg portion with a main knitting thread, transferring from the upper cylinder the needles held therein constituting part of the section of needles which knit the back of the leg and sole of the foot to the lower cylinder, raising the needles of said section before they cast off the stitches of the preceding course in traveling down the main knitting wave, and feeding to said needles only a terry thread, and causing them to travel down a secondary knitting wave, said section of needles drawing the stitch loops of main knitting thread over normal sinker shoulders and the stitch loops of the terry thread over sinker shoulders located at a higher level than the main sinker shoulders to provide longer sinker loops of the terry thread, and forming the sole of the stocking, the remaining needles of the circular

series located in the upper and lower cylinders continuing the knitting of rib fabric in each course, and knitting the heels and toes by reciprocating work and narrowing and widening on the needles of said section of needles.

11. The process of knitting a sock having portions of its inner surface provided with terry loops, by means of a knitting machine having opposed coaxial cylinders and needles provided with hooks at opposite ends, which consists in assembling portions of the needles in the upper cylinder and the remaining needles in the lower cylinder and knitting a rib leg portion with a main knitting thread, transferring from the upper cylinder the needles held therein constituting part of the section of needles which knit the back of the leg and sole of the foot to the lower cylinder, raising the needles of said section before they cast off the stitches of the preceding course in traveling down the main knitting wave, and feeding to said needles only, a terry thread, and causing them to travel down a secondary knitting wave, said section of needles drawing the stitch loops of main thread over normal sinker shoulders, and the stitch loops of the terry thread over sinker shoulders located at a higher level than the main sinker shoulders, to provide longer sinker loops of the terry thread, and forming the high splice and sole of the stocking, the remaining needles of the circular series located in the upper and lower cylinders continuing the knitting of rib fabric in each course, and knitting the heels and toes by reciprocating work and narrowing and widening.

12. The process of knitting a stocking having portions of its inner surface provided with terry loops, by means of a knitting machine having opposed coaxial cylinders and needles provided with hooks at opposite ends, which consists in assembling portions of the needles in the upper cylinder and the remaining needles in the lower cylinder, and knitting a rib leg portion with a main knitting thread, transferring from the upper cylinder the needles held therein constituting part of the section of needles which knit the back of the leg and sole of the foot to the lower cylinder, raising the needles of said section before they cast off the stitches of the preceding course in traveling down the main knitting wave, and feeding to said needles only, a terry thread, and causing them to travel down a secondary knitting wave, said section of needles drawing the stitch loops of main knitting thread over normal sinker shoulders and the stitch loops of the terry thread over sinker shoulders located at a higher level than the main sinker shoulders to provide longer sinker loops of the terry thread, and forming the sole of the stocking, the remaining needles of the circular series located in the upper and lower cylinders continuing the knitting of rib fabric in each course, and knitting the heels and toes by reciprocating work and narrowing and widening on the needles of said previously mentioned section of needles, and feeding the terry thread thereto in like manner in both directions of travel of said needles in their reciprocations, to produce terry loops in each course of the heel and toe.

13. The process of knitting a stocking having portions of its inner surface provided with terry loops, by means of a knitting machine having opposed coaxial cylinders and needles provided with hooks at opposite ends, which consists in assembling portions of the needles in the upper cylinder and the remaining needles in the lower cylinder, and knitting a rib leg portion with a

main knitting thread, transferring from the upper cylinder the needles held therein constituting part of the section of needles which knit the back of the leg and sole of the foot to the lower cylinder, raising the needles of said section before they cast off the stitches of the preceding course in traveling down the main knitting wave, and feeding to said needles only, a terry thread, and causing them to travel down a secondary knitting wave, said section of needles drawing the stitch loops of main knitting thread over normal sinker shoulders and the stitch loops of the terry thread over sinker shoulders located at a higher level than the main sinker shoulders to provide longer sinker loops of the terry thread, and forming the sole of the stocking to a point adjacent to the toe joining, the remaining needles of the circular series located in the upper and lower cylinders continuing the knitting of rib fabric in each course, transferring the remaining needles in the upper cylinder to the lower cylinder and knitting a plurality of complete courses on all the needles by raising them before they cast off the stitches of the preceding course, feeding a terry thread thereto, and causing them to travel down the said secondary knitting wave and produce the longer terry sinker loops in like manner as in the sole portion, and knitting the heel and toe pockets on needles of said first mentioned section by reciprocating work and narrowing and widening, and feeding the terry thread thereto in like manner in both directions of travel of said needles in their reciprocations to produce terry stitches in each course of the heel and toe, having the said longer sinker loops.

