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(54) **Apparatus and method for embossing matrix control**

(57) An apparatus for controlling a position of a matrix (5) in preparation of an embossing process comprises a base element (10) and a carrier plate (30). The base element (10) comprises a main surface (11) and a rotatable guide (20), the rotatable guide (20) comprises an eccentric portion (22) protruding from the main surface (11), wherein the rotatable guide (20) is rotatable about an axis perpendicular to the main surface (11). The carrier plate (30) is to be placed on the main surface (11) and comprises an elongated opening (32) to receive the eccentric portion (22). The carrier plate (30) is configured to hold and move the matrix (5) along at least one direction (R1) of the main surface (11). The elongated opening (32) extends in a direction different from the at least one direction (R1) such that a rotation of the rotatable guide (20) moves the carrier plate (30).

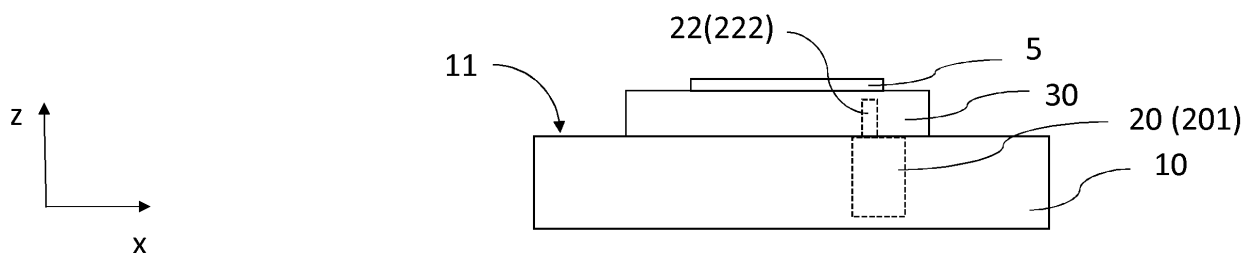


Fig. 1A

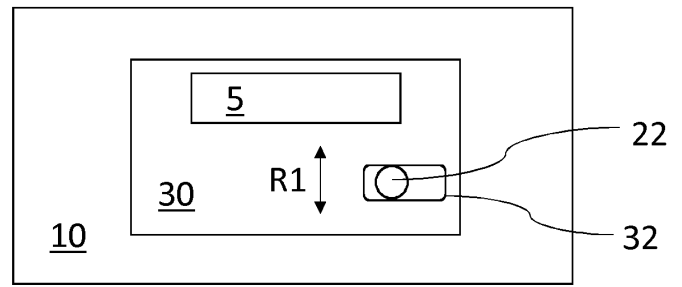
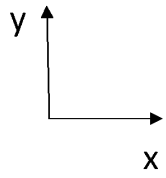


Fig. 1B

Description

[0001] The present invention relates to an apparatus and a method for embossing control and, in particular, to a controlling of a position of a matrix in preparation of an embossing process.

Background

[0002] In the embossing process (blind print) individual segments of, for example, cardboard surfaces (solid or corrugated) are bulged or depressed. This process is also known as landscaping and a matrix (feminine part) and a patrix (masculine part) are used to shape the surface of the exemplary cardboards during a compression process of the matrix and patrix relative to each other. The surface structure formed on the matrix and inversely in the patrix is embossed on the surface of the exemplary cardboard.

[0003] In a typical manufacturing process, the matrix is attached to a carrier tool to allow a correct horizontal placement to a specified position. The carrier tool may be independent or may comprise a steel rule die. The matrix may be controlled manually or with specific devices, to calibrate the matrix position within a desired range. In conventional methods the specific devices are needed to achieve a calibration within the micrometer range. Moreover, templates with a picture to be embossed may be used to define the horizontal position of the matrix.

[0004] DE 20303948 U1 discloses a further conventional matrix control, wherein a positioning of a matrix relative to a base plate is achieved by particular positioning means. The positioning means are formed as adjustable protrusions attached to the matrix and received by recesses in the base plate. After having fixed the position of the adjustable protrusions, the position of the matrix relative to the base plate cannot be modified. In this conventional position control method, the positioning of the matrix relative to the base plate can only be achieved when the matrix is dismantled or separated from the base plate and the protrusions are moved accordingly.

[0005] It is common that a constant re-adjustment is needed in the cardboard manufacturing, because fluctuations in the humidity and moisture will modify the settings. Hence, the dismantling in the conventional methods is of particular disadvantage.

[0006] Therefore, there is a need of having an apparatus and a method which provides a simple guidance of a matrix control relative to a carrier tool without the need of additional devices and without the need of dismantling the apparatus for defining a new position.

Summary of the Invention

[0007] The present invention relates to an apparatus and a method for controlling a position of a matrix in preparation of an embossing process according to claims 1 and 15. Claims 2 to 14 refer to specifically advantageous

realizations of the subject-matter of claims 1 and 15.

[0008] An apparatus for controlling a position of a matrix in preparation of an embossing process comprises a base element comprising a main surface and a rotatable guide. The rotatable guide comprises an eccentric portion protruding from the main surface, wherein the rotatable guide is rotatable about an axis perpendicular to the main surface. The apparatus comprises further a carrier plate to be placed on the main surface and comprising an elongated opening to receive the eccentric portion. The carrier plate is configured to hold and move the matrix in at least one direction of the main surface. The elongated opening extends in a direction different from the at least one direction such that a rotation of the rotatable guide moves the carrier plate.

[0009] According to further embodiments, the elongated opening is a first elongated opening, the rotatable guide is a first rotatable guide, the eccentric portion is a first eccentric portion and the at least one direction is a first direction. The base element may optionally comprise a second rotatable guide with a second eccentric portion. The carrier plate may optionally comprise a second elongated opening, wherein the second elongated opening is configured to receive the second eccentric portion and may extend in a different direction than the first elongated opening such that rotation of second rotatable guide moves the carrier plate in a second direction being different from the first direction, thereby allowing independent adjustments in the first direction and/or in the second direction.

[0010] According to further embodiments, the base element may optionally comprise a third rotatable guide with a third eccentric portion. The carrier plate may optionally comprise a third elongated opening, wherein the third elongated opening is configured to receive the third eccentric portion and extends in a further direction.

[0011] According to further embodiments, the direction of the first elongated opening and the further direction of the third elongated opening are parallel to each other (or span an angle of $\pm 5^\circ$). In addition, the first elongated opening may optionally be perpendicular to the different direction of the second elongated opening (or span an angle between 80 to 100°).

[0012] According to further embodiments, the second rotatable guide may optionally be arranged on a connection line connecting the first and third rotatable guides (e.g. between the first and third rotatable guide).

[0013] According to further embodiments, the apparatus may optionally comprise attachment means for attaching the carrier plate to the base element. The attachment means may optionally be configured to allow movements of carrier plate relative to the base plate in the first direction and/or second direction and/or a rotation about a rotation axis and/or prevents movement in a third direction. Therefore, releasing the attachment means slightly, it becomes possible to shift the carrier plate along the lateral direction without detaching the carrier plate from the base element.

[0014] According to further embodiments, the attachment means may optionally comprise at least one bolt (or other fixation means as e.g. screws). The carrier plate may optionally comprise at least one through-hole for the at least one bolt and the at least one through-hole may optionally comprise an inner diameter which is larger than an outer diameter of the at least one bolt to allow a clearance defining a range of movement of the carrier plate along the main surface of the base element. The clearance may be selected such that the carrier plate can be moved in a predetermined range relative to the base element, thereby avoiding a dismantling during the process of position alignment.

