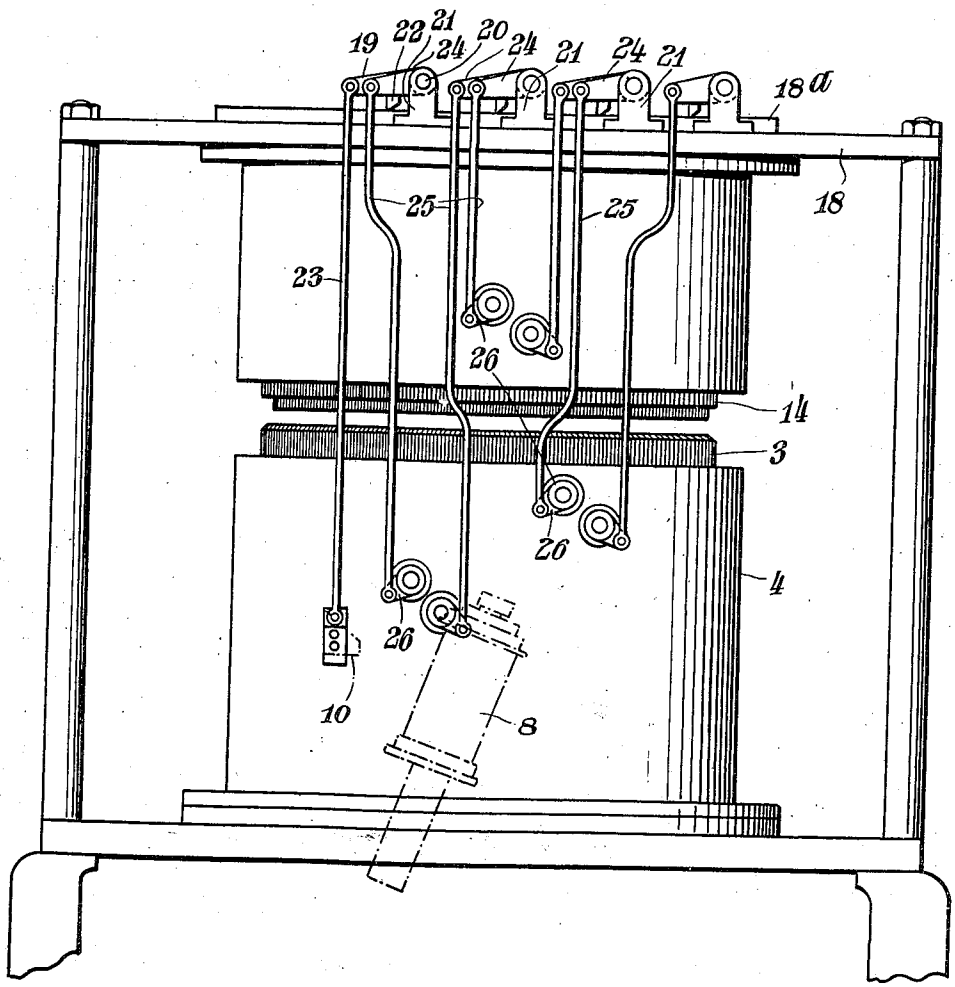
Jan. 4, 1938. E. SPIERS ET AL 2,104,626

CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

Filed Nov. 5, 1936 6 Sheets-Sheet 1

Fig. 1.



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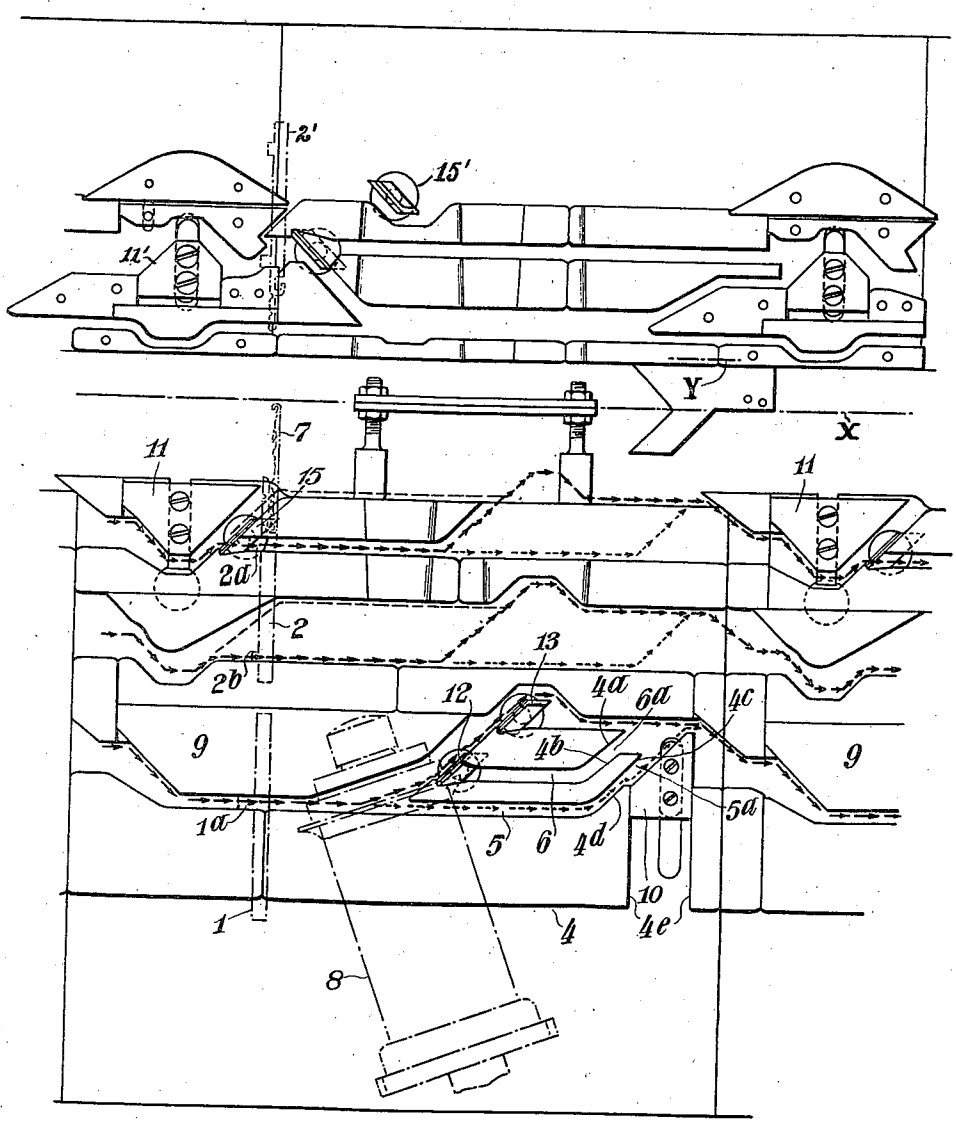
by Frank L. Appleman, attorney.

