

(No Model.)

6 Sheets—Sheet 1.

J. F. NELSON.
STRAIGHT KNITTING MACHINE.

No. 580,290.

Patented Apr. 6, 1897.

Witnesses

J. M. Withrow.
Guy E. Davis.

Inventor,
John F. Nelson,
By his Attorneys,

Alphon Davidson Night

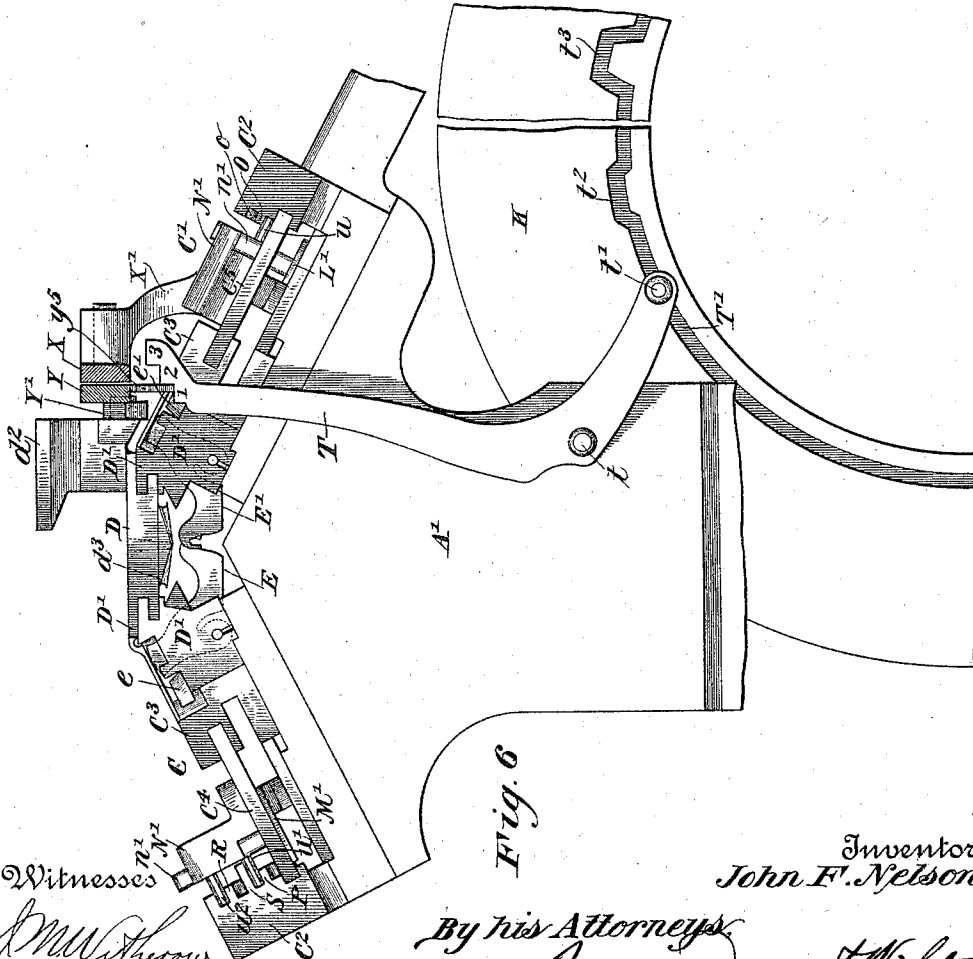
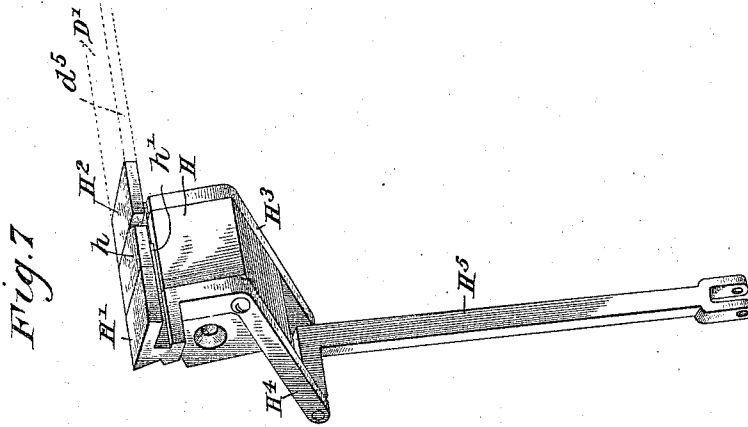
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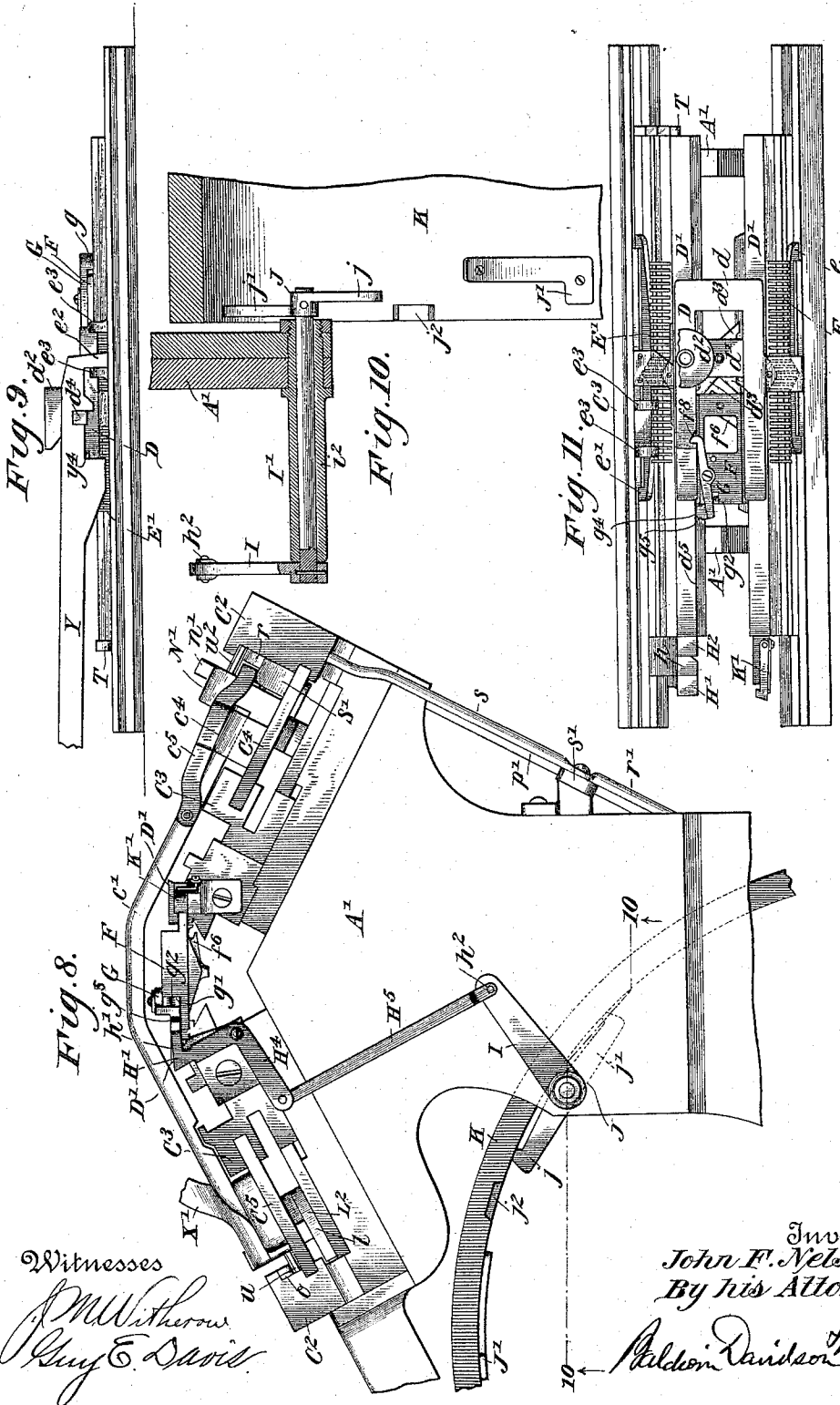
