

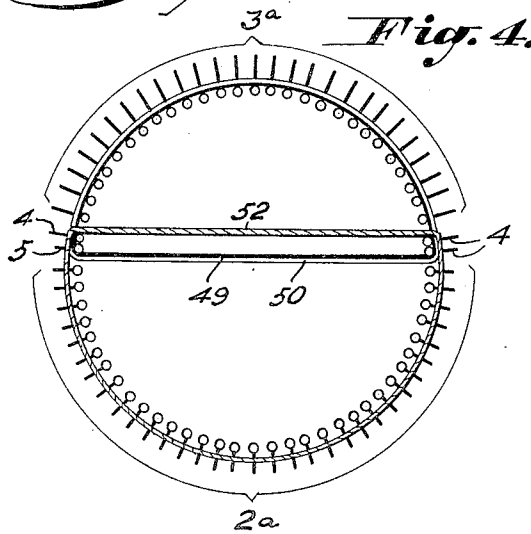
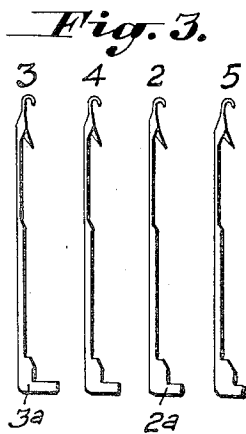
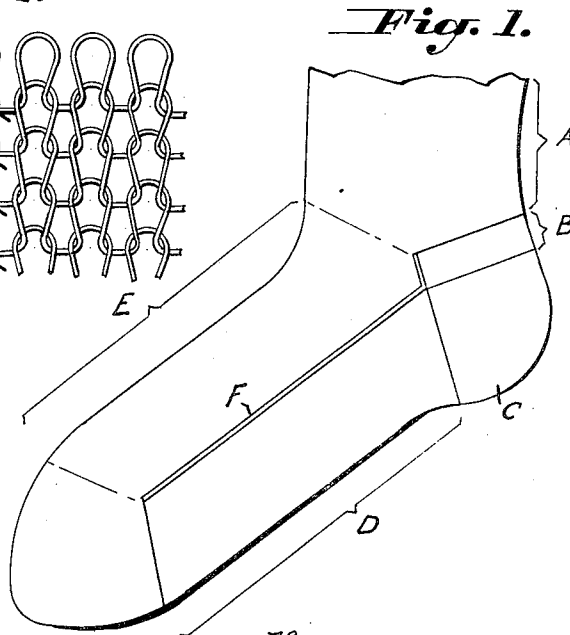
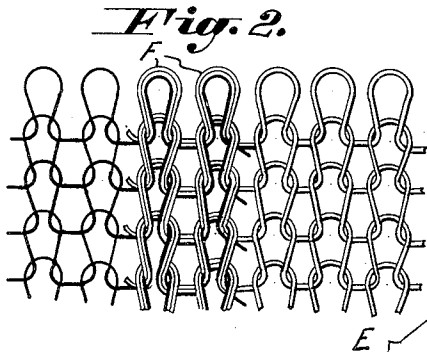
Feb. 27, 1951

