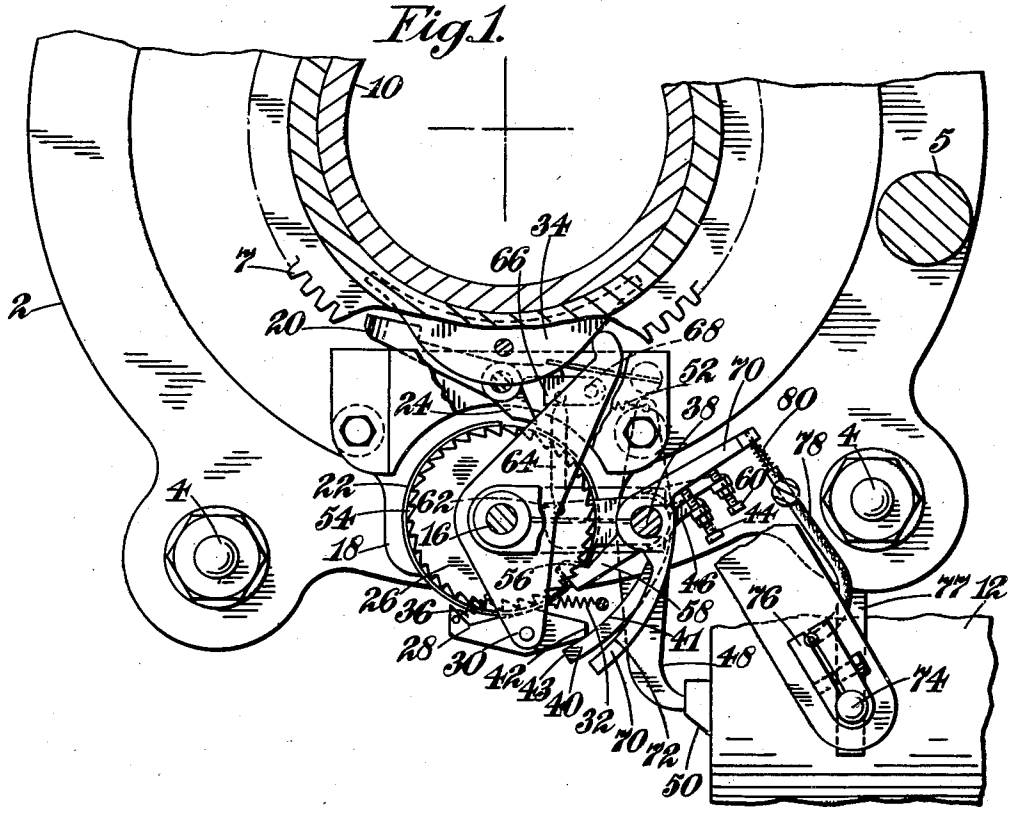
Feb. 16, 1937. C. H. WAINWRIGHT 2,070,762

CIRCULAR KNITTING MACHINE

Filed Jan. 27, 1936 3 Sheets-Sheet 1

Fig. 1.



