April 27, 1965 W. H. IMBODEN ETAL 3,180,114

PATTERN MEANS FOR KNITTING MACHINES

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Fig. 1

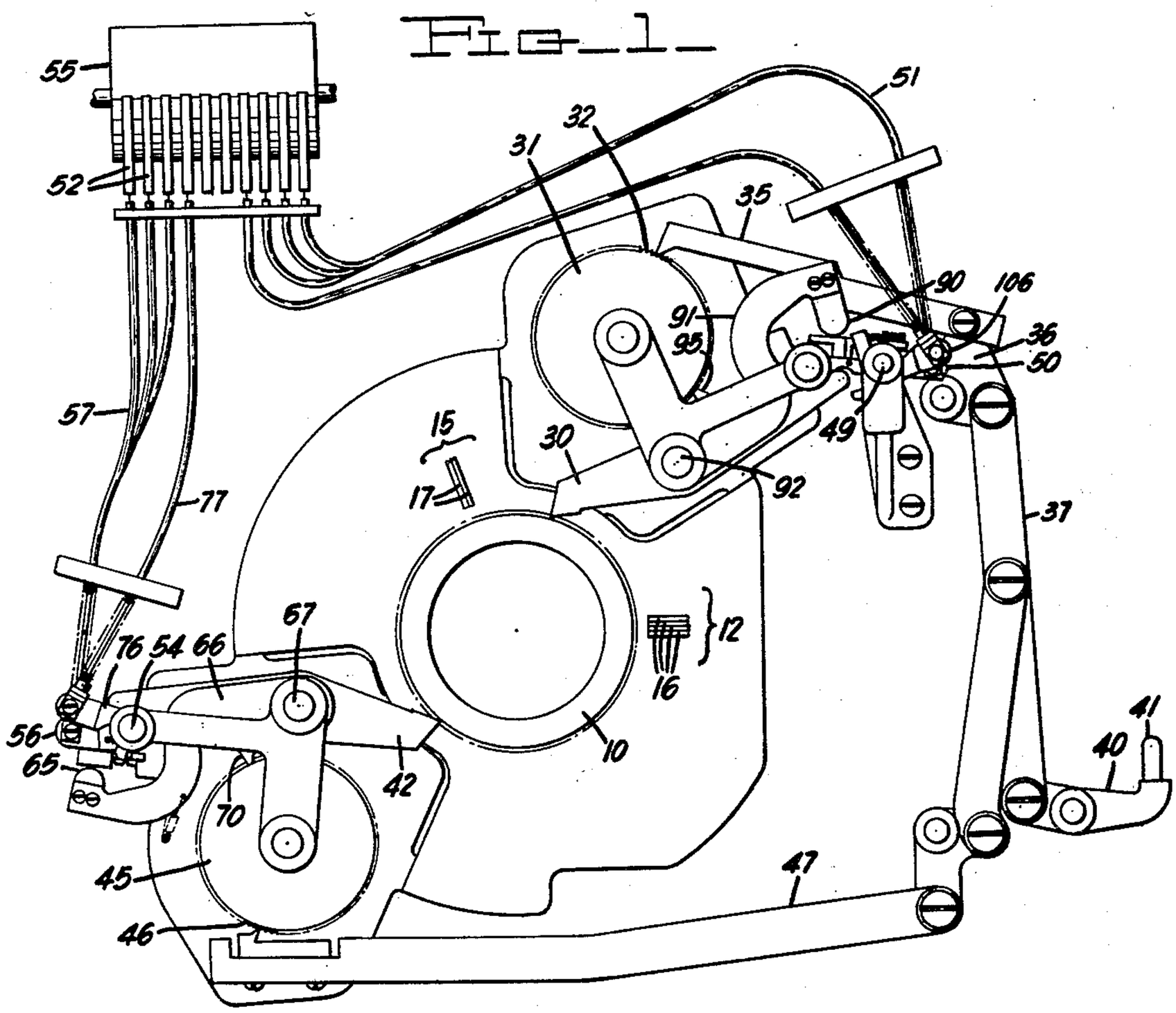
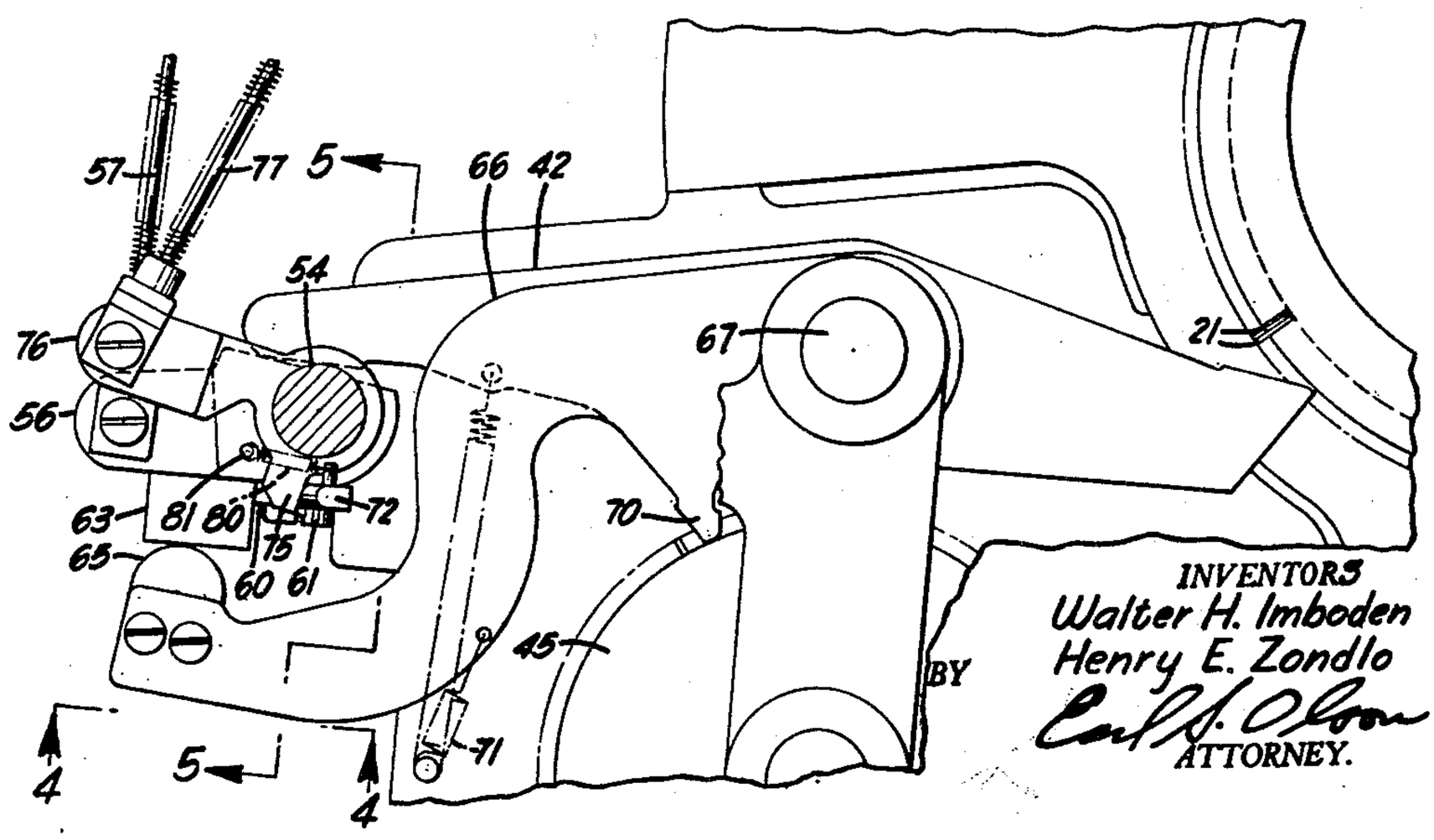


