

May 11, 1943.

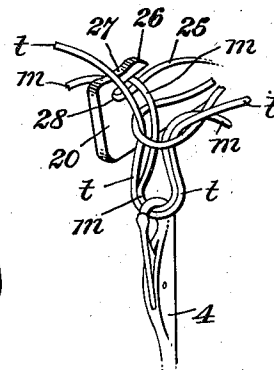
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2,318,643

ARTICLE OF HOSIERY INCLUDING TERRY FABRIC

Filed Jan. 17, 1942

4 Sheets-Sheet 1



May 11, 1943.

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ARTICLE OF HOSIERY INCLUDING TERRY FABRIC

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4 Sheets-Sheet 2

Fig. 2.

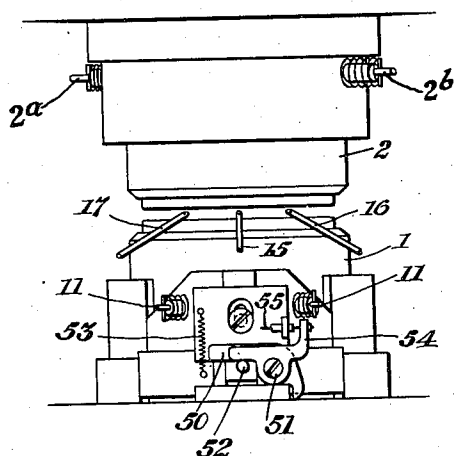


Fig. 4.

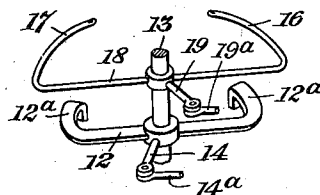
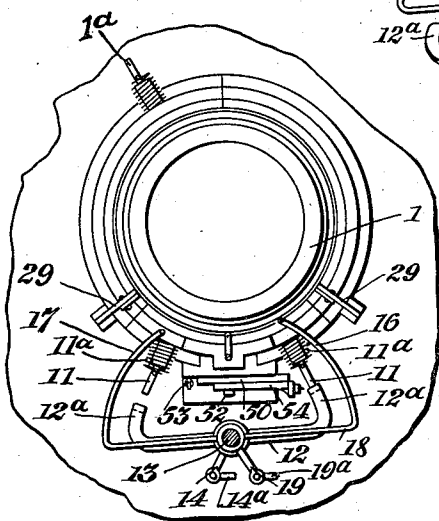


Fig. 3.



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4 Sheets-Sheet 3

Fig. 5.

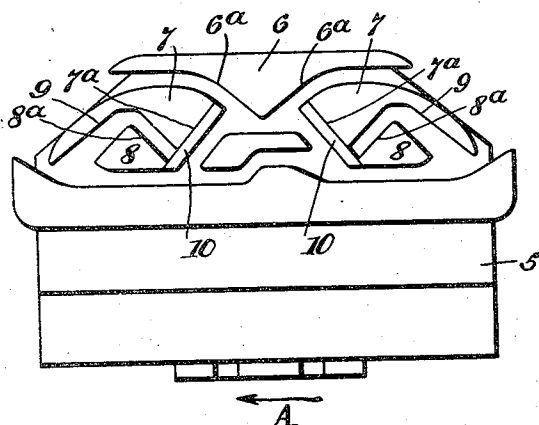


Fig. 8.

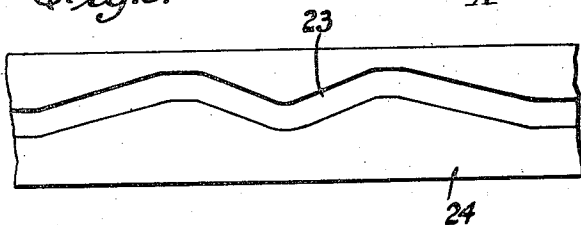


Fig. 9.

