

[54] JACQUARD MACHINE 391,882 9/1908 France..... 139/59  
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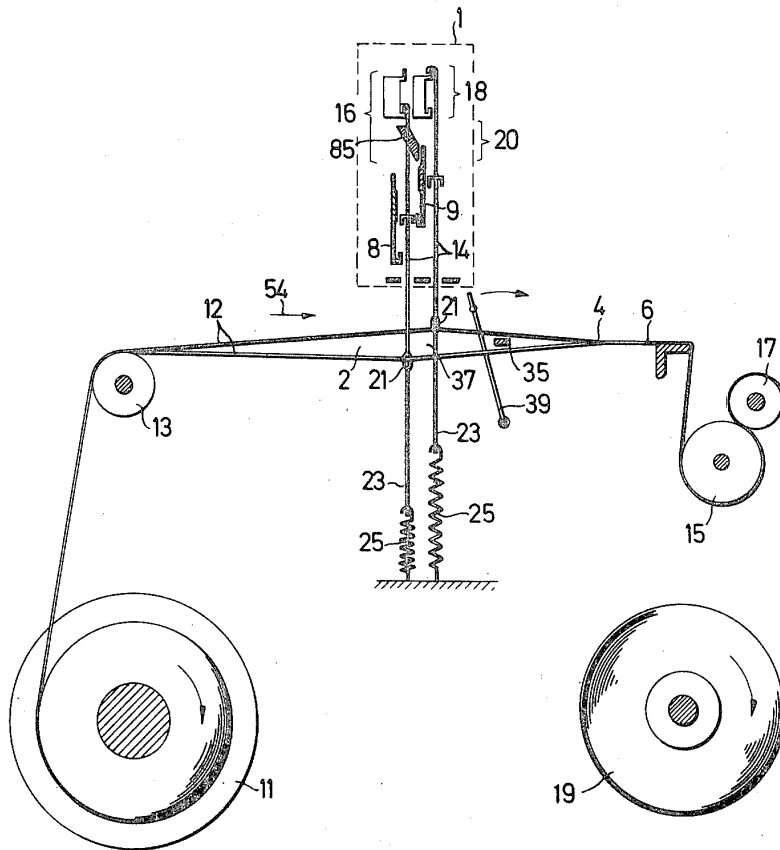
[57] ABSTRACT

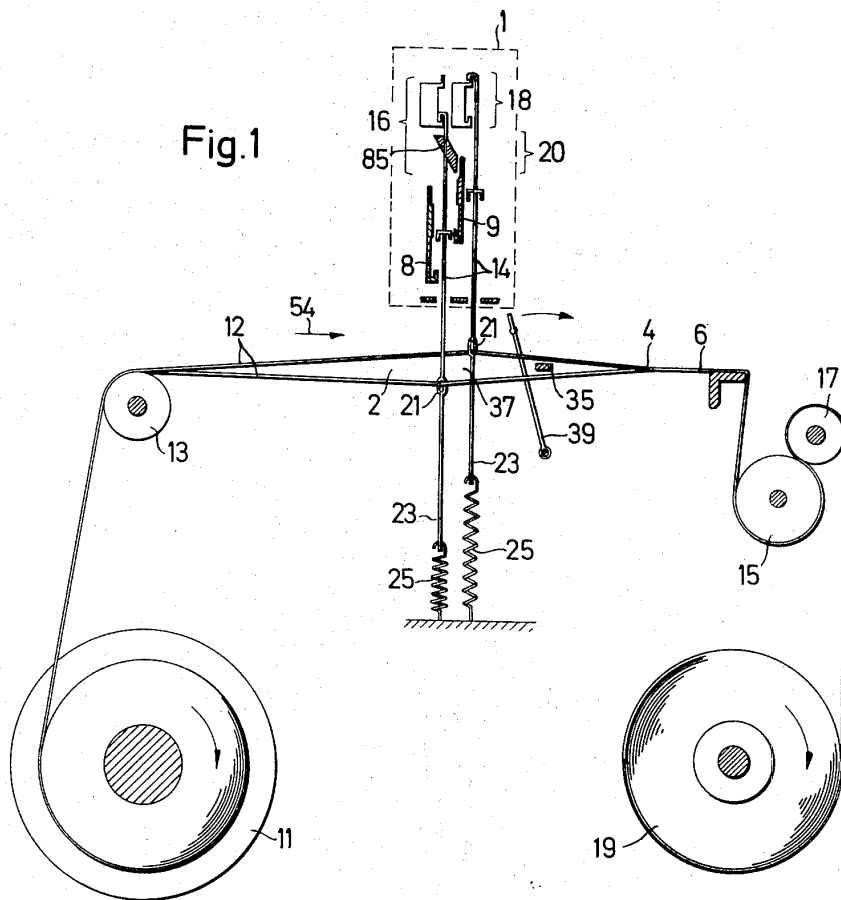
The jacquard machine has a sensor which is movable vertically by the action of the draw knives to sense the position of the flexural element of the selector mechanism as well as a pivotally mounted lever which is pivoted by the draw knives after sensing. The lever is resiliently connected to a guide member which is secured to the lifting hook. The guide member is movable horizontally upon clockwise pivoting of the lever either against a lower surface of the sensor, if the flexural member is straight, or past this lower surface, if the flexural member is moved in a deflected position. The two positions of the guide member allows the lifting hook to engage one or the other of the draw knives.

