

[54] **REVERSIBLE VERDOL JACQUARDS**
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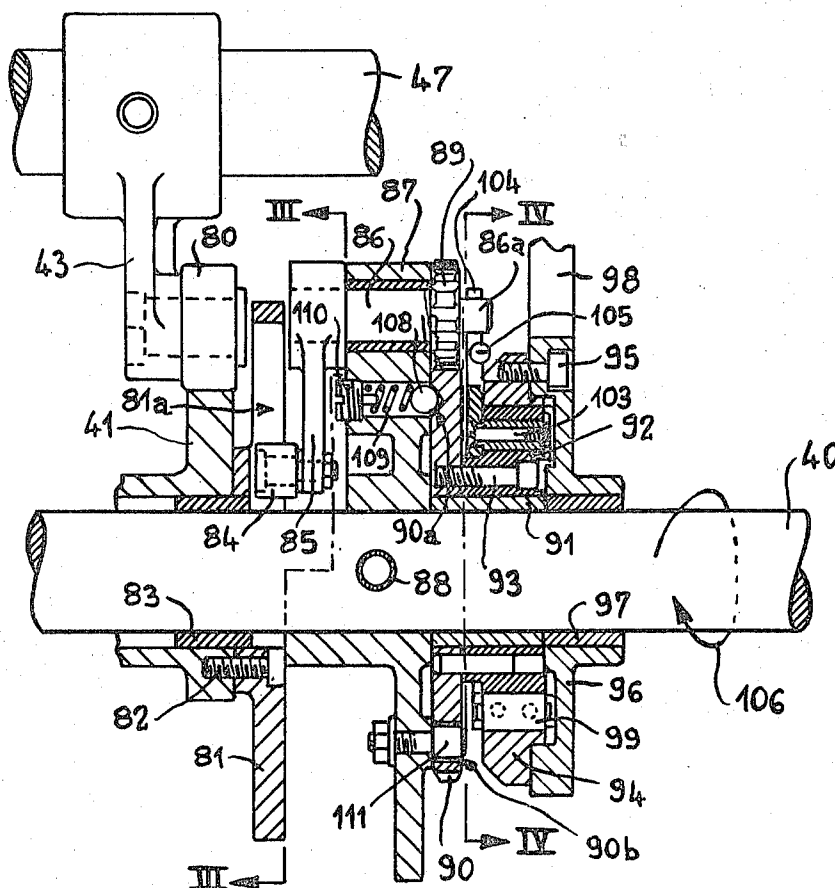