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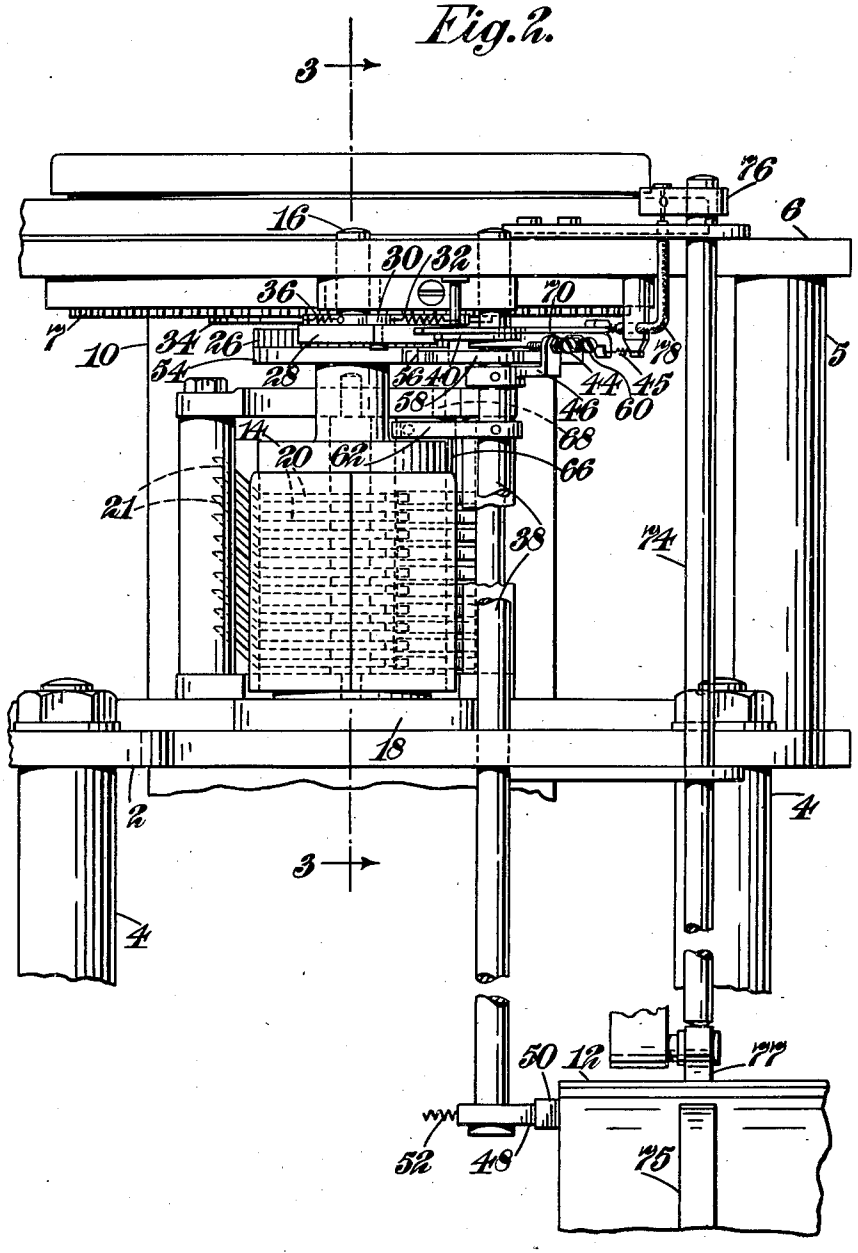
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CIRCULAR KNITTING MACHINE

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Fig. 2.



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CIRCULAR KNITTING MACHINE

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Fig. 3.

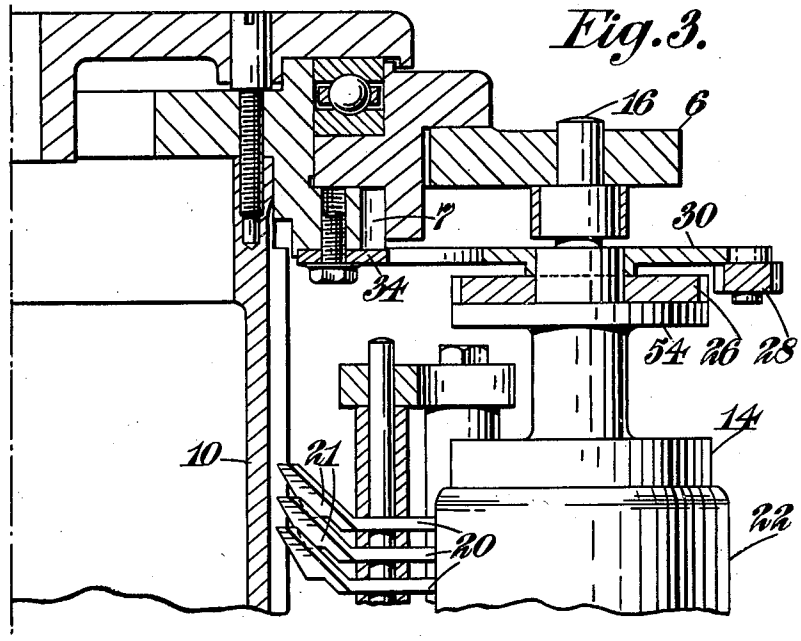
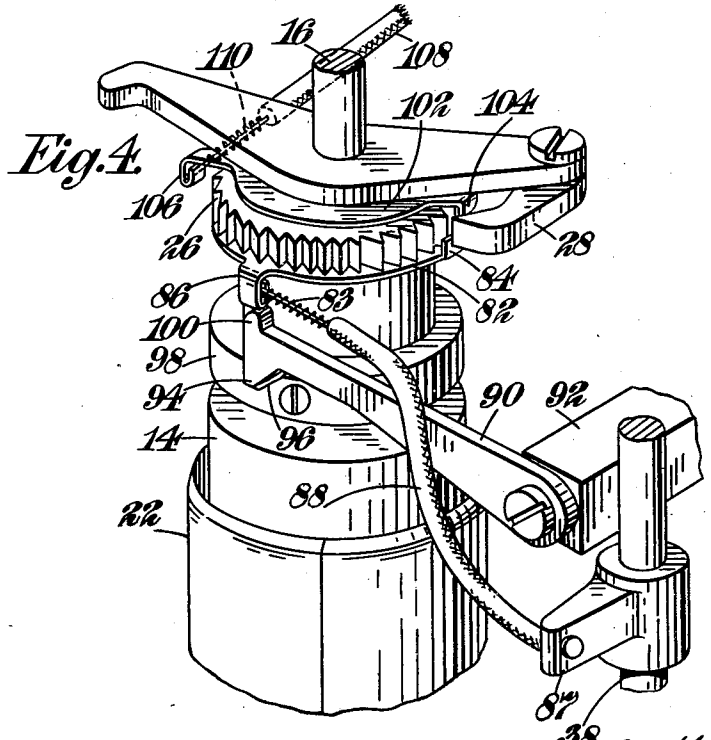


