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(54) **INSTALLATION AND METHOD FOR THE FORMATION OF AT LEAST ONE CORNER REGION IN A METAL PLATE**

(57) Installation and method for forming at least one corner region (1.0) in a rectangular metal plate (1), the corner region (1.0) being formed in the intersection between a first section (1.1) and a second section (1.2) of the metal plate (1). For forming a corner region, the bending of the first section (1.1) of the metal plate (1) is performed first, and then the bending of the second section (1.2) of said metal plate (1) is performed, at least the region of the first section (1.1) closest to the corner region (1.0) being held and kept immobile during said bending of the second section (1.2), said region of the first section (1.1) being released once said bending of the second section (1.2) has been completed.

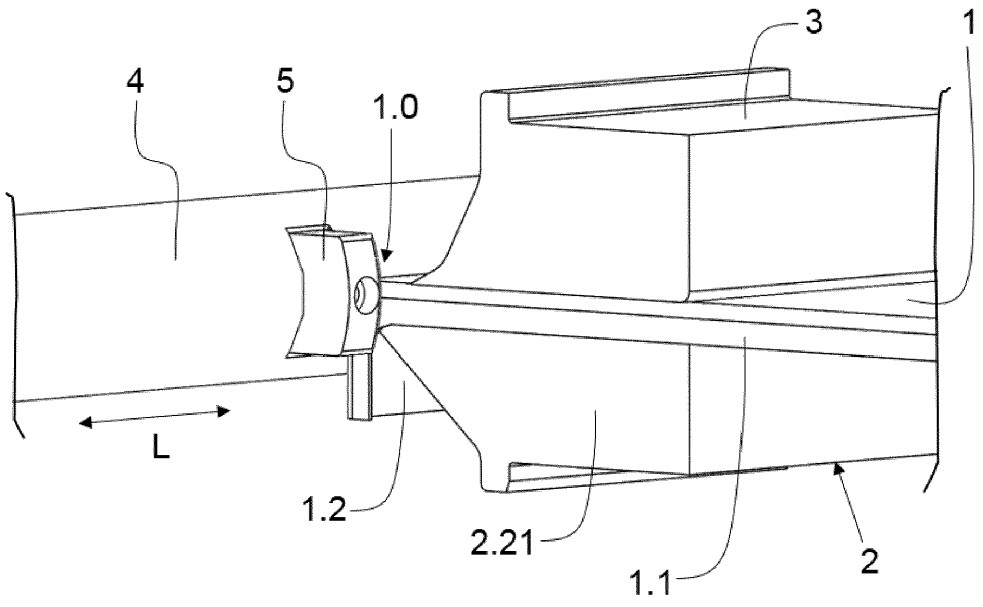

Fig. 8

EP 3 569 324 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to installations and methods for the formation of at least one corner region (corner) in a rectangular metal plate.

PRIOR ART

[0002] Some building elements, such as doors on electrical appliances, for example, are generally produced from metal plates. These metal plates are rectangular, therefore comprising four sides or sections. The plate is acted on to obtain bent or curved sections, giving rise to the end product (the mentioned doors, for example). Although all the sections are generally required to be bent, depending on the end product fewer bends may be required.

[0003] The intersections between two sections are corner regions or corners, which also have bends. When two sections are curved (or bent), excess material is generated in the intersection (corner region) resulting in visibly unacceptable corner regions (an indispensable requirement in most end products, such as the mentioned doors, for example). Alternatives are known to prevent this aesthetic defect.

[0004] One alternative is to cut away part of the material of the metal plate in the corresponding intersection before curving or bending the sections associated with said intersection, with said material corresponding to the excess material mentioned above. Therefore, when said sections are later curved said excess material is no longer in the corner region, and a corner region that is not aesthetically acceptable for the mentioned needs is obtained.

[0005] In another alternative, to prevent said prior operation and the processing of the cut material, once the sections associated with an intersection (corner region) are bent, said intersection is acted on to render it aesthetically acceptable. An example of this alternative is disclosed in EP1287918A1. This patent document discloses an installation for forming a corner region bounded on three sides in a building element from a metal plate having a flat surface, using a tool specific for that purpose. The corner region is an intersection between said sections of said plate, and said sections are first curved or bent. The plate that has been thus curved or bent is then conveyed to another location where the intersection (corner region) is acted on in a later operation with the given tool so as to displace the excess material to where its presence is not relevant, thereby obtaining a part having an acceptable aesthetics. The tool comprises an arrangement of rollers adapted to perform this function.

DISCLOSURE OF THE INVENTION

[0006] The object of the invention is to provide an installation and a method for the formation of at least one corner region in a rectangular metal plate as defined in the claims.

[0007] A first aspect of the invention relates to an installation which is adapted to form at least one corner region in a rectangular metal plate which is normally flat or bowed, the corner region being formed in the intersection between a first section and a second section of the metal plate.

[0008] The installation comprises a die (or wedge) longitudinally extending in a longitudinal direction, and comprising a flat upper surface extending in the longitudinal direction and on which there can be arranged the metal plate, two opposite side walls, and a front actuation contour, a holding device for holding the metal plate against the flat surface of the die, and a bending mechanism adapted to perform the bending of both sections of said metal plate.

[0009] The bending mechanism comprises at least one bending tool extending in the longitudinal direction and is adapted to bend the section of the metal plate protruding from the die frontally, pushing said section against the actuation contour of said die with a corresponding contact surface. The installation comprises actuation means for causing the actuation of the bending tool to perform said bending.

[0010] The installation further comprises at least one holding element which is attached to the bending tool and associated with the contact surface, and which is configured for being arranged in a position facing a side wall of the die while at the same time the bending tool is acting on the metal plate to perform the corresponding bending of a section of said metal plate, so as to prevent the movement of another already bent section of said metal plate that is between said protection element and said side wall, the corner region being the intersection between said two sections.

[0011] So, if there is arranged on the die a metal plate in which a side bending has already been performed, with the installation the front section of said metal plate can furthermore be bent, obtaining as a result a smooth, crease-free corner region (corner). This is achieved as a result of the bent side section (or at least the region of said side section closest to the corner region) being held or contained between the holding element and a side wall of the die while performing the bending of the front section, and this prevents the excess material of the corner region from trying to get out through the upper part of said corner region. A high-quality corner region (aesthetically speaking) is obtained with the proposed installation, without requiring prior operations (for cutting the material) or later operations that may make the installation more expensive and said high-quality corner region is obtained in a simple manner as only bending operations are required.

[0012] A second aspect of the invention relates to a method for the formation of at least one corner region in a rectangular metal plate (which is normally flat or

bowed), whereby a corner of a metal plate is bent, the corner region being formed in the intersection between a first section and a second section of the metal plate.