J. JAVOREK ET AL
CIRCULAR KNITTING MACHINE

2,543,172

Filed Jan. 21, 1947

5 Sheets-Sheet 1



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Feb. 27, 1951

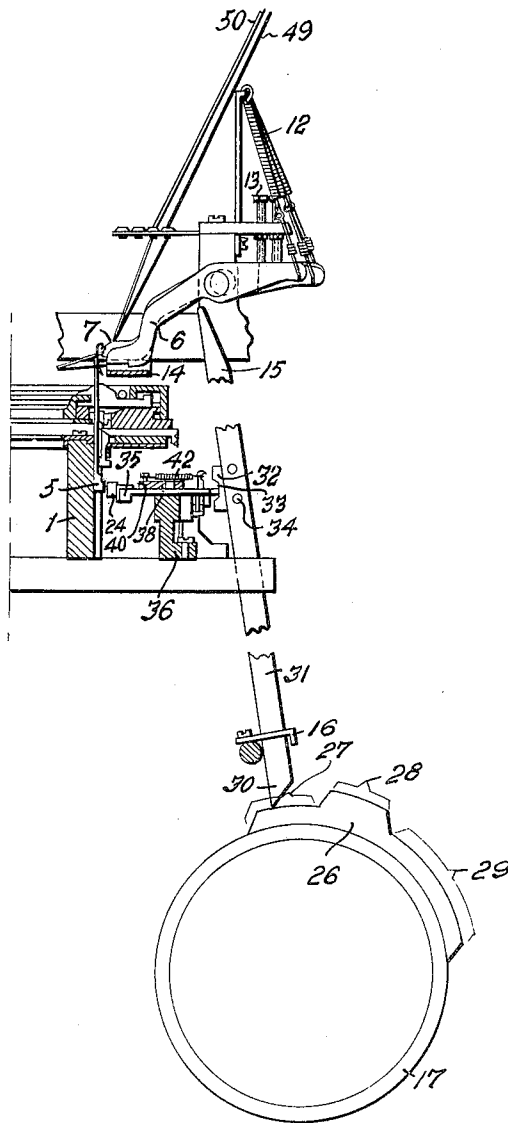
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Fig. 5.



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Fig. 6.

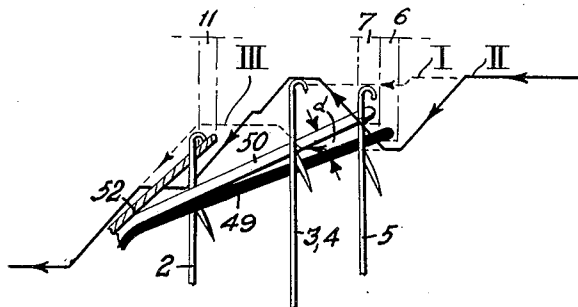


Fig. 7.

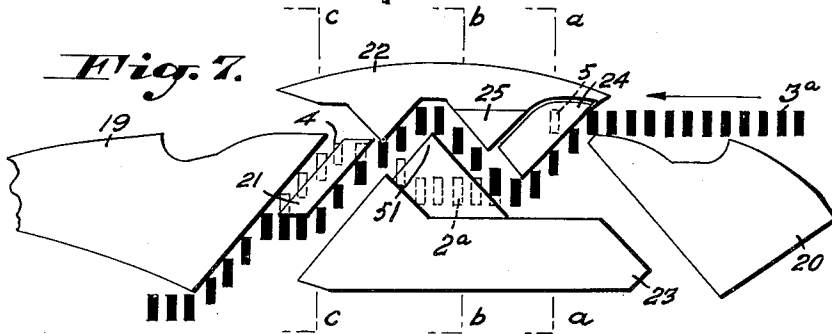
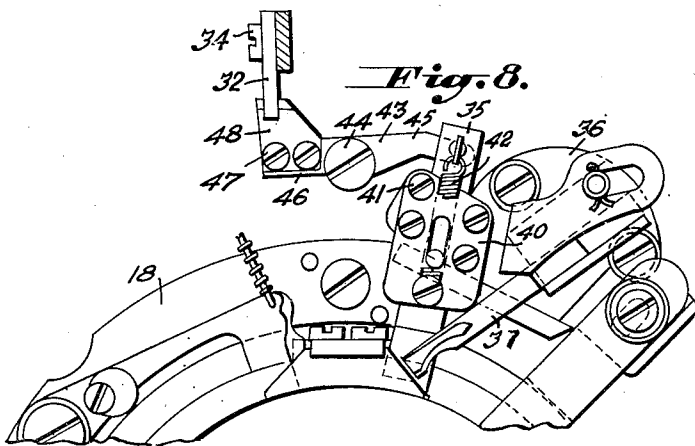


Fig. 8.



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Fig. 9.

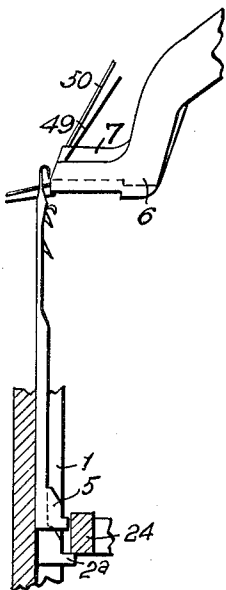


Fig. 10.

