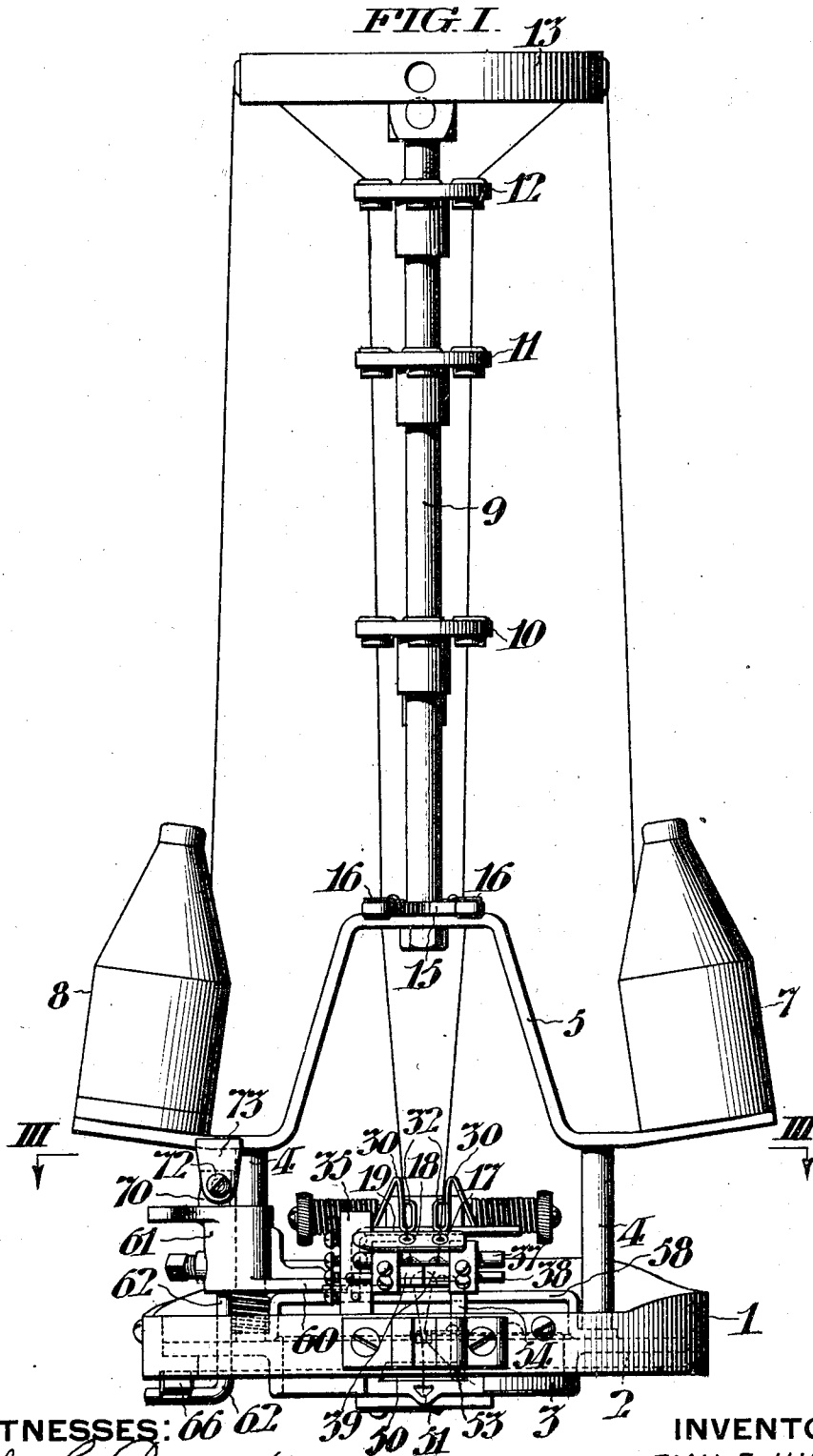


1,023,311.

Patented Apr. 16, 1912.

