

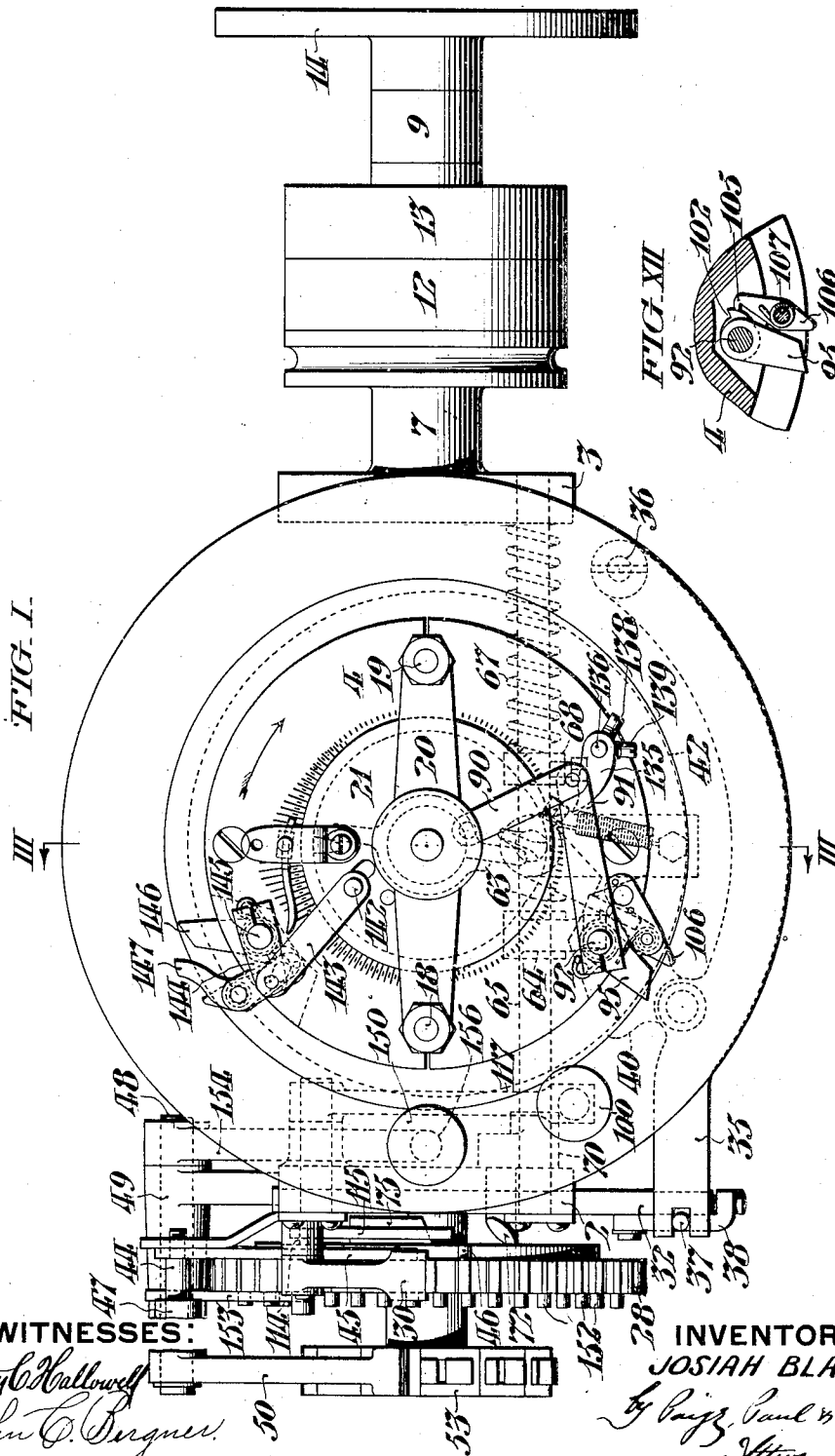
J. BLACK.
KNITTING MACHINE.

APPLICATION FILED JUNE 25, 1906.

933,016.

Patented Aug. 31, 1909.

5 SHEETS—SHEET 1.



WITNESSES:

