No. 694,515. Patented Mar. 4, 1902.

W. P. YOUNG.

YARN CHANGING MECHANISM FOR CIRCULAR KNITTING MACHINES.

(Application filed June 24, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

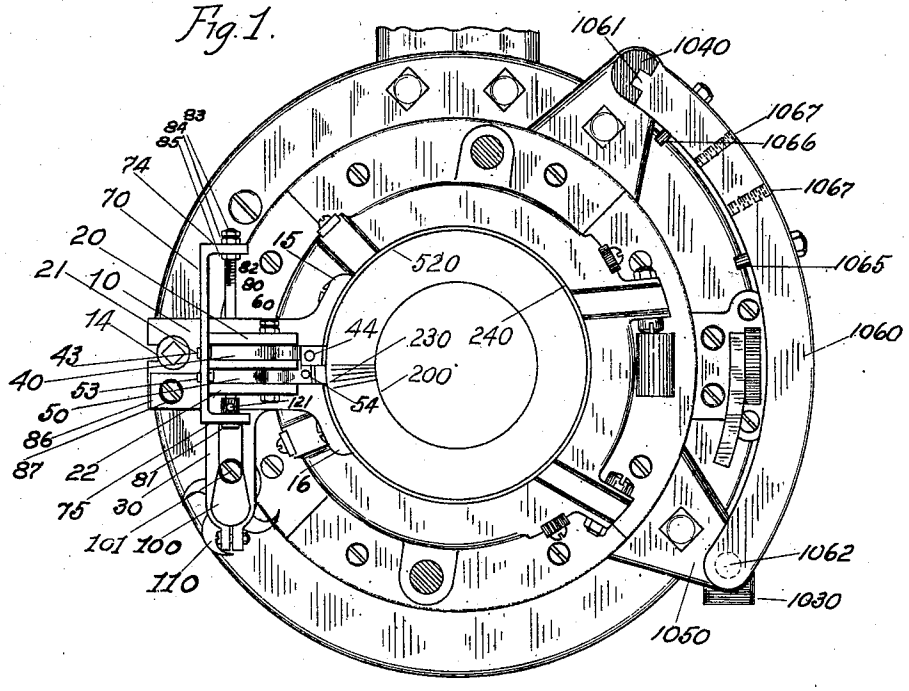
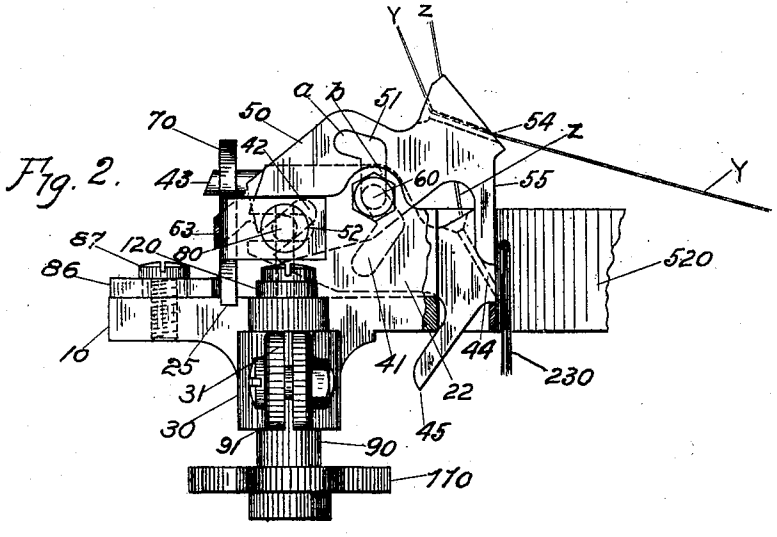


Fig. 2.



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Fig. 3.

