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(54) **DEVICE AND METHOD FOR CLAMPING A WEFT THREAD**

VORRICHTUNG UND VERFAHREN ZUM EINSPANNEN EINES SCHUSSFADENS

DISPOSITIF ET PROCÉDÉ DE SERRAGE D'UN FIL DE TRAME

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(73) Proprietor: **Picanol**
8900 Ieper (BE)

(72) Inventors:
- **VERCLYTE, Eddy**
  B-8900 Ieper (BE)
- **HOORELBEKE, Wim**
  B-8560 Wevelgem (BE)
- **COULEMBIER, Ronny**
  B-8900 Ieper (BE)

(74) Representative: **Patentanwälte**
Ruff, Wilhelm, Beier, Dauster & Partner mbB
Kronenstraße 30
70174 Stuttgart (DE)

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Description

Technical Field

[0001] The invention relates to a device and a method for clamping a weft thread in a weaving machine, more particularly in a rapier weaving machine.

Prior Art

[0002] When weaving, a weft thread positioned in the path of a gripper is gripped by the gripper and inserted into the shed. The inserted weft thread is cut off on the insertion side in order to allow a subsequent weft thread to be inserted. It is known to position a weft thread to be inserted in the path of the gripper by using a presenting element of a presenting device that is arranged on the weaving machine next to the shed, for example as described in EP 0 598 264 A1.

[0003] It is further known to provide a clamping device arranged between a weft presenting device and a weft thread cutter. For example, EP 0 644 286 A1 relates to an apparatus for presenting weft threads on a rapier weaving machine comprising a movably mounted weft thread clamping unit having at least three weft thread clamps which are spaced apart in the direction of movement of the clamping unit, a positioning device for moving each of the weft thread clamps into a reference plane, which positioning device comprises a stepping motor.

[0004] EP 0 421 349 A1 describes a clamping device for a rapier weaving machine. The clamping device comprises a first and a second gripping body, which are movable up and down and are forced in a direction towards a middle position, and a gripper element, which is movable up and down between the first and the second gripping body, wherein the gripper element is able to make contact with the first and second gripping body, when positioned in the middle position between the first and second gripping body, and is able to make contact with one of the gripping bodies so that an open section is defined between the gripper element and the other gripping body when positioned against one of the gripping bodies. The drive means for moving the gripper element up and down are designed as a cam and a lever, two solenoids or an electrical drive.

[0005] DE 10 2008 027 131 A1 further describes to provide a device for cutting a weft thread comprising a first and a second blade moved relative to one another by means of a driving device comprising a pneumatic piston.

Brief description of the invention

[0006] It is the object of the invention to provide a device and a method for clamping an inserted weft thread that allows a reliable clamping of an inserted weft thread.

[0007] This object is solved by a device for clamping a weft thread in a weaving machine, more particularly in a rapier weaving machine, the device comprising a central clamping element, a first outer clamping element and a second outer clamping element, wherein the central clamping element is forced in two opposite clamping directions towards an intermediate position, wherein the central clamping element being sandwiched between the first outer clamping element and the second outer clamping element, when the central clamping element is positioned in the intermediate position, wherein both the first outer clamping element and the second outer clamping element abut against the central clamping element in the intermediate position, the device comprises further a drive device adapted for displacing the central clamping element out of the intermediate position in two clamping directions, a first clamping direction to at least one first position and a second clamping direction to at least one second position, wherein in the first position the central clamping element is at a distance from the first outer clamping element and in the second position the central clamping element is at a distance from the second outer clamping element, wherein the drive device comprises a pneumatic cylinder with at least one piston, wherein the piston and/or a piston rod of the piston (23) is formed integrally with or is mechanically coupled to the central clamping element for a transmission of motion in the clamping directions, and wherein the device further comprises at least one abutment element arranged between the first outer clamping element and the second outer clamping element for limiting a movement of the first outer clamping element and the second outer clamping element towards each other, wherein a height of the central clamping element is larger than the total height of the at least one abutment element.

[0008] The device for clamping a weft thread is also referred to as clamping device. In the context of the invention with clamping direction is meant a movement direction wherein the clamping elements move during the opening or the closing of the clamps.

[0009] A pneumatic cylinder allows the central clamping element to be displaced with a high reliability and at high speeds. In an embodiment, the central clamping element is formed integrally with a piston and/or a piston rod. In other embodiments, the elements are formed as separate parts, which are mechanically coupled. The mechanical coupling in one embodiment is a releasable connection, for example using screw elements. In other embodiments, a permanent connection is chosen, for example by welding or gluing the elements together. When using a pneumatic cylinder, desired forces may be applied. The direct coupling of the central clamping element to the piston allows to achieve a light-weight device suitable for co-operating with a pneumatic cylinder. In this case the piston is directly coupled to the central clamping element for a transmission of movement in the clamping direction.

[0010] Further, when providing a pneumatic cylinder, a compact structure may be obtained. In absence of weft thread, the central clamping element makes contact with

the first outer clamping element and with the second outer clamping element when the central clamping element is positioned in the intermediate position.

[0011] In the context of the invention, the total height of the at least one abutment element arranged between the first and the second outer clamping element is defined as the distance between two abutment surfaces limiting a movement of the first and the second outer clamping element towards each other. If only one abutment element is provided, the total height equals the height of this abutment element. In preferred embodiments, the at least one abutment element is centred with the central clamping element when the central clamping element is arranged in the intermediate position. In other embodiments, the at least one abutment element is a little off centre in one of the two clamping directions. In both cases, the total height of the at least one abutment element is smaller than the height or the thickness of the central clamping element, in order to allow that both the first and the second outer clamping element abut against the central clamping element in an intermediate position. Because of that smaller height of the at least one abutment element a play is achieved between the clamping elements and the at least one abutment element which is advantageous to keep the clamps in the intermediate position closed, in other words against the central clamping element, what allows to always clamp a weft thread, even if the clamping elements due to their sudden movements move or vibrate a bit up and down, more in particular vibrate after the contacting of a clamping element with the central clamping element, this means after the closing of a clamp. In this case all clamping elements can vibrate together over that play without one of the clamps opening and releasing a weft thread.

[0012] According to an embodiment, the pneumatic cylinder is a double acting pneumatic cylinder, more particularly a double acting pneumatic cylinder which can be held in a first position, a second position and a third intermediate position. The piston of the pneumatic cylinder is moveable in the clamping direction. Providing a double acting pneumatic cylinder allows the piston to adopt three positions and, hence, also to couple the central clamping element directly to the piston to adopt three positions. In a preferred embodiment, the piston is arranged vertical or essentially vertical. With this arrangement, the piston may adopt a first upper piston position when only the lower chamber of the pneumatic cylinder is pressurized, adopt a second lower piston position when only the upper chamber of the pneumatic cylinder is pressurized, and adopt a third intermediate piston position when the loads applied on the piston are balanced. Preferably, the loads applied on the piston are balanced when none of the two chambers is pressurized. In this case, the central clamping element will adopt an intermediate position when no pressurized fluid is supplied. However, in other solutions, the intermediate position may be adopted when the both chambers are pressurized.

[0013] In an embodiment, the pneumatic cylinder comprises at least a spring, preferably two springs, loading the piston. The springs are adapted to hold the piston in the third intermediate piston position, wherein also the central clamping element is in its intermediate position. When using two springs, in the third intermediate position the loads applied by the two springs are balanced. When using only one spring the load applied by this spring in the third intermediate position for example is almost negligible.

[0014] In preferred embodiments, the clamping device comprises a first force element forcing the first outer clamping element towards the central clamping element, a second force element forcing the second outer clamping element towards the central clamping element, and at least one abutment element for limiting a displacement of the first and the second outer clamping element caused by the displacement of the central clamping element and a force applied by the first and the second force element on the first and the second outer clamping element, respectively. The first and the second force element in preferred embodiments are realized as spring elements. In an embodiment, the first and the second force elements assume the functions of the springs of the pneumatic cylinder, wherein the springs of the pneumatic cylinder may be omitted. In other embodiments, the force elements are co-operating with the springs of the pneumatic cylinder, wherein the loads applied by the force elements are preferably chosen smaller than the forces applied by the springs of the pneumatic cylinder.

[0015] According to an embodiment, the first outer clamping element and/or the second outer clamping element are formed as a plate being fixed to a guiding shaft. The length of the guiding shafts is chosen in an embodiment in order to limit a movement of the outer clamping elements. The guiding shafts may therefore assume the function of the at least one abutment element. In other embodiments, the guiding shafts co-operate with an abutment element provided between the outer clamping elements. The plates provide a light-weight solution.

[0016] According to another embodiment, guiding shafts for the central clamping element, the first outer clamping element and second outer clamping element are coaxially arranged. In preferred embodiments, the piston rod of the pneumatic cylinder functions as a guiding shaft for the central clamping element. The piston rod extends through the central clamping element, the first outer clamping element and the second outer clamping element. The central clamping element is arranged in a fixed position on the piston rod or is formed integrally with the piston rod. The first outer clamping element and the second outer clamping element are provided with feed-through openings for the piston rod. The guiding shafts for the first outer clamping element and for the second outer clamping element are formed as tubular shaped shafts arranged concentrically around the piston rod.

[0017] In an embodiment, a receiving section of the clamps formed by the central clamping element and the

outer clamping elements are arranged approximately perpendicular to the weft thread when the weft thread is taken up by the associated clamp, because such an arrangement is advantageous for catching the weft thread.

[0018] In alternative or in addition according to another embodiment, the distal end of the central clamping element that is directed towards a weft thread to be clamped forms an intake funnel with the distal end of the first outer clamping element and/or with the distal end of the second outer clamping element. This allows the weft thread to be taken up by the clamping device more easily. The clamping device can be arranged in a fixed position on the weaving machine.

[0019] According to an embodiment, the device also comprises an abutment which limits the movement of the first outer clamping element in the second position and/or an abutment which limits the movement of the second outer clamping element in the first position. This limits vibrations that may arise after reaching the first or second position of the clamping elements, whereby it is avoided that a clamped weft thread is laying free in the clamp, this means is let free, shortly after reaching the first or second position.

[0020] In preferred embodiments, the clamping device is arranged in a module. The module allows an easy and reliable positioning on the weaving machine. In an advantageous embodiment, the device is arranged in a fixed position on the weaving machine, this means in a fixed position with respect to a gripper path, a cloth line and a cloth edge. In preferred embodiments, the fixed position is adjustable and may be chosen suitably with respect to the gripper path, the cloth line and the cloth edge of the woven cloth in order to clamp the inserted weft threads.

[0021] In an embodiment, the module further comprises at least one thread guiding element arranged upstream of the clamping device according to the invention in insertion direction. In the context of the invention with insertion direction is meant the direction of the gripper movement. In preferred embodiments, the thread guiding element is arranged close to the gripper path in the vicinity of an area where the weft thread is taken up by the gripper. Integrating a guiding element in a module allows a reliable and simple assembly.

[0022] According to another embodiment, the module comprises in an alternative or in addition at least one cutting device arranged downstream of the central clamping element in weft direction. By providing a cutting device in a position adjacent to the cloth edge between the clamping device according to the invention and the cloth edge, inserted weft threads may be cut essentially to the same length and the weft thread ends protruding beyond the cloth edge may be kept to a minimum. In an embodiment, the cutting device comprises a stationary jaw and a movable jaw, for example of the type shown in WO 2009/007076 A1. The content of which is hereby incorporated by reference. In preferred embodiments, the module comprising the clamping device and the cutting device is arranged next to the cloth edge, wherein the weft thread ends may be cut to a length of less than 10mm, for example to lengths between 4mm and 8mm. According to an embodiment, the cutting device and the clamping device may be arranged in a certain position and also mutually arranged at a certain settable distance from each other. This setting may be either in the insertion direction as in the warp direction. The cutting device and the clamping device may herein be arranged as a unit or separately in a certain position.