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10 Claims, 4 Drawing Figures





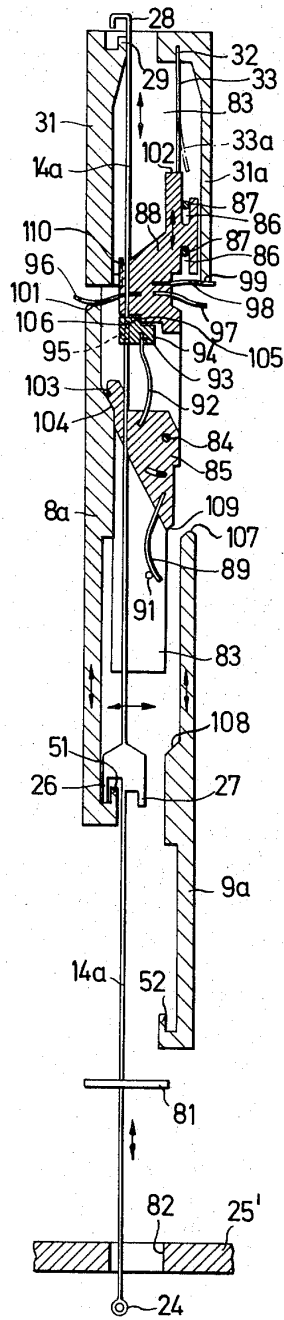


Fig. 2

Fig. 3

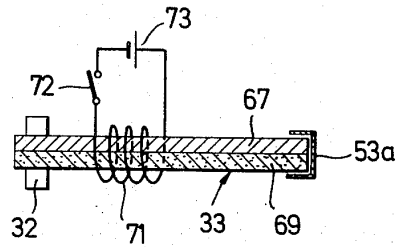
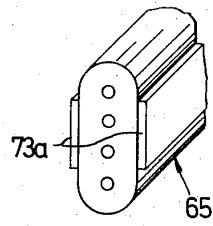


Fig. 4



## JACQUARD MACHINE

This invention relates to a jacquard machine and particularly to a means for controlling the displacement of a lifting hook into coupled engagement with a draw knife.

Jacquard machines are known in which lifting hooks for forming a shed of warps are lowered by means of jacquard needles which are actuated by means of a reciprocating grate. Usually, the jacquard needles are moved into or kept away from the path of grate movement in accordance with a punched card sensed by sensing needles.

Jacquard machines have also been known which do not use a punched card and sensing needles but instead use a selector comprising flexural control elements, e.g. electrostrictive or magnetostrictive elements, for controlling the lifting hooks. In this case, a mechanical or pneumatic transmission is usually provided between such elements and the lifting hooks.

However, the displacing facilities, i.e. coupling means which are used in machines of this kind and which comprise the selector and the transmission mechanism are relatively complicated, take up considerable space and have a number of moving parts and so are fairly likely to be disturbed in operation.

Accordingly, it is an object of the invention to provide a system for displacing the lifting hooks of a jacquard machine which is relatively simple.

It is another object of the invention to provide a system for displacing the lifting hooks of a jacquard machine which occupies a relatively small space.

