Jan. 30, 1951 L. MISHCON ET AL 2,539,790

KNITTING MACHINE WITH SELECTOR WHEEL NULLIFYING CAMS

Filed July 21, 1950 4 Sheets-Sheet 1

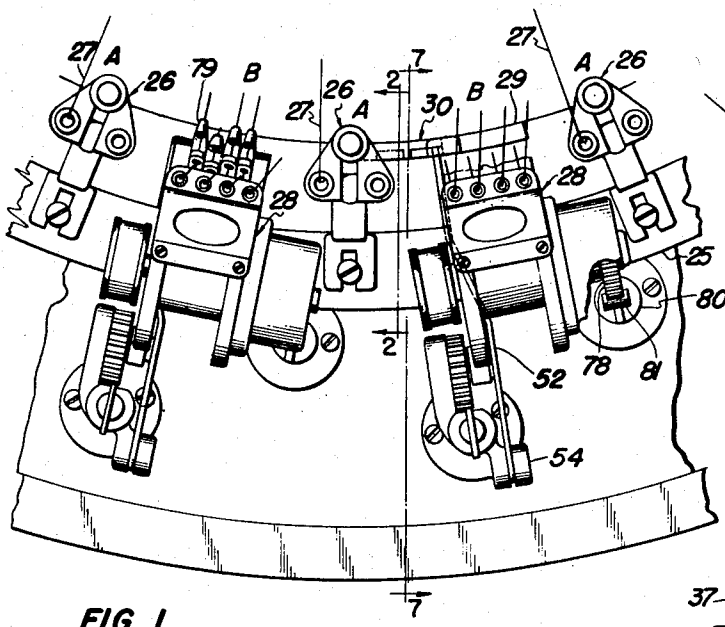



FIG. 1.

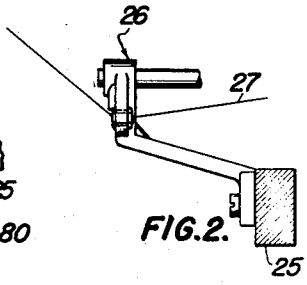



FIG. 2.

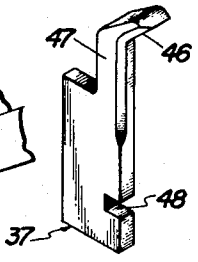



FIG. 6.

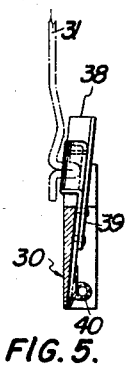



FIG. 5.

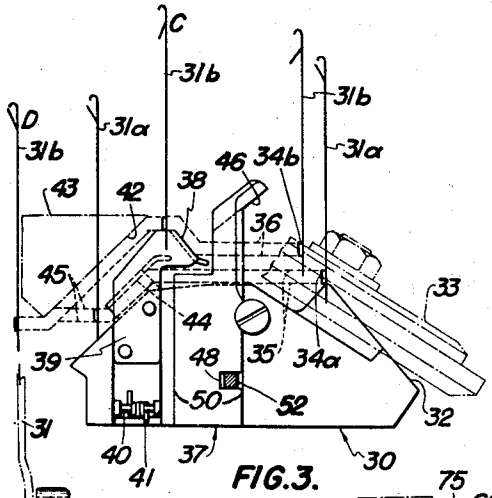



FIG. 3.

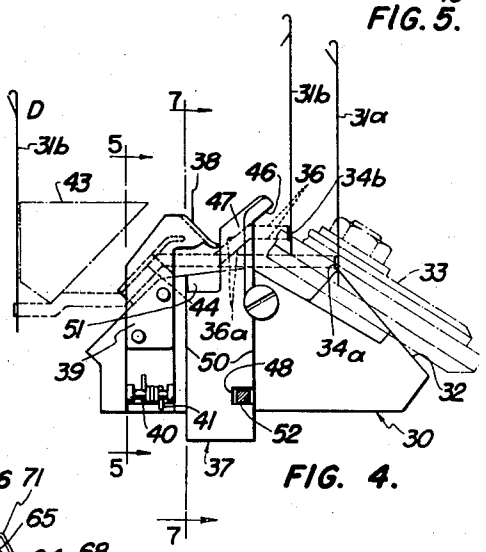



FIG. 4.

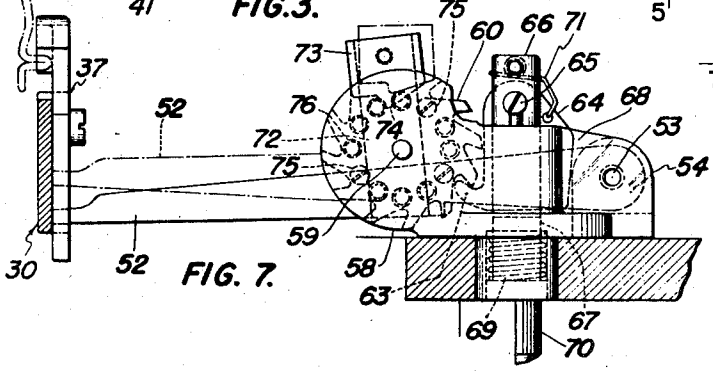



FIG. 7.

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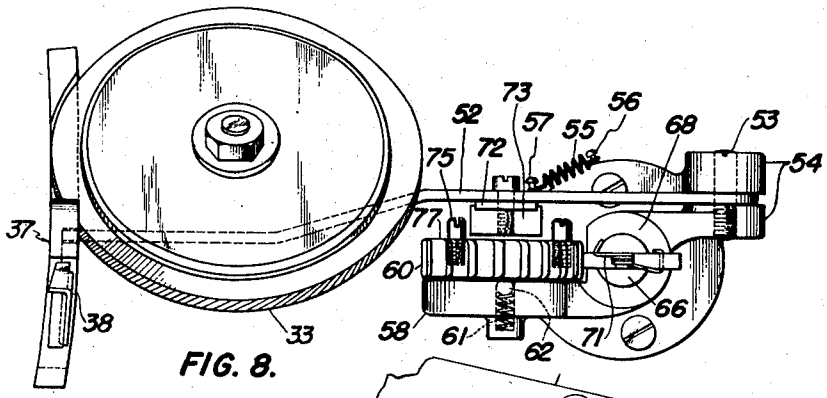



FIG. 8.

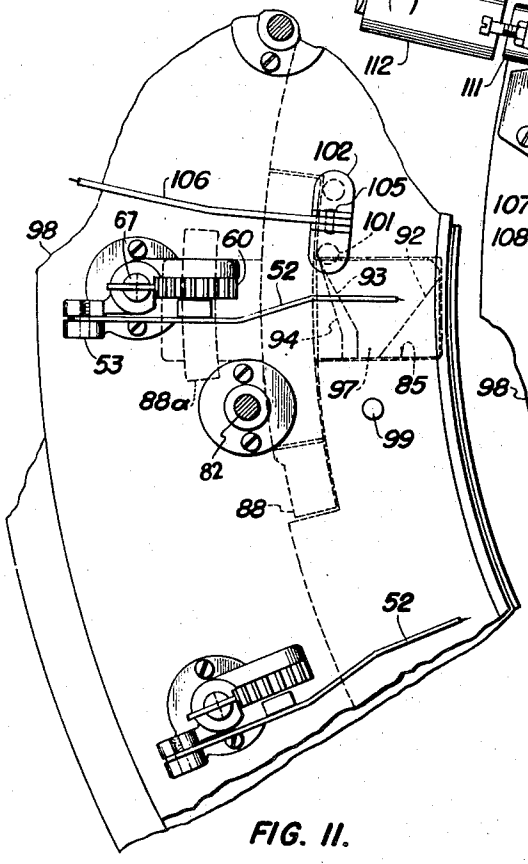



FIG. 11.