Fig. 4.



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UNITED STATES PATENT OFFICE

2,070,762

CIRCULAR KNITTING MACHINE

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Application January 27, 1936, Serial No. 61,089
In Great Britain February 2, 1935

9 Claims. (Cl. 66—50)

This invention is for improvements in circular knitting machines.

Circular knitting machines have heretofore been provided with needle-selecting mechanism for producing pattern effects in the knitted fabric, and in certain types of such selecting mechanism, the pattern is determined, or partly determined, by projections arranged in the desired order upon the peripheral surface of a rotary pattern drum. The pattern drum is usually rotated in a step-by-step manner, one step-movement taking place for each course of the knitting, and each step-movement causing, it may be, a new selection of needles to take place. The pattern drum makes one complete revolution for each complete pattern or for a number of complete patterns according to the "lay-out" of the projections upon its peripheral surface.

When fabric is being knitted in which there are patterned and unpatterned portions, as, for example, in hose, half-hose, etc., it is usually desirable for the patterned portion to begin in each case at the same part of the pattern, so that the articles can be properly paired. The length of the patterned portion of the fabric must, therefore, normally be a multiple of the length of one complete pattern and if the length of the patterned portion of the fabric is required to be increased or decreased, the increase or decrease must be equal to the length of one or more complete patterns, and cannot be equivalent to a part of a pattern. This is particularly inconvenient on hose and half-hose and especially when the pattern is a large one, as the length of, say, the leg or of the foot is limited to a multiple of the pattern length and yet must also be made a definite length according to the size of hose or half-hose being made. The only way these two lengths can be made to agree when they do not naturally do so is by alteration of the length of loops of which the fabric is composed, and this results in an inferior or unsuitable fabric.

An object of the present invention is to overcome this disadvantage by providing mechanism whereby the length of the pattern portion of the fabric, say the leg or foot of a hose or half-hose, etc., may be varied in the usual way (for instance, by adding or subtracting links from the main chain of the machine) without any consideration being given to the pattern and yet leave the starting point of the pattern unaffected.

According to the invention there is provided a circular knitting machine having needle-selecting mechanism comprising a pattern drum which is automatically rotated through one revolution during the formation in the knitted article of one complete pattern or a plurality of complete patterns, said machine having means for automatically stopping the needle-selecting action of the pattern drum and returning the pattern drum idly to a position corresponding to the starting point of the pattern, after the knitting of a length of pattern fabric which differs from the length of the pattern or from a multiple of the length of the pattern.

