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(54) **Buttonholing machine with hammer position adjustment mechanism**

(57) A buttonholing machine includes a hammer position adjustment mechanism for changing the length of a buttonhole being formed, and the hammer position adjustment mechanism includes a hammer, a locating block driven by a driving unit to move vertically, a slidable hammer holder connected to the hammer and slidably assembled to the locating block to move vertically along with the locating block, a driving source mounted on the locating block for driving the slidable hammer holder to move laterally in y-axis direction through meshing of a screw rod connected to the driving source with a threaded hole provided on the slidable hammer holder. When the screw rod is driven by the driving source to rotate in the threaded hole, the slidable hammer holder is caused to move linearly in y-axis direction. With these arrangements, the hammer position adjustment mechanism is simplified and occupies less operational space on the buttonholing machine.

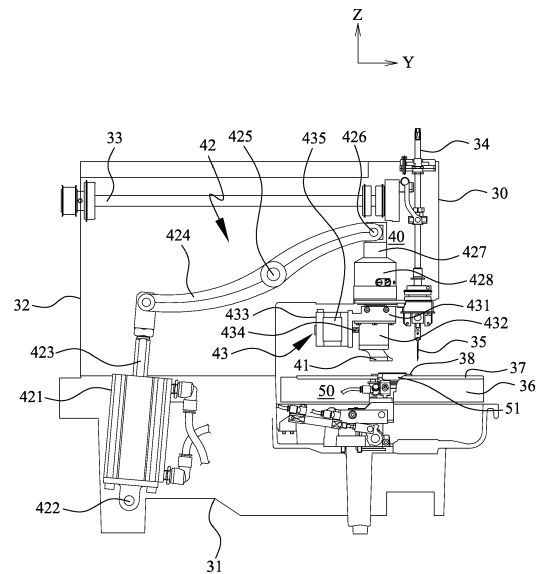


FIG. 3

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a buttonholing machine for forming buttonholes on fabrics, and more particularly to a buttonholing machine that includes a hammer position adjustment mechanism, with which buttonholes of different lengths can be cut on fabrics simply by changing a relative position between a hammer and a knife without the need of replacing any parts on the buttonholing machine.

BACKGROUND OF THE INVENTION

[0002] Fig. 1A schematically shows a conventional buttonhole cutting device of a buttonholing machine includes a vertically movable shaft 10, a locating block 11 connected to a lower end of the shaft 10, an air cylinder 12 enclosed in the locating block 11, a sliding mechanism 13 coupled to and driven by the air cylinder 12 to automatically slide in y-axis direction, and a hammer 14 fixedly connected to a lower end of the sliding mechanism 13. Fig. 1B shows a stitched buttonhole 16 completed with the conventional buttonhole cutting device of the buttonholing machine of Fig. 1A.

[0003] To use the buttonholing machine of Fig. 1A to form a buttonhole on a fabric, first horizontally move the hammer 14 rightward to a first position a1, and then lower the hammer 14 to contact with a knife 15 located below a fabric feeding table of the buttonholing machine, so that the hammer 14 cooperates with the knife 15 to cut a buttonhole 16 on a fabric that is placed on the fabric feeding table between the hammer 14 and the knife 15. In the case an intended overall length L2 of the buttonhole 16 to be formed on the fabric is larger than a length L1 of the hammer 14, it is necessary to horizontally move the hammer 14 leftward to a second position a2, and then lower the hammer 14 again in order to increase the length of the initially formed buttonhole 16. In the case the total length of the buttonhole 16 formed through the first two times of cutting is still shorter than the required overall length L2, it is necessary to horizontally move the fabric feeding table in a direction indicated by the arrow a and then lower the hammer 14 again to cut the fabric a third time for forming the buttonhole 16 with a desired overall length L2.

[0004] With the buttonholing machine of Fig. 1A, it is able to form buttonholes of different lengths on fabrics without the need of replacing any part on the machine. However, in the case of forming a relatively long buttonhole, the hammer must be horizontally moved and repeatedly lowered two to three times and the whole buttonholing operation requires prolonged time to complete. That is, the buttonholing operation could not be completed quickly.

[0005] Fig. 2 schematically shows another conventional buttonhole cutting device of a buttonholing machine

that includes a knife 20 located on a bed portion of the buttonholing machine, a cutting block 21 cooperatively working with the knife 20, a driving shaft 22 driving the cutting block 21 to move vertically relative to the knife 20, a horizontally slidable plate 23 connected to the cutting block 21 and having a guide rod 24 movably fitted in a slide rail 26 that is fixedly connected to a supporting plate 25, which is in turn mounted on a body portion 27 of the buttonholing machine, and a step motor 28 mounted to the supporting plate 25 and having a screw rod 29 connected to the horizontally slidable plate 23 to serve as a driving member. By regulating the step motor 28, the horizontally slidable plate 23 can bring the cutting block 21 to move horizontally and accordingly change its horizontal position relative to the knife 20, enabling the buttonholing machine of Fig. 2 to form buttonholes of different lengths with one single cutting operation.

[0006] However, the buttonholing machine of Fig. 2 has the disadvantage that the whole mechanism for driving the cutting block to move horizontally is bulky in volume and includes a large number of parts. In addition, the driving mechanism also occupies a large part of the operational space on the buttonholing machine between a head portion and a bed portion thereof. That is, the conventional buttonhole cutting device for the buttonholing machine of Fig. 2 not only increases the manufacturing cost of the buttonholing machine, but also causes inconvenience in operating the machine.

