

[54] **LOOM JACQUARDS OF THE DOUBLE-LIFT TYPE**

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[52] **U.S. Cl.** **139/65**

[51] **Int. Cl.** **D03c 3/06**

[58] **Field of Search** 139/55-65

[56] **References Cited**

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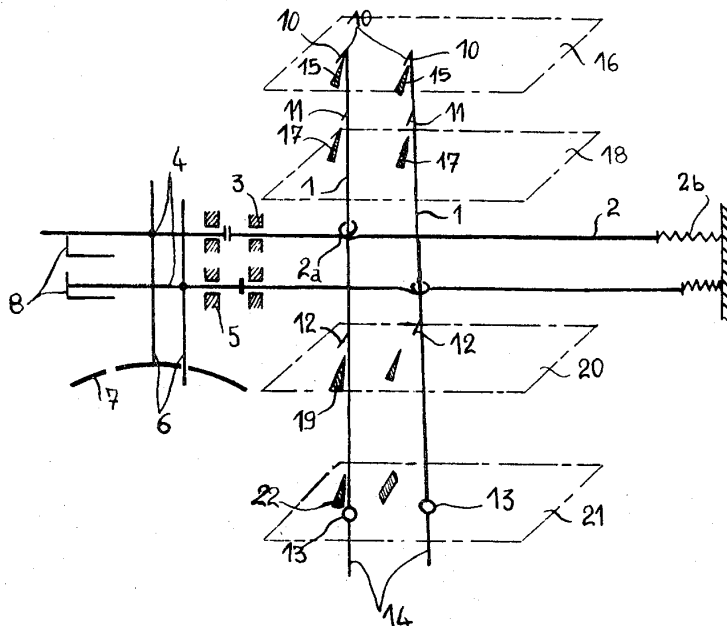
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[57] **ABSTRACT**

In a double-lift jacquard with two superposed movable knife frames and a lower stationary open-shed frame, each of the double hooks comprises a single substantially straight rod-like branch rotatable about its axis; two superposed main beaks each cooperating with one of the movable frames under control of the needle associated with the hook, these main beaks being directed substantially at 90° from each other about the axis of the branch in such manner that when one main beak is caught by a transverse knife of the corresponding movable frame the other main beak is brought by rotation of the hook about the axis of the branch, to an ineffective lateral position at which it cannot be caught by the other movable frame; and a lower open-shed supporting beak adapted to cooperate either with the stationary open-shed frame at the raised position of the hook if same is to remain raised at the next stroke of the loom, or with a transverse bar of a stationary guiding and supporting grid disposed below the open-shed frame, the said open-shed supporting beak being directed along the bissectrix of the main beaks about the axis of the branch in such manner that when it supports the hook the main beaks thereof are at 45° to the knives of the movable frames and may be caught by any of them under control of the needle.

