June 9, 1931. W. S. PARKER 1,809,063

PATTERN MECHANISM FOR STRAIGHT KNITTING MACHINES

Filed April 17, 1929 3 Sheets-Sheet 1

Fig. 1

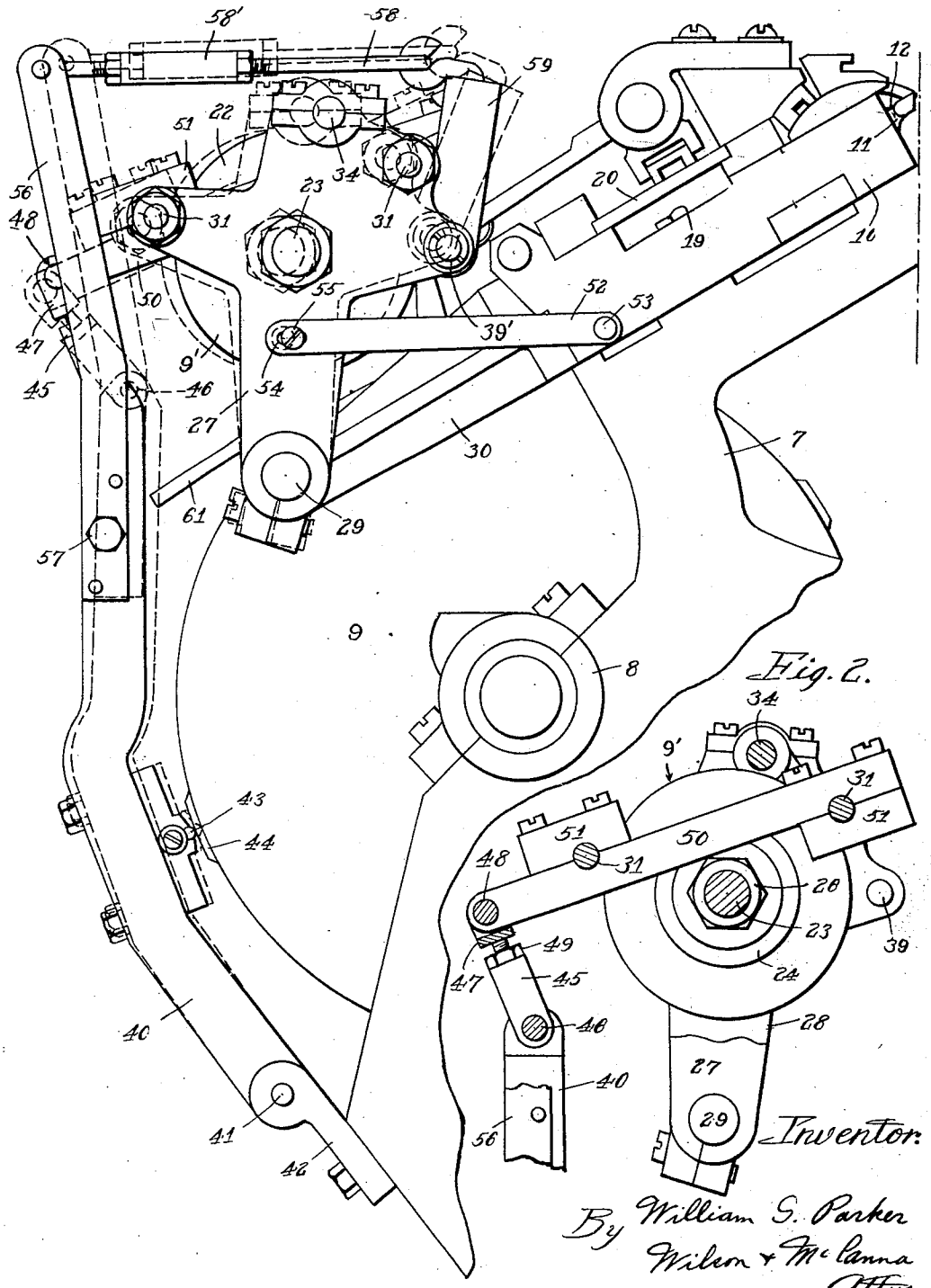


Fig. 2.

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Fig. 3.

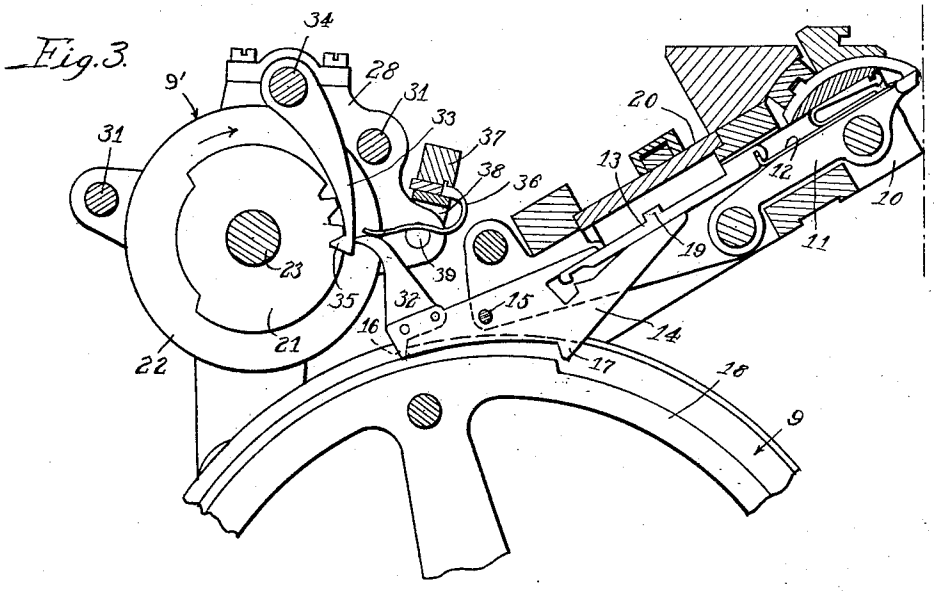
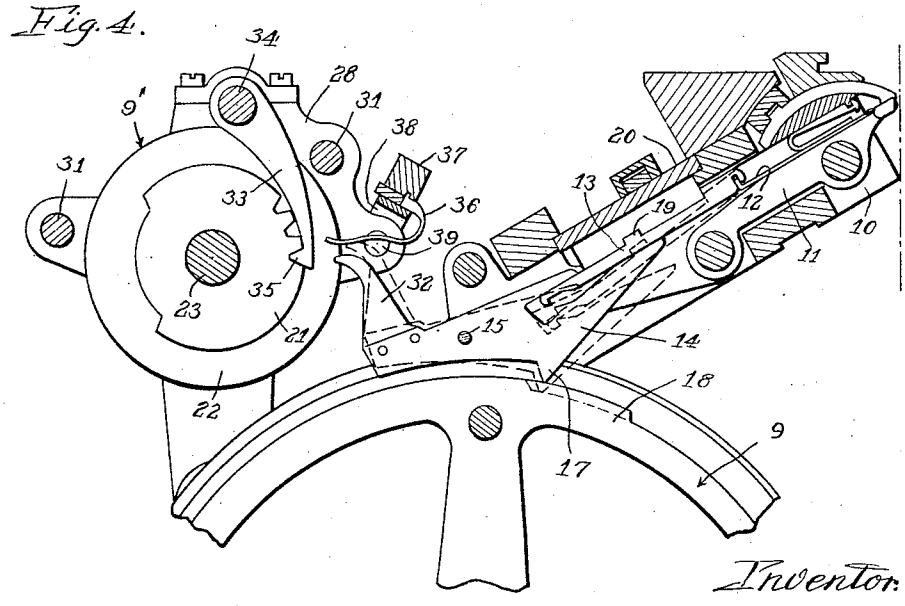


