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B-8510 Kortrijk (Marke) (BE)**(54) Three-position non-open-shed jacquard**

(57) Three-position non-open-shed jacquard, comprising a system encompassing two interacting hooks (5), (6) for lifting warp threads (20), (21) on a loom, two first blades (1), (2) which can be moved up and down in opposite phase and which can each transport from their bottom dead centre a hook (5), (6) situated at a selection height (S) - in the event of selection of the said hook -, a control element (16) by which each hook (5), (6) can be selected, a second blade (3) which can be moved up and down in opposite phase with the one first blade (1)

and which, from its top dead centre, can transport the hook (5) which interacts with the one first blade (1) - in the event of non-selection of the said hook - from the selection height (S), and means, such as, for example, a fixedly disposed blade (4), for securing at the selection height (S) the hook (6) which interacts with the other first blade (2).

Only one control element (16) and one tackle element (12) per system is required, whilst the hooks (5), (6) can be transported by their blades (1), (2), (3) in a jolt-free manner.

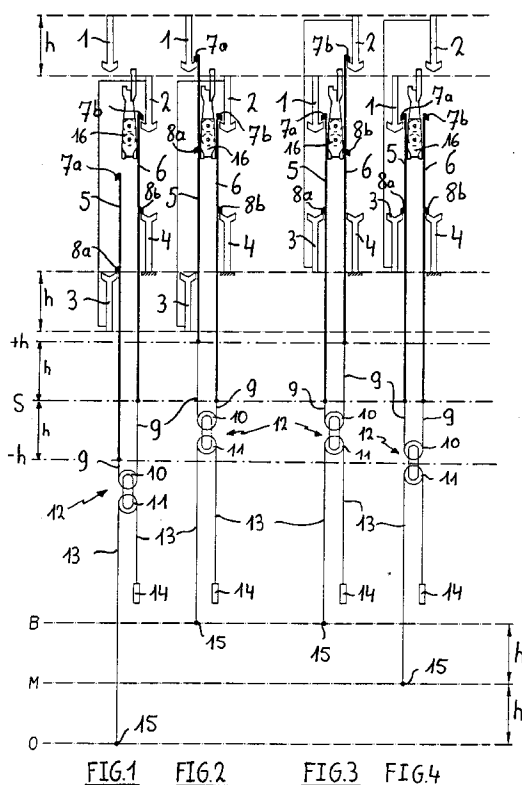


FIG.1

FIG.2

FIG.3

FIG.4

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Description

The present invention relates to a three-position jacquard, comprising a system encompassing two interacting hooks for lifting at least one warp thread on a loom, two first blades (with a lift h_1) which can be moved up and down in opposite phase, the said first blades being provided to take up a respective hook - in the event of its selection - from a selection height, and a control element by which each hook can be selected at the selection height.

This present invention especially relates to a three-position non-open-shed jacquard. In a jacquard of this kind, each system encompassing two interacting hooks can produce at least one warp thread at three different heights - hereinafter referred to as positions - viz.: a "bottom" position, a "middle" position and a "top" position, hereinafter denoted by the initial letters "B", "M" and "T".

After each half motional cycle of the blades - this is respectively where one of the blades is situated in its top dead centre - on the loom one or more weft threads are introduced into the shed formed between the warp threads. The introduction of one or more weft threads is hereinafter referred to as a shot. In the case of a three-position non-open-shed jacquard, only two of the three positions are attainable in each shot, whilst the position which is unattainable in a specific shot is in each case attainable in a following shot (the non-open-shed principle).

In European patent 0 399 930, a known three-position jacquard is described in which (for the enablement of the three positions) a system is required which encompasses two sets of interacting hooks disposed side by side. The interacting hooks of each set are joined together by means of a tackle cord.

Each tackle cord is conducted below an uppermost tackle roller of a respective tackle element. Another tackle cord is fixed by one end and is subsequently conducted over a lowermost tackle roller of the one tackle element, below a reversing roller which is fixed lower than the tackle elements on a fixed component part of the jacquard, and over a lowermost tackle roller of the other tackle element. The other end of this tackle cord is connected to a harness cord for lifting at least one warp thread. A suitable selection of the hooks enables this warp thread to be brought optionally, in each shot, into one of three possible positions. For each set of interacting hooks, a control element is necessary to be able to realize the desired selection.

The fact that two adjacently placed sets of interacting hooks, two adjacently placed control elements, two tackle elements and a reversing roller are provided for each system means that this jacquard takes up twice as much space as a two-position open-shed jacquard. Moreover, this jacquard turns out to be very expensive.

In German patent no. 4 101 778, two three-position jacquards are described, having the characteristics indicated in the first paragraph of this description. Each

system for lifting at least one warp thread into three different positions comprises two interacting hooks, one control element and one tackle element.

In the case of the first jacquard, each blade is provided at two different heights with a driving edge, so that each hook can be transported either by the uppermost driving edge or by the lowermost driving edge of a blade. Where a blade is situated in its bottom dead centre, the uppermost driving edge is situated approximately at the height of the bent-over top end of a hook situated at the selection height.

At the moment in which the lowermost driving edge is situated at the height of the bent-over top end of a hook, this blade is already in the process of moving at top speed to its top dead centre. If a hook has been selected to be transported by the lowermost driving edge, this hook is transported by the blade with a jolt from a stationary position to the selection height. This results in irregular running of the jacquard.

In the case of the second jacquard, the blades have only one driving edge. One of the two blades is connected to a transmission system such that, in its bottom dead centre, it reaches the same height as the other blade, but in its top dead centre it is lifted less high than the other blade.

The drawback of this jacquard lies primarily in the fact that a complicated and expensive transmission system is necessary.

The object of the present invention is to provide a three-position non-open-shed jacquard in which the abovementioned drawbacks of the known three-position jacquards do not arise.

This object is achieved according to the present invention by providing a three-position jacquard having the characteristics indicated in the first paragraph of this description, in which the jacquard further comprises a second blade (with a lift h_2) which can be moved up and down in opposite phase with one of the first blades, the said second blade being provided to take down the hook which interacts with that first blade - in the event of non-selection of the said hook - from the selection height, and means, provided to secure the hook which interacts with the other first blade - in the event of non-selection of the said hook - at the selection height.

In a preferred embodiment of the jacquard, said first blades are provided to take up a respective hook at a location in the environment of their bottom dead centre, whereas said second blade is provided to take down said hook at a location in the environment of its top dead centre.

The abovementioned system for lifting at least one warp thread can comprise any device which interacts with a set of interacting hooks and with at least one warp thread in such a way that three different combinations of locations of the hooks exist in which, respectively, a different position of the said warp thread is attained.

An explanation is given below of how a warp thread can be brought according to the non-open-shed princi-

ple into three. different positions using the jacquard according to the present invention.

