United States Patent

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[72] Inventor **Karl Flad**
Hauptrasse 29, Undingen, Germany

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[33] **Germany**
[31] **P 16 35 805.7**

[54] **PATTERN-KNITTING MACHINE**
27 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **66/154**
[51] **Int. Cl.** **D04b 15/66**
[50] **Field of Search** 66/154, 60–65

[56] **References Cited**
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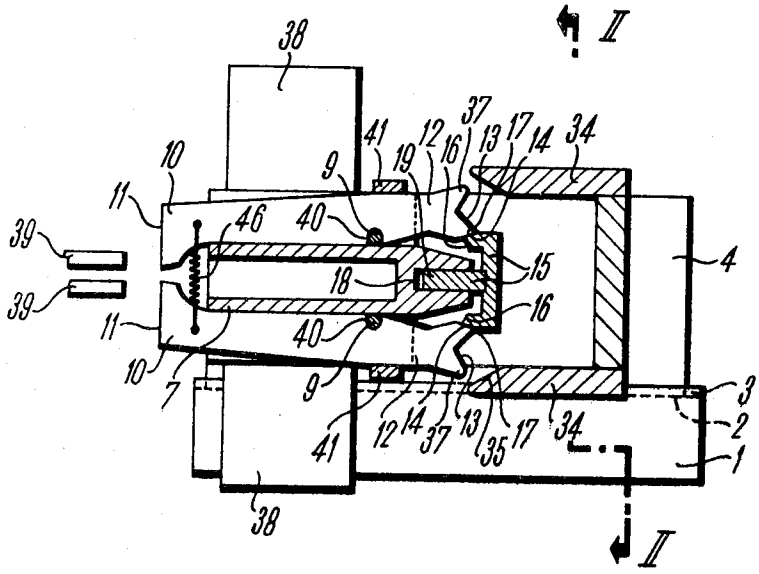
Primary Examiner—Ronald Feldbaum
Attorney—Craig, Antonelli, Stewart & Hill

ABSTRACT: Apparatus for controlling the jacks of a pattern-knitting machine such as a Jacquard machine comprises a displaceable striker bed which is intended to be substituted for the periodically displaced rail which effects displacement of selected jack means in a conventional machine, striker means pivotally mounted on said striker bed, said striker means having striker faces at one end for engagement with said jack means, a detaining device movable into engagement with said striker means at a location remote from said striker faces, means to pivot said striker means for moving said striker faces into a predetermined position prior to said striker bed being moved towards said jack means, said detaining device being arranged to be moved into a striker means locking position when said striker faces are in a selected position relatively to said jacks means prior to said striker faces engaging said jack means, and means for deriving said movement of said striker faces and of said detaining device from said periodic displacement of said striker bed.