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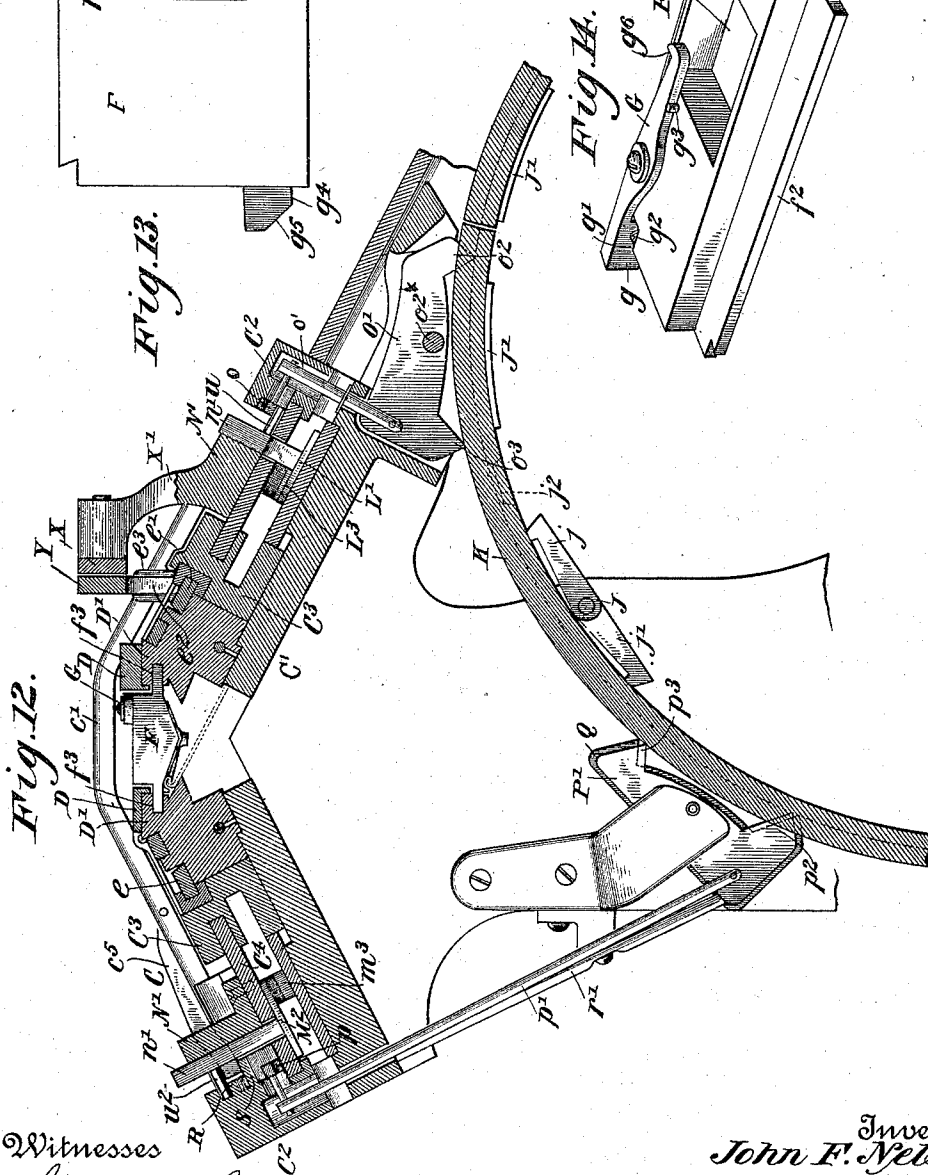
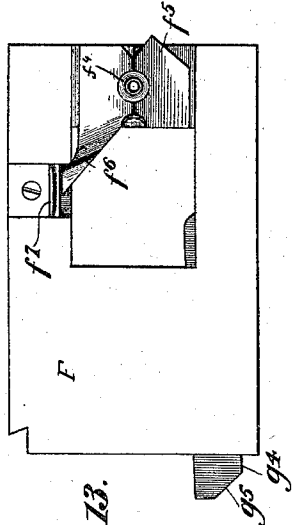
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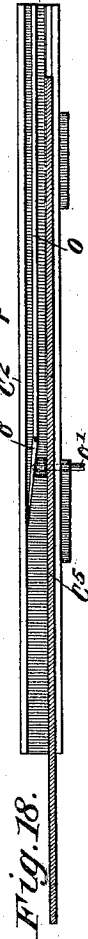
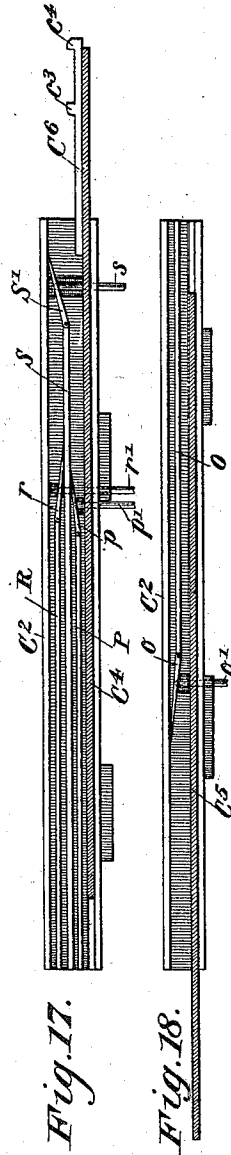
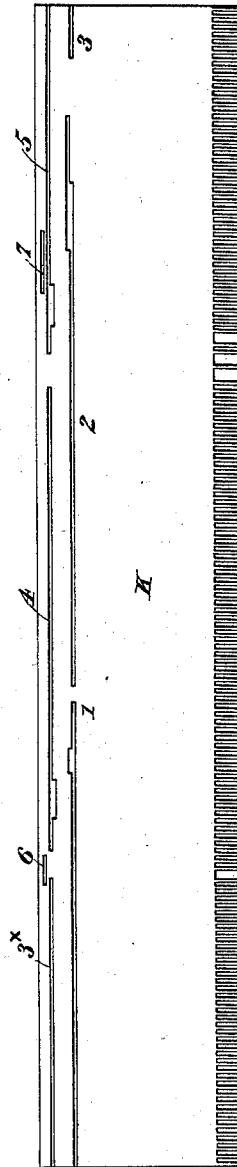
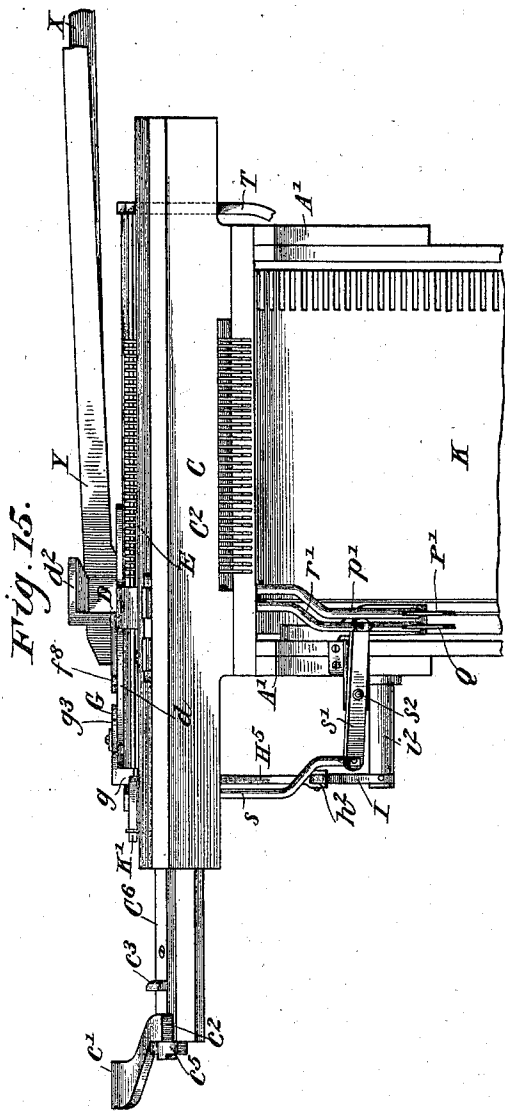
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Fig. 16.

