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volves, the guard opening / closing smoothly and flexibly. It solves the problem existing in the present state of the art, whereby the guard may open gradually as the main body of the saw revolves. The invention thus features a synchronously opening guard unit a main saw body that can be turned over, high safety performance, long service life, etc.



## Description

### Field of the Invention

**[0001]** The present invention relates to a compound saw which can respectively switch between two working modes, namely, a mitre saw and a bench saw, particularly a compound saw with a guard opening apparatus.

### Background of the Invention

**[0002]** The compound saw consists of base, work table, and saw blade elements. The base is composed of a left side frame and a right side frame. The work table is supported between the left side frame and the right side frame and can turn over 180 degrees via the turnover shaft which crosses between the left side frame and the right side frame. Between the work table and the base there are positioning means which can position the work table horizontally. The positioning means can lock the work table in either of two horizontal modes, respectively corresponding to the mitre saw and the bench saw. When the compound saw is used as a mitre saw, a movable guard is normally positioned over the saw blade in the form of a hood to avoid injury to people by the exposed blade protruding beyond the saw blade hood.

**[0003]** China patent of invention (public no.: CN1733403A) page 6, line 9-11, expressly makes public the safety hood corresponding to the movable guard of this invention. The safety hood revolves with the main body of the saw, descending to expose the saw blade. However, the above-mentioned literature has not made public the means used to cause the safety hood to revolve with the main body of the saw as it descends. Therefore, a guard opening apparatus to make the guard open as the main body of the saw revolves needs to be designed. This is a problem that has to be solved urgently for the sake of safety when using the compound saw as a mitre saw.

### Summary of Invention

**[0004]** This invention provides a compound saw with a guard opening apparatus that causes the guard to open gradually as the main body of the saw spins and enables the guard to open / close smoothly and flexibly. It settles the problem existing in the present state of the art, namely, it enables the guard to open gradually as the main body of the saw revolves.

**[0005]** Another object of this invention is to provide a locking trigger on the saw blade to prevent the guard from being opened inappropriately, thereby both protecting the compound saw with guard opening apparatus and protecting users.

**[0006]** A further object of the invention is to provide a compound saw with guard opening apparatus which can prolong the service life of the turnover shaft between the work table and the base.

**[0007]** The above-mentioned technical object of this invention is achieved by the following technical means. The compound saw consists of base, work table, and saw blade elements. The base is composed of a left side frame and a right side frame. The work table, supported by the left side frame and the right side frame, can be turned over 180° by means of the turnover shaft that crosses between the left side frame and the right side frame. Between the work table and the base there are positioning means for positioning the work table horizontally. The work table is equipped with a circular saw guide capable of turning horizontally. The saw blade element is provided with a supporting arm and a main saw body. The supporting arm is fixed at the rear of the saw guide. The rear end of the main body of the saw is connected to the supporting arm by a supporting shaft to enable the main body of the saw move up and down around the supporting shaft. The main body of the saw comprises the saw blade hood as a housing and a drive motor and handle on one side of the saw blade hood. Half the circumference of the circular disk driven by the drive motor projects beyond the saw blade hood. A fan-shaped movable guard revolves coaxially with the circular disk connected to the saw blade hood. Loading on the movable guard by a spring body causes it to tend to press against the circular disk, which will then be exposed beyond the saw blade hood. One side of the said movable guard is fitted with a guide track. One end of a connecting rod is pivotably connected to the supporting arm, the other end is provided with a roller. The said roller engages with rolls along the guide track. The middle section of the said connecting rod is acts as a guide. The upper pivot of the saw blade hood is connected to a guide wheel. The said guide wheel engages with and rolls along the guide in the middle of the connecting rod. The supporting position of the connecting rod with the supporting arm is located between the supporting position of the saw blade hood with its supporting arm and the pivotable connection of the guide wheel on the saw blade hood. When the saw blade hood moves downward around the supporting shaft, the guide wheel and the guide in the middle of the connecting rod cause rolling in the opposite direction. The roller at the end of the connecting rod rolls along the guide track on the side of the movable guard, opening the guard. In this invention, under the loading action of the spring the guard tends to press against the saw blade and stay closed. With the main body of the saw moving downward around the supporting shaft, the guide wheel pivotably connected to the saw blade hood rolls on the guide part in the middle of the connecting rod. The distance between the end with the roller and the circular centre of the guard spanned by the connecting rod gradually increases, thereby causing the roller to roll along the guide track on the side of the guard. However, the guide track on the side of the guard extends from near the circular centre of the guard to a point farther removed from the circular centre of the guard in the direction opposite to that of the guard as it opens. The path between the end of the guide

track near the circular centre of the guard and the point at a far remove from the circular centre of the guard is either straight or smoothly curved. With the main body of the saw moving downward, the roller at the end of the connecting rod rolls from the end of the guide track near the circular centre of the guard to the point at a far remove from the circular centre of the guard, thereby causing the guard to gradually open as the main body of the saw moves downward, exposing the saw blade for cutting. Moreover, when the main body of the saw is lifted upwards, under the loading action of the spring the guard gradually closes, thereby pulling the guard around the blade, which then is not in a cutting position, providing safety and protection.

**[0008]** Optimally, the guide on the connecting rod and the roller on the connecting rod are respectively located on either side of the circular centre of the movable guard. The end of the connecting rod fitted with the roller forms a first curved section. Herein, the first curved end of the connecting rod fitted with the roller follows the end of the connecting rod around the connecting position of the guard and the saw blade hood, reducing interference between them, making for more flexible guard opening and closing action.

**[0009]** Optimally, the said guide is a beveled edge or a groove. On either side of the guide there are respectively located a second curved section and a third curved section bending in opposite directions. Herein, the second curved section and the third curved section curving in opposite directions on each end of the guide can restrict the range of the guide wheel on the saw blade hood as it rolls along the guide on the connecting rod. This further limits the variation in the distance between the roller on the connecting rod end and the circular centre of the guard, thereby restricting the range of movement of the guard.

