

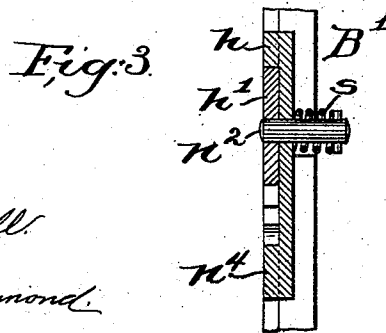
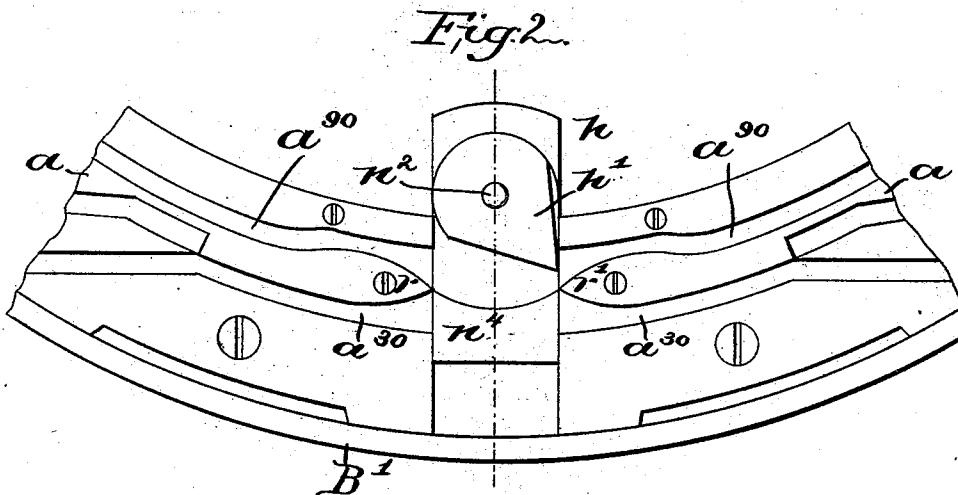
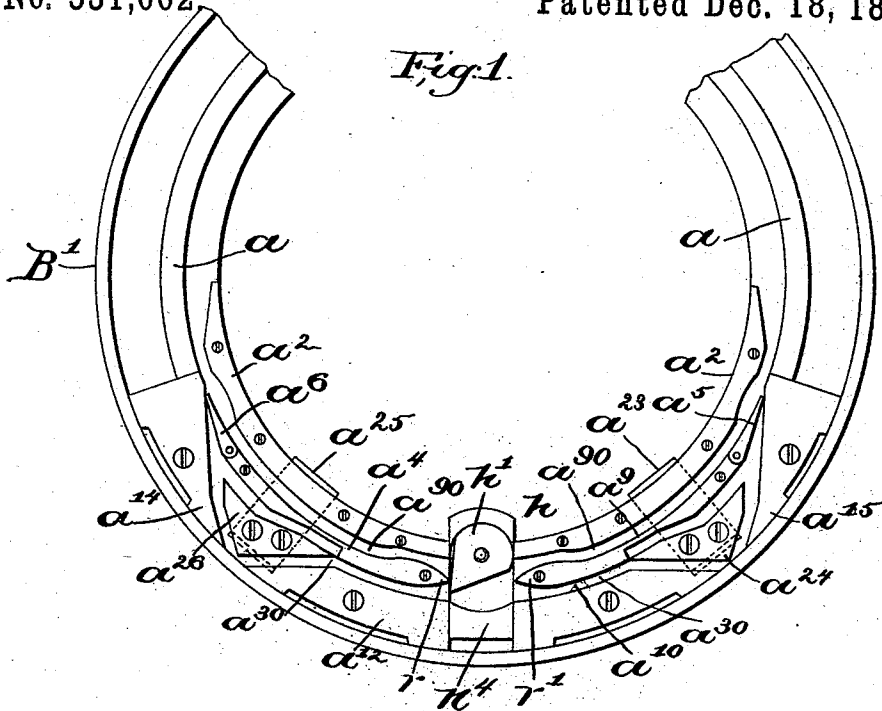
(No Model.)

2 Sheets—Sheet 1.

J. F. PHARO.
KNITTING MACHINE.

No. 531,062

Patented Dec. 18, 1894.



Witnesses

Louis N. Souwell.

Thomas J. Drummond.

