Feb. 19, 1963 A. H. WIDDOWSON ET AL 3,077,756

PATTERNING MECHANISM FOR CIRCULAR KNITTING MACHINES

Filed Sept. 16, 1960 3 Sheets-Sheet 1

Fig. 1.

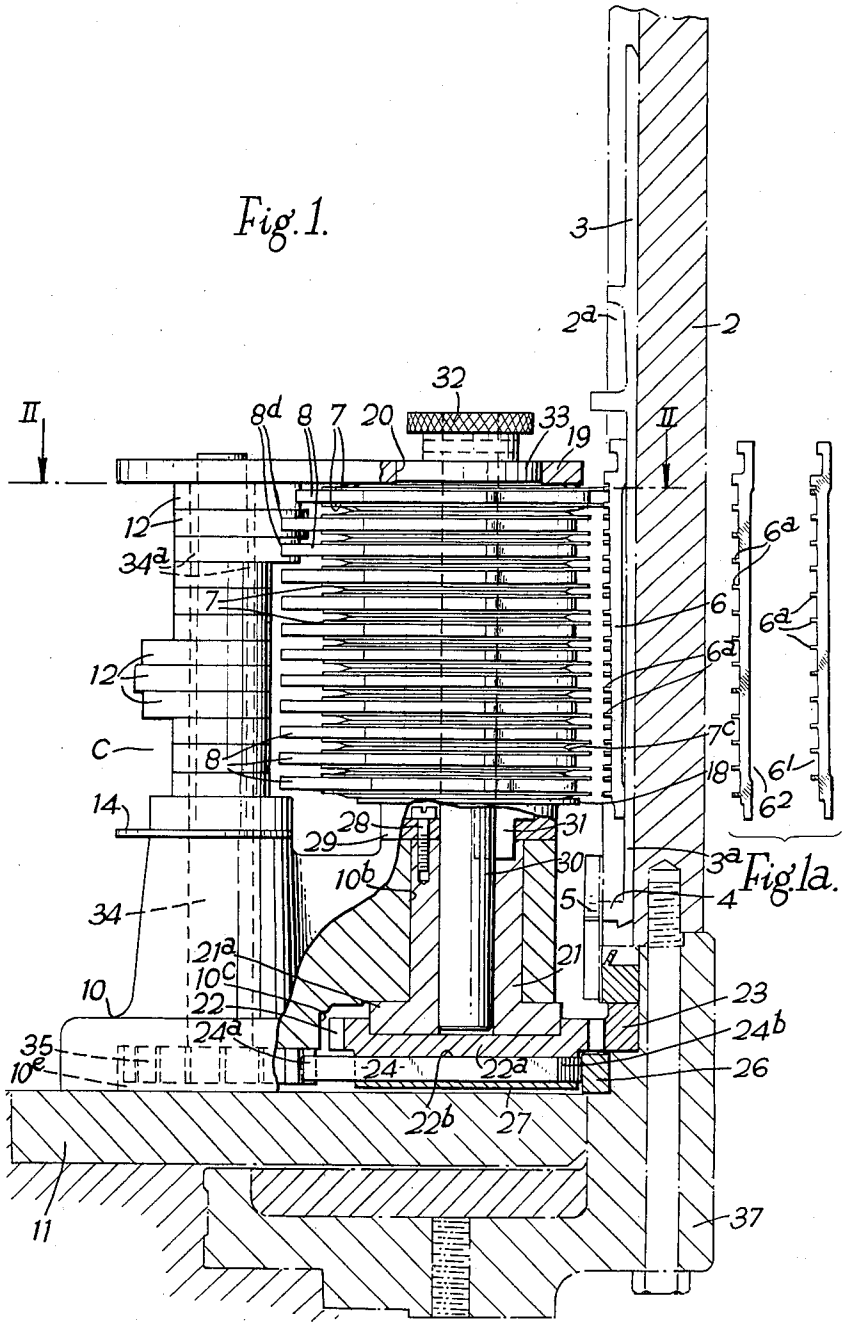


Fig. 1a.

Feb. 19, 1963 A. H. WIDDOWSON ET AL 3,077,756

PATTERNING MECHANISM FOR CIRCULAR KNITTING MACHINES

Filed Sept. 16, 1960 3 Sheets-Sheet 2

Fig. 2.

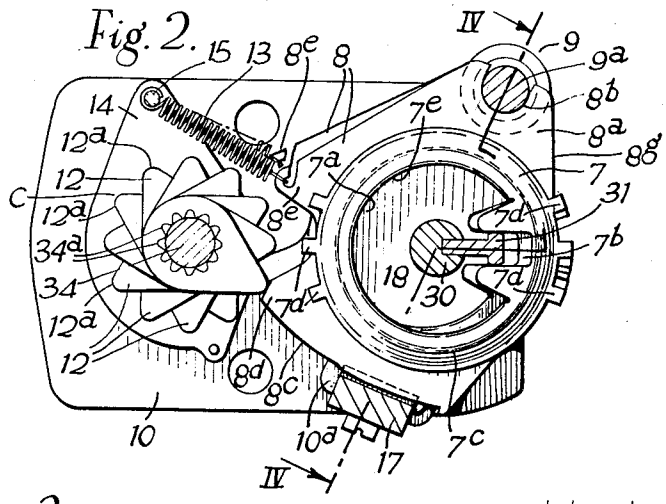


Fig. 3.