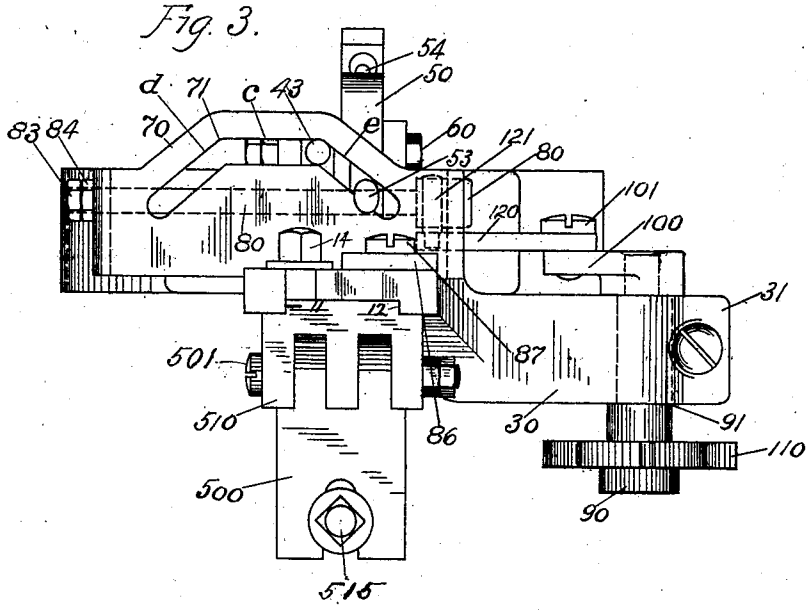
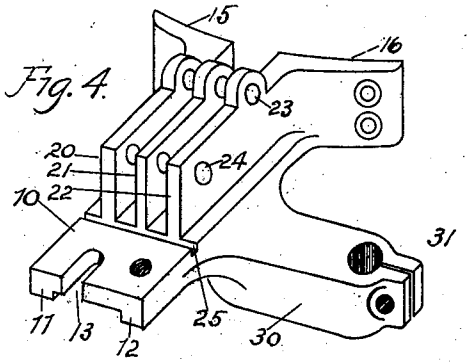


Fig. 4.



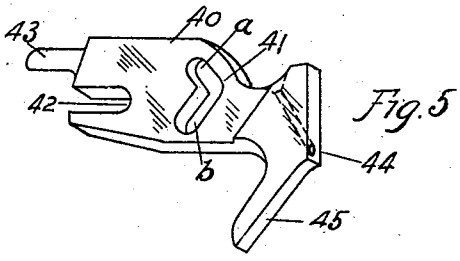
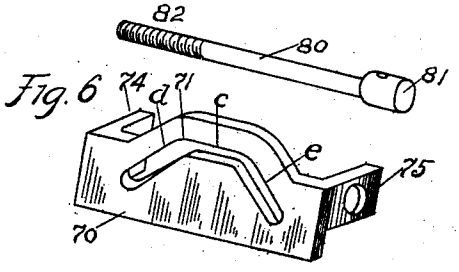


Fig. 5

Fig. 6



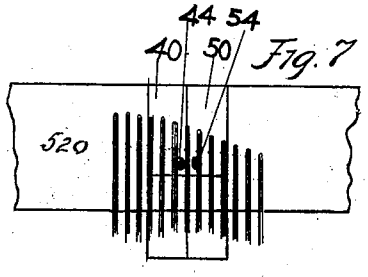


Fig. 7

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UNITED STATES PATENT OFFICE.

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YARN-CHANGING MECHANISM FOR CIRCULAR-KNITTING MACHINES.

SPECIFICATION forming part of Letters Patent No. 694,515, dated March 4, 1902.

Application filed June 24, 1901. Serial No. 65,781. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. YOUNG, a citizen of the United States of America, residing at Woonsocket, in the county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Yarn-Changing Mechanisms for Knitting-Machines, of which the following is a specification.

This invention relates to a yarn-changing mechanism in which both yarns alternately knit into the fabric are constantly connected to the fabric and constantly passed through the yarn-carriers, either being fed to the needles while the other floats inactively within the circular series of needles.

