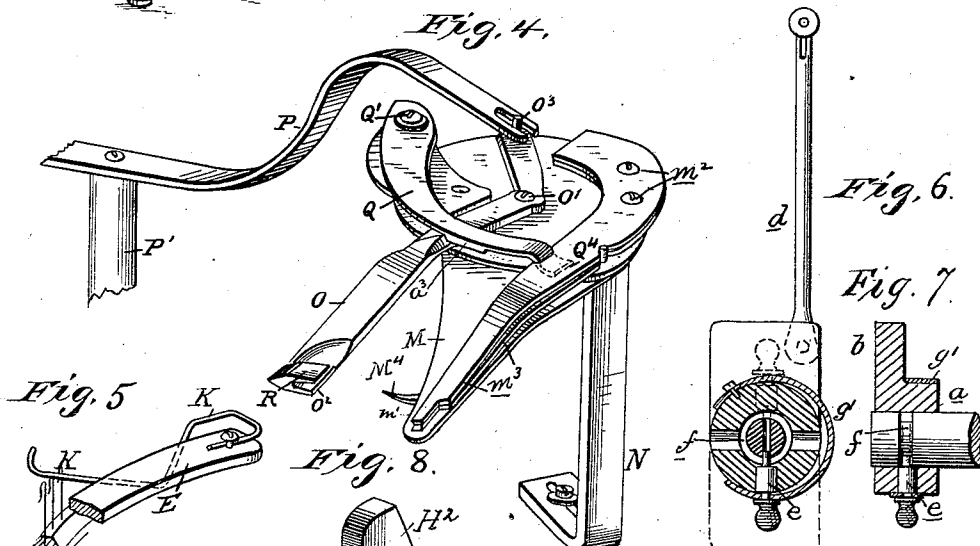
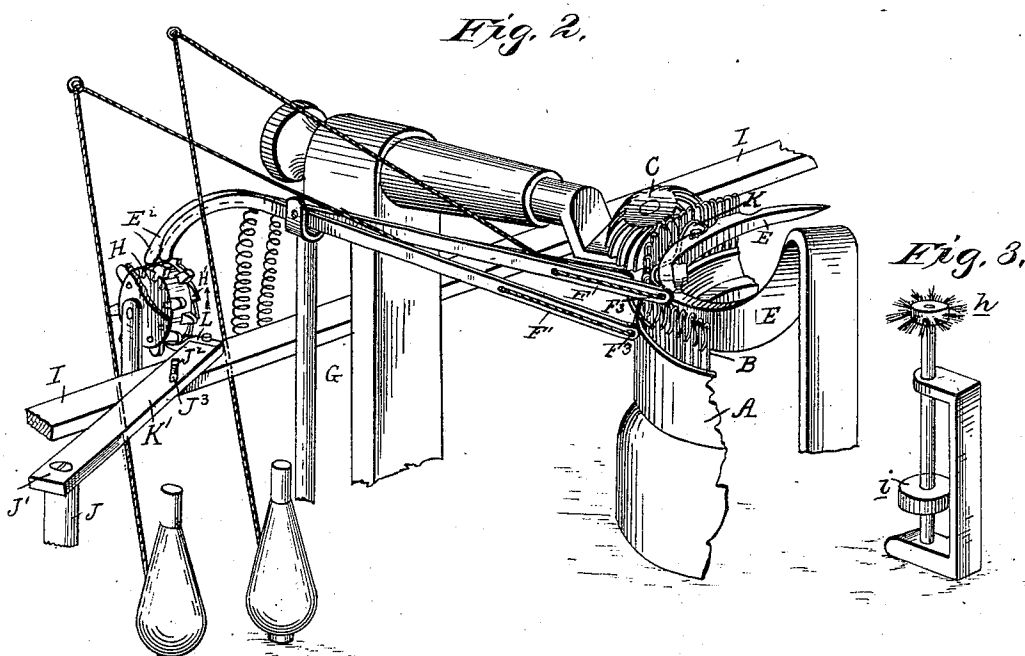


J. BYFIELD.
KNITTING MACHINE.

No. 309,761.

Patented Dec. 23, 1884.



Witnesses
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 A. Robertson

Inventor
 John Byfield
 By J. W. Robertson
 Attorney

(No Model.)