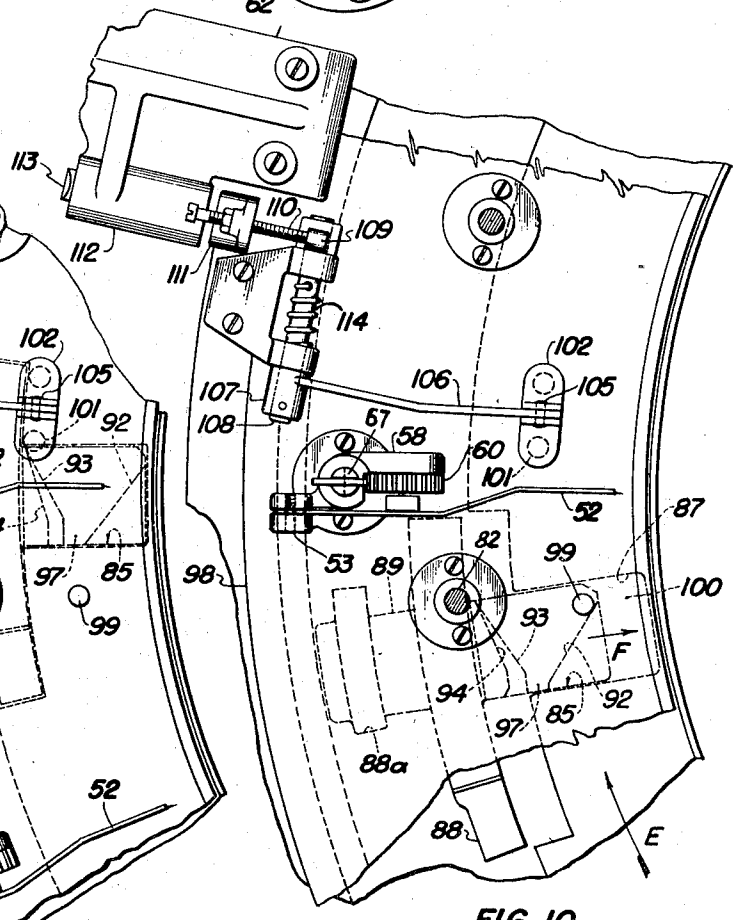



FIG. 10.

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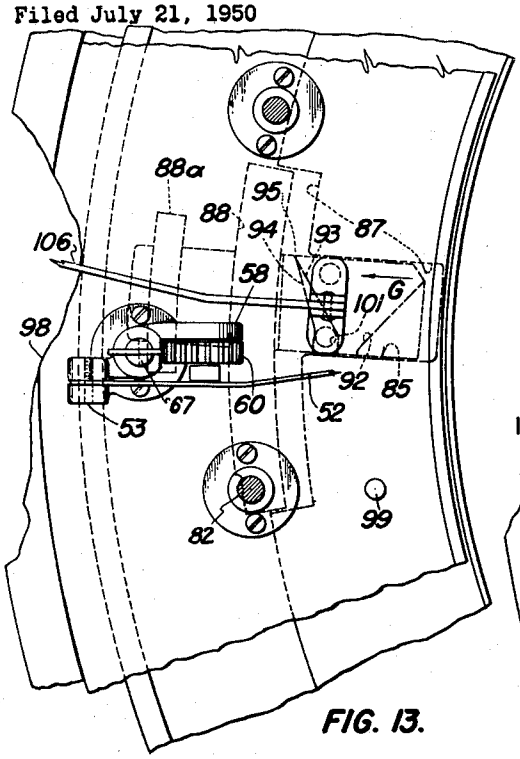



FIG. 13.

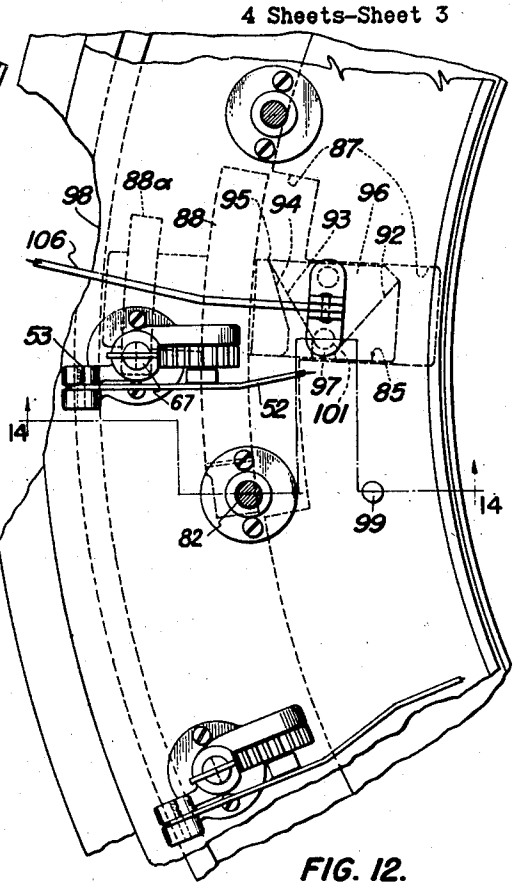



FIG. 12.

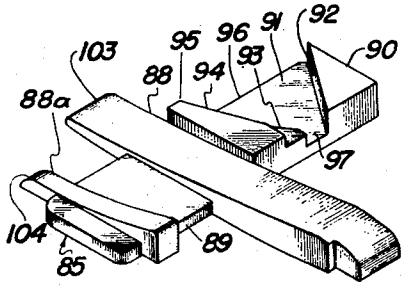



FIG. 9.

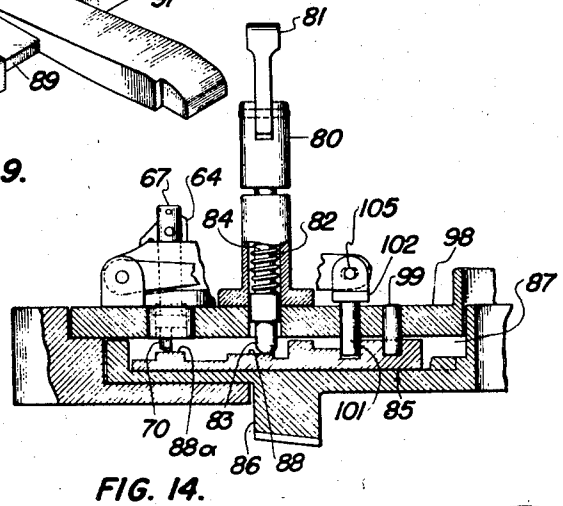



FIG. 14.