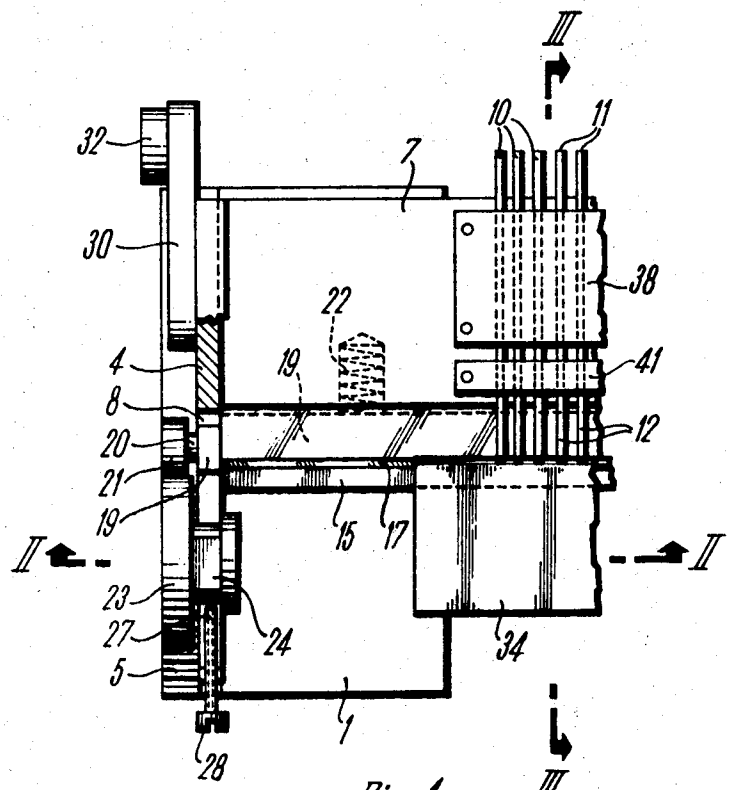


Fig. 1

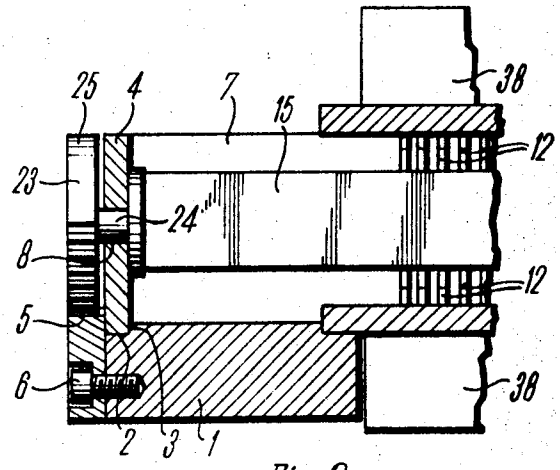


Fig. 2

INVENTOR

KARL FLAD

BY Craig, Antonelli, Stewart & Hill

ATTORNEYS

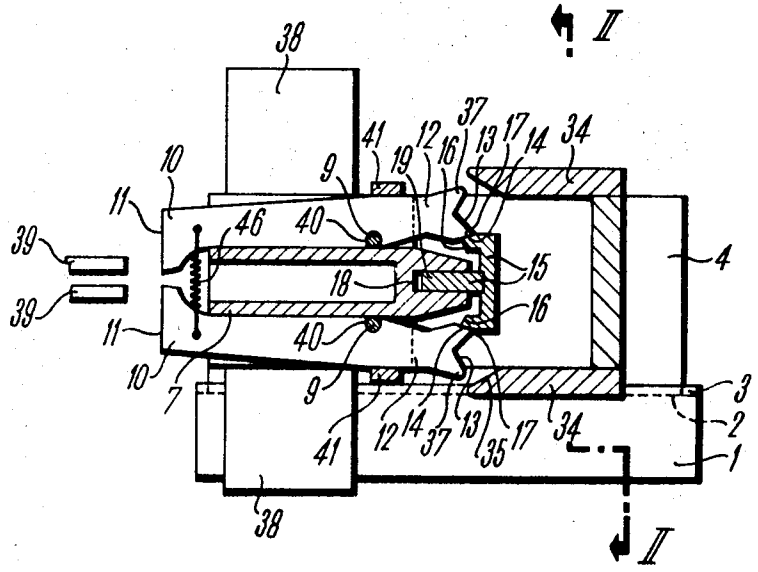


Fig. 3

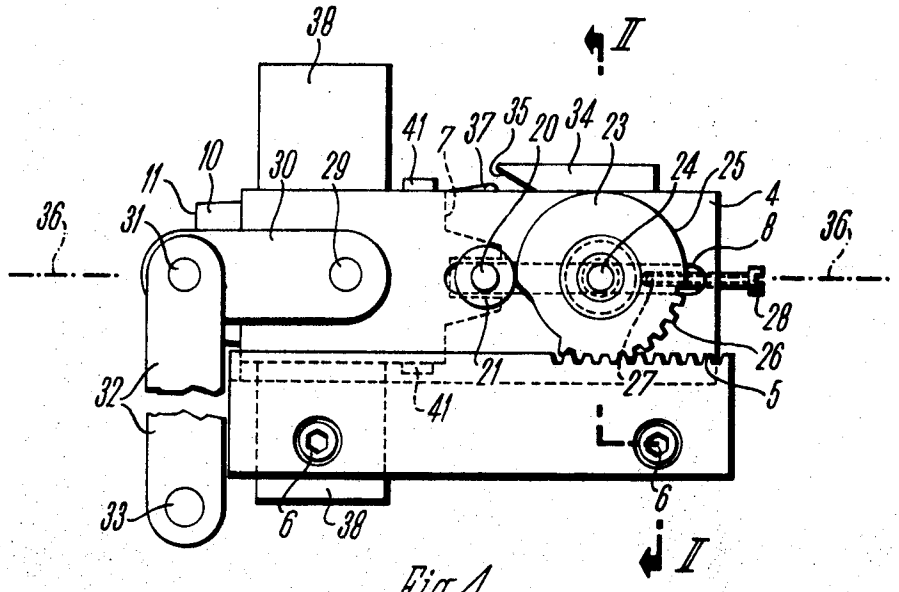


Fig. 4

INVENTOR

KARL FLAD

BY Craig, Antonelli, Stewart & Hill

ATTORNEYS

PATTERN-KNITTING MACHINE

This invention relates to apparatus for controlling the jacks actuating the needles in needle beds of a pattern-knitting machine and is a development of the invention disclosed in copending application Ser. No. 682,856 of Nov. 14, 1967 which describes and claims a knitting machine comprising needles mounted in a needle bed, jack means engageable with said needles, a periodically operable member, operable striker means for selective displacement of said jack means, information storage means to provide control signals in accordance with information stored in said information storage means for selectively operating the striker means to a jack means engaging position, and means for periodically displacing said member for actuation of selected jack means. The invention is applicable in particular to a Jacquard machine having an information storage carrier on which information representing the positions of the individual jacks for each row of loops or course are stored, wherein the knitting machine is provided with a rail which extends over the length of the needle bed and which is guided periodically against the rear end of the jacks for the purpose of adjusting the needles, the machine having displaceable strikers which cooperate with the jack ends remote from the needles and which can be moved into and out of engagement with the jack ends in accordance with a pattern stored in the information carrier. In particular the strikers are locked or latched at least in the engagement position in which they cooperate with the jack ends while the rail is pressed against the jack ends, a detaining device being provided which is driven in synchronism with the operating cycle of the machine.

In the apparatus described in the aforesaid application the strikers are displaced by electromagnets or by a drive which is independent of electromagnets, namely by cam discs which are driven by shafts rotating in synchronism with the operating cycle of the machine. Each striker is associated with an electromagnet which is controlled by the information carrier or pattern template and which detains the selected striker at the respective magnet, whereas the not selected strikers are moved back into their starting position. The detaining device which is driven in synchronism with the operating cycle of the machine, also detains the strikers in the selected position after selection has occurred in accordance with the pattern stored in the information carrier.

