



- (51) International Patent Classification:
D03D 47/20 (2006.01)
- (21) International Application Number:
PCT/EP2016/059247
- (22) International Filing Date:
26 April 2016 (26.04.2016)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:
2015/0142 7 May 2015 (07.05.2015) BE
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- (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

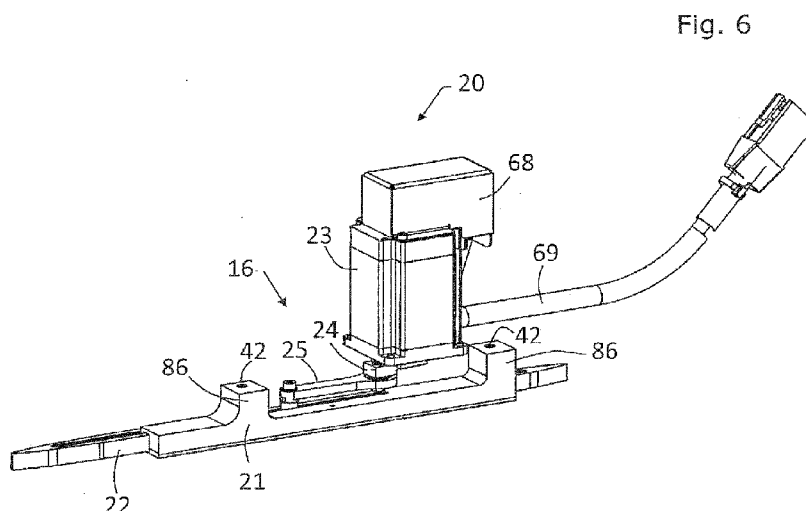
AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

- (84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- with international search report (Art. 21(3))
- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: GRIPPER OPENER FOR A WEAVING MACHINE



(57) Abstract: Weaving machine and gripper opener for opening a gripper clamp (14) of a gripper (2, 3) comprising a strip-shaped opener element (22) and a guide (21), wherein the strip-shaped opener element (22) is provided with a first coupling element (28) and a second coupling element (79), which are arranged centrally and are positioned in mirror symmetry to one another, wherein the guide (21) is provided with at least one counter element (27), and wherein one of the first coupling element (28) and the second coupling element (79) forms a tongue-and-groove connection with the at least one counter element (27) for guiding the strip-shaped opener element (22).



Gripper Opener for a Weaving Machine

TECHNICAL FIELD AND PRIOR ART

[0001] The invention relates to a gripper opener for opening a gripper clamp of a gripper in a weaving machine.

[0002] A gripper opener for opening a gripper clamp of a gripper is disclosed for example in EP 0 309 700 A1. The gripper opener comprises an opener element having an operating surface adapted for cooperating with the gripper clamp for opening the gripper clamp. The opener element is mounted movable along a movement direction of the gripper by means of an adjustment device and is moveable by means of the adjustment device along the movement direction for an adjustment of an opening position.

[0003] As described in WO 97/40218 A1, due to the contact with the gripper clamp, the opener element is subject to wear. In order to increase the life time of the opener element, WO 97/40218 A1 proposes to mount the opener element adjustable in position perpendicular to the movement direction in order to move the opener element away from the movement path of the gripper.

[0004] EP 1 491 670 A1 shows a gripper opener comprising a strip-shaped opener element having four shaped edges, each shaped edge is capable of progressively engaging with a gripper opener lever for opening a gripper clamp. The gripper opener further comprises a guide with a guiding channel, wherein the strip-shaped opener element is mounted in the guiding channel movably along a movement direction of the gripper so that one of the shaped edges is presented to contact the gripper clamp for opening the gripper clamp.

SUMMARY OF THE INVENTION

[0005] It is an object of the invention to provide a gripper opener and a weaving machine having low manufacturing costs and low maintenance costs.

[0006] This object is solved by the gripper opener with the features of claim 1 and the gripper weaving machine with the features of claim 15.

[0007] According to a first aspect a gripper opener for opening a gripper clamp of a gripper in a weaving machine comprising a strip-shaped opener element and a guide with a guiding channel is provided, wherein the guide can be arranged on the weaving machine with the guiding channel extending in parallel to a movement direction of the gripper, wherein the strip-shaped opener element is provided with an upper side, a lower side, a first lateral side and a second lateral side, wherein the first lateral side and the second lateral side extend between the upper side and the lower side, wherein the strip-shaped opener element has a first operating surface provided at the first lateral side, wherein the first operating surface is adapted for cooperating with the gripper clamp for opening the gripper clamp, wherein the strip-shaped opener element is arrangeable in the guiding channel movably along the longitudinal direction of the guiding channel and presents the first operating surface of the opener element to make contact with the gripper clamp for opening the gripper clamp, wherein the strip-shaped opener element is provided at the upper side with a first coupling element and is provided at the lower side with a second coupling element, which is identical in construction to the first coupling element, wherein the first coupling element and the second coupling element are arranged centrally in a direction perpendicular to the longitudinal direction at the upper side and the lower side, respectively, and positioned in mirror symmetry to one another, wherein the guide is provided with at least one counter element, and wherein at least one of the first coupling element and the second coupling element forms a tongue-and-groove connection with the at least one counter element for guiding the strip-shaped opener element in the guiding channel perpendicular to the longitudinal direction.

[0008] The tongue-and-groove connection allows for a reliable guidance of the strip-shaped opener element perpendicular to the longitudinal direction.

[0009] Due to the contact with the gripper clamp to be opened, the first operating surface is subjected to wear. At the end of the life time of the first operating surface, the strip-shaped opener element can be flipped or turned and thereby brought into a different orientation and re-used with a different orientation.

[0010] For example, the strip-shaped opener element can be mounted in the first orientation in the guiding channel presenting the first operating surface. Due to the symmetric, central arrangement of the first coupling element and the second coupling element, the strip-shaped opener element can be dismounted, brought into a second orientation by rotating it by 180° about the longitudinal direction, a normal direction perpendicular to the upper side and/or a third axis perpendicular to the longitudinal direction and the normal direction, and re-mounted in the

second orientation in the guide surface, wherein in each orientation one of the first coupling element and the second coupling element cooperates with the counter element.

[0011] In one embodiment, only one counter element is provided. In other embodiments, two counter elements are provided at opposing sides of the guiding channel, which cooperate with the first coupling element and the second coupling element.

[0012] A respective strip-shaped opener element can be manufactured at low costs. Further, as the strip-shaped opener element can be mounted and used with different orientations, the maintenance costs are low.

[0013] In preferred embodiments, the strip-shaped opener element has four operating surfaces, wherein at each lateral side two operating surfaces are provided. With such a design, the strip-shaped opener element can be used four times, this is with four different orientations, wherein in each orientation one operating surface is presented and in each orientation at least one of the first coupling element or the second coupling element cooperates with the counter element of the guide.

[0014] In one embodiment, the operating surfaces are different in design, wherein by choosing an orientation of the strip-shaped opener element with respect to the guide an opening profile of the gripper clamp is influenced.

[0015] In preferred embodiments, the strip-shaped opener element has two orthogonal lines of symmetry. Hence, the operating surfaces are at least within tolerances identical in design and an orientation of the strip-shaped opener element with respect to the guide does not influence an opening profile of the gripper clamp.

[0016] In one embodiment, the first coupling element and the second coupling element both are tongues, wherein corresponding grooves are provided at the guiding channel for receiving the tongues. In preferred embodiments, the first coupling element and the second coupling element are in the form of a groove each extending in the longitudinal direction, and the counter element is a tongue, in particular a tongue protruding from an edge of an opening of the guiding channel. In one embodiment, two tongues are provided protruding from opposing edges of the opening of the guiding channel. In one embodiment, the tongue extends uninterrupted over a distance allowing for a sufficient displacement of the strip-shaped opener element along the tongue.