**[0010]** Optimally, the guide track on the side of the said movable guard is a single convex rib or a parallel double convex rib or a dovetail groove. Herein, the guide track on the side of the movable guard uses a single rib to enable the roller at the end of the connecting rod to roll along the surface of the convex ribs near the circular centre of the guard. The guide track can also use a parallel double rib construction with the roller rolling between two parallel convex ribs. In addition, the guide track can use a dovetail groove construction with the roller rolling in the dovetail groove. The guide track may be straight or smoothly curving. An involute shape is best.

**[0011]** Optimally, the said roller is a bearing or a rolling sleeve or a rolling wheel. Herein, the roller can be either a bearing or a rolling sleeve or a rolling wheel, thereby decreasing the friction between the roller and the guide track, allowing smoother opening and closing action of the guard.

**[0012]** Optimally, the spring is a helical spring or a band spring or a torsion spring.

**[0013]** Optimally, the blade bears a locking trigger for the movable guard. Locking spring loading on the locking

trigger prevents the movable guard from opening. When the locking trigger is in the locked position, the guard is locked and fails to turn in the direction of opening, thereby preventing the roller at the end of the connecting rod from rolling on the guide track along the side of the guard and further preventing the guide wheel on the saw blade hood and the guide in the middle of the connecting rod from rolling in opposite directions, thus preventing the saw blade hood from moving downward, causing the saw blade body to fail to move downward for cutting when the guard is locked and achieving the objects of safety and protection.

**[0014]** Optimally, there are provided positioning means whereby the sides of the turnover shaft on the left side frame and right side frame are respectively equipped with an upper foot pad and a lower foot pad. One end of the left side frame and the right side frame is fitted with a stop plate. On the side of the work table adjacent to the stop plate there are provided a front convex body and a rear convex body. The said front and rear convex bodies are respectively positioned on both the front and rear ends of the turnover shaft, the said stop plate having a beveled edge that engages the front convex body and a hook that engages the rear convex body. The beveled edge on the stop plate engages the front convex body on the work table. The friction between the beveled edge and the front convex body surface prevents the work table from turning over downward, thus supporting the work table; the hook on the stop plate engages the rear convex body, the upside down hooking element hooking into the stop plate, thereby preventing the work table from turning over upward and locking the work table in position.

**[0015]** Optimally, one end of the said stop plate is hinged to the base frame. The middle section of the stop plate is provided with a curved slot taking the hinge point of the stop plate and the base frame as the centre of the circle. The base frame is equipped with a guide that fits in the curved slot. Between the stop plate and the base frame is an elastic element. The said elastic element tends to push the free end of the stop plate upward. The upper foot pad and the lower foot pad consist of an upside-down L-shaped foot-pad bracket and foot-pad body. The foot-pad bracket has a vertical element and a horizontal element. The said vertical element is fixed to the base frame. The said horizontal element is fixed to the foot-pad body. The mating of the curved slot on the stop plate with the guide on the machine frame restricts the range of motion of the stop plate, and the elastic element tends to push the free end of the stop plate upwards, thereby causing the beveled edge on the stop plate to support the front convex body and causing the hook to hook onto the rear convex body. When the work table is to be turned over, the free end of the stop plate is depressed so that the front convex body crosses over the lower end point of the beveled edge, whereby the front convex body can move freely up and down without the hook hooking onto the rear convex body. The rear convex body can be made to move freely, thereby changing the

operating mode of the work table and the operating mode of the main body of the saw.

**[0016]** Optimally, both ends of the turnover shaft are respectively provided with end cuffs connected to the left and right side frames by connecting screws. There is a wear-resistant connecting sleeve between the connecting screws on the turnover shaft and the left and right side frames. The connecting sleeve buffers the direct contact between the beam, the side frames of the machine frame, and the connecting screws so as to reduce friction wear and prolong service life.

**[0017]** Therefore, the features of this invention include a synchronously opening guard unit, a main saw body that can be turned over, high safety performance, long service life, etc.

#### Brief description of the drawings:

#### [0018]

Fig. 1. Schematic drawing of the compound saw used as a bench saw under the invention.

Fig. 2. Schematic drawing of the compound saw used as a mitre saw under the invention.

Fig. 3. Top view of Fig. 2.

Fig. 4. Direction P view of Fig. 3.

Fig. 5. Drawing of the stop plate on the positioning means of the compound saw under the invention.

Fig. 6 View of the foot pad of the positioning means of the compound saw under the invention.

Fig. 7. Schematic drawing of one side of the drive motor for the saw body.

Fig. 8 Schematic drawing of the closed guard of the main body of the saw under the invention.

Fig. 9. Schematic drawing of the partially open guard of the main body of the saw under the invention.

Fig. 10. Schematic drawing of basically open guard of the main body of the saw under the invention.

Fig. 11. Schematic drawing of the blade guard under the invention.

Fig. 12. B-B view of Fig. 11.

Fig. 13. Schematic drawing of the connecting rod under the invention.

Fig. 14. Partially cut-away top view of Fig. 13.

#### Detailed description of the preferred embodiment:

**[0019]** Hereinafter, the technical features of the present invention will be described in detail with concrete embodiments taken in conjunction with the accompanying drawings.

