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(71) Applicant: **BIESSE S.p.A.**
61100 Pesaro (IT)

(72) Inventor: **BUSETTI, Attilio**
24125, Bergamo (IT)

(74) Representative: **Notaro, Giancarlo Buzzi, Notaro & Antonielli d'Oulx S.r.l.**
Via Maria Vittoria 18
10123 Torino (IT)

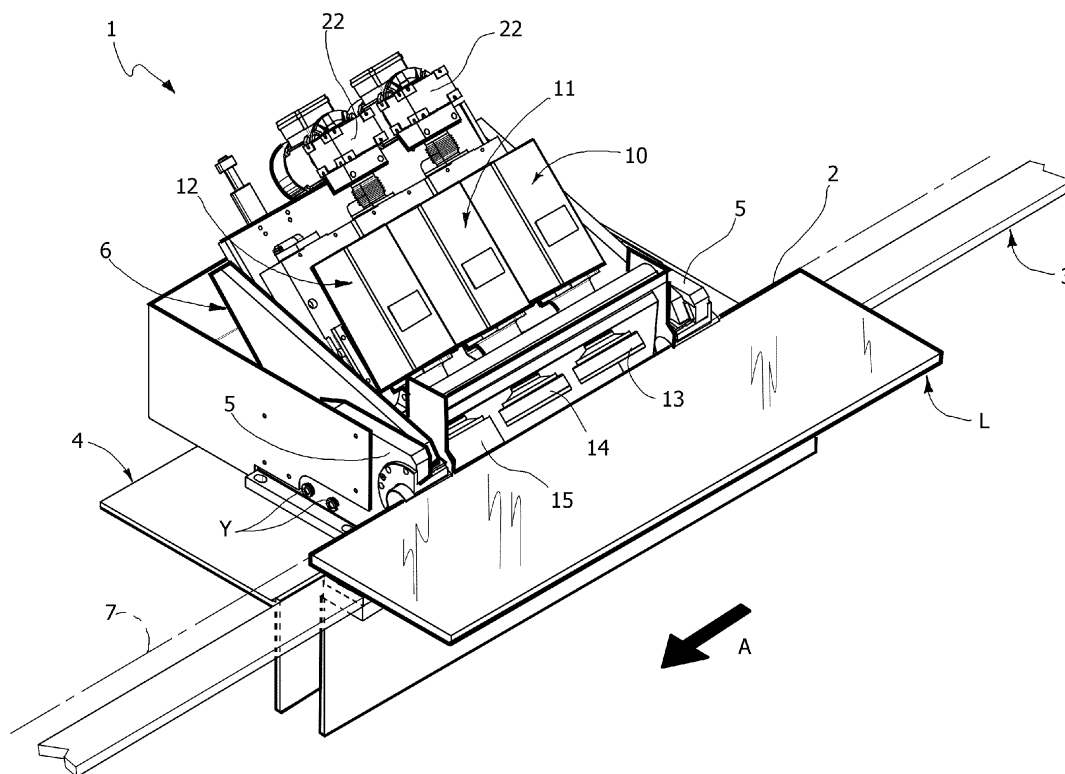
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(54) **Device for obtain bevels with changeable slants on the edge of glass, marble, stone or ceramic materials slabs and the like.**

(57) A device to obtain a bevel S along an edge of a plate (L) of glass, marble, stone or ceramic materials and the like, wherein such edge is defined between a face and a side rim (2) of the plate (L), including means to feed a plate (L) to be worked and means carried by a

fixed structure (4) for performing a bevel along an edge of the plate (L) during the advancing of the plate. Such means for performing the bevel are adjustable in position through an oscillation around an axis (7), parallel to said edge, and with respect to said fixed structure (4) for performing bevels with changeable slants.

FIG. 1



Description

[0001] The present invention relates to a device to obtain a bevel (or "fillet") along an edge of a slab or plate of glass, marble, stone or ceramic material and the like, wherein such edge is defined between a face and a side rim of the plate, said device being of the type including:

- means to feed a plate to be worked horizontally arranged in an advancing direction substantially parallel to said rim, and
- means carried by a fixed structure for performing the bevel along the edge of the plate during the feeding of the plate.

[0002] The present invention particularly relates to a device of the type wherein said means for performing the bevel include:

- at least a grinding wheel-tool,
- a spindle on which the grinding wheel-tool is mounted,
- an electric motor for driving the rotation of the spindle,
- a frame carrying the electric motor and movably mounted on a support structure in a direction parallel to the axis of the spindle, and
- control means of the axial movement of the frame relative to the support structure.

[0003] The devices of the type above-described are known and used for performing, for example, bevels along edges of glass plates. Such known devices allow to perform bevels with a fixed slant of 45° relative to the horizontal line of the working plane. They are typically used in grinding machines which include arrays of grinding wheel-tools suitable for simultaneously performing the grinding of one or two couples of opposite edges of a glass plate.