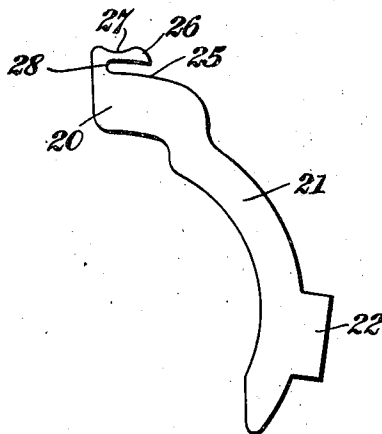
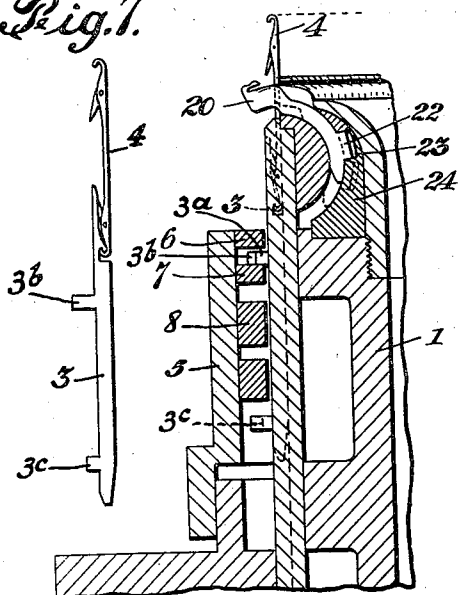


Fig. 6.

Fig. 7.



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4 Sheets-Sheet 4

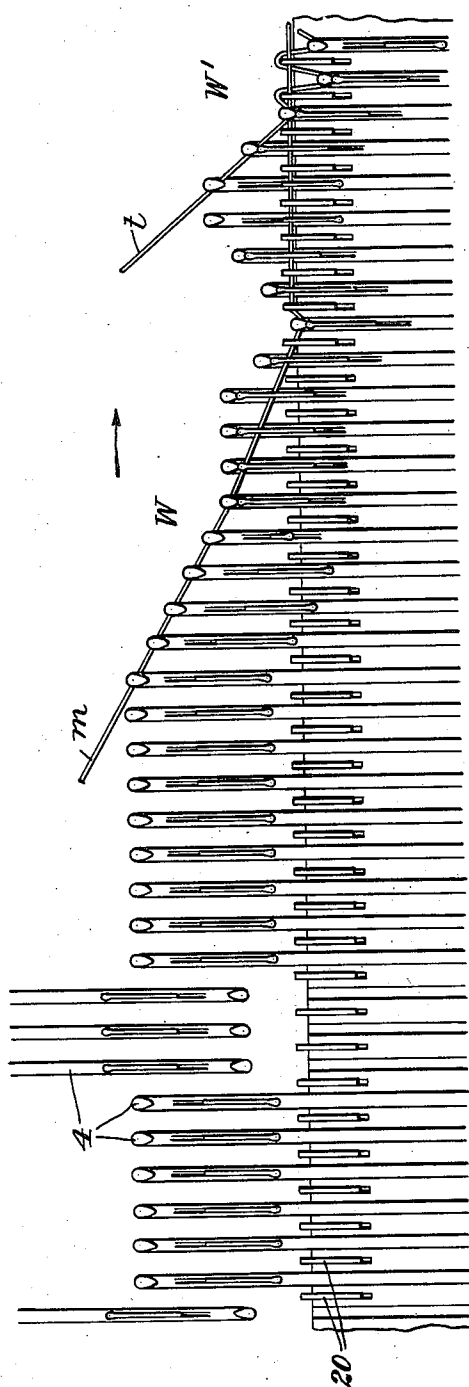


Fig. 10.

