July 9, 1940. H. V. FOSTER 2,207,093

CONTROL FOR JACQUARD NEEDLES

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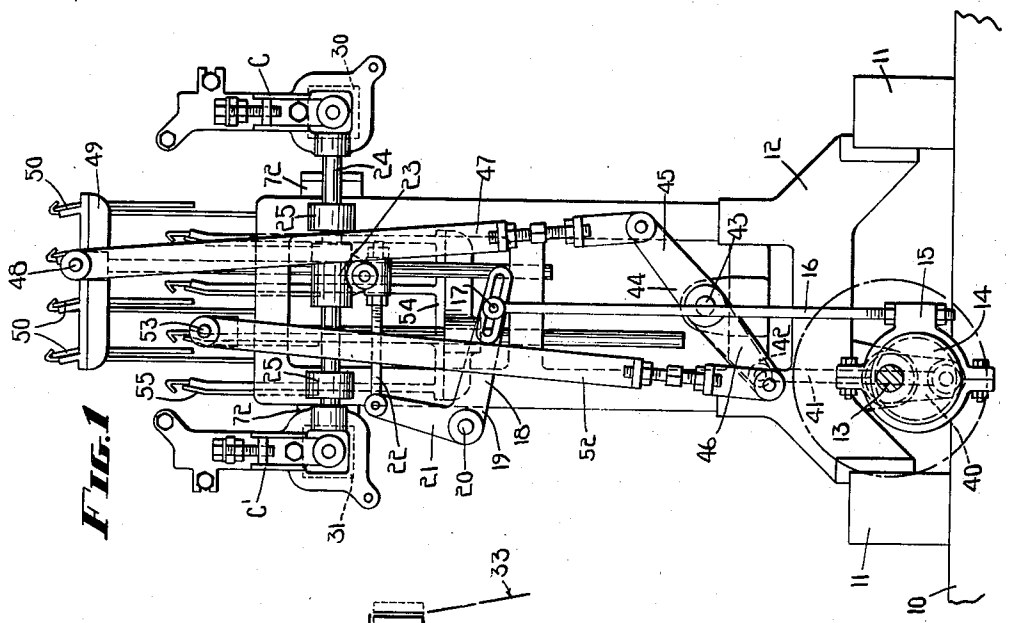


