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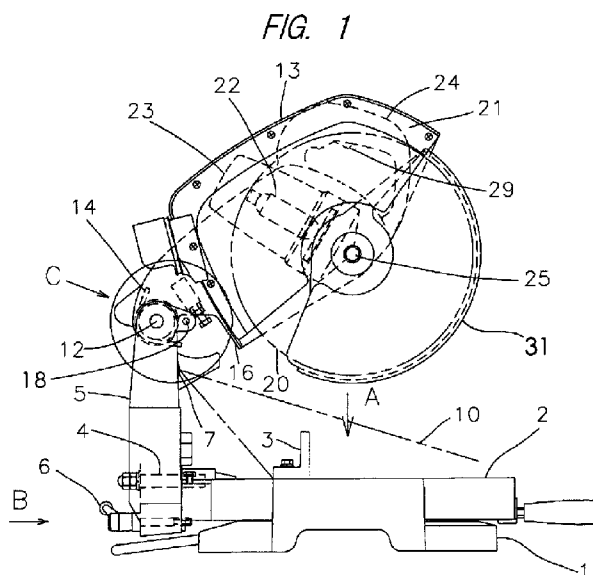
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(54) Title: CUTTING MACHINE

[Fig. 1]



(57) Abstract: When part of a human body enters an entry-prohibited region, a blade is reliably prevented from approaching the part of the human body in the entry-prohibited region. When a hand enters an entry-prohibited region in a state in which electric power of a tabletop cutting machine is turned on, a human-body detecting infrared sensor 7 provided on a front part of a holder 5 detects infrared rays generated by the hand or the like and outputs a restricting signal. As a result, the electric power supply to electromagnets embedded in the holder 5 is cut off, a pin 18 projects in a direction parallel to a shaft 12 by biasing of a spring, abuts a rib provided on a gear case 16, and restricts downward turning of a circular saw retaining part 13.

Description

Title of Invention: CUTTING MACHINE

Technical Field

[0001] The present invention relates to a cutting machine provided with a blade that turns with respect to a base part and cuts a material to be processed supported on the base part.

Background Art

[0002] Generally, when a material to be processed is cut by a tabletop cutting machine, the material to be processed is pushed against and fixed to a fence provided on a base part by an operator or is fixed by a vise device. An entry prohibition mark indicating an entry-prohibited part is shown on the base part. The operator carries out an operation while paying attention so as not to place hands on the entry-prohibited part based on the entry prohibition mark.

[0003] If the width of the material to be processed placed on the base part is narrow, the entry prohibition mark is not covered with the material to be processed, and the entry prohibition mark can be visually checked. However, if the width of the material to be processed placed on the base part is wide, the entry prohibition mark is covered with the material to be processed, and the entry prohibition mark cannot be visually checked. Therefore, when cutting the material to be processed, a circular saw which is moving downward sometimes approaches the hand of the operator fixing the material to be processed.

[0004] Patent Document 1 shown below describes a stationary power tool such as a circular saw provided with a proximity sensor, which detects the presence of an operator in a detection zone. The proximity sensor outputs an electric detection signal corresponding to a detection result.

Citation List

Patent Literature

[0005] PTL 1: Japanese Unexamined Patent Application Publication No. 2008-173761

Summary of Invention

Technical Problem

[0006] Warning by light rays or alarm sound is conceived to have a certain effect. However, there is a possibility that the operator does not notice the warning by the light rays or alarm sound.

[0007] An object of the present invention is to reliably prevent a blade from approaching a moving body, particularly, part of a human body entering the entry-prohibited region.

Solution to Problem

- [0008] An aspect of the present invention is a cutting machine. This cutting machine includes: a base part that supports a material to be processed;
a supporting member provided on the base part;
a blade retaining member turnably supported by the supporting member; and
a blade retained by the blade retaining member, and
the cutting machine is characterized by:
a detection sensor that detects whether part of a moving body is present or not in an entry-prohibited region set on the base part; and
a turn restricting part that restricts turning of the blade retaining member toward the base part when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [0009] The turn restricting part may have a restricting member that projects to a path in which the blade retaining member turns toward the base part when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [0010] At least one restricting part that can be latched with the restricting member may be provided on the blade retaining member.
- [0011] At least one restricting hole part into which the restricting member can be inserted may be provided on the blade retaining member.
- [0012] The turn restricting part may include:
a biasing part that is provided between the supporting member and the restricting member and biases the restricting member in a projecting direction;
a pull-in part that includes an electromagnet and retains the restricting member at a retracted position by attracting force caused by magnet against the biasing of the biasing part; and
an electric-distribution control part that controls electric distribution to the electromagnet so as to reduce or eliminate the attracting force when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [0013] The turn restricting part may include:
a biasing part that is provided between the supporting member and the restricting member and biases the restricting member in a retracting direction;
a projecting part that includes an electromagnet and causes the restricting member to project from the supporting member side by repulsive force caused by magnet against the biasing of the biasing part; and
an electric-distribution control part that controls electric distribution to the electromagnet so as to generate the repulsive force when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [0014] The detection sensor may be an infrared sensor.
- [0015] The base part may have a fixed base provided with a fence that supports a side