It is another object of the invention to provide a system of relatively few parts for moving the lifting hooks of a jacquard machine.

It is another object of the invention to avoid disturbances in the displacing of the lifting hooks of a jacquard machine.

Briefly, the invention provides a jacquard machine of generally conventional structure with a plurality of lifting hooks, draw knives and a means for selectively displacing the lifting hooks into and out of coupling engagement with the respective draw knives in a programmed manner.

The displacing means for each hook comprises a transmission mechanism including a pivoted lever which is operated alternately by the draw knives and is connected to the hook by a yielding connection and selector mechanism for selectively blocking displacing movement of the hook.

Preferably, the selector mechanism comprises a sensor which is movable between a blocking position and a non-blocking position and a control element which has a first geometric form for preventing movement of the sensor from the blocking position to the non-blocking position and a second geometric form for allowing such movement. The selector means also has a means for selectively changing the control element from one form to the other. The means for changing the geometric form of the control element may be external of the control element, for example, a solenoid. Preferably, the control element is constructed to change from one form to the other when heated, for example, when an electric current is passed through the element or when an electric or magnetic field is applied to the element. In the preferred arrangement, the

change of the control element from one geometric form to the other is a flexural movement.

The draw knives are arranged alternately to tend to move the selector between its two positions. This produces an arrangement which is simple and has few parts and can therefore be constructed compactly. This is an advantage where a large number of lifting hooks are used, for example, where the jacquard machine is used with a loom in which all or substantially all of the weft threads are individually controlled.

These and other objects and advantages of the invention will become more apparent from the following detailed description and appended claims taken in conjunction with the accompanying drawings in which:

FIG. 1 illustrates a diagrammatic view of a jacquard machine according to the invention as used in association with a loom;

FIG. 2 illustrates a view to an enlarged scale of a detail of FIG. 1;

FIG. 3 illustrates a view of a control element used in accordance with the invention; and

FIG. 4 illustrates a fractional view of another control element used in accordance with the invention.

Referring to FIG. 1, a jacquard machine 1 is disposed immediately above a shed 2 with a loom of conventional structure. The loom comprises a warp beam 11, a whip roll 13 over which warp yarns 12 pass in the direction indicated by an arrow 54 while the machine is in operation, eyes or mails 21 of heddles 23 and a reed 39. Weft yarns are picked into the shed 2 by a gripper shuttle 35 and beaten up by the reed 39 at the fell 4 to form a cloth (fabric) 6. The cloth passes over a cloth take-up roller 15 and a guide roller 17 and is wound on a cloth beam 19.

The jacquard machine 1 has two draw knives 8, 9 which move in vertical paths for effecting movements of the heddles 23 to form the shed 2. In addition, a downwardly acting tension spring 25 and a lifting hook 14 adapted to be coupled with the knives 8, 9 act on each heddle 23 as shown. Each heddle 23 has a hook (not shown) at the upper end by which the heddle 23 is suspended in an associated lifting hook 14. The knives 8, 9 are constructed to rise and fall continuously and alternately and each carries a hook to engage a lifting hook 14. In this case, the jacquard machine is a double-lift open-shed machine.

Referring to FIG. 2, each lifting hook 14 which is a single hook has an eye 24 to engage a heddle (not shown) as is known and passes through an opening 82 in a stationary board 25'. Each hook 14 carries two hooks 26, 27 for selective engagement with the knives 8a, 9a as well as a hook 28 at the upper end for selective engagement with a claw 29 disposed on a stationary support beam 31 of the machine 1. The board 25' the claw 29 and the support beam 31 each extend over the entire weaving width of the loom.

As shown in FIG. 2, each single lifting hook 14a has a retaining disc 81 at the bottom which prevents the lifting hook, when released by the draw knives 8a, 9a from dropping through the aperture 82 in the board 25' due to the action of spring 25 (cf. FIG. 1). Also, hooks 51, 52 are provided at the bottom end of the draw knives 8a, 9a to selectively engage the hooks 26, 27 of the lifter 14a.

Referring to FIG. 1, the jacquard machine 1 has a displacing means 16 at the top which serves to connect each lifting hook 14 to one or the other of the knives

8, 9. This displacing means 16 includes a selector mechanism 18 and a transmission mechanism 20.

