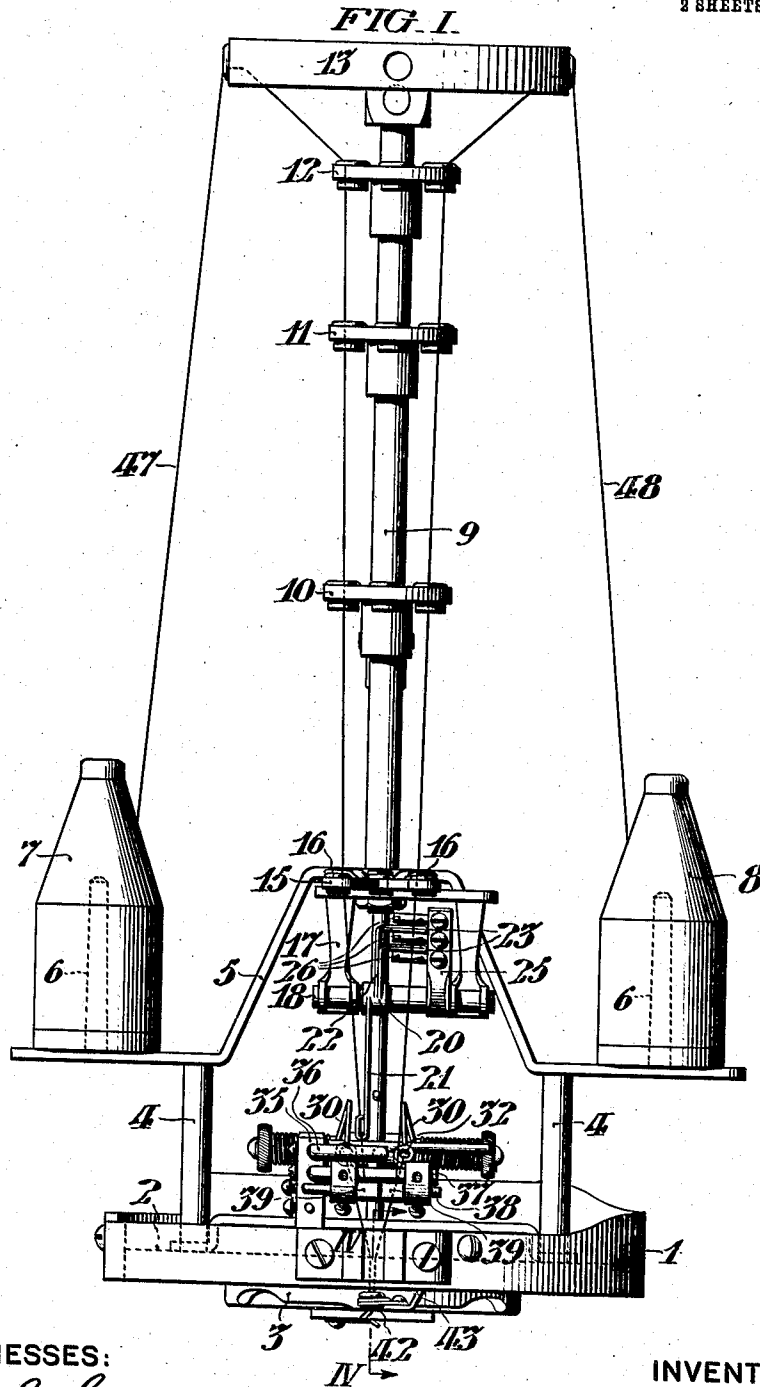


E. A. HIRNER.
 PLATING DEVICE FOR KNITTING MACHINES.
 APPLICATION FILED APR. 17, 1906.

911,656.

Patented Feb. 9, 1909.
 2 SHEETS—SHEET 1.



WITNESSES:

Clifton C. Halliwell
John C. Berger.

INVENTOR:

EMIL A. HIRNER,
by his Attorneys
Paige Paul & Tracy

E. A. HIRNER.
 PLATING DEVICE FOR KNITTING MACHINES.
 APPLICATION FILED APR. 17, 1906.

911,656.

