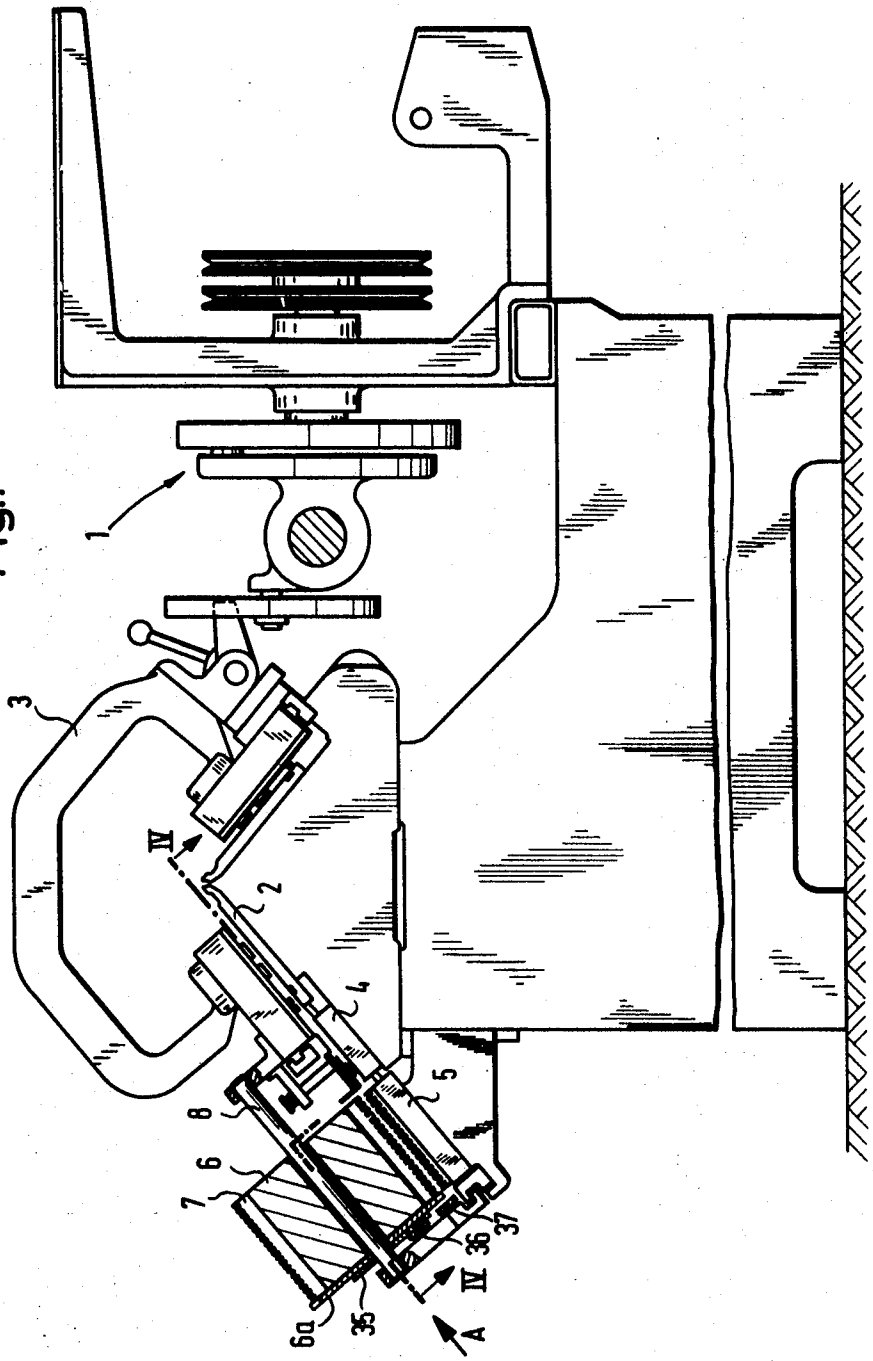
Oct. 12, 1971 E. KRAUSE 3,611,753

# PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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Fig.1