Inventor

John F. Pharo.
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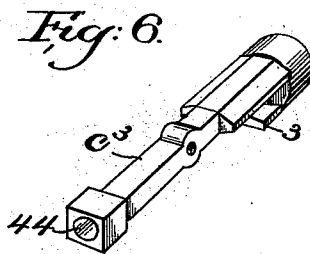
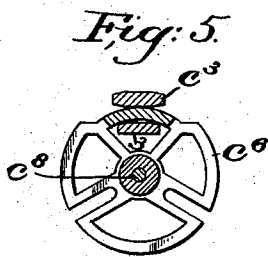
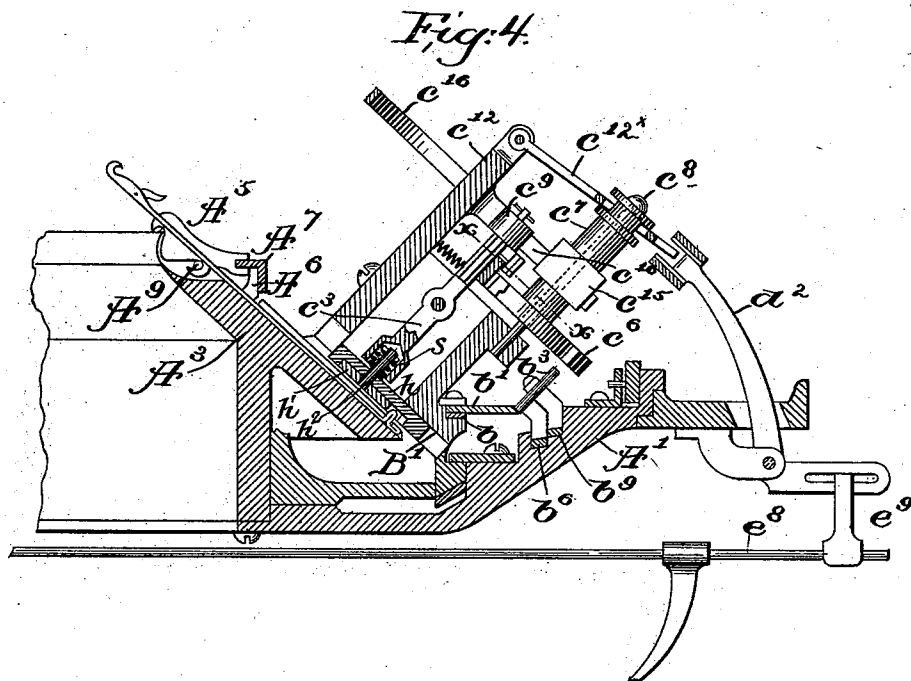
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UNITED STATES PATENT OFFICE.

JOHN FRANKLIN PHARO, OF DANVILLE, ASSIGNOR TO MORITZ BOAS, OF
ST. HYACINTHE, CANADA.

KNITTING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 531,062, dated December 18, 1894.

Application filed December 7, 1893. Serial No. 492,980. (No model.)

To all whom it may concern:

Be it known that I, JOHN FRANKLIN PHARO, a subject of the Queen of Great Britain, residing at Danville, Province of Quebec, Dominion of Canada, have invented an Improvement in Knitting-Machines, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The circular reversible machine described in United States Patent No. 479,986, dated August 2, 1892, shows a cam ring provided with right and left-hand grooves, each leading under a right or left stitch-cam located at a lower level, said grooves crossing each other, portions of each of said grooves from their crossing points in opposite directions forming a non-knitting and also a topping groove, and said cam ring carries at the junction or crossing points of said grooves right and left-hand guiding gates, the points of which are directed each toward the other and left at but a short distance apart, the space between the points of said guiding gates being occupied by a directing cam, said directing cam being shown as free to oscillate about a pivot. In the patent referred to, both right and left-hand guiding gates occupy their upper position when knitting circular work, but when about knitting the last course of circular knitting preparatory to changing from circular to reverse knitting, or when getting ready to narrow, where only a part of the needles of the series of needles is to be used to knit, the said gates are depressed just as the point of one of said gates approaches the particular needle which is not to knit in the first course of reverse knitting, and all the needles then under the stitch cam are returned into the non-knitting groove during the further movement of the cam ring. Then for the first course of reciprocating knitting, the machine having been reversed, the points of the gates are elevated just as one of said points approaches the first needle to be used in the reciprocating course, and it remains in that position until the desired number of needles have been brought down, that depending upon the pattern surface, and then said points are again de-

pressed to allow the balance of the needles to remain in the non-knitting groove, while the cam cylinder continues to travel in the same direction far enough to return all the needles into the non-knitting groove. This done, and the cam cylinder again reversed, the gates are again elevated to engage and draw down only the desired number of needles for the next course, and so on as described.

I have done away with the so-called right and left-hand movable guiding gates, and in so doing have given strength and durability to the machine, and instead of these gates I have provided the cam ring with a carriage adapted to be moved up and down automatically in a suitable guide-way, said carriage having mounted upon it a movable directing cam,—in this instance of my invention shown as oscillating,—and also preferably a guard, the latter being located just below the directing cam, said carriage and its attached parts occupying a position between the fixed points located near the junction of the right and left-hand knitting grooves, said points being directed toward said carriage.