[0017] In preferred embodiments, the counter element comprises two distinct tongue parts for providing two distinct guiding areas in the longitudinal direction. Thereby, a reliable guidance is provided, while a risk of jamming or the like due to tolerances is minimized.

[0018] In one embodiment, the strip-shaped opener element is manually positioned in the longitudinal direction for an adjustment of an opening position of a gripper clamp. In other embodiments, a hydraulic or a pneumatic drive is provided for positioning the strip-shaped opener element. In preferred embodiments, the gripper opener comprises a drive motor drivingly coupled to the strip-shaped opener element and operable to displace the strip-shaped opener element along the longitudinal direction. A coupling mechanism for coupling the drive motor and the strip-shaped opener element is chosen suitably by the person skilled in the art. In preferred embodiments, the drive motor is coupled to the strip-shaped opener element via a crank and a rod.

[0019] In preferred embodiments, the gripper opener comprises a support plate, wherein the guide is fixable to a frame of the weaving machine via the support plate. The gripper and the support plate can be designed as a preassembled submodule allowing for a simple arrangement on the weaving machine.

[0020] The guide in preferred embodiments is arranged on the support plate adjustable in position in at least one of the movement direction of the gripper and a transversal direction perpendicular to the movement direction of the gripper. By adjusting the position of the guide, an opening profile of a gripper clamp, in particular an opening amount, can be adapted to weaving conditions. In one embodiment, at least one drive mechanism is provided for adjusting a position of the guide on the support plate. In preferred embodiments, the guide is arranged on the support plate manually adjustable in position. This allows for a cost-efficient design by reducing the number of drive mechanisms.

[0021] In preferred embodiments, the connection between the support plate and the guide comprises at least one slotted hole and a pin-shaped element extending through the slotted hole. The slotted hole allows for a reliable relative positioning of the support plate and the guide within limits. Preferably, the slotted hole is arranged at a slanted angle with respect to the longitudinal direction of the guiding channel.

[0022] In one embodiment, the support plate carries only the gripper opener. In other embodiments, additional elements are arranged on the support plate. For example, in one embodiment, a suction-unit is mounted on the frame of the weaving machine. The suction-unit

in one embodiment is used to remove dust and/or to keep taut ends of weft threads that are released by the receiving gripper, so that these ends would not bound back into the warp threads.

[0023] In one embodiment, when mounted to a weaving machine the guide and the strip-shaped opener element are positioned underneath the support plate between the frame of the weaving machine and the support plate.

[0024] In this case, in preferred embodiments, the support plate is provided with a removeable cover for allowing access to the guide and/or the strip-shaped opener element positioned underneath the support plate.

[0025] In preferred embodiments, a stop bar is provided that can be arranged fixed in position on the weaving machine, so that the gripper is guided sandwiched between the guide with the strip-shaped opener element and the stop bar. By means of the stop bar, an unintended evasive movement of the gripper clamp in contact with the strip-shaped opener element is avoided.

[0026] According to a second aspect, a weaving machine comprising a gripper with a gripper clamp and a gripper opener as described above is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

[0027] Further characteristics and advantages of the invention will emerge from the following description of the embodiments schematically illustrated in the drawings. Throughout the drawings, the same elements will be denoted by the same reference numerals.

[0028] FIG. 1 is a perspective view of a gripper weaving machine.

[0029] FIG. 2 is a view in the direction of the arrow II of FIG. 1.

[0030] FIG. 3 is a perspective view of the gripper opener from the back, this means towards the fabric.

[0031] FIG. 4 is a perspective view of a gripper opener of FIG. 3 from the front, this means away from the fabric.

[0032] FIG. 5 is a schematic view of a receiver gripper.

[0033] FIG. 6 is a perspective view of parts of a second embodiment of a gripper opener.

[0034] FIG. 7 is a perspective view of a strip-shaped opener element of a gripper opener according to the invention.

[0035] FIG. 8 is a sectional view of the strip-shaped opener element of FIG. 6.

[0036] FIG. 9 is a top view of a part of FIG. 6.

[0037] FIG. 10 is a cross section along plane A-A in FIG. 9.

[0038] FIG. 11 is a cross section along plane B-B in FIG. 9.

[0039] FIG. 12 is the embodiment of FIG. 3 in dismantled state.

[0040] FIG. 13 is the embodiment of FIG. 4 in dismantled state.

[0041] FIG. 14 is a perspective view of a third embodiment of a gripper opener from the back side.

[0042] FIG. 15 is a perspective view of the gripper opener of FIG. 14 from the front side.

[0043] FIG. 16 is the embodiment of FIG. 14 in dismantled state.

[0044] FIG. 17 is the embodiment of FIG. 15 in dismantled state.

DETAILED DESCRIPTION OF EMBODIMENTS

[0045] The weaving machine shown in FIGS. 1 and 2 comprises two rapiers 1, each bearing at its free end a gripper 2, 3. The gripper 2 is further named bringer gripper and the gripper 3 is further named receiver gripper. At the insertion side of a shed formed of warp threads 12, the bringer gripper 2 receives a weft thread 4 which is presented to the bringer gripper 2 by a presenting device 19. A weft thread supply is stored on a spool 17 from which a weft thread 4 to be inserted is to be removed and wound on a prewinder 18 before being inserted into the shed. Usually, there are several spools 17 and several prewinders 18 from which the weft threads are presented in a pre-selectable pattern by the presenting device 19 to the bringer gripper 2.

[0046] The rapiers 1 are driven by drive wheels 6 and are guided around these drive wheels 6 by guides 7. The rapiers 1 move into and out again from the shed and as a result the bringer gripper 2 and the receiver gripper 3 meet centrally in the shed. Thereupon the receiver gripper 3 receives the weft thread 4 and pulls the weft thread 4 to the opposite side, this is the side opposite to the insertion side. Next the inserted weft thread is beaten-up by a reed 11 against the fabric 13. The reed 11 is mounted on a sley 10 and moves in reciprocating manner.

[0047] In order to form a shed, the warp threads 12 are selectively raised and lowered by means of so-called healds 9. The shed is changed after the weft thread 4 has been inserted.

[0048] When the bringer gripper 2 receives a weft thread 4 presented to it, a gripper clamp mounted on the bringer gripper 2 is closed. Similar, the receiver gripper 3 also is provided with a gripper clamp holding the weft thread 4 during transport, which is opened when the receiver gripper 3 has reached the opposite side. Closing the gripper clamp of the bringer gripper 2 when receiving a weft thread 4 and when entering the shed is controlled by a gripper opener 5. Opening the gripper clamp of the receiver gripper 3 in the region outside the shed on the opposite side is controlled by a gripper opener 20.

[0049] The gripper openers 5, 20, for example, each comprise an opener element 22 (shown in FIG. 3) having an operating surface adapted to contact the gripper clamp for opening the gripper clamp. Depending on the design of the gripper clamp of the gripper 2, 3, a gripper opener 5, 20 used for opening the gripper clamp comprises an opener element 22 located away from the fabric 13 with respect to the movement path of the gripper 2, 3, or an opener element 22 located towards the fabric 13 with respect to the movement path of the gripper 2, 3 in order to allow that the opener element 22 makes contact with the gripper clamp.

[0050] FIGS. 3 and 4 show diagrammatically a gripper opener 20 arranged on the opposite side and comprising a strip-shaped opener element 22 arranged away from a fabric 13 with respect to the movement path of the receiver gripper 3. In an embodiment, as known in WO 02/077343 and shown in FIG. 5, the receiver gripper 3 comprises a moveable gripper clamp 14 with a protruding contact element 15 that can cooperate with the opener element 22 of the gripper opener 20 in order to open or close the gripper clamp 14 of the receiver gripper 3. The protruding contact element 15 is, for example, provided at a lever that is part of the gripper clamp 14.