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PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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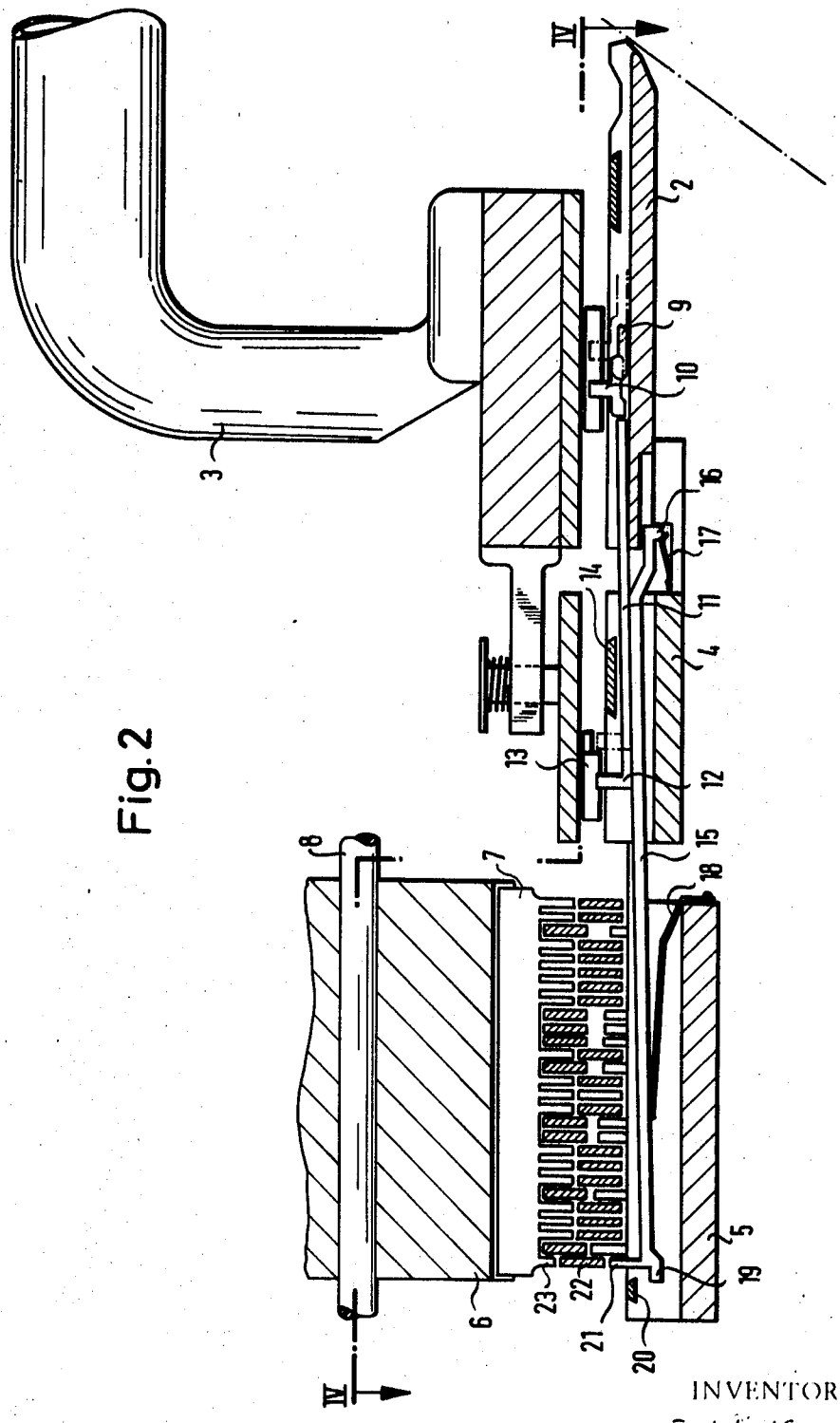