surface of the material to be processed and have a rotation base including a placing surface of the material to be processed and turnably retained by the fixed base, and the supporting member may be provided to stand at the rotation base.

[0016] The blade may be a circular saw blade turnably retained by the blade retaining member.

[0017] The cutting machine may includes a stopping part that stops a drive motor of the blade when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.

[0018] Arbitrary combinations of the above-described constituent elements and those obtained by converting the expression of the present invention among methods, systems, and others are also effective as the aspects of the present invention.

Advantageous Effects of Invention

[0019] According to the present invention, when presence of part of a moving body in an entry-prohibited region is detected by a detection sensor, turning of a blade retaining member is restricted. Therefore, when the moving body, particularly, part of the human body enters the entry-prohibited region, the blade is reliably prevented from approaching the moving body in the entry-prohibited region. The present invention is particularly effective for a tabletop cutting machine provided with a blade that turns with respect to a base part.

Brief Description of Drawings

[0020] [fig.1]Fig. 1 is a left side view of a tabletop cutting machine according to an embodiment of the present invention.

[fig.2]Fig. 2 is a front view of the tabletop cutting machine.

[fig.3]Fig. 3 is a partial enlarged view seen in the direction of the arrow B of Fig. 1.

[fig.4]Fig. 4 is a partial enlarged view seen in the direction of the arrow A of Fig. 1.

[fig.5]Fig. 5 is an enlarged view of a part C of Fig. 1 in a normal state.

[fig.6]Fig. 6 is a partial cross-sectional view taken along a line D-D of Fig. 5.

[fig.7]Fig. 7 is an enlarged view of the part C of Fig. 1 in a turn restricted state.

[fig.8]Fig. 8 is a partial cross-sectional view taken along a line E-E of Fig. 7.

[fig.9]Fig. 9 is a left side view showing a state in which a material to be processed is placed on a base of Fig. 1.

[fig.10]Fig. 10 is a front view of the same state.

[fig.11]Fig. 11 is a partial enlarged view seen in the direction of the arrow F of Fig. 9.

[fig.12]Fig. 12 is a functional block diagram of the tabletop cutting machine of the embodiment.

[fig.13]Fig. 13 is a functional block diagram of the tabletop cutting machine of the embodiment (another example).

[fig.14]Fig. 14 is a flowchart of operation of a restricting switch part (control device).

[fig.15]Fig. 15 is an output characteristic drawing of an infrared sensor.

[fig.16]Fig. 16 is a functional block diagram exemplarily showing a restricting switch part.

[fig.17]Fig. 17 is an enlarged view of a modification example of Fig. 5, in which two restricting hole parts are provided on a gear case.

Description of Embodiments

[0021] Hereinafter, a preferred embodiment of the present invention will be described in detail with reference to drawings. The same or equivalent constituent elements, members, and others shown in the drawings are denoted by the same reference numerals, and redundant descriptions will be appropriately omitted. Also, the embodiment does not limit the invention, but is shown as an example, and all the characteristics and combinations thereof described in the embodiment are not necessarily essential to the invention.

[0022] Fig. 1 is a left side view of a tabletop cutting machine serving as a cutting machine according to the embodiment of the present invention. Fig. 2 is a front view of the tabletop cutting machine. The tabletop cutting machine includes a fixed base 1, a turntable 2 serving as a rotation base, a fence 3, a holder 5 serving as a supporting member, a human-body detecting infrared sensor 7 serving as a detection sensor, a circular saw retaining part 13 serving as a blade retaining member, and a circular saw blade 20 serving as a blade.

[0023] The fixed base 1 is a part which serves as a foundation disposed on a table. The turntable 2 is supported (embedded) in a central part of the fixed base 1 so as to be turnable in the horizontal direction. An upper surface of the turntable 2 is on the same plane as an upper surface of the fixed base 1. As shown in Figs. 9 and 10, a material to be processed 28 such as wood is placed on the upper surfaces of the fixed base 1 and the turntable 2. The turning axis of the turntable 2 is perpendicular to the upper surface (placing surface) thereof. In the present embodiment, the members (the fixed base 1 and the turntable 2) on which the material to be processed 28 is placed are collectively referred to as "base part".