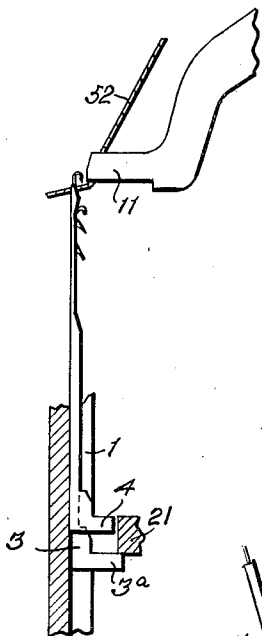


Fig. 11.

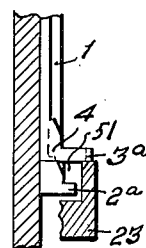


Fig. 13.

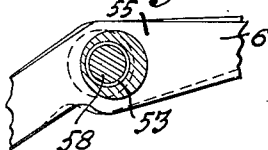


Fig. 14.

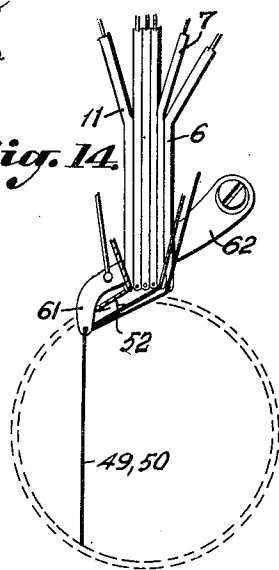
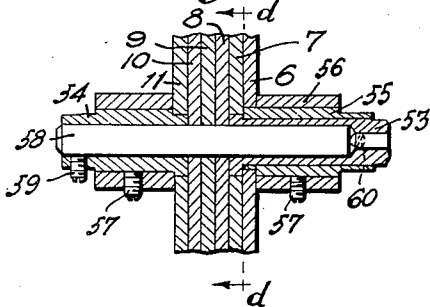


Fig. 12.



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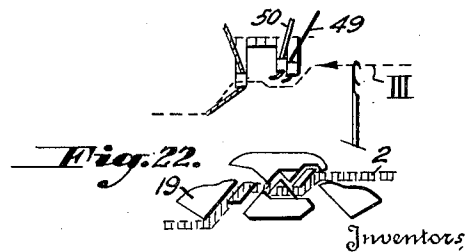
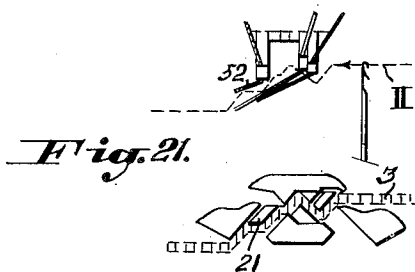
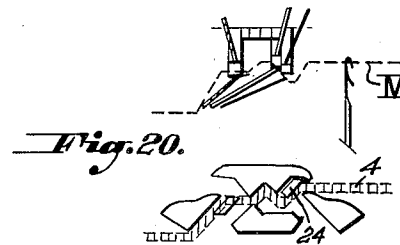
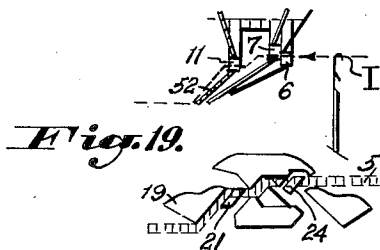
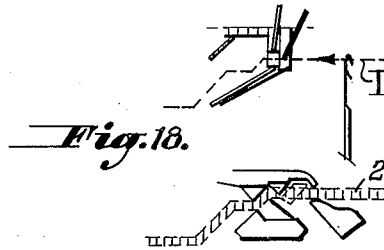
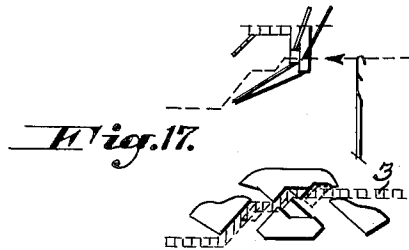
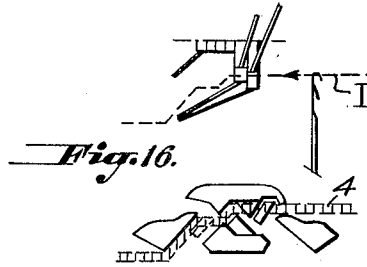
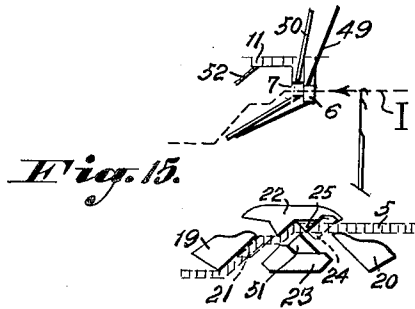
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5 Sheets-Sheet 5