SUMMARY OF THE INVENTION

[0007] A primary object of the present invention is to provide a buttonholing machine with hammer position adjustment mechanism, a hammer position adjustment unit of which has a simplified design to include fewer part and occupy less operational space on the buttonholing machine, and can be automatically or manually operable in different embodiments to satisfy different requirements in use.

[0008] To achieve the above and other objects, the buttonholing machine with hammer position adjustment mechanism provided according to the present invention includes a head portion, a bed portion and a body portion located between the head and the bed portion. The head portion has an upward and downward reciprocatingly movable needle bar mounted thereto, and the bed portion has a fabric feeding table arranged thereon to be horizontally movable in x-axis and y-axis directions. The buttonholing machine includes a buttonhole cutting device that is located behind the needle bar and includes an upper unit assembled to the head portion and a lower unit mounted on the bed portion.

[0009] The hammer position adjustment mechanism includes a hammer connected to the upper unit to cooperatively work with the lower unit for forming a buttonhole; a driving unit for driving the hammer to move vertically in z-axis direction; and a hammer position adjustment unit for horizontally moving the hammer in y-axis direc-

tion. The hammer position adjustment unit includes a locating block connected to the driving unit, a slidable hammer holder connected to the hammer and slidably assembled to the locating block, and a driving source for driving the slidable hammer holder and accordingly the hammer to move laterally in y-axis direction. The locating block defines a slide channel and the slidable hammer holder defines a slide rail. The slidable hammer holder is slidably assembled to the locating block with the slide rail received in the slide channel.

[0010] The buttonholing machine with hammer position adjustment mechanism according to the present invention is characterized by that, in the hammer position adjustment unit, the slidable hammer holder is internally provided with a threaded hole and is connected to the driving source via a screw rod. The screw rod is connected at an end to the driving source and has a centerline parallel to the y-axis direction, in which the slidable hammer holder is laterally moved relative to the locating block, so as to extend into and mesh with the threaded hole. Therefore, when the driving source drives the screw rod to rotate in the threaded hole, the slidable hammer holder is caused to move laterally in y-axis direction relative to the locating block. Further, according to a first embodiment of the present invention, the driving source is a step motor; and in a second embodiment, the driving source is a manually operated adjustment control.

[0011] In the second embodiment, the hammer position adjustment unit further includes a locating member provided between the manually operated adjustment control and the supporting bracket of the locating block, and the screw rod has a locating ring fitted therearound and clamped between the locating member and the supporting bracket, such that the screw rod is restricted from moving axially. Further, the hammer position adjustment unit also includes an indicating unit, which includes an indicator scale provided on a lateral side of the locating block and an indicating pointer provided on one side the slidable hammer holder to point to the indicator scale.

[0012] In brief, the buttonholing machine of the present invention is characterized in that the hammer position adjustment unit thereof includes fewer parts and occupies less space compared to the conventional buttonholing machine, enabling the buttonholing machine to be manufactured at reduced cost. Further, the hammer position adjustment unit can be differently configured to be automatically or manually operable to satisfy different requirements in use.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The structure and the technical means adopted by the present invention to achieve the above and other objects can be best understood by referring to the following detailed description of the preferred embodiments and the accompanying drawings, wherein

Fig. 1A schematically shows the manner in which a

conventional buttonhole cutting device of a buttonholing machine with one single knife forms a buttonhole on a fabric through multiple times of cutting operation;

Fig. 1B is a plan view showing a stitched buttonhole completed with the conventional buttonhole cutting device of Fig. 1A;

Fig. 2 shows another conventional buttonhole cutting device of a buttonholing machine that includes a step motor for driving a cutting block to move;

Fig. 3 is a side perspective view of a buttonholing machine with hammer position adjustment mechanism according to the present invention;

Fig. 4 is a fragmentary sectional view showing an upper unit of a buttonhole cutting device of the buttonholing machine shown in Fig. 3;

Fig. 5 is a perspective view of an automatically operable hammer position adjustment device for the buttonholing machine according to a first embodiment of the present invention;

Fig. 6 is a sectional view of a manually operable hammer position adjustment device for the buttonholing machine according to a second embodiment of the present invention; and

Fig. 7 is a perspective view of the manually operable hammer position adjustment device shown in Fig. 6.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] The present invention will now be described with some preferred embodiments thereof and with reference to the accompanying drawings. For the purpose of easy to understand, elements that are the same in the preferred embodiments are denoted by the same reference numerals.

[0015] Please refer to Fig. 3 that is a side perspective view of a buttonholing machine with hammer position adjustment mechanism according to the present invention. As shown, the buttonholing machine includes a head portion 30, a bed portion 31, and a body portion 32 located between the head portion 30 and the bed portion 31. The head portion 30 includes an upper shaft 33, which has an end connected to and driven by a driving motor (not shown) to rotate, so that a needle bar 34 connected to another end of the upper shaft 33 is brought to move upward and downward in a reciprocating motion. The needle bar 34 has a needle 35 mounted to a leading end thereof. On the bed portion 31, there is arranged a fabric feeding table 36 that is horizontally movable in x-axis and y-axis directions. Two fabric pressers 37 are provided on

the fabric feeding table 36, and each of the fabric pressers 37 has a needle plate 38 provided thereon.

[0016] A buttonhole cutting device is located behind the needle bar 34, and includes an upper unit 40 and a lower unit 50 that cooperatively works with the upper unit 40. The upper unit 40 is connected to a hammer 41, which is located at the head portion 30 and driven by a driving unit 42 to move vertically in z-axis direction in a reciprocating motion. The lower unit 50 includes a knife 51 located below the hammer 41. Therefore, the downward moved hammer 41 is able to contact with the knife 51 of the lower unit 50.