3 SHEETS—SHEET 1.



WITNESSES: 66 62 39 30 31 53 3

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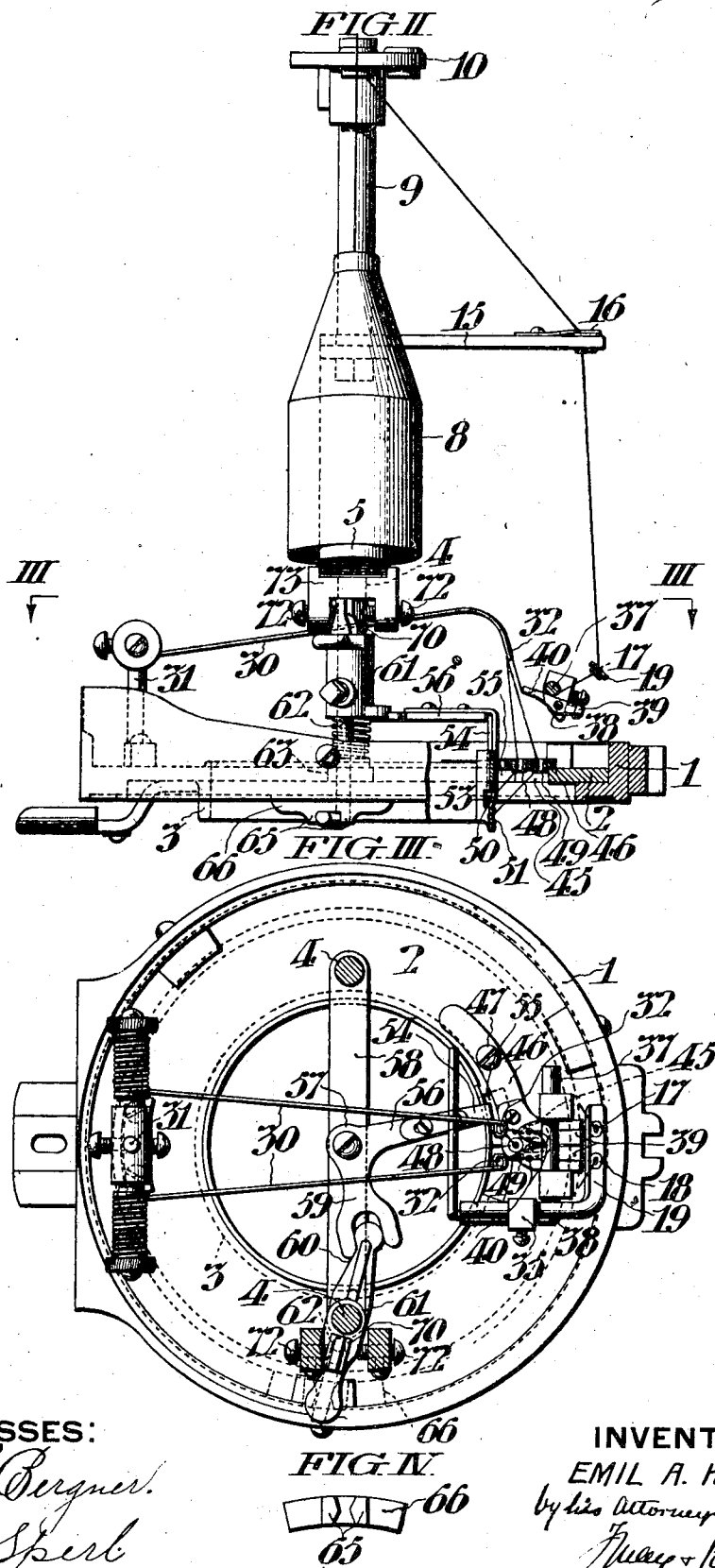
E. A. HIRNER.
PLATING DEVICE.

APPLICATION FILED FEB. 15, 1907.

Patented Apr. 16, 1912.

3 SHEETS-SHEET 2.

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1,023,311.

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3 SHEETS—SHEET 3.