An object of the invention is to improve these devices. The invention consists in that the movement of the striker faces which are provided at the ends of pivotal strikers and/or the movement of the detaining device is derived from the movement of a rail constructed as a striker bed. The particular advantage of the invention resides in that it is unnecessary to provide complicated machine parts which transfer a rotary movement of a stationary shaft driven by the main motor to a shaft which is mounted on a rail which reciprocates at right angles to the axis of the stationary shaft. Also it is necessary to provide a separate drive for the movement of the strikers provided with the striker faces for the movement of the detaining device which drive must be synchronized with the movement of the striker bed and under certain circumstances must be transferred to the reciprocating striker bed. Accordingly the control device of the present invention can be produced in a considerably simpler more economical and more reliable manner.

Moreover the control device according to the invention can be constructed in such manner that the rail constructed as a striker bed can be built into a conventional Jacquard machine without any other modification in place of the prismatic bar carrying the Jacquard rails. Thus it is easily and simply possible, and causes only very low costs, to fit already existing Jacquard machines with the device according to the invention; the time required for effecting modification is very short in this case and accordingly the loss of production caused by the standstill period of the machine during the modification is reduced correspondingly.

In one embodiment of the invention, runup surfaces are provided for the purpose of pivoting the strikers about their axes, the surfaces being stationary in relation to the machine and inclined to the direction of movement of the striker bed and arranged to cooperate with the striker ends which are remote from the striker faces for the jacks. The particular advantage of this embodiment of the invention may be seen in the fact that the runup surfaces do not need any drive at all. The movement of the striker bed serves as a drive for the pivotal movement of the strikers. In this surprisingly simple manner the strikers can be successfully pivoted in synchronism with the operating cycle of the machine. In embodiments of the invention a separate runup surface may be provided for each striker. Alternatively one runup surface extending over the length of the striker bed may be provided for all the strikers disposed in the same row. For example the runup surfaces may consist of a suitably stiff or stiffened metal strip which, as provided in one embodiment of the invention, is disposed at an angle of approximately 20° to the direction of movement to the striker bed. With this angle of inclination a satisfactory short path of the striker bed is obtained along which pivoting of the strikers is effected, and which provides low friction between the runup surfaces and the striker end. With a larger angle the striker bed path necessary for pivoting the strikers is shorter. However, the friction between the striker end and the runup surface increases then quickly. With a smaller angle the path of the striker bed required for pivoting the striker increases to an undesirable extent.