[0024] The fence 3 is fixed to the upper surface of the fixed base 1 and supports a side surface of the material to be processed 28. The holder 5 is provided to stand at a rear end of the turntable 2 via a holder shaft 4. The shaft center of the holder shaft 4 is configured to be at, for example, a height approximately corresponding to the upper surface of the turntable 2. The holder 5 is pivotally supported so as to be left-tiltable (tiltable toward the left side of Fig. 2) with respect to the upper surface of the turntable 2 around the holder shaft 4 serving as a pivot point.

- [0025] Fig. 3 is a partial enlarged view seen in the direction of arrow B of Fig. 1. As shown in the drawing, a long hole 5a about the holder shaft 4 is formed in a back part of the holder 5. A clamp lever 6 penetrates through the long hole 5a, and a male screw part formed at a distal end of the clamp lever 6 is screwed into a female screw hole part formed in a back surface of the turntable 2. When the clamp lever 6 is loosened, the holder 5 is tilted within the range of the long hole 5a around the holder shaft 4 serving as a pivot point. When the clamp lever 6 is tightened, the holder 5 is tightened between the turntable 2 and the clamp lever 6 and fixed at an arbitrary tilt position. In the present embodiment, the long hole 5a is formed to have the range in which the holder 5 can be tilted by 45 degrees to the left. Alternatively, the long hole may be formed so that the holder 5 can be tilted by 45 degrees to both the left and right.
- [0026] As shown in Fig. 1 and Fig. 2, the human-body detecting infrared sensor 7 is provided at a front part of the holder 5. The human-body detecting infrared sensor 7 is widely used for, for example, an automatic water faucet from which water is discharged without touching the faucet and is widely spread. A detection range 10 (corresponding to entry-prohibited region) of the human-body detecting infrared sensor 7 is set so as to cover an entry-prohibited part 9 on the fixed base 1 shown by hatching on an entry prohibition mark 8 of Fig. 4. By virtue of this, as shown in Fig. 11, infrared rays emitted from a human body such as a hand 11 which has entered the detection range 10 are detected by the human-body detecting infrared sensor 7, and a restricting signal described later is output.
- [0027] Above the holder 5, the circular saw retaining part 13 is supported via a shaft 12 serving as a coupling shaft so as to be vertically swingable with respect to the upper surface of the base part. Between the holder 5 and the circular saw retaining part 13, a spring 14 (for example, torsion coil spring), which biases the circular saw retaining part 13 upward, is provided.
- [0028] Fig. 5 is an enlarged view of a part C of Fig. 1. Fig. 6 is a cross-sectional view taken along a line D-D of Fig. 5. The holder 5 retains electromagnets 15a and 15b serving as pull-in parts, a pin 18 (for example, a metal pin) serving as a restricting member, and a spring 30 (for example, compression coil spring) serving as a biasing part in the vicinity of the part engaged with the shaft 12. These are a type of electromagnetic plunger and constitute a turn restricting part. Note that, in the electromagnets 15a and 15b, only magnetic cores are illustrated, and illustration of coils is omitted. The electromagnets 15a and 15b are embedded in a housing space 50 in the holder 5 so that magnetic poles thereof are opposed to each other. The spring 30 is housed between the electromagnets 15a and 15b. The housing space 50 is positioned in the vicinity of a rib 17 provided on a gear case 16 of the holder 5. The pin 18 is attached to the electromagnet 15a. The axial direction of the pin 18 is parallel to, for example, the axial

direction of the shaft 12. The pin 18 can project from the housing space 50 through a penetration hole. The spring 30 biases the electromagnets 15a and 15b in a separating direction (in other words, biases the pin 18 in a projecting direction). In the state shown in Fig. 6, electric power is supplied to the electromagnets 15a and 15b, and the electromagnets attract each other against the biasing of the spring 30. Therefore, the pin 18 does not project from the holder 5. On the other hand, when electric power supply to the electromagnets 15a and 15b is cut off, as shown in Fig. 8, the electromagnets 15a and 15b are separated from each other by the biasing of the spring 30, the pin 18 projects to the outside from the housing space 50 and extends to the path in which the circular saw retaining part 13 turns toward the base part.

