March 17, 1931. V. LOMBARDI 1,797,006

KNITTING MACHINE

Original Filed Nov. 17, 1928

Fig. 1

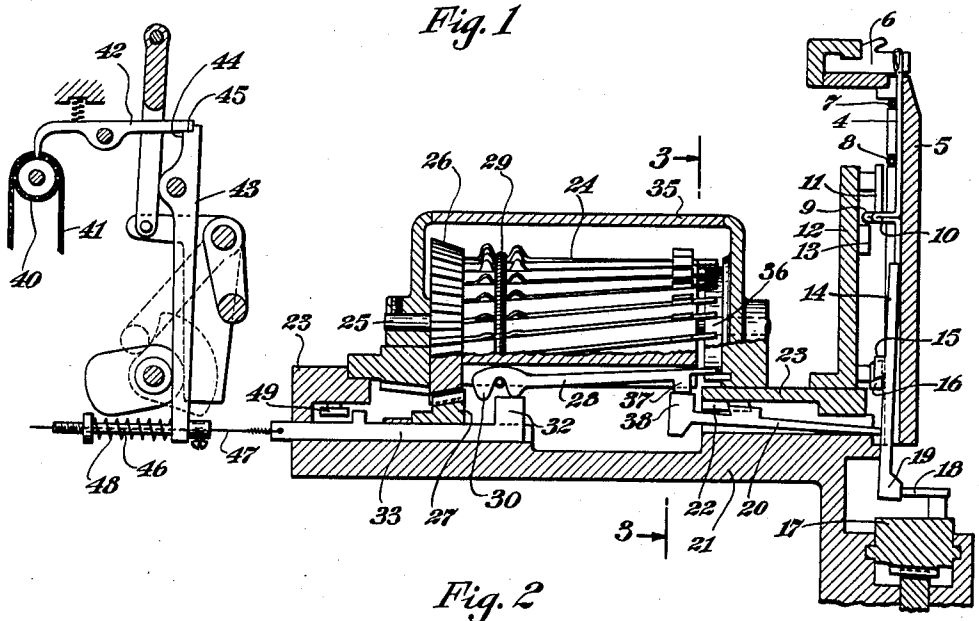


Fig. 2

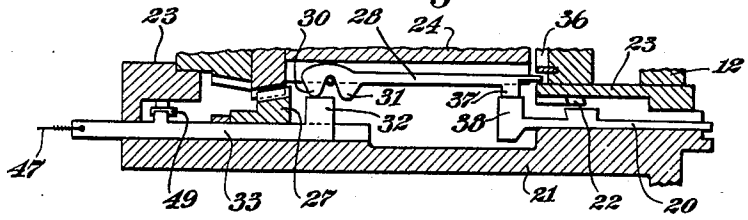
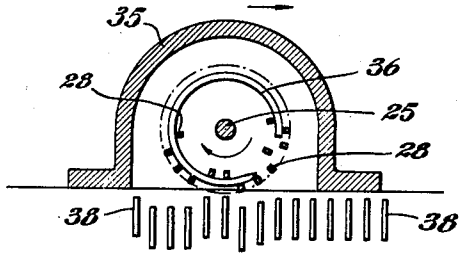


Fig. 3



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UNITED STATES PATENT OFFICE

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KNITTING MACHINE

Original application filed November 17, 1928, Serial No. 320,111. Divided and this application filed March 19, 1930. Serial No. 436,952.

This invention relates to knitting machines and includes certain correlated inventions and discoveries appertaining thereto. It constitutes a division of my application Serial No. 320,111, filed Nov. 17, 1928.

An object of the invention is to provide a knitting machine whereby a large number of varied pattern effects may be readily and economically incorporated into a knitted fabric.

In its more specific aspects, the invention has for an object the provision in a knitting machine of improved pattern control mechanisms arranged to be set periodically in accordance with the configurations presented thereto by a pattern-determining medium, and in response to said setting to impart pattern-controlling actuations to a series of needles.

Another object is to provide an improved type of pattern drum for a knitting machine by means of which the knitting operations of the needles may be more readily controlled.

