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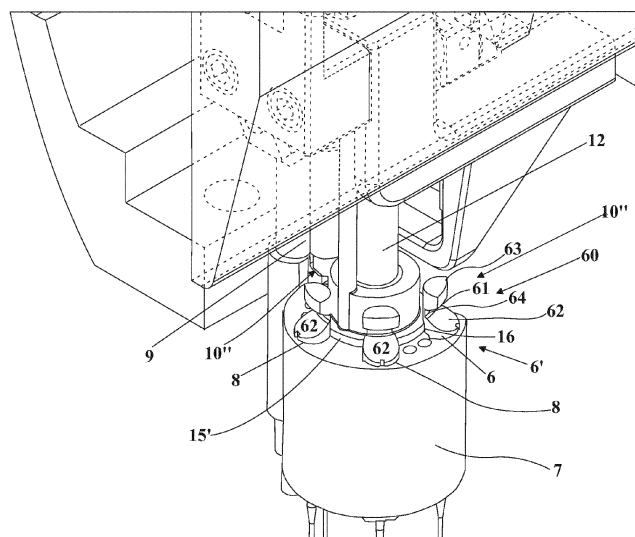
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(54) **Operative head for a sewing machine**

(57) Operative head for a sewing machine, which comprises a storage area (7) rotatably actuatable to rotate on the support structure (2) of the head in order to assume different angular positions and provided with two or more vertical guide tubes (8) arranged along a coaxial circular trajectory with respect to the rotation axis and each housing a needle-carrier rod (6). The first kinematic movement mechanism (3) of the needle (4) comprises a control rod, (9) which extends at the circular trajectory. The storage area (7) is controlled to rotate in order to selectively bring each needle-carrier rod (6) in an oper-

ative position in which through first coupling means (10) it is mechanically engaged to the control rod (9). There is also provided a thread tensioner group (24) provided with two or more thread guide levers (25) housed between the shoulders (30) of a slidable carriage (29) adapted to selectively move each thread guide lever (25) at a work window (31), in which through second coupling means (32) it is mechanically engaged to a movement lever (28) of a second kinematic movement mechanism (27) susceptible to follow the first kinematic movement mechanism of the needle (4).

**Fig. 6 B****EP 2 796 605 A1**

Description

Field of application

[0001] The present invention refers to an operative head for a sewing machine, according to the preamble of the main independent claim.

[0002] The head in question advantageously intended to be used in industrial sewing machines, of the automatic or semi-automatic type, operating with or without the help of a sewing operator with respect other fabrics of different material, such as for example cotton, skin and synthetic materials, as well as with threads of different colors and dimensions and materials such as nylon or cotton.

[0003] The head in question thus applies to the sector of the manufacturing industry for the for making sewing machines or accessories and parts of sewing machines.

State of the art

[0004] Traditionally known in the market are operative heads mounted on a sewing machine provided with a single sewing needle susceptible to sew with un thread unwound from a reel the fabrics that move below it. For the purpose, the needle is cyclically guided with kinematic movement mechanism back and forth to traverse the fabrics, to release the sequence of required points thereon.

[0005] It is known that, especially on off-ground production lines with very repetitive operations, the head moves automatically, due to a memorized actuation system of the pantographic type within a working space delimited by a template. The previously ironed fabric is made to advance al beneath the needle in proximity of a pressure foot, mounted on the operative head at the needle, by a drawing mechanism, which usually uses gripping elements that grip the lower side of the fabric dragging it beneath the foot.

[0006] Even for more automated production lines there is felt the need of changing the color of the thread used (for example for a production of the same model of garment having different colors) or changing the type of thread (for example in the production of airbags in which there are used threads of nylon, mixed or made of cotton depending on the type of airbag to be sewn).

[0007] Currently, in order to change the thread with another different color or material, the sewing heads required replacing the thread starting from the reel, before unarming the entire line where the thread is used i.e. up to the eye of the needle, passing through a thread tensioner. Such sewing head of the known type and it conventionally requires extremely long times for replacing the thread thus stopping production which has a negative impact on the production process.

[0008] With the aim of overcoming this problem there is known a sewing machine provided with two distinct operative heads which can be used selectively by linearly moving the drawer that supports them between two dif-

ferent positions.

[0009] Such operative head also revealed some drawbacks.

[0010] A first drawback lies in the fact that it is quite expensive given that it substantially requires the use of two heads instead of one.

[0011] A second drawback lies in the fact that there can be managed only two different needles, when the needs that are observed in the production process usually require the possibility of using more than two needles.

[0012] A third drawback lies in the fact that both heads use a single thread tensioner and hence the thread changing operation, for example for mounting a thread with different color or characteristics, remains long and tedious given that it is however needed to unarm the thread tensioner from the previous thread and arm it again with the new thread.

[0013] It is known from patent US 2007/0074646 a sewing machine provided with a operative head comprising a turning drum which carries several needles (supplied with corresponding threads) and is operated to rotate around a vertical rotation axis in order to place in an operative position the needle supplied with the selected thread for weaving.

[0014] More in detail, each needle is fixed to a corresponding moving rod which is susceptible, when it is placed in the operative position by the turning drum, to engage a carriage which is positioned alongside of the drum and is actuated to slide on a vertical guide for moving cyclically the needle during weaving operations.

[0015] A drawback of the machine described in the patent US 2007/0074646 lies in the fact that the operative head cannot perform reliably the change of the thread in particular since the carriage engages with difficulty the moving rod of the needle placed in the operative position.

Description of the invention

[0016] In this situation, the main object of the present invention is to overcome the drawbacks of the prior art by providing an operative head for a sewing machine, which allows changing the thread and/or the needle to be used, in a simple and quick manner.

[0017] Another object of the present invention is to provide an operative head for a sewing machine, which allows changing the work setting with different fabrics in a simple and quick manner.

[0018] Another object of the present invention is to provide an operative head for a sewing machine, that is extremely safe for the operators and highly reliable in use.

Brief description of the drawbacks

[0019] The technical features of the invention, according to the aforementioned objects, are clearly observable from the contents of the claims outlined above and the advantages thereof shall be clearer in the description that follows, provided with reference to the attached draw-

ings, which represent a purely exemplifying and non-limiting embodiment, wherein:

- figure 1 shows a first top perspective view of the operative head for a sewing machine, subject of the present invention; 5
- figure 2 shows a second top perspective view of the operative head for a sewing machine, subject of the present invention;
- figure 3 shows a third bottom perspective view of the operative head for a sewing machine, subject of the present invention, according to an embodiment in particular in the provision of second drive means; 10
- figure 4 shows a lateral view of the operative head for a sewing machine, subject of the present invention according to the aforementioned embodiment;
- figure 5 shows a front view of the operative head for a sewing machine, subject of the present invention according to the aforementioned embodiment; 15
- figure 6A shows a first perspective view of an enlarged detail of the operative head for a sewing machine of figure 1 with some parts removed for a better observation of others, regarding a storage area for holding needle carrier rods; 20
- figure 6B shows a second perspective view of the detail of the operative head for a sewing machine of figure 1 with some parts shown transparent for a better observation of others, regarding a storage area for holding needle carrier rods; 25
- figure 7A shows a sectional lateral view of a detail of the operative head for a sewing machine subject of the present invention, regarding the first coupling means for mechanically connecting the control rod to the needle-carrier rod with respect to each other; 30
- figure 7B shows a sectional lateral view of a detail of the operative head for a sewing machine subject of the present invention, regarding a storage area with, inserted in a rod control tube thereof and the needle-carrier rod with respect to each other, joined by a first coupling means; 35
- figure 8 shows a lateral view of the operative head for a sewing machine subject of the present invention with some parts removed to show the movement mechanisms of the needles and thread guide levers; 40
- figure 9 shows a lateral section view, carried out according to a vertical plane, of an enlarged detail of the operative head for a sewing machine of figure 1, regarding the engagement between a slidable carriage and a thread guide lever; 45
- figure 10 shows a front view of the operative head for a sewing machine of figure 1 according to a section carried out along a vertical plane at the slidable carriage and the thread guide levers; 50
- figures 11A and 11B show two transverse sectional views carried out according to a horizontal plane of a detail of the operative head for a sewing machine subject of the present invention regarding the storage area for holding the needle carrier rods arranged 55

in two different angular positions;

- figures 12A and 12B show two front views of the operative head for a sewing machine subject of the present invention with the support carriage and the thread guide levers arranged in two different positions;
- figures 13A and 13B show two views of the operative head for a sewing machine subject of the present invention with some parts removed for a better observation of the others, with a provided support ring respectively in substitution position, with the needles projecting from a storage area, and in safety position, with the needles retracted in such storage area;
- figures 14A and 14B show two further views of the operative head for a sewing machine subject of the present invention represented in the only portion arranged in proximity of the storage area with the latter in transparency better showing the needle carrier rods held therein, the support ring being respectively arranged in substitution position, with the needles projecting from a storage area, and in safety position, with the needles retracted in such storage area.

Detailed description of a preferred embodiment

[0020] With reference to the attached drawings the operative head for a sewing machine subject of the present invention was indicated in its entirety with 1.

[0021] The aforementioned head 1 may be mounted, in a per se entirely conventional manner, on an industrial sewing machine, whether of the entirely automatic type without utilizing the operator, or of the semi-automatic type operating with the help of an operator.

[0022] The fabric is made to advance, in a known manner, below a pressure foot of the fabric (not illustrated) mounted on the operative head at the needle, by a fabric drawing mechanism, which usually uses grippers which grip the drawing it under the foot.

[0023] The aforementioned operative head 1 shall be adapted to sew a fabric which advances below it with an intermittent motion with subsequent steps, inserting the needle into the fabric when it is temporarily stationary and with continuous motion by inserting the needle into the fabric during its advancement motion.

[0024] The term "fabric" shall be used to indicate one or more flexible sheet-like elements intended to be connected with respect to each other with the sewing points, whether superimposed or arranged adjacent to each other, distinct of part of a single sheet and constituted by various types of material such as, by way of example: cotton, skin or synthetic fiber.

[0025] Usually, in case of automatic sewing machines a system for controlling the trajectory to be sewn is of the known pantograph type with templates for delimiting the area to be sewn.

[0026] The system for drawing the fabric, same case applying to the system for controlling the trajectory are well known to a man skilled in the art and they may be

entirely conventional and thus will not be described hereinafter.

[0027] According to the embodiment illustrated in the attached figures, the operative head 1 for a sewing machine subject of the present invention comprises a support structure 2 which is fixed being susceptible to be rigidly mounted on the framework of the sewing machine (not illustrated in its entirety).

[0028] The head 1 is thus provided in an entirely conventional manner with a first kinematic movement mechanism 3 for guiding at least one sewing needle 4 cyclically with a back and forth movement through at least one fabric so as to attain a succession of sewing points with at least one thread.

[0029] The first kinematic movement mechanism 3 of the needle 4 may be obtained according to any kinematic sequence of the known type, and thus it shall not be described in detail given that it is known to a man skilled in the art. It turns into a final vertical movement of a needle 4 between a top dead centre and a bottom dead centre and it may, for example, provide for the use of drive shaft bearing an eccentric which actuates one or more connecting rods adapted to slide a control rod associated to the needle 4 along a vertical track as better described hereinafter.

[0030] Obviously, in the case where the needle 4 should follow the fabric, the needle shall assume a movement made up of a vertical movement and a horizontal movement.

[0031] According to the idea on which the present invention is based, the head 1 comprises a storage area 7, which is mounted rotatably on the support structure 2 and it is actuable to rotate around a vertical rotation axis Y in order to assume different angular positions P1-P4 (where in figures 11A and 11B there are illustrated the positions P1, P3 given that the others are easily deducible without requiring further graphic description).

[0032] It is provided with two or more guide tubes 8, in particular formed by vertical through holes, which are arranged along a coaxial circular trajectory with respect to the rotation axis Y.

[0033] Each of the guide tubes 8 housed a needle-carrier rod 6 bearing, mounted at the lower part thereof, the corresponding needle 4.

[0034] Preferably, the aforementioned storage area 7 is a rigid body for example made of cast iron obtained through casting substantially cylindrical substantially operating like a revolver. According to the preferred embodiment illustrated in the attached figures there are provided four guide tubes 8 with respect to each other spaced by about 30-60 degrees so that the rotation provided for the storage area 7 may advantageously be of the order of 90-180 degrees.