3 Sheets—Sheet 3.

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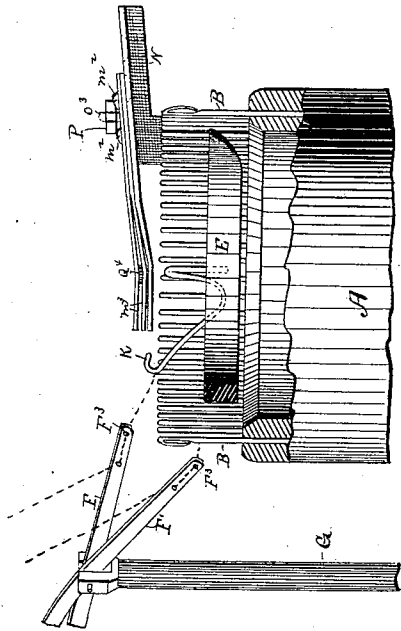


Fig. 9.

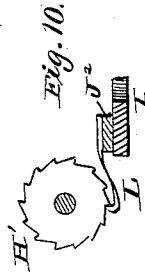


Fig. 10.

WITNESSES:

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UNITED STATES PATENT OFFICE.

JOHN BYFIELD, OF LONDON, ONTARIO, CANADA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 309,761, dated December 23, 1884.

Application filed January 16, 1882. Renewed February 25, 1884. Again renewed October 10, 1884. (No model.) Patented in England January 31, 1882, No. 465; in France February 1, 1882, No. 147,162; in Belgium February 1, 1882, No. 56,943; in Germany February 1, 1882, No. 21,075, and in Austria-Hungary April 17, 1882, No. 5,861 and No. 13,473.

To all whom it may concern:

Be it known that I, JOHN BYFIELD, a citizen of Canada, residing at London, in the county of Middlesex, Ontario, Canada, have
5 invented certain new and useful Improvements in Knitting-Machines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains
10 to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to that class of knitting-machines known as "spring-needle" machines, in which the work revolves with the head and needles, the yarn remaining stationary, in contradistinction to that class of machines in which the needles and work remain
20 stationary and the parts or devices carrying the yarn revolve, as shown in a former application, patented January 31, 1882.

The invention consists in mechanism for guiding and controlling the yarn used in knitting as applied to circular-knitting machines for the purposes of automatically forming any desired pattern in transverse stripes, and for the purpose of working a number of knitting-machines, in all of which the yarn-carriers
30 are changed by mechanism controlled by one pattern-plate, which can be set at one end out of the way of the machines.

In the drawings, Figure 1 is a plan view of a single knitting-machine supplied with a complete pattern mechanism; Fig. 2, a perspective detail view; Fig. 3, a detail view of a revolving brush; Fig. 4, a perspective detail of the yarn cutting and clamping device; Fig. 5, a perspective detail of the guide-wire for carrying the yarn below the needle-beards; Figs. 6 and 7, sectional details of the connection with the driving-shaft; Fig. 8, perspective views of a cam and cam-blocks separated from the pattern-wheel. Fig. 9 is a side view of the cylinder, partly in section, and showing the yarn-levers and the position of the cutting apparatus; and Fig. 10 is a detail section.

A represents the circular head, B the needles fixed solid in the head, and C the loop or

stitch wheel which receives the yarn from the yarn-levers F and F'.

E represents the work-presser, which fits inside the needles, and under which the knitted work is pressed in order to allow the stitch to be thrown under the needle-beards by the stitch-wheel. The other usual appurtenances are not shown, they being well known and unnecessary in describing my invention.

In knitting, the yarn is drawn from the bobbin through the hole F² in the end of the lever F or F' to the stitch-wheel, the guide D preventing it from getting below the stitch and missing stitches.

For every color used in knitting, a separate lever or carrier must be used. These levers
65 are pivoted in the post G, their outer curved ends, E², being drawn by springs upon a pattern-wheel, H, which is provided with a series of steps or teeth to act against said curved ends to raise and lower the end E² of the levers or carriers.

Back of the machines a bar, I, adapted to be moved intermittently, is placed on suitable bearings and extends the whole length of the row of machines desired to be worked in
75 unison.

Alongside of the bar I, at each machine, is placed a post, J, on which an arm, K', is pivoted at the end J'. This arm K' is placed at right angles, or nearly so, to the pattern-wheel H, and at its loose end it is provided with a spring-pawl, L, (see Fig. 10,) which is adapted to operate the ratchet-wheel H', attached to the pattern-wheel H. The arm K' has a cam-slot at J², in which a pin, J², secured to the bar I, is adapted to slide. Thus it will be seen that a forward movement of the bar I will move the end of the arm K' and the pawl L one way, and the backward movement of the bar I will give said pawl L a reverse movement. The
90 pawl L is provided with necessary elasticity to cause it to press against the ratchet-wheel H' and give the necessary movement to the pattern-wheel H, by which the yarn-carriers F F' are changed in their position in feeding
95 the yarn.