[0051] The gripper opener 20 comprises a guide 21 with a guiding channel 26, which is arranged on the weaving machine so that the guiding channel 26 extends in parallel to the

movement direction of the gripper 2, 3. The strip-shaped opener element 22 is mounted in the guiding channel 26 presenting a first operating surface 61, which first operating surface 61 is adapted for cooperating with the gripper clamp 14 of the receiver gripper 3, more particular the protruding contact element 15 (shown in FIG. 5) for opening the gripper clamp 14 of the receiver gripper 3. The strip-shaped opener element 22 is received in the guiding channel 26 movably along the longitudinal direction of the guiding channel 26, wherein the opener element 22 is movable along the longitudinal direction for an adjustment of an opening position for the gripper clamp. In order to move the strip-shaped opener element 22, in the embodiment shown in FIGS. 3 and 4 a drive motor 23 is provided. As shown in more detail in FIG. 6 the drive motor 23 is coupled to the strip-shaped opener element 22 via a crank 24 and a rod 25. An encoder 68 can be provided at the drive motor 23 to determine the angular position of the drive motor 23. The drive motor 23 and/or the encoder 68 are coupled to a control unit (not shown) via an electric cable 69.

[0052] The guide 21, the strip-shaped opener element 22, the drive motor 23 and the coupling mechanism 16 comprising the crank 24 and the rod 25 are shown in FIG. 6. The strip-shaped opener element 22 is shown in FIG. 7 in a perspective view. Further the strip-shaped opener element 22 together with the guide 21 is shown in different ways in FIGS. 8 to 11. FIGS. 12 and 13 show the embodiments of FIGS. 3 and 4 in dismantled state.

[0053] As can be best seen in FIG. 7, the strip-shaped opener element 22 is provided with an upper side 30, a lower side 31, a first lateral side 32 and an opposing second lateral side 33, wherein the first lateral side 32 and the second lateral side 33 extend between the upper side 30 and the lower side 31.

[0054] The strip-shaped opener element 22 shown has two orthogonal lines of symmetry 82 and 83 diagrammatically indicated by broken lines in FIG. 7.

[0055] The strip-shaped opener element 22 has four operating surfaces 61, 62, 63, 64 and can be used in four different orientations. In the embodiment shown, at each lateral side 32, 33 two operating surfaces of the opener element 22 are provided, more particularly two operating surfaces 61, 62 at the lateral side 32 and two operating surfaces 63, 64 at the lateral side 33. Each operating surface 61, 62, 63, 64 is adapted for cooperating with the gripper clamp of the gripper 2, 3 (shown in FIG. 2) for opening the gripper clamp of the gripper 2, 3. In the embodiment shown, the operating surfaces 61, 62, 63, 64 are identical in design. More particular, the strip-shaped opener element 22 shown is provided at each lateral side 32, 33 with five surface parts 34, 35, 36 arranged at different angles with respect to a longitudinal

direction and with four transition regions 37, 38 arranged between the surface parts 34, 35, 36. At both ends, three surface parts 34, 35, 36 and the associated transition regions 37, 38 form an operating surface 61, 62; 63, 64, wherein a central surface part 34 is used by both operating surfaces 61, 62; 63, 64.

[0056] In the embodiment shown, a comparatively long straight central surface part 34 is provided. Such a central surface part 34 is advantageous for controlling an opening amount of the gripper clamp. In addition, at the distal ends of the lateral side 32, 33, surface parts 36 with a comparatively high angle of inclination are provided. Such surface parts 36 are advantageous in order to open the gripper clamp quickly. Between the straight central surface part 34 and the surface parts 36 at the distal ends, in the embodiment shown surface parts 35 having a smaller angle of inclination than the surface parts 36 at the distal ends are provided, which is advantageous for stabilizing the movement of the gripper clamp during opening or closing.

[0057] At the upper side 30 a first coupling element 28 in the form of a groove is provided. At the lower side 31 a second coupling element 79 (shown in FIG. 10), which is identical in construction to the first coupling element 28, hence, also in the form of a groove, is provided. The first coupling element 28 and the second coupling element 79 are arranged centrally in a direction perpendicular to the longitudinal direction at the upper side 30 and the lower side 31, respectively. Further, the first coupling element 28 and the second coupling element 79 are positioned in mirror symmetry to one another. Finally, the first coupling element 28 and the second coupling element 79 each have a plane of symmetry perpendicular to the upper side 30 and the lower side 31.

[0058] At a center of the strip-shaped opener element 22, a through hole 39 is provided for coupling the strip-shaped opener element 22 to the rod 25 shown in FIG. 8.

[0059] FIG. 9 is a top view of the guide 21 and the strip-shaped opener element 22. FIGS. 10 and 11 are cross sections along plane A-A and plane B-B in FIG. 9, respectively. As shown in FIGS. 10 and 11, the guide 21 is provided with a counter element 27 in the form of a tongue protruding from an edge of the opening of the guiding channel 26 of the guide 21. The strip-shaped opener element 22 is mountable in the guiding channel 26 movably along the longitudinal direction of the guiding channel 26. Hereby the opener element 22 can present one of the four operating surfaces 61, 62, 63, 64 of the opener element 22 to contact the gripper clamp, for example for opening the gripper clamp 14 of the receiver gripper 3 shown in FIG. 5. Depending on the orientation of the strip-shaped opener element 22, the first coupling element 28, this is the groove, provided on the upper side 30, or the second coupling element 79, this is

the groove, provided on the lower side 31 is connected to the counter element 27, this is the tongue, provided at the guide 21 to form a tongue-and-groove connection for guiding the strip-shaped opener element 22 in the guiding channel 26 perpendicular to the longitudinal direction.

[0060] In the embodiment shown, the guide 21 comprises a main body 70 and a bottom element 71, which is detachable from the main body 70 for mounting and dismounting the strip-shaped opener element 22. The main body 70 and the bottom element 71 together form a U-shaped guiding channel 26. As can be seen in FIGS. 10 and 11, the counter element 27 is provided at the main body 70 at an edge of the opening of the guiding channel 26. In alternative or in addition, a counter element 27 is provided at the bottom element 71, which is inserted in the groove provided at the coupling element 79 at a side of the strip-shaped opener element 22 facing the bottom element 71.

[0061] In order to avoid interference with the rod 25, the main body 70 is provided with a cut out 72 (shown in FIG. 9). The cut out 72 also separates the tongue provided as the counter element 27 at the main body 70 in two distinct tongue parts providing two distinct guiding areas 84 and 85 in the longitudinal direction of the guiding channel at two sides of the through hole 39.

[0062] As can be best seen in FIG. 6, the guide 21 is provided with mounting blocks 86 having bores 42 for receiving pin-shaped elements 41 (shown in FIGS. 3 and 4).

[0063] As shown in FIGS. 3 and 4, the guide 21 is arranged on a frame 60 of the weaving machine with the guiding channel 26 extending in parallel to a movement direction of the gripper 2, 3 (shown in FIG. 2). In the embodiment shown, the gripper opener 20 comprises a support plate 29 attached using bolts 66 via a support block 47 to the frame 60. The guide 21 is fixable to the frame 60 of the weaving machine via the support plate 29.

[0064] The support plate 29 shown in FIGS. 3 and 4 is provided with two slotted holes 40, which are arranged at a slanted angle with respect to the longitudinal direction of the guiding channel 26. The guide 21 is fixed to the support plate 29 by means of two pin-shaped elements 41 each extending through one slotted hole 40 and are received in a bore 42 (shown in FIG. 6). The guide 21 is manually adjustable in position with respect to the support plate 29 in the movement direction of the gripper 2, 3 (shown in FIG. 2) and a transversal direction perpendicular to the movement direction of the gripper 2, 3 within the limits defined by the slotted holes 40. Both slotted holes 40 are arranged in parallel with respect to each other, hence, the longitudinal direction of the guiding channel 26 remains arranged in parallel to the movement direction of the gripper 2, 3 when adjusting a position of the guide 21. By fastening the pin-shaped elements 41

the guide 21 is fixed at the support plate 29 in a desired position. Butterfly nuts or wing nuts are provided at the pin-shaped elements 41 for fastening or loosening the pin-shaped elements 41. The butterfly nuts or wing nuts allow for a simple handling.

