

April 8, 1969

R. STEIGER

3,436,933

KNITTING MACHINE

Filed July 11, 1966

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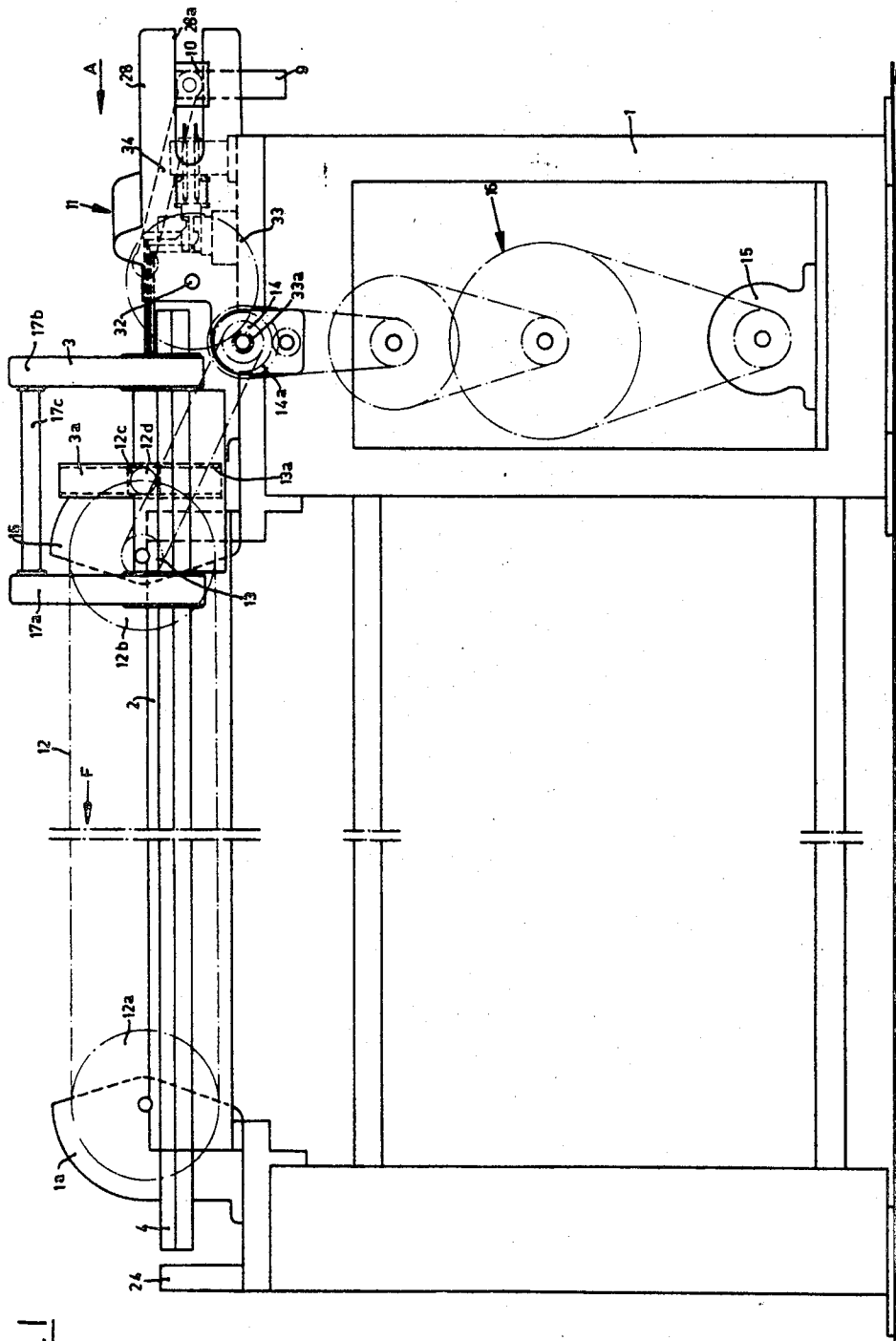