Fig. 2

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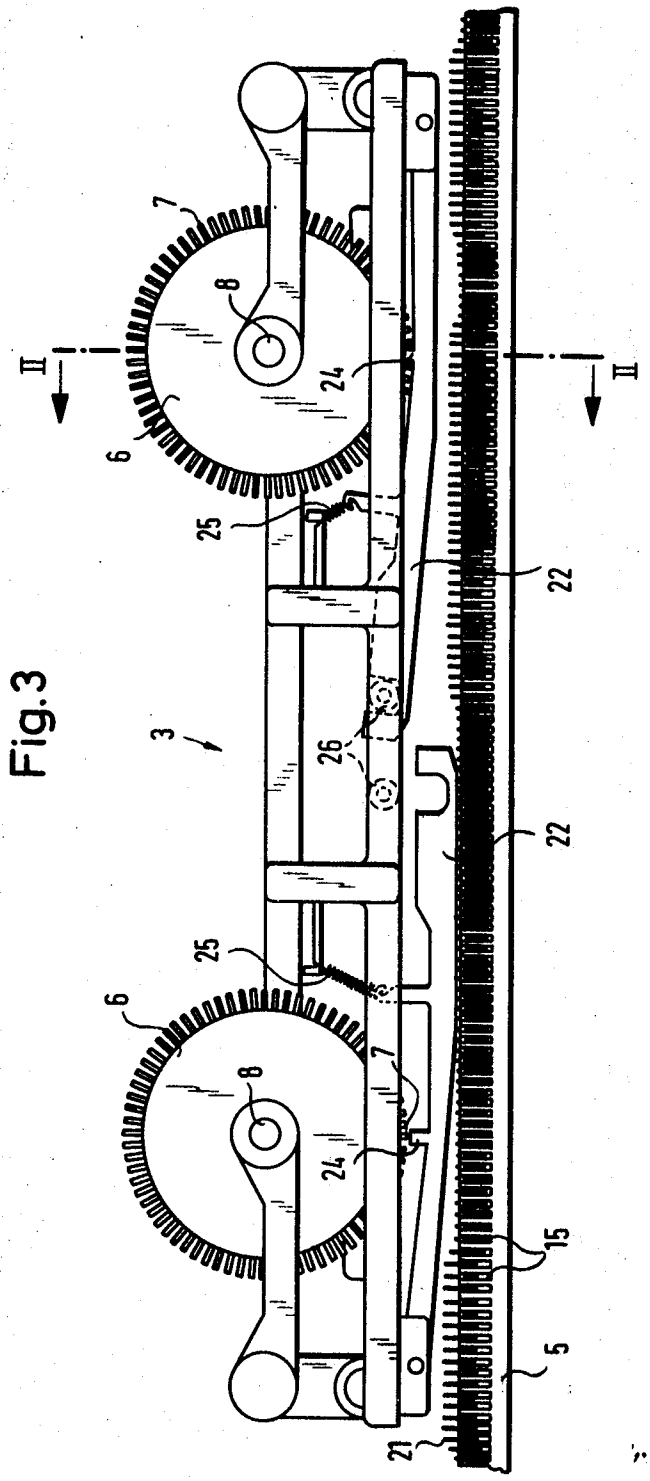
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# PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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Fig.3