14. In a knitting machine, the combination with a series of independently operable needles, of a drawdown cam for normally producing a main knitting wave, without casting off the stitches of the preceding course, a secondary drawdown cam for producing a secondary knitting wave and casting off the stitches of the preceding course, an elevating cam between said main and secondary drawdown cams, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary wave, to form courses of double stitches containing both threads, and a switch cam adjacent to the termination of the main knitting wave to operate selected needles and carry them downward to cast off the stitches of a preceding course, without taking the secondary thread.

15. In a knitting machine the combination with a series of independently operable needles, of knitting cam mechanism for producing successively main and secondary knitting waves before casting off the stitches of a preceding course, means for feeding a main knitting thread to a plurality of the needles in connection with the main knitting wave, means for feeding a second thread to the said needles in connection with the secondary knitting wave, and sinkers having shoulders at different levels over which the main and secondary threads respectively are drawn, to form courses of double stitches, the sinker loops of which are of different size, and a switch cam adjacent to the main knitting wave and movable into and out of operative position to operate selected needles and cause them to cast off the stitches of the preceding course without taking the second thread.

16. In a knitting machine, the combination with a circular series of independently operable needles, certain of which have associated therewith long

knitting butts and others have associated therewith short knitting butts, cam mechanism for producing successively main and secondary knitting waves before casting off the stitches of a preceding course, and an elevating cam interposed between said main and secondary knitting waves, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, a switch cam normally out of operative relation with the needles, located adjacent to the termination of the main knitting wave, and capable of movement into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread.

17. In a knitting machine, the combination with a circular series of independently operable needles, certain of which have associated therewith long knitting butts and others have associated therewith short knitting butts, cam mechanism for producing successively main and secondary knitting waves before casting off the stitches of a preceding course, and an elevating cam interposed between said main and secondary knitting waves, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, a switch cam normally out of operative relation with the needles, located adjacent to the termination of the main knitting wave, and capable of movement into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread, and also movable into position to engage both the long butts and short butts and cause all of the needles to cast off the stitches of the preceding course without taking the second thread.

18. In a knitting machine, the combination with a circular series of independently operable needles, certain of which have associated therewith long knitting butts and others have associated therewith short knitting butts, cam mechanism for producing successively main and secondary knitting waves before casting off the stitches of a preceding course, and an elevating cam interposed between said main and secondary knitting waves, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, sinkers having shoulders of different levels over which the main and secondary threads respectively are drawn to form double stitches, the sinker loops of which are of different sizes, and a switch cam normally out of operative position located adjacent to the termination of the main knitting wave and movable into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread.

19. In a knitting machine, the combination with a circular series of independently operable needles, certain of which have associated therewith long knitting butts and others have associated therewith short knitting butts, cam mechanism for producing successively main and secondary knitting waves before casting off the stitches of a preceding course, and an elevating cam interposed between said main and secondary knitting waves, means for feeding a main knitting thread in connection with the main knitting wave, means

for feeding a second thread in connection with the secondary knitting wave, sinkers having shoulders of different levels over which the main and secondary threads respectively are drawn to form double stitches, the sinker loops of which are of different sizes, and a switch cam normally out of operative position located adjacent to the termination of the main knitting wave and movable into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread, and movable also into position to engage the long and short butts and cause all of the needles to cast off the stitches of the preceding course without taking the second thread.

20. In a knitting machine, the combination with a series of independently operable needles having associated therewith long and short knitting butts, main knitting cam mechanism provided with drawdown grades for drawing down the needles in both circular and reciprocating work without casting off the stitches of the previous course, an elevating cam on each side of the main knitting cam for raising the needles, and a secondary drawdown cam adjacent to each of said elevating cams for drawing down the needles to cast off the stitches of the preceding course, means for feeding a main knitting thread thereto adjacent to the main knitting cam, means for feeding a second thread to the needles adjacent to each secondary drawdown cam, and sinkers provided with shoulders at different heights to receive respectively the main and secondary threads to produce longer sinker stitches of the second knitting thread.