Clifton C. Hallows
John C. Berger

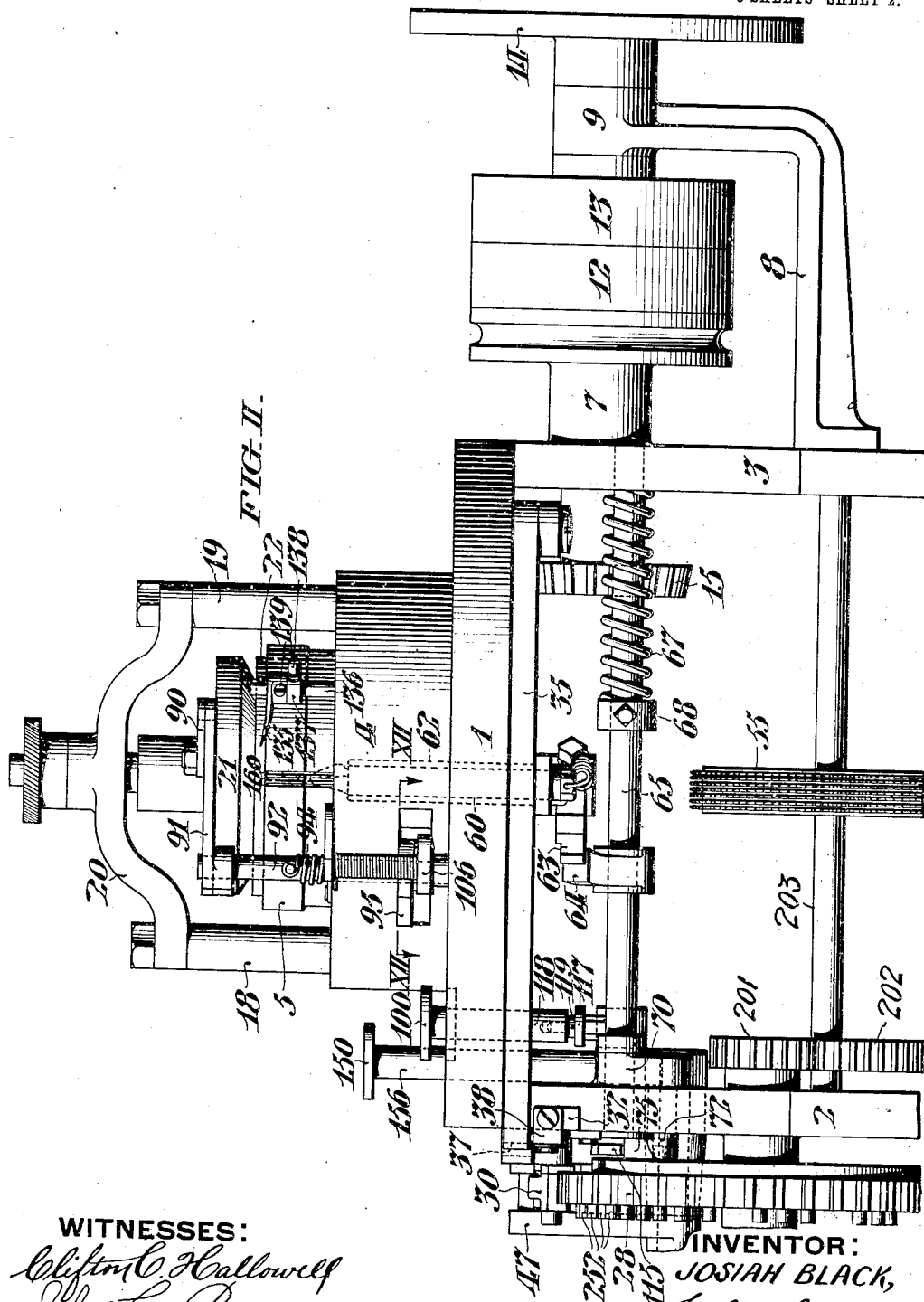
INVENTOR:

JOSIAH BLACK,
By Rugg, Paul & Haley
Atty.

J. BLACK.
KNITTING MACHINE.
APPLICATION FILED JUNE 25, 1906.

933,016.

Patented Aug. 31, 1909.
5 SHEETS—SHEET 2.