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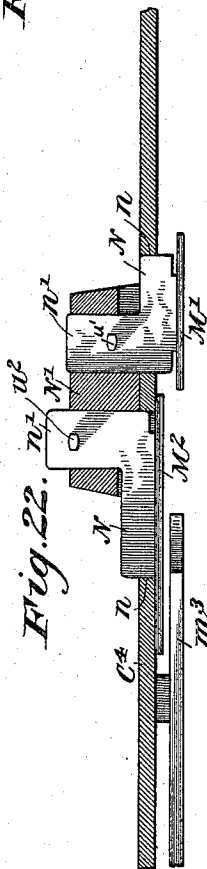
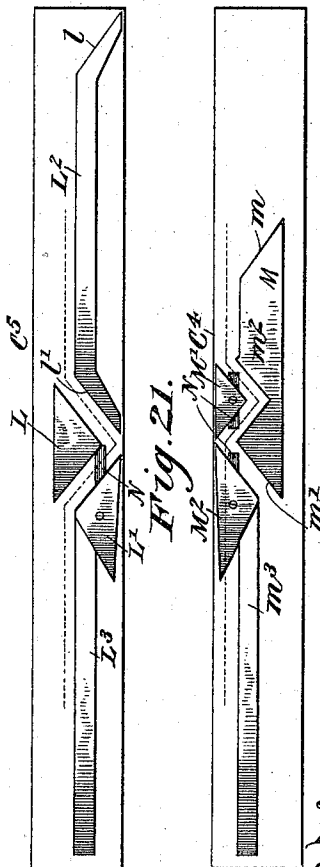
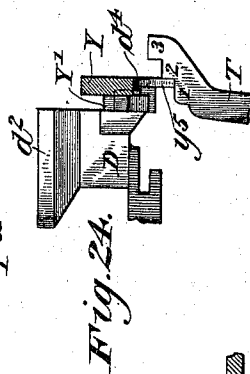
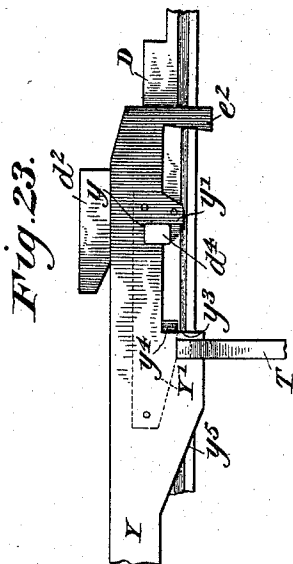
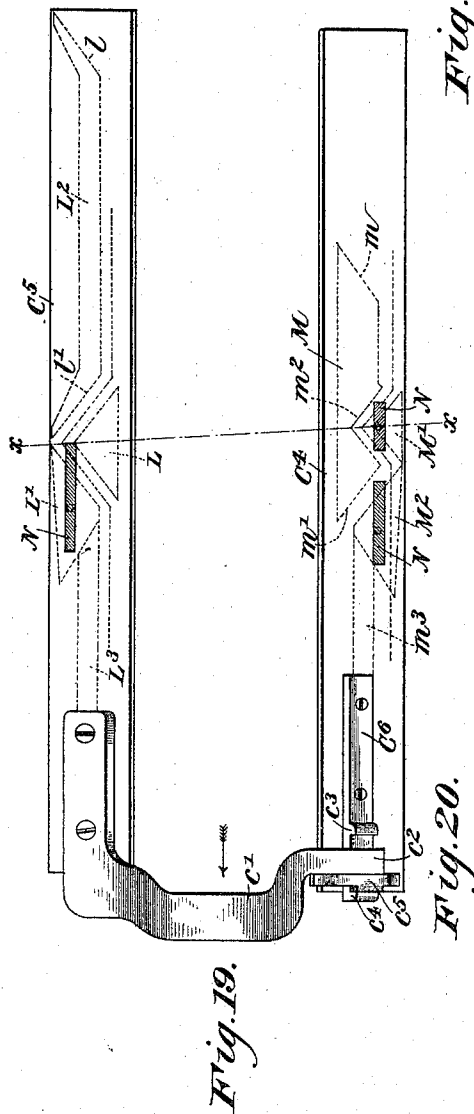
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UNITED STATES PATENT OFFICE.

