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3 Sheets-Sheet 1

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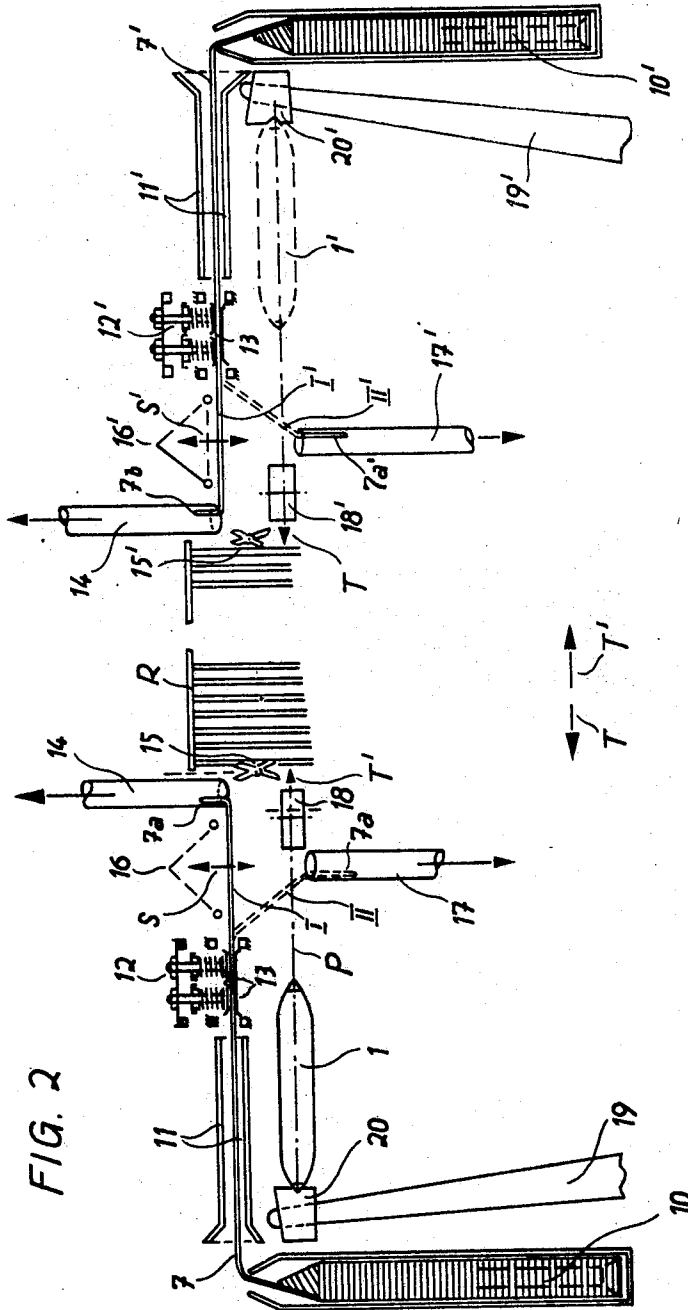
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METHOD AND APPARATUS FOR INTRODUCING WEFT
THREADS IN WEAVING MACHINES

