

(No Model.)

2 Sheets—Sheet 1.

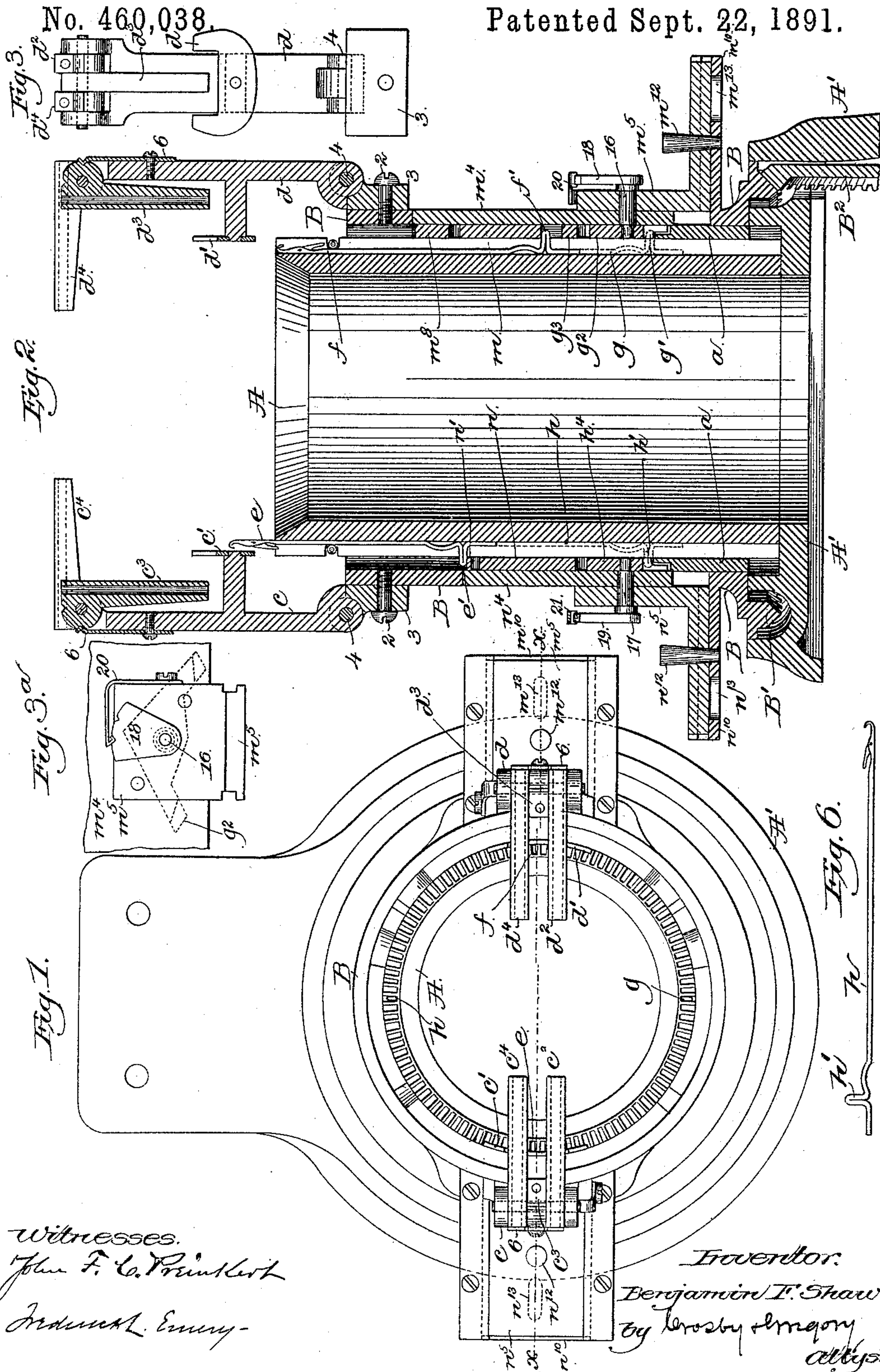
B. F. SHAW, Dec'd.

J. BUTLER, Executor.

CIRCULAR KNITTING MACHINE.

No. 460,038.

Patented Sept. 22, 1891.



Witnesses.
John F. C. Prinkert
Andrew L. Emery-

Inventor:
Benjamin F. Shaw
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attys.