[0023] In an embodiment, the module is arranged to be moveable towards and away from a gripper in a plane approximately parallel or parallel to the cloth edge of the woven cloth. According to an embodiment, the module is arranged at least partly on a rotatable shaft to be moved towards and away from the gripper. The arrangement allows to bring the device close to the gripper path in the vicinity of an area where a weft thread is taken up by the gripper, because such an arrangement is advantageous for keeping a weft thread end protruding beyond the thread clamp in the gripper short, which allows to keep the thread end protruding beyond the cloth edge at the opposite side of the shed under control, this means short.

[0024] The object is further solved by a method for clamping a weft thread in a weaving machine, more particularly in a rapier weaving machine, wherein an inserted weft thread is introduced in a device for clamping a weft thread arranged next to a cloth edge of the woven cloth, wherein the device comprises a central clamping element, a first outer clamping element and a second outer clamping element, wherein the central clamping element being forced in two opposite clamping directions to an intermediate position, wherein the central clamping element being sandwiched between the first outer clamping element and the second outer clamping element, when the central clamping element is positioned in the intermediate position, wherein the device further comprises a drive device adapted for displacing the central clamping element from the intermediate position in two clamping directions, a first clamping direction to at least one first position and a second clamping direction to at least one second position, wherein in the first position the central clamping element is at a distance from the first outer clamping element and in the second position the central clamping element is at a distance from the second outer clamping element, wherein compressed air is supplied to the drive device for displacing or moving the central clamping element in at least one of the intermediate position, the first position or the second position, and wherein a movement of first outer clamping element and the second outer clamping element towards each other is limited by means of at least one abutment element arranged between the first and the second outer clamping element, wherein a height of the central clamping element is larger than the total height of the at least one abutment element.

[0025] An actuating by supplying compressed air allows the central clamping element to be displaced with

a high reliability and at high speeds.

[0026] According to an embodiment, the drive device is a double acting pneumatic cylinder having a first chamber and a second chamber, wherein the first chamber is pressurized for moving the piston in the first position and a second chamber is pressurized for moving the piston in the second position.

[0027] The weft thread is clamped by the clamping device before the cutting device cuts the weft thread. For the subsequent insertion, the weft thread is released by the clamping device. According to a further embodiment, the gripper takes up a weft thread and the weft thread taken up by the gripper is pulled out of a clamp of the clamping device while the clamp is still closed. The clamp only opens afterwards by supplying compressed air.

Brief description of the drawings

[0028] In the following, embodiments of the invention will be described in detail based on several schematic drawings. Throughout the drawings, the same elements will be denoted by the same reference numerals.

Fig. 1 is a perspective view of a device for clamping a weft thread arranged on a rapier weaving machine;

Fig. 2 is a top view of the device for clamping a weft thread of Fig. 1;

Fig. 3 is a perspective detailed view of a device for clamping a weft thread of Fig. 1;

Fig. 4 is a perspective schematic partially cut and detailed view of a central clamping element of the device for clamping a weft thread of Fig. 1;

Fig. 5 is a perspective detailed view of an outer clamping element of the device for clamping a weft thread of Fig. 1;

Fig. 6 is a perspective detailed view of the device for clamping a weft thread of Fig. 1 in the intermediate position;

Fig. 7 is a view of the device of Fig. 6 in the first position;

Fig. 8 is a view of the device of Fig. 6 in the second position;

Fig. 9 is a perspective view of a device for clamping a weft thread according to a second embodiment;

Fig. 10 is a second perspective view of the device for clamping a weft thread of Fig. 9.

Fig. 11 is a top view of another device for clamping a weft thread according to the invention.

Detailed description of embodiments

[0029] Fig. 1 and 2 show a perspective view and a top view of a device 1 for clamping a weft thread, arranged on a rapier weaving machine, also named gripper weaving machine. The rapier weaving machine is only partly shown. The rapier weaving machine comprises presenting devices 2 for weft thread and a gripper 3. In the depicted embodiment, also a thread guiding element 4 and a cutting device 5 for weft thread are provided. In the depicted embodiment, the cutting device 5 is attached to the frame of the device 1 for clamping weft thread 6 and forms an assembly with the device 1 for clamping weft thread 6.

[0030] Weft threads 6 are schematically shown in Fig. 2. According to the insertion direction N, a weft thread 6 runs from the presenting device 2, via the gripper 3, the thread guiding element 4, the device 1 for clamping a weft thread 6, and the cutting device 5 to the cloth edge 8 and the woven cloth 9 with the cloth line 7. The cloth 9 can in this case support on a cloth support not shown. As indicated in Fig. 2 the cloth edge 8 is a side edge of the cloth 9 that extends in warp direction, while the cloth line 7 is the beat-up edge of the cloth 9 that extends in weft direction.

[0031] The thread guiding element 4 is preferably fixedly arranged on the weaving machine. The thread guiding element 4 comprises a guide plate 11 arranged near the gripper 3, which guide plate 11 is directed in the insertion direction N. Further a guide plate 12 is provided between the gripper 3 and the presenting device 2 which is directed in the insertion direction N in order to support a weft thread 6 to be inserted close to the presenting device 2 at the gripper 3.

[0032] The device 1 for clamping a weft thread is described in more detail with reference to Figures 3 to 8, showing the device 1 for clamping a weft thread and parts of the device 1 for clamping a weft thread in detail.

[0033] The device 1 comprises a central clamping element 10 shown in more detail in Fig. 4, a first outer clamping element 15, and a second outer clamping element 16, as shown in Fig. 5. As best seen in Fig. 6, the central clamping element 10 is movable supported, this means is forced in two opposite clamping directions to an intermediate position P shown in amongst others Fig. 6. The central clamping element 10 is sandwiched between the first outer clamping element 15 and the second outer clamping element 16 and makes contact with the first outer clamping element 15 and the second outer clamping element 16 when positioned in the intermediate position P. In other words, both the first clamp 20 formed by the central clamping element 10 and the first outer clamping element 15 and the second clamp 21 formed by the central clamping element 10 and the second outer clamping element 16 are closed in the intermediate po-

sition P in order to clamp a weft thread, each. In the depicted embodiment, two force elements 18, 19 designed as springs are provided in order to force the first outer clamping element 15 towards the central clamping element 10, and the second outer clamping element 16 towards the central clamping element 10, respectively.

[0034] The device 1 further comprises a drive device 22 adapted for displacing, this means moving the central clamping element 10 out of the intermediate position P as shown in Fig. 6 in two clamping directions K and L, this means in a clamping direction K to at least one first position and in a clamping direction L to at least one second position, for example in one clamping direction K downwards and in the other clamping direction L upwards in the orientation of the device 1 as shown in the figures 6 to 8, wherein as shown in Fig. 7, in the first position the central clamping element 10 is at a distance from the first outer clamping element 15, for example in case of an opened first clamp 20, and as shown in Fig. 8, in the second position the central clamping element 10 is at a distance from the second outer clamping element 16, for example in case of an opened second clamp 21.

[0035] As may be seen best in Fig. 4, the drive device 22 is a pneumatic double acting cylinder 30 comprising a piston 23, which piston 23 is directly coupled to the central clamping element 10 for a transmission of motion via the piston rod 24 of the piston 23. The central clamping element 10, the piston rod 24 and the piston 23 are mechanically coupled or manufactured as an assembly, so that the central clamping element 10 is moved directly by the piston 23. The piston 23 is herein balanced by two springs 13, 14 each provided in a chamber 27 or 28, also named pressure chamber, which springs 13, 14 force the piston 23 in a central position as long as no compressed air is fed. In consequence, without a pressure supply, the central clamping element 10 is held in the intermediate position. In other embodiments, the intermediate position is obtained by feeding compressed air to both chambers 27, 28. However, in this case it has to be ensured that no unbalancing due to pressure losses or similar effects occurs in order to avoid that the central clamping element 10 is forced in a direction, while supplying compressed air to both chambers 27, 28.

[0036] The outer clamping elements 15 and 16 are movable arranged and the two force elements 18, 19 ensure that the first clamp 20 and the second clamp 21 initially remain closed upon displacement of the central clamping element 10. The device 1 further comprises an abutment element 17 arranged between the first outer clamping element 15 and the second outer clamping element 16 in the movement path of the outer clamping elements 15, 16, wherein a height H1 of the central clamping element 10 is larger than a height H2 of the abutment element 17, as may be seen in Figures 5 and 6. The difference in height between H1 and H2 defines the play over which the clamping elements 15 and 16, which are part of a mass and spring system, are able to move or vibrate without making contact with the abutment element 17 and without the clamps 20 and 21 are opened and release a weft thread. The play is herein chosen taking into account the properties of the mass and spring system and the damping present in this mass and spring system. When the central clamping element 10 is arranged in the intermediate position as shown, the abutment element 17 does not make contact with any of the outer clamping elements 15 or 16. The depicted abutment element 17 is fork shaped, wherein the two tips of the fork shaped element surround the central clamping element 10 without limiting a movement of the central clamping element 10 in the two clamping directions K and L. The two tips of the abutment element 17 may limit the movement of the clamping elements 15 and 16 by abutting against broadenings provided at the clamping elements 15 and 16.

[0037] According to an embodiment not shown two abutment elements are provided, for example each of which formed by a fork shaped element. These two abutment elements are arranged at a distance from one another and can each co-operate with an associated outer clamping element 15 or 16, and in this way function together as the one piece clamping element 17.

[0038] When moving the central clamping element 10 downwards in clamping direction K, the force element 18 loads the first outer clamping element 15 in order to follow the movement of the central clamping element 10 until the first outer clamping element 15 abuts against the abutment element 17 so that the first clamp 20 opens, while the second clamp 21 remains closed. When moving the central clamping element 10 upwards in clamping direction L, the force element 19 loads the second outer clamping element 16 in order to follow the movement of the central clamping element 10 until the second outer clamping element 16 abuts against the abutment element 17 so that the second clamp 21 opens, while the first clamp 20 remains closed. In an embodiment, the abutment element 17 and the central clamping element 10 are aligned in an intermediate position, wherein through a slit 65 a positioning screw 29 is provided for aligning the abutment element 17 in relation to the central clamping element 10 in the intermediate position. As may be seen in Fig. 4 an alien screw 60 is arranged rotatable in the housing 22. By screwing the alien screw 60 more or less into the housing 22, the intermediate position of the piston 23 can be set relatively accurately and also the force applied by the springs 13 and 14 on the piston 23 can be set.

[0039] As mentioned above, the drive device 22 is a pneumatic acting double cylinder 30 comprising a piston 23, arranged between two chambers 27 and 28, wherein a spring 13, 14 is provided in each chamber 27, 28. Compressed air is supplied to each of the two chambers 27, 28 via respective ducts 31, 32 with valves 33, 34 for interrupting the air supply.