Let us consider two interacting hooks: hook I and hook II, their respective first blades: first blade I and first blade II, as well as a second blade I which can move in opposite phase in relation to the first blade I (or in phase with the first blade II) and means for securing hook II at the selection height. These means comprise, for example, a fixedly disposed second blade II, which can secure hook II at the selection height.

In a specific shot, hook I can be found in one of the following situations:

- situation a: hook I is transported by the first blade I whilst this first blade I is in the top dead centre. Hook I is then situated at a height (+ h_1) above the selection height (the reference height denoted by (S)).
- situation a' hook I is transported by its first blade I whilst this first blade I is in the bottom dead centre. Hook I is then situated at the selection height (S).
- situation b: hook I is transported by the second blade I whilst this second blade I is in the bottom dead centre. Hook I is then situated at a height (- h_2) below the selection height.
- situation b' hook I is transported by the second blade I whilst this second blade I is in the top dead centre. Hook I is then situated at the selection height (S).

In a specific shot, hook II can be found in one of the following situations:

- situation c: hook II is transported by its first blade II whilst this first blade II is in the bottom dead centre. Hook II is then situated at the selection height (S).
- situation c' hook II is transported by its first blade II whilst this first blade II is in the top dead centre. Hook II is then situated at a height (+ h_1) above the selection height (S).
- situation d: hook II is secured at the selection height (S), for example by a fixedly disposed second blade II.

Where this second blade II is able to move up and down (with a lift h_2) in opposite phase with the first blade II, the hook II can also still be found in a situation d', in which hook II is transported by the second blade II whilst this second blade II is in the bottom dead centre. Hook II is then situated at a height (- h_2) below the selection height (S).

Let us assume that, in a first shot, the first blade I is in its top dead centre. The first blade II and the second

blade I are then in their bottom dead centre. If a second blade II is provided, this blade stands fixed in its top dead centre. In this first shot, hook I can consequently be found in situation a or b and hook II can be found in situation c or d.

Hook I can thus be situated at the height (+ h_1) or at the height (- h_2), whilst hook II can only be situated at the selection height (S). In this first shot, there are therefore two options for the locations of the interacting hooks:

A) hook I at the height (+ h_1) and hook II at the selection height (S).

B) hook I at the height (- h_2) and hook at the selection height (S).

In a succeeding (second) shot, the first blade I is in its bottom dead centre and the first blade II and the second blade I are in their top dead centre.

Before moving the blades into their new locations, by either realizing or not realizing a selection by means of the control element, the following situations for the hooks are able to be obtained in the second shot.

- Where hook I, in the first shot, was in situation a, this hook I is transported by its first blade I to the bottom dead centre. In the second shot, hook I is therefore situated at the selection height (S), in situation a'.
- In its location in the first shot (at the height (+ h_1), hook II is, after all, unable to be released by its first blade I. This can only be done at the selection height (S).
- Where hook I, in the first shot, was in situation b, then the second blade I transports the hook to the top dead centre. In the second shot, hook I is therefore situated at the selection height (S), in situation b'.
- Where hook II, in the first shot, is found in situation c, then hook II can be found in the second shot
 - * either in situation d, at the selection height (S), as a result of non-selection of this hook
 - * or in situation c', at the height (+ h_1), as a result of actual selection of this hook.
- Where hook II, in the first shot, was in situation d, then hook II can be found in the second shot
 - * either in situation d, at the selection height (S), as a result of non-selection of this hook
 - * or in situation c', at the height (+ h_1), as a result of actual selection of this hook II.

In the second shot, hook I is brought from every possible situation in the first shot to the selection height (S), whilst hook II is brought from every possible situation in the first shot either to the selection height (S) or to the height

(+ h_1).

In the second shot, there are therefore once again two options for the locations of the interacting hooks:

- C) hook I and hook II at the selection height (S)
- D) hook I at the selection height (S) and hook II at the height (+ h_1).

Each different combination of locations of the interacting hooks is matched by a different position of the warp threads. Where the system for lifting the warp threads is constructed, moreover, such that the warp threads remain in the same position if the locations of the hooks are exchanged, then in option A in the first shot (hook I at the height (+ h_1) and hook II at the height (S)) and in option D in the second shot (hook I at the height (S) and hook II at the height (+ h_1)), one and the same first position of the warp threads is obtained. In option C in the second shot (hook I and hook II at the height (S)) and in option B in the first shot (hook I at the height (- h_2) and hook II at the height (S)), a second and third position of the warp threads is respectively obtained.

In the first shot, the first position and the third position of the warp threads are attainable.

From the first position in the first shot, the warp threads, in the second shot,

- can be held in the first position by the selection of hook II
- can be brought into the second position by the non-selection of hook II.

From the third position in the first shot, the warp threads, in the second shot,

- can be brought into the first position by the selection of hook II
- can be brought into the second position by the non-selection of hook II.

In a third shot, the blades return into those locations in which they were situated in the first shot: the first blade I in the top dead centre; the first blade II and the second blade I in the bottom dead centre.

- Hook I can be brought from situations a' and b' in the second shot into the following situations in the third shot:
 - * into situation a, at the height (+ h_1), by the selection of hook I
 - * into situation b, at the height (- h_2), by the non-selection of hook I
- Hook II is brought from situation c' in the second shot into situation c, at the selection height (S), in the third shot.

- From situation d in the second shot, hook II shall remain at the selection height (S) in the third shot.

In the third shot, hook II is brought from every possible situation in the second shot to the selection height (S), whilst hook I can be brought from every possible situation in the second shot to the height (+ h_1) or to the height (- h_2). For the locations of the hooks, we therefore once again have options A and B, as in the first shot, so that the said first and third position of the warp threads are yet again attainable.

In each odd-numbered shot, the first and the third position can therefore be attained, whilst in each even-numbered shot the first and the second position are attainable.

From the foregoing, we conclude that the jacquard according to the invention is able to bring the warp threads, according to the non-open-shed principle, into three different positions.

In a first particular embodiment of the jacquard according to the present invention, the said system comprises a tackle element having a first and a second tackle roller, a first tackle cord connected to both hooks, which first tackle cord is conducted below the first tackle roller of the tackle element so as to support this tackle element, and a second tackle cord, which second tackle cord is attached by the one end to a fixedly disposed component part of the jacquard, is further conducted over the second tackle roller of the tackle element and is connected by the other end to one or more harness cord(s) for lifting at least one warp thread on a loom.

In the locations of the hooks according to option A, that end of the second tackle cord which is connected to a harness cord is brought into a highest position, so that a warp thread is situated in the "T" position.

In the locations of the hooks according to option B, the abovementioned tackle cord end is brought into a lowest position, so that a warp thread is situated in the "B" position.

