H. A. & H. E. HOUSEMAN.

CIRCULAR KNITTING MACHINE.

APPLICATION FILED JUNE 16, 1913.

1,127,769.

Patented Feb. 9, 1915.

4 SHEETS—SHEET 1.

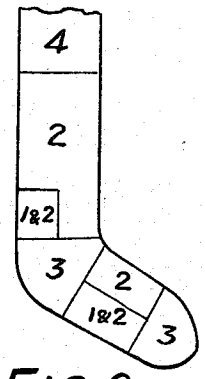

FIG. 9.

FIG. 1.

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4 SHEETS—SHEET 2.

FIG. 3.

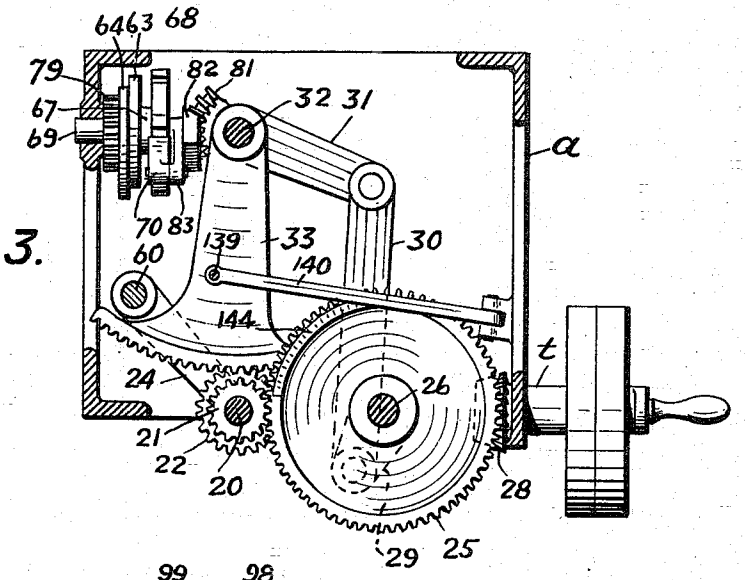
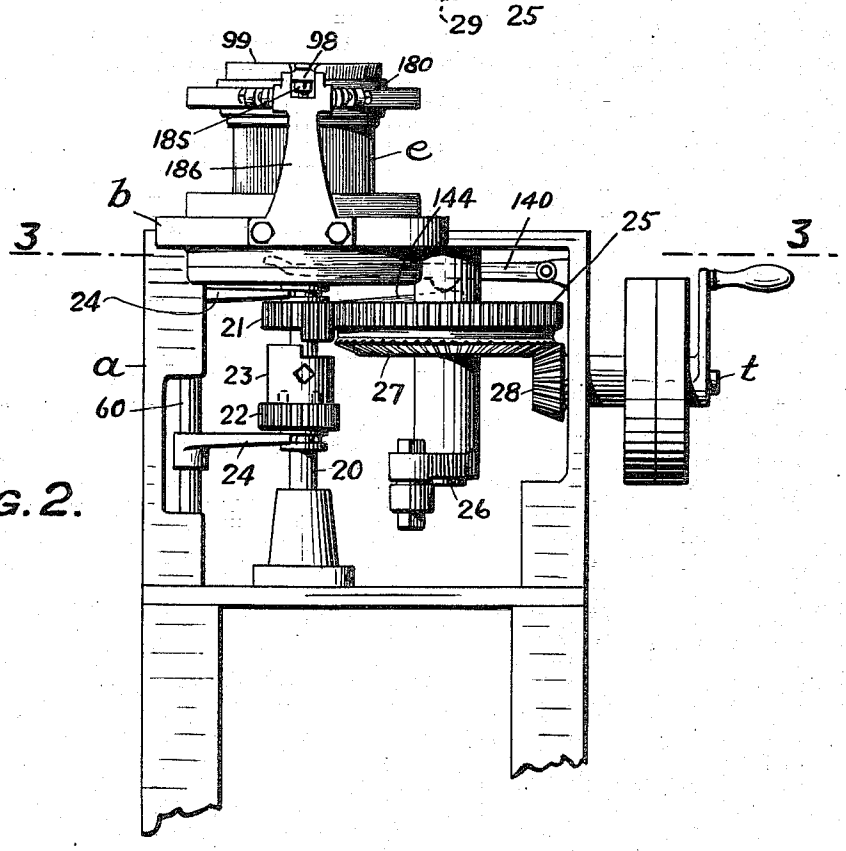


FIG. 2.



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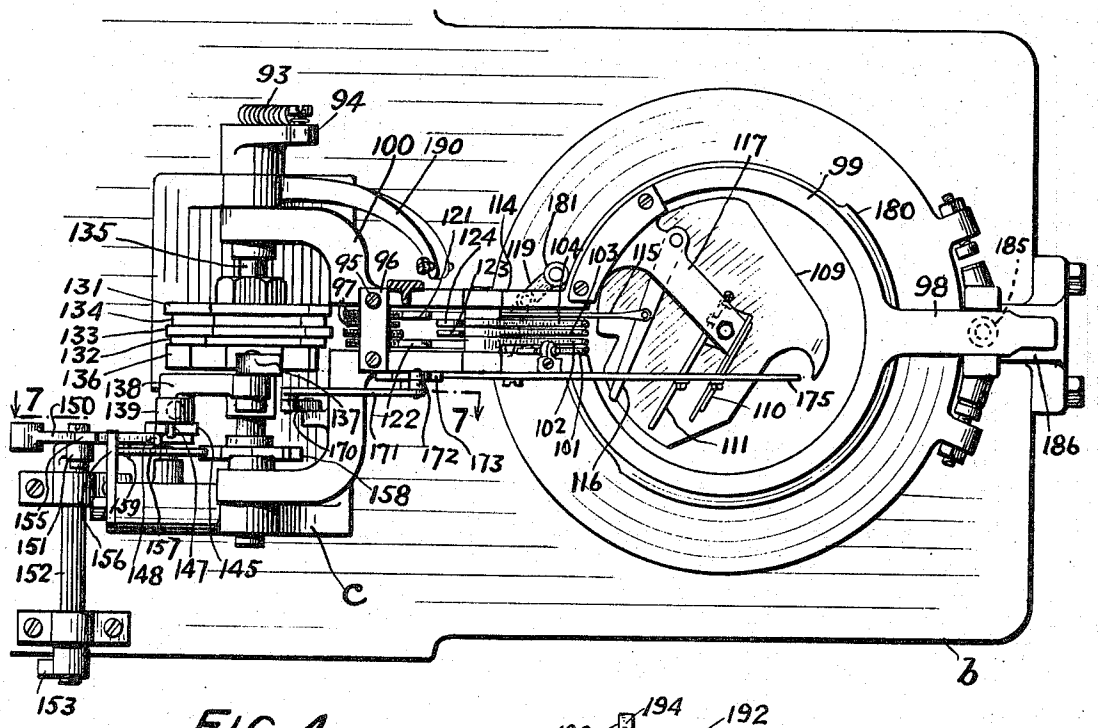

FIG. 4.