JOHN F. NELSON, OF ROCKFORD, ILLINOIS.

STRAIGHT-KNITTING MACHINE.

SPECIFICATION forming part of Letters Patent No. 580,290, dated April 6, 1897.

Application filed September 30, 1896. Serial No. 607,458. (No model.)

To all whom it may concern:

Be it known that I, JOHN F. NELSON, a citizen of the United States, residing at Rockford, in the county of Winnebago and State of Illinois, have invented certain new and useful Improvements in Straight-Knitting Machines, of which the following is a specification.

This invention relates to knitting-machines of the class known as "straight-row" or "parallel-row" knitting-machines, especially to the type of this class of machines known as the "Nelson" machine, and shown, for instance, in Letters Patent to John Nelson, No. 214,308, of April 15, 1879, and No. 576,881, of February 9, 1897. These machines are adapted to knit tubular goods generally, but are especially adapted for knitting socks and hose. The Nelson machine in operation knits the toe and the heel by the needles of the back row only and the foot and the leg of the sock or stocking by the needles of both the front and back rows. In knitting the toe and the heel the needles of the back row knit twice for each reciprocation or double stroke of the cam-carrying slide, but while knitting the foot and leg the needles of the front and back rows are each actuated but once for each reciprocation or double stroke of the cam-carrying slides to knit one round.

The object of my invention is to increase the speed of knitting by causing the needles of both front and back rows to knit once for each stroke or twice for each reciprocation of the cam-carrying slides while forming the foot and the leg. For this purpose I employ a main yarn-carrier and an auxiliary yarn-carrier, and properly operate the knitting-cams to cause the needles of both the front and back rows to take yarn from the yarn-carriers at each stroke thereof, thus knitting two complete rounds at each reciprocation. The organization is such that the front row of needles takes yarn from the main yarn-carrier when the latter is moving in one direction, while the back row of needles takes yarn from this yarn-carrier when it is moving in the opposite direction. Likewise the back row of needles takes yarn from the auxiliary yarn-carrier when the latter is moving in one direction and the front row of needles takes yarn from this yarn-carrier when it is moving

in the opposite direction. Thus tubular goods are produced.

My improvements may be embodied in machines differing in details of construction, but in the accompanying drawings I have shown them as embodied in the Nelson machine, and have shown so much of such a machine as is necessary to illustrate the construction, organization, and operation of my present improvements.

While the special object of my invention is to provide for the operation of two yarn-carriers while knitting the foot and the leg of the stocking, I also contemplate using two yarn-carriers while knitting goods of a different character.