In the locations of the hooks according to option C, the abovementioned tackle cord end is brought into a position lying between the highest and the lowest position, so that a warp thread is situated in the "M" position.

In an odd-numbered (first, third) shot, the warp threads can therefore be brought into the "T" or "B" position, whilst in an even-numbered (second, fourth, ...) shot, they can be brought into the "T" or "M" position.

These positions precisely match the necessary positions for the warp-pile threads in the weaving of a double-weft pile-binding, the dead warp-pile threads being bound into the top weave. In weaving such a weave, a top weave and a bottom weave are formed. In each shot, two weft threads are introduced for this purpose, one above the other, into a shed formed between warp threads, so that each weft thread is bound in by binder warp threads (in this way an uppermost and a lowermost basic weave is formed), so that pile-forming warp-pile threads, in each successive shot, are tied alternately in

the uppermost and the lowermost basic weave over a weft thread and so that dead warp-pile threads are bound in between the successive weft threads of the top weave.

For this purpose, the pile-forming warp-pile threads have to be situated, in the successive shots, alternately below and above the two weft threads and the dead warp-pile threads have to be situated, in the successive shots, alternately above the two weft threads and between the two weft threads.

Pile-forming warp-pile threads therefore have to be brought alternately into the "B" and "T" position, whilst dead warp-pile threads have to be brought alternately into the "T" and "M" position.

In an odd-numbered (first, third) shot, the "B" and "T" positions must consequently respectively be attainable, whilst in an even-numbered (second, fourth,) shot, the "T" and "M" positions have to be attainable.

The above-described first particular embodiment therefore satisfies the requirements for lifting the warp-pile threads when weaving a double-weft pile-binding with dead warp-pile threads bound into the top weave.

In a second particular embodiment of the jacquard according to the present invention, the said system comprises a tackle element having a first and a second tackle roller, a first tackle cord connected to both hooks, which first tackle cord is conducted below the first tackle roller of the tackle element so as to support this tackle element, and a second tackle cord, which second tackle cord is attached by the one end to a component part, which can be moved up and down, of the jacquard, is further conducted over the second tackle roller of the tackle element and is connected by the other end to one or more harness cord(s) for lifting at least one warp thread on a loom, whilst the said component part is designed to move up and down in synchronization with the second blade, which can also be moved up and down.

If the said component part of the jacquard performs an upward and downward motion with an amplitude (h_3), then that end of the second tackle cord which is connected to a harness cord is brought downward over a distance (h_3) by the lifting of the component part when the second blade is in its top dead centre.

Let us consider two interacting hooks: hook I and hook II, their respective first blades: first blade I and first blade II, as well as a second blade II which can move in opposite phase in relation to the first blade II (or in phase with the first blade I) and means for securing hook I at the selection height (S).

Where, in a first shot, the first blade I is in its top dead centre, then the first blade II is in its bottom dead centre and the second blade II is in its top dead centre. The said means for securing the hook I at the selection height (S) can comprise a second blade I. In that case, this second blade I is fixedly disposed in its top dead centre.

This arrangement differs from the previously considered arrangement by virtue of the fact that it is now

hook I which either can be secured at the selection height (S) or can be transported by its first blade I, whilst hook II can now be transported either by its first blade II or by its second blade II. The possible situations for hook I are therefore situations c, c' or d, and for hook II situations a, a', b or b'.

Hook I can be found either in situation c' (at the height ($+h_1$)) or in situation d. Hook II can then be found in situation a' or in situation b', in each case at the selection height (S).

In the first shot, the following options are then available for the locations of the interacting hooks:

- C) Hook I and hook II at the selection height (S)
- A) Hook I at the height ($+h_1$) and hook II at the selection height (S).

In a second shot, the first blade I is in its bottom dead centre, the first blade II is in its top dead centre and the second blade II is in its bottom dead centre. Any second blade I is fixed in its top dead centre.

- Where hook I, in the first shot, was in situation c' or d, then hook I can be situated in the second shot only at the selection height (S).
- Where hook II, in the first shot, was in situation a' or b', then hook II can be found in the second shot
 - * either in situation a (at the height ($+h_1$)) by the selection of hook II
 - * or in situation b (at the height ($-h_2$)) by the non-selection of hook II.

In the second shot, the following options are available for the locations of the hooks:

- D) hook I at the selection height (S) and hook II at the height ($+h_1$)
- E) hook I at the selection height (S) and hook II at the height ($-h_2$).

In the first shot, the point of attachment of the second tackle cord is lifted over a distance (h_3).

In option C the warp threads are consequently brought into a lowest position: "B" position and in option A the warp threads are brought into a middlemost position: "M" position, which, as a result of the lifting (h_1) of hook I, is a distance (h_1) higher than the "B" position in option C.

In the second shot, the point of attachment of the second tackle cord is not lifted.

In option D the position of the warp threads in relation to the "B" position in option C:

- is a distance (h_1) higher as a result of the lifting of hook I
- is a distance (h_3) higher as a result of the point of attachment of the second tackle cord being a dis-

tance (h_3) lower.

In option E the position of the warp threads in relation to the "B" position in option C:

- is a distance (h_2) lower as a result of the falling of hook I
- is a distance (h_3) higher as a result of the point of attachment of the second tackle cord being a distance (h_3) lower.

In option D the "T" position is therefore attained and in option E the "B" position.

The "B" position in option C and the "B" position in option E is the same on condition that $h_2 = h_3$.

In an odd-numbered (first, third) shot the warp threads can therefore be brought into the "M" or "B" position, whilst in an even-numbered (second, fourth, ...) shot they can be brought into the "T" or "B" position.

These are now precisely the necessary positions for the warp-pile threads when weaving a pile-weave according to a double-weft binding with dead warp-pile threads bound into the bottom weave. For this purpose, the figure-forming warp-pile threads have to be situated, in the successive shots, alternately below and above the two weft threads, whilst the dead warp-pile threads have to be situated, in the successive shots, alternately between the two weft threads and below the two weft threads. Figure-forming warp-pile threads must therefore be brought alternately into the "B" and "T" position, whilst dead warp-pile threads have to be brought alternately into the "M" and "B" position. In an odd-numbered shot, the "M" and "B" positions must consequently respectively be attainable, whilst in an even-numbered shot the "T" and "B" positions must respectively be attainable.

The above-described second particular embodiment therefore satisfies the requirements for lifting the warp-pile threads when weaving a double-weft pile-weave with dead warp-pile threads bound into the bottom weave.

In a preferred embodiment of this jacquard, at least one system according to the first particular embodiment and at least one system according to the second particular embodiment are provided.

A jacquard of this kind can be used when a pile-weave is woven according to a double-weft binding, dead warp-pile threads being bound into the top weave and dead warp-pile threads being bound into the bottom weave.