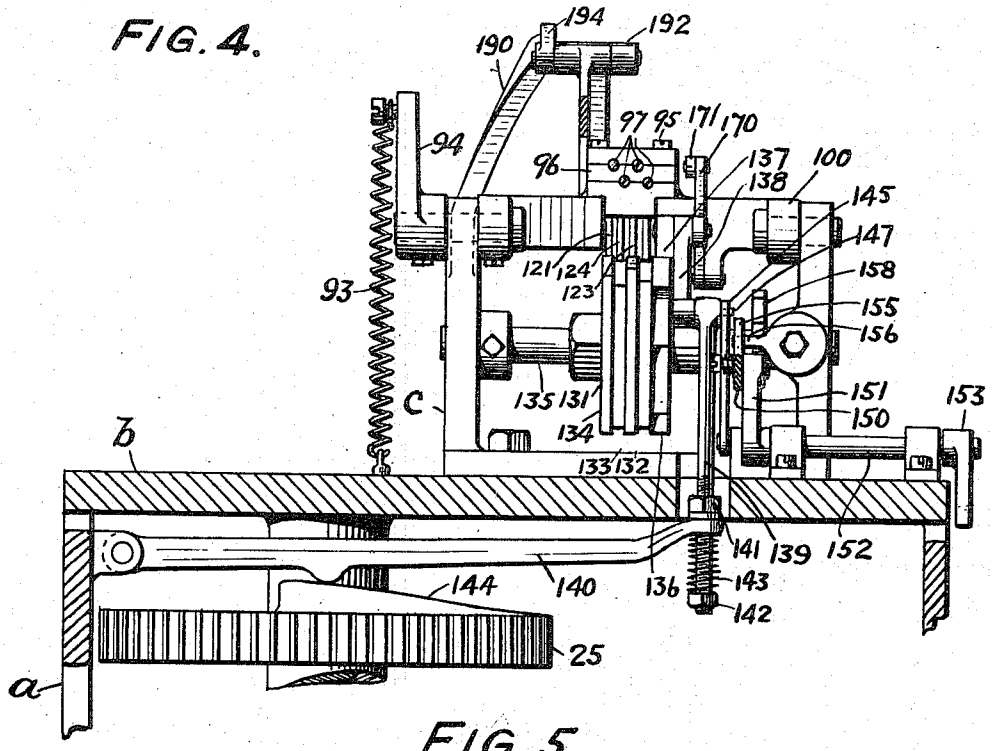

FIG. 5.

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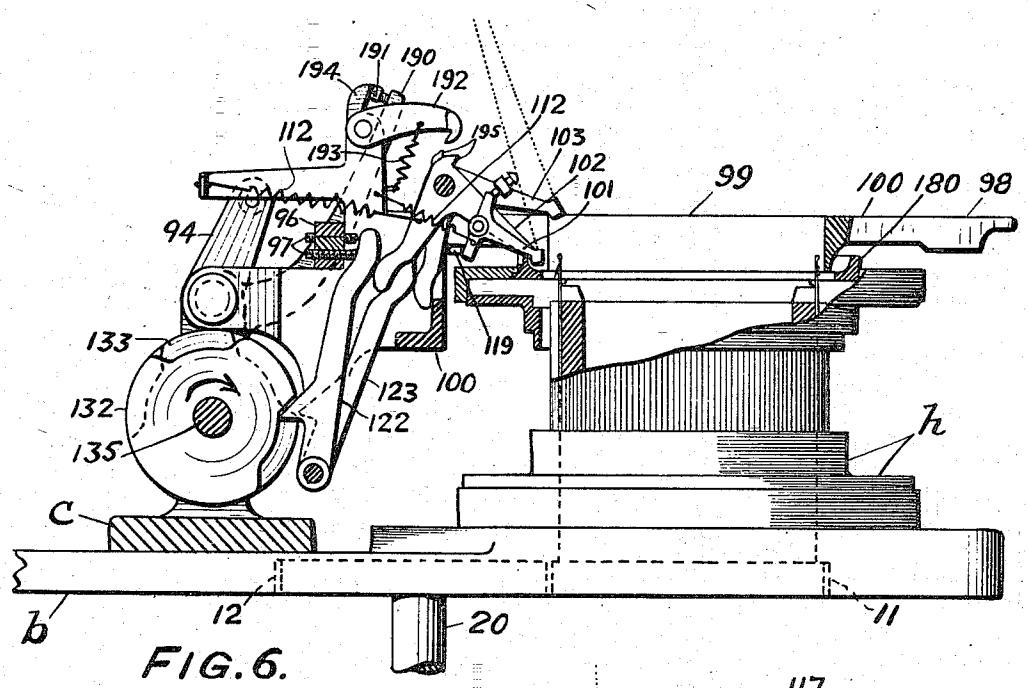

FIG. 6.

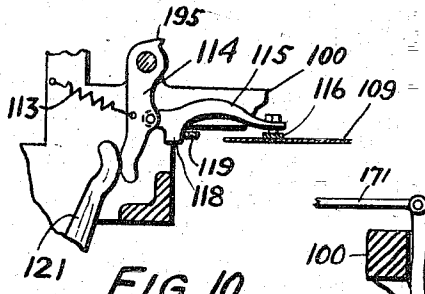

FIG. 10.

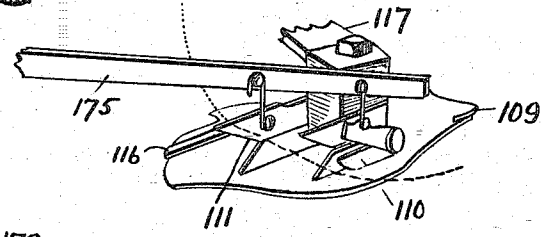

FIG. 8.

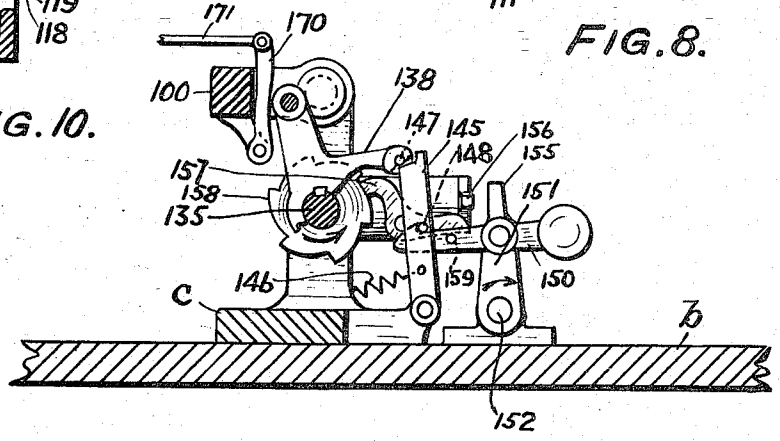

FIG. 7.

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UNITED STATES PATENT OFFICE.

HARRY A. HOUSEMAN AND HAROLD E. HOUSEMAN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNORS TO STANDARD MACHINE COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

CIRCULAR-KNITTING MACHINE.

1,127,769. Specification of Letters Patent. Patented Feb. 9, 1915.

Application filed June 16, 1913. Serial No. 773,829.

To all whom it may concern:

Be it known that we, HARRY A. HOUSEMAN and HAROLD E. HOUSEMAN, citizens of the United States, residing at Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented a new and useful Improvement in Circular-Knitting Machines, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

Our invention relates to circular knitting machines adapted to the manufacture of hosiery in which yarns of different colors or weights are employed in different parts of the stocking.

The object of the invention is to provide means for moving the different yarns into and out of operative relation with the needles and to coördinate said means with the mechanism for effecting the shift of the machine from oscillation to rotation and vice versa.

The invention comprises a number of novel features which are shown as applied to, and which are particularly adapted for application to, a machine in which the needle cylinder is the rotatable element and the needle actuating cams are stationary, although such novel features are not necessarily confined to a machine of this type.

The invention also comprises the combination and coördination of these novel features with certain mechanism, including the means for controlling the shift from rotation to oscillation, and vice versa, forming the subject matter of a patent issued to Harry A. Houseman November 18, 1913, No. 1,078,677, in which the needle cylinder is the stationary element and the cam cylinder the rotary element; which mechanism is also set forth in a joint application filed by us April 15, 1913, Serial No. 761,199, and is therein shown and described as adapted to a machine in which the needle cylinder rotates and the cam cylinder is stationary.

The invention will be understood by reference to the accompanying drawings, in which there is shown the independently novel features of the present application as well as certain of the mechanism, adapted from the applications above mentioned, that is coördinated and combined with said independently novel features.