The invention accordingly comprises the features of construction, combinations of elements, and arrangements of parts, which will be exemplified in the constructions hereinafter set forth and scope of the application of which will be indicated by the appended claims.

For a fuller understanding of the nature and objects of the invention, reference is made to the following detailed description taken in connection with the accompanying drawings, in which—

Fig. 1 represents in cross-section one form of this invention embodied in a knitting machine having cylinder needles;

Fig. 2 is a detail view of a portion of the apparatus of Fig. 1 shown in a different position; and

Fig. 3 is an end view in cross-section of the pattern drum of Fig. 1.

The knitting machine of Fig. 1 is assumed to be of the cylindrical type having a circular row of needles 4 mounted in grooves in the needle cylinder 5. The usual sinkers for the needles are shown at the point 6. Coiled springs 7 and 8 tend to hold the needles in place in their respective grooves. Alternate needles are assumed to have long butts 9, while the remaining needles have short butts 10 in order that the machine if desired may knit the so called interlock fabric described in my U. S. Patent No. 1,541,230. A cam 11 is mounted on the rotatable cam cylinder 12 to retract all needles that are either partially or fully raised. A cam 13 serves to partially raise all needles that are provided with long butts. The raising of the needles to a full knitting position may be performed in a manner now to be described.

Mounted below the needle in each groove of the needle cylinder is a needle jack 14. Each jack 14 has a butt 15 which is actuated by a cam 16 to raise those jacks which during the passage of the cam 16 are thrust outwardly from the needle cylinder so that the butt 15 lies in the path of the cam 16. The arrangement is such that cam 16 will not contact with butt 15 of any jack which lies along the bottom of its groove in the needle cylinder.

Mounted beneath the stationary needle cylinder 5 is a rotatable cam ring 17 on which is mounted a cam 18 which is adapted to periodically contact with portion 19 of each jack and thrust each jack outwardly so that the jack butt 15 lies in the path of cam 16. In Fig. 1 the jack 14 is shown in its outward position. After the passage of cam 18 means are provided for restoring certain of the jacks 14 to the inward positions in the grooves of the needle cylinder.

A plurality of slidable jacks 20 are provided in grooves in the stationary plate 21 which surrounds the needle cylinder. These jacks 20 are radially disposed and there is a jack 20 for each needle jack 14. When the jacks 20 are raised at their ends remote from the needle cylinder they are actuated by a rotating cam 22 to assume an inward position thereby driving the vertical jacks 14 out of the path of cam 16. The subsequent passage of cam 18 serves to restore jacks 20 to their original position remote from the needle cylinder. Pattern means now to be described are provided for determining whether or not

each horizontal jack 20 will be actuated by cam 22.

Mounted on a rotating plate 23 surrounding the needle cylinder is a pattern drum 24 supported by an axle 25 whereby the drum rotates around its own axis in response to its bodily movement around the needle cylinder. The rotation of the drum is secured by a crown 26 at one end of the drum and a stationary tooth rack 27 mounted for cooperation therewith.

The outer surface of the drum 24 is provided with a plurality of spaced longitudinal grooves, arranged therein in a slightly angular fashion with respect to the axle located in each groove is a unitary slidable element 28, suitably pivoted near its end away from the needle cylinder. Thus a coiled spring 29 passing between the two projections 30 and 31 of each element may serve as a pivoting means. The elements 28 may be held in the slots by friction, being bent for example so as to contact with both sides of the slot, so that each element will hold a definite position until positively actuated. The two projections on each element are adapted to be actuated by a projection 32 on a corresponding horizontal jack 33 mounted in a groove in the stationary plate 21, depending on whether projection 32 is under portion 30 or portion 31. The contact of projection 32 with portions 30 or 31 occurs when the said portions have reached the lowermost point of their path of rotation and hence the end of each element 28 adjacent the needle cylinder is adapted to be thrown inwardly or outwardly depending on whether projection 32 contacts with portion 31 or 30. Fig. 2 shows projection 32 in contact with the portion 30 of pivoted element 28.