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KNITTING MACHINE WITH SELECTOR WHEEL NULLIFYING CAMS

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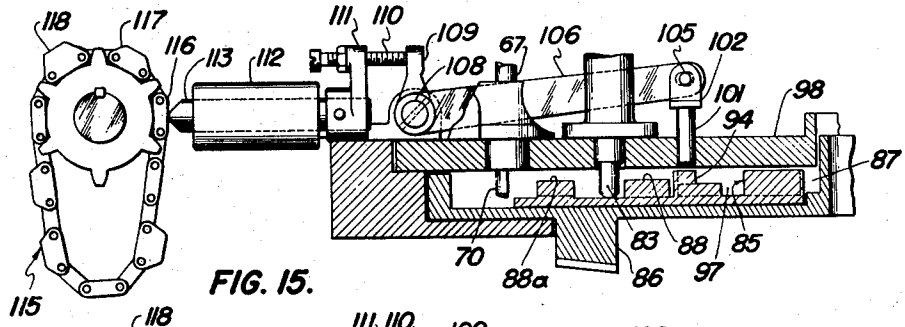



FIG. 15.

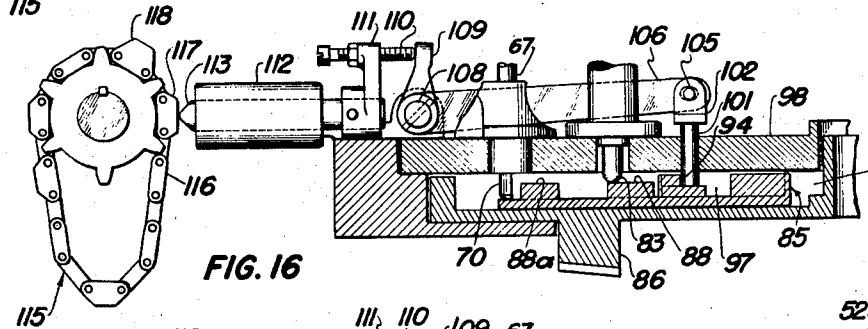



FIG. 16

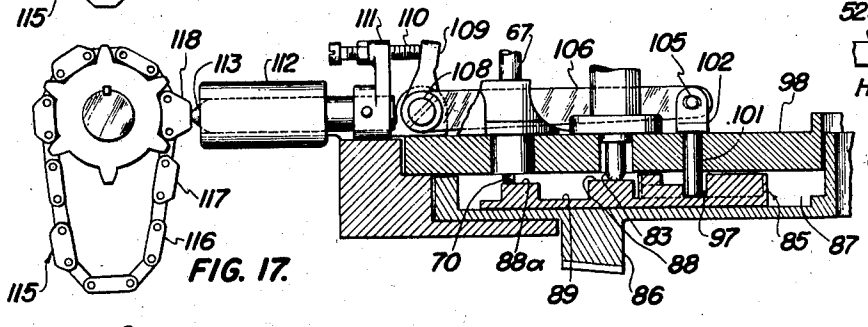



FIG. 17.

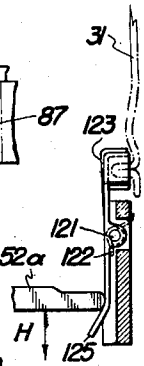



FIG. 20.

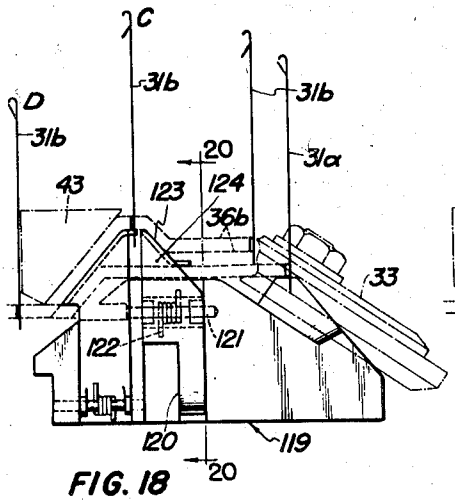



FIG. 18

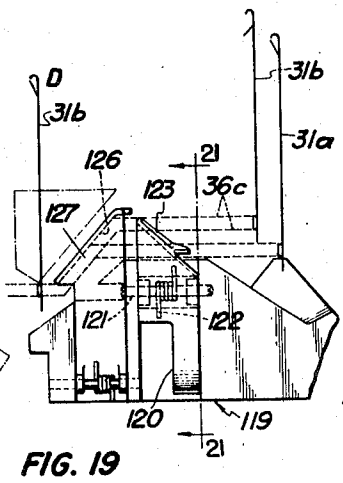



FIG. 19

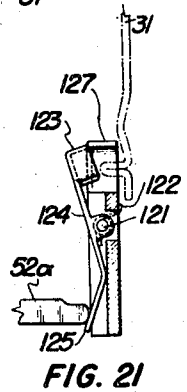



FIG. 21

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Patented Jan. 30, 1951

2,539,790

# UNITED STATES PATENT OFFICE

2,539,790

## KNITTING MACHINE WITH SELECTOR WHEEL NULLIFYING CAMS

Lester Mishcon, Queens, and Harry Agulnek, Brooklyn, N. Y., assignors to Supreme Knitting Machine Co., Inc., Brooklyn, N. Y., a corporation of New York

Application July 21, 1950, Serial No. 175,086

16 Claims. (Cl. 66—50)

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This invention relates to knitting machines—more particularly to the selective production of plain or multi-colored patterns on a multiple-feed circular knitting machine with a rotating cylinder.

It is especially, although not exclusively, within our contemplation to employ our invention in association with a multiple arrangement of striping boxes, so as to selectively produce large or small pattern fields, striping effects, plain jersey effects, or combinations of said various effects. And in this aspect of our invention it is an important object to obtain flexibility of design patterns and sizes in a machine that is simpler in construction and easier to control than conventional knitting machines.

Heretofore when it was desired to obtain larger striped patterns, for example, it was necessary to increase the number of striping boxes. To double the size of the pattern field of a fabric produced by sixteen striping feeds it was necessary to increase the number of such feeds to thirty-two, resulting in a cumbersome and expensive apparatus. It is within our contemplation to accomplish the same effect without increasing the number of striping boxes, but merely by inserting alternately between the striping stations relatively simple cam members constituting one aspect of our invention.

In the accomplishment of the last-mentioned objective, it is a further object of our invention to coactively associate said novel cam member with a selector wheel and stitch cam whereby the said wheel may selectively be permitted to create its intended design effects (along with those of the striping boxes), or be nullified in its operation so that the needles engaged by the wheel will do no knitting. And it is another important and related object of our invention to accomplish this result without in any way changing the position of the selector wheel or disengaging it from the butts of the needles, so that the entire knitting process is effective while the wheel is in constant engagement with the needles on the rotating cylinder.

