



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
**23.11.2022 Bulletin 2022/47**

(51) International Patent Classification (IPC):  
**E05B 27/00** <sup>(2006.01)</sup> **E05B 19/00** <sup>(2006.01)</sup>

(21) Application number: **22172293.7**

(52) Cooperative Patent Classification (CPC):  
**E05B 27/0096; E05B 19/0023; E05B 19/0058**

(22) Date of filing: **09.05.2022**

(84) Designated Contracting States:  
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**  
Designated Extension States:  
**BA ME**  
Designated Validation States:  
**KH MA MD TN**

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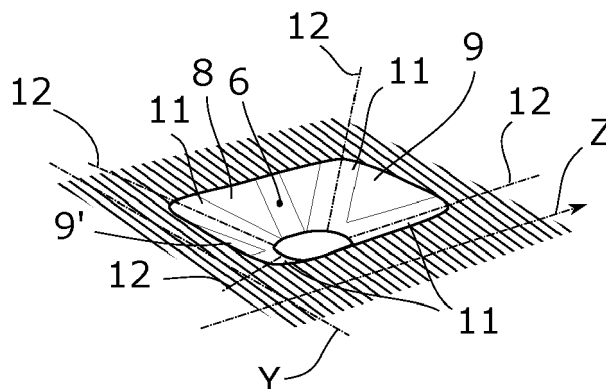
(30) Priority: **19.05.2021 CA 3119156**

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(54) **KEY CODING RECESS, METHOD AND SYSTEM**

(57) The coding recesses of a key blade for engagement with angled coding pins of a cylinder lock are provided with corner fillets so that the angled coding pins

can pass more easily into and out of the recesses as the key is withdrawn or inserted into the lock.



**Fig. 4b**

## Description

### FIELD OF THE INVENTION

**[0001]** The invention relates to the field of keys for cylinder locks, and in particular keys with recesses for engagement with angled cylinder lock pins.

### BACKGROUND OF THE INVENTION

**[0002]** European patent application EP3822433, filed by the same applicant, published on the filing date of this application, and incorporated by reference, describes a key coding arrangement in which cylinder lock pins engage with recesses on the key blade at an angle, which may be for example between 30° and 60°. The recesses can be formed, for example, using a conical end-face milling cutter, and are shown as having the form of a truncated cone. Elongated versions are also described. The recess geometry, in addition to providing the coding (pin-tip-contact) surface, and enough clearance for the angled pin to reach the coding surface, also has surfaces which push the pin out of the recess as the key is moved past the pin (for example when the user inserts or removes the key from the lock). For conventional pin-recess arrangements, in which the pin axis is parallel to the recess axis, and in which the pin rests at the bottom of the recess, the pin can satisfactorily without collision be ejected from the recess by the conical flank of the recess, and the tangential contact of the pin and the recess flank remains effectively at a constant angle (eg 45°) to the direction of movement of the key. This angle is referred to below as the contact angle. However, where the pin axis is at an angle (eg between 30° and 60°) to the recess axis, as described in EP3822433, the contact angle varies as the pin tip moves past the recess flank, and the contact angle can in fact approach 90°, at which point the key movement is blocked. At this point, there is mechanical interference between the side-surface of the pin and the rim of the recess such that the movement of the key is impeded or blocked. The word rim is in this context understood to refer to the inner edge or surface or the recess-centre-facing surface of the recess. The problem will be described in more detail below.

**[0003]** One solution to the above problem would be to use pins with a diameter which is sufficiently large, and/or recesses which are sufficiently shallow, that the interference between the angled pin and the recess-rim does not occur. However, this would reduce the number of pins in the cylinder lock and the number of recesses on the key, and consequently the number of possible codings which can be formed in the key. Reducing the number of possible codings would in turn result in decreased coding combination performance of a cylinder.

### BRIEF DESCRIPTION OF THE INVENTION

**[0004]** The present invention aims to overcome at least

some of the above disadvantages of the straightforward solutions contemplated above. To this end, a key according to the invention is described in the attached claim 1, a method according to the invention is described in claim 14, and a lock system according to the invention is described in claim 17. Further variants of the invention are described in the dependent claims.

**[0005]** The solution proposed avoids the blocking interference between angled pin and recess shoulder, without reducing the number of codings which can be implemented in the key. The solution proposed also increases the difficulty due to its complex structure for a key with such recesses to be copied and printed with a 3D printer, for instance. The solution as well contributes to less wear on the key as the key is able to be inserted into and withdrawn from the key channel with more comfort and less resistance. Another view of the present solution is as well to increase the coding performance of the cylinder and the key within a very compact area of these both parts.

### BRIEF DESCRIPTION OF THE DRAWINGS

**[0006]** The invention will be described in detail with reference to the attached drawings, in which:

Figures 1a to 1d show perspective and cross-sectional views of elongated coding recesses similar to those described in EP3822433. Figure 1e shows in side elevation an example of an end-face milling cutter suitable for forming the recesses of the invention.

Figures 2a to 2d show perspective and plan views of a recess and pin of EP3822433, illustrating the interference problem.

Figures 3a to 3e show a first example embodiment of the invention, with a recess having two corner fillets.

Figures 4a to 4c show a second example embodiment of the invention, with a rectangular recess having four corner fillets.

Figures 5a to 5c show a third example embodiment of the invention, with an X-shaped recess having four corner fillets.

Figure 6a shows a schematic plan view of a reversible key with four-fillet recesses according to the second embodiment.

Figure 6b shows a schematic plan view of a reversible key with two-fillet recesses according to the first embodiment.

Figure 6c shows a schematic plan view of a reversible key with X-shaped recesses according to the

third embodiment.

Figure 6d is a cross-sectional view of the reversible key of figures 6a and 6c.

Figure 6e is a cross-sectional view of the reversible key of figure 6b.

Figures 7a to 7c show examples of lead out ramps used in the first and second embodiments.

## DETAILED DESCRIPTION OF THE INVENTION

**[0007]** It should be noted that the figures are provided merely as an aid to understanding the principles underlying the invention, and should not be taken as limiting the scope of protection sought. Where the same reference numbers are used in different figures, these are intended to indicate similar or equivalent features. It should not be assumed, however, that the use of different reference numbers is intended to indicate any particular degree of difference between the features to which they refer.