Patented Feb. 9, 1909.

2 SHEETS—SHEET 2.

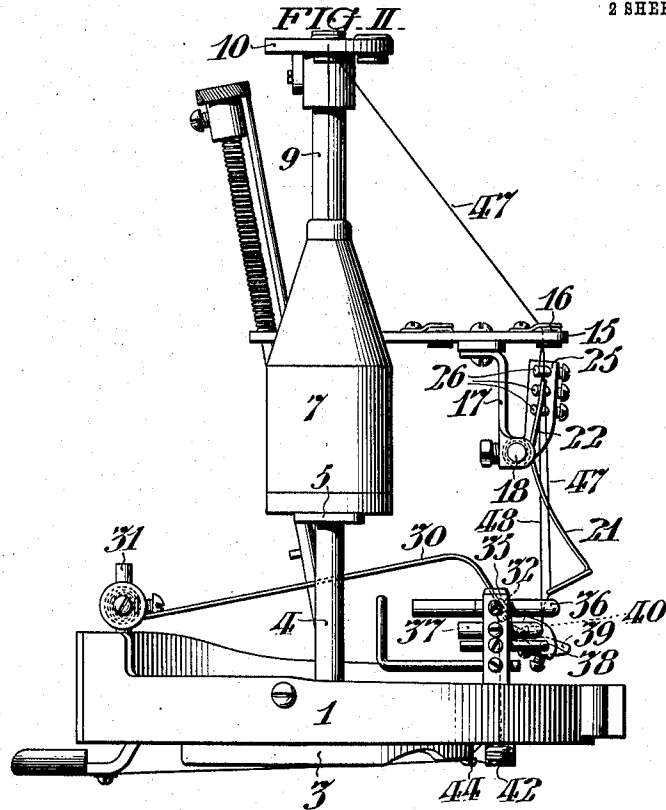


FIG. III.

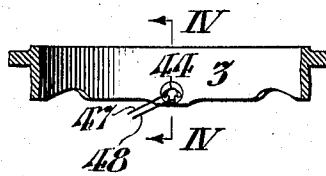


FIG. V.

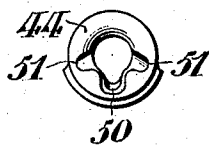


FIG. VI.

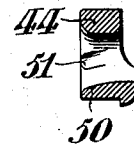
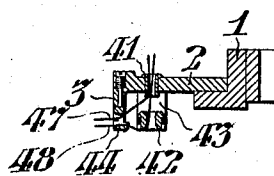


FIG. IV.



WITNESSES:

Clifton C. Holloway
John C. Berger

INVENTOR:

EMIL A. HIRNER,
by his attorneys
Riggs, Paul & Tracy

UNITED STATES PATENT OFFICE.

EMIL A. HIRNER, OF ALLENTOWN, PENNSYLVANIA, ASSIGNOR TO NOVELTY HOSIERY COMPANY, A CORPORATION OF PENNSYLVANIA.

PLATING DEVICE FOR KNITTING-MACHINES.

No. 911,656.

Specification of Letters Patent.

Patented Feb. 9, 1909.

Application filed April 17, 1906. Serial No. 312,074.

To all whom it may concern:

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

My invention relates to devices adjunctive to circular knitting machines employed for the purpose of facilitating the operation of plating. In the knitting art the term "plating" is used to denote a method of knitting by which two yarns are simultaneously fed to and knit by the needles, with provision whereby the relation of the yarns to each other as they pass into the knitting operation is such that a predetermined yarn will be visible upon the face of the resulting fabric while the other yarn will be knit upon the back. In this way a knit fabric may be produced having uniformly a yarn of one color or character for its face, and a yarn of another color or character for its back. It is further common in plating devices to provide means whereby at predetermined intervals, the two yarns thus simultaneously fed to the fabric may be so manipulated as to invert the position of the yarns in the knitting. By thus employing yarns of different color and changing their relation to the knitting at predetermined intervals various patterns may be produced.