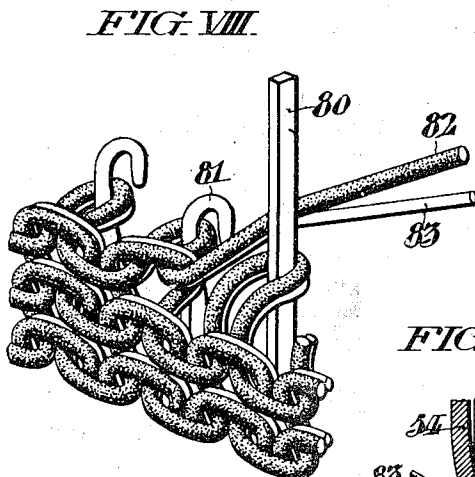
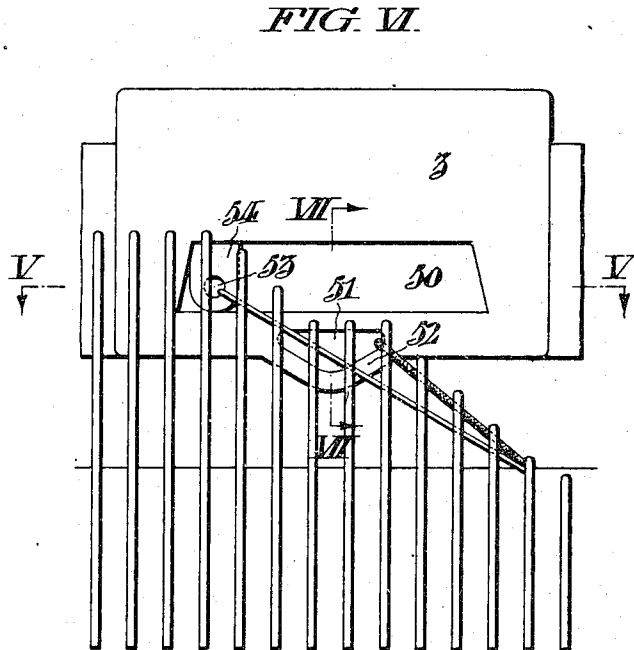
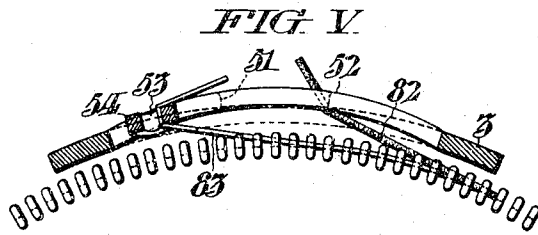
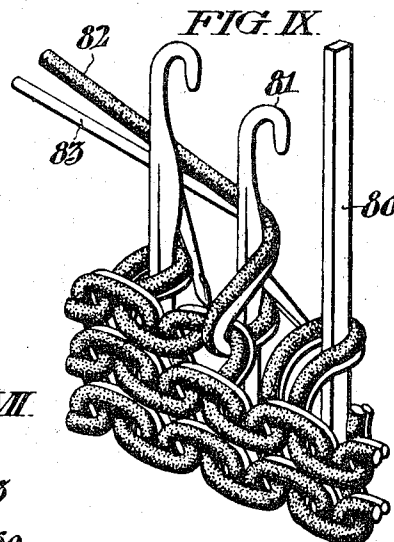
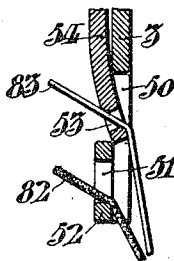


FIG. VII



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UNITED STATES PATENT OFFICE.

EMIL A. HIRNER, OF ALLENTOWN, PENNSYLVANIA.

PLATING DEVICE.

1,023,311.

Specification of Letters Patent.

Patented Apr. 16, 1912.

Application filed February 15, 1907. Serial No. 357,462.

To all whom it may concern:

Be it known that I, EMIL A. HIRNER, of Allentown, in the county of Lehigh and State of Pennsylvania, have invented certain new and useful Improvements in Plating Devices, whereof the following is a specification, reference being had to the accompanying drawings.

My invention relates to devices employed in circular knitting machines to perform the operation of plating, by which two yarns are simultaneously knit in the form of a web in such relation to each other that one yarn (called the plating yarn) is visible upon the face of the fabric, and the other yarn (called the body yarn) is visible upon the back of the fabric.