**[0020]** Embodiment 1: As shown in Fig. 1, Fig. 2, and Fig. 3, the base frame consists of a vertical frame and flange located in the middle of the vertical frame. The front and rear sides on the upper end of the base frame are open. The upper end of the base frame is provided with a left side frame 32 and a right side frame 31, respectively fixed to the vertical frame. Shaft O-O is the axis for work table 11 for installing the saw blade element, which can be turned over via turnover shaft 4 supported between left side frame 32 and right side frame 31 on base frame 3. Both ends of turnover shaft 4 are equipped with cuffs 41, connected to right side frame 31 and left side frame 32 on the base frame by connecting screws 1. Left side frame 32 and right side frame 31 corresponding to the front side of shaft O-O, are respectively provided with an upper foot pad 61, and left side frame 32 and right side frame 31, corresponding to the back of shaft O-O, are respectively equipped with a lower foot pad 62, as shown in Fig. 6. Upper foot pad 61 and lower foot pad 62 consist of an inverted L-shaped foot-pad bracket 8 and a foot-pad body 6. Foot-pad bracket 8 has a vertical section 81 and a horizontal section 82. Vertical section 81 is fixed to the left and right side frames of machine frame 3. Horizontal section 82 is fixed to foot-pad body 6.

**[0021]** The front and the rear sides of work table 11 are respectively equipped with a front flange 111 and a rear flange 112 raised with respect to the surface of work table 11. Front flange 111 is straight, rear flange 112 is curved. The front flange on work table 11 is fitted with a front convex body 12, the rear flange on work table 11 is fitted with a rear convex body 13. Front convex body 12 and rear convex body 13 are both situated on the same side of the work table. Front convex body 12 and rear convex body 13 comprise screw 10 and positioning sleeve 15, fixed coaxially to the side of the work table by screw 10. Near the end of the work table, side frame 31 is fitted with stop plate 5, shown in Fig. 4 and Fig. 5. Stop plate 5 has a beveled edge 51 that mates with front convex body 12 and a hook 52 that mates with rear convex body 13. One end of stop plate 5 is hinged to base frame 3. In the middle of the stop plate there is a curved slot 53 centred on the hinge point of stop plate 5 and base frame 3. The machine frame is equipped with a guide 14 mated with curved slot 53. Between stop plate 5 and the base frame there is provided an elastic element 7. Elastic element 7 tends to push the free end of the stop plate upward. In this embodiment elastic element 7 is a torsion spring.

**[0022]** As shown in Fig. 2 and Fig. 3, when the saw blade element is upright on the base frame, the lower foot pad at one side of shaft O-O hangs under the work

table and supports one side of the work table, the upper foot pad at the other end of shaft O-O hangs over the work table, and the front convex body mated with the beveled edge on the stop plate positions the work table. In this position the saw blade element is located on the work table for mitre cutting. As shown in Fig. 1, when the saw blade element is turned over to an upside-down position, the lower foot pad at one end of shaft O-O is positioned below the work table and the upper foot pad at the other end of shaft O-O hangs under the work table to support the work table, and the rear convex body mated with the hook on the stop plate positions the work table. In this position, the saw blade element is located under the work table for use as a bench saw. Thus, the saw blade element can both be used for mitre cutting and changed over for use as a bench saw as required, enabling the machine to operate in two working modes, thereby reducing tool purchasing costs. When the saw blade element is switched between the two working modes, the free end of the stop plate should be depressed downward such that the front convex body crosses over the lower end of the beveled edge, so the front convex body can move up and down freely, and the hook does not engage the rear convex body. The rear convex body can be made to move freely and change the operational mode of the work table, and the working mode of the saw blade element can thus be switched.

**[0023]** The work table is equipped with a horizontally movable circular saw guide (not shown in the drawing). As shown in Fig. 8, Fig. 9, and Fig. 10., saw blade element 200 includes supporting arm 201 and main saw body 202. Supporting arm 201 is fixedly positioned at the rear of the saw guide. The rear end of main saw body 202 is connected to supporting arm 201 via supporting shaft 203 to make main saw body 202 move up and down around supporting shaft 203. Saw body 202 includes saw blade hood 204, used as a housing, and drive motor 205 and handle 206 on one side of saw blade hood 204. About half the circumference of disk saw blade 207 projects out from saw blade hood 204. Fan-shaped movable guard 208 and disk blade 207 turn coaxially and are connected to saw blade hood 204. One end of tension spring 209 is connected to guard 208 and the other end is connected to saw blade hood 204. Tension spring 209 loading on movable guard 208 causes the movable guard to tend to press against disk blade 207, causing it to project beyond saw blade hood 204.

**[0024]** On the side of guard 208 there is provided a guide track 210. As shown in Fig. 11 and Fig. 12, guide track 210 is a convex bead perpendicular to the side of the guard. The guide track follows an involute path extending from near the circular centre of the guard towards a point at a far remove from the circular centre of the guard in a direction opposite to the direction of opening of the guard.

**[0025]** One end of connecting rod 211 is rotatable and is connected to supporting arm 202. The other end of connecting rod 211 forms first curved section 212. The

end of the first curved section is pivotably connected to bearing 213. The pivotably connected shaft of bearing 213 is parallel to the guide track surface. The outer ring of bearing 213 engages with and rolls along guide track 210. The mid-section of connecting rod 211 is provided with a guide bend 212, and saw blade hood 204 is pivotably connected to guide wheel 218. The pivot shaft of guide wheel 218 is parallel to the axis of disk saw blade 207. Guide wheel 218 engages with and rolls along guide bend 212 on the mid-section of the connecting rod. The guide section of the connecting rod and the roller on the connecting rod are respectively located on either side of the circular centre of the movable guard. The end of the connecting rod provided with the roller, the connecting rod's supporting edge 211, and supporting arm 202 are located between the support position of the saw blade hood and the supporting arm and the pivotably connected position of the guide wheel on the blade hood, guide bend 212 and the first curved section and straight section 221 between the guide bend 212 and the first curved section forms a C shape, angle  $\beta$  formed by the said guide bend 212 and straight section 221 is  $112^\circ$ , and angle  $\varphi$  formed by the line joining connecting points 222 and 223 and connecting points 224 and 223 is in the range of  $7^\circ$ - $11^\circ$  when the guard is in use. When the saw blade hood moves downward around the supporting shaft, the guide wheel and the guide bend on the mid-section of the connecting rod roll in the opposite direction. Bearing 213 on the end of connecting rod 211 rolls along the guide track on the side of the movable guard to open the guard.