4 Claims, 13 Drawing Figures



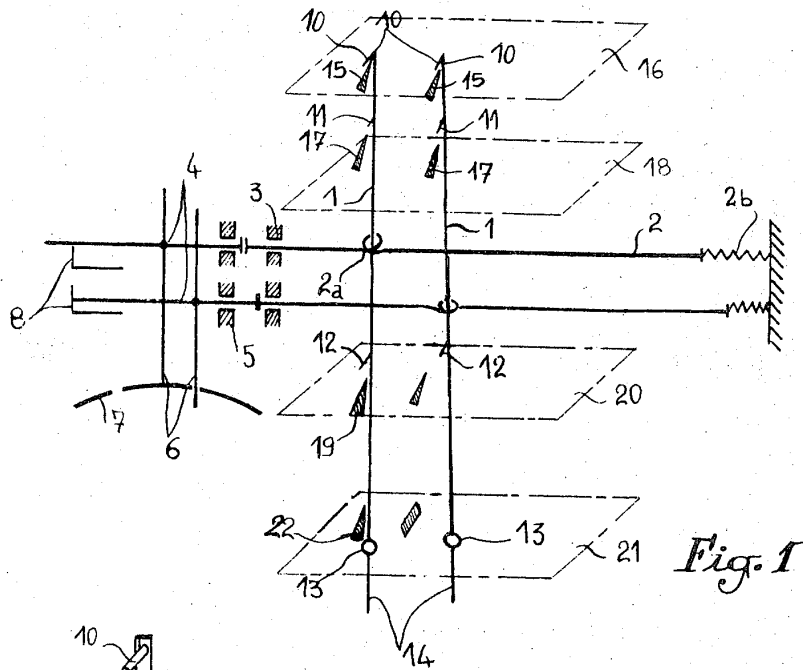


Fig. 1

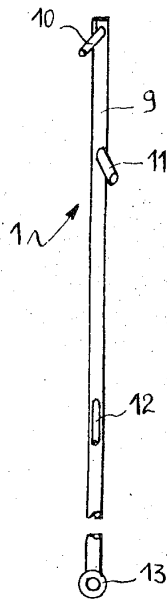


Fig. 2

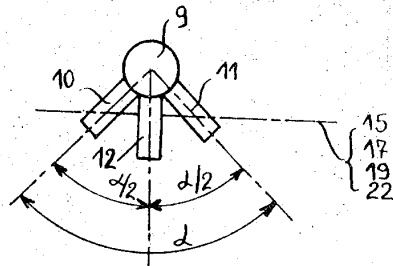


Fig. 3

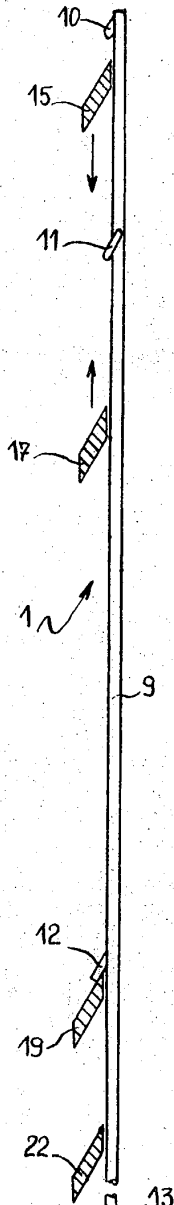


Fig. 4

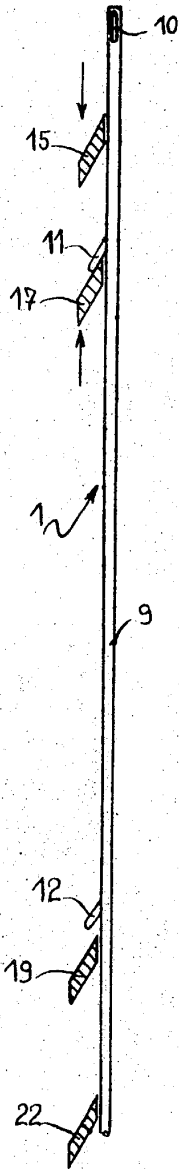


Fig. 5

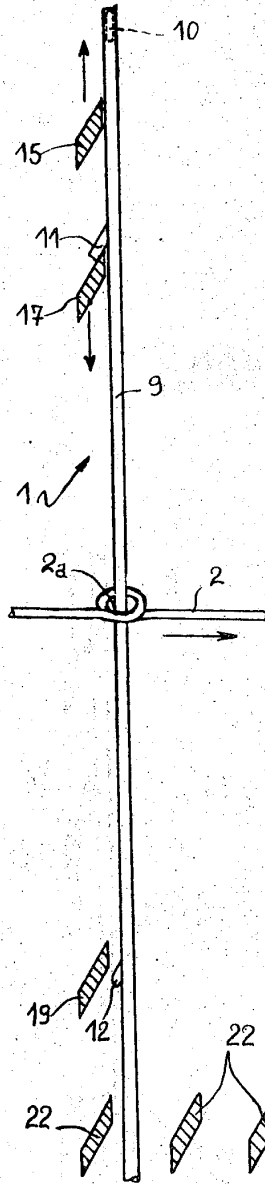


Fig. 7

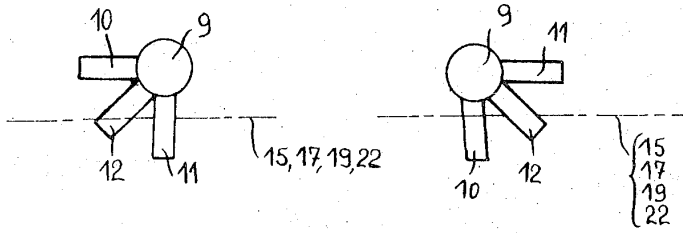


Fig. 6

Fig. 10

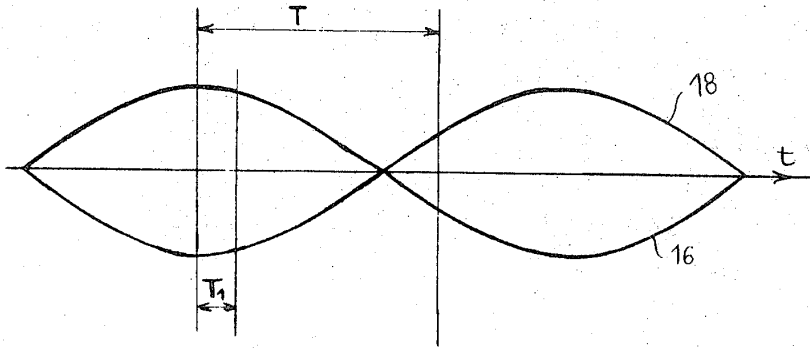


Fig. 13

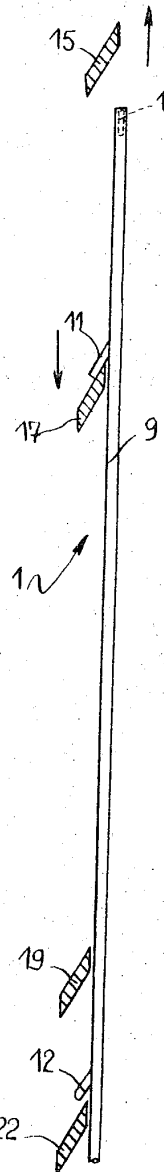


Fig. 8

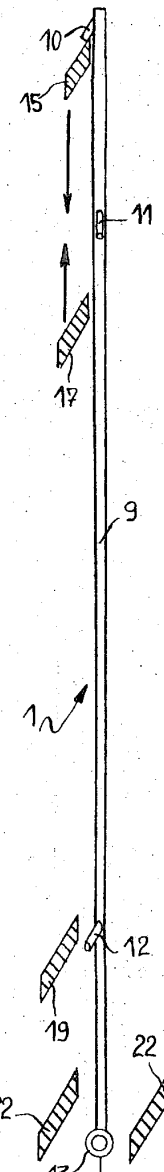


Fig. 9

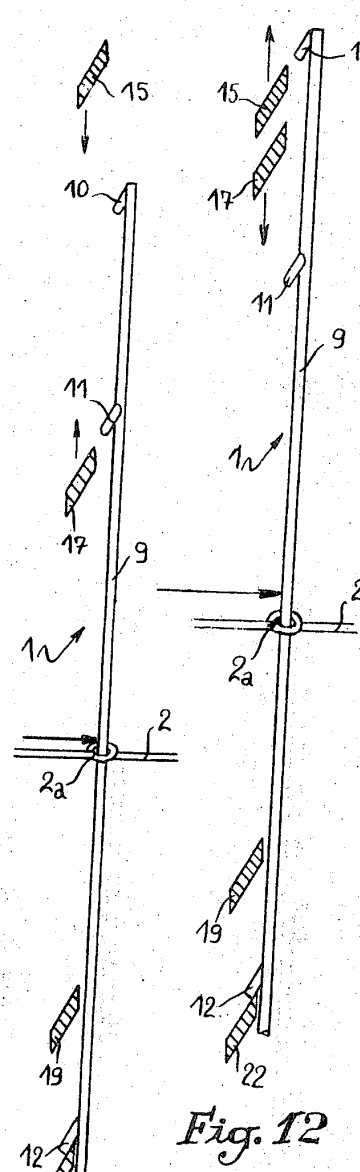


Fig. 11

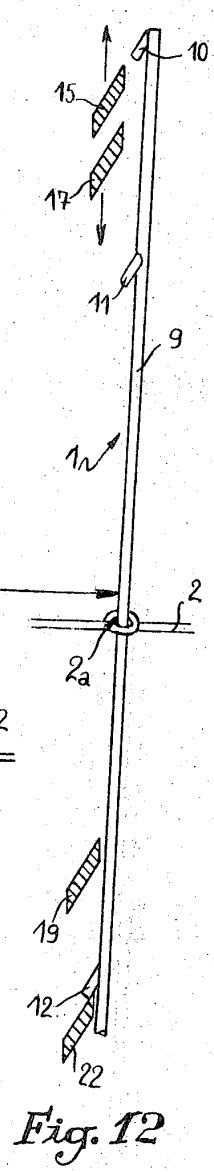


Fig. 12

LOOM JACQUARDS OF THE DOUBLE-LIFT TYPE

The present invention relates to loom jacquards of the double-lift type. These jacquards comprise two movable knife frames which are reciprocated vertically in opposed directions at half the rate of the loom, while each hook is conventionally realized under double form with two parallel branches each having at its free end a main beak adapted to cooperate with one of the movable frames. The branches of each hook may be of equal length, in which case the movable frames should be so arranged as to compenetrate each other, but in modern double-lift jacquards these branches are generally unequal in order that one of the movable frames may remain above the other even when the former is fully lowered and the second fully raised (jacquards with superposed frames).