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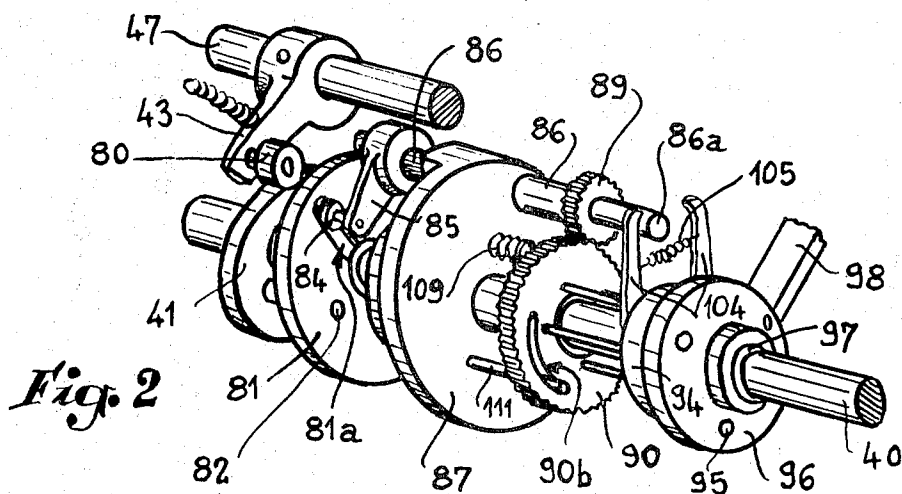
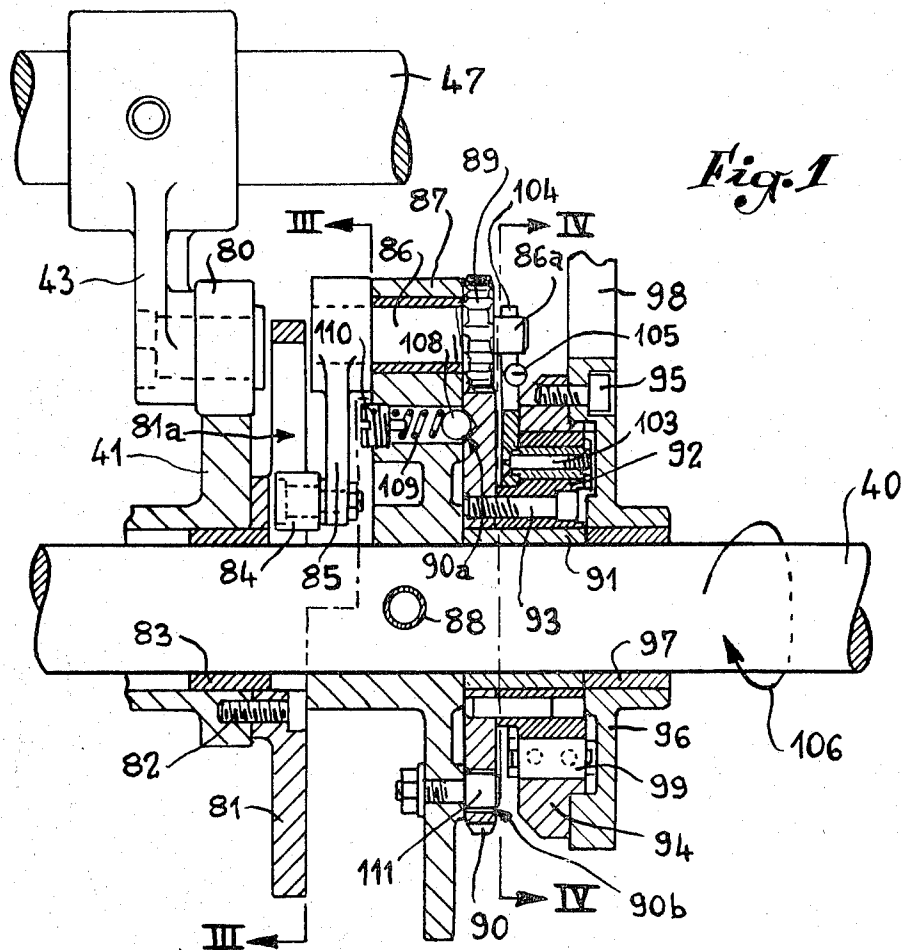