(No Model.)

2 Sheets—Sheet 2.

B. F. SHAW, Dec'd.

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Fig. 4.

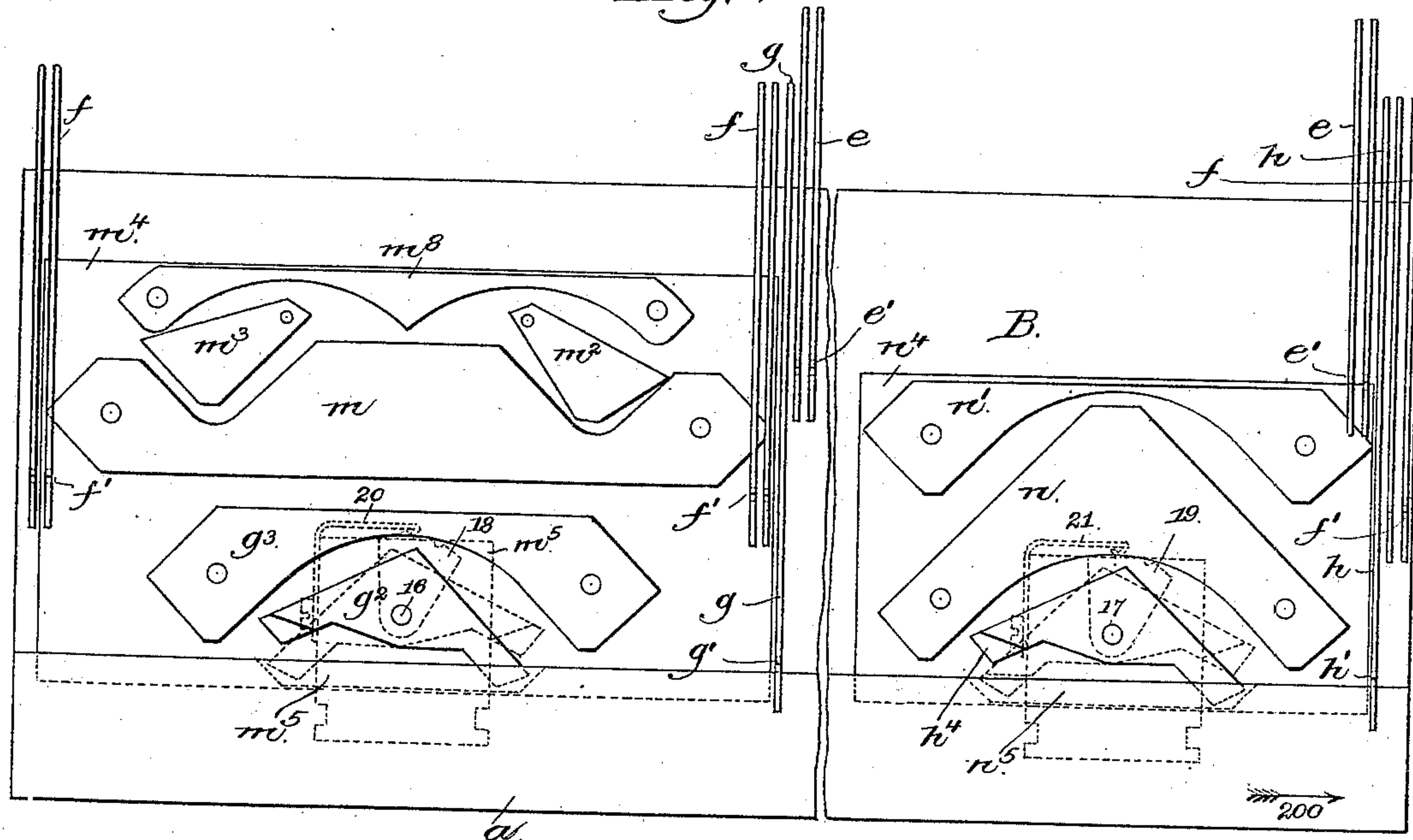
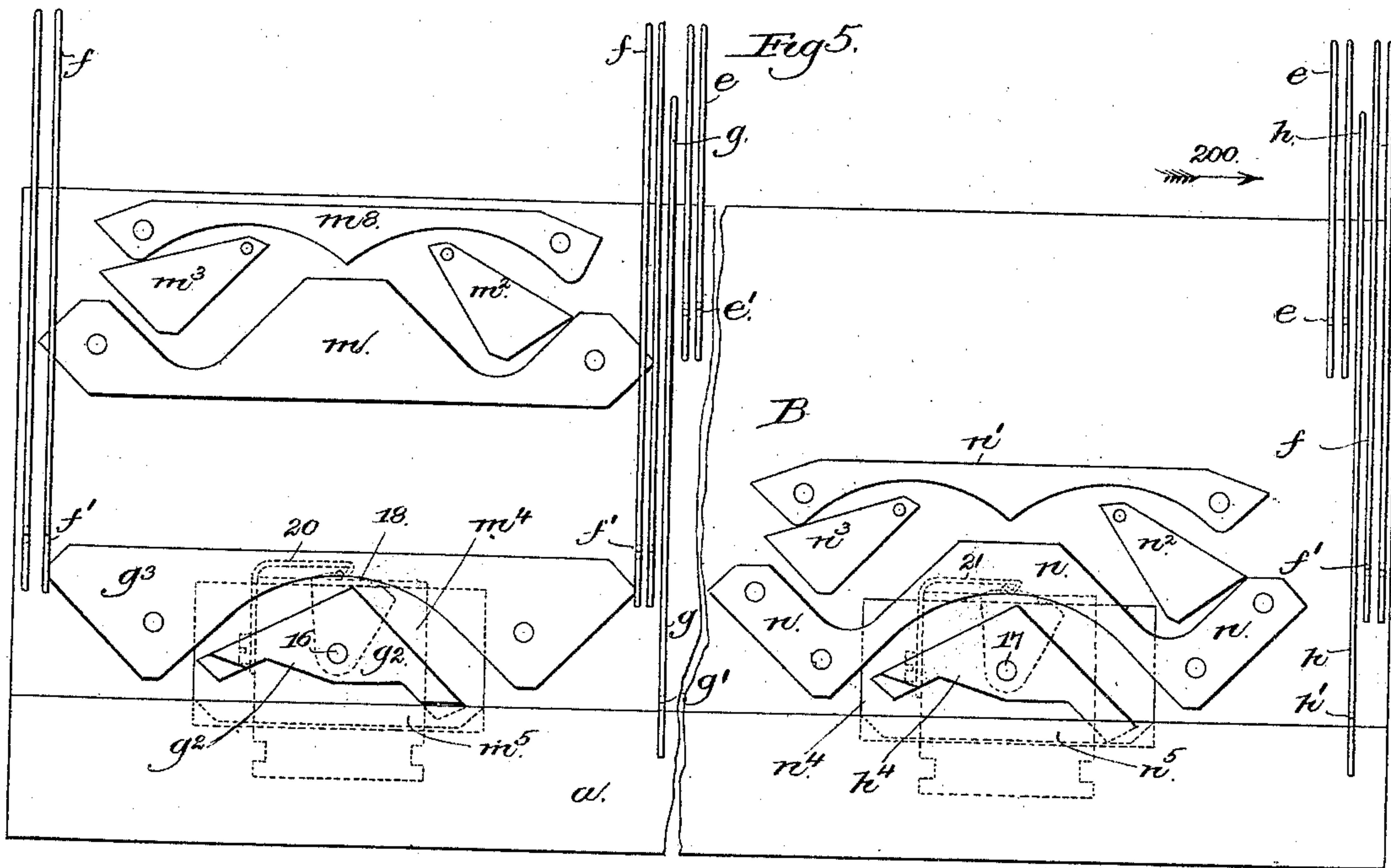


