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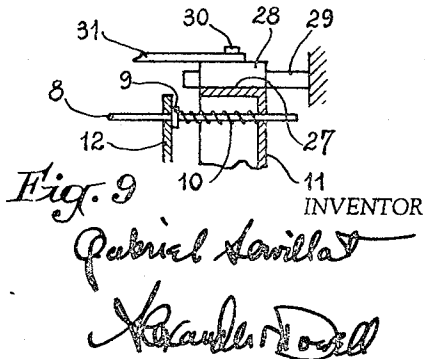
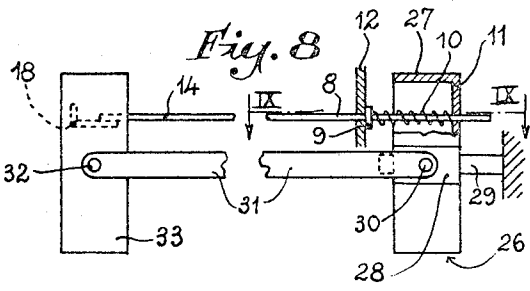
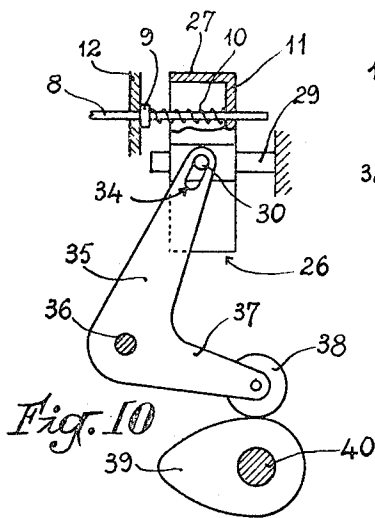
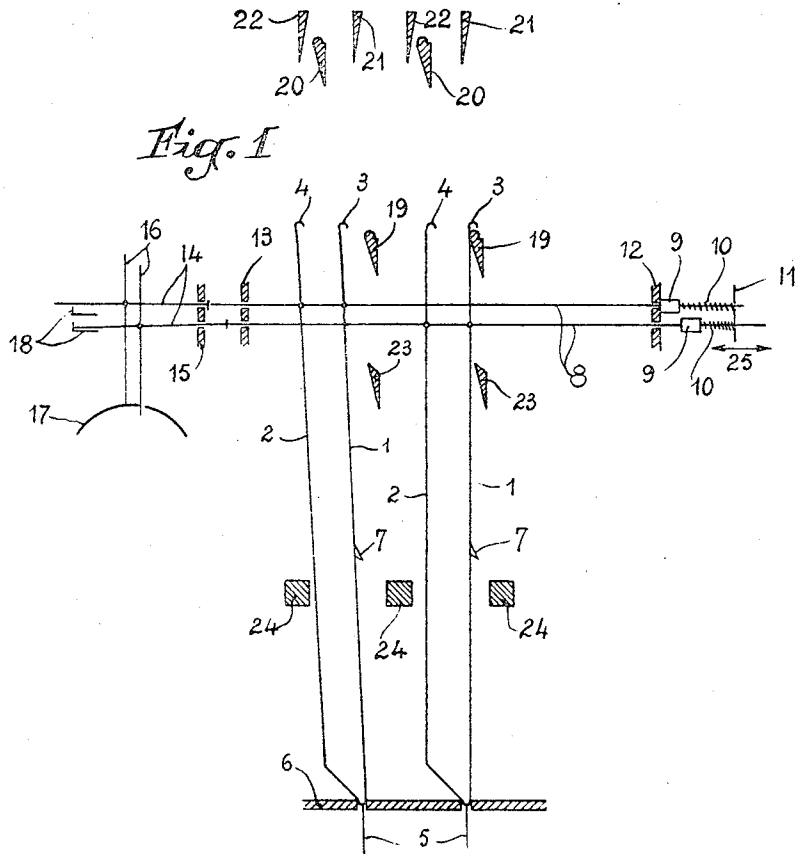
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DOUBLE-LIFT JACQUARDS OPERATING WITH REVERSE SELECTION

