F. W. ROBINSON.

STOCKING.

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1,077,370.

Patented Nov. 4, 1913.

Fig. 1.

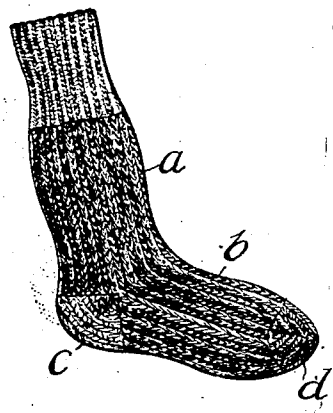


Fig. 2.

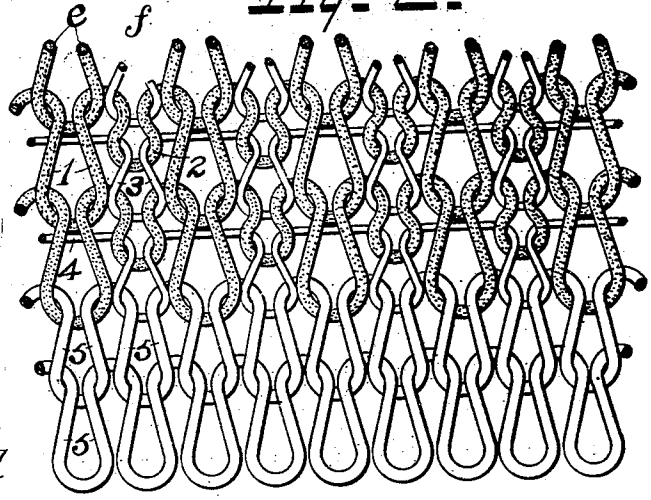


Fig. 3.

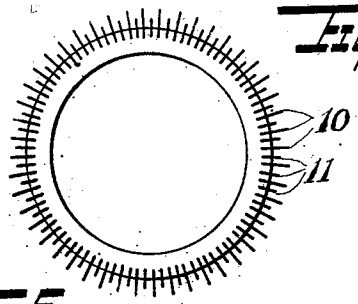


Fig. 5.

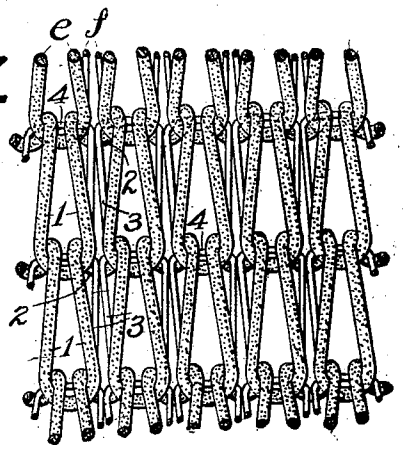
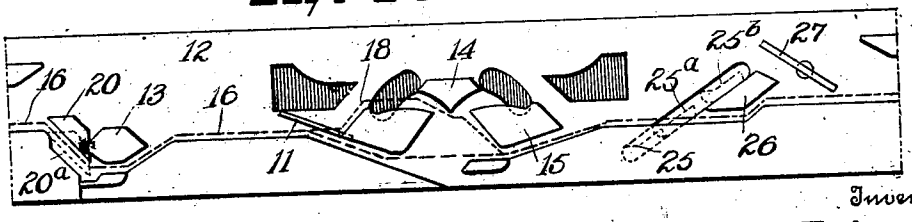


Fig. 4.



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UNITED STATES PATENT OFFICE.

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STOCKING.

1,077,370. Specification of Letters Patent. Patented Nov. 4, 1913.

Application filed December 23, 1912. Serial No. 738,200.

To all whom it may concern:

Be it known that I, FRANK W. ROBINSON, a citizen of the United States, residing at Reading, in the county of Berks and State of Pennsylvania, have invented certain new and useful Improvements in Stockings, of which the following is a specification.

My invention relates to so-called "accordion" stockings, in which two different yarns are knitted so as to produce normally separated one-yarn wales which are closable together accordion-like by lengthwise stretching of the knitted fabric; and my invention consists in providing a seamlessly knitted stocking of this type, as hereinafter fully described in connection with the accompanying drawings, the novel features being specifically pointed out in the claim.

Accordion stockings of the full fashioned type have been heretofore knitted on straight knitting machines, but my invention provides a seamless continuously knitted product with less material and at much reduced cost.

Figure 1 indicates a seamless accordion stocking embodying my invention. Fig. 2 is a greatly enlarged fragmentary view indicating the interlooping of the yarns both for an accordion effect leg or foot portion and for a continuously knitted connecting heel or toe portion. Fig. 3 is another view indicating the accordion-like closing together of the wales which result from lengthwise stretching of the fabric indicated in Fig. 2. Figs. 4 and 5 illustrate special features of circular knitting machine construction which make practicable the production of my improved stocking.