[0035] Each needle-carrier rod 6 may bear a needle of different type, for example for operating with fabrics of different type, or it may be mechanically and operatively associated to a thread of different mechanical characteristics or of different color, as better clarified hereinafter.

[0036] The aforementioned first kinematic movement mechanism 3 comprises a control rod 9, which extends along a vertical extension axis Y', parallel to the rotation axis Y of the storage area 7.

5 **[0037]** The aforementioned control rod 9 has an angular position fixed and predefined with projection on a horizontal plane R passing through the storage area 7 (for example, for the sake of simplicity, reference shall be made to the plane R having - as the laying plane - the upper face of the storage area 7) which intercepts the circular trajectory traversed by the needle carrier rods 6.

10 **[0038]** The storage area 7 is in turn actuable to rotate around its vertical rotation axis Y, between the aforementioned angular positions P1-P4 in order to selectively bring each needle-carrier rod 6 (through the movement of the relative guide tubes 8) in an operative position A arranged aligned below the control rod 9.

15 **[0039]** There are thus provided first coupling means 10 susceptible to mechanically connect with respect to each other the first lower end 9' of the control rod 9 with the second upper end 6' of the needle-carrier rod 6 which is arranged in the aforementioned operative position A.

20 **[0040]** Preferably, the control rod 9 and the needle-carrier rod 6 are both cylindrical-shaped and with the same diameter so as to form a substantially continuous rod after the coupling through the first coupling means 10.

25 **[0041]** According to a preferred characteristic of the present invention, the first coupling means 10 comprise two engagement portions 10', 10", a first 10' associated to the second upper end 6' of the needle-carrier rod 6 and a second 10" to the first lower end 9' of the control rod 9. The aforementioned engagement portions 10', 10" are susceptible to be coupled with respect to each other in relationship form relationship following the rotation movement of the corresponding needle-carrier rod 6 in the operative position A.

30 **[0042]** Preferably, the first engagement portion 10' associated to the upper end 6' of the needle-carrier rod 6 is obtained with a first circumferential opening 60 delimited above and below by two first flat faces 61, 62, which are advantageously approached inclined towards the central rotation axis of the storage area 7 tapering the first circumferential opening 60.

35 **[0043]** Thus, the aforementioned first opening 60 delimits a mushroom-shaped upper body having the head 63 with the top part face 65, for example flat, and which defines a constraint undercut for the corresponding second engagement portion 10" of the control rod 9. Thus, such mushroom-shaped upper body has a first shank 64 connected to the head 63 which rises misaligned with respect to the axis of the needle-carrier rod 6 from the lower flat face of the opening 60. More in detail, the aforementioned head 63 and the aforementioned first shank 64 each have a convex arc-shaped circumferential face.

40 **[0044]** The second engagement portion 10" of the control rod 9 is in turn substantially counter-shaped with respect to the first engagement portion 10' associated to the needle-carrier rod 6.

[0045] For the purpose, the second engagement portion 10" is provided with a second circumferential opening 90 which is delimited by two second inclined flat faces 91, 92 and which is tapered towards the central axis of rotation of the storage area 7.

[0046] The aforementioned second opening 90 delimits a lower base 93 connected through a second shank 94 to the remaining part of the control rod 9. More in detail, the lower base 93 is inserted into the circumferential opening 60 with its own bottom face 95 which is opposite to the first lower flat face 62 of the first circumferential opening 60 and with the second lower flat face 92 of the second circumferential opening 90 which is opposite to the first upper flat face 61 of the first circumferential opening 60. The head 63 of the first engagement portion 10' in turn has the top part face 65 opposite to the second upper flat face 91 of the second circumferential opening 90 and the first upper flat face 61 opposite to the second lower flat face 92 of the second circumferential opening 90.

[0047] More in detail the aforementioned base 93 and the aforementioned second shank 94 each have a circumferential concave arc-shaped face for coupling, by rotation, respectively with the aforementioned first shaft 64 and with the aforementioned head 63 of the first engagement portion 10'.

[0048] The coupling through the first coupling means 10 between the first lower end 9' of the control rod 9 and the second upper end 6' of the needle-carrier rod 6 is defined with the needle-carrier rod 6 arranged in the operating angular position A, and with the control rod 9, arranged by the first kinematic mechanism, at the top dead centre.

[0049] Such top dead centre of the control rod 9 corresponds to a top dead centre also of the needle 4 and of the relative needle-carrier rod 6.

[0050] The rotation of the storage area 7 around its vertical rotation axis Y, is obtained through first drive means 11 mounted on the support structure 2. Such first drive means 11 preferably comprise a vertical drive shaft 12, engaged in a shaft guide bushing 13, and actuated to rotate by a first motor 14 fixed to the support structure 2. For the purpose, the drive shaft 12 is fixed - at the lower part - to the storage area 7, coaxially with respect to its rotation axis Y, and it is mechanically connected at the upper part to the first motor 14, which commands the controlled rotation through a logic control unit, of the storage area 7, in order to selectively bring each of the needle carrier rods 6 in the engagement operative position A with the control rod 9. The shaft 12 terminates - at the lower part - with a threaded portion engaged by an adjustment ring nut 22 which defines the constraint position of the storage area 7 on the shaft 12 and which is provided for adjusting the height of the storage area 7.

[0051] Provided on the storage area of the vertical thread-pass holes 23 covered by upper and lower trumpet-shaped thread guides arranged at the ends of the holes to prevent the thread from touching the storage

area thus getting ruined.

[0052] In order to support them, the needle carrier rods 6, which are not placed in the operative position A, in the guide tubes 6 there are provided support means associated to the tubes 8 which are not aligned to the control rod 9.

[0053] Advantageously, such support means comprise a support ring 15, which is mechanically connected to the support structure 2, arranged coaxially to the drive shaft 12 internally with respect to the tubes 8 and it is provided with a circumferential external edge 15' having a cut portion 16 arranged at the operative position A. Such external edge 15' is engaged with a groove 160 provided in the needle carrier rods 6, obtained at their radially innermost portion directed towards the central axis Y of rotation of the storage area 7, when the needle carrier rods 6 are at angular positions different from operating position A.

[0054] Thus doing, the support ring 15 supports the needle carrier rods 6 which are not operative preventing them from falling, while through the cut portion 16 it frees the sliding of the needle-carrier rod 6 which is in operative position A and which is moved to slide in the tube 8 of the storage area 7 by the control rod 9.

[0055] Thus, operatively, when the operator by selecting, for example on a keypad, or directly when the logic control unit of the sewing machine according to the automatic operating cycles, provide for the needle change 4 to change the type of thread (color and/or material), the logic control unit of the sewing machine rotatably controls the storage area 7 by actuating the first motor 14 which rotates in a controlled manner up to reaching the angular position adapted to bring the needle-carrier rod 6 with the selected needle 4, up to the operative position A. In such operative position A, there occurs the mechanical engagement of the needle-carrier rod 6 with the control rod 9 by engaging the coupling means 10 and simultaneously disengaging the needle-carrier rod 6 from the support means for example constituted by the support ring 15. At the same time, through the same rotation of the storage area 7 the needle-carrier rod 6, which was previously in operative position A, is now disengaged from the control rod 9, and taken over by support means to prevent them from slipping off from the relative tube 8.

[0056] Advantageously, the support ring 15 is mounted on the support structure 2 through a linear actuator 17 which through return mechanisms 170 determines the movement thereof between a safety position 18, in which the tips of the needles 4 mounted on the needle carrier rods 6 which are not in operative position A are lifted, and in particular retracted inside the tubes 8 of the storage area 7, and a substitution position 19, in which the tips of the needles 4 of the needle carrier rods 6 which are not in operative position A are lowered, and in particular extend at the lower part outside the guide tubes 8.

[0057] The return mechanisms 170 in particular comprise a rod 171 fixed at the lower part to the support ring 15 passing in a vertical milling thereof and mechanically

connected to the stem 17' of the actuator 17 through a transverse retention block 172.

[0058] The lowered substitution position 19 of is provided during the operations provided for by the alternation in operative position A of a needle-carrier rod with another, while the raised safety portion 18 is provided for the normal work operations and sewing of the fabric by the operative head 1.

[0059] The safety position 18 allows the operator not to interfere with the tips of the needles 4 not operative when working near the operative needle 4 during the fabric sewing operations.

[0060] Advantageously, in order to prevent the rotation of the needle carrier rods 6 in the guide tube 8 when they are selectively actuated by the control rod 9 with a movement cyclic movement being in the operative position A, the needle carrier rods 6 and the guide tubes 8 are respectively provided: one with a groove 20, the other with a rib 21 engaged with respect to each other in form relationship.

[0061] According to a further characteristic of the present invention, the operative head 1 comprises a thread tensioner group 24 adapted to feed each needle 4 with a dedicated thread and correctly tensioned by a distinct thread guide so as to prevent it - upon changing the needle 4 - to correspond to a tedious operation of setting up the thread on the new needle 4 through prior unarming of the previous thread, for example, like in the known art, by a common thread guide.

[0062] According to the present invention to each needle 4 there is actually advantageously associated a dedicated thread-guide contained in the thread tensioner group 24.

[0063] More clearly, the thread tensioner group 24 comprises two or more thread guide levers 25, each of which is provided with an eyelet 26 to receive the thread which is unwound from a corresponding reel (not illustrated), and a second kinematic movement mechanism 27 provided with a movement lever 28 selectively mechanically couplable with one of the thread guide levers 25 to impart thereto a second back and forth movement having at least one vertical component between a top dead centre and a bottom dead centre.

[0064] The thread guide lever 25 is actuated to be moved by the movement lever 28 with a cyclic following movement of the needle 4 mounted on the needle-carrier rod 6 in operative position A, in order to feed it with the thread under tension which passes through the eyelet 26 of the corresponding thread guide lever 25.

[0065] Actually, in a per se entirely conventional manner, the two mechanisms 3 and 27 of moving the needle 3 and the thread guide 25 are constrained with respect to each other mechanically in the cyclic movement and exploit a common driving means (not illustrated). Also the second kinematic movement mechanism 27 is not illustrated in detail in this description being per se entirely known to a man skilled in the art.

[0066] The thread tensioner group 24 further compris-

es a carriage 29 provided with a plurality of parallel shoulders 30. Between each pair of shoulders 30 there is housed a corresponding thread guide lever 25.

[0067] The carriage 29 is susceptible to slide on the support structure 2 in order to selectively bring each thread guide lever 25 at a work window 31, in which through second coupling means 32 it is mechanically engaged to the movement lever 28 of the second kinematic movement mechanism 27.

[0068] Advantageously, the second coupling means 32 comprise two portions shaped in form relationship 32', 32" one 32' associated to the thread guide lever 25 and the other 32" to the movement lever 28 of the second kinematic movement mechanism 27. The two shaped portions 32', 32" are susceptible to be engaged with respect to each other following the linear movement of the thread guide lever 25, guided by the carriage 29, in the work window 31.

[0069] The second coupling means 32 are advantageously susceptible to engage the two shaped portions 32', 32" with the thread guide lever 25 arranged in the work window 31 and at the aforementioned top dead centre.

[0070] The translation movement of the carriage 29 to selectively move each thread guide lever 25 at the work window 31 and allow the engagement thereof with the movement lever 28 is obtained through second drive means 33 mounted on the support structure 2. Such second drive means 33 preferably comprise a worm screw 36 and a second motor 34 fixed to the support structure 2 mechanically connected to the worm screw 36 to rotate it around its longitudinal development axis. More in detail, the worm screw 36 is mounted rotatably between two spaced and parallel walls 35 which delimit the travel of the carriage 29 and it is engaged with at least one nut (not illustrated) integral to the carriage 29. The second motor 34 by actuating the worm screw 36 in rotation controls the precise movement and in a controlled manner, through the logic control unit, of the carriage 29 so as to selectively move each thread guide lever 25 at the work window 31.

[0071] According to a variant embodiment illustrated in figures 3-5 the second motor 34 is in axis with the worm screw 36 while according to the embodiment of the remaining figures, in particular as shown in figures 1 and 2, the motor 34 rotates the worm screw 36 through belt transmission means 37.

[0072] There are provided means for guiding the movement of the carriage 29, for example comprising a sliding wall of the carriage 29 on a fixed wall of the support structure 2 or comprising a horizontal guide rod 38 mounted fixed between the two parallel walls 35 and fittingly passing in a hole obtained on the carriage 29 and in particular in aligned holes on the lateral walls of the carriage 29.