WITNESSES:
Clifton C. Hallowell
John C. Bergner

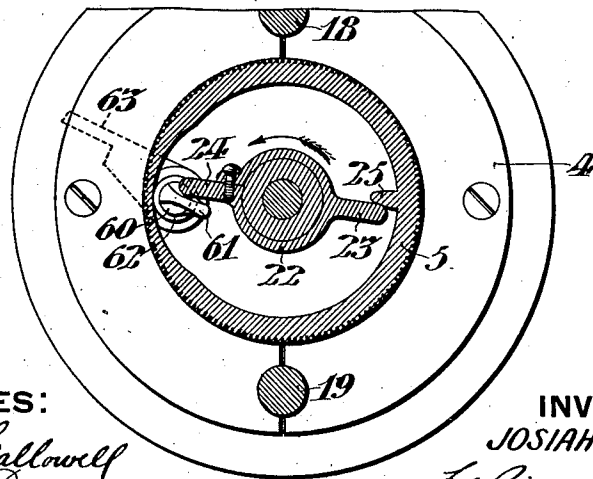
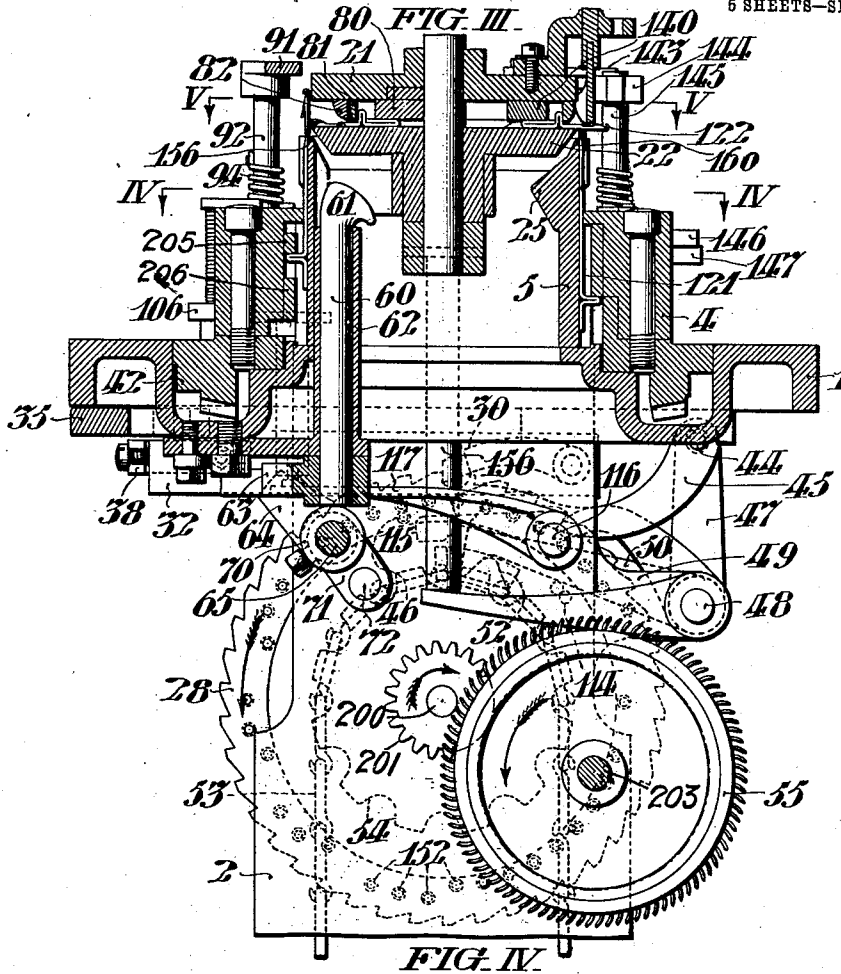
INVENTOR:
JOSIAH BLACK,
By [Signature], [Signature] & [Signature]
Atty's.

J. BLACK.
KNITTING MACHINE.
APPLICATION FILED JUNE 25, 1906.

933,016.

Patented Aug. 31, 1909.

5 SHEETS—SHEET 3.



WITNESSES:

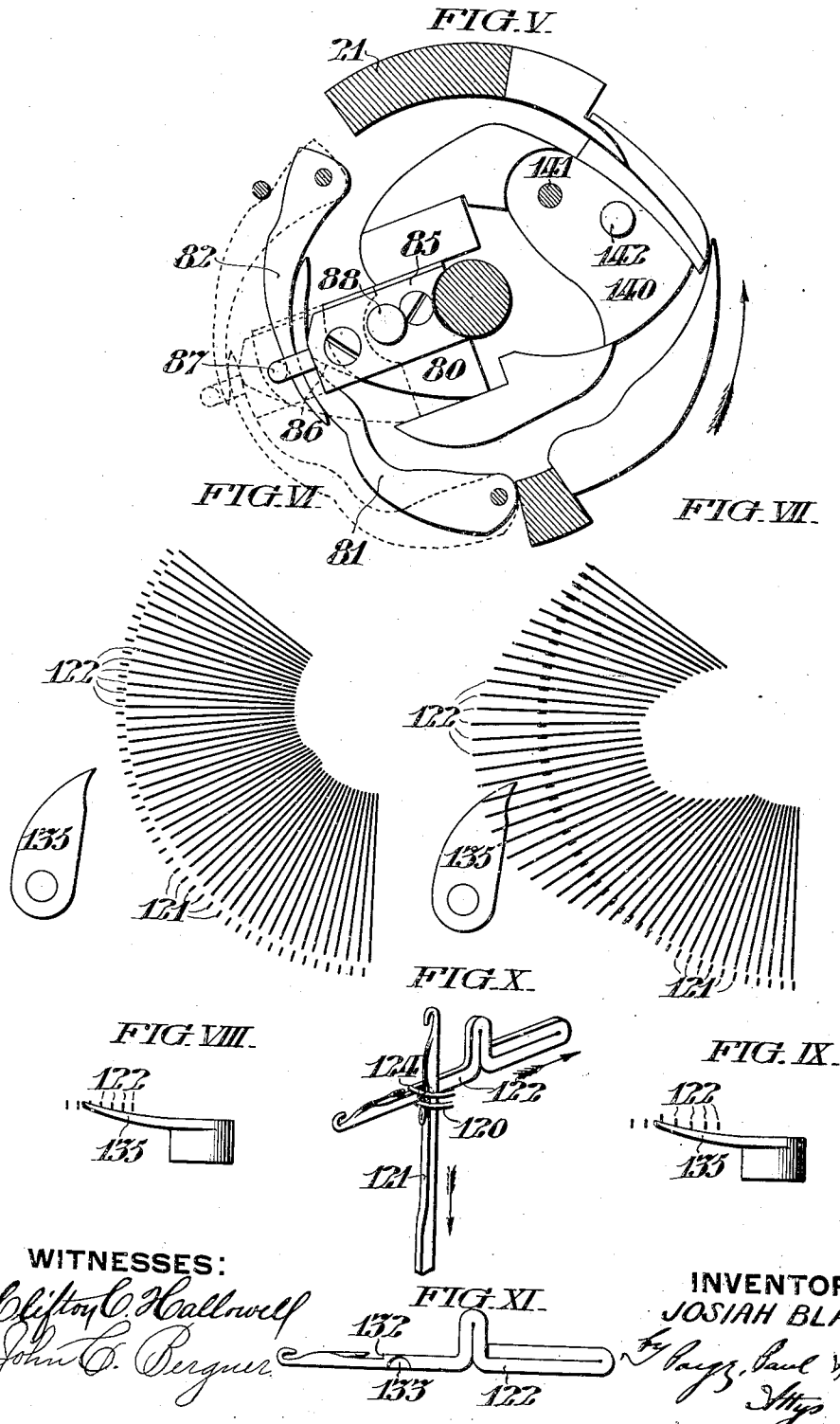
Clifton C. Hallowsell
John C. Bergner.