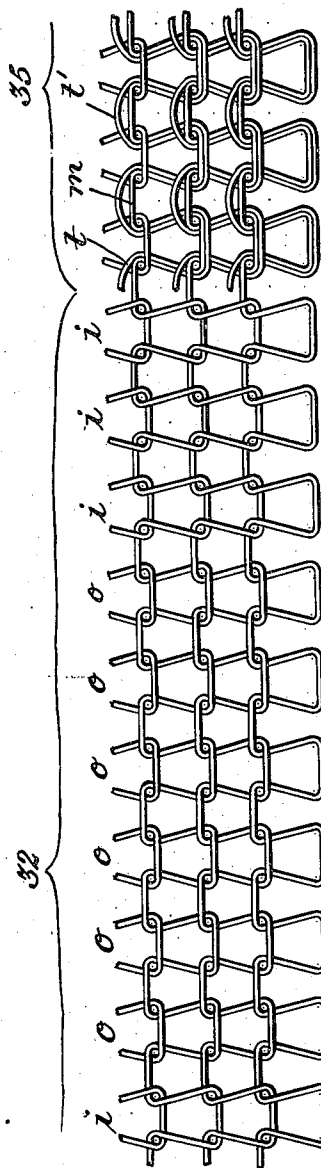


Fig. 11.

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2,318,643

ARTICLE OF HOSIERY, INCLUDING TERRY FABRIC

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Application January 17, 1942, Serial No. 427,124

7 Claims. (Cl. 66—178)

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 relates to the manufacture of hosiery having certain portions thereof formed of terry fabric. For example, the heel, sole and toe of a sock may be formed of terry fabric to provide greater softness and resilience. The terry portion is produced by feeding two threads to the needles of a knitting machine and drawing longer loops of one thread than the other so that the long loops hereinafter referred to as terry loops protrude on one surface of the fabric and provide a soft cushioning effect. For example, the machine may be provided with sinkers having shoulders at different levels, the main knitting thread being drawn over a lower shoulder, and the terry thread over a higher shoulder, whereby the sinker loops of the terry thread are longer than those of the main knitting thread and form the projecting loops of the terry fabric. The terry loops may or may not be combed or brushed so as to separate the exterior fibers and commingle them in a soft matted condition on the surface of the sock, anklet or stocking to provide the soft or cushioning effect desired.

It has heretofore been proposed to form plain knit, i. e., non-rib hose wholly or partly of terry fabric. However, the production of hosiery partly of terry fabric and partly of rib knit fabric presents a more difficult problem. Plain knit fabric has all its stitches facing in one direction, and can be produced on a single series of needles, arranged for example around a single cylinder, the upper end of which is available for the provision of mechanism for forming terry loops. However, to produce rib knit fabric by which is meant fabric composed of a combination of inwardly facing stitches and outwardly facing stitches arranged either in vertical rib or otherwise, it is necessary to provide two separate series of needles with one series arranged, for example, around a vertical cylinder, and the other series arranged on a dial or second cylinder positioned immediately above the first mentioned cylinder. In either event, the second series of needles for making the inwardly facing stitches occupies space that would otherwise be available for the terry mechanism. Moreover, if it is desired to provide the sock with a terry portion extending

only part of the length of the sock and only part way around its circumference, as for example, a sock having leg and instep portions formed of rib knit fabric and a sole portion of terry fabric, the needles that produce the terry fabric must at other times produce rib knit fabric and during the knitting of the terry portion the machine must produce both rib knitting and terry fabric. Thus, in order to produce a sock having rib knit leg and instep portions and a terry sole, it is necessary during the knitting of the foot to produce simultaneously both the terry fabric of the sole and the rib knit fabric of the instep, while during the knitting of the leg, all of the needles including those which produce the terry fabric of the sole must produce rib knit fabric. Hence the production of a sock formed partly of rib knitting and partly of terry fabric presents problems and obstacles not encountered in plain knitting.

An object of the present invention is to provide an article of hosiery having a portion formed of rib knit fabric and an integral portion formed of terry fabric. In the sock shown by way of example in the accompanying drawings, the leg portion and instep portion, i. e., the top of the foot, are formed of rib knitting, while the high splice, heel, sole and toe are provided with terry loops forming a cushion fabric.

Another object of the invention is to increase the softness of the terry portion of the fabric by forming it with longer stitch loops than the remaining fabric. The softness and body of the terry fabric are still further increased in accordance with the present invention by providing terry loops at consecutive wales of consecutive courses of the terry portion, the terry thread being thus united to the fabric at each wale of said courses. As rib knit socks are customarily worn when greater warmth or softness is desired, the soft, thick cushion sole obtained in accordance with the present invention represents an important advance in the art over the thinner, non-cushion soles with which rib knit socks have heretofore been provided.