In ordinary latch needle machines the proper performance of the operation of plating is effected by so feeding the two yarns to the needles that one lies above the other on the hook of the needle, and maintaining this relation until the loop is cast off the needle. Various devices have been designed for the purpose of thus accurately feeding two yarns simultaneously to the needles in proper relation to each other, but great difficulty has been experienced in employing these devices in reciprocatory knitting on circular machines, for where the yarns return upon themselves at the end of each reciprocation, the alternation of the tensions and positions of the yarns consequent upon the reversal of the motion has the effect of disturbing the relation of the threads so as to often occasion a reversal of the threads during the plating operation, thus damaging the work.

My invention relates to means which may be applied to the ordinary circular stocking knitter. By means of my invention, when the machine is reciprocated the yarns are at all times accurately maintained and fed to the needles in their proper position for plating, notwithstanding variation in the number of needles in the fashioning set.

By the machine which I have described it is possible to knit a seamless stocking having heel and toe pockets fashioned by reciprocatory knitting with employment of the same body and plating yarn used during the knitting of the other parts of the stocking and with the maintenance of one yarn visible upon the face and the other yarn visible upon the back of the fabric as uniformly during the parts of the work which are knit

by reciprocation of the machine as in those during which the machine is rotated.

For the accurate performance of the plating operation, I have found that it is desirable that the plating yarn which is to lie within the hook of the needle below the body yarn, should be fed to the needle from an eye well in advance of the yarn guide through which the body yarn is being fed to the needle. In this way the angle at which the yarns respectively pass to the needles varies, the obliquity of the plating yarn being greater than that of the body yarn. To accomplish this, I employ a separate guide for each yarn, the guide for the body yarn being stationary, and preferably somewhat elongated, and the guide for the plating yarn being a yarn eye capable of receiving a reversed reciprocatory motion coincident with the change of motion of the knitting cylinder, so that while the knitting cylinder is rotating in one direction, the yarn eye which carries the plating yarn is in advance of the yarn guide for the body yarn, but, immediately the motion of the knitting cylinder is reversed, the eye for the plating yarn is thrown to the other side of the guide for the body yarn, so that during both directions in which the cylinder moves, the plating yarn eye is always in advance of the body yarn guide.

I will now describe my invention as applied to a stocking knitter, showing only such parts as are necessary for the proper comprehension of my invention, and with the understanding that the invention is not limited to any particular kind of knitting machine.

In the accompanying drawings, Figure I, is an elevation of a rotating latch guard with its yarn guide and supports and other adjunctive parts, such as may be conveniently superimposed upon the knitting cylinders of any ordinary circular knitting machine. Fig. II, is an elevation of the same as seen at right angles from Fig. I; the upper part of the yarn post being removed, and a portion of the latch guard being broken away and shown in section. Fig. III, is a plan view of the same with the yarn posts removed. Fig. IV, is a detail view of the slide-piece 66. Fig. V, is a detail view showing in plan section, the relation of the thread feeds to the needles. This section is indicated by the arrows V, V, in Fig. VI. Fig.

VI, is a fragmentary development of the parts shown in Fig. V, during rotary knitting. Fig. VII, is a fragmentary sectional view indicated by the arrows VII, VII, in

Fig. VI. Fig. VIII, shows the relative positions of the body and plating yarns at the completion of the first course of reciprocatory knitting. Fig. IX, is a similar view showing these relations at the beginning of the second reciprocatory course.

In the figures, 1, is an annular seat which is supported above the knitting cylinders. Within this seat an annular plate 2, is received and supported, rotating freely therein. The inner edge of this annular plate is prolonged downwardly as a flange to form the latch guard 3, which as usual in such machines is maintained in constant relation to the cam cylinder of the knitting machine. Mounted upon the plate 2, are posts 4, 4, which support a yoke 5, the projecting extremities of which carry the bobbins 7, and 8. Mounted centrally upon the yoke 5, is a yarn post 9, provided with successive collars 10, 11, 12, and 13, all pierced by yarn guiding eyes as common in the art. Projecting from the yoke 5, is the plate 15, containing two yarn eyes 16, located over the annular disk 2, in nearly vertical relation to the corresponding yarn eyes 17, and 18, which are set in an arm 19, adjustably supported in an upright post 35, mounted on the plate 2. The post 35, further supports the horizontal pins 37, and 38, the latter of which carries the swinging yarn locks 39, through the ends of which eyes 40, are pierced. On the other side of the annular plate 2, is set a post 31, carrying the long spring tension arms 30, with eyes 32, at their extremities which when pulled down are in proximity to the eyes 40.