Jan. 4, 1938. E. SPIERS ET AL 2,104,626

CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

Filed Nov. 5, 1936 6 Sheets-Sheet 2

Fig. 2.



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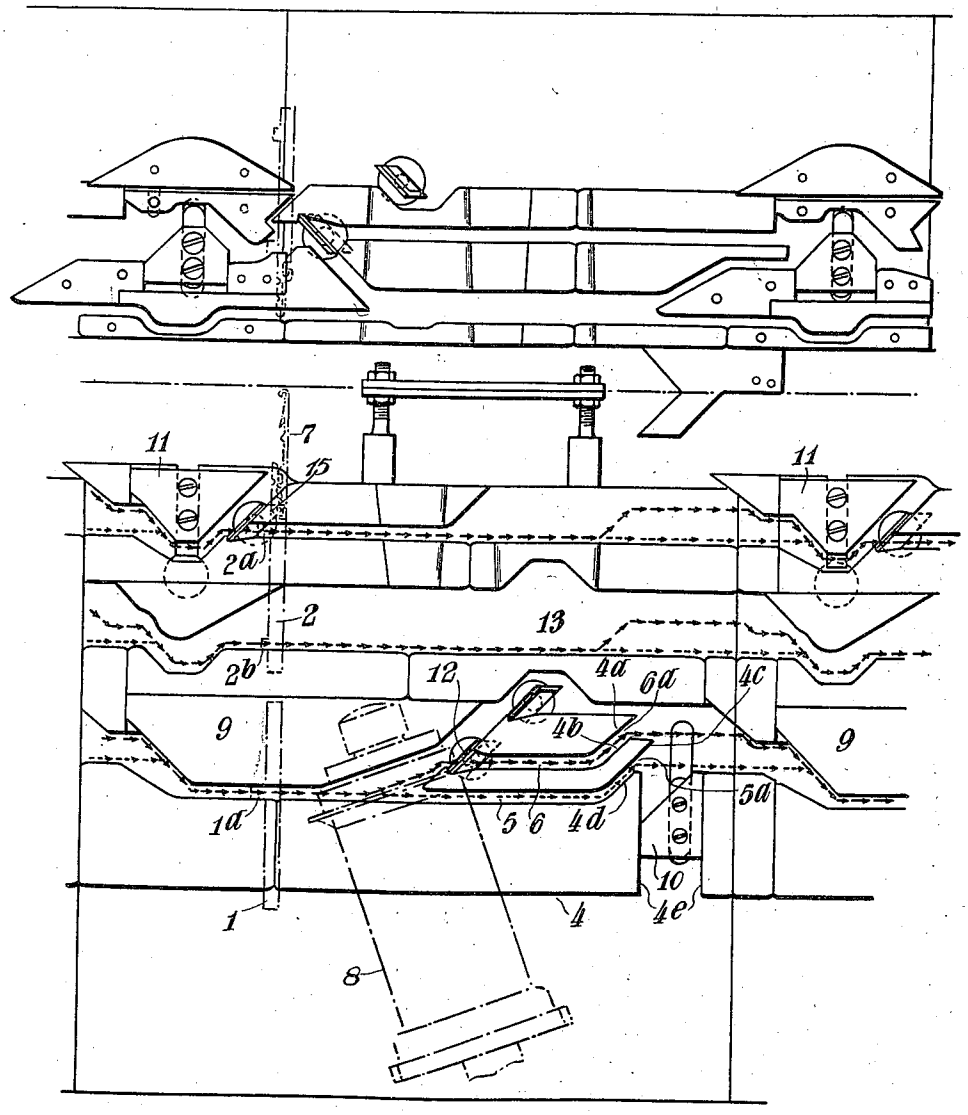
attorney

Jan. 4, 1938. E. SPIERS ET AL 2,104,626

CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

Filed Nov. 5, 1936 6 Sheets-Sheet 3

Fig. 3.



