Dec. 21, 1965 V. LUCHI 3,224,226

NEEDLE SELECTION DEVICE

Filed July 11, 1962 4 Sheets-Sheet 1

Fig.1

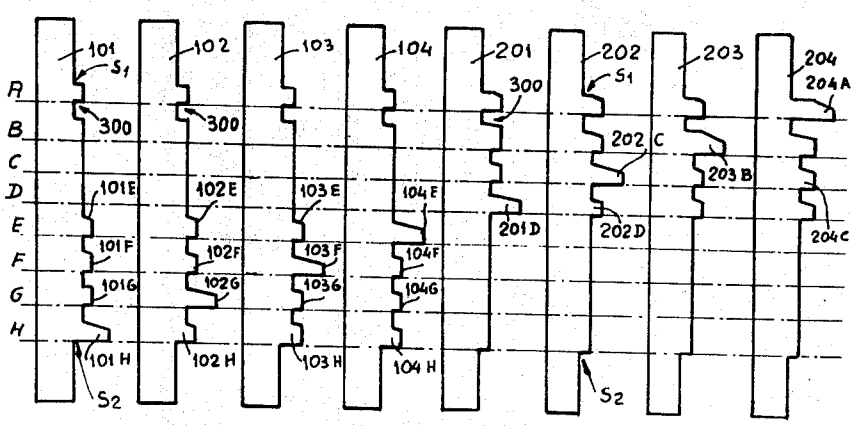


Fig. 2

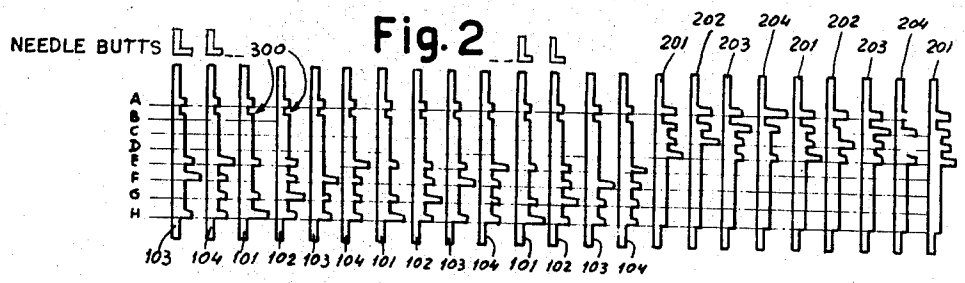


Fig. 4

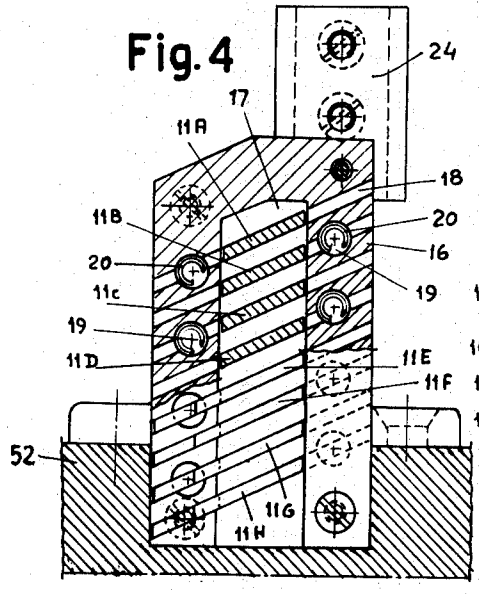
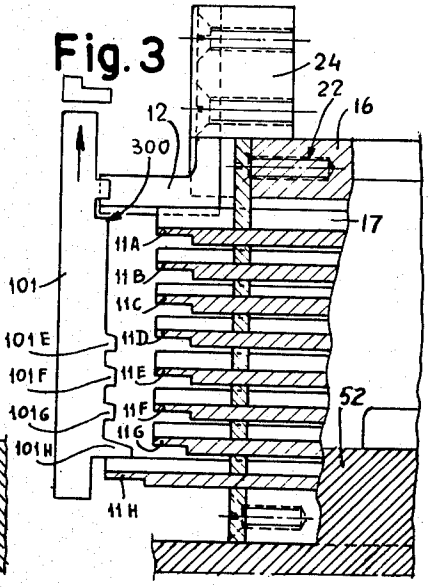