**[0008]** Further references are made to the content of EP3822433, as mentioned above, and in particular to figures 3-10 and 14-19 and the related parts of the description of EP3822433, which illustrate an example of the context in which the present invention can find application. The pins of the cylinder lock described in EP3822433 are angled with respect to the surface of the blade inserted in the key channel of the lock, and the coding of the recesses (and consequently of the pins) is achieved by forming the recesses such that their pin-contact surfaces are located at one of several predetermined locations along a coding axis which is at a predetermined coding angle (eg between 30° and 60°) to the Y-Z plane of the blade. A key coded in this way can be recognised by rows of recesses which are aligned along one edge, as shown in figures 9 and 10 of EP3822433, for example. Figures 1a to 1d show a recess 1 as described in EP3822433, with a base surface 3, end-flanks 9 and 9', pin contact point 6, recess axis E or principal axis, key blade surface 7, and pin contact flank 8 and pin clearance flank 8'. Pin 4 is displaceable along the coding axis C, and the recess coding is also carried out by forming the recess with its pin contact point 6 at a particular distance along the coding axis C. Figure 1e shows a conical milling cutter 13 with cutting faces 14 for forming the recess shown. The key blade is described here and below in reference to an orthogonal XYZ coordinate system in which the X direction is the thickness direction of the key blade, the Y direction is the transverse width direction of the key blade, and the Z direction is the longitudinal direction of the key blade.

**[0009]** It has subsequently been recognised that in some configurations the angled pins can interfere with the rim of the recesses, in particular at the point where the pin is to be displaced out from the recess by the move-

ment of the blade into or out of the key channel of the lock. Because of the angle of the pin, and the circular curvature of the recess rim, the pin, instead of being displaced out of the recess, jams against the rim and impedes or blocks the key movement in the longitudinal Z direction thereby hindering its insertion into or withdrawal from the key channel. The pin 4 and the stator pin (not shown) are usually mounted as a package, in which a force transferring means, such as a spring, pushes or urges the pin 4 and the stator pin towards the key blade into the recess, so that a contact point is created between the tip of the pin and the recess. This problem is illustrated in figures 2a to 2d. As the key blade 7 and the pin 4 move relative to each other in the longitudinal Z direction (for example when the key is inserted into or withdrawn from the key channel of the cylinder lock), the pin 4 must be displaced out of the recess 1 so that the key can move smoothly. However, because of the angle of inclination of the pin (required for the angled coding scheme described in EP3822433), the side of the pin impinges (collides) on the rim of the recess at a certain point, and the longitudinal movement is blocked. The contact path between pin tip and recess surface is indicated by reference 10 in figure 2b and by 15 and 15' in figures 2c and 2d. The contact path on the pin 4 in figure 2d is on the outer surface of the tip of the pin and extends to the cylindrical portion or substantially cylindrical portion (ie the main body portion) of the pin.

**[0010]** Figure 3a shows a recess 2 according to a first example embodiment of the invention, in which material of the key blade has been removed along two corner fillet axes 12, to form a corner fillet 11 at each end of the pin clearance flank 8', thereby clearing the path for the pin 4 to move over the rim of the recess without interference. The respective fillet thus forms a groove, valley or an elongated impression or dimple extending from a central region of the recess to its respective corner region of the recess. The respective fillet may form a rounding of the recess inner surface. The contact path 10 is shown in figure 3d. The fillets can advantageously be formed by moving the tip of the cutting tool along the corner fillet axes 12, from the base 3 up to the key blade surface 7, or vice versa. More specifically, the shape of the recess is such that it is formable by a rotary end-face milling cutter rotating about a rotation axis at a predetermined rotation axis angle to the Y-Z plane of the blade. The recess principal axis or recess axis is in this case parallel to the rotation axis. According to one example, the rotation axis angle is 90°. Furthermore, in this case the cutter is substantially shaped as a truncated cone. The corner fillets are formed by displacing the tip of the cutter along the path of each corner fillet.

**[0011]** According to the first example embodiment, a flat-bladed key can thus be formed having a pattern of one or more coding recesses formed in the blade for coded engagement with angled pins of a cylinder lock. The blade has a longitudinal Z axis, a transverse Y axis and a thickness X axis. The recesses have a first substantially

trapezoidal cross-section in an X-Y plane bisecting the recess transversely, and a second substantially trapezoidal cross-section in an X-Z plane bisecting the recess longitudinally. The sides of the first and second trapezoids are inclined at a predetermined flank angle of between 10° and 80°, 20° and 70°, 25° and 70°, 25° and 65°, or more specifically between 30° and 60° to the Y-Z plane. The recesses comprise first and second longitudinal flanks, on mutually opposed sides of the X-Z plane, running substantially parallel to the Z axis, and referred to hereafter respectively as the pin-clearance flank and the pin-contact flank. The pin-clearance flank and the pin-contact flank extend along a majority of the length of the recess (ie along a length of at least 50% of the total length of the recess, or more specifically along a length of at least 60% or 70% of the total length of the recess). The recesses comprise a first corner fillet joining the pin-clearance flank and a first substantially transverse end flank of the recess, and a second corner fillet connecting the pin-clearance flank to a second transverse end flank of the recess, opposite to the first end flank. The first and second corner fillets have a principal axis extending along a central part of the fillet at a first angle to the X-Z plane of between 10° and 80°, 20° and 70°, 25° and 70°, 25° and 65°, or more specifically between 30° and 60°, and at a second angle to the Y-Z plane which is at least 3° or more specifically at least 5° smaller than the flank angle. All or at least some of the end flanks and the longitudinal flanks are planar or substantially planar across the majority of the respective transverse or longitudinal width of the recess. Advantageously the one or more recesses may comprise a plurality of differently-coded recesses, wherein the coding of the recesses differs in the location along a coding axis of a coding flank of each recess, where the coding axis is in an X-Y plane and at a coding axis angle of between 25° and 70°, or preferably between 30° and 60°, to the Y-Z plane. Furthermore, the recesses are configured for engagement with an angled pin of a cylinder lock, wherein the or each angled pin is inclined at a predetermined pin angle of between 25° and 70° or preferably between 30° and 60° to the recess axis, and wherein the first and/or second end flanks are shaped to displace the tip of an angled pin out of the respective recess as the blade is inserted into or withdrawn from the lock along the Z axis.

**[0012]** Figures 4a to 4c show a recess 2 according to the second example embodiment, in which a similar material-removal process has been performed on the pin contact flank 8 as well as the pin-clearance flank 8'. In this case, material has been removed at four corners of the recess to form four corner fillets 11, and the result is a substantially rectangular recess shape. Other than that, the recess according to the second example embodiment may be similar or substantially identical to the recess according to the first example embodiment. However, other variants of the shape may be achieved by varying the angle of the corner fillet axes 12 to the X-Z plane, and/or to the Y-Z plane, and/or the angle of the flank 8,

8' to the Y-Z plane.

**[0013]** Thus, according to the second embodiment, the recess further comprises a third corner fillet and a fourth corner fillet. The third corner fillet 11 joins the pin-contact flank 8 and the first substantially transverse end flank 9 of the recess 2, while the fourth corner fillet 11 connects the pin-contact flank 8 to the second transverse end flank 9' of the recess 2. The principal axes of the third and fourth corner fillets extend along a central part of the respective fillet at a first angle to the X-Z plane of between 10° and 80°, 20° and 70°, 25° and 70°, 25° and 65°, or more specifically between 30° and 60°, and at a second angle to the Y-Z plane which is at least 3°, or more specifically at least 5° smaller than the flank angle.