[0029] As shown in Figs. 1 and 2, the circular saw retaining part 13 includes a saw shaft 19, the gear case 16, a motor 22, a motor housing 23, and an operation handle 24. The gear case 16 is integrated with a saw cover 21 covering an upper half part of the circular saw blade 20. A protecting cover 31 covering a lower half part of the circular saw blade 20 is provided to be turnable around the saw shaft 19, and when the circular saw retaining part 13 is turned toward the base part, the protecting cover 31 is automatically housed in the saw cover 21 so as to expose the circular saw blade 20. The motor 22 drives the circular saw blade 20 to rotate. The motor housing 23 houses and supports the motor 22. As shown in Fig. 2, the saw shaft 19 is provided in the gear case 16 and extends in the horizontal direction. The circular saw blade 20 is attached to a distal end of the saw shaft 19 via a bolt 25. Although illustration is omitted, a motive-power transmitting mechanism such as a gear is incorporated in the motor housing 23 in order to transmit motive power from the motor 22 to the circular saw blade 20. Moreover, although illustration is similarly omitted, a control device which controls ON/OFF of electric power supply to the motor 22 and the electromagnets 15a and 15b by signals emitted from the human-body detecting infrared sensor 7 is incorporated in the operation handle 24. The control device may be provided at a location other than that in the operation handle 24, that is, in the motor housing 23 or the holder 5.

[0030] As shown in Fig. 2, two projecting parts 5b are formed on a front surface of the holder 5. Moreover, stopper bolts 26 and 27 are screwed in a right-angle direction in the rear of the upper surface of the turntable 2 so as to be positioned on the moving tracks of the projecting parts 5b.

[0031] When the clamp lever 6 is loosened to tilt the holder 5, the projecting part 5b is engaged with a head part of the stopper bolt 26 or the stopper bolt 27 at a predetermined tilt angle to set a tilt position of the circular saw retaining part 13. In the present embodiment, when the holder 5 is tilted to a position toward the left by 45 degrees, the stopper bolt 26 is engaged with the projecting part 5b. When the holder 5 is at a right-angle position (0 degree), the stopper bolt 27 is engaged with the

projecting part 5b. In Fig. 2, the stopper bolt 27 is engaged with the head part of the projecting part 5b. In other words, the holder 5 is at the right-angle position (0 degree).

[0032] On the upper surface of the turntable 2, as is known, a blade opening plate (not shown) having a groove part to which the circular saw blade 20 enters at its center is fixed. When the lower end of the circular saw blade 20 is moved down to a location lower than the upper surface of the turntable 2 in the cutting, the blade enters the groove part of the blade opening plate so as to prevent scuffing on a finishing surface of the material to be processed 28.

[0033] Next, operation of the tabletop cutting machine constituted in the above-described manner will be described.

[0034] An operator places the material to be processed 28 on the upper surfaces of the fixed base 1 and the turntable 2 and pulls a switch 29 provided on the operation handle 24 to turn on the power of the tabletop cutting machine. Then, the motor 22 is driven to rotate, and the circular saw blade 20 starts to rotate via the saw shaft 19. The operator holds the operation handle 24 to turn the circular saw retaining part 13 toward the upper surfaces of the fixed base 1 and the turntable 2, thereby cutting the material to be processed 28 by the circular saw blade 20.

[0035] When a human body such as the hand 11 enters the entry-prohibited part 9 (when the hand 11 or the like enters the detection range 10) as shown in Fig. 11 in the state in which the electric power of the tabletop cutting machine is on, the human-body detecting infrared sensor 7 provided at the front part of the holder 5 detects infrared rays emitted from the hand 11 or the like and outputs the restricting signal. As a result, the electric power supply to the electromagnets 15a and 15b embedded in the holder 5 is cut off, and the electromagnets 15a and 15b are separated from each other as shown in Fig. 8. When the electromagnets 15a and 15b are separated from each other, the pin 18 attached to the electromagnet 15a projects in the direction parallel to the shaft 12 by the biasing of the spring 30 and abuts the rib 17 provided on the gear case 16, by which turning of the circular saw retaining part 13 in the downward direction is restricted. In other words, the circular saw retaining part 13 cannot turn to the base-part side more than the state shown in Fig. 7. In addition, electric power supply to the motor 22 is cut off, and rotation thereof is stopped.

[0036] When the hand 11 or the like gets out of the detection range 10, the human-body detecting infrared sensor 7 stops output of the restricting signal. Then, electric power supply to the electromagnets 15a and 15b is also resumed, and the electromagnets 15a and 15b attract each other as shown in Fig. 6. When the electromagnets 15a and 15b attract each other, the pin 18 attached to the electromagnet 15a retracts in the direction parallel to the shaft 12 against the biasing of the spring 30. In addition, electric power supply to the motor 22 is resumed, and rotation is started again. In this manner, the

turn restriction of the circular saw retaining part 13 is cancelled, the motor 22 is rotated again, and operation can be resumed.