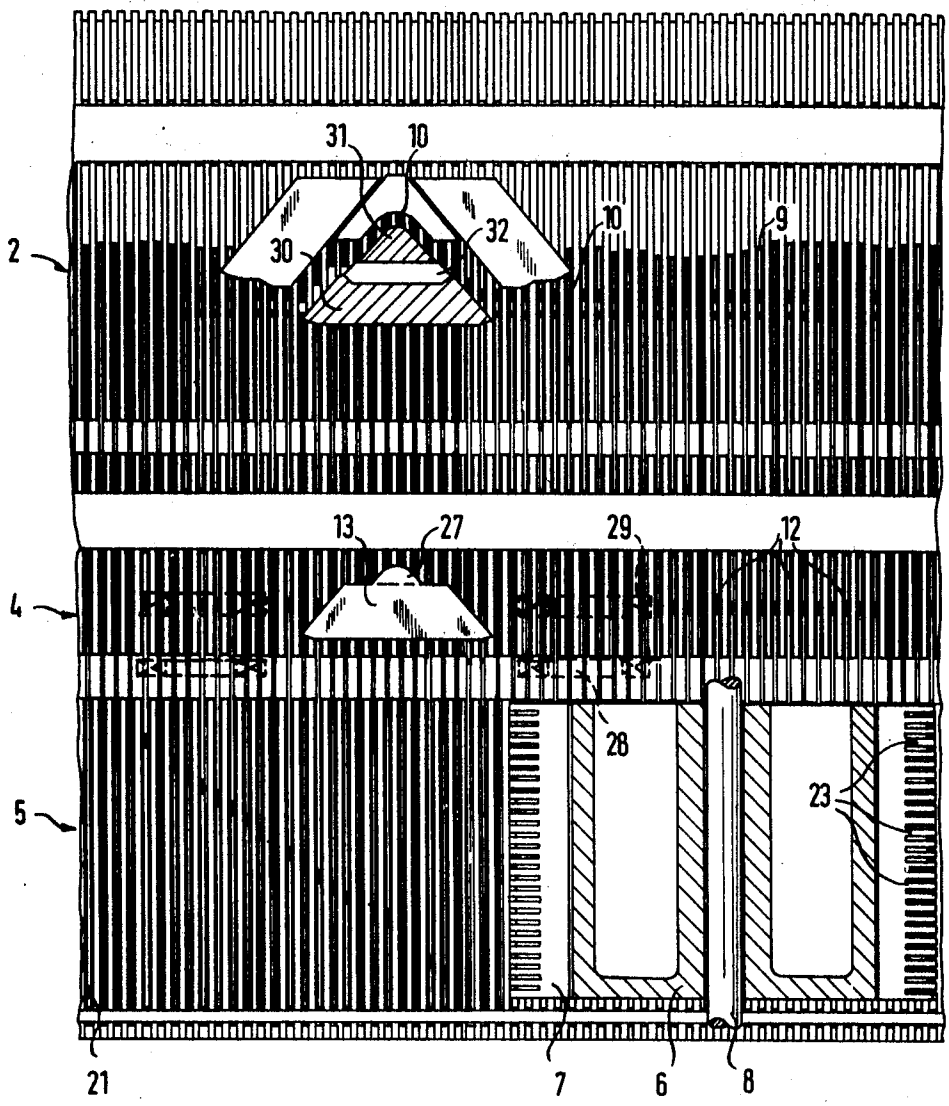



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PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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Fig.4




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# PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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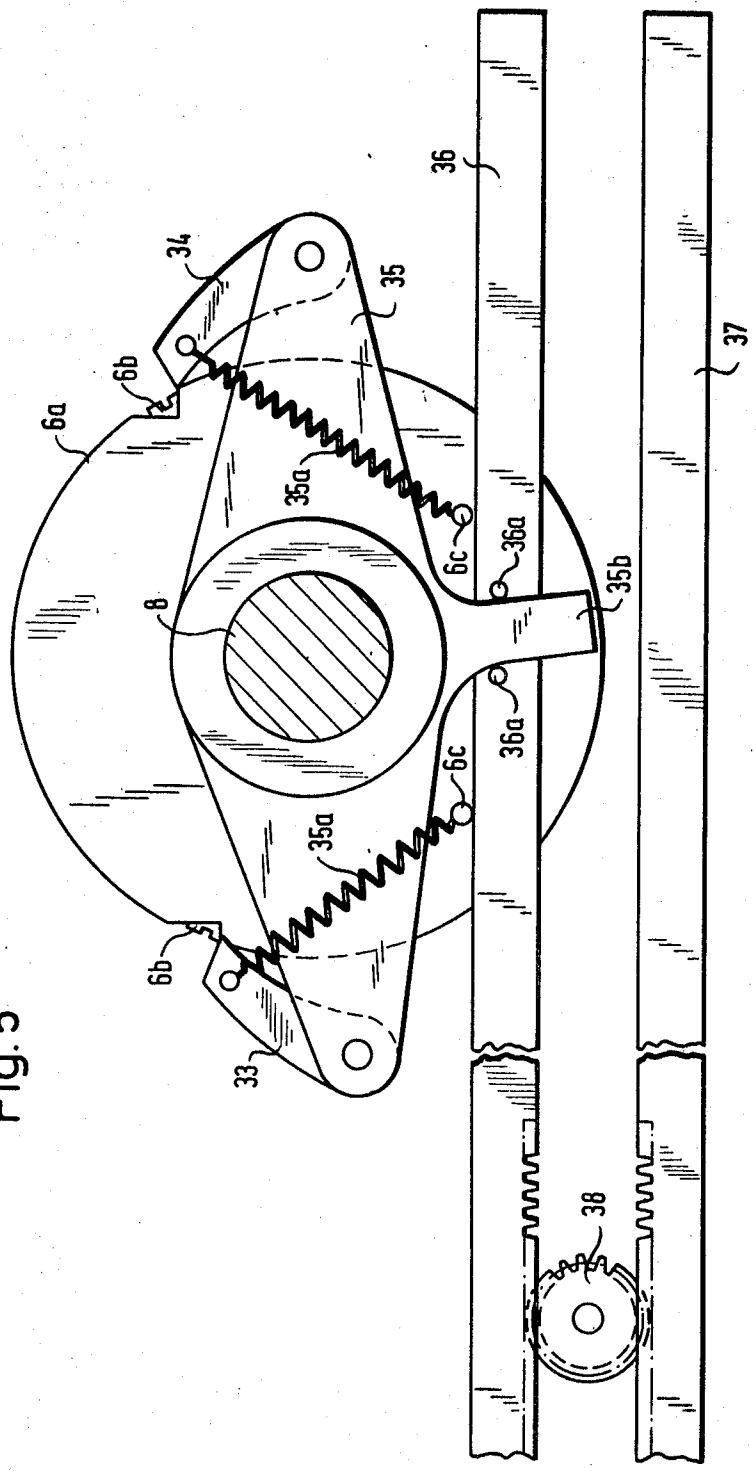



Fig. 5

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PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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Fig.6