[0017] The hammer 41 is connected to the driving unit 42 via a hammer position adjustment unit 43. The hammer position adjustment unit 43 brings the hammer 41 to horizontally move in y-axis direction, so as to adjust a relative position between the hammer 41 and the knife 51 for changing an overall length of a buttonhole being cut.

[0018] In the illustrated embodiment, the driving unit 42 includes a driving cylinder 421, such as an air cylinder, which is actuated when buttonholes are to be cut on a fabric. The driving cylinder 421 is fixedly connected at an end to the bed portion 31 via a first supporting shaft 422, and movably connected at another end to an end of a linking arm 424 via an extension arm 423. The linking arm 424 is freely turnable about a second supporting shaft 425, which is fixedly mounted on the head portion 30, and is connected at another end to an up-down movable shaft 427 via a third supporting shaft 426. The up-down movable shaft 427 is fitted in a guide member 428, which is fixedly mounted to the head portion 30 to limit a vertical range within which the up-down movable shaft 427 can be driven by the driving cylinder 421 to move upward and downward.

[0019] Please refer to Figs. 4 and 5. According to a first embodiment of the present invention, the hammer position adjustment unit 43 is configured to be automatically operable, and includes a locating block 431 connected to a bottom of the up-down movable shaft 427, a slidable hammer holder 432 movably assembled to the locating block 431, and a driving source 433 engaged with the slidable hammer holder 432 for driving the latter to move laterally in y-axis direction. The hammer 41 is connected to the slidable hammer holder 432.

[0020] The locating block 431 has a lower side defining a slide channel 431 a. The slidable hammer holder 432 has a top defining a slide rail 432a, which is slidably received in the slide channel 431a with a predetermined length extendable beyond an end of the slide channel 431a, and has a lateral surface having a hammer presser 432b mounted thereon to enable convenient replacement of the hammer 41 by a user. The slide rail 432a is provided with a threaded hole 432c, which is inward extended from an end of the slide rail 432a in y-axis direction for meshing with a screw rod 434. The screw rod 434 has an end connected to the driving source 433, which can be a step motor 435 located behind the locating block

431, with a centerline of the screw rod 434 parallel to the y-axis direction in which the slidable hammer holder 432 is laterally moved relative to the locating block 431.

[0021] When the driving unit 42 drives the locating block 431, the slidable hammer holder 432 and the hammer 41 to synchronously move upward and downward, the driving source 433 also moves upward and downward along with the locating block 431.

[0022] As can be seen in Figs. 4 and 5, the locating block 431 is formed at an end with a supporting bracket 431b, which is located between the step motor 435 and the slidable hammer holder 432. The supporting bracket 431b has a through hole 431c located corresponding to the threaded hole 432c, and the driving source 433 is located outside the head portion 30 and fixedly mounted on the supporting bracket 431b, such that the screw rod 434 connected at an end to the step motor 435 is extended at a free end thereof through the through hole 431c to mesh with the threaded hole 432c. When the step motor 435 is actuated to rotate the screw rod 434 in the threaded hole 432c, the threaded hole 432c converts the rotary motion of the screw rod 434 into linear motion of the slidable hammer holder 432, bringing the slidable hammer holder 432 to move laterally in y-axis direction relative to the locating block 431.

[0023] Please refer to Figs. 6 and 7 that are sectional and perspective views, respectively, showing the hammer position adjustment unit 43 according to a second embodiment of the present invention. While the hammer position adjustment unit 43 in the second embodiment is generally structurally similar to that in the first embodiment, it is configured for manual operation. For this purpose, the driving source 433 in the hammer position adjustment unit 43 of the second embodiment includes a manually operated adjustment control 436 to replace the step motor 435. Further, a locating member 437 having an opening 437a is provided between the manually operated adjustment control 436 and the supporting bracket 431b of the locating block 431. The screw rod 434 has an end connected to the manually operated adjustment control 436 and another end extended through the opening 437a on the locating member 437 and the through hole 431c on the supporting bracket 431b to mesh with the threaded hole 432c.

[0024] In the hammer position adjustment unit 43 according to the second embodiment of the present invention, there is a locating ring 434a fitted around the screw rod 434 to be clamped between the supporting bracket 431b and the locating member 437, so as to restrict the screw rod 434 from moving axially. Since the slidable hammer holder 432 and the threaded hole 432c are structurally identical to those in the first embodiment of the present invention, they are not repeatedly described herein.

[0025] According to the second embodiment, the hammer position adjustment unit 43 further includes an indicating unit 438, which includes an indicator scale 438a provided on a lateral side of the locating block 431 and

an indicating pointer 438b provided on one side the slidable hammer holder 432 that is located corresponding to the indicator scale 438a, so that the indicating pointer 438b is able to point to the indicator scale 438a, enabling a user to read the indicator scale 438a in a convenient manner.

[0026] The present invention has been described with some preferred embodiments thereof and it is understood that many changes and modifications in the described embodiments can be carried out without departing from the scope and the spirit of the invention that is intended to be limited only by the appended claims.