[0065] As best can be seen in FIGS. 3 and 4, in the shown embodiment, the guide 21 and the strip-shaped opener element 22 are positioned underneath the support plate 29 between the frame 60 of the weaving machine and the support plate 29. In order to allow an operator access to elements that are positioned underneath the support plate 29, such as the guide 21, the strip-shaped opener element 22 and/or a rod 25, without the necessity of dismounting the guide 21 from the support plate 29, the support plate 29 is provided with a removeable cover 43.

[0066] The gripper opener 20 shown in FIGS. 3 and 4 further comprises a stop bar 44, which is arranged fixed in position on the frame 60 of the weaving machine. The stop bar 44 and the strip-shaped opener element 22 are arranged at the opposite sides of the movement path of the receiver gripper 3 (shown in FIG. 2), so that the receiver gripper 3 is guided sandwiched between the strip-shaped opener element 22 and the stop bar 44. The stop bar 44 limits an evasive movement of the receiver gripper 3 away from the strip-shaped opener element 22.

[0067] In the embodiment shown in FIGS. 3 and 4, further a suction-unit 45 is provided. The suction-unit 45 is attached to the frame 60 in the region of the strip-shaped opener element 22. Further a blowing device 46 is provided to blow dust away from the gripper clamp.

[0068] FIGS. 14 and 15 are a perspective view of a second embodiment of a gripper opener 20, while FIGS. 16 and 17 show a dismantled state. The gripper opener 20 is similar to the gripper opener 20 shown in FIGS. 3 to 13 and the same reference numbers will be used for identical or like elements. This allows the strip-shaped opener element 22, which is driven by the drive motor 23 for a displacement along the longitudinal direction of a guiding channel 26, to be arranged on the frame 60 in the direction towards the shed formed of warp threads 12 (shown in FIG. 1) or away from the fabric 13.

[0069] The guide 21 is fixed to the support plate 29 by means of two pin-shaped elements 41 each extending through one associated slotted hole 40 provided at the support plate 29. The support plate 29 is attached to the frame 60 movable in position in the movement direction of the gripper 2, 3 (shown in FIG. 2). For this purpose, slotted holes 80, 81 are provided at the support plate 29 that extend after mounting the support plate 29 in parallel to the movement direction of the gripper 2, 3. A blowing device 46 can be provided on the support plate 29 in order to blow away dust from the gripper clamp.

[0070] In FIGS. 14 to 17, the suction-unit 45 is fixed via the support 67 to the frame 60 of the weaving machine. Hence, the suction-unit 45 is not moved with the support plate 29 when adjusting the position of the support plate 29. The support plate 29 is fixed via a support profile 48 to the frame 60. A stop bar 44 is fixed to the support profile 48, so that a gripper 2, 3 can be guided between the stop bar 44 and the strip-shaped opener element 22. The support plate 29 is also fixed to the frame 60 in a determined length position with respect to the frame 60 via at least one support block 49 and bolts 65.

[0071] In the embodiment shown in FIGS. 3 to 17 a gripper opener 20 is shown that cooperates with a gripper clamp 14 of the receiver gripper 3. The embodiments shown for the gripper opener 20 can of course also be applied for a gripper opener 5 that cooperates with a gripper clamp 14 of the bringer gripper 2.

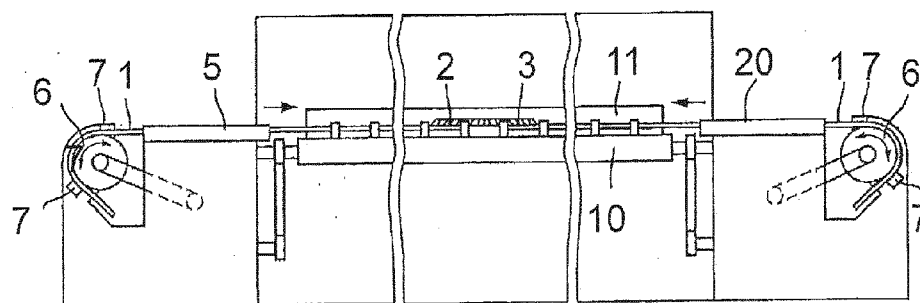
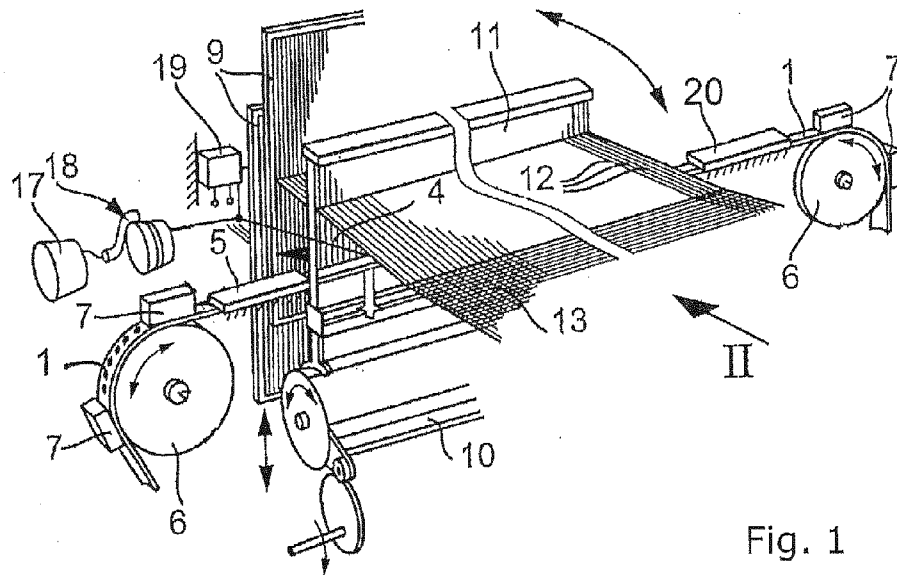
[0072] The invention is not limited to the embodiments described by way of example and illustrated in the drawings. Variant embodiments concerning shapes and dimensions that fall under the claims and combinations of the described and illustrated embodiments are also possible.

CLAIMS

1. A gripper opener for opening a gripper clamp (14) of a gripper (2, 3) of a weaving machine comprising a strip-shaped opener element (22) and a guide (21) with a guiding channel (26), wherein the guide (21) can be arranged on the weaving machine with the guiding channel (26) extending in parallel to a movement direction of the gripper (2, 3), wherein the strip-shaped opener element (22) is provided with an upper side (30), a lower side (31), a first lateral side (32) and a second lateral side (33), wherein the first lateral side (32) and the second lateral side (33) extend between the upper side (30) and the lower side (31), wherein the strip-shaped opener element (22) has a first operating surface (61) provided at the first lateral side (32), wherein the first operating surface (61) is adapted for cooperating with the gripper clamp (14) for opening the gripper clamp (14), and wherein the strip-shaped opener element (22) is arrangeable in the guiding channel (26) movably along the longitudinal direction of the guiding channel (26) and presents the first operating surface (61) of the opener element (22) to make contact with the gripper clamp (14) for opening the gripper clamp (14), **characterized in that** the strip-shaped opener element (22) is provided at the upper side (30) with a first coupling element (28) and is provided at the lower side (31) with a second coupling element (79), which is identical in construction to the first coupling element (28), wherein the first coupling element (28) and the second coupling element (79) are arranged centrally in a direction perpendicular to the longitudinal direction at the upper side (30) and the lower side (31), respectively, and positioned in mirror symmetry to one another, wherein the guide (21) is provided with at least one counter element (27), and wherein one of the first coupling element (28) and the second coupling element (79) forms a tongue-and-groove connection with the at least one counter element (27) for guiding the strip-shaped opener element (22) in the guiding channel (26) perpendicular to the longitudinal direction.
2. The gripper opener according to claim 1, **characterized in that** the strip-shaped opener element (22) has four operating surfaces (61, 62, 63, 64), wherein at each lateral side (32, 33) two operating surfaces are provided.
3. The gripper opener according to claim 1 or 2, **characterized in that** the strip-shaped opener element (22) has two orthogonal lines of symmetry (82, 83).