**[0026]** Guard opening works according to the following principle. Under loading by the spring the guard tends to press against the saw blade and close around it. As the main body moves downwards around the supporting shaft, the guide wheel pivotably connected to the saw blade hood rolls along the guide bend on the mid-section of the connecting rod. The distance between the end of the connecting rod fitted with the bearing and the circular centre of the guard gradually increases, causing the bearing to roll along the guide track on the side of the guard. The guide track on the side of the guard extends from near the circular centre of the guard in a direction opposite to the direction of opening of the guard towards the end at a far remove from the circular centre of the guard. As the saw blade body moves downwards, the roller at the end of the connecting rod rolls from the end of the guide track near the circular centre of the guard to the end at a far remove from the circular centre of the guard, thereby causing the guard to gradually open as the saw blade body moves downwards, thereby exposing the saw blade for cutting. Moreover, when the saw blade body is lifted upwards, under the loading action of the spring the guard gradually closes, causing the saw blade to be enclosed in a non-cutting position for safety and protection.

**[0027]** As shown in Fig 7, there is a locking trigger 214 on the saw blade hood near the upper edge of the guard. The middle section of locking trigger 214 is connected to

the saw blade hood by rocker shaft 215. Locking trigger 214 has a bend 216 next to the upper edge of the guard. There is an opening 217 on the saw blade hood at the upper edge of the guard which allows bend 216 to enter. Under the action of rocker shaft 215, bend 216 on locking trigger 214 tends to enter opening 217. When bend 216 enters opening 217, the guard is prevented from opening. When the guard needs to be opened, the other end of the locking trigger is pressed to disengage the bend from the opening on the saw blade hood, and the guard can then open when the main body of the saw moves downward.

## Claims

1. A compound saw with guard opening apparatus consisting of base, work table, and saw blade elements, the base comprising a left side frame and a right side frame, the work table being rotatable over 180° and supported between the left side frame and the right side frame by a turnover shaft crossing between the left side frame and the right side frame, while between the work table and the base there are positioning means for positioning the work table horizontally; the work table is provided with a circular saw guide which can turn horizontally; the saw blade element comprises a supporting arm and the main body of the saw, the supporting arm being fixed to the rear of the saw guide, the rear end of the main body of the saw being connected to the supporting arm by a supporting shaft such that the main body of the saw can move up and down around the supporting shaft; the main body of the saw comprises a saw blade hood by way of housing and a drive motor and handle on one side of the saw blade hood, half the circumference of the circular disk driven by the drive motor being exposed beyond the saw blade hood, with a fan-shaped movable guard revolving coaxially with the circular disk connected to the saw blade hood **characterized in that:** spring loading on the movable guard causes the said guard to tend to press against the circular disk, which is thus made to project outwards beyond the saw blade hood, and one side of the said movable guard is provided with a guide track, one end of the connecting rod is pivotably connected to the supporting arm and the other end is provided with a roller and the said roller engages and rolls along the guide track; the middle section of the said connecting rod has a guide bend, the upper pivot of the said saw blade hood is connected to a guide wheel, the said guide wheel engages and rolls along the guide bend on the middle section of the connecting rod, the supporting position of the connecting rod with the supporting arm is located between the supporting position of the saw blade hood with the supporting arm and the pivotably connected position of the guide wheel on the saw

blade hood, such that when the saw blade hood moves downward around the supporting shaft, the guide wheel and the guide bend in the middle of the connecting rod cause rolling in an opposite direction, and the roller at the end of the connecting rod rolls along the guide track on the side of the movable guard to open the guard.

2. A compound saw with guard opening apparatus according to claim 1, **characterized in that:** the guide on the said connecting rod and the roller on the connecting rod are respectively located on either side of the circular centre of the movable guard, the end of the connecting rod having the roller forms a first curved section, the said guide is a beveled edge or a groove and on either side of the guide there is respectively a second curved section and a third curved section bending in opposite directions, the said guide and the first curved section and the straight segment between them forming a C shape.
3. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** the angle  $\beta$  formed by the said guide and the straight segment is 95°-125°.
4. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** the angle  $\phi$  formed by the line joining by the connecting points on the main body of the saw and the supporting arm and the connecting points on the guide wheel and the blade hood is 4°-18°.
5. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** the said roller is a bearing, or a rolling sleeve, or a rolling wheel.
6. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** the said spring is a helical spring, or a band spring, or a torsion spring.
7. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** the blade has a locking trigger for the movable guard, locking spring loading on the locking trigger causing the locking trigger to prevent the movable guard from opening when the locking trigger is in the locked position under pressure from the locking spring.
8. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** the construction of the positioning means is as follows: the sides of the turnover shaft on the left side frame and right side frame are respectively provided with an upper foot pad and a lower foot pad, with a stop plate at one end of the said left side frame and right

side frame; on the side of the work table adjacent to the stop plate there are a front convex body and a rear convex body, the said front and rear convex bodies are respectively positioned on both the front and rear sides of the turnover shaft; the said stop plate has a beveled edge that engages with the front convex body and the a hook that engages with the rear convex body; the beveled edge of the stop plate engages with the front convex body of the work table; friction between the beveled edge and the front convex body surface prevents the work table from turning downwards and over, thereby serving to support the work table; the hook on the stop plate engages with the rear convex body, and the upside down hooking element engages the stop plate, thereby preventing the work table from turning upwards and over and serving to position the work table.