In the drawings: Figure 1 is a side elevation of the machine partly broken away; Fig. 2 is a partial front view of the machine; Fig. 3 is a section on the line 3—3 of Fig. 2; Fig. 4 is an enlarged plan view of a portion of the machine; Fig. 5 is a rear view of the yarn carrier actuating mechanism; Fig. 6 is a sectional elevation through the knitting head and yarn carrier mechanism; Fig. 7 is a section on the line 7—7 of Fig. 4 looking in the direction of the arrows; Fig. 8 is a detail perspective view of the clamp and cutter and means for directly actuating them; Fig. 9 is a diagram illustrating a typical stocking which may be knit on the machine; Fig. 10 is a detail view showing the operating lever for actuating one of thread carriers and the yarn deflectors operating in connection therewith.

Referring first to Figs. 1, 2, 3 and 6: *a* is the frame of machine and *b* the bed plate for the rotatable needle cylinder *e*, the stationary cam ring *h* and appurtenant mechanism. The needle cylinder has secured to its lower end a driven gear 11, which is driven from a gear 12 on the clutch shaft 20, on which are slidably mounted the two pinions 21 and 22, which have sleeves to which are yoked the vertically movable arms 24, 24, which are moved up or down in unison as hereinafter described. The clutch 23 is fixed on the shaft 20, between pinions 21 and 22. The upper pinion 21 is constantly rotated and the lower pinion 22 constantly oscillated. When the arms 24 are moved down, thus engaging the rotary pinion with the clutch 23 and disengaging the oscillatory pinion 22 therefrom, the gear 12 is continuously rotated, thus rotating the needle cylinder. When the arms 24 are elevated, thus disengaging the rotary pinion 21 from the clutch 23 and engaging the oscillatory pinion therewith, the gear 12 is constantly oscillated, thus oscillating the knitting cylinder. The pinion 21 is constantly rotated by means of a spur gear 25 meshing with the pinion 21. The shaft 26 of the spur gear 25 also carries a bevel gear 27 driven from a bevel pinion 28 on the driving shaft *t*. The pinion 22 is constantly

oscillated by the following means: On the shaft 26 is a crank 29 connected by a link 30 with an arm 31 turning on a post 32. Extending from the hub of the arm 31 is a quadrant 33 engaging the pinion 22. The arms 24 are secured to a post 60, which has a pair of collars between which extend the forked ends of a lever 62 pivoted between its ends on the frame of the machine. The lever is actuated by means of a double cam 63, 64, secured to a sleeve 67 on the shaft 69. These cams rotate together and may be integral with one another and are adapted in their rotation to actuate the lever 62, as more fully described in the above mentioned applications, so as to move and hold the post 60 either up or down. When the post 60 is moved down, the rotary pinion 21 is clutched with the clutch 23, thus dictating the rotation of the needle cylinder. When the post 60 is moved up, the oscillatory pinion 22 is clutched with the clutch 23, thus dictating the oscillation of the needle cylinder. The double cam 63, 64, is caused to turn by means of a pattern ratchet wheel 68, also secured to the sleeve 67, which ratchet wheel is turned initially by first turning the sleeve 67 and then by means of a pawl 70. Just before it is desired to change from rotation to oscillation, the cam shaft 77, which is geared to the sleeve 67 by means of the intermeshing pinions 78 and 79, is given a partial turn, thereby turning the sleeve 67 together with the double cam 63, 64 and the ratchet wheel 68. The cam shaft 77 is so turned by lever and pawl and ratchet mechanism, set forth in the last mentioned application, but not herein shown, actuated from the pattern chain *u*. The pawl 70 is constantly reciprocated by being carried on a holder 83 secured to the shaft 69, on which is a bevel pinion 82 driven by a bevel pinion 81 secured to the hub of the oscillatory arm 31. The ratchet wheel 68 has a number of teeth, all of uniform length except one, which is substantially longer than the others. During oscillation of the cam cylinder, the pawl 70 plays upon the long tooth, its extent of movement being insufficient to cause it to drop back of the same. Consequently, it is inoperative to turn the ratchet wheel 68. But after the ratchet wheel has been given the initial turn just described, the long tooth is advanced to such position that on the next reciprocation of the pawl 70 it drops back of the long tooth and proceeds to turn the ratchet-wheel, together with the double cam 63, 64. As the pawl 70 engages and pushes the next tooth of the ratchet 68, the double cam 63, 64 lifts the post-engaging end of lever 62, clutching the lower or oscillatory pinion 22 to the clutch shaft 20, and unclutching the rotary pinion 21, and causing the needle cylinder to oscillate. This operation occurs at the beginning of the knitting of the heel and at the beginning of the knitting of the toe. So long as the pawl 70 is in operative relation with the ratchet wheel 68, the latter will turn a distance of one tooth, at each four rotations of the driving shaft. As continued rotation of the ratchet wheel 68 would dictate the premature shifting from oscillation to rotation, means are provided, not herein shown but set forth fully in said application Serial No. 697,861, to withdraw the pawl 70 from action after it has turned the ratchet wheel two more teeth. The pawl 70 remains in its inoperative position throughout the knitting of the heel or toe. After the knitting of the heel or toe is completed, the pawl 70 is restored to operative position and immediately turns the ratchet wheel another tooth, causing the double cam 63, 64 to actuate lever 62 to move down the post 60, arms 24 and pinions 21 and 22, and clutching the rotary pinion 21 with the clutch 20, thereby causing the needle cylinder to rotate. The pawl 70 continues to turn the ratchet wheel 68 to the position where the pawl plays idly on the long tooth, which condition continues during rotation until, when it is desired to again shift from rotation to oscillation, the cam shaft 77 is again given a partial turn, thereby again turning the ratchet wheel 68 into position to allow the pawl 70 to drop back of the long tooth and, after actuating it and the next tooth of normal length, again effects the shift from rotation to oscillation as hereinbefore described.

Having now described the mechanism set forth more fully in the applications hereinbefore mentioned, we shall proceed to describe the independently novel features characterizing the present invention.

Mounted on the bed plate *b* of the machine is a frame *c* carrying a stud on which is fulcrumed a frame 100. The frame 100 carries studs on which are pivoted a plurality of yarn carriers. Any desired number may be provided, but for the purpose of illustrating my invention, we have shown four yarn carriers, 101, 102, 103 and 104, the first being pivoted on one stud and the other three on another stud. These carriers are provided with end orifices through which the threads 1, 2, 3 and 4 form the cops 105, 106, 107 and 108 pass to the needles, as is well understood in the art. Within the needle cylinder is a yarn guiding plate 109, which, although of peculiar shape, performs in general the well known function of guiding any thread (except thread 1 as will be hereinafter described) that has been moved by its carrier out of operative relation to the needles, from the thread engaging ends of the yarn carriers into operative relation with a cutter 110 and clamp 111 (see particularly Fig. 8), which respectively cut the