Mounted on the side of the housing 35 and hence not rotating with the drum 24 is an annular ring shaped member 36 which however has its two ends separated a short distance at a position corresponding to the point where each pivoted element 28 will be thrown inwardly or outwardly by jack 33. The effect of this incomplete ring 36 is that certain of the pivoted elements 28 will have their ends bearing against the outside of ring 36 and other elements 28 will have their ends bearing against the inside of ring 36 during the rotation of the drum around the needle cylinder and will continue in such relative positions until the drum passes over the jacks 33 for a new pattern setting. This is illustrated clearly in Fig. 3 where some of the jacks 28 are inside ring 36 and some are outside.

After a particular pivoted member 28 has had its end moved outside of ring 36, the further rotation of the pattern drum 24 causes cam surface 37 on said member 28 to contact with the cam surface 38 of the outer end of a corresponding jack 20, thereby forcing the said jack 20 downwardly out of the path of cam 22. It will be noted from Fig. 3 that any element 28 placed inside ring 36 by jack 33 will upon further rotation of the drum be free of any control of its related jacks 20, so that the jacks corresponding to those elements 28 inside the ring will be actuated by cam 22.

It is of course to be understood that there is a jack 20 for each needle so that the jacks 20 are spaced around the entire needle cylinder. If we assume that there are three hundred of the jacks 20, the drum 24 may for example contain thirty of the pivoted elements 28. This therefore would mean that during the movement of drum 24 around the needle cylinder each element 28 would control ten of the jacks 20 uniformly spaced around the needle cylinder. It is also to be understood that most of the apparatus just described would be necessary for every yarn carrier of the machine. Thus properly spaced for each yarn carrier would be suitable needle cams 11 and 13, needle jack cams 16 and 18, actuating cams such as cam 22 for the horizontal jacks 20, and a pattern drum 24, all properly related in their sequence of operation to produce the desired knitting effects.

As previously stated there is a horizontal jack 33 for each element 28 on the pattern drum. It remains to be described how these jacks are given pattern controlling actuations. Mounted on a perforated cylinder 40 rotatable in a suitable step by step manner is a pattern sheet 41 containing pattern configurations such as perforations. A plurality of pivoted levers 42 have fingers which are adapted to pass through the perforations of the pattern, the opposite ends of said levers contacting with other pivoted levers 43 at points 44 or 45 depending upon the presence or absence of a hole in the pattern for each particular lever. Each of the apertured lower ends of the levers 43 is provided with a sleeve 46 to which is attached a wire 47 leading to one of the jacks 33. A stop and a biasing spring 48 tend to pull the jacks 33 towards the levers 43 an amount dependent upon whether lever 42 contacts with point 44 or point 45. A rotating cam 49 serves to periodically advance all the jacks 33 and when the point 45 is in contact with lever 42 each jack remains advanced, but when point 44 is in contact with lever 42 the jacks will be retracted by the spring 48 to place projection 32 in the path of projection 30. For a fuller explanation of the operation of this part of the pattern control apparatus reference may be had to the above cited application Serial No. 320,111.

It will be apparent from the above description in what manner the pattern drum 24 serves to control the needles in accordance with the pattern on pattern sheet 41. The said pattern sheet may of course exert a simi-

lar control on any other pattern drums carried by the machine. Those jacks 14 which are left in their outward position after the passage of the drum 24 will be raised by cam 16 to cause their needles to be raised to a full knitting position independent of cam 13. Those needles with long butts corresponding to jacks 14 that were pushed inwardly under the control of the pattern drum 24, will be raised to interlock position by cam 13; while those needles with short butts corresponding to jacks 14 that were pushed inwardly under the control of the pattern drum 24, will remain lowered. The above however, is merely typical of the varied control that the pattern drum may exercise in the knitting operations of the machine, and other types besides an interlock fabric may be produced.

Certain of the cams of the machine have been only briefly referred to since they do not form a part of the invention claimed herein and may operate in any desired known manner, such as the manner described in detail in my above mentioned patent application. It may also be noted that the projections 38 are periodically raised prior to the passage of the pattern drum by a cam not shown but similar to cam 52 of Fig. 2 of the patent application referred to above.

The above described embodiment is merely typical of a variety of forms the invention may possess without departing in any wise from the spirit of this invention as defined in the appended claims.