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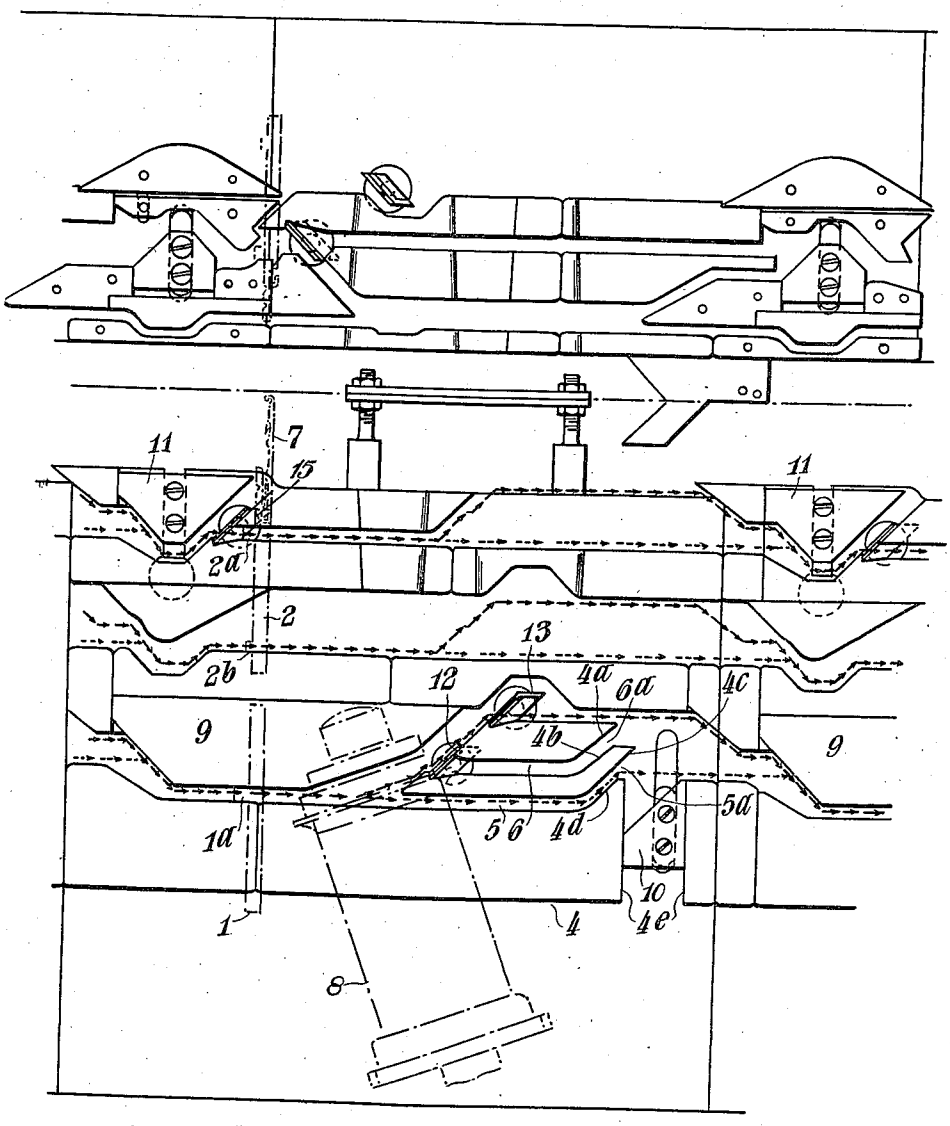
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Jan. 4, 1938. E. SPIERS ET AL 2,104,626

CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

Filed Nov. 5, 1936 6 Sheets-Sheet 4

Fig. 4.



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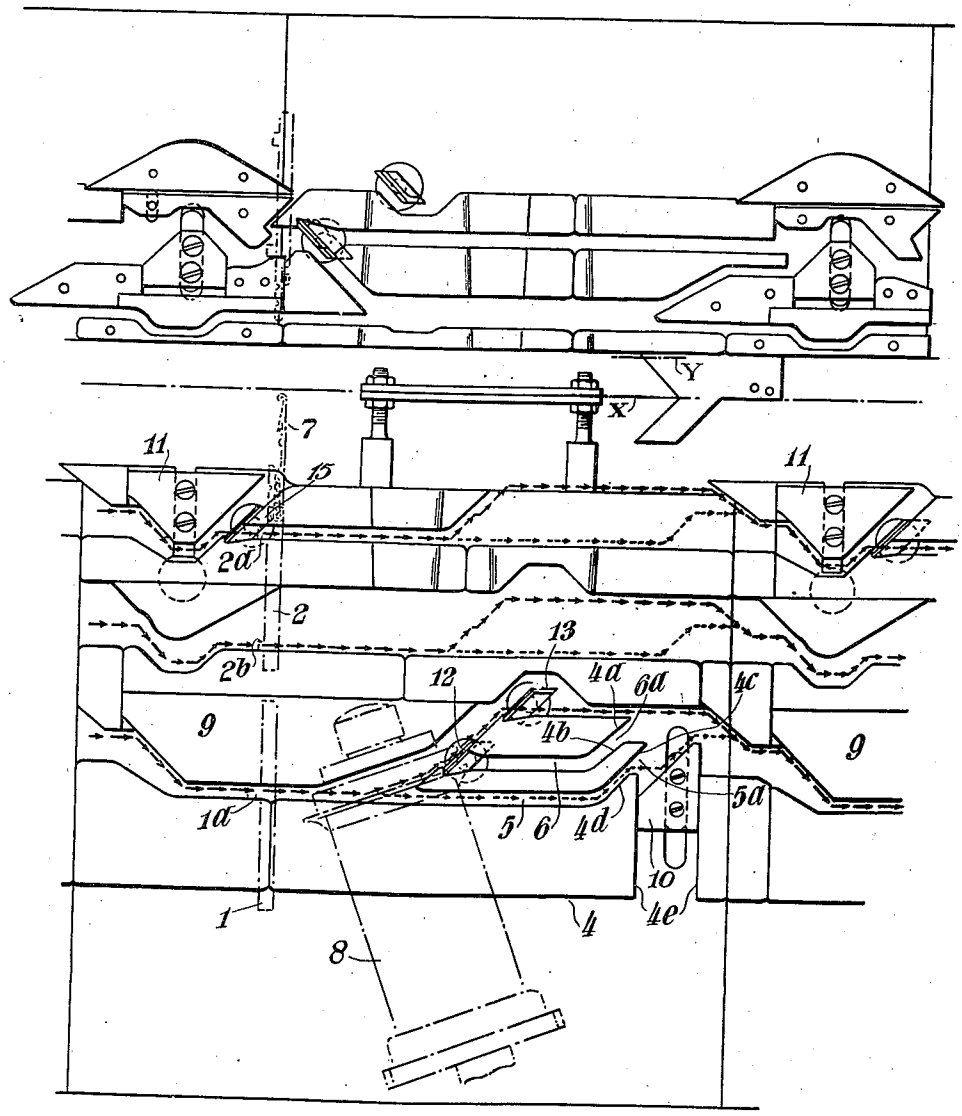
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CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

Filed Nov. 5, 1936 6 Sheets-Sheet 5

Fig. 5.