yarn and clamp it, as will be hereinafter described. The thread of any given yarn carrier is thus so held that when the yarn carrier is again moved down, it will bring the thread into operative relation with the needles and cause it to again knit into the fabric, the clamp being released at the proper time. The object of the mechanism hereinafter described is to actuate these yarn carriers and the clamp and cutter at the proper times, and more specifically to actuate them at certain stages in the knitting of the stocking and to that end to control their movements from the pattern chain and the clutch-shifting mechanism. It will of course be understood that the number of thread carriers that will be employed, and the precise points in the knitting of the stocking at which given thread carriers and the clamp and cutter will be actuated, are variable factors, and that our invention is not limited to the provision of any particular number of yarn carriers or to their actuation at any specific stages in the knitting of the stocking. The specific arrangement of mechanism herein set forth must therefore be understood to be illustrative merely, being provided to knit a typical stocking, although other stockings with a greater or a less number of threads and differently positioned in the stocking are equally adapted to be made on the machine by rearranging the mechanism in a manner which will be obvious to the skilled mechanic. We have deemed it advisable, however, in order to clarify the invention, to assume that it is desired to make one specific style of stocking, which we shall now proceed to briefly describe. In Fig. 9 is shown diagrammatically such a typical stocking. In knitting the stocking, starting say, at the top of the leg, a garter top is first knitted from one thread, say thread 4. To knit this part of the stocking the yarn carrier 104 is held down in action while the remainder of the yarn carriers are held up out of action. Next the remainder of the leg down to the ankle part thereof is knit from thread 2. To effect this the carrier 102 is moved down into action and the carrier 104 is moved up out of action. Next the ankle portion of the stocking is knit. In knitting this portion of the stocking the thread 2 is retained and a reinforcing thread 1 is knit into the rear half of the ankle. To effect this the carrier 102 remains down in operative position and the carrier 101 is also moved down into operative position, the thread, however, being caused to knit only on the rear half of the needles by means to be hereinafter described. Next the heel of the stocking is knit from the thread 3. This portion of the stocking is knit by oscillating the needle cylinder, as before described, and on the shift from rotation to oscillation, the carrier 103 is moved down into action and the carriers 101 and 102 moved up out of action. At the conclusion of the heel knitting, the machine is shifted from oscillation to rotation and at the same time the carriers 101 and 102 are moved down into action and the carrier 103 moved up out of action, and the knitting of the foot proceeds; the foot being formed, like the ankle, from thread 2 and reinforcing thread 1, the latter being knitted only in the sole, or lower half, of the foot. When the foot is completed, the machine again shifts from rotation to oscillation, the carrier 103 is moved down into action and the carriers 101 and 102 moved up out of action, thus forming the toe, like the heel, from thread 3. At the conclusion of the toe, the machine again shifts from oscillation to rotation, the carrier 104 is moved down into action and the carrier 103 moved up out of action, and the knitting of the garter top from thread 4 again proceeds. We shall now describe the means whereby these operations are automatically effected.

Each carrier 102, 103, 104 is of bell crank shape, while the carrier 101 is of T shape; all, however, being moved down into operative position by means of springs 112, each fastened at one end to one arm of the carrier and at the other end to the frame 100. The carriers are moved up into inoperative position by means of levers 121, 122, 123, 124, pivoted at their lower ends on a common stud. Each lever 122, 123 and 124 so actuates its corresponding yarn carrier by directly engaging the depending arm of the carrier. The lever 121, however, actuates the yarn carrier 101 somewhat indirectly, by means of the following mechanism: On the same stud on which the carriers 102, 103 and 104 are pivoted is pivoted a lever 114, which is normally held back by a spring 113. This lever is connected, by a bridge rod 115, with a yarn-deflecting lever 116 (the function of which will be hereinafter described) pivoted on a bracket 117 secured to the ring 99, which constitutes the front part of the frame 100. The bracket 117 also carries the clamp 111 and cutter 110 hereinbefore mentioned. The bridge rod 115 has a projection 118 which extends back of a lever 119 pivoted between its ends. One arm of the lever 119 extends across under the overhanging front arms of the carriers 102, 103 and 104 back of the depending arm of the carrier 101. When the lever 121 is swung forward, it actuates the lever 114, which moves the bridge rod 115 forward in the direction of its length, causing the projection 118 to engage and swing the cross-lever 119, which in turn engages the carrier 101 and swings it up into inoperative position.

To actuate the carrier-actuating levers 121, 122, 123, 124 there are provided four

cam disks 131, 132, 133, 134 fixed on a shaft 135 revoluble in bearings on the frame *c*. Each cam disk is provided with one or two cut away or depressed portions in its periphery. The cams are turned in unison and may be integral with each other. The cams work against projections on the several levers 121, 122, 123, 124. When the high face of a given cam engages its corresponding lever, the latter is held forward, thus holding the corresponding yarn carrier up out of operative position. When the cam is turned so as to bring the low or depressed part of its periphery opposite its corresponding lever, the corresponding yarn carrier springs down into operative position, moving the projection of the corresponding actuating lever into said depressed section of the cam. Adjustable stops are provided for levers 121, 122, 123 and 124, in their rearward movements, so that the thread carrier 101, 102, 103, and 104 may be gaged to bring threads 1, 2, 3 and 4 into nice relation with the needles. These stops are in the form of screws 97, one for each of the thread carrier operating levers. These screws are held in the clamping device 96, on the frame 100. By tightening bolts 95 this clamping device holds screws 97 securely from turning. It will thus be understood that by giving the shaft 135 a step-by-step motion and by providing appropriately located depressions in the periphery of the cam disks, any given yarn carriers, at any step in the rotation of the shaft 135, may be moved into or out of operative position. The following means are provided for imparting such a step-by-step motion to the shaft 135: Secured to the shaft is a ratchet wheel 136, which is provided with a number of teeth corresponding to the number of desired steps in a complete rotation of the shaft 135. In the drawings a six-tooth ratchet is shown. The ratchet is actuated by a pawl 137 depending from one arm of a bell crank lever 138 pivoted on the shaft 135. The other arm of the bell-crank is attached to the upper end of a rod 139 the lower end of which extends through an orifice in the end of a lever 140 pivoted on the main bed plate. A nut 141 is threaded on the rod 139 above the lever 140 and another nut 142 is threaded on the lower extremity of the rod. A spring 143 is confined between the nut 142 and the lever 140. The lever 140 is moved up on its pivot once at each turn of the gear wheel 25, the latter carrying a cam 144 having a long gradually sloping face which engages the lever 140 between its ends. As before described, the gear 25 is part of the chain of mechanism which actuates the needle cylinder and rotates once at each four revolutions of the needle cylinder when the latter is rotating or once at each complete oscillation back and forth of the needle cylinder when the latter is oscillating. Thus the pawl 137 has the capacity to actuate the ratchet wheel 136 once at each turn of the gear wheel 25, but pattern-controlled mechanism is provided to normally hold up the rod 139 and the arm of the lever 138 connected thereto, so that the pawl will be ineffective to actuate the ratchet 136, this mechanism being rendered inoperative by the pattern chain or by the clutch shifting mechanism at such times as it is desired to allow the pawl 137 to actuate the ratchet wheel 136, and thereby, through the cam-disks and levers actuated thereby, effect a shift of yarn-carriers. The pattern-controlled mechanism will now be described.

A stop lever 145, pivotally supported at its lower end is held, by a spring 146, in such position that its free end rests under and back of a pin 147 projecting laterally from one arm of the pawl-carrying lever 138. Thus the rod 139 is held up so that the lever 140 will not drop when the cam 144 passes beyond it in the rotation of the gear 25. When, however, the stop or lever 145 is moved from under the pin 147, the lever 140 and rod 139 will be free to drop when the cam 144 recedes from the lever 140, thus carrying the pawl 137 back into engagement with the next tooth of the ratchet 136, so that, on the next rotation of the gear 25, the cam 144 will lift the lever 140 and rod 139, thereby turning the lever 138 so as to cause the pawl 137 to actuate the ratchet 136 one-sixth of a complete turn. The lever 145 is retracted from engagement with the pin 147 by means of a lever 150, which has a hooked end engaging a pin 148 on the lever 145. The lever 150 is pivoted between its ends on an arm 151 secured to a shaft 152. The lever 150 is counterweighted so as to hold its hooked end in engagement with the pin 148. On the shaft 152 is secured an arm 153 which is moved by a spring 154 into position to turn the shaft 152 so as to move the lever 150 to allow its hooked end to engage the pin 148. The movement of the lever 150 in this direction is limited by a stop 156 against which an arm 155 on the lever 150 abuts, which swings up the hooked end of the lever 150 and causes it to hook the pin 148. When it is desired to release the mechanism for reciprocating the pawl 137, the arm 153 is moved against the action of its spring 154 so as to turn the shaft 152 and move back the arm 150, thereby withdrawing the lever 145 from the pin 147. As will be hereinafter described this movement is effected by a device directly actuated by the pattern chain or by clutch-shifting mechanism. Thereupon the lever 140 and rod 139 drops, thereby turning the lever 138 to cause the pawl 137 to drop back of the next tooth of the ratchet 136. As soon as the cam 144, in the continued rotation of the gear 25,