In one embodiment of the invention a rack is provided which is rigidly attached to the machine for driving the detaining device and/or for moving the strikers, and a gear wheel or toothed segment is rotatably mounted on the striker bed and meshes with the rack. In this case the toothed segment may drive a cam disc the periphery of which cooperates with a roller which is mounted on a detaining rail and is displaceable relatively to the striker bed. The particular advantage of this embodiment of the invention resides in the fact that any external drive can be omitted and yet a simple and economic drive is produced which gives little trouble in operation. Owing to the absence of transmission elements which drive the detaining device from an outside source the machine cannot only be built in an easily accessible and accident-reducing manner owing to the absence of reciprocating members but also conversion from a conventional knitting machine with Jacquard bar to a knitting machine with the device according to the invention is considerably facilitated and simplified.

The construction of the drive for the detaining device is particularly simple when, as provided in one embodiment of the invention, the toothed segment and the cam disc are produced in one piece and the cam track of the cam disc is disposed in the continuation of the periphery of the toothed track of the toothed segment. The toothed segment and the cam disc may be adjustable relatively to the rack in the direction of movement of the striker bed. Thereby it is possible to select and adjust the time of movement of the detaining device relatively to the movement of the striker bed in the manner required by the operation of the knitting machine.

In one embodiment of the invention the ends of the strikers cooperating with the detaining device have inclined surfaces which in the detained position rest against corresponding wedge surfaces of the detaining device. In this manner small inaccuracies can be compensated without the detained or locked strikers having play in the detaining device, because the inclination surfaces and the wedge surfaces effect an appropriate adjustment of the parts carrying them.

In a particularly preferred embodiment of the invention the detaining device consists of a rail which is divided in two in the longitudinal direction and which has an approximately T-shaped cross section, the web of the T supporting the rollers traveling on the cam discs, and the flange of the T extending transversely to the direction of movement of the striker bed and the detaining device and being provided at its ends with wedges which are disposed parallel to the web and are provided with wedge surfaces. By dividing the rail in two a detain-

ing rail is obtained which can be produced from semifinished stock without much milling work, and the web of the detaining rail can be guided as a guide section in an appropriate groove of the striker bed. By constructing the surfaces effecting detention as wedge surfaces which cooperate with the inclined surfaces of the striker the possibility is obtained to attain play-free detention by selecting the angles which are included between these faces.

Details and constructional features of the invention may be seen from the following description, in which the invention is described and explained in detail with reference to one embodiment illustrated by way of example in the accompanying drawings. The features can be found in the description and the drawings which may in other embodiments of the invention be utilized singly by themselves or severally in any combination. In the drawings:

FIG. 1 is a plan view of the striker bed partly broken away with the drive parts for the detaining device,

FIG. 2 is a longitudinal section through the striker bed along the line II—II in FIG. 1,

FIG. 3 is a cross section through the striker bed along the line III—III in FIG. 1, and

FIG. 4 is a side view of the drive of the detaining device.

Guide faces 2 and 3 (FIG. 2) extending at a right angle to each other are provided in a stationary machine body 1 of a knitting machine and form a rectangular groove together with the side face of a rack 5 which is attached to the machine body 1 by means of screws 6. One such rectangular groove is located at the right-hand end and one at the left-hand end of the knitting machine in the rearward portion of the machine body, the grooves extending transversely to the direction of the sinker cam. A plate 4 is guided upright in each of the two rectangular grooves. A plate bed 7 is located between and attached to these two plates 4 and thus extends over the whole of the machine; together with the plates 4 it is periodically moved in the rectangular grooves in the direction of the longitudinal axis of the needles of the knitting machine against the rear end of jacks 39 disposed behind the needles.

The plate 4 extends beyond the rear end of the plate bed 7 and this extension is provided with a slotlike recess 8.