Preferably, the jacquard is constructed such that the second blade, which can be moved up and down, is disposed below the first blade which is movable in opposite phase with this second blade and, during the movement of the blades, is situated at any moment lower than this first blade, and that below the other first blade there is disposed a supporting element for supporting one of the hooks at the selection height.

The said control element is preferably a blade which is disposed at a fixed height. A jacquard of this kind can be easily converted into a jacquard having two first blades which can be moved up and down and two second blades which can be moved up and down.

The hooks can be selected in a particularly effective manner if the hooks are provided with a driving means by which they can hook onto a respective first blade so as to be transported by this blade, whilst each hook can be brought at the selection height into two different positions by the control element, a hook being transportable in the one position and being non-transportable in the other position by its first blade.

In a most preferred embodiment of the jacquard according to the present invention, the control element comprises means for exerting an electromagnetic force, whilst each hook situated at the selection height is elastically deformable at the level of its driving means by this magnetic force, so that each hook can be brought respectively into a deformed position and can revert to its non-deformed position by the connection and disconnection of the said means.

In the one position the hook is able to be transported by its first blade, in the other position not. Both the hooks and the control element are relatively simple in design, whilst a very efficient working of the jacquard is guaranteed.

Preferably, the said means of the control element comprise at least one spool with pole plates, so that an electromagnetic field can be induced by directing an electric current through the spool(s).

Once an electromagnetic field is induced, a hook which is situated at the selection height is brought into its deformed position.

If the direction of an electric current through the spool(s) is terminated, the electromagnetic field dissipates and the hook reverts to its non-deformed position.

In a particular embodiment, each first blade is provided with a control element for bringing a respective hook into two different positions, so that each hook in the one position is transportable and in the other position is non-transportable by its first blade.

In another particular embodiment, each hook has a driving means by which it can hook onto a driving element provided on a respective first blade, whilst each driving element can be brought by the control element into two different positions, so that a hook situated at the selection height (S), in the one position of the driving element, is transported and, in the other position, is not transported by its first blade.

In this embodiment, it is not the hooks which can be brought by the control element into two different positions, but a driving element provided on each blade. Non-deformable hooks can also consequently be used.

The control elements which are used can be of the electromagnetic or the bistable type.

Preferably, the means for bringing the driving elements into two different positions are provided on the

respective first blades.

In a specific embodiment, the hooks are provided with a supporting boss, by which the one hook is able to rest on the second blade and the other hook is able to rest at the selection height on a supporting element disposed at a fixed height.

This invention is further illustrated in the following description of a preferred embodiment thereof. In this description, reference is made to the attached figures, in which:

Figures 1 and 2 show a diagrammatic representation of a jacquard according to the present invention, designed to determine the position of the warp-pile threads when a pile-weave is woven according to a double-weft binding, with dead warp-pile threads bound into the top weave, in an odd-numbered shot, and with the left hook in its first and in its second possible location respectively.

Figures 3 and 4 show a diagrammatic representation of the jacquard of Figures 1 and 2, in an even-numbered shot, and with the right hook in its first and in its second possible location respectively.

Figure 5 shows a diagrammatic representation of the pattern of a dead warp-pile thread and of a pile-forming warp-pile thread in relation to the weft threads of a first and a second shot, with respect to a pile-weave which has been woven according to a double-weft binding, with dead warp-pile threads bound into the top weave.

Figure 6 shows a selection polygon on which the possible changes to the position of the warp threads in the transition from an odd-numbered shot to an even-numbered shot and vice versa, in a jacquard according to Figures 1 to 4, are able to be read off.

Figures 7 and 8 show a diagrammatic representation of a jacquard according to the present invention, designed to determine the position of the warp-pile threads when a pile-weave is woven according to a double-weft binding, with dead warp-pile threads bound into the bottom weave, in an odd-numbered shot, and with the left hook in its first and in its second possible location re-

Figures 9 and 10

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Figure 11

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Figure 12

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spectively.

show a diagrammatic representation of the jacquard of Figures 7 and 8 in an even-numbered shot and with the right hook in its first and in its second possible location respectively.

shows a diagrammatic representation of the pattern of a dead warp-pile thread and of a pile-forming warp-pile thread in relation to the weft threads of a first and a second shot, with respect to a pile-weave which has been woven according to a double-weft binding, with dead warp-pile threads bound into the bottom weave.

shows a selection polygon for a jacquard according to Figures 7 to 10.

The jacquard depicted in Figures 1 to 4 has two first blades (1), (2) with a lift *h*, which first blades are disposed side by side and can be moved up and down in opposite phase by a known drive mechanism (not represented), a second blade (3) with one and the same lift *h*, which second blade is disposed below the left first blade (1) and can be moved up and down by a known drive mechanism (not represented), and a blade (4), which is disposed below the right first blade (2) at a fixed height. The second blade (3) is situated in its top dead centre lower than the superior first blade (1) in its bottom dead centre. The blade (4) is fixedly disposed at the height at which the second blade (3) is situated in its top dead centre. The second blade (3) is designed to move up and down in opposite phase with the superior first blade (1) (or in phase with the other first blade (2)). This is represented diagrammatically in Figures 1 to 4 by a connecting line between the second blade (3) and the right first blade (2).

The jacquard comprises a plurality of systems for lifting at least one warp thread on a loom. One system is represented in Figures 1 to 4. Each system comprises two interacting hooks (5), (6) consisting of a very flexible metal strip, the uppermost end of which is provided with a sideways-directed hook-shaped projection (7a), (7b). Furthermore, each hook (5), (6) is provided on a flank with a supporting boss (8a), (8b), which extends in the same direction as the hook-shaped projection (7a), (7b) of this hook (5), (6). The one hook (5) interacts with the left first blade (1) and the second blade (3), whilst the other hook (6) interacts with the right first blade (2) and the fixedly disposed blade (4). For this purpose, two hooks (5), (6) are disposed side by side, with their hook-shaped projection (7a), (7b) and their supporting boss (8a), (8b) directed away from each other in the direction of the blades (1), (2), (3), (4) with which they interact,

so that the left hook (5) either can rest with its supporting boss (8a) on the second blade (3) or can be transported by the left first blade (1) by virtue of the hook (5) hooking with its hook-shaped projection (7a) onto the first blade (1), and so that the right hook (6) either can rest with its supporting boss (8b) on the fixedly disposed blade (4) or can be transported by the right first blade (2) by virtue of the hook (6) hooking with its hook-shaped projection (7b) onto the first blade (2).

Each system comprises one tackle element (12) having an uppermost (10) and a lowermost tackle roller (11).

A first tackle cord (9) is attached by the one end to the left hook (5), conducted below the uppermost tackle roller (10) of the tackle element (12) and attached by the other end to the right hook (6), so that the tackle element (12) with its uppermost tackle roller (10), suspended in the down-hanging loop of the first tackle cord (9), is supported by both hooks (5), (6).