The object of this invention is to provide a yarn-changing mechanism for a high-speed knitting-machine which will operate with certainty and precision, which is simple in construction, composed of few parts, and not liable to get out of order.

Another object of the invention is to provide a yarn-changing device which will effect a change of yarns during the narrowing and widening operations for producing different colors in the same heel or toe.

Figure 1 of the accompanying drawings represents a plan view of a knitting-head of a circular-knitting machine provided with this yarn-changer. Fig. 2 represents a front elevation of this yarn-changer on a larger scale, one of the yarn-carriers thereof being in horizontal position for feeding one of the yarns to the needles and the other yarn-carrier being in elevated and extended position for withholding the yarn from the needles and permitting it to float behind the needles across the interior of the stocking or tubular fabric being knit. Fig. 3 represents a side elevation of the yarn-changer, the parts being in the same position as in Fig. 2. Fig. 4 represents a perspective view of the supporting-bracket of this yarn-changer. Fig. 5 represents a perspective view of one of the yarn-carriers and its fulcrum-rod detached. Fig. 6 represents a perspective view of the cam-slide for shifting the yarn-carriers and its fulcrum-rod detached. Fig. 7 represents an elevation of the inner face of a fragment of the circular needle-guard and the ends of the yarn-carriers, both the latter being in depressed active position and the yarn-guides of said carriers being in the same relative positions with relation to the pyramid of active needles, whereby either carrier may be used in alternation during the formation of a heel or toe. The same reference-numbers are used in all the figures in the designation of the same parts.

This yarn-changer attachment may be applied to any circular-knitting machine to which it is applicable in which yarns of different colors are used in alternation. It is herein shown as applied to what is known to the trade as the "New Victor Knitting Machine," the general structure of which is shown in United States Patent No. 537,802 and it is a substitute for improvement upon the yarn-changer shown in United States Patent No. 580,925.

This invention is illustrated in connection with a knitting-head similar in its general structure to that shown in the patent above referred to, comprising a needle-cylinder, as 200, containing a circular series of independent vertically-reciprocating latch-needles 230, whereof one half have long butts or studs and the other half short studs, a rotary cam-cylinder, as 240, surrounding the needle-cylinder and provided with cams for engaging said studs to actuate said needles, and other known parts which need not be here described. A standard 500 is detachably secured by a clamp-screw 515 or otherwise to a bracket attached to the cam-cylinder, which may correspond to bracket marked 303 in the patents referred to, and a horizontal arm 510 is hinged at its front end to said standard and projects toward the circular series of needles, as shown in said patents. This arm is held in horizontal or adjusted position by means of a spring (not shown) or otherwise, as by the tension of the bolt 501, which serves as the pintle.

The illustrated embodiment of this invention comprises a base-plate 10, secured to the hinged arm 510. This base-plate is provided with flanges 11 and 12 on its under side, form-

ing a recess into which said hinged arm tightly fits, and at its front end it has a slot 13, through which a clamping-screw 14 passes into a tap-hole in the hinged arm. By means of this clamp-screw the base-plate may be adjusted toward or from the needles. This base-plate is provided at its rear end with two arc-shaped arms 15 and 16, to which the needle latch-guard 520 is secured in the ordinary manner. Three vertical webs 20, 21, and 22 are disposed on the upper side of the base-plate 10 radially of the needle-cylinder and form guideways for the yarn-carriers, hereinafter described. These webs are provided with a set of registering holes 23 in their upper rear portions and with a set of registering slots 24 in their lower front portions. A transverse recess 25 is formed in front of the vertical webs. An arm 30 extends laterally from the right side of the base-plate 10 and supports a vertical shaft, hereinafter described. The outer end of this arm is preferably split and provided with a bolt forming a clamp 31. All these parts are preferably integral with the base-plate. Two extensible yarn-carriers 40 and 50 are movable in the guideways formed by the webs of the base-plate. The yarn-carrier 40 is provided with a transverse cam-slot 41 in its body, with a longitudinal fulcrum-slot 42 and a stud 43 at its outer end, with a thread-guide 44 at its inner or rear end, and with an inclined latch-guard 45 at its lower edge near its inner end. The yarn-carrier 50 is provided with corresponding cam and fulcrum slots 51 and 52, stud 53, thread-guide 54, and latch-guard 55. Each of the cam-slots 41 and 51 is composed of an upper portion *a*, which from its top is inclined downward toward the thread-guide end of the carrier, and a lower portion *b*, which from the lower end of the portion *a* is inclined downward and away from said thread-guide end. A rod 60 passes through the holes 23 and through the cam-slots 41 and 51 of the yarn-carriers and serves as a guide for said carriers.