[0037] Fig. 12 is a functional block diagram of the tabletop cutting machine of the present embodiment. A power-supply part 101 is, for example, a connection part to commercial power source and executes AC/DC conversion in the case of direct-current drive. The switch 29 is an operation switch which the operator turns on/off and is connected to the motor 22 in series. A switch element 29' is composed of, for example, FET and is connected to the motor 22 in series. When the power-supply part 101 is connected to a commercial power source or the like, a drive voltage is supplied to a restricting switch part 102 (control device) and the human-body detecting infrared sensor 7, and a drive voltage is supplied from the restricting switch part 102 to the electromagnets 15a and 15b. Also, a control signal B is output from the restricting switch part 102 so that the switch element 29' is in an on state.

[0038] In a normal state, the restricting switch part 102 supplies the voltage from the power-supply part 101 to the electromagnets 15a and 15b and outputs an on-signal B to the switch element 29'. When the switch 29 is operated (on) by the operator in this state, the electric power from the power-supply part 101 is supplied to the motor 22 via the switch 29 and the switch element 29', and the motor 22 is driven.

[0039] On the other hand, when the restricting switch part 102 receives the restricting signal output from the human-body detecting infrared sensor 7, it outputs an off-signal B to the switch 29' to cut off the voltage supply to the motor 22 and the voltage supply (signal A) to the electromagnets 15a and 15b.

[0040] Instead of the configuration shown in Fig. 12, a configuration shown in Fig. 13 may be employed as a functional block. When the power-supply part 101 is connected to a commercial power source or the like, a drive voltage is supplied to the human-body detecting infrared sensor 7 via the switch 29, and a drive voltage is supplied to the motor 22 and the electromagnets 15a and 15b via the switch 29 and the restricting switch part 102 serving as an electric-distribution control part. In a normal state, the restricting switch part 102 supplies the voltage from the switch 29 to the motor 22 and the electromagnets 15a and 15b, whereas when it receives the restricting signal from the human-body detecting infrared sensor 7, it cuts off the voltage supply to the motor 22 and the electromagnets 15a and 15b.

[0041] In the tabletop cutting machine of the present embodiment, the human-body detecting infrared sensor 7, which detects whether part (for example, hand) of a human body is present or not in the detection range 10 (entry-prohibited region) set in advance, is provided, and when the presence of the part of the human body is detected in the detection range 10 by the human-body detecting infrared sensor 7, turning of the circular saw retaining part 13 with respect to the base part is restricted. Therefore, even

if a moving body, particularly, part of a human body enters the entry-prohibited region, the blade can be reliably prevented from approaching the moving body in the entry-prohibited region. In addition to the turn restriction, motor is also stopped in combination (rotation of the circular saw blade is stopped).

[0042] Operation of the restricting switch part 102 (control device) will be described with reference to the flowchart of Fig. 14. When the power-supply part 101 is connected to the commercial power source and the drive voltage is supplied to the restricting switch part 102 (including a microcomputer serving as a control part), a human-body detecting process is started (S1).

[0043] The restricting switch part 102 outputs the on-signal to the switch element (FET) 29' to put the motor 22 to a drivable state (S2) and start electric power supply to the electromagnets 15a and 15b (S3). Then, the restricting switch part 102 (microcomputer) monitors a detection signal from the human-body detecting infrared sensor 7 (S4). In the present embodiment, the infrared sensor 7 is described as a thermal sensor. As shown in Fig. 15, it is known that the output voltage from the sensor is increased immediately after when the infrared sensor 7 detects a human body. This increased value becomes larger as the temperature becomes higher. Since the temperature of a human body is higher than that of the material to be processed 28, when the infrared sensor 7 detects a human body, the output voltage of the infrared sensor 7 is largely increased. Since the output voltage comes to a stable state when predetermined time elapses after the detection, restricting control is carried out immediately after the output voltage exceeds a threshold value as described later. Also, the output voltage is changed also when the human body moves and gets out of the detection range after the stable state, but the voltage is changed to be reduced with respect to a reference voltage in this case.

[0044] As shown in Fig. 16, the restricting switch part 102 is provided with an amplifying part 102a (for example, OP amplifier) which amplifies the detected voltage signal, a comparator part 102b which compares the amplified signal with threshold values, and a storage part 102c which stores the threshold values set in advance. The comparator part 102b and the storage part 102c may be configured to be included in a microcomputer or may be composed of analog elements (resistors and the like).