INVENTOR:

JOSIAH BLACK,
By Craig, Paul & Haley
Atty.

933,016.

Patented Aug. 31, 1909.
5 SHEETS—SHEET 4.



WITNESSES:

Clifton C. Halliwell
John C. Berquer

INVENTOR:

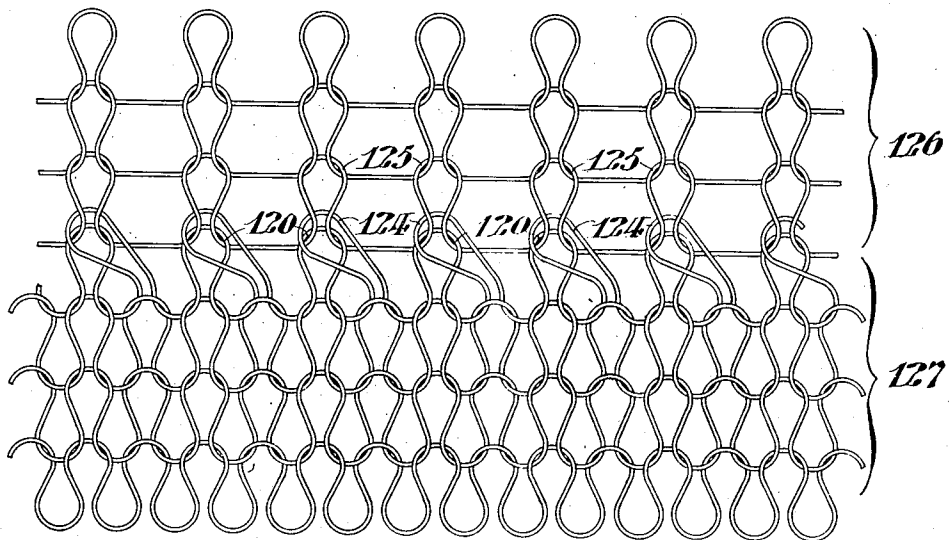
JOSIAH BLACK,
By [Signature] Paul & Haley
Attys

J. BLACK.
KNITTING MACHINE.
APPLICATION FILED JUNE 25, 1906.

933,016.

Patented Aug. 31, 1909.
5 SHEETS—SHEET 5.

FIG. XIII.



WITNESSES:

Clifton C. Hallowell
John C. Bergner.

INVENTOR:

JOSIAH BLACK,
By Craig, Paul & Haley
Attys.

UNITED STATES PATENT OFFICE.

JOSIAH BLACK, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO ELIZA VAUGHAN, OF PHILADELPHIA, PENNSYLVANIA.

KNITTING-MACHINE.

933,016.

Specification of Letters Patent.

Patented Aug. 31, 1909.

Application filed June 25, 1906. Serial No. 323,206.

To all whom it may concern:

Be it known that I, JOSIAH BLACK, of the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented a certain new and useful Improvement in Knitting-Machines, whereof the following is a specification, reference being had to the accompanying drawings.

My improvement relates to circular knitting machines of the class which are arranged to alternately knit plain and ribbed fabrics.

It is the object of my invention to provide a knitting machine, commonly known as a ribber, with means whereby the dial needles are shifted into the path of the cylinder needles to permit the latter to pass up through the loops formed on said dial needles, which are then retracted into idle position, thereby leaving their loops on the cylinder needles, which continue to operate independently of said dial needles and thus to knit plain fabric in continuous relation with the ribbed fabric.

My invention also comprehends a novel arrangement of the dial needles whereby the loops which are carried by said dial needles are distended to permit the cylinder needles to readily pass up through said loops, which are taken thereby to permit the free withdrawal of the dial needles therefrom.