4. The gripper opener according to claim 1, 2 or 3, **characterized in that** the first coupling element (28) and the second coupling element (79) each are in the form of a groove extending in the longitudinal direction, and the counter element (27) is a tongue, in particular a tongue protruding from an edge of an opening of the guiding channel (26).
5. The gripper opener according to claim 4, **characterized in that** the counter element (27) comprises two distinct tongue parts for providing two distinct guiding areas (84, 85) in the longitudinal direction.
6. The gripper opener according to any one of claims 1 to 5, **characterized in that** the gripper opener (5, 20) comprises a drive motor (23) drivingly coupled to the strip-shaped opener element (22) and operable to displace the strip-shaped opener element (22) along longitudinal direction, wherein in particular the drive motor (23) is coupled to the strip-shaped opener element (22) via a crank (24) and a rod (25).
7. The gripper opener according to any one of claims 1 to 6, **characterized in that** the gripper opener (20) comprises a support plate (29), wherein the guide (21) is fixable to a frame (60) of the weaving machine via the support plate (29).
8. The gripper opener according to claim 7, **characterized in that** the guide (21) is arranged on the support plate (29) adjustable in position in at least one of the movement direction of the gripper (2, 3) and a transversal direction perpendicular to a movement direction of the gripper (2, 3), wherein in particular the guide (21) is arranged on the support plate (29) manually adjustable in position.
9. The gripper opener according to claim 8, **characterized in that** the connection between the support plate (29) and the guide (21) comprises at least one slotted hole (40) and a pin-shaped element (41) extending through the slotted hole (40).
10. The gripper opener according to claim 9, **characterized in that** the slotted hole (40) is arranged at a slanted angle with respect to the longitudinal direction of the guiding channel (26).
11. The gripper opener according to any one of claims 7 to 10, **characterized in that** a suction-unit (45) is mounted on the frame (60) of the weaving machine.

12. The gripper opener according to any one of claims 7 to 11, **characterized in that** when mounted to a weaving machine the guide (21) and the strip-shaped opener element (22) are positioned underneath the support plate (29) between the frame (60) of the weaving machine and the support plate (29).
13. The gripper opener according to claim 12, **characterized in that** the support plate (29) is provided with a removeable cover (43) for allowing access to the guide (21) and/or the strip-shaped opener element (22) positioned underneath the support plate (29).
14. The gripper opener according to any one of claims 1 to 13, **characterized in that** a stop bar (44) is provided that can be arranged fixed in position on the weaving machine, so that the gripper (2, 3) is guided sandwiched between the guide (21) with the strip-shaped opener element (22) and the stop bar (44).
15. A weaving machine comprising a gripper (2, 3) with a gripper clamp (14) and a gripper opener (5, 20) according to any one of claims 1 to 14.