[0013] In the method, the bending of the first section of the metal plate is performed first and then the bending of the second section of said metal plate is performed, at least the region of the first section closest to the corner region being held and kept immobile during said bending of the second section, said region of the first section being released once said bending of the second section has been completed. The advantages mentioned for the first aspect of the invention are also obtained with the method.

[0014] These and other advantages and features of the invention will become evident in view of the drawings and detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0015]

Figure 1 shows a perspective plan view of a metal plate that has not been bent.

Figure 2 shows the front of a metal plate with the side sections having been bent.

Figure 3 is a schematic side view of a die, a holding device, a bending tool and a holding element of an embodiment of the installation of the invention.

Figure 4 shows the elements of Figure 3, with a metal plate with a side bend arranged on the die.

Figure 5 shows the elements of Figure 3, with a metal plate with a side bend held between the holding device and the die.

Figure 6 shows the elements of Figure 3, with a metal plate with a side bend held between the holding device and the die, and with the bending tool in contact with said metal plate.

Figure 7 shows the elements of Figure 3, with a metal plate with a side bend held between the holding device and the die, and with the bending tool having performed the front bending of said metal plate.

Figure 8 is a rear perspective view of the situation of Figure 7, where a holding element participating in containing a bent side section is depicted.

Figure 9 laterally shows a bending tool of an embodiment of the installation of the invention, comprising a roller and a plurality of holding assemblies attached to said roller.

Figure 10 is a perspective view of the bending tool of Figure 9.

Figure 11 shows the bending tool of Figures 9 and 10, without the holding assemblies.

DETAILED DISCLOSURE OF THE INVENTION

[0016] A first aspect of the invention relates to an installation for the formation of at least one corner region 1.0 (corner) in a rectangular metal plate 1, which is normally flat as shown by way of example in Figures 1 and 2, but which can also have other shapes, such as bowed, for example, the corner region 1.0 being formed in the intersection between a first section 1.1 and a second section 1.2 of the metal plate 1.

[0017] The installation comprises at least one die 2, a holding device 3 and a bending tool 4, as schematically shown in Figures 3 to 8. The die 2 is fixed in a structure of the installation not depicted in the drawings, longitudinally extends in a longitudinal direction L, and comprises a flat upper surface 2.0 extending in the longitudinal direction L and on which there can be arranged the metal plate 1, two opposite side walls 2.21 and 2.22, and a front actuation contour 2.1.

[0018] The holding device 3 is preferably arranged on the die 2 with freedom of vertical movement for holding the metal plate 1 against the flat surface 2.0 of the die 2. The movement of said holding device 3 is caused with actuation means for holding the metal plate 1 against the die 2. In other embodiments, it can be the holding device 3 that which is fixed in the structure, with the die 2 being movable. In other embodiments, the die 2 can likewise be arranged on the holding device 3.

[0019] The installation comprises a bending mechanism adapted to make the corresponding bends of the metal plate 1. The bending mechanism may comprise a single bending tool to make each of the bends, or a bending tool may be adapted to make said bends (or at least more than one). Hereinafter reference shall be made to a bending tool 4 which is adapted to make at least one bend, and reference shall be made to making a given bend without this being limited to the fact that said bending tool 4 is adapted only to make said bend.

[0020] The die 2, the bending tool 4 of the bending mechanism (or the entire bending mechanism), the holding device 3 and the actuation means required for acting on said elements can be part of a bending machine of the installation.

[0021] The bending tool 4 extends in the longitudinal direction L, and comprises a longitudinal central axis 4.0 extending in said longitudinal direction L. The bending tool 4 is adapted to bend the section 1.2 of the metal plate 1 protruding from the die 2 frontally, pushing said section 1.2 against the actuation contour 2.1 of said die 2 with a contact surface. Hereinafter and for the sake of clarity, said section 1.2 is identified as front section 1.2. The die 2 preferably remains stationary during the bending of the front section 1.2, the bending tool 4 being the element which moves for causing said bending. The installation thereby comprises actuation means not depict-

ed in the drawings for causing said movement of the bending tool 4.

[0022] The installation further comprises at least one holding element 5 which is attached to the bending tool 4 and associated with the contact surface, and which is configured for being arranged in a given position when the bending tool 4 is acting on the metal plate 1 to perform the bending of the front section 1.2, facing a side wall 2.21 or 2.22 of the die 2, such that during said actuation of the bending tool 4 an already bent section 1.1 of the metal plate 1, hereinafter side section 1.1, is held or contained between said holding element 5 and said side wall 2.21 or 2.22 of the die 2, the corner region 1.0 being the intersection between said side section 1.1 and said front section 1.2.

[0023] To perform the bending of the front section 1.2, there is arranged on the upper surface 2.0 of the die 2 a metal plate 1 with an already bent section, the front section 1.2 to be bent being located in the front of the die 2 and protruding from said die 2. The already bent section (side section 1.1) is located on one side of said die 2 (facing a corresponding side wall 2.21 or 2.22 of the die 2). Therefore, since the bending tool 4 causes the front section 1.2 to push against the actuation contour 2.1 of the die 2, the side section 1.1 (at least one region) is held between the holding element 5 and the corresponding side wall 2.21 or 2.22 during said actuation of the bending tool 4.

[0024] The holding element 5 projects from the associated contact surface of the bending tool 4 and is attached to said bending tool 4 such that when said bending tool 4 is bending the front section 1.2 of the metal plate 1, said holding element 5 is arranged on one side of one of the side walls 2.21 or 2.22 of the die 2, such that the intersection between the front section 1.2 and the side section 1.1 of the metal plate 1 is arranged between the bending tool 4, the corresponding side wall 2.21 or 2.22 of the die 2, and the holding element 5, the corner region 1.0 being formed with the properties mentioned above.

[0025] The bending tool 4, the holding element 5 and the die 2 are configured so that when the bending tool 4 is bending the front section 1.2 of the metal plate 1, the distance between the corresponding side wall 2.21 or 2.22 of the die 2 and the holding element 5 is substantially equal to the thickness of the metal plate 1, thereby assuring that the side section 1.1 remains stationary (at least the region closest to the intersection with the front section 1.2) during the bending of the front section 1.2.

[0026] In some embodiments, the bending tool 4 is adapted to make bends on metal plates 1 which result in different widths A of said bent metal plate 1 (see Figure 2).