Figure 1 is a top plan view of a knitting-machine embodying my improvements with some of the operating parts omitted and the auxiliary yarn-carrier disconnected and out of operation. Fig. 2 is a detail view of the yarn-carrier-operating pitman, showing the manner of connecting it with the main yarn-carrier when both yarn-carriers are in operation. Fig. 3 shows a transverse section thereof. Fig. 4 is a detail view of the yarn-carrier-operating pitman, showing its relation to the main yarn-carrier when dropping the sock. Fig. 5 is a transverse section thereof. Fig. 6 is a right-hand side elevation of the machine with the mechanism in position to form the heel and toe of the sock. This figure shows a portion only of the pattern-cylinder, two opposite portions being brought together to show the active portions of the groove formed in the end of the pattern-cylinder. Fig. 7 is a detail perspective view of part of the mechanism for throwing the auxiliary yarn-carrier into and out of operation. Fig. 8 shows a left-hand side elevation of the machine with the mechanism in position to form the heel and the toe of the sock. Fig. 9 is a detail view, in rear elevation, of the yarn-carrier-operating pitman, showing its connection with the yarn-carrier and back presser-hook-operating mechanism. Fig. 10 shows a section of the machine on the line 10 10 of Fig. 8, looking in the direction of the arrows. Fig. 11 shows a top plan view of the yarn-carriers and some of the mechanism connected therewith. In this view the two yarn-carriers

are connected to operate simultaneously. Fig. 12 shows a transverse section on the line 12 12 of Fig. 1. This figure shows a portion only of the pattern-cylinder. The two opposite portions are brought together in order to show mechanism located at diametrically opposite portions of the cylinder. Fig. 13 is a bottom plan view of the auxiliary yarn-carrier. Fig. 14 is a perspective view of the same. Fig. 15 shows a front elevation of the machine with some of the operating mechanism omitted. The parts are arranged to knit the heel and the toe of the sock. Fig. 16 is a plan view of the pattern-cylinder developed. Fig. 17 shows a longitudinal section of the front cam-carrying slide and an elevation of the adjoining grooved bar for operating the front knitting-cams. Fig. 18 is a similar view of the back cam-carrying slide and the corresponding grooved bar. Fig. 19 shows a top plan view of the two cam-carrying slides with the knitting cams shown in dotted lines in the position they assume when both yarn-carriers are in operation to form the foot and leg of the sock. Fig. 20 is a bottom plan view of the back slide and the cams carried thereby in position to knit the foot and leg of the sock with two yarn-carriers. Fig. 21 is a similar view of the front slide. Fig. 22 is a longitudinal sectional view, on an enlarged scale, of the front slide and the cams carried thereby, which latter are shown in the position they occupy when knitting with the two yarn-carriers. Fig. 23 is a detail view of the yarn-carrier-operating pitman, showing its connection with the main yarn-carrier when knitting the heel and toe of the sock. Fig. 24 shows a transverse section of the same.

The driving-shaft A, extending transversely of the machine, is mounted in suitable bearings z in the main frame A' , which may be of any suitable construction. A hand-wheel A^2 is secured to the front end of the driving-shaft, and at its rear end the driving-shaft is provided with fast and loose pulleys, as usual. A pinion a on the driving-shaft meshes with a gear-wheel a' , (shown in dotted lines,) which latter is connected with mechanism for actuating the pitmen X and Y and for also actuating the pattern-cylinder in any suitable way, preferably in the same manner as that described in the Nelson patent, No. 576,881, above referred to.

A front needle-bed C and a rear needle-bed C' are provided with front and rear rows of needles, which, as usual, are provided with jacks having lugs operated by the knitting-cams. The bed-plates are inclined, as heretofore, and provided with lower longitudinal grooved bars or channel-plates C^2 and upper longitudinal grooved bars or channel-plates C^3 .

A front main cam-carrying slide C^4 and a back main cam-carrying slide C^5 , connected by a yoke c' , reciprocate longitudinally in their guideways in the front and back channel-bars. These main cam-slides carry cams

for actuating the two rows of needles to advance and retract them and are reciprocated by means of a pitman X, connected at X' in the usual way to the back cam-carrying slide C^5 . The yoke c' is rigidly connected with the back cam-carrying slide C^5 and has a shifting connection with the front cam-carrying slide C^4 . At its front end the yoke c' is provided with an arm c^2 , which extends between two upwardly-projecting lugs $c^3 c^4$ on a bracket C^6 , secured to the front cam-carrying slide C^4 . A lever c^5 is pivotally connected to the left-hand side of the arm c^2 and is adapted to be raised and lowered at proper times to occupy either a position above the plane of the lugs $c^3 c^4$ or to enter the space between them, and thus limit the stroke of the arm c^2 between the lugs. The purpose of this organization will be hereinafter explained.

A main yarn-carrier D, of well-known construction, is guided in ways formed in the adjacent edges of the guide-bars D' . This yarn-carrier consists of a U-shaped frame d , having a cross-piece or bridge d' , having an eye for the passage of the yarn and a bracket d^2 , on which may be mounted devices for guiding a plurality of yarns. The frame d is fitted, as shown in Fig. 6, to move longitudinally from right to left of the machine in the guide-bars D' . The bridge d' is provided with devices d^3 for opening the latches of the needles. A lug d^4 extends rearwardly from the frame of the yarn-carrier D and connects with the yarn-carrier-actuating pitman Y, which is actuated in the same manner as that of the machine described in the Nelson patent No. 576,881, of February 9, 1897.

The front row of presser-hooks E is actuated by a cam e , of usual construction, and connected with the yarn-carrier frame d , as illustrated. The back row of presser-hooks E' is in like manner actuated by a presser-hook-actuating cam e' , constructed in the usual way and operated by a tooth e^2 on the end of the yarn-carrier-actuating pitman Y, which operates between lugs e^3 , projecting upwardly from the cam e' . As the construction and operation of these parts are well known, no further description of them is necessary, further than to say that they are suitably operated to actuate the presser-hooks at the proper time with reference to the movement of the needles and the position of the yarn-carriers.