Fig. 4.



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Fig. 5.

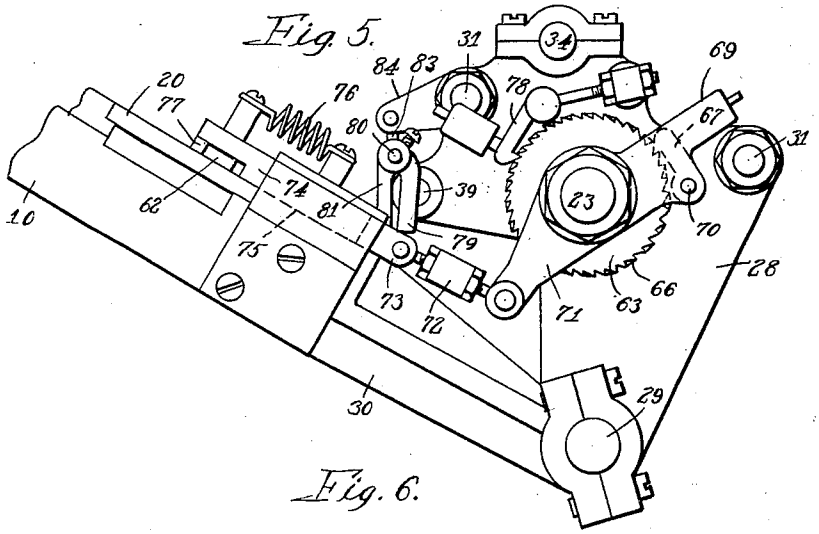
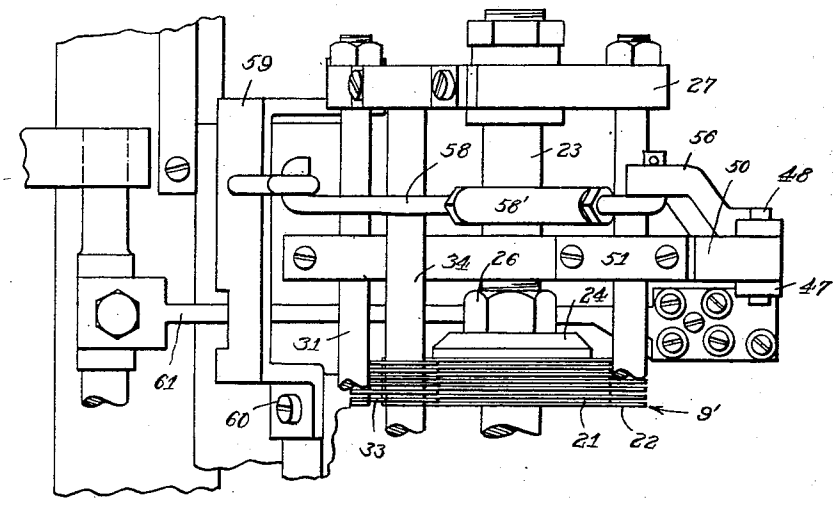
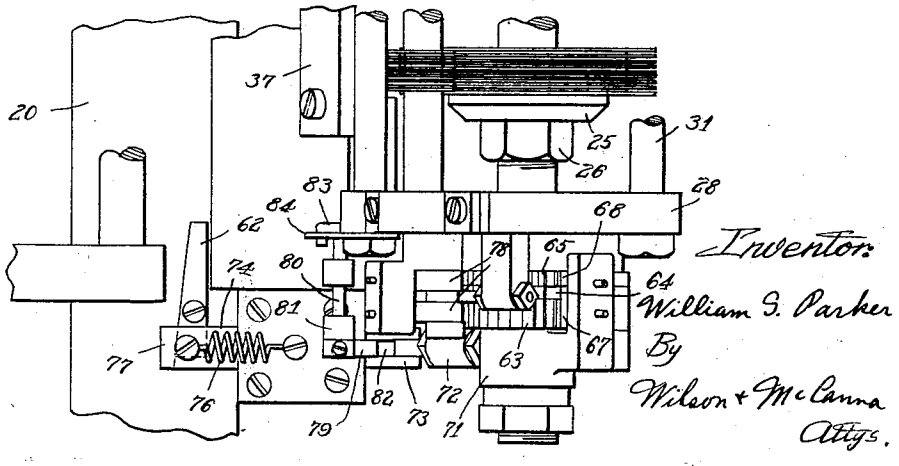


Fig. 6.





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Patented June 9, 1931

1,809,063

UNITED STATES PATENT OFFICE

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PATTERN MECHANISM FOR STRAIGHT KNITTING MACHINES

Application filed April 17, 1929. Serial No. 355,691.

This invention relates to straight parallel row knitting machines and has particular reference to pattern mechanisms therefor.