In producing socks on a circular knitting machine, the heel and toe are knit by reciprocation of the needle cylinder, while the high splice and sole may be knit either by continuous rotation of the needle cylinder in one direction or by reciprocation as in split foot socks. It has been found difficult in reciprocating work as at the toes and heels to form terry loops during the reverse reciprocations of the needle cylinder of the knitting machine, and it has been customary

therefore to knit the terry loops only in the alternate courses of the heel and toe 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 fewer cushioning loops in the heels and toes where the greatest wear comes and where such cushioning is particularly needed. It is an object of my invention to provide terry loops in consecutive courses throughout terry portions produced by reciprocating knitting such as the heel and toe as well as in other terry portions.

Hosiery formed wholly or in part of terry fabric has heretofore been made 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 cushioning effect at the parts of the sock or stocking desired, and at the same time to knit the fabric of higher class and finer yarn so as to produce hosiery which may be worn for normal purposes where a soft surface or 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 the main knitting thread and the terry thread, i. e., the thread that is to form the terry loops at the same feeding station and to provide the sinkers with portions adapted to pass between the two threads so that the main knitting thread is drawn over a shoulder at a lower level to form the stitch loops and the terry thread is drawn over a shoulder at a higher level to form the longer terry loops. It will be obvious that the movement of this dividing portion of the sinker between the two threads fed at the same points requires rapid radial movement of the sinker and that the slightest variation in the relative position of the threads with respect to the sinkers due to slight variation in tension, vibration of the thread or otherwise will result in the failure of a sinker to properly engage and support the separate threads, thereby producing defective 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 difficulty would be aggravated in knitting with finer threads and with larger numbers of needles and finer needles. The production of this type of hosiery has therefore been practically limited to the more or less coarse fabric used mainly for athletic purposes.

In accordance with my invention, it is possible to produce terry fabric hosiery of higher class yarns on finer gauge machines. This is accomplished by feeding the main knitting thread and the terry thread at two different feeding stations. The main knitting thread fed at the first feeding station is drawn down onto the lower shoulder of the sinkers and held by the sinkers without casting off the previously drawn stitches, while the needles are raised at the second feeding station to receive the terry thread. The needles are then drawn down a second knitting wave, sufficiently to cast off the preceding loop or loops while 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, 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. The separation of the two feeds allows ample time

for the radial movement of the sinkers to position the higher shoulder to receive the terry thread after the main thread has been drawn down to the lower shoulder of the sinkers. This results in an easier operation of the sinker actuating cam and insures the efficient and accurate operation of the sinkers in producing the fabric stitches and the terry loops even with the use of finer grades of thread both as to quality and diameter and the use of finer and more numerous needles in the knitting machine.

According to my present invention therefore, I am able to produce the terry effect in the high splice above the heel in every course of the heel and toe throughout the sole of the stocking, and throughout a circular portion at the end of the foot of the stocking adjacent the toe which is ordinarily termed the toe band. I am also able to form the leg and instep portions of the stocking of rib knitting and of relatively fine thread. A further advantage of the embodiment of my invention shown in the drawings is that the instep portion of the stocking is knit of the main knitting thread alone, the terry thread being cut and bound in each course, thereby conserving the amount of terry thread required and making the stockings more economical to produce.

The nature and advantages of my invention and the manner in which it may be carried out will appear more fully from the following of an embodiment shown by way of example in the accompanying drawings in which—

Fig. 1 is a side elevation of a sock in accordance with my invention, portions of the foot being broken away to show the terry loops on the inner face portions thereof.

Fig. 2 is a side elevation of portions of a knitting machine having superposed coaxial needle cylinders constructed and arranged for carrying out my invention, portions of the apparatus being removed and the thread feed fingers being broken away.

Fig. 3 is a top plan view of the lower cylinder of the machine illustrated in Fig. 2 showing the means for operating the switch cam and terry thread feed fingers.

Fig. 4 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. 7 is a detailed view of one of the needles and the slider therefor located in the lower cylinder.

Fig. 8 is a detailed view showing the partial development of the sinker operating cam shown in Fig. 6.

Fig. 9 is an enlarged detailed view of one of the sinkers.