underrides the lever 140, it and the rod 139 are moved up, thereby turning the lever 138 to cause the pawl to engage said tooth and turn the ratchet 136 one-sixth of a complete turn. It is necessary that at this time the lever 145 should immediately spring into locking engagement with the pin 147, even though at this time the device for actuating the arm 153 has not receded. This is brought about by releasing the hooked end of the lever 150 from the pin 148. This release is effected by means of a lever 157 pivoted between its ends, one end being actuated by a stepped cam 158 on the shaft 135 to cause its other end to engage a pin 159 on the lever 150 and move the hooked end of the lever 150 down out of engagement with the pin 148. Thus the lever 145 is released and is snapped into locking position as soon as the pawl 137 has completed its forward ratcheting movement, and the ratchet 136 and the cam disks on the shaft 135 are again held stationary until after the device actuating arm 153 recedes from its actuating position and is again operated by the pattern mechanism.

The device for immediately operating the arm 153 is a projection 161 on a link 160. The link 160 is attached at one end to a pivoted lever 162 and at the other end to a pivoted lever 165. The lever 162 carries a roller 163 which is actuated by a cam 164 on the cam-shaft 77. As before described the cam-shaft 77 is given one complete turn during each complete cycle of rotation and oscillation of the machine. The two high parts of the cam 164 are so positioned that they engage the cam roller 163 at each shift from rotation to oscillation and vice versa. At each engagement of a high part of cam 164 with roller 163 the lever 162 and link 161 are moved to cause the projection 160 to actuate the arm 153, thereby, through the mechanism hereinbefore described, releasing the mechanism for locking the pawl-carrying lever 138. Thus, at each shift from rotation to oscillation or vice versa, one or more of the yarn carriers may be moved into operation and one or more of the yarn carriers may be moved out of operation, as will hereinafter be more particularly described with reference to the particular stocking (shown in Fig. 9 and hereinbefore described) which the machine is adjusted to knit.

The lever 165 is pivoted between its ends and carries at its lower end a projection in line of travel of the lugs 166 and 167 on the pattern chain, which may be actuated by any convenient means, such, for example, as the means set forth in the said application Serial No. 697,861. As a pattern lug passes under the projection on lever 165, the latter is swung to impart to link 161 a movement similar to that imparted to it by the lever 162, thereby, through the mechanism hereinbefore described, releasing the mechanism for locking the pawl-carrying lever 138.

It has been hereinbefore stated that when any given yarn carrier 102, 103 or 104 is moved up out of operative position, the thread extending from the last needle which has caught the thread to the thread-eye of the carrier will be drawn over the upper face of the guide-plate 109 and between the members of the clamp 111 and cutter 110. As soon as the thread is drawn into this position it becomes necessary to clamp the yarn and then to cut it. This is effected by the following chain of mechanism operated from the pawl-carrying lever 138.

In the movement of the pawl-lever 138 by which the pawl 137 ratchets the wheel 136, the pawl-lever engages and moves a pivoted lever 170 (see Fig. 7). This lever, through a link 171, actuates a pawl lever 172 (see Fig. 1) loose on a shaft carrying a small ratchet wheel 173, thereby turning the latter a distance of one tooth. The teeth of the ratchet 173 also act as cams to operate one arm 174 of a lever pivoted between its ends, the other arm 175 of the lever extending over the knitting head and connected to the movable members of the clamp 111 and cutter 110. When the lever 170, link 171, pawl lever 172, ratchet 173 and arm 174 are so operated, the effect is to lift the arm 175 and retract the upper members of the clamp 111 and cutter 110, thereby releasing any threads that may be clamped and permitting any new thread that is moved, by its carrier, out of operative relation with the needles to be drawn between the jaws of the clamp and the knives of the cutter. As soon as the tooth of the ratchet 173 that has so actuated arm 174 rides from under the arm 174, a spring 176 immediately snaps back the arm 174 into its original position thereby causing the arm 175 to descend and effect the clamping and cutting of the newly introduced thread. The pawl-lever 172 remains in its forward position so long as the pawl lever 138 remains in its forward position, which it does, as before described, by reason of the action of the locking lever 145, until just before the yarn carriers are again shifted. As soon as the pawl-lever 138 is unlocked, thereby allowing the rod 139 to drop and the pawl-lever to be retracted as before described, the lever 170 is released from engagement with the pawl-lever 138, allowing a spring 177 to return the pawl-lever 172 into position to engage the next tooth of the ratchet 173 and into position to again actuate the ratchet when it is again operated by the pawl-lever 138.

The peculiar manner of actuating the yarn carrier 101 has been hereinbefore described. It has also been stated that this

carrier controls the feed to the needles of yarn 1 and that this yarn is knitted into only the rear of the fabric or in that part thereof which forms the back part of the ankle and the sole of the foot. It has also been shown how the lever 121 actuates the yarn carrier 101, to move it into inoperative position, through lever 114, bridge rod 115 and lever 119, and how the bridge rod also actuates the deflecting lever 116. It will be understood that when the carrier 101 is released and allowed to move into operative position, it must remain in operative position during only a half rotation of the needle cylinder and must then be moved out of operative position during the next half rotation and must then again be moved into operative position during the next half rotation, and so on. This is accomplished by the following means: When the cam disk 131 is moved to allow the lever 121 to swing back, thereby permitting the carrier 101 to swing into operative position, the lever 119 is swung into such position that a roller 181 on the end thereof is brought into operative relation with a cam 180 extending entirely around the needle cylinder. While the roller 181 rides on the low part of the cam, which it does during one half a revolution of the needle cylinder, the carrier 101 remains in operative position; but when the roller 181 rides on the high face of the cam, which it does during the other half of the needle cylinder's rotation, the lever 119 is swung to lift the carrier 101 out of operative position. Thus the yarn 1 is in operative relation with only those of the needles that knit the rear half of the stocking. It will be understood that when the lever 121 is swung forward by the cam disk 131 so as to actuate the lever 114 to push forward the rod 115, the lever 119 is moved out of operative relation with the cam 180 as well as into position to withdraw the carrier 101 from operative position.

We have hereinbefore described how the movement of one of the carriers 102, 103 or 104 out of operative position causes the corresponding thread to be drawn over the guide plate 109 into operative relation with the clamp 111 and cutter 110; but it is obvious that this must be avoided when the carrier 101 is moved into operative position, as it would be impracticable to clamp and cut the thread 1 at each rotation of the needle cylinder; and further, a greater waste of yarn would be caused by so drawing it around the clamp and cutter. The most convenient expedient is to allow the thread 1, during the half rotation of the needle cylinder that it is out of operative position, to be carried across the stocking from the last needle that it engages on one course to the first needle that it engages on the next course. To accomplish this it is necessary to carry the thread from said last needle under the guide plate 109 just as if the thread carrier were in active relation with the needles during the complete rotation of the needle cylinder. This is accomplished by the deflecting lever 116 hereinbefore described. During the time that the high part of the cam disk 131 rides upon the lever 121 and the latter holds the lever 114 and the rod 115 forward and the carrier 101 out of action, the lever 116 is held in such position that its free extremity entirely overlies the guide plate 109 and it is therefore functionless; but when the low part of the cam disk 101 allows the said parts to move back, thus allowing the carrier 101 to move the lever 119 into operative relation with the cam 180 to cause the carrier 101 to be moved alternately into and out of active position as above described, the free extremity of the deflecting lever 116 extends over the edge of the guide plate 109 into such position that, as soon as the carrier 101 is moved up the thread extending from the same engages the deflecting lever 116 and is thereby carried under the guide plate 109. Of course when the cam disk is again turned to cause its high part to engage the lever 121, the deflecting lever 116 again moves forward and allows the thread 1 to be carried over the guide plate 109 into operative relation with the clamp and cutter.