The yarn-carrier-actuating device comprises a cam-slide 70 and a fulcrum-rod 80, connected thereto parallel therewith. The cam-slide is disposed edgewise in the recess 25 in front of the webs and is provided with an angular slot 71, consisting of a central horizontal portion *c* and inclined portions *d* and *e* at opposite ends of the central portion. The cam-slide 70 is provided with inwardly-extending ears 74 and 75, in which the fulcrum-rod 80 is supported. This rod passes through the slots 42 and 52 at the front of the yarn-carriers, and the studs 43 and 53 of said carriers enter the cam-slot 71 of the cam-slide. The reciprocation of the cam-slide through the action of its cam-slot on said studs causes the yarn-carriers to oscillate on the rod 80 as a fulcrum, and the guide-rod 60, engaging the angular slots 41 and 51 of said carriers, causes them to move inward and outward on said fulcrum-rod in their oscillations. The horizontal portion *c* of the cam-slot 71 is sufficiently long to admit the studs of both yarn-carriers at the same time, and when the studs are in this portion of the slot the carriers are both horizontally disposed and in operative position. In this position the tops of the portions *a* of the guide-slots 41 and 51 of the yarn-carriers rest on the guide-rod 60. The movement of the cam-slide 70 toward the left causes the inclined portions *e* of cam-slot 71 of the cam-slide to engage the stud 53 of the carrier 50, whereby the outer end thereof is depressed and the inner or thread-guide end elevated. In the first part of this upward swing of the yarn-carrier the upper portion *a* of its cam-slot on guide-rod 60 causes a slight retraction of said carrier from the cylinder to permit it to escape contact with the needles. In the latter part of said swing the yarn-carrier is extended or thrust toward the needle-cylinder by the action of the lower portion *b* of its cam-slot 51 on guide-rod 60, whereby the yarn-guide of said carrier is thrust over the needles, carrying the yarn behind them and permitting it to float without action in the circuit of the needles.

The rod 80 is preferably provided with an enlargement or head 81 at one end and with a screw-thread 82 at the other. The head 81 enters a larger hole in the ear 75, and the screw-threaded end passes through a smaller hole in the ear 74. The head 81 is provided with a transverse hole, and the screw-threaded end is provided with clamping-nuts 83, 84, and 85 on opposite sides of the ear 74. These nuts hold the rod in place. The rod 60 is preferably adapted to turn loosely in its bearings to reduce friction of the yarn-carriers in contact therewith. The clamping-nuts also enable the cam-slide to be adjusted to proper position for actuating the yarn-carriers in case the cam-slot thereof becomes worn.

The slide-plate 86 is clamped to base-plate 10 by means of a screw 87. This plate by a slot is adjustable on said base-plate and bears against the slide-plate 70 and serves to hold it in position.

A vertical crank-shaft 90 is disposed in the outer end of the arm 30 and is held in the clamp 31 thereof with sufficient tension to prevent accidental turning. This vertical crank-shaft is provided at its upper end with a crank 100 and at its lower end with a star-wheel 110. The shaft is provided with a shoulder 91, which rests against the under side of the arm 30. A link 120 is connected at one end with said crank and at other end with the cam-slide, which actuates the yarn-carriers. The connection of the link with the crank is preferably made by means of a shouldered crank-pin 101, the small lower end of which is screw-threaded and engages a tap in said crank. The connection of the link with the actuating-slide is preferably made by pin 121, which engages a hole in head

81 of the fulcrum-rod 80. The turning of the star-wheel causes the cam-slide to reciprocate through the action of the crank and link.