[0015] According to further embodiments, the base element may optionally comprise an opening (cut-out portion). The apparatus may optionally comprise a supporting block which is configured to be attached to an opposite surface of the carrier plate relative to the matrix. The supporting block may optionally be configured to fit in the opening of the base plate while leaving a gap. The support block may be suitable to provide support in the embossing process and to allow movement of the base plate in the at least one direction without the need to detach the supporting block. Also these features may ensure that a position adjustment of the carrier plate is possible without any dismantling, but only by releasing the attachment means.

[0016] According to further embodiments, the base element may optionally comprise at least one cylindrical recess for receiving the at least one rotatable guide.

[0017] According to further embodiments, the at least one rotatable guide may optionally comprise a rod-like structure with a first rod-like portion for fitting in the cylindrical recess of the base element and a second rod-like portion which may be configured to fit in the elongated opening. To achieve a high accuracy, it is of advantage that the second rod-like position is in contact with the elongated opening on two opposite points, while still allowing a rotation of the second rod-like portion in the elongated opening (i.e. a clearance which is typically present in minimized).

[0018] The second rod-like portion may optionally have a smaller (or larger) diameter than the first rod-like portion, wherein axial axes of the first rod-like portion and the second rod-like portion are shifted such that the second rod-like portion is eccentric when compared to the first rod-like portion. The second rod-like portion may thus be configured to perform a circular movement about the axial axis of the first rod-like portion.

[0019] According to further embodiments, the elongated opening may optionally be a through hole through the carrier plate, and the outer diameter of the first rod-like portion is larger than a smallest diameter of the elongated opening. As a result, no separate fixation of the eccentric guide is needed, because the fixation of carrier plate fixes also the eccentric guide in the orthogonal direction (z-axis). The at least one rotatable guide may optionally comprise a circlip which may optionally be attachable at

the second rod-like portion and may optionally comprise an outer diameter being larger than the smallest diameter of the elongated opening. Hence, the second rod-like portion can extend through the elongated opening and is prevented from moving perpendicular to the carrier plate by the circlip arranged on one side and by the first rod-like portion arranged on the opposite side.

[0020] According to further embodiments, the base element and/or the supporting block may optionally comprise a non-metal material. The base element may optionally comprise a same thickness as the supporting block and may also comprise wood as material.

[0021] According to further embodiments, the matrix and/or the carrier plate are configured to accommodate substrate material arranged between the matrix and the carrier plate. The substrate material may optionally comprise a predetermined thickness to adjust an embossing intensity, e. g. by modifying the height of the matrix and/or the deformability of the matrix or the underlying material.

[0022] According to further embodiments, the base element and/or the carrier plate may optionally comprise positioning markings. The positioning markings may be configured to indicate a position of the carrier plate relative to the base element to help a user to modify the position of the matrix or to establish a predetermined position.

[0023] Further embodiments relate to a method for controlling a position of a matrix in preparation of an embossing process, wherein the matrix is attachable to a carrier plate which is moveable relative to a base element. The method may comprise steps implementing at least one of the above mentioned functions or an arbitrary combination thereof. In particular, the method comprises a step of rotating a rotatable guide with an eccentric portion about an axis perpendicular to the main surface of the base element. The method comprises further a step of engaging the eccentric portion with an elongated opening of the carrier plate. The method comprises further a step of moving the carrier plate in at least one direction of the main surface by the rotation of the rotatable guide.

[0024] According to further embodiments, the method comprises optionally the steps of rotating a first rotatable guide with a first eccentric portion within a first elongated opening and rotating a second rotatable guide with a second eccentric portion within a second elongated opening, wherein the first and second elongated openings are different (e.g. perpendicular to each other) and wherein the rotation of the first rotatable guide is independent from the rotation of the second rotatable guide to achieve adjustments in two independent directions (e.g. with respect to x- and y-axis).

Brief description of the drawings

[0025] The present invention will be described in the following by way of examples only, and with reference to the accompanying figures, in which:

- Figs. 1A, B depict an apparatus for controlling a position of a matrix in preparation of an embossing process;
- Fig. 2 depicts a top view of the apparatus for position control according to further embodiments;
- Fig. 3 depicts a view from below of the apparatus of Fig. 2;
- Fig. 4 depicts a cross-sectional view through the apparatus depicted in Figs. 2;
- Figs. 5A-D depict further details of the eccentric guides according to embodiments;
- Fig. 6 depicts a further embodiment of the apparatus including positioning markings; and
- Fig. 7 depicts a flow diagram for a method for controlling a position of a matrix in preparation of an embossing process.

Detailed Description

[0026] Various examples will now be described with reference to the accompanying drawings in which some examples are illustrated. In the figures, the thicknesses of lines and/or regions may be exaggerated for clarity.

[0027] Accordingly, while examples are capable of various modifications and alternative forms, the illustrative examples in the figures will herein be described in detail. It should be understood, however, that there is no intent to limit examples to the particular forms disclosed, but on the contrary, examples are to cover all modifications, equivalents, and alternatives falling within the scope of the disclosure. Like numbers refer to like or similar elements throughout the description of the figures.

[0028] It will be understood that when an element is referred to as being "connected" or "coupled" to another element, it can be directly connected or coupled to the other element or intervening elements may be present. In contrast, when an element is referred to as being "directly connected" or "directly coupled" to another element, there are no intervening elements present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., "between" versus "directly between," "adjacent" versus "directly adjacent," etc.).

[0029] The terminology used herein is for the purpose of describing illustrative examples only and is not intended to be limiting. As used herein, the singular forms "a," "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises," "comprising," "includes" and/or "including," when used herein,

specify the presence of stated features, integers, steps, operations, elements and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components and/or groups thereof.

[0030] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which examples belong. It will be further understood that terms, e.g., those defined in commonly used dictionaries, should be interpreted as having a meaning that is consistent with their meaning in the context of the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

[0031] Fig. 1 shows an apparatus for controlling a position of a matrix 5 in preparation of an embossing process, wherein Fig. 1A depicts a side view whereas Fig. 1B shows a top view. The apparatus comprises a base element 10 with a main surface 11 (spanning the x- and y-directions) and a rotatable guide 20, wherein the rotatable guide 20 comprises an eccentric portion 22 protruding from the main surface 11 (in the depicted z-direction). The rotatable guide 20 is rotatable about an axis perpendicular to the main surface 11 (e.g. about the z-direction). The apparatus comprise further a carrier plate 30 to be placed on the main surface 11 and comprises an elongated opening 32 to receive the eccentric portion 22. The carrier plate 30 is configured to hold and move the matrix 5 along at least one direction R1 of the main surface 11. The elongated opening 32 extends in a direction different from the at least one direction R1 such that a rotation of the rotatable guide 20 moves the carrier plate 30 in the at least one direction R1.

[0032] Therefore, the present invention solves the above-mentioned problems by using eccentric guides 20 for controlling a position of the embossing matrix 5 relative to the base element 10. There is no need for a specific device to position the matrix 5 and there is no need for a dismantling during the position adjustment. By simply turning the eccentric guides, the matrix 5 can be moved horizontally to a desired position with high accuracy. The achievable accuracy is set by the eccentricity of the eccentric guides 20, which can be defined by the horizontal distance (e.g. in the x-direction) of the axial axis of eccentric portion 22 compared to the axial axis of the bottom portion of the eccentric guide 20. This distance may optionally be about 1 mm (or within the range of 0.1 mm to 3 mm, or between 0.5 mm and 1.5 mm). In particular, it is possible to allow positioning accuracies even within a micrometer ranges.

[0033] The carrier plate 30 may optionally be formed as a carrier metal plate and may comprise a thickness between 0.5 mm and 5 mm or between 1 mm and 2 mm or about 1.2 mm. The base element 10 may be formed as base bound plate and may comprise a thickness between 5 and 50 mm (or between 10 and 20 mm or about 15 ... 18 mm).

[0034] Fig. 2 shows a further embodiment of the apparatus for controlling the position of the matrix which includes further, optional, components.