FIG. 1

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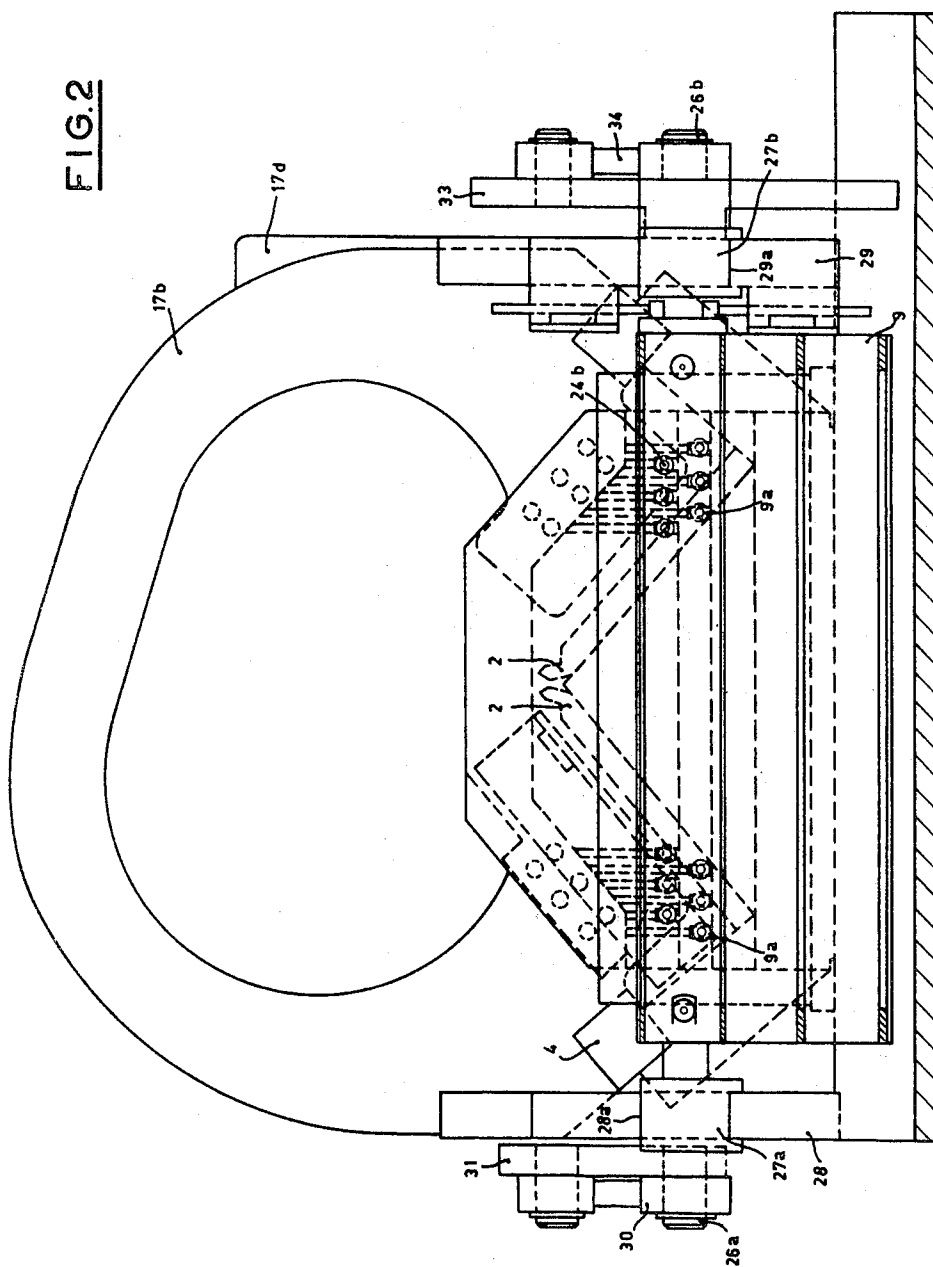
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FIG. 3