The auxiliary yarn-carrier F consists of a rectangular frame f , open at f' to reduce its weight and having on opposite sides rails f^2 , adapted to move across the machine in guide-grooves f^3 in the guide-bars D' . It is provided with an eye f^4 for the yarn and with a device f^5 , of well-known construction, for holding down the latches of the needles. It is also provided with a latch-opener f^6 , cooperating with a flange f^7 , which acts on the ends of the needles to move them downward into the path of the latch-opener when necessary.

A catch-pawl G is pivoted to the top of the auxiliary yarn-carrier. It has a projection g , extending downwardly into a recess g' at the rear left-hand end of the frame f . In this recess is arranged a spring g^2 , which normally presses the left-hand end of the pawl rearwardly, thus pressing the right-hand end forwardly, this forward movement being limited by a stud g^3 . The projection g is formed with a lug g^4 , having an inclined rear left-hand edge g^5 . The frame d of the main yarn-carrier has a notch f^8 , with which a tooth g^6 on the right-hand end of the catch-pawl G is adapted to engage. When thus engaged, the two yarn-carriers reciprocate together. When disengaged, the main yarn-carrier reciprocates alone.

At the left-hand end of the machine is secured a bracket H, having a head h , the front edge of which is in line with the edge d^3 of the rear guide-bar D'. It is also grooved at h' correspondingly with the guide-groove in the rear bar D'. On opposite sides of the bracket H are arranged dogs H' H², similar in shape to the head h . They are arranged to at times be in line with the bar D' and have grooves corresponding with the guide-grooves therein and the guide-groove in the head h . The dogs H' and H² are provided with rearwardly-extending arms H³ H⁴, pivotally connected with the bracket H and pivotally connected at their rear ends with a downwardly-extending link H⁵, in turn jointed at h^2 to an arm I, extending laterally from a shaft I', projecting through a sleeve i^2 , secured to the main frame A'.

To the inner or right-hand end of the shaft I' is secured a dog J, having two arms j and j' . The arm j is adapted at times to ride on the ribs J', secured to the inside of the pattern-cylinder K near its left-hand edge. The arm j' is adapted at times to enter recesses j^2 in the inner left-hand edge of the pattern cylinder. There are two ribs J', arranged diametrically opposite to each other, and two corresponding recesses j^2 , also arranged opposite to each other in the pattern-cylinder. In Fig. 8 the dog J is shown as separated from the ribs and recesses and riding on the plain inner surface of the pattern-cylinder. When in this position, the dogs H' H² are retracted, as shown in Figs. 1 and 8, and the lug g^4 is moved back behind the front edge of the rear guide-bar D', the tooth g^6 being withdrawn from the frame of the main yarn-carrier, so as not to enter the notch f^8 . Thus the main yarn-carrier can reciprocate without moving the auxiliary yarn-carrier. When, however, the dog J engages the rib J' and the notch j^2 , the dogs H' H² will be moved forward to the position shown in Figs. 7 and 11. At this instant the main yarn-carrier is at the limit of its movement to the left and the notch f^8 is directly opposite the tooth g^6 of the catch-pawl. This forward movement of the dogs causes the catch-pawl to shift, as above described, and thereafter the two yarn-carriers

will move together until the dogs are again shifted, the lug g^4 riding along the edges of the dogs H' and H² and the head h . A spring-pawl K', pivotally connected with the front guide-bar D', prevents the auxiliary yarn-carrier from moving too far to the left, but permits of its being removed when detached from the main yarn-carrier.

The back cam-carrying slide C⁵ is provided with a stationary triangular cam L, a movable triangular cam L', and a guide-rail L², having an inclined right-hand end l and an inclined left-hand end l' , the edge of which corresponds with the adjacent edge of the cam L, there being sufficient space between the two edges to permit of the passage of the lugs on the needle-jacks. A straight rail L³ is also secured to the left-hand end of the slide C⁵, and at the inner end of this rail is arranged the movable triangular cam L'. This cam is adapted to be raised and depressed. When raised, it is out of operation, and when depressed it operates as one of the knitting-cams.

The front slide C⁴ is provided with a stationary cam M, having inclined ends m m' , and a triangular recess m^2 , into which projects the point of a triangular cam M', adapted to be raised and depressed. A guide-rail m^3 is secured to the slide to the left of the cam M, and at the inner end of this rail is mounted a triangular cam M², which is adapted to be raised and depressed. The cam M' is only brought into operation when both yarn-carriers are employed. I therefore call this cam the "auxiliary" cam.

The knitting-cams act on the jacks of the needles in the same way as they do in the well-known Nelson machines, but are arranged to actuate the needles at proper times to correspond with the movements of the yarn-carriers as arranged in accordance with my improvements. The movable cams L', M', and M² are provided with upwardly-projecting arms having studs which enter guide-grooves that raise and lower the cams at the proper times. The construction of the arms and the arrangement of the lugs is similar for all the movable cams. This construction is shown in Fig. 22, which shows the movable cams on the front slide.

Each cam has a plate N projecting upwardly from it through a slot n in the slide. The plate has an upwardly-projecting arm n' , which extends through a slotted guide-bracket N', secured to the top of the slide. Each of these plates carries a stud adapted to move in a corresponding guide-groove. In the prior Nelson machines the movable cams have been secured to arms which have a pivotal movement, but by my present improvements I give to the cam a straight up-and-down movement.

The lug u on the arm of the movable cam L' of the back slide extends into a groove in the rear guide-bar C². A rail O divides the groove into two parts, and at its left-hand

end is a pivoted switch o . By this switch the lug is caused to travel either below or above the rail O . When traveling below the rail, the cam L' is depressed and in operation. When the lug travels above the rail, it is elevated and out of operation. The switch o is operated by a rod o' , which extends downwardly through the frame of the machine and is pivotally connected with a shoe O' , pivoted at o^{2x} to the frame and having at opposite ends pointed lugs o^2 o^3 , adapted to ride on the periphery of the cylinder and in grooves 1 2 3 therein. As shown in Fig. 16, the pattern-grooves are such as to raise and depress the switch o at proper times to either raise or depress the cam L' .