[0004] In particular are known and used since long machines of the type above-mentioned, called "bilateral" machines, which include a first working assembly for performing the working of a first couple of rims of a glass plate, and a second working assembly, downstream of the first one, for performing the working of the remaining couple of rims of the plate.

[0005] The aim of the present invention is to carry out a device having all the features which have been shown at the beginning of the present description and which does not show the drawbacks above-mentioned. More generally, an object of the invention is to carry out a device which ensures to perform a bevel along an edge of a plate with relatively simple and inexpensive means, and which is also characterized by a high use flexibility.

[0006] In view of attaining these and further purposes, the object of the invention is a device having all the features which have been shown at the beginning of the present description and further characterized in that the

aforesaid means for performing the bevel on an edge of a plate are adjustable in position through an oscillation around an axis, parallel to said edge, and relative to the fixed structure for carrying out bevels with changeable slants.

[0007] In the preferred embodiment, said means for performing the bevel include:

- at least a grinding wheel-tool,
- a spindle on which the grinding wheel-tool is mounted,
- an electric motor for driving the rotation of the spindle,
- a frame carrying the electric motor and movably mounted on a support structure in a direction parallel to the axis of the spindle, and
- control means of the axial movement of the frame relative to the support structure, said device being further characterized in that the aforesaid support structure is swingingly mounted on said fixed structure around said axis of oscillation.

[0008] Furthermore, said axis of oscillation preferably substantially corresponds, in the use, with the edge of the plate to be worked.

[0009] Thanks to the aforesaid features, the device according to the invention allows to easily perform bevels of any slants, with the use of a machine having the general configuration above-described.

[0010] The possibility of setting, as one wishes, the slant of the bevel is particularly advantageous when two edges placed stepwise along an edge of the plate have to be worked with a single grinding wheel-tool. In this case, in fact, the slant of the bevels along the two edges must correspond to that of a plane tangent to the two edges, such slant being in general other than 45°.

[0011] Finally, the possibility of carrying out with relatively simple and economic means glass plates with worked and square edges, having bevels with a slant even different from 45°, opens up new prospects of architectural glasses in the building field, where there is the need of employing glass plates as structural components, as well as mechanical components for bonding and fixing these plates, but where such a need involves the ability of obtaining slants of the bevels of any value.

[0012] It is further to be considered that the use of rotary grinding wheel-tools orientable according to different inclinations is already known in so-called "rectilinear" grinding machines, wherein the glass plate is moved by maintaining it in a plane substantially vertical, or in the machines, called "bisector", of the type with vertical or horizontal arrangement of the plates.

[0013] However, the present invention covers the application of this concept to a machine of the class stated at the beginning of the present description.

[0014] Further features and advantages of the invention will result from the following description with reference to the enclosed drawings, which are given by mere

way of not limiting example, wherein:

- figure 1 is a diagrammatic perspective view of a device according to the invention,
- figure 2 is a sectional view of the device of figure 1 in a plane normal to the advancing direction of the plate,
- figure 3 is a further sectional view of the device of figure 1 in a further plane normal to the advancing direction of the plate as well,
- figures 4 and 5 are views in an enlarged scale showing two possible uses of the device according to the invention, and
- figure 6 is an exploded view of a part of the device of figure 1.

[0015] In figure 1, numeral 1 generally shows a preferred embodiment of the device according to the invention. The figure only shows the device arranged for working a side rim 2 of a glass plate L, a device completely similar being preferably arranged for working the opposite side (not visible in the drawing) of the plate. Furthermore, it is to be considered that the device described and shown herein is preferably used in a machine for working glass plates of the so-called "bilateral" type which has been above-mentioned. However, it is apparent that the application of the invention is entirely general and therefore the devices carried out according to the teachings of the present invention can be used in machines of any type and in particular also in machines suitable for performing the working of a single couple of opposite rims of the glass plate.

[0016] Finally, although the present description refers to the working of a glass plate, the invention is also applicable to the working of slabs of marble, stone, gravestone or ceramic materials and the like.

[0017] Still referring to figure 1, numeral 3 shows one of the closed-ring belts on which the glass plate L is supported and which are driven for causing the advancing of the glass plate L in the direction shown by the arrow A. The construction details relating to these belts and the means for their operation are not described or shown herein, as they can be carried out in any known way, and further as these details do not lay, per se, in the ambit of the present invention. Moreover, the omission of these details in the drawings makes these latter of a prompter and easy understanding.