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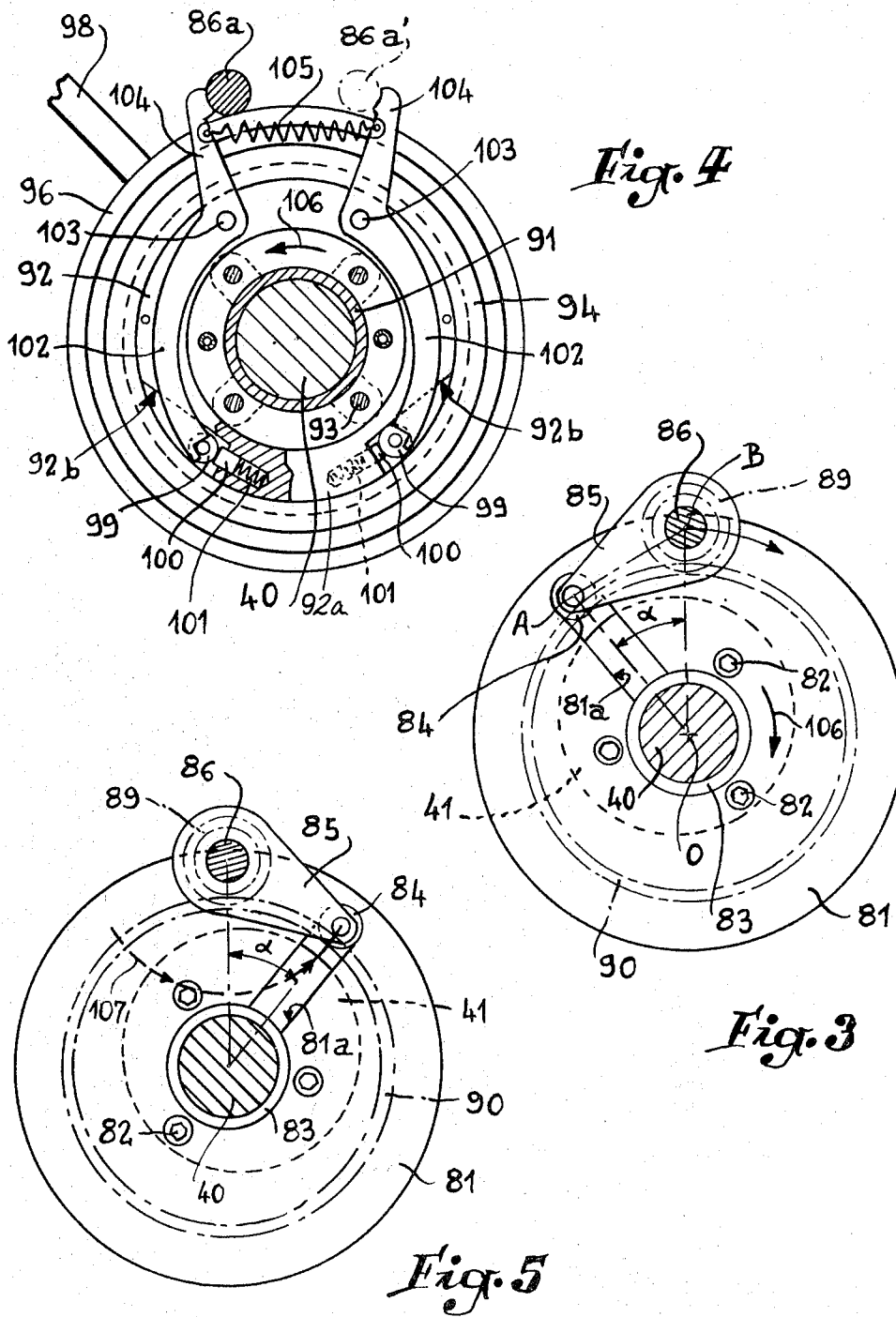
[57] **ABSTRACT**