[0027] In some of these embodiments, the holding element 5 is linearly movable in the longitudinal direction 4 with respect to the bending tool 4, such that its distance with respect to one end 4.3 of said bending tool 4 can be adjusted. If the metal plate 1 to be bent comprises a width A that is less than the preceding bent metal plate 1, the holding element 5 moves to the center of the bending tool 4 and is fixed when it reaches its new position. This in turn entails the replacement of at least the die 2 that was previously used with another one having a smaller width (or if the die 2 is segmented, the corresponding segment or segments would have to be removed so as to adjust the die 2 to the new width A of the metal plate 1).

[0028] In other embodiments, the bending tool 4 comprises a plurality of contact surfaces, one for each possible width A, which are distributed along the bending tool 4 with a distribution angle β separating them (with respect to the central axis 4.0, as shown in the example of Figure 9). Once bent, the front section 1.2 comprises a given inner angle α with respect to the part of the metal plate 1 that is not bent, and the distribution angle β has to be equal to, or preferably greater than, the inner angle α so as to assure that one contact surface does not come into conflict with another contact surface. In these embodiments, the holding elements 5 are furthermore fixed and arranged at different distances with respect to one and the same end 4.3 of the bending tool 4 (or with respect to the center in the longitudinal direction L of said bending tool 4). In said embodiments, the bending tool 4 is furthermore adapted to enable turning with respect to its central axis 4.0 in a controlled manner so as to position the corresponding contact surface in place for acting on the front section 1.2 of the metal plate 1 protruding from the die 2 frontally, the installation comprising actuation means for causing said controlled turning.

[0029] In some embodiments, the installation is furthermore configured for forming a second corner region 1.4 in the metal plate 1 at the same time as the first corner region 1.0 which has been discussed above, the second corner region 1.4 being formed in the intersection between the front section 1.2 and a third section 1.3 of the metal plate 1, said third section 1.3 being a side section opposite the side section 1.1, as shown in Figure 1. In this case, the bending assembly is adapted to furthermore bend said third section 1.3.

[0030] To generate the second corner region 1.4, the installation further comprises an additional holding element 5 for each contact surface of the bending tool 4, facing the first holding element 5 in the longitudinal direction L and arranged at a given longitudinal separation distance D, both holding elements 5 associated with one and the same contact surface of the bending tool 4 forming a holding assembly. Each of the holding elements 5 of a holding assembly is adapted for a respective bent side section 1.1 and 1.3 of the metal plate 1 to be contained between said holding element 5 and a respective side wall 2.21 and 2.22 of the die 2, while at the same time the bending tool 4 is bending the front section 1.2 with the contact surface with which said holding assembly is associated.

[0031] In the event that the bending tool 4 is configured to enable obtaining bent metal plates 1 with different widths A, the installation may comprise a single holding assembly or a plurality of holding assemblies (one holding assembly for each possible width A). If it has a single

holding assembly, at least one of the holding elements 5 of said holding assembly is movable in the longitudinal direction L with respect to the other holding element 5, so as to adjust the separation distance D therebetween and thereby adjust the width A for the metal plate 1, although there could be two movable holding elements 5 (which may move independently or simultaneously in opposite directions). If it has a plurality of holding assemblies, the separation distance D between two holding elements 5 of the different holding assemblies is different, each of said separation distances D being a different width for the metal plate 1. The distribution of the different holding assemblies is as discussed above for the similar embodiment where each contact surface has one associated holding element 5 (not two), and the bending tool 4 is adapted to enable turning with respect to its central axis 4.0 in a controlled manner so as to position the corresponding contact surface in place for acting on the front section 1.2 of the metal plate 1 protruding from the die 2 frontally, the installation comprising actuation means for causing said controlled turning.

[0032] In any of the embodiments, the bending tool 4 may comprise a roller, for example, such as the one shown by way of example in Figures 9 to 11. The roller is adapted to turn with respect to its central axis, which makes bending easier and prevents said bending tool 4 from marking the metal plate 1 during the corresponding bending. In the example shown in said drawings, the bending tool 4 comprises a plurality of holding assemblies, and the roller is furthermore adapted to turn in a controlled manner (to arrange the suitable holding assembly in each case in the operative position to perform bending). Furthermore, in these cases the roller preferably comprises a groove 4.2 on its outer surface for housing each holding element 5, each holding element 5 being housed in a corresponding groove 4.2 and attached to said roller (by means of a screw, for example, or by other attachment means providing a solid and fixed attachment).

[0033] A second aspect of the invention relates to a method for forming at least one corner region 1.0 in a rectangular metal plate 1, which is normally flat or bowed, whereby a corner 1.0 of a metal plate 1 is bent, the corner region 1.0 being formed in the intersection between a first section 1.1 and a second section 1.2 of the metal plate 1. The method is adapted to be implemented in an installation such as the installation of the first aspect of the invention, in any of its embodiments and/or configurations, the method thereby comprising the embodiment and/or configuration required for the corresponding installation.

[0034] In the method, to form a corner region 1.0 the bending of the first section 1.1 of the metal plate 1 is performed first with a given bending tool and then the bending of the second section 1.2 of said metal plate 1 is performed with a given bending tool 4. Both bending tools can be the same tool or two different tools. The first section 1.1 (at least the region of said first section 1.1 closest to the corner region 1.0) is held and kept immobile during the bending of the second section 1.2, said first section 1.1 being released once said bending of the second section 1.2 has been completed.

[0035] To perform the bending of the second section 1.2 of the metal plate 1, the metal plate 1 is arranged with the already bent first section 1.1 on a flat upper surface 2.0 of a die 2 (see Figure 4), such that the second section 1.2 of the metal plate 1 protrudes from the die 2 frontally, said second section 1.2 being a front section 1.2. With the metal plate 1 thus arranged, said metal plate 1 is held against said upper surface 2.0 by means of a holding device 3 (see Figure 5), and said front section 1.2 is bent by means of the bending tool 4, said bending tool 4 pushing said front section 1.2 against the actuation contour 2.0 of the die 2 (see Figures 6 and 7). The already bent first section 1.1 (side section 1.1) is simultaneously kept in place between a side wall 2.21 or 2.22 of the die 2 and a holding element 5, as explained above.

[0036] In some embodiments, the method is furthermore adapted to form a second corner region 1.4 in the metal plate 1 at the same time as the first corner region 1.0, the second corner region 1.4 being formed in the intersection between the second section 1.2 (front section 1.2) and a third section 1.3 (side section opposite side section 1.1) of the metal plate 1. The third section 1.3 is bent before the front section 1.2, and with the already bent two side sections 1.1 and 1.3, the metal plate 1 is arranged on the flat upper surface 2.0 of a die 2, such that the front section 1.2 of the metal plate 1 protrudes from the die 2 frontally. With the metal plate 1 thus arranged, said metal plate 1 is held against said upper surface 2.0 by means of a holding device 3, and said front section 1.2 is bent by means of the bending tool 4, said bending tool 4 pushing said front section 1.2 against the actuation contour 2.0 of the die 2. Simultaneously, the already bent side section 1.1 is kept in place between a side wall 2.21 or 2.22 of the die 2 and a holding element 5, and the already bent side section 1.3 is kept in place between the other side wall 2.21 or 2.22 of the die 2 and the other holding element 5, as explained above.