9. A compound saw with guard opening apparatus according to claim 8, **characterized in that:** one end of the said stop plate is hinged to the base frame, the middle section of the stop plate is provided with a curved slot centred on the hinge point of the stop plate and the base frame; the base frame is equipped with a guide that fits into the curved slot; between the stop plate and the base frame there is an elastic element, the said elastic element tending to push the free end of the stop plate upwards; the upper foot pad and the lower foot pad consist of the an upside-down L-shaped foot-pad bracket and a foot-pad body; the foot-pad bracket has a vertical section and a horizontal section, the said vertical section being fixed to the base frame and the said horizontal section being fixed to the foot-pad body; the mating of the curved slot on the stop plate with the guide on the base frame restricts the range of motion of the stop plate, and the elastic element tends to push the free end of the stop plate upwards, thereby causing the beveled edge on the stop plate to support the front convex body and causing the hook to hook onto the rear convex body; such that when the work table is to be turned over, the free end of the stop plate is depressed so that the front convex body crosses over the lower end point of the beveled edge, whereby the front convex body can move up and down freely without the hook hooking onto the rear convex body; the rear convex body can be made to move freely, thereby changing the operating mode of the work table and the operating mode of the working status of the main body of the saw.
10. A compound saw with guard opening apparatus according to claims 1 or 2, **characterized in that:** both ends of the said turnover shaft are respectively equipped with end cuffs connected to the left and right side frames by connecting screws, and there is a wear-resistant connecting sleeve between the con-

necting screws on the turnover shaft and the left and right side frames.