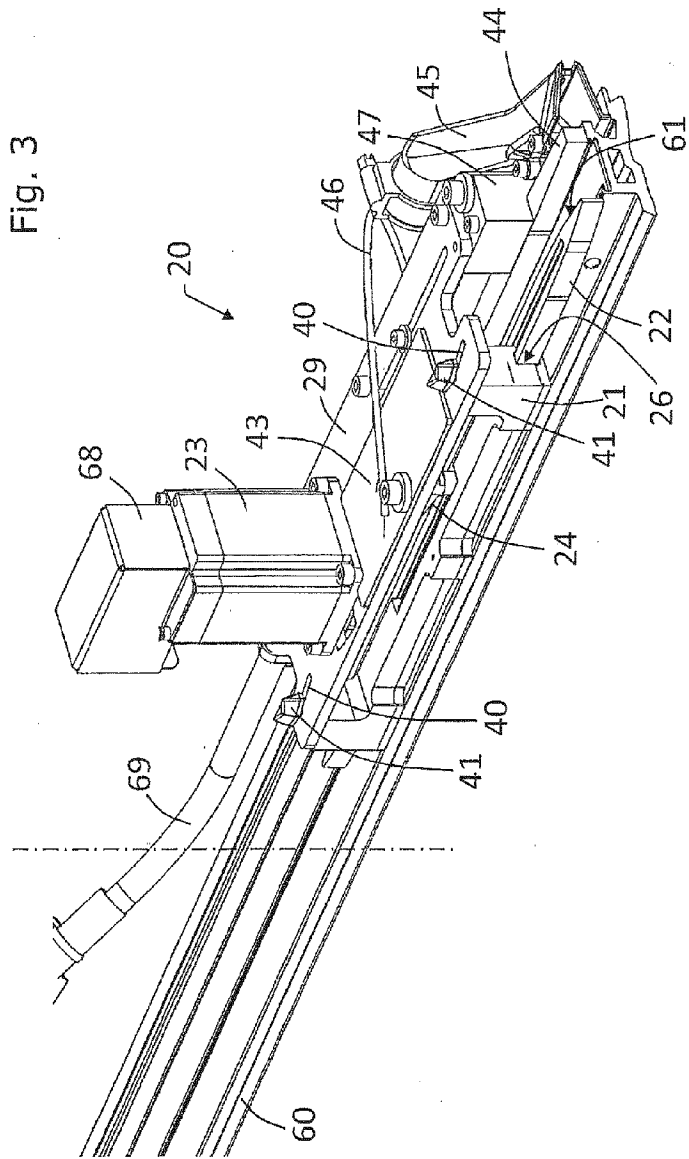


Fig. 4

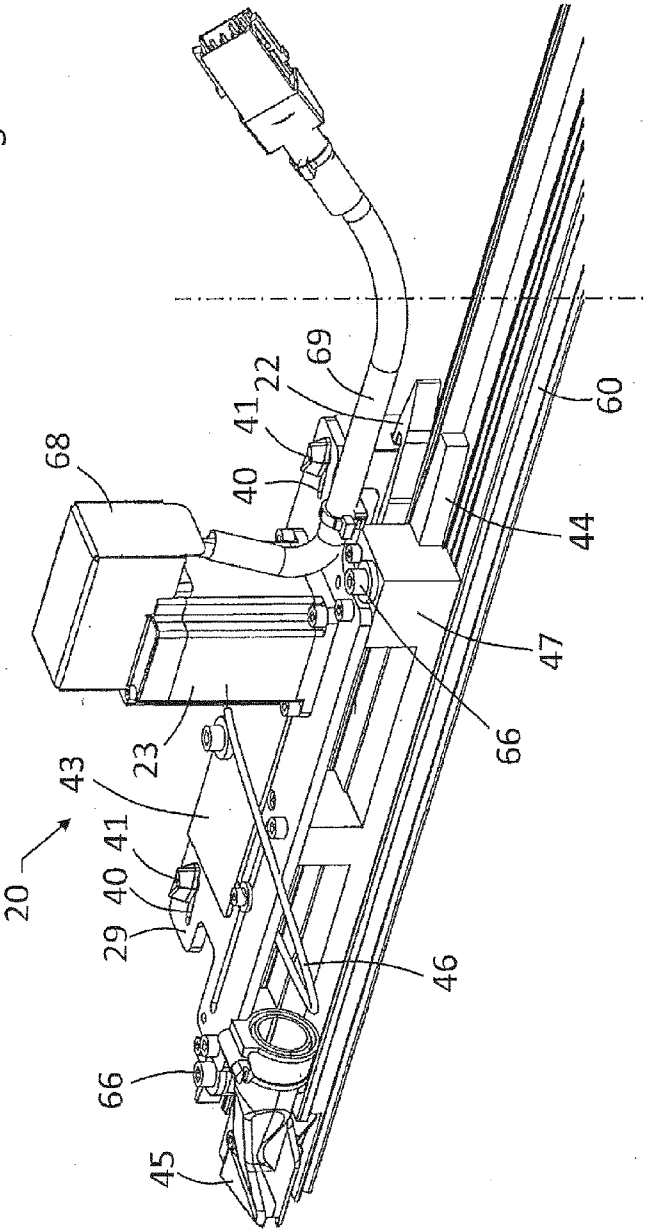


Fig. 5

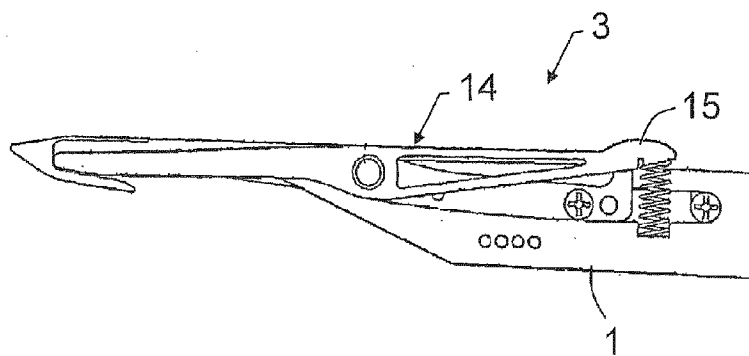


Fig. 9

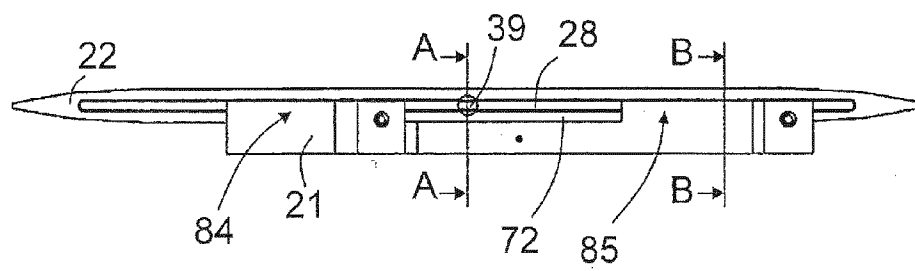


Fig. 6

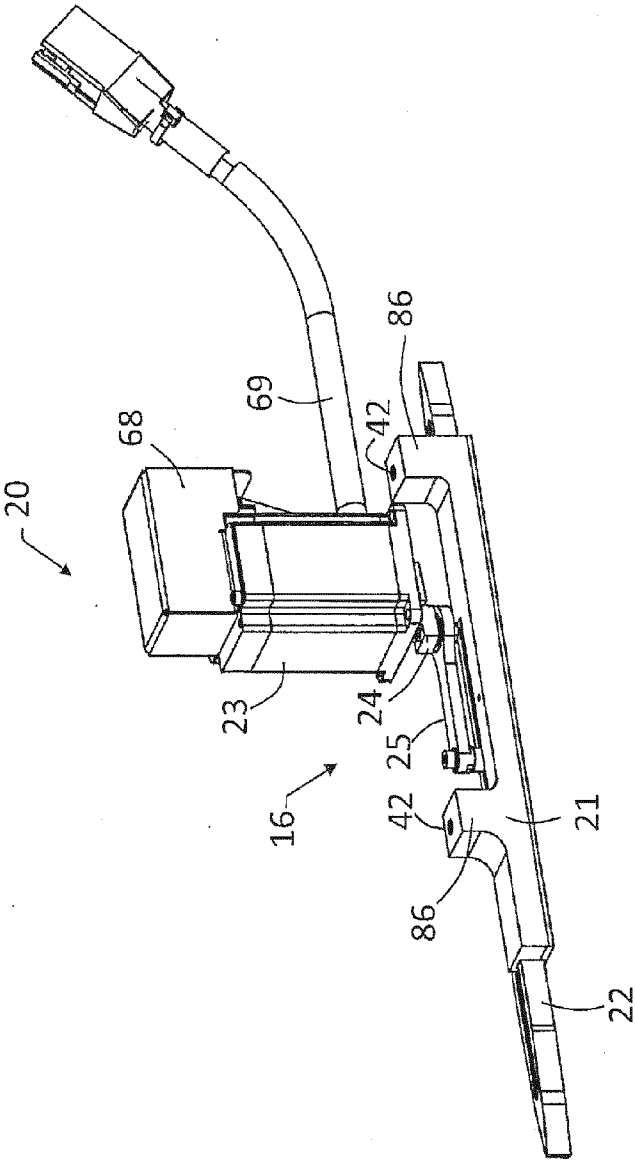


Fig. 7