Fig. 5.



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UNITED STATES PATENT OFFICE.

BENJAMIN F. SHAW, OF LOWELL, MASSACHUSETTS; JOSIAH BUTLER,
EXECUTOR OF SAID BENJAMIN F. SHAW, DECEASED, ASSIGNOR TO
THE SHAW STOCKING COMPANY, OF SAME PLACE.

CIRCULAR-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 460,038, dated September 22, 1891.

Application filed December 9, 1889. Serial No. 333,113. (No model.)

To all whom it may concern:

Be it known that I, BENJAMIN F. SHAW, of Lowell, county of Middlesex, State of Massachusetts, have invented an Improvement in Circular-Knitting Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention has for its object the production of a novel knitting-machine for knitting stockings, wherein the leg is tubular and without seam, the front and the back of the leg being composed of independent yarns, the yarn in the back of the leg not appearing in the front of the leg, and vice versa, the said machine containing provisions whereby the stocking may, if desired, be made party-colored or striped, and whereby parts of the stocking may be narrowed and widened at desired points for the production of heel and toe.

My invention is embodied in a machine containing two series of needles, the hooks of which are so arranged in the grooves of a suitable bed, in conjunction with certain "suture-needles," as to enable the production of a tubular web, the said two series of needles being herein represented as of different lengths or having their butts located at different distances from their hooks, so that for brevity in this specification I shall denominate the said series of needles as "longer needles" and "shorter needles" and sometimes as "series-needles."

I have in this present embodiment of my invention arranged two series of needles in grooves of a circular bed so that the needles of one of the said series are disposed opposite the needles of the other series, the two series being in concentric arcs of a circle; but I desire to have it understood that the bed in which the said two series of needles are placed to be reciprocated, instead of being of the exact shape and style shown, may be of any other usual shape common in knitting-machines customarily used to knit a tubular fabric. Each series of needles has its own cam or actuator and one or more yarn-guides, and the cam-carrier—in this instance shown as cylindrical—is moved in one and then in the opposite direction, so that by the movement of

the said cam-carrier in either direction each of the cams carried by it traverses the butts of all of, but actuates only its own, series of needles. In addition to the two series of longer and shorter needles, the machine is provided with suture-needles, two such needles being shown in this embodiment of my invention, one suture-needle being placed between each of the opposing ends of the two series of longer needles and shorter needles, the said suture-needles having their butts at a distance from their hooks different from that of the butts of the needles of either of the two series of needles, so that they may be reciprocated by special cams or actuators, which will not reciprocate the series-needles.

The cams or actuators with which the cam-carrier is provided to reciprocate these suture-needles, and which do not actuate the longer and shorter needles, are such that the suture-needles are operated next after the last needle of the series-needles to make loops or stitches at the end of each half-circular course or stroke, and so that when the cam-carrier has its movement reversed or is traveling in the direction to commence the knitting of said half-circular courses of loops on the longer and the shorter needles, the said suture-needles are not acted upon or are not elevated, and the last needle in each of the two series of needles actuated in knitting the last previous courses is made the first needle to receive the yarn of the course to be commenced. These suture-needles, located, as described, between the opposing ends of the two series of needles described, so as with them to form a complete circle of needles, cooperate with the said two series of needles in such manner as to receive the yarns being fed to the said two series of needles and effect the interlooping successively of the two half-circular courses of loops knitted on the two series of needles; or, in other words, the suture-needles take the yarns fed to both sets of needles and make simultaneously at both sides of the needle-bed loops to join at their edges and make a single tubular fabric from what but for their interaction would be two separate flat fabrics.

In the machine herein described the su-

ture-needles have each a single butt and are operated each by a suture-cam, the said needles taking yarn and forming stitches only at that part of a stroke of the cam-carrier where the said cams leave the needles, and as a result thereof peculiar rows of stitches or wales are formed where the two sides knitted on the longer and shorter needles are interlooped at their edges, the said wales running longitudinally along each side of the stocking.

In another application, Serial No. 342,960, I have shown suture-needles of another construction, so operated that at the sutures there are twice as many loops as result from the operation of the construction herein described.

The machine may have a number of yarn-feeders for each series of needles, so that yarns of different colors or characters may be fed to the needles, as desired, and the machine will preferably be so constructed as to enable one series of needles to be used in knitting heels and toes while the other series is left inactive.

The needle-bed (herein shown as a hollow cylinder) will be removable to facilitate the running on of cuffs or rib-tops to which the stocking may be knitted.

The cams or actuators will be preferably so mounted, as will be described, as to enable them to be withdrawn from and returned into operative position in the cam-carrier whenever desired.

My invention is embodied in a knitting-machine having a needle-bed, two series of needles, intermediary suture-needles located between the said two series of needles and having their butts located at a distance from their hooks different from that of the butts of either of the series of needles, a cam or actuator carrier, cams or actuators to reciprocate the said two series of needles and the said suture-needles, means to reciprocate the said cam-carrier, and two yarn-delivery guides, each to supply one of the said series of needles with yarn, and not the other of the said series of needles, each yarn being, however, engaged at proper times by the suture-needles, substantially as will be described.