On the inside of the circle of the needles, and fastened to the work-presser E, is a

curved wire, K, running from the lower part of the stitch-wheel to the top of the needles, and curving out over the needles, as shown in Fig. 5, at a distance above them just sufficient to allow the free movement of the levers without being struck thereby. The upper end of the post G should stand such a distance above the tops of the needles B that when the end of either lever carrying the yarn is raised it will describe a segment of a circle extending over the line of the needles, thus throwing the yarn against the needles and behind the projecting end of the curved wire K, which latter, as the cylinder revolves, carries the yarn between the needles and presses it down under the beard of each needle, to be knit up to the point where it is passed between the needles, and then cut, and the end in the carriers held by mechanism hereinafter described.

Over the loop or stitch wheel C is fastened a knife, M, resting on the post N, the cutting part m' of the knife being inside the circle of needles and over the work-presser E. Over the knife, and fastened to it at m^2 , are two springs, m^3 , which hold the end of the yarn which is not being knit.

On the knife M a lever, O, provided with a knife, O^2 , is pivoted at O' , the two knives forming a pair of shears.

On the rear end of the lever O is securely fastened a pin, O^3 . A lever, P, pivoted on the post P' , has at one end a slot, in which the pin O^3 works, the other end extending between two pins, I^1 and I^2 , fastened in the bar I. The moving of the bar I in the direction indicated by the arrow moves the pin I^2 against this end of the lever P, thus throwing back the other end of the lever and vibrating the lever O upon its fulcrum O' .

When the bar I is moved forward, as indicated by arrow in Fig. 1, it moves the ratchet H^1 through the bar K^1 and pawl L in the direction shown by arrow in Fig. 2, so that one of the cams on the pattern-wheel H is drawn under the end E^2 of the lever that is not knitting, and thus depressing the other end for knitting. The end of the yarn being fast in the springs m^3 and being drawn through the lever at F^3 , the yarn drops across and between the needles, and is carried by them till caught by the stitch-wheel C.

Over the lever O a third spring, Q, is placed, one end being fastened at Q' , the other end resting between the springs m^3 at Q^1 . The under side of the spring Q is provided with a cam, q^2 , adapting it to be lifted by the closing of the knife O, thus easing the springs m^3 on the yarn just as the stitch-wheel C takes it, and allowing the end thereof to be drawn from the springs without breaking it. As one lever drops into position for knitting, the other lever, which has been knitting, is raised by one of the cams on the pattern-wheel being drawn from under its end E^2 . The raising of the lever throws the yarn up against the projecting end of the wire K and

between the knives of the shears, as hereinbefore described.

On the knife M there is a projection, M^1 , extending over the line of the needles. At the time the yarn is thrown against the projecting end of the wire K by the upward movement of the end of the lever carrying the yarn, it is drawn against the projection M^1 , and cut by the knife O^2 upon the vibration of the lever O. The upper side of the lever O is provided with a wedge, R, which, when the lever O is closed, catches the yarn across its edge and presses it between the spring m^3 sufficiently to hold it tight until wanted again. The backward movement of the bar I opens the lever O through mechanism hereinbefore described, thus withdrawing the wedge R from between the said springs, leaving the yarn between them, as aforesaid. If only two colors are used, but two levers are required, and the cams on the pattern-wheel are placed alternately. If more than two colors are required, there must be a separate lever for each color, and the cams placed on the pattern-wheel, one for each movement of the ratchet-wheel, so as to throw the levers in succession to give the different colors required. The movement of this pattern-wheel controls the order of the colors; but the number of rounds of each color is controlled by the movement of the bar I, to be afterward described. If desired to have the order of the colors changed, the pattern-wheel must be made with removable cams H^2 . (Shown in Fig. 8 of the drawings.) This can be done by fastening them with a screw, as many circumferential rows of holes being tapped in the pattern-wheel as there are levers used; or slots can be cut across the face of the pattern-wheel H, one for each movement of the ratchet-wheel H^1 , which will take in the cam H^2 . (Shown in Fig. 8 of the drawings.) There must also be small blocks placed in the slots alongside the cams to fill up the surface. These blocks must be the exact size of the slot, as shown at H^3 in Fig. 8. The cam H^2 and the block H^3 must be the same width as the levers, so as to come exactly under them. The cam H^2 is placed in the cam-wheel under the lever it is desired to depress at the feeding end, and the blocks under the other lever or levers. The pattern-wheel H should be made a trifle narrower than the cam and blocks, so they can be kept to their places by fastening plates on each side of the pattern-wheel, so that when the plates are screwed tight they will press on the cams and blocks and hold them fast. The reciprocating bar I is moved by a rock-shaft, S, at the end; and at right angles to the reciprocating bar I, on the end of this rock-shaft, is a crank-arm, T, which is provided with two pivoted pawls, T^1 and T^2 , whose loose ends rest on the reciprocating bar I. As the rock-shaft is thrown forward the shortest pawl, T^1 , catches in an elevation, I^4 , on the reciprocating bar I, and as the rock-shaft comes back the second pawl, T^2 , whose