FIG. 1

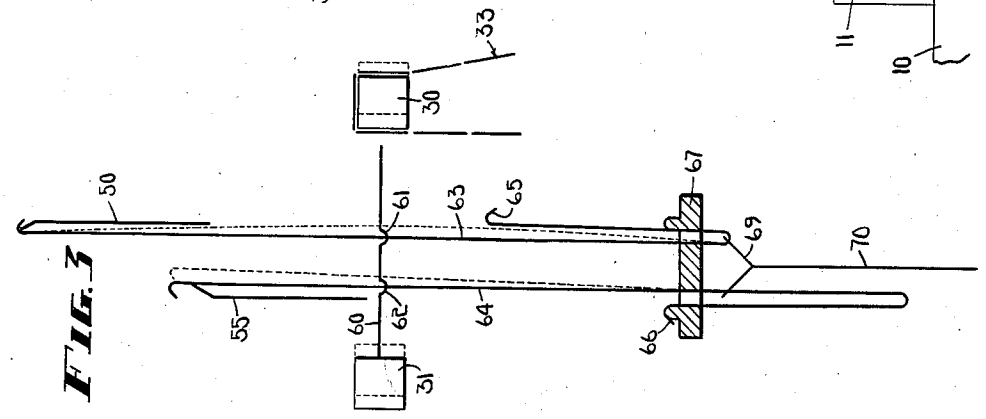


FIG. 3

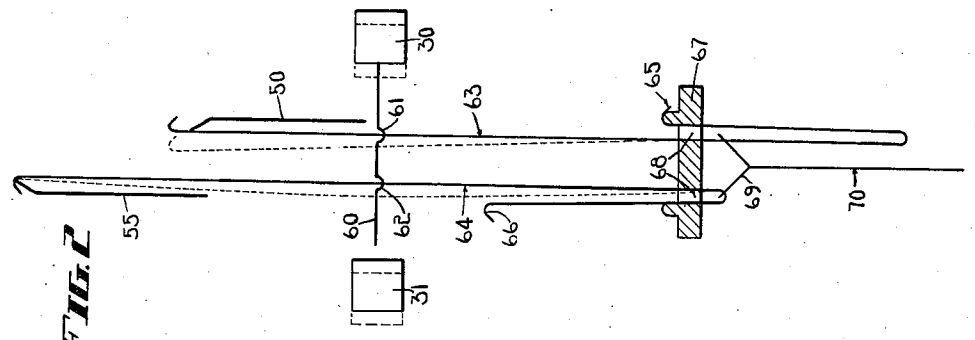


FIG. 2

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FIG. 4

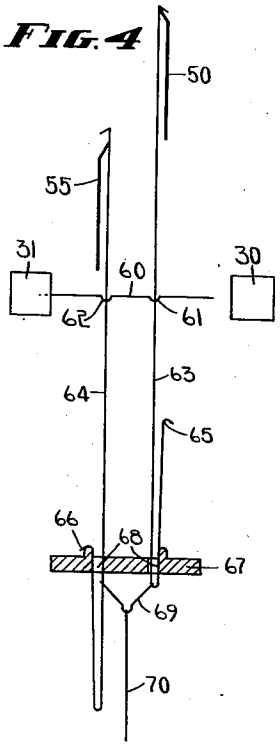



FIG. 5

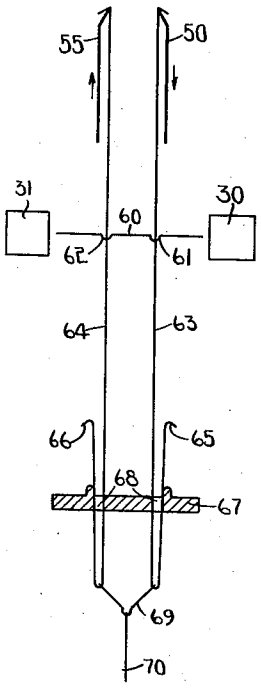



FIG. 6

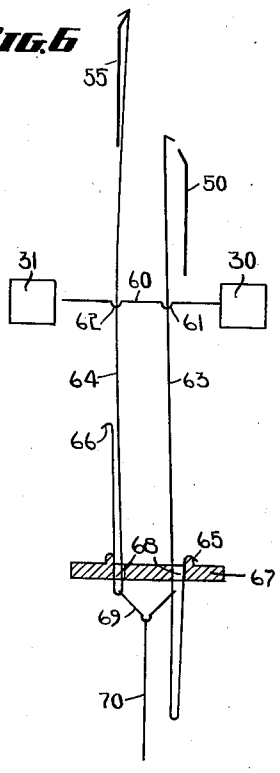



FIG. 7

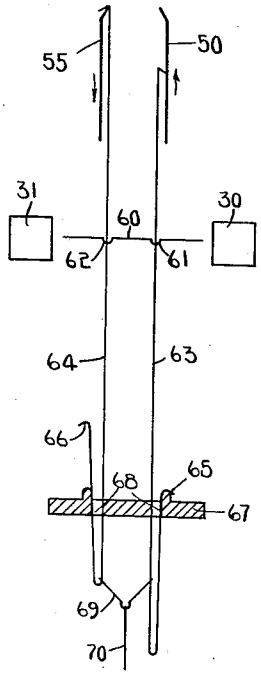



FIG. 8

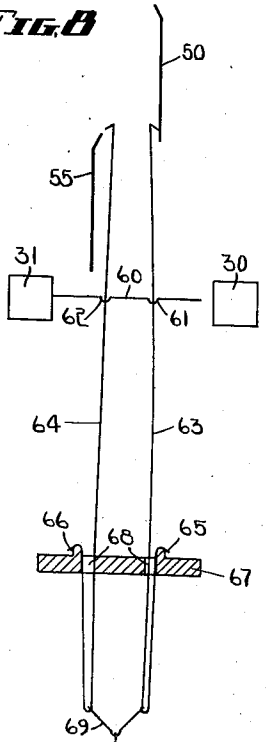
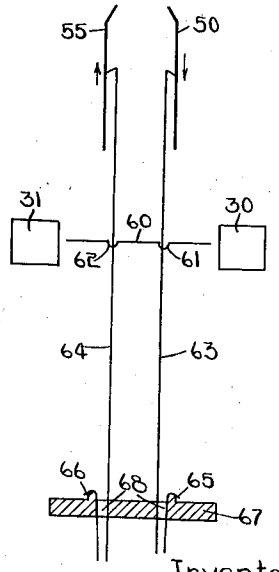



FIG. 9




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## CONTROL FOR JACQUARD NEEDLES

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Application April 26, 1939, Serial No. 270,195

4 Claims. (Cl. 139—61)

This invention relates to improvements in jacquards and has for its general purpose the elimination of the small helical springs customarily used to position the needles which cooperate with the pattern cards.

In the usual jacquard the needles are held yielding in position by a form of spring such as shown for instance in my prior Patent No. 2,103,814. When it is necessary to accommodate a large number of needles it becomes a matter of practical difficulty to provide sufficient room for the springs since the latter necessarily have a larger diameter than do the needles. When helical springs are used it is also necessary to provide a housing for them which includes a fixed support against which the springs can press as they urge the needles toward the pattern surface. The springs together with their housing and the labor of applying them to the needles increase the cost of the jacquard and as already indicated limit the number of needles which can be accommodated in any given space.

The needles cooperate with upright jacks formed usually of wire and positioned for control by the needles. These jacks cooperate with lifting griffs or knives which engage and raise those jacks the needles of which enter holes in the pattern surface, while the needles which are pushed back by engaging a blank part of the pattern surface move their jacks out of the ascending path of the knife and therefore remain down. I have found that the jacks possess sufficient inherent resilience to position the needles and it is an important object of my present invention to utilize the resilience of the upright jacks for holding the needles yieldingly in position for cooperation with the pattern surface and thereby eliminate the usual springs.