Double-lift jacquards are as a rule provided with open-shed means including an auxiliary or open-shed beak on one of the branches of each hook and a stationary open-shed knife frame which supports the open-shed beak of those of the hooks which are to remain raised at the next stroke of the loom.

A difficulty encountered with such double-lift jacquards is that when a previously raised hook is being lowered by the one of the movable frames which effects its descending stroke, the main beak of this hook corresponding to the other movable frame should not be caught by the latter which is then effecting its ascending stroke. This means that the needles should maintain their pushing action until the frames have passed the "crossing point" of their operative cycle, i.e. the position at which, if the movable frames, were at standstill, they could simultaneously support each one of the main beaks of each hook. The time during which the perforated cards of the jacquard may be disengaged from the feeler needles in order to permit rotation of the cylinder is correspondingly reduced, which of course is a marked disadvantage in the case of high-speed looms.

It has been proposed to mount the main beaks of each hook respectively at the lower and at the upper end of a flat bar having its centre pivoted to a single vertical branch of the hook in such manner that when a beak is supported by the corresponding movable frame, the bar is deviated and the other beak is brought to such a position with respect to the branch that it cannot be caught by its own movable frame. Such a construction fully solves the problem, but it is somewhat intricate, delicate and expensive due to presence of the pivoted bar.

It is an object of the present invention to provide a jacquard of the double-lift type with double hooks of simple and sturdy construction, in which the difficulty above referred to is also fully avoided.

The invention concerns a double-lift jacquard of the superposed knife frame type with double hooks each having a single branch and two downwardly extending main beaks, wherein the main beaks of each hook are directed at about 90° from each other about the axis of the branch which is freely rotatable about its own axis, in such manner that when one of the said main beaks is supported by the corresponding one of the said movable knife frames, the other main beak is directed laterally with respect to the jacquard and thus cannot be caught by the other movable knife, while means are provided for bringing each lowered hook to such an an-

gular position about the axis of its branch that its main beaks extend substantially at 45° with respect to the knives of the movable knife frames and may be caught by one of the latter when the hook is to be raised.