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3 Sheets-Sheet 3

FIG. 4A

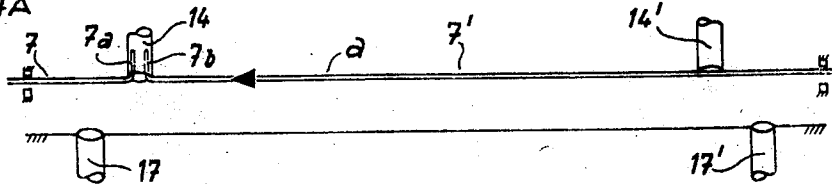


FIG. 4B

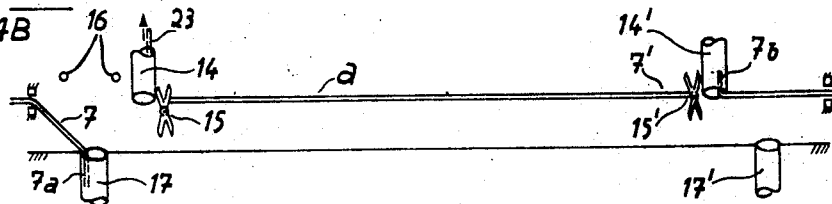


FIG. 4C

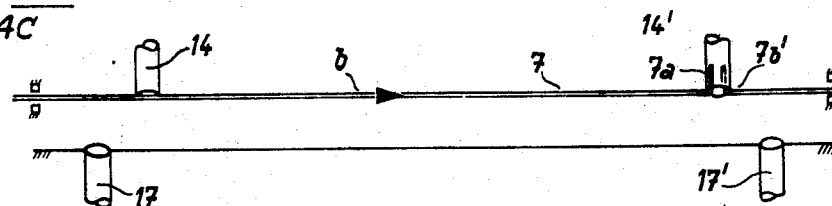


FIG. 4D

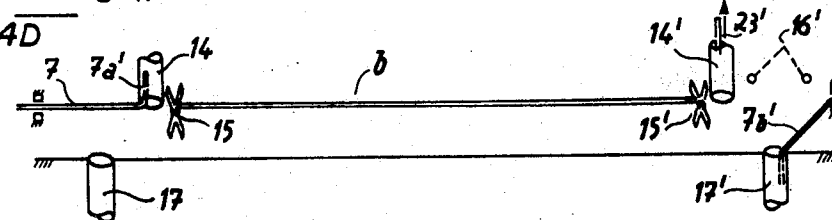


FIG. 4E

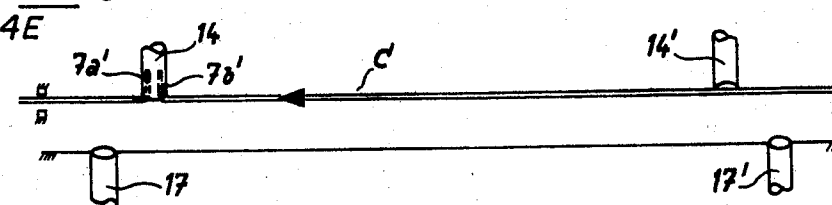
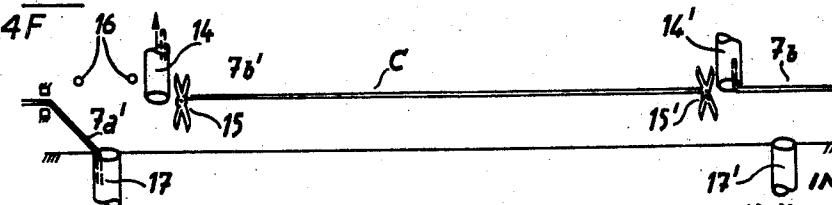


FIG. 4F



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3,498,338

METHOD AND APPARATUS FOR INTRODUCING WEFT THREADS IN WEAVING MACHINES

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10 Claims

ABSTRACT OF THE DISCLOSURE

A method and device for inserting weft threads by means of a reciprocating shuttle. The starting ends of threads wound on a pair of spools on each side of a warp are held by suction in a position exteriorly of the path of travel of the shuttle and are brought in timed relationship to the reciprocation of the shuttle into another position. In this position one thread is taken along by the shuttle and inserted in the warp of the fabric. The thread is then trimmed. During the return flight of the shuttle the other starting end of the thread is taken along in an opposite direction, inserted in the warp and trimmed.

This invention relates to a method and a device for inserting weft threads in weaving machines by means of a reciprocating shuttle which draws the weft thread from a pair of stationary arranged spools on both sides of the machine.

In customary machines for weaving the spools of yarn are accommodated in the weft shuttle. This requires relatively small spools of corresponding small capacities. In order to achieve substantial weaving loads with such machines, there must be provided spool change mechanisms of expensive construction, which however accomplish their purposes only when thin or medium thicknesses of yarn are used. On the other hand, when thick yarn is employed, it is no longer possible to achieve satisfactory loads since in such cases it is necessary to frequently reload the magazine of the spool change mechanism.

As an innovation, there have also been developed weaving machines which draw the weft thread and insert it by means of shuttles, rods or plastic bands from spools arranged externally of the machine. Since in this case the yarn mechanism is not limited as to size, it is also possible to achieve good performances when using thick yarn.

The invention relates to weaving machines of the above type. The object of the invention is to provide a method and a device for inserting the weft thread which will make it possible to achieve high performances with thick yarn in conventional weaving machines, through inexpensive construction and thus in an economical manner.

According to the method of the invention, the starting end of each yarn which is to be inserted, is held by suction in a position exteriorly of the path of travel of the shuttle and is brought or fed, in timed relationship to the reciprocation of the shuttle, into another position. In this other position it is under the influence of a suction force which is arranged in the path of travel of the shuttle member and can thus be taken along by the shuttle for insertion of the yarn. Thus, after the yarn has been inserted, it is separated at its end and the new starting end is held by suction in a position exteriorly of the path of travel of the shuttle until the following yarn is inserted by the returning shuttle.