The form of my invention hereinafter described comprises a series of cylinder needles, and a series of dial needles arranged to cooperate therewith in knitting ribbed fabric, means arranged to rotatably shift said dial needles substantially into the path of said cylinder needles, and means arranged to abnormally shift said dial needles radially outward to stretch their loops beyond the cylinder needles so as to permit the latter to pass up therethrough.

My invention also includes the various novel features of construction and arrangement hereinafter more definitely specified.

In the accompanying drawings, Figure I, is a plan view of a circular knitting machine conveniently embodying my invention. Fig. II, is a front elevation of said machine. Fig. III, is a central transverse vertical section taken on the line III—III, in Fig. I. Fig. IV, is a plan sectional view taken on the line IV—IV, in Fig. III. Fig. V, is a plan sectional view taken on the line V—V, in Fig. III showing the arrangement of the

dial cams. Fig. VI, is a diagrammatic plan view showing the normal positions of the dial needles with relation to the cylinder needles. Fig. VII, is a diagrammatic plan view showing the positions of the dial needles with relation to the cylinder needles when transferring their loops. Fig. VIII, is a diagrammatic side elevation, showing the normal relation of the dial needles and the deflecting cam. Fig. IX, is a diagrammatic side elevation showing the cooperative relation of the dial needles and the deflecting cam when transferring their loops. Fig. X, is a perspective view comprising a dial needle and a cylinder needle in cooperative relation to transfer the loop. Fig. XI, is a side elevation of a dial needle. Fig. XII, is a fragmentary plan sectional view taken on the line XII—XII, in Fig. II. Fig. XIII, is a diagrammatic view of the fabric on a greatly enlarged scale.

In said figures, the bed plate 1, is supported on suitable standards 2, and 3, and carries the rotatable cam cylinder 4, and the stationary needle cylinder 5. The standard 3, comprises the bearing 7, and supports bracket 8, having the bearing 9, in which bearings the main driving shaft is suitably journaled. Said driving shaft carries the usual fast and loose pulleys 12, and 13, the hand wheel 14, the bevel gear 15, which is arranged to rotate the cam cylinder in the usual manner employed in such machines.

The cam cylinder 4, comprises the standards 18, and 19, supporting the yoke 20, from which is suspended the dial cam plate 21, arranged to rotate with said cam cylinder 4, and the dial needle plate 22, arranged to be retained normally in stationary relation with the needle cylinder 5, by the engagement with the wing 23, on said plate 22, with the lug 25, on the needle cylinder 5, as best shown in Fig. IV.

The standard 2, is provided with a suitable bearing for the pattern mechanism, which comprises the ratchet wheel 28, arranged to be rotated by the pawl 30, which is pivoted on the reciprocatory slide bar 32. Said bar 32, is arranged to be reciprocated in accordance with the rotation of the machine, by the lever 35 which is pivoted at one end 36, to the bed plate 1, while its opposite free end is bifurcated and engages a pin 37, on an adjustable piece 38, carried by the bar 32. The lever 35, is arranged to be os-

cillated on its pivot 36, to reciprocate the bar 32, by engagement of its pivoted shoe 40, with an eccentric 42, carried by the cam cylinder 4, as shown in dotted lines in Fig. 1, and in full line in Fig. III.

The pawl 30, is normally upheld from engagement with the teeth of the ratchet 28, by the lever 45, whose free extremity normally rests on the pin 46, carried by the ratchet 28 and whose opposite end is pivoted on the stud 44, on the rocker arm 47, which is carried by the rockshaft 48, suitably journaled in the bracket 49, extending from the standard 2. Secured to said rockshaft 48, is the lever arm 50, whose free end extends into coöperative relation with the high link 52, of the pattern chain 53, which is carried by the sprocket 54, which is carried on the shaft 200, which also carries a pinion 201, which engages the gear wheel 202, on the shaft 203, and is rotated in the direction of the arrow indicated in Fig. III, by the brush wheel 55, which is rotated by the fabric as it is drawn down from the cylinder in contact therewith.

The parts thus far described comprise a rib knitting machine of well known construction to which my invention hereinafter described is conveniently applied.

The dial plate 22, as above stated is normally in stationary relation with the needle cylinder 5, but is capable of being slightly shifted rotatively as indicated by the arrow in Fig. IV, by the slight rotation of the vertical shaft 60, whose flattened head 61, engages the wing 24, on said dial plate 22, and rotates said plate sufficiently to shift each needle from its normal equidistant relation to the adjacent cylinder needles (shown diagrammatically in Fig. VI) into a position of lateral contact with one of the pair of said adjacent needles, as shown diagrammatically in Fig. VII.

The shaft 60, is rotatably supported in the sleeve bearing 62, which is secured, in rigid relation with the needle cylinder 5, to the bed plate 1, and is provided at its lower end with the lever arm 63, arranged to be shifted to rock said shaft, by engagement with the finger 64, which is secured on the slide rod 65. Said rod 65, is normally shifted to its extreme left hand position with respect to Fig. II by the coil spring 67, interposed between the collar 68, and the standard 3, and is provided at its left hand end with respect to said frame, with the collar 70, having a radially extending lug 71, from which projects the pin 72, extending through a suitable aperture in the standard 2, and having its outer end chamfered to be engaged by the cam 75, on the ratchet wheel 28, and thereby shifted toward the right with respect to Figs. I and II, to shift the rod 65, in opposition to the tension of the spring 67.