[0045] The detection signal output from the human-body detecting infrared sensor 7 is amplified by the amplifying part 102a in the restricting switch part 102, converted to a digital signal, input to the microcomputer (the comparator part 102b), and compared with the threshold value stored in advance in the storage part 102c (S5). As the threshold values, for example, the relations between a plurality of outside air temperatures, the temperatures of the material to be processed 28 in accordance with the plurality of outside air temperatures, and human-body temperatures are stored in a

matrix.

[0046] If the detection signal is smaller than the threshold value (NO in S5), the electric power supply to the electromagnets 15a and 15b is maintained (S6). When the switch 29 is turned on, the motor 22 can be driven, and the circular saw retaining part 13 can be turned to the base-part side.

[0047] On the other hand, if the detection signal is larger than the threshold value (YES in S5), the restricting switch part 102 outputs a cut-off signal to the electromagnets 15a and 15b (S7) so as to cut off the electric power supply to the electromagnets 15a and 15b and outputs a cut-off signal (off-signal) to the switch element 29' (S8). As a result, since the pin 18 projects from the housing space 50 and abuts the rib 17, the downward turning of the circular saw retaining part 13 can be restricted. Furthermore, since the switch element 29' is turned off, the electric power supply of the motor 22 is cut off, and the motor 22 is stopped. Instead of turning off the switch element 29', the switch element 29' may be controlled so as to apply braking to the motor 22.

[0048] Then, it is determined whether the hand 11 gets out of the detection region 10 or not (S9). If the hand 11 enters the detection region 10, the output of the infrared sensor 7 is largely varied in a positive direction from a reference voltage, but reversely, if the hand 11 gets out of the detection region 10, the output voltage which is in the stable state is largely varied in a negative direction. If the detected voltage at this point becomes smaller than the threshold value of the negative side (YES in S9), it is determined that the hand 11 is outside of the detection region 10, and the process returns to S2. However, since the circular saw blade 20 may be suddenly rotated and damage the material to be processed 28 if the switch 29 is in an on state, it is preferred that the state of the switch 29 is checked after YES in S9 to return to S2 if the switch 29 is off and wait until the switch 29 is turned off if it is on.

[0049] On the other hand, if NO in S9, it is determined whether the switch 29 has been turned off or not (S10). If turned off (YES in S10), the process returns to S2. If still on (NO in S10), the determination of S9 is repeated.

[0050] The present invention has been described above with taking the embodiment as an example. It is understood by those skilled in the art that various modifications can be made in the constituent elements and processes of the embodiment within the range described in claims. Hereinafter, modification examples will be mentioned.

[0051] The cutting machine is not limited to those placed on a table.

[0052] Instead of either one of the electromagnets 15a and 15b, a permanent magnet may be used, or a soft magnetic body such as iron may be used.

[0053] Instead of cutting off the electric power supply to the electromagnets 15a and 15b when outputting the restricting signal, the voltages supplied to the electromagnets 15a and 15b may be reduced so that the mutual attracting force thereof becomes weaker

than the biasing force of the spring 30.

- [0054] The spring 30 may be, for example, an extension coil spring, which biases the electromagnets 15a and 15b in the attracting direction (biases the pin 18 in the retracting direction). In that case, the electromagnets 15a and 15b function as projecting parts instead of pull-in parts when the restricting signal is output. In other words, for example, electricity is not distributed to the electromagnets 15a and 15b in a normal state, and the electromagnets are mutually attracted by the biasing of the spring 30 (the pin 18 is at a retracted position). On the other hand, when the human-body detecting infrared sensor 7 outputs the restricting signal, electricity is distributed to the electromagnets 15a and 15b, repulsive force (repelling force) works mutually between them, and the electromagnets are separated from each other against the biasing of the spring 30 (the pin 18 projects).
- [0055] Instead of or in addition to the configuration in which the pin 18 can abut an edge of the rib 17 provided on the gear case 16 when the restricting signal is output, the pin 18 may be configured to enter a restricting hole part provided on the gear case 16 when the restricting signal is output. Fig. 17 is an enlarged view of a modification example of Fig. 5, in which two restricting hole parts 161 and 162 are provided on the gear case 16. In the example of this drawing, when the circular saw retaining part 13 is not turning, the restricting hole part 161 is at the same position as the pin 18 in a side view. When the circular saw retaining part 13 is turned to the base-part side by a predetermined angle, the restricting hole part 162 is at the same position as the pin 18 in a side view. When the two restricting hole parts are provided in this manner, turn restriction can be carried out even when the human-body detecting infrared sensor 7 outputs the restricting signal during the turning of the circular saw retaining part 13. The restricting hole parts may be penetrating holes or bottomed holes, and the number thereof is not particularly limited.
- [0056] A plurality of turn restricting parts (the electromagnets 15a and 15b, the spring 30, and the pin 18) may be provided so as to be located at different turn restricting positions. Also in this case, like the case in which the two or more restricting hole parts are provided, the turn restriction can be carried out even when the human-body detecting infrared sensor 7 emits the restricting signal during the turning of the circular saw retaining part 13.
- [0057] The pin 18 may be configured to be pushed against a side surface of the rib 17 so as to reduce the speed of turning of the circular saw retaining part 13 (disturb downward turning) by the friction of the pin 18. In that case, a distal end part of the pin 18 is preferably made of an elastic material such as rubber. Reducing the speed of the circular saw retaining part 13 is also included in the idea of turn restriction.
- [0058] The detection sensor is not limited to an infrared sensor, but may be constituted of,