[0035] The carrier plate 30 may be attached on the base element 10 by using attachment means 401, 402 comprising a first attachment element 401 and a second attachment element 402 (or more). The matrix 5 with a pattern 502 (surface structure to be embossed) is secured on the carrier plate 30 using fixation means 601, 602 which include a first fixation element 601 and a second fixation element 602 (or more). In this embodiment, the relative position of the carrier plate 30 with respect to the base element 10 is adjusted by using three rotatable guides, a first rotatable guide 201, a second rotatable guide 202 and a third rotatable guide 203. In further embodiments, only two rotatable guides or more than three rotatable guides are formed to define or modify the position of the carrier plate 30 relative to the base plate 10. Each of the rotatable guides 201, 202, 203 comprises respective eccentric portions that protrude from the base element 10 and are received by elongated openings in the carrier plate 30 as it is described in Figs. 1A and 1B with respect to a single rotatable guide 20.

[0036] Fig. 2 further shows that underneath the matrix 5, a supporting block 50 is arranged within an opening 110 of the base plate 10. The supporting block 50 and the matrix 5 sandwich the carrier plate 30, wherein the supporting block 50 is configured to support the embossing process (e.g. by providing an abutment). By selecting the material of the supporting block (e.g. wood) and the thickness, the intensity of the embossing may be modified. The opening 110 and the supporting block 50 are indicated in Fig. 2 only by dashed lines, because they are covered by the carrier plate 30 and are not visible in the top view of fig. 2.

[0037] In particular, the three eccentric guides 20 can be employed to allow a positioning of the matrix relative to a carrier block 10 and a supporting block in multiple directions.

[0038] By having three independent eccentric guides it becomes possible to move the carrier plate 13 relative to the base element 10 independently in different directions. There are various possibilities. Fig. 2 depicts only one possible arrangement of the first, second and third rotatable guides 201, 202 and 203 engaging with respective first, second and third elongated openings 321, 232 and 323. For example, in the embodiment as depicted in Fig. 2, two of the three elongated openings are arranged such that they extend in a same direction, whereas the third elongated opening extends in the direction perpendicular to the other two elongated openings. For example, the first, second and third rotatable guides 201, 202 and 203 may be arranged within a line, wherein the two outer, the first and third, rotatable guides engage with elongated openings arranged in a same direction, whereas the second rotatable guide 202 is arranged between the first and third rotatable guides 201 and 203 engages with a second elongated opening extending in a direction perpendicular

to the extension direction of the first and third elongated openings 321 and 323. In further embodiments, the first, second and third rotatable guides 201, 202 and 203 may not be arranged along one line but may also be arranged as a triangle, thereby providing other possibilities to perform respective movements by rotating the eccentric portions of the first, second and third rotatable guides 201, 202 and 203. For more details, it is referred to Fig. 6 where the motion possibilities are set out in more detail.

[0039] Fig. 3 depicts a view from the opposite side of the apparatus as shown in Fig. 2. Again, all elements indicated by a dashed line refer to element which are not directly visible from the respective side, but are arranged underneath the top elements. For example, in Fig. 3 the carrier plate 30 is arranged on the opposite side of the base element 10 and is depicted with a dashed line (i.e. the outline of the carrier plate 30). The matrix 5 is also shown with a dashed line indicating that the matrix 5 is arranged on the opposite side of the base element 10.

[0040] In Fig. 3 the base plate 10 can be seen with the opening 110 on the surface opposite to the main surface 11 of Fig. 1. The opening 110 may comprise a rectangular shape as shown in Fig. 3. In further embodiments, the shape of the opening 110 can be modified and may comprise any other forms, as e.g. an oval, quadratic or circular shape.

[0041] Within the opening 110, no base element 10 is formed and the supporting block 50 is arranged such that the supporting block 50 comprises a size which is smaller than the size of the opening 110. As a result, a gap or a clearance is formed between the supporting block 50 and the base element 110. This clearance may be selected such that a desired positioning range of the carrier plate 30 with respect to the base element 10 is made possible without the need of releasing the supporting block 50 from the carrier plate 30. For example, the gap may optionally comprise a width W to move the carrier plate 30 in the x-direction and y-direction with a maximum distance of W which is within a range of 1 to 10 mm, or 2 to 4 mm or about 2.8 mm.

[0042] In the embodiment of Fig. 3, the base element 10 may optionally comprise a first attachment opening 141 and a second attachment opening 142 which may be formed as through-holes through the base element 10. The first attachment opening 141 may be configured to receive and secure the first attachment element 401, e.g. a bolt, to fix the carrier plate 30 on the base element 10. Similarly, the second attachment opening 142 may be configured to receive and secure the second attachment element 402, e.g. a further bolt, to fix the carrier plate 30 to the base element 10. Optionally, the first attachment opening 141 and/or the second attachment opening 142 may comprise an internal threaded surface to achieve a fixation of the carrier plate 30 to the base plate by using the bolts.

[0043] In further embodiments any other fixations may be used. In particular, any releasable connection is suitable.

[0044] The embodiment as shown in Fig. 3 comprises further a first cylindrical recess 101, a second cylindrical recess 102 and a third cylindrical recess 103. The first, second and third cylindrical recesses 101, 102, 103 may also be formed as cylindrical holes passing through the base element 10 to receive respective rod-like elements of the first eccentric guide 201, the second eccentric guide 202 and the third eccentric guide 203. Therefore, in the embodiment as depicted in Fig. 3, the rod-like portions 20 may extend through the carrier plate 10 (see Fig. 1A).

[0045] The embodiment of Fig. 3 comprises a first part 651 (e.g. a pin) and a second part 652 (e.g. a pin) as optional elements which are configured to provide a fixation of the first fixation element 601 and for the second fixation element 602 (see Fig. 2). Again, the first and second parts 651, 652 may comprise through-holes through the matrix 5 and the carrier plate 30 to provide a fixation of the matrix 5 relative to the carrier plate 30 and to fix the support block 50 to the carrier plate 30.

[0046] Fig. 4 depicts a cross-sectional view along the line A-A' of the embodiment as shown in Figs. 2. The cross-section is formed through the first attachment element 401, the first fixation element 601, the first rotatable guide 201, the second rotatable guide 202, the third rotatable guide 203, the second fixation element 602 and the second attachment element 402.

[0047] In the cross-sectional view of Fig. 4, the supporting block 50 is depicted which is attached to the carrier plate 30 by using the first fixation element 601 and the second fixation element 602. The supporting block 50 is arranged inside the opening 110 and is spaced from the base element 10 by a clearance W.

[0048] In the embodiment depicted in Fig. 4, the first and second attachment means 401, 402 and the first, second and third rotatable guides 201, 202, 203 as well as the first and second fixation means 601, 602 are provided inside through-holes of the base element 10 or the supporting block 50. For example, the first attachment element 401 is arranged in part inside a first through-hole 141 by using a first sleeve 801 providing a threaded portion to allow the first attachment element 401 to be screwed to the base element 10. Similarly, the first fixation element 601 engages with a through-hole 541 in the supporting block 50, wherein again an optional sleeve can be arranged so that the first fixation element 601 can be formed as a bolt for fixation of the matrix 5 and the supporting block 50 by a threaded engagement. Same applies to the second fixation element 602 and the second attachment elements 402 which can also be configured to be formed inside a second through-hole 142 inside the base element 10 and a second through-hole 542 in the supporting block 50.

[0049] As already depicted in Fig. 3, the first eccentric guide 201 may be formed in part within a first cylindrical recess 101. The second eccentric guide 202 may be formed inside a second cylindrical recess 102. The third eccentric guide 203 may be formed within a third cylin-

drical recess 103. However, the first, second and third eccentric guides 201, 202 and 203 do not need to be fixed to the base element 10. Instead, the cylindrical or rod-like portions of the eccentric guides 201, 202, 203 need only to be rotatable within the first, second and third cylindrical recesses 101, 102 and 103 such that the eccentric, rod-like portions of the eccentric guides 201, 202, 203 will move the carrier plate 30 relative to the base plate 10 upon rotation of the eccentric guides 201, 202, 203 as it will be described in more detail with the next Figures.