Fig. 2



INVENTORS
Walter H. Imboden
Henry E. Zondlo
BY
ATTORNEY.

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FIG 3

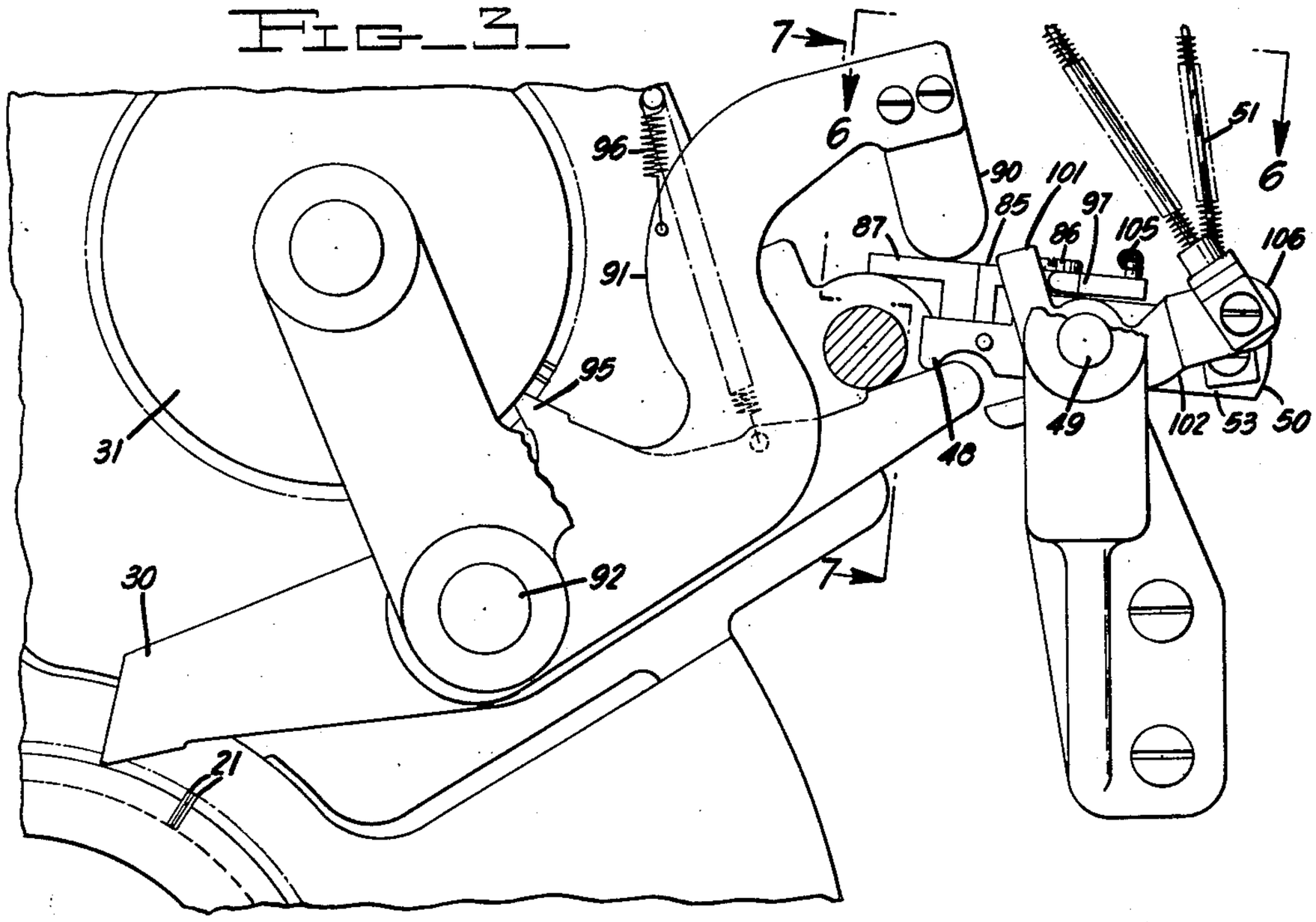


FIG 4

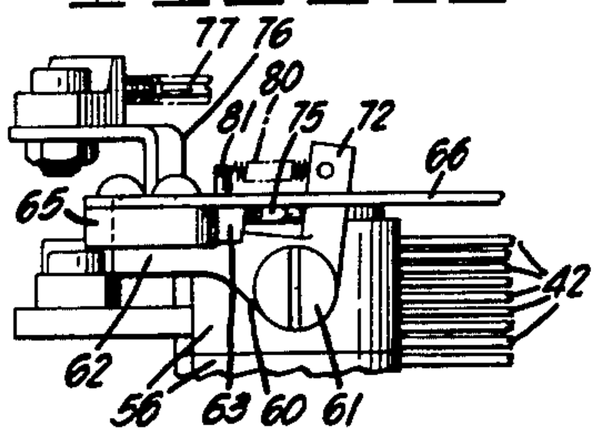


FIG 5

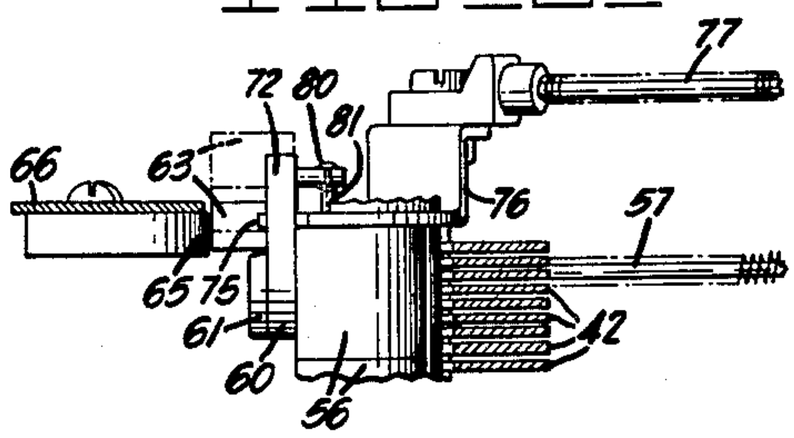


FIG 6

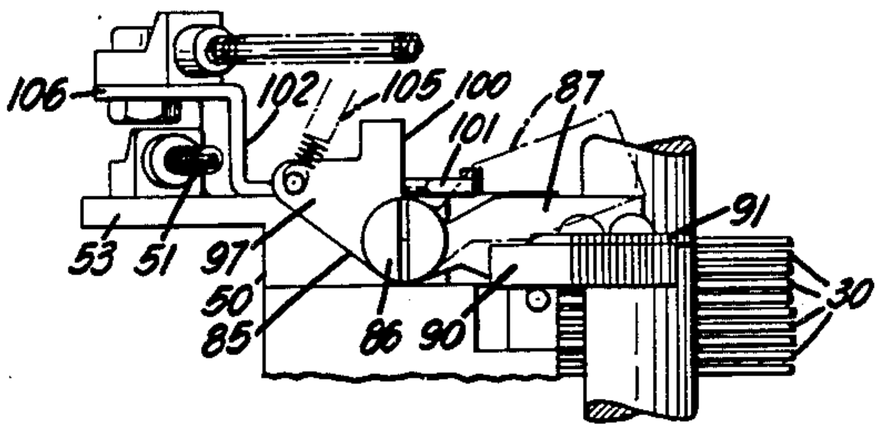