[0073] Such guide means counter the rotation of the carriage 29 around the axis of the worm screw 36 thus allowing the carriage 29 to perform just a simple translation.

[0074] In addition, there is provided at least one pair of support rods 39, which are fixed to the support structure 2 so as to have the relative free ends 40 opposite and aligned. Such rods 39 extend through the carriage 29 starting from the parallel walls 35 traversing provided aligned holes obtained respectively on the shoulders 30 and on the thread guide levers 25 up to reaching with the free ends 40 thereof the limit of the work window 31, to support the thread guide levers 25 outside the work window 31 i.e. when the thread guide levers 25 are not engaged and supported by the movement lever 28.

[0075] Preferably, according to the examples of the attached figures, there are provided two pairs of support rods 39 for example arranged one on the other.

[0076] In addition, advantageously, such two pairs of support rods have different length (for example the lower pair being longer than the upper one) for engaging/disengaging the holes of the thread guide levers 25 in different positions during the movement of the carriage 29. Advantageously, the free ends 40 of the support rods 30, faced towards the work window 31, are with tapered shape.

[0077] To each needle 4 of a needle-carrier rod 6 there corresponds a thread prearranged on a corresponding thread guide lever 25 of the thread tensioner group 24.

[0078] Thus, operatively upon selecting a needle 4 the logic control unit controls the rotation of the storage area 7 to bring the needle-carrier rod 6 which mounts the selected needle 4 in the operative position A, and also controls the translation of the carriage 29 to bring the thread guide lever 25 associated to the thread of the selected needle 4, at the work window 31.

[0079] Upon reaching the window 31 the thread guide lever 25 is progressively engaged with the relative movement rod 28 and it is progressively disengaged from the support rods 39 whose tapered shape simultaneously allows the thread guide lever 25, which should be replaced, to be progressively inserted on the rods 39 placed on the side towards which the carriage 29 is sliding. In addition, the clearance allowed by the tapered shape of the free ends 40 of the support rods 39 allows adjustments in the engagement between the two portions shaped in form relationship 32', 32" one 32' associated to the thread guide lever 25 and the other 32" to the movement lever 28. Such clearance, useful for the engagement between the two shaped portions 32', 32" is facilitated by the possibility of rotation of the thread guide lever 25 which is entering into the work window 31 around the rod of the pair of longer aligned rods 39, given that the thread guide lever 25 is already partly disengaged from the other rod of the pair of shorter aligned rods 39.

[0080] Thus, the operative head thus conceived attains the preset objects.

[0081] Advantageously due to the present invention the needle and thread change times are extremely short, i.e. in particular in the order of a few seconds and they do not require a particular intervention of operators given that the entire change operation is managed through a

control logic which acquiring the angular position of the main drive axis synchronizes the actuation respectively of the storage area which carries the needle carrier rods and the slidable drawer of the thread-tensioner.

Claims

1. Operative head for a sewing machine, which comprises:

- a fixed support structure (2), susceptible to being mounted on said sewing machine;
- at least one sewing needle (4) susceptible to sew, with at least one thread, at least one fabric that moves below it;
- a first kinematic movement mechanism (3), which guides said sewing needle (4) cyclically with back-and-forth movement through said fabric;

characterized in that it comprises:

- a storage area (7) rotatably actuable to rotate on said support structure (2) around a rotation axis (Y) in order to assume different angular positions (P1-P4), provided with two or more guide tubes (8) arranged vertically along a circular trajectory that is coaxial with respect to said rotation axis (Y), each of such tubes (8) housing a needle-carrier rod (6) bearing, on the lower part thereof, a corresponding needle; said first kinematic movement mechanism (3) comprising a control rod (9), which is extended along a vertical extension axis (Y') arranged to intercept said circular trajectory; said storage area (7) being actuable to rotate around said rotation axis (Y) in order to selectively bring each said needle-carrier rod (6) to an operative position (A) aligned below said control rod (9);
- first coupling means (10) susceptible to mechanically connect the first lower end (9') of said control rod (9) together with the second upper end (6') of said needle-carrier rod (6) in said operative position (A).

2. Operative head according to claim 1, **characterized in that** said first coupling means (10) comprise two engagement portions (10', 10"), one associated with the second upper end (6') of said needle-carrier rod (6), and the other associated with the first lower end (9') of said control rod (9), and susceptible to being engaged with each other in a form relationship at said operative position (A).

3. Operative head according to claim 1 or 2, **characterized in that** said control rod (9) is actuated by said first kinematic movement mechanism (3) with back-and-forth movement having at least one vertical component between a top dead center and a bot-

tom dead center; said first coupling means (10) being susceptible to engage the first lower end (9') of said control rod (9) with the second upper end (6') of said needle-carrier rod (6), with said control rod (9) arranged at said top dead center and with said needle-carrier rod (6) arranged in said operative position (A).

4. Operative head according to claim 1, **characterized in that** it comprises first drive means (11) for rotating said storage area (7) around said rotation axis (Y), which comprise a vertical drive shaft (12) fixed to said storage area (7) coaxially with respect to said rotation axis (Y), a first motor (14) mounted on said support structure (2), mechanically connected to said drive shaft (12) in order to selectively command the rotation of said storage area (7), in a controlled manner, between angular positions (P1-P4) that are each adapted to arrange a needle-carrier rod (6) in said operative position (A).

5. Operative head according to any one of the preceding claims, **characterized in that** one of said needle-carrier rods (6) and said guide tubes (8) is provided with a groove (20) and the other is provided with a rib (21), such groove and rib engaged with each other in order to prevent the rotation of each said needle-carrier rod (6) in said corresponding guide tube (8).

6. Operative head according to any one of the preceding claims, **characterized in that** said storage area (7) is associated with a support ring (15) coaxial with the rotation axis (Y) of said storage area (7), such support ring (15) provided with a cut portion (16) at said operative position (A) and with a circumferential edge (15') that is engaged in an internal groove (160) obtained in said needle-carrier rods (6), with the latter placed in angular positions different from said operative position (A), in order to support said needle-carrier rods (6) in said guide tubes (8).

7. Operative head according to claim 6, **characterized in that** said support ring (15) is actuatable to be moved between a safety position (18), in which the tips of the needles (4) of the needle-carrier rods (6) which are not in operative position (A) are in a raised position, in particular retracted inside the guide tubes (8) of said storage area (7), and a substitution position (19), in which the tips of the needles (4) of the needle-carrier rods (6) which are not in operative position (A) are lowered, in particular being extended on the lower part to the outside of said guide tubes (8).

8. Operative head according to any one of the preceding claims, **characterized in that** it comprises at least one thread tensioner group (24) comprising:

- two or more thread guide levers (25), each of

which provided with an eyelet (26) for receiving the thread that is unwound from a corresponding reel;

- a second kinematic movement mechanism (27) provided with a movement lever (28) selectively mechanically couplable with a thread guide lever (25), susceptible to follow the movement of the needle (4) mounted on said needle-carrier rod (6) in operative position, in order to feed it with the thread under tension of said corresponding thread guide lever (25);

- a carriage (29) provided with a plurality of parallel shoulders (30) between which said thread guide levers (25) are housed; said carriage (29) being susceptible to slide on said support structure (2) in order to selectively bring each said thread guide lever (25) to a work window (31), in which by means of second coupling means (32) such lever is mechanically engaged to the movement lever (28) of said second kinematic movement mechanism (27).

9. Operative head according to claim 8, **characterized in that** said second coupling means (32) comprise two portions shaped in a form relationship (32', 32''), one associated with the thread guide lever (25) and the other associated with the movement lever (28) of said second kinematic movement mechanism (27) and susceptible to being engaged with each other at said work window (31).

10. Operative head according to claim 9, **characterized in that** said thread guide lever (25) is actuated by said second kinematic movement mechanism (27) with a second back-and-forth movement having at least one vertical component between a top dead center and a bottom dead center; said second coupling means (32) being susceptible to engage said two shaped portions (32', 32'') in a form relationship, with said thread guide lever (25) arranged at said work window (31) and at said top dead center.

11. Operative head according to claim 8, **characterized in that** it comprises second drive means (33) for translating said carriage (29) in front of said work window (31), which comprise a worm screw (36) engaged with said carriage (29), a second motor (34) fixed to said support structure (2) mechanically connected to said worm screw (36) in order to command said carriage (29) to be moved in a controlled manner to selectively bring each said thread guide lever (25) to said work window (31).

12. Operative head according to any one of the claims from 8 to 11, **characterized in that** it comprises at least one pair of support rods (39), which are fixed to said support structure (2) and are extended through aligned holes obtained on said shoulders

(30) and on said thread guide levers (25) up to said work window (31), in order to support said thread guide lever (25) outside said work window (31).

13. Operative head according to claim 12, **characterized in that** said support rods (39) are provided with a free end (40) directed towards said work window (31) with tapered shape. 5
14. Operative head according to claim 12 or 13, **characterized in that** it comprises two pairs of support rods (39), which have different lengths for engaging/disengaging the holes of said thread guide levers (25) in different positions during the movement of said carriage (29). 10 15

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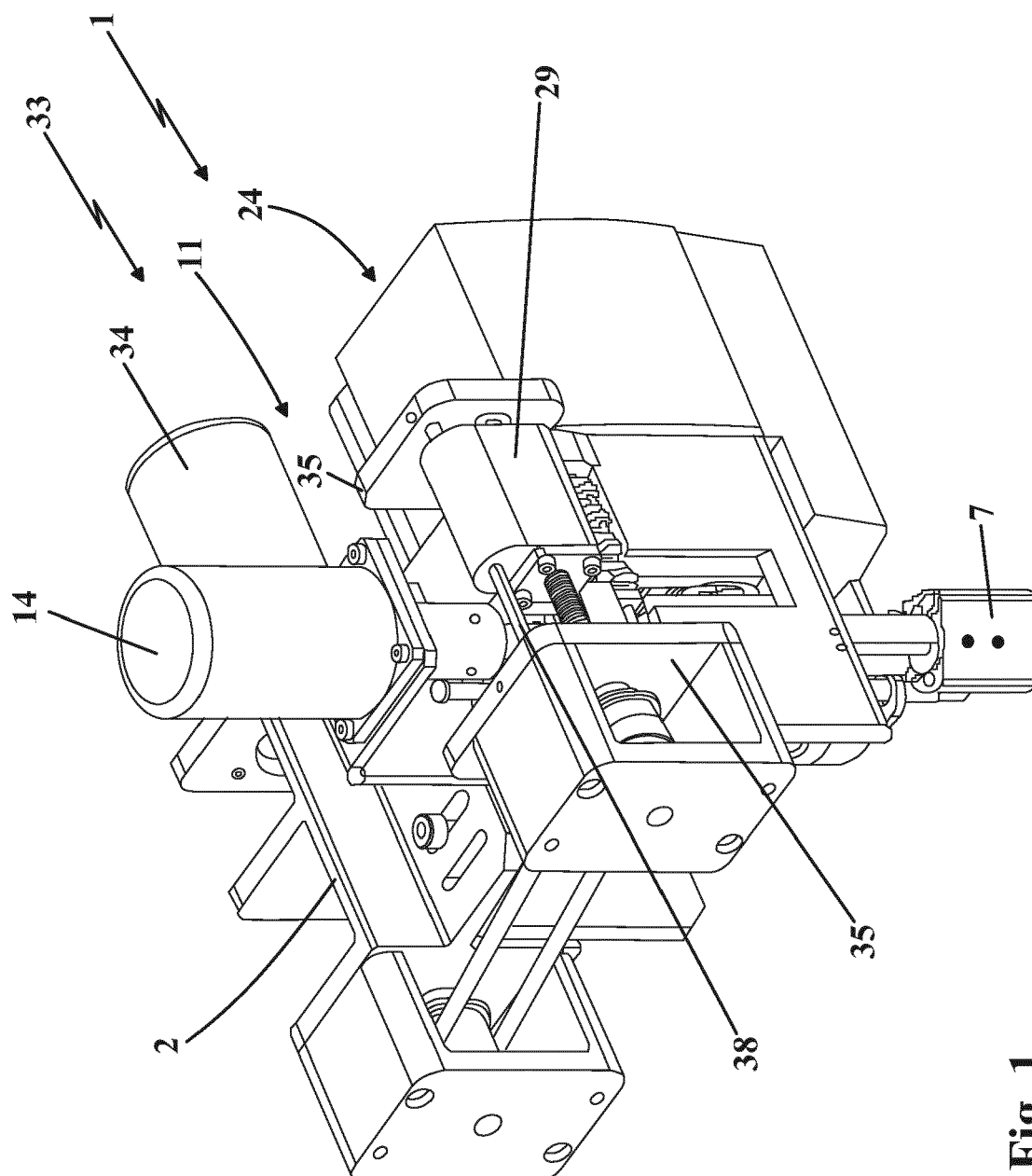
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File 1