In a reversible Verdol jacquard wherein the cam which actuates the pusher grid to press the needles is displaceable angularly on its driving shaft between two angular positions respectively corresponding to forward and to backward operation of the jacquard, this displacement is automatically realized by means responsive to the direction of rotation of the driving shaft. The cam may carry a member having a radial slot which guides the free end of a connecting lever mounted on a lateral shaft parallel to but spaced from the driving shaft and rotatably carried by a support keyed on the driving shaft, the said lever rotating between two end positions at each of which it is substantially perpendicular to the slot. Rotation of the lateral shaft may be obtained by means of a planet pinion carried by the said lateral shaft to cooperate with a sun gear loosely mounted on the driving shaft, this gear being retained against rotation by locking means which are automatically released when the driving shaft has rotated through a predetermined angle after reversal of its rotation.

10 Claims, 5 Drawing Figures







REVERSIBLE VERDOL JACQUARDS

The present invention relates to jacquards for looms, more particularly to double-lift jacquards of the Verdol type, wherein means are provided to permit backward rotation of the jacquard for pick finding or other purposes.

It is known that if such a Verdol jacquard of conventional design is rotated backwards, some of the feeler needles are liable to be urged downward by the pusher grid on an unperforated zone of the pattern paper and that they may thus either perforate the paper or be damaged.

It is known to avoid this disadvantage by providing in the jacquard means whereby the effective zone of the cam system which drives the pusher grid horizontally is displaced on the operating diagram of the jacquard towards a position symmetrical of its normal position with respect to the crossing of the knife frames. Such an arrangement is disclosed in the French patent 71, 12, 604 filed Mar. 31, 1971 in the name of the present Assignee. This may be obtained by displacing angularly the cam system on the cam supporting and driving shaft. But this requires that the operator of the loom actuates the displacing mechanism first in one direction before causing the loom to rotate backwards and then in the other direction before resuming normal weaving. Any error or omission may damage the feeler needles or the pattern paper.

It is an object of the present invention to avoid this drawback by providing a mechanism which acts automatically to displace the pusher grid driving cam system in one direction when the jacquard shaft begins rotating backwards and in the other when normal forward rotation is resumed.

In a preferred embodiment the cam system, loosely mounted on its driving shaft, has a substantially radial guide which receives the end of a lever pivotally carried by a support keyed on the shaft, in such manner as to rotate on this support about an axis substantially parallel to, but spaced from the axis of the shaft, while means are provided which, when the rotational direction of the shaft is reversed, cause the said lever to rotate through such an angle that the cam system is angularly displaced as required on the shaft.

The lever driving means may conveniently comprise a planet pinion keyed on the shaft of the lever and meshing with a sun gear loose on the cam system driving shaft, and a device adapted to maintain the said sun gear stationary for an appropriate time whenever the rotation of the cam supporting shaft is reversed. This device may be formed of a brake or of a locking mechanism. It may be released automatically when the cam system has rotated on the driving shaft through the angle required, or in the case of a brake it may remain in action provided the torque which it develops is small enough to cause no overload to the jacquard during normal running.

In the accompanying drawings:

FIG. 1 is a general longitudinal section of a mechanism according to the invention.

FIG. 2 is a quite diagrammatical perspective view illustrating the relations between the various parts of the mechanism.

FIG. 3 is a cross-section corresponding to line III—III of FIG. 1, the parts being illustrated at the position which corresponds to the normal or forward running.

FIG. 4 is a cross-section taken along line IV—IV (FIG. 1).

FIG. 5 reproduces FIG. 3, but the parts being shown during backward running.

In FIG. 1, reference numeral 40 designates the shaft of the jacquard on which the pusher grid driving cam 41 is loosely mounted. In the example illustrated this cam acts on a follower roller 80 carried by the free end of a lever 43 keyed on an oscillating shaft 47 connected with the pusher grid by a rod-and-lever gearing in the conventional manner. Roller 80 may be urged towards cam 41 by a spring or the cam may be of the constant diameter type acting on two opposed rollers, as usual in high-speed Verdol jacquards. A circular plate 81 is secured to cam 41 co-axially thereto by means of screws such as 82. Cam 41 and plate 81 thus form a single unit loosely mounted on shaft 40 by means of a bushing 83. Plate 81 has a radial slot 81a (see also FIG. 3) which terminates short of its periphery, this slot forming a guide for a roller 84 carried by a connecting lever 85 the other end of which is fixed onto a lateral shaft 86 (FIG. 1) spaced from but parallel to the driving shaft 40 and rotatably supported by a flat circular support 87 keyed on shaft 40 by means of a cotter pin 88. The end of the lateral shaft 86 opposed to roller 84 carries a pinion 89 beyond which it extends in the form of a projecting end 86a (FIGS. 1 and 2).

Pinion 89 cooperates as a planet gear with a sun gear 90 carried by a sleeve 91 loose on shaft 40. This sleeve also supports the hub 92 of a double locking mechanism which will be described below, the said hub being secured to gear 90 by screws such as 93.