The plate bed 7, supports plates 10 which are mounted for pivotal movement through a limited angle on a continuous pin 9 which extends over the whole width of the machine. The plates 10 are disposed in recesses in the plate bed 7 and each is provided at its end adjacent to the jack ends 39 with a striker face 11 which is intended for abutment with the jack ends 39. Corresponding to two rows of jacks disposed one above the other, plates 10 are located on the upper surface as well as on the lower surface of the plate bed 7. The ends 12 of the plates 10 remote from the striker faces 11 are profiled and are provided with two inclined faces 13, 14 which cooperate with corresponding inclined faces 16 and 17 provided on wedgelike ends of a detaining rail 15. This detaining rail 15 has a T-shaped cross section. The web 19 of this cross section is displaceably guided in a slotlike recess 18 at the rear end of the plate bed 7. At its two lateral ends extensions of the web 19 engage in the slot 8 of the plate 4 and are guided therein. Because the recess 8 extends parallel to the lower edge of the plate 4 guided in the rectangular groove, the detaining rail 15 is displaceably guided by the extension of the web 19 in the direction of movement of the plate bed 7. A roller 21 is rotatably mounted by means of a bearing pin 20 in the extension of the web 19 engaging in the recess 8. Springs 22 are disposed in the plate bed 7 and tend to press the web 19 rearwardly out of the recess 8. The roller 21 is pressed thereby against the periphery of a cam disc 23 which is rotatably mounted on a bearing pin 24 which is also displaceably guided in the slotlike recess 8 of the plate 4. A portion of the periphery of the cam disc 23 has a cam track 25 which cooperates with the roller 21. Another portion of the periphery is provided with teeth 26 which engage in the rack 5. The cam disc 23 is thus provided with a cam segment and a toothed segment.

An adjusting screw 28 which engages in the recess 8 is screwably guided in the plate 4 and its axis extends in the center plane of the recess 8. The bearing pin 24 is supported by the inner end of the adjusting screw 28. By rotating the adjusting screw 28 the position of engagement of the detaining rail 15 with the plate ends 12 can be adjusted. Thereby the instant can also be adjusted at which detention of the plates 10 begins or finishes in the operating cycle. The cam disc 23, the roller 21 and the other parts of the drive of the detaining rail are each provided once at the two ends of the detaining rail 15 extending over the whole width of the machine.

A bearing pin 29 is attached to the plate 4 on each side of the striker bed 7 and a link member 30 is pivotally mounted on each of them. The free end of the link member 30 is pivotally connected by a pin 31 to the free end of a swinging lever 32 which is securely fixed to a shaft 33 which in turn is rotatably mounted in the machine body and is oscillated by a known driving arrangement. The swinging lever 32 is present also in conventional Jacquard machines. In these machines it moves the Jacquard bars. The apparatus according to the invention can be connected to the ends of the swinging lever 32 either without modification or with only minor modification, by means of the link member 30. Further driving connections of the apparatus according to the invention with the machine are not required.

Aligning rails 34 are symmetrically disposed on both sides of the displacement path travelled by the striker bed 7 and are rigidly connected to the machine body 1. The aligning rails 34 have runup surfaces 35 which have an inclination of between 15° and 60° relatively to a plane of symmetry 36 extending through the striker bed but are preferably inclined at an angle of 20°. The reciprocatory movement of the striker bed 7 occurs in planes parallel to the plane of symmetry of the striker bed. During the return movement of the striker bed 7 in which the striker bed moves away from the jack ends 39, rounded projections 37 at mutually opposite locations on the striker ends 12 come into engagement with the inclined surfaces 35. During continued return movement of the striker bed 7 these projections and thus the striker ends 12 are moved inwardly towards each other by the inclined surfaces 35, the strikers pivoting about the pins 9 so that the striker faces 11 move outwardly away from each other.

Each striker 10 is associated with an electromagnet 38. All electromagnets 38 on one side of the striker bed 7 are attached to a common rail one such magnet rail being provided on each side of the striker bed 7. After all strikers 10 have been moved by the inclined surfaces 35 into contact with the magnets 38 during the return movement of the striker bed 7 individual magnets 38 are energized in accordance with a desired pattern and detain the selected strikers 10. The swinging lever 32 then swings back and pulls the striker bed 7 forward again towards the jack ends 39 whereby those strikers 10 which are not detained by the respective magnets 38 pivot back into their original position under the effect of a tension spring 46 which is always disposed between two mutually opposite strikers 10; in this position of the strikers the striker faces 11 are located in an inward position in which they provide an abutment for the jack ends 39.