It is accordingly within our contemplation to enable a machine provided with our invention in combination with striping boxes to knit plain jersey or striped fabric when the alternate non-striping stations are not knitting, or to knit plain jersey or striped fabric together with the selected pattern of the wheel at said non-striping stations when the latter are knitting. And it is our object to selectively vary these effects by taking out of and bringing into action, through

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our said novel cam member, the needles at said non-striping stations, in accordance with a predetermined setting of the machine, whereby the machine can be automatically changed from a sixteen feed striping arrangement, for example, to a thirty-two feed machine with alternate striping stations.

It is a further object of our invention to provide a relatively simple automatic mechanism cooperatively associated with both said striping boxes and said novel cam members for selectively actuating said boxes and members independently, so that they may be brought in and out of play together or separately. And in this aspect of our invention it is an important object to provide an improved floating cam apparatus, involving a modification of that illustrated in patent application Serial No. 35,376, adapted separately to actuate said striping and alternate knitting stations, and adapted as well to separately actuate a plurality of other coactively associated knitting members. It is our further objective to have said floating cam movable with the rotating cylinder, and adapted to be actuated by remotely disposed automatic selective controls, without the employment of linkage or other continuous connections or complicated electrical mechanisms for effectuating the controlled movement of the said floating cam.

It is a more specific object of our invention to provide a simple and relatively small device for taking out of action all needles leaving a selector wheel, and bringing said needles to a non-knitting or welt position prior to their engagement with the stitch cam. And in a broader aspect of this objective it is a further object to make any yarn feeding station inoperative for feeding yarn into the hooks of needles moving therepast. And it is also an object of our invention to enable this device to be instantly moved to and from its operative projected and retracted positions, whereby selective controls may be readily effected.

Other objects, features and advantages will appear from the drawings and the description hereinafter given.

Referring to the drawings:

Figure 1 is a fragmentary plan view, with portions broken away for clarity, of a circular knitting machine embodying our invention, the drawing showing five feeding stations including two alternate striping boxes.

Figure 2 is a fragmentary section of Figure 1 taken along line 2—2, showing the yarn carrier bracket and the yarn guide.

Figure 3 is a schematic front view of the

novel cam member of our invention shown disposed between a stitch cam and a selector wheel (a portion broken away for clarity) represented by dot-dash lines, the retractable nullifying cam being shown in its raised retracted or inoperative position, several needles being shown in various positions and the paths of their butts being represented by dotted lines.

Figure 4 is a view like Figure 3, except that the nullifying cam is in its lowered projected or operative position.

Figure 5 is a section of Figure 4 taken along line 5—5, showing a fragment of a needle being operatively drawn down by a depressing cam just prior to the stitch cam.

Figure 6 is a perspective view of the nullifying cam unit.

Figure 7 is a section taken substantially along line 7—7 of Figures 1 and 4, the nullifying cam actuating arm being shown in full lines when the cam is in its lower position and in dot-dash lines when the cam is in its upper position.

Figure 8 is a plan view of Figure 7, showing also the position of the selector wheel relative to the novel cam member.

Figure 9 is a perspective view of the floating cam unit for selectively actuating the nullifying cam and the striping box mechanism.

Figure 10 is a fragmentary plan view of the knitting machine, the striping boxes and the supporting ring therefor being removed, the floating cam being shown in its extreme outer position and about to be engaged by a stationary retracting pin at the beginning of one cycle.

Figure 11 is a view substantially like Figure 10, but showing an advanced position of the floating cam just prior to being engaged by a pin on the control bracket.

Figure 12 is a view like Figure 10, but showing the floating cam advanced somewhat beyond the position in Figure 11, the control bracket pin being in engagement with the inner and lower vertical cam surface, the floating cam being shown in its limiting outer position.

Figure 13 is a view substantially like Figure 12, the control bracket pin being shown in engagement with the outer and upper vertical cam surface, the floating cam being shown in an intermediate position.

Figure 14 is a section of Figure 12 taken substantially along line 14—14, fragments being removed for clarity, the striper control rod and the nullifying control rod being both shown in operatively raised positions.

Figure 15 is a section substantially like that of Figure 14, but showing the floating cam and associated parts substantially in the position of Figure 11, the striping box and nullifying cam control elements being in their operatively lowered position, the view also showing a timing chain for operating the control bracket.

Figure 16 is a view substantially like Figure 15, but showing the floating cam and associated parts substantially in the position of Figure 13, the striping box control element being shown in its raised position whereas the nullifying cam element being shown in its lowered position.

Figure 17 is a view substantially like Figure 16, but showing the floating cam and associated parts substantially in the position of Figures 12 and 14.

Figure 18 is a schematic front view of a modified form of our nullifying cam member, the needles being substantially in the position shown in Figure 3 when the nullifying cam is in its retracted or inoperative position.



Figure 19 is a view like Figure 18, but showing the nullifying cam in its projected or operative position, the needles being substantially in the position like that of Figure 4.

Figure 20 is a fragmentary sectional view of the nullifying cam member in the position of Figure 18, a fragment of the actuating arm being shown in engagement therewith, and

Figure 21 is a fragmentary section of Figure 19 taken substantially along line 21—21, a fragment of the actuating arm being shown in pressing engagement with the nullifying cam to bring it into its projected operative position.

In the particular form of our invention illustrated in the figures, a circular knitting machine is shown having a stationary ring 25 on which are mounted the yarn carrier brackets 26 for feeding strands of yarn 27 to operatively engage needles passing stations generally designated A, there being also alternate striping boxes 28 at stations generally designated B (Figure 1). The rotating cylinder carries vertically moveable needles raised and depressed by various cam and selector wheel devices, certain of which will hereinafter be described, the lateral periphery of the revolving cylinder carrying the needles being adjacent the inner wall 29 of the outer ring structure of the machine, said cylinder not being shown since it is of conventional construction well known to those skilled in the art. Suffice it to say that the vertically mounted needles are so disposed that their hooks will receive yarn from either or both the yarn carrier brackets 26 or the striping boxes 28, as will more clearly hereinafter appear. Disposed along the said inner wall 29, and adjacent each of the yarn carrier brackets 26 at stations A is our novel cam member 30 with which needles 31 are engageable substantially as indicated in Figures 3, 4, 5, and 7.