It has been hereinbefore stated that the frame 100 is pivoted on the frame *c*, thus enabling the frame, with all its attached parts, to be swung up so as to permit ready access to the needle cylinder for the transferring operation or for any other purpose. When the frame 100 is swung down, the nose 98 in front of the ring 99 rests upon a screw 185 threaded in a bracket 186 secured to the bed plate *b*. By means of this screw, the level of the ring 99 and its attached parts may be nicely regulated. When the frame 100 is swung up on the frame *c*, the levers 121, 122, 123, 124 are moved out of operative relation with their respective cam disks 131, 132, 133 and 134, and therefore, without means to prevent it, the needle engaging ends of all the yarn carriers would move down. It is desirable to avoid this and to retain all the yarn carriers in the relative positions which they had before the frame 100 is swung up. This is accomplished by the following means: A bracket 190 is secured to and extends above the frame *c*. This bracket at its upper end carries an adjustable stop 191. On the frame 100 is pivoted a hooked lever 192. Each of the carrier levers 102, 103 and 104 and the lever 114 has a projection 195 near its pivot. A spring 193 tends to draw the hooked lever down, but this is normally prevented by the engagement of a lug

194 connected to the hooked lever with the stop 191. When, however, the frame 100 is swung back on its pivot, the lug 194 recedes from the stop 191 and the spring 193 draws the hooked lever 192 into engagement with the projections 195 on any of the levers 102, 103, 104 or 114 that have been moved into position to hold the respective threads 2, 3, 4 and 1 controlled thereby out of engagement with the needles. Thus the carriers all remain in the same relative positions until the frame 100 is again swung down into its normal position. In order to retain frame 100 in its upper position when raised as just described, there is an arm 94 connected with the frame at its pivot, and a spring 93 connects the end of the arm with the bed plate *b*. The arm 94 is so positioned that in the raising of the frame 100, the arm is swung past its dead center with respect to spring 93. In this manner the spring holds frame 100 down when it is in operative position and holds it elevated when raised.

Having thus described the construction and operation of our invention, it may be well to give a brief résumé of the operation of the several thread carriers and their actuating mechanism as arranged to produce the stocking of Fig. 9. By reference to the last named figure, it will be observed that in the complete cycle of operations necessary to knit a complete stocking each of the threads 1, 2 and 3 is moved into and out of operation twice, while thread 4 is moved into and out of operation once. It will also be observed that six rearrangements of the thread carriers are required. Hence the mechanism for operating the shaft 135 carrying the cam disks is arranged to give the shaft six turns in each complete rotation of the shaft. The cam disks 131, 132 and 133 controlling the respective levers 121, 122 and 123, which in turn control the respective carriers 101, 102 and 103 feeding the respective threads 1, 2 and 3, are each provided with two depressions which dictate the movement into active position of its corresponding carrier twice in a complete cycle of operations; while the cam disk 134 controlling the lever governing the carrier 104 feeding thread 4, is provided with a single depression which dictates the movement into active position of carrier 104 once in a complete cycle of operations. Assuming that the needle cylinder is rotating and that the garter top is being knit. At this stage, lever 134 rests in the single depression in cam disk 124 and carrier 104 is in active position. This continues until the lug 166 on the pattern chain *u* strikes the lever 165, thereby, through link 160 and projection 161, actuating arm 153 to turn the shaft 152, thus causing arm 151 and lever 150 to withdraw lever 145 from the pawl lever 138, thus permitting the rod 139 and lever 140 to drop and permitting the cam 144, during the continued rotation of gear wheel 25, to actuate the rod 139 and pawl lever 138 to turn the ratchet wheel 136, thus turning all the cam disks one-sixth of a complete rotation. This causes lever 124 to ride out of the single depression in cam disk 134 and lever 122 to move into one of the two depressions in cam disk 132, thus withdrawing carrier 104 from active position and permitting carrier 102 to move into active position. This actuation of the pawl lever 138 operates the chain of mechanism (lever 170, link 171, pawl lever 172, ratchet 173, lever 174—175) controlling the cutter 110 and clamp 111. It may be here mentioned that the adjustment of the mechanism is such that during the time that the lever 140 is riding upon the cam 144, the several above described operations are successive. That is, first, the carrier 102 moves into operative position, then the carrier 104 moves out of operative position, and then the cutter and clamp are actuated to cut and clamp the thread 4. Thus at all times at least one thread is being knit into the needles, and the clamp and cutter are of course not actuated until after the carrier 104 moves into operative position and the thread is drawn into position to be cut and clamped. In the continued rotation of the needle cylinder the cam disks 131, 132, 133 and 134 remain stationary until the completion of that part of the leg of the stocking above the reinforced rear of the ankle. At this time the lug 167 actuates the lever 165, thereby, through the mechanism above described, allowing the cam disks to be given another turn, causing lever 121 to move into one of the depressions in cam disk 131, thereby permitting carrier 101 to move into operative position. Thereafter both carriers 101 and 102 are in operative position and the reinforcing thread 2 is caused to knit into the rear of the ankle portion as hereinbefore described. When the end of the leg portion is reached, the machine shifts from rotation to oscillation, in which movement the shaft 77 is turned to cause one of the cams 164 to actuate the lever 162 and link 160, thereby allowing the cam disks to be given another turn, causing lever 123 to move into one of the two depressions in cam disk 133 and levers 121 and 122 to ride onto the high faces of their respective cam disks 131 and 132; whereby the carrier 103 is moved into operative position and the carriers 101 and 102 are moved out of operative position; the cutter and clamp being subsequently actuated to cut and clamp threads 1 and 2. After the heel is completed, the machine shifts from oscillation to rotation, in which movement the shaft 77 is turned to cause the other of the

cams 164 to actuate the lever 162 and link 160, thereby allowing the cam disks to be given another turn, causing each of levers 121 and 122 to move into the other depression in its controlling cam disk 131 or 132 and lever 123 to ride onto the high face of its cam disk, whereby the carriers 101 and 102 are moved into operative position and the carrier 103 is moved out of operative position, the cutter and clamp being subsequently operated to cut and clamp thread 3. After the circular foot portion of the stocking is completed, the machine shifts from rotation to oscillation, in which movement the shaft 77 is turned to again cause the first of the two cams 164 to actuate the lever 162 and link 160, thereby allowing the cam disks to be given another turn, causing lever 123 to move into the second depression in cam disk 133 and levers 121 and 122 to ride onto the high faces of their respective disks 131 and 132, whereby the carrier 103 is moved into operative position and the carriers 101 and 102 are moved out of operative position, the cutter and clamp being subsequently actuated to cut and clamp threads 1 and 2. After the toe is completed, the machine shifts from oscillation to rotation, in which movement the shaft 77 is turned to again cause the second of the cams 164 to actuate the lever 162 and link 160, and thereby allowing the cam disks to be given another turn, which restores them to the position at the beginning of the cycle of operations. Lever 124 is thereby allowed to move into the single depression in cam disk 134, and lever 123 rides onto the high face of the cam disk 133; whereby the carrier 104 is moved into active position and the carrier 103 out of operative position; the clamp and cutter being subsequently operated to cut and clamp thread 3. The machine then again proceeds to knit the garter top, after which the cycle of operations is repeated.

While we have disclosed a machine in which the needle cylinder is rotatable and the cam cylinder and yarn carriers are non-rotatable, we do not mean to exclude the application of our invention to the well known equivalent machine in which the needle cylinder is stationary and the needle-actuating cams and yarn carriers rotate.