[0050] Figs. 5A to 5D depict further details of the eccentric guide 20. For example, each of the eccentric guides as disclosed in Figs. 2 to 4 may comprise the features as further described now with Figs. 5A to 5D.

[0051] Fig. 5A shows a side view of the eccentric guides 20. The eccentric guide 20 comprises a first rod-like portion 201 and a second rod-like portion 222. On the second rod-like portion 222, a circlip holder 207 may be arranged such that it can receive a circlip when the eccentric guide is arranged inside one of the cylindrical recesses 101, 102 and 103 so that the carrier plate 30 can be arranged within the region C between the beginning of the first rod-like portion 201 and the circlip holder 207. Moreover, the eccentric guide may comprise a screw nut 209 to allow a screwdriver to engage with the second rod-like portion 222 such that a rotation of the eccentric guide 20 can easily be achieved by using a screwdriver.

[0052] In further embodiments the screw nut 209 may be replaced by any structure suitable to engage with a tool (e.g. a wrench) to rotate or to support a rotation of the rotatable guide 20 manually.

[0053] The first rod-like portion 201 may comprise a length (in the direction of the rod) of about 16.9 mm (or within the range of 10 mm to 30 mm, or between 15 mm and 20 mm). The length of the region C may be about 1.5 mm (or within the range of 0.3 mm to 3 mm, or between 1 mm and 2 mm). The circlip holder may comprise a length of about 0.5 mm (or within the range of 0.2 mm to 2 mm, or between 0.3 mm and 1 mm). The second rod-like portion 222 may comprise a length of about 3 mm (or within the range of 2 mm to 5 mm, or between 2 mm and 4 mm).

[0054] The diameter of the first rod-like portion 201 may be about 0.6 mm (or within the range of 0.3 mm to 2 mm, or between 0.4 mm and 1 mm). The diameter of the second rod-like portion 222 may be about 0.4 mm (or within the range of 0.1 mm to 2 mm, or between 0.3 mm and 0.8 mm).

[0055] Fig. 5B depicts a top view of the eccentric guide 20. Again, the first rod-like portion 201 comprises a larger diameter than the second rod-like portion 222. Moreover, the second rod-like portion 222 is arranged eccentrically relative to the first rod-like portion 201 such that the axial axis A1 of the second rod-like portion 222 and the axis A2 of the first rod-like portion are shifted relative to each other. The distance between A1 and A2 define the ec-

centricity and the achievable accuracy. This distance may, for example, be about 0.5 mm or about 1 mm or about 2 mm. Moreover, Fig. 5B shows the indentations of the circlip holder 207 (dashed line) which comprises a circumferential shape with a diameter which is smaller than the diameter of the second rod-like portion 222 to allow a secure fixation of a circlip within the circlip holder 207.

[0056] Fig. 5C depicts a top view of the eccentric guide 20 when placed inside the cylindrical recess of the base plate 10 and shows the carrier plate 30 with the elongated opening 32. In the embodiment as shown in Fig. 5C, the diameter of the second rod-like portion 222 is essentially equal to a smaller diameter of the elongated opening 32 inside the carrier plate 30. The elongated opening 32 comprises a smaller diameter d1 and a larger diameter d2. The smaller diameter d1 is approximately the same as the diameter of the second rod-like portion 222. Moreover, the diameter of the first rod-like portion 201 is larger than the smaller diameter d1 of the elongated opening 32 inside the carrier plate 30. Therefore, when the carrier plate 30 is arranged on the base element 10, the eccentric guide 20 cannot move in the upward direction (right direction in Fig. 5A), because the carrier plate 30 will block the first rod-like portion 201 because of its larger diameter.

[0057] Moreover, the second rod-like portion 222 comprises the screw nut 209 such that a rotation of the second rod-like portion 222 can be achieved by using, for example, a screwdriver. The second rod-like portion 222 will move in a clock-wise direction D1 when rotating the optional screwdriver in a clock-wise direction, thereby forcing the carrier plate 30 to the left (relative to the base element 10). In the same way, the second rod-like portion 222 will move in a counter-clockwise rotation direction D2 when the screwdriver is rotated in a counter-clockwise rotation, thereby forcing the carrier plate 30 to the right (relative to the base element 10).

[0058] Fig. 5D depicts a further top view on one of the rotatable guides 20 which is arranged within the cylindrical portion of the base element such that the eccentric portion 222 is received by the elongated opening 32. Moreover, Fig. 5D depicts the circlip 250 which is attached to the circlip holder 207 inside the second rod-like portion 222 (see Fig. 5A) such that the circlip will prevent a movement perpendicular to the drawing plane to separate the second rod-like portion 222 from the elongated opening 32 (i.e. a motion along the negative z-axis). Fig. 5D shows further that the diameter of the first rod-like portion 201 is larger than the smallest diameter of the elongated opening 32, thereby preventing a motion of the rotatable guide 20 in the direction of the positive z-axis (see Fig. 1).

[0059] In further embodiments, the circlip 250 can be replaced by any other fixation means which allows a rotation of the rotatable guide 20, while preventing a separation of the eccentric guide 20 from the carrier plate 30.

[0060] Fig. 6 depicts a further embodiment with option-

al position markings (reference points) 75. The position markings are arranged on the base element 10 and on the carrier plate 30 and indicate a desired position. The position markings 75 may be arranged on all sides of the carrier plate 30 to allow the visual inspection of the relative position of the carrier plate 30 relative to the base element 10 in all direction. Multiple position markings 75 may be arranged on at least one side (in Fig. 6, the upper side and the lower side comprise each two position markings), to detect a rotational displacement of the carrier plate 30 with respect to the base element 10.

[0061] Each of the position markings 75 may comprise several lines which may have, for example, different lengths. In the embodiment of Fig. 6, each of the position markings comprise three lines being arranged on the carrier plate 30 and three lines being arranged on the base element 10. The middle line of the three lines is longer than the two outer lines. This may simplify the visual inspection and to ensure a correct alignment. In further embodiments, the position markings comprise more than three lines or less than three lines (for example only a single line or five or 10 lines), wherein each of the multiple lines comprise a predetermined distance from each other.

[0062] These position markings 75 are configured to indicate a desired (relative) position. Therefore, by using the eccentric guides 20 to adjust the position of the carrier plate 30 relative to the base element 10, the position markings 75 can be used to define a precise positioning of these two elements.

[0063] The embodiment of Fig. 6 comprises again three elongated openings 321, 322 and 323 which receive three rotatable guides 201, 202 and 203. Moreover, the elongated openings 321, 322 and 323 are arranged along a line such that the middle elongated opening 322 extends in a perpendicular direction (for example, y-axis), whereas both outer elongated openings 321 and 323 extend in the x-direction, i.e. perpendicular to the y-axis. The first elongated opening 321 may extend along the positive x-axis, whereas the third elongated opening 323 may extend along the negative x-axis. The extension of the elongated openings is identified by the location of the eccentric portions inside the openings. Although this position will change by rotation of the rotatable guides 20, they cannot be selected freely, because of constraints imposed by the other elongated openings (see Fig. 6).

[0064] In Fig. 6 the arrows indicate the motion directions, when the respective rotatable guides are rotated. Some examples will be described in the following.