[0018] The device 1, in the case of the preferred example shown herein, includes a fixed structure 4 arranged on a side of the line along which the glass plate L is moved, which includes two sides 5 consisting in plates arranged in parallel and spaced planes, transversally to the advancing direction A. The two sides 5 support in an oscillating way, as it will be described in detail below, a support structure 6 around an axis of oscillation 7 which is parallel to the advancing direction A and which substantially corresponds, in the use, with the upper edge of the side rim 2 of the plate L. The support structure 6,

which is rotatably mounted on the fixed structure 4 around the axis 7, includes in turn (see figure 6) two sides 8 joined together by a central portion 9 and it is further equipped with a protection casing 33 of the structure from the cooling liquid used during the working. The emission nozzles of the liquid and the relative feeding system are not shown herein. The casing 33 has two sides 33a (only one is visible in figure 6) from which tubular casings 32 with a substantially semicircular section are protruding. The central portion 9 supports three assemblies 10, 11, 12 for supporting and controlling three grinding wheel-tools 13, 14, 15. The two tools 13, 14 are two abrasive tools having the cup conformation visible for example in figure 2, assigned for carrying out a bevel along the upper edge of the longitudinal rim 2 of the plate L during the advancing of the plate, while the tool 15 is a tool also having a cup conformation but with a function of polishing of the blunt edge (visible in figure 3).

[0019] Figure 2 shows in greater detail the assembly 10 for supporting and controlling the grinding wheel tool 13. In the following, the structure of such assembly will be described in detail, being understood that the structure of the assembly 11 adjacent thereto is completely similar. The grinding wheel-tool 13 is mounted on a spindle 16 driven by an electric motor 17. The structure of the motor 17, with the spindle 16 associated thereto is carried by a frame 18 which is movably mounted on the support structure 6 in the B direction shown in figure 2, parallel to the axis 16a of the spindle 16. In the example shown, the movement of the frame 18 in the B direction is driven through a coupling between a leadscrew 19 firmly connected with the frame 18 and a screw 20 which is threaded within the leadscrew 19 and is rotatably driven by an electric motor 21 through an angle box 22. The engine 21 and the box 22 have their structures firmly connected with the support structure 6 which, as already above stated, is in turn swingingly mounted on the fixed structure 4 of the device. The oscillation movements of the oscillating support structure 6 relative to the fixed structure 4 around the oscillation axis 7 are driven by a stationary electric motor 23 which drives a gear 24 (partly visible in figure 2) engaging a toothed sector 25. The toothed sector 25 is mounted on a structure stiffly connected with the oscillating structure 6a and has a general circle arc-profile whose radius of curvature lays on the oscillation axis 7.

[0020] As it will also be described below, the arrangement is such that the oscillation axis 7 is substantially corresponding, or very close, to the upper edge of the side rim 2 of the glass plate L.

[0021] In the use, by driving the electric motor 23 it is possible to cause an oscillation of the oscillating structure 6 around the axis of oscillation 7 following to the engagement of the gear 24 on the toothed sector 25. In this way, it is possible to adjust the slant of the axis 16a of the grinding wheel-tool 13 and accordingly to obtain a bevel with a corresponding slant along the upper edge of the rim 2 of the plate. The possibility of moving the motor

assembly 17 - spindle 16 in the B direction serves, on the contrary, according to a technique per se known, for ensuring the proper positioning of the tool upon the plate, also depending on the thickness of the plate which is worked from time to time.

[0022] As already above stated, the assembly 11 is completely similar to the assembly 10, while the assembly 12, carrying the polishing tool 15, is shown in figure 3. In this figure, the parts corresponding to those of figure 2 are shown with the same numeral.

[0023] Basically, the assembly 12 shown in figure 3 differs from the assembly 10 above-described in that here a power-driven control of the shifting of the tool 15 in the B direction is not foreseen, but on the contrary, a pneumatic cylinder 26 which ensures that the polishing tool 15 is constantly pressed against the rim of the glass plate during the passage of this latter is arranged. In this case the frame 18 carrying the motor 17 is then freely slidably mounted by means of tracks 27 relative to the support structure 6, the fluid cylinder 26 being in turn mounted on the structure 6 and having a stem 28 operably connected with the frame 18.

[0024] Figures 4 and 5 show how the device according to the invention allows, thanks to a proper adjustment of the slant angle of the tool, to perform bevels S along the upper edge of the rim 2 of the plate having angles other than 45°. Figure 5 particularly shows how the tool of the device according to the invention can simultaneously work two edges S1, S2 arranged stepwise along the rim 2 of the plate, thus obtaining a slant of these bevels which corresponds to the slant of the plane T tangent to the two edges S1, S2.