The operative rotation of the cylinder carrying needles 31 will cause said needles to come into successive engagement with the yarn from said striping boxes 28 at stations B and then into engagement with the raising and lowering devices at stations A, and raising and lowering devices being shown in Figures 3 and 4. The needle butts first engage the approach cam 32, in conventional manner, to be elevated to a position where the butt will engage the selector wheel 33. Thereafter the needles are raised to one of two positions, depending upon whether or not there are jacks or fillers within the selector wheel. For example, as shown in Figure 3, needle 31*a* has been raised to one level, whereas needle 31*b* has been raised to a somewhat higher level because of a jack within the pattern wheel which engaged the butt 34*b*. Butts 34*a* and 34*b* thereafter continue along horizontal paths 35 and 36, respectively, to follow certain further paths dependent upon the position of the vertically moveable nullifying cam 37 the action of which will hereinafter be described. For the present it need merely be noted that in Figure 3 the said nullifying cam 37 is in its raised retracted or inoperative position. The arrangement is hence such that the butt 34*b* continues to travel along path 36 until it strikes the elevating cam 38 on the wing member 39 pivotally mounted at 40 (the pivotal movement of said wing enabling a retraction thereof against the action of spring 41 for reasons which need not be set forth for the purpose of the present application). The said elevating cam 38 brings

the needle 31b to the uppermost or latch-clearing position shown at C at which point it will take yarn 27 from the yarn carrier bracket 26, in conventional manner. Thereafter, upon a continued movement of needle 31b the butt engages the depressing surface 42 of the stitch cam 43, to perform a knitting operation by lowering needle 31b to the position D, the cast-off position. Following the course of needle 31a, it will be seen that the butt 34a continues along the path 35 until it strikes the underside of the depressing cam 44, whereby it will be brought down to path 45 to engage the lowermost tip of the stitch cam 43 and move to the left. It is apparent that since butt 34a was not elevated to the level of path 36, it could not engage lifting cam 38 and hence could not be brought to the latch-clearing position; and hence the needle 31a, in traveling along a lower level than needle 31b performed no knitting operation whatsoever. And it will be further observed that since the said nullifying cam 37 was in its raised position, it offered no obstruction whatsoever to the movement of needle 31b until its butt engaged lifting cam 38, thereby permitting needle 31b to take the yarn and perform a knitting operation.

By referring to Figure 4 it will be seen that the nullifying cam 37 has now been brought to its lower projected or operative position. Here the depressing surface 46 of the upwardly extending arm 47 is interposed in the path of butt 34b. Accordingly, this butt engages the depressing surface 46, the butt following downwardly inclined path 36a until the butt reaches the depressing cam 44, whereby the needle will ultimately be carried to the position D. It thus appears that when said nullifying cam 37 is in its lowered position, it will engage all the needles that were raised by jacks in the selector wheel 33, depressing them to a level below lifting surface 38, thereby diverting said needles from the path of Figure 3 where such elevated needles 31b would be further elevated to a latch-clearing position. The lowered position of cam 37 did in no way affect the movement of needle 31a, its butt 34a moving horizontally until striking the depressing surface 44 as in the case of Figure 3.

From the foregoing it is thus evident that the nullifying cam 37, when lowered into its projected operative position, will nullify the action of selector wheel 33 in raising needles 31b to a level where it will be elevated again by cam 38 to a latch-clearing position. In other words, the said nullifying cam when in its operative position is adapted to take out of action all such needles raised by jacks in the selector wheel for forming a predetermined pattern, this nullifying effect being accomplished without in any way removing the selector wheel from continuous engagement with successive needles on the rotating cylinder. However, when the nullifying cam 37 is retracted to its upper position, as indicated in Figure 3, there is no such interference with the action of the selector wheel, and the latter is permitted to perform its design function according to the arrangements of jacks therein. As will hereinafter more clearly appear, the raising and lowering of the nullifying cam 37 is effectuated by means of an improved floating cam and associated apparatus, said floating cam at selected intervals causing a raising and lowering of the nullifying cam through its comparatively short stroke. The operation is such that the operative projection and retraction of the nullifying cam is accomplished practically instantly, without any delay or lag which might interfere with the continued and uninterrupted operation of the machine.

The nullifying cam 37 contains a slotted portion 48 extending inwardly from the lateral side thereof. Extending through said slot and in engagement with the upper and lower walls thereof is the actuating arm 52 which is connected with a mechanism for moving said arm up and down, whereby corresponding movements are imparted to the nullifying cam 37, said latter cam slidably moving vertically between the lateral walls 50 of a suitably recessed portion 51 of cam member 30.

By referring to Figure 7 it will be seen that the said actuating arm 52 is pivotally mounted at 53 and disposed between the ends of the bifurcated bracket 54 (Figure 8), the arm being yieldably urged downwardly by spring 55 anchored on base 56 and attached to the arm 52 at 57. The framework 58 rotatably supports, at axial portion 59, the ratchet wheel 60, a spring 61 urging the ball 62 into pressing engagement with suitable recesses in the lateral wall of the ratchet wheel to yieldably maintain it against movement after each rotative movement. In underlying operative engagement with said ratchet wheel 60 is the pawl 63 extending from the plate 64 pivotally mounted at 65 between the bifurcated upper portion 66 of the rod 67 movable vertically within housing 68 against the action of spring 69, said spring normally urging said rod 67 downwardly. It will be noted that the lowermost protruding portion 70 of said rod is of reduced thickness, to enable it to clear certain portions of the apparatus, as will appear from the drawings. A spring 71, mounted at said upper portion 66, is in engagement with plate 64, thereby normally urging said plate 64 and the pawl 63 inwardly towards the ratchet wheel 60.

The actuating arm 52 carries thereon the vertical bar 72 to the upper portion of which is attached the cam block 73 containing a cam portion 74. Engageable with said cam portion 74 are a plurality of studs 75 in threaded engagement with holes 76 extending inwardly from the inner surface 77 of the ratchet wheel. The number and spacing of said studs depends upon predetermined design considerations, since it is only when one of said studs engages the cam portion 74 of the cam block 73 that the actuating arm 52 is raised, as will hereinafter appear.

The said downwardly protruding portion 70 of the rod 67 is selectively (by a method to be hereinafter described) forced upwardly at predetermined intervals, whereupon the plate 64 will be correspondingly raised to cause the pawl 63 to engage an overlying tooth of the ratchet wheel 60, causing it to rotate through the pitch distance of said teeth. When a stud 75 engages the cam surface 74, it will lift the entire cam block 73, and thereby cause a corresponding lifting of the actuating arm 52 to the dot-dash position shown in Figure 7, thereby correspondingly moving the nullifying cam 37 to its upper position. The arm 52 remains in its elevated position until a stud 75 will have disengaged itself from the said cam portion 74, whereupon the spring 55 will urge arm 52 into its lower position. Obviously, the actuating arm 52 will remain in its lower position, regardless of the rotation of the ratchet wheel 60 until a stud 75 comes into operative engagement with the cam portion 74.

The device for operatively actuating the nullifying control rod 67 is, as aforesaid, a novel

type of floating cam which serves also the additional function of actuating the striper box mechanism. No details are herein given with respect to said striper mechanism, since it is well known to those skilled in the art (a description of its operation appearing in said application Serial No. 35,376). As is characteristic of conventional striping box constructions, there is a ratchet wheel 78 (Figure 1) operatively associated with a rotating drum (not shown) which, through known mechanisms, actuates the striping fingers 79 carrying striping yarn. Said ratchet wheel 78 is operated by a pawl-carrying member 80 to which is attached the pawl 81 (Figure 14) the said member 80 being attached to the striper pawl control rod 82, the bottom of said rod containing the terminal 83. In a manner to be hereinafter described, said terminal 83 is operatively engaged by the aforementioned floating cam to cause the pawl 81 to move upwardly into operative engagement with ratchet wheel 78, against the action of spring 84 which normally urges the rod 82 downwardly.