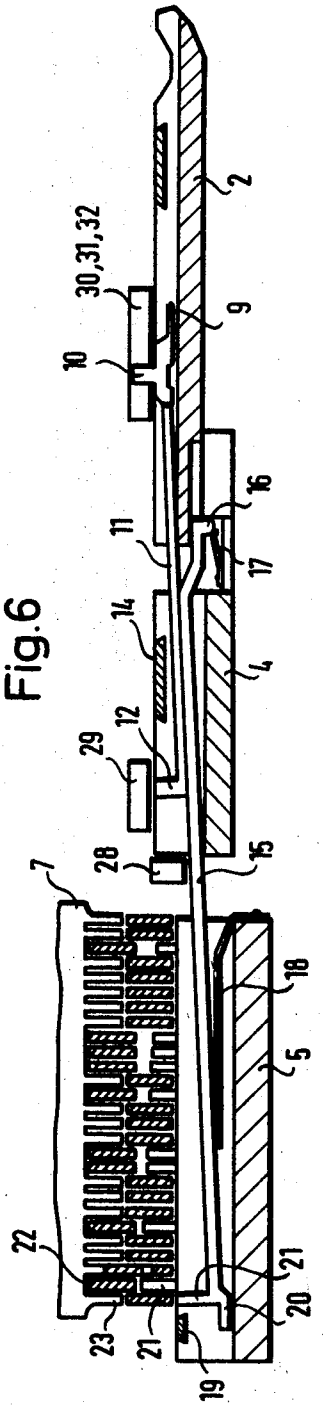
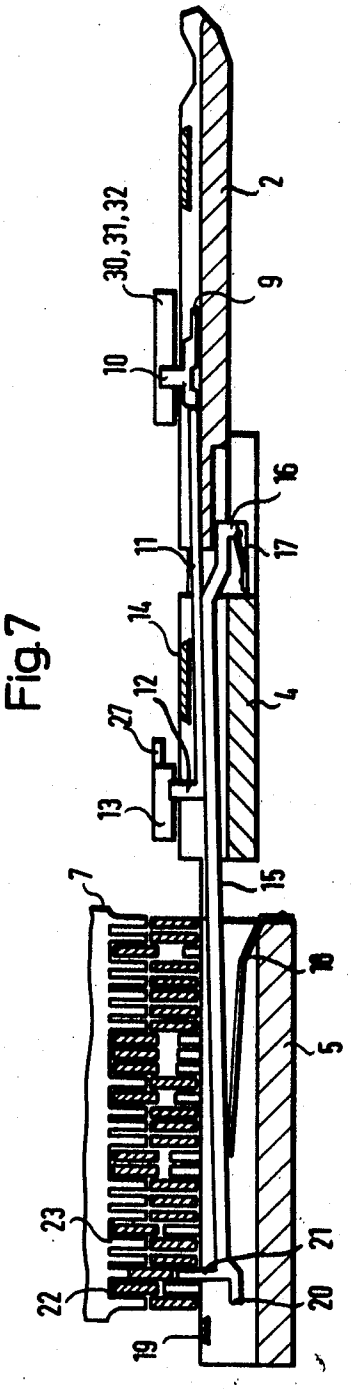



Fig.7



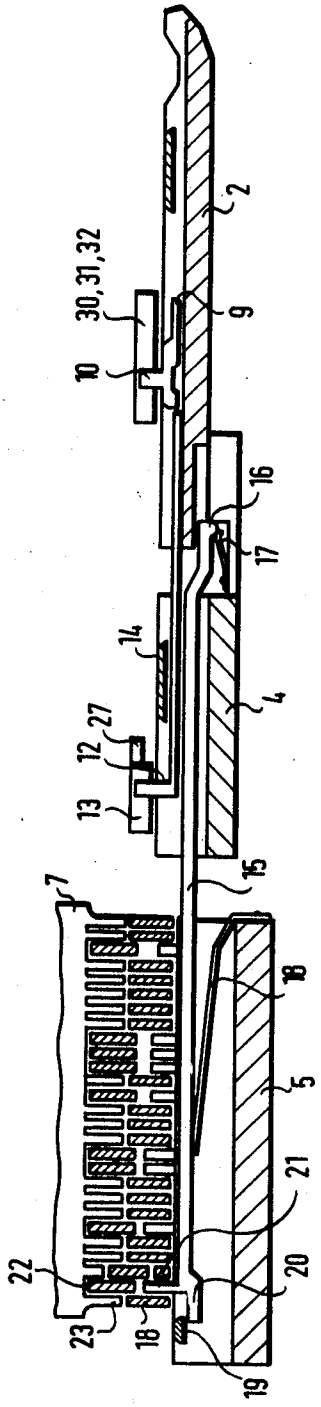

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PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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Fig.8




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United States Patent Office 3,611,753 Patented Oct. 12, 1971