[0040] By supplying compressed air via the duct 31 and the valve 33 in the chamber 27 of the spring 13, the central clamping element 10 and the two outer clamping

elements 15, 16 are moved downwards until the first outer clamping element 15 abuts against the abutment element 17 so that the first clamp 20 opens and the second clamp 21 remains closed. If compressed air is supplied via the duct 32 and the valve 34 in the chamber 28 of the spring 14, the central clamping element 10 and the two outer clamping elements 15, 16 are moved upwards until the second outer clamping element 16 abuts against the abutment element 17 so that the second clamp 21 opens and the first clamp 20 remains closed. If no compressed air is fed, then the springs 13, 14 force the central clamping element 10 in its intermediate position. The strength of the springs 13 and 14 is preferably higher than the strength of the force elements 18, 19.

[0041] In an alternative embodiment, the force elements 18, 19 take over the function of the springs 13 and 14 and the springs 13, 14 may be omitted. In this case, a balancing of the force elements 18, 19 is to be ensured.

[0042] In the embodiment shown, the outer clamping elements 15, 16 are formed as plates that are fixed on guiding shafts 25, 26. The guiding shafts 25, 26 are of tubular shape and coaxially arranged with the piston rod 24, so that the guiding shafts 25, 26 surround the piston rod 24 and the piston rod 24 is displaceable inside the tubular shaped guiding shafts 25, 26. The tubular shaped guiding shafts 25, 26 allow that the outer clamping elements 15 and 16 move coaxially with the guiding shafts 25, 26, but independent of the piston rod 24. In the embodiment shown, the length of the tubular shaped guiding shafts 25, 26 is further chosen so that the movement of the outer clamping elements 15, 16 is limited by additional abutments 51, 52. The abutment 51 forms part of a ring element 66 and limits the movement of the first clamping element 15 in the second position, while the abutment 52 forms part of a ring element 67 and limits the movement of the second clamping element 16 in the first position. When the first outer clamping element 15 via the guiding shaft 25 abuts against the abutment 51, the first outer clamping element 15 is almost not able to vibrate, since the first outer clamping element 15 is held between the abutment 51 and the central clamping element 10, and a weft thread is with certainty clamped further by the clamp 20. When the second outer clamping element 16 via the guiding shaft 26 abuts against the abutment 52, the second outer clamping element 16 is almost not able to vibrate, since the second outer clamping element 16 is held between the abutment 52 and the central clamping element 10, and a weft thread is with certainty clamped further by the clamp 21. At the tubular shaped guiding shafts 25, 26 the outer clamping elements 15, 16 respectively have a feed-through opening 61, 62 where through the piston rod 24 is movable.

[0043] In an embodiment shown, the central clamping element 10 is provided with a distal end 53 shaped as a wedge shaped tip. The distal end 54 of the first outer clamping element 15 and the distal end 55 of the second outer clamping element 16 are each bent away from the central clamping element 10, more particularly bent in such a way that the distal ends 54, 55 each form an intake funnel 56, 57 with the distal end 53 of the central clamping element 10. The distal ends 53 and 54 form a receiving section 58 for the one weft thread, while the distal ends 53 and 55 form a receiving section 59 for the other weft thread.

[0044] As best seen in Fig. 3, the device 1 is arranged in a module 35 and can be positioned with respect to the weaving machine using two positioning elements 36, 37. This allows a reliable and easy positioning of the device 1. The module 35, for example, comprises also the thread guiding element 4 that is arranged in insertion direction N upstream of the central clamping element 10 of the device 1. The module 35, for example, also comprises the cutting device 5 that is arranged in insertion direction N downstream of the central clamping element 10 of the device 1. According to a variant not shown, all aforementioned elements may be arranged separately at a settable distance from each other.

[0045] Fig. 9 and 10 show an alternative embodiment, wherein the device 1 is provided with a module 35, which module 35 is arranged to be movable towards and away from the gripper 3 according to arrow P in a plane parallel or approximately parallel to the cloth edge 8 of the woven cloth 9. The device 1 is similar to the device of Figures 1 to 8 and the same or similar elements will be denoted by the same reference numerals. In the depicted embodiment, an arm 38 is provided that can be moved to and fro by a drive mechanism 39, such as a cam drive mechanism, arranged on a frame 40. The device 1 is attached to the arm 38.

[0046] The arm 38 is arranged on a rotatable shaft 41, which shaft 41 is driven via a rod 42, a coupling rod 43 and a lever 44 by the cams 48. The position of the coupling rod 43 on the lever 44 may be adjusted by using a bolt 45 arranged in a slot 46 provided on the lever 44 in order to set the moving course of the device 1. A spring 47 forces the lever 44 into contact with the cams 48. In preferred embodiments, the drive axis 49 for the cams 48 is synchronised with the movement of the weaving machine, for example via a mechanical coupling or via a drive by an own controllable drive motor, in order to avoid that the device 1 according to the invention may come into contact with a reed 50 or with a sley 63 on which a reed can be fixed, shown in Fig. 2. In an alternative embodiment, instead of a drive system with cams, a pneumatic system and/or an electromagnetic system can be provided for moving the device 1 towards and away from the gripper 3. In an embodiment, the valves 33, 34 for regulating the supply of compressed air via the ducts 31, 32 are fixedly arranged on the frame 40. By moving the arm 38 in the rotation direction R, the device 1 according to the invention may be positioned towards or away from the gripper 3. Herein the device 1 can be arranged close to the gripper 3 during the taking up of a weft thread by the gripper 3 and during the taking up of a weft thread by the device 1 be arranged away from the gripper 3 and almost be arranged in the elongation of the cloth line 7.

[0047] According to the embodiment of Fig. 11 at the thread guiding element 4, for example at the guiding plate 11 at the side of the thread guiding element 4 faced away from the cloth edge 8, a suction nozzle 64 may be arranged for catching and holding weft threads that are released unwanted from the device 1 for clamping a weft thread. This allows to still catch and keep such weft threads in the suction nozzle 64, so that these weft threads still can be taken up and inserted by the gripper 3 during a next insertion and subsequently be clamped again in the device 1 for clamping weft thread according to the invention.

[0048] During the insertion of a weft thread, the device 1 is brought in such a position that the inserted weft thread can be taken up in an opened clamp 20 or 21 and subsequently be clamped by closing this clamp 20, 21. Preferably, the device 1 is arranged so that during the taking up the weft thread extends almost perpendicular to the direction of the taking up of the weft thread in the clamp 20 or 21. Subsequently the clamped weft thread is cut off by the cutting device 5 between the device 1 and the cloth 9. During a subsequent insertion a weft thread presented by the presenting device 2 is taken up by the gripper 3 and inserted in the shed, wherein this weft thread is pulled out of the device 1 by the gripper 3 while the associated clamp 20, 21 is preferably still closed and the weft thread is released by the device 1. Preferably, the associated clamp 20 or 21 is opened afterwards in order to take up an inserted weft thread.

[0049] The device 1 for clamping a weft thread is adapted to co-operate with two weft threads. However, in embodiments not shown several such devices for clamping a weft thread are provided. The devices for clamping a weft thread are preferably each arranged on a movable frame, which thus allows to weave with more than two weft threads and more than two presenting devices for weft thread. In an embodiment, two devices according to the invention are used which are arranged mirror symmetrical to each other. At the cloth edge 8 the cloth 9 can be bound by so-called leno-threads which are arranged approximately parallel to and next to the warp threads.

[0050] The device and the method for clamping a weft thread according to the invention are not limited to the embodiments shown and described by way of example, but can also comprise variants and combinations of these embodiments that fall under the claims.

Claims

1. Device for clamping a weft thread (6) in a weaving machine, the device (1) comprises a central clamping element (10), a first outer clamping element (15) and a second outer clamping element (16), wherein the central clamping element (10) is forced in two opposite clamping directions (K, L) to an intermediate position (P), wherein the central clamping element (10) is sandwiched between the first outer clamping element (15) and the second outer clamping element (16) when the central clamping element (10) is positioned in the intermediate position (P), wherein both the first outer clamping element (15) and the second outer clamping element (16) abut against the central clamping element (10) in the intermediate position, the device (1) further comprises a drive device (22) adapted for displacing the central clamping element (10) out of the intermediate position (P) in two clamping directions (K, L), a first clamping direction (K) to at least a first position and a second clamping direction (L) to at least a second position, wherein in the first position the central clamping element (10) is at a distance from the first outer clamping element (15) and in the second position the central clamping element (10) is at a distance from the second outer clamping element (16), **characterized in that** the drive device (22) comprises

   - a pneumatic cylinder (30) comprising at least a piston (23), wherein the piston (23) and/or a piston rod (24) of the piston (23) is formed integrally with or is mechanically coupled to the central clamping element (10) for a transmission of motion in the clamping directions (K, L) and
   - at least one abutment element (17) arranged between the first outer clamping element (15) and the second outer clamping element (16) for limiting a movement of the first outer clamping element (15) and the second outer clamping element (16) towards each other, wherein a height (H1) of the central clamping element (10) is larger than the total height (H2) of the at least one abutment element (17).

2. The device according to claim 1, **characterized in that** the pneumatic cylinder (30) is a double acting pneumatic cylinder, which is displaceable to the intermediate position, the first position and the second position.

3. The device according to claim 1 or 2, **characterized in that** the pneumatic cylinder (30) comprises at least a spring (13, 14), preferably two springs, loading the piston (23).

4. The device according to any one of claims 1 to 3, **characterized in that** the device (1) further comprises a first force element (18) forcing the first outer clamping element (15) towards the central clamping element (10) and a second force element (19) forcing the second outer clamping element (16) towards the central clamping element (10), wherein the at least one abutment element (17) limits a displacement of the first and the second outer clamping element (15, 16) caused by the displacement of the central clamping element (10) and a force applied by the first or

the second force element (18, 19) on the first and the second outer clamping element (15, 16), respectively.

5. The device according to any one of claims 1 to 4, **characterized in that** the first outer clamping element (15) and/or the second outer clamping element (16) are formed as a plate, which plate being fixed to a guiding shaft (25, 26).

6. The device according to any one of claims 1 to 5, **characterized in that** the outer clamping elements (15, 16) comprise a guiding shaft (25, 26) that is guided coaxially with respect to a piston rod (24) of the piston (23).

7. The device according to any one of claims 1 to 6, **characterized in that** the central clamping element (10) comprises a distal end (53), wherein the distal end (53) facing a weft thread (6) to be clamped forms an intake funnel (56, 57) with the distal end (54) of the first outer clamping element (15) and/or with the distal end (55) of the second outer clamping element (16).

8. The device according to any one of claims 1 to 7, **characterized in that** the device (1) comprises an abutment (51) which limits the movement of the first outer clamping element (15) in the second position and comprises an abutment (52) which limits the movement of the second outer clamping element (16) in the first position.

9. The device according to any one of claims 1 to 8, **characterized in that** the device (1) is arranged in a module (35).

10. The device according to claim 9, **characterized in that** the module (35) further comprises at least a thread guiding element (4) arranged upstream of the central clamping element (10) in insertion direction (N).

11. The device according to claim 9 or 10, **characterized in that** the module (35) comprises at least a cutting device (5) arranged downstream of the central clamping element (10) in insertion direction (N).

12. The device according to any one of claims 9 to 11, **characterized in that** the module (35) is arranged to be movable towards and away from a gripper (3) in a plane approximately parallel or parallel to the cloth edge (8) of the cloth (9).