In the two constructions hereinafter described as illustrative of the invention, the driving machanism for the pattern drum is under control of two independent mechanisms, of which mechanisms one tends to stop the action of the driving mechanism when the patterned fabric being knitted reaches a point where patterning is to end, while the other of said mechanisms over-rides the action of the first-named mechanism, if the pattern drum is not at pattern-starting position, and allows the driving mechanism to continue to drive the pattern drum to such position, at which position rotation of the pattern drum is automatically arrested.

In each of said two constructions also, the control mechanism which, as aforesaid, overrides the action of the companion control mechanism, comprises a part which rotates in time relation with the pattern drum.

The invention comprises also a circular knitting machine having the feature of invention above set forth, and provided also with means whereby the rotation of the pattern drum is automatically arrested during the knitting of a heel-pouch in a hose or like article and then is automatically resumed. By the provision of such means patterning in the instep portion of the article is not adversely affected.

The said two constructions of mechanism according to this invention will now be described by way of example, and—also by way of example—will be considered as applied to a machine of the kind described in application Serial No. 743,460, filed September 10, 1934, and application Serial No. 32,110, filed July 18, 1935.

In the accompanying drawings:—

Figure 1 is a plan of one construction according to the invention of needle-selecting mechanism;

Figure 2 is an elevation of parts shown in Figure 1;

Figure 3 is a sectional detail of parts on the line 3—3 of Figure 2; and

Figure 4 is a perspective view of another construction, according to the invention, of needle-selecting mechanism.

The two constructions of mechanism illustrated in the drawings are shown as applied to the upper or rib-needle cylinder of a superposed cylinder type of circular knitting machine, whereas in the said prior applications, the pattern drum and its appurtenances are shown as cooperating with the lower or plain needle cylinder of the said two cylinders.

The machine illustrated in the drawings comprises a circular bed plate 2 secured to the frame of the machine by means including pillars 4. Above the bed plate 2 and spaced therefrom by pillars 5, one of which is shown in Figure 2, is a second bed plate 6. The needle cylinder 10 which is the upper or rib cylinder of the machine, is rotated about its axis by connections, including a gear wheel 7, from the main shaft of the machine.

The machine is provided with the customary control drum 12 by rotation of which various changes in the knitting operation are brought about, the rotation of the control drum 12 being controlled, as usual, by the main pattern chain (not shown) of the machine which travels in timed relation with the rotation of the needle cylinders.

In addition to the main control drum 12, there is present in the machine a pattern drum 14 which is rotatably mounted upon a stud 16 projecting upwardly from a plate 18 secured to the bed plate 2. The peripheral surface of the pattern drum 14 is, in practice, provided with a number of holes in which, as explained in said applications, pins or cam pieces are inserted in accordance with the pattern to be produced in the knitted fabric. These pins co-operate with a series of selector levers 20 by the aid of which a selective action is performed upon the needles in the needle cylinder. In the constructions shown in the drawings, the pins are protected by a cylindrical guard 22 which adjacent the ends 24 of the selector levers 20 has a vertically-disposed slot formed in it to enable the ends 24, to extend into the paths of the said pins.

In one of the two constructions hereinbefore mentioned the pattern drum 14 (see Figures 1 to 3) has fast upon its upper end a ratchet wheel 26 which is arranged to be engaged by a pawl 28 pivotally mounted upon a pawl-carrying lever 30 which is mounted to swing about the axis of the pattern drum and is oscillated in one direction by a spring 32 and in the reverse direction by a cam 34 which is secured to the gear wheel 7 and thus rotates with the needle cylinder 10. A spring 36 tends to maintain the pawl 28 in engagement with the ratchet wheel 26. Adjacent the pattern drum and arranged substantially parallel with the axis thereof, is a vertical shaft 38, upon and near the upper end of which a pawl-controlling lever 40 is freely pivoted. One end of this lever has a curved side-surface 41 which is adapted to engage a tail 42 formed on the pawl 28, when the lever 40 is moved into its active position, as hereinafter explained, and thereby hold the pawl out of engagement with the ratchet wheel. The other end of the pawl-controlling lever 40 extends into a position where it can be engaged by an adjusting screw 44 threaded in an arm 46 which is fast upon the vertical shaft 38. The lower end of the vertical shaft has fast upon it a cam-operated lever 48 arranged to engage cams one of which as shown at 50 on a side surface of the main control drum 12 of the machine. A spring 52 acting upon the cam-controlled lever 48 tends to keep its acting end against the surface of the control drum. With the arrangement as thus far described and assuming that the pattern drum 14 is being rotated step by step by the pawl 28 and ratchet wheel 26 and that patterning is being effected, the operation will be as follows: When patterning is to cease, a movement of the control drum 12 brings a cam 50 thereon into engagement with the cam-operated lever 48 and moves that lever in a clockwise direction (as seen in Figure 1) causing it correspondingly to turn the vertical shaft 38 upon which, as aforesaid, the lever is secured. The turning of the vertical shaft clockwise tends to move the arm 46 away from the pawl-controlling lever 40, permitting the pawl-controlling lever, under the action of a spring 45 (Figure 2) to bring its curved side-surface 41 into engagement with the tail 42 of the pawl and thereby disengage the pawl from the ratchet wheel 26 and stop the step by step rotation of the pattern drum 14. The pawl-controlling lever 40 is so dimensioned and so disposed in relation to the pawl that at the end of the driving stroke of the pawl, the tail of the pawl, after it has trailed along the said side-surface 41, engages the end 43 of the lever thereby preventing the pawl-carrying lever 30 from making its return stroke into the path of its actuating cam 34.