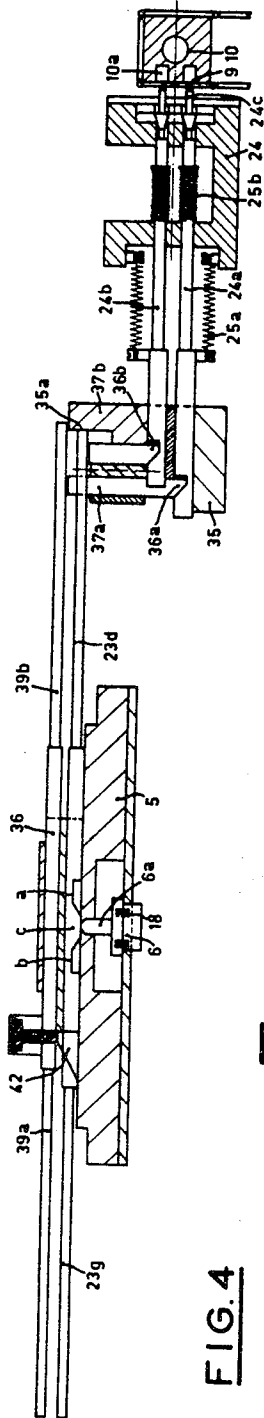


FIG. 4

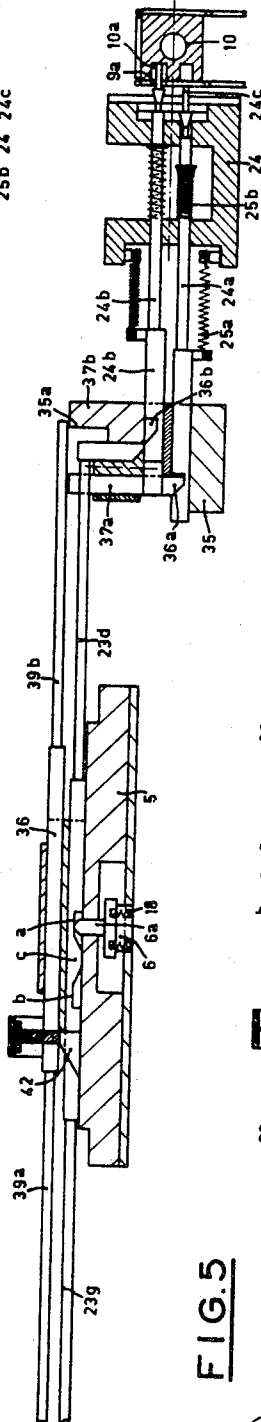


FIG. 5

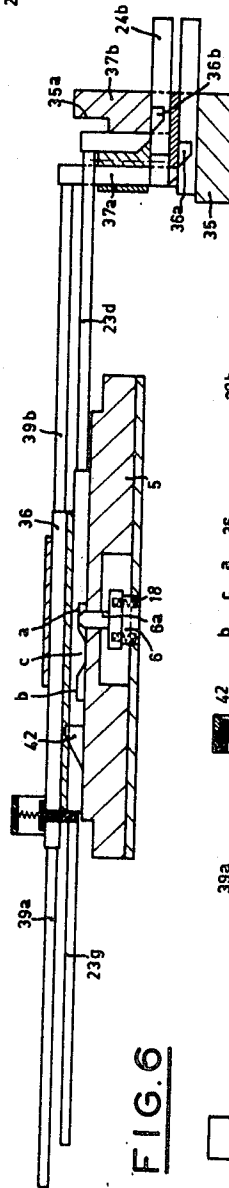


FIG. 6

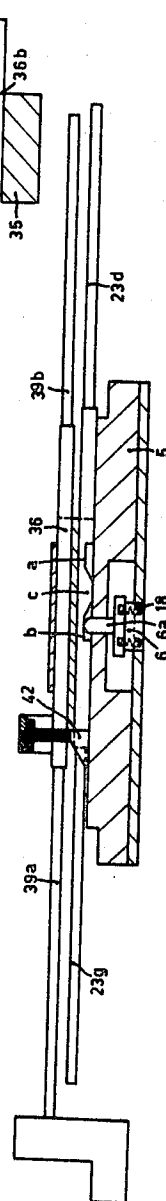
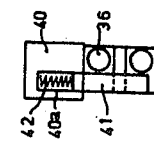


FIG. 3a



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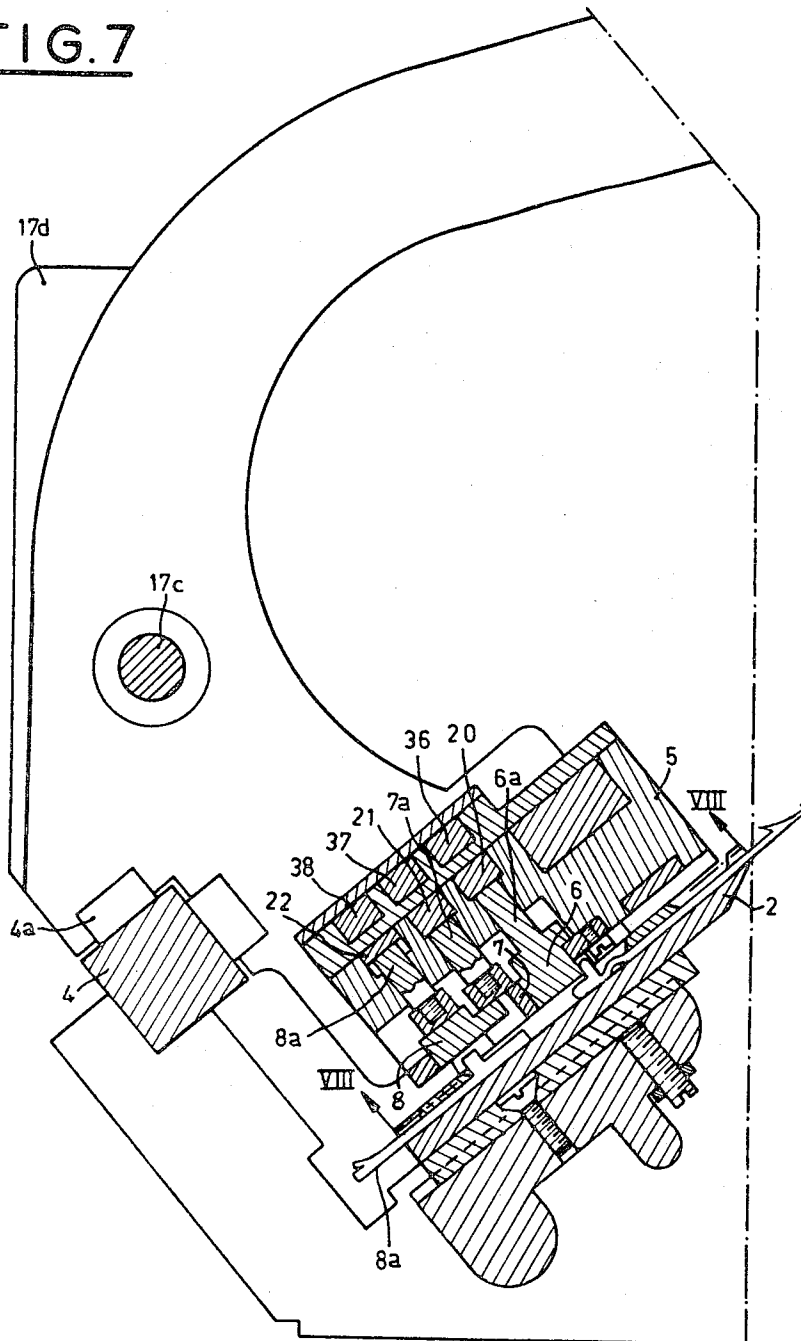
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FIG. 7