13. Method for clamping a weft thread (6) in a weaving machine, wherein an inserted weft thread is introduced in a device (1) for clamping a weft thread (6) arranged next to a cloth edge (8) of the cloth (9), wherein the device (1) comprises a central clamping element (10), a first outer clamping element (15) and a second outer clamping element (16), wherein the central clamping element (10) is forced in two opposite clamping directions (K, L) to an intermediate position (P), wherein the central clamping element (10) is sandwiched between the first outer clamping element (15) and the second outer clamping element (16) when the central clamping element (10) is positioned in the intermediate position (P), wherein the central clamping element (10) is displaceable from an intermediate position (P) in two clamping directions (K, L), a first clamping direction (K) to at least a first position, wherein the central clamping element (10) is at a distance from the first outer clamping element (15), and a second clamping direction (L) to at least a second position, wherein the central clamping element (10) is at a distance from the second outer clamping element (16), **characterized in that**

- -compressed air is supplied to a drive device (22) for displacing the central clamping element (10) in at least one of the intermediate position, the first position or the second position, and
- a movement of the first outer clamping element (15) and the second outer clamping element (16) towards each other is limited by means of at least one abutment element (17) arranged between the first and the second outer clamping element (15, 16), wherein a height (H1) of the central clamping element (10) is larger than the total height (H2) of the at least one abutment element (17).

14. Method according to claim 13, **characterized in that** the drive device (22) is a double acting cylinder (30) with a first chamber (27) and a second chamber (28), wherein the first chamber (27) is pressurized for moving the cylinder (30) in the first position and a second chamber (28) is pressurized for moving the cylinder (30) in the second position.

15. Method according to claim 13 or 14, **characterized in that** the weft thread (6) is taken up by a gripper (3) and the weft thread (6) taken up by the gripper (3) is pulled out of the clamp (20, 21) while the clamp (20, 21) is still closed.

Patentansprüche

1. Vorrichtung zum Klemmen eines Schussfadens (6) in einer Webmaschine, die Vorrichtung (1) umfasst ein zentrales Klemmelement (10), ein erstes äusseres Klemmelement (15) und ein zweites äusseres Klemmelement (16), wobei das zentrale Klemmelement (10) in zwei entgegengesetzten Klemmrichtun-

gen (K, L) zu einer Zwischenposition (P) gezwungen wird, wobei das zentrale Klemmelement (10) sandwichartig zwischen dem ersten äusseren Klemmelement (15) und dem zweiten äusseren Klemmelement (16) eingeklemmt ist, wenn das zentrale Klemmelement (10) in der Zwischenposition (P) positioniert ist, wobei sowohl das erste äussere Klemmelement (15) und das zweite äussere Klemmelement (16) in der Zwischenposition (P) gegen das zentrale Klemmelement (10) anschlagen, die Vorrichtung (1) umfasst weiter eine Antriebsvorrichtung (22), die angepasst ist zum Verschieben des zentralen Klemmelements (10) aus der Zwischenposition (P) in zwei Klemmrichtungen (K, L), eine erste Klemmrichtung (K) zu mindestens einer ersten Position und eine zweite Klemmrichtung (L) zu mindestens einer zweiten Position, wobei in der ersten Position das zentrale Klemmelement (10) in einem Abstand von dem ersten äusseren Klemmelement (15) ist und in der zweiten Position das zentrale Klemmelement (10) in einem Abstand von dem zweiten äusseren Klemmelement (16) ist,
dadurch gekennzeichnet, dass die Antriebsvorrichtung (22) umfasst

- einen pneumatischen Zylinder (30) umfassend mindestens einen Kolben (23), wobei der Kolben (23) und/oder eine Kolbenstange (24) des Kolbens (23) integral ausgebildet ist mit oder mechanisch gekoppelt ist an das zentrale Klemmelement (10) für eine Bewegungsübertragung in die Klemmrichtungen (K, L) und
- mindestens ein Anschlagelement (17), das zwischen dem ersten äusseren Klemmelement (15) und dem zweiten äusseren Klemmelement (16) angeordnet ist, zum Begrenzen einer Bewegung des ersten äusseren Klemmelements (15) und des zweiten äusseren Klemmelements (16) aufeinander zu, wobei eine Höhe (H1) des zentralen Klemmelements (10) grösser ist als die Gesamthöhe (H2) des mindestens einen Anschlagelements (17).

2. Die Vorrichtung nach Anspruch 1, **dadurch gekennzeichnet, dass** der pneumatische Zylinder (30) ein doppeltwirkender pneumatischer Zylinder ist, welcher zu der Zwischenposition, der ersten Position und der zweiten Position verschiebbar ist.

3. Die Vorrichtung nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** der pneumatische Zylinder (30) mindestens eine Feder (13, 14), vorzugsweise zwei Federn, umfasst, die den Kolben (23) belastet.

4. Die Vorrichtung nach einem der Ansprüche 1 bis 3, **dadurch gekennzeichnet, dass** die Vorrichtung (1) weiter ein erstes Kraftelement (18), das das erste äussere Klemmelement (15) zum zentralen Klemmelement (10) hin zwingt, und ein zweites Kraftelement (19), das das zweite äussere Klemmelement (16) zum zentralen Klemmelement (10) hin zwingt, umfasst, wobei das mindestens eine Anschlagelement (17) eine Verschiebung des ersten und des zweiten äusseren Klemmelements (15, 16) begrenzt, die durch die Verschiebung vom zentralen Klemmelement (10) verursacht wird, und eine Kraft, die jeweils von dem ersten oder dem zweiten Kraftelement (18, 19) auf das erste und das zweite äussere Klemmelement (15, 16) ausgeübt wird.

5. Die Vorrichtung nach einem der Ansprüche 1 bis 4, **dadurch gekennzeichnet, dass** das erste äussere Klemmelement (15) und/oder das zweite äussere Klemmelement (16) als eine Platte ausgebildet sind, welche Platte an einer Führungswelle (25, 26) befestigt ist.

6. Die Vorrichtung nach einem der Ansprüche 1 bis 5, **dadurch gekennzeichnet, dass** die äusseren Klemmelemente (15, 16) eine Führungswelle (25, 26) umfassen, die koaxial zu einer Kolbenstange (24) des Kolbens (23) geführt ist.

7. Die Vorrichtung nach einem der Ansprüche 1 bis 6, **dadurch gekennzeichnet, dass** das zentrale Klemmelement (10) ein distales Ende (53) umfasst, wobei das distale Ende (53), das einem zu klemmenden Schussfaden (6) zugewandt ist, eine Einführungsöffnung (56, 57) mit dem distalen Ende (54) des ersten äusseren Klemmelements (15) und/oder mit dem distalen Ende (55) des zweiten äusseren Klemmelements (16) bildet.

8. Die Vorrichtung nach einem der Ansprüche 1 bis 7, **dadurch gekennzeichnet, dass** die Vorrichtung (1) einen Anschlag (51) umfasst, der die Bewegung des ersten äusseren Klemmelements (15) in die zweite Position begrenzt, und einen Anschlag (52) umfasst, der die Bewegung des zweiten äusseren Klemmelements (16) in die erste Position begrenzt.

9. Die Vorrichtung nach einem der Ansprüche 1 bis 8, **dadurch gekennzeichnet, dass** die Vorrichtung (1) in einem Modul (35) angeordnet ist.

10. Die Vorrichtung nach Anspruch 9, **dadurch gekennzeichnet, dass** das Modul (35) weiter mindestens ein Fadenführungselement (4) umfasst, das stromaufwärts von dem zentralen Klemmelement (10) in Eintragrichtung (N) angeordnet ist.

11. Die Vorrichtung nach Anspruch 9 oder 10, **dadurch gekennzeichnet, dass** das Modul (35) mindestens eine Schneidvorrichtung (5) umfasst, die stromabwärts von dem zentralen Klemmelement (10) in Eintragrichtung (N) angeordnet ist.

12. Die Vorrichtung nach einem der Ansprüche 9 bis 11, **dadurch gekennzeichnet, dass** das Modul (35) so angeordnet ist, dass es zu einem Greifer (3) hin und davon weg bewegbar ist in einer Ebene, die etwa parallel oder parallel zur Gewebekante (8) des Gewebes (9) liegt.

13. Verfahren zum Klemmen eines Schussfadens (6) in einer Webmaschine, wobei ein eingetragener Schussfaden in eine Vorrichtung (1) zum Klemmen eines Schussfadens (6) eingeführt wird, die neben einer Gewebekante (8) des Gewebes (9) angeordnet ist, wobei die Vorrichtung (1) ein zentrales Klemmelement (10), ein erstes äusseres Klemmelement (15) und ein zweites äusseres Klemmelement (16) umfasst, wobei das zentrale Klemmelement (10) in zwei entgegengesetzten Klemmrichtungen (K, L) zu einer Zwischenposition (P) gezwungen wird, wobei das zentrale Klemmelement (10) sandwichartig zwischen dem ersten äusseren Klemmelement (15) und dem zweiten äusseren Klemmelement (16) eingeklemmt ist, wenn das zentrale Klemmelement (10) in der Zwischenposition (P) positioniert ist, wobei das zentrale Klemmelement (10) aus einer Zwischenposition (P) in zwei Klemmrichtungen (K, L) verschiebbar ist, eine erste Klemmrichtung (K) zu mindestens einer ersten Position, wobei das zentrale Klemmelement (10) in einem Abstand von dem ersten äusseren Klemmelement (15) ist, und eine zweite Klemmrichtung (L) zu mindestens einer zweiten Position, wobei das zentrale Klemmelement (10) in einem Abstand von dem zweiten äusseren Klemmelement (16) ist, **dadurch gekennzeichnet, dass**

- Druckluft zu einer Antriebsvorrichtung (22) zugeführt wird zum Verschieben des zentralen Klemmelements (10) in mindestens eine der Zwischenposition, der ersten Position oder der zweiten Position, und
- eine Bewegung des ersten äusseren Klemmelements (15) und des zweiten äusseren Klemmelements (16) aufeinander zu durch mindestens ein zwischen dem ersten und dem zweiten äusseren Klemmelement (15, 16) angeordnetes Anschlagelement (17) begrenzt ist, wobei eine Höhe (H1) des zentralen Klemmelements (10) grösser ist als die Gesamthöhe (H2) des mindestens einen Anschlagelements (17).

14. Verfahren nach Anspruch 13, **dadurch gekennzeichnet, dass** die Antriebsvorrichtung (22) ein doppeltwirkender pneumatischer Zylinder (30) mit einer ersten Kammer (27) und einer zweiten Kammer (28) ist, wobei die erste Kammer (27) mit Druck beaufschlagt wird, um den Zylinder (30) in die erste Position zu bewegen, und eine zweite Kammer (28) mit Druck beaufschlagt wird, um den Zylinder (30) in die zweite Position zu bewegen.

15. Verfahren nach Anspruch 13 oder 14, **dadurch gekennzeichnet, dass** der Schussfaden (6) von einem Greifer (3) aufgenommen wird und der vom Greifer (3) aufgenommene Schussfaden (6) aus der Klemme (20,21) herausgezogen wird, während die Klemme (20, 21) noch geschlossen ist.