After the ensuing insertion and while the shuttle is moving further in the direction of the insertion, the starting end of the inserted yarn is released by the shuttle

at a point which is in the suction zone of that suction device which holds the starting end of the yarn which is to be inserted during the following return movement of the shuttle, in the position exteriorly of the shuttle's path of travel. The transfer of the starting end of the yarn from the position in which it is disposed exteriorly of the path of travel of the shuttle, to the position required for taking it along, may be effected by controlling the suction device and/or by a stream of air. On the other hand, a mechanical adjustable device could be employed for this purpose, said device being reciprocable in timed relationship to the movement of the shuttle.

Conventional weaving machines may be employed to carry out the method according to the invention. These can be adapted for this purpose at a slight cost. To accomplish this purpose, according to the invention, suction devices are arranged in the area of the path of travel of the shuttle and spaced therefrom. One of these suction devices holds the starting end of the yarn thread at a point outside of the path of travel of the shuttle, while the other suction device holds the starting end of the yarn thread in a position where it can be taken along. In order to transfer the starting end of the yarn from the former position to the latter, there is provided a displaceable device which is controlled according to the rhythm of the reciprocating movement of the shuttle; advantageously this could be a mechanical device. In order to take along the starting end of the yarn to insert it, the shuttle may be provided with a gripping device or the like.

The suction device which holds the starting end outside of the path of the shuttle's path of movement is appropriately arranged above said path, while the suction device which holds the starting end of the thread in the insertion position is arranged directly under the path of travel of the shuttle member. Suction tubes, suction scoops or the like can be used and their suction openings may be arranged in the path of movement of the shuttle. To separate the weft thread, after each insertion, from the spool of yarn, there may be advantageously provided cutting levers, rotary knives or the like which may be arranged directly near the suction devices which hold the starting end of the thread outside the path of travel of the shuttle member.

According to a further feature of the invention, there are arranged, in the thread feeds, brake devices which hold the threads tight.

According to the invention, a shuttle provided with clamping members or the like is provided for inserting the weft thread. The clamping members clamp the starting end of weft thread and are releasable by means of stops such as rollers disposed in the path of the movement of the shuttle, whereby the thread is freed after the weft thread has been inserted. The clamping members comprise spring-tensioned clamping elements, which extend into slots arranged in the shuttle, thus forming clamping slots.

The method and device, according to the invention, will be explained below according to the drawing illustrating, by way of example, an embodiment of the invention.

In the drawing:

FIG. 1 is a shuttle shown in top plan view;

FIG. 2 is a schematic elevational view of the inserting device;

FIG. 3 is a time diagram of the individual steps of the method, and

FIGS. 4A-4F consists of schematic illustrations of the steps used in the insertion of the weft threads.

Referring now to the drawing in detail, the shuttle 1, shown in FIG. 1 is symmetric to its central plane. The shuttle is provided with a pair of clamping levers 2 and

2', which are pivoted about shafts 3 and 3'. Springs 4, 4' press against one arm of each of the levers, thus pressing the other arms against the movable plate 5 which is secured to the lower side of the shuttle housing in such a manner as to form slots 6, 6' open at the front. The weft threads 7, 7' are inserted into these slots and are clamped by the clamping levers 8, 8' in these slots so that they can be carried along by the shuttle.

Both levers 2 and 2' have rounded control surfaces 9 and 9' on their other arms and extend past the longitudinal edges of the shuttle housing and can thus come in contact with control rollers 18, 18' (FIG. 2). The rollers swing the levers against the springs' tension, thus opening the slots 6, 6' for freeing the weft thread.

FIG. 2 illustrates schematically the entire arrangement of the weft inserting device. The reed member of the machine is indicated by R. Yarn spools 10, 10' are arranged at both sides near the material ledges and weft thread 7, 7' is drawn therefrom according to requirements. The weft threads are carried through thread guide tubes 11, 11' provided with entrance cones which are further made with inlet and outlet lobes which serve to hold the thread tight when it is pulled in.

Between the reed member R and the spring brakes 12, 12', above the travel path of the shuttle 1, indicated by the dotted line P, there are disposed suction scoops 14, 14'. Laterally of these scoops there are provided cutting devices 15, 15'. There is further provided, between the spring brake and the suction scoops 14, 14', a fork shaped thread adjusting device 16, 16' which is displaceable in the direction of the arrow S. The threads 7 and 7' are tensioned under the fork.

Arranged laterally under the suction scoops 14, 14' are suction scoops 17, 17' whose suction openings lie under the path of travel P of the shuttle. Near each of these suction scoops there are arranged rollers 18, 18' rotatable about a vertical shaft which cooperate with the control surfaces 9, 9' of the swinging levers of the shuttle.