Hub 92 is surrounded by a ring 94 secured by screws such as 95 (FIG. 1) to a disc 96 loosely mounted on shaft 40 by means of a bushing 97. This disc is maintained against rotation in any appropriate manner, as for instance by means of an arm 98 (FIG. 2) secured to the frame of the jacquard.

FIG. 4 shows the detail of the double locking mechanism. As shown hub 92 is formed with two peripheral recesses having in transverse section the shape of two opposed elongated right-angled triangles with their smaller sides directed substantially radially and separated by an intermediate unrecessed portion 92a of relatively small angular extension. Each recess thus determines a cam surface 92b which extends from the intermediate portion 92a towards the periphery of the hub. In each depression there is disposed a roller 99 resiliently urged along cam surface 92b by a pusher 100 which slides in a blind bore of the intermediate portion 92a under the action of a spring 101. It will be noted that each depression with its roller 99, its cam surface 92b and the inner periphery of ring 94 forms a free-wheel mechanism well known in the art, which permits free rotation of hub 92 in one direction but prevents it from rotating in the other direction. Since the two depressions are opposed to each other, hub 92 is normally wholly locked with respect to ring 94.

Each roller 99 may be pushed against the action of the corresponding spring 101 by an arcuate releasing lever 102 pivoted on a pin 103 carried by hub 92, the said lever being in one with an arm 104 which extends outwardly and substantially radially beyond ring 94 for cooperation with the above described extension 86a. Arms 104 are urged towards each other by a spring 105 which thus tends to move the inner ends of levers 102 away from rollers 99.

The operation is as follows:

It will be assumed that during forward or normal running shaft 40 rotates in the direction indicated by arrow 106 in FIGS. 1 and 3. The flat circular support 87 rotates with shaft 40 and supposing that the lateral shaft 86 is free to rotate, lever 85 will act as a pulling rod to drive plate 81 by means of roller 84 and of slot 81a. The parts thus assume the position illustrated in FIG. 3. Plate 81 in turn drives cam 41. The angular position of cam 41 with respect to shaft 40 may be represented by the angle (FIG. 3) between the respective radii of the axis of roller 99 and of the axis of the lateral shaft 86.

But in order that lever 85 may remain at the position of FIG. 3 during normal running, gear 90 should be free to rotate with support 81 and shaft 40, since it is in mesh with pinion 89, which means that hub 92 should be unlocked for the direction corresponding to arrow 106. This implies that in FIG. 4 the left-hand roller 99 should be brought to the ineffective or "released" position by the corresponding lever 102 (it will be noted in FIG. 1 that the arrows of the section lines III—III and IV—IV are directed in opposed directions, which explains that arrow 106 in FIG. 4 is counterclockwise while it is clockwise in FIG. 3). This is automatically obtained by the action of the projecting end 86a which acts on the left-hand arm 104. Hub 92 and gear 90 may thus freely rotate in the direction of arrow 106 together with plate 81.

If now shaft 40 is stopped and then rotated backwards, the right-hand roller 99 in FIG. 4 acts almost immediately and locks hub 92 with gear 90. Since plate 81 goes on rotating in the direction opposed to arrow 106 (i. e. counterclockwise in FIG. 3 and clockwise in FIG. 4), pinion 89 must roll on the periphery of gear 90 and it is easy to see that its rotation takes place counterclockwise in FIGS. 3 and 5. Lever 85 will therefore move along an arc of a circle as indicated at 107 in FIG. 5. Roller 84 will be displaced radially in slot 81a first inwardly and then outwardly thus causing a relative angular movement of plate 81 with respect to support 87. The parts thus come to the position of FIG. 5 which is exactly symmetrical with respect to FIG. 3. The angular position of cam 41 with respect to shaft 40, as above defined, is again represented by angle α but in the reverse direction.