From what has been mentioned hereinbefore, it will be clear that the position in which the pattern drum 14 has been stopped as just explained is not necessarily the position which corresponds to the starting point of the pattern. To ensure that the pattern drum 14 shall be brought into the appropriate position in readiness to start the next patterning operation at the starting point of the pattern, mechanism is provided, a convenient form of which is as follows:—

On the pattern drum, immediately below the ratchet wheel 26, there is secured a disc 54 having a notch 56 formed in its peripheral surface. This notch is adapted to be engaged by the pointed end of an auxiliary control lever 58 which is freely pivoted upon the vertical shaft 38 and has at its other end a screw 60 threaded into it which, at times, can engage the pawl-controlling lever 40. The parts are so arranged that when the pointed end of the lever 58 is seated in the notch 56, the pattern drum 14 is in the position which corresponds to the starting point of the pattern. In the operation of the mechanism including the auxiliary control means just described, when that point in the fabric is reached at which patterning is required to start, a movement of the control drum 12 will move a cam 50 thereon from engagement with the cam-operated lever 48. This action will cause the vertical shaft 38 to be turned in a counter-clockwise direction, with the result that the pawl-controlling lever 40 will be moved, by the action thereon of the arm 46, from engagement with the tail 42 of the pawl 28, allowing the pawl to engage the ratchet wheel 26 and the pawl-carrying lever 30 to move into the path of its actuating cam 34. The pattern drum 14 will now be driven step by step by the action of the pawl and ratchet wheel. At the first step-by-step movement of the pattern drum the pointed end of the auxiliary control lever 58 will be moved out of the notch 56 in the disc 54, the said pointed end and notch having appropriate inclined surfaces for this pur-

pose. This movement of the auxiliary control lever 58 brings the screw 60 thereon into contact with the pawl-controlling lever 40 which thus cannot move toward the pawl 28 to disengage it from the ratchet wheel so long as the pointed end of the auxiliary control lever 58 trails along the cylindrical surface of the disc 54. The pattern drum 14 continues to rotate and may make several revolutions before it is required to stop. When the end of the patterned portion of the fabric is reached, the main control drum 12 makes another movement and brings another of the cams 50 upon it into engagement with the cam-operated lever 48 whereby the vertical shaft 38 is turned in a clockwise direction and the arm 46 is moved away from the pawl-controlling lever 40. If at the time the vertical shaft 38 is turned clockwise as just stated, the pattern drum 14 happens to be in the position in which the notch 56 in the disc 54 is within range of the pointed end of the auxiliary control lever 58, the pawl-controlling lever 40 will be free to move toward the pawl 28 to stop the rotation of the pattern drum 14, since the adjusting screw 44 on the arm 46 will have been moved, by movement of this arm, away from the pawl-controlling lever 40. But if the pattern drum is not in the position just mentioned, as will more probably be the case, the pointed end of the auxiliary control lever 58 will be on the cylindrical part of the disc 54 and the screw 60 upon that lever will consequently hold the pawl-controlling lever 40 away from the pawl 28 with the result that the pawl and ratchet mechanism will continue to rotate the pattern drum until the pointed end of the auxiliary control lever 58 is again within range of the notch 56, whereupon the pawl-controlling lever 40 will be free to act to stop the rotation of the pattern drum.