21. In a knitting machine, the combination with a series of independently operable needles having associated therewith long and short knitting butts, main knitting cam mechanism provided with drawdown grades for drawing down the needles in both circular and reciprocating work without casting off the stitches of the previous course, an elevating cam on each side of the main knitting cam for raising the needles, and a secondary drawdown cam adjacent to each of said elevating cams for drawing down the needles to cast off the stitches of the preceding course, means for feeding a main knitting thread adjacent to the main knitting cam, a separate thread feed finger for feeding a second thread adjacent to each of said secondary drawdown cams, said thread feed fingers being normally out of operative position, and means for shifting one or other of said thread feed fingers into operative position, and sinkers provided with shoulders at different heights to receive respectively the main and secondary threads to produce longer sinker stitches of the second knitting thread.

22. In a knitting machine, the combination with a series of independently operable needles having associated therewith long and short knitting butts, main knitting cam mechanism provided with drawdown grades for drawing down the needles in both circular and reciprocating work without casting off the stitches of the previous course, an elevating cam on each side of the main knitting cam for raising the needles, and a secondary drawdown cam adjacent to each of said elevating cams for drawing down the needles to cast off the stitches of the preceding course, means for feeding a main knitting thread thereto adjacent to the main knitting cam, means for feeding a second thread to the needles adjacent to each secondary drawdown cam, and sinkers

provided with shoulders at different heights to receive respectively the main and secondary threads to produce longer sinker stitches of the second knitting thread, and a switch cam normally out of operative relation with the needles located adjacent to the termination of the main drawdown cam operative during circular work, and capable of movement into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread.

23. In a knitting machine, the combination with a series of independently operable needles having associated therewith long and short knitting butts, main knitting cam mechanism provided with drawdown grades for drawing down the needles in both circular and reciprocating work without casting off the stitches of the previous course, an elevating cam on each side of the main knitting cam for raising the needles, and a secondary drawdown cam adjacent to each of said elevating cams for drawing down the needles to cast off the stitches of the preceding course, means for feeding a main knitting thread thereto adjacent to the main knitting cam, means for feeding a second thread to the needles adjacent to each secondary drawdown cam, and sinkers provided with shoulders at different heights to receive respectively the main and secondary threads to produce longer sinker stitches of the second knitting thread, and a switch cam normally out of operative relation with the needles located adjacent to the termination of the main drawdown cam operative during circular work, and capable of movement into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread, and movable into position to engage all of the said butts to cause all of the needles to cast off the stitches of the preceding course without taking the second thread.

24. In a knitting machine, the combination with a series of independently operable needles having associated therewith long and short knitting butts, main knitting cam mechanism provided with drawdown grades for drawing down the needles in both circular and reciprocating work without casting off the stitches of the previous course, an elevating cam on each side of the main knitting cam for raising the needles, and a secondary drawdown cam adjacent to each of said elevating cams for drawing down the needles to cast off the stitches of the preceding course, means for feeding a main knitting thread thereto adjacent to the main knitting cam, means for feeding a second thread to the needles adjacent to each secondary drawdown cam, and sinkers provided with shoulders at different heights to receive respectively the main and secondary threads to produce longer sinker stitches of the second knitting thread, a switch cam normally out of operative relation with the needles located adjacent to the termination of the main knitting cam grades, and means for moving each of said switch cams into position to engage said long knitting butts and cause the needles associated therewith to cast off the stitches of the preceding course without taking the second thread.

25. In a knitting machine, the combination with a series of independently operable needles having associated therewith long and short knitting butts, of cam mechanism for producing a main knitting wave without casting off the stitches of

the preceding course, a secondary knitting wave for casting off the stitches of the preceding course, and an elevating cam between said main and secondary knitting waves, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a terry thread in connection with the secondary wave, sinkers provided with shoulders at different levels for determining the length of the main and terry sinker loops, a switch cam for engaging the long knitting butts adjacent to the termination of the main knitting wave for carrying the needles associated with said butts further downward to cast off the stitches of the preceding course without taking the terry thread, means operable during the portion of the movement of the cylinder when the short knitting butts are in operation for depressing said cam mechanism to produce a looser fabric at that portion thereof where terry loops are formed.

26. In a knitting machine, having superimposed coaxial cylinders and needles having a hook and latch at each end, the lower cylinder being provided with a drawdown cam for normally producing a main knitting wave without casting off the stitches of the preceding course, a secondary drawdown cam for producing a secondary knitting wave and casting off the stitches of the preceding course, an elevating cam between said main and secondary drawdown cams, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, sinkers provided with shoulders at different elevations for determining the size of the sinker loops of said main and second threads, and transfer mechanism for transferring the needles from one cylinder to the other.