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UNITED STATES PATENT OFFICE

2,543,172

CIRCULAR KNITTING MACHINE

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Application January 21, 1947, Serial No. 723,438
In Germany August 7, 1942

Section 1, Public Law 690, August 8, 1946
Patent expires August 7, 1962

3 Claims. (Cl. 66—8)

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This invention relates to circular knitting machines and has for its object to simplify the means hitherto used in an operative system in circular knitting for the manufacture of split-worked hosiery and so to improve them that the split-worked hosiery has a better appearance.

The means hitherto employed, in which at each course of the circulating needles it was the object to obtain always at the same place a change between two or more thread guides, consisted of thrust cams which were fixed on an auxiliary pattern drum revolving synchronously with the needle cylinder and driven by the main shaft. This arrangement, however, necessitated the interposition of a transmission device in the form of levers or connecting bars between the auxiliary pattern drum and the thread guide. Through the action of the thrust cams on the transmission device it was intended, that the putting into and out of operation of the thread guides operative during the split work should take place exactly at the same needles.

Experience showed, however, that at high machine speeds there was with such an arrangement still not sufficient certainty, that the threads would always enter or leave the fabric at exactly the same needle, resulting in an untidy transition between the split worked lower part and the normal or plaited upper part. This was to be accounted for by the more or less accurate position of the rapidly revolving thrust cams fixed on the auxiliary pattern drum, which tends to loosen during operation and the periphery of which has to be described by the transmission device pressed against them by spring tension, which was, however, rendered uncertain through the spring tension gradually changing. A further cause of trouble was the gradual wearing away of the ascending and descending surfaces of the thrust cams. The continuously moving thread guides and threads caused the untidiness of the plaited and reverse plaited hosiery.

The invention does away with the aforesaid disadvantages; it makes possible a greatly simplified construction of the machine and scrupulously neat lines of loops in the split or joining seam.

The present invention consists substantially in this, that on the cam frame additional cam members are provided, by means of which the

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knitting needles, the butts of which are of different length, are moved into or out of the range of the stationary thread guides.

This eliminates what has hitherto been necessary at each half circuit, when knitting split-worked parts of a stocking, namely the alternate engagement and disengagement of rockable thread guides and the hitherto used, rotary auxiliary pattern drum with its drive and the transmission device.

Further characteristic features of the present invention will be gathered from the following description and drawings of a constructional example, in which the application of the invention to a reverse plaiting circular knitting machine of a known kind is illustrated.

In the accompanying drawings:

Figure 1 is a side view of the lower part of a stocking with a split-worked sole D and the upper part B of the heel,

Figure 2 a partial view of the loops of a split-worked part to an enlarged scale,

Figure 3 a view of the latch needles used,

Figure 4 the arrangement of the needle butts in the ring of needles and a diagrammatic representation of the guiding of various threads,

Figure 5 a vertical section through the needle cylinder and the pattern drum,

Figure 6 a diagrammatic representation of the motion of the needle hooks with respect to the thread guides,

Figure 7 a development of the cam members,

Figure 8 a view from above on to the cylinder cam frame shell,

Figure 9 a section along line *a—*a** of Figure 7,

Figure 10 a section along line *c—*c** of Figure 7,

Figure 11 a section along line *b—*b** of Figure 7,

Figure 12 a section through the eccentric supporting means of the thread guides,

Figure 13 a section along line *d—*d** of Figure 12,

Figure 14 an arrangement of the presser of the usual construction,

Figures 15–18 the paths followed by the needles during normal knitting without split-work and

Figures 19–22 the paths followed by the needles during the split-work.

In Figures 15–22 there are indicated by two parallel dotted lines the paths of the needle butts

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and by a single dotted line the paths of the needle hooks.