Referring to FIG. 2, each selector mechanism 18 is mounted on a pair of stationary support beams 31, 31a which extend across the weaving width of the loom and are secured at each end to a baseplate 83. In addition, each selector mechanism 18 for a lifter 14a includes a control element such as a flexural member 33 which is clamped or otherwise secured in a region 32 of the support beam 31a. The selector mechanism 18 moves the control elements 33 into a particular position in accordance with a pattern program. In addition, the selector mechanism includes a sensor 88 which is vertically reciprocally mounted between the beams 31, 31a. The sensor 88 is guided between two limit pins 87 which are disposed in slots 86 of the sensor 88 to move between a blocking position and a non-blocking position.

The sensor 88 carries three springs 96, 97, 98, two of which 96, 97 are disposed in the path of the knives 8a, 9a. The other spring 98 bears against a surface 99 of the stationary support beam 31a to bias the sensor 88 downwardly upon deflection. In addition, the sensor 88 has a sensing surface 102 for abutting the control element 33 when the element 33 is in a vertical plane as shown in solid lines.

The transmission mechanism 20 includes a lever 85 which is pivotally mounted on a pivot 84 secured in the baseplate 83 and which is secured to the lifting hook 14 in a yielding manner. The lever 85 carries a depending compression spring 89 which bears against a pin 91 disposed on the baseplate 83. This compression spring 89 serves to bias the spring 89 in a counterclockwise direction, as viewed. The amount of pivoting of the lever 85 is limited, as shown, by a pin which is received in an arc-like slot in the lever 85. In addition, the lever 85 carries a spring 92 at the upper end which, in turn, carries a guide member 94 at the top end. This guide member 94 has a slot 95 for guiding the lifting hook 14a while the spring 92 biases the guide member 94 and lifting hook 14a to the right as viewed. The guide member 94 also has a vertical surface 105 for selectively abutting a vertical sensor surface 106 on the lower end of the sensor 88.

The respective knives 8a, 9a are provided with surfaces for lifting the sensor 88 via the springs 96, 97 as well as surfaces for pivoting the lever 85. That is, one knife 8a is provided with a top end 101 for abutting the spring 96 as well as an inclined surface 103 for abutting a mating inclined surface 104 on the lever 85 during upward movement of the knife 8a. The other knife 9a is provided with a top end 107 for abutting the spring 97 as well as an inclined surface 108 for abutting a mating surface 109 on the lever 85 during upward travel.

The springs 96, 97 are adapted to lift the sensor 88 when abutted by the knives 8a, 9a while the spring 98 is adapted to return, i.e. lower, the sensor 88 after downward movement of a knife. The size and characteristics of the springs 96, 97 are such that they can overcome the force of knife 8a, 9a.

The construction shown in FIG. 2 operates as follows:

During the rise of knife 8a and the simultaneous fall of knife 9a, a pick-off or signal generator controls the element 33. The assumption is that element 33 moves into the solid-line straight position. Shortly before the top reversal or dead center position of the knife 8a, the top end 101 of the knife 8a strikes the spring 96, and

so the sensor 88 moves into the sensing position which is shown in which the sensing surface 102 strikes the element 33, i.e. the blocking position. Because the element 33 blocks further movement, the sensor 88 must remain in a low position. In the highest phase of the rise of the knife 8a, the inclined surface 103 strikes the inclined surface 104 of the lever 85 to pivot the lever clockwise as viewed. However, since the surface 105 of the guide member 94 abuts the sensor surface 106, the guide member 94 and the lifting hook 14a remains in the "left" position shown. Knife 8a is now in the top reversal position shown in FIG. 2 and the hook 28 has been lifted above the claw 29. Shuttle 35 now makes a pick, the jacquard machine 1 operating as a double-lift open-shed machine.

During the next fall of the knife 8a and rise of the knife 9a, the lever 85 pivots counterclockwise and the hook 28 and claw 29 engage with one another. The element 33 is then re-actuated. Assuming that the element 33 moves into the chain-line bent position 33a, when the top end 107 of the knife 9a strikes the spring 97, the sensor 88 rises. As a result, the vertical surface 106 is therefore above the surface 105 of the guide member 94 i.e. the non-blocking position of the sensor 88. When the inclined surface 108 of the knife 9a then strikes the surface 109 of the lever 85, the lever pivots clockwise. Consequently, the guide member 94 and the central and bottom zone of the lifting hook 14a move to the right, the hook 28 and claw 29 still being in engagement. The hook 52 of the knife 9a then engages with the hook 27 so that the lifting hook 14a is disengaged at the hook 28 and claw 29 and the top part of the lifting hook 14a moves into the "right" position. There is another pick in the top position of knife 9a. The movements then continue in a similar fashion.