When the position of FIG. 5 is reached, the projecting end 86a, which has rotated together with support 87, is at the position indicated at 86a in FIG. 4. As illustrated it acts on the right-hand arm 104 in such manner that the corresponding lever 102 engages and pushes the corresponding roller 99 which is thus "released" to liberate hub 92. Gear 90 is thereby free to rotate together with support 87. The whole mechanism may thus freely rotate backwards with cam 41 displaced through an angle 2α with respect to the case of forward rotation illustrated in FIG. 3.

It will be understood that the mechanism may easily be devised in such manner that this angle 2α may correspond to the angular displacement of the cam which is required for proper backward operation of the jacquard.

When shaft 40 is again rotated in the forward direction, the same operative steps take place but in the reverse direction. In other words, considering FIG. 5, pinion 89 rotates clockwise, roller 84 moves along arc

107, but towards the right, and the parts are again brought to their normal running position of FIG. 3.

It is obvious that for proper operation of the jacquard either forward or backward, lever 85 should remain at the position illustrated respectively in FIG. 3 or in FIG. 5 in spite of the unavoidable shocks which appear owing to the weight and to the inertia of the parts actuated by cam 41. In other words, considering FIG. 3, this lever which acts normally as a pulling member, should not rotate if it is momentarily submitted to compressive forces, even in the presence of vibrations. For this purpose angle OAB (FIGS. 3 and 5) is provided slightly lower than 90° in order that any compression may tend to urge roller 84 outwardly against the closed outer end of slot 81a. Of course such a position is theoretically unstable since the normal pulling force will tend to bring angle OAB to 90° , but if the difference is small (for instance for OAB comprised between 86° and 88°), stability may be obtained by means of a rather reduced retaining force. In the embodiment illustrated there has been provided for this purpose a resilient locking device formed of a ball 108 slidable within a longitudinal perforation of support 81 and which is urged into a lateral depression 90a of gear 90 by a spring 109 resting against a screw 110. Gear 90 is of course formed with two depressions respectively corresponding to the positions of FIG. 3 and of FIG. 5.

In the embodiment illustrated the angular displacement of gear 90 with respect to support 81 is limited by an arcuate slot 90b (see more particularly FIG. 2) formed in the gear, this slot receiving a pin 111 carried by the support. This limitation of the relative angular displacement of gear 90 with respect to support 81 duplicates of course the effect of the closed outer end of the radial slot 81a which limits the outward movement of roller 84.

It may further be remarked that pinion 89 only rolls along a limited portion of the periphery of gear 90 which may therefore be replaced by a mere toothed sector.

While the releasable locking mechanism illustrated in FIG. 4 is of practical advantage for ensuring the angular displacement of lever 85 when rotation of the jacquard is reversed, it should be noted that this displacement could be obtained by other means. For instance gear 90 could be submitted to the action of an electric brake which would be released by appropriate contacts so arranged, as for instance on gear 90 and on support 87, as to release the brake as soon as the angular displacement required is obtained. Also gear 90 could permanently receive the action of a frictional brake which would develop a sufficiently low braking torque in order not to apply an excessive load on shaft 40 during normal running. It will also be understood that the mechanical system formed of roller 84, slot 81a and lever 85 could be replaced by any other equivalent gearing, as for instance by a cam mounted on shaft 86 and acting on appropriate follower members carried by plate 81, by a radial fork and a pin slidable therein, etc..

It is further obvious that the jacquard may comprise more than a single cam such as 40, these cams being angularly fixed with respect to each other, as for instance by being mounted on a common tubular shaft loosely supported by the driving shaft 30.