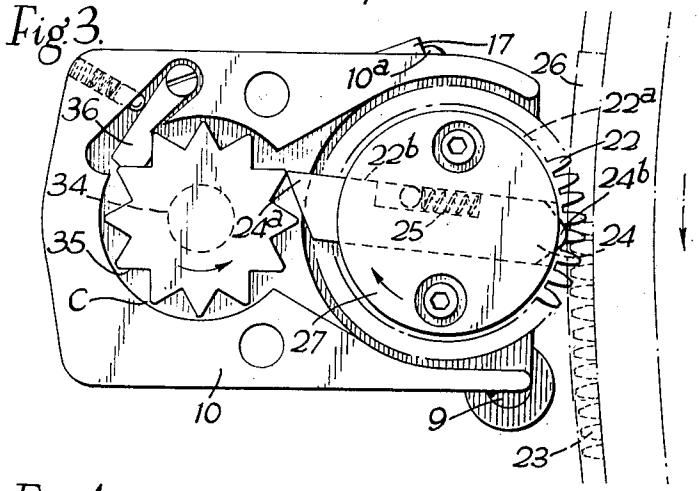
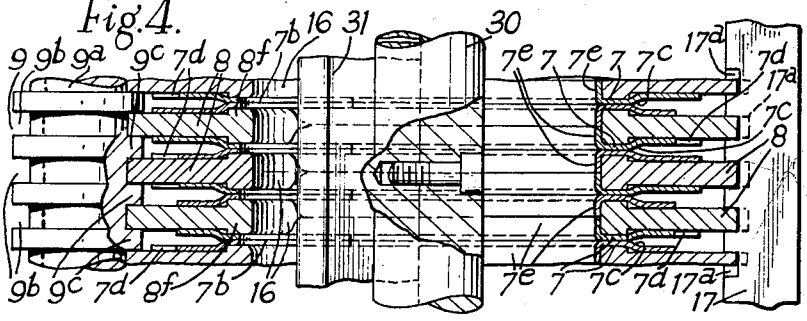


Fig. 4.



Feb. 19, 1963 A. H. WIDDOWSON ET AL 3,077,756

PATTERNING MECHANISM FOR CIRCULAR KNITTING MACHINES

Filed Sept. 16, 1960 3 Sheets-Sheet 3

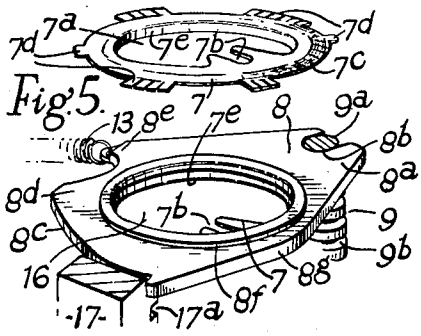


Fig. 5.

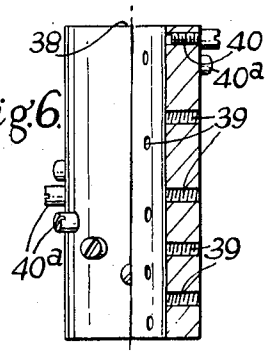
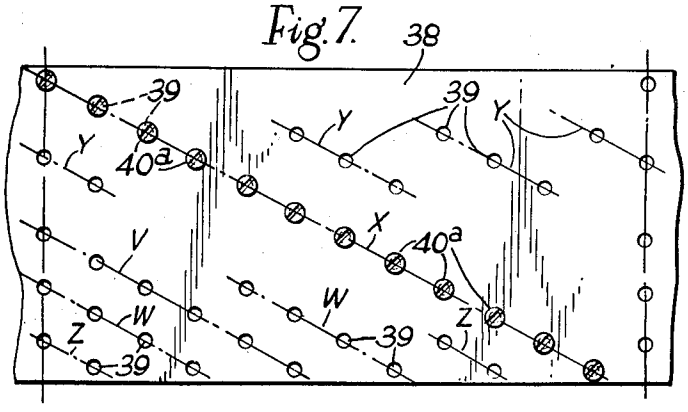


Fig. 6.

Fig. 7.



United States Patent Office 3,077,756 Patented Feb. 19, 1963

3,077,756

PATTERNING MECHANISM FOR CIRCULAR KNITTING MACHINES

Albert H. Widdowson, Ernest L. Farmer, and Arthur T. D. Jackson, all of Leicester, England, assignors to Wildt Mellor Bromley Limited, Leicester, England, a British company

Filed Sept. 16, 1960, Ser. No. 56,529
Claims priority, application Great Britain Sept. 29, 1959
3 Claims. (Cl. 66—50)

This invention relates to patterning mechanism for circular knitting machines, and concerns such mechanism of the kind which has a selective action upon stitch forming or other elements of the machine requiring to be controlled or influenced for producing pattern effects in knitted fabric.