3,611,753

# PATTERN CONTROL MECHANISM FOR A FLAT-BED KNITTING MACHINE

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Int. Cl. D04b 15/70
U.S. Cl. 66—75 6 Claims

## ABSTRACT OF THE DISCLOSURE

Butts on pattern jacks under knitting needles in a flat-bed knitting machine are engaged by cams on the machine carriage for lifting the knitting needles to two levels depending on the extent to which the jack butts project from the needle bed and for thereby presenting the needles to needle cams on the carriage. The jacks are moved transversely by tilting fingers operated by control arms on the carriage which engage butts on the fingers and are backed by projections on pattern plates circumferentially distributed on a pattern drum on the carriage. The drum may be indexed during each reversal of carriage movement for changing the positions of the control arms.

This invention relates to flat-bed knitting machines, and particularly to a pattern control mechanism for a flat-bed knitting machine.

It is common practice to control a knitted pattern on a flat-bed knitting machine by means of punched steel cards in a Jacquard mechanism. The cards are costly and heavy, and therefore are not convenient unless the repeat of the pattern is relatively short. The cards require a complex mechanism which is heavy and bulky and interferes with access to other machine parts during maintenance operations. Pattern drums have therefore been recommended for flat-bed knitting machines, but the known machines equipped with pattern drums are sharply limited in the width of the repeat that can be produced.

A primary object of the invention is the provision of a pattern control mechanism for a flat-bed knitting machine which is relatively simple, occupies but little space, and permits the production of patterns which have a long repeat, particularly in a coursewise direction.

With this object and others in view, the invention provides a flat-bed knitting machine with a group of control arms mounted on the machine carriage for movement toward and away from a position of engagement with tilting fingers aligned with respective knitting needles, arranged for pivoting movement between an operative position and an inoperative position, and connected to the associated needles by a needle moving mechanism which moves the needles in the path thereof during carriage movement in response to the position of the associated tilting finger.

The control arms are biased away from the respective positions of engagement and may cooperate with respective backing means on a pattern drum mounted on the carriage for angular displacement about an axis between a plurality of control positions. The backing means back selected control arms against movement away from the position of engagement in one of the angular positions of the pattern drum, and thereby may move the tilting fingers from the operative toward the inoperative position during carriage movement.

An indexing mechanism moves the pattern drum toward and away from the afore-mentioned one angular position in timed sequence with the carriage movement.



The needle moving mechanism may include a jack aligned with each needle for longitudinal movement in the needle path in abutting engagement with the aligned needle. Each jack engages a corresponding tilting finger for movement thereby transversely of the needle path between an active position and an inactive position when the tilting finger moves between the operative and inoperative positions. A jack cam arrangement on the carriage can be engaged with the jack only when it is remote from its inactive position, and may move the engaged jack in the needle path during carriage movement.

Other features, additional objects, and many of the attendant advantages of this invention will readily become apparent from the following detailed description of a preferred embodiment when considered in connection with the appended drawing in which:

FIG. 1 shows a flat-bed knitting machine of the invention in side elevation and partly in section;

FIG. 2 illustrates a portion of the machine of FIG. 1 on a larger scale and in section on the line II—II in FIG. 3;

FIG. 3 illustrates the pattern mechanism of the machine of FIG. 1 in a frontal view taken in the direction of the arrow A;

FIG. 4 shows the machine in fragmentary section on the line IV—IV in FIGS. 1 and 2;

FIG. 5 shows the drive arrangement of the pattern mechanism in a fragmentary view; and

FIGS. 6 to 8 illustrate a portion of the apparatus of FIG. 2 in different operating positions.

Referring now to the drawing in detail, and initially to FIG. 1, there is seen a flat-bed knitting machine whose main drive **1** causes a carriage **3** to travel from side to side along a needle bed, as is conventional. According to the invention, the needle bed has a needle-holding section **2** and sections **4** and **5** spacedly juxtaposed to the needle bed section **2**. Two pattern drums **6**, of which only one is seen in FIG. 1, carry each a group of circumferentially spaced comb-like pattern plates **7** which are releasably retained in axial slots of the drum surfaces, as is better seen in FIG. 2. Each drum **6** is mounted on a shaft **8** secured to the carriage **3**.