The lug u' of the cam M' travels above and below the rail P , the switch p controlling the position of the lug and the position of the switch being controlled by a rod p' , connected at its lower end to a dog P' , having at its opposite ends pointed lugs p^2 p^3 , adapted to move in grooves 3, 4, 5 in the pattern-cylinder, the arrangement being such as to shift the switch at proper times. In like manner the lug u^2 of the cam M^2 is adapted to travel above and below the rail R , its position being controlled by a switch r , operated by a rod r' , connected to and operated by a shoe Q , similar to the shoe P' and operating on the periphery of the pattern-cylinder and in grooves 6 and 7.

A rail S , interposed between the rails P and R , controls the position of the lever c^5 . This lever is adapted to move either above or below the rail S as the slides reciprocate. A switch S' controls the position of the lever. This switch is operated by a rod s , connected at its lower end with a lever s' , pivoted at s^2 to the frame and connected at its right-hand end with the rod r' . When the switch S' is elevated, as shown in Fig. 17, the lever c^5 will travel below the rail S , the end of the lever being then arranged inside the lug c^4 , as shown in Fig. 19. When the lever is arranged above the rail S , it will be also arranged above the plane of the lugs c^3 c^4 . This organization is for the purpose of shifting the position of the knitting-cams at proper times. I also provide for shifting the connection between the yarn-carrier and its actuating-pitman. This pitman at its left-hand end is provided with a tooth e^2 for actuating the rear presser-hook cam and with a notch y , into which projects at times the lug d^4 on the main yarn-carrier. It is also provided with a shoulder y' , projecting below the notch, and with another shoulder y^3 at its right-hand end. On its inner or front side the end of the pitman is reinforced by a plate Y' , notched correspondingly with the notch y and having an end y^4 , projecting beyond the shoulder y^3 . The head of the pitman is also provided on its under side with an inclined edge y^5 . The lower edge of the head of the pitman is adapted to ride on the upper end or head of a bell-

crank lever T , pivoted at t to the right-hand side frame of the machine, and having a lug t' , projecting into a pattern-groove T' in the right-hand end of the pattern-cylinder. This groove is provided with an inwardly-projecting offset t^2 , which shifts the lever, causing its upper end or head to move forwardly. It is also provided with a similar offset t^3 , directly opposite the offset t^2 , which causes the upper end of the lever T to move still farther forward. As shown in Fig. 6, the head of the lever T is provided with three steps on which the lower edge of the head of the yarn-carrier-actuating pitman is adapted to slide. When the head of the pitman rests on the step 1, the lug d^4 on the yarn-carrier will be arranged in the notch y , as shown in Fig. 23. This is the position which the parts occupy when the knitting is started and when the toe and heel are being formed, also while two rounds are being knit just after knitting the toe, and ten rounds at the upper end of the leg of the stocking. When the pitman rests on the step 2, both yarn-carriers are in operation. At this time the lug d^4 is arranged in the notch y when the pitman is moving to the right and until its head rides up over the step 2. It will then leave the notch, and when the pitman moves to the left the lug d^4 will be engaged by the projection y^4 from the plate Y' . The parts remain in this position (see Fig. 2) until the pitman has completed its stroke to the left. On its return stroke the pitman will move for a short distance without moving the yarn-carrier, but soon the lug d^4 will enter the notch y and the yarn-carrier will be actuated as before. This shifting of the connection between the yarn-carrier and its actuating-pitman at the end of each stroke, in connection with the actuation of the knitting-needles at the proper times, facilitates the transfer of yarns from the front to the back row of needles, and vice versa, when knitting the foot and the leg.

When the pitman rests on the step 3, (see Figs. 4 and 5,) the lug d^4 will be below the lower edge of the plate Y' , and therefore the pitman will reciprocate without actuating the yarn-carrier. It performs this operation when dropping or casting off a completed sock.

In starting to knit a sock the main yarn-carrier carries the yarn from right to left across the projecting ends of both the front and back rows of needles. Both sets of needles are withdrawn and form a zigzag line with the yarn, which constitutes what I call the "set-up." At the end of the movement of the slides to the left the front row of needles are thrown out of operation and the back row are operated to knit the yarn to form the toe. After the toe is formed two rounds of tubular work are knit with a single yarn. Then both yarn-carriers are thrown into operation to knit the foot. After this is completed the front row of needles is thrown out of operation and the back row knits the heel.

When the heel is completed, the auxiliary yarn-carrier is thrown in and the leg is knit on both rows of needles with both yarn-carriers. Finally one yarn-carrier is dropped, ten rounds are knit at the top of the leg, and the sock is cast off and dropped.

When a sock is finished, the head of the pitman Y will ride on the step 3 of the bell-crank lever T, thus causing the opening y to clear the lug d^4 and permit the yarn-carrier to rest while the sock is being dropped. When the cam-slides are at the end of their movement to the left after the dropping of the sock, the cam L' of the back slide is depressed and the lever T is shifted, so that on the next stroke to the right the head of the pitman will ride over the step 1 and thereby cause the pitman to take up the main yarn-carrier. The set-up is next made in the usual way as the yarn-carrier is moved to the left. When the set-up is being made, all the cams of the back slide are in operation and the cam M^2 of the front slide is depressed and cam M' elevated, while the lever c^5 is raised above the lugs c^3 c^4 and rides in the groove above the rail S.