[0065] In the embodiment of Fig. 6 the carrier plate 30 moves along the y-axis by rotating the first eccentric guide 201 in the counter clock-wise direction combined with a clock-wise rotation of the third eccentric guide 203, while not rotating the second eccentric guide 202. By rotating the first and third eccentric guides 201, 203 in the opposite directions, the carrier plate 30 will move downward (negative y-direction). Similarly, by rotating the first and third rotatable guides 201, 203 in the same

rotation direction, i.e. the first rotatable guide 201 in the clockwise direction while rotating the third rotatable guide 203 also in the clockwise direction, the carrier plate 30 will rotate in the counter-clockwise direction. Again, by rotating both the first and third rotatable guides 201, 202 together in the opposite direction, the carrier plate 30 will rotate in the opposite direction, i. e. clockwise direction. Of course, by selecting different rotational guides that are rotated, the movement of the carrier plate 30 can be adjusted with high accuracy relative to the base element 10.

[0066] In further embodiments, more the three elongated openings can be formed such that they represent a triangle. In other embodiments, the extension directions of the elongated openings are different, for example, the middle elongated opening can extend along the x-direction (positive or negative), whereas the first and second elongated openings can extend along the positive and negative y-axis or both can extend along the same direction (for example, the y-axis).

[0067] Fig. 7 depicts a flow diagram for a method for controlling a position of a matrix in preparation of an embossing process, wherein the matrix is attachable to a carrier plate which is moveable relative to a base element. The method comprises a step of rotating S110 a rotatable guide with an eccentric portion about an axis perpendicular to the main surface of the base element. The method comprises further a step of engaging S120 the eccentric portion with an elongated opening of the carrier plate. The method comprises further a step of moving S130 the carrier plate in at least one direction of the main surface by the rotation of the rotatable guide.

[0068] The method shown in Fig. 7 may further comprise the optional steps of rotating a first rotatable guide with a first eccentric portion within a first elongated opening and rotating a second rotatable guide with a second eccentric portion within a second elongated opening, wherein the first and second elongated openings are different (e.g. perpendicular to each other) and wherein the rotation of the first rotatable guide is independent from the rotation of the second rotatable guide to achieve adjustments in two independent directions (e.g. with respect to x- and y-axis).

[0069] The present invention provides the following advantages. There is no need of dismantling the device during the position adjustments. Therefore, the matrix positioning can be achieved fast and simple. Only the attachment means have to be 401, 402 have to be loosened to allow a lateral motion of the carrier plate 30. In addition, a high precision is achievable by adjusting the eccentricity accordingly. The embossing intensity can be modified by the additional substrate material (padding material). The matrix can be replaced quickly by releasing the attachment means. The matrix can be re-adjusted with only few steps.

[0070] The present invention can also be summarized in the following way.

[0071] Embodiments of the present invention relate to

a simple and quick guidance of a matrix 5 with the help of a carrier metal plate (carrier plate 30) and a supporting block 15 with eccentric guides 20, without any specific devices to achieve a positioning accuracy even within micrometer ranges. When the eccentric guides 20 are rotated, the horizontal position of the matrix 5 is guided to a desired position. The initial or current position of the matrix 5 may be defined by positional markings 75, which may be engraved on the base bound board (base element 10) and the carrier metal board (the carrier plate 13).

[0072] The intensity or power of the embossing process can be set independently from the matrix position and may be modified with the help of padding material. Various thicknesses of padding material can be placed directly under the matrix 5. In this process, the position of the embossing remains unchanged.

[0073] The process of matrix control may be carried out on an independent embossing tool or together with a steel rule die.

[0074] The components of the apparatus for embossing control may comprise: a base element 10 (base bound plate), a matrix 5, a matrix, a carrier plate 30 (for example a carrier metal plate), a supporting block 50, eccentric guides 20, metal pins (pins 651, 652), threaded sleeves 801, 802, attachment and fixation means (for example, screws), external circlips, etc.

[0075] The control of the matrix 5 may be carried out relative to a desired position with the help of the eccentric guides 20 across the exemplary carrier metal board 30 and supporting block 50. The system enables a quick and precise horizontal matrix movement.

[0076] The matrix 5 may be attached to a supporting block 50 through the exemplary carrier metal plate 30, which may be 1.4 mm smaller than the opening 110, which, in turn, enables the movement of the matrix 10. The eccentric guide 20 may be used to control the position of the matrix 5 along the x- as well as y-axis.

[0077] In further embodiments, the exemplary base bound element 10 is a standard carrier for steel rule die or an independent embossing tool. The base bound element 10 may comprise a thickness of about 15 mm or 18 mm (or a range with between 10 and 30 mm). An optional laser cutter may be used to create the opening 110, the holes for the threaded sleeves and an opening for the eccentric guide 20. Predetermined locations may be marked with position markings 75 which may facilitate the positioning of exemplary carrier metal plate 30 with the matrix 5.

[0078] According to further embodiments, the support block 50 is about 1.8 mm smaller than the opening 110 formed in the base element 10 and serves as a carrier for the matrix 5. The exemplary base bound plate 10 with respect to its shape and the size of the matrix 5 can be cut with a laser cutter (to be cut out in the size of 1.4 mm). The support block 50 may comprise holes, wherein pins can be inserted which are used to fix the matrix 5 across the exemplary carrier metal plate 30 onto the support block 15 with optional screws.

[0079] According to further embodiments, the exemplary carrier metal plate 30 is made of straight iron sheet comprising thickness of about 1.25 mm. The exemplary carrier metal plate 30 comprises holes which can be used to fix it on the exemplary base bound plate. In addition, the exemplary carrier metal plate 30 may comprise holes for a matrix attachment onto the supporting block 50 and may comprise holes for the eccentric guides 20. Edges of the exemplary metal plate 30 may be engraved with positional markings 75 which define the current position allowing a quick and precise positioning along the x- axis and y-axis. Furthermore, the exemplary carrier metal plate 30 may be attached on the exemplary base bound plate 10 with M3 screws with a washer, which is screwed into the threaded M3 sleeves in the exemplary base bound plate 10.

[0080] In further embodiments, three eccentric guides 20 are used to position the matrix 5 to enable a horizontal movement of the matrix 5 across the exemplary metal plate 30 together with the supporting block 50 up to +/- 1.4 mm along the x-axis and/or y-axis. The eccentric guides 20 may comprise grooves which are used to apply the external circlip that prevents the guides 20 from falling off the exemplary base bound plate 10 and the metal plate 30. A screwdriver may be used to move the eccentric guides 20.

[0081] The exemplary method can also be described as follows. The base bound plate 10 is equipped with threaded sleeves M3, the eccentric guides 20 are inserted in prepared holes. The exemplary support block 50 is equipped with metal pins with e.g. M3 threads. The carrier metal plate 30 may be placed onto the support block 50. The carrier plate 30 is further placed on the base element 10 and fixed with M3 screws and washers - directly into the exemplary threaded sleeves. For example, three eccentric guides 20 may be equipped with external circlips, which additionally fix the carrier metal plate 30 and prevents the guides 20 from falling off the base element 10.

[0082] The matrix 5 can be attached onto the M3 metal pins on the supporting block 50 and fixed with M3 screws. Engraved position markings 75 on the metal plate 30 may be aligned with the engraved markings on the base element 10 which represents the basic starting position of the matrix 5. The intensity or power of the embossment can be regulated with padding materials of various thicknesses, which are of the same dimension as the matrix 5 itself, and may be placed directly under the matrix 5 onto the carrier metal plate 30.

[0083] During the positioning of the embossment, the screws for the fixation of the carrier metal plate 30 onto the base element 10 are slightly unscrewed. This enables movement of the matrix 5 along the carrier plate 30 and the supporting block 50. The movement is carried out by the eccentric guides 20 which are rotated into the desired direction. The position of the matrix 5 is controlled with the position markings 75 on the metal plate 30 and the base bound plate 10. If the new position of the matrix is defined, the previously unscrewed M3 screws are

screwed back and the position of the matrix is fixed.