Claims

1. A buttonholing machine, comprising a head portion, a bed portion, a body portion located between the head portion and the bed portion, a buttonhole cutting device, and a hammer position adjustment mechanism; the head portion having an upward and downward reciprocatingly movable needle bar mounted thereto, the bed portion having a fabric feeding table arranged thereon to be horizontally movable in x-axis and y-axis directions, and the buttonhole cutting device being located behind the needle bar and including an upper unit assembled to the head portion and a lower unit mounted on the bed portion; the hammer position adjustment mechanism including:

a hammer connected to the upper unit to cooperatively work with the lower unit for forming a buttonhole;

a driving unit for driving the hammer to move vertically in z-axis direction; and

a hammer position adjustment unit for horizontally moving the hammer in y-axis direction and including:

a locating block connected to the driving unit;

a slidable hammer holder connected to the hammer and slidably assembled to the locating block, and provided with a threaded hole;

a driving source for driving the slidable hammer holder and accordingly the hammer to move laterally in y-axis direction; and

a screw rod connected at an end to the driving source and having a centerline parallel to y-axis direction, in which the slidable hammer holder is laterally moved relative to the locating block, so as to extend into and mesh with the threaded hole;

whereby when the driving source drives the screw rod to rotate in the threaded hole, the sl-

idable hammer holder is caused to move laterally in y-axis direction relative to the locating block.

2. The buttonholing machine as claimed in claim 1, wherein the locating block includes a supporting bracket located perpendicular to the centerline of the screw rod, and the driving source being mounted on the supporting bracket.
3. The buttonholing machine as claimed in claim 2, wherein the driving source is a step motor.
4. The buttonholing machine as claimed in claim 2, wherein the driving source is a manually operated adjustment control.
5. The buttonholing machine as claimed in claim 4, wherein the hammer position adjustment unit further includes a locating member provided between the manually operated adjustment control and the supporting bracket of the locating block, and the screw rod has a locating ring fitted therearound; the locating member having an opening formed thereon for the screw rod to extend therethrough, and the locating ring being clamped between the locating member and the supporting bracket to restrict the screw rod from moving axially.
6. The buttonholing machine as claimed in claim 4, wherein the hammer position adjustment unit further includes an indicating unit.

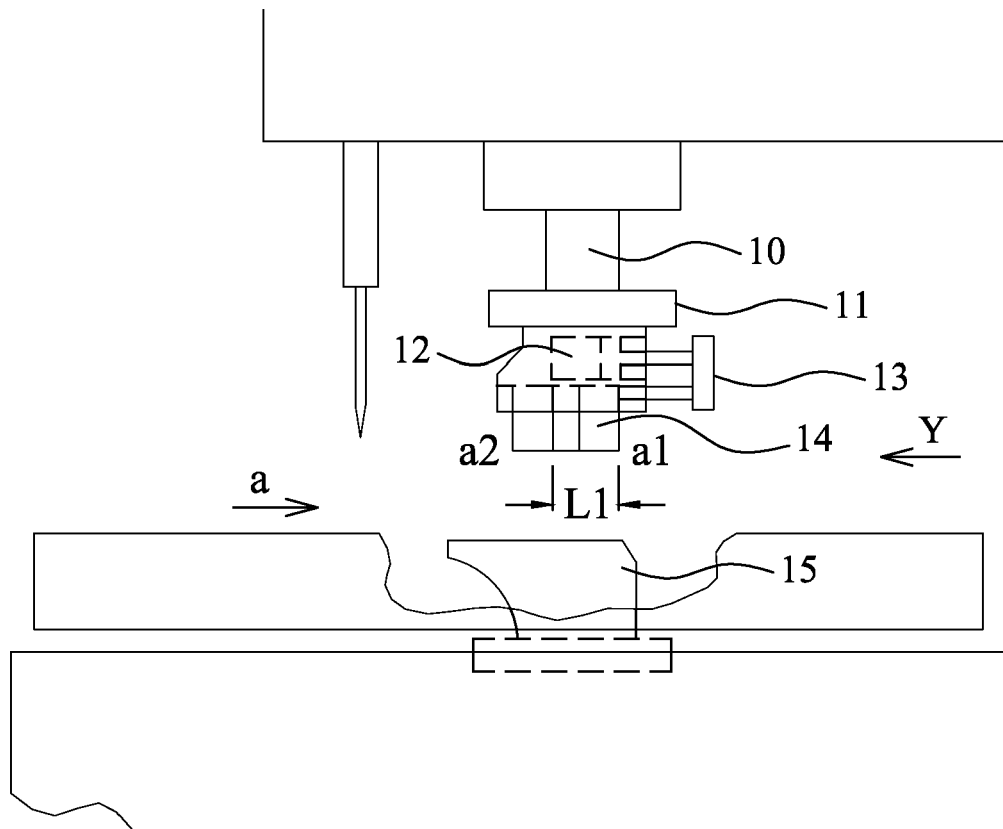


FIG. 1A
(Prior Art)

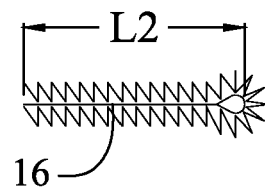


FIG. 1B
(Prior Art)

