B. F. SHAW.

Method of Knitting Stockings.

No. 200,225. Patented Feb. 12, 1878.

Fig. 1.

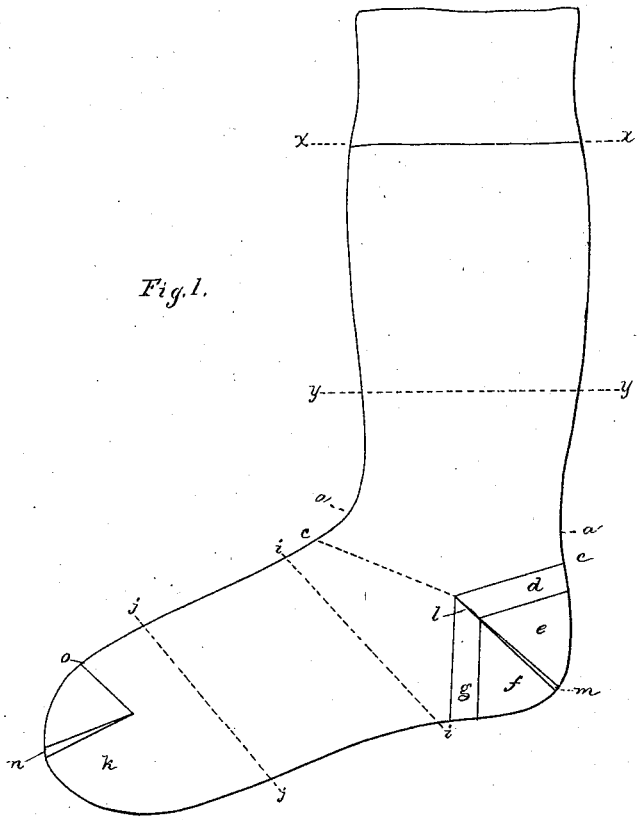
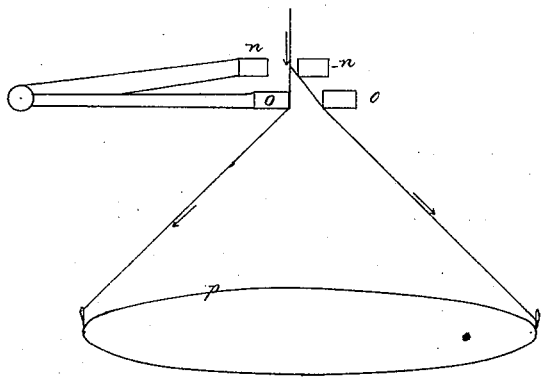


Fig 2.



Witnesses.
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BENJAMIN F. SHAW, OF CAMBRIDGE, MASSACHUSETTS.

IMPROVEMENT IN METHODS OF KNITTING STOCKINGS.

Specification forming part of Letters Patent No. **200,225**, dated February 12, 1878; application filed May 15, 1877.

To all whom it may concern:

Be it known that I, BENJAMIN F. SHAW, of Cambridge, in the county of Middlesex and State of Massachusetts, have invented an Improvement in and Method of Knitting Stockings, of which the following is a specification:

This invention relates to improvements in and to a new method of giving form to machine-knitted stockings during the process of knitting, and especially to those which are produced upon machines which are operated both circularly and reciprocally, turning out a product substantially like that patented to me in United States Letters Patent No. 64,154, dated April 23, 1867, to which reference may be had.

My improved stocking can be made just as well when begun at the toe as when begun at the top of the leg; but in this specification I shall only describe the process followed when beginning with the leg.

The invention consists in knitting into the heel, upon both sides thereof, selvaged portions, as hereinafter described, whereby the point of the heel may be set farther back from the instep, to thereby give more room within the stocking for the heel and instep than has hitherto been given in stockings whose heels have been knitted entire by the process of narrowing and widening, as described in the aforementioned Letters Patent granted to me; also, in the method of fashioning the web by varying the length of the loops upon opposite sides of the fabric, (the front and the rear.)

Figure 1 represents, in side elevation, a stocking delineating my invention, and Fig. 2 one plan by which to automatically vary the tension on the yarn.

When a stocking is commenced at the top of the leg, (the ribbed top in half-hose being disregarded,) the yarn is supplied to the needles as free as possible from tension while knitting between the lines *x x* and *y y*, and the fabric is knitted loosely until the small part of the leg above the ankle-joint is reached, when tension is gradually put on the yarn, and a close-knitted portion, less expansive than the preceding part, is knitted until the enlargement of the ankle-joint is reached. This closely-knitted portion is included substantially between the lines *y y* and *a a*. At about the line *a a* the tension on the yarn is gradually taken off, and a portion expansive enough for the upper part of the instep and the ankle-joint is produced. This brings the knitting to that point *c c* at which the heel is begun. Here a part of the needles are made inoperative, while the remainder are used in the fabrication of the heel.

My present machine employed to knit these stockings contains eighty-four needles, and to form the heel thirty-nine needles are stopped, while forty-five are continued in operation. The needles employed to knit the heel may be denominated the "heel-needles." With them a straight-sided selvaged portion, *d*, of the desired length—say about three-fourths of an inch—is knitted, all the heel-needles being employed, the machine then being reciprocated. When this selvaged portion *d* is completed the number of heel-needles is continually diminished, one needle being withdrawn from action at each reciprocation of the machine, until about fifteen needles are operative, or until this portion of the web is sufficiently narrowed to form the portion *e*.