Means are provided for suspending the action of the pattern drum 14 upon the needle-selecting mechanism of the machine during the time interval in which the pattern drum is driven idly to the starting position. These means conveniently comprise an arm 62 fast upon the vertical shaft 38, which arm is connected by a ball-ended link 64 with a bar 66 pivoted on a rod 68 to swing about a vertical axis and adapted to engage all the selector levers 20 so as to move the cam-inclines 21 thereon when the vertical shaft 38 is turned clockwise, away from the parts which are operated upon by said inclines, as explained in said applications; it being noted that as the selector levers in the present application appertain to needles of the rib cylinder, the cam-inclines 21 are on the lower sides of these levers.

In the knitting of hose or half-hose, etc., having patterned fabric at the legs and feet by machines which also knit the heel and toe pouches, the patterning must be suspended while the heel-pouch is being knitted (at which time of course knitting at the instep portion of the article is stopped) and resumed again after completion of the heel pouch and when knitting at the instep portion is resumed. It is therefore necessary to stop the step-by-step movement of the pattern drum 14 during this interval in the knitting of the instep portion, otherwise and uniformity of the pattern at that portion will usually be destroyed. There is accordingly provided in the present construction a second pawl-controlling lever 70 which is situated just above the pawl-controlling lever 40 and which like that lever is freely pivoted upon the vertical shaft 38 and moveover has a curved side-surface 72 similar to and serving the same purpose as the corresponding surface 41 on the pawl-controlling lever 40. There is present in the machine a vertical rod 74 which is raised automatically at the beginning of the knitting of the heel pouch by means of a cam 75 on the control drum 12 which cam lifts a lever 77 upon the upper side of which the bottom end of the rod 74 bears. This movement of the rod 74, in the present construction, is utilized to turn the second pawl-controlling lever 70 to cause it to disconnect the pawl 28 from the ratchet wheel 26 and thereby stop the rotation of the pattern drum 14. For this purpose an arm 78 clamped on the vertical rod 74 is connected by a Bowden-wire connection 78 to the second pawl-controlling lever 70 in such manner that when the vertical rod rises the second pawl-controlling lever 70 is pulled by the Bowden-wire connection, against the action of a spring 80, and its curved side-surface 72 is forced into engagement with the tail of the pawl 28, with the result that the pawl is disconnected from the ratchet wheel 26 and patterning is consequently suspended. It will be appreciated that the tail of the pawl 28 is of a thickness sufficient to enable it to be engaged by either of the superposed pawl-controlling levers 40 and 70. At the end of the heel-pouch knitting operation, the vertical rod 74 automatically drops and, through the connections described, allows the pawl 28 to re-engage the ratchet wheel 26 whereupon the patterning operation is resumed.

In the second construction according to the invention, the pawl-controlling lever 40 of the construction just described is represented by a disc 82 (Figure 4) situated just beneath the ratchet wheel 26 of the pattern drum 14 and concentric with that wheel. On the edge of the disc 82 there is formed an upturned arm 84 which extends across about half the width of the ratchet wheel 26 and serves, at times, as a shield which prevents the pawl 28 from engaging the ratchet wheel 26. At another part of the edge of the disc 82 there is a down-turned arm 86 which is operatively connected by a Bowden-wire connection 88 with an arm 37 on the vertical shaft 38 which, as before mentioned, is turned by a cam on the control drum 12. In this construction the auxiliary control lever 58 before mentioned, takes the form of a lever 90 pivoted upon a stationary part 92 of the machine so that it can swing in a vertical plane and its pointed end 94, which is down-turned, is adapted to enter a notch 96 formed in the upper surface of a collar 98 which is concentric with and rotates with the pattern drum 14. Above its down-turned pointed end 94 the lever has a projection 100 which when the pointed end 94 is trailing on the plane part of the upper surface of the collar 98, can engage the down-turned arm 86 of the disc 82 and thus prevent the disc from turning under the action of a spring 83 to bring the shield 84 thereon between the pawl 28 and the ratchet wheel 26. When the pointed end 94 of the lever is in the notch 96, however, the projection 100 is below the path of movement of the down-turned arm 86.