[0025] Figure 6 shows the detail of the supports through which the fixed structure 4 supports in an oscillating way the structure 6 around the axis of oscillation 7. In such a figure it is shown how each side 5 of the fixed structure 4 exhibits a seat 5a with a semicircular profile which receives a pin 30 with a semicircular profile as well having a fastening flange 31 which is fixed to the side 5. The pin 30 acts as a joint pin, as it rotatably receives and supports a semi-bushing 34, with a substantially circular profile, equipped with a flange 35 for the fastening to the relative side 8 of the oscillating structure 6. This semi-bushing 34 is housed in a seat 8a, with a semicircular profile, obtained in the side 8. Thanks to the arrangement above-described, the support structure 6 is swingingly mounted on the fixed structure 4 around the aforesaid axis of oscillation, such axis substantially corresponding with the upper edge of the longitudinal rim 2 of the glass plate. The advantage of the described arrangement is to allow, in any case, the passage of the plate without interference with the parts serving for the oscillating support of the structure 6.

[0026] In the use, the motor 23 is driven for positioning the oscillating assembly 6 according to the desired angle, depending on the slant of the bevel that one wishes to obtain.

[0027] Of course, the electric motors of the device ac-

cording to the invention are driven by an electronic unit control according to a pre-established program, also depending on the dimensions and particularly on the thickness of the plate to be worked. The system is arranged in order to obtain a perfect coincidence of the axis of oscillation 7 with the upper edge of the rim 2 of the plate for a determined value of the plate thickness. For plates with different thickness, the electronic control automatically provides for repositioning the tool in the proper working position in contact with the edge along which the bevel has to be obtained. In this condition, of course, the axis of oscillation 7 will not be anymore corresponding with the edge of the plate, but however it will be close thereto.

[0028] As it is apparent from the preceding description, the device according to the invention is characterized by a relative structural simplicity and nevertheless it ensures a high flexibility in the use by allowing to obtain plates with bevels (or "fillets") having any slant, with the advantages which have been discussed hereinbefore.

[0029] Obviously, without prejudice to the principle of the invention, construction details and embodiments could widely vary with respect to what has been described and shown by mere way of example, however without leaving the scope of the present invention.

Claims

1. Device to obtain a bevel along an edge of a plate (L) of glass, marble, stone or ceramic materials and the like, wherein such edge is defined between a face and a side rim (2) of the plate, said device including:

- means to feed a plate to be worked horizontally arranged in an advancing direction substantially parallel to said edge, and
- means carried by a fixed structure for performing the bevel along the edge of the plate during the advancing of the plate,

characterized in that said means to obtain the bevel are adjustable in position through an oscillation around an axis (7), parallel to said edge, and relative to said fixed structure (4) for obtaining bevels with changeable slants.

2. Device according to claim 1, wherein said means to obtain the bevel include:

- at least a grinding wheel-tool (13, 14),
- a spindle (16) on which the grinding wheel-tool (13, 14) is mounted,
- an electric motor (17) for driving the rotation of the spindle (16),
- a frame (18) carrying the electric motor (17) and movably mounted on a support structure (6) in a direction (B) parallel to the axis (16a) of the spindle (16), and

- control means (19-22) of the axial movement of the frame (18) relative to the support structure (6),

characterized in that the aforesaid support structure (6) is swingingly mounted on said fixed structure (4) around said axis (7) of oscillation. 5

3. Device according to claim 1 or 2,
characterized in that said axis (7) of oscillation substantially corresponds, in the use, with the edge to be worked of the plate (L). 10
4. Device according to claim 1 or 2,
characterized in that control means (23-35) of said oscillation are foreseen. 15
5. Device according to claim 4, **characterized in that** said control means (23-25) of the oscillation include a stationary electric motor (23), a toothed pinion (24) rotatably driven by the electric motor (23), and a toothed sector (25) engaging with said toothed pinion (24), which is carried by the oscillating structure (6) and which has a general circle arc-profile with a center of curvature placed on said axis (7) of oscillation. 20 25
6. Device according to claim 5, **characterized in that** said fixed structure includes two parallel and spaced sides (5) from which two respective tubular pins (30), having a substantially semicircular section and received in a rotatably way within two respective semi-bushings (34) carried by the aforesaid oscillating structure (6) are protruded inwardly. 30
7. Device according to claim 3, **characterized in that** said axis (7) corresponds, in the use, to the edge to be worked of the plate (L) in case such plate has a thickness of a predetermined value, whereby the axis of oscillation (7) results, on the contrary, slightly spaced from the edge to be worked of the plate (L), should the plate have a different thickness from said predetermined thickness. 35 40
8. Device according to claim 7, **characterized in that** control electronic means of electrically driven means are associated thereto for adjusting the position of one or more tools (13, 14, 15), said control electronic means being programmed for properly positioning said one or more tools taking into account the difference between said predetermined value of the plate thickness and the actual value of the thickness of the plate to be worked. 45 50
9. Device according to claim 5, **characterized in that** the oscillating structure (6) carries one or more control assembly (10, 11) of grinding wheel-tools (13, 14) and a control assembly (12) of a tool (15) for the polishing of the worked edge. 55