The three bed sections **2**, **4**, **5** of the needle bed are formed with longitudinally aligned grooves whose bottoms are transversely staggered. The closely juxtaposed, parallel grooves of the needle bed section **2** slidably receive knitting needles **9** provided with butts **10** near their ends remote from the hooks, not themselves shown in FIG. 2. The grooves of section **4** partly receive pattern jacks **11** which extend into the higher grooves of the needle section **2** and are each pivoted on the lower transverse edge of the associated needle section groove. The lower ends of the jacks **11** carry butts **12** which, in the active angular jack position of FIG. 2, project out of the groove in the jack bed section **4** into the path of a jack raising cam **13** on the carriage **3**. A cover **14** retains the jacks **11** in the bed section **4**. A tilting finger **15** extends from each groove of the bed section **5** into an aligned groove of the jack section and between the jack **11** and the groove bottom. A boss **16** at the top end of the finger **15** is pivotally secured against longitudinal movement between a leaf spring **17** and the fixed machine structure. Another leaf spring **18** in the bed **5** biases the lower end of the finger **15** outwardly of the bed section **5**, and thereby normally holds the jack butt **12** in the illustrated, projecting operative position. The lower half of the finger **15** is permanently retained in the associated groove of the bed section **5** by a terminal lug **19** aligned with a fixed bar **20** which extends over the length of the bed **2**, **4**, **5**. Only a butt **21** on each finger **15** projects from the bed section **5** into the path of a plate **7** as the plate moves with

the carriage 3, the butts 21 being staggered over the lower half of the several fingers 15 in the section 5. In the illustrated embodiment, 27 butt positions are offset longitudinally of the fingers 15.

A flat control arm 22 is associated with each pattern drum 6 and with each butt position on the fingers 15, and is pivotally mounted on the carriage 3, as is better seen in FIG. 3. Corresponding to each butt position, the pattern plate 7 has a long tooth 23 or a short tooth 23 or a gap without a tooth, thereby holding the arms 22 in corresponding positions and also the finger butts 21 which are engaged by the arms 22, as is seen in FIG. 3. Each arm 22 has an upright lug 24 for engagement with the aligned tooth or gap on the plate 7, the lug being held against the pattern plate 7 by a helical tension spring 25 which biases each control arm away from a position of engagement with an associated butt 21. When the angular position of the drum 6 is such that the lugs 24 can be received between two circumferentially adjacent plates 7, all arms 22 are withdrawn by the springs 25 against an abutment 26 and out of range of the butts 21, as is seen at the right in FIG. 3.

FIG. 4 shows only as much of the cams mounted on the carriage 3 as is needed for an understanding of this invention, the non-illustrated cams being conventional, and some of the cams being illustrated in phantom view when located above the level of FIG. 4. The jack raising cam 13 has a hump 27 which is offset from the remainder of the cam, as best seen in FIGS. 7 and 8 so that its cam face engages only those jack butts 12 which are lifted by the fingers 15 into the active position, that is, as far as the cover 14 permits (FIG. 8). Butts 12 only partly lifted by the fingers 15 into an intermediate position clear the hump 27, but are engaged by a cam face on the main portion of the jack raising cam 13 (FIG. 7). The cam 13 cannot act on inactive jacks 11 whose butts 12 are fully retracted into the grooves of the jack bed 4 (FIG. 6).

The jacks 11 are pivoted into the positions of FIGS. 8 and 7 when the associated tilting fingers 15 are engaged by arms 22 not backed by a tooth 23 or backed by a short tooth 23 respectively during traverse of the carriage 3. When no tooth 23 is aligned with the finger butt 2, the jack butt 12 is engaged by the hump 27, and the jack drives the associated knitting needle 9 to the clearing level. When a short tooth 23 is aligned with the butt 2, the knitting needle 9 is raised to the tucking level by the main portion of the cam 13 acting on the jack butt 12.

A fixed cam 28 on the carriage is associated with each pattern drum 6 to engage the fingers 15 in the gap between the jack bed section 4 and the finger bed section 5 (see FIGS. 4 and 6) and thereby permit the jack butts 12 to be retracted into the grooves of the section 4 and pulled down into their inoperative positions by a fixed cam 29 on the carriage 3 before the butts 21 are reached by the arms 22. The cams 28, 29 release the butts in time for engagement with the arms 22 and the cams 13, 27.

Knitting cams 30, 31, 32 on the carriage 3 engage the butts 10 of the needles 9 in a conventional manner if the needles are sufficiently raised by the jacks 11.

As is shown in FIG. 5, each pattern drum 6 may be indexed during each reversal of carriage movement by an angle equal to one half the angular spacing of the pattern plates 7.

The drum is obscured in FIG. 5 by a generally circular disc 6*a* rotatably supported on the shaft 8 and held in a fixed angular position by two pins 6*c* which abut against a smooth face of an elongated rack member 36. The shaft 8 also carries a rocker 35 whose diametrically opposite arms are hinged to respective oppositely directed pawls 33, 34. Pawl springs 35*a* connect the pawls to the pins 6*c* and thereby hold the pawls in engagement with the circumference of the disc 6*a* or with teeth of a ratchet rim 6*b* on the drum 6, not otherwise visible, and partly accessible through V-shaped notches in the disc 6*a*.