It is well known that in the operation of a straight knitting machine, such as the Burson machine, the pattern cylinders controlling the beds of needles control the shape of the article by determining the number of needles thrown into action in different stages in the knitting of the article, this shaping being generally known in the trade as fashioning. The pattern cylinders were, furthermore, specially constructed to control the throwing into and out of action of the needles in predetermined order to produce a certain amount of design in the fabric. In other words, the pattern cylinders produced a fixed shape and design. Certain variations in design were possible with the same cylinders by changes in the control thereof or changes in the yarn control but the amount of variation capable of being produced in that way was limited owing to the design and construction of the pattern cylinder and yarn control mechanisms. As a result, it was usually necessary to provide new pattern cylinders when a change in design was desired. This, necessitated almost complete dismantling of the machine, to replace the old pattern cylinders by new ones, so that a machine was apt to be kept out of service for several days, at great loss to the manufacturer, aside from the labor expense involved in making the change. The present invention aims to avoid these difficulties and to make it possible to produce a multiplicity of different designs with the same pattern cylinders without necessitating serious changes and adjustments on the machines.

In my copending application, Serial No. 26,016, filed April 27, 1925, I disclosed the novel idea of providing auxiliary pattern cylinders in conjunction with the main pattern cylinders, arranged to cooperate in such a way that the main cylinders serve primarily to control the shape of the fabric and to a certain extent the design, whereas the auxiliary pattern cylinders serve entirely to control the design of the fabric. In said application I also disclosed means for throwing the auxiliary pattern cylinders into and out of operative position, as well as other incidental mechanism, such as means for intermittently advancing the auxiliary pattern cylinders in timed relation with the operation of parts of the machine, such as the reciprocating cam bars; means for locking the auxiliary pattern cylinders against advancement when moved to inoperative position, and means whereby the pressure of actuating springs for the jack-levers, required in connection with the operation of said jack-levers by the auxiliary pattern cylinders, is arranged to be released when the auxiliary pattern cylinders are moved to inoperaitve position. In the present application I show improved means for controlling the shifting of the auxiliary pattern cylinders into and out of operative position. The main pattern cylinders are relied upon to throw the auxiliary pattern cylinders into operative position, in a generally similar manner as shown in the other application, but in this case I take advantage of the action of the jack-lever actuating springs to automatically move the auxiliary pattern cylinders to inoperative position. This greatly simplifies the construction and results in a much more practical machine, aside from a great saving in cost realized by the change in design. Furthermore, a rocker beam, provided in connection with each main pattern cylinder and arranged to be rocked thereby, has a simple form of toggle connection with the auxiliary pattern cylinder to throw the same into operative position as it is moved toward a dead center position in the rocking movement of the rocker beam and is thereby arranged to communicate enough movement to the auxiliary pattern cylinder to throw it from inoperative to operative position, and an adjustable connection between the toggle link and the frame of the auxiliary pattern cylinder is provided to insure the bringing of the auxiliary pattern cylinder to precisely the right position when it is moved to operative position, the importance of that being self-evident. The rocker beam of each pattern mechanism is also connected, in accordance with the present invention, with the

rocker carriage provided for the jack-lever springs so as to automatically rock the carriage and release the pressure of the springs from the jack-levers when the auxiliary pattern cylinder is moved to inoperative position.

These and other improvements are fully described in the following specification wherein reference is made to the accompanying drawings, in which—

Figure 1 is an end view of one half of a Burson type machine showing the auxiliary pattern mechanism of my invention applied thereto, the same appearing in full lines in operative position and in dotted lines in the inoperative position;

Fig. 2 is a vertical section through a portion of Fig. 1;

Fig. 3 is a vertical section through the needle bed and pattern mechanism shown in Fig. 1, the auxiliary pattern cylinder being shown in operative position;

Fig. 4 is a similar section showing the auxiliary pattern cylinder in the inoperative position;

Fig. 5 is an end view of the needle bed and pattern mechanism looking at the opposite end from that shown in Fig. 1. and

Fig. 6 is a plan view of Fig. 5.

The same reference numerals are applied to corresponding parts throughout the views.

In the present application, as in the other above identified, I have shown my invention applied to a straight knitting machine of the Burson type, in which each bed of needles is arranged to be controlled by a separate pattern cylinder, thus necessitating a separate auxiliary pattern mechanism for each main pattern cylinder. It should be understood, however, that my invention in its broader aspect is not confined to application to this particular type of machine but is applicable to straight knitting machines of various types and comprehends broadly the use of plural pattern control mechanisms, where one serves primarily to control shape and another to control design of the fabric, as well as the use of plural pattern control mechanisms for each bed of needles irrespective of the particular function of each of such mechanisms.

Referring to the drawings wherein I have shown only enough of the machine to properly illustrate the application of my invention thereto, a portion of the frame 7 is shown with one end bearing 8 for the main pattern cylinder 9. The needle bed appears at 10 with needle supports 11, needles 12, needle-operating jacks 13, and jack-levers 14. As is well known in this art, there is a jack and jack-lever for each needle. Each jack-lever is pivoted on a cross-rod 15 and has opposed feet 16 and 17 arranged to ride on the periphery of cam plates 18 on the main pattern cylinder 9 so as to rock the jack-lever, as indicated in Fig. 4, to throw the needle associated therewith into and out of action, the full line position of the parts in Fig. 4 serving to indicate the relationship thereof when the needle is in action, and the dotted line position serving to show the relationship of the parts when the needle is out of action. An upstanding lug 19 on each jack 13 in the rocking of its jack-lever 14 is moved into or out of the path of needle advancing and retracting cams (not shown) on the reciprocating cam bar 20. In other words, a needle is advanced and retracted in a knitting operation or remains at rest depending on the position of its jack-lever. The cams just referred to for advancing and retracting the needles in the reciprocation of the cam bar 20 are well known to this art; they appear, for instance, in my Patent 1,520,479 of December 23, 1924 and in various other patents. The means for reciprocating the cam bar is also not shown but reference may be had to Rolston Patent 990,595 of April 25, 1911 for a showing thereof, as well as for a showing of means for intermittently turning the main pattern cylinder 9. It should be clear from the foregoing that the main pattern cylinder determines the number of needles thrown into action in various stages in the knitting of an article and consequently controls the shaping or fashioning thereof, and might also be employed to control to a limited extent the throwing into and out of action of said needles to control the pattern or design of the fabric, it being understood that the pattern or design is further modified by reason of the number or color of yarns employed in the knitting; the yarn feed being controlled by separate mechanism not forming any part of the present invention. Reference may be had, however, to Burson Patent No. 616,601, December 27, 1898, for a showing of yarn transfer means.