Fig. 3



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NEEDLE SELECTION DEVICE

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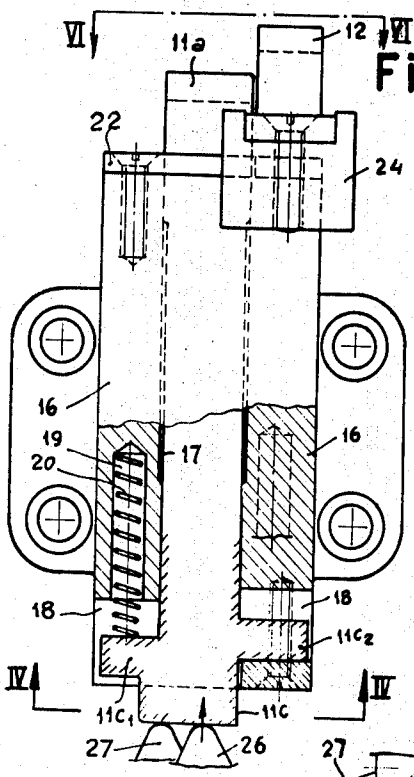


Fig. 5

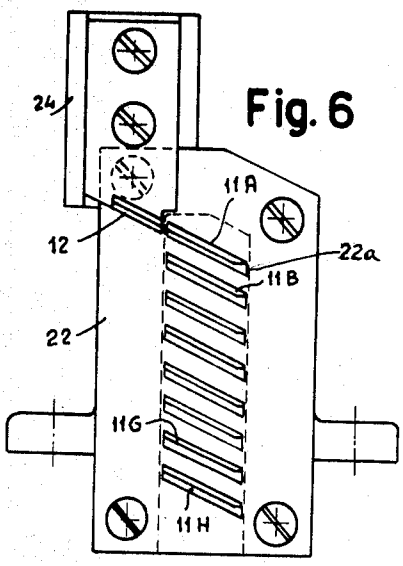


Fig. 6

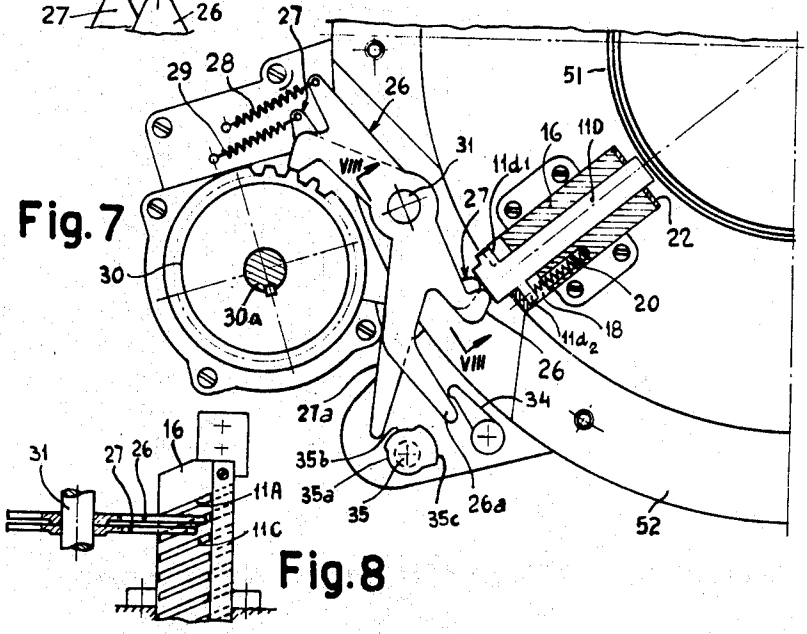


Fig. 7

Fig. 8

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NEEDLE SELECTION DEVICE

