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PATENTED FEB. 24, 1903.

E. A. HIRNER.  
MANUFACTURE OF SPLITFOOT HOSIERY.

APPLICATION FILED APR. 15, 1901.

NO MODEL.

3 SHEETS—SHEET 1.

FIG. 1.

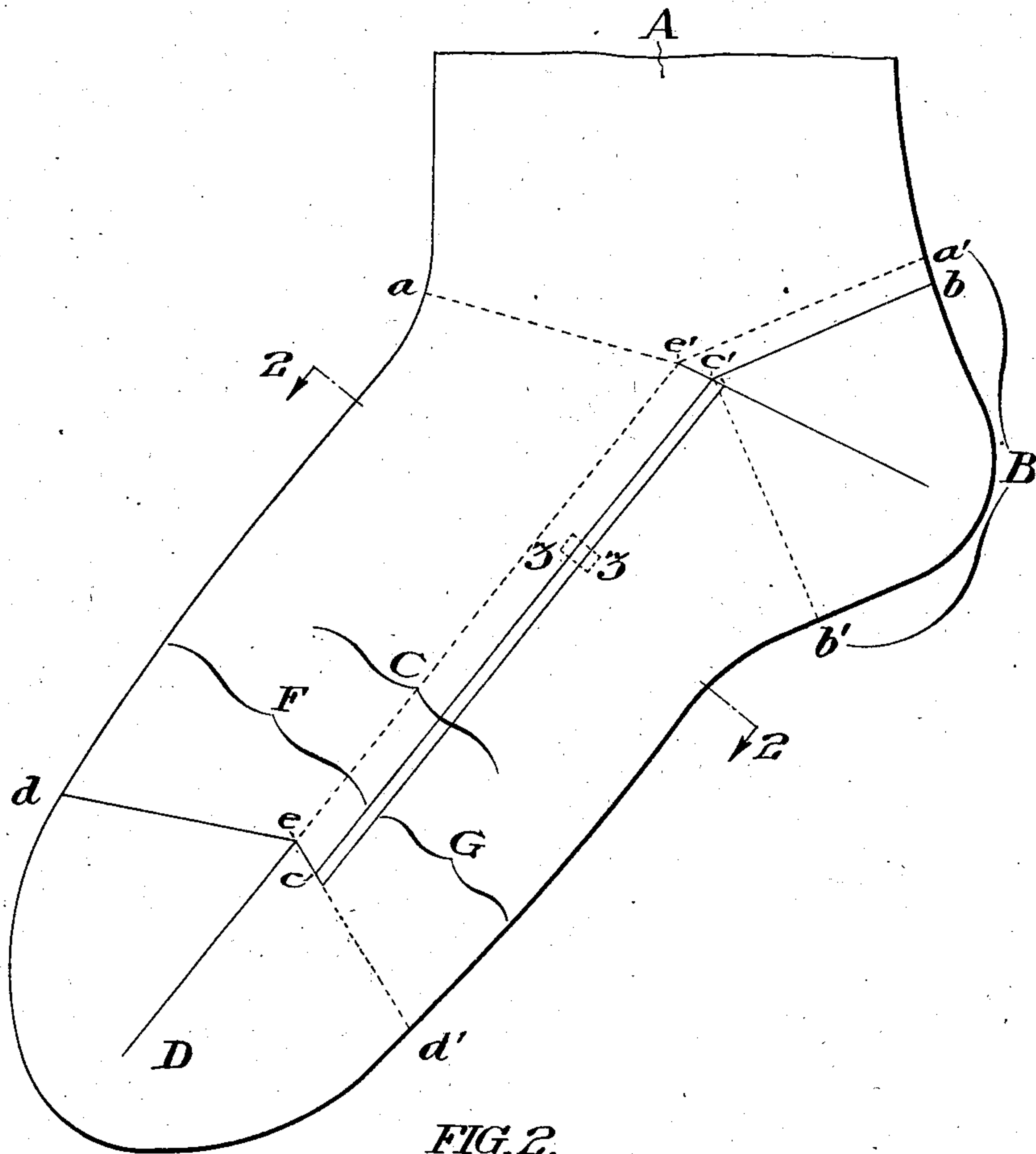
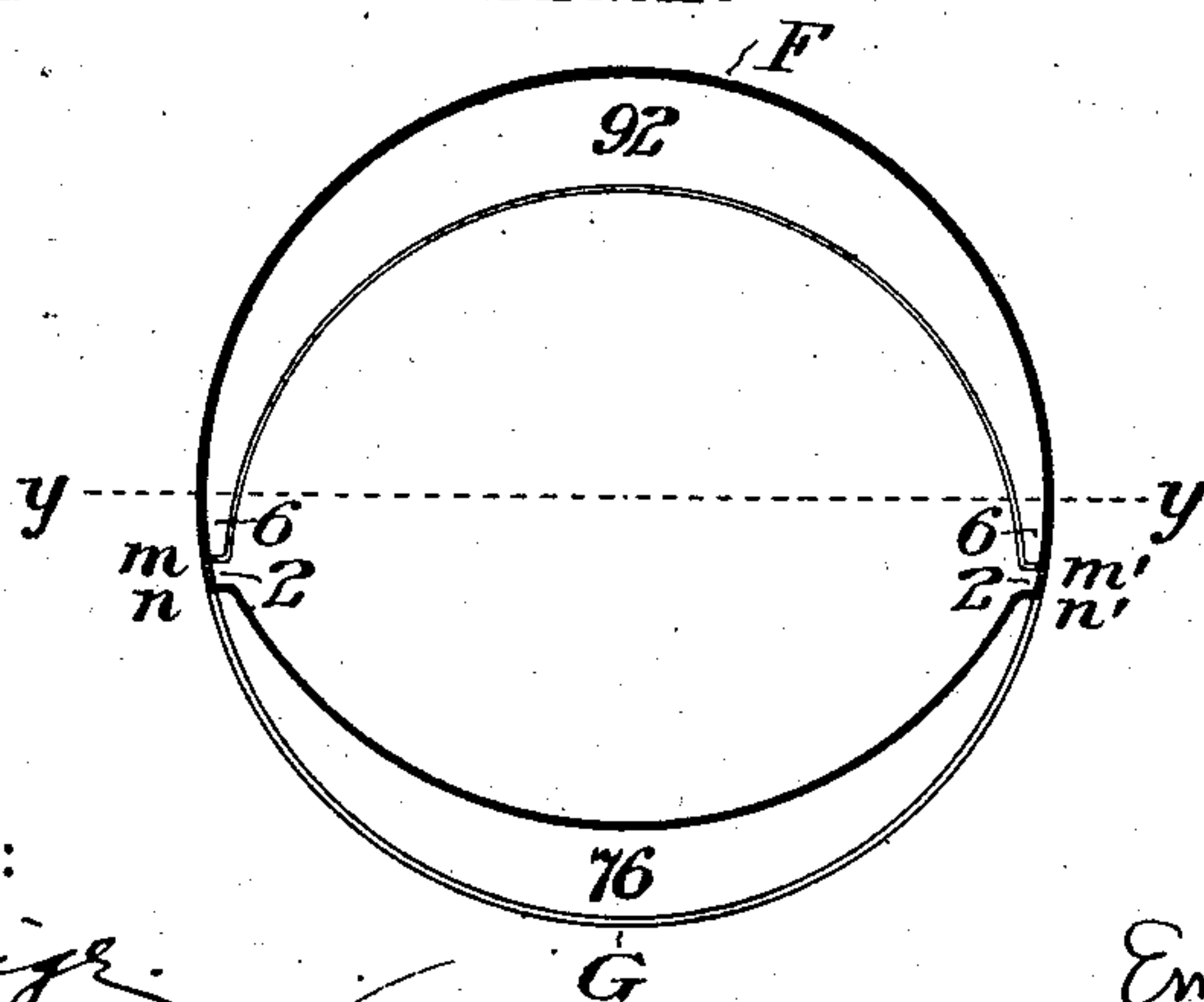