[0037] An installation according to the invention is configured to enable implementing the method according to the invention in any of its embodiments and/or configurations, and vice versa. The installation therefore comprises the configuration necessary for implementing the required configuration or embodiment of the method, and vice versa. The description of the method is therefore also valid for the corresponding embodiments/configurations of the installation, and the description of the installation is therefore also valid for the corresponding embodiments/configurations of the method.

Claims

1. Installation for forming at least one corner region (1.0) in a rectangular metal plate (1), the corner re-

gion (1.0) being formed in the intersection between a first section (1.1) and a second section (1.2) of the metal plate (1), the installation comprising

- a die (2) longitudinally extending in a longitudinal direction (L), and comprising a flat upper surface (2.0) extending in the longitudinal direction (L) and on which there can be arranged the metal plate (1), two opposite side walls (2.21, 2.22), and a front actuation contour (2.1),
- a holding device (3) for holding the metal plate (1) against the flat surface (2.0) of the die (2),
- a bending mechanism adapted to perform the bending of both sections (1.1, 1.2) of said metal plate (1) and comprising at least one bending tool (4) extending in the longitudinal direction (L) and comprising a longitudinal central axis (4.0) extending in said longitudinal direction (L), the bending tool (4) being adapted to bend the section (1.1, 1.2) of the metal plate (1) protruding from the die (2) frontally, pushing said section (1.1, 1.2) against the actuation contour (2.1) of said die (2) with a contact surface, and
- actuation means for causing the actuation of the bending tool (4) to perform said bending,

characterised in that the installation further comprises at least one holding element (5) which is attached to the bending tool (4) and associated with the contact surface, and which is configured for being arranged facing one of the side walls (2.21, 2.22) of the die (2) while at the same time the bending tool (4) is acting on the metal plate (1) to perform the corresponding bending of a section (1.1, 1.2) of the metal plate (1), the already bent other section (1.1, 1.2) of said metal plate (1) being kept in place between said side wall (2.21, 2.22) and said holding element (5) during said actuation of the bending tool (4), the corner region (1.0) being the intersection between said two bent sections (1.1, 1.2).

2. Installation according to claim 1, wherein the holding element (5) projects from the associated contact surface and is attached to the bending tool (4) such that when said bending tool (4) is bending the corresponding section (1.1, 1.2) of the metal plate (1), said holding element (5) is arranged on one side of one of the side walls (2.21, 2.22) of the die (2), such that the corner region (1.0) of the metal plate (1) is retained between said surface of the bending tool (4), said side wall (2.21, 2.22) of the die (2), and the holding element (5).

3. Installation according to claim 2, wherein the bending tool (4), the holding element (5) and the die (2) are configured so that when the bending tool (4) is bending the corresponding section (1.1, 1.2) of the metal plate (1), the distance between the corresponding side wall (2.21, 2.22) of the die (2) and the holding element (5) is substantially equal to the thickness of the metal plate (1) to be bent.

4. Installation according to any of claims 1 to 3, wherein the bending tool (4) comprises a plurality of contact surfaces configured for acting against a section (1.1, 1.2) of the metal plate (1) protruding from the die (2) frontally for bending said section (1.1, 1.2), said contact surfaces being distributed over an outer surface of the bending tool (4) with a given distribution angle (β) therebetween with respect to the central axis (4.0) of said bending tool (4), the installation comprising at least one holding element (5) associated with each contact surface and arranged at a different distance with respect to a longitudinal end (4.3) of said bending tool (4).

5. Installation according to claim 4, wherein after the bending of a section (1.1, 1.2) performed by the corresponding contact surface of the bending tool (4), said section (1.1, 1.2) describes a given inner angle (α) with respect to the part of the metal plate (1) supported on the upper surface (2.0) of the die (2), the distribution angle (β) being equal to or greater than said inner angle (α).

6. Installation according to claim 4 or 5, wherein the cutting tool (4) is adapted to enable turning with respect to its central axis (4.0) in a controlled manner so as to position the corresponding contact surface in place for acting on the section (1.1, 1.2) of the metal plate (1) protruding from the die (2) frontally, the installation comprising actuation means for causing said controlled turning.

7. Installation according to any of claims 1 to 3, wherein the holding element (5) is attached to the bending tool (4) such that it is linearly movable in the longitudinal direction (L).

8. Installation according to any of claims 1 to 3, which is furthermore configured for forming a second corner region (1.4) in the metal plate (1) at the same time as the first corner region (1.0), the second corner region (1.4) being formed in the intersection between the second section (1.2) and a third section (1.3) of the metal plate (1), the bending assembly furthermore being adapted to bend said third section (1.3), and the installation comprising an additional holding element (5) for each contact surface of the bending tool (4), facing the first holding element (5) in the longitudinal direction (L) and arranged at a given longitudinal separation distance (D), both holding elements (5) associated with one and the same contact surface of the bending tool (4) forming a holding assembly and each of the holding elements (5) of a holding assembly being adapted to press on a

bent section (1.1, 1.2, 1.3) of the metal plate (1) facing a corresponding side wall (2.21, 2.22) of the die (2) while at the same time the bending tool (4) is bending the corresponding section (1.1, 1.2, 1.3) with the contact surface with which said holding assembly is associated.

9. Installation according to claim 8, wherein the bending tool (4) comprises a plurality of contact surfaces configured for acting against a section (1.1, 1.2, 1.3) of the metal plate (1) protruding from the die (2) frontally for bending said section (1.1, 1.2, 1.3), said contact surfaces being distributed over an outer surface of the bending tool (4) with a given distribution angle (β) therebetween with respect to the central axis (4.0) of said bending tool (4), the installation comprising at least one holding assembly associated with each contact surface and the separation distances (D) between the holding elements (5) of the different holding assemblies being different from one another.

10. Installation according to claim 9, wherein after the bending of a section (1.1, 1.2, 1.3) performed by the corresponding contact surface of the bending tool (4), said section (1.1, 1.2, 1.3) describes a given inner angle (α) with respect to the part of the metal plate (1) supported on the upper surface (2.0) of the die (2), the distribution angle (β) being equal to or greater than said inner angle (α).