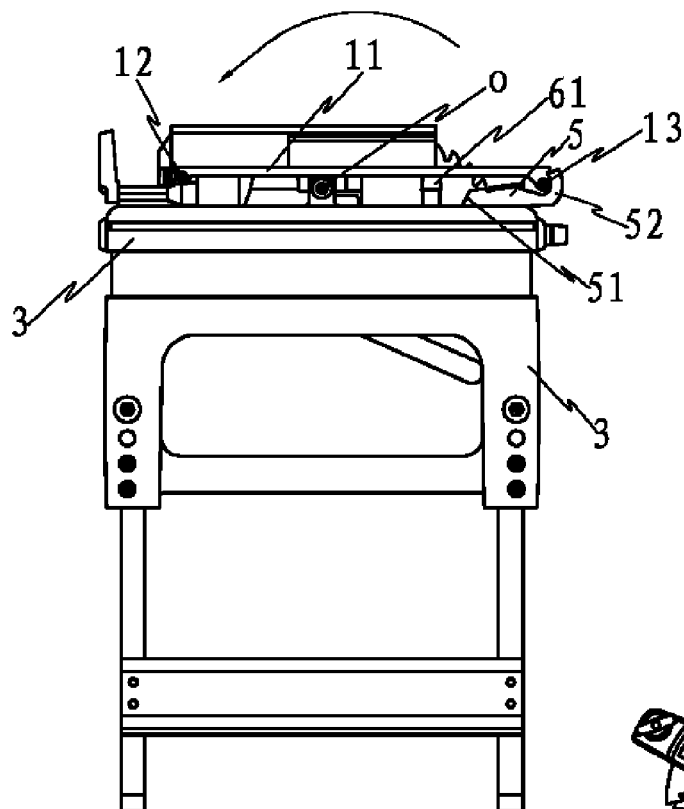


FIG1

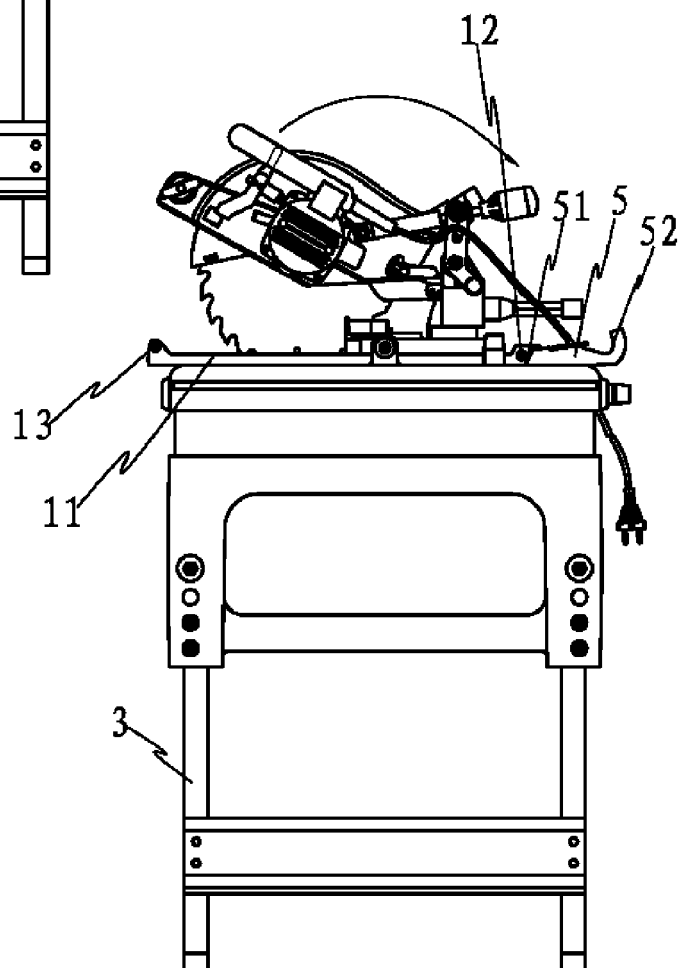
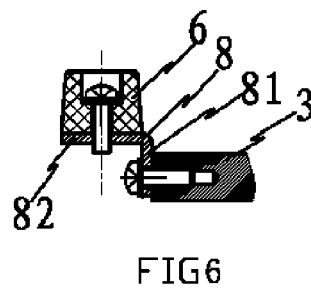
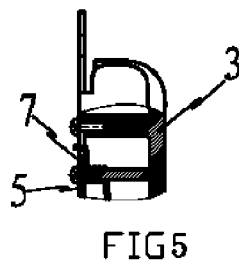
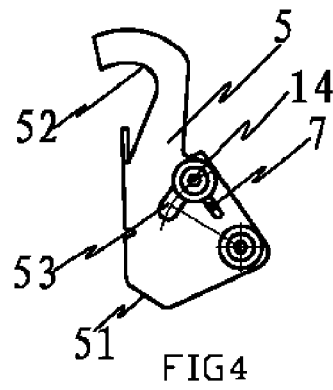