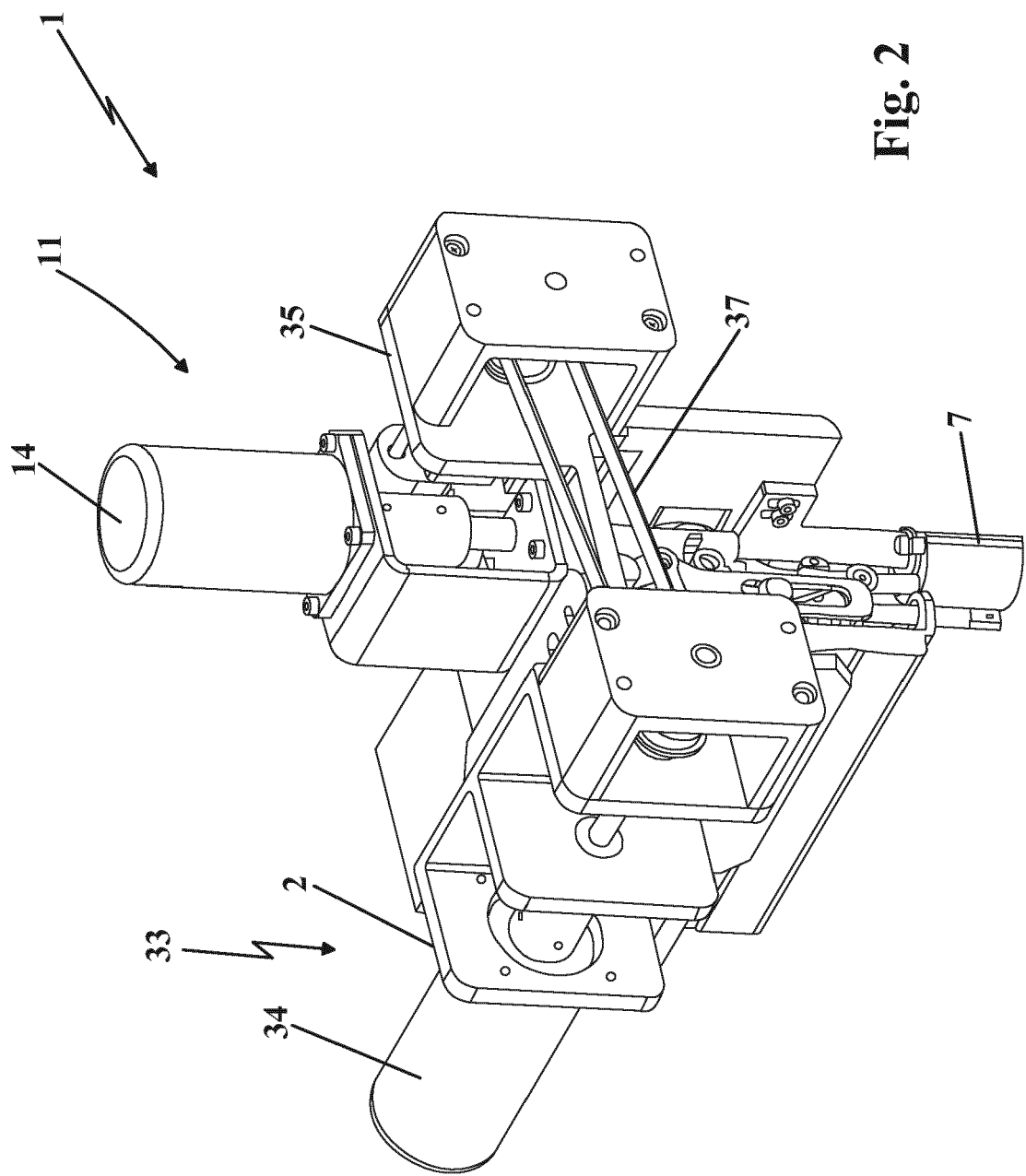


Fig. 2

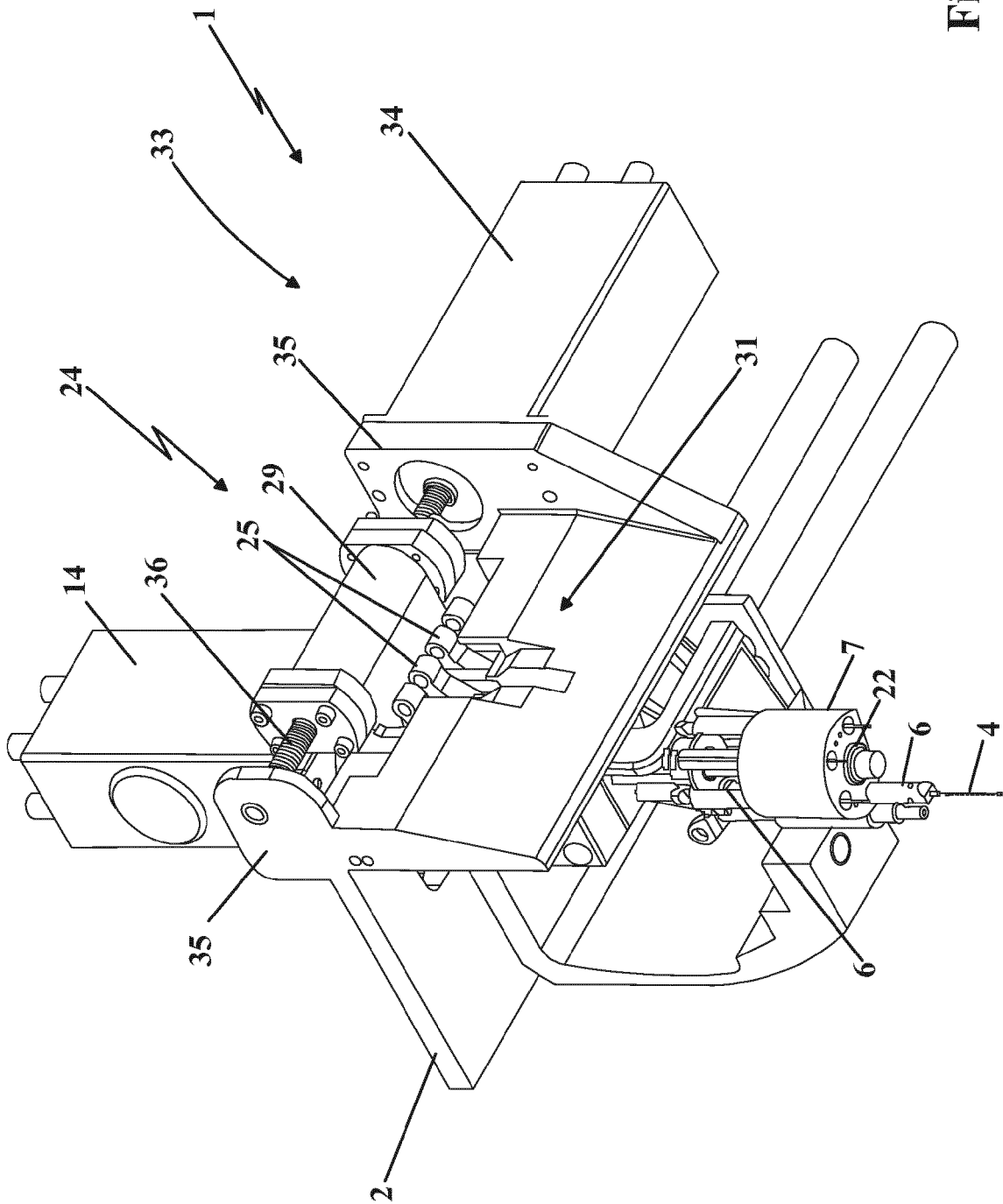


Fig. 3

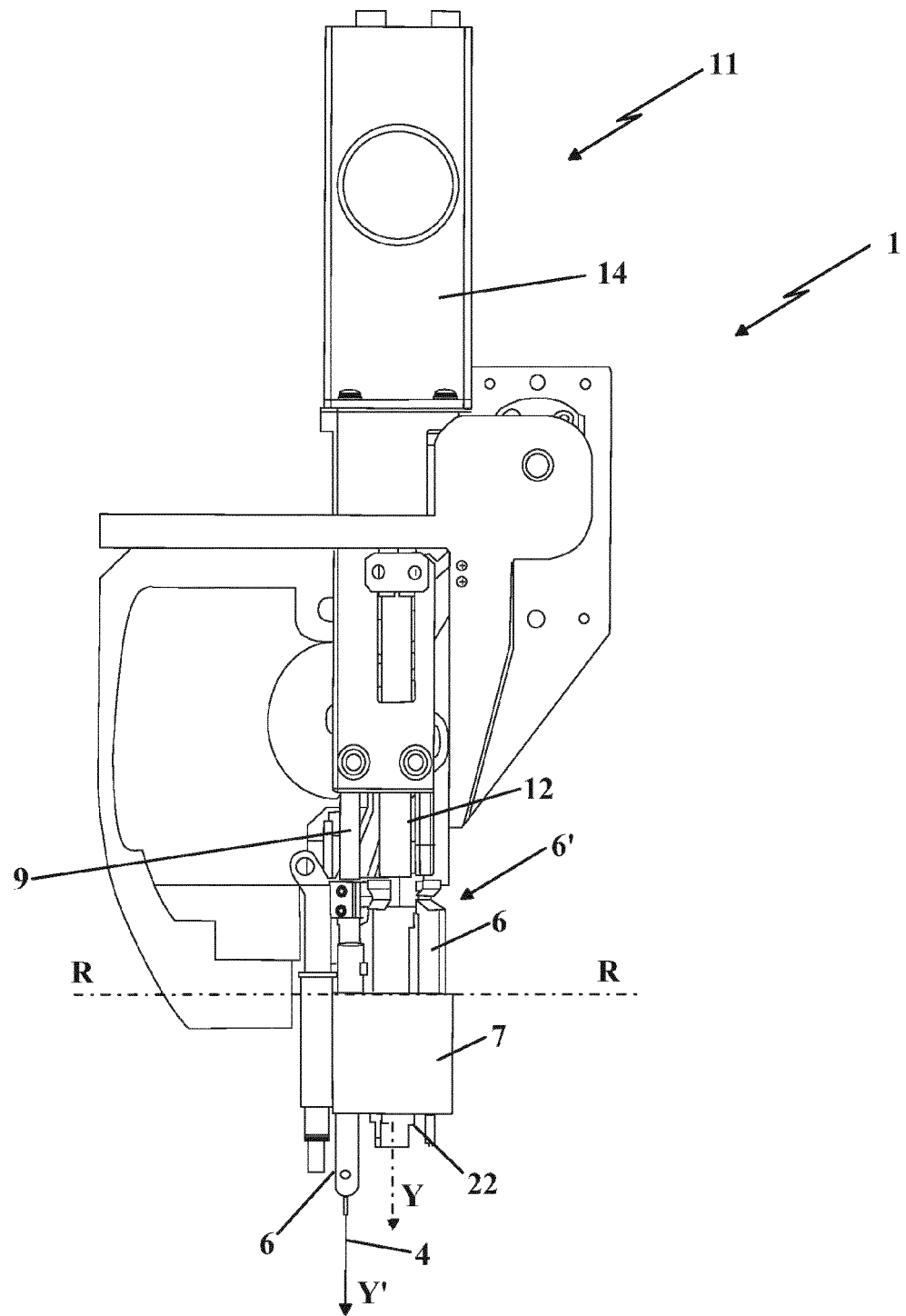