In addition to the parts thus shown and described, I may employ a tension equalizing device, which is ordinarily interposed between the yarn eyes 16, and the yarn eyes 17, and 18. Such a tension equalizing device is shown and described in Letters Patent of the United States No. 911,656, issued to me under date of February 9th, 1909, but as this forms no essential part of my present invention, and as other devices may be employed, I have not shown or described the same in this application.

Beneath the yarn guiding members thus far described, the annular plate 2, has a slot 45, of indefinite size cut within it and over this lies attached to the plate a small supplemental plate 46, the exact position of which in relation to the plate 2, is capable of adjustment by the screw 47. The plate 46, has two yarn guiding eyes 48, and 49, the former of which is nearer the axis of the machine than the latter.

The latch guard 3, in the region where the yarn is fed to the needles is provided

with two apertures, the uppermost an elongated horizontal slot 50, and the lowermost a yarn guide 51. The two are separated by a suitable interval, and the lower edge 52, of the latch guard is projected slightly downward to surround the yarn guide 51, as shown in Figs. V, and VII, for reasons which will be explained later. Immediately behind the slotted opening 50, is an oscillating yarn finger 54, which plays within a circumferential slot 55, and whose lower end is curved, so as to project its terminal yarn eye 53, forward into the said opening as best seen in Fig. VII. This finger is adjustably attached to one arm 56, of a bell crank lever 57, which is pivoted to the bridge 58, and which unites the posts 4. The other arm 59, of this bell crank lever forms a yoke which grasps the rounded extremity of an arm 60, formed upon the collar 61, which surrounds one of the posts 4. Upon the side opposite to this arm the collar 61, carries a vertical pin 62, the lower end of which reaches down through a slot 63, in the annular plate 2, and is at its lower end turned outwardly so as to be received between two lugs 65, 65, on the lower side of a slide piece 66, which runs with slight friction in a circular groove cut in the lower side of the seat 1. The inner opposing edges of these lugs 65, are beveled in relation to each other as shown in Fig. IV. The collar 61, is also provided with an upwardly extending arm 70, upon the side opposite to the arm 60. The collar is free to rotate upon the post 4, but this rotation is limited in each direction by the contact of the arm 70, with the screws 72, opposed to each other and set within a saddle piece 73, attached to one end of the yoke 5.

The bobbin 7, carries the plating yarn which passes from the bobbin up to an eye in the collar 13, thence down through eyes in the collars 12, 11, and 10, to the eye 16, from thence it passes to the eye 17, through the eye in the yarn lock, through the eye 32, of the spring tension, and thence down through the eye 48, to the eye 53, in the extremity of the oscillating yarn finger 54, from whence it is fed to the needles. The bobbin 8, carries the body yarn, which pursues a similar course through the eyes in the collars 13, 12, 11, and 10, the plate 15, and after passing through the eye 18, and the eyes in the yarn lock and spring tension passes to the eye 49, and from thence is led to the eye 51, which constitutes the yarn guide for the body yarn by which it is fed to the needles.

When the knitting machine is rotating for the production of tubular knitting the parts remain in the relation in which they are shown in Figs. I, to VI, of the drawings, the yarn finger 54, being situated at the leading extremity of the slot 50, and feed-

ing the plating yarn to the needle from an eye which leads the yarn guide 51; but upon the commencement of reciprocation a reversal of these parts takes place, for when the annular plate 2, starts its reversal the collar 61, rocks as far as it is permitted to do so, by the movement of the pin 62, between the lugs 65, the extent of its motion being limited as described. This motion of the arm occasions a corresponding throw of the arm 60, which is communicated to the bell crank lever 57, and therefore to the depending yarn finger which carries the plating yarn, thus occasioning the immediate throwing of the finger to the other end of the slot 50, so that immediately upon each reversal of the reciprocating plate 2, this finger is thrown to the leading or advancing end of the slot. Furthermore, the play of the finger across the slot 50, is sufficiently great to carry the yarn eye at each extremity of its motion sufficiently far in advance of the yarn guide 51, to compel the yarns to travel to the needles at distinct angles, whereby their complete separation is maintained and the possibility of entanglement avoided. It will be observed that the yarn guide 51, is not a mere circular eye, but a horizontal slot having its lower edge depressed centrally. This shape is functionally important.