In certain types of jacquards which employ two cylinders reciprocating in unison so that they have alternate control over the needles it is customary to use two sets of needles, one set for each cylinder. This relationship has been necessary because of the helical springs at one end of the needles and the latter therefore have but one end which can be engaged by a pattern surface. By eliminating the customary springs and relying upon the inherent resilience of the upright jacks each end of the needle is available for cooperation with a pattern surface, and it is a further object of my present invention to control the upright jacks in a double cylinder jacquard by needles both ends of which can respond to a pattern surface. This result can conveniently be accomplished by using the resilience of the upright jacks.

When two jacks are controlled by a single needle either jack may be bent to provide the resilience necessary for return of the needle and other jack to normal position as one of the cylinders moves to outward position. This condition must exist whether the upright jack is hooked on to a knife to be raised or remains in down position without having lifting relationship with the knife. It is another object of my present invention so to form the knife that when up it will still project down far enough to resist lateral motion of a lowered jack to cause bending of the latter, thereby setting up a stress in the bent jack which acts later to return the needle to normal position.

The demands of the pattern being woven may require that a given warp thread remain in the lower shed for several beats of the loom, under which condition both jacks of a pair controlled by a single needle should be out of lifting relation with respect to their knives. The latter reciprocate in opposite directions vertically, and it is a further object of my invention to relate the two jacks of a pair to their needle and knives in such a way that one jack will be pushed against its raised knife to be bent while the other jack is pushed away from its lowered knife. On the following beat the needle and knives will be reversed and the said other jack will be bent while the first jack clears its knife. In this way each jack of a pair helps to position its needle and both jacks act to move their needle toward normal position.