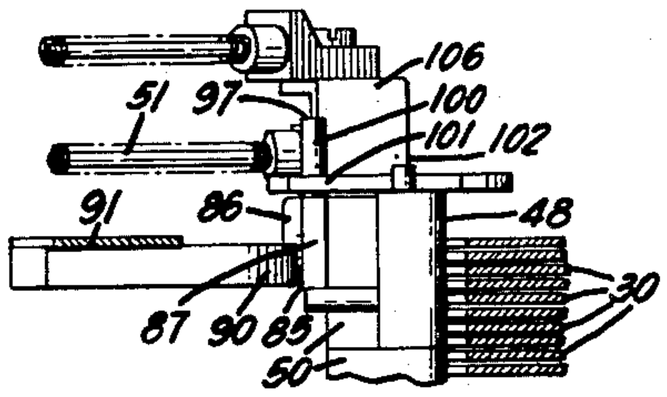


FIG 7



INVENTORS
Walter H. Imboden
Henry E. Zondlo

BY Earl A. Cloon
ATTORNEY.

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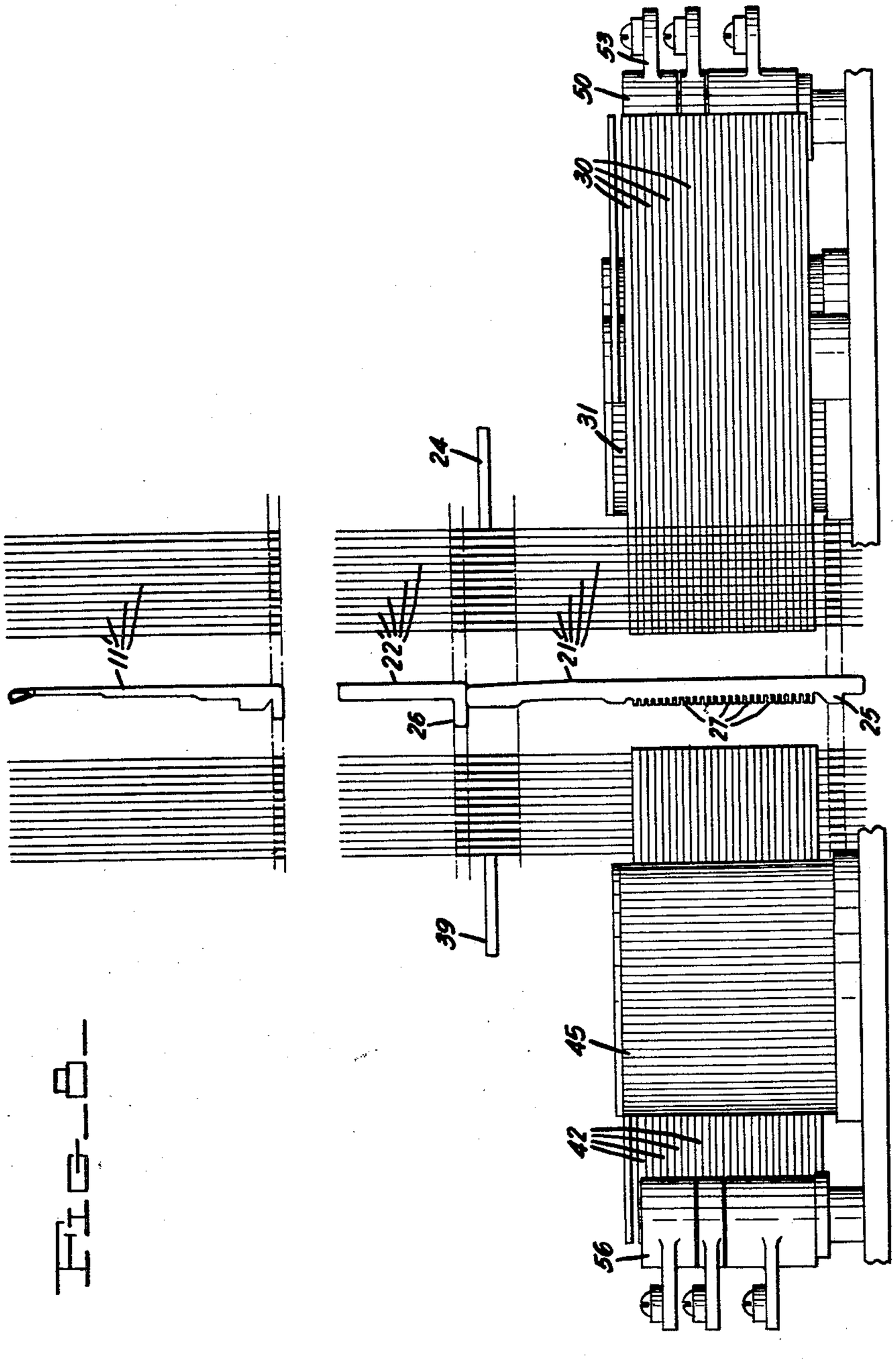

Fig. 8

INVENTORS
Walter H. Imboden
Henry E. Zondlo
BY Earl S. Olson
ATTORNEY.