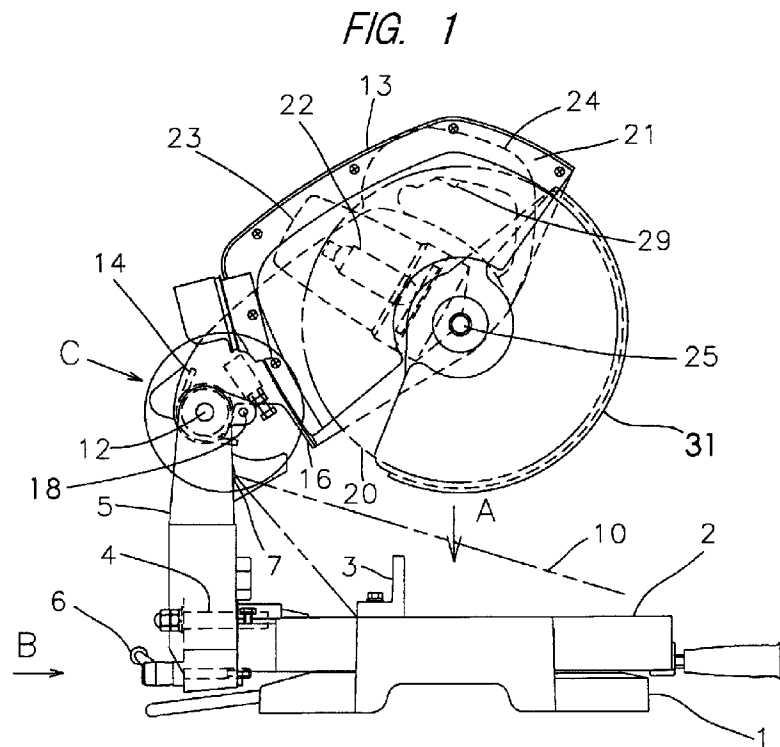
for example, imaging means such as a camera and image processing means.

Claims

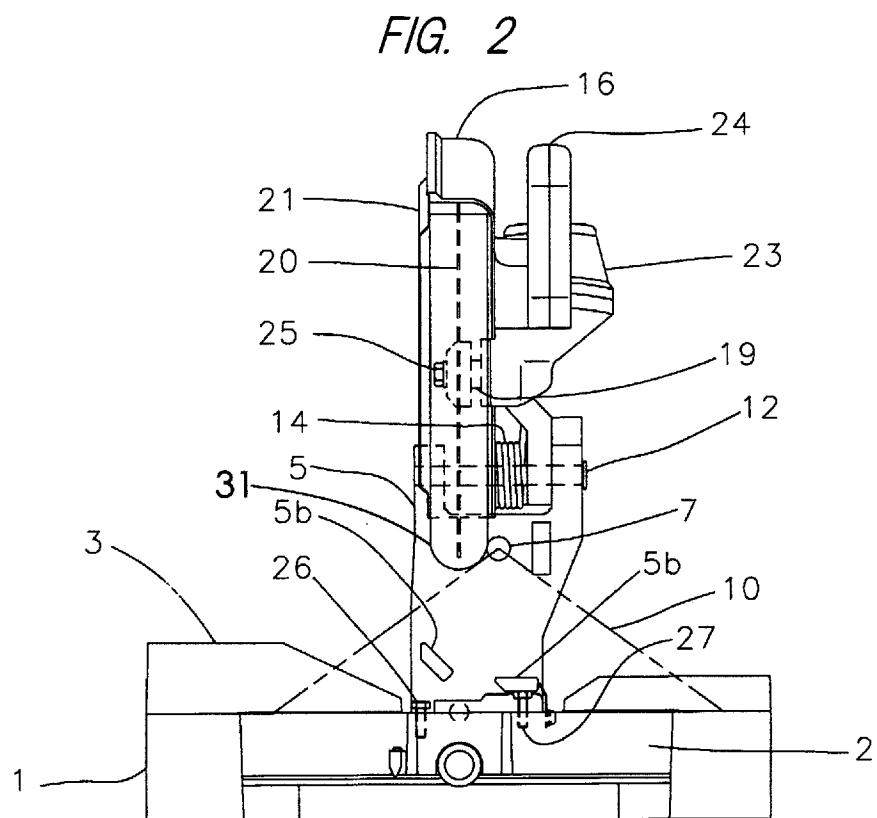
- [Claim 1] A cutting machine including:
a supporting member provided on a base part that supports a material to be processed;
a blade retaining member turnably supported by the supporting member; and
a blade retained by the blade retaining member,
the cutting machine characterized by:
a detection sensor that detects whether part of a moving body is present or not in an entry-prohibited region set on the base part; and
a turn restricting part that restricts turning of the blade retaining member toward the base part when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [Claim 2] The cutting machine according to claim 1, characterized in that the turn restricting part has a restricting member that projects to a path in which the blade retaining member turns toward the base part when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [Claim 3] The cutting machine according to claim 2, characterized in that at least one restricting part that can be latched with the restricting member is provided on the blade retaining member.
- [Claim 4] The cutting machine according to claim 2, characterized in that at least one restricting hole part into which the restricting member can be inserted is provided on the blade retaining member.
- [Claim 5] The cutting machine according to any one of claims 2 to 4, characterized in that
the turn restricting part includes:
a biasing part that is provided between the supporting member and the restricting member and biases the restricting member in a projecting direction;
a pull-in part that includes an electromagnet and retains the restricting member at a retracted position by attracting force caused by magnet against the biasing of the biasing part; and
an electric-distribution control part that controls electric distribution to the electromagnet so as to reduce or eliminate the attracting force when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.