Fig. 4

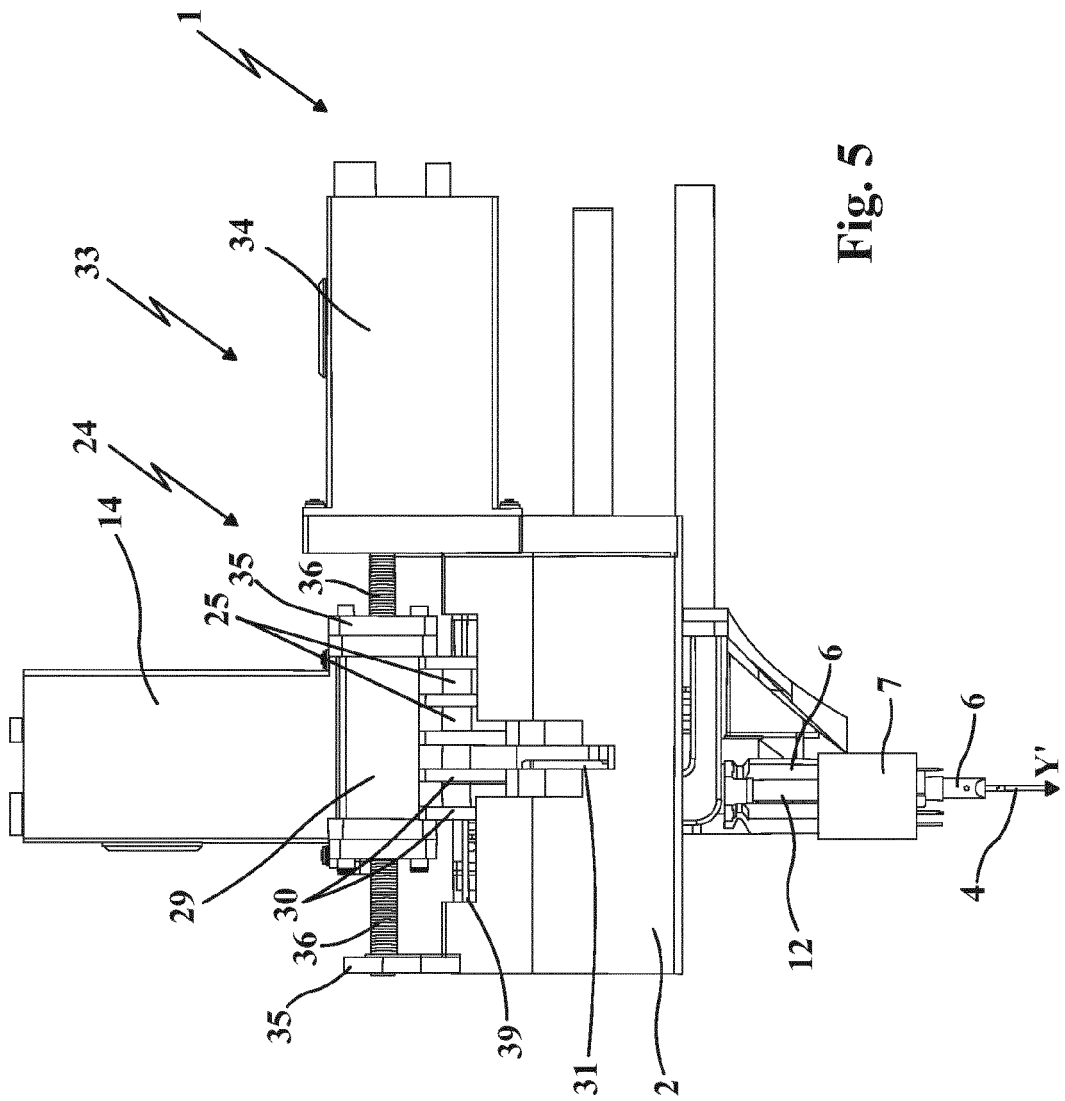


Fig. 5

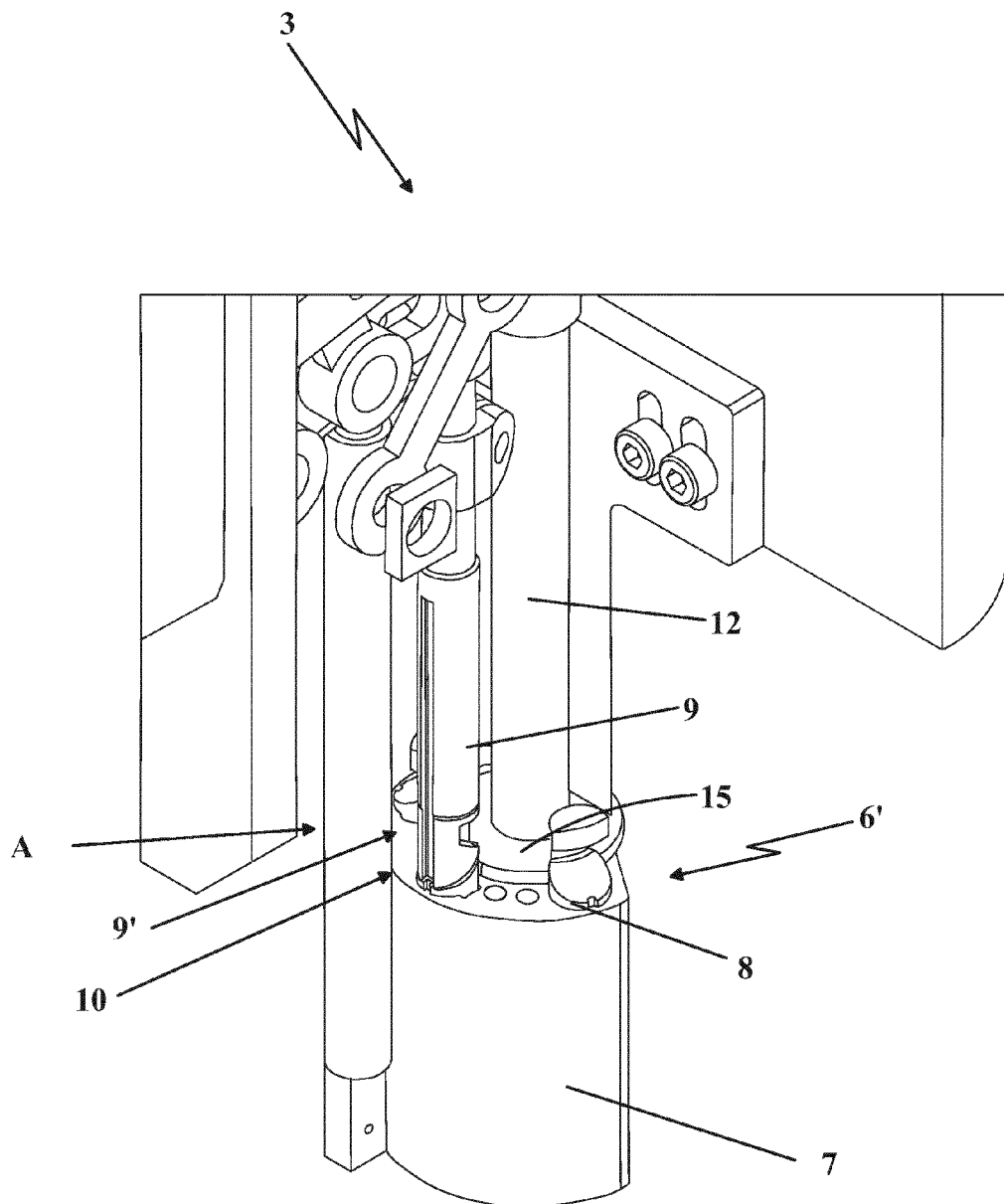


Fig. 6A