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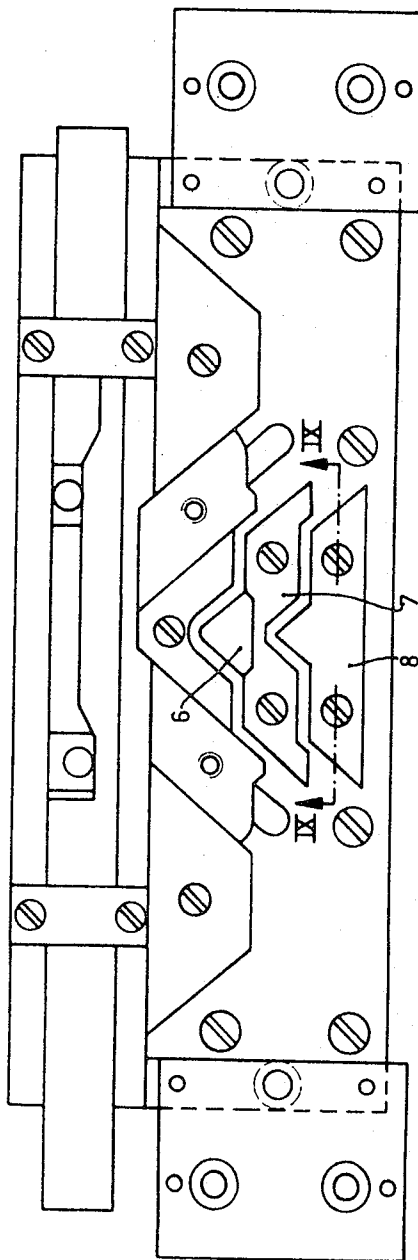
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FIG. 8



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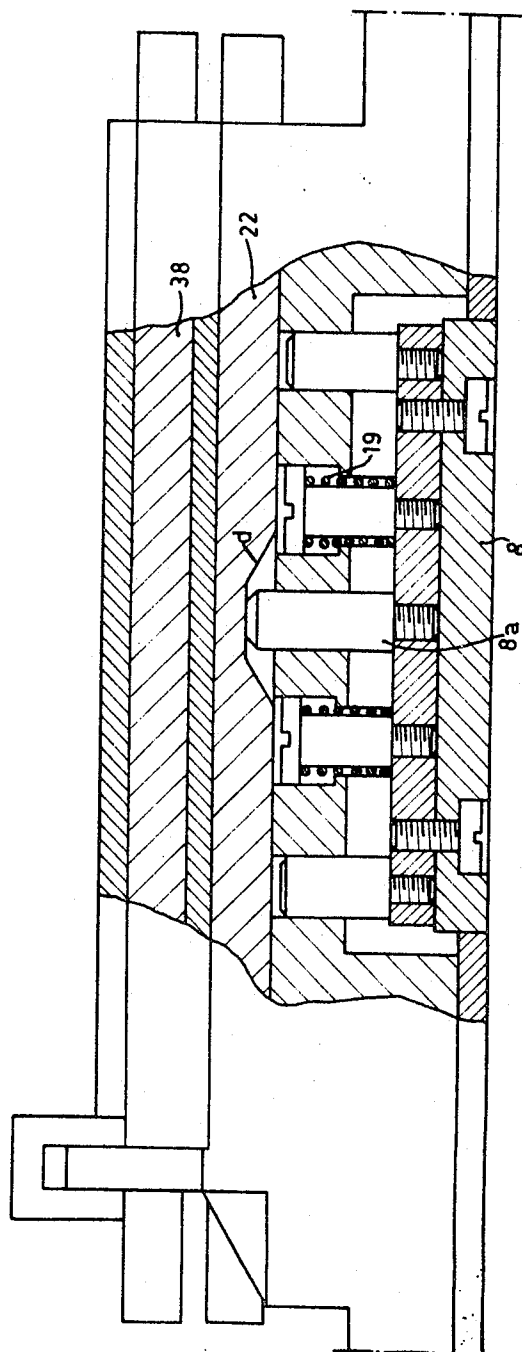
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FIG. 9



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KNITTING MACHINE

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Int. Cl. D04b 7/04; D03c 17/06

U.S. Cl. 66—60

9 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure concerns a knitting machine in which at least one cam holder carriage slides along the length of the bed of needles from a first end of the bed to a second end which has a stop and carries cams for actuating the needles according to a predetermined program. Means are provided for driving the carriage in a reciprocating movement between the two ends of the bed of needles and also programming means having indications characteristic of the program set for the machine. A reading device is interconnected with the programming means and operates a servo-control device which acts on the cams of the carriage when the carriage is at one end of the bed to modify the program. Relay stations are connected to the carriage and receive from the control device indications characteristic of the position which the cams must have during return of the carriage from the second end of the bed toward the first end in conformity to indications read in the programming means, the relay stations acting on the cams when the carriage reaches the second end of the bed and encounters a stop position at said end.

The present invention has for its object a knitting machine, comprising at least one cam-holder carriage adapted to slide the length of at least one bed of needles of which the cams assure the actuation according to a predetermined programme, at least one memory carrying some characteristic indications of this programme, at least one reading device for these indications and at least one control device slave to the reading device and acting on the cam-holder carriage to modify the programme of actuating the needles.

In certain of these known machines, the programme for actuating the cams of the carriage is recorded in one memory for movements of the carriage from the first end of the bed towards the second, and in another memory, distinct from the first, for movements in the opposite direction.

With each memory is of course associated a corresponding reader which transmits the indications received to a control device proper.