**[0014]** Figures 5a to 5c show a recess 2 according to the third example embodiment, in which similar material-removal process has been performed on the pin contact flank 8 and pin-clearance flank 8' as in the first and second embodiments. In this case, the angle  $\alpha$  between the first and second corner fillets on the one hand, and the angle  $\alpha$  between the third and fourth corner fillets have been increased compared with the corresponding angles according to the second embodiment. This angle  $\alpha$  is in this example in the range of 90° to 170°, and more specifically between 90° and 140°, between 90° and 120°, or between 100° and 130°. In this manner, a substantially X-shaped outline of the recess when seen from the side of the key blade can be achieved. It is to be noted, that at least the transverse flanks are non-planar according to the third embodiment. This shape further facilitates the pin clearance process. This design thus contributes to even smoother movement of the key in the key channel, which becomes evident when the key is being inserted into or withdrawn from the key channel, in which the pin interacts with the recess.

**[0015]** Figure 6a shows a reversible key blade in which two rows of two four-fillet coding recesses have been formed in the key blade. In a respective row, the pin-clearance flanks are aligned. Because the blade is reversible, and because the recesses (and hence the corresponding angled pins of the lock, as in EP3822433) are in a central region of the key, each recess must accommodate pins angled in both transverse directions. For this reason, both the pin-contact and pin-clearance flanks are provided with corner fillets 11 for ensuring that the pins can pass by without impediment.

**[0016]** In the case of figure 6b, the recesses are located away from the central region, and each will only need to accommodate pins angled in one direction. For this reason, only the pin-clearance flank needs to be provided with the corner fillets which permit easy passage of the pins past the recess.

**[0017]** Figure 6c shows a reversible key blade in which two rows of two four-fillet coding recesses according to the third embodiment have been formed in the central region of the key blade. In this case, the two recesses have been longitudinally merged to form a combined recess. Two combined recesses are shown in Figure 6c.

[0018] Figures 6d shows a possible cross section of the key blade of Figure 6a or 6c along the X-Y plane together with the pins 4 and a rotor 16, while figure 6e shows a cross section of the key blade of Figure 6b along the X-Y plane together with the pins 4 and the rotor 16. These figures illustrate how the pins 4 engage with the recesses on a reversible key and why it is advantageous that the recesses have four corner fillets when the recesses are located in the centre region of the blade along the longitudinal axis Z of the blade.

[0019] Figures 7a to 7c show a further refinement, in which a lead-out ramp 14 is provided at the rim of one (or both) end flanks of the recess. Figure 7c is a side view of the recess 2 showing how the pin contact path 10 extends along the ramp 14 and recess 2. The additional lead-out ramp provides an additional feature that can help ease the transition of the angled pins into and out of the recess, thereby reducing wear and providing the user with a smoother insertion or withdrawal of the key when the key is being inserted into or withdrawn from the key channel (in the lock). The pin contact path 10 on the recess and the ramp is visualised in figure 7c. When the key is being inserted into or withdrawn from the key channel, the angle of force that pushes the pin actually changes, thereby creating this path 10. The lead-out ramp thus forms a continuous transition surface between the face of the key blade and one of the end flanks of the recess.

[0020] The invention also proposes a lock system comprising one or more cylinder locks each having a key channel and a plurality of angled pins, and one or more keys according to any one of the above example embodiments, wherein the angled pins are arranged to engage in coded fashion with the recesses of the one or more keys when inserted into the one or more key channels.

[0021] While the invention has been illustrated and described in detail in the drawings and foregoing description, such illustration and description are to be considered illustrative or exemplary and not restrictive, the invention being not limited to the disclosed embodiments. Other embodiments and variants are understood, and can be achieved by those skilled in the art when carrying out the claimed invention, based on a study of the drawings, the disclosure and the appended claims. New embodiments may be obtained by combining any of the teachings above.

[0022] In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that different features are recited in mutually different dependent claims does not indicate that a combination of these features cannot be advantageously used. Any reference signs in the claims should not be construed as limiting the scope of the invention.

## Claims

1. Flat-bladed key having a pattern of one or more cod-

ing recesses (2) formed in the blade (7) for coded engagement with angled pins (4) of a cylinder lock, the blade having a longitudinal Z axis, a transverse Y axis and a thickness X axis, the or each recess (2) having a first substantially trapezoidal cross-section in an X-Y plane bisecting the recess (2) transversely, and a second substantially trapezoidal cross-section in an X-Z plane bisecting the recess (2) longitudinally, the sides of the first and second trapezoids being inclined at a predetermined flank angle of between 30° and 60° to the Y-Z plane, the or each recess (2) comprising first and second longitudinal flanks (8; 8'), on mutually opposed sides of the said X-Z plane, running substantially parallel to the Z axis, and referred to hereafter respectively as the pin-clearance flank (8') and the pin-contact flank (8),

**characterised in that**

the pin-clearance flank (8') extends along a majority of the length of the recess (2); and the recess (2) comprises a first corner fillet (11) joining the pin-clearance flank (8') and a first substantially transverse end flank (9) of the recess (2), and a second corner fillet (11) connecting the pin-clearance flank (8') to a second transverse end flank (9') of the recess (2), opposite to the first end flank (9), each of the first and second corner fillets (11) having a principal axis extending along a central part of the fillet (11) at a first angle to the X-Z plane of between 30° and 60°, and at a second angle to the Y-Z plane which is at least 5° smaller than the said flank angle.

2. Key according to claim 1, wherein:

the pin-contact flank (8) extends along a majority of the length of the recess (2); the recess (2) further comprises a third corner fillet (11) and a fourth corner fillet (11), the third corner fillet (11) joining the pin-contact flank (8) and the first substantially transverse end flank (9) of the recess 2, and the fourth corner fillet 11 joining the pin-contact flank (8) and the second transverse end flank (9') of the recess (2), each of the third and fourth corner fillets (11) having a principal axis extending along a central part of the fillet (11) at a first angle to the X-Z plane of between 30° and 60°, and at a second angle to the Y-Z plane which is at least 5° smaller than the said flank angle.

3. Key according to claim 2, wherein the or each recess (2) has a substantially rectangular, preferably a rounded-rectangular cross-sectional shape in a cross-sectional plane parallel to the Y-Z plane.

4. Key according to claim 3, wherein the one of more

rectangular coding recesses (2) are in a central region of the blade (7).