As best shown in Fig. II, the shifting of the rod 65, to the right, will cause the finger 64, to engage the lever arm 63, so as to rock the shaft 60, and to thereby rotatably shift the needle dial to the position wherein the dial needles and cylinder needles occupy the relative position shown in Fig. VII. In the new position of the dial, the dial needles are in such relation to the cylinder needles, as to make lateral contact therewith when the dial needles are protruded and the cylinder needles raised. The actuation of the dial needles for this purpose, (which may be termed their abnormal protrusion as distinguished from their normal protrusion in the act of knitting), is effected by means of the cams 80, 81, and 82, which are disposed on the opposite side of the dial from the ordinary knitting cam 140. Hence the abnormal protrusion of the dial needles occurs in the region opposite to the thread guide, so that no yarn is taken by the needles under these circumstances.

During the ordinary knitting of the dial needles, the cams 80, 81, and 82, are maintained in their extreme inward position, as shown in the solid lines in Fig. V, and hence of course, are not operative upon the needles. To render said cams operative for abnormal protrusion of the dial needles, they are shifted outwardly into the position indicated by the dotted lines in Fig. V, by means of the following devices. The cam 80, carries the piece 85, which is provided with a ledge 86, bearing against the inner side of the free end of the cam 81. Said piece 85, also carries an outwardly projecting and downwardly depending hook 87, which overhangs the free end of the cam 82, so as to be capable of engagement therewith, on the outer side thereof. The piece 85, is provided with a stud 88, connected by means of the link 90, with the lever arm 91, on the vertical rock shaft 92. Said rockshaft is normally rocked to the position shown in drawing, by the coiled spring 94, but is arranged to be rocked in opposition to the tension of said spring by the engagement of its cam arm 95, with the roller cam 100 which is arranged to be shifted into the path of said cam arm 95, as will be hereinafter described. It will thus be seen that the cams 81, and 82, can be shifted simultaneously outwardly by means of the ledge 86, into the position shown in the dotted lines in Fig. V, and, conversely, the retraction of the piece 85, inwardly will, by means of the hook 87, shift said cams 81, and 82, inward into the position shown in the solid lines in Fig. II.

As best shown in Fig. XII, cam arm 95, is provided with a notch 102, which is arranged to be engaged (when shifted to its abnormal position), by the hook 105, on the arm 106, carried by the rock shaft 107, which is normally spring pressed to engage said

hook with said notch when they are made to register by the rotation of the rock shaft 92, and thereby maintain said shaft 92, in the position to protrude the dial needles as shown in Fig. VII, by the arrangement of the cams 80, 81, and 82, as shown in dotted lines in Fig. V. Immediately following the engagement of the cam 75, with the pin 72, the projection 114, also carried by the ratchet wheel 28, uplifts the lever arm 115, on the rock shaft 116, which uplifts the lever arm 117, whose free end is disposed beneath the depending stem 118, of the roller cam 100, so that when said shaft 116, is rocked by the engagement of said projection with the lever arm 115, the free end of the lever arm 117, uplifts the cam 100, into the path of the cam arm 95, and shifts the latter to set the cams 80, 81, and 82, in the position shown in dotted lines in Fig. V. As best shown in Fig. II, the stem 118, is provided with the adjusting screw 119, whereby the height of the cam 100, may be conveniently varied. In substantial correspondence with this abnormal protrusion of the dial needles for the purpose of distending their loops and permitting their removal, there occurs a sufficient advance of the cylinder needles to enable them to come in contact with the dial needles and engage their loops. This advance of the cylinder needles is occasioned by the coaction of two cams in the cam cylinder (205 and 206, Fig. III), of which the lower cam operates to advance the needles, and the upper cam to retract them to their normal position. The advance under the influence of the cam 206, need not be so great an advance as normally occurs in forming the knitting stitch and need only be sufficient to cause the cylinder needles to pass up through the distended loop held by the dial needle immediately above it. The transfer of the loops is effected as best shown in Fig. X, wherein the loop 120, of the cylinder needle 121, is disposed beneath the projecting dial needle 122, through whose loop 124, the cylinder needle 121, has been thrust, so as may readily be seen, the withdrawal of the needles in the direction of the arrows indicated in said figure permits the release of the loop 124, from its dial needle 122, and insures its engagement in the hook of the cylinder 121, together with the loop 120, so that the next succeeding loop 125, see Fig. XIII, will be drawn through both of said loops 120 and 124, and plain fabric 126, may be then knit on the cylinder needles in continuous relation with the ribbed fabric 127. The loop 124, is distended as shown in Fig. X, by engagement with the notch 132, in the upper edge of the dial needle 122, as best shown in Fig. XI. Said dial needle 122, is provided with a beveled notch 133, to receive the cylinder needle 121, as it rises through the loop 124.