Such a machine comprises thus two assemblies of identical members—memory, reader and control device—placed, one at one end of the bed, and the other at the second end.

These assemblies must work in a rigorously synchronised fashion and are consequently particularly delicate. Their price is moreover very high.

It has already been proposed to palliate these disadvantages by using only one assembly of members to control the movement of the cams of the carriage regardless of whether the latter is displaced in one direction or in the other direction. In this type of machine, the cams are actuated directly, when the carriage is in the neighbourhood of the assembly of members, which is placed at one end of the bed, and by the intermediary of a system of rods extending under this bed, when the carriage arrives at the opposite end.

Such devices have not given entire satisfaction because of this system of rods which is a continual source of

trouble and of repairs. That is why, in more modern constructions, the system of rods has been replaced by an electrical cabling permitting some electromagnetic devices disposed at the end opposite to that where the memory is located, the reader and the control device to be controlled, which provides the actuation of the cams of the carriage when the latter arrives within their reach. Within the framework of such a development, it has also been proposed to mount the electromagnets directly on the carriage.

The present invention has precisely for its aim to obviate the various disadvantages mentioned and has for its object a knitting machine of the type previously indicated which is characterized by the fact that the control device is arranged in such a manner to act on the cams of the carriage, directly when the latter is at one end of the bed, according to the knitting programme which the needles of the machine must execute in the course of the displacement of the carriage towards the second end of this bed, and by the intermediary of relay members associated with the carriage to which the control device transmits an order characteristic of the position which the cams must have during the return of the carriage from the second end of the bed towards the first according to the indications read in the memory, the said relay members acting on the cams when the carriage reaches the second end of the said bed.

The annexed drawings represent, by way of example, one embodiment of the present invention:

FIGURE 1 is a front elevation;

FIGURE 2 is a view according to A of FIGURE 1;

FIGURE 3 is detailed schematic view of elements for controlling the position of the cams of the machine illustrated in FIGURE 1;

FIGURE 3a is a local view according to III—III of FIGURE 5;

FIGURES 4 to 6 represent the principal elements of FIGURE 3 in different positions;

FIGURE 7 is a section according to VII—VII of FIGURE 1;

FIGURE 8 shows a section according to VIII—VIII of FIGURE 7;

FIGURE 9 is a section according to IX—IX of FIGURE 8, on an enlarged scale.

The knitting machine shown comprises a frame 1 (FIGURE 1) supporting two beds of needles 2 above which moves a carriage 3 mounted slidably on guiding bars 4 extending parallelly on both sides of the beds 2. The carriage 3 carries two cases 5 on the lower face of which are mounted three cams 6, 7 and 8. The cam 6 is that commonly called a center knitting cam. The cam 7 controls the raising of the needles from the bed and will be called hereafter "needles" cam. The cam 8 is that for the control of the raising of the jacks such as 8b (FIGURE 7) and will be specifically named jacks cam.

The cams 6, 7 and 8 can be retracted into the plane of the plate constituting the bottom of the case 5 or on the contrary can be made to project outwards from this plate, as will be seen later on as a function of the data recorded in the form of perforations on a series of cards 9 (FIGURES 1 and 2) which are articulated one to another and which constitute the memory of the machine. The assembly of these plaquettes forms an endless band which is driven in rotation by a block 10, this block being intended to bring successively the different cards within reach of an assembly 11 determining the positioning of the three cams provided on each case 5 as a function of the indications carried by each card 9.

The driving of the carriage 3 on the guiding bars 4 is effected mechanically. To this effect, the frame of the machine according to the invention carries two supports 1a and 1b on each of which is pivoted a gear 12a and 12b

respectively, forming return pulleys for an endless chain 12 extending behind the bed 2.

The gear 12b is keyed on the axle of a pinion 13 which meshes with a chain 13a driven by another pinion 14 mounted on the axle of a wheel 14a which is connected to a motor 15 by the intermediary of a reducing transmission 16.

The carriage 3 is connected to the chain 12 by the intermediary of a vertical slide 3a fixed to this carriage and in which can be displaced a slider 12c in which a roller 12d rigid with the chain 12 is pivoted.

Thus if this chain 12 is driven by the plate 12 in the direction F, the slider 12c will be located at the upper part of the slide 3a as long as the segment of chain to which is fixed the roller 12d forms part of the upper rectilinear part of the loop which the chain 12 forms, this slider being on the contrary at the bottom of the slide 3a when this segment of chain forms a part of the lower rectilinear portion of the loop.

When the segment of chain to which is fixed the roller 12d comes to form part of one of the two incurved portions of the loop formed by the chain 12, the slider 12c is displaced to the interior of the slide 3a, descending if the said segment of chain is in contact with the plate 12a and rising if on the contrary it is the plate 12b which supports this segment.

The carriage 3 is formed by two arches 17a and 17b (FIGURE 1) connected one to another by three tie-rods 17c and which have on their hind part a boss 17d to which is fixed the slide 3a indicated previously.

The arches 17a and 17b rest on the guiding bars 4 by pairs of flanges 4a (FIGURE 7) in contact with two adjacent faces of these bars.

Between the arches 17a and 17b are fixed two cam-holder cases 5.