27. In a knitting machine, having superimposed coaxial cylinders and needles having a hook and latch at each end, the lower cylinder being provided with a drawdown cam for normally producing a main knitting wave without casting off the stitches of the preceding course, a secondary drawdown cam for producing a secondary knitting wave and casting off the stitches of the preceding course, an elevating cam between said main and secondary drawdown cams, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, sinkers provided with shoulders at different elevations for determining the size of the sinker loops of said main and second threads, and transfer mechanism for transferring the needles from one cylinder to the other, and a switch cam located adjacent to the termination of the main knitting wave for causing selected needles to cast off the stitches of the preceding course without taking the second thread.

28. In a knitting machine having superimposed coaxial cylinders and needles having a hook and latch at each end, the lower cylinder being provided with a drawdown cam for normally producing a main knitting wave without casting off the stitches of the preceding course, a secondary drawdown cam for producing a secondary knitting wave and casting off the stitches of the preceding course, an elevating cam between said main and secondary drawdown cams, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, sinkers

provided with shoulders at different elevations for determining the size of the sinker loops of said main and second threads, and transfer mechanism for transferring the needles from one cylinder to the other, sliders in the lower cylinder provided with long and short knitting butts, a switch cam adjacent to the termination of the main knitting wave movable into position to engage the long butts of the sliders, to cause the needles connected therewith to cast off the stitches of the preceding course without taking the second thread.

29. In a knitting machine having superimposed coaxial cylinders and needles having a hook and latch at each end, the lower cylinder being provided with a drawdown cam for normally producing a main knitting wave without casting off the stitches of the preceding course, a secondary drawdown cam for producing a secondary knitting wave and casting off the stitches of the preceding course, an elevating cam between said main and secondary drawdown cams, means for feeding a main knitting thread in connection with the main knitting wave, means for feeding a second thread in connection with the secondary knitting wave, sinkers provided with shoulders at different elevations for determining the size of the sinker loops of said main and second threads, and transfer mechanism for transferring the needles from one cylinder to the other, sliders in the lower cylinder provided with long and short knitting butts, a switch cam adjacent to the termination of the main knitting wave movable into position to engage the long butts of the sliders, to cause the needles connected therewith to cast off the stitches of the preceding course without taking the second thread, and also movable into position to engage the butts of all the sliders to cause all the needles to cast the stitches of the preceding course without taking the second thread.

30. In a knitting machine having superimposed coaxial cylinders and needles provided with hooks at both ends, the combination with a main drawdown cam for the lower cylinder for producing a main knitting wave without casting off the stitches of the preceding course in both directions of movement of the cylinder, a secondary drawdown cam at each side of the main knitting cam for producing a secondary knitting wave and cast off the stitches of the preceding course in both directions of movement of the cylinder, and an elevating cam between the main cam and each secondary drawdown cam, means for feeding a main knitting thread in connection with the main knitting wave, and means for feeding a second thread in connection with the secondary knitting wave in each direction of movement of the cylinder, sinkers provided with shoulders at different elevations to determine the length of the sinker loops of the main and secondary threads, sliders in the lower cylinder provided with long and short knitting butts, a switch cam adjacent to the termination of the main knitting wave operative for circular work and normally out of operative position, means for moving the switch cam into position to engage the long butts of the sliders, and transfer mechanism for transferring the needles from one cylinder to the other.

31. In a knitting machine having superimposed coaxial cylinders and needles provided with hooks at both ends, the combination with a main drawdown cam for the lower cylinder, for producing a main knitting wave without casting off the

stitches of the preceding course in both directions of movement of the cylinder, a secondary draw-down cam at each side of the main knitting cam for producing a secondary knitting wave and cast
5 off the stitches of the preceding course in both directions of movement of the cylinder, and an elevating cam between the main cam and each secondary drawdown cam, means for feeding a
10 main knitting thread in connection with the main knitting wave, and means for feeding a second thread in connection with the secondary knitting wave in each direction of movement of the cylinder, sinkers provided with shoulders at different elevations to determine the length of the sinker

loops of the main and secondary threads, sliders in the lower cylinder provided with long and short knitting butts, a switch cam adjacent to the termination of the main knitting wave operative for circular work and normally out of
5 operative position, means for moving the switch cam into position to engage the long butts of the sliders, and a second switch cam for the main knitting wave when the cylinder is moved in reversed direction, and means for moving it into
10 position to engage the long butts of the sliders, and transfer mechanism for transferring the needles from one cylinder to the other.

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