After the set-up has been formed and the yarn-carrier has moved to the left, the switches r and S' and cam M^2 will be shifted, and thus the front row of the needles will be thrown out of operation. At the same time the lever c^5 will be allowed to fall in between the lugs c^3 c^4 . The toe of the sock is then knit by the back row of needles, the auxiliary yarn-carrier being out of operation and situated at the left-hand end of the machine. After the knitting of the toe the switches r , S' , and o are shifted, thus elevating the cam L' and depressing the cam M^2 and also raising the lever c^5 above the plane of the lugs c^3 c^4 . Two rounds are then knit with one yarn-carrier, the two slides C^4 C^5 being in the same relative position. As soon as the two rounds are knit and while the main yarn-carrier is at the left-hand end of the machine the switches r , S' , p , and o are shifted, thus elevating the cam M^2 , depressing the cam M' , elevating the cam L' , and causing the lever c^5 to fall in between the lugs c^3 c^4 . At the same time the auxiliary yarn-carrier is attached to the main yarn-carrier in the manner hereinbefore described and the bell-crank lever T is shifted so that its head will ride on the step 2.

When knitting with two yarn-carriers, the back row of needles is always raised and the front row is lowered at the end of each stroke. As soon as the auxiliary yarn-carrier is attached to the main yarn-carrier they move together to the right, the needles of the back row draw successively and take yarn from the main yarn-carrier and form stitches. As soon as the stitches are formed the needles of the front row are raised and lowered and take yarn from the auxiliary yarn-carrier and likewise form stitches. As soon as these are formed the needles of the back row are raised

and so on, the needles being left in the same position when the yarn-carriers arrive at the right-hand end of the machine as they were when the yarn-carriers were at the left-hand end of the machine. The return stroke is begun when the head of the pitman Y rests on the step 2 of the bell-crank lever T, thus allowing the yarn-carrier to rest as the notch y clears the lug d^4 . The end y^4 of the plate Y' now moves against the lug d^4 and carries the yarn-carrier to the left. (See Fig. 2.) The operation is such as to produce a dwell to allow the auxiliary yarn-carrier to transfer yarn to the back row of needles and the main yarn-carrier to feed yarn to the front row. The foot of the sock is next formed with both yarn-carriers, after which the auxiliary yarn-carrier is dropped and the switch p is shifted so as to elevate the cam M' . At the same time the bell-crank lever T is shifted, causing the head of the pitman Y to ride on step 1. The heel is next knit, after which the auxiliary yarn-carrier is again brought into operation and lever T is shifted, bringing step 2 under the pitman Y. The switch p is shifted, causing cam M' to be brought into operation. The leg is knit in the same manner as the foot. Afterward switches r , S' , p , and o are shifted, causing cams L' and M' to be elevated and cam M^2 to be depressed, and causing lever c^5 to be raised above the plane of the lugs c^3 c^4 . The bell-crank lever T is also shifted, so that step 1 will be under the pitman Y. The auxiliary yarn-carrier is dropped, and ten rows are knit with one yarn-carrier, thus completing the sock, which is dropped and a new one started.

While knitting-machines have heretofore been provided with two yarn-carriers supplying yarn simultaneously to the front and back rows of needles, so far as I am aware two yarn-carriers have not been so arranged that one may be thrown into and out of operation, when desired, at the different stages of the formation of the goods, nor has provision been made for so operating the knitting-cams and the yarn-carriers as to provide for the changes in knitting incident to forming such goods as stockings.

The machine herein shown and described is so organized and operated that the main yarn-carrier only is employed in knitting the toe and heel, while the auxiliary yarn-carrier is brought into operation to assist the main yarn-carrier only while the foot and leg are being formed; but I do not herein broadly claim this subject-matter, as it is claimed in my prior application, Serial No. 592,606, filed May 22, 1896.

I claim as my invention—

1. In a knitting-machine, the combination with the needles and their actuating-cams, of a main yarn-carrier and an auxiliary yarn-carrier detachably connected therewith.

2. The combination with the needles and their actuating-cams, of a main yarn-carrier,

an auxiliary yarn-carrier detachably connected therewith, means for actuating the main yarn-carrier, and devices for automatically connecting and disconnecting the auxiliary

5 yarn-carrier and the main yarn-carrier.
 3. The combination with the needles and their actuating-cams, of the main yarn-carrier, the auxiliary yarn-carrier, a catch-pawl adapted to engage directly with the main
 10 yarn-carrier, and devices for automatically operating the catch-pawl to engage with or disengage from the main yarn-carrier.

4. The combination with the needles and their actuating-cams, of a main yarn-carrier,
 15 an auxiliary yarn-carrier, a pivoted catch-pawl adapted to engage with a notch in the frame of the main yarn-carrier, the pivoted dogs adapted to engage with the end of the pawl, the pattern-cylinder and connections
 20 between the pattern-cylinder and the dogs for operating them.

5. The combination with the needles and their actuating-cams, of the yarn-carriers, their actuating-pitman and the stepped lever
 25 engaging with the pitman, the pattern-cylinder, and connections between the pattern-cylinder and the lever for actuating it.

6. The combination with the needles and their actuating-cams, of the yarn-carriers,
 30 their actuating-pitman provided with the notches and shoulders as described, the stepped lever, the pattern-cylinder, and con-

nections between the pattern-cylinder and the stepped lever for actuating it.

7. The combination of the main yarn-carrier, the auxiliary yarn-carrier, means for reciprocating them, the guide-bars and the spring-catch on the end of one of the guide-bars for limiting the movement of the auxiliary yarn-carrier and permitting of its with-
 40 drawal from the machine.

8. In a knitting-machine, the combination of the front and back cam-carrying slides, a yoke rigidly connected to one slide, lugs on the other slide between which one end of the yoke is adapted to move, and a lever pivoted
 45 to the yoke adapted at times to enter between the end of the yoke and one of the lugs.

9. In a knitting-machine, the combination of the front and back cam-carrying slides, a yoke rigidly connected to one slide and projecting between lugs on the other slide, a lever pivoted to the yoke and adapted to enter
 50 between the end of the yoke and one of the lugs, a guide-rail for the lever, a switch for
 55 guiding the lever to the opposite sides of the rail, and means for shifting the switch.

In testimony whereof I have hereunto subscribed my name.

JOHN F. NELSON.

Witnesses:

A. D. EARLY,
 H. W. TAYLOR.