Each of the cams 6 to 8 carries at its back face a guiding rod 6a, 7a and 8a respectively, these three rods extending perpendicularly to the plane of the bed 2 of which the cams 6 to 8 are intended to actuate the needles and the keys respectively, and the rods are mounted slidably in corresponding passages in the case 5.

The cams 6 and 7 are subjected to the action of return springs 18 (FIGURE 3) and the cam 8 to springs 19 (FIGURE 9), these various springs tending to make the corresponding cams retract when nothing opposes the corresponding displacement of the guiding axle associated with each of these cams.

In the knitting machine according to the invention, the axial position of the push rods 6a to 8a is controlled by a corresponding number of cam bolts 20, 21 and 22 formed each by a small bar extending parallel to the general axis of the beds and mounted slidably in corresponding housings in the case 5.

The cam bolts 20 and 21 are cut on their face turned towards the corresponding cam as shown in FIGURES 3 to 6. Each bolt has two notches a and b delimiting between them a lock c with inclined faces. The length of the cut-outs a and b is greater than the diameter of the rods 6a or 7a, so that the end of these rods can engage freely in these cut-outs. In FIGURE 3, the bolt 20 is in a position such that the push rod 6a is in contact with the lock c so that the cam 6 which is associated with it is made to project under the cam-holder case 5.

When the bolt 20 is displaced towards the left, as shown in FIGURE 4, and the push rod 6a is engaged by its end in the notch a of this bolt, the cam 6 is retracted (FIGURES 4 to 6).

The bolt 22 controlling the jacks cam 8 has a single notch d (FIGURE 9) having inclined edges. The cam 8 projects from the case when the guiding rod 8a is in contact with the portion of the bolt 22 immediately to the left or to the right of the notch d.

At each of their ends, the bolts 20 to 22 have a rod 23g and 23d according as whether it concerns the left or the right rod in FIGURES 3 to 6. These rods are mounted

slidably in the corresponding openings formed in the arches 17a and 17b.

The rods 23g are intended to enter into contact with a fixed stop 24 disposed at the left end of the frame 1 of the machine (FIGURE 1). The position of the stop 24 is such that if the bolt 20 or 21 is in the position shown in FIGURE 3 the rods 23g of these bolts do not enter into contact with the stop 24 when the carriage arrives in its extreme left position. When, on the contrary, the bolts 20 and 21 occupy the position illustrated in FIGURE 4 for which the center knitting cams and the needles cams are retracted, the rods 23g of these cams will meet the stop 24 and will be retained while the carriage finishes its run so that the cam-holder case and the bolts take again the position of FIGURE 3.

The events take place in an analogous way when it is the rod 23g of the cam bolt controlling the rise of the keys which comes into contact with the fixed stop 24. It is thus that if this bolt is in the position shown in FIGURE 9 nothing happens since the rod 23g does not touch the stop 24 while if it is displaced towards the left in a manner sufficient for the guiding rod 8a to be in contact by its end with the portion immediately to the right of the right of the notch d, the bolt is brought back into the relative position illustrated in FIGURE 9 by the meeting the corresponding rod 23g with the said stop.

The positioning of the bolts 20, 21 and 22 on the cam-holder case is effected by acting on the rod 23d of these bolts, as is going to be described now, taking into account the record carried by the card 9 of the memory of the machine.

These cards constitute, as already described, an endless tape which envelops the block 10 on which it rests by three cards. This block is intended to lead successively the cards 9 to within reach of two groups of six rods disposed, one, perpendicular to cam-holder case 5, on the left (FIGURE 5) and the other perpendicular to a similar case fixed at the right end of the arches 17a and 17b (as viewed in FIGURE 7).

In each group, the rods are disposed according to two stages, those of the lower stage being indicated by the reference 24a and those of the upper stage by the reference 24b. There are, in fact, twice as many rods as there are cams 6, 7 and 8 previously indicated, each of these cams being susceptible to be actuated, just as that will be described later on by means of a rod 24a or of the rod 24b immediately above and to the right for the left group and to the left for the right group.

Each rod 24a or 24b is slidably mounted in a nail box 24 (FIGURE 3) which is fixed at the right end of the frame of the machine opposite the prism 10. The rods 24a and 24b are subjected each to the action of two return springs 25a and 25b tending to push these rods towards the right in the drawing (FIGURES 3 and 4) when they have left their rest position which is that of the rod 24b in FIGURE 4.

The right ends 24c of rods 24a and 24b (FIGURE 3) are intended to enter into contact with the surface of the card 9 which faces them (FIGURE 3) on the condition, nevertheless, that the block 10 is located sufficiently near to box 24.

As illustrated in FIGURE 3, this block is constituted by a parallelepiped member having a square right section and in the four faces of which are hollowed longitudinal grooves 10a extending at a level corresponding to that of perforations 9a which are formed in the cards 9 as a function of the position that it is desired to give to the cams 6 to 8 during movement of the carriage towards the left and towards the right. A single card 9 permits effectively the adjustment of the position of the cams of the two cases which the carriage includes, taking into account a given point which one wishes to obtain during movement from right to left of the carriage just as during the return movement of the latter.

Thus if the card disposed facing the rods 24a and 24b

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only has a perforation at right angles to the rod 24b, this nail penetrates through this perforation into the upper groove 10a while the rod 24a is pushed again towards the left by putting the springs 25a and 25b under tension as illustrated in FIGURE 4.

Before describing more exactly the function of the rods 24a and 24b, let use see which are the members determining the displacement of the block 10.