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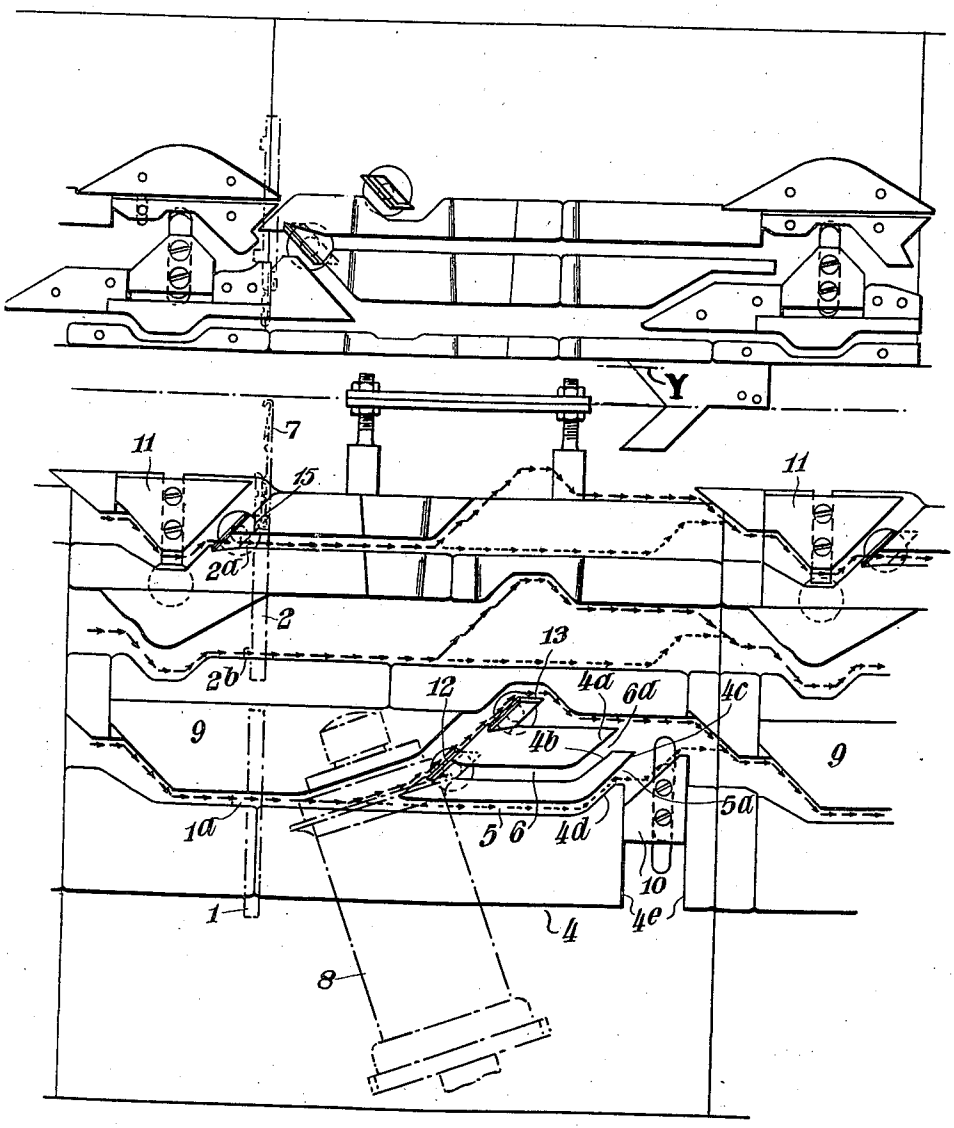
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CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

Filed Nov. 5, 1936 6 Sheets-Sheet 6

Fig. 6.



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Patented Jan. 4, 1938 2,104,626

UNITED STATES PATENT OFFICE

2,104,626

CIRCULAR KNITTING MACHINE OF THE DOUBLE AXIALLY OPPOSED NEEDLE CYLINDER TYPE

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Application November 5, 1936, Serial No. 109,380
In Great Britain November 14, 1935

14 Claims. (Cl. 66—14)

This invention relates to circular knitting machines of the double axially opposed needle cylinder type, and has reference to those furnished with double ended needles operated by sliders and means for transferring needles from one cylinder to the other, such machines being thereby adapted to produce plain, ribbed and purl fabric.

There is at present a demand for patterned knitted fabric for outerwear, particularly garment lengths for pullovers, slip-overs, jumpers, jackets and the like having rib borders with welts and a patterned body portion or top. In order to meet this demand it is necessary to produce fabrics with a diversity of stitch effects.

The present invention is therefore mainly intended for application to machines of the type aforesaid which are adapted to produce body fabric and, consequently, are known as body machines, but the invention is not to be regarded as limited in this respect as it may find a useful application to machines of the same type which are adapted to produce seamless hose, half-hose, socks and like articles.

The principal object of the present invention is to provide a machine of the type specified improved in such a way as to enable knitted fabric with so-called honeycomb effects to be produced, an important desideratum being to produce on such machines garment lengths having rib borders with welts, and body portions or tops with honeycomb effects.

The improved machine may, however, also be adapted to produce any one or more of the following, viz. other fancy tuck effects, fancy rib and purl effects, so-called ripple effects, striping effects, and patterns produced by having stitches of different colours in individual courses of knitting, with or without rib borders, or interposed bands of rib or plain fabric so that an exceptional diversity of stitch effects can be obtained.

In a broad aspect the invention comprehends a machine of the type concerned having in association with one of the cylinders, for example the plain cylinder, means adapted to enable prearranged needles to take up a tucking position and the remainder to take up a non-knitting position at the same feeder or feeders, together with means for causing all of the needles periodically to clear and knit. The invention may be applied to single feeder as well as multi-feeder machines of the type concerned.