In the accompanying drawings:

FIG. 1 is a diagrammatical view illustrating the main components of a double-lift open-shed jacquard according to this invention.

FIG. 2 is a front view of one of the hooks of this jacquard.

FIG. 3 is a plan view corresponding to FIG. 2.

FIG. 4 is a diagrammatical side view showing the hook supported by the open-shed knife frame, the upper and lower movable knife frames being respectively descending and ascending.

FIG. 5 shows the hook raised by the lower movable knife frame at the end of its ascending stroke.

FIG. 6 is a plan view of the hook when being raised or lowered by the lower movable knife frame.

FIGS. 7 and 8 illustrate two successive positions of the hook while it is lowered by the lower movable knife frame and after its open-shed beak has freely passed in front of the open-shed knife frame.

FIG. 9 is a view similar to FIG. 7, but illustrating the hook as being lowered by the upper movable knife frame.

FIG. 10 is a plan view similar to FIG. 6, but in which the hook is illustrated as being supported by the upper movable knife frame.

FIGS. 11 and 12 illustrate the hook at its lowered position with the upper and lower movable frames beginning respectively their descending and ascending strokes in FIG. 11 and their ascending and descending strokes in FIG. 12.

FIG. 13 is a diagram showing the extent of the pressing period with respect to the operative cycle of the movable knife frames.

Referring to FIG. 1 a double-lift open-shed jacquard of the Verdol type according to the present invention comprises a large number of hooks 1, two only of which have been illustrated for the sake of clearness. As in conventional Verdol jacquards each hook is slidably connected with a needle 2, all these needles being guided in perforations of a first guiding plate 3 situated on the left with respect to the hook and of a second guiding plate, not illustrated, disposed on the right, where the said needles are submitted to the action of biasing springs 2b. Needles 2 are actuated by pushers 4 having a first end guided by a plate 5 provided in the vicinity of plate 3, while their second end carries vertical feeler needles 6 adapted to cooperate with the perforated Verdol pattern paper 7. The second end of pushers 4 is raised and lowered together with feeler needles 6 by a set of L-shaped bars 8 which are at the same time reciprocated horizontally to actuate those of pushers 4 whose feeler needles 6 have been retained by an unperforated zone of paper 7.

Each hook 1 (FIGS. 2 and 3) comprises a single straight rod-like branch 9 made of steel wire and which has, starting from its upper end, a first main beak 10, then a second main beak 11 which, as seen from above, is directed at 90° from the first one about the axis of the branch, and finally an open-shed beak 12 extending along the bissectrix of the angle formed by the main beaks 10 and 11, in the vicinity of the lower end of branch 9, this lower end being formed with an eyelet 13 adapted to receive a harness cord 14 (FIG. 1). The cor-

responding needle 2 forms the usual loop 2a which surrounds branch 9 between the lower main beak 11 and the open-shed beak 12. Beaks 10, 11 and 12 are preferably in the form of straight downwardly directed fingers which are welded to branch 9.

Each main beak 10 is adapted to cooperate with a knife 15 (FIG. 1) of the upper movable knife frame 16 of the jacquard, while the corresponding main beak 11 may cooperate with a knife 17 of the lower movable knife frame 18. As to the open-shed beak 12, it cooperates either with a knife 19 of a stationary open-shed knife frame 20 or with one of the transverse bars 22 of a lower guiding and supporting grid 21.