A third arm 35*b* of the rocker 35 is restrained between two pins 36*a* on the rack member 36 so that the rocker oscillates when the rack member reciprocates longitudinally. The rack member 36 is coupled to another, parallel rack member 37 by an idler pinion 38 supported on the carriage 3 in a manner not shown in detail so that the rack members, which are slidably supported in the carriage 3, move in parallel paths in opposite directions. Non-illustrated abutments on the stationary machine frame, not shown and conventional in themselves, may be set to engage the rack members during each reversal of carriage movement, thereby causing the drum 6 to be indexed angularly through an angle equal to at least one half of the angular spacing of the plates 7 carried by the drum either clockwise or counterclockwise. The drum 6 not shown in FIG. 5 is provided with pawls and a rocker which are actuated by the rack member 36 in the same manner as shown in FIG. 5.

As is seen in FIG. 3, one of the pattern drums 6 and the associated plates 7 and arms 22 are effective during carriage movement from the left to the right, and the other pattern drum is effective during movement from the right to the left.

It is inherent in the illustrated multiplicity of pattern plates 7 arranged on the circumference of each drum 6 that the pattern mechanism of the invention is capable of producing long repeats in the direction of the wales. The great number of teeth 23 on each plate 7 and the corresponding number of finger butt positions permit a long repeat in a coursewise direction. The great versatility of the illustrated mechanism is achieved with a relatively simple and correspondingly sturdy and reliable apparatus of little bulk and weight.

What is claimed is:

1. In a knitting machine having a flat needle bed, a multiplicity of elongated knitting needles juxtaposed in said needle bed for longitudinal movement in respective parallel paths, a carriage mounted for movement transversely of said paths, needle cam means on said carriage for longitudinally moving said needles during said movement of the carriage, and pattern control means for selectively presenting said needles to said cam means, the improvement in the pattern control means which comprises:

(a) a tilting finger longitudinally aligned with each needle and arranged for pivoting movement between an operative position and an inoperative position;

(b) needle moving means operatively interposed between said carriage and said needle for moving said needle in the path thereof during movement of said carriage in response to the position of the associated tilting finger;

(c) a plurality of control arms, each control arm being mounted on said carriage for movement toward and away from a position of engagement with a respective one of said tilting fingers when the same is remote from the inoperative position thereof, and for moving the engaged lifting finger toward the inoperative position during said movement of the carriage;

(d) biasing means biasing said control arm away from said position of engagement;

(e) a pattern drum mounted on said carriage for angular displacement about an axis between a plurality of control positions;

(f) a plurality of backing means arranged on said pattern drum for backing selected respective control arms against movement by said biasing means in a direction away from said position of engagement in one of said angular positions of said pattern drum; and

(g) indexing means for moving said pattern drum toward and away from said one angular position in timed sequence with said movement of the carriage.

2. In a knitting machine as set forth in claim 1, said needle moving means including a jack aligned with each needle for longitudinal movement in said path of the

aligned needle in abutting engagement with the same, each jack engaging a corresponding tilting finger for movement thereby transversely of said path between an active position and an inactive position when said tilting finger moves between said operative and inoperative positions thereof, and jack cam means on said carriage engageable with said jack when remote from said inactive position for moving the jack in said path during said movement of said carriage.

3. In a machine as set forth in claim 2, a plurality of pattern plates mounted on said pattern drum in circumferentially offset relationship, each pattern plate carrying an axial row of radial projections respectively constituting said backing means.

4. In a machine as set forth in claim 3, said projections including short projections and long projections, said control arms when backed by said long projections moving the engaged tilting fingers from the operative to the inoperative position, said control arms when backed by said short projections moving the engaged tilting fingers from the operative position to a position intermediate said operative and inoperative positions.

5. In a machine as set forth in claim 4, said tilting fingers when in the intermediate position holding the associated jacks in a position intermediate said active and inactive positions, said cam means having a first cam face



engaging said jacks in the intermediate position thereof for moving the engaged jacks longitudinally of said needles over a first distance, and a second cam face engaging said jacks in the active position thereof for moving the engaged jacks longitudinally of said needles over a second distance greater than said first distance.

6. In a machine as set forth in claim 2, said needle bed having a plurality of sections spaced in the direction of said paths and respectively receiving said knitting needles, said jacks, and said tilting fingers, said tilting fingers having respective butts offset in the direction of said path and projecting from said needle bed in said operative position of each tilting finger for engagement with the associated control arm, said control arms being offset in said direction.

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