United States Patent Office

3,180,114

Patented Apr. 27, 1965

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3,180,114

PATTERN MEANS FOR KNITTING MACHINES

Walter H. Imboden, Midvale Manor, and Henry E. Zondlo, Lincoln Park, Pa., assignors to Textile Machine Works, Wyomissing, Pa., a corporation of Pennsylvania

Filed May 3, 1962, Ser. No. 192,241

7 Claims. (Cl. 66—50)

This invention relates to improvements in circular knitting machines and more particularly to the needle selecting means of such machines for forming ornamental stitch designs in tubular stocking fabrics knitted thereon.

In circular knitting machines adapted for both single and multifeed operation, means are provided for feeding yarns to and for operating the needles at the feed stations during rotary operation to form run-down portions of stocking fabrics and during reciprocatory operation to form heel and toe portions of the stockings. The machines are also provided with means for selectively controlling the operations of the needles to form various types of design stitches such as tuck stitches, float stitches and tuck and float stitches in the run-down portions of the stockings having both ornamental and run-resisting characteristics. The means for this purpose commonly comprises pattern jacks and pattern devices for selectively controlling the operation of the jacks, the pattern devices having selector levers which are divided into separate groups each of which is adapted to control the selection of the jacks to form one of the design stitch formations in a particular portion of the stocking fabric. The operation of the pattern devices and the operation of the separate groups of selector levers is controlled from a main pattern drum, one move of the pattern drum being required to start the pattern devices and activate the desired group of selector levers and another move of the pattern drum being required to again inactivate the pattern devices and group of selector levers.

Inasmuch as the number of moves of the pattern drum is limited usually to twenty-four and the drum must control all of the machine operations necessary to form a stocking fabric, and since most of the available drum moves are required to control the operations necessary to form the welt and foot of the stocking, some of the operations required to activate and again inactivate each different group of selector levers at the start and end of its patterning function must be arranged to occur during pattern drum moves used to control other machine operations. Where it may also be desired to interrupt the design pattern in spaced courses of the fabric formed by a particular group of selector levers by momentarily moving this group of selector levers to inactive position and then again returning it to active position to resume the design pattern, unless the additional operations of the group of selector levers required for this purpose can also be correlated in drum moves as they are normally arranged to control the various machine operations, they cannot be made.

It is therefore an object of the invention to provide means in a circular knitting machine for overcoming the above and other difficulties in the operation of the means for forming design stitches in tubular knitted fabrics such as stockings and the like.

A further object of the invention is the provision of means in a circular knitting machine for forming design stitch patterns in tubular fabrics knitted on the machine, and means for controlling the operation of the design stitch forming means including a first means for activating and inactivating the design stitch forming means and a second means for activating and inactivating the design stitch forming means after it has been activated by the first means, the second means being in part controlled by the first means and in part by the design stitch forming means.

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Another object of the invention is the provision of means in a circular knitting machine for forming design stitch patterns in tubular knitted stockings which means includes pattern jacks associated with the needles of the machine, selecting means including a group of selector levers acting on the jacks, a member associated with the group of selector levers, a main control means for operating the member to move the group of selector levers between active and inactive positions, and additional means for operating the member to move the group of selector levers between active and inactive positions after it is activated by the member through the main control means, the additional means being controlled in part by the main control means and in part by the selecting means.

With these and other objects in view, which will become apparent from the following detailed description of the illustrative and practical embodiment of the invention shown in the accompanying drawings, the invention comprises the novel elements, features of construction and combination of parts in cooperative relationship as hereinafter more particularly pointed out in the claims.

In the drawings:

FIGURE 1 is a top plan view of a portion of a multifeed circular knitting machine having mechanism according to the invention applied thereto:

FIG. 2 is a view of a portion of FIG. 1 shown on an enlarged scale;

FIG. 3 is a view of a further portion of FIG. 1 shown on an enlarged scale;

FIG. 4 is a view of mechanism according to the invention associated with one of the feeds of the machine taken in the direction of the arrows 4—4 of FIG. 2;

FIG. 5 is a view taken substantially along the line and in the direction of the arrows 5——5 of FIG. 2, certain parts being shown in elevation and other parts being shown in section;

FIG. 6 is a view similar to FIG. 4 of the mechanism associated with another feed of the machine taken in the direction of arrows 6—6 of FIG. 3;

FIG. 7 is a view taken along the line and in the direction of the arrows 7—7 of FIG. 3, certain parts being shown in elevation and other parts being shown in section; and

FIG. 8 is a view diagrammatically illustrating the needles and associated jacks together with the jack selecting means associated with each of the feeds of the machine.