The second pawl-controlling lever 46 of the first construction is represented, in this second construction, by a disc 102 similar to the disc 82 above-mentioned but located on the upper side of the ratchet wheel 26. This disc 102 has a downturned arm 104 which extends across about half the width of the ratchet wheel 26 and serves, at times, as a shield for the pawl 28. The disc 102 is provided also with a second arm 106 which

is connected by a Bowden-wire connection 108 to the vertical rod 74 above-mentioned which has movements automatically imparted to it by the control drum 12 at the beginning and end, respectively, of the heel-pouch knitting operation.

In operation, the second construction just described is similar to the first construction. When patterning is to start, the disc 82 is turned by its connections from the control drum 12 and removes its shield 84 from between the pawl 28 and ratchet wheel 26, allowing the pawl to act to drive the pattern drum 14 round step by step. This operation continues until the end of the patterned portion of the fabric is reached at which time the pull on the Bowden-wire connection 88, previously exerted by the connections from the control drum 12, will be relaxed, and the disc 82, under action of the spring 83, will tend to return to its pawl-shielding position. At the same time the action by the pattern drum 14 upon the needle-selecting mechanism will be suspended by the mechanism hereinbefore described and comprising the arm 62 which is fast on the vertical shaft 38 and is connected with the bar 66 by the ball-ended link 64. In all probability, however, the pattern drum 14 at this time will not be at its pattern-starting position and consequently the disc 82 will be prevented from turning by the engagement of its down-turned arm 86 with the projection 100 on the auxiliary control lever 90, which projection will have been lifted into the path of the down-turned arm 86 on the disc at the first movement of the pattern drum, the pointed end 94 of the lever and one side of the notch 96 having appropriately-inclined surfaces for this purpose. The pattern drum 14 will therefore be driven idly by the pawl and ratchet mechanism towards the pattern-starting position and when it arrives in that position the pointed end 94 of the auxiliary control lever 90 will fall into the notch 96 thereby permitting the lower disc 92 to be turned by its spring 83 to bring its shield between the pawl and ratchet wheel and thus stop rotation of the pattern drum. The upper disc 102 when heel-pouch knitting is to begin, will be moved by its connections with the control drum 12 to bring its shield 104 into shielding relation with the pawl 28 and thus suspend the rotation of the pattern drum 14, which rotation will be resumed at the end of the heel-pouch knitting by the action of the control drum in permitting a spring 110 to return the disc 102 into its initial position in which its shield 104 does not interfere with the operation of the pawl 28 upon the ratchet wheel 26.

From the foregoing it will be appreciated that in each of the constructions described, the production of pattern in the knitted fabric may be stopped by the action of the main control mechanism of the machine, but that the pattern drum may continue to be driven idly until it reaches the position corresponding to the position it should occupy at the start of a pattern, in which position it will remain until it is required to rotate to start another pattern in the fabric. Further, both of the said constructions include means whereby the rotation of the pattern drum may be stopped, for heel production, and then resumed without adverse effect upon the pattern produced in the fabric.

I claim:—

1. In a circular knitting machine, needle-selecting devices, a pattern drum for controlling said devices, disengaging means for removing all of said devices from cooperative relation with the pattern drum, driving means for rotating said drum, a stop device therefor, control mechanism adapted to operate said disengaging means to remove all of said devices from cooperative relation with the pattern drum and simultaneously to operate said stop device to stop the driving action of said driving means at a point in the knitting operation at which patterning is to be stopped, and another control mechanism adapted, if said point does not correspond with a pattern-starting position of the drum, to override the action of the first-named control mechanism upon said stop device without affecting the operation of said mechanism upon the disengaging means and thus permit the driving means to continue to drive the drum idly towards the pattern-starting position, and also to cause said stop device to stop the action of the driving means upon the drum when the drum arrives at the pattern-starting position.

2. A circular knitting machine according to claim 1, wherein the first-named control mechanism comprises a control member, a cam projection thereon, a part adapted to be engaged and moved by said cam projection, operative connections between said part and said disengaging means and operative connections between said part and said stop device, said last-named operative connections including yielding means which tend to actuate said stop device upon movement of said part.