Revendications

1. Dispositif pour serrer un fil de trame (6) dans une machine à tisser, le dispositif (1) comprend un élément de serrage central (10), un premier élément de serrage extérieur (15) et un deuxième élément de serrage extérieur (16), dans lequel l'élément de serrage central (10) est forcé dans deux directions de serrage opposées (K, L) à une position intermédiaire (P), dans lequel l'élément de serrage central (10) est pris en sandwich entre le premier élément de serrage extérieur (15) et le deuxième élément de serrage extérieur (16) quand l'élément de serrage central (10) est positionné dans la position intermédiaire (P), dans lequel à la fois le premier élément de serrage extérieur (15) et le deuxième élément de serrage extérieur (16) butent contre l'élément de serrage central (10) dans la position intermédiaire, le dispositif (1) comprend en outre un dispositif d'entraînement (22) adapté pour déplacer l'élément de serrage central (10) hors de la position intermédiaire (P) dans deux directions de serrage (K, L), une première direction de serrage (K) vers au moins une première position et une deuxième direction de serrage (L) vers au moins une deuxième position, dans lequel dans la première position l'élément de serrage central (10) est à une distance du premier élément de serrage extérieur (15) et dans la deuxième position l'élément de serrage central (10) est à une distance du deuxième élément de serrage extérieur (16), **caractérisé en ce que** le dispositif d'entraînement (22) comprend

- un cylindre pneumatique (30) comprenant au moins un piston (23), dans lequel le piston (23) et/ou une tige de piston (24) du piston (23) est formé intégralement avec ou est couplé mécaniquement à l'élément de serrage central (10) pour une transmission de mouvement dans les directions de serrage (K, L) et
- au moins un élément de butée (17) disposé entre le premier élément de serrage extérieur (15) et le deuxième élément de serrage extérieur (16) pour limiter un mouvement du premier élément de serrage extérieur (15) et du deuxième élément de serrage extérieur (16) l'un vers l'autre, dans lequel une hauteur (H1) de l'élément de serrage central (10) est plus grande que l'hauteur totale (H2) de l'au moins un élément de butée (17).

2. Le dispositif selon la revendication 1, **caractérisé en ce que** le cylindre pneumatique (30) est un cylindre à double effet, qui est déplaçable à la position intermédiaire, la première position et la deuxième position.

3. Le dispositif selon la revendication 1 ou 2, **caractérisé en ce que** le cylindre pneumatique (30) comprend au moins un ressort (13, 14), de préférence deux ressorts, chargeant le piston (23).

4. Le dispositif selon l'une quelconque des revendications 1 à 3, **caractérisé en ce que** le dispositif (1) comprend en outre un premier élément de force (18) forçant le premier élément de serrage extérieur (15) vers l'élément de serrage central (10) et un deuxième élément de force (19) forçant le deuxième élément de serrage extérieur (16) vers l'élément de serrage central (10), dans lequel l'au moins un élément de butée (17) limite un déplacement du premier et du deuxième élément de serrage extérieur (15, 16) causé par le déplacement de l'élément de serrage central (10) et une force appliquée par le premier ou le deuxième élément de force (18, 19) au premier et deuxième élément de serrage extérieur (15, 16) respectivement.

5. Le dispositif selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le premier élément de serrage extérieur (15) et/ou le deuxième élément de serrage extérieur (16) sont formés comme une plaque, laquelle plaque est fixée à un arbre de guidage (25, 26).

6. Le dispositif selon l'une quelconque des revendications 1 à 5, **caractérisé en ce que** les éléments de serrage extérieur (15, 16) comprennent un arbre de guidage (25, 26) qui est guidé coaxialement par rapport à une tige de piston (24) du piston (23).

7. Le dispositif selon l'une quelconque des revendications 1 à 6, **caractérisé en ce que** l'élément de serrage central (10) comprend une extrémité distale (53), dans lequel l'extrémité distale (53) faisant face à un fil de trame (6) à serrer forme une orifice d'entrée (56, 57) avec l'extrémité distale (54) du premier élément de serrage extérieur (15) et/ou avec l'extrémité distale (55) du deuxième élément de serrage extérieur (16).

8. Le dispositif selon l'une quelconque des revendications 1 à 7, **caractérisé en ce que** le dispositif (1) comprend une butée (51) qui limite le mouvement du premier élément de serrage extérieur (15) dans la deuxième position et comprend une butée (52) qui limite le mouvement du deuxième élément de serrage extérieur (16) dans la première position.

9. Le dispositif selon l'une quelconque des revendications 1 à 8, **caractérisé en ce que** le dispositif (1) est disposé dans un module (35).

10. Le dispositif selon la revendication 9, **caractérisé en ce que** le module (35) comprend en outre au moins un élément de guidage de fil (4) disposé en amont de l'élément de serrage central (10) en direction d'insertion (N).

11. Le dispositif selon la revendication 9 ou 10, **caractérisé en ce que** le module (35) comprend au moins un dispositif de coupe (5) disposé en aval de l'élément de serrage central (10) en direction d'insertion (N).

12. Le dispositif selon l'une quelconque des revendications 9 à 11, **caractérisé en ce que** le module (35) est disposé de manière à être mobile vers et à distance d'une pince (3) dans un plan approximativement parallèle ou parallèle au bord du tissu (8) du tissu (9).

13. Procédé pour serrer un fil de trame (6) dans une machine à tisser, dans lequel un fil de trame inséré est introduit dans un dispositif (1) pour serrer un fil de trame (6) disposé à côté d'un bord du tissu (8) du tissu (9), dans lequel le dispositif (1) comprend un élément de serrage central (10), un premier élément de serrage extérieur (15) et un deuxième élément de serrage extérieur (16), dans lequel l'élément de serrage central (10) est forcé dans deux directions de serrage opposées (K, L) à une position intermédiaire (P), dans lequel l'élément de serrage central (10) est pris en sandwich entre le premier élément de serrage extérieur (15) et le deuxième élément de serrage extérieur (16) quand l'élément de serrage central (10) est positionné dans la position intermédiaire (P), dans lequel l'élément de serrage central (10) est déplaçable d'une position intermédiaire (P) dans deux directions de serrage (K, L), une première direction de serrage (K) vers au moins une première position, dans lequel l'élément de serrage central (10) est à une distance du premier élément de serrage extérieur (15), et une deuxième direction de serrage (L) vers au moins une deuxième position, dans lequel l'élément de serrage central (10) est à une distance du deuxième élément de serrage extérieur (16), **caractérisé en ce que**

- de l'air comprimé est fourni à un dispositif d'entraînement (22) pour déplacer l'élément de serrage central (10) dans au moins l'une de la position intermédiaire, de la première position ou de la deuxième position, et
- un mouvement du premier élément de serrage extérieur (15) et du deuxième élément de serrage extérieur (16) l'un vers l'autre est limité au

moyen d'au moins un élément de butée (17) disposé entre le premier et le deuxième élément de serrage extérieur (15, 16), dans lequel une hauteur (H1) de l'élément de serrage central (10) est plus grande que l'hauteur totale (H2) de l'au moins un élément de butée (17).

14. Procédé selon la revendication 13, **caractérisé en ce que** le dispositif d'entraînement (22) est un cylindre à double effet (30) avec une première chambre (27) et une deuxième chambre (28), dans lequel la première chambre (27) est pressurisée pour mouvoir le cylindre (30) dans la première position et une deuxième chambre (28) est pressurisée pour mouvoir le cylindre (30) dans la deuxième position.

15. Procédé selon la revendication 13 ou 14, **caractérisé en ce que** le fil de trame (6) est pris par une pince (3) et le fil de trame (6) pris par la pince (3) est tiré hors de la pince (20, 21) tandis que la pince (20, 21) est encore fermée.

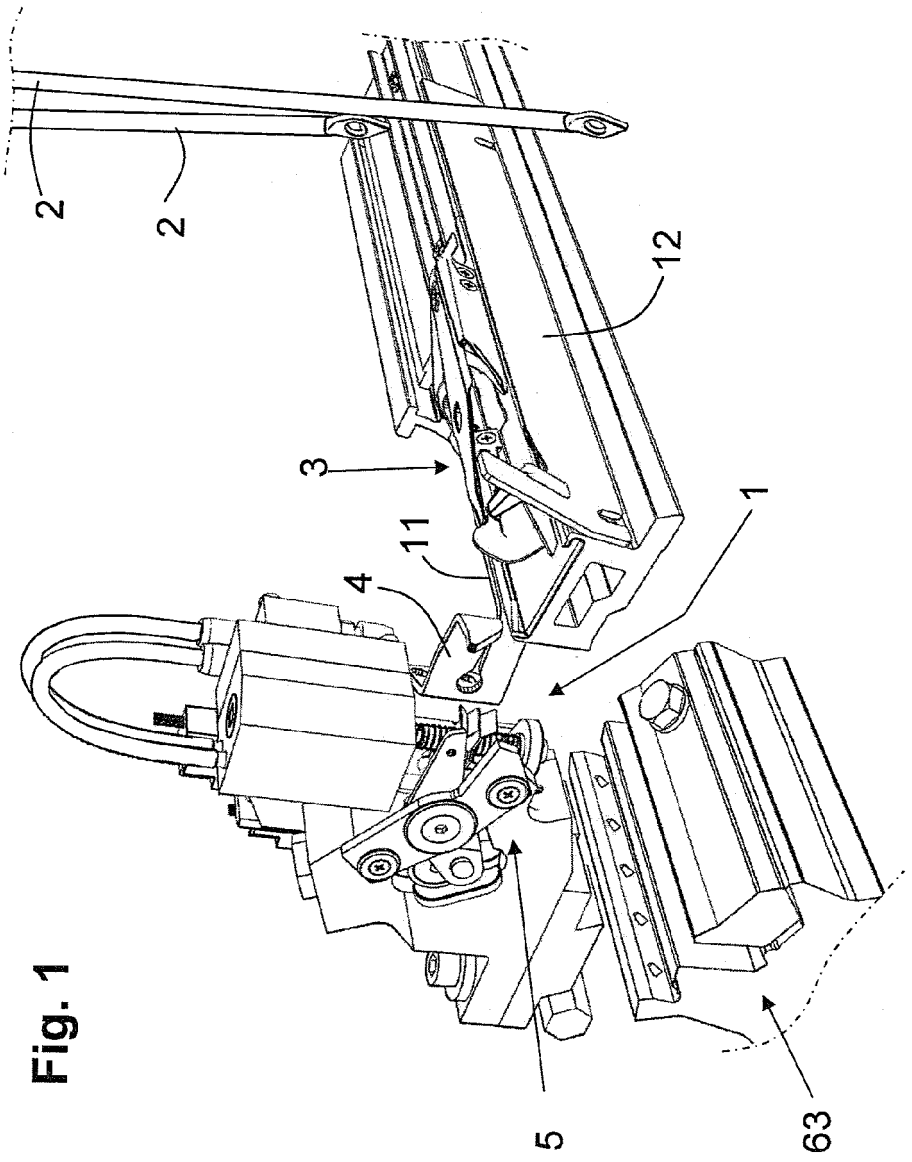
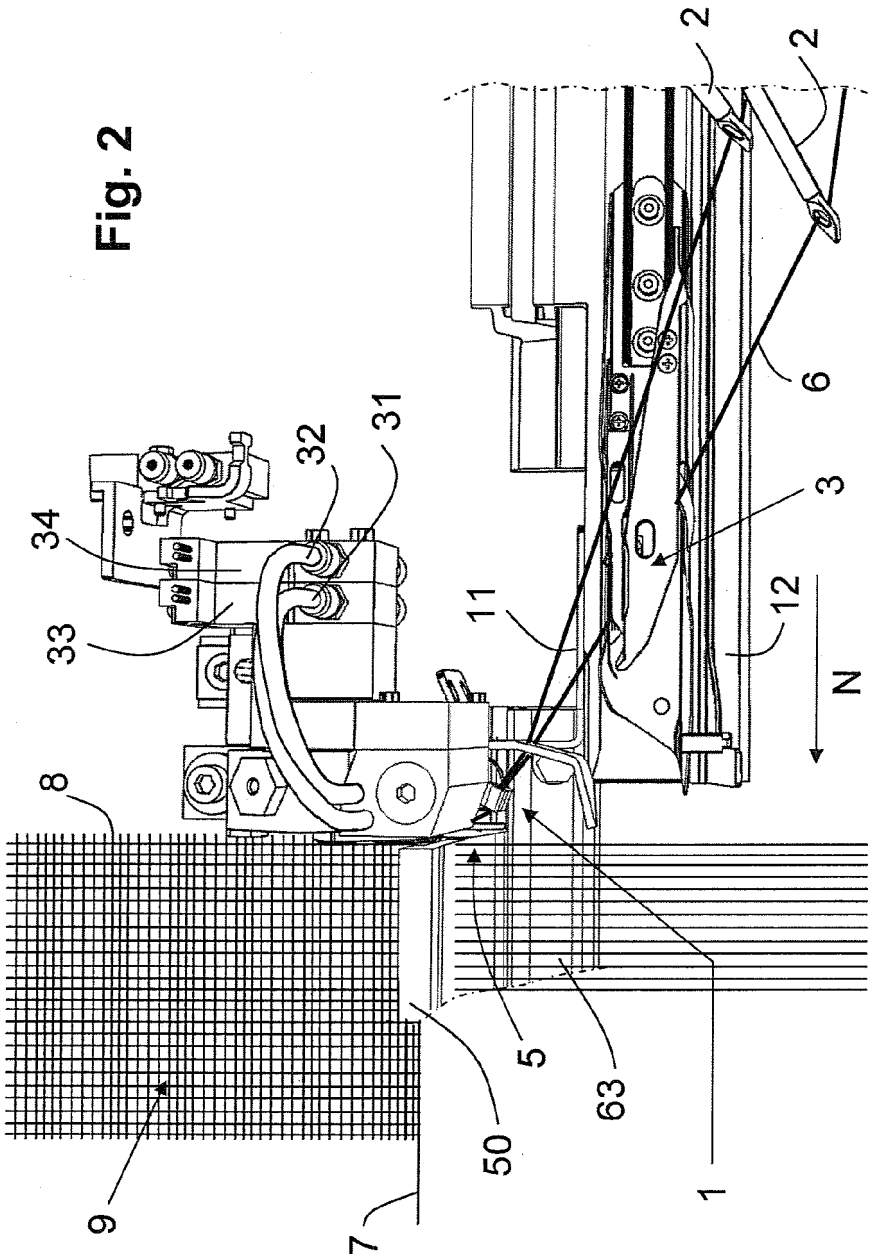