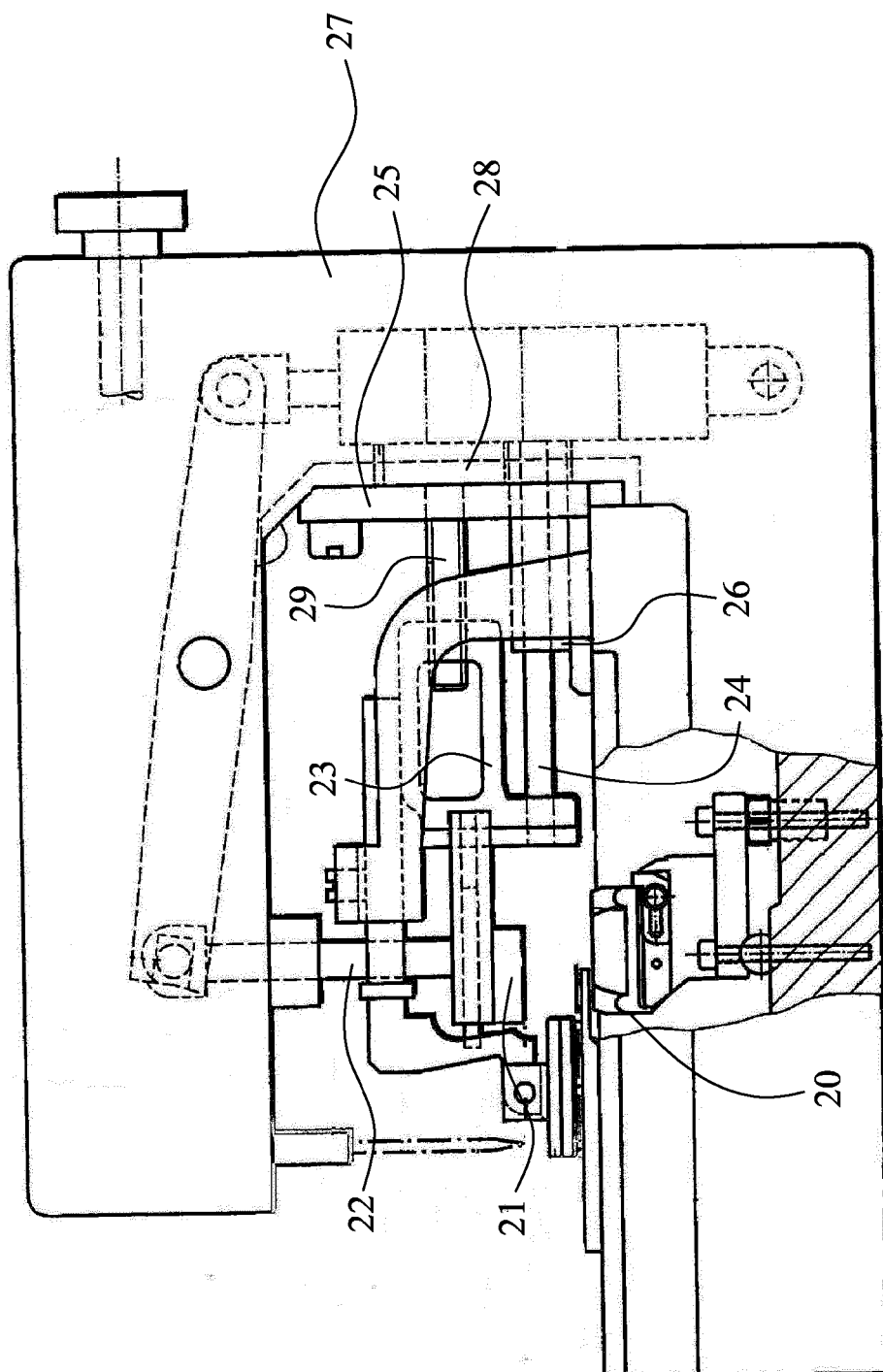


FIG. 2
(Prior Art)