In plating devices hitherto known, difficulty is often experienced in constantly maintaining the proper relative position of the two yarns under the varying conditions and contingencies of the knitting operation. The yarn which forms the back of the fabric is called the body yarn, and that which goes to the face of the fabric is called the plating yarn, and in the ordinary knitting machines plating is usually accomplished by so feeding the yarns that the plating yarn passes into the hook of the needle simultaneously with but underneath the body yarn.

By reason of there being no room for special manipulation of the yarns between the yarn guide through which both yarns pass and the needles, it frequently occurs in practice that, without any apparent reason therefor, the two yarns will reverse their positions, throwing the wrong yarn to the face of the fabric and producing flaws in the work. This unintentional reversal of the yarns is

usually due to accidental, but almost inevitable, changes of tension. For example yarn will occasionally catch as it reels off a bobbin; and there is a difference between the tension with which the yarn reels off a new bobbin and off one partially unreel. These and many other unavoidable causes well known to knitters result in variations of the tension of the yarns, and notwithstanding the use of delicately adjusted tension arms, and the other well known devices, these accidental variations of tension are sufficient to frequently cause the plating operation to be defective.

My invention relates to certain means which I have devised whereby I have overcome this difficulty, and am able under all conditions ordinarily occurring in practice to maintain constant the relation of the threads during the knitting operation and their proper relative tensions.

My invention includes means which I have devised whereby the proper relation of the plating yarn and body yarn may be maintained, not only during ordinary circular or full knitting, but during what is known as reciprocatory knitting. It is a common feature in all stocking knitters, and in some other forms of circular knitting machines, that the machine after knitting a continuous tube by rotation of the parts, ceases temporarily to thus operate and proceeds to knit for a time by a motion of reciprocation of the same parts, the most common instance of this being the formation of the heel and toe pockets in the knitting of stockings. In the ordinary stocking knitter it has hitherto been found impossible to so maintain the relative position of two yarns as that they will be fed in the same relation to the needles when the machine is reciprocating, because at the end of each stroke the reversal of the motion tends to invert the position of the threads. According to my present invention, I have by a very simple device entirely overcome this difficulty, and am enabled to plate as accurately during reciprocatory knitting as during rotary knitting. In this way I am enabled to knit an entire stocking including the heel and toe pockets of two yarns, constantly maintaining one thread upon the face of the fabric and another thread upon the back.

I will now describe my invention with reference to the accompanying drawings.

which show a convenient embodiment of my inventive idea; but it will be understood that in thus describing this form of my invention I am not describing the only form which it is capable of assuming, and that the only limitations which are to be imposed upon the definition of the invention are those which will be found in the claims appended to this specification.

10 In the accompanying drawings, Figure I, is an elevation of a rotating latch guard with its thread guide and supports and their adjunctive parts, such as may be conveniently superimposed upon the knitting cylinders of any ordinary circular knitting machines. 15 Fig. II, is an elevation of the lower half of the same parts shown in Fig. I, but viewed from a point at right angles to that from which Fig. I, is taken. Fig III, is a detailed view partly in section showing that portion 20 of the latch guard which carries the main yarn guide. Fig. IV, is a section of the same taken along the line IV, IV, in Figs. I, and III. Fig. V, is an enlarged view of the 25 main yarn guide, and Fig. VI, is a section of the same.

In the figures, 1, is a ring shaped seat which is supported above the knitting cylinders. Within this seat is received an annular plate 2, rotating freely upon the seat. 30 The inner edge of this annular plate is prolonged downward as a flange to form the latch guard 3. In ordinary practice the above parts are so related to the knitting cylinders as to maintain the latch guard in 35 constant relation to the cam cylinder of the knitting machine, irrespective of whether the machine be of that class where the cam cylinder rotates, or of that class where the 40 knitting cylinder rotates. For the purpose merely of more convenient description I will speak of the plate 2, and its latch guard as though it rotated around the needles. Mounted upon the annular plate 2, are two 45 opposed posts 4, 4, which support a yoke 5, provided with supports 6, 6, carrying the bobbins 7, and 8. Mounted centrally upon the yoke is a post 9, provided with successive collars 10, 11, 12, and 13, all pierced by yarn 50 guiding eyes as common in the art. Projecting from the yoke 5, is the plate 15, containing the eyes 16, which are by it supported over the annular disk 2, in nearly vertical relation to the tension devices about to be 55 described.