At two ends of this prism project two diametrically opposed axles 26a and 26b pivoted each to a corresponding flange 27a and 27b respectively, mounted slidably, the first, between the sides of a horizontal slot 28a cut in a plate 28 of the frame and, the second, in a similar slot 29a of a plate 29. On the axle 26a is pivoted by one end a rod 30 articulated by its other end on a lever 31 keyed to the end of a shaft 32 (FIGURE 1) whose other end carries a gear 33 connected to the axle 26b by a rod 34 similar to the rod 30. The gear 33 is in contact with the pinion 33a (FIGURE 1) keyed on the same shaft as the pinion 14 for driving the chain 12.

It is seen immediately that for one complete rotation of the plate 33, the block 10 effects a horizontal to and fro movement and that it is at the end of the displacement towards the left of this prism that the card 9 which it carries on its left face enters into contact with the end of the rods 24a and 24b. It will be noted moreover that the reduction of the various trains controlling the driving of the carriage 3 the length of the beds 2 as well as that driving the block 10 in a horizontal movement, is chosen such that this block only leads the cards 9 within reach of the rods 24a and 24b when the carriage 3 is in its extreme right position.

The left ends of the rods 24a and 24b are mounted in a slidable manner in the corresponding passages formed in a support 35 fixed to the frame 1 and have a trapezoidal cut-out 36a for rods 24a and 36b for the rod 24b.

The cut-outs 36a and 36b of twelve rods 24a and 24b are intended to receive the ends of stops 37a, for the rods 24a, and 37b for the rods 24b mounted slidably in the stud 35 and susceptible to be displaced vertically under the action of their own weight when the cut-outs of the corresponding nails assume a position below them, which takes place when these rods are driven in as illustrated in FIGURE 3.

Any displacement of a rod 24a or 24b towards the right under the action of the springs 25a and 25b has for its consequence to raise the stop associated with the corresponding rod.

As shown, the stops 37a are appreciably longer than the stops 37b.

These latter stops are disposed in the plane containing the bolts 20, 21 and 22 previously described, in a manner to lock these bolts when their rods 23d meet them at the end of the course of the carriage 3 towards the right.

In the case of the bolts of the center knitting cams and of the "needles" cams, this stopping due to the stops 37b is translated by a relative displacement of the said bolts and of the corresponding cam-holder case and by the penetration of the push rod 6a of the cams 6 and 7 into the cut-out a (FIGURE 4). The stopping of the bolts 20 and 21 can only take place if the stop 37b is raised, that is to say if the corresponding nail 24b has penetrated into the groove 10a of the prism 10 by passing through a perforation 9a of a card 9.

If the stop 37b is on the contrary in the lowered position, as shown in FIGURE 3 and the bolt 20 or 21 occupies the position of FIGURE 6 during displacement from left to right of the carriage 3, the rod 23g will enter into contact with the projecting parts 35a of the stud 35, forming a stop. At the end of the course towards the right of the carriage, the cam-holder case and the bolt 20 or 21 will occupy the relative position illustrated in FIGURE 3 in which the guiding axle is in contact with

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the lock c and the corresponding cam 6 and 7 projects and is adapted to make contact with the needles of the machine. Parts 35a, 37b, 37a, 36a and 36b constitute a servo control device including the rods associated with the perforated cards.

When the bolt 20 or 21 occupies the position illustrated in FIGURE 4 by meeting with the corresponding stop 37, when the carriage reaches its extreme left position (FIGURE 1) and when for its return to the right the cams 6 and/or 7 must equally remain in the retracted position, it is necessary to prevent the rods 23g of the bolts 20 and 21 from entering into contact with the fixed stop 24 failing which the bolts will be put in the position illustrated in FIGURE 3 as described previously.

To this effect, each cam-holder case comprises moreover for each bolt 20, 21 and 22 a return bolt 36, 37 and 38. Each of these bolts is equipped at its left end with relay station 39a and at its right end with a similar relay station 39b and these are mounted slidably in the cam-holder case, parallel to the cam bolts 20, 21 and 22.

On the left end of each bolt 36 to 38 is fixed a stud 40 hollowed with a vertical housing 40a in which is slidably mounted the end of a stop 41 subjected to the action of a spring 42 tending to push this stop out of the housing 40a (FIGURE 3a). The stop 41 extends vertically at the left of the bolt 36, 37 and 38 respectively, and of the corresponding cam bolts 20, 21 and 22.

In the rest position of the return bolts 36 to 38, the retractable stops associated with each of these bolts rests by their lower ends at the top of a ramp 42 which the cam-holder case has in the vicinity of the left end of each cam bolt 20 to 22. Still in this rest position of the return bolts, the end of relay station 37b passes above the fixed stop 35a disposed to the right of the frame of the machine when the carriage reaches its extreme right position, and when the stop 37a is engaged by its end in the cut-out 36a of the corresponding rods 24a.