Referring to FIG. 1 of the drawings there is shown a slotted cylinder 10 for a circle of independently operated latch needles 11 the butts of which are acted on by cams to operate the same at main and auxiliary knitting stations, indicated generally at 12 and 15, respectively, of a multistation circular machine for knitting fabrics such as for hosiery. The cams for operating on the butts of the needles at the main and auxiliary stations are not shown in detail herein but may be the same as those shown in a co-pending application of Benjamin Franklin Coile, Serial No. 98,872, filed March 28, 1961. The cams at the main station direct the needles along paths to take and knit yarn fed thereto by fingers 16 in both forward and reverse directions of rotation of the cylinder, and the needles after being raised to latch clearing level at the auxiliary station are directed by the cams at the latter station along a path to take and knit yarn fed thereto by fingers 17 only in the forward rotations of the cylinder all in the manner set forth in said Coile application.

The means for raising the needles 11 to latch clearing level at the auxiliary station 15 includes pattern jacks 21 (see FIG. 8) which are conventionally of the rocking

type and which act through intermediate jacks 22, there being a pattern jack and an intermediate jack in the cylinder for each of the needles. Each pattern jack 21 has a lower lug 25 adapted for engagement with a raising cam (not shown) when the lower ends of the jacks are rocked outwardly through engagement of a presser cam indicated diagrammatically at 24 in FIG. 8 with upper portions of the jacks. The presser cam is moved by pattern means from inactive to active position in which it will engage and rock the jacks 21 to position the lower lugs for engagement with the raising cam. Following a raising movement of the pattern jacks 21 intermediate jacks 22 and needles 11 the jacks are again moved to their lowermost positions by a cam (not shown) acting on butt portions 26 of the intermediate jacks.

The pattern jacks are also adapted to be controlled so that selected ones thereof are raised by the raising cam to raise associated needles to latch clearing level while other needles remain at a low or tucking level for the purpose of forming design stitch formations in the courses formed at station 15. For so selecting the pattern jacks they are provided with breakable butts 27 adapted to be engaged by selector levers 30 to again move the lower lugs 25 on the jacks 21 out of the path of the raising cam after the jacks have been rocked outwardly by the presser cam 24. Hence the jacks on which the butts 27 are unbroken are acted on by the selecting levers 30 while those jacks having butts removed engage and are raised by the raising cam to in turn raise their associated needles to clearing level as hereinbefore set forth. The selector levers 30 are controlled and operated by a trick drum 31 (FIGS. 1, 3 and 8) having ratchet teeth 32 thereon which are engaged by a pawl 35 connected to a pivoted lever 36. The lever 36 is connected by a link 37 to a lever 40 which is operated by a lever indicated at 41 in FIG. 1. The lever 41 is adapted to be oscillated during each rotation of the cylinder 10 to in turn operate the pawl 35 to advance the trick drum for each selection of the selector levers 30 from a constantly operating part of the machine and the lever 41 may be idled to in turn idle the trick drum 31 by means not shown herein but which is conventional in circular machines.

Means are also provided for selectively controlling movement of the needles 11 at station 12 through the jacks 21 and 22 in the same manner as at station 15 for the purpose of forming design stitches in the courses knit at station 12. The means for this purpose includes a raising cam (not shown) for raising the jacks 21, a presser cam 39 similar to the cam 24, a cam (not shown) acting on the butts 26 of the jacks 22 for lowering these jacks and the jacks 21 raised by the raising cam, and selector levers 42 acting on the butts 27 on the jacks in the same manner and for the same purpose as selector levers 30, as above set forth. The selector levers 42 are controlled and operated by a trick drum 45 which is provided with ratchet teeth 46 (FIG. 1) engaged and operated by a pawl 47 connected to the link 37 to advance the trick drum during each rotation of the cylinder 10 in the same manner as trick drum 31.

In forming a stocking fabric on the machine the portions of the stocking knit during rotary operation of the machine are formed at both stations 12 and 15. The welt of the stocking is commonly formed of plain stitches, the afterwelt is provided with lace designs usually in the form of float stitch patterns and the leg portion of the stocking is provided with tuck stitch patterns. In forming the different stitch patterns, the arrangement of the pattern butts 27 on the jacks 21 for each of the patterns may be formed in the same group of butt levels on all of the jacks 21 so that a group of selector levers 42 acting at station 12 and a corresponding group of selector levers 30 at station 15 acting on the same pattern butts form complete courses of the pattern at each station. Likewise the butts on the jacks controlling the formation of the design pattern in one half of the cylinder may be arranged at one group of levels for selection at one station and the butts on the jacks in the other half of the cylinder may be arranged in another group of levels for selection at the other station.

The different groups of selector levers 30 are moved between active and inactive positions by levers 50 pivotally mounted on a shaft 49 (FIGS. 1 and 3) each of the levers 50 having an arm 48 at one side of the shaft 49 engaging a group of the selector levers and a second arm 53 at the other side of the shaft being connected by a Bowden wire 51 to one of a group of pattern levers 52 controlled and operated by a pattern drum 55. The different groups of selector levers 42 are also moved between active and inactive positions by levers 56 pivotally mounted on a shaft 54 (FIGS. 1 and 2), each of which is connected by a Bowden wire 57 to one of the group of pattern levers 52. Each of the levers 50 and 56 is operated by a movement of the drum 55 to activate its associated group of selector levers and by a second movement of the drum to again inactivate the group of selector levers.