In the knitting of various articles of merchandise, such for example as socks and stockings, the main pattern cylinder or cylinders, as the case may be, control the shape of the knitted article and may also be so constructed as to produce various designs or ornamental effects in the fabric. However, in view of the ever-changing demand for different designs the matter of changing the main patterns or substituting new patterns therefor involves not only a considerable expense but also requires a great amount of time and labor in making the new patterns and in substituting them in the machine. The present invention overcomes these difficulties by the provision of an auxiliary pattern mechanism of the endless pattern type adapted to be applied as an attachment operating in conjunction with each main pattern cylinder for controlling the needles in action and adapted to be thrown into and out of operation at will or by control of the main pattern cylinder. Thus while the main pattern

cylinder controls the shape of the fabric and the design to any extent desired, the auxiliary pattern mechanism is intended to control the needles in conjunction with and supplemental to said control of the main pattern cylinder. And, inasmuch as the auxiliary pattern mechanism, in this instance of cylindrical form, is considerably smaller than the main pattern cylinder and constructed so that it may be produced at a comparatively low cost and changed quickly, a greater variety of different fabrics may be produced at a lower cost than was heretofore possible.

The auxiliary pattern cylinder 9′ comprises a series of pattern plates 21 with spacing plates 22 inserted therebetween on an arbor 23, the same being clamped in position between opposed heads 24 and 25. Nuts 26 threading on the arbor are arranged when tightened to impart the clamping pressure and upon removal of either one or both nuts either one or both heads 24 and 25 along with the plates 21 and 22 may be removed for replacement because of breakage or wear or for other reasons. The plates are not intended to be removed for the purpose of changing designs; on the contrary it is expected that each auxiliary cylinder shall be kept for the purpose of knitting the particular design that it is capable of producing and that it shall be readily interchangeable with another cylinder on one machine or likewise readily transferable from one machine to another.

The arbor 23 is journaled at its ends in a suitable rocker frame comprising brackets 27 and 28 pivotally mounted on studs 29 carried by brackets 30 fastened rigidly to the frame of the machine. Parallel tie rods 31 serve to rigidly interconnect the brackets 27 and 28 and stiffen the frame of the auxiliary pattern cylinder 9′. The latter, it should be evident from the foregoing, is disposed in juxtaposition to the main pattern cylinder 9 and the jack-levers 14, the latter being disposed above the main cylinder, between the two cylinders for operation by both.

Each jack-lever 14 is arranged to be oscillated about the rod 15 as a center, either by the main cylinder 9 or auxiliary cylinder 9′. When the auxiliary cylinder is in retracted position, as appears in Fig. 4, the jack-levers are arranged to be oscillated by the main cylinder as indicated by the full line and dotted line showing of the jack-lever in Fig. 4. Each jack-lever has a finger 32 projecting upwardly therefrom into a groove formed between two adjoining plates 22, and arranged to be moved by the engagement therewith of a cam follower 33 also projecting into the same groove in between the end of the finger 32 and the periphery of the plate 21. The cam followers 33 are pivotally mounted for oscillation on a cross-rod 34 and have teeth 35 provided on the free ends thereof to ride on the periphery of the cam plates 21, substantially as shown in Figs. 3 and 4, so that the cam followers are oscillated as the teeth ride into and out of the depressions in the periphery of the cam plates in the turning of the cylinder 9′ in a clockwise direction as indicated by the arrow in Fig. 3. In the same figure it will be observed that the back of the cam follower 33 is in engagement with the hooked end of the finger 32 to oscillate the jack-lever 14 in the oscillation of the cam follower. In other words, the auxiliary pattern cylinder is arranged when in its operative position to move the jack-levers positively when throwing the needles out of action. Leaf springs 36, suitably secured to a cross-bar 37, have their outer ends arranged, as shown in Fig. 3, to engage the hooked ends of the fingers 32 to tend normally to move the jack-levers 14 yieldingly in a counter-clockwise direction toward the position shown in Fig. 3, namely that in which the needles are thrown into action. Manifestly it is only when the tooth 35 on the end of the follower 33 drops down into a depression that the jack-lever associated therewith will move to the position shown in Fig. 3 to throw the needle associated therewith into action. These depressions may be provided at short intervals as shown on the right hand half of the cam plate 21 appearing in the drawings, or a long dwell may be provided, as shown on the left hand half of the plate appearing in the drawings, the needles being thrown into and out of action at intervals in the first case and being kept in action for a protracted interval in the other case. The pressure of the springs 36 on the fingers 32 is arranged to be released by moving the cross-bar 37 in a clockwise direction from the position shown in Fig. 3 to that shown in Fig. 4, in a manner which will presently be described, in connection with a description of the means for rocking the frame of the auxiliary pattern cylinder 9′ to move it into and out of operative position. The cross-bar 37 has an arm 38 at one end thereof pivotally mounted on the bracket 28, as indicated at 39, to permit rocking of the cross-bar 37 from the one position to the other. A similar pivot 39′ appearing in Fig. 1 is provided for the other end of the cross-bar 37 on a bracket 59 fastened to the latter end of the cross-bar, as indicated at 60 in Fig. 6. The bracket 59 bridges a tension lever 61, forming a part of the standard Burson machine, to give the same sufficient operating clearance, and it will presently appear how this bracket plays a part in rocking the cross-bar 37 relative to the pivots 39 to release the spring pressure from the fingers 32. In passing, the cam followers 33 require special mention; there is a decided advantage in the provision of these parts, first, from the standpoint that excessive thrust and consequent power consumption and wear on the parts is avoided,

and second, from the standpoint that the design of the periphery of the cam plates is made a much simpler matter and a greater range of control movements can be provided for without difficulty. Considering first the matter of thrust; it will be seen that the cam followers 33 in riding out of a depression in the periphery of the cam plate 21 has the outer end thereof moving in a direction substantially at right angles to the hooked outer end of the finger 32, by reason of the particular location of the pivot 34. There is, therefore, no tendency for parts to bind and work hard and the wear incident to the operation of the jack-lever is consequently reduced to a minimum. If the hooked outer ends of the fingers 32 were extended for engagement directly with the periphery of the cam plates the thrust on the fingers would come almost directly in a line with the pivot 15 and the power required to operate the machine with such a design would be excessive, not to mention the excessive wear on the inter-engaging parts and the likelihood of breakage. Considering next the simplification in the design of the cam which is rendered possible by the arrangement disclosed; that arises from the fact that the location of the pivot 15 would have to be a primary consideration in designing the cam plates 21 if the intermediate followers 33 were not provided. The provision of the followers 33 eliminates that problem and a very simple form of periphery can be given each cam plate and not only that but practically any number and arrangement of control movements can be provided for.