While we have herein shown certain features set forth in the prior patent and application hereinbefore mentioned and in other applications heretofore filed by one or both of us, we do not claim herein any such features except so far as they may be claimed in combination with the independently novel features set forth for the first time in this application. Nor do we claim the subject matter claimed in the application filed by Harry A. Houseman, of even date herewith, Serial No. 773,900, which, although set forth in this application, and claimed in combination with other elements, is, separately considered, the sole invention of the said Harry A Houseman.

Having now fully described our invention, what we claim and desire to protect by Letters Patent is:

1. In a circular knitting machine, in combination, a rotary needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a pattern chain, yarn carriers, means dictating the movement of certain yarn carriers into operative position in a predetermined order at different stages of the knitting operation and simultaneously with each of said movements the movement of a yarn carrier out of operative position, means arranged to be operated by the shifting mechanism preparatory to the shift from rotation to oscillation and vice versa, means arranged to be operated by the pattern chain independently of the shifting mechanism at another predetermined stage in the knitting operation, and common mechanism, operable by either of the two last named means independently of the other, adapted to control the operation of said yarn carrier operating means.

2. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a pattern chain, a plurality of yarn carriers, means operable from the driving means controlling the movement of the yarn carriers into and out of operative relation with the needle cylinder, and means arranged to be operated independently either by the shifting mechanism or by the pattern chain to place the yarn carriers in operative relation with the driving means.

3. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a pattern chain, a plurality of yarn carriers, means adapted to move the yarn carriers into and out of operative relation with the needle cylinder, mechanism actuated from the driving means adapted to dictate the operation of the yarn carrier actuating means, devices normally rendering the last named mechanism inoperative but adapted to be actuated to render it operative, and two mechanisms for so actuating said devices connected respectively with the shifting mechanism and with the pattern chain and adapted to be independently operated thereby at different stages of the knitting operation.

4. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary

driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a pattern chain, a plurality of yarn carriers, a clamp and cutter adapted to cooperate to cause the thread of a carrier moving out of operative position to be cut and clamped, mechanism actuated from the driving means adapted to dictate the operation of the yarn carrier and clamp and cutter actuating means, devices normally rendering the last named mechanism inoperative but arranged to be actuated to render it operative, and two mechanisms so actuating said devices and connected respectively with the shifting mechanism and with the pattern chain and adapted to be independently operable thereby.

5. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a plurality of yarn carriers adapted to be moved into and out of operative relation with the needle cylinder, means controlling the movement of the yarn carriers into and out of operative relation with the needle cylinder, mechanism actuated from the driving means to actuate the last named means, a pattern chain, and means arranged to be operable independently either by the shifting mechanism or by the pattern chain to place the last named mechanism in operative relation with the driving means.

6. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a plurality of yarn carriers adapted to be moved into and out of operative relation with the needle cylinder, a clamp and a cutter adapted to coöperate to cause the thread of a carrier moving out of operative position to be cut and clamped, means controlling the movement of the yarn carriers and the operation of the clamp and cutter, connecting mechanism actuated from the driving means adapted to operate the last named means, a pattern chain and two levers one connected with the shifting means and adapted to be actuated thereby preparatory to the shift from rotation to reciprocation and vice versa, and the other connected with the pattern chain and adapted to be actuated independently of said shift at a different stage in the knitting operation, said levers adapted, when either is actuated by its respective actuating means, to render said connecting mechanism operative.

7. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, spring actuated yarn carriers normally tending to move into operative relation with the needle cylinder, means adapted to move into and out of operation to hold the yarn carriers out of operative relation with the needle cylinder, connecting mechanism actuated from the driving means to operate the last named means, a pattern chain, and means arranged to be operable independently either by the shifting mechanism or by the pattern chain to place the connecting mechanism in operative relation with the driving means.

8. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a pattern chain, a plurality of yarn carriers, a plurality of rotatable cams, means actuated by the respective cams controlling the movements of the respective yarn carriers into and out of operative position, mechanism actuated from the driving means to turn the cams step by step, devices normally rendering the last named mechanism inoperative but adapted to be actuated to render it operative, and two mechanisms for so actuating said devices connected respectively with the shifting mechanism and with the pattern chain and adapted to be independently operated thereby at different stages in the knitting operation.

9. In a circular knitting machine, in combination, a rotary needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a shaft turning with the shifting mechanism, a cam on said shaft, a pattern chain, yarn carriers, means dictating the movement of certain yarn carriers into operative position in a predetermined order at different stages of the knitting operation and simultaneously with each of said movements the movement of a yarn carrier out of operative position, a lever, arranged to be operated by said cam preparatory to the shift from rotation to oscillation and vice versa, a lever arranged to be operated by the pattern chain at another predetermined stage in the knitting operation, and common mechanism, operable independently by either lever, adapted to control the operation of said yarn carrier operating means.

10. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a pivoted stop lever normally engaging said means and holding it from operation, a second lever pivoted on an axis different from that of the first lever and adapted to withdraw the first

lever out of operative position, a pattern chain, a lug thereon, and devices actuated by said lug and connected with the second lever and adapted, in such actuation, to operate the second lever to withdraw the first lever from its holding position, and means operating independently of the second lever to return the first lever to its holding position whereby the first lever may be so returned before the second lever is restored to operative position.

11. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a stop lever normally engaging said means and holding it from operation, a second lever adapted to withdraw the first lever out of operative position, shifting mechanism including a cam, and a device, connected with the second lever, permanently in the path of the cam and adapted to be actuated thereby, in the shift from rotation to oscillation and vice versa, to operate the second lever to withdraw the first lever from its holding position, a pattern chain, and means arranged to be operated by the pattern chain, independently of the shifting mechanism, to actuate the second lever.

12. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, mechanism dictating the movement of the yarn carriers into and out of operative position, means normally holding said mechanism from operation, means adapted to withdraw said holding means from operation, pattern controlled mechanism adapted to so operate said withdrawing means, and means, actuated by said yarn carrier controlling mechanism when released, adapted to release said withdrawing means from said holding means to permit the latter to move into operative position.

13. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a stop lever normally engaging said means and holding it from operation, a second lever adapted to withdraw the first lever out of operative position, pattern-controlled means adapted to so operate the second lever, and a third lever, actuated by said yarn carrier controlling means when released, adapted to release the second lever from the first lever to permit the first lever to return to operative position.

14. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a stop lever normally engaging said means and holding it from operation, a pin on the stop lever, a hooked lever engaging said pin and pattern controlled means adapted to move the hooked lever and thereby withdraw the stop lever from operative position.

15. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a stop lever normally engaging said means and holding it from operation, a pin on the stop lever, a pivoted hooked lever engaging said pin, pattern controlled mechanism adapted to move the hooked lever and thereby withdraw the stop lever from operative position, a pin on the hooked lever, a third lever, actuated by said means when released, adapted to engage the last named pin and move the hooked lever out of engagement with the stop lever, and a spring adapted to return the stop lever, when released, into operative position.

16. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, rotatable cams, means controlled thereby to control the movement of the yarn carriers into and out of operative position, means adapted to turn the cams step by step, a stop lever normally engaging said means and holding it from operation, a second lever adapted to withdraw the first lever out of holding position, pattern controlled means adapted to so operate the second lever, and means turning with said cams adapted to disengage the second lever from the first lever and permit the latter to return to holding position.

17. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, rotatable cams, means controlled thereby to control the movement of the yarn carriers into and out of operative position, means adapted to turn the cams step by step, a stop lever normally engaging said means and holding it from operation, a second lever engaging the stop lever, pattern controlled means adapted to actuate the second lever and thereby withdraw the stop lever from operative position and thus permit the yarn carrier controlling-cams to turn, a cam turning with the yarn carrier controlling cams, and a lever operated by the last named cam to disengage the said levers and permit the stop lever to return to holding position.

18. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a stop

lever normally engaging said means and holding it from operation, a weighted hooked lever normally engaging the stop lever, a shaft, an arm thereon on which the weighted lever is pivoted, pattern controlled mechanism adapted to turn the shaft and thereby cause the weighted lever to withdraw the stop lever from holding position, and a third lever actuated by the carrier controlling means to move the weighted hooked lever out of engagement with the stop lever.

19. In a circular knitting machine, in combination, a rotatable needle cylinder, rotary driving means, oscillatory driving means, shifting mechanism for alternately connecting the two driving means with the needle cylinder, a shaft turning with the shifting mechanism, a pattern chain, a cam on said shaft, a lever operated by said cam, a lever operated by the pattern chain, a link connecting said levers, a shaft, an arm on the shaft adapted to be actuated by said link, yarn carriers, mechanism operated by the driving means dictating the shift of the yarn carriers into and out of operative position, devices normally holding said mechanism inoperative, and means operated from the last named shaft controlling the operation of said devices.

20. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, yarn carriers, means dictating the movement of the yarn carriers into and out of operative position, a clamp and a cutter, a lever controlling the operation of the clamp and cutter, a lever actuatable in the movement of the yarn carrier controlling means, a link actuatable by said lever, a pawl actuatable by said link, a wheel operating as a ratchet actuatable by said pawl and operating as a cam to actuate the first lever, a spring adapted to return the second lever, link and pawl to their normal position, and a spring to return the first lever to its normal position.

21. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, a yarn carrier, a lever adapted to move the yarn carrier out of operative position, means to retract the lever to so move the yarn carrier, mechanism actuated by the driving means to actuate the lever-retracting means, pattern controlled means normally rendering the last named mechanism inoperative but adapted at intervals to render said mechanism operative, a spring tending to hold the yarn carrier in operative position and advance the lever while said mechanism is inoperative, and a cam turning with the needle cylinder adapted to engage the lever while said mechanism is inoperative and move the yarn carrier alternately into and out of operative position in each rotation of the needle cylinder.

22. In a circular knitting machine, in combination, a rotatable needle cylinder and driving means therefor, a yarn carrier, a spring tending to hold the yarn carrier in operative position, a lever engaging the yarn carrier, a cam turning with the needle cylinder and adapted during a part of each rotation thereof to engage the lever and withdraw the yarn carrier out of operative position, a rod engaging said lever and movable to withdraw the same out of operative relation with the cam and thereby move the yarn carrier out of operative position, a second lever adapted to operate the rod, a third lever adapted to operate the second lever, a shaft, means to turn the same step by step, a cam disk on the shaft adapted in the turning of the shaft to operate the third lever and thereby, through the second lever and rod, operate the first lever and yarn carrier as specified, and a spring adapted, in the further turning of the shaft, to retract the second and third levers and the rod, and allow the yarn carrier and the first lever to be moved by the first spring into operative position.

23. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, a swinging frame pivotally connected with the machine frame so as to swing into and out of operative relation with the needle cylinder, yarn carriers and mechanism coöperating therewith carried by the swinging frame, the yarn carriers being pivotally mounted thereon to swing into and out of operative position, means adapted to withdraw and hold the respective yarn carriers out of active position while the swinging frame is in operative relation with the needle cylinder, and independent means adapted, when the swinging frame is moved out of operative relation with the needle cylinder, to engage the yarn carrier or carriers that have been moved into their inactive positions and prevent them from swinging to the level of the other yarn carrier or carriers.

24. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, a swinging frame pivotally connected with the machine frame so as to swing into and out of operative relation with the needle cylinder, yarn carriers and mechanism coöperating therewith carried by the swinging frame, the yarn carriers being pivotally mounted thereon to swing into and out of operative position, means adapted to withdraw and hold the respective yarn carriers out of active position while the swinging frame is in operative relation with the needle cylinder, springs adapted to move the yarn carriers

into operative relation with the needle cylinder when the same are not withdrawn by said withholding means, and independent means adapted, when the swinging frame is moved out of operative relation with the needle cylinder, to engage the yarn carrier or carriers that have been withdrawn from active position and hold them from being operated by their respective springs.

25. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, a swinging frame pivotally connected with the machine frame so as to swing into and out of operative relation with the needle cylinder, yarn carriers and mechanism coöperating therewith carried by the swinging frame, the yarn carriers being pivotally mounted thereon to swing into and out of operative position, means mounted on the main frame and connected with the respective yarn carriers and adapted to be operated to withdraw and hold the yarn carriers out of operative position while the swinging frame is in operative relation with the needle cylinder and adapted to be rendered inoperative when the swinging frame is moved out of operative relation with the needle cylinder, and independent means adapted, when the swinging frame is moved out of operative relation with the needle cylinder, to engage and retain the yarn carrier or carriers that have been withdrawn from active position.

26. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, a swinging frame pivotally connected with the machine frame so as to swing into and out of operative relation with the needle cylinder, yarn carriers and mechanism coöperating therewith carried by the swinging frame, the yarn carriers being pivotally mounted thereon to swing into and out of operative position, means adapted to withdraw and hold the respective yarn carriers out of active position while the swinging frame is in operative relation with the needle cylinder but to be rendered inoperative when the swinging frame is moved out of operative relation with the needle cylinder, and a lever pivotally connected with the main frame and adapted, when the swinging frame is moved out of operative relation with the needle cylinder, to engage and retain the yarn carrier or carriers that have been moved into their inactive positions.

27. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, a swinging frame pivotally connected with the machine frame so as to swing into and out of operative relation with the needle cylinder, yarn carriers and mechanism coöperating therewith carried by the swinging frame, the yarn carriers being pivotally mounted thereon to swing into and out of operative position, means adapted to withdraw and hold the respective yarn carriers out of active position while the swinging frame is in operative relation with the needle cylinder but to be rendered inoperative when the swinging frame is moved out of operative relation with the needle cylinder, a lever pivotally connected with the main frame and adapted, when the swinging frame is moved out of operative relation with the needle cylinder, to engage and retain the yarn carrier or carriers that have been moved into their inactive positions, a spring so actuating the lever, and a stop on the swinging frame adapted, when the latter is in operative engagement with the needle cylinder, to move into position to hold the lever from being actuated by the spring.

28. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, cams mounted on the machine frame, means to turn the cams step by step, a swinging frame pivotally mounted on the machine frame so as to swing down into operative relation with the needle cylinder and up out of operative relation therewith, yarn carriers pivotally mounted on the swinging frame, springs tending to move the yarn carriers into operative position, means operatively engaging the respective cams and adapted to be controlled thereby to move the respective yarn carriers out of operative position when the frame is swung down but adapted to be disengaged from the cams when the frame is swung up, and independent means adapted, when the frame is swung up, to engage the yarn carrier or carriers that have been moved into their inactive positions and prevent them from swinging into their active positions relatively to the frame.

29. In a circular knitting machine, in combination, the machine frame, a needle cylinder mounted thereon, cams mounted on the machine frame, means to turn the cams step by step, a swinging frame pivotally mounted on the axis of the cams so as to swing down into operative relation with the needle cylinder and up out of operative relation therewith, yarn carriers pivotally mounted on the swinging frame, springs tending to move the yarn carriers into operative position, means operatively engaging the respective cams and adapted to be controlled thereby to move the respective yarn carriers out of operative position when the frame is swung down but adapted to be disengaged from the cams when the frame is swung up, a lever pivotally connected with the main frame and adapted when the frame is swung up, to engage the yarn carrier or carriers that have been moved into their

inactive positions and prevent them from swinging into their active positions relatively to the frame, a spring so actuating the lever, and a stop on the frame adapted, when the frame is swung down, to hold the lever from being actuated by the spring but adapted, when the frame is swung up, to recede from the lever and allow it to be operated by its spring.

In testimony of which invention, we have hereunto set our hands, at Philadelphia, on this 12th day of June, 1913.

HARRY A. HOUSEMAN.
HAROLD E. HOUSEMAN.

Witnesses:
WM. P. BROCKERMANN,
RAYMOND FAHRE.