The plate 15, carries a depending bracket 17, with a short horizontal shaft 18, mounted therein. Upon this shaft rotates the collar 20, carrying the two arms of which the arm 60 21, is a more or less vertical yarn tension arm, while the other arm 22, projects in the opposite direction and is provided at its extremity with horizontal fingers 23, 23. Fixedly set upon the shaft 18, is an upright 25, 65 also carrying horizontal fingers 26. The re-

lation of these parts is such that the fingers 23, play between the intervals of the fingers 26, without coming in contact therewith.

Beneath the parts just described the plate 2, supports a multiple yarn tension device of 70 any convenient description. In the drawings I have shown the long spring tension arms 30, supported by a post 31, and carrying the eyes 32, at their extremities; and near the free ends of these arms an upright 75 35 is mounted on the plate 2, carrying the guide wire 36, and two horizontal pins 37, and 38. The pin 38, carries the slightly over-weighted tension blocks 39, through the ends of which eyes 40, are pierced. Beneath these 80 tension devices the annular plate 2, is pierced by a vertical eye 41, (seen in section in Fig. IV), below this eye is a second vertical eye 42, supported substantially in line therewith by an adjustable bracket arm 43. The eye 42, 85 is slightly below the level of and immediately adjacent to the main yarn guide 44, which pierces the latch guard and leads the thread directly into the hooks of the needles.

Of the parts thus described the more im- 90 portant portions for the purpose of my invention are the tension equalizer and the lower yarn eye 42. The latter maintains a separation of the yarns as they pass through the yarn guide. The tension equalizer operates 95 by the coaction of the tension arm 21, mounted on the shaft 18, and the alternating fingers 23, and 26, and for the purpose of understanding its method of operation the course of the threads must be traced. 100

The bobbin 7, carries the body yarn 47, which after passing through successive yarn eyes carried by the collars on the post 9, runs through the corresponding eye 16, of plate 15, and then passes through the terminal 105 loop of the tension arm 21. From thence it passes through the ordinary tension device, that is down under the pin 37, back over block 39, down through its eye 40, through tension eye 32, and thence down through the eye 41, in plate 2, from whence it is led directly to the main yarn guide 44, assuming a position near the top thereof, as seen more clearly in Fig. IV. The yarn 48, on the 110 other hand, which is to constitute the plating yarn, and which is to be knit on the face of the fabric, is led from the bobbin 8, through a succession of eyes as above, but, after passing through the eye 16, it runs between the fingers 23, on the one side and the fingers 26, 120 on the other. Thence it passes down through the tension device in precisely a similar manner to the other thread, and passes down with the other thread through the eye 41, but instead of passing directly to 125 the yarn guide 44, it is led down through the supplemental eye 42, and thereby caused to assume a lower position in the guide 44, than the other thread as more clearly appears in Fig. IV. The operation of this tension 130

equalizer depends upon the relative position of the tension arm 21, and the finger arm 22. This must be adjusted so that yarn 47, when running under the normal tension, will be drawn by arm 21, slightly out of its vertical run, with the result that the fingers 23, on the finger arm 22, are in such relation to the fixed fingers 26, that the thread 48, as it passes between them is subjected to but slight friction. But the moment that a slight increase of tension on yarn 47, draws in the arm 21, there is a change in the position of the fingers. In plating it is ordinarily necessary that the body yarn be subjected to a greater tension than the plating yarn, this tension tending to hold the body yarn in the uppermost position as it passes to the needles. But it is equally essential that any substantial increase in the tension of the body yarn should be accompanied by a corresponding increase in the tension of the plating yarn, and this is the function which my device accomplishes; for the adjustment between the parts thus described is such that any increase in the tension of the body yarn causing it to run more vertically out of the eye 16, draws in the tension arm 21, towards the center line of the machine and simultaneously, throws the fingers 23, forward so as to require the plating yarn 48, to intertwine more deeply between the fingers 23, and the fingers 26, instantly placing upon the plating yarn the required increase of tension. The devices which have been described are very delicate in their operation and I find that by means of them the slightest increased tension upon one yarn is immediately communicated to the other, so that the relative tension between the two yarns is always maintained constant irrespective of their absolute tensions. This is the important element in the successful practice of the plating operation.