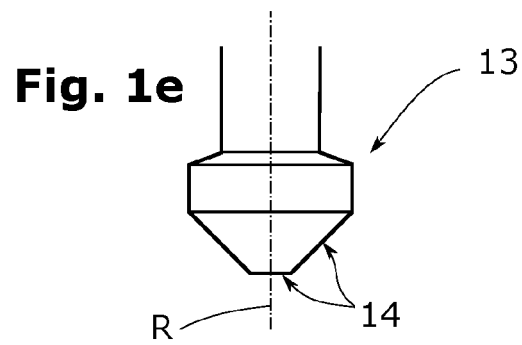
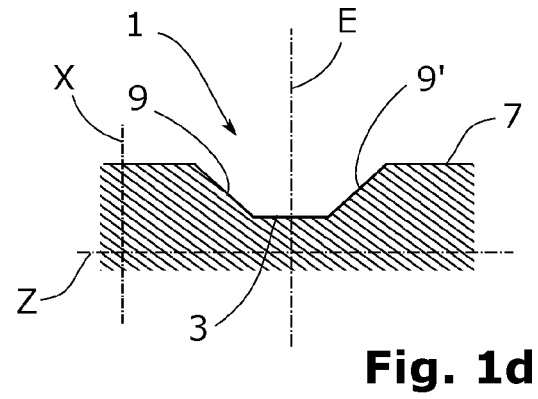
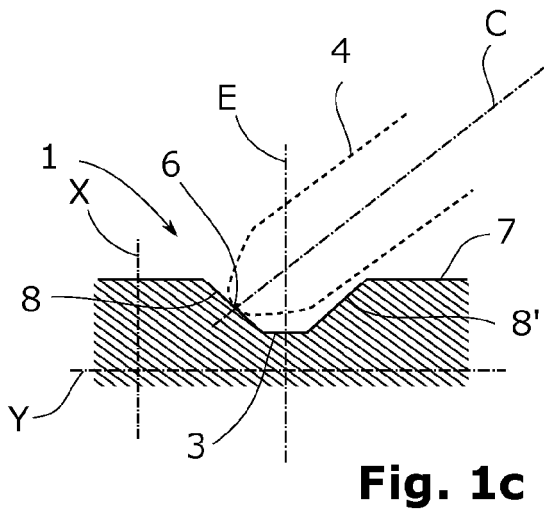
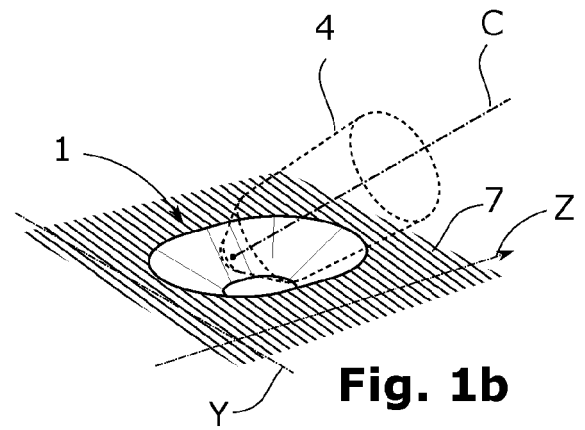
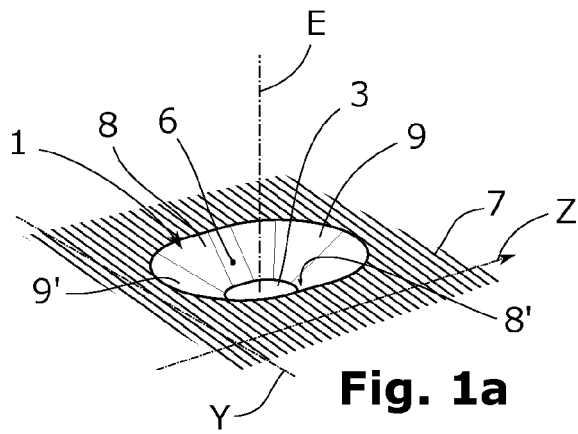
5. Key according to one of the preceding claims, wherein the shape of the or each recess (2) is such that it is formable by a rotary end-face milling cutter rotating about a rotation axis at a predetermined rotation axis angle to the Y-Z plane of the blade (7), the recess (2) having a principal axis, referred to hereafter as the recess axis, parallel to the rotation axis. 5
6. Key according to claim 5, wherein the rotation axis angle is 90°. 10
7. Key according to one of the preceding claims, wherein the key is reversible, and the said pattern is formed on each flat Y-Z face of the blade (7). 15
8. Key according to one of the preceding claims, wherein the or each end flank is substantially planar across the majority of the transverse width of the recess (2). 20
9. Key according to one of the preceding claims, wherein said one or more recesses (2) comprises a plurality of differently-coded recesses (2), wherein the coding of the recesses (2) differs in the location along a coding axis of a coding flank of each recess (2), where the coding axis is in an X-Y plane and at a coding axis angle of between 25° and 70°, or preferably between 30° and 60°, to the Y-Z plane. 25 30
10. Key according to one of the preceding claims, wherein the blade (7) comprises a lead-out ramp (14) forming a continuous transition surface between the face of the key blade (7) and one of the said end flanks (9; 9') of the recess (2). 35
11. Key according to one of the preceding claims, wherein the or each recess (2) is configured for engagement with an angled pin (4) of a cylinder lock, wherein the or each angled pin (4) is inclined at a predetermined pin angle of between 25° and 70° or preferably between 30° and 60° to the recess axis, and wherein the first end flank (9) is shaped to displace the tip of an angled pin (4) out of the recess (2) as the blade (7) is withdrawn from the lock along the Z axis. 40 45
12. Key according to claim 11, wherein the second end flank (9') is shaped to displace the tip of an angled pin (4) out of the recess (2) as the blade (7) is inserted into the lock along the Z axis. 50
13. Flat-bladed key having a pattern of one or more coding recesses (2) formed in the blade (7) for coded engagement with angled pins (4) of a cylinder lock, **characterized by** one or more substantially rectangular coding recesses (2). 55

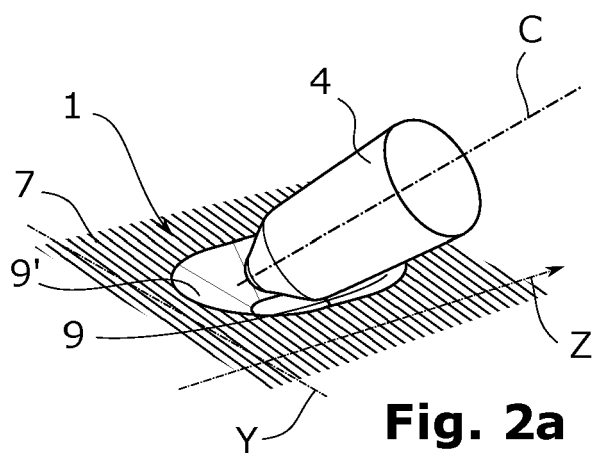
14. Method of forming the or each recess of a key according to one of the preceding claims, the method comprising using a rotary end-face milling cutter, rotating about a rotation axis, to form the or each recess (2) with the said two or four corner fillets (11).