11. Installation according to claim 10, wherein at least one of the two holding elements (5) of one and the same holding assembly is linearly movable with respect to the other holding element (5) in a direction parallel to the central axis (4.0) of the bending tool (4), so as to adjust the separation distance (D) between said holding elements (5), both holding elements (5) preferably being movable in said direction.

12. Installation according to any of claims 1 to 11, wherein the bending tool (4) comprises a roller with a central axis (4.0), said roller being adapted to turn with respect to said central axis (4.0) in a free manner and in a controlled manner.

13. Method for forming at least one corner region (1.0) in a rectangular metal plate (1), whereby a corner (1.0) of a metal plate (1) is bent, the corner region (1.0) being formed in the intersection between a first section (1.1) and a second section (1.2) of the metal plate (1), **characterised in that** the bending of the first section (1.1) of the metal plate (1) is performed first and then the bending of the second section (1.2) of said metal plate (1) is performed, at least the region of the first section (1.1) closest to the corner region (1.0) being held and kept immobile during said bending of the second section (1.2), said region of the first section (1.1) being released once said bending of the second section (1.2) has been completed.

14. Method according to claim 13, wherein to perform the bending of the second section (1.2) of the metal plate (1), the metal plate (1) is previously arranged with the already bent first section (1.1) on a flat upper surface (2.0) of a die (2), such that the second section (1.2) of the metal plate (1) protrudes from the die (2) frontally, said metal plate (1) is held against said upper surface (2.0) by means of a holding device (3), and said second section (1.2) is bent by pushing it against an actuation contour (2.0) of the die (2) by means of a bending tool (4), while at the same time the already bent first section (1.1) is kept in place between a side wall (2.21, 2.22) of the die (2) and a holding element (5).

15. Method according to claim 13 or 14, which is furthermore configured for forming a second corner region (1.4) in the metal plate (1) at the same time as the first corner region (1.0), the second corner region (1.4) being formed in the intersection between the second section (1.2) and a third section (1.3) of the metal plate (1), the third section (1.3) being bent before the second section (1.2) and, at least the region (1.30) of the third section (1.3) closest to the second corner region (1.4) and at least the region of the first section (1.1) closest to the first corner region (1.0) being held and kept immobile during the bending of the second section (1.2), said regions of the first section (1.1) and of the third section (1.3) being released once said bending of the second section (1.2) has been completed.