In order to facilitate the transfer of the loop 124, into the cylinder dial 121, I prefer to provide a deflecting finger 135, which engages beneath the dial needles as they approach the region of transfer, and springs them upward for a short distance while the loop 124, is in engagement with the notch 132. As the dial needles ride off from the end of the finger 135, they snap down again to their normal plane, still carrying the loops 124, in engagement with said notch. A two-fold effect is accomplished by this operation; first, the loop 124, is elongated or enlarged by its distortion from its normal plane, and second, the quick snapping action tends to throw it more effectively onto the end of the cylinder needle, which is then in the act of rising against the side of the dial needle. The finger 135, is adjustably mounted on the vertical post 136, which is provided with a collar 137, adapted to be set at the required vertical height by means of the set screw 138. The finger 135, may also be rotatively adjusted with reference to its post by means of the set screw 139. The cam 140, which normally shifts said dial needles outwardly to take the thread, is pivoted at 141, and provided with the stud 142, connected by the link 143, to the lever arm 144, on the vertical rock-shaft 145, whose cam arms 146, and 147, are arranged to shift the cam 140, respectively outward or inward according to the vertical position of the roller cam 150. The vertical position of said roller cam 150, is determined by the pins 152, on the ratchet 28, upon which pins the free end of the lever 153, on the rock-shaft 48, rides. Said rockshaft carries the arm 154, supporting the stem 156, of the roller cam 150, and when the lever 153 is actuated to rock the shaft 48, so as to throw the arm 154, upward, the roller cam 150, is raised to the required operative position, the non-operative position being attained by the descent of the arm 154, when the shaft 48, is permitted to rock in the opposite direction.

In order to prevent the displacement of the fabric when the needle dial plate 22, is shifted, the needle cylinder 5, is provided with a series of notches 160, which are local to respective needles, as shown in Figs. II and III, so that when said needles are lowered the threads of their loops will be in their respective notches 160, and thereby prevent any tendency of the fabric to be rotatively shifted by the movement of said needle dial plate.

The operation of the machine is as follows:—The ribbed knitting is proceeded with until a predetermined length has been knit and drawn down in contact with the brush roller 55, by the take up mechanism (not shown). When the required length of ribbed knitting has been formed, the pawl 30, drops into engagement with the ratchet 130

28, which is rotated thereby so as to engage its cam 75, with the dial plate shifting mechanism. The projection 114, is also caused to engage with the lever arm 115, to uplift the
 5 cam 100, into the path of the cam arm 95, which controls the actuating mechanism of the cams 80, 81, and 82. The shifting movement of the dial plate (with the dial needles still held in their extreme retracted position), brings said needles into their altered
 10 position with relation to the cylinder needles, so that when again protruded, they will lie in juxtaposition to their corresponding cylinder needle. The protrusion of the
 15 cams 80, 81, and 82, throws the dial needles forward to their abnormal position of protrusion, which carries their loops into the path of the cylinder needles. The rapidity of the protrusion of the cams above mentioned is such that commencing with the first
 20 needle, which is in contact with its cam surface and in continuous succession thereafter, all of the dial needles are protruded to a position of engagement. Continued rotation of the machine successively carries the dial
 25 needles out to their extreme position, which permits transfer, after which they are again retracted by cam 82, into inactive position before they approach the thread guide. In
 30 the meantime the dial stitch cam 140, which normally throws the dial needles out to take thread has been retracted, so that the dial needles are no longer advanced as they reach the thread guide, and therefore they perform
 35 no function in the knitting operation during the transfer operation.

I do not desire to limit myself to the precise details of construction and arrangement herein set forth, as various modifications
 40 may be made therein without departing from the essential features of my invention.

I claim:—

1. In a circular knitting machine, the combination with a needle dial and a needle
 45 cylinder, provided with needles normally spaced in equi-distant alternation; of means arranged to relatively shift said dial and cylinder, whereby the needles of one set are shifted into position to contact laterally with
 50 adjacent needles of the other set; and means for transferring the loop from one of the pair of contacting needles to the other, substantially as set forth.

2. In a circular knitting machine, the combination with a needle dial and a needle
 55 cylinder, provided with needles normally spaced in equi-distant alternation; of means arranged to relatively shift said dial and cylinder, whereby the needles of one set are shifted into position to contact laterally with
 60 adjacent needles of the other set; and means for engaging the loop of one of the pair of contacting needles with the other, substantially as set forth.

65 3. In a circular knitting machine, the

combination with a needle dial and needle cylinder provided with needles normally spaced in equi-distant alternation; of means arranged to relatively oscillate said dial and cylinder, whereby the needles of one set are
 70 shifted into position to contact laterally with adjacent needles of the other set; and means for transferring the loop of one of the pair of contacting needles to the other, substantially as set forth.

4. In a circular knitting machine, the combination with a needle dial and a needle cylinder, provided with needles; of means arranged to relatively shift said dial and cylinder, whereby the loops formed on one
 80 set of needles may be engaged by the other; and means arranged to distend said loops, to facilitate said engagement, substantially as set forth.