Although the elements of the machine to be controlled or influenced by the patterning mechanism of this invention will usually be either independent slidable needles, or associated jacks or sliders, there is no limitation in this respect since the said mechanism may also be used for acting selectively upon, say, sinkers, web-holders or any other appropriate elements for producing pattern effects in the fabric as it is knitted. The invention is, however, confined to those cases in which the selective actuation of the elements concerned is initiated by pushing the elements radially inwards into their tricks or grooves towards the axis of the knitting head of the circular knitting machine.

The invention, moreover, has reference exclusively to pattern mechanism of the kind referred to and of a previously proposed form comprising, in combination, a pile or stack of co-adjacent rotary members for action upon the elements of the machine to be controlled or influenced for patterning, carriers for these members which carriers are movable individually towards and away from the said elements whereby the rotary members are rendered operative and inoperative, and associated controlling means for moving the carriers in a predetermined manner whereby the corresponding rotary members are brought into and out of action, according to patterning requirements.

In a pattern mechanism of the known form just described, the rotary members are constituted by discs, wheels, rings or the like having peripheral formations, bits or equivalent for selective action upon the elements of the machine to be controlled or influenced.

Furthermore, these rotary members are driven by a common component, the arrangement being such that the driving connection with the members is maintained irrespective of their movements into and out of action as aforesaid.

The carriers, on the other hand, consist of plates or the like movable either pivotally, e.g. on a common fulcrum, or slidably in suitable guides.

Heretofore, the controlling means for the carriers have, in practice, consisted of a control drum of comparatively large diameter in which are inserted pins or projections, and pawl and ratchet mechanism, separate and distinct from the rotary members, for intermittently racking round the drum.

The primary object of the present invention is to provide improvements in a pattern mechanism of the form herein referred to designed to make possible the continuous production, with a compact pattern mechanism of relatively small size, of very large pattern areas which could otherwise only be produced with a rotary patterning disc or wheel of a great and impracticable diameter.

Another aim is so to improve the general construction and operation of pattern mechanism of the form concerned, as to simplify it and make it more compact.

In the pattern mechanism constituting this invention,

the controlling means associated with the pile or stack of rotary members and the carriers for the latter are so constructed, arranged and operable as to be capable of moving the carriers inwards sequentially to render the corresponding rotary members, or pairs of such members, operative one after another.

That is to say, in the case where each carrier supports a pair of rotary members, then after a first operative pair of rotary member has been driven through a predetermined number of revolutions, corresponding to a whole or a partial revolution of the knitting machine, the carrier of that pair is withdrawn and the next co-adjacent carrier is simultaneously moved in by the controlling means to bring into operation the second pair, in order, which second pair remains in operation for the same number of revolutions thereof. Then, as the carrier of the second pair is automatically withdrawn, the carrier of the third pair in the pile or stack is moved in, and so on. Thus, by appropriately correlating the peripheral formations, bits or equivalent on the sequentially active pairs of rotary members, the continuous patterning effect produced by bringing these individual members into action successively in a strict sequential order is precisely the same as that which would (if practicable) be produced by a massive single pattern wheel or disc of a very large diameter.

It is to be clearly understood, of course, that all of the rotary members are continuously driven together so that when any particular rotary member is rendered inoperative, by withdrawal of its carrier, it simply revolves idly until next required to act on elements of the machine to be controlled or influenced.

The cylindrical bed for the said elements (of which there is a single set) is of substantially larger diameter compared with the diameter of a rotary patterning member. Accordingly, each such member, when in action, revolves several times to control or influence either all, or a predetermined group of, the elements of the set.

In a fine gauge machine, however, it may be found to be necessary or desirable, especially in a case where the rotary members consist of thin, small discs cut at their peripheries to form pre-arranged radially extending teeth, to provide two rotary members to each movable carrier, these two members complementing one another. In this way, the pitch of the teeth on any one rotary member can be coarser than the pitch of the elements of the set to be controlled or influenced. By the provision of pairs of complementary rotary members supported in respective carriers it is possible satisfactorily to apply the improved pattern mechanism to fine gauge circular knitting machines of up to, say, 20 or even 24 needles per inch.

Preferably, the carriers are spring controlled and thereby normally held in their inoperative, i.e. withdrawn, positions, the controlling means for the carriers functioning to act on the latter and push them into their operative positions against the spring influence. Thus, when so permitted by the controlling means, the carriers automatically spring back into their inoperative positions.

In accordance with an important feature of the invention, the said controlling means may conveniently consist of a axially extending series of identical edge cams, one to each carrier, secured upon a common shaft which is adapted to be racked round intermittently, i.e. each time the knitting head of the machine makes one complete revolution, or a predetermined portion of a revolution, as the case may be. Accordingly, to achieve the bringing of the rotary members, or the pairs of rotary members, into action sequentially as hereinbefore described, the identical control cams, each of which extends radially with respect to the axis of the common cam shaft or spindle, may be so offset angularly relatively to one

another in an axially progressive manner that a line joining their highest points extends spirally about the said axis.

Alternatively, the controlling means may consist of a drum which is adapted to be racked round intermittently and is formed with holes to receive projecting pins or studs, the said holes and the pins or studs being arranged in the particular manner hereinafter to be described.