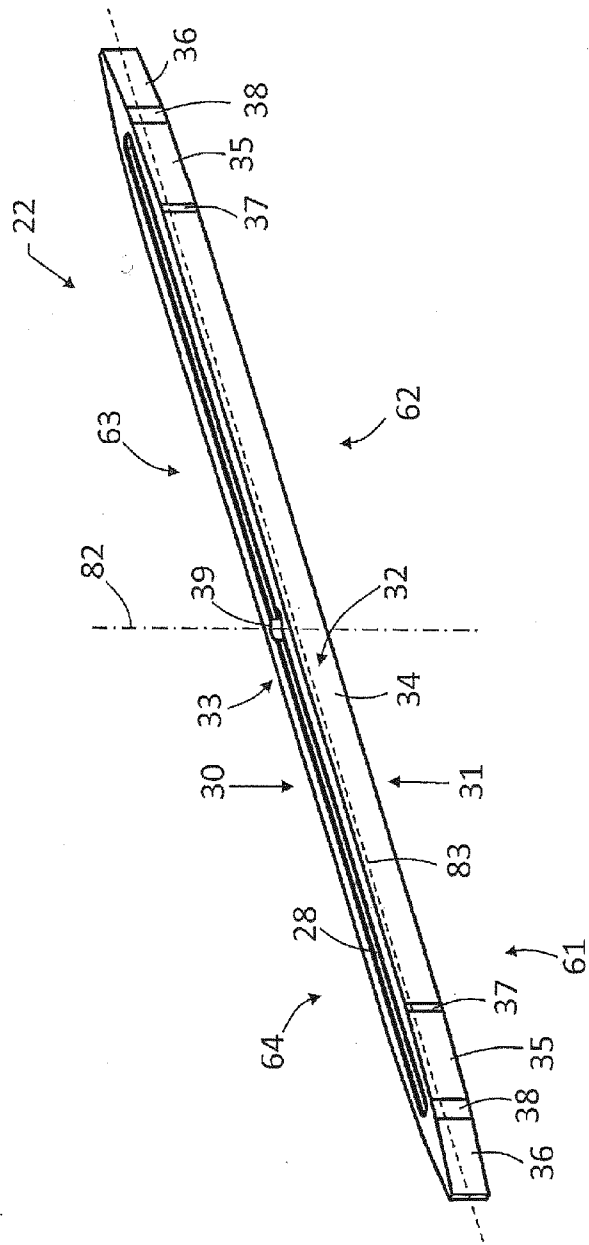


Fig. 8

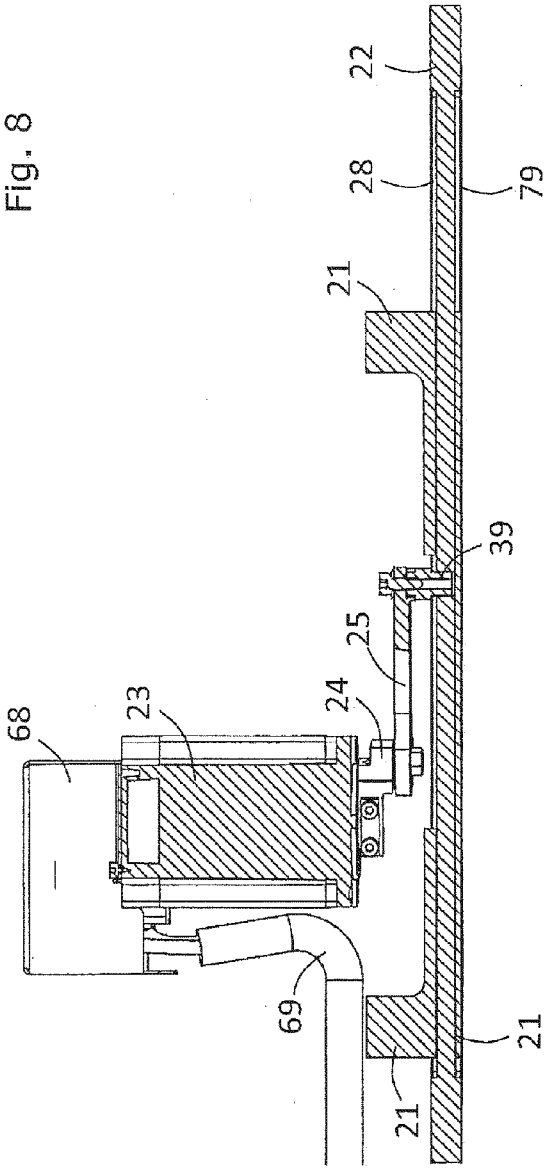


Fig. 10

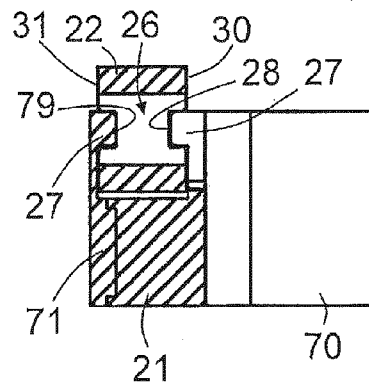


Fig. 11

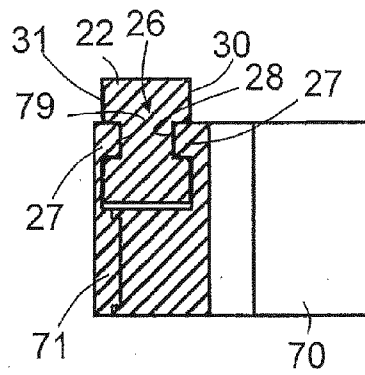


Fig. 12

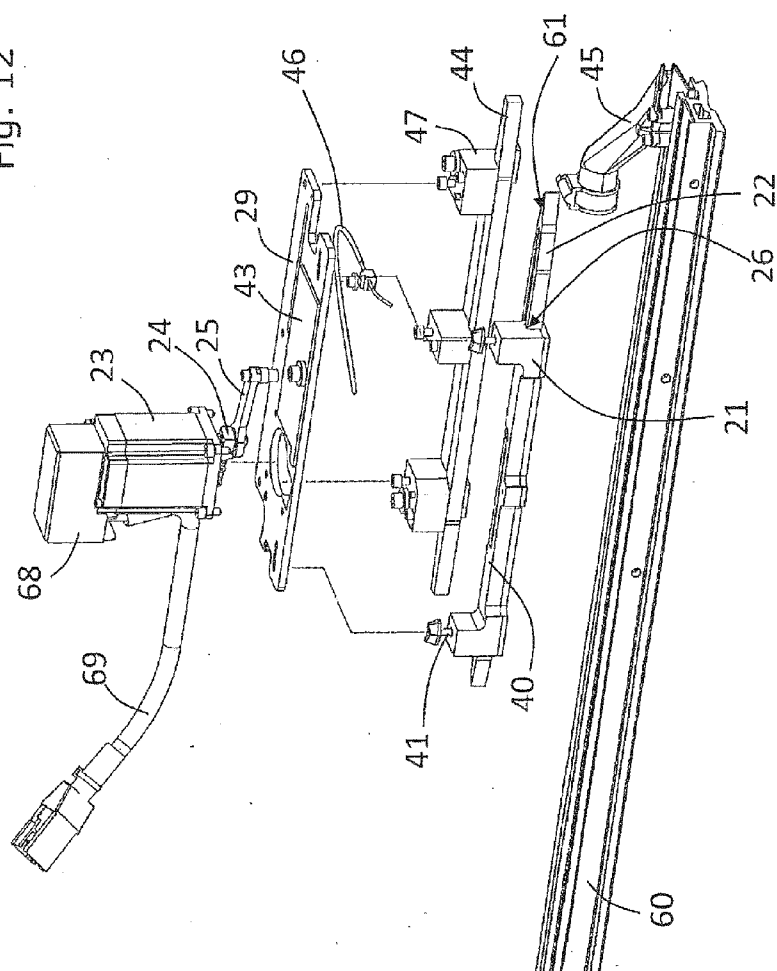
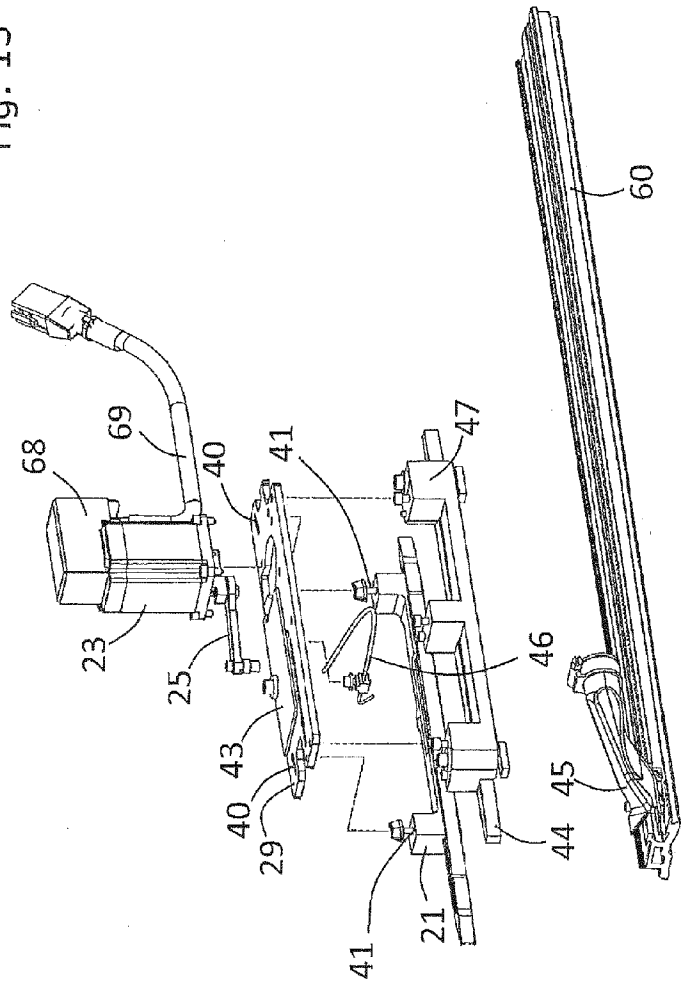