All strikers which are detained by the magnets 38 are pivoted into a position in which the striker faces 11 are located away from the jack ends 39. However, before the other striker faces 11 come into engagement with the jack ends, the cam disc 23 rotates to such an extent that the roller 21 is moved out of a region of the cam track 25 with a small radius and on to a peripheral region of the track with a larger radius whereby the detaining rail 15 which is rigidly connected to the roller 21 is moved against the rear striker ends 12, an the wedge surfaces 16, 17 of the detaining rail 15 engage either the inclined surfaces 13 or the inclined surfaces 14 and lock the strikers 10 in the adjusted position.

In their edge turned towards the striker bed the strikers 10 have an open slot 40 by means of which they are pushed on the respective pin 9. The strikers 10 are held on the continu-

ous pins 9 by means of rails 41. The rails 41, the pins 9, the detaining rail 15 and the aligning rail 34 are produced from a work material which has as low a magnetic conductivity as possible, for example stainless steel. Each rail 41 is attached to the respective rail carrying the magnets 38.

In the embodiment of the invention in which a runup surface is provided for each striker these runup surfaces may be displaceable, in which case their movement may be controlled by the information carrier in accordance with the stored pattern. This has the advantage that the parts necessary for driving the runup surfaces, for example electromagnets, can be disposed on the stationary machine body. Apart from he strikers only the detaining device must then be attached to the striker bed.

What I claim is:

1. Apparatus for controlling the jacks of the needles in needle beds of a pattern-knitting machine, by means of an information carrier on which the positions of the individual jacks are stored for each course, the knitting machine being provided with a rail which extends over the length of the needle bed and which is guided periodically against the rear ends of the jacks for setting the needles, and which has displaceable striker faces cooperating with the jack ends, the striker faces being movable into and out of engagement with the jack ends in accordance with information stored in the information carrier, the striker faces being locked by a detaining device at least in the position in which they can engage the jack ends when the rail is pressed against the jack ends, the detaining device being driven in synchronism with the operating cycle of the machine, wherein the movement of the striker faces which are provided at the ends of pivotal strikers is derived from the movement of the rail constructed as a striker bed.

2. Apparatus according to claim 2, wherein for pivoting the strikers about their axes, runup surfaces are provided which are inclined to the direction of movement of the striker bed and cooperate with the striker ends remote from the striker faces for the jack ends.

3. Apparatus according to claim 3, wherein the runup surfaces extend over the length of the striker bed.

4. Apparatus according to claim 1, wherein the detaining device and/or the strikers are arranged to be driven by a rack which is stationarily attached to the machine and a toothed segment which is rotatably mounted on the striker bed and which engages in the rack.

5. Apparatus according to claim 4, wherein for the drive of the detaining device a cam disc driven by the toothed segment is provided, with the periphery of which a roller cooperates which is mounted on a detaining rail displaceable guided relatively to the striker bed.

6. Apparatus according to claim 5, wherein the toothed segment and the cam disc are produced in one piece and the cam track is constructed as a continuation of the teeth on the periphery of the toothed segment.

7. Apparatus according to claim 5, wherein the toothed segment and the cam disk are adjustable relatively to the rack in the direction of movement of the striker bed.

8. Apparatus according to claim 1, wherein the ends of the strikers cooperating with the detaining device are provided with inclined surfaces which in the detaining position rest against corresponding wedge surfaces of the detaining device.

9. Apparatus according to claim 1, wherein the detaining device consists of a rail which is longitudinally divided in two and has an approximately T-shaped cross section, the web of which carries the rollers running along the cam discs and the flange of which extends transversely to the direction of movement of the striker bed and the detaining device and which is provided at its end with wedges which are parallel to its web and which have wedge faces.