A second tackle cord (13) is attached by its one end to a fixedly disposed component part (14) of the Jacquard, conducted over the lowermost tackle roller (11) of the tackle element (12) and connected by the other end (15) to one or more harness cords for lifting at least one warp thread on a loom (not represented in the figures).

Where the left hook (5) is supported by the second blade (3), it is situated at the selection height (S) when the second blade (3) is situated in its top dead centre and at a height (-h) when the second blade (3) is situated in its bottom dead centre.

Where the right hook (6) is supported by the fixedly disposed blade (4), it is situated at the selection height (S). Both hooks (5), (6) are situated at the selection height (S) if they are transported by their respective first blade (1), (2) whilst this first blade (1), (2) is situated in its bottom dead centre and are situated at the height (+h) when this first blade (1), (2) is situated in its top dead centre.

Between the two hooks (5), (6) there is disposed a control element (16) having two spools with pole plates. An electric current can be directed into these spools in order to induce an electromagnetic field. The control element (16) is disposed such that an electromagnetic force can be exerted upon the uppermost portion of the hooks (5), (6) when these hooks (5), (6) are situated at the selection height (S).

As a result of an electric current being directed through the spools, the uppermost portion of a hook (5), (6) situated at the selection height (S) is bent over towards the control element (16), so that the hook-shaped projection (7a), (7b) passes outside the range of its first blade (1), (2). A hook (5), (6) cannot in this position be transported by its first blade (1), (2) and is therefore not selected.

If the direction of the electric current is terminated, no electromagnetic force is any longer exerted, so that the uppermost portion of a hook (5), (6) situated at the

selection height (S) reverts to its regular position. The hook-shaped projection (7a), (7b) returns within the range of the first blade (1), (2). In this position, a hook (5), (6) is able to be transported by its first blade (1), (2) and is therefore selected.

A hook (5), (6) is able to be selected and transported by its first blade (1), (2) only at the selection height (S) and is able to be unhooked again from its first blade (1), (2) only at the selection height (S).

A highest, middlemost and lowest position of the end (15) of the second tackle cord (13) is respectively matched by an uppermost, middlemost and lowest position of the warp threads. These positions of this tackle cord end (15) have consequently been respectively denoted by the positions "T", "M" and "B" of the warp threads.

In an odd-numbered (first, third) shot (see Figures 1 and 2), the left first blade (1) is in its top dead centre and the right first blade (2) and the second blade (3) are in their bottom dead centre. The right hook (6) is securely situated at the selection height (S), whilst the left hook (5) either is supported by the second blade (3) and is situated at the height (-h) (see Figure 1) or is transported by its first blade (1) and is situated at the height (+h) (see Figure 2).

There are consequently two options for the location of the hooks (5), (6): either the left hook (5) is situated at the height (-h) and the right hook (6) is situated at the height (S) (see Figure 1) or the left hook (5) is situated at the height (+h) and the right hook (6) is situated at the height (S) (see Figure 2).

In the option according to Figure 1, the warp threads are brought into the "B" position. In the option according to Figure 2, they are brought into the "T" position. The "T" position is a distance (2h) higher than the "B" position by virtue of the fact that the left blade (5) in the option according to Figure 2 is lifted a distance (2h) higher than in the option according to Figure 1.

An even-numbered (second, fourth) shot (see Figures 3 and 4), the left first blade (1) is in its bottom dead centre and the right first blade (2) and the second blade (3) are in their top dead centre.

The left hook (5) is now securely situated at the selection height (S), whilst the right hook (6) either is supported by the fixedly disposed blade (4) and is situated at the selection height (S) (see Figure 4) or is transported by its first blade (2) and is situated at the height (+h) (see Figure 3).

Once again, there are two options for the locations of the hooks: either both hooks (5), (6) are situated at the selection height (S) (see Figure 4) or the left hook (5) is situated at the selection height (S) and the right hook (6) is situated at the height (+h) (see Figure 3).

By not selecting the right hook (6) in an odd-numbered shot, the option according to Figure 4 is obtained; by selecting the right hook (6), the option according to Figure 3 is obtained.

In the option according to Figure 4, the warp threads

are brought into the "M" position. In the option according to Figure 3, the warp threads are brought into the "T" position. In relation to the option according to Figure 2, in the option according to Figure 3 the left hook (5) is, after all, lowered by a distance (h), whilst the right hook (6) is raised by a distance (h), so that the position of the warp threads remains unchanged. The "M" position is a distance (h) lower than the "T" position by virtue of the fact that the right blade (6) in the option according to Figure 4 is brought a distance (h) lower than in the option according to Figure 3.

In each odd-numbered shot, the "B" and "T" positions are attainable.

In each even-numbered shot, the "T" and "M" positions are attainable.

When a warp-pile thread is woven according to a double-weft binding with one or more dead warp-pile threads (20) bound into the top weave it is precisely these positions which in each shot have to be attainable for the warp-pile threads (20), (21). This can clearly be seen in Figure 5. A pile-forming warp-pile thread (21) is situated in a first shot below the two weft threads (22), (23) and in a second shot above the two weft threads (24), (25). A dead warp-pile thread (20) is situated in the first shot above the two weft threads (22), (23) and in the second shot between the two weft threads (24), (25). It is evident from this that in each odd-numbered (first, third) shot, the positions "B" (for a pile-forming warp-pile thread) and "T" (for a dead warp-pile thread) must be attainable, and that in each even-numbered (second, fourth) shot, the positions "T" (for a pile-forming warp-pile thread) and "M" (for a dead warp-pile thread) must be attainable.

Figure 6 is a selection polygon on which the possible changes in the position of the warp threads, in the transition from an odd-numbered shot to an even-numbered shot, and vice versa, are indicated by arrows. Those numerals (0) and (1) which are placed alongside the arrows indicate that the change in position indicated by the arrow is obtained respectively by not directing an electric current through the spools and by directing an electric current through these spools.

The numeral (0) therefore indicates that a selection is being made, whilst the numeral (1) indicates that no selection is being made of the hook (5), (6) situated, in the odd-numbered shot, at the selection height (S).

From the "T" position in an odd-numbered shot (Figure 2), the "M" position in an even-numbered shot (Figure 4) is thus attained by not realizing a selection of the right hook (6).

This is represented in Figure 6 by the arrow from the "T" position on the left of the figure to the "M" position on the right of the figure, whilst a numeral "1" is shown next to this arrow.