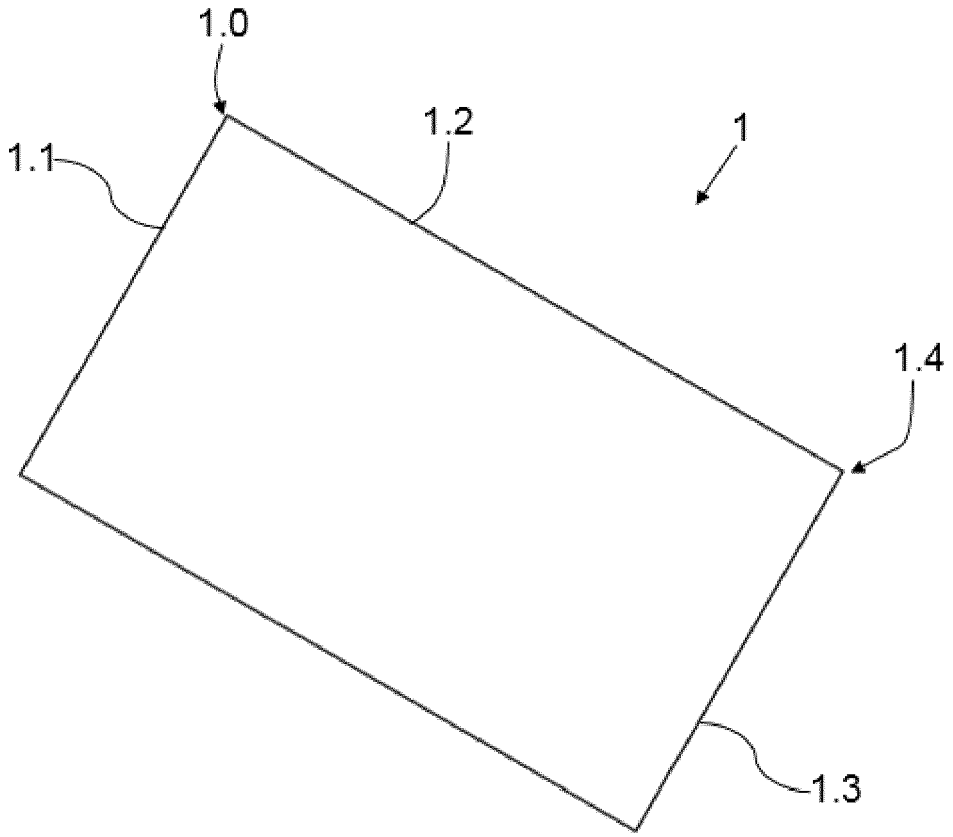

Fig. 1

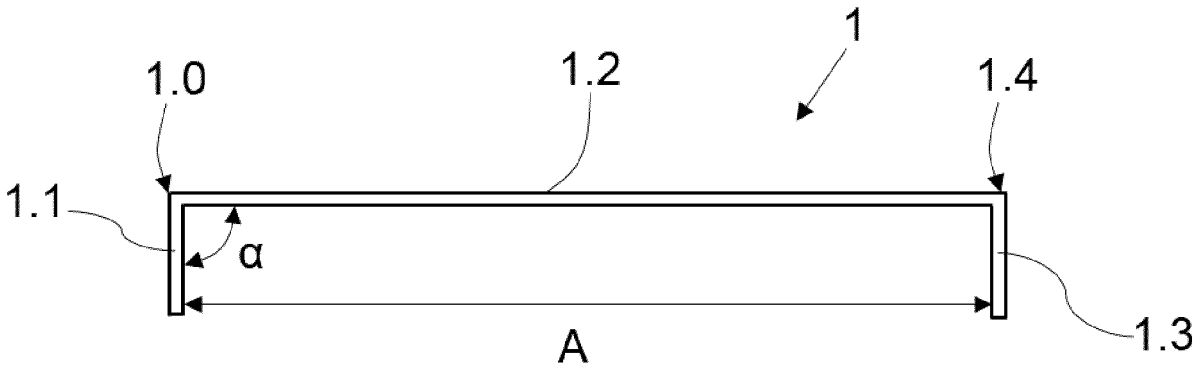

Fig. 2

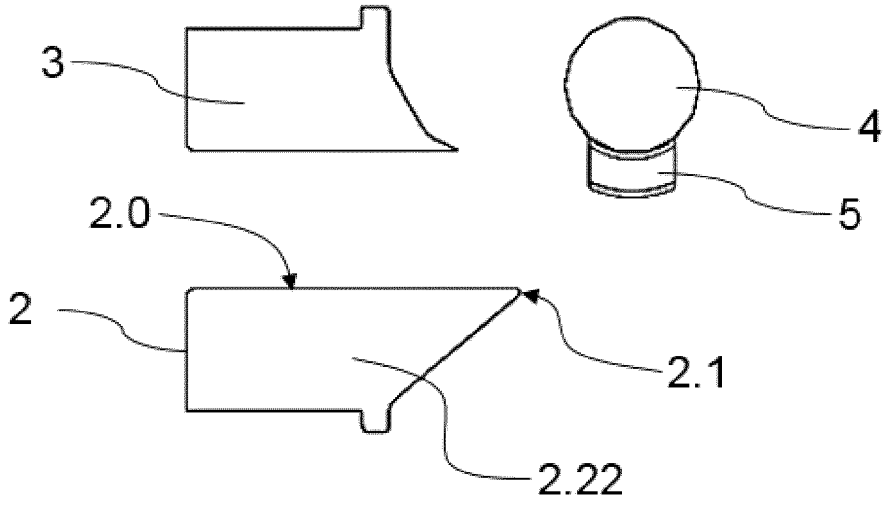

Fig. 3

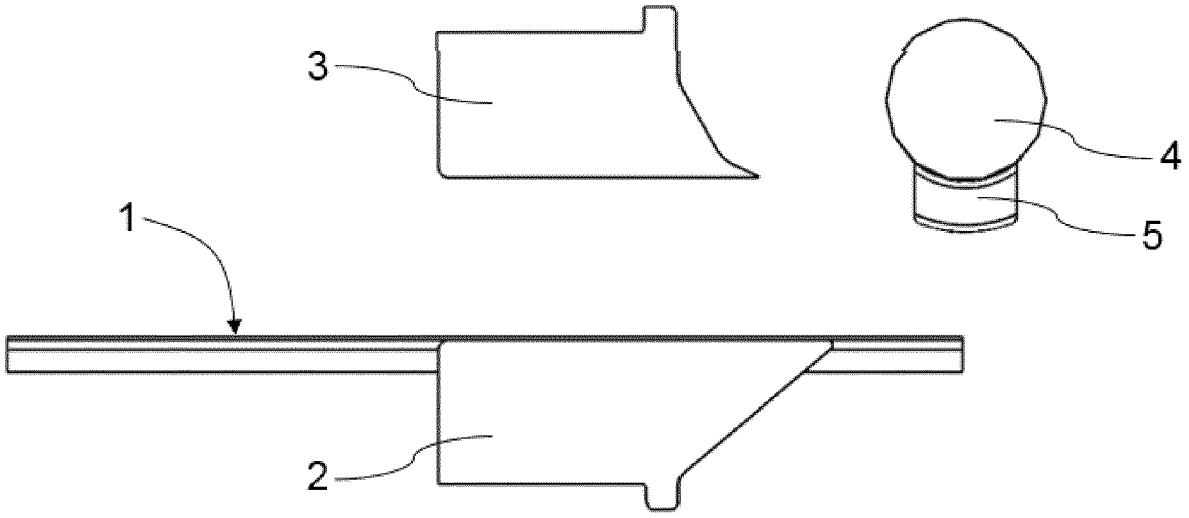

Fig. 4

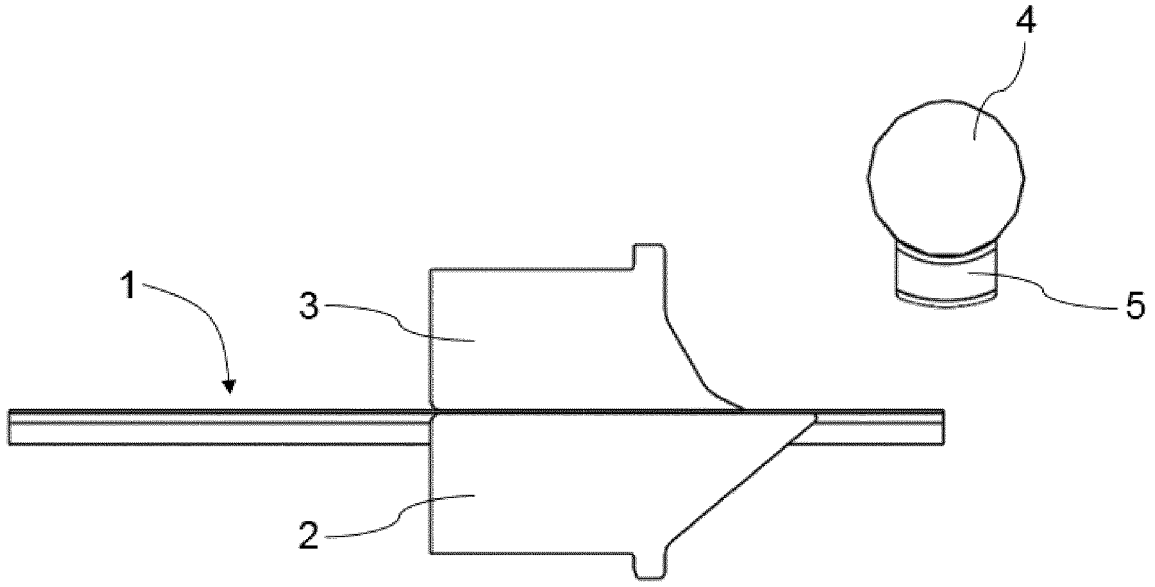

Fig. 5

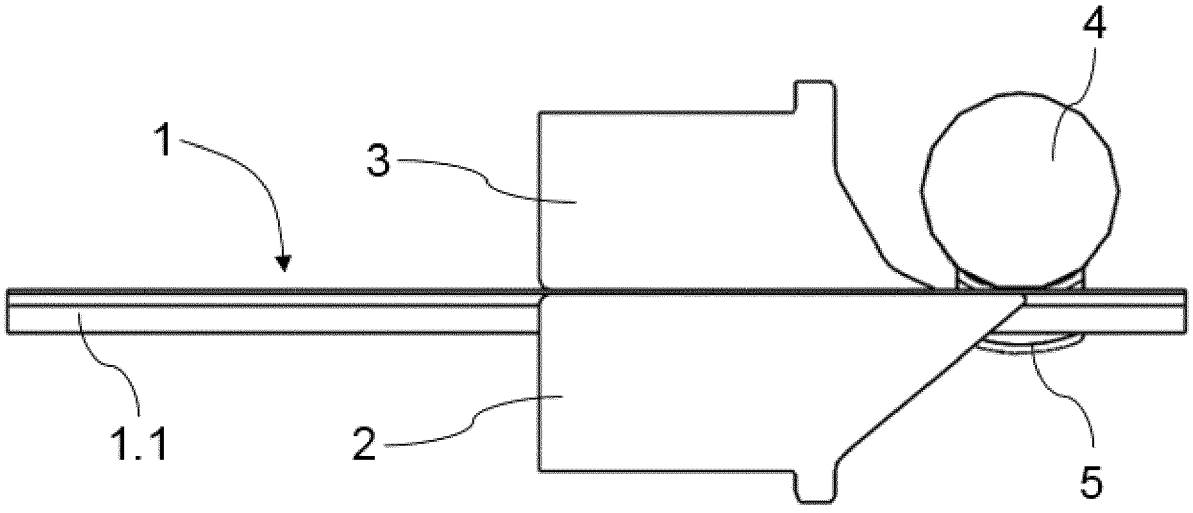

Fig. 6