FIG. 4 illustrates a hook 1 having its open-shed beak 12 supported by a knife 19 of the open-shed frame 20. The angular position of beaks 10, 11 and 12 is then as shown in FIG. 3 wherein knife 19 is indicated in dash and dot lines. It will be noted that in cross-section (see FIG. 4) this knife is inclined at the same angle as beak 12. Owing to the possibility of free rotation of branch 9, when beak 12 is supported by the said knife, it is brought to the position shown in FIG. 3, i.e. it is directed longitudinally with respect to the jacquard, while the main beaks 10 and 11 are at 45° on each side of beak 12. The knives 15, 17 of the movable frames and the transverse bars 22 of the lower guiding and supporting grid are situated above or below knife 19 and are therefore also represented by the dash and dot line of FIG. 3. They are quite similar to knife 19 in cross-section.

When the lower movable frame 18 terminates its ascending stroke, one of its knives 17 may easily catch the main beak 11 of the hook 1 illustrated in FIG. 4; this hook is thus slightly raised in the conventional manner and beak 12 is disengaged from the open-shed knife 19 (position of FIG. 5). When hook 1 is thus supported by knife 17, it rotates through 45°, clockwise in FIG. 3, until beak 11 is directed longitudinally with respect to the jacquard (position of FIG. 6). The other main beak 12 is thus brought to an ineffective lateral position. As soon as the movable frames have reached their extreme positions, the needles 2 are selectively actuated. Assuming the needle 2 of hook 1 is pushed, hook 1 is deviated, its open-shed beak 12 being moved backwards, i.e. to the right, in such manner that at the beginning of the descending stroke of knife 17 it escapes the corresponding knife 19 of the open-shed frame, as illustrated in FIG. 7. The needles 2 are then liberated from the action of pushers 4 and of bars 8 (FIG. 1), and hook 1 returns to its former vertical position. It is obvious that the operative steps just described remain the same when hook 1 is raised by the knife 15 of the upper movable frame 16 during another beat of the loom, except that hook 1 is then supported by its upper main beak 10.

Returning to FIG. 7, when the movable frames reach the crossing point the upper main beak 10 of the descending hook 1 cannot be caught by the ascending knife 15 since this beak is directed laterally (see FIGS. 6 and 7). When knife 17 approaches the end of its descending stroke, the open-shed beak 12 of hook 1 engages the corresponding transverse bar 22 of the lower guiding and supporting grid 21 of FIG. 1, as indicated in FIG. 8 which shows hook 1 just when beak 12 reaches the level of bar 22. Since the latter is formed as knives 15, 17 and 19, it causes rotations of the hook through 45° so as to return it to the angular position of

FIG. 3 with beak 12 extending longitudinally with respect to the jacquard i.e. perpendicularly to the knives.

The spacing apart of the transverse bars 22 of grid 21 is such as to permit free longitudinal deviation of the lower portion of hooks 1 under the action of needles 2. It should further be remarked that grid 21 also comprises longitudinal bars, not illustrated, which guide hooks 1 laterally.

If hook 1 should again be raised by the one of knives 15 and 17 which begins its ascending stroke, the corresponding main beak 10 or 11 may be caught since it extends at 45° as indicated in FIG. 3. FIG. 5 shows hook 1 being raised by knife 17, its angular position being as illustrated in FIG. 6 as soon as the open-shed beak 12 is disengaged from knife 19, while in FIG. 9 hook 1 is shown as being raised by knife 15 just before the latter reaches the uppermost point of its ascending stroke, FIG. 10 illustrating the corresponding angular position of the hook. In both cases the main beak 10, respectively 11, which is not supported by the corresponding knife 15 or 17, is at an ineffective lateral position.

If hook 1 is not to be raised, its needle 2 is pushed towards the right and it deviates the hook about bar 22, as illustrated in FIGS. 11 and 12 which respectively correspond to the ascending step of knife 17 or of knife 15. In both cases the main beaks 10 and 11 are displaced backwards (to the right in the figures) and they cannot be caught by the ascending knife.