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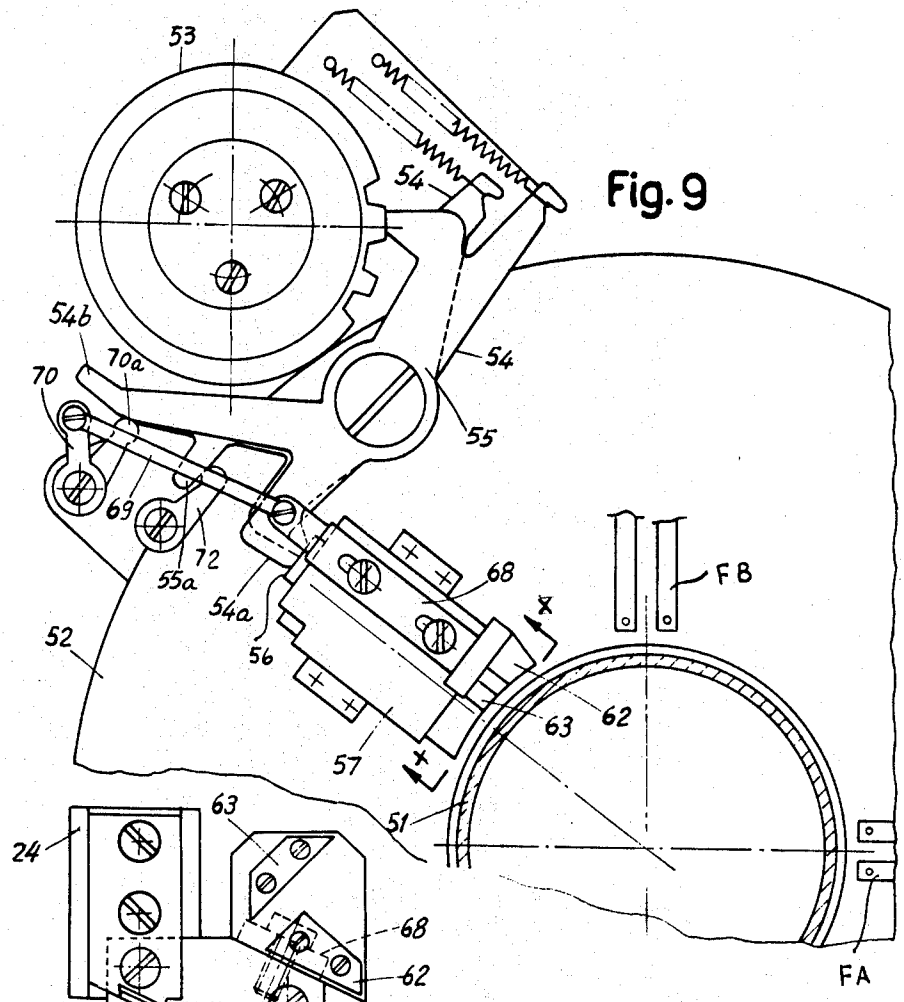


Fig. 9

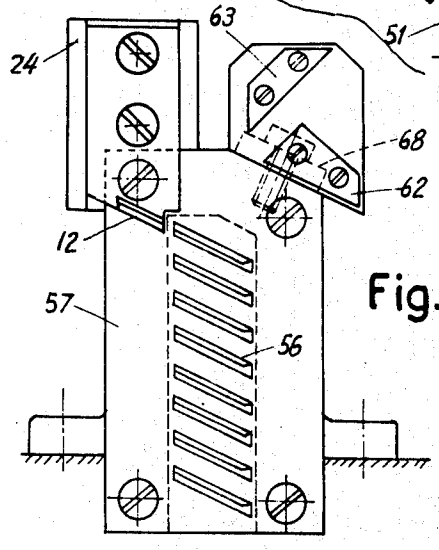


Fig. 10

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NEEDLE SELECTION DEVICE

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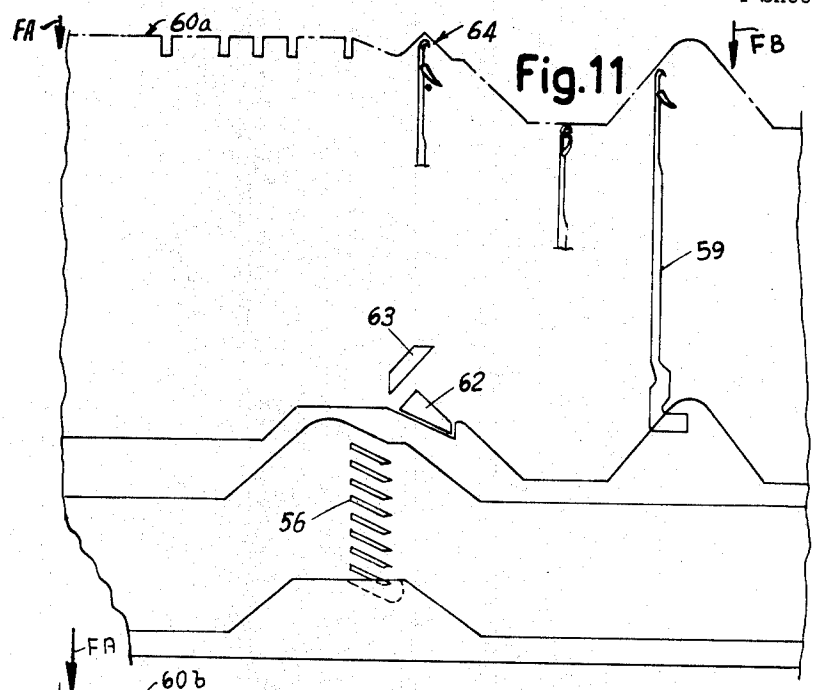