The jacquard which is diagrammatically represented in Figures 7 to 10 differs from the jacquard represented in Figures 1 to 4 by the fact that the fixedly disposed blade (4) is now situated below the left first blade (1),

whilst the second blade (3) is now disposed below the right first blade (2), and by the fact that the component part (14) of the jacquard, to which the one end of the second tackle cord (13) is attached, is now designed to be moved up and down with a lift h in phase with the second blade (3) and with the left blade (1). This is represented diagrammatically in Figures 7 to 10 by joining together this component part (14), the second blade (3) and the left first blade (1) with a drawn line.

The second blade (3) is designed to move in opposite phase with the right first blade (2).

In an odd-numbered shot (see Figures 7 and 8), the left first blade (1) and the second blade (3) are in their top dead centre and the right first blade (2) is in its bottom dead centre.

The right hook (6) is securely situated at the selection height (S), whilst the left hook (5) either can be supported at the height (S) by the fixedly disposed blade (4) or can be transported to the height (+ h) by the left first blade (1).

In an odd-numbered shot, two options are available for the locations of the hooks: either both hooks (5), (6) are situated at the selection height (S) (see Figure 7) or the left hook (5) is situated at the height and the right hook is situated at the selection height (S) (see Figure 8).

In an odd-numbered shot, the component part (14) is raised by a distance (h), so that the end (15) connected to a harness cord is lowered by a distance (h).

Where both hooks are situated at the selection height, a "B" position for the warp threads is obtained (see Figure 7). In the option according to Figure 8, the warp threads are raised by a distance "h" - into the "M" position - by virtue of the left hook (5) being situated a distance (h) higher than in the option according to Figure 7.

In an even-numbered shot (see Figures 9 and 10), the left first blade (1) and the second blade (3) are in their bottom dead centre and the right first blade (2) is in its top dead centre. The left hook (5) is securely situated at the selection height (S), whilst the right hook (6) either can be supported at the height (- h) by the second blade (3) (Figure 10) or can be transported to the height (+ h) by the right first blade (2) (Figure 9). In an even-numbered shot, two options are therefore once again available for the locations of the hooks: either the left hook (5) and the right hook (6) are respectively situated at the height (S) and at the height (+ h) (see Figure 9) or these hooks (5), (6) are respectively situated at the height (S) and at the height (- h) (see Figure 10).

In relation to the option according to Figure 7 ("B" position), in the option according to Figure 9 the warp threads are situated:

- a distance (h) higher by virtue of the right hook (6) having been raised by a distance (h)
- a distance (h) higher by virtue of the component part (14) to which the second tackle cord (13) is attached

having been lowered by a distance (h).

The warp threads are therefore situated a distance (2h) higher than the "B" position. This position is the "T" position.

In relation to the option according to Figure 7 ("B" position), in the option according to Figure 10 the warp threads are situated:

- a distance h lower by virtue of the right hook (6) having been lowered by a distance (h)
- a distance h higher by virtue of the component part (14) to which the second tackle cord (13) is attached having been lowered by a distance (h).

In the option according to Figure 10, the warp threads are therefore also situated in the "B" position.

In an odd-numbered shot, the "B" and "M" positions are attainable. In an even-numbered shot, the "B" and "T" positions are attainable.

When a pile-weave is woven according to a double-weft binding with one or more dead warp-pile threads (26) bound into the bottom weave (BW), it is precisely these positions of the warp-pile threads which have to be attainable in each shot. This can clearly be seen in Figure 11.

In a first shot, the positions "B" - for a pile-forming warp-pile thread (21) - and "M" - for a dead warp-pile thread (26) - are attainable. In a second shot, the positions "B" - for a dead warp-pile thread (26) - and "T" - for a pile-forming warp-pile thread (21) - are attainable.

Figure 12 represents a selection polygon on which the possible changes in the position of the warp threads, in the transition from an odd-numbered shot to an even-numbered shot, and vice versa, are indicated by arrows. Those numerals (0) and (1) which are placed alongside the arrows have the same significance as in Figure 6.

The advantage of the present invention consists primarily in the fact that, for the generation of three positions, only one control element (16) and only one tackle element (12) per system is required to lift the warp threads (21), (26), whilst the hooks (5), (6) can respectively be transported by a blade (1), (2), (3), in a jolt-free manner, from a stationary position to the selection height (S).

A secondary advantage is that this jacquard is able to be converted, by a simple mechanical procedure, into a two-position open-shed jacquard having a large lift 2h; it is, after all, sufficient to make the second blade (3) and the blade (4) which was fixedly disposed move simultaneously up and down in opposite phase with the superior first blade (1), (2), whilst the component part (14) to which the second tackle cord (13) is attached is fixedly disposed. In this case, only the "B" and "T" positions are attained.

By making the component part (14) move up and down, 2 other positions can be obtained, so that three or four positions are successively attainable.

Through the addition of a tackle element at two points (15), a three-position open-shed jacquard or a four-position non-open-shed jacquard is able to be constructed.

Both the first blades (1), (2) and the inferior blades (3), (4) can be given a different lift. By setting a suitable combination of lifts, a three, four or five-position jacquard is able to be constructed.

Claims

1. Three-position non-open-shed jacquard, comprising a system encompassing two interacting hooks (5), (6) for lifting at least one warp thread (20), (21), (26) on a loom, two first blades (1), (2) which can be moved up and down in opposite phase, the said first blades being provided to take up a respective hook (5), (6) - in the event of its selection - from a selection height (S), and a control element (16) by which each hook (5), (6) can be selected at the selection height (S), characterized in that the jacquard further comprises a second blade (3) which can be moved up and down in opposite phase with one of the first blades (1), (2), provided to take down the hook (5); (6) which interacts with that first blade (1); (2) - in the event of non-selection of the said hook - from the selection height (S), and means (4), provided to secure the hook (6); (5) which interacts with the other first blade (2); (1) - in the event of non-selection of the said hook - at the selection height (S).
2. Three-position non-open-shed jacquard, according to claim 1, characterized in that said first blades (1), (2) are provided to take up a respective hook (5), (6), at a location in the environment of their bottom dead centre; and in that said second blade (3) is provided to take down said hook (5); (6), at a location in the environment of its top dead centre.
3. Three-position non-open-shed jacquard according to Claim 1 or claim 2, characterized in that the said system comprises a tackle element (12) having a first (10) and a second tackle roller (11), a first tackle cord (9) connected to both hooks (5), (6), which first tackle cord is conducted below the first tackle roller (10) of the tackle element (12) so as to support this tackle element (12), and a second tackle cord (13), which second tackle cord is attached by the one end to a fixedly disposed component part (14) of the jacquard, is further conducted over the second tackle roller (11) of the tackle element (12) and is connected by the other end (15) to one or more harness cord(s) for lifting at least one warp thread (20), (21), (26) on a loom.
4. Three-position non-open-shed jacquard according

to Claim 1 or claim 2, characterized in that the said system comprises a tackle element (16) having a first (10) and a second tackle roller (11), a first tackle cord (9) connected to both hooks (5), (6), which first tackle cord is conducted below the first tackle roller (10) of the tackle element (12) so as to support this tackle element (12), and a second tackle cord (13), which second tackle cord is attached by the one end to a component part (14), which can be moved up and down, of the jacquard, is further conducted over the second tackle roller (11) of the tackle element (12) and is connected by the other end (15) to one or more harness cord(s) for lifting at least one warp thread (20), (21), (26) on a loom, and in that the said component part (14) is designed to move up and down in phase with the second blade (3), which can also be moved up and down.