As the parts travel back, as soon as the yarn guide reaches the end needle of the fashioning set of needles, where the yarn ends the web, the body yarn is drawn to the following end of the yarn guide, thus a separation between the yarns is effected, just at the most critical time, for it is along the suture formed upon the lines of the fashioning needles that reversal of the yarns often accidentally takes place. By observing the position of the yarns in the figures, and especially in Figs. V, VI, and VII, it will be observed that during this critical movement the yarns are maintained well separated, so that no contact between them occurs, nor do they approach near enough for the projecting fuzz of the one to become entangled in the fuzz of the other, a cause which frequently occasions reversal of the yarns.

It should be borne in mind that in mechanism of this type, the needle actuating cams occupy approximately one-half of the inner periphery of the cam cylinder, and therefore to permit reversing during reciprocatory knitting, this portion of the cam cylinder must first be rotated until all of its cams have cleared the fashioning set of needles. This, as is well known in the art, requires a complete revolution of the machine, for each reciprocatory course, no matter how small a number the fashioning set may be reduced to. It will be seen that the throwing of the yarn eye 53, to the other

extremity of its oscillatory motion, occurs before actual feeding of the yarn from its eye to the needles takes place. In Figs. VIII, and IX, the first needle of the series which is idle during reciprocatory knitting, is designated by the numeral 80, and the first active or fashioning needle by 81. The shaded thread 82, represents the body yarn, and 83, the plating yarn. After the completion of the first reciprocatory course, (Fig. VIII), continued rotation of the machine causes the threads to wrap themselves against the shanks of the needles of the idle series, until the full rotation of the machine is completed. As soon as rotation in the reverse direction takes place, the relative position of the thread feeds are changed, the arms 30, maintaining the yarns taut at all times. Continued rotation of the machine causes the threads to be twisted about the first needle of the fashioning set, as shown in Fig. IX, without the slightest alternation of the relative position of the threads, that is with the body yarn always above the plating yarn, so that the plating yarn appears upon the face of the fabric during the selvege or suture, as well as during all other parts of the knitting operation.

Having thus described my invention, I claim:—

1. In a circular knitting machine, the elements of which have capacity for both rotary and reciprocatory knitting, a yarn guide by which a body yarn is fed continuously to the needles; an oscillating yarn eye, the yarn feeding portion of which is so related in position to the first mentioned yarn guide that at either extremity of its oscillation it feeds a plating yarn to the needles in such relation to the body yarn that said plating yarn lies on the shank of each needle immediately below the body yarn; and means for so oscillating said yarn eye, in relation to the body yarn guide during reciprocatory knitting as to cause said yarn eye to always lead the yarn guide sufficiently to compel the yarns to travel to the needles at distinct angles.

2. In a circular stocking knitter, a yarn guide by which a body yarn is fed continuously to the needles; a yarn eye oscillating in a horizontal plane above that of the yarn guide; means for feeding a plating yarn through the oscillating yarn eye to the needles; and means whereby the oscillation of said yarn eye is so timed during reciprocatory knitting as to always feed to the needles from a point sufficiently in advance of the yarn guide to throw the plating yarn onto the shank of the needle below the body yarn, so that it is knit into the face of the fabric.

3. In a circular stocking knitter, a yarn guide for a body yarn; an oscillating finger; a second yarn eye for the plating yarn car-

ried by said oscillating finger; means for causing said finger to oscillate above the yarn guide an equal distance from one side of it, to the other, under control of the reciprocation of the needle cylinder, whereby
5 at each change of reciprocation said oscillating finger is thrown to the advance extremities of its range of motion.

4. In a stocking knitter, means for simultaneously feeding two yarns to the needles
10 for the knitting of plated fabric, in combination with guiding means for feeding said yarns to the needles, said guiding means for the plating yarn comprising a horizontally

oscillating finger, and the guiding means for the body yarn consisting of an eye situated below the plane in which the finger oscillates and centrally between the extremities of its oscillation.

In testimony whereof, I have hereunto signed my name, at Philadelphia in the State of Pennsylvania this thirtieth day of January, 1907.

EMIL A. HIRNER.

Witnesses:

JAMES H. BELL,
E. L. FULLERTON.