Filed Feb. 16, 1968

2 Sheets-Sheet 1



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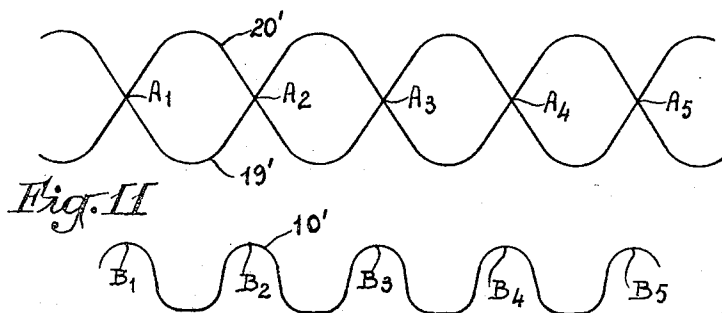
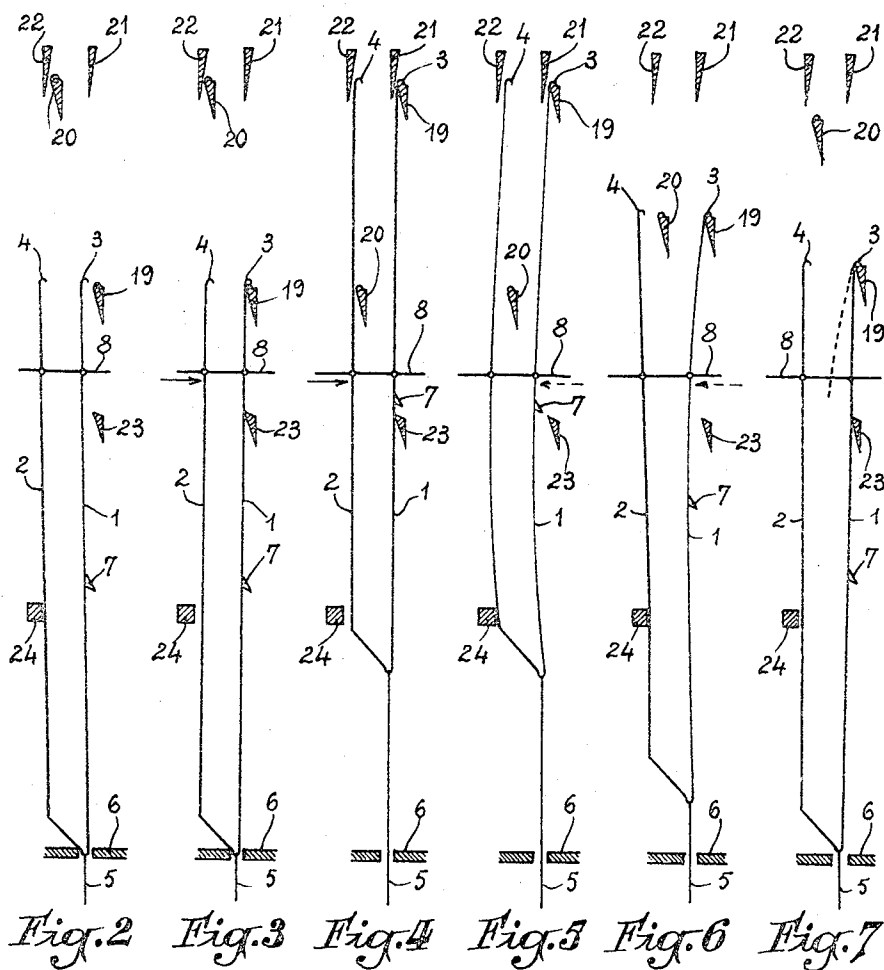
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DOUBLE-LIFT JACQUARDS OPERATING WITH REVERSE SELECTION

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4 Claims

ABSTRACT OF THE DISCLOSURE

In a double-lift Jacquard operating with reverse selection, i.e. wherein, when unactuated by the selecting means of the Jacquard, the spring-loaded needles which control the double hooks maintain the latter at a position for which they escape the action of the knife frames which reciprocate vertically with a phase difference of 180°, the reaction of the needle-loading springs is increased when the said frames are midway of their respective strokes and on the contrary decreased when one of the frames reaches the end of its descending stroke. For this purpose the perforated plate against which the springs rest may be reciprocated in unison with the operation of the Jacquard.