Fig.11

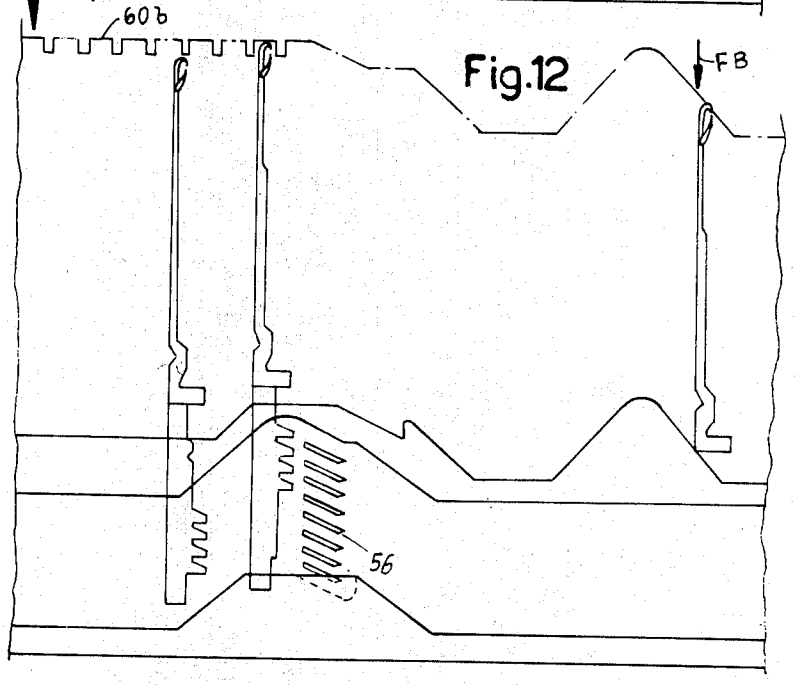


Fig.12

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3,224,226

NEEDLE SELECTION DEVICE

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Filed July 11, 1962, Ser. No. 209,116
Claims priority, application Italy, July 17, 1961, 13,435/61; Oct. 10, 1961, 18,597/61
9 Claims. (Cl. 66—50)

The present invention relates to a selective control device for the jacks and needles of a knitting machine, particularly a circular knitting machine of the type in which a rotary needle cylinder is provided with grooves in which the neeedles and corresponding jacks are mounted for sliding movement.

In the apparatus of the invention, the jacks are controlled to form patterns including tuck stitches and other patterns.

In the preferred embodiment of the invention, the jacks have butts disposed at eight circumferential levels. A first group of four jacks has butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks has butts at four other adjacent levels located along a second circumferential arc. Each group of jacks has shorter butts of the same length at the respective four adjacent levels, and each jack of each group has one longer butt. The longer butts are located at different levels and cause the formation of tuck stitches by the respective needles. Selected butts of the shorter butts can be omitted, or removed for forming a selected pattern different from the tuck stitch pattern.

Preferably, eight slider cams are provided which are inclined to the axis of the needle cylinder and to the horizontal levels along which the butts of the jacks are located. The slider cams are mounted on a stationary support for movement between a retracted position and an operative position for engaging the butts at corresponding levels, and since the slider cams are inclined, the respective jacks are raised and raise the corresponding needles.

Rotary cams control cam followers which act on the slider cams to advance the same to operative positions located in the paths of movement of the butts of the jacks, and the cam followers can be controlled to cause movement of the slider cams to positions cooperating with the longer butts, or with the shorter butts, respectively.

The shorter butts permit the forming of very different patterns since different shorter butts can be removed for producing different patterns. The longer butts, which serve to form tuck stitches, must not be omitted or removed.

In the preferred embodiment of the invention, the operative slider cams do not fully raise the jacks, but each jack has a recess at the uppermost level, and a shoulder of the recess engages, if the corresponding jack is raised by a slider cam, a stationary cam following the slider cams in the direction of rotation of the needle cylinder. The stationary cam is inclined and raises every jack which was raised by a slider cam to a higher level so that the corresponding needle is raised as required by the pattern.

If a jack is not engaged and raised by a slider cam, the recess remains below the level of the stationary cam so that the respective jack and needle are not raised at all.

In a modified embodiment of the invention, two feeding stations for feeding yarn to the needles are provided for each selecting station at which slider cams are located. In this embodiment, additional ascending and descending cams are provided which permit a rapid raising and lowering of the needles directly before the corresponding jack moves to a position cooperating with the slider cams. These additional cams are mounted on slides, and are

advanced to an operative position by the standard pattern control device of the knitting machine to cause the knitting of a course of plain stitches of yarn fed at the auxiliary feeding station before the needle forms a pattern under the control of the slider cams and jacks of yarn fed at the main feeding station.