A rocker beam 40, pivoted at its lower end at 41 on a bracket 42 suitably secured to the frame 7 of the machine, has a cam follower point 43 thereon near the lower end thereof arranged to ride on the periphery of a cam 44 on the main pattern cylinder 9 to rock the same from the dotted line position shown in Fig. 1 to the full line position as the follower rides out of a depression in the periphery of the cam in a manner believed to be self-evident. The free end of the rocker beam 40 has a toggle link 45 pivoted thereto, as shown at 46, and the latter has a clevis 47 screw-threaded in the outer end thereof to adjust the radius of a pivot pin 48 relative to the pivot 46. A lock nut 49 threading on the shank of the clevis 47 is arranged, when tightened, to lock the clevis in adjusted position. A bar 50 straddling the parallel tie rods 31 and clamped thereto, as shown at 51, for rigid connection with the frame of the auxiliary pattern cylinder 9′, has the end thereof fastened in the clevis 47 by means of the pivot pin 48. The latter, as appears in Fig. 2 or Fig. 6, is arranged to be driven out when an adjustment of the clevis 47 is desired either to elongate or contract the length of the toggle link 45. In operation, when the rocker beam 40 is moved in a counter-clockwise direction from the dotted line position shown in Fig. 1 to its full line position, the toggle link 45 moves toward a dead center position, that is, toward a position where the pivots 41, 46 and 48 would come into line, which, however, never occurs, inasmuch as the rocker beam is not given sufficient movement. The toggle link is thereby caused to rock the frame of the pattern cylinder 9′ in a clockwise direction about its pivots 29 from the dotted line position shown in Fig. 1 to the full line position, the dotted line position being the inoperative position and the full line position the operative position. The auxiliary pattern cylinder 9′ is thus arranged to be held in the operative position so long as the cam follower 43 is not riding in a depression in the periphery of the cam 44 on the main pattern cylinder 9. When, however, the cam follower 43 rides down into a depression, the auxiliary pattern cylinder 9′ is arranged to move of itself back to its inoperative position, its movement being suitably limited by a link 52 pivoted at one end, as at 53, on the frame of the machine and having a slot 54 in the other end thereof receiving a screw 55 on the bracket 27 of the frame of the auxiliary pattern cylinder. The adjustment of the clevis 47 plays an important part since it will be realized that the more the toggle link 45 is elongated the farther forward the auxiliary pattern cylinder will be brought when moved to operative position. After the auxiliary pattern cylinders on a machine have been changed it is usually necessary to make some slight adjustment of the clevis 47 to insure bringing the auxiliary pattern cylinders to precisely the right position. It has been stated that the auxiliary pattern cylinder is arranged to move practically of itself from operative position back to inoperative position when allowed to do so by reason of the cam follower 43 on the rocker beam 40 riding down into a depression. The reason for this is that the mass of the auxiliary pattern cylinder 9′ and all its appurtenances is almost, but preferably not quite, balanced, that is to say, in equilibrium, on either side of the pivots 29, the center of mass being preferably slightly to the left of the pivots 29 as the parts are viewed in Fig. 1, when the auxiliary pattern cylinder is in the operative position. In other words, the auxiliary pattern cylinder has to be held in the operative position by the rocker beam 40. It will now be shown that the action of the springs 36, as a matter of fact, is taken advantage of to assist in the movement of the auxiliary pattern cylinder from the operative to the inoperative position.

An arm 56 is fastened, as by means of a bolt 57, to the free end of the rocker beam 40 and has a link connection 58 with the bracket 59 previously described. When the rocker

beam 40 is moved to the left, or counter-clockwise, from its dotted line position to the full line position shown in Fig. 1, the bracket 59, by reason of the link connection 58, is shifted to the left, or counter-clockwise, from the dotted line position shown in Fig. 1 to the full line position; in other words, the cross-bar 37, in such movement of the beam 40, is moved from the position shown in Fig. 4 to that shown in Fig. 3. The springs 36 are all moved into engagement with the fingers 32 and deflected sufficiently to place the fingers under appreciable pressure, sufficient at least to take care of the movement of the jack-levers 14 from the inactive to the active position. The rocker beam 40 is, therefore, placed under the load of the entire bank of springs 36 when it is brought to the full line position shown in Fig. 1. Thus, the moment the cam follower 43 rides down into a depression in the periphery of the cam 44 on the main pattern cylinder 9 the action of the springs 36 is a factor in moving the rocker beam 40 from the full line position toward the dotted line position shown in Fig. 1 whereby to correspondingly move the auxiliary pattern cylinder from the operative to the inoperative position. In this movement of the parts the bracket 59 and cross-bar 37 are, of course, moved enough to relieve the fingers 32 of the jack-levers 14 from the pressure of the springs 36. The spring action is effective only during the first part of the movement of the auxiliary pattern cylinder from the operative to the inoperative position; once the cylinder has moved a certain distance the unbalanced weight in the assembly, previously referred to, insures movement thereof the rest of the way. In that way, the springs 36 are insured of enough movement to bring the ends thereof clear of the fingers 32, as shown in Fig. 4. A turnbuckle 58′ is provided for adjusting the length of the link connection 58 whereby to increase or decrease the pressure of the springs 36 both from the standpoint of their operation of the jack-levers and from the standpoint of their assisting in the retracting of the auxiliary pattern cylinder from the operative position. Obviously, a slight take-up of the link connection will increase the spring pressure, and vice versa.