The invention claimed is:

1. A knitting machine comprising a pattern drum having diagonally disposed grooves along its outer surface mounted for movement relative to other parts of said machine and rotating in response to said movement, a single unitary element in each of a plurality of said grooves, jacks located in slots in a stationary portion of the machine for contacting with said elements to impart pattern settings to said elements, and other jacks located in slots in a stationary part of the machine and contacting with other portions of said unitary elements for regulating the knitting operations of said machine.

2. A knitting machine comprising a pattern drum having diagonally disposed grooves along its outer surface mounted for movement relative to said machine and rotating in response to said movement, a single pivoted lever in each of a plurality of said grooves, each lever having a length substantially equal to the length of said drum, jacks located in slots on a stationary portion of the machine for contacting with said levers at points on one side of the pivot for each lever to impart pattern settings to said levers, and other jacks located in slots in a stationary portion of the machine and contacting with portions of said levers on the other side of the pivot for each lever for regulating the knitting operations of said machine.

3. A knitting machine comprising a pattern drum mounted for movement with respect to a part of said machine and rotating in response to said movement, said drum having parallel grooves along its outer surface, a pivoted member mounted in each groove, knitting controlling elements controlled by said members, and mounted on a stationary part of said machine, means contacting with each member on one side of its pivoting point for imparting pattern determining actuations thereto, said elements contacting at times with said members on the opposite side of their pivoting points to receive said pattern determining actuations.

4. A knitting machine comprising a pattern drum mounted for movement around said machine and rotating in response to said movement, a plurality of movable elements mounted in slots in said drum, means operating during a portion of the cycle of rotation of said drum for causing said elements to assume either of two positions, and positive means for preventing said elements from assuming the other position during the remainder of the cycle.

5. A knitting machine comprising a pattern drum mounted for movement with respect to said machine and rotating in response to said movement, pivoted elements mounted on said drum, means operating during a portion of a cycle of rotation of said drum for causing said elements to assume either of two positions, and non rotating means for separating the groups of elements in the two positions during the remainder of the cycle.

6. A knitting machine comprising a pattern drum mounted for movement with respect to said machine and rotating in response to said movement, pivoted elements mounted on said drum, means operating during a portion of a cycle of rotation of said drum for causing said elements to assume either of two positions, and an incomplete ring surrounding a part of said drum for separating the groups of elements in the two positions.

7. A knitting machine comprising a pattern drum with its axis horizontally mounted for movement around said machine and rotating in response to said movement, said drum containing diagonally arranged grooves in its outer surface, pivoted elements mounted in said grooves, pattern controlled means for moving one end of each of a plurality of said elements away from the drum surface, while causing the corresponding ends of other elements to remain closely adjacent the drum surface, and a non-rotating ring circumferentially incomplete for maintain-

ing the elements in the two different positions during the major portion of a cycle of rotation of said drum.

8. A knitting machine of the cylinder needle type comprising a pattern drum having its axis at right angles to the axis of said cylinder, said drum being mounted for movement around said cylinder and rotating in response to said movement, pivoted elements mounted on said drum, a circumferentially incomplete ring surrounding said drum, and means for causing certain of said elements to be outside said ring while other elements lie between said ring and said drum.

9. A knitting machine of the cylinder needle type comprising a pattern drum having its axis at right angles to the axis of said cylinder, said drum being mounted for movement around said cylinder and rotating in response to said movement, pivoted elements diagonally mounted on said drum with respect to the axis of said drum, a circumferentially incomplete and non-rotating ring surrounding said drum near one end thereof, a selected point on said drum passing the opening in said ring shortly prior to reaching its lowermost position, and means when said elements are passing said opening for placing portions of certain of said elements inside said ring.

10. A knitting machine comprising a pattern drum having parallel grooves along its outer surface mounted for movement relative to other parts of said machine and rotating in response to said movement, a single unitary element in each of a plurality of said grooves, jacks located in slots in a stationary portion of the machine for contacting with said elements to impart pattern settings to said elements, and slidable elements located in slots in a stationary part of the machine and contacting with other portions of said unitary elements for controlling the knitting operations of said machine.

In witness whereof, I hereunto subscribe my name this fifth day of February, 1930.

VINCENT LOMBARDI.