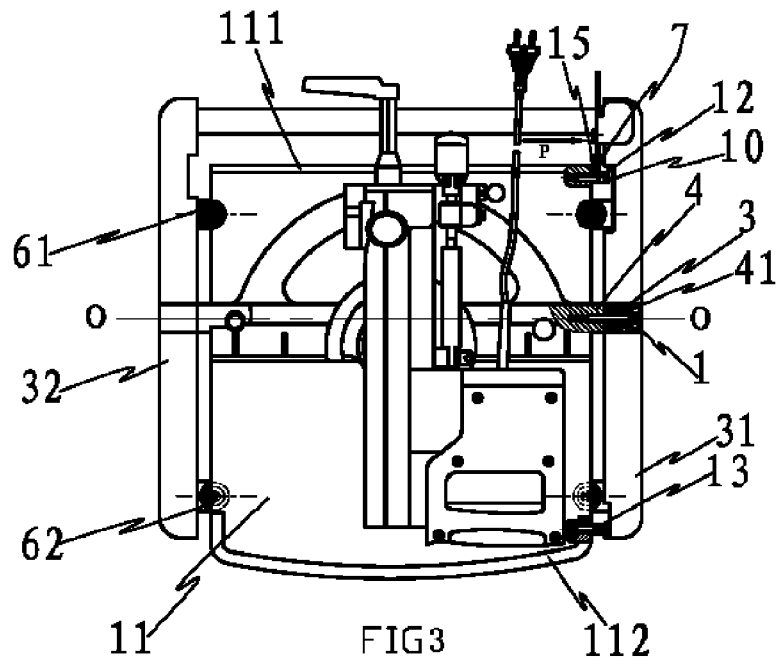
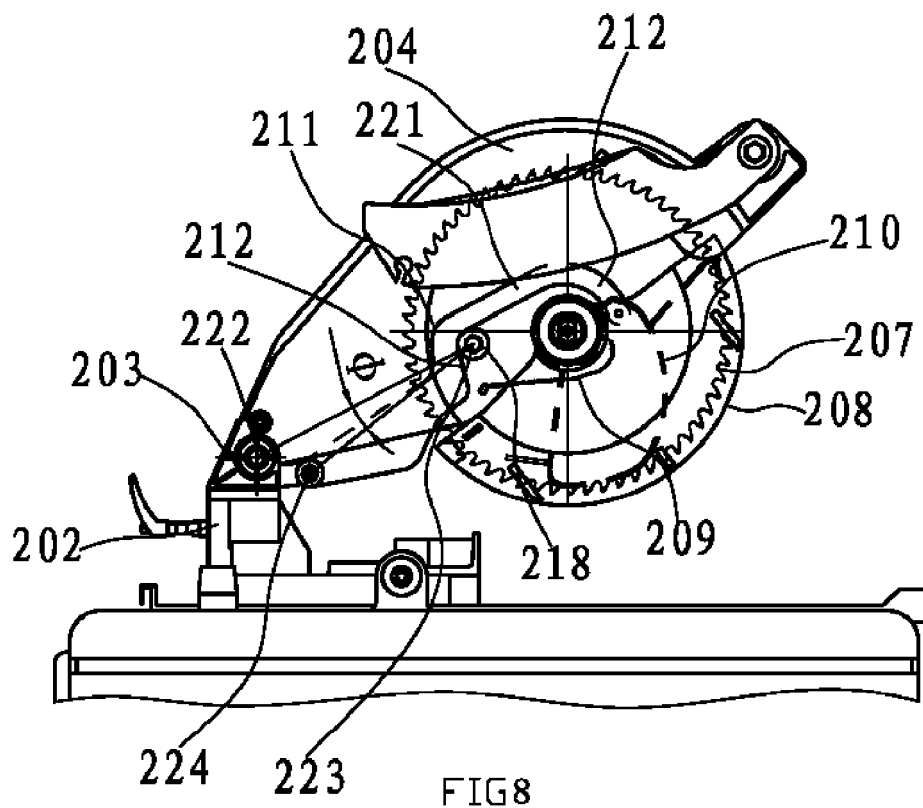
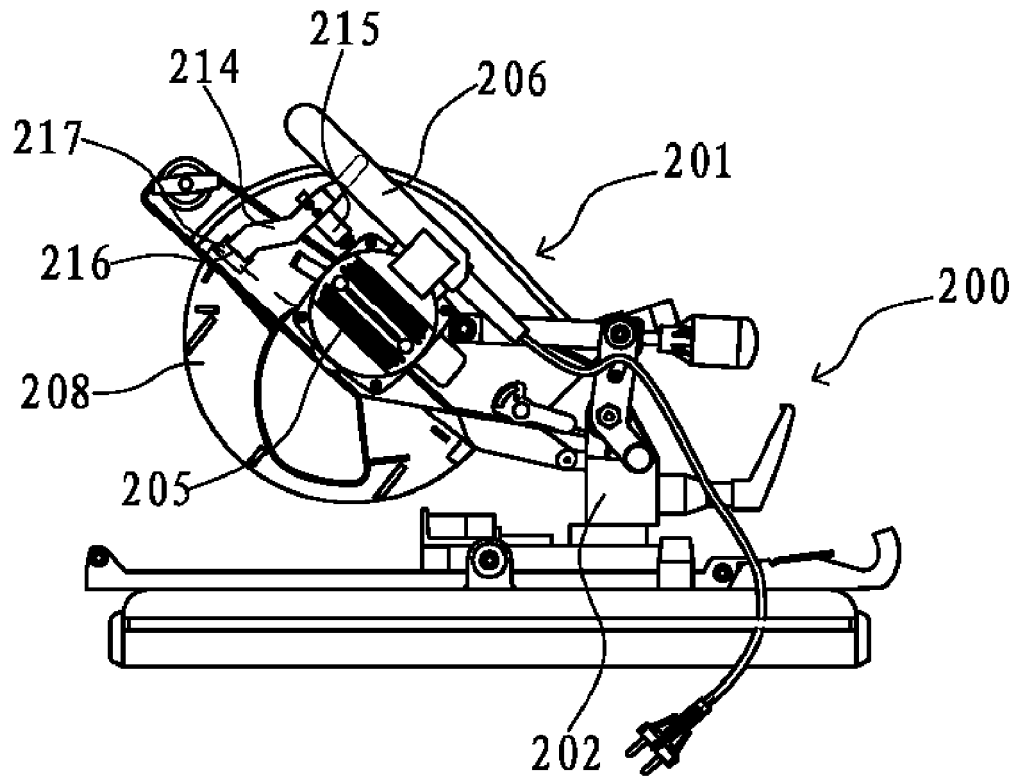
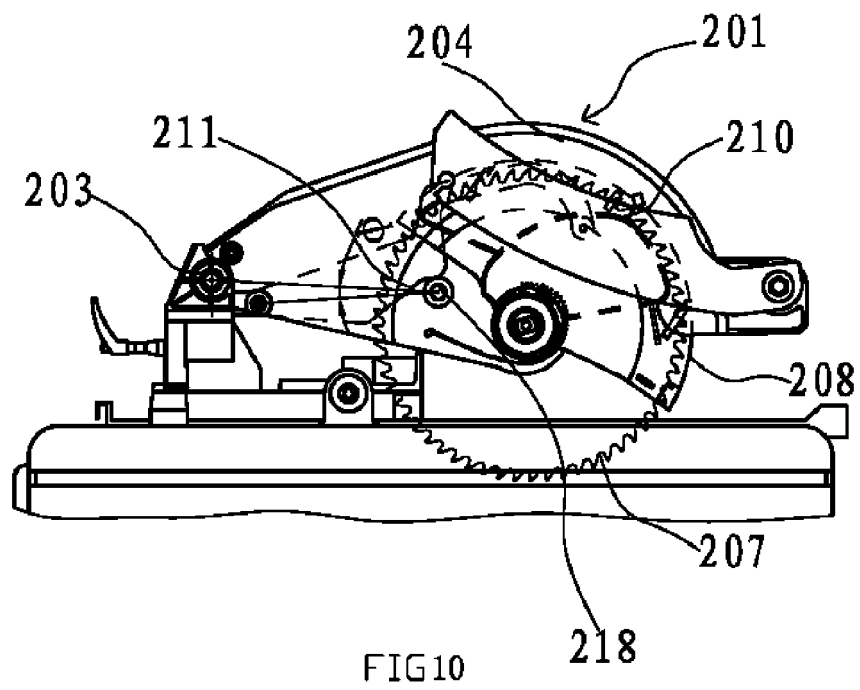
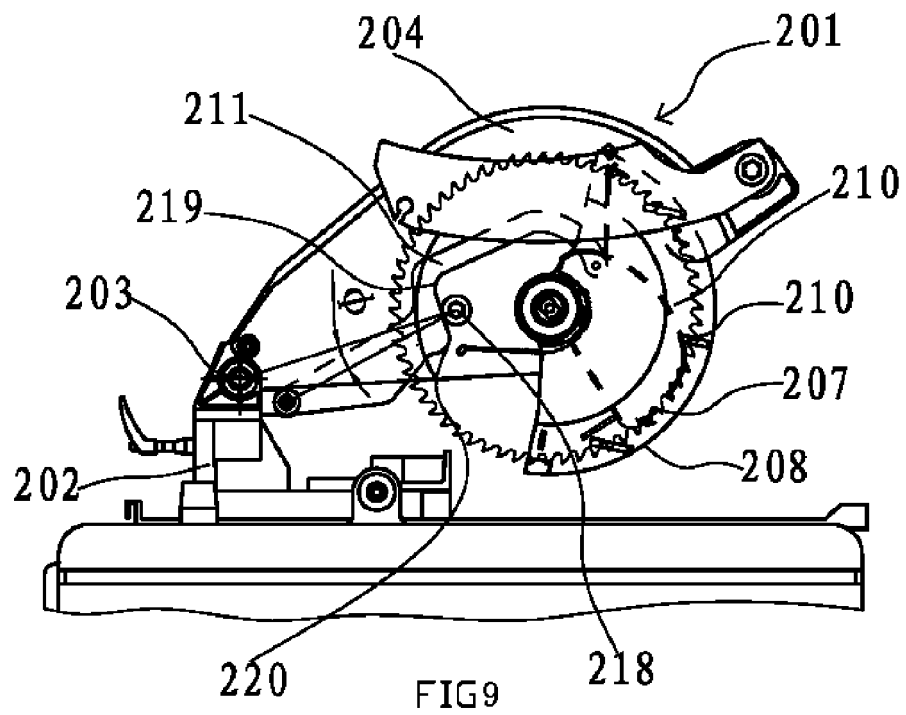