This invention relates to Jacquards for looms of the so-called "double-lift" type.

Such Jacquards conventionally comprise double hooks, each comprising two branches with hooked ends or elementary hooks adapted to selectively cooperate respectively with one or the other of two knife frames or griffes which are reciprocated vertically in opposed direction (i.e. with a phase difference of 180°). In order to eliminate or to reduce to a negligible amount the ineffective vertical movements of the double hooks (i.e. the full lowering of a hook after a pick when it is to be raised for the next pick), these Jacquards generally comprise an open-shed device conventionally formed of a lateral tooth or catch secured to one of the branches of each double hook and of a fixed retaining grid adapted to cooperate with these teeth.

As any other kind of Jacquards, these double-lift and open-shed Jacquards may operate with direct or reverse selection. In the first case the action of the member which actuates selectively the hook-controlling needles (bars of a Verdol Jacquard, cards of a Jacquard of conventional type) is negative in the sense that under the action of their loading springs the unactuated needles retain the corresponding hooks at the position for which they are caught and raised by the knife frames and that those which are selectively actuated by the actuating member bring their hooks to a position for which they escape the action of the knife frames; with the reverse selection the hooks of the unactuated needles escape the knives of the knife frames and those of the actuated needles are brought to the position for which they are caught and raised by the said frames.

In double-lift open-shed Jacquards of the reverse selection type the hooks are disengaged either from the movable knife frames or from the stationary grid frames by the sole action of the needle-loading springs. It would therefore seem that in order to obtain an efficient operation with modern high speed looms these springs should be relatively strong. Actual practice however shows that a too high reaction of the needle springs is an inconvenience because when these springs disengage the hooks from a knife frame at the end of the descending stroke of the

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latter, their action is too strong and results in substantial vibrations or rebounds of the hooks which are sometimes again caught by the ascending knife frame instead of being retained at their lowermost position. In order to avoid such defects the needle-loading springs should be relatively light.

On the contrary when the knife frames cross each other, or more exactly when they are midway of their respective strokes, in order that the hooked end of the free branch of a descending double hook should not be caught by the ascending frame, the needle-loading springs should be strong enough to flex to a sufficient extent the other branch of the double hook.

A proper adjustment of the needle-loading springs is therefore a quite difficult problem which has hitherto limited the operating speed of the Jacquards of the kind in question.

It is the object of the present invention to avoid the above-mentioned inconvenience.

In accordance with the invention in a double-lift Jacquard operating with reverse selection and comprising for this purpose double hooks adapted to cooperate selectively with two knife frames reciprocated vertically with a phase difference of 180°, and spring-loaded hook-controlling needles which, when unactuated by the selecting mechanism of the Jacquard, maintain the double hooks at the position for which they escape the action of the ascending knife frame, means are provided to vary the reaction imparted to the needles by their loading springs in such manner that this reaction be higher when the knife frames are substantially midway of their strokes than when one of the said frames reaches the end of its descending stroke.

The variation of the reaction of the needle-loading springs is preferably obtained by displacing longitudinally with respect to the needles and in synchronism with the operation of the Jacquard, a perforated plate through which the needles are threaded and against which the said springs rest.

In the accompanying drawings:

FIG. 1 is a very simplified and diagrammatical sectional view of a double-lift open-shed Verdol Jacquard of the reverse selection type, according to the invention.

FIGS. 2 to 7 illustrate diagrammatically the operation of the hooks of such a Jacquard.