FIG. 1

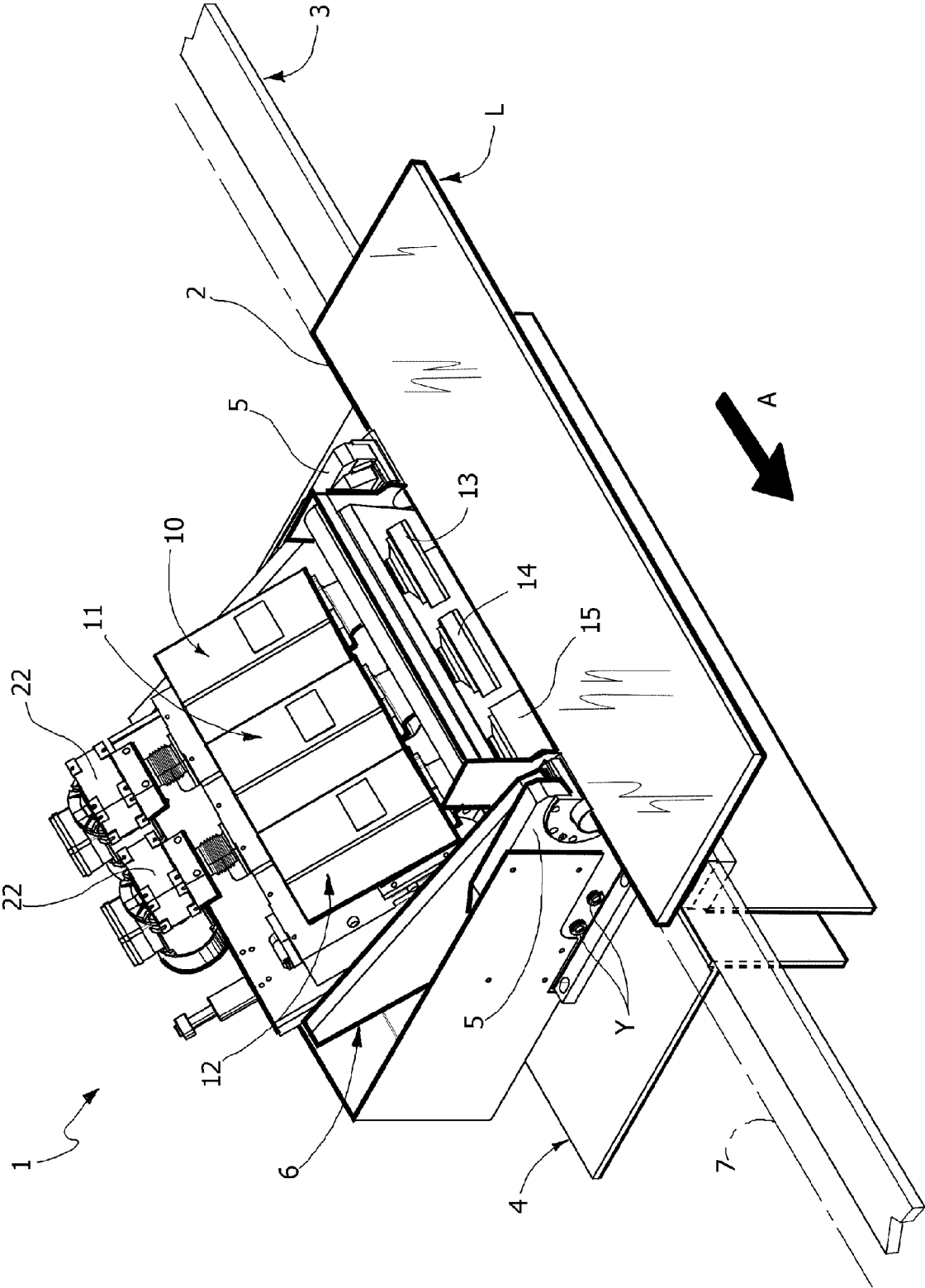


FIG. 2

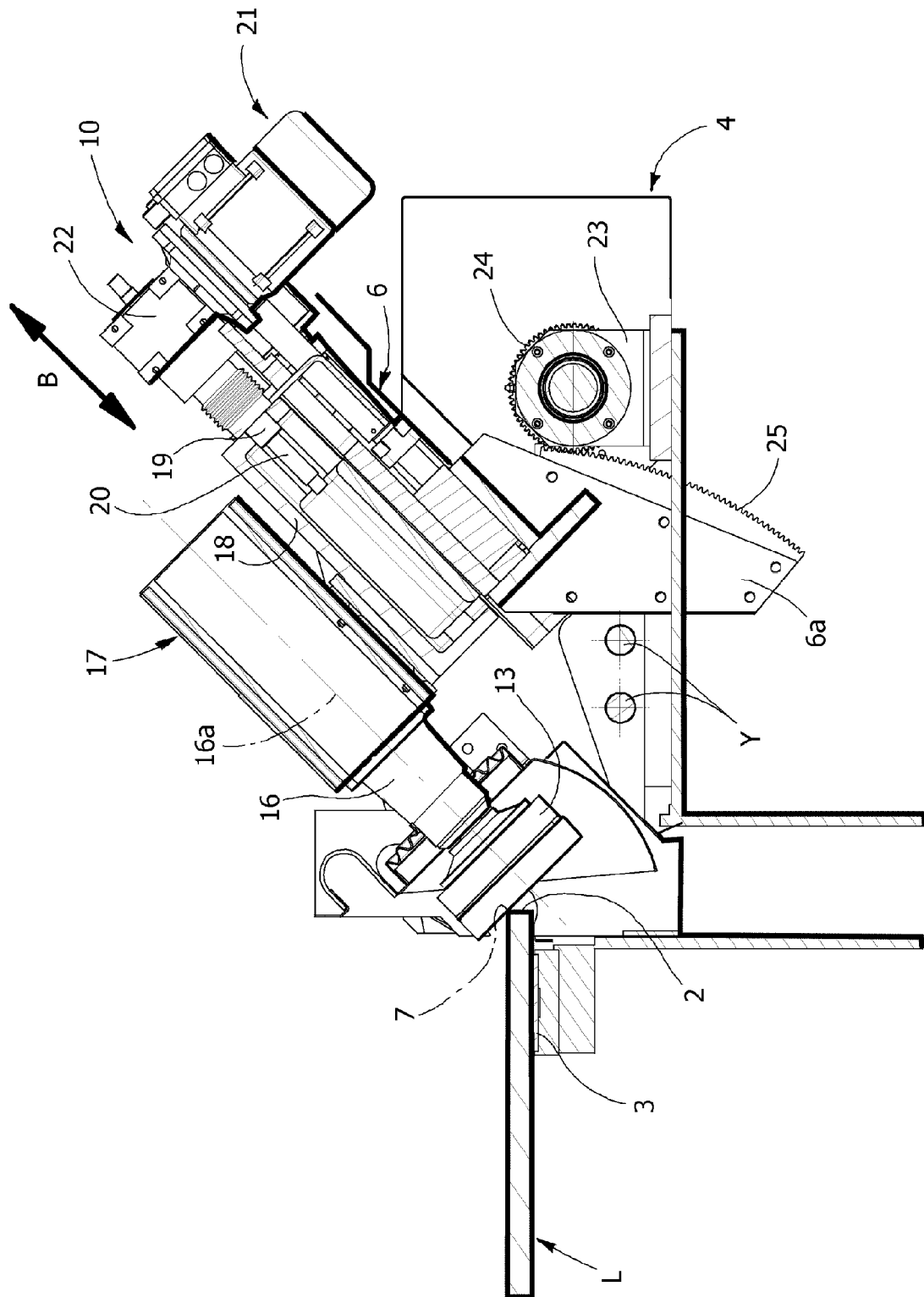


FIG. 3

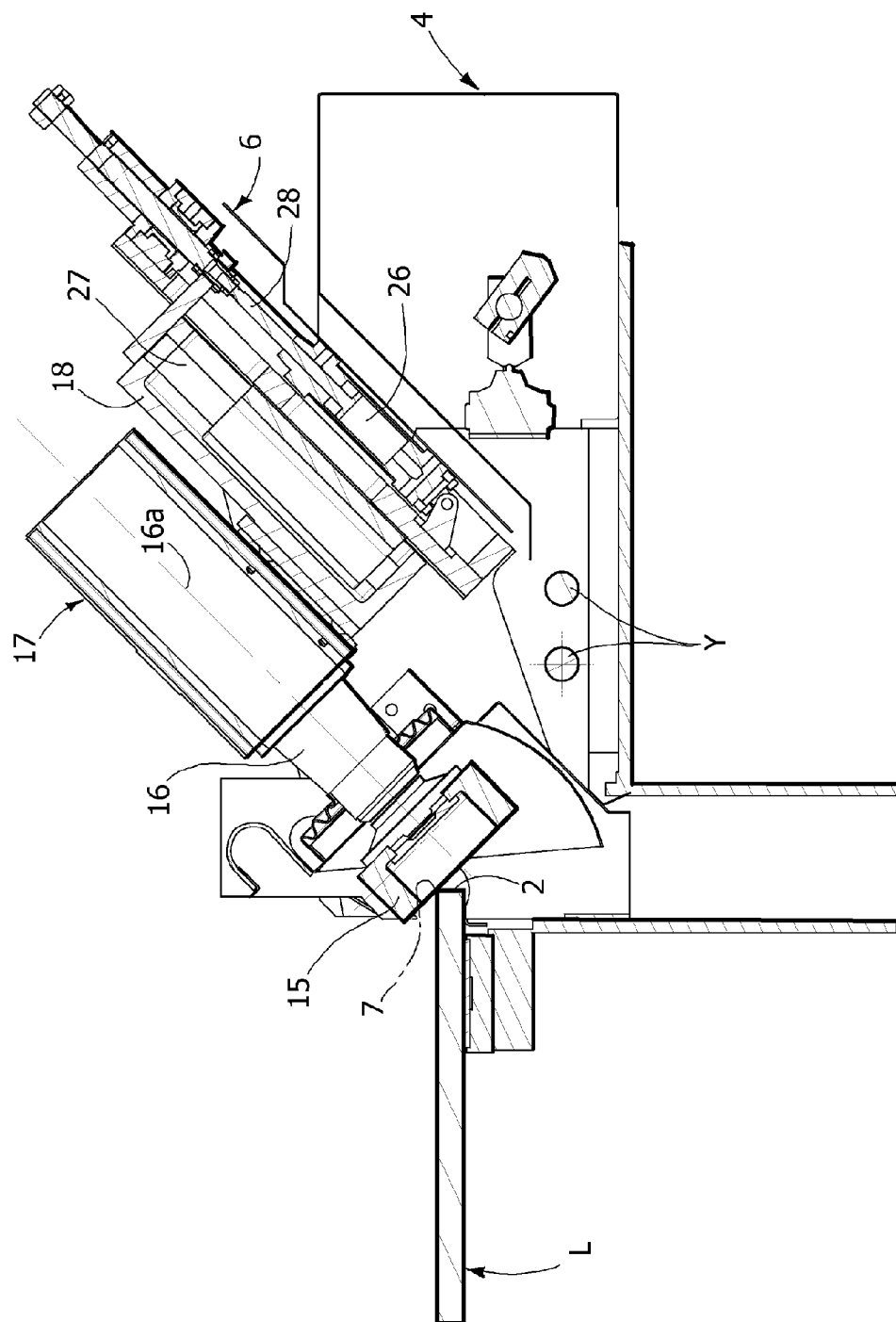