Other features in which my invention consists will be hereinafter described, and pointed out in the claims at the end of this specification.

Figure 1 is a top view or plan of a knitting-machine embodying my invention, the two suture-needles being indicated, and all but two of the needles of the two series of longer and shorter needles being omitted, the cam-carrier being shown as stopped with the longer needle cam or actuator under the butts of the shorter needles and with the shorter needle cam or actuator over the butts of the longer needles, as in Fig. 4; Fig. 2, a vertical section of the same in the irregular dotted line x , the said figure showing by dotted lines the two suture-needles with their butts below

the butts of the longer and shorter needles; but it will be understood that with the cam-carrier in the position indicated in Figs. 2, 4, and 5 the said suture-needles could not be seen in such section, for they are ninety degrees distant from the line x , Fig. 1; Fig. 3, an inward side view of one of the arms and thread-guides to be described. Fig. 3^a is a detail showing the outer side of the slide m^5 and notched plate and catch, (shown by dotted lines in Figs. 4 and 5,) together with part of the segment m^4 ; Fig. 4, a detail of the inner side of the cylindrical cam-carrier, the cams or actuators, and some of the longer and some of the shorter needles, and the suture-needles in the positions they will occupy with relation to the shown cams when disengaged by them, the needle-bed being wholly omitted. Fig. 5 is a similar view of a modification to be referred to, and Fig. 6 shows one of the suture-needles.

The needle-bed A is herein shown as a hollow cylinder; but instead of the particular form of needle-bed represented I may use any other form of bed commonly employed in knitting-machines for the production of tubular fabrics—as, for instance, a conical bed, as in United States Reissued Patent No. 2,419, dated December 18, 1866, or a circular flat bed, as in United States Patent No. 31,287, dated February 5, 1861. The needle-bed is set upon a foot-plate A', which also supports the cam-carrier B, (shown as a hollow cylinder,) provided at its lower end with a suitable gear B', of usual construction, which is engaged and driven by any usual bevel-gear B². (Partially shown in Fig. 2.) The cam-carrier has attached to it, as herein shown, by like screws 2 the feet 3 of two like arms c d , each jointed or hinged in suitable manner, as at 4, to its own foot, so that the said arms may stand upright, as in Figs. 1 and 2, or be turned on the joints 4 into substantially horizontal positions, when desired. The arm c has a yarn-delivery guide c' and three auxiliary feeders c^2 c^3 c^4 , each being herein represented as hinged and provided with a suitable spring, as 6, by which to retain it in elevated position, as indicated by the feeders c^2 c^4 , or down in working position, as indicated by the feeder c^3 . The yarn from the feeder left down next the delivery-guide c' will be led therefrom to the said guide c' , and the latter will present said yarn, whatever may be its color, size, or number, to the hooks of the longer needles f . The arm d has a yarn-delivery guide d' and three auxiliary feeders d^2 d^3 d^4 , like those of arm c , the guide d' supplying the yarn delivered to it to the hooks of the shorter needles e . The needles e , termed "shorter needles," have their butts e' located at such a distance from their hooks as to enable them to be acted upon by the shorter-needle cam or actuator, (shown at the left in Figs. 4 and 5,) while the series of needles f , having their butts f' at a greater distance from their hooks,

and consequently called "longer needles," are acted upon by the longer-needle cam or actuator. (Shown in detail at the right of Figs. 4 and 5.)

5 In the drawings the longer-needle cams or actuators are shown as having passed the series of longer needles and as having been stopped under the series of shorter needles, and the shorter-needle cams or actuators are shown as having passed the series of shorter needles, and as having been stopped opposite the series of longer needles, but above their butts. The suture-needles g h are located between the endmost needles of the series of longer and shorter needles, as best shown in Figs. 4 and 5, the said suture-needles being shown by dotted lines in Fig. 2. The suture-needle g constitutes the last needle to take a loop and make a stitch as the longer-needle cam or actuator leaves the longer-needles, and the suture-needle h is the last to receive yarn and make a stitch as the shorter-needle cam or actuator leaves the series of shorter needles when the machine is moved in the direction of the arrow 200, and vice versa when the machine is moved in the opposite direction.