FIG. 8 is a diagrammatical side view with parts in section showing how the spring box of the Jacquard may be directly reciprocated by the bar frame thereof in accordance with an embodiment of the invention.

FIG. 9 is a fragmental horizontal section taken along line IX—IX of FIG. 8.

FIG. 10 is a diagrammatical side view with parts in section showing how the spring box of the Jacquard may be reciprocated by a cam-and-lever gearing in accordance with another embodiment of the invention.

FIG. 11 is a graphic illustrating the vertical motion of the knife frames of the Jacquard and the reciprocating motion of the spring box thereof.

Referring to the drawings, FIG. 1 shows the main elements of a double-lift open-shed Jacquard of the Verdol type. Such a Jacquard comprises a large number of double hooks each being formed of a U-shaped wire with two branches 1 and 2, the free ends of which are bent towards the right in FIG. 1 (i.e. towards the front side of the Jacquard) in the form of two elementary hooks respectively 3 and 4. The lower portion of each double hook (i.e. the lower bar of the U) is oblique in order to determine a lower end where the corresponding neck cord 5 is attached, the latter being threaded through a hole of the bottom board 6 which supports the double hooks when the latter are not raised. The branch 1 of each double hook carries an open-shed tooth or catch 7

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which is directed downwardly towards the right in FIG. 1 as the elementary hooks 3 and 4.

A horizontal needle 8 is associated with each double hook in the conventional manner. The needle may for instance be formed with loops (which in practice are open laterally for insertion of the branches of the hooks during the mounting of the Jacquard) which surround the branches of the hook in order to actuate the latter. Each needle carries in the vicinity of its front end (right-hand end in FIG. 1) a small circular abutment 9 on which acts a coil spring 10 mounted on the needle, the other end of the spring resting against a perforated guiding plate 11 generally formed by the bottom of a protective casing or spring box which surrounds the springs. Another perforated plate 12 limits the displacements of abutments 9 and of needles 8 under the action of springs 10.

The rear ends of needles 8 are guided by a perforated plate 13 and they are selectively actuated by pushers or driver needles 14 the front end of which is guided by a perforated plate 15. The rear portion of each driver needle 14 passes through a loop of a vertical feeler needle 16 the lower end of which cooperates at each pick with the conventional perforated paper band 17.

The rear ends of the driver needles are actuated vertically and horizontally by L-shaped bars 18 carried by a movable bar frame, not illustrated.

The hooked ends 3, 4 of the double hooks of the Jacquard cooperate with transverse knives respectively 19, 20 carried by two movable frames or griffes (not shown) which are reciprocated vertically in opposed direction, i.e. with a phase difference of 180°. Stationary grids 21, 22 are disposed in the upper portion of the Jacquard in order to retain the hooked ends 3 or 4 in engagement with the knives 19 or 20 at the raised position of the hooks against any tendency to overtravel. The stationary grids adapted to co-operate with the open-shed teeth or catches 7 are illustrated at 23, while reference numeral 24 designates the conventional cross-bars which separate the successive transverse rows of double hooks and guide the lower portion of same.

The operation of such a double-lift open-shed Verdol Jacquard is as follows:

At the beginning of an operative cycle the bars 18 are at their uppermost and rearmost position (to the left in FIG. 1) for which the rear ends of the driver needles 14 are spaced from the vertical flanges of the bars, and are raised by the horizontal flanges thereof together with the feeler needles 16 which clear the perforated paper band 17. The latter is then advanced from one card to the next one. Bars 18 are thereafter lowered whereby the feeler needles are selected by the perforations of band 17. When a feeler needle 16 passes through a hole, the corresponding driver needle 14 is not retained and remains on the horizontal flange of the corresponding bar. It may therefore be actuated by the vertical flange of the bar during the advancing step of the bar frame. On the contrary when a feeler needle is retained by a plain portion of the paper band, it escapes the action of the bars.