It is a further object of my invention to retain the high speed advantages of a double cylinder jacquard while using half the number of needles heretofore required and omitting the usual springs.

With these and other objects in view which will appear as the description proceeds, my invention resides in the combination and arrangement of parts hereinafter described and set forth.

In the accompanying drawings wherein a convenient embodiment of my invention is set forth,

Fig. 1 is a front elevation of a jacquard having my invention applied thereto,

Figs. 2 and 3 are diagrammatic views indicating the relationship between the two jacks of a pair and their controlling needle and the manner in which the jacks bend when the needle is moved in either of two directions, and

Figs. 4 to 9 are diagrammatic views showing

successive positions of a needle, its two jacks and the pair of cylinders.

Referring to Fig. 1, the usual cross timber 10 extending over the loom to which the jacquard is applied supports a pair of bars 11 on which is mounted the frame 12 of the jacquard. Rotatably mounted on the frame is a shaft 13 timed to have a complete revolution each two beats of the loom. Mounted on this shaft is an eccentric 14 having a head 15 from which projects upwardly a cylinder operating rod 16 connected as at 17 to the laterally extending arm 18 of a lever 19 pivoted at 20 on the jacquard frame. An upwardly projecting arm 21 of the lever is connected by rod 22 to a driving collar 23 which connects right and left horizontally sliding rods 24 and 26, respectively, which slide in bearings 25 on the frame. The right hand rod 24 carries a cylinder mechanism C while the left rod 26 carries a similar mechanism C'. The mechanisms C and C' are provided, respectively, with cylinders 30 and 31 which are operated in the usual well-known manner and are given a one-quarter turn for each outward motion thereof away from the center of the jacquard to present a new card of the jacquard pattern surface. This surface, as indicated in Fig. 3, is composed of a number of separate cards 33 laced together and movable one at a time to controlling position as the cylinder advances angularly. It is not thought necessary to show the mechanism by which the cylinder is turned nor illustrate the details of the cylinder mechanism, since these parts may be of the usual construction and of themselves form no part of my present invention.

A crank arm 40 secured to the shaft 13 is connected by rod 41 to an arm 42 fastened to a rocking shaft 43. Secured to the latter is a lever 44 having right and left arms 45 and 46, respectively. An adjustable link 47 connected to arm 45 extends upwardly to be pivotally connected as at 48 to a griff or knife frame 49 carrying several lifting knives 50.

The other arm 46 is similarly connected to an adjustable link 52 the upper end of which is pivoted as at 53 to a second knife frame 54 carrying several knives 55. As shown in Fig. 1 the upper ends of the knives 50 are bent to the left while the upper ends of the knives 55 are bent to the right. The arrangement of the frames 49 and 54 together with the links and lever 44 may be of the usual construction and the knives except as described hereinafter may be of the usual form and attached to their corresponding griff frames in any approved manner.

In the operation of the matter thus far described shaft 13 makes half a revolution for each beat of the loom and during each half revolution will raise one of the knife frames from its lowest to its highest position and at the same time lower the other knife frame from its highest to its lowest position. On the ensuing half revolution the knife frames reverse their motion and in this way one frame rises with the formation of the shed for one beat or pick of the loom and the other griff frame rises to form the next succeeding shed for the following beat of the loom. Shaft 13 also controls the cylinder mechanisms C and C' so that one of these mechanisms moves toward the center of the jacquard on one beat of the loom and the other mechanism moves toward the center of the jacquard on the following beat of the loom. In this way one cylinder only is in controlling position at a time, one cylinder controlling alternate beats and the other controlling the intervening beats of the loom.