10. Apparatus for controlling the jacks of the needles in needle beds of a pattern-knitting machine, by means of an information carrier on which the positions of the individual jacks are stored for each course, the knitting machine being provided with a rail which extends over the length of the needle bed and which is guided periodically against the rear ends of the jacks for setting the needles, and which has displaceable striker faces cooperating with the jack ends, the striker faces being movable into and out of engagement with the jack ends in accordance with information stored in the information carrier, the striker faces being locked by a detaining device at least in the position in which they can engage the jack ends when the rail is pressed against the jack ends, the detaining device being driven in synchronism with the operating cycle of the machine, wherein the movement of the detaining device is derived from the movement of the rail constructed as a striker bed.

11. Apparatus according to claim 10, wherein for pivoting the strikers about their axes, runup surfaces are provided which are inclined to the direction of movement of the striker bed and cooperate with the striker ends remote from the striker faces for the jack ends.

12. Apparatus according to claim 11, wherein the runup surfaces extend over the length of the striker bed.

13. Apparatus according to claim 10, wherein the detaining device and/or strikers are arranged to be driven by a rack which is stationarily attached to the machine and a toothed segment which is rotatably mounted on the striker bed and which engages in the rack.

14. Apparatus according to claim 13, wherein for the drive of the detaining device a cam disc driven by the toothed segment is provided, with the periphery of which a roller cooperates which is mounted on a detaining rail displaceably guided relatively to the striker bed.

15. Apparatus according to claim 14, wherein the toothed segment and the cam disc are produced in one piece and the cam track is constructed as a continuation of the teeth on the periphery of the toothed segment.

16. Apparatus according to claim 14, wherein the toothed segment and the cam disc are adjustable relatively to the rack in the direction of movement of the striker bed.

17. Apparatus according to claim 10, wherein the ends of the strikers cooperating with the detaining device are provided with inclined surfaces which in the detaining position rest against corresponding wedge surfaces of the detaining device.

18. Apparatus according to claim 10, wherein the detaining device consists of a rail which is longitudinally divided in two and has an approximately T-shaped cross section, the web of which carries the rollers running along the cam discs and the flange of which extends transversely to the direction of movement of the striker bed and the detaining device and which is provided at its end with wedges which are parallel to its web and which have wedge faces.

19. Apparatus for controlling the jacks of the needles in needle beds of a pattern-knitting machine, by means of an information carrier on which the positions of the individual jacks are stored for each course, the knitting machine being provided with a rail which extends over the length of the needle bed and which is guided periodically against the rear ends of the jacks for setting the needles, and which has displaceable striker faces cooperating with the jack ends, the striker faces being movable into and out of engagement with the jack ends in accordance with information stored in the information carrier, the striker faces being locked by a detaining device at least in the position in which they can engage the jack ends when the rail is pressed against the jack ends, the detaining device being driven in synchronism with the operating cycle of the machine, wherein the movement of the striker faces which are provided at the ends of pivotal strikers and the movement of the detaining device is derived from the movement of the rail constructed as a striker bed.

20. Apparatus according to clam 19, wherein for pivoting the strikers about their axes, runup surfaces are provided which are inclined to the direction of movement of the striker bed and cooperate with the striker ends remote from the striker faces for the jack ends.

21. Apparatus according to claim 20, wherein the runup surfaces extend over the length of the striker bed.

22. Apparatus according to claim **20**, wherein the detaining device and/or the strikers are arranged to be driven by a rack which is stationarily attached to the machine and a toothed segment which is rotatably mounted on the striker bed and which engages in the rack.

23. Apparatus according to claim **22**, wherein for the drive of the detaining device a cam disc driven by the toothed segment is provided, with the periphery of which a roller cooperates which is mounted on a detaining rail displaceably guided relatively to the striker bed.

24. Apparatus according to claim **23**, wherein the toothed segment and the cam disc are produced in one piece and the cam track is constructed as a continuation of the teeth on the periphery of the toothed segment.

25. Apparatus according to claim **23**, wherein the toothed segment and the cam disc are adjustable relatively to the rack in the direction of movement of the striker bed.

26. Apparatus according to claim **19**, wherein the ends of the strikers cooperating with the detaining device are provided with inclined surfaces which in the detaining position rest against corresponding wedge surfaces of the detaining device.

27. Apparatus according to claim **19**, wherein the detaining device consists of a rail which is longitudinally divided in two and has an approximately T-shaped cross section, the web of which carries the rollers running along the cam discs and the flange of which extends transversely to the direction of movement of the striker bed and the detaining device and which is provided at its end with wedges which are parallel to its web and which have wedge faces.