FIG. 2.



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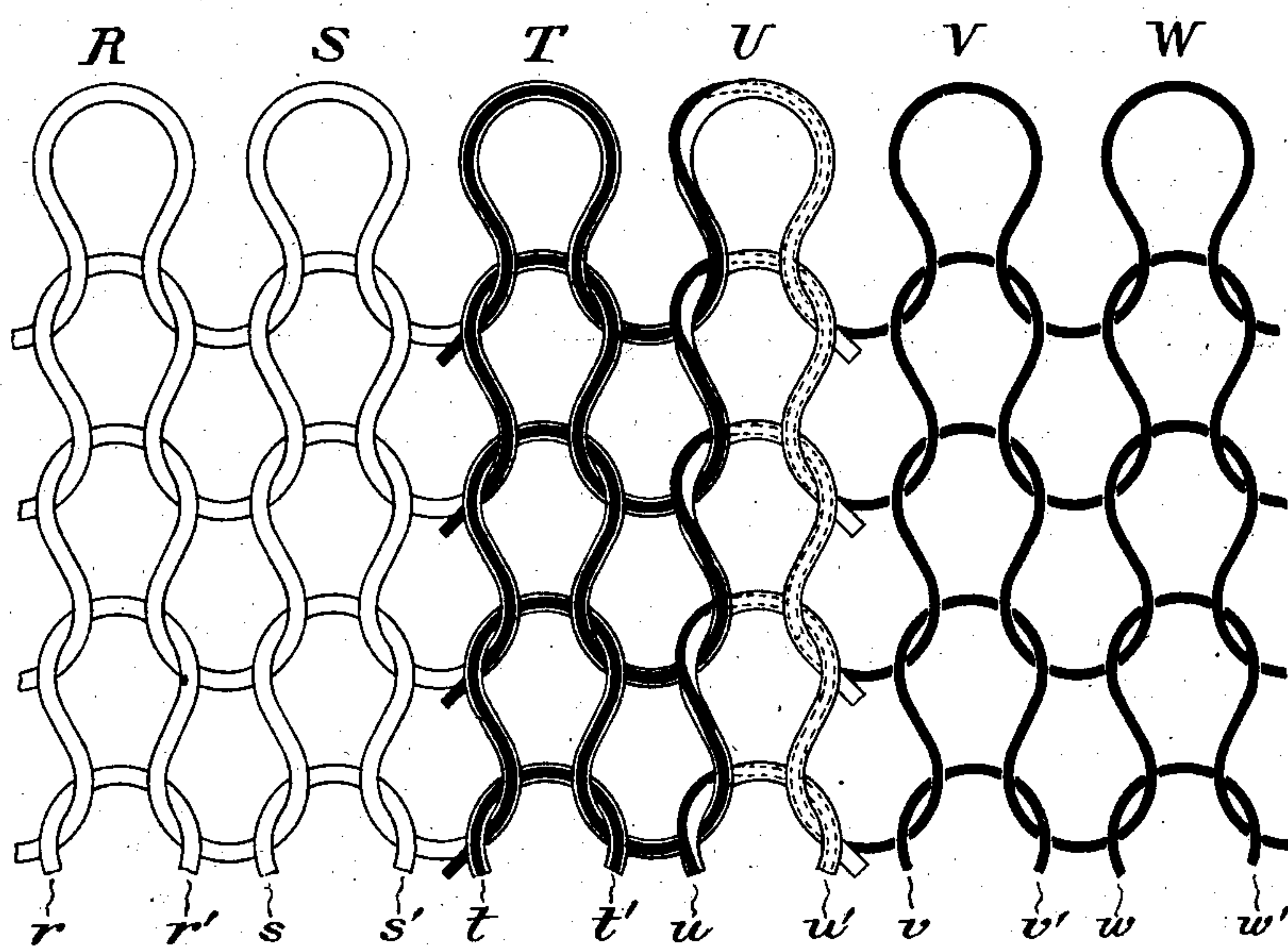
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3 SHEETS—SHEET 2.

FIG. 3.