The circular knitting machine of a kind known per se, with reference to which the invention shall now be explained, is provided with a revolving needle cylinder 1 with normal needles 2, 3, 4, 5 (Figure 3), of which about half of all the needles disposed around the periphery have short butts 2a and the other half long butts 3a (Figure 4). At one end of the set 3a of long-butted needles are two needles 4 with butts of medium length and at the other end one needle 5 with a quite short butt. The arrangement may, however, also be such that only one needle 5 with a quite short butt is provided on one side and one needle 4 with a butt of medium length on the opposite side.

The short-butted needles 2 (heel needles) serve the purpose of knitting the rear side of the length A, the split-worked upper part B of the heel, the heel C and the split sole D. The long-butted needles 3 (upper foot part or instep needles) serve the purpose of knitting the front side of the length A and the upper side of the foot E (Figure 1). The medium-butted needles 4 and the quite short-butted needle 5 act as binding or joining needles (split needles) between the knitted upper part and the split-worked upper part B of the heel and the sole D. The rows of loops F, formed on the needles 4 and 5, therefore contain all the threads in common (Figures 2, 4).

Six thread guides 6 to 11 (Figure 12) are provided, of which, for instance, the two thread guides 6, 7 serve the purpose of knitting the length A and the instep part E in reverse plaited pattern, whilst the thread guide 11 is used for knitting the split sole D and the split-worked upper part B of the heel, the thread guide 8 for knitting the heel C, the thread guide 9 for knitting the top and the thread guide 10 for instance for striping or for other patterns.

All the thread guides are drawn by helical springs 12 (Figure 5) into the operative position, in which the thread guides 6, 7, 11 are set by set screws 13, whilst the other thread guides 8, 9, 10 are outside the operative position, when knitting split articles. In their operative position they rest on the guide plate 14. For controlling the thread guides there are push bars 15 of a known kind, which run in guides 16 and are raised and lowered by thrust cams of a control drum 17 at suitable moments, that is, when passing from the border to the leg, heel, split sole and toe.

The operative system consists of a stationary cylinder cam frame shell 18 (Figure 8) with the cam members 19, 20, 21 (Figure 7) of the usual construction, the modified central, upper cam member 22, and the lower cam member 23, and the cam member 24 according to the invention. The inner concave surfaces of the cam members 19, 20 lie so close to the needle cylinder that they can actuate all the butts of the needles. The cam member 21 which is actuated by the control drum and is adjustable radially with respect to the needle cylinder influences in this direction during the knitting of the split part only the long-butted needles 3 (Figure 10), whilst the usual row of short-butted and medium-butted needles 2, 4, 5 moves past the cam member 21 and is only sunk by the cam member 19. The central upper cam member 22 has at the lower right-hand point a cut-away portion 25 of such a depth that the short-butted and medium-butted needles 2, 4, 5 pass through it, whilst the rest of the concave surface bears against the needle cylinder.

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The cam member 24 according to the invention can be brought into and out of the operative position with respect to the needle cylinder and, during the split work, sinks (as will be seen in Figures 20-22) all the needles with the exception of the short-butted needle 5 (Figure 19) in front of the thread guides 6, 7 which remain in the operative position and knit the upper part of the foot (Figure 6). The radial adjustment of the cam member 24 with respect to the needle cylinder is effected by the thrust cam 26 fixed on the control drum 17 (Figure 5), with its sliding surfaces 27, 28, 29 of different height and by the push bar 31 which slides on them with its end 30 and on which a lifting plate 32 with a symmetrical incision 33 is fixed by screws 34.

The cam member 24 is rigidly connected with a sliding member 35 which is guided in the bracket 36 of the right-hand picker 37 (Figure 8). The extreme positions of the sliding member 35 are fixed by a pin 38 provided in it, which slides in the slot 39 of the small cover plate 40 screwed to the bracket 36. The accurate radial adjustment of the sliding member 35 and of the cam member 24 with respect to the needle cylinder 1 is effected by a radial displacement of the small cover plate 40 which is secured in its position by screws 41, the helical spring 42 being attached with one of its ends to the sliding member 35 and with its other end to the small cover plate 40 and drawing the cam member 24 as far towards the cylinder as the pin 38 is allowed to move by the slot 39 of the small cover plate 40.