Fig. 1

Fig. 2



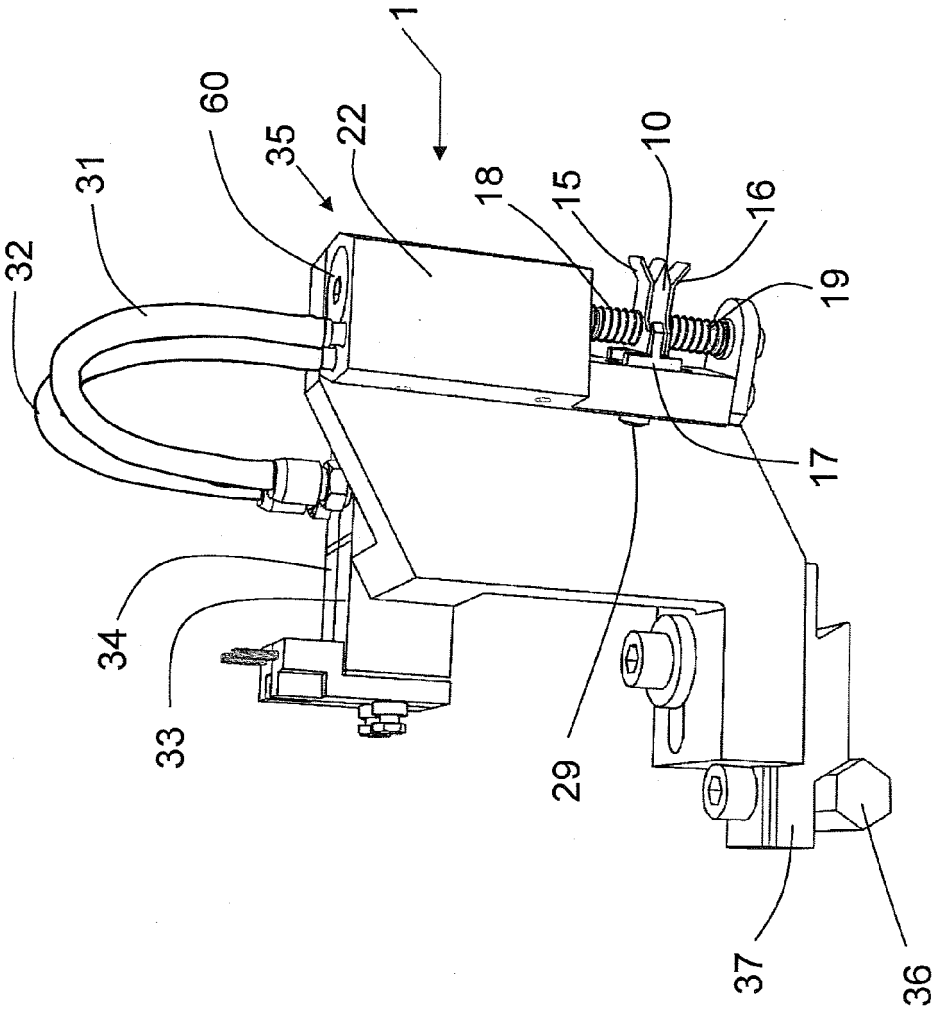


Fig. 3

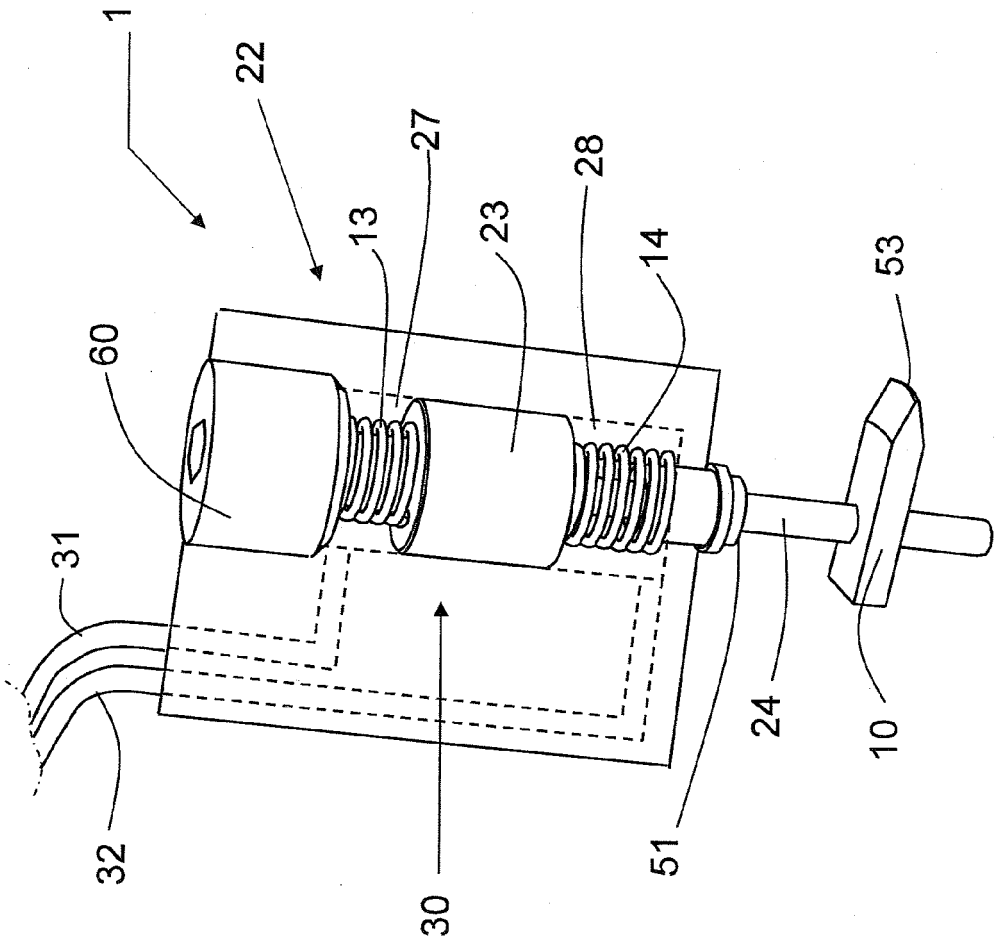
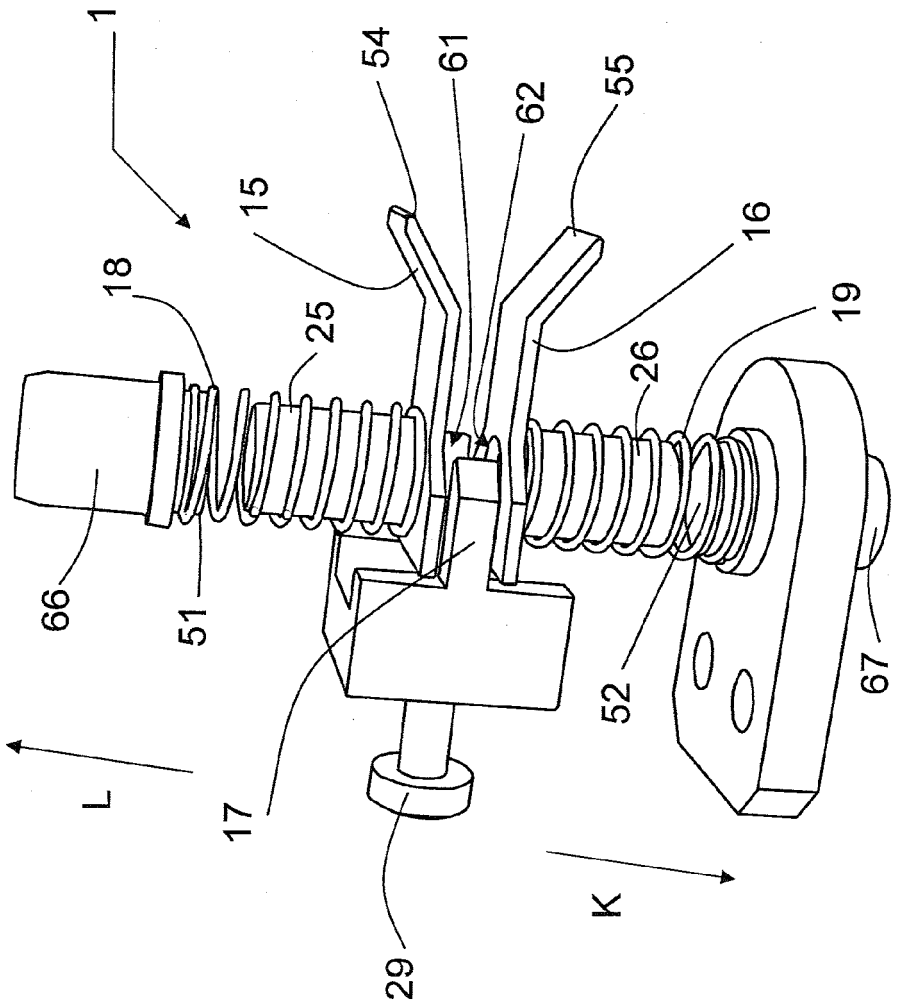