According to one manner of carrying the invention into practice there are provided from one side to the other of the feeder in a single feeder machine, or between feeders in a two or more feeder machine, co-extensive e. g. substantially parallel tucking and non-knitting tracks for the needle operating sliders, or jacks associated with the said sliders, means in advance of these tracks for dividing the sliders or jacks so that prearranged sliders or jacks are caused to take the tucking track, and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the feeder, or feeders, or prearranged feeders as the case may be, and means for action upon all of the sliders or jacks periodically for the purpose of causing the needles to clear and knit at the feeder, or one or more of the feeders, in order to produce the effect required in the knitted fabric. It will of course be understood that in a machine having two or more feeders, the tracks and associated dividing means are repeated as often as required, depending on the number of feeders provided. Accordingly when tracks are hereinafter referred to this is to be understood as meaning either the tracks in a single feeder machine or, where the context so admits, the tracks between one feeder and the other, or any two adjacent feeders, in a machine having two or more feeders.

The means for dividing the sliders or jacks for the purpose described may be of any suitable form, but it is preferred to adopt a pattern controlling unit or device adapted to act selectively on the sliders or jacks. Conveniently a patterning unit of the obliquely disposed rotary wheel or drum type is employed so that selected sliders or jacks are moved endwise in order to cause same to take one track while the others are permitted to take the other track. The said unit is preferably of the form having slider or jack engaging bits movable into and out of an operative position either manually, for example as described in the specification of British Patent No. 430,440, or automatically, for example as described in the specification of British Patent No. 282,904, so as to enable a diversity of slider or jack selections to be made. It will be understood that in a multi-feeder machine there are as many patterning units or devices as feeders.

There may be provided in association with the aforesaid tracks a cam adapted to be rendered operative periodically for operation on the sliders or jacks which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said sliders or jacks to cause the corresponding needles to take up a clearing position instead of the tucking position. Another cam also adapted to be rendered opera-

tive periodically may be provided for action either upon the sliders or jacks which, after division, take the non-knitting track, so that said sliders or jacks are operated to cause the corresponding needles to take up either a tucking or a clearing position, or upon all of the said jacks or sliders so that all of the needles are caused to clear and knit. Another cam may also be provided for action upon the sliders or jacks operated by the first mentioned cam so that the corresponding needles are transferred to the opposite cylinder. In this way provision is made for changing from knitting of one character to knitting of another character so that a diversity of stitch effects is obtained. Thus by appropriate settings of the machine pieces of fabric or garment lengths having respectively different stitch effects can be produced, or by making appropriate changes at intervals in the production of a piece of fabric or a garment length, e. g. between feeders in a machine having two or more feeders, a variety of stitch effects may be produced in one and the same piece of fabric or garment length.

The aforesaid cams may be movably mounted and automatically operated in any conventional manner applicable to circular knitting machines, such as by means of intermediate levers and linkage from a timing chain or drum, or from a cam ring rotating with the rotary parts of the machine.

It is preferred to provide jacks in association with the needle operating sliders in the appropriate cylinder and to provide the tracks for the jacks in an appropriate portion of the corresponding cam box, or in an auxiliary cam box, and means for action selectively upon butts on the jacks in order to cause selected jacks to follow the tucking track and the remainder to follow the non-knitting track when required. Furthermore it is mainly the intention to carry the invention into practice in connection with the plain cylinder of the machine so that selected plain needles can be caused to tuck while the remainder do not knit, and all of the needles in the plain cylinder are caused to clear and knit as and when required.

In the accompanying drawings,

Figure 1 is an elevational view, shown more or less diagrammatically, of the head of the said machine.

Figures 2–6 are views each representing a development of the cam systems of the machine at two feeds and illustrating various cam arrangements which may be adopted to produce the various effects hereinafter specified.

In the example of the invention now to be described jacks such as 1 (see Figures 2–5) each having a single butt 1*a* thereon are provided under the needle operating sliders such as 2 in the bottom cylinder 3 of the machine and in the lower portion of the bottom cam box 4 and adjacent each feeder are two tracks 5 and 6 which are disposed one above the other substantially parallel to each other and, for the major portions of their lengths, extend horizontally but at the far end (in relation to the direction of the rotation of the needles such as 7) are upwardly diverted as at 5*a* and 6*a*. The height of the horizontal portion of the upper track 6 is such that needles corresponding with jacks having their butts in this track are disposed at the non-knitting height indicated at X but at the upwardly diverted end 6*a* the height is such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height indicated at Y. The horizontal portion of the lower track 5 is, of course, at a lower level, but at the upwardly diverted end 5*a* reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at the non-knitting height aforesaid. Located at the entrance to each of these pairs of tracks 5, 6, is a patterning unit such as 8 adapted for action selectively on the jack butts 1*a*, and in advance of this unit is a cam 9 whereby all of the jacks such as 1 are positioned at a common level i. e. the level of the lower track 5. As will be seen, the patterning unit is obliquely disposed so that jacks 1 engaged by the unit are raised to bring their butts to the entrance of the upper track 6 so that these butts pass along this track while the butts missed by the patterning unit are permitted to pass along the lower track 5. The result is that the sliders such as 2 corresponding to the jacks in the upper track 6 pass through the feeder adjacent to the upwardly diverted ends 5*a* and 6*a* of the tracks, with the needles 7 at tucking height Y and the remainder of the sliders pass through the same feeder with the needles at the non-knitting height X.

A somewhat similar arrangement to that just described may, of course, be applied to a single feeder machine in which case one pair of tracks only would be provided adjacent the feeder and the sliders corresponding to the jacks in the upper track would pass through the feeder with the needles at tucking height while the remainder of the sliders would also pass through the single feeder with the needles at a non-knitting height.

The upward diversion of each pair of tracks is provided for by appropriately inclined edges 4*a*, 4*b*, 4*c* and 4*d* at the far ends of the said tracks. There is, however, adjacent to the upwardly diverted ends of each pair of tracks a vertically movable cam 10 which occupies the low position indicated in Figures 3 and 4 when the selected needles are required to occupy the tucking position and the remaining needles are required to occupy the non-knitting position when passing the adjacent feeder. At the upward limit of its movement this cam occupies a position indicated in Figure 2, this position being such that jacks 1 leaving the tracks 5 and 6 are all raised to position their needles 7 at clearing height (see Z, Figure 2) preparatory to passing the feeder so that the butts, such as 2*a* of the needle operating sliders 2 are acted upon by the stitch cam 11 at the feeder and the needles are caused to knit. In this way some needles can be caused to pass the feeders or two or more of the feeders at tucking height and the remainder at non-knitting height and then all of the needles can be caused to knit at a prearranged feeder or feeders by locating the appropriate movable cam or cams, such as 10, in the highest position. For example, in a four feeder machine some of the needles may be caused to pass three of the feeders at tucking height, the remaining needles can be caused to pass the same feeders at non-knitting height, and all of the needles can be caused to knit at the fourth feeder at every revolution of the machine.