The reciprocating movement of the shuttle takes place in an usual manner, by means of striker rods 19, 19' and actuators 20, 20'.

In FIG. 2 there are shown, in extended solid lines, the position I, I' of the weft threads 7, 7', in which the starting ends 7a, 7b of both weft threads are positioned under the effect of the suction scoops 14, 14'. In this position the starting ends are outside of the path of movement of the shuttle 1.

The ready position in which the starting ends 7a, 7b are under the influence of the lower scoops 17, 17', is indicated in dotted lines and shown as II and II'. In this position the threads lie in the path of movement of the shuttle, so that during the passage of the latter they extend into the slots 6, 6' of the shuttle. The thread is securely clamped, according to its thickness in the clamp opening (FIG. 1) between the points 21, 21' and the points 22, 22' respectively, so that it is taken along by the shuttle 1 and drawn into the weave.

The course of the operation is as follows:

During the movement of the shuttle 1 in the direction of the arrow T, the starting end of the thread 7 of spool 10 is under the influence of the suction scoop 14 exteriorly of the path of travel of the shuttle. Before the shuttle changes its direction of movement and has reached the zone of the suction scoop 17, while moving in the direction of the arrow T', the starting end 7a is brought into the suction zone of the suction scoop 17, i.e. into the ready position II, by the downward movement of the fork 16. The starting end of the thread 7a therefore enters into the clamping slot 6', as the shuttle passes by, and is clamped in the clamp opening, so that it is carried along by the shuttle moving in the direction of arrow T', for insertion. As the shuttle flies by under the suction scoop 14' during this step, the control face 9' of the lever strikes the roller 18' and the lever 2' is lifted, thereby

releasing the thread 7. The starting end of the thread thereby reaches into the suction zone of the suction scoop 14' and is held securely in the latter, while the shuttle 1 flies further, to be lodged in the actuator 20'. The lever 2' remains in a raised position during this further flight of the shuttle since the curved control face 9' is emplaced on the wall of the housing (not shown), said wall preventing the return position of the lever. Finally the yarn thread 7 is separated by the cutting device 15 in such a manner that the starting end of the thread extends into the suction scoop 14 (position I).

The final weft insertion in the direction of arrow T follows appropriately in the same manner, whereby the thread 7' is drawn into the clamping slit 8 (FIG. 1) and the clamping is released by means of the roller 18, after the ensuing insertion of the weft thread.

FIGS. 3 and 4A-4F illustrate the timing control of the individual steps. FIG. 3 shows a time diagram in which the first crankshaft revolution (1st revolution) during the insertion of the weft b is rendered in the form of a circle which is divided by numerals 31 to 42, while the second crankshaft revolution (2nd revolution) corresponding to the insertion of the following weft c is represented by a concentric inner circle which is divided by means of numerals 31' to 42'.

The following operational steps correspond to the individual points of the diagram:

39—The dead point: The starting end 7a of the weft b is drawn into the suction scoop 14. (Position 1.) Weft a is inserted, since the shuttle flies through the open compartment (FIG. 4A).

31.5—The left fork 16 begins to move down.

32.5—The left cutting device 15 cuts off the piece of thread 23 in the suction scoop 14 from the weft a at the starting end 7b; the short rest of the weft 23 is drawn off. The right cutting device 15' separates weft a into a thread end of the weft a and the new starting end 7b' of weft c. The starting end of thread 7b' of weft c moves into the position I', i.e. it is aspirated by scoop 14' (FIG. 4B).

33—Stroke of weft a through the reed at the edge of the fabric. The left fork 16 has arrived at the dead point and has thereby brought the starting end of the thread 7a of weft b into the suction zone of the suction device 17; the starting end 7a is in the ready position II; it can be taken over by the shuttle member 1.

34.5—The left fork 16 has again moved upward.

35—Introduction on the left for the flight of the shuttle member 1 from left to right (arrow direction T'). During the initial acceleration of the shuttle member 1 the starting end 7a of weft b enters the slot 6' of the shuttle.

36—The starting end 7a of weft b is clamped securely, depending on its thickness, between the points 22' and 21', in the shuttle. The weft thread b is taken along, i.e. the weft b is pulled in (FIG. 4C).

36-41—The shuttle member 1 flies through the compartment from left to right.

40.5—Roller 18' on the machine opens the clamping position 8'; the suction scoop 14' aspirates the freed starting end 7a of the weft b.

31.5' (2nd revolution)—Right fork 16' begins to move downward (arrow S').