FIG2







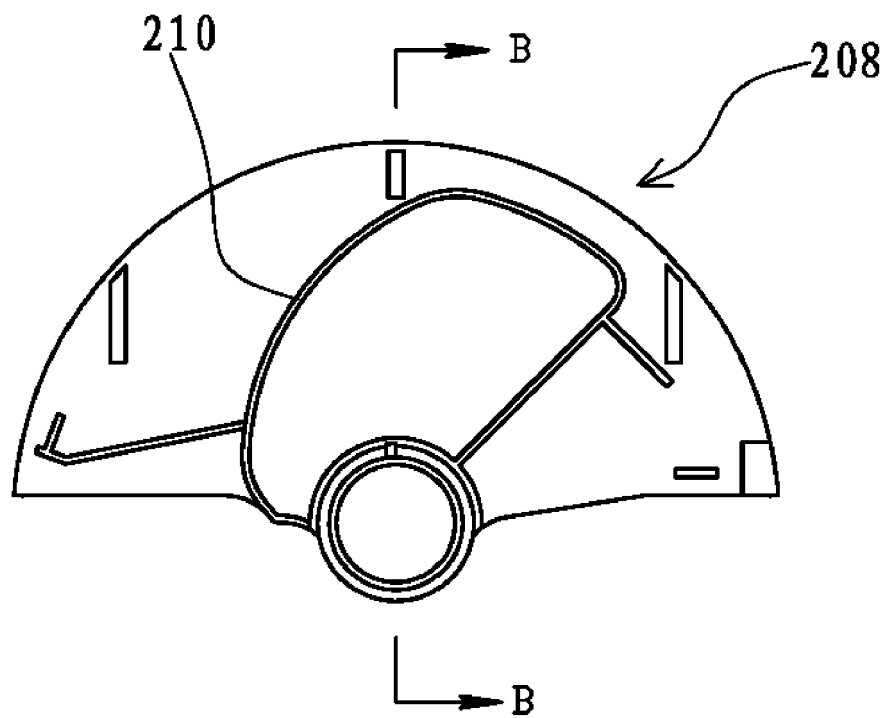


FIG11

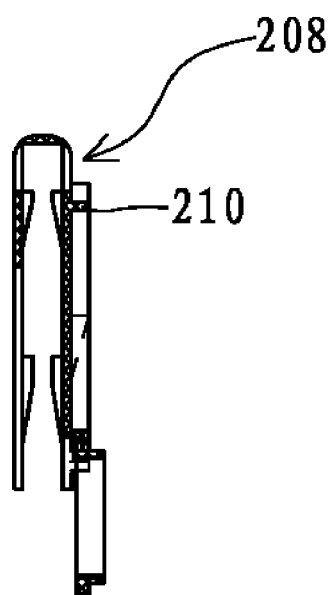
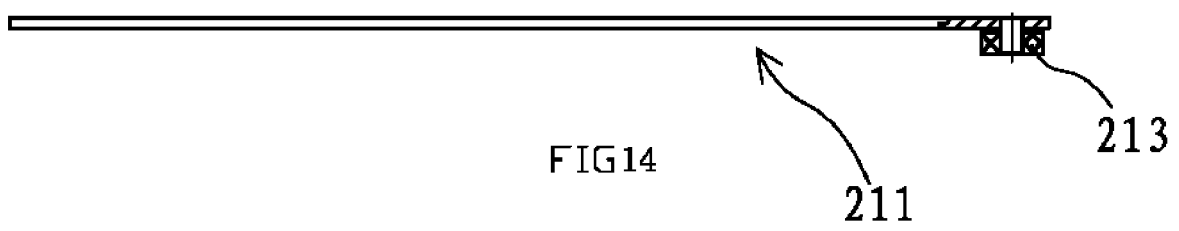
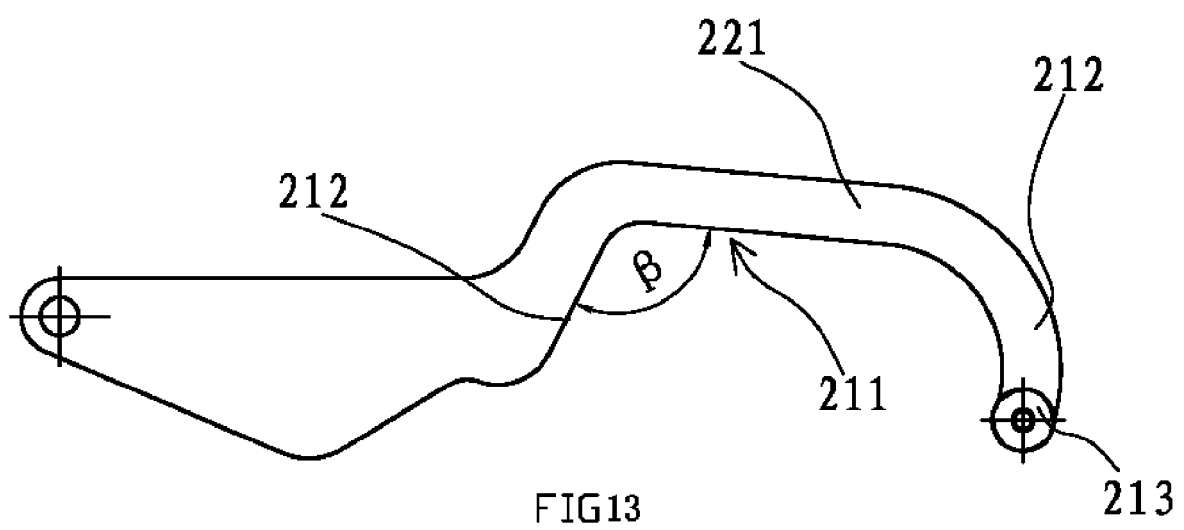


FIG12





| DOCUMENTS CONSIDERED TO BE RELEVANT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                             |                                                         |                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|--------------------------------------------------------|
| Category                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Citation of document with indication, where appropriate, of relevant passages                                                               | Relevant to claim                                       | CLASSIFICATION OF THE APPLICATION (IPC)                |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | JP 2006 044069 A (MAKITA CORP)<br>16 February 2006 (2006-02-16)<br>* abstract; figures 1-5 *<br>-----                                       | 1-10                                                    | INV.<br>B23D45/04<br>B27B5/16<br>B27B5/20<br>B27G19/02 |
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| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                             |                                                         |                                                        |
| Place of search<br><b>Munich</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                             | Date of completion of the search<br><b>19 June 2007</b> | Examiner<br><b>Frisch, Ulrich</b>                      |
| CATEGORY OF CITED DOCUMENTS<br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>& : member of the same patent family, corresponding document |                                                                                                                                             |                                                         |                                                        |

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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