15. Method according to claim 14, wherein the cutter is substantially shaped as a truncated cone.

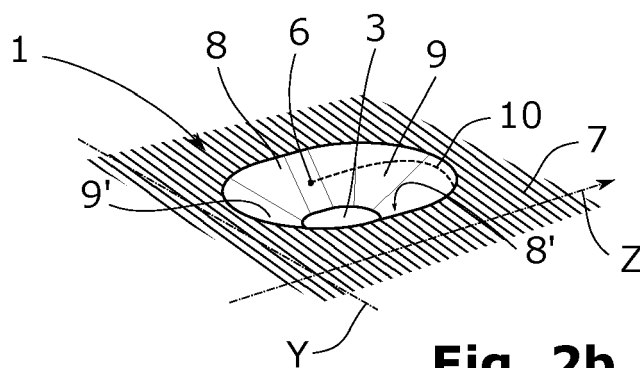
16. Method according to claim 14 or 15, wherein the said forming comprises displacing the tip of the cutter along the path of each corner fillet (11).

17. Lock system comprising one or more cylinder locks each having a key channel and a plurality of angled pins (4), and one or more keys according to one of claims 1 to 13, wherein the angled pins (4) are arranged to engage in coded fashion with the recesses (2) of the one or more keys when inserted into the one or more key channels.