In a single feeder machine the same needles may be caused to pass the feeder at tucking height and the remainder at non-knitting height for a required number of revolutions of the needle cylinders, and then by moving the single vertically movable cam to its highest position

all of the needles can be caused to knit at the feeder.

To enable the character of the knitting to be further diversified a radially movable cam 12 is provided at the entrance to the tucking, i. e. upper, track 6 for opening and closing this track so that by closing the latter selected needles can be caused to clear and subsequently knit. Another similarly movable cam 13 is provided beyond and at a higher level than the cam 12 for the purpose of effecting transference of selected needles to the top cylinder 14.

In the cam arrangement illustrated in Figure 2, the cam 12 is in, the cam 13 in, and the cam 10 right up to produce reverse knitting. With this arrangement the butts 1a of the jacks 1 engaged by the patterning unit, i. e. the butts of selected jacks are prevented by the cam 12 from entering the tucking track 6 and are engaged by the cam 13 with the result that the corresponding (selected) needles are transferred to the top needle cylinder of the machine there to be caused to knit at the feeder by engagement with the upper stitch cam 11'. The path of the butts 1a of the selected jacks and the paths of the butts, such as 2a and 2b, of the corresponding needle operating sliders 2 are indicated by full line arrows. Those butts, such as 1a, missed by the patterning unit 8 pass along the lower track 5, up the inclined edge 4d and onto the cam 10 so that the unselected jacks are raised to position their needles at clearing height (see Z) preparatory to passing the adjacent feeder so that the butts 2a of the corresponding needle operating sliders are acted upon by the stitch cam 11 at the feeder and their needles are caused to knit. The paths of the butts of the unselected jacks and of the butts of the corresponding sliders are indicated by dotted arrows in Figure 2.

The arrangement shown in Figure 3 produces tucking and non-knitting (honeycomb fabric). As will be seen, the cams 12 and 13 are out and the cam 10 is right down, with the result that the butts of selected jacks pass along the tucking track 6 and up the inclined edge 4b thereby causing the associated needles to pass the feed and take yarn in a tuck position while the butts of unselected jacks pass along the lower track and up the inclined edge 4d, the butts of all the jacks, when they leave the tracks, passing straight across to the next cam 9 where they are lowered and positioned at a common level prior to selection as they approach the next feeder. In this and the succeeding three figures of the drawings the paths of the butts on the jacks 1 and the needle operating sliders 2 are indicated in a similar manner to the various paths indicated in Figure 2.

In the arrangement shown in Figure 4, cam 12 is in, cam 13 out and cam 10 right down for clearing and non-knitting and when employing this cam arrangement yarns of different colours will be supplied at adjacent feeders to produce two colour jacquard effects in individual courses. This arrangement, moreover, may also be employed at three or four feeds for the production of jacquard effects in the appropriate number of colours.

Referring now to Figure 5, it will be seen that cam 12 is in, cam 13 out and cam 10 half way up to produce clearing and tucking effects, and by adopting the arrangement shown in Figure 6, wherein cams 12 and 13 are in and cam 10 half way up, selective transferring and tucking effects can be produced.

It will be understood that the machine has cam systems of conventional form to enable it to knit either rib or plain fabric, and welts to be produced in the ordinary way so that rib borders with welts and/or plain areas can be produced as and when required. In a multi-feeder machine the patterning units and transfer cams may be so arranged and operated as to enable purely purl designs to be produced as the result of selective needle transference.

The clearing cam 15 in the plain knitting cam system at each feeder of the machine shown (or at the feeder of a single feeder machine) is preferably made radially movable so that it can be withdrawn to an inoperative position to enable the sliders such as 2 to assume a non-knitting position when required after leaving the stitch cam 11. If the cam 15 is in its inward position, all the needles are raised to clearing height and consequently knit at the following feed, independently of any selective action upon the jacks. In this connection it may be mentioned that in the specific example of the invention herein described the jacks 1 which are permitted to pass along a lower track 5 are not in contact or engagement with their sliders 2, so that the latter remain in the non-knitting position unless the said jacks are acted upon by cam 10, whereas the selected jacks are brought into contact with their sliders as the result of the selective action so that these sliders are ultimately raised to tucking position or further if the jacks are actuated by cam 12, or cams 12 and 13 or 10 as hereinbefore mentioned. In Figure 2 there is indicated by means of plain dotted lines the paths which are taken by the butts 2a and 2b of the sliders when the cam 15 is in its operative position. At such times a similar radially movable cam 15' is arranged to be in so that the top sliders, such as that shown at 2', will transfer the needles 7 to the bottom sliders 2.

The cam 10 is movable up and down between parallel guiding edges 4e in the bottom cam box 4 while the various radially movable cams herein mentioned are of more or less conventional form and adapted to be operated in any well known manner.

For rendering the vertically movable cam 10 and the radially movable cams 12, 13 and 15 operative and inoperative at the appropriate times any convenient means may be employed, although for this purpose it is preferred to provide on the top plate 18 of the machine a cam ring 18a furnished with a series of cam pieces (not shown) respectively for the cams to be controlled, and intermediate connections of the character shown in Figure 1. The connections for the cam 10 comprise a lever 19 mounted on a spindle 20 carried by a bearing, such as 21, said lever having associated therewith a tail-piece 22 for co-operation with one of the cam pieces on the ring 18a, and a link 23 connecting the lever 19 with a convenient part formed or provided on the cam 10. The connections for the radially movable cams are similar and each comprise a lever 24 mounted to pivot in a bearing, such as 21, and adapted to be rocked from the cam ring 18a, and a link 25 connecting the lever 24 with another lever 26 which is adapted, when turned in one direction, to withdraw the corresponding radially movable cam and to render this cam operative when turned in the opposite direction.