The control cams or the pins or studs, as the case may be, are designed for action on suitably shaped nose portions of the carriers. In the case of control cams, these may be individually adjustable angularly about the axis of the common cam shaft so as to enable the offsetting of the cams relatively to one another to be readily determined to a nicety.

Now whilst the herein described arrangement of control cams or control pins or studs is essentially such that these cams or pins or studs are capable of being set or disposed to move the carriers inwards sequentially to render the corresponding rotary members, or pairs of such members, operative one after another as aforesaid, it is to be clearly understood that many and variable selections of the carriers, other than a strict succession, can also, if desired, be effected by suitably varying the angularity of the cams relatively to one another or varying the disposition of the pins or studs.

According to a further feature of the invention, the control cam shaft or the spindle of the control drum may advantageously be mounted closely adjacent to the pin or stack of carriers and for intermittent rotation in a bearing provided in a bracket or support upon which the movable carriers and rotary members are also mounted. It is by virtue of this particular arrangement that the improved pattern mechanism is so compact.

In a convenient embodiment of the invention rotation may be imparted to all of the stacked rotary members simultaneously by means of a key which, besides extending through, and mating with complementary formations in, the said members is also engaged in a part of or combined with a pinion arranged in mesh with a toothed ring or gear rotatable together with a needle cylinder of the circular knitting machine. The rotary members are thus driven in proper ratio with the cylinder or cylinders of the machine.

The control cam shaft or the spindle of the control drum, as the case may be, is racked round at intervals, each corresponding to a predetermined number of revolutions of the rotary members (in turn related to a single rotation of the needle cylinder or cylinders of the machine). The racking mechanism for this purpose may advantageously include a toothed rack wheel secured to the control cam shaft or drum spindle, a pawl which is mounted in the pinion for driving the rotary members and is movable from the pinion into co-operative engagement with the rack wheel, and a cam provided on any convenient component of the machine rotating in unison with a needle cylinder or cylinders and adapted to act on and move the pawl into engagement with the rack wheel for the purpose of turning the cam shaft or drum spindle to the extent of one step at each of the predetermined intervals.

Variations in a pattern may be produced, if desired, by interrupting the regular racking round of the control cam shaft or spindle. For example, this may be achieved by the adoption of a bluffing mechanism which temporarily prevents engagement of the pawl with the rack wheel or operates in any equivalent manner.

In order that the invention may be more clearly understood and readily carried into practical effect, specific constructional examples of the improved pattern mechanism will now be described with reference to the accompanying drawings, wherein,

FIGURE 1 is a part side elevation and part vertical section of one constructional example of the complete pattern mechanism,

FIGURE 1*a* shows, side by side, and in appropriate relation with respect to FIGURE 1, a pair of jack pressers formed with butts at respectively different heights to be acted upon by teeth on complementary pairs of patterning discs, as will be hereinafter explained,

FIGURE 2 is a part-sectional plan view of the mechanism, taken on the line 11—11 of FIGURE 1, and with the top plate removed for clarity,

FIGURE 3 is an underside view of the mechanism showing the means employed to rack round the control cam shaft or the spindle of the control drum, as the case may be,

FIGURE 4 is a detail vertical sectional view, taken on the line IV—IV of FIGURE 2, depicting a few of the stack of superimposed carrier plates and the pairs of rotary toothed patterning discs mounted therein,

FIGURE 5 is a detail perspective view illustrating one of the said carrier plates and the associated pair of patterning discs, one of the latter being shown mounted in position and the other separate from the carrier plate,

FIGURE 6 is a detail view of a control drum formed with tapped holes to receive pins—the left-hand half of this figure showing the exterior of the drum whilst the right-hand side is a vertical section through the same,

FIGURE 7 is a developed layout of the drum, showing the main series, and the smaller supplementary groups, of tapped holes therein.

Like parts are designated by similar reference characters throughout the drawings.

Referring to FIGURE 1 it will be seen that the needle cylinder of a circular knitting machine is indicated at **2**, whilst one of a circular series of needle-actuating jacks placed beneath the needles in the needle grooves **2***a* of this cylinder is indicated at **3**. In the specific patterning system illustrated, each needle-actuating jack **3** is provided with a downwardly extending springy extension **3***a* which, whenever permitted to do so, moves outwardly under the spring influence to effect engagement of its lower butt **4** with a jack-raising cam **5** whereby the jack and hence also the corresponding needle (not shown) is raised. Whenever, however, it is desired to select jacks **3** to miss the cam **5** so that these jacks will remain down and not raise the corresponding needles, the springy extensions **3***a* are pressed back into the relevant grooves **2***a*. This displaces the lower butts **4** clear of the jack-raising cam **5**. For the purpose of pressing back the springy extensions **3***a* of the jacks **3** each of the latter has mounted in front of it, in the same groove **2***a*, a jack presser **6** the outer edge of which is furnished with patterning butts **6***a* disposed at different heights.

The pattern mechanism shown in the drawings comprises generally a pile or stack of rotary patterning discs **7** for action upon the jack pressers **6** to be influenced for patterning, carrier plates **8** for these discs **7** which plates are movable individually towards and away from the jack pressers **6** whereby the rotary discs **7** are rendered operative and inoperative and associated controlling means, generally designated C, for moving the carrier plates **8** inwards sequentially to render the corresponding rotary discs, or pairs of such discs, operative one after another.