In referring in the claims to parts of my tension equalizing device I will speak of the arm 21, as a tension arm by which I mean that it is a tension device, the position of which is dependent upon the degree of tension under which the yarn runs through its eye, but it will be understood that this tension arm is capable of great variation of form. Likewise I will speak of the parts which include the arm 22, with its fingers 23, and the corresponding fixed fingers 26, as a friction device. This it will be understood is composed of a fixed and movable part (or it might be two movable parts), the motion of which is dependent upon the motion of the tension arm 21, so that the degree of friction imposed upon the yarn which passes through the friction device is dependent upon the tension of the yarn which runs through the tension arm, but the form of these devices may be much varied, it not being essential that the alternating fingers

be employed for causing the intertwining of the thread, as other well known means of imparting friction to a running yarn may be employed.

I will now describe that part of my invention which has especial reference to the proper maintenance of the relative position of the yarns during reciprocatory knitting. This consists in the peculiar configuration of the main yarn guide 44, as shown in enlarged detail in Figs. V, and VI. This yarn guide is an eye with a throat formed with a flare for the easing of the run of the yarn from it. For the purpose of my invention I provide the lower inner edge of this eye at the part which I have called the throat with a little notch or depression 50, sufficiently large to readily receive the lowermost yarn. As it is the plating yarn will rest within the notch 50. The body yarn which must be fed above the plating yarn ordinarily passes out of the yarn guide higher up on its side and passes from its throat in an inclined position. These positions of the yarns will be best understood by examination of Figs. III, and IV, where 47, indicates the body yarn running diagonally from the side of the yarn guide, while 48, indicates the plating yarn running from near the bottom of the yarn guide parallel to 47, but slightly below it. It will now be apparent what is the cause of the difficulty experienced during reciprocation, when the ordinary circular eye is employed as yarn guide. The upper yarn 47, must as the direction of the motion changes pass from one side of the guide to the other, and in doing this it must override the yarn 48, otherwise in passing from one side to the other the yarn 47, will force the yarn 48, in front of, and therefore above it, causing an inversion of the position in which the yarns pass to the needles. This difficulty is overcome by the provision of the notch 50, within which the yarn 48, rests, for the yarn 47, when the motion of the machine is reversed, leaps over the notch and passes to the other side of the eye without touching or disturbing the position in which the yarn 48, is running therefrom. In addition to the notch 50, I find that the operation of this device is further improved by the employment of two supplemental notches 51, 51, at the side of the throat of the yarn guide. In this way, the yarn 47, is fed alternatively from one or the other of these notches 51, its exact position on the side of the throat of the guide being thus determined by the height of these notches, although the yarn is capable of leaping from one of the side notches 51, to the other, without coming into contact with the yarn 48, which is running constantly from the lower notch 50. It will be understood that when in the claims, I speak of this part 50, and 51, as notches, I do not confine myself to the particular con-

figuration shown. By the use of my yarn guide the lowermost yarn is prevented from coming into contact with the upper yarn at the time of changed motion during reciprocation, thereby overcoming the tendency of the top yarn to force the bottom yarn above it as it passes from one side to the other of the yarn guide.

Having thus described my invention,
10 I claim:—

1. In a knitting machine, provided with means for simultaneously feeding two yarns to the needles, tension devices, means for imposing additional tension upon one of said
15 yarns which is automatically operated by the occurrence of an additional tension upon the other yarn, whereby the tension ratio of the two yarns is maintained constant, substantially as set forth.