What we claim then is:—

1. A circular knitting machine of the double axially opposed needle cylinder type equipped with double ended needles, associated instrumentalities for operating the needles, and means for

transferring needles from one cylinder to the other, which includes in combination and in association with one of the cylinders, means for action on the said instrumentalities for dividing the same and causing prearranged needles to take up a tucking position and the remainder to take up a non-knitting position, and periodically operated means for action on the needle-operating instrumentalities whereby after division of the needles, those which take up a tucking position, as well as those which take up the non-knitting position, are caused to clear and knit.

2. A circular knitting machine comprising, in combination, plain and rib needle cylinders axially opposed, double-ended needles slidable in said needle cylinders, instrumentalities in said cylinders for operating the needles, means for transferring needles from one cylinder to the other, cam systems associated with said cylinders, one of said cam systems including co-extensive tucking and non-knitting tracks for the needle operating instrumentalities in one of the cylinders, means in advance of the tucking and non-knitting tracks for dividing the needle operating instrumentalities in the last mentioned cylinder so that prearranged instrumentalities are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively, and means for action periodically upon all the needle operating instrumentalities in the said cylinder, for the purpose of causing the associated needles to clear and knit.

3. A circular knitting machine comprising, in combination, plain and rib needle cylinders axially opposed, double-ended needles slidable in said needle cylinders, instrumentalities in said cylinders for operating the needles, cam systems associated with the said cylinders, one of said cam systems including co-extensive tucking and non-knitting tracks for the needle operating instrumentalities in one of the cylinders, a pattern controlled unit or device disposed in advance of the tucking and non-knitting tracks and adapted to act selectively on the needle operating instrumentalities in the last mentioned cylinder so that prearranged instrumentalities are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively, and means for action periodically upon all the needle operating instrumentalities in the said cylinder, for the purpose of causing the associated needles to clear and knit.

4. A circular knitting machine comprising, in combination, plain and rib needle cylinders axially opposed, double-ended needles slidable in said needle cylinders, instrumentalities in said cylinders for operating the needles, means for transferring needles from one cylinder to the other, cam systems associated with said cylinders, one of said cam systems including co-extensive tucking and non-knitting tracks for the needle operating instrumentalities in one of the cylinders, means in advance of the tucking and non-knitting tracks for dividing the needle operating instrumentalities in the last mentioned cylinder so that prearranged instrumentalities are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively, and a cam adapted to be rendered operative periodically for action at predetermined times upon those needle operating instrumentalities in the said cylinder which, after division, take the non-knitting track, so that the said instrumentalities are operated to cause the corresponding needles to take up either a tucking or a clearing position and for action at other times upon all of the said instrumentalities so that the associated needles are caused to clear and knit.

5. A circular knitting machine comprising, in combination, plain and rib needle cylinders axially opposed, double-ended needles slidable in said needle cylinders, instrumentalities in said cylinders for operating the needles, means for transferring needles from one cylinder to the other, cam systems associated with said cylinders, one of said cam systems including co-extensive tucking and non-knitting tracks for the needle operating instrumentalities in one of the cylinders, means in advance of the tucking and non-knitting tracks for dividing the needle operating instrumentalities in the last mentioned cylinder so that prearranged instrumentalities are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively, a cam associated with the tucking and non-knitting tracks, said cam being adapted to be rendered operative periodically for operation on those needle operating instrumentalities in the said cylinder which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said instrumentalities to cause the corresponding needles to take up a clearing position instead of a tucking position, and means for action periodically upon all the needle operating instrumentalities in the said cylinder for the purpose of causing the associated needles to clear and knit.

6. A circular knitting machine comprising, in combination, plain and rib needle cylinders axially opposed, double-ended needles slidable in said needle cylinders, instrumentalities in said cylinders for operating the needles, cam systems associated with said cylinders, one of said cam systems including co-extensive tucking and non-knitting tracks for the needle operating instrumentalities in one of the cylinders, means in advance of the tucking and non-knitting tracks for dividing the needle operating instrumentalities in the last mentioned cylinder so that prearranged instrumentalities are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively, a cam associated with the tucking and non-knitting tracks, said cam being adapted to be rendered operative periodically for operation on those needle operating instrumentalities in the said cylinder which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said instrumentalities to cause the corresponding needles to take up a clearing position instead of a tucking position, a further cam adapted to be rendered operative periodically for action upon the needle operating instrumentalities operated by the first mentioned cam so that the corresponding needles are transferred to the opposite cylinder, and means for action periodically upon all the needle operating instrumentalities in the first mentioned cylinder for the purpose of causing all the needles in said cylinder to clear and knit.

7. A circular knitting machine comprising, in combination, plain and rib needle cylinders axi-

ally opposed, double-ended needles slidable in said needle cylinders, instrumentalities in said cylinders for operating the needles, cam systems associated with said cylinders, one of said cam systems including co-extensive tucking and non-knitting tracks for the needle operating instrumentalities in one of the cylinders, means in advance of the tucking and non-knitting tracks for dividing the needle operating instrumentalities in the last mentioned cylinder so that prearranged instrumentalities are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively, a cam associated with the tucking and non-knitting tracks, said cam being adapted to be rendered operative periodically for operation on those needle operating instrumentalities in the said cylinder which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said instrumentalities to cause the corresponding needles to take up a clearing position instead of a tucking position, a further cam adapted to be rendered operative periodically for action upon the needle operating instrumentalities operated by the first mentioned cam so that the corresponding needles are transferred to the opposite cylinder, and a still further cam adapted to be rendered operative periodically for action at predetermined times upon those needle operating instrumentalities in the first mentioned cylinder which, after division, take the non-knitting track, so that the said instrumentalities are operated to cause the corresponding needles to take up either a tucking or a clearing position and for action at other times upon all of the said instrumentalities so that the associated needles are caused to clear and knit.