3. A circular knitting machine according to claim 1, comprising a second stop device for the pattern drum driving means, and operative connections between said first-named control mechanism and said second device adapted to cause said second stop device to stop the driving action of the pattern drum driving means during the knitting of a heel pouch by the machine.

4. In a circular knitting machine, a pattern drum, devices controlled thereby, means for suspending the control of said drum upon said devices, driving means for rotating said drum comprising a pawl and ratchet wheel, disengaging means for disengaging the pawl from the ratchet wheel, control mechanism for simultaneously operating said control-suspending means and said disengaging means, and another control mechanism comprising a part rotating with the pattern drum arranged to prevent the disengaging means, irrespective of the action upon said means of the first-named control mechanism, from disengaging the pawl from the ratchet wheel until the pattern drum arrives at a pattern-starting position of the drum, whereby the pattern drum moves idly to said position after operation of said control-suspending means by said first-named control mechanism.

5. In a circular knitting machine, a pattern drum, devices controlled thereby, means for suspending the control of said drum upon said devices, driving means for rotating said drum comprising a pawl and ratchet wheel, a pawl-disengaging member yieldingly urged in a direction to disengage the pawl from the ratchet wheel, control mechanism normally preventing said member from moving in the said direction but at times, releasing said member and simultaneously operating said control-suspending means, and another control mechanism comprising two mutually-engaging parts, one of which rotates with the pattern drum and the other of which is adapted to engage the pawl disengaging member, the said two parts having cooperating en-

gaging surfaces so located in relation to a pattern-starting position of the pattern drum, and so formed relatively that when the drum arrives in that position to which it is driven idly after actuation of said first-named control mechanism, the appropriate one of said two parts by the coaction of said surfaces moves to permit the pawl-disengaging member to move in the said direction thereby to disengage the pawl from the ratchet wheel and stop the rotation of the pattern drum.

6. In a circular knitting machine, a pattern drum, devices controlled thereby, means for suspending the control of said drum upon said devices, driving means for rotating said drum comprising a pawl and a ratchet wheel, a lever for disengaging the pawl from the ratchet wheel, yielding means for operating said lever, a control mechanism for actuating said control-suspending means, a member movable by said mechanism into and from a position in which it prevents pawl-disengaging movement of said lever, a cam rotating with the pattern drum, a second lever movable by said cam into and from a position in which it prevents pawl-disengaging movement of said first-named lever, said cam permitting said second lever to move from said position when the pattern drum arrives in a pattern-starting position to which it is driven idly after actuation of said control-suspending means by said control mechanism to suspend control of the pattern drum upon said devices.

7. A circular knitting machine according to claim 6, comprising a second lever for disengaging the pawl from the ratchet wheel, and operative connections between said control mechanism and said second pawl-disengaging lever adapted to cause said lever to disengage the pawl from the ratchet wheel and thus stop rotation of the pattern drum during the knitting of a heel pouch by the machine.

8. In a circular knitting machine, a pattern drum, devices controlled thereby, means for suspending the control of said drum upon said devices, driving means for rotating said drum comprising a pawl and ratchet wheel, a member movable about the axis of said ratchet wheel, a shield carried by said member and adapted to be interposed between the pawl and ratchet wheel to stop the driving action of said driving means upon the pattern drum, yielding means for moving said shield-carrying member into pawl-shielding position, a control mechanism for actuating said control-suspending means, operative connections between said mechanism and the shield-carrying member for moving said member out of pawl-shielding position, a cam rotating with the pattern drum, a lever operated by said cam, and coacting surfaces on said lever and shield-carrying member adapted when in engagement to prevent movement of said member into pawl-shielding position, said cam being arranged to permit said lever to move to disengage said surfaces when the pattern drum arrives in a pattern-starting position to which it is driven idly after actuation of said control-suspending means by said control mechanism to suspend control of the pattern drum upon said devices.

9. A circular knitting machine according to claim 8, comprising a second member movable about the axis of the ratchet wheel, a shield carried by said member and adapted to be interposed between the pawl and ratchet wheel to stop the driving action of said driving means upon the pattern drum, and operative connections between said control mechanism and said second member adapted to cause said member to move to pawl-shielding position to stop the driving action upon the pattern drum during the knitting of a heel pouch by the machine.

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