In carrying my present invention into effect I provide a set of needles to be positioned by the cylinders and also provide a number of upright jacks. Since the operation of my invention can be understood from a single needle and a pair of upright jacks controlled thereby together with the knives 50 and 55 I have set forth these parts as a unit and will describe their relationship and operation in connection with Figs. 2 to 9. It is to be understood, however, that the jacquard will have a plurality of needles and pairs of jacks and the description given in connection with the diagrammatic views applies to each unit of the jacquard.

Referring particularly to Fig. 2 I have provided a needle 60 looped at 61 and 62 to receive right and left hand upright jacks 63 and 64, respectively. Each end of the needle 60 is straight and formed for cooperation with a pattern surface, and each needle slides in guides 72 carried by the jacquard frame, see Fig. 1. The lower ends of the jacks 63 and 64 are bent back to provide hooks 65 and 66, respectively, for cooperation with a stationary support 67 held to the frame of the jacquard. This support is provided with holes 68 through which the lower ends of the upright jacks pass. A V-shaped link 69 has oppositely extending arms which pass through the bent ends of the bottoms of the jacks and this link is connected to a neck cord 70 which controls one or a group of warp threads of the loom.

As shown in Fig. 2 the vertical dimension of the knives 50 and 55 is preferably somewhat greater than or equal at least to the upward travel thereof so that a jack in lowest position will have the upper hooked end thereof in horizontal alignment with some part of its knife. Both of the jacks move together with the needle 60 and both are formed of wire sufficiently resilient to withstand repeated slight deflections without taking a permanent set. The jacks are preferably straight in their normal condition and return to a straight position after a bending strain is relieved.

As already set forth an important feature of my present invention lies in the use of the inherent resilience of the jacks to position each other and their controlling needle. As shown in Fig. 2 knife 55 is up while knife 50 is down, a condition which exists at the completion of the formation of a shed and at a time in the loom cycle when the lay not shown will be in rear position with the shuttle not shown in flight through the warp shed. The cylinders 30 and 31 are shown in full line position at the beginning of an indicating motion on the part of the cylinder 30 and it is assumed in Fig. 2 that the needle 60 is to be moved to the left by engagement with a blank part of the pattern surface. As the cylinder 30 moves from the full to the dotted line position of Fig. 2 the needle will be moved to the left and by reason of the loop 61 will move jack 63 from its normal full line position over knife 50 to the dotted line position out of the ascending path of knife 50. Under the conditions shown in Fig. 2 jack 64 is hooked on to knife 55, and motion of the needle to the left will act through loop 62 to move jack 64 from the straight full line position to the bent dotted line position. When in the dotted line position jack 64 is caused to bend to the left since its upper and lower ends are held by the knife 55 and the guide 67, respectively. When so bent jack 64 offers yielding

resistance to left hand motion of the needle 60 and tends to move the latter to the right and, through the needle, also tends to move jack 63 to the right. As knife 50 rises and knife 55 descends, jack 63 will either be raised or remain down depending upon whether it is in the full or dotted line position of Fig. 2. In this figure, therefore, it is apparent that the deflection of jack 64 tends to return the needle to the right.

In a similar manner and as shown in Fig. 3 the jack 63 will also exert yielding resistance on the needle. In this Figure 3 cylinder 31 is in control of the jacquard and as it moves from the full to the dotted line position jack 64 is moved out of the path of knife 55 and jack 63 is bent to the right, thereby tending normally to move the needle 60 to the left.

From Figs. 2 and 3 it will be seen that each jack of the pair is bent when the needle moves, the direction of movement of the needle determining which jack is to be bent to exert yielding resistance on the needle. As shown in Figs. 2 and 3, one or the other of the jacks is connected to the knife in high position, but it will be shown hereinafter that the same general condition exists when both jacks are free from their knives.