8. A multiple feeder circular knitting machine comprising, in combination, superposed rotary plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, means for transferring needles from one cylinder to the other, cam boxes associated with the needle cylinders, the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles corresponding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, means at the entrance of the tucking and non-knitting tracks for dividing the jacks in the plain cylinder so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the same feeders, and, in association with the appropriate cam box, means for action periodically upon all the jacks in the plain cylinder for the purpose of causing the corresponding needles to clear and knit.

9. A multiple feeder circular knitting machine comprising, in combination, superposed rotary plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, means for transferring needles from one cylinder to the other, cam boxes associated with the needle cylinders, the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles corresponding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, means at the entrance of the tucking and non-knitting tracks for dividing the jacks in the plain cylinder so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the same feeders, and a vertically movable cam disposed adjacent to the upwardly diverted ends of the tucking and non-knitting tracks, said cam being adapted to be rendered operative periodically for action at predetermined times on those jacks which, after division, take the non-knitting track, so that said jacks are operated to cause the corresponding needles to take up either a tucking or a clearing position and for action at other times upon all of the jacks in the plain cylinder so that the associated needles are caused to clear and knit.

10. A multiple feeder circular knitting machine comprising, in combination, superposed rotary plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, means for transferring needles from one cylinder to the other, cam boxes associated with the needle cylinders, the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles cor-

responding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, means at the entrance of the tucking and non-knitting tracks for dividing the jacks in the plain cylinder so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the same feeders, a radially movable cam at the entrance to the tucking track for opening and closing this track, said cam being adapted to be rendered operative periodically for operation on those jacks which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said instrumentalities to cause the corresponding needles to take up a clearing position instead of a tucking position, and, in association with the appropriate cam box, means for action periodically upon all the jacks in the plain cylinder for the purpose of causing the corresponding needles to clear and knit.

11. A multiple feeder circular knitting machine comprising, in combination, superposed rotary plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, cam boxes associated with the needle cylinders, the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles corresponding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, means at the entrance of the tucking and non-knitting tracks for dividing the jacks in the plain cylinder so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the same feeders, a radially movable cam at the entrance to the tucking track for opening and closing this track, said cam being adapted to be rendered operative periodically for operation on those jacks which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said instrumentalities to cause the corresponding needles to take up a clearing position instead of a tucking position, another radially movable cam provided beyond and at a higher level than the first mentioned radially movable cam and adapted to be rendered operative periodically for action upon the jacks operated by said first mentioned radially movable cam so that the corresponding needles are transferred to the opposite cylinder, and, in association with the appropriate cam box, means for action periodically upon all the jacks in the plain cylinder for the purpose of causing the corresponding needles to clear and knit.

12. A multiple feeder circular knitting machine comprising, in combination, superposed rotary plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, cam boxes associated with the needle cylinders, the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles corresponding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, means at the entrance of the tucking and non-knitting tracks for dividing the jacks in the plain cylinder so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the same feeders, a radially movable cam at the entrance to the tucking track for opening and closing this track, said cam being adapted to be rendered operative periodically for operation on those jacks which, after division, would be otherwise caused to follow the tucking track, so that further movement is imparted to said instrumentalities to cause the corresponding needles to take up a clearing position instead of a tucking position, another radially movable cam provided beyond and at a higher level than the first mentioned radially movable cam and adapted to be rendered operative periodically for action upon the jacks operated by said first mentioned radially movable cam so that the corresponding needles are transferred to the opposite cylinder, and a vertically movable cam disposed adjacent to the upwardly diverted ends of the tucking and non-knitting tracks, said cam being adapted to be rendered operative periodically for action at predetermined times on those jacks which, after division, take the non-knitting track, so that said jacks are operated to cause the corresponding needles to take up either a tucking or a clearing position and for action at other times upon all of the jacks in the plain cylinder so that the associated needles are caused to clear and knit.

13. A multiple feeder circular knitting machine comprising, in combination, superposed rotary

plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, means for transferring needles from one cylinder to the other, cam boxes associated with the needle cylinders, the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles corresponding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, an obliquely disposed patterning unit located at the entrance to the tucking and non-knitting tracks, said unit being adapted for action selectively on the jack butts for dividing the jacks so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the feeders, a cam in advance of said patterning unit whereby all of the jacks are positioned at a common level, i. e. the level of the non-knitting track, and, in association with the appropriate cam box, means for action periodically upon all the jacks in the plain cylinder for the purpose of causing the corresponding needles to clear and knit.

14. A multiple feeder circular knitting machine comprising, in combination, superposed rotary plain and rib needle cylinders, double-ended needles slidable in said needle cylinders, sliders in the cylinders for operating said needles, jacks each having a butt thereon provided under the needle operating sliders in the plain cylinder, means for transferring needles from one cylinder to the other, cam boxes associated with the needle cylinders, said boxes having therein knitting cam systems including stitch cams and the cam box associated with the plain cylinder having associated therewith tucking and non-knitting tracks for reception of the said butts on the slider operating jacks, said tracks being provided between feeders and disposed one above the other in parallel relation and extending horizontally for the major portions of their lengths but at the far end (in relation to the direction of rotation of the needles) being upwardly diverted, the height of the horizontal portion of the upper (tucking) track being such that needles corresponding with jacks having their butts in this track are disposed at a non-knitting height but at the upwardly diverted end the height being such that the jacks caused to pass along the track are raised to position the corresponding needles at tucking height whereas the upwardly diverted end of the lower track reaches a height at which jacks caused to pass along this track are raised to position the corresponding needles at a non-knitting height, means at the entrance of the tucking and non-knitting tracks for dividing the jacks in the plain cylinder so that prearranged jacks are caused to take the tucking track and the remainder the non-knitting track, whereby the corresponding needles are caused to take up tucking and non-knitting positions respectively at the same feeders, means in association with the appropriate cam box for action periodically upon all the jacks in the plain cylinder for the purpose of causing the corresponding needles to clear and knit and, in the plain knitting cam system, movable cam means to enable the needle operating sliders to assume a non-knitting position when required after leaving the stitch cam.

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