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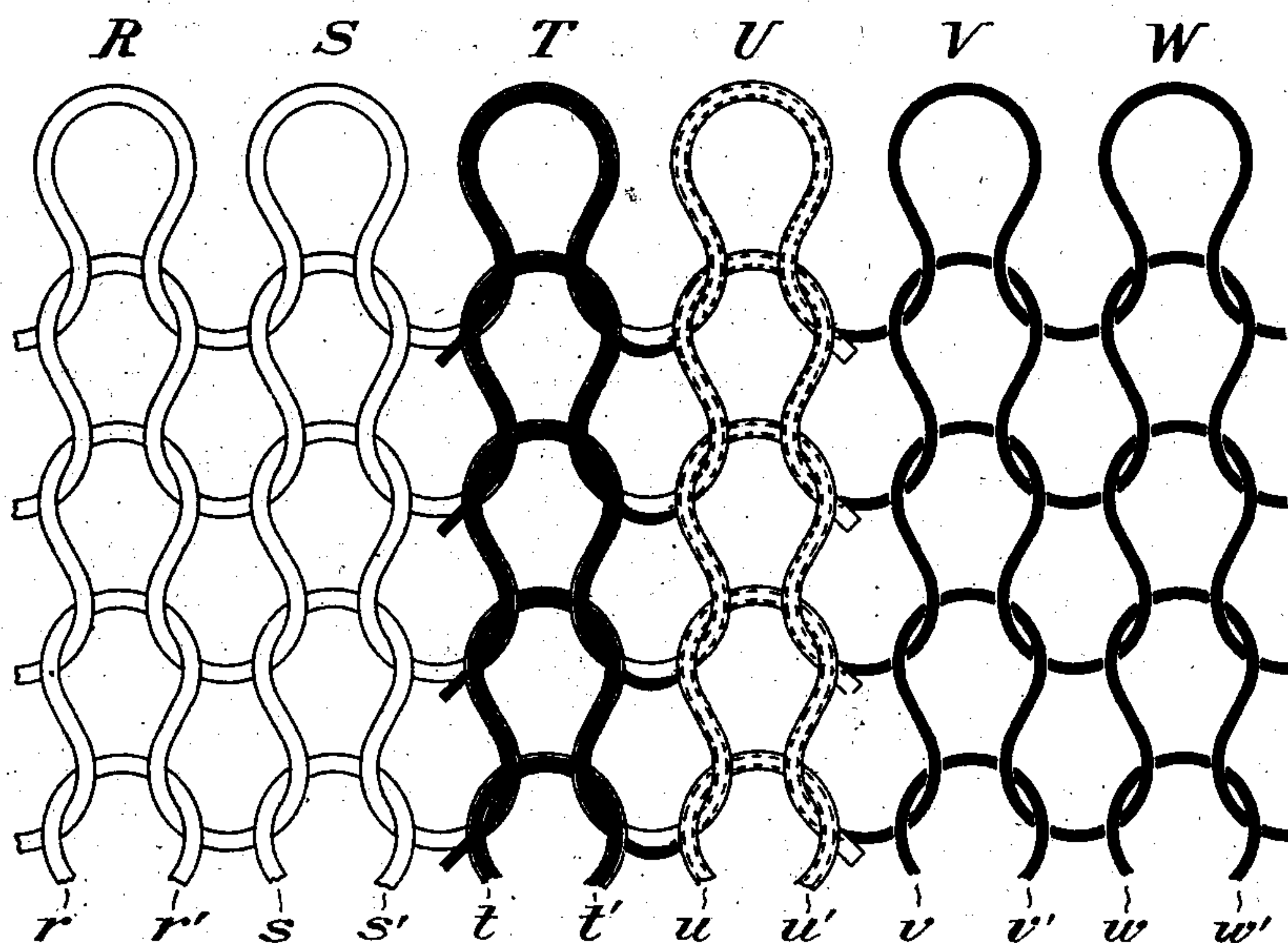
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3 SHEETS—SHEET 3.

FIG. 4



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# UNITED STATES PATENT OFFICE.

EMIL A. HIRNER, OF ALLENTOWN, PENNSYLVANIA.

## MANUFACTURE OF SPLITFOOT HOSIERY.

SPECIFICATION forming part of Letters Patent No. 721,190, dated February 24, 1903.

Application filed April 15, 1901. Serial No. 55,904. (No model.)

*To all whom it may concern:*

Be it known that I, EMIL A. HIRNER, a citizen of the United States, residing at Allentown, in the county of Lehigh and State of Pennsylvania, have invented certain new and useful Improvements in the Manufacture of Splitfoot Hosiery, whereof the following is a specification, reference being had to the accompanying drawings.

10 The name "splitfoot hosiery" is applied to stockings of which the upper part of the foot is knit from one kind of thread and the lower part of the foot from another kind of thread differing from the first either in  
15 weight or color, or both. The upper is usually knit from the same sort of thread as the leg of the stocking, while the lower, along with the heel and toe pockets, is usually knit from a heavier white thread.  
20 By my improvements the splitfoot of a stocking may be knit upon an ordinary circular-knitting machine by means of continuous round-and-round knitting. This I accomplish by using two threads and changing  
25 the thread twice for each rotation of the machine, both changes occurring in each course of the knitting at the loops corresponding to the changes of the preceding course. There is thus obtained an alternation of the  
30 threads which causes the upper to be knit entirely from one of the threads and the lower from the other. The sutures between the two parts of the splitfoot thus formed are effected by causing the threads to interlap for  
35 two or three loops at each change of thread.