In Fig. 4, which shows clearly the different cams or actuators used in the machine represented in Figs. 1 and 2, the shorter-needle cam at the left of the figure is represented as composed of a notched plate m , a top plate m^8 , and two pivoted blocks or tumblers m^2 m^3 .

35 The longer-needle cam in Fig. 4 is composed of an elevating-plate n and a depressing-plate n' .

When the cam-carrier B is given a movement in one direction and then in a reverse direction the shorter-needle cam passes the set of shorter needles e , acts on their butts and reciprocates them, and when completing its movement passes over some of the longer needles above their butts without actuating them, and at the same time the longer-needle cam crosses the series of longer needles and, engaging their butts, actuates the said longer needles, and in its further movement to complete its stroke passes under the butts of some of the shorter needles without actuating them.

50 Instead of the longer-needle cam being composed of the rigid parts n n' , as in Fig. 4, it may be composed of a notched plate, as n , a top plate n' , and two tumbler-cams n^2 n^3 , as at the right of Fig. 5.

The longer and shorter needle cams shown in Figs. 4 and 5 are all of usual shape or construction, and when in action they operate on the butts of the needles to reciprocate the needles, as in earlier knitting-machines; but instead of the particular longer-needle cams and the particular shorter-needle cams herein shown, I desire it to be understood that I may employ any other suitable cams commonly employed in machines for knitting a tubular web and capable of being reciprocated at times for shaping heels and toes. The par-

70 ticular forms of the said longer needle cams or actuators and the shorter needle cams or actuators are not of my invention, and there are a great variety of such cams shown in United States patents, any of which may be employed, and the longer-needle cams and the shorter-needle cams may be alike or be different from each other.

75 The drawings, Figs. 1, 2, and 4, show the longer-needle cam as secured to a movable segment n^4 , while the shorter-needle cam is secured to a movable segment m^4 , both segments fitting openings made in the cylindrical cam-carrier. The L-shaped slides m^5 n^5 have their feet fitted to slide in guideways m^{10} n^{10} , projecting from the cam-carrier horizontally, the said slides having locking devices m^{12} n^{12} , (shown as pins,) adapted to enter holes, as shown, or the slots m^{13} or n^{13} when the segments are to be withdrawn, the said locking devices preventing the withdrawal of the slides farther than necessary. I, however, desire it to be understood that instead of securing the said longer needle cam or actuator and the said shorter needle cam or actuator to the said segments, as in Figs. 2 and 4, they may be fixed in any usual manner to the inner side of the cam-carrier, as shown in Fig. 5, in which figure the suture-cams are shown as attached to segments m^5 n^5 ; but I prefer to fix the said cams to segments, as shown in Figs. 2 and 4, so that the longer-needle cam may be moved out of operative position when the shorter needles are to be used in knitting heels and toes, and so that the shorter-needle cam may be moved out of the way to facilitate the removal of the needle-bed with the needles therein for the application to the needles of the loops of a rib top or cuff.

Each suture-needle g h has a butt, as g' h' , and is actuated by both the suture cams or actuators, but not by the other cams or actuators. The two suture-cams are substantially alike, one being located below the shorter-needle cam and the other below the longer-needle cam. The suture-cam located below the shorter-needle cam m at the left in Figs. 4 and 5 and at the right in Fig. 2 is composed of a drawing-down plate, as g^3 , and of a tilting portion g^2 , fast on a rock-shaft 16, extended through the segmental plate m^4 and the slide m^5 , to the outside thereof, where the said rock-shaft is provided with a plate or arm 18, notched or shaped to be engaged by a yielding catch 20, made preferably as a spring secured to the said slide. The other suture-cam consists of a tilting cam h^4 and the lower edge of the cam-plate n , the tilting cam being connected to a rock-shaft 17, extended outwardly through the segment n^4 , and a slide n^5 , like the slide m^5 , the outer end of the said rock-shaft being provided with a notched arm, plate, or segment 19, acted upon and held frictionally in either of its two extreme positions by a spring 21, attached to the slide n^5 , the plates 19 and 18 and the springs 21 and 20 being alike.