[0084] The apparatus may comprise one or more additional optional features corresponding to one or more aspects mentioned in connection with the proposed concept or one or more examples described above.

[0085] The description and drawings merely illustrate the principles of the disclosure. It will thus be appreciated that those skilled in the art will be able to devise various arrangements that, although not explicitly described or shown herein, embody the principles of the disclosure and are included within its spirit and scope. Furthermore, all examples recited herein are principally intended expressly to be only for pedagogical purposes to aid the reader in understanding the principles of the disclosure and the concepts contributed by the inventor(s) to furthering the art, and are to be construed as being without limitation to such specifically recited examples and conditions. Moreover, all statements herein reciting principles, aspects, and examples of the disclosure, as well as specific examples thereof, are intended to encompass equivalents thereof.

[0086] It is to be noted that methods disclosed in the specification or in the claims may be implemented by a device having means for performing each of the respective steps of these methods.

[0087] Further, it is to be understood that the disclosure of multiple steps or functions disclosed in the specification or claims may not be construed as to be within the specific order. Therefore, the disclosure of multiple steps or functions will not limit these to a particular order unless such steps or functions are not interchangeable for technical reasons. Furthermore, in some examples a single act may include or may be broken into multiple sub steps. Such sub steps may be included and part of the disclosure of this single act unless explicitly excluded.

Claims

1. Apparatus for controlling a position of a matrix (5) in preparation of an embossing process, the apparatus comprising:

a base element (10) comprising a main surface (11) and a rotatable guide (20), the rotatable guide (20) comprises an eccentric portion (22) protruding from the main surface (11), wherein the rotatable guide (20) is rotatable about an axis perpendicular to the main surface (11); and
a carrier plate (30) to be placed on the main surface (11) and comprising an elongated opening (32) to receive the eccentric portion (22), the carrier plate (30) being configured to hold and move the matrix (5) along at least one direction (R1) of the main surface (11),
wherein the elongated opening (32) extends in a direction different from the at least one direction (R1) such that a rotation of the rotatable

- guide (20) moves the carrier plate (30).
2. Apparatus according to claim 1, wherein the elongated opening (32) is a first elongated opening (321), the rotatable guide (20) is a first rotatable guide (201), the eccentric portion (22) is a first eccentric portion (221) and the at least one direction is a first direction (R1),
the base element (10) further comprising a second rotatable guide (202) with a second eccentric portion (222),
the carrier plate (30) further comprising a second elongated opening (322), wherein the second elongated opening (322) is configured to receive the second eccentric portion (222) and extends in a different direction than the first elongated opening (221) such that rotation of second rotatable guide (202) moves the carrier plate (30) in a second direction (R2) being different from the first direction (R1), thereby allowing independent adjustments in the first direction (R1) and in the second direction (R2).
 3. Apparatus according to claim 1 or claim 2, wherein the elongated opening (32) is a first elongated opening (321), the rotatable guide (20) is a first rotatable guide (201), the eccentric portion (22) is a first eccentric portion (221) and the at least one direction is a first direction (R1),
the base element (10) further comprising a third rotatable guide (203) with a third eccentric portion (223),
the carrier plate (30) further comprising a third elongated opening (323), wherein the third elongated openings (323) is configured to receive the third eccentric portion (222) and extends in a further direction.
 4. Apparatus according to claim 3 referring to claim 2, wherein the direction of the first elongated opening (321) and the further direction of the third elongated opening (323) are parallel to each other and perpendicular to the different direction of the second elongated opening (322).
 5. Apparatus of claim 3 or claim 4, wherein the second rotatable guide (202) is arranged on a connection line connecting the first and third rotatable guides (201, 203).
 6. Apparatus according to one of the preceding claims, further comprising attachment means (40) for attaching the carrier plate (30) to the base element (10), wherein the attachment means are configured to allow movements of carrier plate (30) relative to the base plate (10) in the first direction (R1) and/or second direction (R2) and/or a rotation about a rotation axis and prevents movement in a third direction (R3).
 7. Apparatus according to claim 6, wherein the attachment means (40) comprise at least one bolt (410), and wherein the carrier plate (30) comprises at least one through-hole for the at least one bolt (230) and the at least one through-hole comprises an inner diameter which is larger than an outer diameter of the at least one bolt (230) to allow a clearance defining a range of movement of the carrier plate (30) along the main surface (11) of the base element (10).
 8. Apparatus according to one of the preceding claims, wherein the base element (10) comprises an opening (110), the apparatus further comprising a supporting block (50) which is configured to be attached to an opposite surface of the carrier plate (30) relative to the matrix (5) and is configured to fit in the opening (110) of the base plate (10) while leaving a gap to provide support in the embossing process and to allow movement of the base plate (5) in the at least one direction (R) without detaching the supporting block (50).
 9. Apparatus according to one of the preceding claims, wherein the base element (10) comprises at least one cylindrical recess (10x) for receiving the at least one rotatable guide (20).
 10. The apparatus according to claim 9, wherein the at least one rotatable guide (20) comprises a rod-like structure with a first rod-like portion (201) for fitting in the cylindrical recess (10x) of the base element (10) and a second rod-like portion (222) which is configured to fit in the elongated opening (32), wherein the second rod-like portion (222) has a smaller diameter than the first rod-like portion (201), wherein axial axes of the first rod-like portion (201) and the second rod-like portion (222) are shifted such that the second rod-like portion (222) is eccentric when compared to the first rod-like portion (201) so that the second rod-like portion (222) is configured to perform a circular movement about the axial axis of the first rod-like portion (101).
 11. Apparatus according of claim 10, wherein the elongated opening (32) is a through hole through the carrier plate (30), and the outer diameter of the first rod-like portion (201) is larger than a smallest diameter of the elongated opening (32), and wherein the at least one rotatable guide (20) comprises a circlip, the circlip being attachable at the second rod-like portion (222) and comprising an outer diameter being larger than the smallest diameter of the elongated opening (32) so that the second rod-like portion (222) can extend through the elongated opening (32) and is prevented from moving perpendicular to the carrier plate (30) by the circlip arranged on one side and by the first rod-like portion (201) arranged on the opposite side.

12. The apparatus according to one of the preceding claims, wherein the base element (10) and/or the supporting block (50) comprises a non-metal material and the base element (10) comprises a same thickness as the supporting block (50). 5
13. The apparatus according to one of the preceding claims, wherein the carrier plate (30) is configured to accommodate substrate material to be arranged between the matrix (5) and the carrier plate (30), wherein the substrate material comprises a predetermined thickness to adjust an embossing intensity. 10
14. The apparatus according to one of the preceding claims, wherein the base element (10) and the carrier plate (30) comprises positioning markings (75), which are configured to indicate a relative position of the carrier plate (30) relative to the base element (10). 15
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15. Method for controlling a position of a matrix (5) in preparation of an embossing process, wherein the matrix (5) is attachable to a carrier plate (30) which is moveable relative to a base element (10), the method comprising: 25
- rotating (S110) a rotatable guide (20) with an eccentric portion (22) about an axis perpendicular to the main surface (11) of the base element (10); 30
- engaging (S120) the eccentric portion (22) with an elongated opening (32) of the carrier plate (30); and
- moving (S130) the carrier plate (30) in at least one direction (R1) of the main surface (11) by the rotation of the rotatable guide (20). 35
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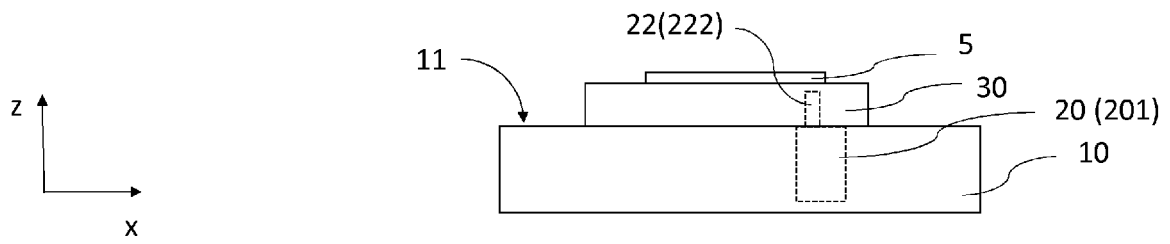