The invention will be best understood with reference to the following description of the accompanying drawings in which:

FIG. 1 is a diagrammatic view illustrating first and second groups of four jacks;

FIG. 2 is a diagrammatic developed view illustrating a plurality of jacks arranged along a circumferential arc of the needle cylinder;

FIG. 3 is a sectional view illustrating a stationary frame supporting slider cams cooperating with a jack, the needle cylinder being omitted for the sake of simplicity;

FIG. 4 is a view in the direction of the arrows IV in FIG. 5 and partially in cross section;

FIG. 5 is a plan view of the structure shown in FIGS. 3 and 4, partially in horizontal section;

FIG. 6 is an elevation viewed in the direction of the arrow VI in FIG. 5;

FIG. 7 is a fragmentary plan view of the apparatus on a reduced scale, and partially in a horizontal section;

FIG. 8 is a fragmentary sectional view taken on line VIII—VIII in FIG. 7;

FIG. 9 is a fragmentary plan view illustrating a modified embodiment of the invention;

FIG. 10 is an elevation as view in the direction of the arrows X—X in FIG. 9;

FIG. 11 is a schematic developed view showing the position of auxiliary cams and including a diagram illustrating the needle operations; and

FIG. 12 is a schematic developed view illustrating the control of the needles by slider cams and jacks, and including a diagram illustrating the needle operations.

Referring now to the drawings, and more particularly to FIG. 1, eight jacks are shown which are provided with butts at eight different levels A to H. The first group of jacks **101** to **104** is located along a circumferential arc of the needle cylinder, and a second group of jacks **201** to **204** is located along an adjacent arc. Jacks **101** to **104** have butts only at the levels E to H, while jacks **201** to **204** have butts only at the levels A to D. The butts are designated in FIG. 1 by the reference numeral of the respective jack and by one of the letters from A to H for representing the respective level. Each jack has three short butts and one long butt, the long butts being disposed at different levels. For example, the long butts **101**H, **102**G, **103**F and **104**E are located at the levels H to E, and the long butts **201**D, **202**C, **203**B, **204**A are located at the levels D to A. Each jack has a recess **300** provided with a shoulder at the level A. Recesses **300** of jacks **201** to **204** are located under the corresponding butts provided at this uppermost level.

The short butts of the jacks are removable, and one butt is omitted in every second jack in the arrangement of jacks shown in FIG. 2.

A set of slider cams **11**A to **11**H is mounted on a stationary frame block **16** for movement in substantially radial direction toward the needle cylinder **51**, as best seen in FIG. 7, in order to cooperate with the butts of the jacks which are mounted in axial grooves of the needle cylinder. A slider cam is provided at each level A to H. If a slider cam is partly advanced, it will cooperate with a long butt of a jack, and if a slider cam is fully advanced it will cooperate with a short butt of a jack. As clearly shown in FIGS. 4 and 5, the slider cams are plates inclined to the horizontal levels A to H, and consequently, a jack whose butt engages the

upper surface of a stationary slider cam in its operative position will slide up the inclined top surface of the respective slider cam while the jack rotates with the rotating needle cylinder whereby the jack, and the needle above the same are raised. However, the slider cams **11A** to **11H** are capable of only partly lifting the jacks and the needles to the required height. In order to complete the lifting of the jacks and of the corresponding needles, a stationary inclined cam **12** is provided, whose position is best seen in FIG. 6. The stationary cam **12** is inclined at the same angle as the slider cams, and forms a continuation of the uppermost slider cam **11A**. However, the stationary cam **12** projects farther toward the needle cylinder, as best seen in FIG. 3, and cooperates with a shoulder of recess **300**.

If none of the butts of a jack is engaged by slider cam, the recess remains in a position which is so low that it passes under the stationary cam **12**. If any jack is lifted by one of the slider cams **11A** to **11H**, the shoulder of recess **300** is placed at the level of the stationary cam **12**, and engaged by the same during further turning of the respective jack with the rotary needle cylinder. The stationary cam **12** raises the jack higher than the slider cam so that the respective needle is raised to the desired position since the upper end of the jack engages the lower end of the needle in the same groove of the needle cylinder.

Since the shoulder of recess **300** is located at the uppermost level A, the lower edges of the corresponding butts of jack **201** to **204** form continuations of this shoulder, as shown in FIG. 1.

In order to produce a tuck stitch pattern, the slider cams of groups **11A** to **11D**, or **11E** to **11H**, respectively, are cyclically advanced toward the needle cylinder according to the type of fabric which is to be made, considering that the slider cams are to be advanced only so far as to act on the long butts, one of which is provided in each group of four adjacent jacks, and one at each level of the respective four levels. For example, if four slider cams **11E** to **11H** have cooperated with the long butts **101H** to **104E**, they are arranged in a new order in accordance with the pattern while passed by the following group of jacks **201** to **204** which have no butts at the levels E to H.