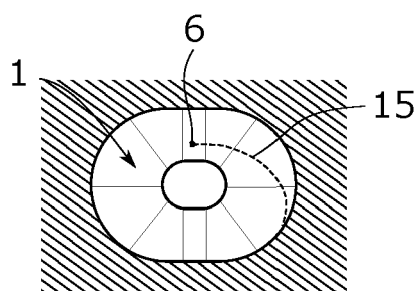




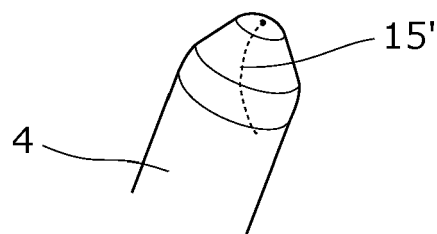
**Fig. 2a**



**Fig. 2b**

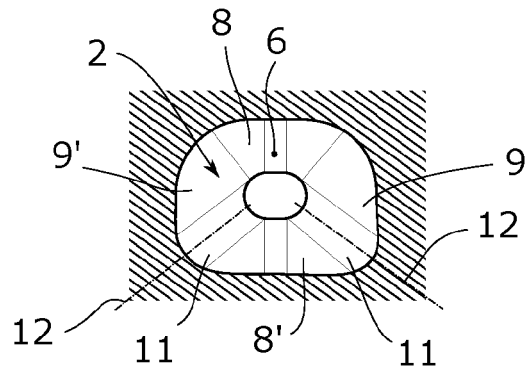


**Fig. 2c**

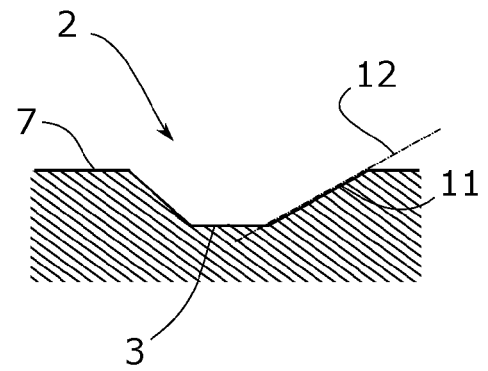


**Fig. 2d**

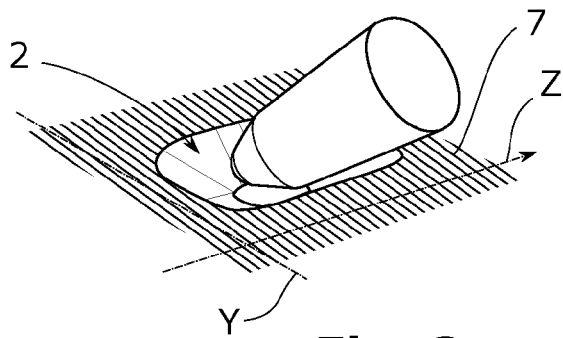




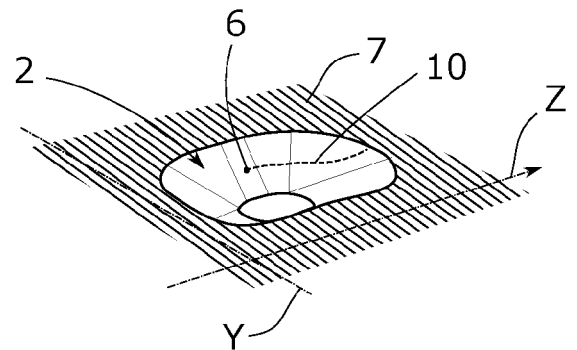
**Fig. 3a**



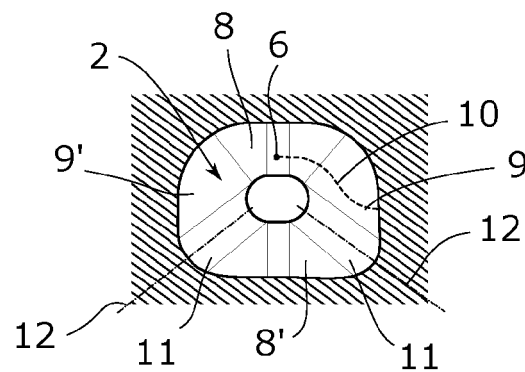
**Fig. 3b**



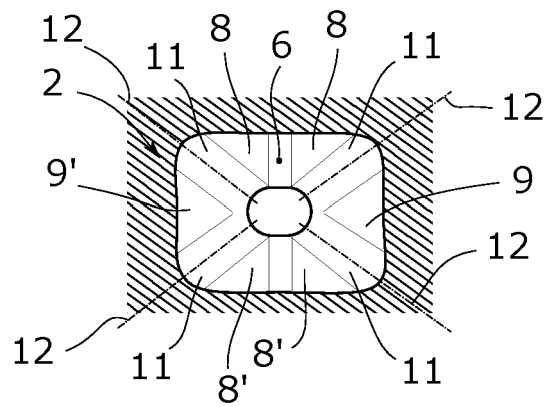
**Fig. 3c**



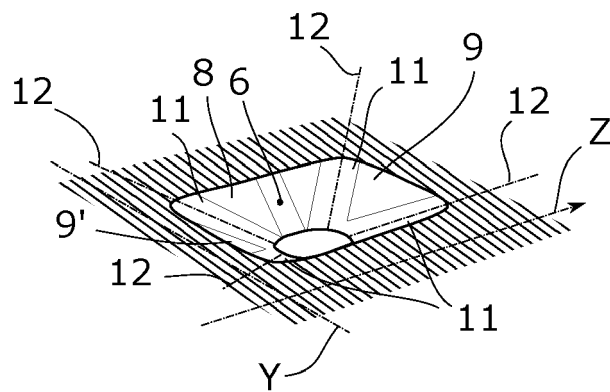