Within the cam-carrier and at its lower end is a ring a , on which the butts of the suture-needles rest when down, the said ring below the projecting ends of the tilting portions of the suture-cams being cut away, so that that end of each tilting part which is to act on the butt of a suture-needle to lift it may descend into the space cut in the said ring a , as shown by the right-hand end of the said tilting part. (See Fig. 4.) The suture-cam containing the tilting part h^4 reciprocated the suture-needle g as it completed its stroke in the direction of the arrow 200, and at the same time the suture-cam containing the tilting part g^2 reciprocated the suture-needle h . On beginning the return stroke of the cam-carrier the elevated end of the tilting part h^4 of the suture-cam passes over the butt of the suture-needle g , and its depressed end striking against the said butt causes the cam to be tilted and turn the rock-shaft 17, to which it is attached, and with it the plate 19 until the spring-catch 21 enters the other notch in the said plate. At the same time the butt of the suture-needle h performs the same function for the other suture-cam having the tilting part g^2 . These suture-cams, each respectively rocked by the butt of the needle which it is not to lift, thus have their leading ends lowered, so that when the said suture-cams arrive at the suture-needles they are to act upon and lift, the leading ends of the said cams will pass under the butts of the suture-needles and cause them to knit. These suture-cams, like the shorter and longer needle cams, will preferably be attached to movable segments of the cam-carrier, so as to be withdrawable from operative position, Fig. 3^a showing a suture-cam and part of a segment.

To remove the needle-bed for applying a rib-top in the construction shown in Fig. 4, the cam-carrier is stopped in position, so that the butts of the shorter needles are over the the longer-needle cams. The cams are then to be withdrawn, whereupon the needle-cylinder with its needles therein may be removed. After applying the ribbed top to the needles in the usual way in the construction shown in Fig. 4, the needle-bed is returned to the machine. The actuating-cams are next returned into operative position, the yarn-guides are brought into position to deliver yarn to the needles, one of the three auxiliary feeders of each upright c d being down in working position and supplied with yarn from any usual slack yarn take-up—such, for instance, as in United States Patent No. 123,687, dated February 13, 1872—when the knitting is proceeded with by reciprocating the cam-carrier.

To remove the needle-bed for applying a rib-top in the construction shown in Fig. 5, the cam-carrier is stopped in position stated as for Fig. 4., the shorter and longer needles are pulled up by hand out of range of their respective cams, and the cam-carrier given half a revolution. The needle-bed may now

be lifted out. After applying the rib-top in the usual way in the construction shown in Fig. 5, the needle-bed is returned to the machine, the cam-carrier given half a revolution, the needles pushed down into position to have their butts acted upon by their respective cams, when, yarn having been supplied as described in the case of Fig. 4, knitting may be proceeded with. As the machine is turned in one direction, the suture-cams engage the butts of the suture-needles and raise them so as to take yarn, and as these suture-cams are in a vertical line with the knitting-cams above them it follows that the path taken by each suture-needle in its descent will be the same as that taken by the needles of the respective series of longer or shorter needles, and consequently the thread-guides will deliver yarn to all of them in the same manner. As the longer and shorter needle-cams in their reciprocations leave their respective series of longer or shorter needles, each suture-needle is acted upon by a suture-cam, (the leading end of the tilting part then being down,) so that said suture-needle is the last needle lifted at that stroke of the cam-carrier, and consequently it is the last needle to take yarn and form a stitch. Upon reversal of the movement of the cam-carrier the elevated ends of the tilting parts of the suture-cams pass each over the butt of a suture-needle and the under side of each suture-cam comes in contact with the upper side of the butt of the suture-needle which was raised and lowered during the preceding stroke of the cam-carrier, and the suture-needles are not lifted and do not at such time take yarn; or, in other words, the suture-needles act only at the end of the stroke and not at the commencement of the stroke of the cam-carrier. It will be noticed that with this construction the last stitch of each course knitted on each series of needles is made by the suture-needle, and that the first stitch of the next course is made by the needle next after the suture-needle in the direction of movement of the cam-carrier, and that the suture-needles form only one stitch each for each half-circular course knitted.