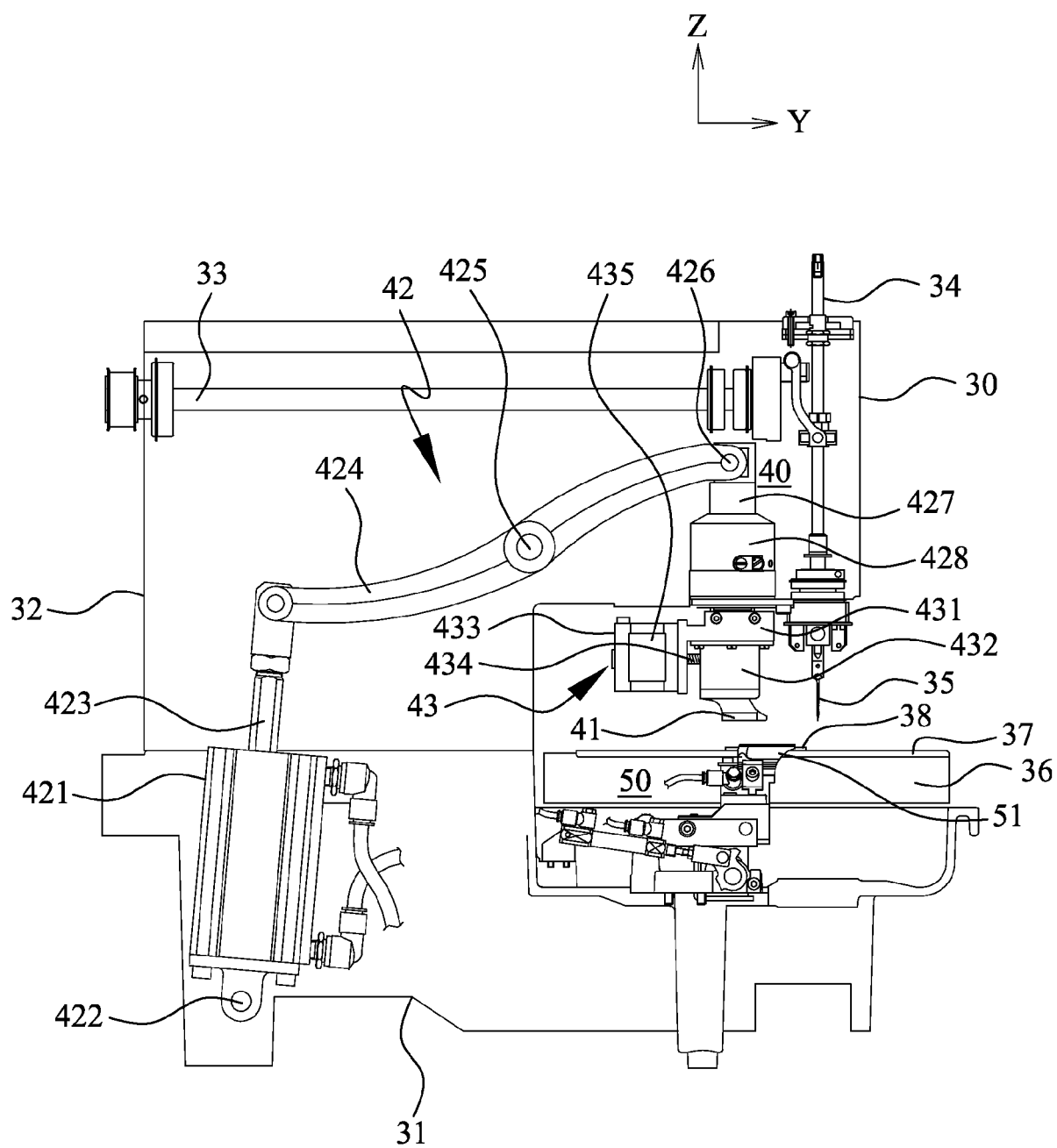


FIG. 3

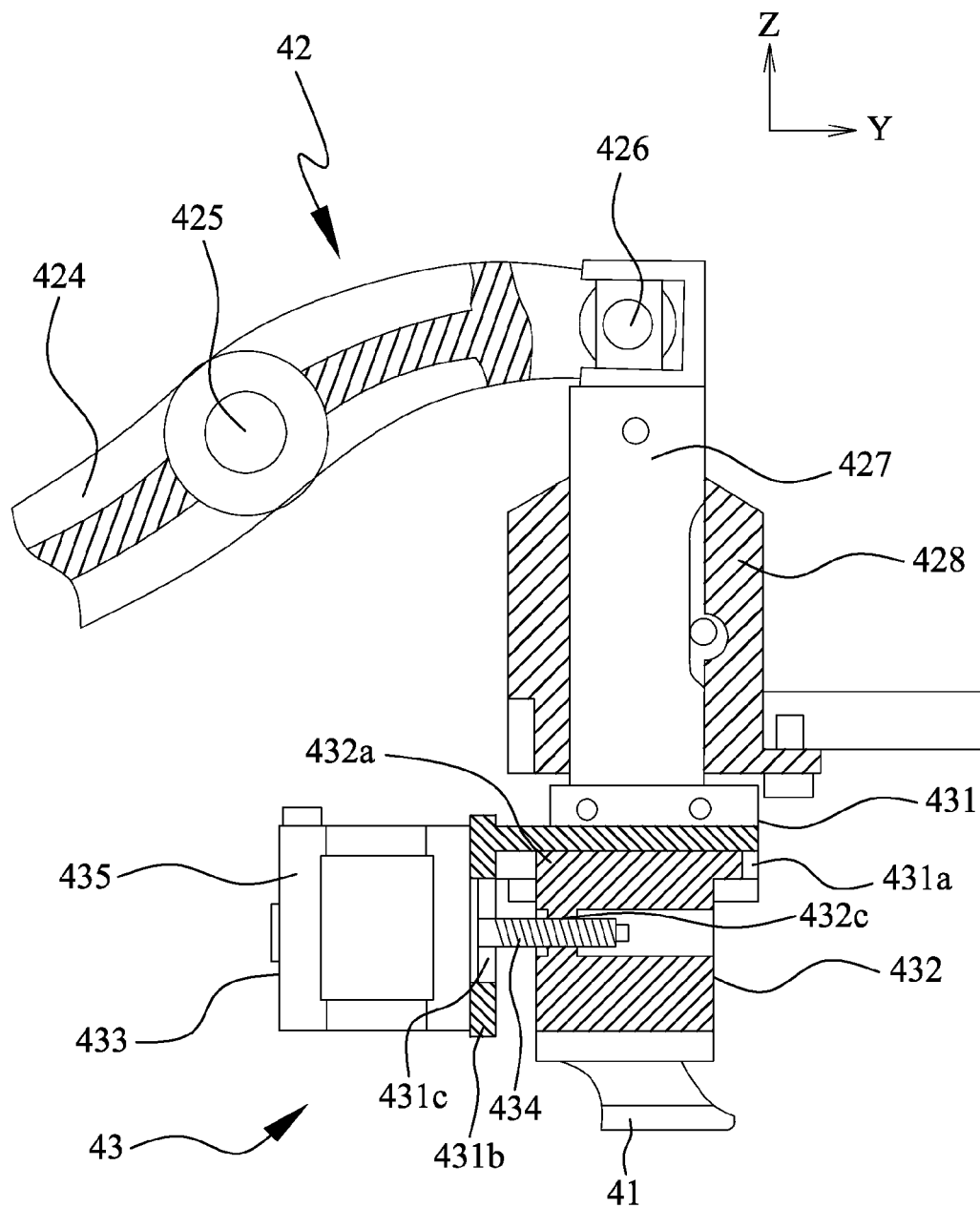


FIG. 4

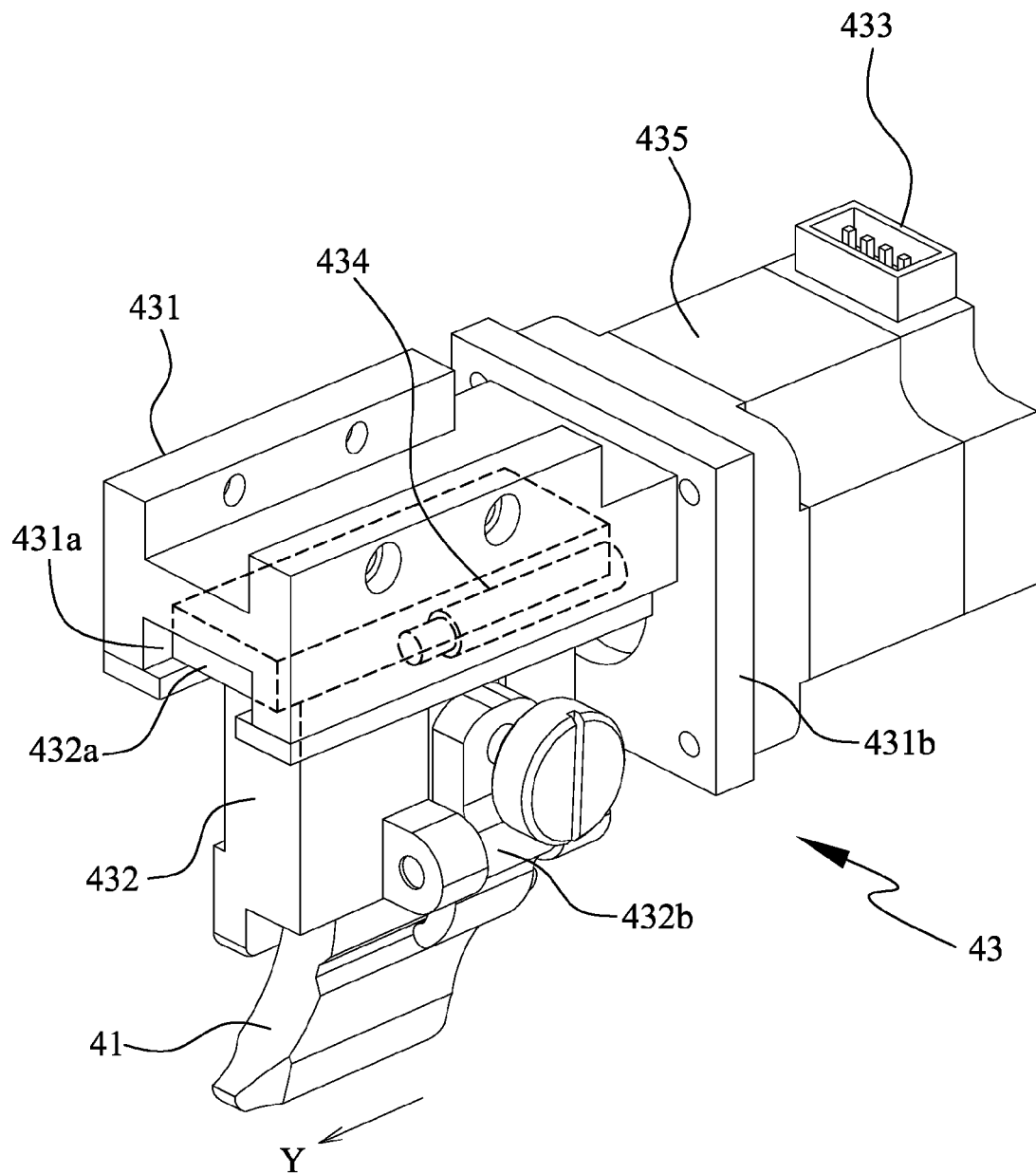


FIG. 5

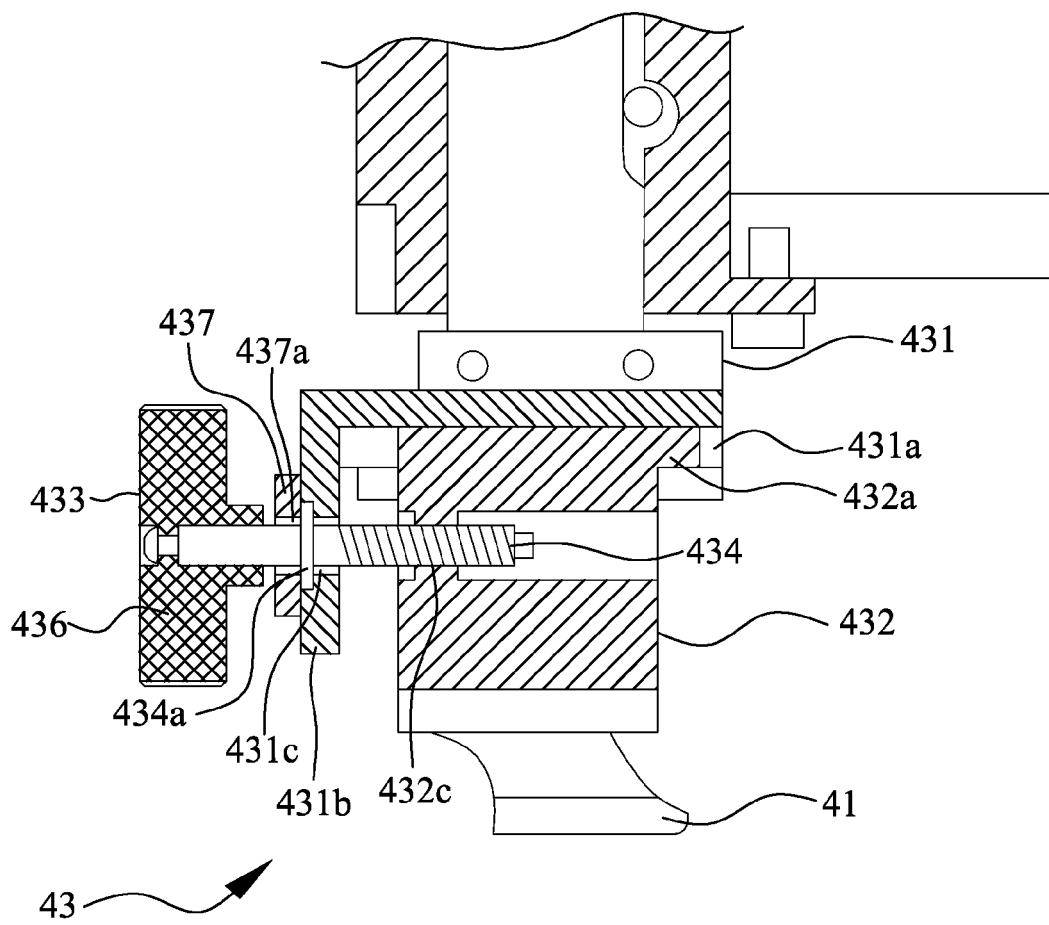


FIG. 6

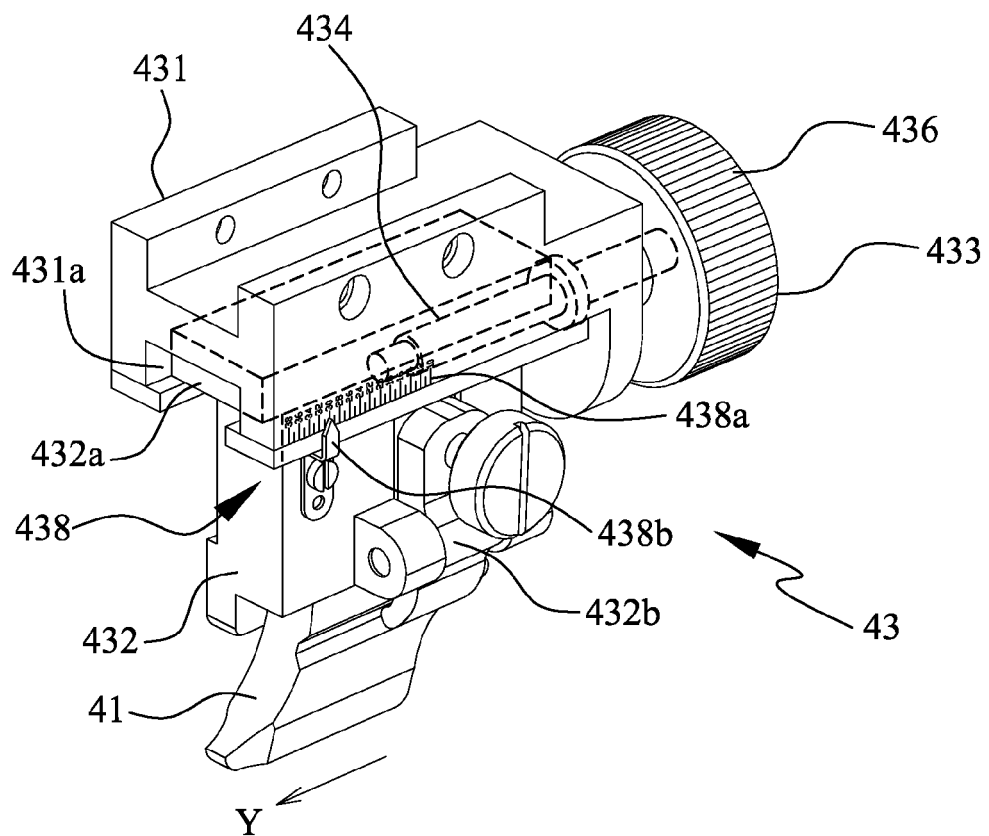


FIG. 7



EUROPEAN SEARCH REPORT

Application Number
EP 14 17 1354

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 722 021 A1 (DUERKOPP ADLER AG [DE]) 15 November 2006 (2006-11-15)	1	INV. D05B3/06 D05B37/04 D05B69/00
A	* paragraph [0012] - paragraph [0031]; figures 1-14 *	2-6	
A	EP 0 887 454 A2 (JUKI KK [JP]) 30 December 1998 (1998-12-30) * column 15, line 38 - column 74, line 43; figures 1-112 *	1-6	
A	US 5 692 447 A (PAPAJEWSKI RUDY [DE] ET AL) 2 December 1997 (1997-12-02) * column 2, line 65 - column 4, line 48; figures 1-7 *	1-6	
			TECHNICAL FIELDS SEARCHED (IPC)
			D05B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		10 June 2015	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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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 14 17 1354

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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