**Fig. 3d**



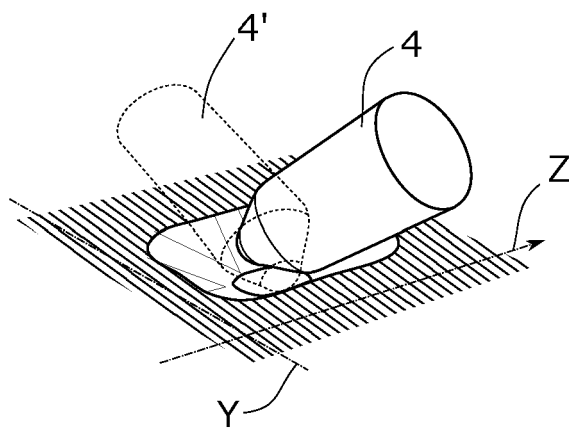
**Fig. 3e**



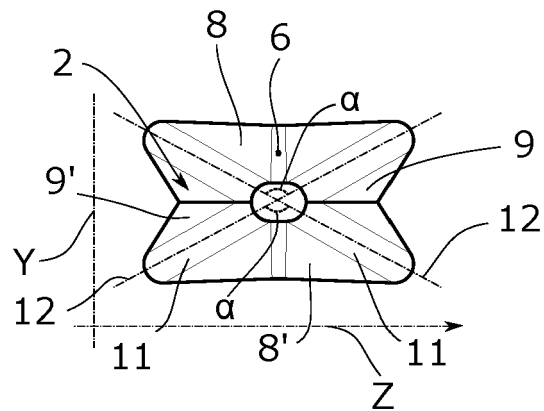
**Fig. 4a**



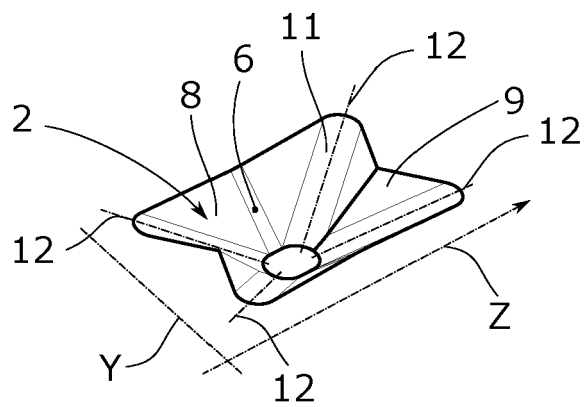
**Fig. 4b**



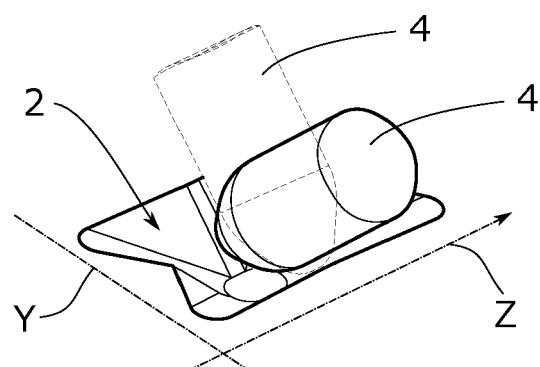
**Fig. 4c**



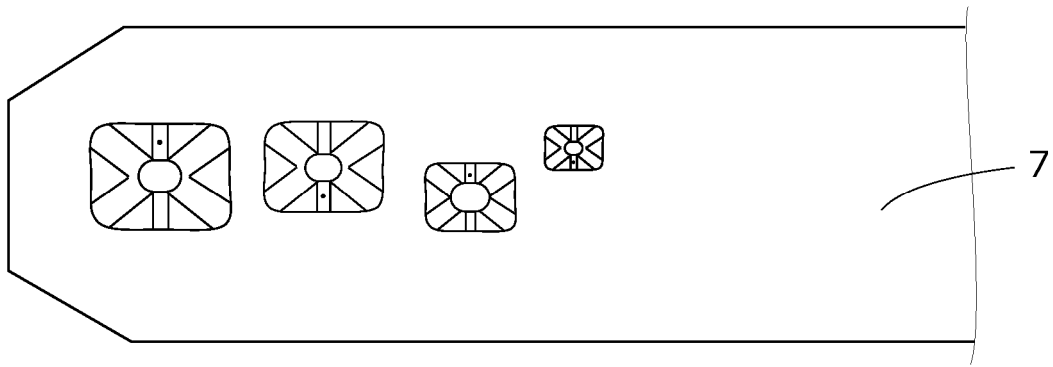
**Fig. 5a**



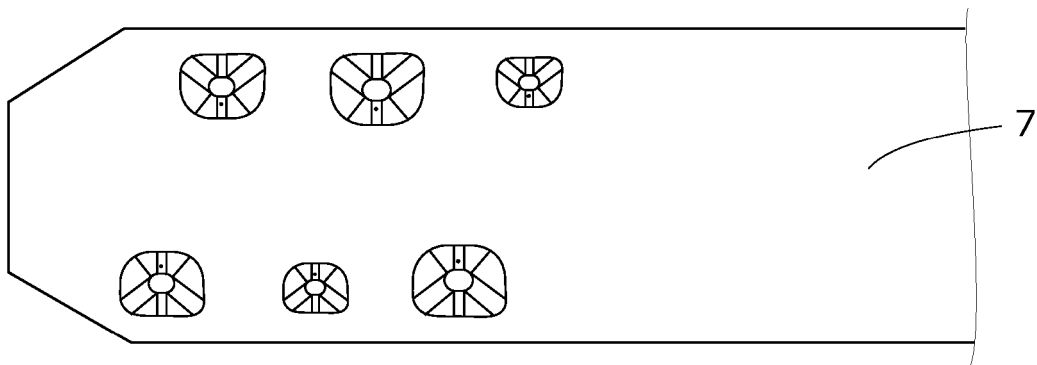
**Fig. 5b**



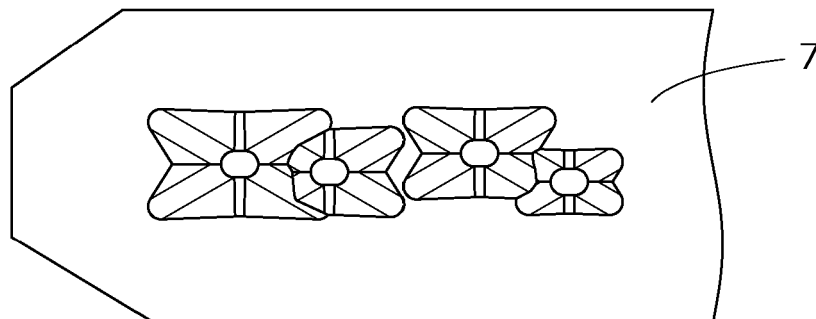
**Fig. 5c**



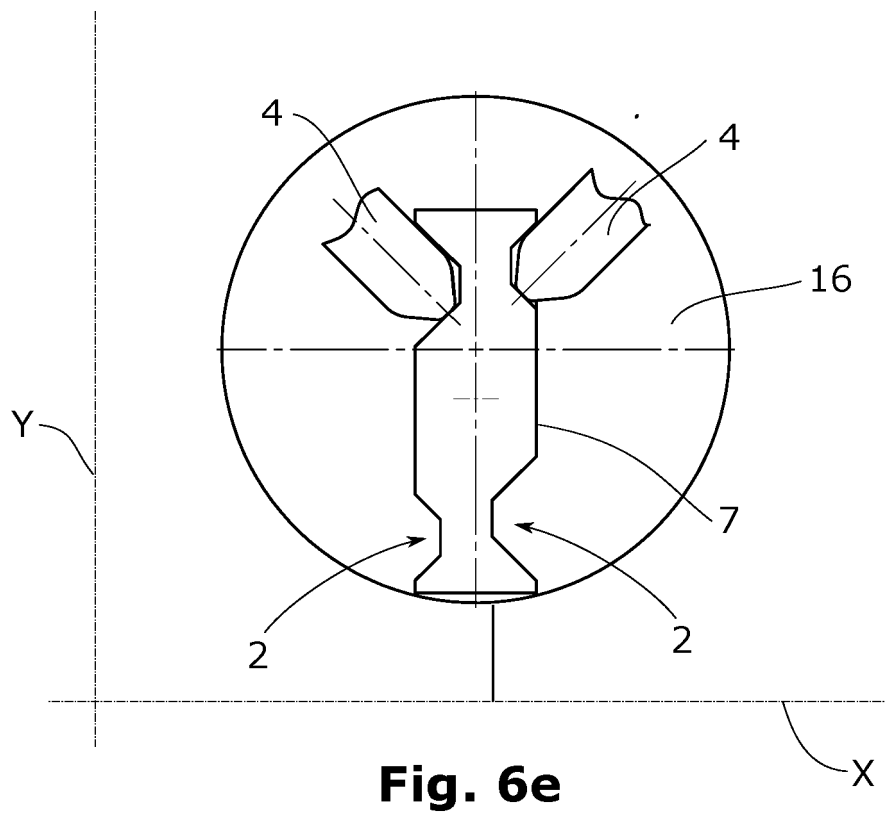
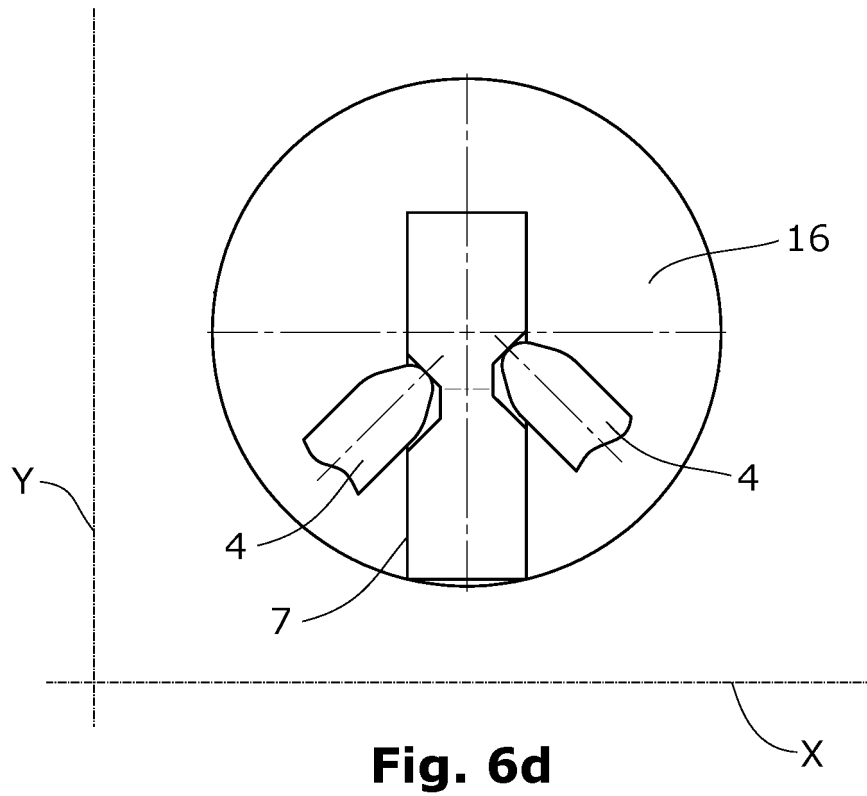
**Fig. 6a**