As will be seen more clearly at the top of FIGURE 5, each of the rotary patterning discs **7** consists of a thin metal disc having formed centrally therein a part-circular aperture **7***a* from which extends a radially extending key slot **7***b*. The annular portion **7***c* of each disc **7** adjoining its peripheral margin is bent down or beveled somewhat and the said margin is cut with teeth **7***d* which are grouped and circumferentially spaced according to patterning requirements. Moreover, each rotary disc **7** has formed on its inner face an annular rib **7***e* of shallow axial dimension (see FIGURES 4 and 5).

In this example, each of the rotary disc carrier plates **8** is mainly flat and generally wedge-shaped. In the narrow tapered end **8***a* of each such plate **8** is formed a semi-circular recess **8***b* enabling the plate to be engaged

with and to turn about the main central portion 9*a* of a vertical fulcrum rod 9. This fulcrum rod, which has formed in it a plurality of axially spaced circumferential grooves 9*b* to receive the tapered ends 8*a* of the carrier plates 8, is secured at its lower end in a casting 10 constituting the bracket or support of the mechanism. As shown in FIGURE 1, the said bracket or support rests upon and is attached to an annular plate 11 let into the bed of the circular knitting machine. Depending upon the design of the machine, this annular plate may in an appropriate case, consist of the outer flange formed on the bottom of the cylindrical cam box or shell surrounding the needle cylinder 2. The outer free edge 8*c* of each carrier plate 8 remote from the recess 8*b* therein is arcuate (see FIGURES 2 and 5). The corner portion of the said plate contained between one end of this arcuate edge 8*c* and the adjoining back edge of the plate is so shaped as to present a nose 8*d* arranged to be acted upon by a corresponding control cam 12 included in the controlling means C. On the said back edge is also formed a lug 8*e* to which one end of a controlling tension spring 13 is anchored. The opposite ends of these springs 13 are hooked around a vertical pin 15 which is mounted in a fixed plate 14 arranged as shown in FIGURES 1 and 2. The central portion of each carrier plate 8 is thickened at 8*f* and has formed therein a comparatively large circular aperture 16 constituting a bearing for a pair of the rotary toothed patterning discs 7. Thus, the shallow annular rib 7*e* of one such disc 7 is mounted in this bearing from the top side of the carrier plate 8 whilst the corresponding rib of another toothed disc is similarly mounted in the bearing but from the underside of the same plate—all as will be clearly apparent from FIGURES 4 and 5. Consequently, the pair of patterning discs 7, the sets of peripheral teeth 7*d* on which are cut to complement one another, can freely rotate together within and relatively to the carrier plate 8. The teeth on the pair of discs extend radially over and clear of the slightly outwardly curved front edge 8*g* of the carrier plate.

A stack of superimposed horizontal carrier plates 8, each having mounted therein a pair of the rotary toothed patterning discs 7, are mounted to turn individually about the vertical fulcrum rod 9, with the circumferentially un-grooved portions of the rod interposed between co-adjacent carrier plates 8. These circumferentially ungrooved portions of the rod 9—indicated at 9*c* in FIGURE 4—are accordingly in the nature of distance pieces to support and separate the carrier plates 8. To hold the said plates with the bottoms or backs of their semi-circular recesses 8*b* pressed up against the main central portion 9*a* of the fulcrum rod 9, the outer arcuate edge portions 8*c* of the stack of plates 8 are engaged slidably within a series of square-section recesses or notches 17*a* cut in a vertical post 17 which is set at its lower end in an appropriate vertically recessed part 10*a* of the bracket 10. Fragmentary portions of the post 17 are depicted in FIGURES 4 and 5, whilst practically the whole of such a post is shown in FIGURE 8.

Any one of the carrier plates 8 can, therefore, be turned pivotally about the axis of the fulcrum rod 9 to render active the corresponding pair of rotary discs 7. Each plate 8 is accordingly swung forward to render the relevant discs 7 active against the action of the corresponding spring 13, the latter functioning to restore the plate to its normal inoperative position at required times. In FIGURE 2, the top most carrier plate is shown swung forward whilst the next plate below in the stack is in its inoperative position.

The bottom rotary disc 7 of the pile is supported adjacent to a horizontal plate 18 hereinafter to be referred to. Above the top-most disc of the pile is mounted a fixed top plate 19 (see FIGURE 1) having therein a circular opening 20 immediately beneath which are the part-circular apertures 7*a* and key slots 7*b* formed in the rotary discs 7. Mounted for rotation freely within a vertical bearing hole 10*b* bored in the bracket or support 10—beneath the stack of carrier plates 8—is a cylindrical driving sleeve 21. The lower end of this sleeve is formed with a horizontal flange 21*a* which is embraced by and has secured to it a spur pinion 22 adapted to mesh with a gear 23 rotating together with the needle cylinder 2 of the machine. The pinion 22 which is accommodated in a recess 10*c* formed in the underside of the bracket or support 10, is formed on its underside with a cylindrical boss 22*a* which is diammetrically channelled at 22*b* to receive a longitudinally slidable bar 24 the leading end of which is bevelled at 24*a* to provide a pawl (see FIGURE 3). This slidable pawl bar 24 is controlled by a compression spring 25, and its tail end 24*b* protrudes from the cylindrical boss 22*a* and is suitably rounded for co-operation with a cam 26 hereinafter to be mentioned. The arrangement is such that the pawl 24*a* is projected from the pinion 22 against the spring action, and vice versa. To retain the slidable pawl bar 24 in position within its accommodating channel 22*b* a disc 27 is attached to the underside of the cylindrical boss 22*a* on the pinion 22. The upper end of the cylindrical driving sleeve 21 has secured thereto by screws 28 a collar 29 which seats upon the bracket or support 10 and carries the aforementioned horizontal support plate 18. In the upper end of the driving sleeve 21 and also in the collar 29 is formed a key slot. The slot in the collar 29 is of the same width as the key slots 7*b* in the patterning discs 7.