Fig. 10 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. 11 is a diagrammatic perspective view of the needle circle illustrating the arrangement of the needles for producing the high splice and sole.

Fig. 12 is a detailed 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. 13 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. 14 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 higher auxiliary shoulder adjacent the needle.

Fig. 15 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. 16 is a perspective view of the parts illustrated in Fig. 15.

Fig. 17 is a diagrammatic view of a section of fabric showing the stitch structure of the rib knit instep and the integral terry fabric sole portion.

In accordance with my invention there is provided an article of hosiery formed in part of rib knit fabric and in part of terry fabric, the terry section extending only part way around the circumference of a tubular seamless portion of the article so that certain courses are each formed partly of terry and partly of rib knitting. In Fig. 1 there is shown by way of example a men's sock embodying the invention. 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, 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 formed of plain knit fabric with or without the insertion of an elastic thread, or the top may be knit at 1 x 1, 2 x 2 or other rib with or without an elastic thread as desired. The leg portion 31 and the instep portion 32 are formed of rib knit fabric. The stitch structure of a portion of the instep 32 and the adjacent portion of the integral sole 35 is illustrated in Fig. 17. It will be seen that the instep portion shown at the left hand side of the figure is composed of a combination of inwardly facing stitches *i*, and outwardly facing stitches *o*. While the fabric is shown as having vertical ribs composed of groups of six outwardly facing stitches alternating with three inwardly facing stitches, it will be understood that the leg and instep may be formed of any desired combination of inwardly facing stitches and outwardly facing stitches. The sole portion 35 knit integrally and simultaneously with the instep is formed of terry fabric. As shown at the right hand end of Fig. 17, the sole portions is composed of a main knitting thread *m*, knit to form the base of the fabric, and a terry thread *t*, knit in plating relation with the main thread *m*, but having longer sinker loops forming terry loops *t'* on the inner face of the fabric. It will be seen that the terry loops *t'* occur at consecutive wales in consecutive courses throughout the terry portion and that the terry thread is securely united to the fabric so that it will not pull out. In the example illustrated in the drawings, the terry portion is shown as being plain knit fabric, i. e., all of the stitches are drawn in the same direction as distinguished from rib knit fabric in which certain stitches face outwardly and other stitches face inwardly. However, the terry fabric differs from ordinary

plain knit fabric by the provision of the terry loops *t'* which gives the fabric both a distinctive appearance and soft cushion-like characteristics.

The high splice 33, heel 34, toe band 36 and toe 37, are likewise formed of terry fabric. The high splice is formed by circular knitting in the same manner as the sole, the terry fabric extending only part way around the tubular seamless fabric section and the front portion of the section being formed of rib knitting. The heel and toe are formed by reciprocatory knitting, one course of the fabric being knit with the needle cylinder rotating in one direction and the succeeding course being knit in the opposite direction. As hereinbefore described, the terry thread *t*, as well as the main knitting thread *m*, is fed during both directions of rotation so that in the heel and toe, as in the high splice and sole, the terry loops *t'* are formed in consecutive wales of consecutive courses, providing a thick, uniform terry fabric. In the integral toe band 36, the terry fabric extends completely around the tubular section. Thus the wales extending down the top of the foot are formed of rib knitting for part of their length and of terry fabric the remainder of their length.

In carrying my invention into effect, 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 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 plain 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 carried into effect by a Komet machine, in connection with certain additions thereto and changes therein, which are described and claimed in my Letters Patent No. 2,231,399.

Referring to Fig. 2, 1 represents the lower cylinder of a Komet machine, modified as hereinafter 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 Figs. 6 and 7 and with a circular series of needles 4, in this instance having hooks and latches at each end in the manner usual 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 hereinafter 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. 7, 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 7.

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 as desired. In Fig. 2, the operating plungers for the transfer cams of the upper cylinder are indicated at 2a, 2b, and in Fig. 3 the plunger operatively connected with the transfer cam of the lower cylinder is indicated at 1a. The operation of these cams is as usual in the Komet machine.