5. In a circular knitting machine, the combination with a needle dial and a needle cylinder provided with needles; of a pattern mechanism; means controlled by said pattern mechanism arranged to relatively oscillate said dial and cylinder, whereby the needles of one set are shifted to laterally contact
 90 with adjacent needles of the other set; and means for causing the loops carried by the needles of one set to be engaged by the needles of the other set, substantially as set forth.

6. In a circular knitting machine, the combination with a needle dial and a needle cylinder provided with needles; of a pattern mechanism; and means carried by said pattern mechanism arranged to relatively shift
 100 said dial and cylinder, whereby the needles of one set are shifted to laterally contact with the needles of the other set, so that the loops formed on one set of needles may be transferred to the other, and the operation thus changed from ribbed knitting to plain
 105 knitting, substantially as set forth.

7. In a circular knitting machine, the combination with a needle dial and a needle
 110 cylinder provided with needles; of a pattern mechanism; means carried by said pattern mechanism, arranged to relatively shift said dial and cylinder; and means carried by said pattern mechanism arranged to abnormally
 115 protrude one set of needles and thereby distend their loops in position to be engaged by the other set of needles, substantially as set forth.

8. In a circular knitting machine, the combination with a needle dial and a needle cylinder provided with needles; notches in said needles, of a pattern mechanism; means carried by said pattern mechanism arranged to relatively shift said dial and cylinder; means carried by said pattern mechanism arranged to abnormally project said needles, whereby their notches engage and effect the distention of their loops and permit the engagement of said distended loops by their
 130

coöperative needles, substantially as set forth.

9. In a circular knitting machine, the combination with a needle dial and a needle cylinder provided with needles; of a pattern mechanism; a cam carried by said pattern mechanism; a slide rod arranged to be shifted by said cam; a rockshaft connecting said slide rod and said dial whereby the latter is oscillated relatively to said cylinder to shift the dial needles and cylinder needles into alinement; and, means arranged to abnormally project said needles and thereby distend their loops to be engaged by their coöperative needles, substantially as set forth.

10. In a circular knitting machine, the combination with a needle dial and a needle cylinder provided with needles; of a pattern mechanism; a cam carried by said pattern mechanism; a slide rod arranged to be shifted by said cam; a rockshaft connecting said slide rod and said dial whereby the latter is oscillated relatively to said cylinder to shift the dial needles and cylinder needles into alinement; a projection carried by said pattern mechanism; a lever arranged to be shifted by engagement with said projection; a cam arranged to be shifted by the movement of said lever; means controlled by said cam, whereby the needles are projected to distend their loops, which are engaged by their coöperative needles, substantially as set forth.

11. In a circular knitting machine, the combination with a needle dial and a needle cylinder, provided with needles; of means arranged to relatively shift said dial and cylinder whereby the paths of their needles may intersect; means arranged to simultaneously project the coöperative needles to engage the loops of one set of needles with the other set of needles; and means arranged to withdraw one set of needles into inoperative position and thereby leave their loops on the other set of needles which continue to knit plain fabric, substantially as set forth.

12. In a circular knitting machine, the combination with a needle dial and a needle cylinder, provided with needles; of a notch in the edge of the dial needles; means arranged to project said dial needles and thereby distend their loops by engagement with said notch, to permit the adjacent co-

operative needles to be thrust through said loops; and means arranged to gradually deflect the outer ends of said needles and then permit their sudden return to their normal plane, to facilitate the disengagement of their loops from said notch, substantially as set forth.

13. In a circular knitting machine, the combination with a needle dial and a needle cylinder, provided with needles; of a notch in the edge of the dial needles; means arranged to project said dial needles and thereby distend their loops by engagement with said notch, to permit the adjacent coöperative needles to be thrust through said loops; and a cam plate arranged to gradually deflect the outer ends of said needles and then permit their sudden return to their normal plane, to facilitate the disengagement of their loops from said notch, substantially as set forth.

14. In a circular knitting machine, the combination with a needle dial and a needle cylinder, provided with needles; of means arranged to relatively shift said dial and cylinder, whereby the needles of one set are shifted to laterally contact with adjacent needles of the other set; means for engaging the loop of one of the pair of contacting needles with the other; and means arranged to prevent the displacement of the loops held by said needles, substantially as set forth.

15. In a circular knitting machine, the combination with a needle dial and a needle cylinder, provided with needles; of means arranged to relatively shift said dial and cylinder, whereby the needles of one set are shifted to laterally contact with adjacent needles of the other set; means for engaging the loop of one of the pair of contacting needles with the other; and notches disposed in the upper edge of the needle cylinder arranged to prevent the displacement of the loops held by said needles, substantially as set forth.

In testimony whereof, I have hereunto signed my name, at Philadelphia, Pennsylvania, this 22nd day of June 1906.

JOSIAH BLACK.

Witnesses:

ARTHUR E. PAIGE,
CLIFTON C. HALLOWELL.