At this stage of the knitting I prefer—but it is not absolutely necessary—to bring into action all the forty-five heel-needles, first the fifteen on the one side of those which remain operative, and then the fifteen upon the other side, and to knit upon all the heel-needles two courses of loops, as at *m*, the second of these courses terminating upon the last needle of the middle series of fifteen, or those on which the narrowest course, just before described, was knitted.

At this point a gradual widening process is begun, so that an attached piece, *f*—a counterpart in reverse of the previously-formed narrowed part *e*—is produced. During this widening process one needle after another upon each side of the middle series of fifteen needles (each needle holding the loop engaged by it when thrown out of action) is brought into operation at each reciprocation. These narrowed and widened portions *e f* constitute a bulge. At this point, where the widening of the last described part of the heel ceases, all the forty-five needles have been restored to action. Then another straight-sided selvaged portion is knitted, as at *g;* but it is preferred to knit it a little longer than the first selvaged portion described. This ends the knitting of the heel.

The entire number of needles in the machine

are now made operative, and circular knitting is proceeded with in the production of the foot. The yarn is supplied without avoidable tension until the larger and thicker portion of the instep and middle foot has been provided for, as between lines *i i* and *j j*, when tension is gradually put upon the yarn, and a close portion produced until the toe *k* is reached. Here a part of the needles are withdrawn from action, as when the heel was reached, while the knitting of the toe is proceeded with on the remainder. In knitting the toe, no selvage parts are produced, the work being limited to the narrowed and widened parts, with the preferred two courses, *n*, interposed.

The stocking, after its removal from the machine, is to be raveled at the toe until the same number of loops are formed upon each side of the opening, after which the opening is to be closed by hand or otherwise, as at *o*.

The selvage-edged holes *l* between *d* and *g*, one at each side, under the ankle-joint, are to be closed, preferably by needle and thread, the smooth short seam being unobjectionable.

It will be obvious that in accordance with the foregoing plan it is practicable to produce upon a series of needles of fixed extent, by suitable adjustment of tension, a web which will, without discomfort to the wearer, adapt itself to the enlargements of the calf, the heel, and instep, and yet fit closely enough the smaller parts of the leg and foot.

It will also be obvious that the heel may be extended backward from the instep to any desired distance, it being only necessary for that purpose to govern the length of the two selvaged parts, which form a portion thereof, as described.

The curved portions of the front and rear of a stocking shaped to conform to the foot are in arcs of different circles, the front of the stocking being nearer the center of the circle.

In a straight cylindrical web the loops of each course are of substantially the same length. I have demonstrated, if the loops of each course at that portion of the web which is to form the rear of the stocking are made longer than at the front, that the cylindrical web produced, instead of being straight, will be curved, its shortest side being where the loops are shortest, or at the front. This assists in giving shape to the stocking.

Commencing at the front of the stocking, where the loops are shortest, the loops of each course are gradually lengthened to the back of the stocking, and then gradually shortened to the front of the stocking. This result is attained by the use of the web-holders described in an application for United States Patents heretofore made by me, and filed October 4, 1876. Such web-holders will, however, have their faces in slightly different planes, as will be fully described in another application for patent to be made by me. This variation in the length of loops may be accomplished in other ways, as, for instance, by making one portion of the knitting-machine bed higher than the other, or by moving the needles different distances. At the same time the variation of tension co-operates, making the entire web firmer or more slack, as before described, according to the part of the stocking being knit.

In Fig. 2 I have shown, in section, two guide-eyes, *n o*. The thread is led through such eyes to the needles arranged in a circle, as at *p*. When the thread is in the position as shown at the right, the tension is least, and when at the position shown at the left it is the greatest, for then it rubs more about the guide-eye, and is subjected to greater friction and consequent tension than when at the right of the machine.

This elongation of the heel might be made as follows, viz: by beginning at the first selvage portion described with the whole number of heel-needles, as described, but knitting only a few courses; then diminishing the number of needles in action, and knitting a few courses with the remainder; then again diminishing the number of needles, and knitting a few more courses, and so on until the first part of the heel is sufficiently narrowed and large enough; then widening out, and producing a counterpart of the narrowed portion, bringing into action, in reverse order, the needles which, in narrowing, were withdrawn from action. Produced in this way, the web would exhibit upon each side of the heel, instead of the straight selvaged edges first described, and which I prefer, a series of selvaged serrations. The connection of the two bulged parts effected by the two courses would be marked by holes as long as each serration or gap. These holes would have to be closed by hand. The heel made in this way would cockle or draw, and be rather unsightly, and for such reason I prefer to put the selvage edge in all at once, rather than to introduce it in separate portions.

By a "selvage edge" I mean a plain edge formed where the yarn is turned backward or forward in the operation of knitting, or an edge formed at the same parts, but provided with loops, which may be interlocked by means of a crochet-hook to form a seam.

I claim—

1. A stocking the heel of which is composed of independent selvaged pieces and narrowed and widened portions connecting them, substantially as described.

2. In the manufacture of a knitted web, the method of fashioning the web, consisting in varying the length of the loops in each course of the web, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BENJAMIN F. SHAW.

Witnesses:

G. W. GREGORY,

S. B. KIDDER.