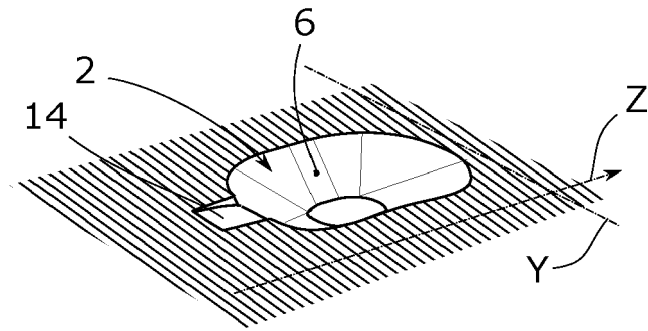


**Fig. 6b**

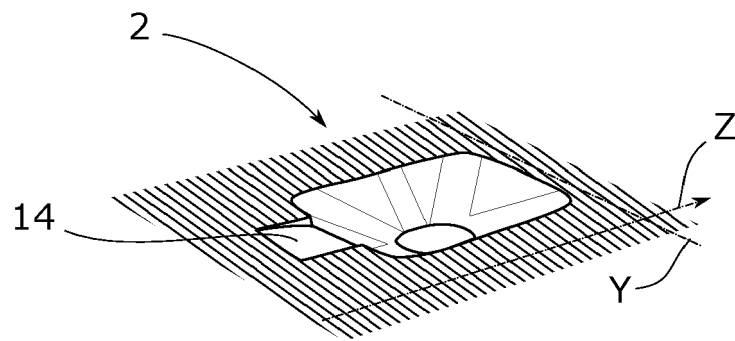


**Fig. 6c**

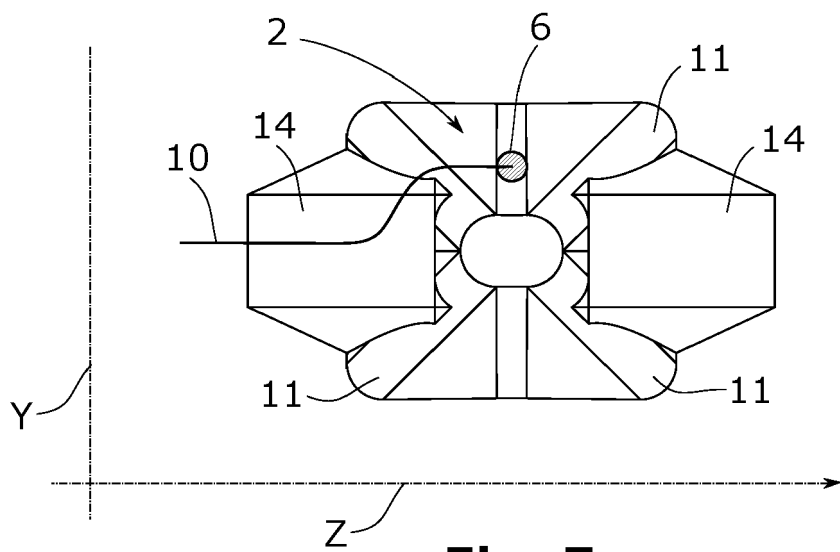




**Fig. 7a**



**Fig. 7b**



**Fig. 7c**



## EUROPEAN SEARCH REPORT

Application Number

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EPO FORM 1503 03.82 (P04C01)

| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                    |                                                                                                                                               |                                                                                                                                                                                                                                                                                       |                                                |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|
| Category                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                                 | Relevant to claim                                                                                                                                                                                                                                                                     | CLASSIFICATION OF THE APPLICATION (IPC)        |
| A                                                                                                                                                                                                                                                      | US 4 289 002 A (GRETTLER HEINRICH)<br>15 September 1981 (1981-09-15)<br>* the whole document *                                                | 1-17                                                                                                                                                                                                                                                                                  | INV.<br>E05B27/00<br>E05B19/00                 |
| X                                                                                                                                                                                                                                                      | WO 2013/152597 A1 (WEI KONGMING [CN])<br>17 October 2013 (2013-10-17)<br>* the whole document *                                               | 13-17                                                                                                                                                                                                                                                                                 |                                                |
| X                                                                                                                                                                                                                                                      | US 2019/010732 A1 (SHEN MIN-TE [TW])<br>10 January 2019 (2019-01-10)<br>* paragraph [0031] - paragraph [0033];<br>figure 7 *                  | 13                                                                                                                                                                                                                                                                                    |                                                |
| X                                                                                                                                                                                                                                                      | CN 110 630 101 A (YU QUNMOU)<br>31 December 2019 (2019-12-31)<br>* figure 29 *                                                                | 13                                                                                                                                                                                                                                                                                    |                                                |
| X                                                                                                                                                                                                                                                      | DE 10 2018 107501 A1 (DOM<br>SICHERHEITSTECHNIK [DE])<br>19 July 2018 (2018-07-19)<br>* paragraph [0098] - paragraph [0108];<br>figures 1-4 * | 13                                                                                                                                                                                                                                                                                    | TECHNICAL FIELDS<br>SEARCHED (IPC)<br><br>E05B |
| The present search report has been drawn up for all claims                                                                                                                                                                                             |                                                                                                                                               |                                                                                                                                                                                                                                                                                       |                                                |
| Place of search<br><b>The Hague</b>                                                                                                                                                                                                                    |                                                                                                                                               | Date of completion of the search<br><b>8 September 2022</b>                                                                                                                                                                                                                           | Examiner<br><b>Ansel, Yannick</b>              |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document |                                                                                                                                               | T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                                |

# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 22 17 2293

08-09-2022

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent document<br>cited in search report |    | Publication<br>date |      | Patent family<br>member(s) |  | Publication<br>date |
|-------------------------------------------|----|---------------------|------|----------------------------|--|---------------------|
| US 4289002                                | A  | 15-09-1981          | AT   | 343506 B                   |  | 12-06-1978          |
|                                           |    |                     | AU   | 503093 B2                  |  | 23-08-1979          |
|                                           |    |                     | BR   | 7605443 A                  |  | 16-08-1977          |
|                                           |    |                     | CH   | 591618 A5                  |  | 30-09-1977          |
|                                           |    |                     | DE   | 2637831 A1                 |  | 17-03-1977          |
|                                           |    |                     | DK   | 408976 A                   |  | 12-03-1977          |
|                                           |    |                     | FR   | 2323849 A1                 |  | 08-04-1977          |
|                                           |    |                     | GB   | 1557245 A                  |  | 05-12-1979          |
|                                           |    |                     | HK   | 28284 A                    |  | 06-04-1984          |
|                                           |    |                     | IL   | 50382 A                    |  | 12-03-1979          |
|                                           |    |                     | IT   | 1068321 B                  |  | 21-03-1985          |
|                                           |    |                     | JP   | S5237198 A                 |  | 22-03-1977          |
|                                           |    |                     | JP   | S5549667 B2                |  | 13-12-1980          |
|                                           |    |                     | NL   | 7609370 A                  |  | 15-03-1977          |
|                                           |    |                     | NO   | 145171 B                   |  | 19-10-1981          |
|                                           |    |                     | SE   | 419467 B                   |  | 03-08-1981          |
|                                           |    |                     | US   | 4289002 A                  |  | 15-09-1981          |
| -----                                     |    |                     |      |                            |  |                     |
| WO 2013152597                             | A1 | 17-10-2013          | CN   | 103233617 A                |  | 07-08-2013          |
|                                           |    |                     | WO   | 2013152597 A1              |  | 17-10-2013          |
| -----                                     |    |                     |      |                            |  |                     |
| US 2019010732                             | A1 | 10-01-2019          | CN   | 109236061 A                |  | 18-01-2019          |
|                                           |    |                     | EP   | 3428372 A1                 |  | 16-01-2019          |
|                                           |    |                     | TW   | 201908582 A                |  | 01-03-2019          |
|                                           |    |                     | US   | 2019010732 A1              |  | 10-01-2019          |
| -----                                     |    |                     |      |                            |  |                     |
| CN 110630101                              | A  | 31-12-2019          | NONE |                            |  |                     |
| -----                                     |    |                     |      |                            |  |                     |
| DE 102018107501                           | A1 | 19-07-2018          | NONE |                            |  |                     |
| -----                                     |    |                     |      |                            |  |                     |



**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- EP 3822433 A [0002] [0006] [0008] [0009] [0015]