I claim:

1. In a Verdol jacquard comprising at least one cam adapted to actuate the pusher grid horizontally, the

said cam being carried by a driving shaft on which it is selectively displaceable between a first angular position corresponding to forward operation of the jacquard and a second position corresponding to backward operation thereof, the improvement according to which said jacquard further comprises means responsive to the direction of rotation of said driving shaft and acting on said cam to displace same angularly thereon from said first angular position to said second angular position when said direction is reversed from normal forward rotation to backward rotation and to retain said cam at said second angular position during said backward rotation, and to displace said cam angularly on said shaft from said second angular position to said first angular position when said direction is again reversed from backward rotation to normal forward rotation and to retain said cam at said first angular position during said forward rotation, said means comprising:

- a support mounted on said driving shaft at a fixed angular position thereon;
- a lateral shaft rotatably carried by said support, said lateral shaft being substantially parallel to but spaced from said driving shaft;
- a connecting lever fixed to said lateral shaft, said lever having a free end;
- guiding means loosely mounted on said driving shaft at a fixed angular position with respect to said cam, said guiding means being arranged to guide the free end of said lever substantially radially to said driving shaft;
- and means to cause rotation of said lateral shaft through a predetermined angle whenever the direction of rotation of said driving shaft is reversed to cause said connecting lever to displace angularly said guiding means and said cam on said driving shaft between one and the other of said first and second angular positions of said cam on said driving shaft.

2. In a Verdol jacquard as claimed in claim 1, said means to cause rotation of said lateral shaft comprising:

- a planet pinion mounted on said lateral shaft at a fixed angular position thereon;
- a toothed sector loosely carried by said driving shaft co-axially thereto to form a sun wheel meshing with said planet pinion;
- and means to retain said toothed sector against rotation when the direction of said driving shaft is reversed and to permit rotation of said sector together with said driving shaft after a predetermined angle of rotation of said driving shaft.

3. In a Verdol jacquard as claimed in claim 2, said retaining means comprising:

- a hub member loosely mounted on said driving shaft, said hub member being angularly fixed with respect to said sector;
- a stationary crown co-axial to said hub and surrounding same;
- first and second locking means interposed between said hub member and said crown to prevent rota-

tion of said hub member respectively in one and the other directions;

means to selectively unlock said first and second locking means;

and means carried by said support to selectively actuate said unlocking means after said predetermined angle of rotation of said driving shaft.

4. In a Verdol jacquard as claimed in claim 2, said retaining means comprising a brake to apply to said toothed sector a reduced permanent braking torque.

5. In a Verdol jacquard as claimed in claim 2, means to resiliently lock said toothed sector with respect to said driving shaft at said first and second positions of said cam on said driving shaft.

6. In a Verdol jacquard as claimed in claim 2, means to limit the angular displacement of said toothed sector on said driving shaft.

7. In a Verdol jacquard as claimed in claim 1, said connecting lever being substantially at a dead point position with respect to said guiding means at said first and second angular positions of said cam on said driving shaft.

8. In a Verdol jacquard as claimed in claim 1:

- said guiding means including a member having a radial slot;
- said connecting lever having at its free end a follower member displaceable in said slot;
- and said connecting lever being substantially perpendicular to said slot at said first and second angular positions of said cam on said driving shaft.

9. In a Verdol jacquard as claimed in claim 8, said slot having a closed end to limit the angular displacement of said connecting lever and of said lateral shaft with respect to said support.

10. In a Verdol jacquard comprising at least one cam adapted to actuate the pusher grid horizontally, the said cam being rotatably carried by a reversible driving shaft on which it is angularly displaceable with respect to said shaft between a first fixed position which it occupies during forward operation of the jacquard and a second fixed position which it occupies during backward operation thereof, the improvement comprising: a support member fixed to the shaft adjacent to said cam; connecting means interposed between said cam and said support member and including lever means displaceable selectively into either of two opposed orientations, one orientation maintaining the cam in said first fixed position and the other orientation maintaining the cam in said second fixed position; and means carried by the shaft responsive to reversals in its direction of rotation and coupled to said connecting means and operative when the shaft reverses from forward to backward rotation to displace said lever means and move said cam into the second position, and operative when the shaft reverses from backward to forward rotation to displace said lever means and move the cam into the first position.

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