A two-armed lever 43 capable of turning about a pivot 44 acts with its right-hand arm on the sliding member 35. To its left-hand arm is fixed by means of screws 47 a small plate 48 which with its bevelled surfaces on both sides slides either on the upper or the lower surface of the incision 33. When the small plate 48 is in the middle of the incision 33 and the end 30 of the push bar is on the sliding surface 27 of the thrust cam 26, as shown in Figure 5, then the cam member 24 has its concave surface in the operative position for the knitting of split work, that is to say, is at such a distance from the needle cylinder, that only the quite short-butted needle 5 will pass through it and will therefore not be sunk (Figure 19).

The hook of the needle 5 will then travel along the path marked I (Figures 6, 19), in which it catches hold of the two threads 49, 50 of the stationary thread guides 6, 7 knitting the upper part of the foot. These threads, having once been seized by the needle 5, will also be caught hold of by the instep needles 3, 4 with medium and long butts, which follow it and travel along the path II (Figures 6, 21), as the cut-away part 51 of the stationary cam member 23 only allows the short-butted needles 2 to pass and steers the needles 3, 4 again within range of the thread guides 6, 7.

The cam member 21 which is also actuated by the control drum 17, adjustable radially with respect to the needle cylinder and is of ordinary construction has, during the knitting of the split part, its concave surface at such a distance from the needle cylinder that the short-butted and medium-butted needles 2, 4 and the needle 5 with the quite short butt pass through it (Figures 19, 20, 22), their hooks travelling in the paths I, III (Figure 6), in which they catch hold of the thread 52 of the thread guide 11, intended for the split part, whilst the needle hooks of the long-butted instep needles 3 has already been sunk by the cam

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member 21, therefore travel in the path II and receive no split thread 52 (Figure 21).

During the knitting of the remaining parts of the stocking, that is to say, during normal knitting, the cam member 24 will, owing to a change in the position of the control drum 17 and of the sliding surface 23 of the thrust cam 26 (Figure 5), occupy a position of rest, that is to say, it is at such a distance from the needle cylinder, that the butts of all the needles pass through it and are therefore not sunk. The same applies to the cam member 21 of known construction (Figures 15-18).

A further characteristic feature of the invention consists in this, that during the knitting of split-worked hosiery both the split thread guide 11 used for the lower part D (sole) and the thread guides 6, 7 used for the upper part E of the foot part remain around the whole of the periphery of the courses of loops in an operative, stationary position and are put out of operation only during the production of top, heel and toe.

To make this advantage possible the needles 2 with their butts 2a are before they receive the split thread 52, so controlled in their position as regards height, that they cannot take up the threads 49, 50 intended for the long-butted needles 3 (Figure 22). The thread guides 6, 7, 11 which are in operation during the split-work are not, as was formerly the case, brought into and out of the operative position alternately by a special control device, the production of the split-work being effected solely through the control of the needles.

Each thread taken up by a thread guide is worked in by all the needles which are in operation, that is to say, those thread guides, which are operative during the knitting of a tubular portion of the stocking deliver their thread to the whole row of needles. When the split upper part of the heel or the split sole is being knitted, both the just mentioned split thread guides and those freshly put in operation deliver their threads only to those needles, which come within their range of action with the aid of cam members according to the invention. The operative and the inoperative position of all the thread guides is brought about in a known manner by the control drum with thrust cams and push bars.

A further feature consists in this, that individual thread guides are mounted so as to be capable of rocking on eccentric bushes supported on a common journal, by turning which a relative displacement of those thread guides in a radial plane to the needle hooks is effected and thus the angle, at which the yarns are supplied to the latter, can readily be altered.

By this means the accurate engagement and disengagement of the thread in the hooks and from the hooks of the needles controlled by the cam members is determined by the correct position of the individual thread guide ends with respect to the needle hooks. If, for instance, a split sole with a reverse plated upper foot part is to be knitted, in which three threads 49, 50, 52 (Figure 6) are to be worked in simultaneously, it is necessary for the threads 49, 50 to be laid in the needle hooks at a certain relative angle α which prevents an undesired turning of the threads. At the same time unavoidable manufacturing faults of the individual parts which determine the accuracy of the position under the needle hooks of the threads to be introduced are counteracted by the said relative adjustability of the individual thread guides. Furthermore,

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different threads according to their peculiar structure and nature require their special position of entry to the needles, if in knitting the split-work neatness is to be obtained both in the rows of loops F and also for instance, when reverse plaiting or when aiming at other pattern effects.