Fig. 4

Fig. 5



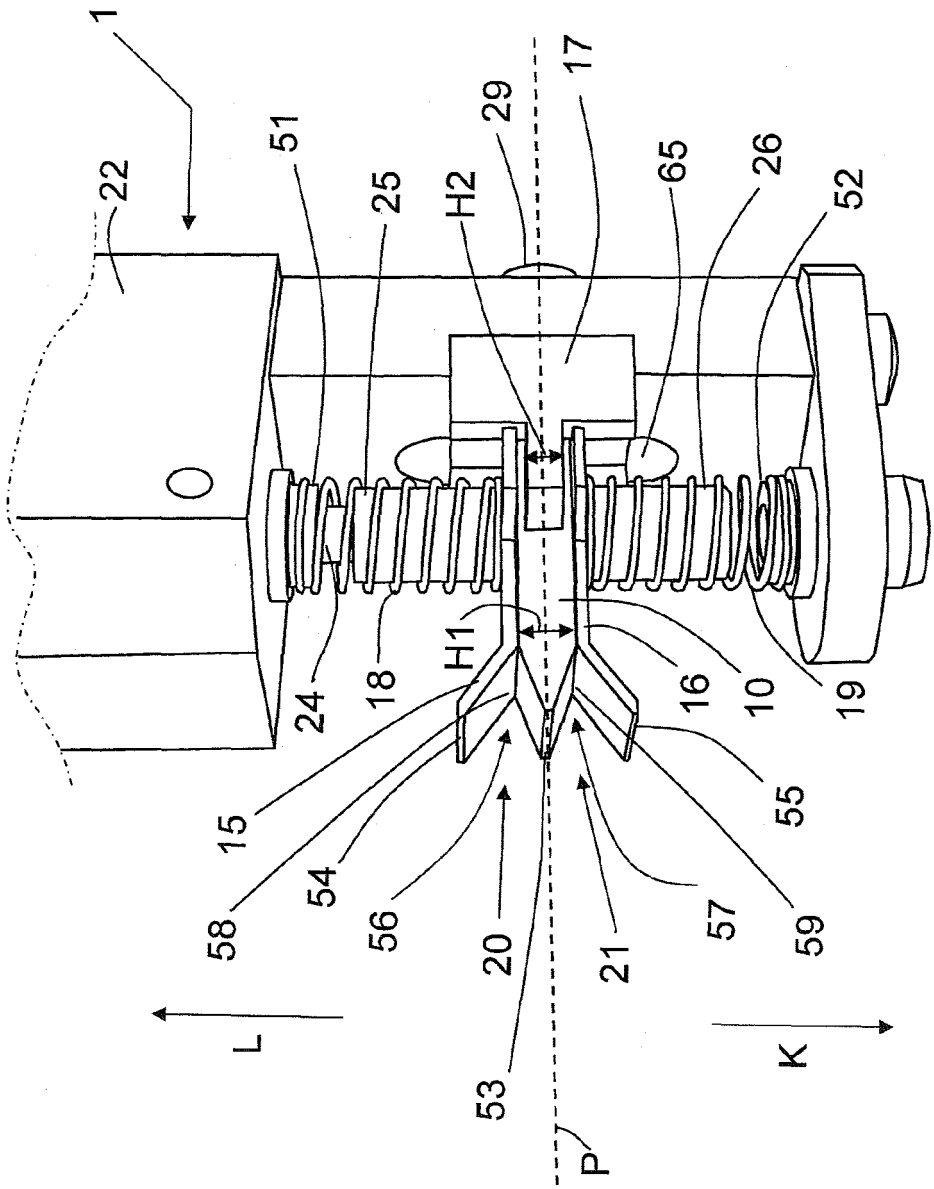

1
22
51
25
H2
29
17
65
26
52
24
18
H1
16
10
19
15
54
58
56
20
21
57
59
55
L
K
53
P

Fig. 6

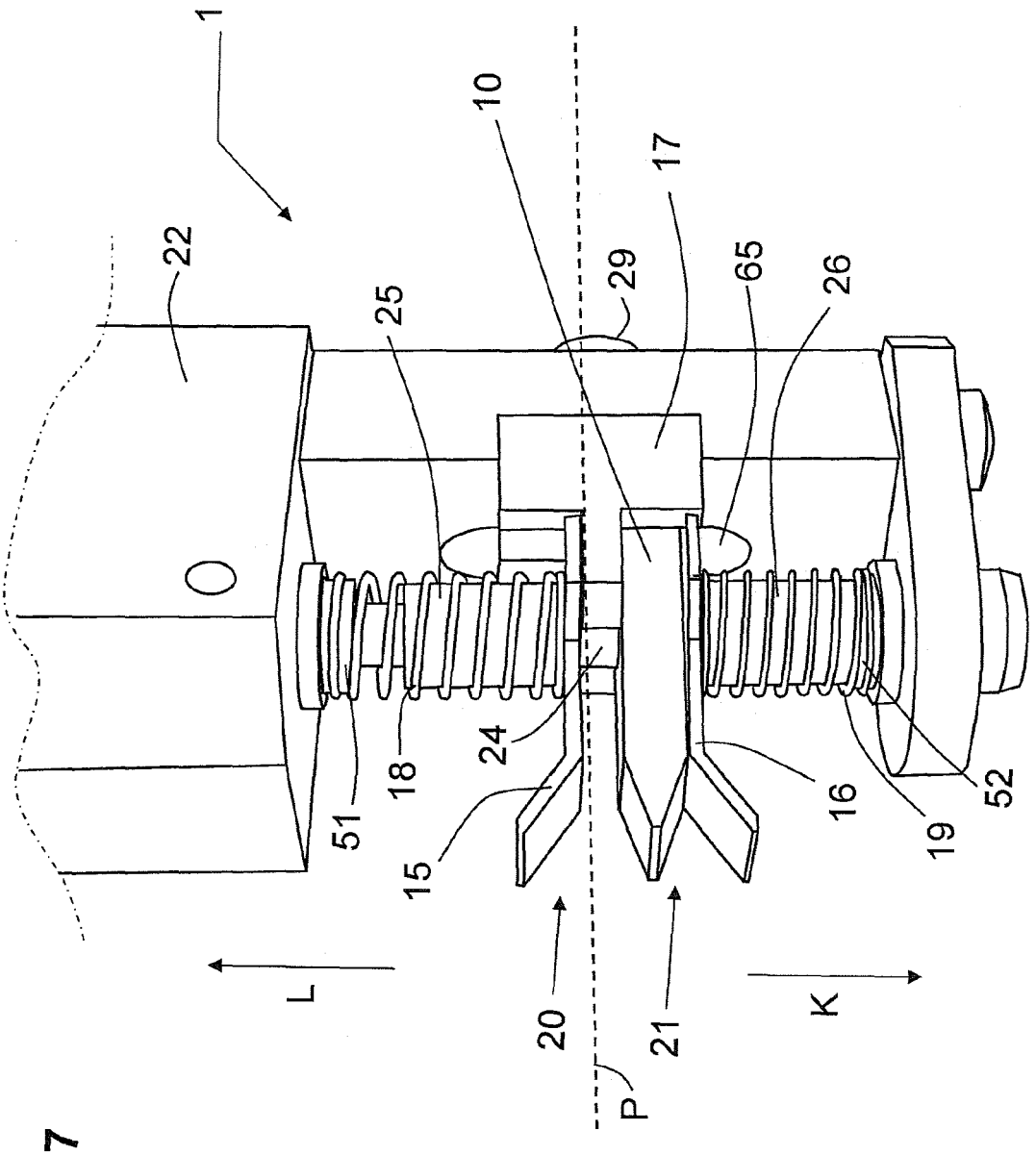


Fig. 7

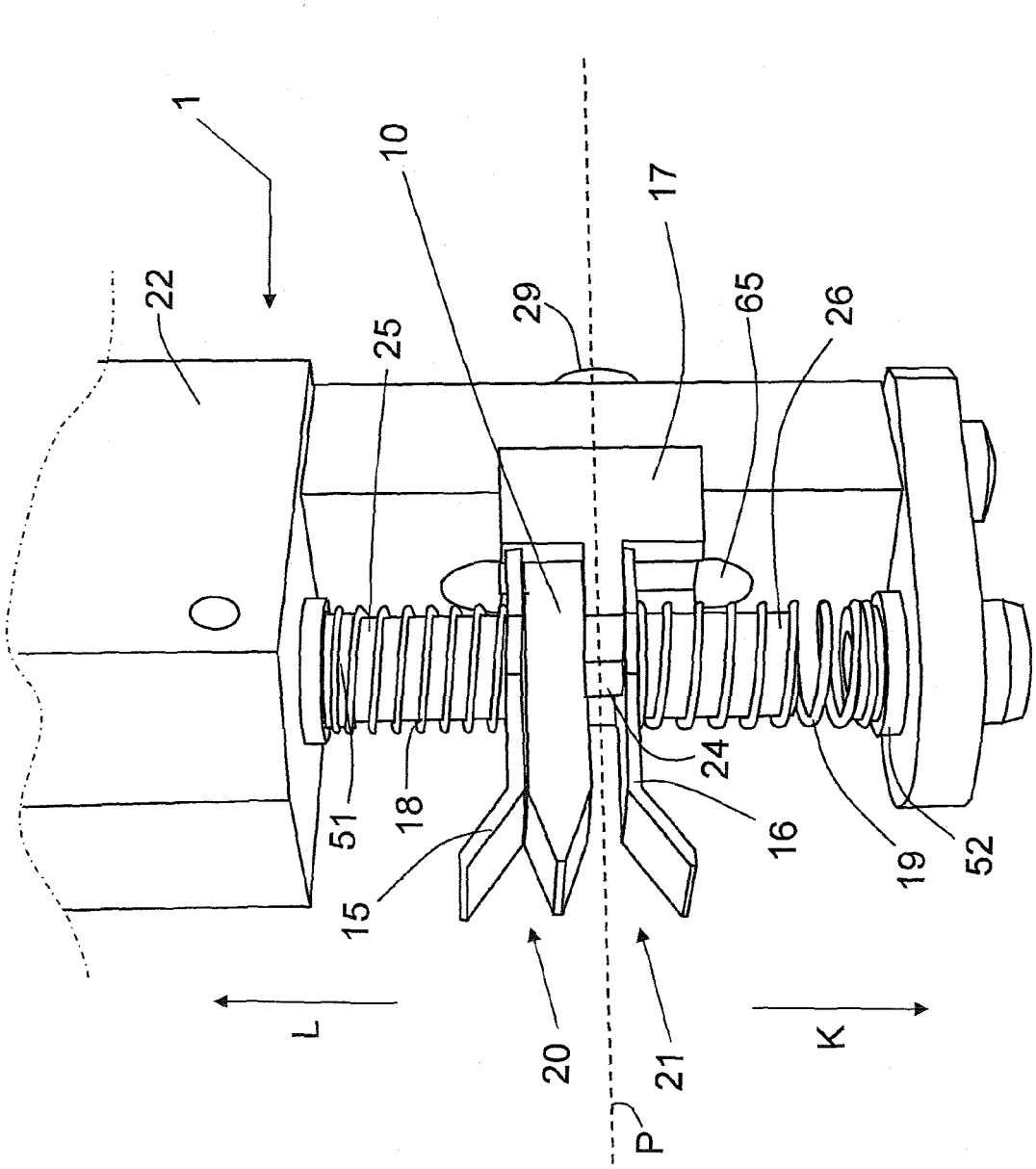