My improvements also relate to an arrangement of the interlapping threads at the sutures, whereby I set off the sutures from the rest of the stocking.

40 I prefer to make the upper and lower parts of the splitfoot of unequal width, with the lower part the narrower, and my improvements further relate to certain changes in the knitting of the heel and toe pockets by which  
45 their construction is brought into adjustment with the unequally-split foot.

In the accompanying drawings, Figure 1 represents the lower part of a stocking embodying my invention. Fig. 2 is a diagrammatic cross-section of the same along the line  
50 2 2, Fig. 1. Fig. 3 is an enlarged diagrammatic representation of a portion of the fabric

represented by the dotted rectangle 3 3, Fig. 1, illustrating the method of knitting employed at the overlap by which the lines of  
55 juncture are formed. Fig. 4 is a similar representation illustrating a slightly-varying structure.

Referring to Fig. 1, A is the lower portion of the leg of the stocking, B is the heel-pocket, C is the foot, and D the toe-pocket.

I will first describe the method of knitting by which the splitfoot C is produced from two different threads by round-and-round  
60 knitting. For this purpose the upper part F will be supposed to be knit with a black thread and the lower, G, with a white thread. The knitting-machine must be provided with means for feeding either one of these threads  
65 to the needles as the knitting proceeds. After the heel-pocket B has been inserted by reciprocation of the machine, as is well understood in the art of knitting hosiery, rotation of the machine again commences and round-  
70 and-round knitting to form the foot proceeds. Each course is then knit as follows: One of the threads—say the black thread—is fed first to the needles, and knitting therewith proceeds until a half-circle, or thereabout, has  
75 been completed and the point is reached (*m*, Fig. 2) where it is desired that a suture shall begin. The white thread is then introduced, and for a few needles—say two—both threads  
80 are knit simultaneously. Then the black thread is thrown out (*n*, Fig. 2) and knitting proceeds with the white thread alone until the opposite suture begins, (*n'*, Fig. 2.) Then  
85 the black thread is again thrown in, and for two needles both threads are knit with simultaneously, as on the opposite side. Then the white thread is thrown out (*m'*, Fig. 2) and  
90 knitting with the black thread alone proceeds, at which point the operation begins to repeat itself. The throwing in and throwing out of the threads must be accurately timed,  
95 so as to occur for each course between the same needles. In this way a suture is formed at each side by the interlapping threads, always on the same needles. When the thread is thrown  
100 out of the needles, it is allowed to float across the tube to the point where it is again thrown in—that is to say, the white thread is floated from *m'* to *m* and the black thread from *n* to *n'*. The number of needles forming the suture



by simultaneous knitting with both threads may vary according to fancy. After the completion of the knitting of the stocking the float-threads are removed by being cut from the interior of the tube. The foot thus produced has its upper portion entirely knit from one thread, its lower portion entirely knit from another thread, and sutures at both sides knit with both threads, the courses thus formed in regular alternation being continuous, as in round-and-round knitting. Although the two portions thus formed are not actually interknit, yet the suture formed by loops interlapping for the space of two loops is equally strong and cannot be opened except by breaking the threads.

In Fig. 3 a part of one side of a stocking is illustrated, including a suture, so as to show in detail the method of knitting these interlapping threads. So much of four courses of knitting as are produced by six needles is shown. The six series of interknit loops thus formed (one on each of the six needles) are lettered, respectively, R S T U V W. Series R and S are knit exclusively with white thread, series T and U are knit with both black and white thread, and series V and W are knit exclusively with black thread. This is accomplished, as has been explained, by throwing in the black thread between needles S and T and throwing out the white thread between needles U and V.

I will now explain the arrangement of the interlapping threads by which the suture is set off from the rest of the stocking.

In all fabrics produced by ordinary knitting the face of the fabric consists of a series of parallel vertical wales, two for each series of loops, which are formed, respectively, by the left and right feet of the loops. The wales formed by loops R on the face of the fabric are lettered  $r$  and  $r'$ , those formed by loops S are lettered  $s$  and  $s'$ , and so on. The tops of the loops form the back of the fabric. It must be understood that although for purposes of illustration the loops are drawn in an upright position they are really partly horizontal, extending through from the face to the back of the fabric. When a fabric is knit by two threads simultaneously, the tension always forces the threads to lie with the loop of one thread within the loop of the other. Under these circumstances the outside thread appears on the back of the fabric, where the top of the loop shows, while the inside thread appears on the face of the fabric, where it forms the visible portion of the feet of the loops. This is indicated diagrammatically at series T, Fig. 3, by superimposing the black thread over the white, which means that the white forms the outside of the loop, and therefore the back of the fabric, while the black threads appear on the face, forming the two wales  $t$  and  $t'$ . It is evident that if the whole suture of the stocking—that is to say, the whole of the double-thread knitting which comprises the series of loops marked T