One part of my invention in a reversible circular knitting machine consists in a cam ring having right and left stitch-cams and needle elevating cams and provided with right and left knitting grooves, each leading under said right and left stitch cams, they occupying a position in a lower plane, said grooves crossing each other, portions of said grooves from their crossing points in opposite directions forming non-knitting and also topping grooves, a slidable carriage located at the junction of said grooves and having a movable directing cam and a guard; and a cam, and intermediate devices actuated thereby to move said carriage down at the commencement of a reciprocating course to enable the directing cam to direct the needles to be used in that course into the knitting groove, and then to elevate said cam to prevent the entrance into said knitting groove of the needles not to knit in said course, and enable the needles already used in that course to return from the knitting into the non-knitting groove preparatory to knitting a succeeding reciprocal course.

I have chosen to illustrate my invention in

connection with a machine such as represented in said Patent No. 479,986.

Figure 1, shows an inner side developed view of a cam ring of conical form embodying my invention. Fig. 2 is a detail showing the carriage and directing cam in another position. Fig. 3 shows the carriage detached. Fig. 4 is a sectional detail taken vertically through the needle-bed, cam ring, and carriage, with some of the parts to operate said carriage. Fig. 5 is a section in the line $x-x$. Fig. 4, chiefly to show the cam c^6 . Fig. 6 shows the lever in perspective.

The bed plate A^1 , the needle-bed A^3 having the rim A^6 on which rests and moves the sinker actuating ring A^7 ; the sinkers A^8 mounted on the fulcrum wire A^9 ; the cam c^6 ; the stud or pivot c^8 about which it turns; the yoke c^{12x} ; the controlling lever d^2 ; the arm e^9 ; rock-shaft e^8 ; the lever c^3 ; the cam ring B^1 , its ledge or flange a ; guard strip a^2 ; segmental bars a^4 , a^9 to separate the knitting groove below them from the non-knitting or topping groove above them; the latches a^5 , a^6 ; the plates a^{10} , a^{12} constituting by their upper edges one side wall of the knitting groove, the needle elevating plates a^{14} , a^{15} ; the slides a^{23} , a^{25} their attached drawing down cams a^{24} , a^{26} ; the stop rings b^6 , b^9 ; and the rings b , b' , having suitable tripping pins,—only one b^3 of which is shown,—are and may be all as shown in said Patent No. 479,986, wherein like parts are designated by like letters and figures, and it will be understood that said parts may be moved or actuated as provided for in said patent. The plates a^{14} , a^{15} , and the drawing down cams a^{24} , a^{26} , constitute stitch cams.

I have slightly modified the shape of the lever c^3 , I having provided it, see Fig. 6, with a hole 44.

I have shaped the adjacent ends of the bars a^4 , a^9 to constitute stationary points r and r' with a throat or passageway, see Figs. 1 and 2 between them, said throat permitting the butts of the knitting machine needles to pass through it when the said butts are led from the non-knitting groove a^{30} into the knitting groove a^{30} , and vice versa.

I have provided the cam ring with a groove from its top to its bottom edge, or substantially so, and in this groove I have placed a carriage h , on which I have mounted a directing cam h' , said cam being movable on said carriage so as to present an inclined face toward one or the other of said points r , r' , as in Figs. 1 and 2, said directing cam in this instance of my invention being shown as a heart cam having at its center of motion a pin n^2 . This directing cam is turned in one or the other direction on the carriage by contact either against the butts of the needles or by friction against the needle-bed as the cam ring is being reciprocated, the directing cam striking a needle butt being moved toward the ledge point r or r' farthest from the pin n^2 in the direction of movement of the

cam ring. This carriage, as shown, also carries as part of it a guard n^4 concaved at its upper side, the acting edge of said guide nearest the directing cam at times constituting a continuation of the lower edge of the knitting cam, as in Fig. 1, or closing the throat between the stationary points r and r' , as in Fig. 2, as when it is desired to retain the butts of all the needles in the non-knitting or topping groove above ledge a , and bars a^4 , a^9 , said guide preventing the butts of the needles from dropping to positions lower than desired. The carriage may be moved in the cam ring by a lever c^3 such as common to said patent, the inner end of which may engage the pin n^2 referred to, said lever being actuated at the proper time by cam c^6 which may be oscillated as provided for in said patent, the times of oscillation of said cam, and consequently the movement of said lever, being determined in practice as to time in the reciprocations of the cam ring, by or through a pattern chain or surface, as provided for in said Patent No. 479,986.