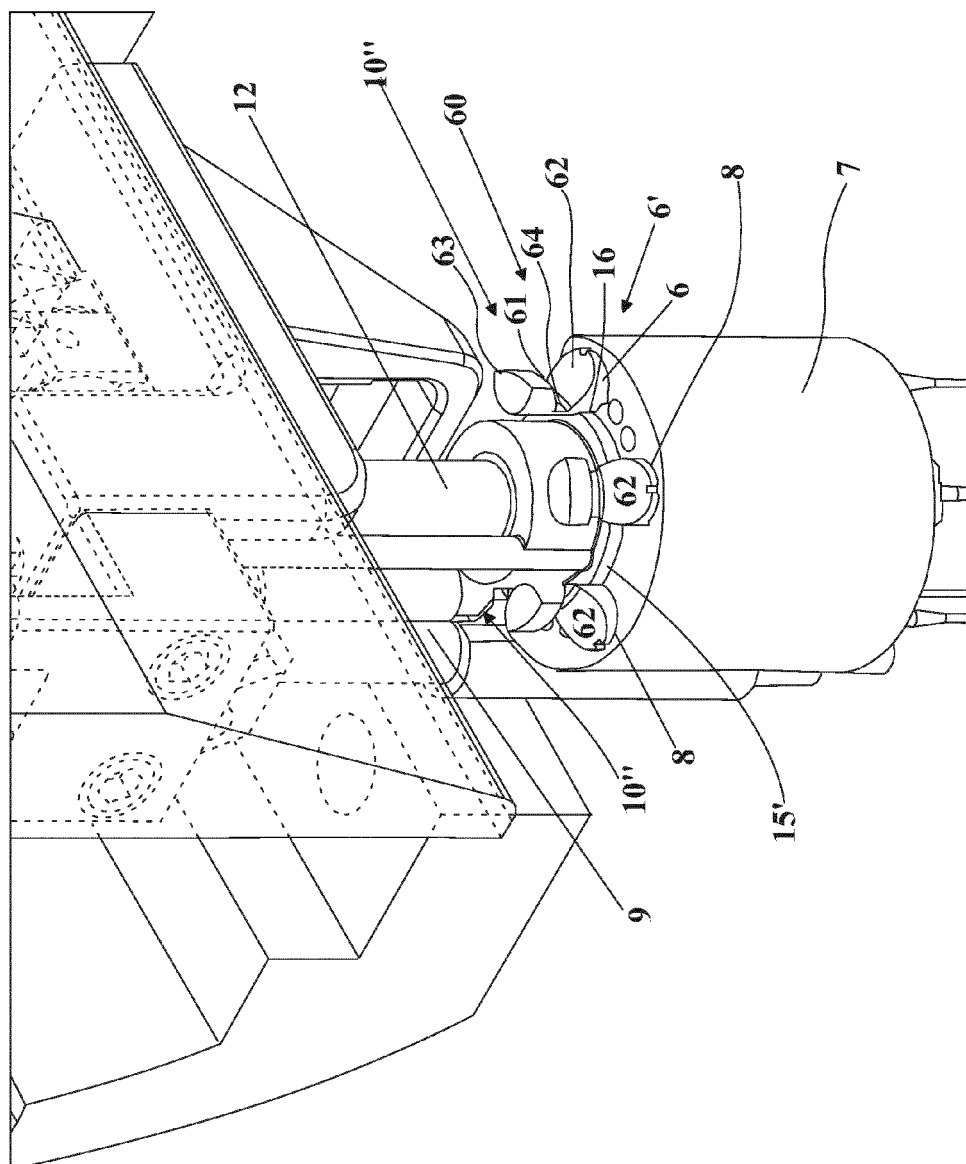


Fig. 6B

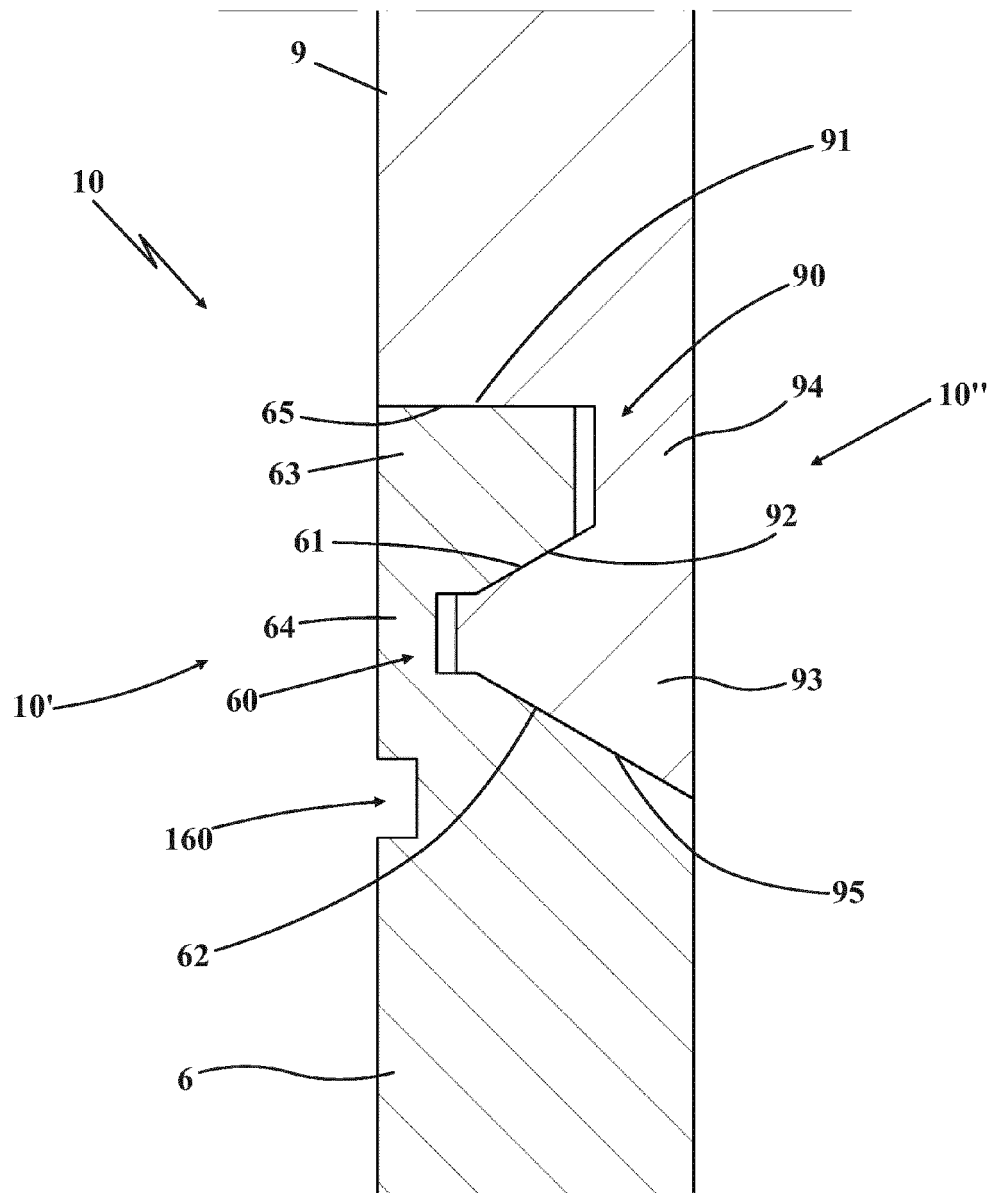
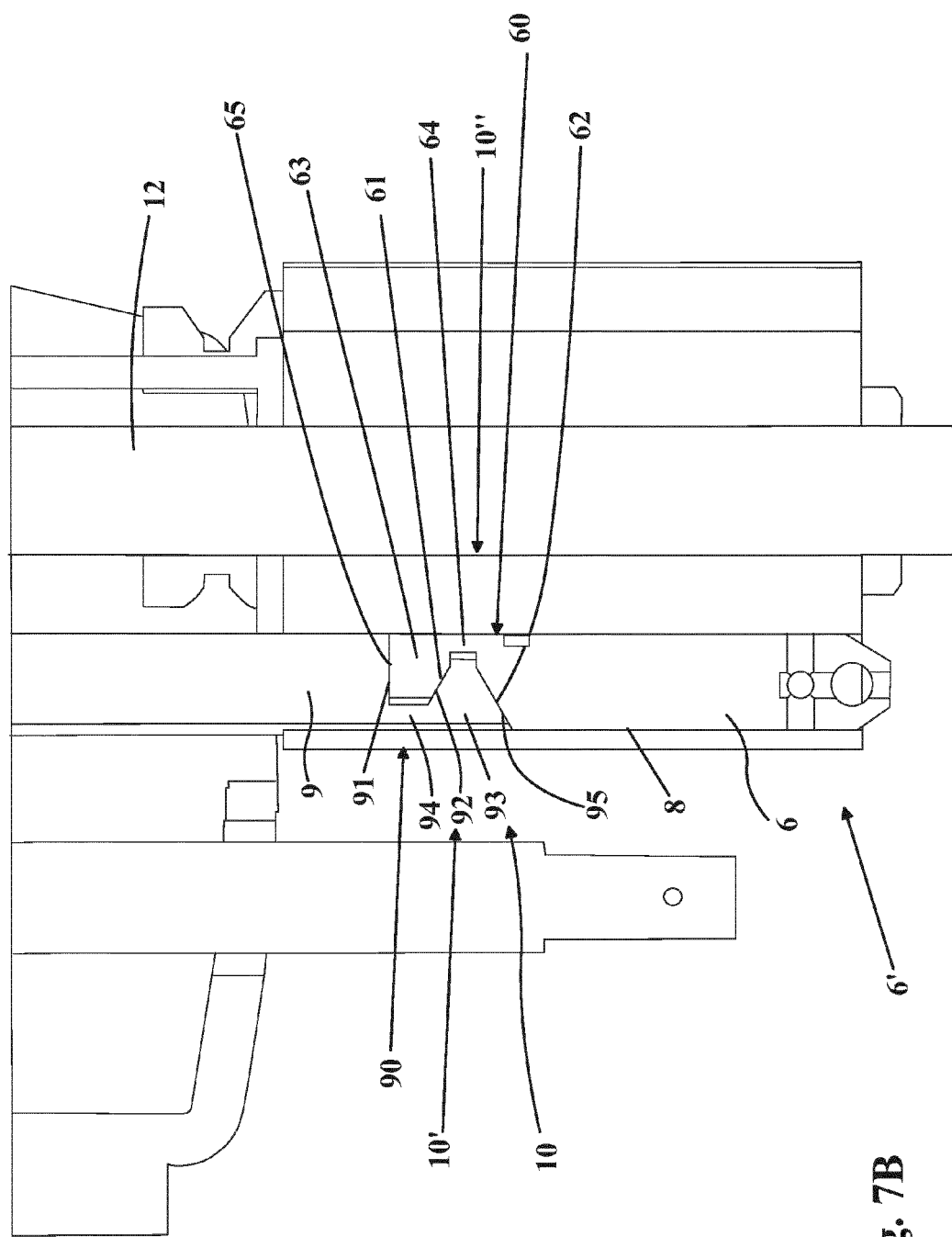