The floating cam above referred to, designated generally by the reference numeral 85, rests upon the floor of the revolving cylinder ring 86 (Figure 14), the cam being disposed within a pocket or recessed portion 87 proportioned to slidably accommodate therein said cam for radial slidable movement, as will more clearly hereinafter appear. The cam 85 comprises, in its preferred form illustrated, a narrow arcuate strip 88 adapted to operatively engage the lower terminal 83 of the said striper control rod 82, and spaced outwardly and laterally therefrom another narrow arcuate cam strip 88*a* adapted to engage the lower terminal 70 of the nullifying cam control rod 67. Connecting said strips 88 and 88*a* is the relatively thin connecting bar 89; and extending radially inwardly from strip 88 is the block 90 which contains a channel 91 providing three vertical cam surfaces 92, 93 and 94, respectively, adapted for engagement with certain pins (to be hereinafter described) for slidably shifting said cam unit 85 radially within the said pocket 87 of the cam ring. The vertical surface 92 forms the inner wall of channel 91 and is obliquely disposed with respect to the radial extent of block 90; and the vertical walls 93 and 94 form the oppositely disposed walls of channel 91, wall 93 being lower than 94, and being at a lesser angle with respect to the radial extent of block 90 than wall 94, both of said walls 93 and 94 having preferably a common juncture 95 at the front of block 90. It will be further observed that vertical cam walls 92 and 93 slope towards each other rearwardly from the entrance portion 96 of channel 91 to the outlet portion 97 thereof.

By referring particularly to Figures 14 to 17, inclusive, it will be seen that disposed above the cylinder ring 86 is the stationary plate 98 having fixedly mounted therein the downwardly extending return pin 99 (see also Figures 10 to 13). This pin is so disposed with respect to the cam that it will engage surface 92 of the floating cam 85 during the latter's rotating movement with the cylinder ring 86. The engagement occurs as indicated in Figure 10 (the cylinder ring moving in the direction of arrow E). In this figure the floating cam 85 is shown in its extreme left position, providing a space 100 in the aforementioned pocket 87. Upon a continued movement of the cylinder ring with the floating cam 85, it is evident that said floating cam 85 will be forced to the right in the direction of arrow F (Figure 10), due to the engaging action of return pin 99 with surface 92. Figure 11 shows the final or return position of the cam 85, after the pin 99 had engaged the entire surface 92, and been permitted to completely disengage itself from said surface through the rear opening 97. At this point the actuating pin 101 (to be hereinafter described) is in position to engage either the upper cam surface 94 or the lower cam surface 93, depending upon the level of the bracket 102. If bracket 102 is at a higher level, it will engage only cam surface 94 as the floating cam revolves with the cylinder ring. Such action is illustrated in Figures 13 and 16. The engagement of said actuating pin 101 with surface 94 causes an outward radial movement of the entire floating cam 85 in the direction of arrow G (Figure 13) thereby bringing the said floating cam to an intermediate position at which it will engage only the terminal 83 of the striper control rod, and not the terminal 70 of the nullifying cam control rod. But if the said bracket 102 is at its lower operative level, the actuating pin 101 will engage surface 93, and cause a complete shifting of the floating cam 95 to its extreme left limiting position, as illustrated in Figures 12, 14 and 17. In the latter position the floating cam is in operative engagement with both the striper control terminal 83 and the nullifying cam terminal 70.

In further elaboration of this action, it will be noted that when the floating cam is in its extreme inner or return position, as illustrated in Figures 11 and 15, both control rod terminals 83 and 70 are out of engagement with the cam strips 88 and 88*a*; and hence no upward motions are imparted to the striper pawl 81 and the nullifying cam control rod 67. When the floating cam 85 is, however, moved to its intermediate position shown in Figures 13 and 16, it will be seen that the striper terminal rod 83 is in engagement with cam strip 88, whereas the nullifying cam control terminal 70 is still out of engagement with the cam strip 88*a*; and accordingly in this position the striper pawl 81 has been raised into its operative position without in any way affecting the nullifying cam action. When the floating cam has been moved to its extreme outer limiting position as shown in Figures 12 and 17, it will be observed that both the striper and nullifying cam control rods 82 and 70 have been elevated by the cam strips 88 and 88*a* to their upper operative positions.

It will be further noted that since the cam strips 88 and 88*a* are each provided with relatively thin leading edges 103 and 104 respectively, the upward movements of the said rod terminals 83 and 70 are effected gradually until they will have reached their respective maximum rises in accordance with the respective maximum heights of said cam strips 88 and 88*a*.

The structural details of the mechanism associated with bracket 102 is substantially like that described in the said previous application Serial No. 35,376. Said bracket is pivotally articulated at 105 with the lever arm 106 to which is fixed the hollow boss 107, the latter being keyed on to the shaft 108 which carries the upwardly extending arm 109 (Figures 10 and 15). In abutting engagement with said arm 109 is the adjustable stud 110 supported by the bracket 111 operatively associated with the support 112 within which is slideably mounted the plunger 113. A spring 114, mounted over shaft 108, normally urges the arm 109 into engagement with the stud

110, substantially as set forth in the said prior patent application Serial No. 35,376.

In engagement with the outermost terminal of plunger 113 is the timing chain 115, said chain carrying links of different heights. The said timing chain is moved through a distance of one link for each revolution of the knitting machine, substantially in the manner described in said prior application, the details of the actuating mechanism not being herein set forth since it is not necessary for an understanding of the present invention. Suffice it to say that the timing chain carries links which are in constant engagement with the plunger 113, whereby said plunger is maintained in one of three different positions depending upon the height of the links. If the shortest link 116 is in engagement with plunger 113, the plunger is in its outermost position, whereby the stud 110 is in a corresponding outermost position, whereby the arm 109, which is in constant pressing engagement with stud 110, will cause the lever arm 106 to be in its maximum raised position. It is apparent that said latter position is the one in which the bracket 102 is at its higher level, with the actuating pin 101 in its completely retracted position as shown in Figure 15. When the link 117 of intermediate height is in engagement with the plunger 113, it will have forced the plunger inwardly somewhat, causing corresponding movements of all the associated parts until the bracket 102 is in its upper operative level shown in Figure 16, whereby the actuating pin 101 is in engagement with the said upper vertical cam surface 94. And when the highest link 118 is in engagement with plunger 113, the bracket 102 will have operatively been brought down to its lower operative position as shown in Figure 17, the actuating pin 101 being now in engagement with the lower vertical cam surface 93.