FIG. 4

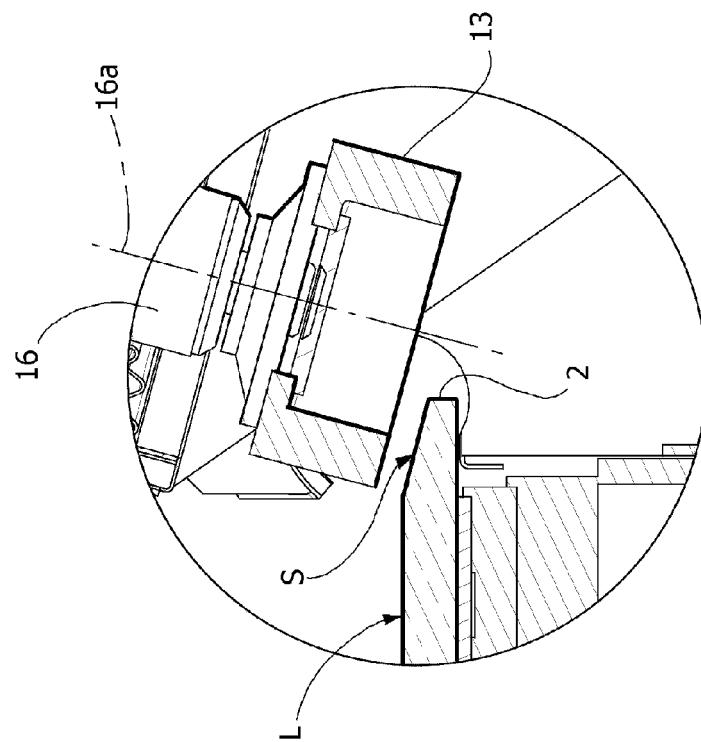


FIG. 5

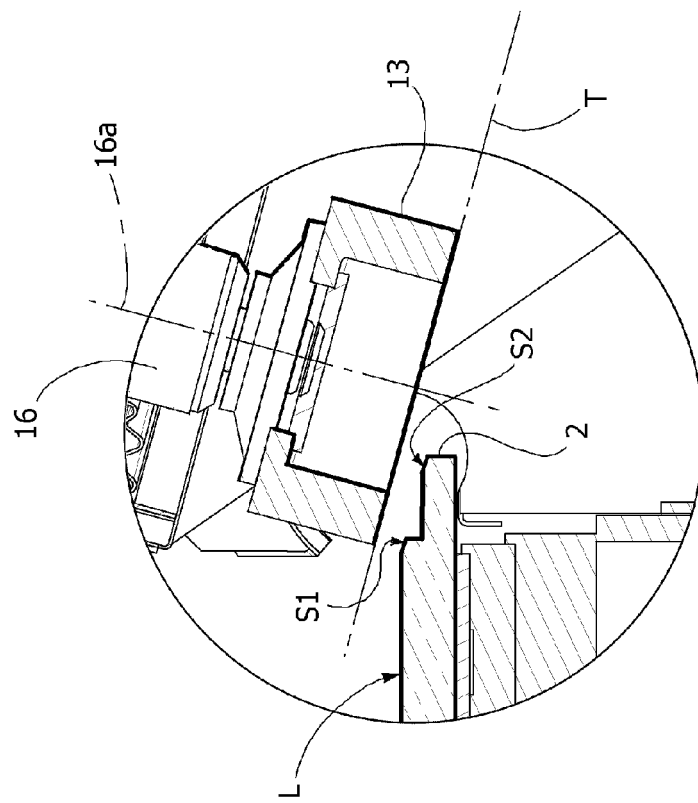
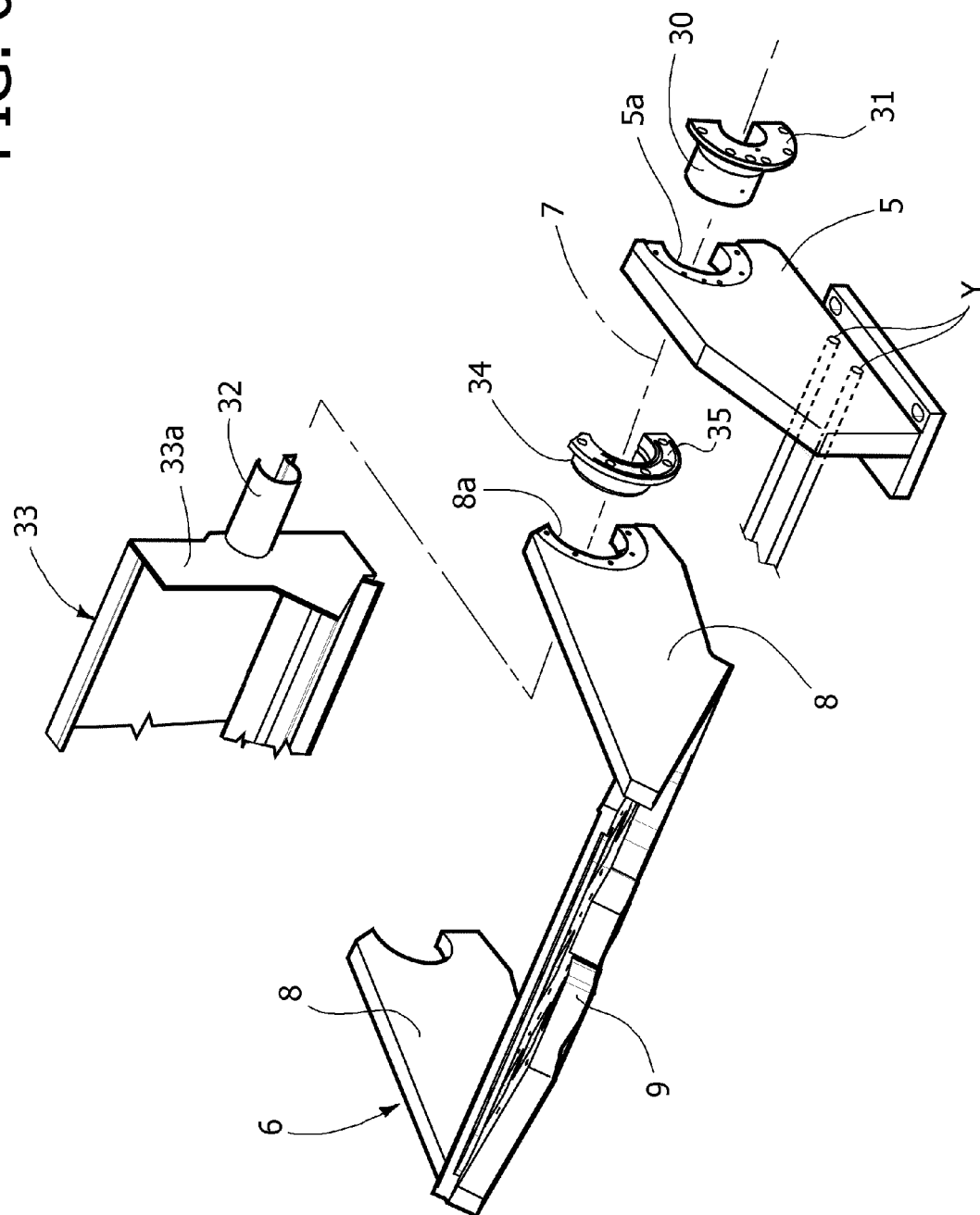


FIG. 6





European Patent
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Application Number
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 December 2005	Examiner Garella, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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