As shown in FIG. 2, the spacing of the lever 85, sensor 88, knives 8a, 8b and springs 96, 97 are such that each knife 8a 8b abuts a spring 96, 97 and, thus, the sensor 88 before the inclined surfaces 103, 108 of the knives 8a, 9a abut the lever 85. In this way, the sensing movement of the sensor 88 relative to the control element occurs before pivoting of the lever 85.

Referring to FIG. 2, the purpose fulfilled by the disc 81 can be fulfilled by a second hook 110, disposed at the bottom end of the support beam 31, for coupling the lifting hook 14a in the bottom position, the hook 110 engaging with the hook 28.

As shown in FIG. 3, the control element 33 can be e.g. a magnetostrictive element, comprising two strips 67, 69 which expand differently from one another in an applied magnetic field, so that bending occurs. Such a field can be produced by means of a winding 71 which can be connected via a switch 72 to a power supply 73 or else can be connected to the appropriate part of a programmer.

In an alternative form, shown in FIG. 4, an electrostrictive (piezoelectric) flexural oscillator 65 is used, in the form e.g. of two strips of different material, the two materials expanding differently when an electric field is applied to the two outer electrodes 73a. Due to the different expansions of the materials, the oscillator 65 takes up a bent or flexed position.

What is claimed is:

1. In a jacquard machine having a lifting hook, a pair of draw knives disposed to move in predetermined paths, and means for selectively displacing said lifting hook into and out of coupling engagement with a re-

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spective draw knife; said displacing means including a pivotally mounted lever disposed in the path of each said knife and connected to said hook, and a selector mechanism for selectively blocking displacing movement of said hook.

2. In a jacquard machine as set forth in claim 1, said selector mechanism including a sensor movably mounted between a blocking position and a non-blocking position, a control element having a first geometric form for preventing movement of said sensor from said blocking position to said non-blocking position and a second geometric form for allowing movement of said sensor from said blocking position to said non-blocking position, and means for selectively changing said control element from one geometric form to the other geometric form.

3. In a jacquard machine as set forth in claim 2 wherein said control element is heat-responsive to change from one geometric form to the other geometric form.

4. In a jacquard machine as set forth in claim 2 wherein said control element is electrically-responsive to change from one geometric form to the other geometric form.

5. In a jacquard machine as set forth in claim 2 wherein said control element is magnetically-responsive to change from one geometric form to the other geometric form.

6. In a jacquard machine as set forth in claim 2 wherein said control element is a flexural member.

7. In a jacquard machine as set forth in claim 2 wherein said sensor is disposed in said paths of said draw knives to be moved thereby from said blocking position to said non-blocking position.

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8. In a jacquard machine as set forth in claim 7 wherein said sensor and said lever are each positioned relative to said draw knives to have each draw knife abut said sensor during an upward movement prior to abutting said lever.

9. In a jacquard machine as set forth in claim 1 wherein said hook has a pair of hooks for selectively engaging each respective one of said draw knives.

10. In a jacquard machine having a stationary support, a pair of draw knives disposed to move in vertical paths, at least one lifting hook for a heddle, said lifting hook including a pair of hooks for selectively engaging with a respective one of said draw knives and a hook for engaging said support, and means for displacing said lifting hook into and out of coupling engagement with a respective draw knife; said displacing means including a selector mechanism including a vertically reciprocal sensor movable between a blocking position and a non-blocking position in the path of each draw knife and a control element movable between two positions to selectively block movement of said sensor, and a transmission mechanism including a pivotally mounted lever secured to said lifting hook for pivoting in the path of each draw knife and a guide member about said lifting hook and spring mounted on said lever for movement towards said sensor upon pivoting of said lever in response to a lifting of a respective draw knife thereagainst whereby with said sensor in said blocking position, said guide member retains said lifting hook in one vertical path and with said sensor in said non-blocking position, said guide member is able to move said lifting hook to the other vertical path.

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