A more detailed description of the sequences when the link 69 is to be raised and when it is to be lowered will be given in connection with Figs. 4 to 9. In Fig. 4 cylinder 31 is assumed to have moved to the right, with knife 55 ready to ascend as soon as the cylinder has placed jack 64, and knife 50 ready to descend as knife 55 rises. It is assumed that a hole in the pattern surface of cylinder 31 permits the needle to remain unmoved. The previous raising of jack 63 lifted the link 69 to high position so that its corresponding warp will be in the top shed. As knife 55 moves upwardly it will pass through the intermediate position shown in Fig. 5 when it is at substantially the same level as the descending knife 50. During descent of jack 63 from the position of Fig. 4 to that of Fig. 5 the link 69 has fallen, but as the parts continue their motion from the position of Fig. 5 to that of Fig. 6, jack 64 will lift the link 69 to maintain the corresponding warp thread in the top shed.

When either knife reaches low position engagement of the corresponding jack by the support 67 will permit the needle to move the hooked end of the jack out of engagement with its knife. When each knife reaches its low position one of the cylinders can therefore move into controlling position with respect to the needle, and in Fig. 6 it is assumed that cylinder 30 has moved to the left and has presented a blank space to the needle 60, thereby moving the latter to the left. Under these conditions jack 63 is moved clear of knife 50 and jack 64, being still in engagement with knife 55, will be in the curved full line position. As knife 50 starts to ascend therefore it clears jack 63 and the latter remains down. The corresponding descent of knife 55 lowers jack 64 and the link 69 moves down through a position corresponding to but the reverse of that shown in Fig. 5 and indicated in Fig. 7.

Further descent of knife 55 to the position shown in Fig. 8 disconnects jack 64 so that it is free to respond to pattern control. At this time link 69 is in its lowest position and the corresponding thread is in the bottom warp shed, since both jacks 63 and 64 are down.

Cylinder 31 now moves to the right and moves the jack 64 to the right by a blank space on the pattern surface, thereby moving the hooked end of this jack 64 out of the path of knife 55 which is about to start up. At the same time the needle 60 by its motion to the right, bends the jack 63 to the curved form shown in Fig. 8. This bending of jack 63 when in down position is made possible by the fact that the knife 50 is of such a height that when in the high position shown in Fig. 8 the lower portion thereof will be in horizontal alignment with the upper end of view 63 and therefore limit its right hand motion to cause the deflection shown. This condition is true of both knives.

As knife 55 ascends and knife 50 descends the parts will assume the position shown in Fig. 9 with both jacks disconnected from their knives and the link 69 in low position.

It is to be understood that one of the pattern cylinders will move toward the needle when one of the knives is in lowest position and that the other cylinder will move toward the needle when the other knife is in low position. There must therefore be a motion of the cyinders to the left when one of the knives is moving down and a subsequent motion to the right when the other knife is moving down. As soon as the low knife starts up and has reached a position where it cannot engage the hook of a jack in low position there is no further need for control by the pattern and the cylinders can therefore start to move. Since one or the other of the cylinders must control the needle for each beat of the loom, they will move from one to the other of their extreme positions during the ascent of the low knife. In the intermediate position shown in Fig. 9 both cylinders are out of control of the needle and both jacks are free from their knives. Under this condition the normal tendency of the jacks 63 and 64 to remain straight will tend to move the needle to a neutral or normal position from which it may be moved either to the right or the left.

If the necessary pattern demand requires needle 60 to move to the left from the position shown in Fig. 9 the lower part of knife 55 will limit left hand motion of the top of jack 64 and the latter will be bent to the left to enable jack 63 to clear knife 50, thereby maintaining the link 69 and its warp thread in the bottom shed for another beat of the loom. Under this last assumed condition the relationship will be opposite to that shown in Fig. 8 where the jack 63 when in low position is caused to deflect by right hand motion of the needle.

It will be seen therefore that whether the jacks are hooked on to the knives, as in Figs. 2, 3 and 6, or whether the jacks are disconnected from the knives as in Fig. 8, the upper end of one of the pair of jacks is restrained against lateral motion by the lower part of its knife to cause bending of the jack and this bending at a later time acts during removal of the controlling cylinder to restore the needle to normal position.