The main pattern cylinder 9, as was stated before, is arranged to be advanced intermittently in timed relation with the operation of a part of the machine, such as the cam bar 20, as is well known in this art. It will now be shown how the auxiliary pattern cylinder 9′ is likewise arranged to be intermittently advanced, but only when the same is in the operative position. This cylinder motion might, of course, be imparted through some other operating part of the machine although I have chosen to utilize the reciprocating cam bar 20. Briefly stated, a ratchet and pawl device acting on the arbor 23 and operated by a cam 62 provided on the cam bar 20 is arranged to take care of the intermittent advancement of the auxiliary pattern cylinder 9′ when the latter is in the operative position. In this particular application of the auxiliary pattern mechanism its cylinder is arranged to be actuated only upon each alternate stroke of the cam bar 20, such alternate operation being produced by virtue of the provision of a special form of pawl device, as will be presently explained. This alternate operation is required because in round and round knitting by the needles on the opposed beds one bed of needles is at rest while the other bed is in action. Consequently, during each alternate stroke of the cam bar 20 motion should be transmitted by the cam 62 to the auxiliary cylinder 9′ associated with each bed of needles. The ratchet device comprises a series of ratchet wheels 63, 64 and 65 similar to those shown in my copending application above referred to. As described in said application, the ratchet 63 is keyed to the arbor 23 and the other two are loose thereon but riveted, or otherwise suitably secured, together to turn as one. The ratchets 63 and 65 have the same number of teeth but the intermediate ratchet 64 has only one-half that number of teeth; in other words, there are blanks 66 between alternate teeth. A single pawl 67 engages the teeth on both ratchets 63 and 64 and another pawl 68 engages the teeth on the ratchet 65. These pawls are held in by springs in the housing 69 and are both pivotally mounted on the same bolt 70 in a ratchet arm 71 mounted for oscillation on the end of the arbor 23, as shown, and connected through an adjustable turnbuckle link 72 with a clevis 73 formed on the end of a cam follower slide 74 reciprocably mounted in a guide 75 on the frame. The slide 74 is constantly urged to move to the right under the action of a coiled tension spring 76 to swing the ratchet arm 71 in a counter-clockwise direction, as viewed in Fig. 5, and thus advance the pawls 67 and 68 for a new bite on the ratchets, the movement of the pawls being one tooth at a time this movement placing the end 77 of the slide 74 in the path of the cam 62 on the reciprocating cam bar 20. The cam 62 is so located on the cam bar that it will engage the end 77 and move the slide 74 to the left at the end of the return stroke of the cam bar, thus moving the pawls 67 and 68 a distance equivalent to one tooth of the ratchets and imparting a control movement to the auxiliary pattern cylinder just prior to the knitting stroke. Because of the special ratchet device described, the ratchet 65 will be actuated at each stroke of the cam bar 20 and the ratchet 63 will be actuated only at each alternate stroke of the cam bar due to the fact, as described in my copending application, that

the pawl 67 will be held up out of engagement with the ratchet 63 by the alternate blanks 66 on the ratchet 64. Suitable spring-pressed pawls 78, one of which engages the ratchet 63 and the other the ratchet 65, serve to prevent back motion of the ratchets. So long as the auxiliary pattern cylinder 9′ occupies the operative position, the ratchet device will function to intermittently advance the cylinder at each alternate stroke of the cam bar 20 in the manner described. However, when the auxiliary pattern cylinder 9′ is moved to inoperative position the same is arranged to be locked against advancement by the cam 62. This lock will now be described.

The lock comprises an arm 79 fixed on the end of a rock shaft 80 received in bearings provided on arms 81 reaching upwardly from the frame adjacent the guideway 75 for the cam follower slide 74. The arm 79 is swingable in the oscillation of the rock shaft 80 into and out of the slot 82 in the clevis 73. A crank arm 83, provided on the end of the rock shaft 80, is pivotally connected by means of a link 84 with the adjacent end of one of the parallel tie rods 31 whereby to provide a link connection between the arm 83 and the bracket 28. Thus, when the auxiliary pattern cylinder is moved to the operative position, in which position of the cylinder the parts are shown in Fig. 5, the arm 79 is retracted from the slot 82 in the clevis 73 to permit free reciprocation of the slide 74 under the action of the spring 76 in one direction and under the action of the cam 62 in the other direction. The moment, however, that the auxiliary pattern cylinder is moved to the inoperative position, in which movement the bracket 28 along with the bracket 27 is moved in a clockwise direction, as it is viewed in Fig. 5, the rock shaft 80 is turned enough to bring the end of the arm 79 into a position in the slot 82 where the end 77 of the slide 74 is held at least as far advanced to the left as the cam 62 is ever arranged to move it, and to hold the slide in that position so long as the auxiliary pattern cylinder remains held in the inoperative position. Thus, there is no danger of the auxiliary pattern cylinder changing its position no matter how long it is held out of operative position.

From the foregoing it will be manifest that the auxiliary pattern cylinder will be brought into and out of operation at predetermined times under control of suitable cams on the main pattern cylinder and that when in the operative position it will be automatically operated by the cam bar to impart a needle control movement to put needles into or out of action prior to each knitting stroke. And, inasmuch as the auxiliary pattern cylinder will be operative on all needles held in action by the main cylinder, it will control the design or pattern of the fabric as distinguished from the shape thereof which is determined by said main cylinder.

While I have described my invention as applied to various specific details of construction and arrangement it should be understood that certain changes might be made without departing from the spirit and scope of the invention, especially as brought out in the appended claims.

I claim:

1. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be thrown into and out of operation to control the active needles, a carriage for said auxiliary cylinder, the auxiliary cylinder with its carriage tending normally to move freely in one direction to a certain position and arranged to assume such position when not otherwise operated, and means arranged to be operated at one or more intervals in the operation of the machine having connection with the carriage to move the same with the cylinder in the opposite direction to another position.

2. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be thrown into and out of operation to control the active needles, a carriage for said auxiliary cylinder, the auxiliary cylinder with its carriage tending normally to move freely in one direction to inoperative position and arranged to assume such position when not otherwise operated, and means arranged to be operated at one or more intervals in the operation of the machine having connection with the carriage to move the same with the cylinder in the opposite direction to operative position.

3. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be thrown into and out of operation to control the active needles, a rocker frame carrying the auxiliary pattern cylinder, said cylinder tending normally to move with the frame freely in one direction to bring the cylinder to inoperative position and arranged to assume such position when not otherwise operated, and means arranged to be operated at one or more intervals in the operation of the machine having connection with the rocker frame to move the same with the cylinder in the opposite direction to operative position.

4. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be thrown into and out of operation to control the active needles, a rocker frame pivotally mounted on the frame of the machine for oscillation and having the auxiliary pattern cylinder carried thereby, the cylinder being disposed substantially in balanced equilibrium relative to the rocker frame pivots but tending normally to move in one direction toward inoperative position, a rocker beam pivotally mounted on the frame of the machine for oscillation, a link pivotally connected to the free end of said beam and pivotally connected with the rocker frame, said link forming a toggle with the rocker beam and being arranged in the movement of said beam in one direction to move the rocker frame in the opposite direction to bring the auxiliary pattern cylinder toward operative position, and means arranged to be operated at a predetermined time in the operation of the machine for communicating rocking motion to the rocker beam.

5. A structure as set forth in claim 4 including means for limiting movement of the rocker frame toward inoperative position.

6. A structure as set forth in claim 4 wherein one member of the toggle is adjustable as to length whereby to predetermine the operative position of the auxiliary pattern cylinder.

7. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be thrown into and out of operation to control the active needles, a rocker frame pivotally mounted at its lower end on the frame of the machine for oscillation and having the auxiliary pattern cylinder carried thereby, the cylinder being disposed substantially in balanced equilibrium above and relative to the rocker frame pivots but tending normally to move in one direction toward inoperative position, a rocker beam pivotally mounted at its lower end on the frame of the machine for oscillation, a link pivotally connected to the free upper end of said beam, and pivotally connected with the rocker frame, said link forming a toggle with the rocker beam and being arranged in the movement of said beam in one direction to move the rocker frame in the opposite direction to bring the auxiliary pattern cylinder toward operative position, and means arranged to be operated at a predetermined time in the operation of the machine for communicating rocking motion to the rocker beam.

8. A structure as set forth in claim 7 including a link pivotally connected to the frame of the machine and pivotally connected to the rocker frame above the pivots thereof, the said link being slotted at one of its pivots to afford a limited amount of movement for the rocker frame in moving toward inoperative position.

9. In a straight knitting machine, the combination with a frame and a bed of needles thereon, of a main pattern cylinder, jack-levers normally operated by the main pattern cylinder to throw a different number of needles into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be shifted into and out of operative position with relation to the jack-levers so as to control the jack-levers for the active needles, the said jack-levers extending in between the two cylinders, a rocker frame pivotally mounted by its lower portion on the main frame for oscillation relative thereto and serving to support the auxiliary pattern cylinder for movement into and out of operative position, springs carried by a part on the rocker frame and normally engaging the jack-levers, the jack-levers in the operative position of the auxiliary cylinder being operated positively in one direction by the cylinder and yieldingly in the other direction by said springs, said springs serving also normaly to tend to move the rocker frame with the cylinder to inoperative position, and means arranged to be operated at a predetermined time in the operation of the machine for moving the rocker frame to operative position.

10. In a straight knitting machine, the combination with a frame and a bed of needles thereon, of a main pattern cylinder, jack-levers normally operated by the main pattern cylinder to throw a different number of needles into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be shifted into and out of operative position with relation to the jack-levers so as to control the jack-levers for the active needles, the said jack-levers extending in between the two cylinders, a rocker frame pivotally mounted by its lower portion on the main frame for oscillation relative thereto and serving to support the auxiliary pattern cylinder for movement into and out of operative position, a cross-bar on the rocker frame extending over the jack-levers, springs mounted on the cross-bar and engaging the jack-levers for the purpose described, said springs tending normally to move the rocker frame toward inoperative position, said cross-bar being mounted for movement relative to the rocker frame to an inoperative position where the spring pressure on the jack-levers is relieved, means for moving the rocker frame toward operative position against the action of the springs at a pre-

determined time in the operation of the machine, and means for moving the cross-bar toward and away from operative position in the movement of the rocker frame toward and away from operative position.

11. In a straight knitting machine, the combination with a frame and a bed of needles thereon, of a main pattern cylinder, jack-levers normally operated by the main pattern cylinder to throw a different number of needles into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be shifted into and out of operative position with relation to the jack-levers so as to control the jack-levers for the active needles, the said jack-levers extending in between the two cylinders, a rocker frame pivotally mounted by its lower portion on the main frame for oscillation relative thereto and serving to support the auxiliary pattern cylinder for movement into and out of operative position, the said auxiliary pattern cylinder being disposed substantially in balanced equilibrium with the rocker frame relative to the rocker frame pivots when in the operative position, springs carried by a part on the rocker frame and normally engaging the jack-levers, the jack-levers in the operative position of the auxiliary cylinder being operated positively in one direction by the cylinder and yieldingly in the other direction by said springs, said springs serving also normally to tend to move the rocker frame with the cylinder to inoperative position, and means arranged to be operated at a predetermined time in the operation of the machine for moving the rocker frame to operative position.

12. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action in different stages in the knitting of an article, an auxiliary pattern cylinder arranged to be thrown into and out of operation to control the active needles, a rocker frame pivotally mounted on the frame of the machine for oscillation and having the auxiliary pattern cylinder carried thereby, the cylinder being disposed substantially in balanced equilibrium relative to the rocker frame pivots, a rocker beam pivotally mounted on the frame of the machine for oscillation, a link pivotally connected to the free end of said beam and pivotally connected with the rocker frame, said link forming a toggle with the rocker beam and being arranged in the movement of said beam in one direction to move the rocker frame in the opposite direction to bring the auxiliary pattern cylinder toward operative position, means arranged to be operated at a predetermined time in the operation of the machine for communicating rocking motion to the rocker beam, there being jack-levers identified with the bed of needles disposed between the two cylinders, a cross-bar mounted on the rocker frame, springs carried thereby and engaging the jack-levers for the purpose described, said springs in the operative position of the auxiliary pattern cylinder tending to move the latter with its rocker frame toward inoperative position, said cross-bar being movable relative to the rocker frame from the operative position to an inoperative position wherein the pressure of the springs on the jack-levers is relieved, and means whereby the cross-bar is shifted to and from operative position in the movement of the rocker frame to and from operative position.

13. A structure as set forth in claim 12 wherein the cross-bar is mounted for oscillation relative to the rocker frame and wherein the means for moving the cross-bar to and from operative position comprises a link connection between the rocker beam and said cross-bar for oscillating the cross-bar with the rocker beam.

14. A structure as set forth in claim 12 wherein the cross-bar is mounted for oscillation relative to the rocker frame and wherein the means for moving the cross-bar to and from operative position comprises a link connection between the rocker beam and said cross-bar for oscillating the cross-bar with the rocker beam, the said link connection being adjustable in length whereby to vary the spring pressure on the jack-levers in the operative position of said cross-bar substantially as and for the purposes described.

15. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder, an auxiliary pattern cylinder adjacent the main pattern cylinder, supporting frames for said cylinders, jack-levers disposed in between the cylinders normally operated by the main pattern cylinder to throw a different number of needles into action in different stages in the knitting of an article, fingers provided on the jack-levers and extending toward the auxiliary cylinder to permit control of the jack-levers for the active needles by the auxiliary pattern cylinder, cam followers pivotally mounted on the auxiliary cylinder frame adjacent the auxiliary cylinder on the opposite side thereof from the fingers of said jack-levers and extending inwardly in between the cylinder and the ends of said fingers and having their free ends riding on the periphery of said cylinder whereby to transmit positive movement to the jack-levers in one direction, and spring means for transmitting movement to the jack-levers in the other direction.

16. A structure as set forth in claim 15 including means movably mounted on the auxiliary cylinder frame carrying the springs and arranged to assume an inoperative position wherein the pressure of the springs on the jack-levers is relieved.