FIG. 13 shows the diagram of the vertical motion of the movable knife frames 16 and 18 (knives 15 and 17). In a conventional double-lift jacquard the "pushing period" during which the needles act on the hooks should extend from the end of the stroke of the movable frames to a point situated somewhat beyond their crossing point, this corresponding to the time T, while in the jacquard according to the invention the said pressing period may end just after the open-shed beaks 12 of the hooks 1 which are to be lowered, have passed the corresponding knives 19 of the open-shed frame 20. This corresponds to the time T1 which is much shorter than T. The time available for the rotation of the cylinder which supports the pattern paper and for the selection of the feeler needles is thus considerably increased. Moreover the hooks are deviated and no more resiliently flexed as in conventional double-lift jacquards, which reduces the stresses to which the needles and their actuating mechanism are submitted in operation.

In a modification the hooks could comprise a separate supporting beak adapted to cooperate with the transverse bars 22 of the lower guiding and supporting grid, the distance between the latter and the open-shed frame (knives 19) being increased in order that this supporting beak and the open-shed beak only co-act each with its corresponding grid or frame. With such a supporting beak the invention may be applied to jacquards having no open-shed frame.

I claim:

1. In a double-lift jacquard comprising: a pair of superposed movable knife frames reciprocated in opposed directions, each including a series of substantially parallel knives extending transversely of said jacquard; double hooks each adapted to be selectively driven vertically by a knife of any of said movable knife frames to be raised or lowered by same;

5

and selecting needles each adapted to act on one of said double hooks to control cooperation of same with one of said movable knife frames; the improvement which consists in: each of said double hooks including a single substantially straight branch having an axis, said branch being rotatable about said axis, and two superposed main beaks extending obliquely downwardly from said branch, said main beaks being substantially directed at 90° from each other about the axis of said branch;

and said jacquard further comprising first orientating means to bring each lowered hook to such an angular position about the axis of its branch that its main beaks extend substantially at 45° to the knives of said knife frames about the axis of said branch.

2. In a double-lift jacquard as claimed in claim 1 comprising a stationary open-shed frame having knives parallel to the knives of said movable knife frame, with the branch of each of said double hooks having a downwardly extending open-shed beak to cooperate with a knife of said stationary open-shed frame:

the improvement which consists in said open-shed beak of each double hook being directed along the bisectrix of the angle formed by the main beaks of said last named hook about the axis of said branch to form with said open-shed frame second orienting means to orientate each of those said double hooks which are supported by said open-shed frame, at such an angular position about the axis of its branch that its main beaks extend substantially at 45° to the knives of said movable knife frames.

3. In a double-lift jacquard as claimed in claim 1, said first orientating means comprising:

- a. a lower grid to guide said double hooks, said grid including transverse bars parallel to the knives of said movable frame;
- b. and a downwardly extending auxiliary supporting

6

beak carried by the branch of each double hook to cooperate with one of said transverse bars to support said last-named hook when same has been lowered by one of said movable frames, with said supporting beak being directed along the bisectrix of the angle formed by the main beaks of said last-named double hooks about the axis of its branch.

4. In a double-lift jacquard as claimed in claim 1: said first orientating means comprising:

- a. a lower grid to guide said double hooks, said grid including transverse bars parallel to the knives of said movable frames;
- b. and a downwardly extending auxiliary supporting beak carried by the branch of each double hook to cooperate with one of said transverse bars to support said last-named hook when said has been lowered by one of said movable frames, with said supporting beak being directed along the bisectrix of the angle formed by the main beaks of said last-named double hook about the axis of its branch

and said double-lift jacquard further comprising a stationary open-shed frame having knives parallel to the knives of said movable knife frames, said open-shed frame being situated at such a distance above said lower grid that said auxiliary beak cooperates with said open-shed frame at the raised position of each of said double hooks to support same, said auxiliary supporting beak thus forming with said open-shed frame second orientating means to orientate each of those of said double hooks which are supported by said open-shed frame, at such an angular position about the axis of its branch that its main beaks extend substantially at 45° to the knives of said movable knife frames.

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