Fig. 1A

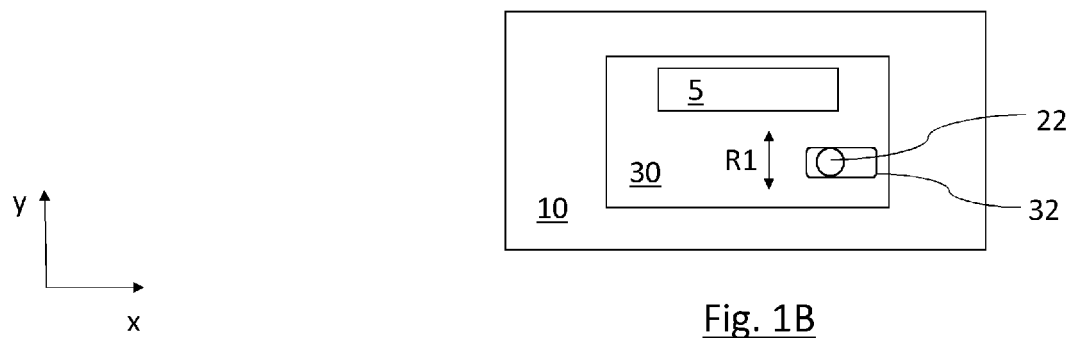
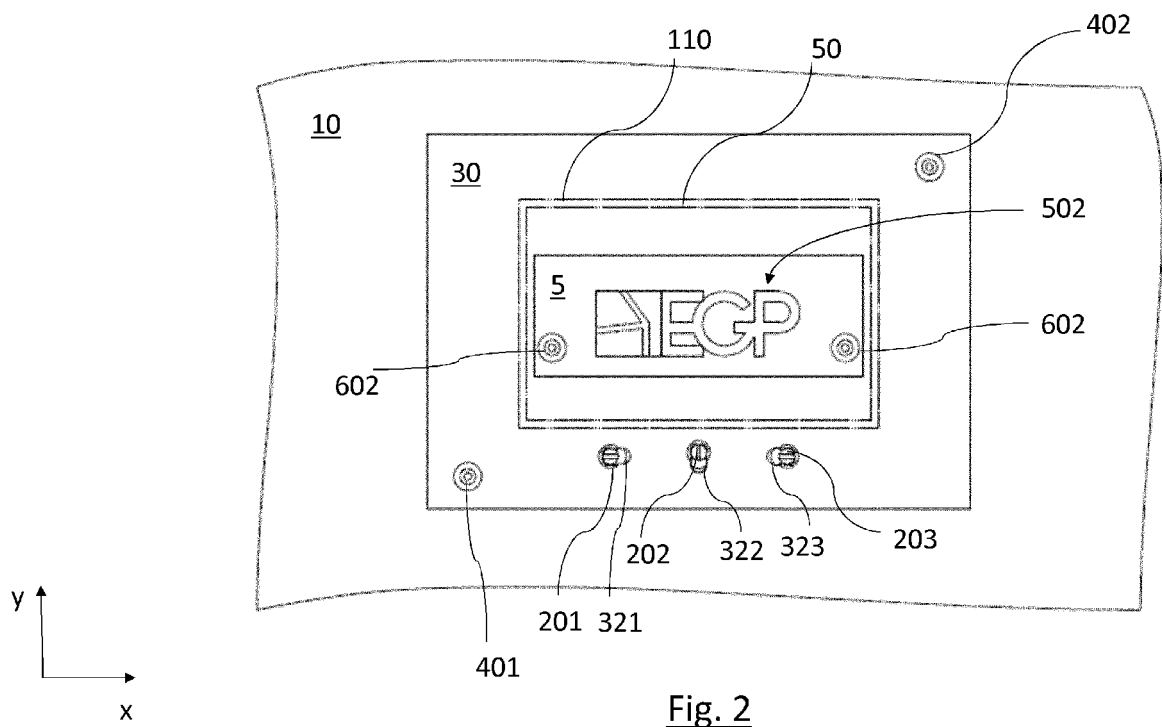
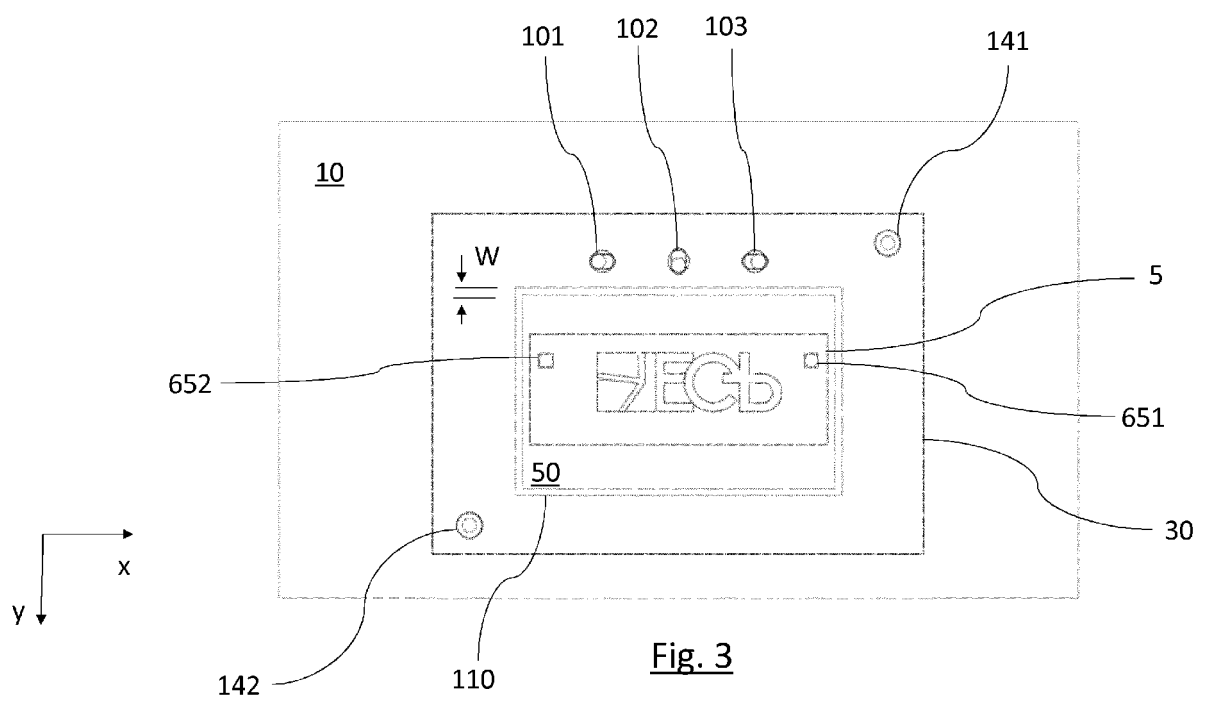