and U—were thus knit with the white thread on the outside and the black thread on the inside the suture would consist of a fabric with a black face and a white back. This would result in a single line of demarcation between the upper and lower parts of the foot of the stocking, which, as seen in Fig. 3, would occur on the face of the fabric between loops S and T and on the back of the fabric between loops U and V—that is to say, one edge of the future would be clearly marked, but the other would not be. This construction is not pleasing to the eye, for the reason that the suture has a different appearance by reason of its being knit with two threads from the other parts of the stocking knit with one thread alone. To relieve this irregularity of appearance, I have invented the construction illustrated in Fig. 3, by means of which I produce a single white wale upon the face of the fabric along the upper edge of the suture, leaving the three remaining wales of the suture with the black thread on the face of the fabric. This sets the entire suture off from the rest of the fabric and prevents the objectionable appearance which would otherwise exist. This is accomplished by arranging the threads as shown in Fig. 3, where it will be observed that of the loops T and U which are knit with two threads the whole of loop T and the half of loop U are knit with the black thread on the inside of the loops—that is to say, on the face of the fabric—while, on the other hand, the remaining half of loop U is knit with the threads in the reverse position. The difference is produced by giving the two threads a half-twist in the region of the top of loop U, so that although the left foot of loop U carries its black thread on the face the right foot carries its white thread on the face. In this way wales  $t$ ,  $t'$ , and  $u$  are black and wale  $u'$  is white. This latter white wale  $u'$ , which is isolated from the white knitting, is the one which sets off from the rest of the stocking that part of the fabric which is knit with two threads simultaneously and gives the whole stocking a very neat and pleasing appearance. Somewhat the same effect may be obtained by causing the twist of the threads to occur at a different place. Thus if they be twisted between loops T and U the line of change will show two white wales set off by two black ones, as illustrated in Fig. 4, and so on; but I prefer to knit the fabric, as I have illustrated in Fig. 3, with a single white wale set off by three black ones.

Thus far I have described the construction and method of knitting the foot irrespective of the precise position of the sutures, merely describing them as occurring on opposite sides of the stocking. If the sutures are knit directly opposite each other, making the upper and lower portions of the splitfoot of equal width, the rest of the stocking may be knit in the usual way. There is, however, an objection to thus equally dividing the foot by reason of the fact that the suture is thereby



brought too high up on the side of the foot, so that when a low slipper is worn the white thread of the lower portion will be visible at the sides. In order to prevent this, I prefer to make the upper  $m m'$  of greater width than the lower  $n n'$ , thus throwing the sutures well down on the sides of the foot, and this is the form in which I have illustrated my improvement in Figs. 1 and 2. For example, if a stocking is knit on a machine having one hundred and eighty-four needles instead of employing ninety needles to form the upper and the same number to form the lower, with two suture-needles at each side, I employ, say, one hundred and four needles in knitting the upper, and seventy-six needles in knitting the lower, leaving two suture-needles at each side. I have inserted figures (representing the number of needles employed) on the diagram of Fig. 2, so that it will be seen that by such arrangement the upper portion passes down below the horizontal median line  $y y$  at both sides to the extent of six needles—i. e., six loops—after which it is followed by the two suture-needles. This method of manufacturing the foot renders necessary a change in the mode of manufacturing the rest of the stocking, which I will now describe.