In order to obtain a pattern which is different than can be obtained by the long butts only, the slider cams are farther advanced toward the needle cylinder so as to cooperate with the short butts of the jacks. Selected short butts are omitted, or removed, and for example may be sheared off. In the arrangement of FIG. 2, the short butt of jack **103** at the level G is missing, as are butts **101F**, **103E**, **101F**, **103G**, **101F**, **103E**, and so on so that at each of the levels A to H, butts are omitted in a certain sequence from every second jack.

By removing selected short butts, and by using the maintained long butt, very varied patterns can be made with only eight butts on each jack. Multiple patterns can be obtained in this manner, even patterns representing the letters of the alphabet.

The jacks have two narrower end portions, and a wider center portion between the shoulders S_1 and S_2. Recess **300** is formed in the wider center portion, and the butts project from the wider center portion.

The control and operation of the slider cams **11A** to **11H** will be best understood with reference to FIGS. 3 to 8. The frame block **16** has a central cavity **17** between lateral walls in which short slots **18** are provided near the outer ends of the slider cams. Slots **18** are inclined, and each pair of slots **18** is located in a common plane, as best seen in FIG. 4. Each slider cam has a pair of lateral projections $11C_1$ and $11C_2$, which are guided in a pair of slots **18**, see FIG. 5, so that the main portion of each slider cam is inclined and located in the plane of the respective pair of slots **18**, as best seen in FIG. 4. Bores **19** are provided at the levels of the slots **18** alternately on opposite sides of the slider cams and house springs **20** which act on the lateral projections of the slider cams to urge the same outwardly and away from the needle cylinder and the jacks.

The inner end of the cavity **17** in frame block **16** is closed by a plate **22** which is secured by screws to frame block **16**. Plate **22** has inclined slots **22***a*, see FIG. 6, in which the respective sliders cams **11A** to **11H** are guided near the inner ends thereof at levels corresponding to the levels of the respective slots **18**.

The stationary inclined cam **12** is mounted on a support **24** which is secured by screws to frame block **16**. The ends of the slider cams are tapered as indicated at **11***a* and **11***c* in FIG. 5 so that the end portions **11***a* have sufficient room in the spaces between adjacent butts of the jacks.

The slider cams are actuated against the action of springs **20** to move toward the jacks by pairs of cam follower levers **26** and **27** which engage the outer end of each slider cam under the action of springs **28** and **29**. Each cam follower lever is operated by corresponding rotary circular cam against which the respective cam followers are pressed by springs **28**, **29** which overcome the action of springs **20**. A shaft **31** supports all cam follower levers **26**, **27** for angular movement. An assembly of coaxial circular cams **30** is driven by a shaft **30***a* so that cams **30** control cam follower levers **26**, **27** and thereby actuate the corresponding slider cams. Stop means are provided for excluding either cam follower levers **26** or cam follower levers **27** from the operation. A stop arm **34** can be secured in a position which prevents movement of cam follower lever **26** under the action of spring **28** for advancing a slider cam even if the recess in the corresponding cam **30** would permit such movement. Stop means **34** in the illustrated stop position engages an arm **26***a* of cam follower lever **26**.

Another stop member **35** is turnable between three positions in which three peripheral portions **35***a*, **35***b* and **35***c*, respectively, cooperate with the arm **27***a* of lever **27**. When stop portion **35***c* is operative, lever **27** cannot move under the action of spring **29**. When stop portion **35***b* is operative, follower lever **27** can move a certain distance corresponding to the movement of the respective slider cam to a position cooperating with the long butts of the jacks. The lowest portion **35***a* permits turning of lever **27** to a position fully advancing the respective slider cam to a position cooperating with the short butts of the jacks.

FIG. 8 clearly shows that a pair of cam follower levers **26**, **27** cooperate with each slider cam. Eight pairs of cam follower levers **26**, **27** are provided for eight slider cams **11A** to **11H** so that a set of eight cam follower levers **26** and a set of eight cam follower levers **27** are provided, the cam follower levers of each set alternating with the cam follower levers of the other set.

Referring now to FIGS. 9 to 12, which illustrate a modified embodiment, the general arrangement of the slider, cams, jacks, rotary cams, and cam follower levers corresponds to the arrangement described with reference to FIGS. 3 to 8. A needle cylinder **51** is surrounded by stationary support frame **52**. A frame block **57** supports the slider cams **56**, and a support **27** supports the stationary cam **12** at the level of the uppermost slider cam. A main feeding station FA, and an auxiliary feeding station FB are provided for each selecting station constituted by a set of slider cams, the corresponding sets of cam follower levers **54** and **55**, and rotary cams **53**. The ends of a pair of cam follower levers **54**, **55**, for example the end portion **54***a*, cooperates with the outer end of each slider cam **56**. The slider cams **56** cooperate with butts on the jacks under the control of cam follower levers **55** or **54**, respectively, to produce a tuck stitch pattern as described with reference to FIGS. 3 to 8, when cooperating with the long butts, and another pattern when cooperating with the short butts.