From the foregoing it will be seen that I have provided a jacquard wherein the usual helical springs are omitted and their function is performed by the natural resilience of a part customarily employed in jacquards, that is, the upright jacks. It will further be seen that whether the jacks be hooked on to the knives or disconnected from them, a bending of one of the jacks will attend each presentation of a cylinder to the needle, and this bending tends to assert itself upon removal of the controlling pattern surface to return the needle to normal position. It will also be seen that the knives are made sufficiently

high so that when they are in their uppermost positions they will reach down far enough to restrain lateral motion of a jack which is in low position.

Having thus described my invention it will be seen that changes and modifications may be made therein by those skilled in the art without departing from the spirit and scope of the invention and I do not wish to be limited to the details herein discosed, but what I claim is:

1. In a jacquard mechanism for a loom, a pair of spaced pattern cylinders, means to reciprocate said cylinders in unison, a needle having a normal position between the cylinders and movable longitudinally in one direction by one of the cylinders and in the opposite direction by the other cylinder, a pair of harness jacks formed of resilient material to be moved in unison by the needle, a guide for the lower end of the jacks, and a pair of oppositely reciprocating lifter knives for the upper ends of the jacks, each knife to lift one of the harness jacks, each jack capable of remaining in a low position when supported by the guide and each knife when in its highest position extending down to a point in horizontal alignment with the upper part of a jack in low position, movement of the needle causing bending of a jack in low position by reason of engagement between the upper end of said jack and the knife, and the bent jack tending to return the needle to its normal position.

2. In a jacquard mechanism for a loom, a pair of resilient harness lifter jacks, a needle to cause said jacks to move in unison, a pair of spaced pattern cylinders between which the needle is located, means to cause the cylinders to reciprocate in unison, the needle being movable longitudinally from normal position in one direction by a force derived from one of the cylinders and movable longitudinally from normal position in the opposite direction by a force derived from the other cylinder, and a pair of oppositely reciprocating lifter knives for the jacks, each knife to lift one of the harness jacks and each knife when in highest position having a part thereof positioned for engagement with the jack corresponding thereto when the latter is in lowest position to cause the latter jack to bend and thereby resist movement of the needle away from normal position thereof, the bent jack tending to return the needle to normal position.

3. In a jacquard mechanism for a loom, a pair of spaced pattern cylinders, means to reciprocate the cylinders in unison, a needle located between the cylinders to be engaged by said cylinders one at a time and movable by the cylinders in opposite directions, a pair of resilient lifter jacks movable by and moving with the needle when the latter is moved by the cylinders, oppositely vertically reciprocating lifter knives, one for each jack, each lifter knife movable upwardly from low to high position and each jack capable of remaining in low position, the vertical dimension of each knife being sufficient to effect engagement between a jack in low position when the latter is moved laterally toward an adjacent knife in high position to resist motion of the upper end of the jack and thereby cause bending of the latter against the resilience of the jack which tends normally to maintain the needle in a position intermediate the extreme positions thereof.

4. In a jacquard mechanism for a loom, a pair of spaced pattern cylinders, means to reciprocate said cylinders in unison, a needle located between and positioned for engagement by the cylinders one at a time, said needle movable in one direction from a normal position by a force derived from one of the cylinders when the latter moves in one direction and said needle movable in the opposite direction from a normal position by a force derived from the other of the cylinders when the latter move in the opposite direction, a pair of resilient lifter jacks movable by and moving with the needle, oppositely moving vertically reciprocating lifter knives, one for each jack, means to lift each knife through a given distance, the vertical dimension of the knife being greater than said given distance, to the end that a knife in highest position will have a portion thereof in horizontal alignment with a jack in low position, longitudinal motion of the needle causing engagement between a jack in low position and the corresponding lifter knife when the latter is in high position to cause bending of said jack and thereby resist the longitudinal motion of the needle, said jack tending to straighten itself and thereby exert a force on the needle tending to move the latter toward normal position.

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