loose end is hook-shaped, catches on the opposite side of the projection and brings the reciprocating bar I back again. A pattern-plate, U, having teeth on its periphery, rests on the frame and can be worked on either side of the rock-shaft, although I show it in the drawings between the rock-shaft and the knitting-machine. On this plate rests a lever, V, which is pivoted at one end by a screw to the center of the plate, its other end having a pin or roller to rest in a diagonal groove in a cam-block, W, through which the rock-shaft works. Under this lever, and pivoted to it between the edge of the pattern-plate and the cam-block, is a double pawl, X, which is made to work against the teeth of the pattern-plate on either side of the lever desired. This is done by a spring, X', which has one end fastened solid on the projecting pivot of the pawl, as shown at V'. Between this pivot and the pivoted end of the lever is a projection, V², in which are cut three slots, as shown at V³. When the spring is placed in the center slot, it holds the pawl centrally and prevents its ends from engaging with the teeth of the pattern-plate on either side; but when it is dropped in the slot on either side of the center of the lever it causes the pawl to engage with the teeth on the opposite side of the lever, thus causing the pattern-plate to move one tooth with each motion of the lever. Thus it will be seen that the pattern-plate can be turned either way, by which I am enabled to set up and knit a pattern, and then by operating the pattern-plate in the opposite direction, knit said pattern in reverse order, which is very important on some kinds of work. A series of holes spirally arranged is drilled in the face of the plate, so that one hole in each circle corresponds with each tooth on the ratchet-wheel I'. A lever, Y, pivoted in a post, Y', rests one end on the pattern-plate and the other under the pawl T', raising it up so that the pawl just clears the elevation I', when it is pushed forward by the rock-shaft, as will be hereinafter described. As the knitting proceeds the pattern-plate is moved forward one tooth each round of knitting, the holes in its face being brought under the end of the lever Y. Whenever it is desired, in forming a pattern, to change the color, a pin with a rounded head is dropped into the hole at the desired point, and when the head of this pin is pushed under the lever it raises the same and depresses the other end, so as to allow the pawl T' to catch in the elevation I', when the bar I is moved forward and the yarn changed simultaneously on all the machines controlled by the bar I. The pattern-plate is moved, together with the cam-block W, so as to bring the spiral pattern under the lever, by suitable mechanism, which is fully described in a former application patented January 31, 1882. If desired, the rock-shaft can be placed between the pattern-plate and the machine and worked by a cam on the knitting-machine, as

described in the patent referred to. I prefer, however, to work it direct from the shaft below the table, as I will now describe. The knitting-machines are driven by a shaft connecting with them by miter-gearing, so that one revolution of the shaft gives a single revolution to each machine. On the end of the shaft a collar, a, and an arm, b, are fastened. From the arm b to a crank, c, fastened by a double-acting joint, C', in the rocking shaft S, and connecting the two, is a pitman or connecting-rod, d. The collar a is fastened on the shaft by a pin, e, which passes through the collar and into a hole drilled through the shaft, and is held in place by a spring, g'. A groove is turned on the surface of the shaft in the line of the holes, as shown at f in Fig. 6 of the drawings. By pulling the pin until it is withdrawn from the hole and turning the collar a on the shaft, letting the pin e follow the groove until it slips into the hole on the opposite side of the shaft, it reverses the junction of the yarn to the opposite side of the stocking.