Fig. 7A



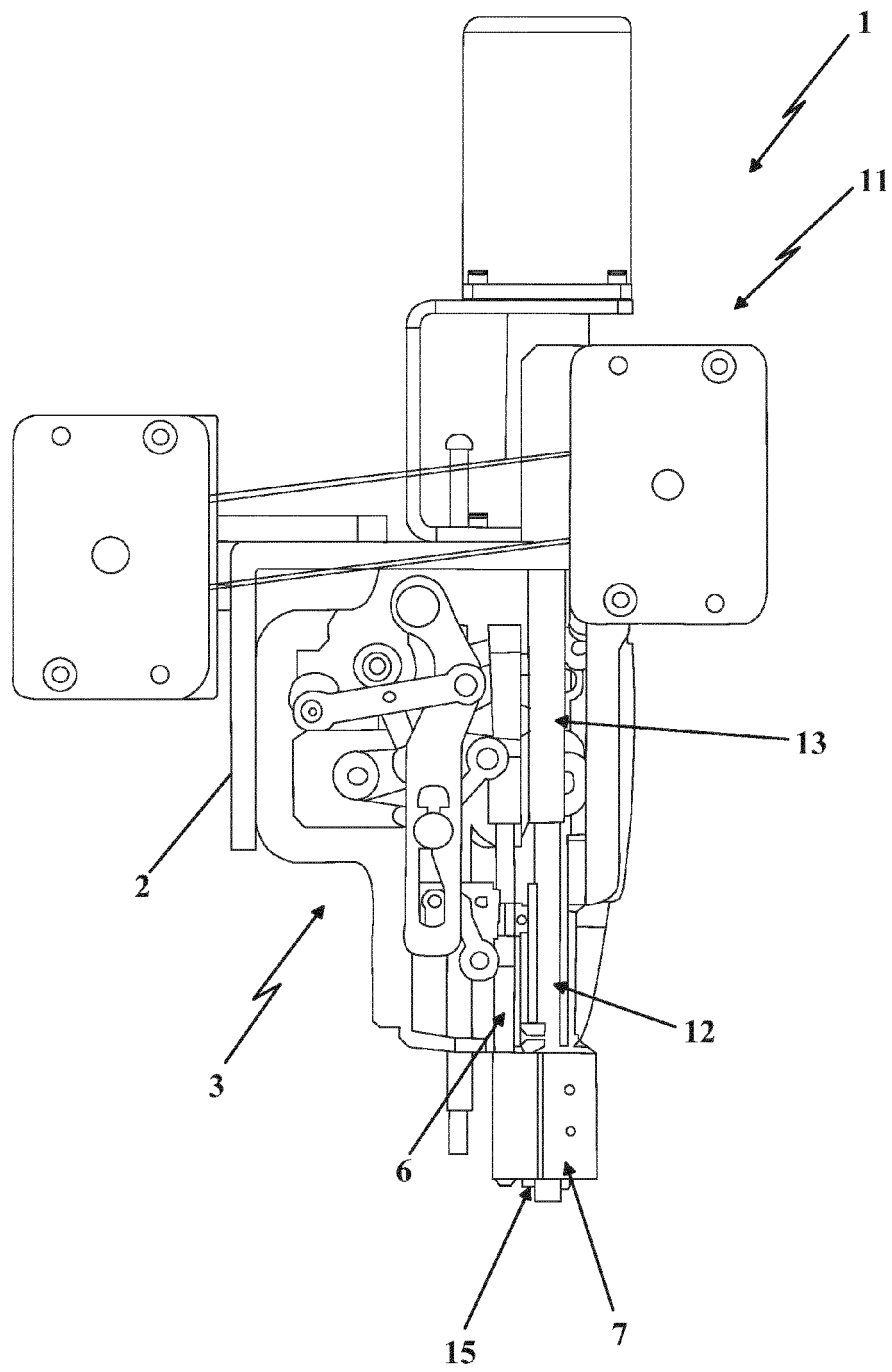


Fig. 8

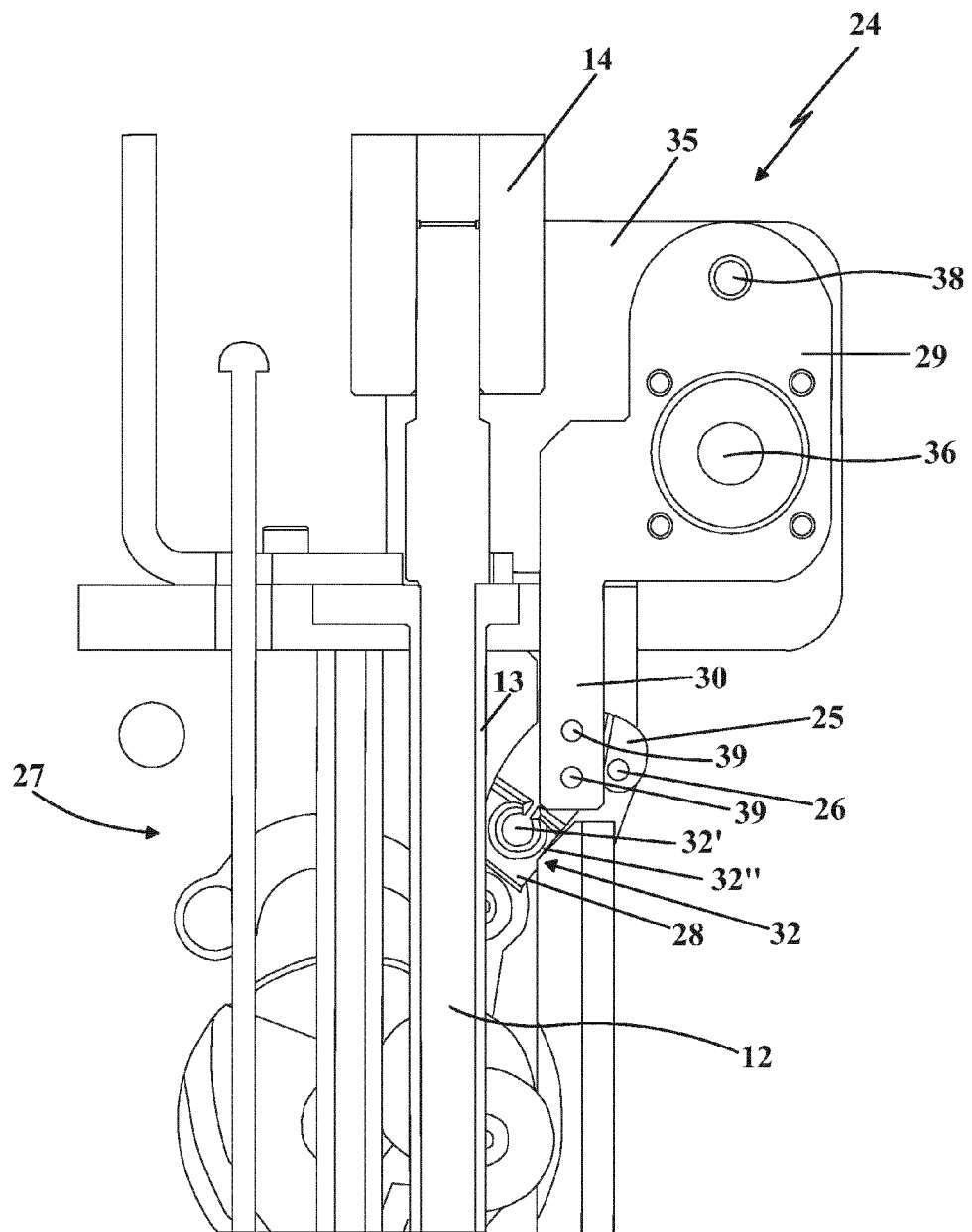


Fig. 9

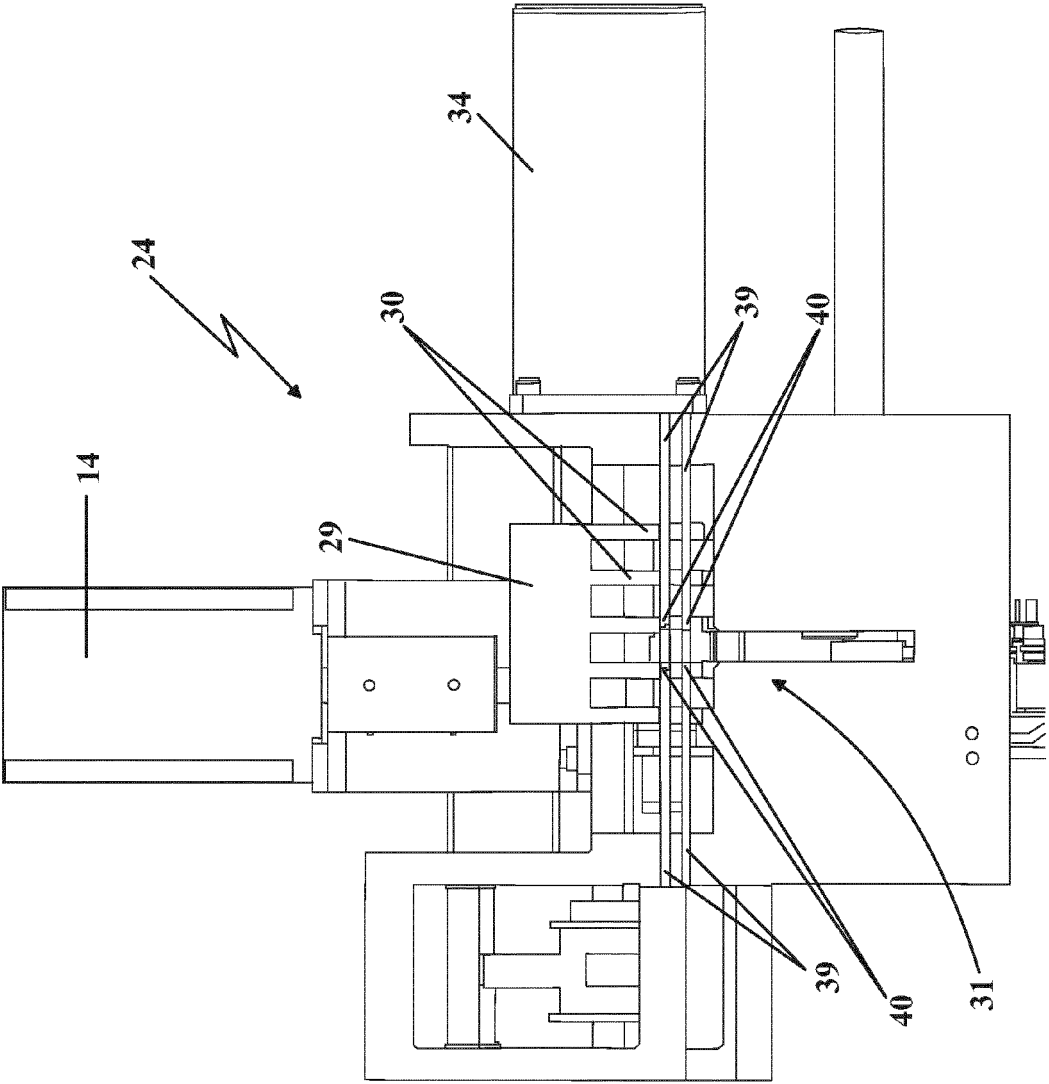
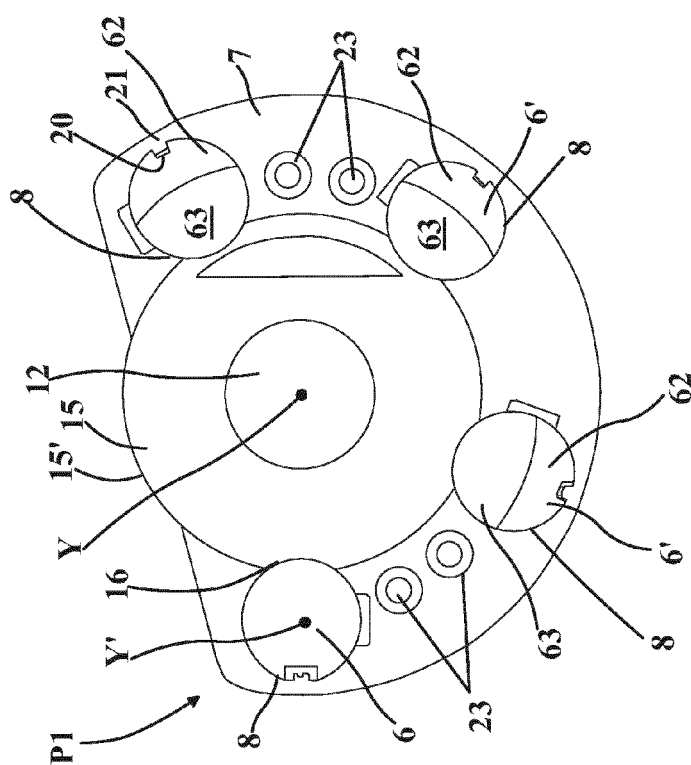
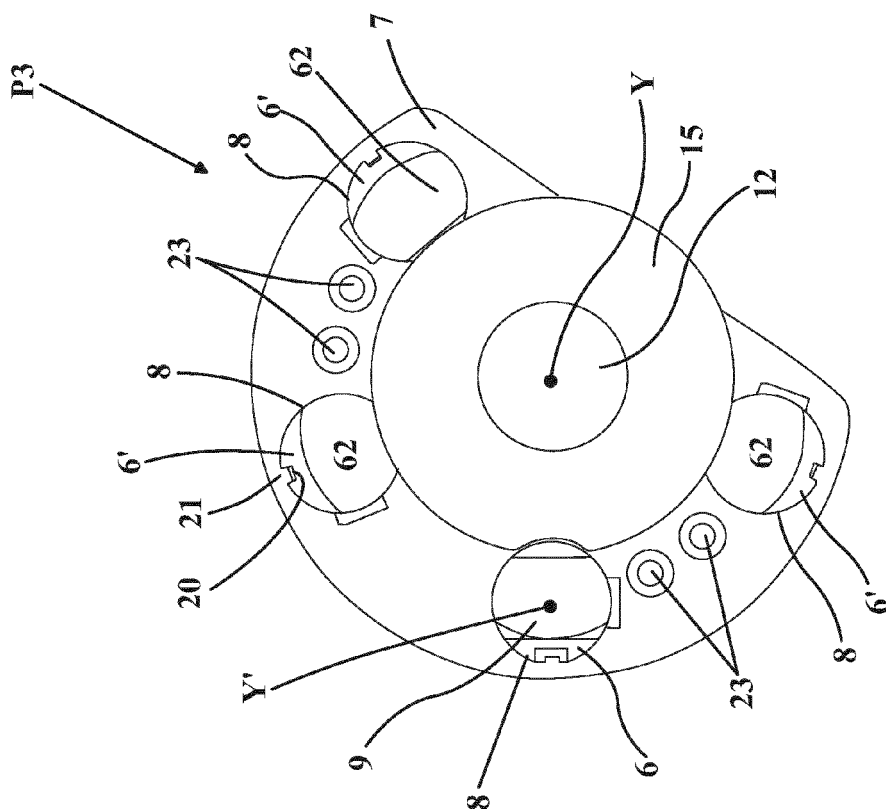