The drive is transmitted from the pinion 22 and the associated driving sleeve 21 to all the rotary patterning discs 7 simultaneously by a rod 30 fitted with a key 31, this rod being inserted vertically downwards through the top plate 19 and being slidably engaged in all of the key slots—including those formed in the sleeve 21 and the collar 29. To enable this to be done, however, the discs 7 must first be all set so that the key slots 7*b* therein are in alignment as shown in FIGURE 4. The key slots are of such form that the drive is maintained even when a carrier plate 8 is turned about the fulcrum rod 9. The upper end of the rod 30 fitted with the key 31 is furnished with a knurled knob 32 and an associated disc 33 which is accommodated in the circular opening 20 and may be marked with an index line. The rod 30 is removable to enable carrier plates 8 to be swung aside and rotary discs 7 changed, as occasion demands.

Rotatably mounted in the bracket or support 10 adjacent to the stack of carrier plates 8 is a vertical control shaft 34 upon which is mounted an axially extending series of approximately pear-shaped control cams 12—one to each carrier plate. The cams 12 are set on the shaft 34 in the particular manner hereinbefore described to achieve sequential actuation of the carrier plates 8. That is to say, and as shown in FIGURES 1 and 2, these control cams 12, each of which extends radially with respect to the axis of the shaft 34, are so offset angularly relatively to one another in an axially progressive manner that a line joining their highest points 12*a* extends spirally about the said axis. To enable the cams 12 to be angularly set in this way, at least the upper portion of the vertical shaft 34 with which the said cams are engaged is longitudinally fluted, the flutes 34*a* being equally spaced apart at predetermined angles about the shaft, and apertures in the cams being complementarily formed to fit the flutes. This is shown more clearly in FIGURE 2. The lower portion of the cam shaft 34 is mounted to turn within a bearing 10*d* projecting up from the base of the bracket 10.

As the control shaft 34 is racked round, the highest points 12*a* of successive cams 12 act on the noses 8*d* of successive carrier plates 8 to turn them seriatim against the action of the respective springs 13. As each carrier plate 8 is turned in this way, the previously operative plate is released and springs back into its inoperative position. The lower end of the control cam shaft 34

has secured thereon a toothed rack-wheel 35 which is also accommodated in a recess 10*a* formed in the underside of the bracket or support 10. The pawl 24*a* associated with the driving pinion 22 co-operative with this rack-wheel 35 to turn it round a step at a time, and a spring-influenced detent 36 (FIGURE 3) is engaged with the said wheel to hold it in position after being so turned. If desired, although this is not shown, the upper end of the cam shaft may protrude above the top plate 19 and be furnished with a knob and an associated disc calibrated to facilitate setting of the shaft.

In the particular example illustrated, the pawl bar 24 is contacted and caused to slide, for the purpose of projecting the pawl 24*a* into engagement with the rack-wheel 35, only once per revolution of the needle cylinder 2. The hereinbefore mentioned cam 26 acts on the tail end 24*b* of the pawl bar 24 for this purpose. As will be seen in FIGURE 1, the cam 26 is secured to a rotary component 37 to which the needle cylinder 2 is bolted, this component also having attached thereto the gear 23 meshing with the pinion 22.