5. Three-position non-open-shed jacquard according to Claim 1 or claim 2, characterized in that the jacquard comprises at least one system according to Claim 3 and at least one system according to Claim 4.

6. Three-position non-open-shed jacquard according to one of the preceding claims, characterized in that the second blade (3); (4), which can be moved up and down, is disposed below the first blade (1); (2), which is movable in opposite phase with this second blade, and, during the movement of the blades (1), (2), (3), is situated at any moment lower than this first blade (1); (2), and in that below the other first blade (2); (1) there is disposed a supporting element (4) for supporting one of the hooks (6); (5) at the selection height (S).

7. Three-position non-open-shed jacquard according to Claim 6, characterized in that the supporting element is a blade (4) disposed at a fixed height.

8. Three-position non-open-shed jacquard according to one of the preceding claims, characterized in that the hooks (5), (6) are provided with a driving means (7a), (7b) by which they can hook onto a respective first blade (1), (2) so as to be transported by this blade (1), (2), and in that each hook (5), (6) can be brought at the selection height (S) into two different positions by the control element (16), a hook (5), (6) being transportable in the one position and being non-transportable in the other position by its first blade (1), (2).

9. Three-position non-open-shed jacquard according to Claim 8, characterized in that the control element (16) comprises means for exerting a magnetic force, and in that each hook (5), (6) situated at the selection height (S) is elastically deformable at the level of its driving means (7a), (7b) by this magnetic

force, so that each hook (5), (6) can be brought respectively into a deformed position and can revert to its non-deformed position by the connection and disconnection of the said means.

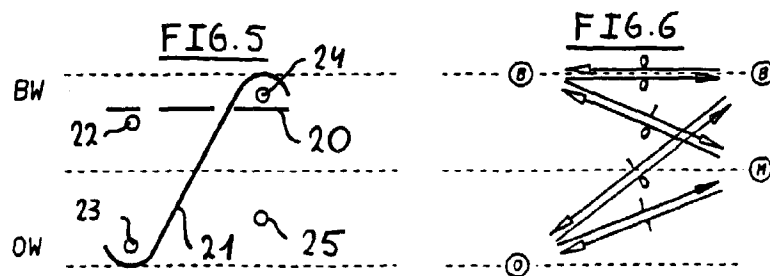
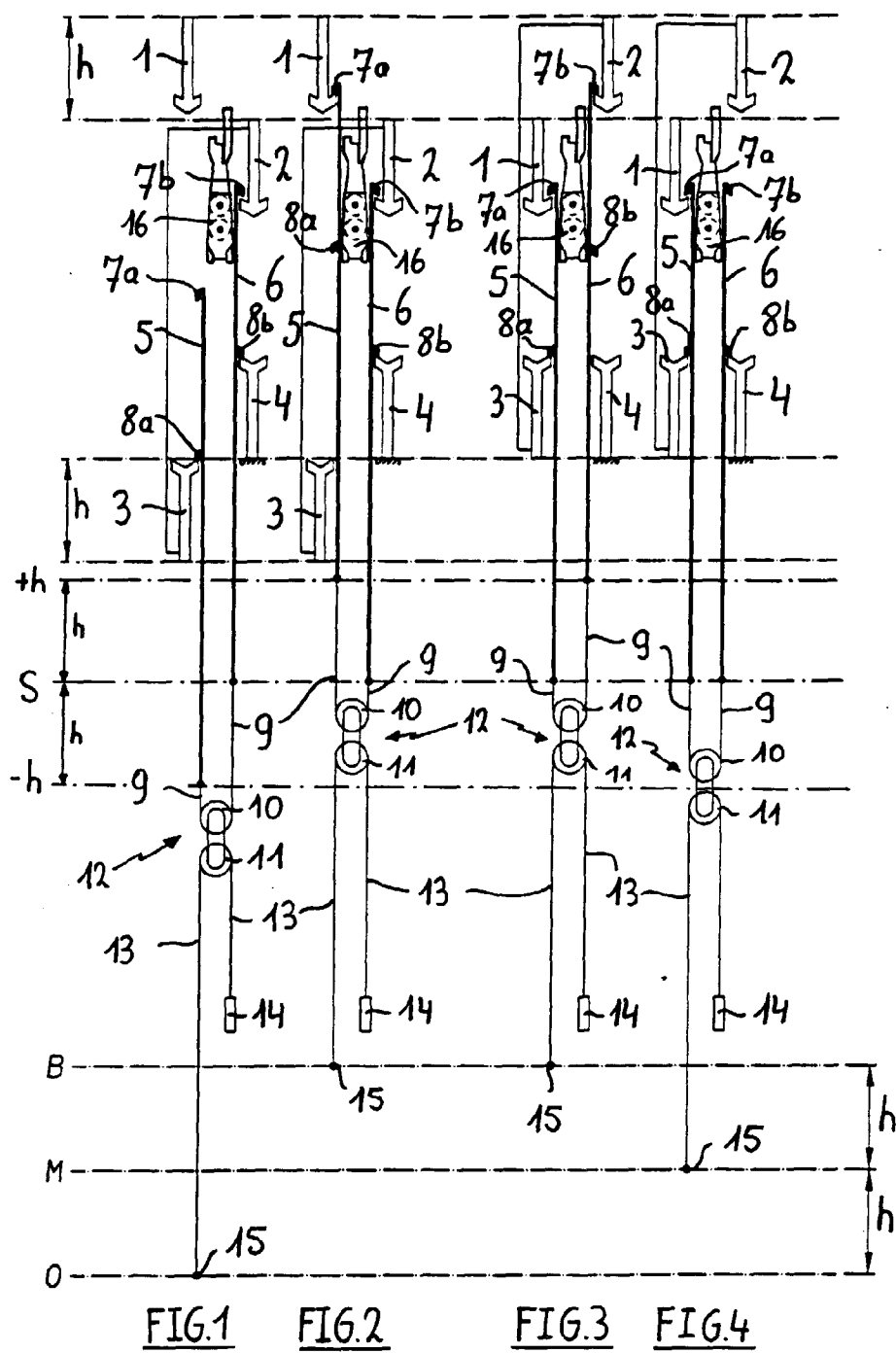
10. Three-position non-open-shed jacquard according to Claim 9, characterized in that the said means for exerting a magnetic force comprise at least one spool with pole plates.