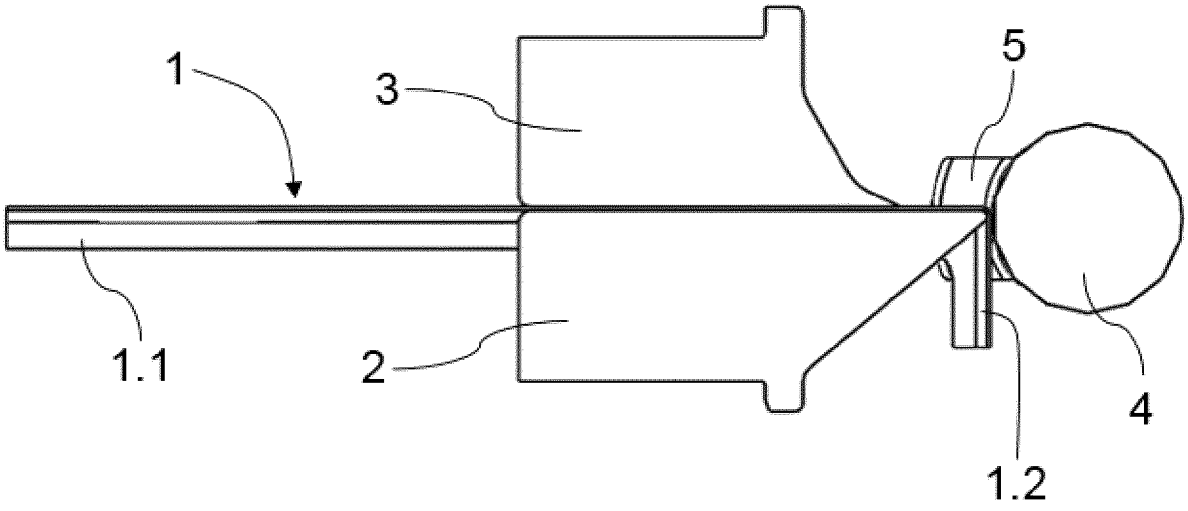

Fig. 7

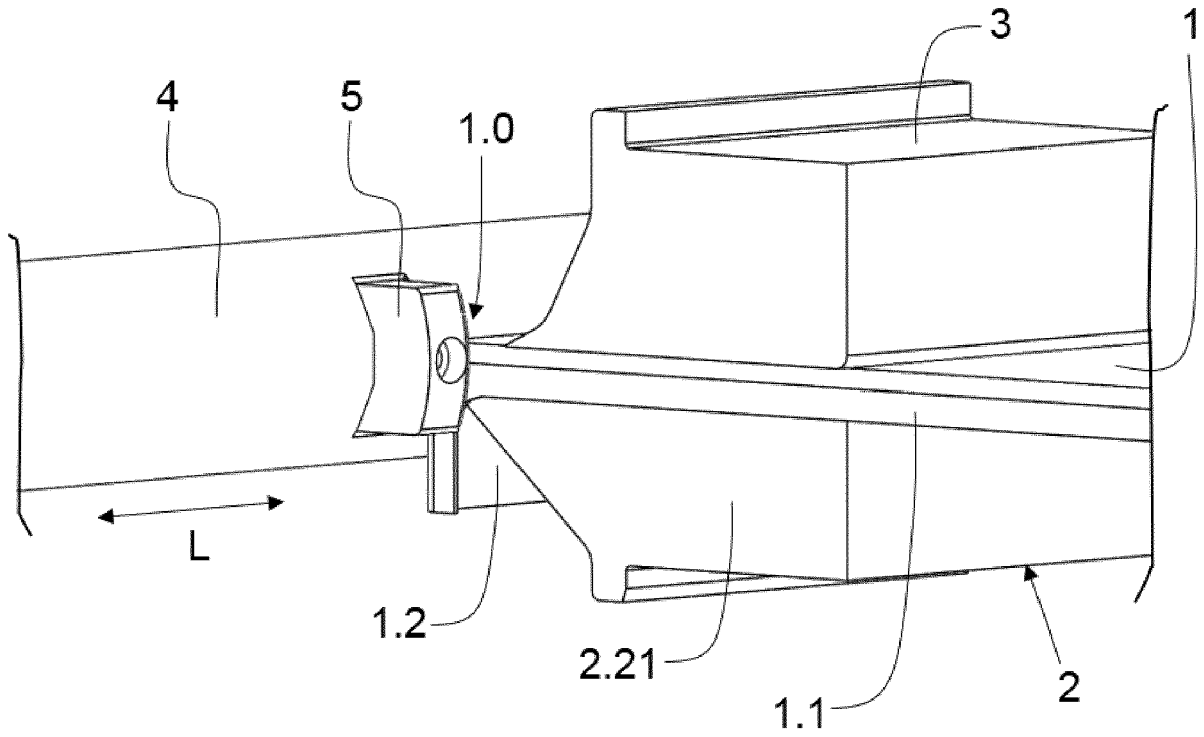

Fig. 8

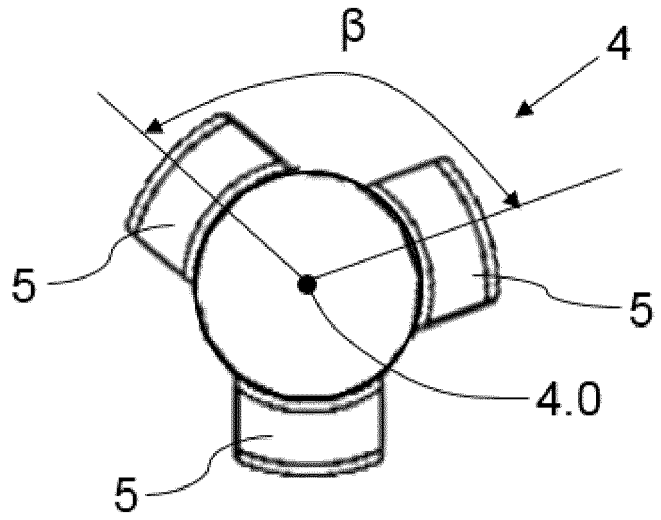

Fig. 9

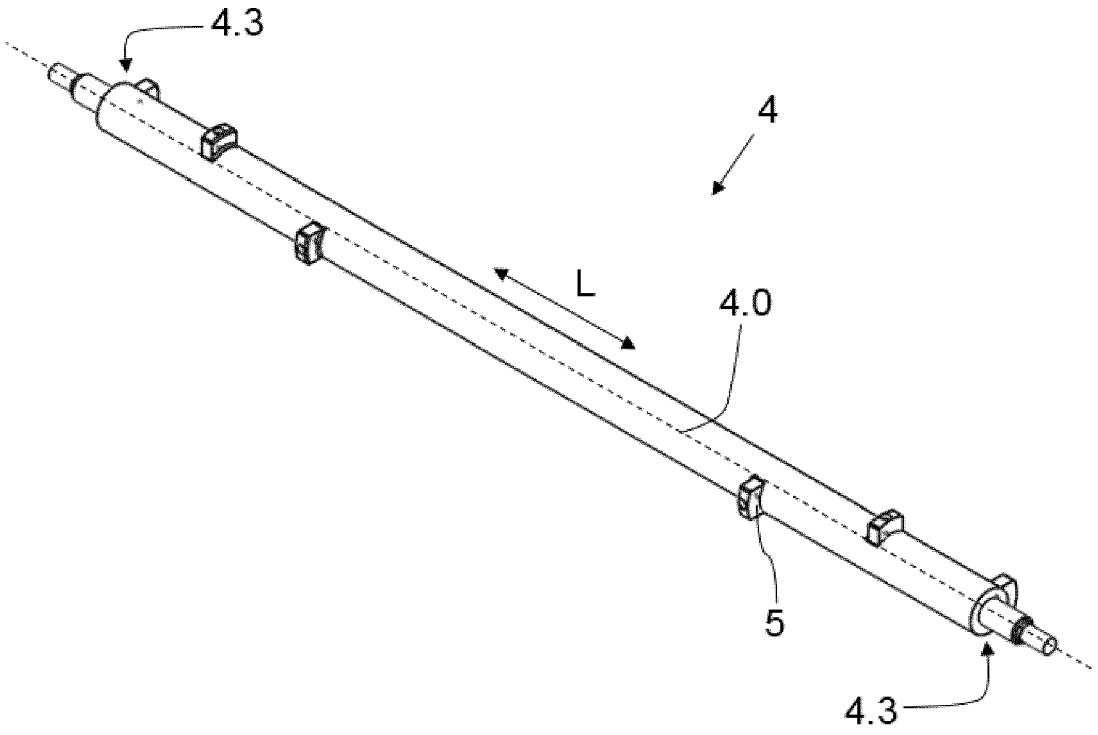

Fig. 10

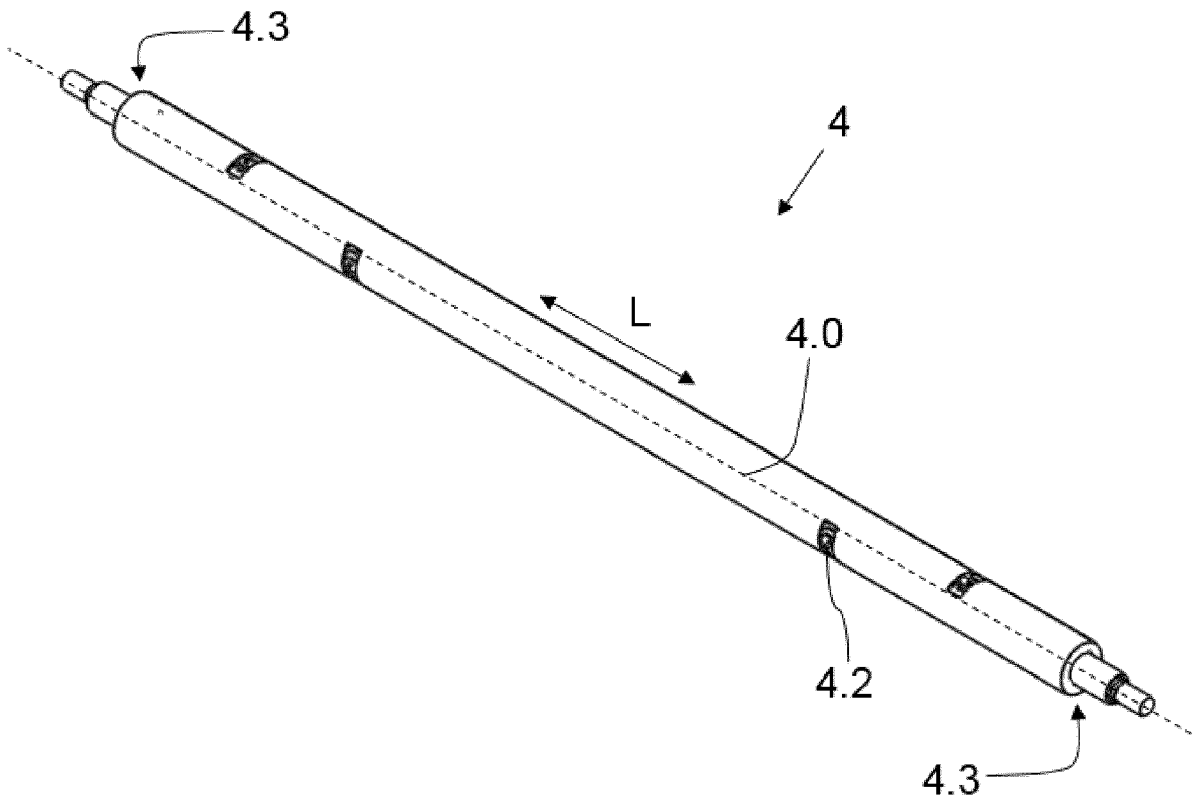

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 18 38 2328

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A	* abstract; figures 1,17,20-25 *	1-12,15	B21D19/04 B21D19/08
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B21D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 November 2018	Cano Palmero, A

CATEGORY OF CITED DOCUMENTS

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