Any suitable mechanism for intermittently actuating the star-wheel at the proper interval of time for effecting the changing of the yarn may be employed. The means herein shown comprise an arc-shaped or crescent slide 1060, which is provided with a tongue 1061 at one end and with a dependent post 1062 at other end. The post and tongue slide in recessed and tubular brackets 1040 and 1050. The post 1062 extends below the bed-plate of the knitting-head and is engaged by a lever 1030, whereby the slide is raised and lowered. This lever is connected with the moving parts of the machine in any suitable manner—as, for instance, in a manner shown in my application No. 60,446. This crescent-shaped slide has two inwardly-projecting lateral studs 1065 and 1066, the stud 1065 being preferably disposed at about the center of the crescent and the stud 1066 near the rear end thereof. In this position of the studs the change of yarn is effected at the back end of the stocking, which is the preferable point. The crescent slide is preferably provided with a series of holes 1067, in which these studs are adjusted into different positions relatively to each other and to the needle-cylinder, being placed farther apart when coarse needles are used to insure the engagement therewith of the yarn thrown in on the shifting operation.

Both the yarn-carriers 40 and 50 are provided with a corresponding thread-guide, thread-guide 44 of the yarn-carrier 40 extending from the upper part of said guide at an incline toward the lower corner thereof adjacent to the guide 50, and the thread-guide 54 of the yarn-carrier 50 extends from the top of said guide at an opposite incline to the lower corner of the inner end of the carrier adjacent to the carrier 40. By this arrangement of the thread-guides yarn is supplied to the needles by either yarn-carrier in either direction in which the cam-cylinder may rotate, the end of each carrier being adjacent to a radial line passing from the center of the needle-cylinder between said guides. In this position the yarn cannot escape the pyramid of active needles, as was sometimes the case with the substitute yarn-guide of one of the prior patents hereinbefore referred to. Owing to this correspondent construction of the thread-guides, the yarn may be changed during the knitting of the heel or toe when the cam-cylinder has a reciprocatory motion.

In the use of this yarn-changer two yarns of different characters or colors are threaded from any suitably-arranged yarn-guides through the yarn-guides 44 and 54 of the yarn-carriers 40 and 50. In the ordinary operation of the machine one of the yarn-carriers is in elevated inoperative position—as, for instance, the carrier 50—while the carrier 40 is in a depressed operative position, supplying yarn to the needles. Whenever it is desired to effect a change of the yarn-supply to the needles, the crescent slide 1060 is raised so that the star-wheel comes in contact with the stud 1065 thereof, whereby a partial stroke is imparted to the cam-slide 70, and the stud of the inoperative yarn-carrier is made to engage the horizontal part of the cam-slot 71 and throw the yarn-carrier into operative position. The star-wheel next engages the stud 1066, whereby the cam-slide is made to complete its stroke, and the heel of the other yarn-carrier is engaged by the other inclined portion of said slot and said yarn-carrier raised to inoperative position. This raising of the crescent slide to effect a change of the yarn may be made to occur in changing from leg to heel knitting, from heel to foot knitting, or from foot to toe knitting, or be made to occur for the purpose of producing striped work at one or more intervals during either the leg, heel, foot, or toe knitting.

I claim as my invention—

1. In a yarn-changing mechanism for a knitting-machine the combination of a plurality of yarn-carriers each provided with a cam and a fulcrum slot, a support for said carriers provided with means for engaging said cam-slots, and an actuating device for said carriers comprising a cam-slide provided with a slot engaging said carriers and a fulcrum-rod extending through said fulcrum-slots.

2. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of yarn-carriers each provided with a cam-slot and a fulcrum-slot, a fixed guide engaging said cam-slots, and means for tilting said carriers on their fulcrums; said cam-slots being shaped to cause first the retraction of each yarn-carrier to escape the needles, then the projection thereof to carry the yarn behind the needles.

3. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of yarn-carriers each provided with a cam, a fulcrum-slot and a stud, a support therefor provided with a rod extending through said cam-slots, and an actuating device for said carriers comprising a cam-slide provided with a cam-slot engaging said studs and a fulcrum-rod extending through said fulcrum-slot.

4. In a yarn-changing mechanism for a knitting-machine, a combination of a yarn-carrier support, comprising a base-plate provided with vertical webs forming yarn-carrier guideways, yarn-carriers mounted in said guideways and each provided with a fulcrum-slot and a cam-slot, a rod extending through said webs and cam-slots, a cam-slide movable transversely at one end of said webs and engaging said yarn-carriers, a fulcrum-rod extending through said webs and fulcrum-slots, and means for actuating said cam-slide.

5. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of yarn-carriers, a support therefor, a cam-slide for shifting said carriers into inoperative and operative positions, means for ac-

tuating said cam-slide, and an adjustable connection between said slide and said means.

6. In a yarn-changing mechanism for a knitting-machine, the combination of two movable yarn-carriers disposed side by side and provided at their inner ends with yarn-guides inclined in opposite directions and converging to their delivery-openings adjacent to each other at the lower corners of said yarn-guides.

7. A yarn-carrier for a knitting-machine provided with a yarn-guide at one end, a stud for the engagement of an actuating device, a slot to receive a fulcrum and cam-slot to receive a guide.

8. In a yarn-changing mechanism for a knitting-machine, the combination of a yarn-carrier support comprising a base-plate provided with vertical webs forming yarn-carrier guideways, yarn-carriers mounted in said guideways and each provided with a fulcrum-slot and a cam-slot, means engaging said fulcrum-slots and serving as fulcrums for said carriers and means engaging said cam-slots and serving as guides for said carriers, and means for tilting said carriers on their fulcrums.

9. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of yarn-carriers each provided with a cam-slot and a fulcrum-slot, means engaging said fulcrum-slots and serving as fulcrums for said carriers, means engaging said cam-slots and serving as guides for said carriers, and means for tilting said carriers on their fulcrums.

10. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of yarn-carriers each provided with a cam-slot and a fulcrum-slot, means engaging said fulcrum-slots and serving as fulcrums for said carriers, means engaging said cam-slots and serving as guides for said carriers, and means for tilting said carriers on their fulcrums, said cam-slots being shaped to cause first the retraction of each yarn-carrier to escape the needle and then the projection thereof, to carry the yarn behind the needles.

11. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of movable yarn-carriers, means for tilting said carriers, and means for controlling the direction of movement of said carriers during the tilting thereof, the latter means being adapted to cause first the retraction of each yarn-carrier to escape the needles and then the projection thereof to carry the yarn behind the needles.

12. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of movable yarn-carriers, and means for shifting each yarn-carrier from operative to inoperative position and the reverse, said means being adapted to cause first the retraction of each yarn-carrier to escape the needles and then the projection thereof over the tops of the needles to carry the yarn behind them.

13. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of movable yarn-carriers provided with dependent latch-guards for the needles, and means for shifting each yarn-carrier from operative to inoperative position and the reverse, said means being adapted to cause first the retraction of each yarn-carrier to escape the needles and then the projection thereof over the tops of the needles to carry the yarn behind them.

14. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of pivoted yarn-carriers each having a shifting fulcrum and each provided with a cam-slot, means engaging said cam-slots and serving as guides for said carriers, and means for tilting said carriers respectively on their fulcrums.

15. In a yarn-changing mechanism for a knitting-machine, the combination of a plurality of pivoted yarn-carriers each provided with a cam-slot and a fulcrum-slot, means engaging said cam-slots and serving as guides for said carriers, and an actuating device for said carriers comprising a slide provided with a cam-slot engaging said carriers and means engaging said fulcrum-slots, the cam-slot of the slide comprising inclined portions for tilting said carriers respectively and an intermediate straight portion which permits both carriers to remain simultaneously in operative position.

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