A yarn is generally fed only at the main feeding station FA, so that the needles **59** operated by the jacks under the control of slider cams **56** assume the positions indicated by the diagrammatic line **60***b* in FIG. 12 to form a tuck stitch pattern. The path of the needles under the control of the short butts is indicated at **60***a* in FIG. 11. In the embodiment of FIGS. 9 to 12, the yarn of the auxiliary feeding station FB is also used for the pattern, so that plain stitches can be made of yarn fed at feeding station FB while the needles move from the auxiliary feeding station FB to the selecting station where the slider cams **56** are located.

An auxiliary ascending lifting cam and an auxiliary descending lowering cam **63** are provided and operable during the knitting of the pattern to influence the path of the needles as indicated at the point **64** in FIG. 11. The needle is raised and lowered again directly before being selected by a slider cam, and the respective jacks reach the slider cams when the needles have already been lowered. The following pattern is formed by yarn from the feeding station FA under the control of the slider cams as described above. In this manner, the slider cams determine the pattern independently of the plain stitch fabric formed of the yarn supplied by the auxiliary feeding station FB. Actually, the pattern is knitted with two yarns supplied by feeding station FA, one of the yarns being located higher and caught by the needles moving to the highest position, while the other yarn is located lower and is caught by the higher moving needles and by the needles which do not reach the highest position.

In the embodiment illustrated in FIGS. 9 and 10, cams **62** and **63** are mounted on a slide **68** which is mounted on frame block **57** for sliding movement in radial direction, and is operated by connecting rod **69** and crank **70** under the control of the pattern control device of the knitting machine, not shown, in the usual manner. Crank member **70** has an arm **70***a* cooperating with a projecting arm **54***b* of cam follower levers **54** to inactivate the same when cams **62, 63** are withdrawn and inoperative.

A stop member **72**, corresponding to stop member **34** of FIG. 7, cooperates with projecting arms **55***a* of cam follower levers **55** to prevent the knitting of a tuck stitch pattern when a different pattern is desired.

It will be understood that the drawings illustrate only preferred embodiments of the invention by way of example, and that various modifications of the invention are possible without departing from the scope of the appended claims.

I claim:

1. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, a first group of four jacks having butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks having butts at four other adjacent levels located along a second circumferential arc, each group of jacks having short butts of the same length at the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuckstitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern; a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams, said cam follower means including two sets of eight cam follower levers, respectively; a shaft supporting said cam follower levers and being parallel to said axis of said needle cylinder, the cam follower levers of each set alternating with the cam follower levers of the other set, each cam follower lever being controlled by a corresp.onding rotary cam, two adjacent cam follower levers of said two sets controlling the same slider cam for shifting the same between said positions; and means for preventing operation of said slider cams by all the cam follower levers of each set.

2. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, each jack having a wider center portion and two narrower end portions and a pair of shoulders between said center portions and said narrower end portions, one of said shoulders being located at one of said levels, a first group of four jacks having on said center portion butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks having on said center portion butts at four other adjacent levels located along a second circumferential arc, each group of jacks having short butts of the same length at the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern; a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams; and means for selectively disconnecting said rotary cams and said cam follower means from said slider cams so that the respective jacks are not operated.

3. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, each jack having a wider center portion and two narrower end portions and a pair of shoulders between said center portions and said narrower end portions, one of said shoulders being located at one of said levels, a first group of four jacks having on said center portion butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks having on said center portion butts at four other adjacent levels located along a second circumferential arc, each group of jacks having short butts of the same length at the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern; a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the

corresponding levels for lifting the respective jacks and needles; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams, said cam follower means including two sets of eight cam follower levers, respectively; a shaft supporting said cam follower levers and being parallel to said axis of said needle cylinder, the cam follower levers of each set alternating with the cam follower levers of the other set, each cam follower lever being controlled by a corresponding rotary cam, two adjacent cam follower levers of said two sets controlling the same slider cam for shifting the same between said positions; and means for preventing operation of said slider cams by all the cam follower levers of each set.

4. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at a selected number of circumferential levels, a first group of jacks having butts at adjacent levels located along a first circumferential arc, and a second group of jacks having butts at other adjacent levels located along a second circumferential arc, each jack of said first group having a recess at the uppermost level of the second group, each group of jacks having short butts of the same length at the respective adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, a stationary structure including a support; slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; a stationary cam at said uppermost level of said recesses and being inclined to said level and to the axis of said needle cylinder for engaging said recesses of each jack operated by one of said slider cams for rising the respective jack to a higher level; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams; and means for selectively disconnecting said rotary cams and said cam follower means from said slider cams so that the respective jacks are not operated.

5. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, a first group of four jacks having butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks having butts at four other adjacent levels located along a second circumferential arc, each jack of said first group having a recess at the uppermost level of the second group, each group of jacks having short butts of the same length at the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern, a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; a stationary cam at said uppermost level of said recesses and being inclined to said level and to the axis of said needle cylinder for engaging said recesses of each jack operated by one of said slider cams for rising the respective jack to a higher level; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams; and means for selectively disconnecting said rotary cams and said cam follower means from said slider cams so that the respective jacks are not operated.

6. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, a first group of four jacks having butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks having butts at four other adjacent levels located along a second circumferential arc, each jack of said first group having a recess at the uppermost level of the second group, each group of jacks having short butts of the same length at the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern; a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; a stationary cam at said uppermost level of said recesses and being inclined to said level and to the axis of said needle cylinder for engaging said recesses of each jack operated by one of said slider cams for rising the respective jack to a higher level; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams, said cam follower means including two sets of eight cam follower levers, respectively; a shaft supporting said cam follower levers and being parallel to said axis of said needle cylinder, the cam follower levers of each set alternating with the cam follower levers of the other set, each cam follower lever being controlled by a corresponding rotary cam, two adjacent cam follower levers of said two sets controlling the same slider cam for shifting the same between said positions; and means for preventing operation of said slider cams by all the cam follower levers of each set.

7. A circular knitting machine as set forth in claim 5 and including a main feeding station, and an auxiliary feeding station; a slide operable parallel to said slider cams and mounted on said structure; control means for shifting said slide to and from an operative position; a lifting cam and a lowering cam mounted on said slide and being positioned so as to operate the needles before said jacks operate said needles under the control of said slider cams and adapted to cause formation of a course of plain stitches of yarn fed by said auxiliary feeding station before said needles form a pattern under the control of said jacks.

8. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axially extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, a first group of four jacks having butts at four adjacent levels located along a first circumferen-

tial arc, and a second group of four jacks having butts at four other adjacent levels located along a second circumferential arc, each group of jacks having short butts of the same length at the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern; a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams, said cam follower means including two sets of eight cam follower levers, respectively; a shaft supporting said cam follower levers and being parallel to said axis of said needle cylinder, the cam follower levers of each set alternating with the cam follower levers of the other set, each cam follower lever being controlled by a corresponding rotary cam, two adjacent cam follower levers of said two sets controlling the same slider cam for shifting the same between said positions; spring means acting on said cam follower levers to urge the same toward said rotary cams; and control stop means cooperating with said cam follower levers of each of said sets to prevent selected follower cam levers from actuating the respective slider cams.

9. In a circular knitting machine, in combination, a rotary needle cylinder having an axis and axailly extending grooves; needles disposed in said grooves for sliding movement; jacks mounted in said grooves for lifting said needles, said jacks having butts disposed at eight circumferential levels, a first group of four jacks having butts at four adjacent levels located along a first circumferential arc, and a second group of four jacks having butts at four other adjacent levels located along a second circumferential arc, each group of jacks having short butts of the same length in the respective four adjacent levels, and each jack of each group having one long butt, said long butts being located at different levels and adapted to cause the formation of tuck stitches by the respective needles, selected butts of said short butts being adapted to be omitted for forming a selected pattern different from the tuck stitch pattern; a stationary structure including a support; eight slider cams inclined to the axis of said needle cylinder and to said levels, and mounted on said support at said levels, respectively, for movement between a retracted position and an operative position for engaging said butts at the corresponding levels for lifting the respective jacks and needles; an assembly of coaxial rotary cams supported on said structure for turning movement about an axis parallel to said axis; cam follower means controlled by said rotary cams and respectively acting on said slider cams, said cam follower means including two sets of eight cam follower levers, respectively; a shaft supporting said cam follower levers and being parallel to said axis of said needle cylinder, the cam follower levers of each set alternating with the cam follower levers of the other set, each cam follower lever being controlled by a corresponding rotary cam, two adjacent cam follower levers of said two sets controlling the same slider cam for shifting the same between said positions; spring means acting on said cam follower levers to urge the same toward said rotary cams; first control stop means cooperating with said cam follower cams of one of said sets and having a position for preventing the same from actuating the respective slider cams; and second control stop means having two stop portions and being movable between an inoperative position and two operative positions in which said stop portions are respectively effective and cooperate with said cam follower levers of the other set to prevent in one position actuation of the respective slider cam and in another position full advance of the respective slider cams.

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