32.5'—The right cutting device 15' cuts off the thread piece in the suction scoop 14' from the weft b at the starting end 7a; the short rest of the weft 23' is aspirated. The left cutting device 15 separates weft b while forming the new starting end of the thread 7a'. The starting end 7a' of weft d moves into the position I, i.e. it is aspirated by the suction scoop 14 (FIG. 4D).

33'—Impact of weft b against the fabric's edge. The fork 16' has moved into the lower dead point and has thereby carried the starting end 7b' of weft c into the suction zone of the suction scoop 17'; the starting end 7b' is

5

in the ready position II' and can be taken over by the shuttle member 1.

34.5'—The right fork 16' has moved upwards again.

35'—Insertion for the flight of the shuttle member from right to left (arrow T). The starting end 7b' of weft c enters the slot 6 of the shuttle member 1.

46'—The starting end 7b' of the weft c is clamped, according to its thickness, between the points 22 and 21 in the shuttle member. The weft thread c is taken along, i.e. the weft c is drawn in (FIG. 4E).

36'—41'—The shuttle member flies through the compartment from right to left (arrow T).

40.5'—Roller 18, on the left side of the machine, opens the clamping position 8; the suction scoop 14 aspirates the released starting end of the thread 7', of the weft c.

FIG. 4F illustrates the further steps until the stopping of the weft c, i.e. the cutting device 15 separates the remainder of the weft in the suction scoop 14 and the cutting device 15' separates the weft c. The fork 16 has moved downwards in the direction of the arrow S and has brought the starting end 7a' of the thread into the suction zone of the suction scoop 17.

The rapport of the movement including two compartment openings, a passage from left to right, a passage from right to left and two stops is thus completed.

I claim:

1. The method of inserting weft thread in the warp of a fabric to be woven from opposite sides of a warp, comprising arranging a pair of starting ends of weft threads in a horizontal upper path at stations on each side of a fabric warp, deflecting one weft thread end downward, conducting the one weft thread in a horizontal lower path in one direction, inserting the one weft thread in the warp; following the insertion of the one end of the weft thread, deflecting the starting end of the second weft thread downward, conducting said second weft thread in a horizontal lower path in an opposite direction from said one direction to the other side of the fabric warp, inserting the second thread in the fabric warp, aspirating the terminal portions of the starting ends of the weft threads, securing the starting ends of the threads while in said upper path, aspirating the terminal portions of the starting ends while thus secured, after said ends have been deflected downward, arresting the travel of each of the weft threads at a predetermined point and cutting off the remainder of each said warp at the respective warp.

2. In a weaving machine arranged for moving a warp for a fabric in a horizontal plane, a pair of spools of thread spacedly disposed on each side of the warp, means for holding the starting ends of the thread in an upper horizontal path transverse to the warp, a shuttle reciprocating through the warp in a lower path parallel to said upper path, said shuttle having clamping means for clamping said ends, means for imparting reciprocal movement to said shuttle, means for downwardly deflecting the starting ends of the thread in the path of said shuttle, means for holding said ends in the downwardly deflected

6

position, means for interrupting the movement of the shuttle after its passage through the warp in one direction, means for interrupting the movement of the shuttle after its passage through the warp in an opposite direction and cutting means for severing remainder of the thread after the respective passages.

3. In a weaving machine as claimed in claim 2, said means for holding the starting ends of the thread in said upper path being arranged above said lower path, said means for holding the starting end in the downwardly deflected position being arranged below said lower path.

4. In a weaving machine as claimed in claim 3, said holding means consisting of suction scoops.

5. In a weaving machine as claimed in claim 4, said means for downwardly deflecting the starting ends of the thread being formed as vertically displaceable fork members.

6. In a weaving machine as claimed in claim 5, brake means arranged in said upper path, for holding the starting ends of said threads.

7. In a weaving machine as claimed in claim 6, said clamping means in said shuttle comprising a pair of two-armed clamping levers pivotably mounted in said shuttle, a movable plate in said shuttle, the lower ends of said levers protruding downwardly of said shuttle, and spring means for biasing the upper ends of said levers against said movable plate for engaging said starting ends of the thread therebetween.

8. In a weaving machine as claimed in claim 7, said means for interrupting the movement of the shuttle consisting of a pair of rollers mounted for vertical axial rotation in said lower path of the shuttle.

9. In a weaving machine as claimed in claim 8, said cutting means being arranged intermediate said rollers and the warp.

10. In a weaving machine as claimed in claim 9, said means for imparting movement to the shuttle consisting of a pair of striker rods and actuators secured to said rods.

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