Fig. 8

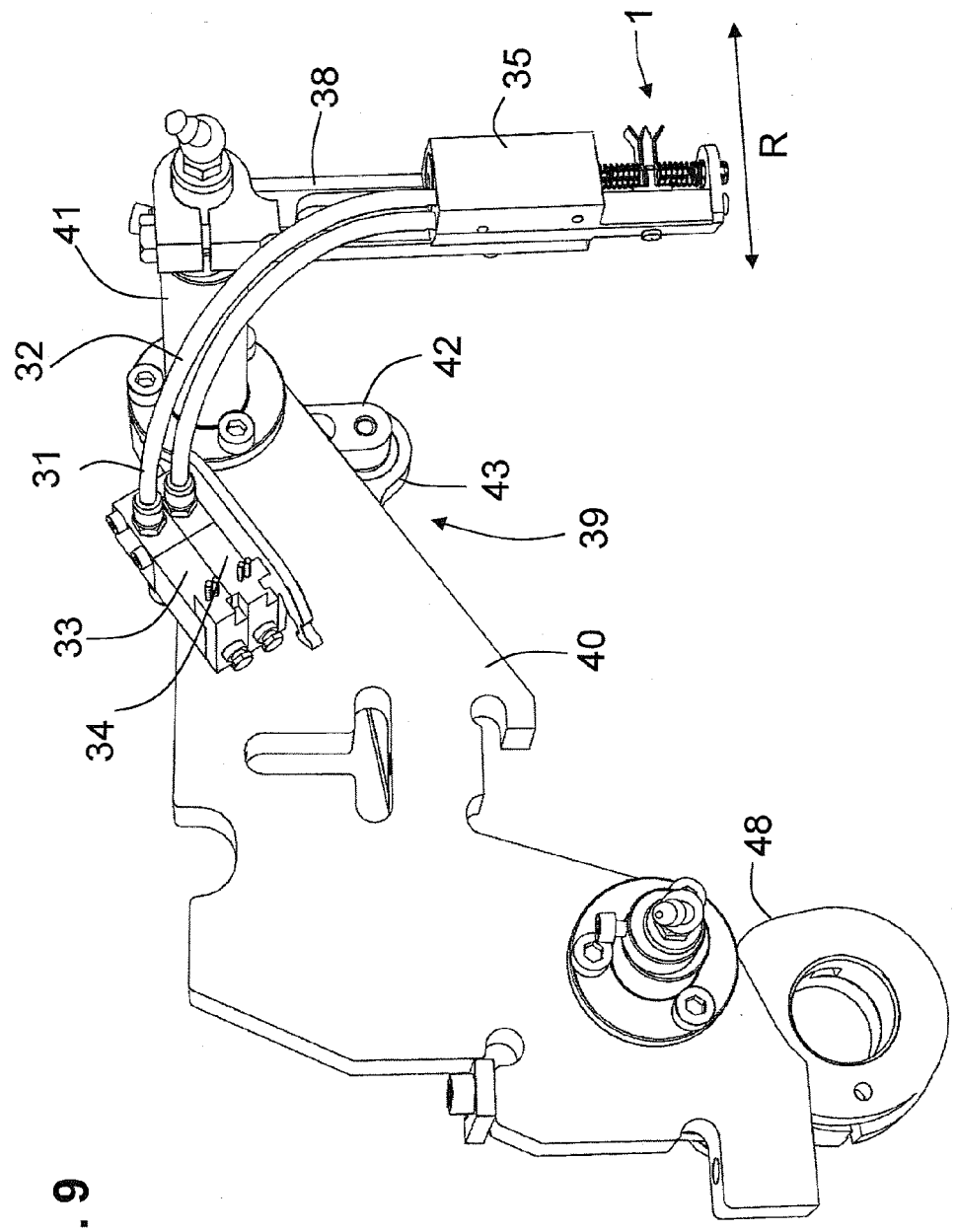


Fig. 9

Fig. 10

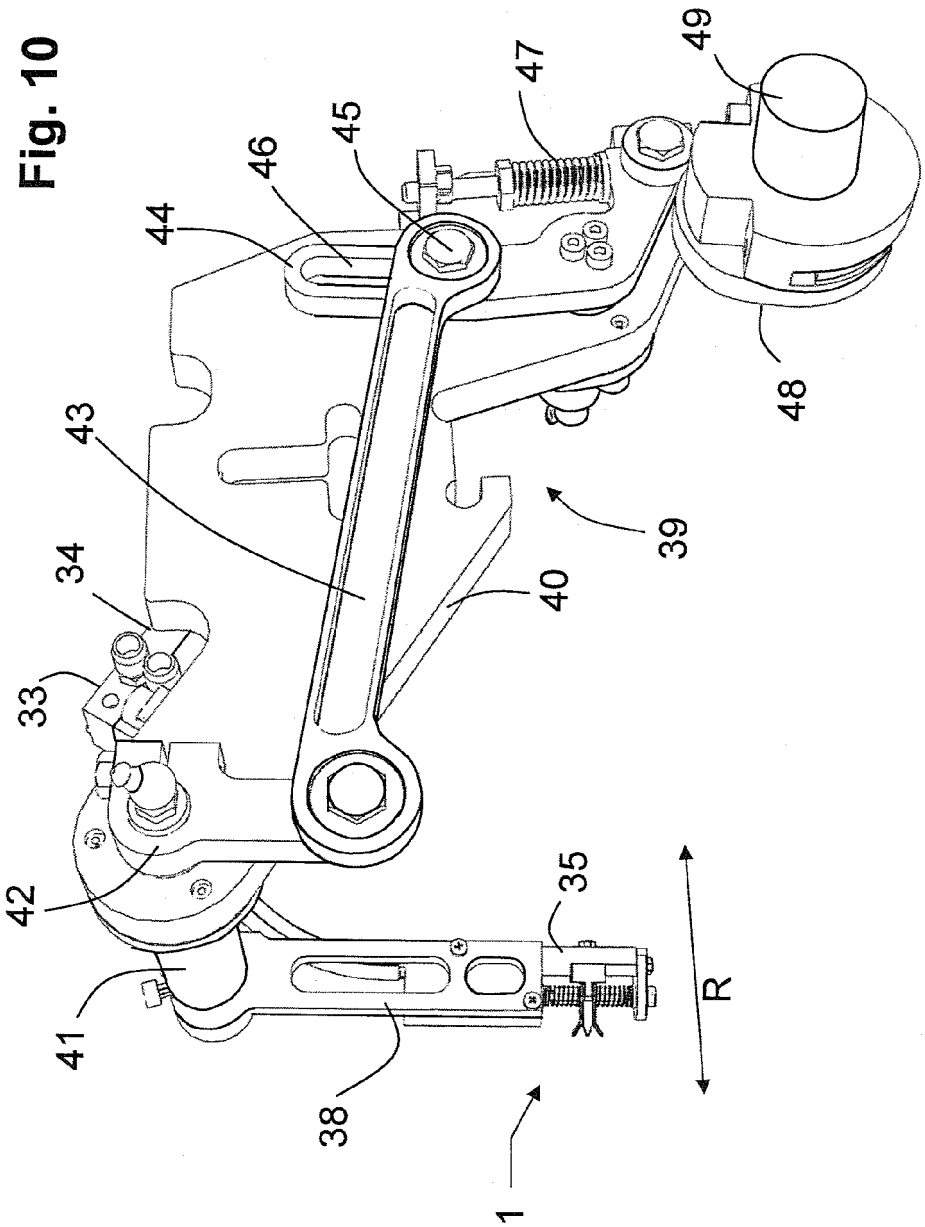
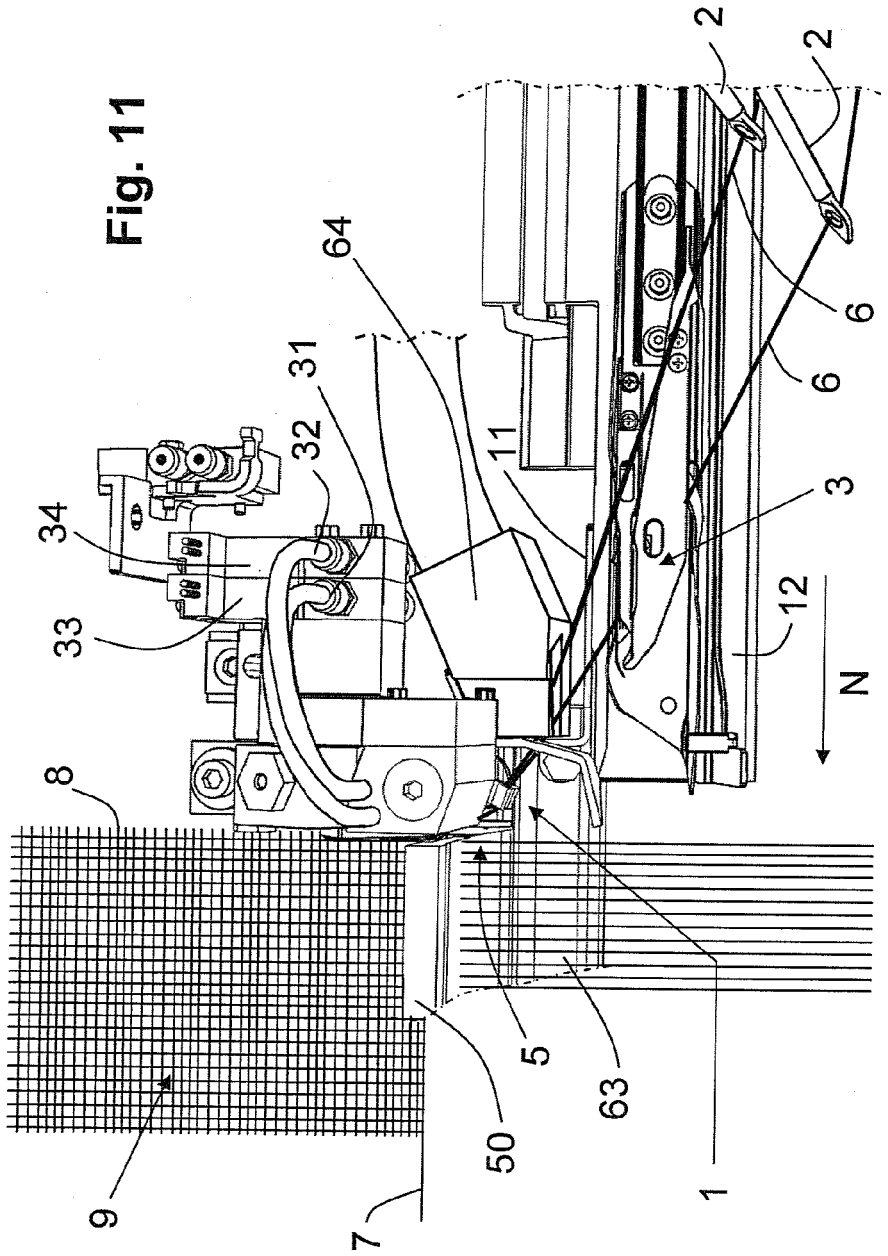


Fig. 11



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