20 2. In a knitting machine, provided with means for simultaneously feeding to the needles a body yarn and a plating yarn, a tension equalizer, comprising a tension arm through which one of said yarns is led;
25 a friction device acting upon the other yarn; and connections whereby an increase in the tension of the first mentioned yarn communicates, through said tension arm and by way of the friction device, a corresponding
30 increase of tension to the other yarn, substantially as set forth.

3. In a knitting machine provided with means for simultaneously feeding two yarns to the needles; a tension equalizer, comprising a swinging tension arm through which
35 one of said yarns is led, and a set of fingers between which the other yarn is intertwined, the two devices being so connected and adjusted that the movement of the tension arm due to increased tension upon its yarn communicates movement to the fingers which correspondingly increases the tension upon
40 its intertwined yarn, substantially as set forth.

45 4. In a circular knitting machine provided with means for simultaneously feeding to the needles a body yarn and a plating yarn, the combination of a swinging arm through which the body yarn passes; opposed sets
50 of fingers between which the plating yarn is intertwined one or more of said fingers being movable and mounted upon an arm which swings upon a common center with, and in union with the tension arm, whereby
55 accidental increase of tension upon the body yarn communicates increased tension of the plating yarn, substantially as set forth.

5. In a stocking knitting machine provided with means for simultaneously feeding
60 to the needles a body yarn and a plating yarn, and also having capacity for both circular and reciprocatory motions; a yarn eye through which both yarns are simultaneously fed to the needles one above the
65 other, provided with a depression in its

lower edge capable of receiving the lowermost or plating yarn and which permits the body yarn to overleap said plating yarn when the motion of reciprocation compels said body yarn to pass from one side to the
70 other of the yarn guide, substantially as set forth.

6. In a stocking knitting machine provided with means for simultaneously feeding to the needles a body yarn and a plating
75 yarn, and also having capacity for both circular and reciprocatory motions, a main yarn guide consisting of an eye with a central yarn-receiving depression within its lower edge, and two other yarn-receiving
80 depressions one on either side of the first-mentioned depression, substantially as set forth.

7. In a stocking knitting machine provided with means for simultaneously feeding
85 to the needles a body yarn and a plating yarn, and also having capacity for both circular and reciprocatory motions, a yarn eye through which both yarns are simultaneously delivered to the needles one above the other,
90 provided with a notch in its lower edge for the lowermost yarn, and two notches at its side for receiving the uppermost yarn alternately at one side or the other according to the direction in which the yarn eye
95 moves relatively to the needles, substantially as set forth.

8. In a circular knitting machine with capacity for reciprocatory knitting; a main yarn eye provided with two notches, one on
100 either side of its throat, which receive the thread alternately according to the direction of the reciprocation of the machine, substantially as set forth.

9. In a knitting machine a main yarn
105 guide capable of simultaneously feeding a plurality of yarns directly to the needles; and separated eyes, one or more of which receives but one yarn, and all of which deliver their yarn to the main yarn guide
110 at levels differing according to the positions of said separate eyes, substantially as set forth.

10. In a knitting machine the combination of the yarn guide 44, feeding two yarns
115 to the needles; the lower eye 42, feeding one yarn to the guide 44; and the eye 41, feeding two yarns, one directly to the yarn guide 44, and the other to the eye 42, substantially as set forth.
120

11. In a knitting machine provided with yarn feeding devices and a yarn guide, a vertical eye by which both yarns are carried into proximity to the yarn guide; and an eye below said vertical eye, through which
125 one of said yarns is led to the yarn guide and delivered to it in a lower position than the other, substantially as set forth.

12. In a knitting machine provided with yarn feeding devices and a yarn guide, a ver-
130

tical eye above the level of said yarn guide by which both yarns are carried into proximity with said yarn guide; and an eye below the level of said yarn guide, through which one of said yarns is led to the yarn guide and delivered to it in a lower position than the other, substantially as set forth.

In testimony whereof, I have hereunto

signed my name, at Allentown, in the State of Pennsylvania, this fourteenth day of 10 April, 1906.

EMIL A. HIRNER.

Witnesses:

MARCUS S. HOTTENSTEIN,
CHARLES L. HOTTENSTEIN.