In making what is known as "cut goods" in hosiery it is customary to knit from the top to the toe and then back to the top of the next stocking. As the foot is split and each side of the split part makes the top of one foot, it is very important to reverse the junction at the foot, and in knitting the second stocking backward or from the toe to the top it is necessary for the pattern-plate to work the reverse way in all except the most simple patterns, which is accomplished by the use of the collar a.

As the machine revolves with the work sometimes the ends of the yarn drop across the ends of the needles before being carried out of the way, and consequently show on the wrong side of the stocking. To obviate this I place a small revolving brush, h, as shown. This is run by a friction-wheel, i, pressing against the cylinder (or it can be run by a pulley and an elastic band around the cylinder) and revolving against and faster than the cylinder, so as to brush the loose ends forward and out of the road of the needle.

What I claim as new is—

1. The pattern-plate U, provided with knobs and having peripheral teeth, in combination with the lever V, the double-acting pawl X, the spring X', constructed to bring the opposite ends of the pawl into proper position for reversing the movement of the pattern-plate, the main shaft of the machine, and connecting mechanism, substantially as described, between the lever V and said main shaft, for intermittently moving said lever, as and for the purposes set forth.

2. The combination of the pattern-plate U and mechanism for revolving it with the sliding bar I, a series of sets of yarn-carriers, and intermediate mechanism, substantially as described, between said pattern-plate and bar and between said bar and the sets of yarn-carriers, whereby said bar is caused to operate

the devices for governing the position of the yarn-carriers in a number of distinct machines by a single pattern mechanism.

3. The sliding bar I, in combination with the yarn-carriers and yarn-cutters, and mechanism, substantially as described, between the bar and the yarn-cutters and between the bar and the yarn-carriers, and mechanism for giving said bar an intermittent motion, substantially as and for the purpose specified.

4. The pattern-plate U, provided with peripheral teeth, in combination with the lever V, spring X', pawl X, cam W, rock-shaft S, arm c on said shaft, the main shaft of the machine, the collar a, adjustably secured to the main shaft, and suitable connections between said collar a and arms c, substantially as described.

5. The collar a, carrying the crank-arm b, in combination with the main shaft provided with recesses on opposite sides, and the pin e, adapted to fit within the recess upon either side of the shaft, substantially as described.

6. The sliding bar I, provided with a pin, J², in combination with a pattern mechanism, substantially as described, for governing the movements of said bar, the pivoted arm K', provided with a diagonal slot, J³, the pawl L, pivoted to the said bar, the pattern and ratchet wheels H and H', and the yarn-carriers F F', substantially as and for the purpose specified.

7. The combination, with a clamp for holding the yarn and a device for severing it, of a wedge or projection constructed to positively force the yarn into a clamp, and mechanism for operating said wedge, substantially as described.

8. The combination, with a clamp for holding the yarn and mechanism for severing it, of a carrier bearing one of the severing-edges, and devices for forcing the yarn between the jaws of the clamp and automatically relieving the pressure thereof, all substantially as described.

9. The combination, with two or more yarn-carriers, of a knife for cutting the yarn, a spring-clamp for holding the cut end, and means, substantially as described, for operating the yarn-carriers and knife, as set forth.

10. The combination, with two or more yarn-carriers, of a fixed knife, a movable knife, and a spring-clamp, the movable knife being constructed to alter the tension of the clamp during its travel to and from the fixed knife, substantially as and for the purpose specified.

11. In combination with a device for severing the yarn, a clamp for holding the severed end, and a wedge or projection, R, attached to and moving with the movable knife, for positively introducing the yarn into the clamp, substantially as described.

12. In combination with a fixed knife, M, and a pivoted knife, O, the spring-clamps m² and the wedge and projection R, secured to the pivoted knife and adapted to pass between the clamps, substantially as and for the purpose specified.

13. In combination with a fixed and pivoted knife and a clamp consisting of two sections, m², a wedge or projection, R, secured to the movable knife, and the spring Q, having a downwardly-projecting portion between the two knives, and having its outer end situated between the two clamp-sections, substantially as and for the purpose specified.

14. In combination with a series of needles and two or more yarn-carriers, a stationary yarn-guide situated inside of the needles and curved outward beyond the line of the same, for the purpose of forcing the yarn under the needle-beards after the yarn-carrier has been raised, substantially as described.

15. The combination, with a rotary needle-head, of a revolving brush adapted to act against the outside of the work to throw up the loose ends of the yarn out of the way of the needles, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN BYFIELD.

Witnesses:

F. O. MCCLEARY,
T. J. W. ROBERTSON.