Fig. 1B





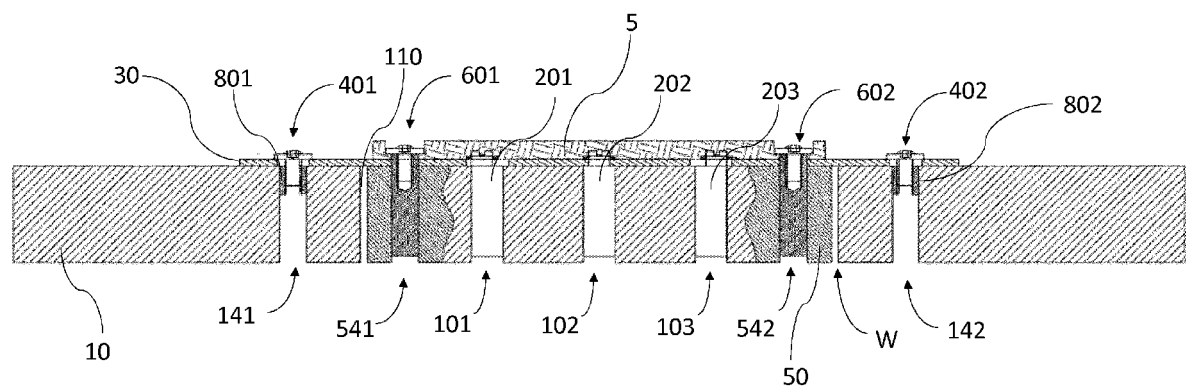


Fig. 4

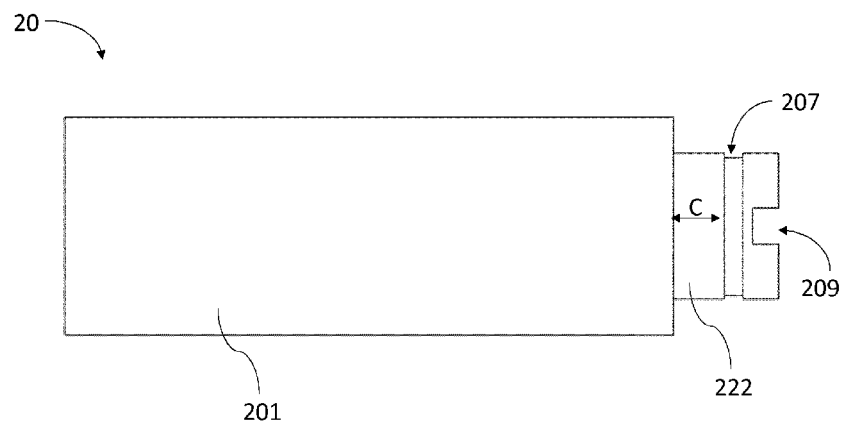


Fig. 5A

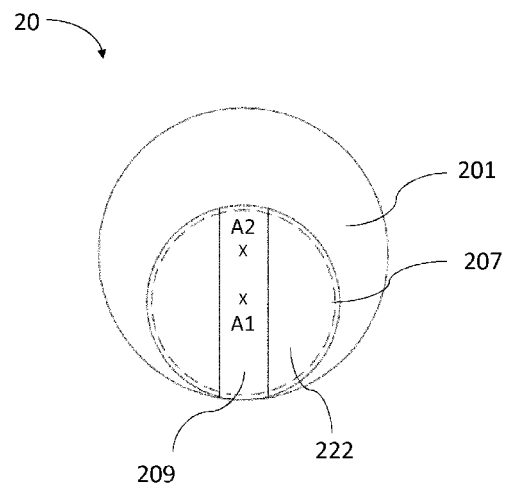


Fig. 5B

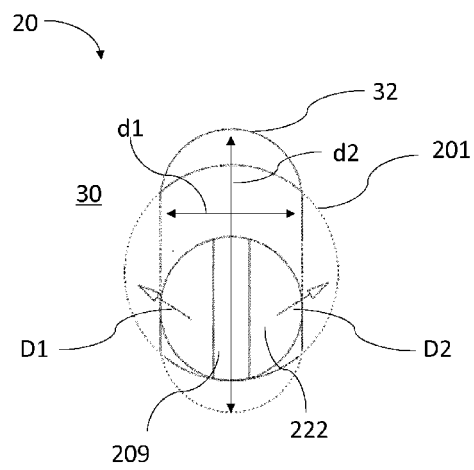


Fig. 5C

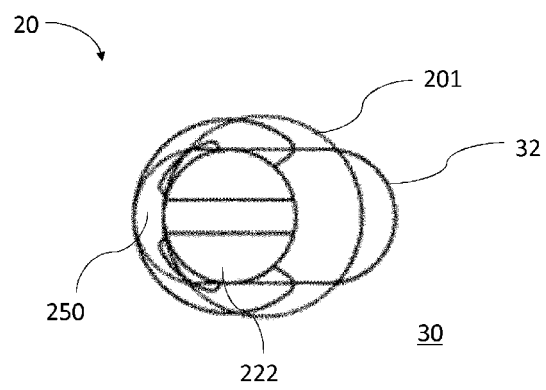


Fig. 5D

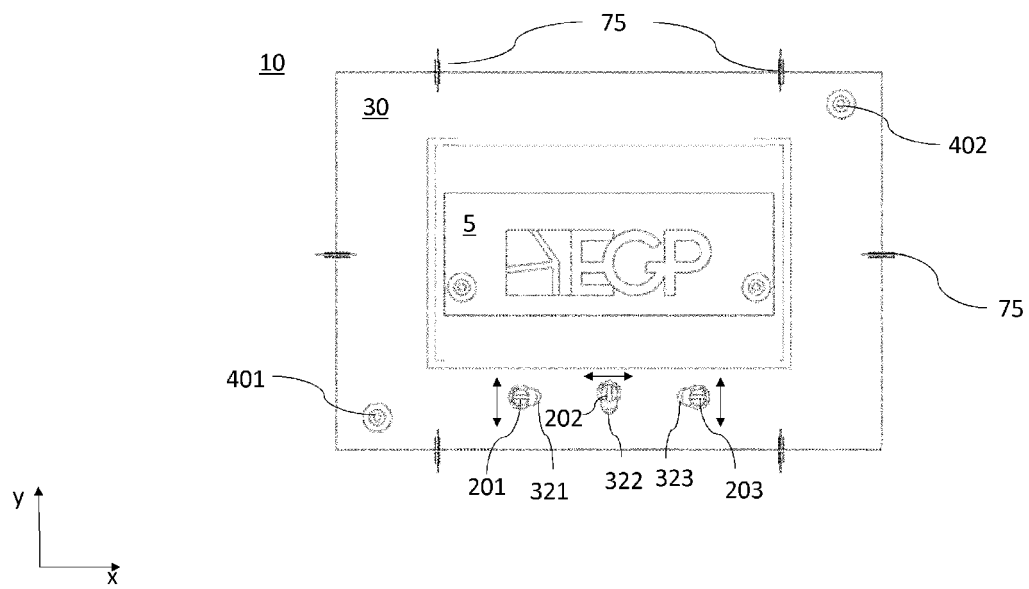


Fig. 6

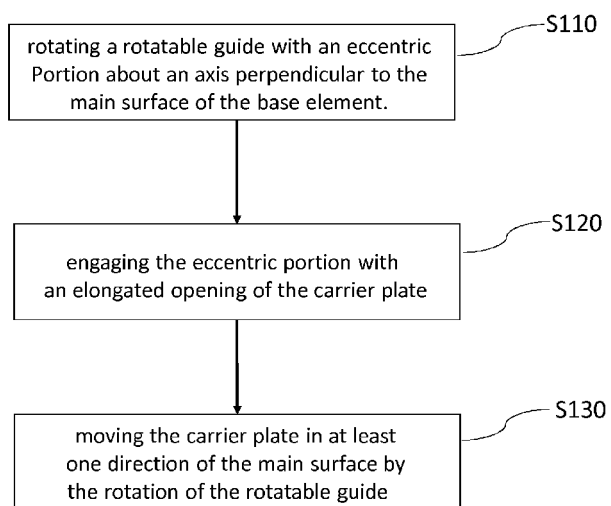


Fig. 7



EUROPEAN SEARCH REPORT

 Application Number
 EP 14 17 8269

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