My improved stocking is of the usual continuously knitted seamless type, the leg portion *a* and foot portion *b* being knitted in circular courses, while the heel portion *c* and toe portion *d* are produced as usual by the well known narrowing and widening operation in which only half of the circular series of needles, consecutively arranged, are used with the movement of the cam cylinder changed from rotary to reciprocating. In my improved construction of this type of stocking the circularly knitted leg and foot portions are made up of two different yarns, *e* and *f*, so interlooped as to produce the accordion effect referred to, while the heel and toe portions are knitted as usual; the different texture of these knitted-together portions, and the accordion action of the leg and foot portions, being clearly illustrated in Figs. 2 and 3 respectively. As shown in the upper courses of Fig. 2, each circularly knitted course is made up of long single loops 1, 1, of the heavier yarn *e*, alternating with two linked-together shorter loops 2 and 3 of the yarns *e* and *f* respectively; said intervening linked-together loops 2 and 3 being jointly equal in length to the longer loops 1, and said loops 3 of the lighter yarn *f* as indicated, being connected by drop-stitch portions 4 of said yarn which float across the rear of the longer loops 1, 1; so that said one-yarn loops 1, 1 of successively knitted courses form parallel wiles which are normally separated by the intervening lines of connected shorter loops 2—3, 2—3. When these circular courses reach the heel or toe, the knitting is changed to the ordinary looping as indicated at the lower part of Fig. 2, the regular loops 5, 5, 5, being formed of one or both of the yarns *e*, *f* or of different yarn spliced thereto as usual.

The accordion action of the leg and foot knitting above described, is indicated in Fig. 3, where the fabric is represented as stretched longitudinally; thereby lengthening the loops 1, 1 by adding thereto the material of the shorter loops 2 of the same yarn *e*, and correspondingly lengthening the shorter loops 3 by adding thereto the material of the floating drop stitches 4 of the same yarn *f*, while at the same time closing together laterally the wales formed by the loops 1, 1 so as to more or less completely conceal the lighter yarn *f* and thus ornamentally vary the appearance of the fabric.

The production of this improved seamless stocking involves changes in the ordinary knitting operation and mechanism which will now be described in connection with Figs. 4 and 5; the main features thereof being that one of the two yarns which make up the circularly knitted courses of the leg and foot portions must be knitted upon all the needles and the other upon alternate needles only, while the continuous yarn forming the heel and toe portions must be knitted upon certain consecutive needles as in the ordinary widening and narrowing operation. In order to produce this different looping of the two yarns forming the leg and foot portions, alternate needles 10 10 of the circular series employed in knit-

ting (see Fig. 5) must be operated differently from the intervening needles 11 11; and to accomplish this, they are provided with hubs of greater length than the hubs of the intervening needles, so that the rotary cam cylinder of the machine may engage and operate these two groups of needles as required for producing the Fig. 2 texture. As already stated however the knitting of the heel and toe portions of my improved stocking is effected in the ordinary manner, upon a consecutively arranged half of the needles. Thus it will be seen that while a separate grouping of alternately arranged needles of the series is required in knitting the leg and foot portions of my improved stocking, the ordinary grouping of consecutively arranged needles of the same series is also required in order to continuously produce the heel and toe portions. To show how this may be satisfactorily effected, I indicate in Fig. 4 a special arrangement of cam cylinder by which the proper working of required needles, for successive portions of the stocking, may be effected in a continuous operation.

Fig. 4 shows diagrammatically the interior face of this special cam ring 12, developed as a plane surface. The long and short butt needles being arranged alternately in the needle cylinder as indicated in Fig. 5, and the long butt needles 10 being required to loop the heavier yarn *e* only while the short butt needles 11 are required to loop both yarns during the leg and foot knitting, the cam ring is provided at one point with a knitting cam 13, and at an approximately opposite point, as indicated, with knitting cams 14, 15. The long and short dotted line 16 indicates the travel of the long and short butt needles together, the long-dotted line 17 the travel of the long butt needles alone, and the short-dotted line 18 the travel of the short butt needles alone. An adjacent cam 20 being lowered to dotted position 20^a the knitting cam 13 is thrown out of action so that all the needles travel above it for the different heel and toe knitting. A separating cam 11 serves to throw the long butt needles 10 down into inoperative position (while holding the long loops 1), and the short butt needles 11 into position for being operated by the knitting cams 14, 15. A special halving cam 25 is provided which is adjustable to three different positions in an inclined slot as indicated; the lowered position 25 allowing all the needles to pass above it, as required for the two-feed leg and foot knitting described; the intermediate position 25^a in connection with fixed cam 26, raising both short and long butt needles out of action while it is retained in that position; and the raised position 25^b placing it out of action. This cam 25 is automatically operated by suitable means so as to place and hold it in position 25^a during a half-turn of the cam ring in order to raise one-half the needles out of action when the usual reciprocating knitting for heel or toe is to be effected, and so as to raise it to position 25^b with the last-raised needle carried upon its hooked end. When the heel or toe knitting is completed, a cam 27 is suitably pressed into the path of the raised needles so as to lower them into normal action again for the resumption of circular knitting. While the same yarns that are used in knitting the leg and foot portions as described, may be also used to form the differently knitted heel and toe portions, other yarns may be introduced in well known manner as desired, the two different textures being continuously knitted in either case.

My improved stocking may be made with the well known split-foot, in which case the heel and toe knitting would extend the full length of the foot as usual.

What I claim is:—

A seamless stocking comprising circularly knitted accordion-effect leg and foot portions made up of two yarns of different thicknesses with long loops of the heavier yarn alternating in each course with interlocked half-length loops one of each yarn: and continuous ordinarily knitted heel and toe portions; substantially as set forth.

In testimony whereof I affix my signature in presence of two witnesses.

FRANK W. ROBINSON.

Witnesses:
D. M. STEWART,
W. G. STEWART.