Fig. 10



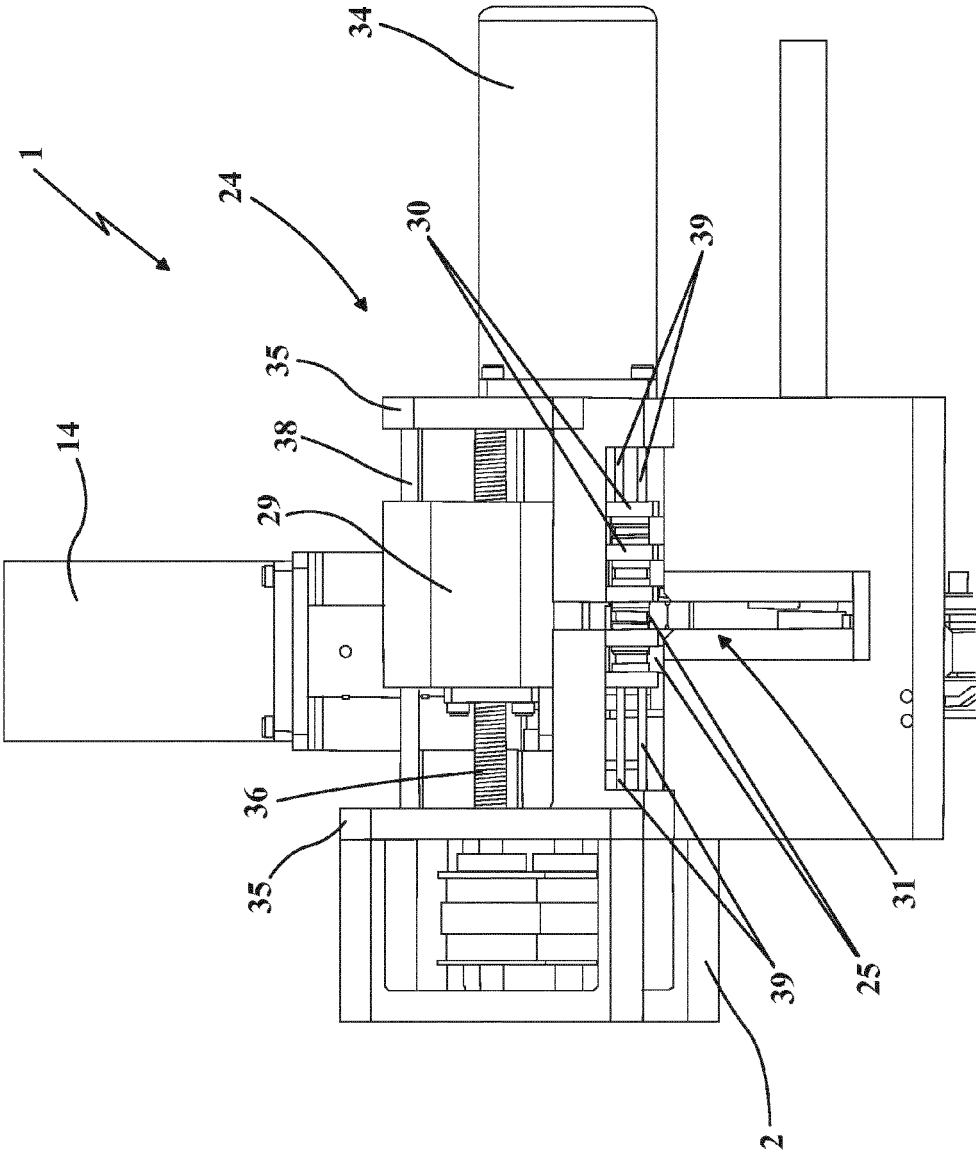


Fig. 12 A

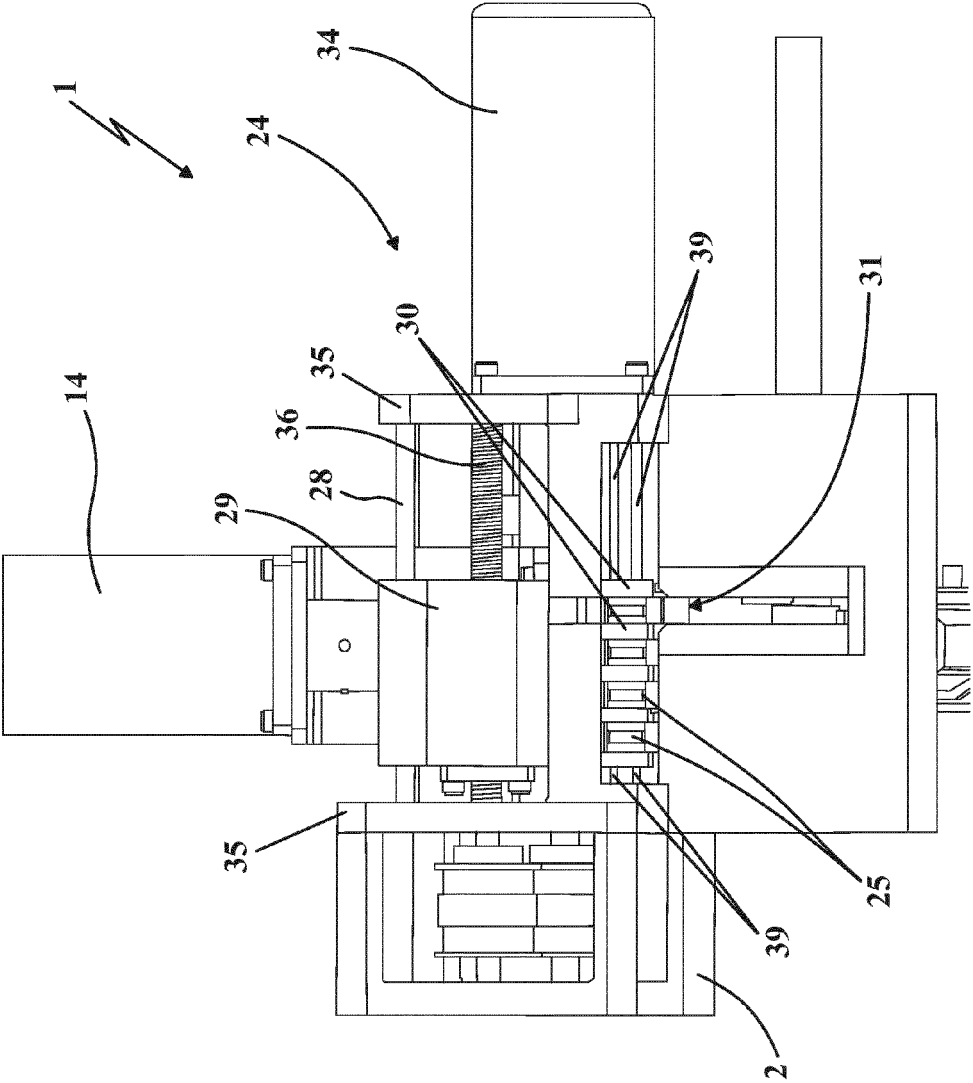


Fig. 12 B

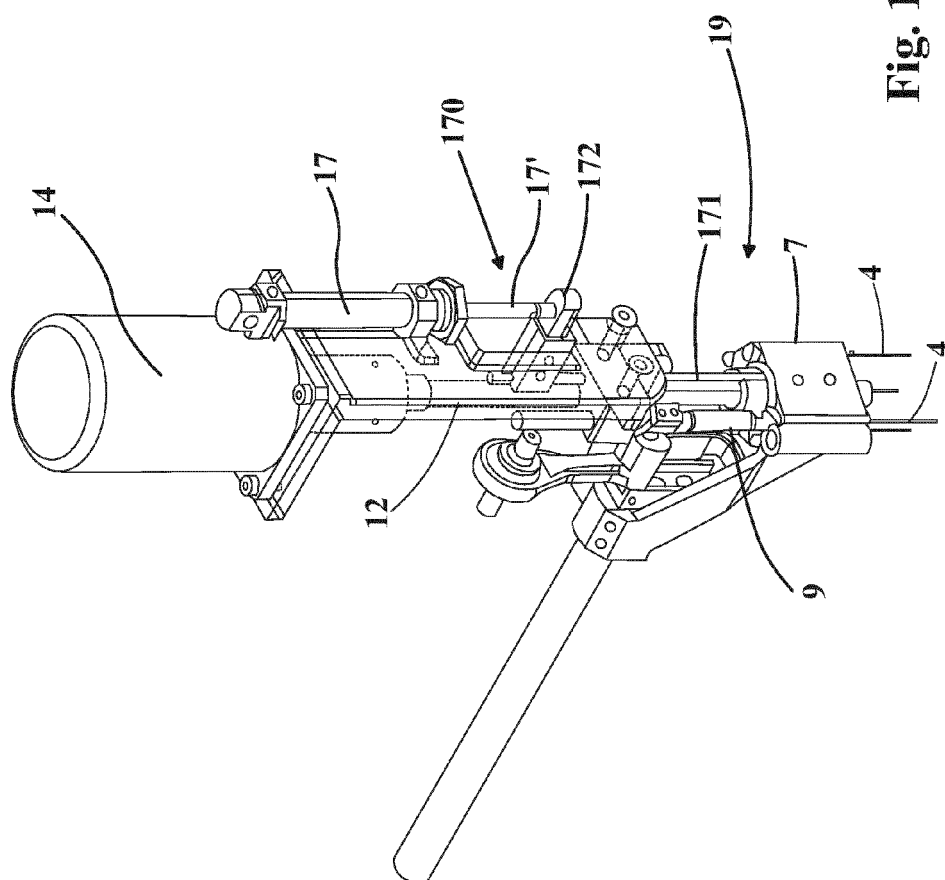
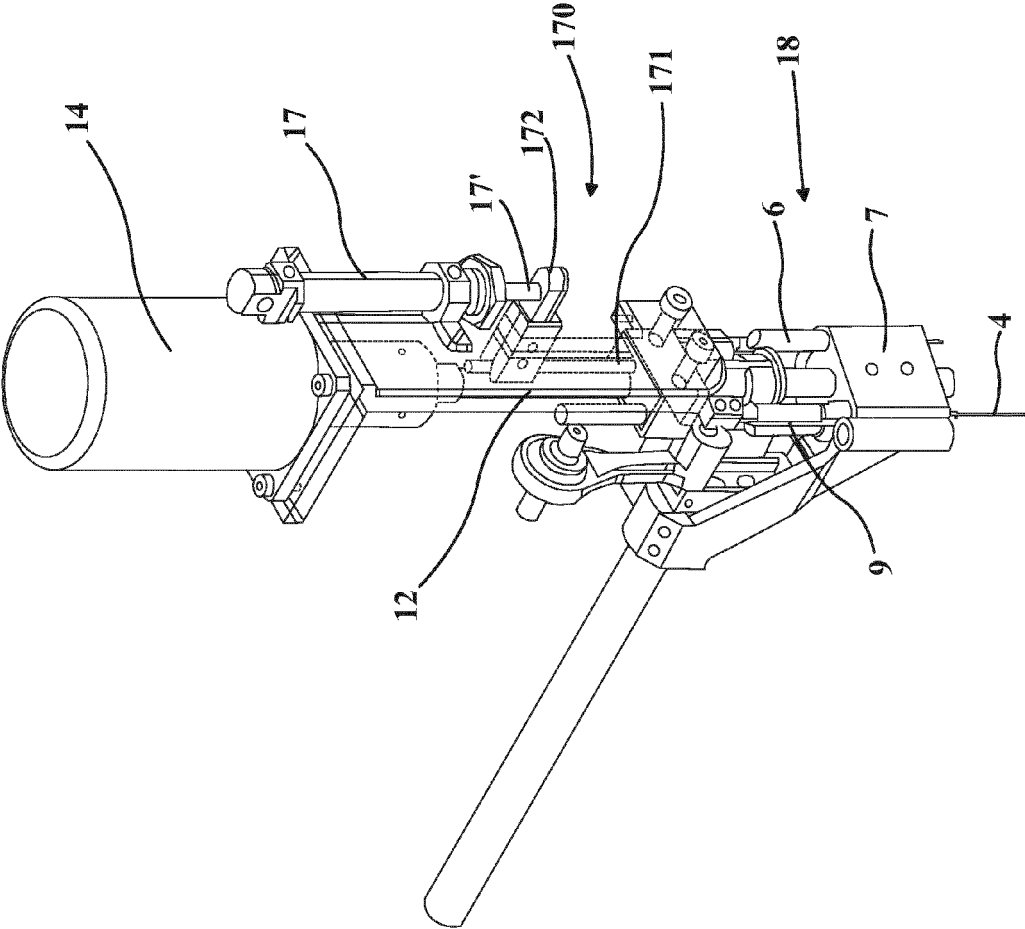


Fig. 13 A

Fig. 13 B



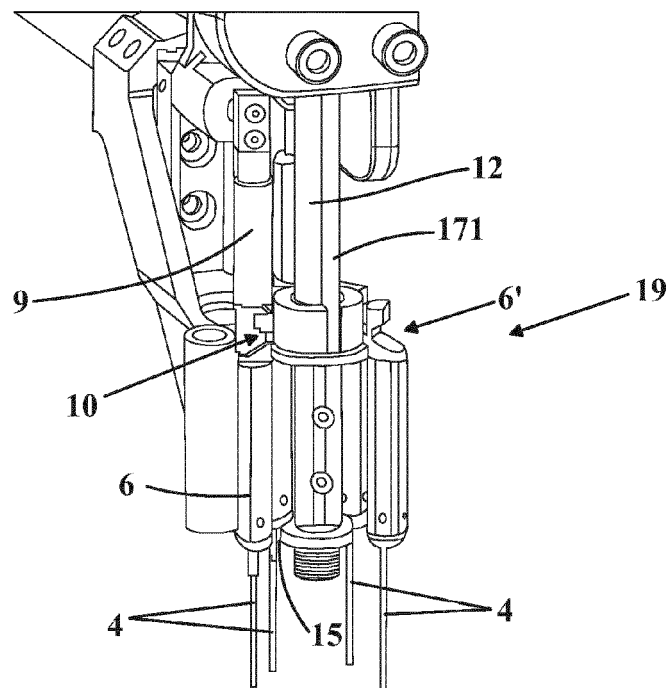


Fig. 14A

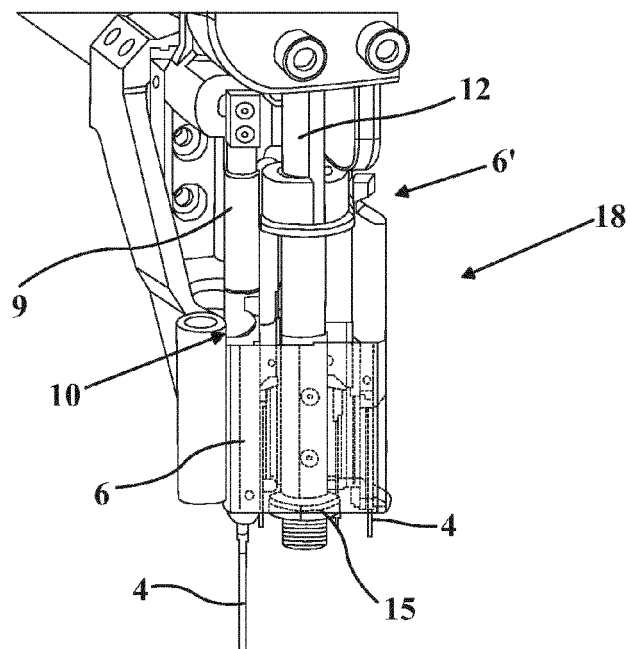


Fig. 14B



EUROPEAN SEARCH REPORT

Application Number
EP 14 16 5550

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 3 September 2014	Examiner Herry-Martin, D
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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