Thus, for instance, the thread guides 7, 11 are mounted so as to be capable of rocking on the eccentric bushes 53, 54 (Figures 12, 13) and the thread guide 6 on the eccentric bush 55. By turning the bush 55 on the eccentric bush 53 the thread guide 6 can be displaced. The non-circular bushes 53, 54 are supported by a common journal 58 and a stationary bracket 56, where they are secured against turning by screws 57. The bush 54 is secured against turning on the journal 58 by the screw 59 and the bush 55 on the bush 53 by the screw 60. The described eccentric manner of mounting can be used for any sort of thread guide and for other purposes as well, than for knitting split-work and reverse plaiting work.

When, for instance, the reverse plaited length A is being knitted, the thread guides 6, 7 are in the operative position. In this section of the work the push bar 31 bears with its end 30 against the surface of the control drum 17 in front of the thrust cam 23, whereby the cam member 24 is at such a distance from the needle cylinder 1 that the butts of all the needles 2, 3, 4, and 5 will pass through the cam member 24, without being sunk by it. The long butts of the needles 3 will, therefore, move along the path indicated in Figure 17, whilst the butts of the remaining needles 2, 4, 5 will travel through the cut-away place 25 without altering their vertical position (Figures 15, 16, 18). During this period the cam member 21 is also at such a distance from the needle cylinder, that the butts of all the needles are not sunk by it. Through the cam members 21, 24 being inoperative, it becomes possible for the two threads 49, 50 to be taken from the thread guide 6, 7 by all the needle hooks.

On going over to the split-worked upper part of the heel, B, the thread guide 11 with the split thread 52 is brought by the push bar 15 and the thrust cam and control drum 17 into the operative position and brings the split thread 52 into the hooks of the last short-butted needles 2, the thread guides 6, 7, which are already operating in the leg part, continuing in their position. In the last course of the leg part before the split-worked upper part B of the heel, in which the short butts of the needles 2 are disposed in front of the cam members 21, 24, they are brought into the operative position.

The cam member 21 is brought into operation in a known manner and influences in the radial direction only the long-butted needles 3, whilst the row of short-butted and medium-butted needles 2, 4, 5 moves past the cam member 21 and is only sunk by the cam member 19 (Figures 19-22).

The cam member 24 is brought by turning the control drum 17, the end 30 of the push bar bearing on the upward slope of the sliding surface 27 of the thrust cam, towards the needle cylinder in the radial direction, but at first only so far that, after the free passage of the short-butted needles 2, 5, the medium-butted and long-butted needles 3, 4 are sunk. During the sinking of these needles the push bar end 30 passes, through the further revolution of the control drum 17, on to the low sliding surface 27 of the thrust cam 26,

whereby the cam member 24 is brought in the range of the long-butted needles 3 still closed to the needle cylinder, which results in the sinking of all the butts of the needles 2, 3, 4 with the exception of the quite short-butted needle 5 (Figures 19-22). While the cam member 24 is moving into this position, the rest of the short-butted needles 2, the quite short-butted needle 5 and the medium-butted needle 4 move past the cam member 21, in order to receive the split thread 52 of the thread guide 11. The following long-butted needles 3 will be sunk by the cam member 21, so that they cannot take up the split thread 52 of the thread guide 11.

The thread 52, thus disengaged, lays itself, drawn by the medium-butted needle 4, into the end 61 of the inwardly swung presser 62 of a known kind (Figure 14), where it remains until it is inserted under the short-butted and medium-butted needles 2, 4, 5. By this means the split thread 52, which is not knitted in, lays itself right across the needle cylinder (Figure 4). When the cam member 24 is interposed in the region of the long-butted needles, 3, the latter and the medium-butted needles 4 are continuously supplied with thread from the thread guides 6, 7 which are in the operative position. The paths of these needle hooks are shown in Figures 20 and 21.