Instead of the carrier plates 8 being rendered operative sequentially by cams on a cam shaft, it is possible to provide, in lieu of such cams, a cylindrical control drum such as that designated 38 in FIGURES 6 and 7. This drum, if provided, may advantageously be engaged with a longitudinally fluted spindle similar to the cam shaft 34, this spindle having the rack-wheel 35 attached to its lower end, and the bars of the drum being complementarily formed to receive the flutes. Thus, in a similar way to the cam shaft 34, the control drum 38 is racked round to the extent of one step each time the needle cylinder 2 makes one complete revolution. The drum 38 is formed with tapped holes 39 to receive screws such as 40 the heads 40*a* of which constitute control studs for engagement with the noses 8*d* of the carrier plates 8. Referring to FIGURE 7, there is a complete main series of twelve of the holes 39, one to each carrier plate, these holes being angularly offset relatively to one another in an axially progressive manner so that a line X joining the said holes extends spirally about the axis of the drum. Accordingly, if screws 40 are screwed into all twelve of the main series of tapped holes extending along the line X, the effect produced by the intermittently rotating drum 38, will, of course, be precisely the same as that produced by the cams 12 on the cam shaft 34. But, in addition to this main series of tapped holes, the drum is also formed with smaller supplementary groups of holes so arranged along spirally extending lines V, W, Y and Z running parallel to the line X that by pre-arrangement of screws 40 in appropriate holes of the main series and in holes of desired supplementary groups, a number of carrier plates 8 less than, and divisible into, the full complement of such plates can be moved inwards in a repeating sequence. For example, if a desired pattern requires only the two bottom carrier plates 8 of the stack to be rendered operative one after the other in a repeating sequence, then screws 40 will only be screwed into the holes in the two lowermost horizontal rows of such holes; in other words, the two lowermost holes of the main series on the line Y will receive screws and so also will the two lowermost holes of the supplementary groups on the lines V and W as well as the pairs of holes on the lines Z. Again, if only three of the carrier plates are required to be rendered operative seriatim in a repeating sequence, these plates must occupy, the third, fourth and fifth positions in the stack, counting from the top of the latter, and screws 40 must be screwed into the third, fourth and fifth holes 39 (from the top) of the main series on the line X and into the three holes of each of the three supplementary groups extending along the lines Y. Yet again, if four carrier plates are to be rendered operative sequentially in a repeating sequence, then these must occupy the bottom four positions in the stack, and screws must be screwed into the bottom four holes of the main series and into the four holes of each of the two supplementary groups extending along the lines W. Finally, assuming a desired pattern could be produced when using only half of the full complement of the carrier plates, then the bottom six plates would be used and screws would be screwed into the bottom six holes of the main series on the line X and in all six holes of the supplementary group extending along the line V.

In the example hereinbefore described with reference to FIGURES 1–5, each of the carrier plates 8 carries two rotary patterning discs 7 and in this connection it has previously been stated that the sets of peripheral teeth 7*d* on the two discs of each pair are cut to complement one another. By adopting this arrangement, suitable for a fine gauge machine, the pitch on the teeth 7*d* on any one disc 7 can be coarser than the pitch of the jack pressers 6 to be influenced. But, of course, to enable the arrangement to function, the patterning butts 6*a* on the pressers 6 to be acted on by teeth 7*d* on the upper discs 7 of the respective pairs must be at higher levels than the butts on the pressers to be acted on by teeth on the lower discs of the said pairs. This is shown in FIGURE 1*a* in which a jack presser having butts 6*a* at the said higher levels is indicated at 6′ whilst a presser presenting butts at the lower levels is indicated at 6^2, these two pressers being drawn in the correct heightwise relation with respect to FIGURE 1.

As will be appreciated, the pattern mechanism of this invention may be applied to any circular knitting machine having independent slidable needles, a series of jacks associated with the needles, and a cam system for causing the jacks to affect the action of the needles, the pattern mechanism being for action either directly or indirectly on the jacks to determine their engagement with the said cam system. In this regard, the specfic system of jack selection hereinbefore described with reference to FIGURE 1 is only one of many possible alternative systems in conjunction with which the invention may be employed. Manifestly, the pattern mechanism of the invention can be applied to circular knitting machines of many different types.

We claim:

1. In a circular knitting machine, in combination, a cylindrical bed having axially extending parallel grooves formed around its periphery; elements mounted movably in said grooves, said elements having butts and being adapted to be selectively actuated and controlled for producing pattern effects in knitted fabric and capable of movement radially inwards into their grooves towards the axis of the cylindrical bed so as to initiate such selective actuations, said elements being arranged in an odd and even set out, alternate elements having butts at the same height and intervening alternate elements having butts at a different height; and, adjacent to said cylindrical bed, a patterning mechanism comprising a stack of co-adjacent rotary patterning members having peripheral formations for selective action upon the aforesaid elements to be controlled as to push them radially inwards, apertured carrier plates in which said patterning rotary members are freely rotatable, each carrier plate supporting two of the rotary patterning members respectively in upper and lower positions, the upper and lower rotary members associated with each carrier plate being so relatively arranged as to complement one another so that the pitch of the formations on either one of the pair of members can be coarser than the pitch of the said elements, the formations on the set of said rotary members located in upper position on said carrier plates being adapted to actuate the butts of said alternate elements and the formations on the set of said rotary members located in lower positions on said carrier plates being adapted to actuate the butts on the intervening elements, said plates having nose portions and being movable in-

dividually towards and away from the said elements whereby the rotary members are rendered opertaive and inoperative, a rotatable rod fitted with a driving key which is common to all the patterning members and is so arranged that the driving connection with said members is maintained irrespective of their movements into and out of action, and, located closely adjacent to the carrier plates, a control unit, means for racking round said unit intermittently each time the cylindrical bed rotates through a predetermined number of degrees and the rotary patterning members have been driven through a predetermined number of revolutions, and an axially extending series of individual control elements, one to each carrier plate for action upon the nose portion thereof, mounted upon the said control unit, said elements extending radially with respect to the axis of the unit and being so offset angularly relatively to one another in an axially progressive manner that a line joining their outer ends extends spirally about the axis whereby the carrier plates are moved inwards sequentially to render the corresponding pairs of rotary patterning discs operative seriatim.