Fig. 13



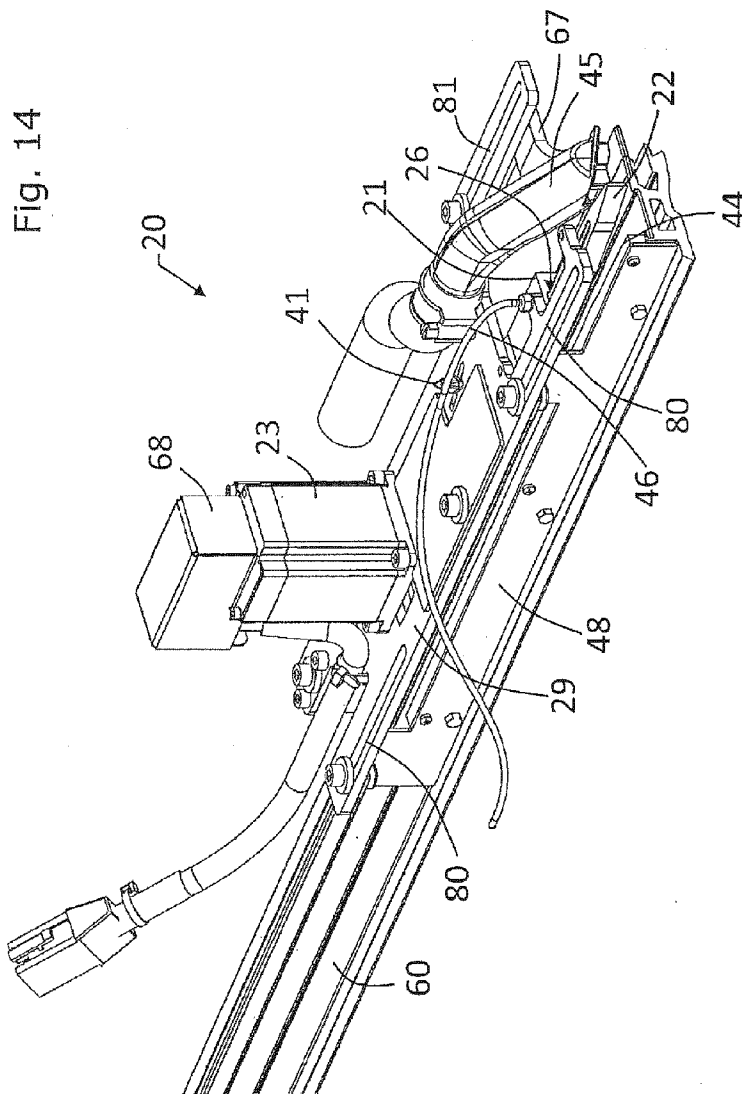


Fig. 15

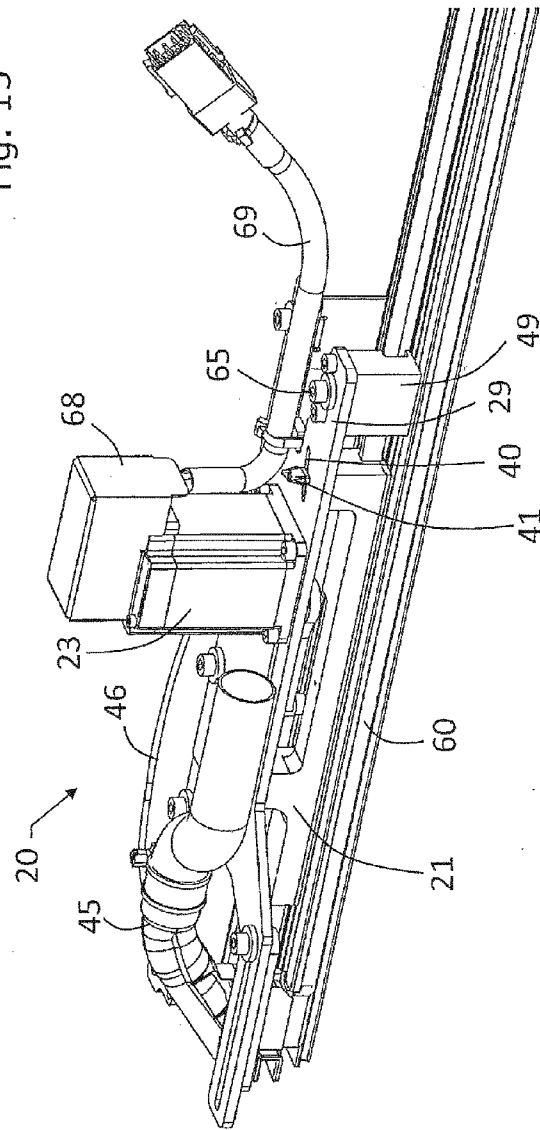
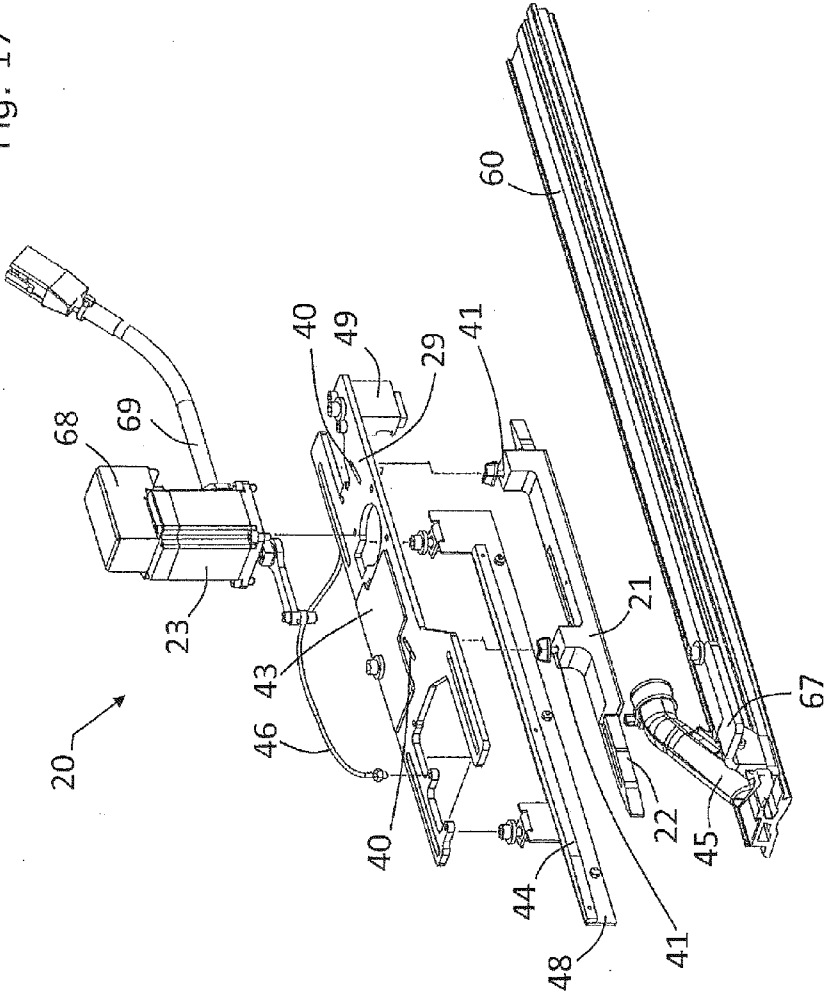


Fig. 17



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/059247

A. CLASSIFICATION OF SUBJECT MATTER
 INV. D03D47/20
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 D03D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 1 491 670 A2 (PROMATECH SPA [IT]) 29 December 2004 (2004-12-29) cited in the application abstract paragraphs [0003], [0004], [0024], [0025], [0033], [0038]; figures 1-7 -----	1-15
A	WO 97/40218 A1 (PICANOL NV [BE]; SHAW HENRY [BE]; MEYNS IGNACE [BE]) 30 October 1997 (1997-10-30) cited in the application page 9, paragraph 8 - page 11, paragraph 4; figures 1-17 -----	1-15



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search

12 September 2016

Date of mailing of the international search report

21/09/2016

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Louter, Petrus

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/059247

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