The short-butted needles 2 which follow the aforesaid needles are also sunk by the cam member 24, but pass through the cut-away place 51 provided by the invention in the cam member 23 (see Figure 22) without being raised by the sliding surface of the later (Figure 11); consequently they cannot take up any threads 49, 50 from the thread guides 6, 7. The two threads 49, 50, thus put out of action, lay themselves, drawn by the medium-butted needles 4, into the end 61 of the presser 62, which is in the operative position (Figure 14) from which the previously inserted, free split thread 52 knits itself again into the needle hooks of the needles 2, 5, 4 through the rotation of the needle cylinder. After the production of the split-worked lower part and the reverse plaited upper part, the unknitted portions of the split thread and the reverse plaiting thread at each course of loops extend unsupported right across the inside of the tube (Figure 4) so that, after the production of the piece of hosiery, they have to be cut off on the inside at both ends of each course of loops in a known manner.

In working further courses the needles 3 move in accordance with Figure 21 (knitting the upper part of the foot) and the needles 2 in accordance with Figure 22 (knitting the split-worked upper part of the heel and the split sole).

At the commencement of the knitting of part C (heel) the cam member 21 is moved away from the needle cylinder in a known manner through the rotation of the control drum 17. At the same time the cam member 24 increases its distance from the needle cylinder through the push bar end 30 running up on to the raised sliding surface 28 of the thrust cam 26. The thread guides 6, 7, 11, which during the knitting of the split-worked upper part of the heel were in a fixed operative position, are replaced by the thread guide 8 which now alone inserts the heel thread into the short-butted needles 2.

After the completion of the part C (heel) the thread guide 8 is again replaced by the thread guides 6, 7, 11 for knitting the split-worked part D (split sole) and through the further rotation of

the control drum 17, during which the sliding surface 29 comes into action, as at the beginning of the split-worked part B (upper part of heel), the parts 21, 24 become operative, so that the knitting operation already described is repeated.

We claim:

1. A circular knitting machine for the manufacture of split-worked hosiery, comprising: a cam frame, a fixed central upper cam member thereon, knitting needles having short butts, knitting needles having butts of medium length, some of the said knitting needles being adapted to serve as connecting needles, knitting needles having long butts, a radially movable cam member disposed beneath the central upper cam member and movable into one position to allow the connecting needle with the shortest butt to pass through while causing the other needles to sink and a fixed lower cam member on the cam frame, the active surface of which, in the circumferential path of movement of the needles is circumferentially spaced rearwardly of the said radially movable cam member and is adapted to raise again the needles with medium and long butts while permitting the needles with short butts to pass through without altering their vertical height.

2. A circular knitting machine for the manufacture of split-worked hosiery, comprising: knitting needles, hooks on the knitting needles, a common journal mounted in a stationary position, eccentric bushes supported on the common journal, a split lower thread guide to be used for knitting the lower part of the hosiery, and upper thread guides to be used for knitting the upper part of the hosiery, the said lower and upper thread guides being rockably mounted on the eccentric bushes in such a way that by turning the bushes the thread guides are displaceable in radial planes relatively to the needle hooks, whereby the angle between the threads supplied can be altered.

3. A circular knitting machine for the manufacture of split-worked hosiery, comprising: a cam frame, a fixed central upper cam member thereon, knitting needles having short butts, knitting needles having butts of medium length, some of the said knitting needles being adapted to serve as connecting needles, knitting needles having long butts, a radially movable cam member disposed beneath the central upper cam member and radially movable into one position to allow the connecting needle with the shortest butt to pass through while causing the other needles to sink, a fixed lower cam member on the cam frame, the active surface of which, in the circumferential path of movement of the needles, is circumferentially spaced rearwardly of the said radially-movable cam member and is adapted to raise again the needles with medium and long butts while permitting the needles with short butts to pass through without altering their vertical height, additional cam members provided on the cam frame, by means of which the said knitting needles are moved into and out of range of the respective thread guides, hooks on the knitting needles, a common journal mounted in a stationary position, eccentric bushes supported on the common journal, a split lower thread guide to be used for knitting the lower part of the hosiery, and upper thread guides to be used for knitting the upper part of the hosiery, the said upper and lower thread guides being adapted to remain stationary in their operative position around the whole periphery of the loop

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courses during the knitting of the split-worked hosiery and to be put out of action only during the knitting of the heel and the toe, and the said lower and upper thread guides being rockably mounted on the eccentric bushes in such a way that by turning the bushes the thread guides are displaceable in radial planes relatively to the needle hooks, whereby the angle between the threads supplied can be altered.

JAROSLAV JAVOREK.
ANTONÍN VANÁTKO.

10

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