If the rod 24a is not driven in in opposition to the return springs 25a and 25b, that is to say if the card 9 facing its end does not have an opening at this place, the relay station 39b associated with the corresponding return bolt enters into contact with the stop 37a before the carriage attains its extreme right position, so that this return bolt is locked while the carriage continues to move. At the end of the movement of this carriage, the cam-holder bolt and the return bolt whose corresponding rods will have been pushed into the rod-holder case will have the position occupied in FIGURE 5. It is seen then that the retractable stop 41 is displaced in front of the left front face of the corresponding cam bolt so that when the carriage arrives in the neighborhood of its extreme left position and when the relay station 39a of the return bolts meets the fixed stop 24, the cam bolt will be immobilised by the return bolt until the rod 6a has penetrated into the opening b of the cam bolt (FIGURE 6). During the relative displacement of the cam bolts and of the return bolts with respect to the case, the retractable stop 41 comes into contact, at the end of this displacement, with the ramp 42 and brings it back into its rest position (FIGURES 3, 4 and 6) in which it no longer engages with the corresponding cam bolts.

The return bolt associated with the "keys" cam bolt functions in an absolutely identical way to that which has just been described.

It results thus from what has been shown and described that the position of the cams assuring the control of the needles as well as that of the keys can be controlled when the carriage of the machine is displaced from right to left or from left to right, using a single device placed at the end of the bed and with the aid of members forming relay stations carried directly by the carriage. Such a construction has thus with respect to known constructions, the advantage of a simple mounting of its elements and of a sure operation.

What is claimed is:

1. A knitting machine comprising

(A) a frame;

(B) programming means secured to one end of said frame and carrying indications characteristic of the program of said machine, said programming means including a series of pattern cards having perforated and imperforated portions, said cards being articulated to one another; a driven supporting block carrying said cards having longitudinal faces provided with hollow housings in places corresponding to the positions of said perforated portions of said cards said block presenting said cards in turn;

(C) adjacent needle beds supported by said frame;

(D) a cam holder carriage slidable lengthwise over said beds from a first end to a second end of said frame, said second end having a fixed stop;

(E) means for driving said carriage in a reciprocating to-and-fro movement between said two ends of said bed of needles including pulleys, chain means stretched between said pulleys along the length of said bed in the shape of a loop of a certain width, a slide extending transversely to said loop and having a length at least equal to said width and a slider movable in said slide rigid with said carriage and fixed to said chain;

(F) a plurality of retractable cams on said carriage for actuating said needles according to said program; spring urged push rods in contact with said cams and adapted to retract same; cam bolts slidable to from different positions to control the axial position of said push rods; slidable rods having one extremity thereof in contact with said fixed stop for certain positions of said bolts and another end for actuating said bolts, and hence said needles and jacks when said carriage is at one end of said frame;

(G) a reader device comprising slidable feeler rods having a feeler end adapted to penetrate into said housings of said block of said programming means or to be pushed back thereby and another extremity actuating said slidable bolt and hence said needles when said carriage is at the other end of said beds;

(H) relay stations for preventing said slidable rods from contacting said fixed stop to thereby retain at least some of said cams in retracted position, comprising return bolts having one extremity adapted to contact said stop and another extremity for locking said cam bolts.

2. Machine according to claim 1, further having block-driving means for driving said block and at least one of the cards within reach of the said rods, so that the ends of the rods can penetrate into the said housings where the card is perforated and that the rod ends which contact an imperforated portion of the card are pushed away, the said block driving means moving the block away from the feeler rods as soon as said control device has actuated the cams or transmitted its order to one of said relays, other means being provided for making this block pivot as soon as it is sufficiently distant from the rods to carry a new card from said programming means in front of said rods.

3. Machine according to claim 2, wherein said feeler rods are mounted slidably, and elastic means are provided for urging said rods to penetrate into said housings of the block when one of said cards has a perforation aligned with a feeler rod.

4. Machine according to claim 1, comprising a parallelepipedal block mounted slidably between two sides parallel to that of the feeler rods, a rod crank system kinematically fast to the carriage in a direction transversal to its longitudinal axes and controlling the displacement of the block in said slides.

5. Machine according to claim 2, wherein the end of each rod opposite to the feeler end has a notch having a side forming a ramp; there being one vertically slidable stop associated with each rod and adapted to occupy two positions, one, lowered, when it is engaged in a corresponding notch and the other, raised, when it is in contact with a part of a rod adjacent to this notch, the two positions of the stop being obtained, the one when the rod is engaged in a perforation of the card, and the other when this rod is in contact with the surface of the said card.

6. Machine according to claim 5, wherein said ramp of said notch and the stop are positioned in such a way that the stop is engaged in the notch of the corresponding rod when this rod is in contact with the surface of the card, the said stop being in its raised position when the rod passes through a perforation of this card.

7. Machine according to claim 2, wherein the feeler rods are double in number to the number of cams of the carriage, each pair of rods being associated with a particular cam, and having a return belt and locking means, a second rod of each pair and said stop at the second end of a bed controlling the position of said return belt to bring this belt into operative position, the said belt carrying means making contact with said locking means when said carriage is about to reach the second end of the bed and said return belt has been stopped by the said stop member, for stopping the movement of said locking means across the bed and modifying its relative position with respect to the carriage, thereby varying the position of the corresponding cam thus carrying out the programme triggered by the return movement of the carriage towards said first end of the bed.

8. Machine according to claim 7, wherein said contact making means become inoperative when they have brought the corresponding locking means into a desired relative position with respect to the carriage.

9. Machine according to claim 8, wherein said beds have extensions and said feeler rods, said locking means and return bolt are parallel to one another and are disposed in said extensions.

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RONALD FELDBAUM, *Primary Examiner.*

U.S. Cl. X.R.

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