During the advancing step of the bars the needles 8 which correspond to a hole in the paper band 17 are therefore pushed towards the right against the action of their loading springs 10. Their double hooks are also displaced towards the right and one of their hooked ends or elementary hooks 3, 4 is thus brought just above a knife 19, 20 of the lowermost knife frame.

FIG. 2 shows a double hook 1, 2 corresponding to a feeler needle which has met a plain portion of the paper band. This double hook has not been actuated and its elementary hook 3 will escape the corresponding knife 19 during the next ascending stroke thereof. On the other hand the double hook of FIG. 3, which corresponds to a hole in the paper band, has been pushed towards the right, as indicated by the arrow, and its elementary hook 3 will therefore be caught by knife 19.

When a double hook has been brought to its uppermost

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position, as indicated in FIG. 4, its lateral tooth or catch 7 is situated just above the stationary grid 23. If the corresponding neckcord 5 is to remain raised at the next pick, the needle 8 is again pushed towards the right, as indicated in FIG. 4, and during the descending motion of knife 19 catch 7 will be retained by grid 23, whereby the hook will not have to effect a useless downward half-stroke immediately followed by an upward half-stroke. If on the other hand the neckcord is to be lowered for the next pick, needle 8 is not pushed towards the right by its driver needle and under the action of its loading spring 10 it bends the branch 1 of the double hook (as indicated by the arrow is dash line in FIG. 5) in order that at the beginning of the descending stroke of knife 19, catch 7 may escape grid 23. FIG. 6 shows the double hook midway of its downward stroke when the knife frames cross each other. FIG. 7 illustrates the position of the parts just before the lower end of the double hook engages the bottom board 6. It will be remarked that when the double hook has come to rest on board 6, knife 19 still moves downwardly for a short distance in order that the elementary hook 3 may be fully disengaged from the said knife.

It has been hitherto supposed that the double hook had been raised by knife 19 and was thereafter lowered by this same knife. But it will be understood that the operation remains substantially the same when the double hook is raised by knife 20 and thereafter lowered by knife 19 or when it is raised by knife 19 or 20 and thereafter lowered by knife 20.

In order that when the knife frames cross each other (position of FIG. 6) the ascending knife 20 should not catch the descending elementary hook 4, the latter must be sufficiently displaced towards the left or rear by needle 8, which obviously implies a substantial movement of the needle in the said direction and therefore a marked bending of branch 1 of the other elementary hook 3 retained by the descending knife 19. The reaction of the needle-loading springs 10 of FIG. 1 should therefore be high.

On the other hand at the end of the descending stroke of the double hook (FIGS. 7 and 2) the reaction of the needle-loading springs should be moderate in order to avoid an exaggerated deformation of branch 1 (for instance as very diagrammatically illustrated in dash lines at 1' in FIG. 7) and thereafter the appearance of too marked rebounds of the double hook against cross-bar 24 when the elementary hook 3 is finally liberated from knife 19.

According to the present invention these apparently contradictory conditions are both fulfilled by reciprocating the spring box or front perforated plate 11 in synchronism with the operation of the Jacquard, as indicated by arrows 25 in FIG. 1, in such manner that this plate or box 11 may be displaced rearwardly or towards the left when the knife frames cross each other (position of FIG. 6), whereby the reaction of the springs on the needles is increased, and forwardly or towards the right at the end of the descending stroke of each knife frame, whereby the reaction of the springs is reduced.

This to and fro motion of the spring box or front perforated plate 11 may be realized in any appropriate manner.

In the embodiment of FIGS. 8 and 9 the spring box 26 comprising the perforated plate 11 and side walls 27 surrounding the latter, is provided with a pair of lateral supporting sleeves 28 each slidably mounted on a horizontal longitudinal guiding rod 29 secured to the frame of the Jacquard. Each sleeve 28 has a laterally protruding pin 30 on which is pivoted the front end of a connecting rod 31 the rear end of which is mounted on a lateral pin 32 secured to the conventional movable frame 33 in which the L-shaped bars 18 of the Jacquard are mounted. The horizontal to and fro motion of the bar frame is thus directly transmitted to the spring box. This system is quite simple but it has the disadvantage that the timing

of the bar frame does not correspond exactly to the best conditions for the variation of the reaction of the needle-loading springs 10 in the operative cycle.