In the known machine described above the pattern drum 55 is operated through a predetermined number of moves, usually twenty-four, constituting a complete rotation of the drum during which all of the machine functions required to form a complete stocking are instituted. Since the majority of the drum moves are required to control the various machine functions in forming the welt and foot portions of the stocking some of the additional operations necessary to move the different groups of selector levers between active and inactive positions to perform their required function must be timed to occur during the drum moves controlling other machine functions. Where a variation in the design pattern formed by any one of the groups of selector levers may be desired which would require additional operations of this group of selector levers between active and inactive positions, unless such additional operations can be timed to occur in the normal drum moves, they cannot be made.

In accordance with the instant invention the lever 56, associated with the group of selector levers 42 controlling the operation of the jacks and needles at station 12 to form the design pattern in the leg of the stocking, after being moved by the drum 55 to activate this group of selector levers, is adapted to be operated to inactivate the group of levers to interrupt the design pattern in spaced portions of the leg and then to again activate the selector levers to resume the design pattern without additional moves of the pattern drum 55. For this purpose there is provided a lever 60 which is pivotally mounted on a stud 61 secured to the lever 56 (FIGS. 4 and 5). One arm 62 of the lever 60 has a block-like projection 63 adapted at times to be engaged by a nose portion 65 of a lever 66 pivotally mounted on a pin or shaft 67 fixed in position on the machine and constituting the supporting means for the selector levers 42. The lever 66, which is mounted on the shaft 67 immediately above the selector levers 42, is provided with a follower portion 70 adapted to read the butt pattern at one butt level on the trick drum. A spring 71 connected between the lever 66 and a fixed part of the machine biases the follower portion 70 toward the trick drum (FIG. 2).

Lever 60 is also provided with a vertically extending tail portion 72 adapted to engage a lug 75 projecting from a lever 76 pivotally mounted on the shaft 54 above the lever 56. The lever 76 is connected by a Bowden wire 77 to one of the pattern levers 52 operated by the drum 55. A spring 80 connected between the tail 72 of lever 60 and a pin 81 on the lever 56 tends to hold the tail in engagement with lug 75.

Normally when the group of selector levers 42 is to be held in inactive position the lever 56 associated therewith is turned clockwise from its position of FIG. 2 by a cam on the pattern drum 55. The lever 76 is turned counterclockwise by the drum 55 from its position of FIG. 2 to turn the lever 60 clockwise from its position of

FIG. 4 to raise the projection 63 on the lever 60 to the inactive dot-and-dash position indicated in FIG. 5 above the path of movement of the nose portion of the lever 66. When the group of selector levers is to be activated the lever 56 is turned to its position of FIG. 2 by the pattern drum and with the lever 76 remaining in position to hold the projection 63 in inactive position above the nose 65 of the lever 66, the group of selector levers will be in continuous operation to form the design pattern dictated by the trick drum 45. At this time the lever 66 is also operated by the trick drum to idly move the nose 65 thereof back and forth beneath the raised inactive projection 63. When it is desired to interrupt the design pattern, the lever 76 is moved to its position of FIG. 2 and the lever 60 is turned to its position of FIGS. 4 and 5 by the spring 80 to place the projection 63 in alignment with the nose 65 of the lever 66. Thereupon engagement of the follower portions 70 of the lever 66 with blank spaces on the trick drum permits the lever 56 to remain in its position of FIG. 2 and the selector levers 42 in jack selecting position. On the other hand, engagement of the follower portion 70 with butts on the trick drum 45 turns the lever 66 clockwise and the nose 65 of the lever 66 acting through the projection 63 turns the lever 56 to move the group of selector levers to inactive position. The spaces and butts on the trick wheel are so arranged as to move the group of selector levers to inactive position to interrupt the formation of the design pattern for selected courses and then permit the levers to return to active position to resume the design pattern at predetermined intervals without advancing the pattern drum. When the design pattern is again to be formed without interruption the pattern drum acts to move the lever 76 counterclockwise to raise the projection 63 on the lever 60 out of the path of movement of the lever 66 and although the latter continues to be moved by the spaces and butts on the trick drum as above set forth, such movement will not be transmitted to the lever 56 and the group of selector levers 42 will remain in active position to select the jacks according to the pattern dictated by the butt patterns on the trick drum 45.

When the design pattern or a portion thereof is also formed at station 15 and it is also desired to interrupt the formation of the pattern at this station in the same manner as above set forth in connection with station 12, the lever 50 after being moved by the pattern drum 55 to activate the group of selector levers 30, is also adapted to be moved by the trick drum 31 to inactivate and activate the selector levers 30. For this purpose a lever 85 is mounted for pivotal movement on a stud 86 carried on the lever 50 (FIGS. 3, 6 and 7). An arm 87 of the lever 85 is in sliding engagement with the arm 48 of the lever 50 and the lever 85 is adapted to be turned about the stud 86 at times to move the arm from a raised inactive position to an active position shown in FIGS. 6 and 7 in which the arm lies in the path of movement of a nose portion 90 formed on a lever 91. The lever 91, which is similar to lever 66, is pivotally mounted on a pin or shaft 92 carried in fixed position to the machine and constituting the mounting means for the selector levers 30. The lever 91 is mounted on the shaft 92 immediately above the selector levers and has a follower portion 95 adapted to read the butts at one butt level on the trick drum 31. A spring 96 connected between the lever 91 and a fixed part of the machine (FIG. 3) biases the follower portion 95 toward the trick drum.