If it is desired to make a stocking with a leg and upper half of foot striped, say red and drab yarn, and the heel, toe, and sole of a different color, say of brown yarn, an auxiliary feeder on each arm c and d will be supplied with yarn, as follows, viz: c^3 and d^3 will be supplied with drab, c^4 and d^4 with red, and c^2 and d^2 with brown yarn. When the auxiliary feeders are down, as shown by the feeders c^3 d^3 , they feed the yarn to the needles through the main delivery-guides c' and d' and do not supply yarn to the needles when turned up, as shown by the feeders c^2 , c^4 , d^2 , and d^4 . After say eight courses have been knitted from the drab yarn supplied by the feeders c^3 and d^3 and it is desired to change the color to red, the feeders c^4 and d^4 are swung into position and the feeders c^3 and d^3 are swung out of position. If two courses of red are desired,

the cam-carrier is moved back and forth to knit that number, when the guides are again changed and drab knit as before for the desired number of courses. This may be repeated until the point is reached at which it is desired to make the heel. If this is to be made of the brown yarn, the feeder of the guide for supplying yarn to the shorter needles having that color is brought into position and all the other auxiliary feeders swung out of position. The longer-needle cam and suture-cams in the construction Fig. 4, are then moved out of operative position and the heel is knitted in the usual way by narrowing and widening, or in any other convenient way, the suture-needles and the longer needles being then out of action. At the completion of the last course of the heel the said cams are again moved into actuating position. If the sole is to be made of the same color as the heel, then the feeder used in knitting the heel can remain in the same position during the knitting of the foot, it only being necessary to alternate the feeders for supplying yarn to the needles on which the instep is knitted, as in the operation of knitting the leg. After the desired length has been knitted for the foot, the cams for operating the longer and the suture needles are moved out of actuating position, as in knitting the heel, and the toe is knitted on the shorter needles.

The machine described may be used to knit the heel and toe of a stocking, as in United States Patent No. 64,154, dated April 23, 1867, or other usual heel. After a sufficient length of tubular fabric has been knitted on construction shown in Fig. 5 to form a leg, a heel may be knitted on either series of needles, the suture-cams being withdrawn, the series of needles not to be used in making the heel being lifted by hand until their butts are out of range of the series of cams for operating them. The heel, if the ordinary seamless one, is knitted by raising the needles one at a time out of range of the knitting-cams in narrowing, and returning them one at a time to the proper position to be engaged by the cams when widening, this being done by hand in the usual way. At the completion of the heel that series of needles not used during the making of the heel is returned to the proper position to be engaged by its cams, the suture-cams are returned, and the foot is knitted by reciprocating the cam-carrier, as in knitting the leg. At the completion of the foot the needles not to be used for the production of the toe are raised out of action, as in knitting the heel, the suture-cams are withdrawn, and the toe is knitted in the usual way. It will be noticed that the heel or toe may be made on either series of needles, and that the heel may be made on one series and the toe on the other, when it is desired to make them that way.

I have used the terms "longer" and "shorter" needles to aid in describing the construction and operation of the parts of my new machine; but in the claims I shall use the term "two series of needles," thereby meaning the series of needles *e* and *f*, adapted to be actuated separately, each by its own proper cam or needle actuator.

I do not desire to limit my invention herein contained to the exact form of suture-needle shown, nor to the exact location of their butts with relation to the two series of needles with which they co-operate to join the webs produced thereon, as the gist of my invention herein contained lies in such a construction of suture-needles that they are operated at one stroke of the cam-carrier and not at the return stroke thereof, as described.

I claim—

1. A knitting-machine containing the following specified instrumentalities: a needle-bed, two series or ranks of needles, intermediary suture-needles interacting between said two series, substantially as and to the effect described, combined with needle-actuators to operate said two series of needles, needle-actuators to operate said suture-needles, two yarn-supplying guides, and means for application of motive power, substantially as described.

2. A needle-bed, a series of shorter needles, a series of longer needles, intermediary suture-needles located between the said series of longer and shorter needles and having their butts located at a distance from their hooks different from the distance of the butts upon the longer or shorter needles, and two yarn-delivery guides, one for each series of longer and shorter needles, combined with a cam-carrier, a longer needle cam or actuator, a shorter needle cam or actuator, independent cams or actuators to actuate the said suture-needles, and means to reciprocate the said cam-carrier, substantially as described.

3. A knitting-machine containing the following instrumentalities, viz: a needle-bed, two series of needles, intermediary suture-needles located between the said two series of needles, combined with independent needle-actuators to actuate the said two series of needles and the said suture-needles, two yarn-delivery guides to supply yarns, each to one of the said series of needles and to the suture-needles, as described, and auxiliary feeders co-operating with each of the said yarn-delivery guides and adapted to supply them with yarn, 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:

MARTIN L. HAMBLET,
CHAS. F. LIBBY.