In Fig. 1 round-and-round knitting with a black thread, whereby the leg of the stocking was formed, came to an end upon reaching the dotted line  $a a'$ . Here half of the needles—say ninety-two—were thrown out of action and reciprocation commenced for the purpose of knitting the heel-pocket on the remaining ninety-two needles. According to the ordinary method of knitting stockings the thread would at this point be changed to a heavy white thread capable of resisting the more severe wear to which the heel is subjected; but in making the stocking which I am now describing, with the lower portion of the splitfoot narrower than the upper, to change the thread at the line  $a' e'$  would be objectionable, because it would result in causing the line of division between the whole black and white knitting to take the irregular shape indicated in Fig. 1 by the line  $a' e' c' c e d$ . This produces an unsightly indentation at  $e' c'$ , which gives the stocking an awkward appearance. To prevent this, I depart from the ordinary method of knitting and proceed as follows: Upon reaching the line  $a' e' a'$ , where is begun the formation of the heel-pocket on the ninety-two active needles which form the fashioning set by reciprocation of the machine, I do not change the thread, but allow the narrowing process to proceed with the same thread with which the leg of the stocking was knit for so many courses as there are needles at each side between the horizontal median line  $y y$  and the upper edge of the suture—that is to say, according to the example which I have chosen I knit six courses with the black thread, thus reaching the line  $c' b$  before changing to the white thread by which the heel-pocket is to

be knit. Thereupon narrowing and widening are proceeded with in the usual way, except that the whole of the original fashioning set are not again thrown into operation; but the widening is brought to an end with six needles short at either side of the original set—that is, at the line  $c' b$ . Thereupon round-and-round knitting is proceeded with for the formation of the foot, and by spacing the changes of thread on the needles at the intervals as designated in Fig. 2 the edge of the suture  $c c'$  will be six loops below the line  $e e'$ , so as to form a practically continuous line  $c c' b$  with the change of color at the back of the heel. Speaking more accurately, it is the single white wale  $u$  which forms the precise continuation of the line  $c' b$ , so that the three black wales  $t, t'$ , and  $u$  are thrown out into the white territory. This I find is a neat and desirable arrangement; but of course the black thread may, if desired, be knit down two or three more courses below  $c' b$ , and thus the change at the back of the heel be made to correspond with wale  $t$ —that is, with the bottom instead of the top of the line of juncture. Upon completing the foot the toe-pocket D is knit in the usual way with a white thread and a fashioning set of ninety-two needles, the narrowing and widening being in this case of equal extent. Of course the number of needles between  $e$  and  $c$  may vary. I have named six because it is a convenient number and results in throwing the line of juncture sufficiently far down upon the side of the foot; but the number will necessarily vary according to the fineness of the knitting and other considerations. Likewise, although I have referred to two needles as the number upon which the suture is formed by interlapping of the threads this number may vary according to convenience.

Having thus described my invention, I claim—

1. A splitfoot stocking having a suture formed by interlapping the ends of the threads of the upper and lower parts of the foot for two or more loops, and twisting the lapping ends so that for part of the lap one thread forms the face of the fabric, and for another part the other thread, substantially as described.

2. A splitfoot stocking, having a suture at each side below the horizontal median line of the foot and having a heel-pocket, the top of the narrowed portion of which is knit with a thread corresponding to the upper part of the foot for substantially as many courses as there are loops between the suture and the horizontal median line, while the rest of the heel-pocket is knit with a thread corresponding to the lower part of the foot, substantially as described.

3. A splitfoot stocking, having a suture at each side below the horizontal median line of the foot and having a heel-pocket, the top of the narrowed portion of which is knit with a thread corresponding to the upper part of the



foot for substantially as many courses as there are loops between the suture and the horizontal median line, while the rest of the heel-pocket is knit with a thread corresponding  
5 to the lower part of the foot, and having its widened portion shorter than its narrowed portion by substantially as many courses as there are loops between the suture and the horizontal median line, substantially as de-  
10 scribed.

4. The improvement in the art of knitting bicolored hosiery with an unevenly-split foot, which consists in knitting the leg round and round with a colored thread; then knitting a  
15 few  $x$  courses of the narrowed part of the heel-pocket back and forth with the same thread; then knitting the rest of the heel-pocket back and forth with white thread, the widened part being  $x$  courses shorter than  
20 the narrowed part; then knitting the foot round and round with both threads in alternation; the white thread being thrown in on every course on one side at a point  $x$  needles

below the horizontal median line of the foot and knitting from that point around the bot- 25  
tom of the stocking to another point  $x$  needles below the horizontal median line on the other side, and being returned to the first point by floating across the inside of the stocking; and the colored thread being thrown in on every 30  
course at one side at a point some two or three needles lower down than the point where the white is thrown out, and knitting from that point around the top of the stocking to an- 35  
other point the same number of needles lower down than the point on the other side where the white thread was thrown in, and being re-  
turned to the first point by floating across the inside of the stocking; then knitting the toe-  
pocket; then removing the float-thread from 40  
the interior, substantially as described.

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Witnesses:

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