17. A structure as set forth in claim 15 wherein the auxiliary cylinder frame is movable relative to the main cylinder frame to bring the auxiliary cylinder into and out of operative relation to the jack-levers, and including a cross-bar mounted on the auxiliary cylinder frame and having the jack-lever operating springs carried thereby, and means for moving said cross-bar to and from operative position in the movement of the auxiliary cylinder frame to and from operative position, whereby the pressure of the springs on the jack levers is relieved when the auxiliary cylinder is moved to inoperative position.

18. In a straight knitting machine, such as the Burson machine, the combination with a frame and a bed of needles thereon, of a main pattern cylinder mounted in said frame, jack-levers normally operated by the main pattern cylinder to throw a different number of needles into action in different stages in the knitting of an article, a rocker frame pivotally mounted by its lower portion on the main frame for oscillation relative thereto, an auxiliary pattern cylinder mounted in said rocker frame over the main pattern cylinder and arranged in the oscillation of said rocker frame to be moved toward and away from operative relation to the jack-levers, there being means operated by the auxiliary pattern cylinder for transmitting control movements to the jack-levers, the main cylinder being arranged to be intermittently advanced in timed relation with the operation of a part of the machine, such as the reciprocating cam bar thereof, means arranged in the operative position of the auxiliary cylinder for intermittently advancing the same in timed relation with the operation of a part of the machine, such as the reciprocating cam bar thereof, means for holding the auxiliary pattern cylinder against advancement when the same is in the inoperative position, a rocker beam pivotally mounted by its lower end on the main frame for oscillation relative thereto, a link pivotally connected with the free upper end thereof and pivotally connected with the rocker frame, the link forming a toggle with the rocker beam arranged in the movement of the rocker beam in one direction to communicate movement to the rocker frame in the other direction, and means for rocking the beam at predetermined intervals in the operation of the machine.

19. A structure as set forth in claim 18 including a cross-bar on the rocker frame, springs carried thereby for engagement with the jack-levers for the purpose specified, said cross-bar being mounted to oscillate relative to the rocker frame to and from an operative position to throw the springs into and out of action relative to the jack-levers, and means arranged in the movement of the rocker frame to and from operative position to oscillate the cross-bar to and from operative position.

20. In a straight knitting machine, such as the Burson machine, the combination with a frame and a bed of needles thereon, of a main pattern cylinder mounted in said frame, jack-levers normally operated by the main pattern cylinder to throw a different number of needles into action in different stages in the knitting of an article, a rocker frame pivotally mounted by its lower portion on the main frame for oscillation relative thereto, an auxiliary pattern cylinder mounted in said rocker frame over the main pattern cylinder and arranged in the oscillation of said rocker frame to be moved toward and away from operative relation to the jack-levers, there being means operated by the auxiliary pattern cylinder for transmitting control movements to the jack-levers, the main cylinder being arranged to be intermittently advanced in timed relation with the operation of a part of the machine, such as the reciprocating cam bar thereof, a reciprocable member for intermittently advancing said auxiliary cylinder in timed relation with the operation of a part of the machine, such as the reciprocating cam bar thereof, there being positive means for moving said member positively in one direction and spring means for returning the same, means for rocking the rocker frame to bring the auxiliary cylinder to and from operative position, and means arranged to keep the auxiliary cylinder in fixed position when the same is moved to inoperative position, said means comprising an oscillating arm carried on the frame of the machine and swingable toward said member in such a direction that it is arranged to move the same against the spring action, and a link connection between said arm and the rocker frame for oscillating the arm in the manner stated in the rocking of the frame to inoperative position.

21. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder, an auxiliary pattern cylinder, a carriage for said auxiliary cylinder for moving the same into and out of operative position, jack-levers operable by the main cylinder to throw needles into action and to a certain extent control the active needles, the auxiliary cylinder when in the operative position being also arranged to cooperate with the jack-levers to control the active needles, said auxiliary cylinder being arranged to move the jack-levers in one direction, spring means for moving the jack-levers in the opposite direction, the spring means being retractible to inoperative position, and means providing a connection between the carriage and the spring means for retracting the latter in the retracting of the auxiliary cylinder, and vice versa.

22. A machine as set forth in claim 21, wherein the spring means when moved to op-

erative position exert a pressure tending to move the carriage with the auxiliary cylinder to retracted position, the machine including means operable at predetermined points in the operation of the machine for moving the carriage to operative position against the action of the spring means.

23. A machine as set forth in claim 21, including a toggle linkage arranged in the movement thereof toward dead center to move the carriage with the auxiliary cylinder toward the operative position, the spring means in the operative position of the auxiliary cylinder tending to break the toggle to return the auxiliary cylinder to retracted position, and means arranged at predetermined intervals in the operation of the machine to move the toggle linkage toward dead center position.

24. In a straight knitting machine, the combination with a bed of needles, of a fixedly positioned main pattern cylinder arranged to determine the number of needles thrown into action, an auxiliary pattern cylinder arranged to be moved into and out of operative position to control the active needles, a carriage for said auxiliary cylinder, spring means normally tending to move the carriage to retracted position, and a toggle linkage connected with the carriage and arranged when moved toward dead center position to move the carriage to operative position, said toggle linkage being operable toward dead center position at predetermined points in the rotation of the main pattern cylinder.

25. In a straight knitting machine, the combination with a bed of needles, of a main pattern cylinder arranged to be operated to determine the number of needles thrown into action, an auxiliary pattern cylinder arranged to be moved into and out of operative position to control the active needles, a rocker support for said auxiliary cylinder arranged in its inward swinging movement to move the auxiliary cylinder to active position, said rocker support tending normally to swing outwardly, and a toggle linkage connected with the rocker support and tending normally to swing inwardly but arranged when swung outwardly toward dead center position to move the rocker support inwardly, said toggle linkage being operable at predetermined points in the turning of the main cylinder.

26. The structure set forth in claim 25 including an adjustable connection between the toggle linkage and the rocker frame, whereby to accurately predetermine the operative position of the auxiliary cylinder with reference to the dead center position of the toggle linkage.

27. The structure as set forth in claim 25 including jack-levers normally operated by the main cylinder to throw the needles into action, said jack-levers being operable by the auxiliary cylinder to control the active needles, leaf springs cooperating with the jack-levers to move the same in the opposite direction, a rocker mounting for said leaf springs whereby the same are arranged to be moved to retracted position, and means providing a connection between the toggle linkage and the rocker frame for moving the springs to retracted position in the breaking of the toggle linkage.

In witness of the foregoing I affix my signature.

WILLIAM S. PARKER.