Lever 85 has a second arm 97 provided with a vertically extending surface 100 adapted for engagement with one arm 101 of a lever 102 mounted on the shaft 49 above the lever 50. A spring 105 (FIG. 6) connected between the arm 97 and a fixed part of the machine tends to turn the lever 85 to maintain the surface 100 in engagement with the arm 101 of the lever 102. Lever 102 is provided with a second arm 106 which is connected by a Bowden wire to one of the pattern levers 52.

Normally the lever 50 is turned counterclockwise from its position of FIG. 3 by the pattern drum 55 to inactivate the group of selector levers 30 associated therewith and the lever 102 is moved clockwise from its position of FIG. 3 by the pattern drum to raise the arm 87 of lever 85 to inactive position, as indicated in dot-and-dash outline in FIG. 6, above the path of movement of the nose 90 of the lever 91. When the group of selector levers 30 is to be activated the lever 50 is turned to its position of FIG. 3 by the pattern drum which permits the selector levers to read the butt pattern on the trick drum to select the jacks in forming the design pattern. At this time if it is desired to continue the design pattern without interruption the lever 102 remains in its clockwise position to maintain the arm 87 in raised inactive position out of the path of movement of the nose 90 of the lever 91 as it follows the butt pattern on the trick wheel 31 without affecting the operation of the group of selector levers. When however, it is desired to interrupt the design pattern the lever 102 is turned to its position of FIG. 3 by the drum 55 and the lever 85 is moved to the full line position of FIGS. 6 and 7 to lie in the path of the lever 91 whereupon movement of lever 91, as controlled by the butt pattern associated therewith on the trick wheel, will move lever 50 between active and inactive positions to interrupt and restart the design pattern according to the desired sequence.

It will be apparent from the foregoing that in addition to the usual pattern drum means for controlling the movement of a group of jack selector levers between inactive and active positions at one knitting station or similar groups of selector levers at each of a plurality of knitting stations, the mechanism of the invention provides an additional means for repeatedly moving the same groups of selector levers between active and inactive positions to interrupt the design pattern formed thereby, the latter means acting independently of and without additional moves of the pattern drum means after the groups of selector levers are initially moved to active position by the pattern drum means.

It will be understood that the improvements specifically shown and described by which the above results are obtained, can be changed and modified in vairous ways without departing from the invention herein disclosed and hereinafter claimed.

What is claimed is:

1. In a circular knitting machine having a knitting station, a cylinder adapted for movement relative to said station, a circle of needles in said cylinder, means for feeding yarns to said needles at said station to form knitted fabric, and means for selectively operating said needles to form design stitches in said fabric including a jack associated with each of said needles, selector levers acting on said jacks, a trick drum for operating said selector levers when in active positions, a member associated with a group of said selector levers, a first means for operating said member to move said group of selector levers between inactive positions and active positions for operation by said trick drum, and a second means for operating said member to move said group of selector levers between active and inactive positions to interrupt the operation of said group of selector levers by said trick drum after said member is operated to move said group of selector levers to active positions by said first means.

2. In a machine according to claim 6 in which said first means for operating said member is controlled and operated by pattern means, and said second means for operating said member includes a first lever which is controlled and operated by said pattern means, and a second lever which is controlled and operated by said trick drum.

3. In a circular knitting machine having a knitting station, a cylinder adapted for movement relative to said

station, a circle of needles in said cylinder, means for feeding yarns to said needles at said station to form knitted fabric, a jack associated with each of said needles, selector levers acting on said jacks, a trick drum for operating said selector levers when in active positions, a member associated with a group of said selector levers, pattern means for controlling the operation of said member to move said group of selector levers between inactive positions and active positions for operation by said trick drum, and additional means for operating said member to move said group of selector levers between active positions and inactive positions to interrupt the operation thereof by said trick drum after said group of selector levers has been moved to active position by said member under the control of said pattern means.

4. In a machine according to claim 3 in which said additional means for operating said member to move said group of selector levers between active and inactive positions includes means in part controlled by said pattern means and in part controlled by said trick drum.

5. In a machine according to claim 3 in which said additional means for operating said member to move said group of selector levers between active and inactive positions includes a second member cooperating with said member, means for moving said second member between active and inactive positions, and a third member cooperating with said second member when said second member is in active position.

6. In a machine according to claim 5 in which said means for moving said second member between active and inactive positions is operated by said pattern means.

7. In a machine according to claim 5 in which said third member is operated by said trick drum.

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RUSSELL C. MADER, *Primary Examiner.*