It is thus apparent that the apparatus above described is capable of independently operating the striping apparatus and nullifying cam. This is rendered possible by a combination of the novel floating cam 85 above described with cooperative actuating rods in engagement with means to operate the striping box mechanism and the nullifying cam mechanism. This is accomplished by relatively simple settings in accordance with the desired pattern of the fabric to be produced by the machine. This has never heretofore been possible, as aforesaid, with a rotating cylinder machine, unless very cumbersome and expensive electrical controls were employed, or unless complex connecting linkages were used between the outside setting mechanism and the inner actuating mechanism for the stripers or other machine knitting elements. In the present apparatus, however, the use of the floating cam requires no such complex apparatus, the entire machine being flexibly controlled to obtain a great variety of knitting operations. With the nullifying cam 37 in its raised retracted and inoperative position, the selector wheel 33 is permitted to perform its design function in normal manner; and the striper stations may be operated in accordance with the positioning of the floating cam, without in any way altering the position of the said nullifying cam 37. But should it be desired to completely nullify the action of the selector wheel 33, that can readily be effected by means of the setting hereinabove described, whereby the nullifying cam control rod 70 may either be engaged or disengaged by the cam strip 88*a* on the floating cam, without affecting the striper mechanism. The arrangement also obviates the need to increase the number of striping stations to obtain, for example, larger striped patterns, since the combination of the alternate striping stations and knitting stations at the nullifying cam positions will coactively produce such larger patterns, in accordance with the presetting of the machine.

It is apparent that the flexibility of the apparatus above described for producing various types and patterns of fabric is to a large degree dependent upon the action of the nullifying cam 37, controlled by the floating cam mechanism 85. Although the nullifying cam above described is vertically movable, as exemplified by nullifier 37, it is within our contemplation not to limit the construction of this mechanism to a vertically slidable nullifying element. For example, Figures 18 to 21 illustrate a modified form of nullifying cam producing the same result as the preferred form above mentioned.

The cam member 119 is substantially like cam 30 above described, except that a pivotally mounted nullifying cam 120 is employed. Said cam 120 is pivotally mounted at 121 and is normally maintained in its retracted and inoperative position substantially in the plane of cam 127, by the spring 122 (Figures 18 and 20). In this position the raising surface 123 of the wing 124 of the nullifying cam engages the butts of needles 31*b*, whereby such needles will travel along path 36*b*, to the latch clearing level indicated by the letter C, whereafter the needles will be drawn down by the stitch cam 43. When it is desired to bring the nullifying cam into its operative projected position, an actuating arm 52*a*, substantially like 52 above mentioned, is moved downwardly in the direction of arrow H (Figure 20) thereby engaging the curved arm 125 to produce a pivotal movement of the cam about the pivot 121 against the action of said spring 122. In this position, the wing 124 with its raising cam 123 is moved out of the path of the butts of needles 31*b* (see Figure 19), and out of the plane of cam 127, thereby permitting the needles to travel along a straight horizontal level, as indicated by the path 36*c* of Figure 19. The needles are accordingly not elevated to latch clearing position, and are thereby caused to engage the depressing surface 126 of the cam 127, whereby the needles are then brought to their cast-off positions. The movement of actuating arm 52*a* is not herein described, since its movement to two different levels can be accomplished substantially in the manner in which the operative movements of the above described actuating arm 52 have been accomplished.

In the above description, the invention has been disclosed merely by way of example and in preferred manner; but obviously many variations and modifications may be made therein. It is to be understood, therefore, that the invention is not limited to any specific form or manner of practicing same, except insofar as such limitations are specified in the appended claims.

We claim:

1. In a circular knitting machine having a needle cylinder with vertically movable needles, a selector wheel in operative engagement with the butts of adjacent needles on the cylinder for operatively raising selected needles and permitting others to pass therethrough unelevated, whereby the needles leave said wheel at predetermined upper and lower levels, and a stitch cam for depressing to a cast-off level needles that

had passed through said wheel, a cam assembly having a body portion, a nullifying cam between said selector wheel and stitch cam movably associated with the body portion and movable between retracted and projected limiting positions, said nullifying cam having a needle depressing surface engaging the needles at said upper level when the nullifying cam is in its said projected position and being out of engagement therewith when in its said retracted position, said needle depressing surface being out of engagement with the needles at said lower level when the nullifying cam is in both of its said limiting positions, whereby the needles unelevated by the wheel will be permitted to follow their non-knitting course and needles selectively elevated by the selector wheel may be diverted from their knitting course.

2. In a circular knitting machine having a needle cylinder with vertically movable needles, a selector wheel in operative engagement with the butts of adjacent needles on the cylinder for operatively raising selected needles and permitting others to pass therethrough unelevated, whereby the needles leave said wheel at predetermined upper and lower levels, and a stitch cam for depressing to a cast-off level needles that had passed through said wheel, a cam assembly having a body portion, a nullifying cam movable between retracted and projected limiting positions, a lifting cam and a lowering cam, said nullifying, lifting and lowering cams being disposed on said body portion between said selector wheel and stitch cam, said lifting cam being proportioned and positioned to engage the needles at said upper level and raise them to a latch-clearing position, said lowering cam being proportioned and positioned to engage needles at said lower level and lower them to a welt level, said nullifying cam having a needle depressing surface engaging the needles at said upper level when the nullifying cam is in its said projected position and being out of engagement therewith when in its said retracted position, said needle depressing surface being out of engagement with the needles at said lower level when the nullifying cam is in both of its said limiting positions, said needle depressing surface of the nullifying cam being proportioned and positioned to depress the needles operatively engaged thereby to a level where they will be operatively engaged by said lowering cam, whereby the needles unelevated by the wheel will be permitted to follow their non-knitting course and needles selectively elevated by the selector wheel may be deflected from their knitting course.

3. In a circular knitting machine having a needle cylinder with vertically movable needles, a selector wheel in operative engagement with the butts of adjacent needles on the cylinder for operatively raising selected needles and permitting others to pass therethrough unelevated, whereby the needles leave said wheel at predetermined upper and lower levels, and a stitch cam for depressing to a cast-off level needles that had passed through said wheel, a cam assembly having a body portion, a recessed portion in said body portion between said selector wheel and stitch cam, a nullifying cam slidably movable within said recessed portion between retracted and projected limiting positions, said nullifying cam having a needle depressing surface engaging the needles at said upper level when the nullifying cam is in its said projected position and being out of engagement therewith when in its said retracted position, said needle depressing



surface being out of engagement with the needles at said lower level when the nullifying cam is in both of its said limiting positions, and selective means for reciprocatingly actuating said nullifying cam between its said limiting positions, whereby the needles unelevated by the wheel will be permitted to follow their non-knitting course and needles selectively elevated by the selector wheel may selectively be diverted from their knitting course.

4. In a circular knitting machine of the class described, the combination according to claim 2, there being a recessed portion in said body portion between said selector wheel and stitch cam, the nullifying cam being slidably movable within said recessed portion between its said limiting positions, an actuating arm in engagement with said nullifying cam, and selective means for reciprocatingly moving said actuating arm.

5. In a circular knitting machine of the class described, the combination according to claim 2, the nullifying cam being reciprocatingly movable vertically upon said body portion between its said limiting positions, the nullifying cam having an upwardly extending arm carrying its said needle depressing surface, the nullifying cam having a slotted portion therein, an actuating arm in engagement with said slotted portion, and selective means for reciprocatingly moving said actuating arm.