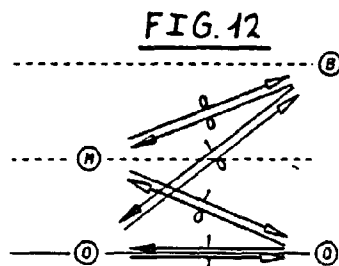
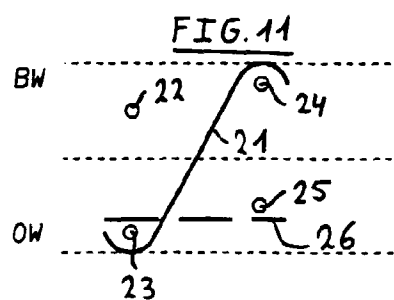
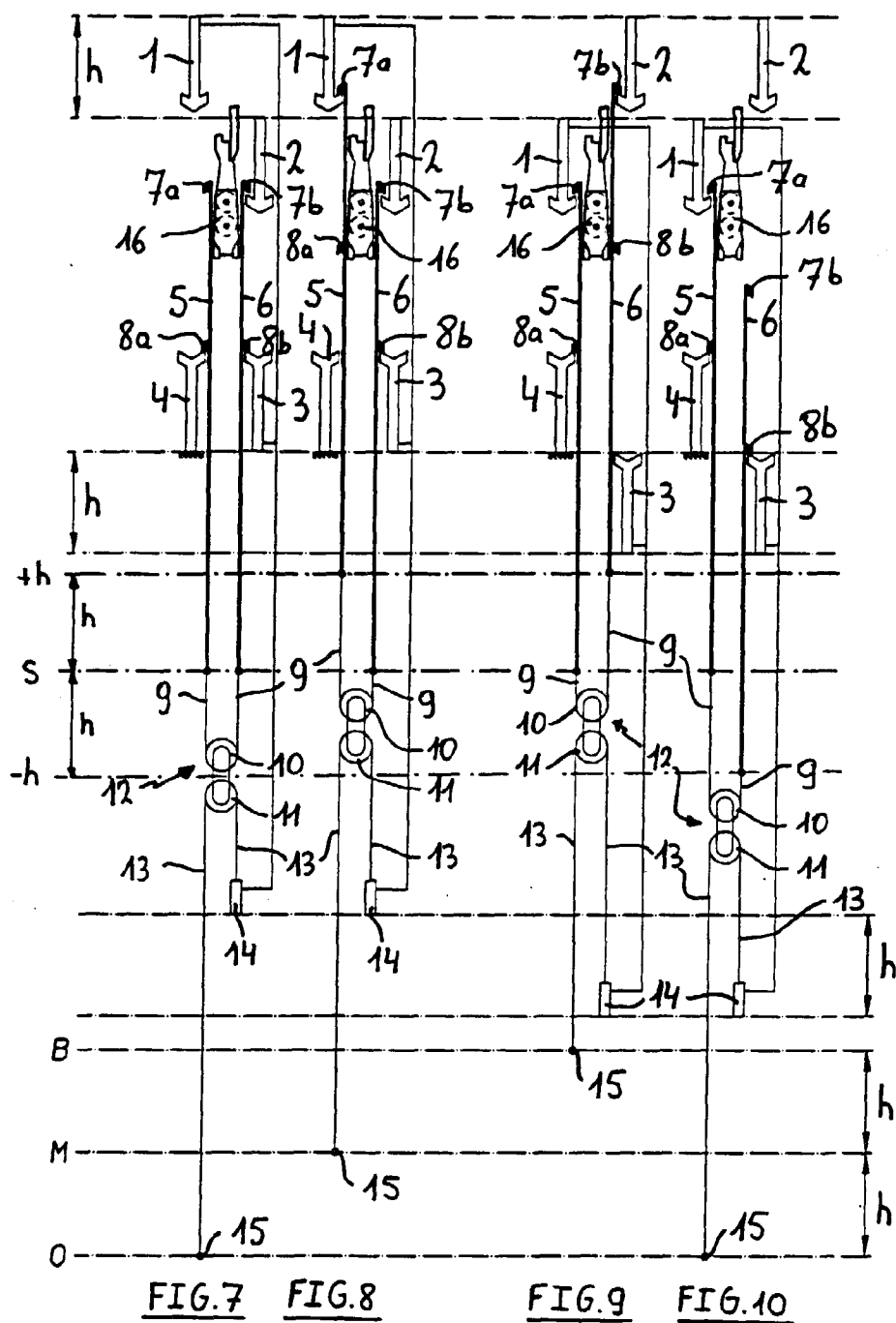
11. Three-position non-open-shed jacquard according to Claim 8 or 9, characterized in that each first blade (1), (2) is provided with a control element (16) for bringing a respective hook into two different positions, so that each hook (5), (6) in the one position is transportable and in the other position is non-transportable by its first blade (1), (2).

12. Three-position non-open-shed jacquard according to Claim 1 to 7, characterized in that each hook (5), (6) has a driving means (7a), (7b) by which it can hook onto a driving element provided on a respective first blade (1), (2), and in that each driving element can be brought by the control element (16) into two different positions, so that a hook (5), (6) situated at the selection height (S), in the one position of the driving element, is transported and, in the other position, is not transported by its first blade (1), (2).

13. Three-position non-open-shed jacquard according to Claim 12, characterized in that each first blade is provided with means for bringing its driving element into two different positions.

14. Three-position non-open-shed jacquard according to one of the preceding claims, characterized in that the hooks (5), (6) are provided with a supporting boss (8a), (8b), by which the one hook (5); (6) is able to rest on the second blade (3) and the other hook (6); (5) is able to rest at the selection height (S) on a supporting element (4) disposed at a fixed height.







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EUROPEAN SEARCH REPORT

Application Number
EP 96 20 0382

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
D,A	DE-C-41 01 778 (OSKAR SCHLEICHER) * the whole document *	1,3	D03C3/12 D03C3/20 D03C3/06
A	DE-U-94 16 017 (OSKAR SCHLEICHER) * the whole document *	1,3	
A	FR-A-2 587 046 (TEXTIMA) * page 7, line 17 - page 8, line 34; figure 1 *	1,8-11	
A	FR-A-2 287 539 (CARL ZANGS) * the whole document *	1,3,6-8	
A	EP-A-0 459 582 (VAN DE WIELE) * figures 7A,7B *	1,3,4	
A	FR-A-2 648 160 (TEXTIMA) * figures *	1,3,4	
A	EP-A-0 408 076 (VAN DE WIELE) * figures *	8-10	TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	EP-A-0 108 700 (STAUBLI-VERDOL) * figures *	12,13	D03C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 23 May 1996	Examiner Rebiere, J-L
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