The embodiment of FIG. 10 avoids this inconvenience. In this construction each lateral pin 30 passes through an elongated opening 34 provided in the free end of an arm 35 pivoted at 36 on the frame of the Jacquard. Arm 35 is in one with another arm 37 which carries at its free end a follower 38 cooperating with a cam 39 mounted on the Jacquard shaft 40.

It will be understood that the arrangement illustrated in FIG. 10 is duplicated on the other side of the Jacquard.

In the graphical representation of FIG. 11 curves 19' and 20' represent the vertical movements of the knife frames 19, 20 of FIGS. 1 to 7. Points A₁, A₂, A₃, A₄, A₅ correspond to the successive crossings of frames 19, 20 during operation of the Jacquard. The lower curve 10' represents the reaction of the needle-loading springs 10, i.e. to the force which they apply to the needles 8. As illustrated this reaction varies periodically in synchronism with the operation of the Jacquard. It is at a maximum B₁, B₂, B₃, B₄, B₅ just when the knife frames cross each other (points A₁, A₂, A₃, A₄, A₅) and at a minimum when the descending frame reaches its lowermost position. The springs may therefore be strong enough to bend substantially the hooks when the knife frames are midway of their respective strokes as indicated in FIG. 6, while becoming relatively "light" when the hooks are liberated from the knives at the end of the stroke of the descending knife frame (FIGS. 7 and 2).

It is to be noted that it has already been proposed in single-shed Jacquards operating with direct selection to attach to each needle one end of a spring having its other end secured to a reciprocating member, but in such a case the purpose sought for was to actuate the needles, the springs playing the role of the conventional needle actuating member. In such a case their reaction does not vary during the stroke of the single knife frame. In double-shed Jacquards operating with direct selection it has also been suggested to attach the needle-loading springs to the needles and to a movable plate in order that during the descending stroke of a knife frame the needles may be pulled towards the front of the Jacquard (i.e. the end thereof opposed to the needle selecting means). But here again the reaction of the spring was not increased at the midway position of the frames and decreased at the end of the descending stroke of one of them.

I claim:

1. A double-lift Jacquard operating with reverse selection, comprising two groups of knives reciprocating vertically with a phase difference of 180°, each effecting an ascending stroke and a descending stroke; double hooks each formed of two elementary hooks having a substantially vertical branch and a hooked end, said elemen-

tary hooks being capable of cooperation respectively with one and the other of said knife groups to be selectively caught by same; longitudinally movable needles each associated to one of said double hooks to control same; spring means imparting a reaction to said needles to cause said double hooks to escape the one of said knife groups which is effecting an ascending stroke; a plate forming a resting abutment for said spring means, said plate being reciprocable longitudinally with respect to said needles; needle selecting means to act on said needles to selectively displace same longitudinally against the action of said spring means to cause those of said double hooks which correspond to the displaced needles to be caught by said one knife group which is effecting an ascending stroke; and means to so reciprocate said plate rearwardly and forwardly with respect to the displacement of said needles against said spring means in unison with operation of the Jacquard that said plate is at its rearmost position when said knife groups are substantially midway of their respective strokes, and at its foremost position when said knife groups are substantially at the end of their strokes.

2. In a Jacquard as claimed in claim 1, said spring means comprising a helicoidal compression spring mounted on each of said needles, and having a first and a second end; each of said needles having an abutment for the first end of the corresponding one of said helicoidal springs with the second end thereof engaging said plate; and said plate being perforated for the free passage of said needles.

3. In a Jacquard as claimed in claim 2, said means to reciprocate said perforated plate being formed of a connection between said plate and said needle selecting means.

4. In a Jacquard as claimed in claim 2, said means to reciprocate said perforated plate comprising cam and lever means acting on said plate in synchronism with said needle selecting means.

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