6. In a circular knitting machine having a revolving needle cylinder with vertically movable needles, a selector wheel in operative engagement with the butts of adjacent needles on the cylinder for operatively raising selected needles and permitting others to pass therethrough unelevated, whereby the needles leave said wheel at predetermined upper and lower levels, a stitch cam for depressing to a cast-off level needles that had passed through said wheel, a cam assembly having a body portion, a nullifying cam between said selector wheel and stitch cam movably associated with the body portion and movable between retracted and projected limiting positions, said nullifying cam having a needle depressing surface engaging the needles at said upper level when the nullifying cam is in its said projected position and being out of engagement therewith when in its said retracted position, said needle depressing surface being out of engagement with the needles at said lower level when the nullifying cam is in both of its said limiting positions, an actuating arm in engagement with said nullifying cam and movable between two limiting positions corresponding to those of the nullifying cam, a cam block carried by said arm, a ratchet wheel adjacent said block, stud members extending from a lateral face of the ratchet wheel and engageable with said block to actuate it and the said arm, whereby the said nullifying cam will be correspondingly actuated, a pawl operatively engageable with said ratchet wheel, a nullifying cam control rod operatively connected with said pawl, and selective means for reciprocatingly actuating the said cam control rod.

7. In a circular knitting machine, the combination according to claim 6, further provided with a revolving cylinder ring carrying the needle cylinder, a floating cam resting on said cylinder ring and slidably movable relative thereto substantially radially between retracted and operative limiting positions, said floating cam when in an operative position being adapted to engage said control rod during a revolution of the cylin-

der ring, thereby actuating said nullifying cam.

8. In a circular knitting machine having a revolving cylinder ring carrying a needle cylinder with vertically movable needles and a plurality of stationary striping boxes circumferentially disposed about the machine, and having a movable actuator operatively connected to each box, the combination of a plurality of non-striping stations alternately disposed about the cylinder between said striping boxes, each of said stations having a selector wheel in operative engagement with the butts of adjacent needles on the cylinder for operatively raising selected needles and permitting others to pass therethrough unelevated, whereby the needles leave said wheel at predetermined upper and lower levels, a stitch cam for depressing to a cast-off level needles that had passed through said wheel, a cam assembly having a body portion, a nullifying cam between said selector wheel and stitch cam movably associated with the body portion and movable between retracted and projected limiting positions, said nullifying cam having a needle depressing surface engaging the needles at said upper level when the nullifying cam is in its said projected position and being out of engagement therewith when in its said retracted position, said needle depressing surface being out of engagement with the needles at said lower level when the nullifying cam is in both of its said limiting positions, an actuating arm in engagement with said nullifying cam and movable between two limiting positions corresponding to those of the nullifying cam, a movable nullifying cam control rod operatively connected to each of said actuating arms, a movable striper control rod operatively connected to each of said movable actuators, a floating cam resting on said cylinder ring and slidably movable relative thereto substantially radially into three different positions, namely innermost and outermost limiting positions and an intermediate position, said floating cam when in one of said positions being out of engagement with both of said control rods, when in another of said positions being in successive engagement with the striper control rods and out of engagement with the other control rod, and when in the third of said positions being in successive engagement with both of said control rods, during the operative revolution of the cylinder ring.

9. In a circular knitting machine, the combination according to claim 8, the bottom terminal of each of said control rods being in slidable engagement with the floor of the cylinder ring when the said floating cam is out of engagement therewith.

10. In a circular knitting machine, the combination according to claim 8, the position of the floating cam in which it is out of engagement with both of said control rods being the said innermost position, its position when in engagement with both of said control rods being its said outermost position.

11. In a circular knitting machine, the combination according to claim 8, the said floating cam having two spaced elongated strips the upper surfaces of which are operatively engageable with said respective control rods, one of said strips being engageable only with the striper control rods, and the other only with the nullifying cam control rods.

12. In a circular knitting machine, the combination according to claim 8, the said floating cam having a channel formed by opposite vertical converging cam walls, one side of said channel having a single wall obliquely disposed with respect to the radial extent of the floating cam, the other side of the channel having two walls of different heights converging rearwardly towards said single wall and forming an opening at the rear of the floating cam, further provided with a return pin engageable with said single wall to slidably move the floating cam to its limiting position where it is out of engagement with both of said control rods, and a movable actuating pin engageable selectively with said other two walls for slidably moving the floating cam to said respective intermediate and other limiting positions.

13. In a circular knitting machine, the combination according to claim 12, the said rear opening formed by said channel walls being proportioned and positioned to clear the said pins during the rotary movement of the floating cam with the cylinder ring.

14. In a circular knitting machine, the combination according to claim 8, the said floating cam having a channel formed by opposite vertical converging cam walls, one side of said channel having a single wall obliquely disposed with respect to the radial extent of the floating cam, the other side of the channel having two walls of different heights converging rearwardly towards said single wall and forming an opening at the rear of the floating cam, further provided with a return pin engageable with said single wall to slidably move the floating cam to its limiting position where it is out of engagement with both of said control rods, and a movable actuating pin engageable selectively with said other two walls for slidably moving the floating cam to said respective intermediate and other limiting positions, the said actuating pin being selectively movable to three different levels, one in which it is engageable with the higher of the said two walls, another in which it is engageable with the lower of the said two walls, and one in which it is above and out of engagement with both of said walls, the said two walls being at different inclinations to the radial extent of the floating cam.

15. In a circular knitting machine, the combination according to claim 8, the said floating cam having a channel formed by opposite vertical converging cam walls, one side of said channel having a single wall obliquely disposed with respect to the radial extent of the floating cam, the other side of the channel having two walls of different heights converging rearwardly towards said single wall and forming an opening at the rear of the floating cam, further provided with a return pin engageable with said single wall to slidably move the floating cam to its limiting position where it is out of engagement with both of said control rods, and a movable actuating pin engageable selectively with said other two walls for slidably moving the floating cam to said respective intermediate and other limiting positions, the said return pin being fixed and disposed radially inwardly with respect to the said actuating pin, the said single wall being disposed inwardly with respect to the said two walls.

16. A camming mechanism comprising a revolvable member, a floating cam slidably mounted on said revolvable member and movable relative thereto between two limiting positions and an intermediate position, said positions being at different distances from the center of rotation of the revolvable member measured along a horizontal plane, two movable elements adapted to be actuated by different portions of said cam

when the cam is in two of its said positions and out of engagement with said cam when it is in the third of its said positions, and a cam control intermittently engageable with the cam for operatively moving it selectively into said respective positions, said cam control being operatively associated with the revolvable member, said cam being out of engagement with said cam control except when operatively actuated thereby.

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## REFERENCES CITED

The following references are of record in the file of this patent:



UNITED STATES PATENTS


| Number | Name | Date |
|---|---|---|
| 999,853 | Paquette | Aug. 8, 1911 |
| 1,181,520 | Glenn | May 2, 1916 |
| 1,590,293 | Krieble | June 29, 1926 |
| 1,970,238 | Kretser | Aug. 14, 1934 |
| 2,006,821 | Agulnek | July 2, 1935 |
| 2,123,534 | Lawson et al. | July 12, 1938 |
| 2,124,304 | Lombardi | July 19, 1938 |
| 2,130,769 | Lombardi | Sept. 20, 1938 |
| 2,475,170 | Zieve | July 5, 1949 |