The pin n^2 is shown as surrounded by a friction device, represented as a spring s which acts to hold the directing cam in place on the carriage as against accidental movement or movement due to gravity or momentum.

By mounting the directing cam on a carriage movable in the cam ring and transverse to the knitting and non-knitting grooves, so that the said cam may be not only moved up and down between the stationary points r and r' and also move toward and from said points in the reciprocation of the cam ring, I am enabled to control with certainty the movements of the butts of the needles into the proper grooves below said points to knit or to remain above said points out of action, and this by the employment of fewer and stronger parts than when the guiding gates are moved as provided for in said patents, and simplicity and durability of parts are also gained. This invention is not limited to moving the said carriage by the particular lever and cam shown, nor is this invention limited to the exact shape shown for the movable directing cam, and it will be understood that other equivalent parts might be devised by the exercise of only the skill of a mechanic versed in the art of knitting, and such equivalents would be within the scope of this invention.

It will be understood that the directing cam h' when swung about its center by striking against the butt of a needle, should remain in that position against any accidental movement except when, in the positive movement of the cam ring, the said directing cam again meets the butt of a needle; and while I have shown a spring s as a friction device to retain the cam in the position in which it may be left until again positively moved, I desire it to be understood that this invention is not limited to the use of such a friction device as shown, but that instead I may em-

ploy any other usual or suitable device to enable the directing cam to be retained in either of its two extreme positions, Figs. 1 and 2, by friction, that may be safely overcome by the action of the cam against the butt of the needle.

Prior to my invention it has been customary in knitting machines to provide a cam ring with a knitting groove and with an idle groove above it, and in said machine when it was desired to do reciprocating knitting, the needles not to be used were acted upon by a switch and transferred bodily into the idle groove where they were permitted to remain during the time that the cam ring was being reciprocated to narrow and widen in the formation of a heel or toe, and said machine had at each side the open space between the usual stitch-cam and between the knitting groove and the idle groove, a needle elevator and a needle depressor, the needle elevators working alternately during narrowing on the end-most needles being used to knit, and putting said needles one after another from opposite ends of the series of needles into the idle groove, and the narrowest course having been knitted, the depressors come into operation and depress the needles alternately from opposite ends to bring down from the idle grooves one after another the needles put into said idle grooves by the elevators.

In the machine herein described and made the subject of this invention, when circular knitting is being done, the carriage *h* occupies its lowest position, and in the last course of circular work preparatory to narrowing, the carriage is raised when the last needle of the last circular course passes under the stationary point located at one side of the crossing between the right and left knitting grooves, so that said directing cam opens a passage for the next needle to enter the non-knitting groove above said point, and the cam ring continues to move in the same direction until all the needles then in the knitting groove have been returned into the non-knitting groove. This done, the movement of the cam ring is reversed, the carriage, however, remaining up until the point of the directing cam comes opposite that needle which is to constitute the first needle in the first reciprocating course to be made, when the carriage is lowered, causing the directing cam to meet and direct said needle under the stationary point at the junction of the right and left-hand grooves, and at that side thereof in the direction of the rotation of the cam ring, causing said needle and a number of needles following it, sufficient for the course then to

be knitted, to pass under the stitch cam, and as the last needle of the number to knit in the said course passes under said stationary point, the said carriage is again lifted automatically to cause the directing cam, as before stated, to open a passage above said point for the entrance into the non-knitting groove of the needles not to be used in said course, this being repeated at each reciprocating course.

It will be understood from the foregoing, that a simple change in the position of the carriage *h* between one and the next course of reciprocating knitting enables me to employ in any one course of reciprocating knitting any desired number of needles of the entire number in the circular series, and said directing cam consequently performs the duty heretofore performed by the right and left guiding gates referred to, and also by the said switch, the two elevators and the two depressors and the idle groove referred to as belonging to another well known form of machine.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

In a reversible circular knitting machine the following instrumentalities, viz:—a cam ring having right and left stitch cams and needle elevating cams and provided with right and left knitting grooves, each leading under said right and left stitch cams, they occupying a position in a lower plane, said grooves crossing each other between stationary points, portions of said grooves from their crossing points in opposite directions forming non-knitting and also topping grooves, a slidable carriage located at the junction of said grooves and having a movable directing cam and a guard; and a cam, and intermediate devices actuated thereby to move said carriage down at the commencement of a reciprocating course to enable the directing cam to direct the needles to be used in that course into the knitting groove, and then to elevate said cam to prevent the entrance into said knitting groove of the needles not to knit in said course, and enable the needles already used in that course to return from the knitting into the non-knitting groove preparatory to knitting a succeeding reciprocal course, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOHN FRANKLIN PHARO.

Witnesses:

M. BOAS,

F. A. BRIEN.