2. In a circular knitting machine, in combination, a cylindrical bed having axially extending parallel grooves formed around its periphery; elements mounted movably in said grooves, said elements having butts and being adapted to be selectively actuated and controlled for producing pattern effects in knitted fabric and for this purpose being capable of movement radially inwards into their grooves towards the axis of the cylindrical bed so as to initiate such selective actuations, said elements being arranged in an odd and even set out, alternate elements having butts at the same height and intervening alternate elements having butts at a different height; and, adjacent to said cylindrical bed, a patterning mechanism comprising a stack of co-adjacent rotary patterning members having peripheral formations for selective action upon the aforesaid elements to be controlled suchwise as to push them radially inwards, apertured carrier plates in which said patterning rotary members are freely rotatable, each carrier plate supporting two of the rotary patterning members respectively in upper and lower positions, the upper and lower rotary members associated with each carrier plate being so relatively arranged as to complement one another so that the pitch of the formations on either one of the pair of rotary members is coarser than the pitch of the said element, the formations on the set of said rotary members located in upper position on the carrier plates being adapted to actuate the butts of said alternate elements and the formations on the set of said rotary members located in lower positions of the carrier plates being adapted to actuate the butts on the intervening elements, said plates having nose portions and being movable individually towards and away from the said elements whereby the rotary patterning members are rendered operative and inoperative, a rotatable rod fitted with a driving key which is common to all the patterning members and is so arranged that the driving connection with said rotary members is maintained irrespective of their movements into and out of action, and, located closely adjacent to the carrier plates, a control shaft, means for racking round said shaft intermittently each time the cylindrical bed rotates through a predetermined number of degrees and the rotary patterning members have been driven through a predetermined number of revolutions, and an axially extending series of identical edge cams, one to each carrier, secured upon the said shaft, each of said cams extending radially with respect to the axis of the shaft and the cams being so offset angularly relatively to one another in an axially progressive manner that a line joining their highest points extends spirally about the axis whereby the carriers are moved inwards sequentially to render the corresponding rotary patterning members operative seriatim.

3. In a circular knitting machine, in combination, a rotary needle cylinder having formed therein axially extending parallel needle grooves; a toothed ring rotatable together with said cylinder; needle-actuating jacks slidably mounted in said grooves and having portions adapted to be pressed radially inwards into the grooves to effect selection of said jacks, jack pressers adapted to be selectively actuated and controlled for pressing inwards such portions of the jacks and thereby producing pattern effects in knitted fabric, said pressers being arranged in an odd and even set out, alternate pressers having butts at the same height and intervening alternate pressers having butts at a different height; and, adjacent to said needle cylinder, a patterning mechanism comprising a bracket in which is provided a bearing, a vertical fulcrum rod mounted in said bracket, a stack of superimposed carrier plates mounted to turn individually about said fulcrum rod, springs for controlling the carrier plates and normally holding same in withdrawn positions, said carrier plates having nose portions and being movable individually against the spring action towards the jack pressers and under such action away from said pressers, thin patterning discs which are mounted for rotation freely in the carrier plates and are cut at their peripheries with prearranged radially extending teeth for action on the butts of the jack pressers for the purpose of selectively actuating the same, each carrier plate supporting two of the rotary patterning discs respectively in upper and lower positions, the upper and lower discs associated with each carrier plate being so relatively arranged as to complement one another so that the pitch of the teeth of either one of the pair of discs is coarser than the pitch of the jack pressers, the teeth on the set of upper discs being adapted to actuate the butts of said alternate pressers and the teeth on the set of lower discs being adapted to actuate the butts on the said intervening jack pressers, said discs being centrally apertured and formed with key slots, a rotary driving sleeve which has therein a key slot and is mounted in the bracket beneath the stack of carrier plates, a pinion secured to said sleeve and arranged in mesh with the aforesaid toothed ring rotatable together with the rotary needle cylinder, a rod provided with a key which besides extending through and mating with the key slots in the rotary discs is also engaged with the key slot in the driving sleeve, the arrangement being such that a drive transmitted from the pinion to the discs is maintained irrespective of the movements of the discs into and out of action, and, located closely adjacent to the carrier plates, a control drum with a spindle mounted in the aforementioned bearing in the bracket and having therein radial holes to receive radially projecting pins, and means for racking round said drum intermittently each time the needle cylinder rotates through a predetermined number of degrees and the rotary patterning discs have been driven through a predetermined number of revolutions, there being in the said drum an axially extending complete main series of the said holes, one to each carrier plate, offset angularly relatively to one another in an axially progressive manner so that a line joining the holes of this main series extends spirally about the axis of the drum whereby with the pins in all of such holes the carrier plates of a full complement are moved inwards seriatim, and smaller supplementary groups of holes so arranged along spirally extending lines running parallel to the aforesaid complete main series that by prearrangement of pins in appropriate holes of the main series and in holes of desired supplementary groups a number of carrier plates less than and divisible into the full complement thereof can be moved inwards in a repeating sequence.

References Cited in the file of this patent

UNITED STATES PATENTS

1,889,631	Bromley et al.	Nov. 29, 1932
2,025,463	Lombardi	Dec. 24, 1935
2,928,266	Overton	Mar. 15, 1960