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 draw down cam 6, having the draw-down cam grades 6a, disposed oppositely for reciprocating work, and cooperating with the additional draw down cams 7, having draw-down cam grades 7a, 7b, cooperating with the grades 6a, 6b, 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 draw down 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 draw down cam grades 9 will each produce a secondary knitting wave. The lowest point of the additional draw-down cams 7 will draw the needles down to a point (see Fig. 13) 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 draw down 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. 15).

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 draw down 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, 12b, 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 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 draw down 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 movably sinkers 20, which in the Komet machine are formed, as best shown in Figs. 6 and 9. 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. 8 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. 10 to 17. 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 preceding course 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. 10, the sinkers being in their outermost positions, all as indicated in Fig. 12. All of the needles will be drawn down by one of the main draw down cam grades 8a, 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 8a, 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 of 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. 13, 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. 12 and 13, and thereby bring the projections 26 of the adjacent sinkers over the main thread, as shown in Fig. 14.

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 draw down cam 9, following down the secondary knitting wave, indicated at *W'* in Fig. 10. 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. 15, 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. 15 and 17.

To produce a stocking such as that shown in Fig. 1, the method of knitting will preferably be

carried out substantially as follows. 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, 2 x 2 or other rib, 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. Upon completion of the top portion, the needles will be transferred as required to produce the rib knit leg portion 31. Thus, for a 6 x 3 leg, groups of three needles in the upper cylinder will alternate with groups of six needles in the lower cylinder. The switch cam 10 on the left side of the main draw down 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. The short butt needles which, during the knitting of the leg have produced rib knit fabric, will now produce terry fabric. The arrangement of the needles for producing the high splice and the corresponding portion of the instep is shown diagrammatically in Fig. 11 wherein it will be seen that the needles on one side of the needle cylinder, i. e., the short butt needles are all positioned in the lower cylinder to produce the terry fabric of the high splice while the needles on the other side of the needle cylinder are arranged with selected needles in the upper cylinder and the remaining needles in the lower cylinder to produce the rib knitting of the instep. This needle arrangement is also illustrated in Fig. 10 wherein the needles producing terry fabric are represented at the right hand side of the figure while needles producing rib fabric appear at the left. Thus, during the knitting of the high splice the machine produces both the terry fabric of the high splice and the rib knit fabric of the instep. To accomplish this, 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. 3. As the knitting proceeds, the long butt needles, part of which are in the upper cyl-

inder, will take only the main knitting thread and will continue the knitting of 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 at the same time, the front of the corresponding portion of the leg will be knit as rib knitting.

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 plu-

rality 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.

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 desirable 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 a shifting of 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 may 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 instance the combing of the terry sinker loops may be omitted if found desirable.

It will be understood that the cam block shown in Figs. 2, 3 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. 2 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. 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 mecha-

nism (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, anklet or stocking. In fact, it is desirable that such portions of the sock, anklet 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, anklet or stocking.

It will be understood that where reference is made in the preceding specification 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 by which my present invention is carried out.

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 knit-

ting, 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. An article of hosiery comprising leg and instep portions formed of inwardly facing stitches and outwardly facing stitches and an integral sole portion comprising thread knit to form the base of the fabric and additional thread forming terry loops providing a soft cushioning surface for said sole portion.

2. An article of hosiery comprising leg and instep portions formed of rib knit fabric and an integral sole portion formed of plain knit terry fabric.

3. An article of hosiery comprising thread knit to form rib knit leg and instep portions and an integral plain knit sole portion and additional thread knit in plating relation with the thread of said sole portion and forming terry loops.

4. An article of hosiery comprising leg and instep portions formed of rib knit fabric and heel, sole and toe portions formed of terry fabric with terry loops in consecutive courses throughout said terry portion.

5. An article of hosiery comprising leg and instep portions formed of rib knit fabric and integral heel, toe and sole portions formed of terry fabric having terry loops formed by thread knit at consecutive wales in consecutive courses throughout said terry portion.

6. An article of hosiery comprising leg and instep portions of rib knit fabric and an integral sole portion of terry fabric having larger stitch loops than the fabric of the leg and instep portion.

7. An article of hosiery having a tubular seamless portion formed of terry fabric throughout part of its circumference and of rib knit fabric throughout another part of its circumference.

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