- [Claim 6] The cutting machine according to any one of claims 2 to 4, characterized in that the turn restricting part includes:
a biasing part that is provided between the supporting member and the restricting member and biases the restricting member in a retracting direction;
a projecting part that includes an electromagnet and causes the restricting member to project from the supporting member side by repulsive force caused by magnet against the biasing of the biasing part; and
an electric-distribution control part that controls electric distribution to the electromagnet so as to generate the repulsive force when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.
- [Claim 7] The cutting machine according to any one of claims 1 to 6, characterized in that the detection sensor is an infrared sensor.
- [Claim 8] The cutting machine according to any one of claims 1 to 7, characterized in that
the base part has a fixed base provided with a fence that supports a side surface of the material to be processed and has a rotation base including a placing surface of the material to be processed and turnably retained by the fixed base, and
the supporting member is provided to stand at the rotation base.
- [Claim 9] The cutting machine according to any one of claims 1 to 8, characterized in that
the blade is a circular saw blade turnably retained by the blade retaining member.
- [Claim 10] The cutting machine according to claim 9, characterized by
a stopping part that stops a drive motor of the blade when presence of the part of the moving body in the entry-prohibited region is detected by the detection sensor.

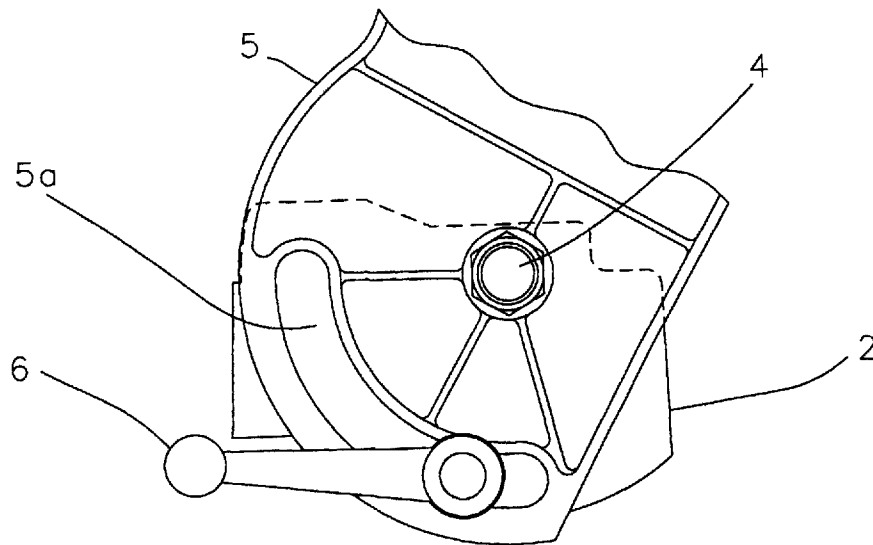
[Fig. 1]



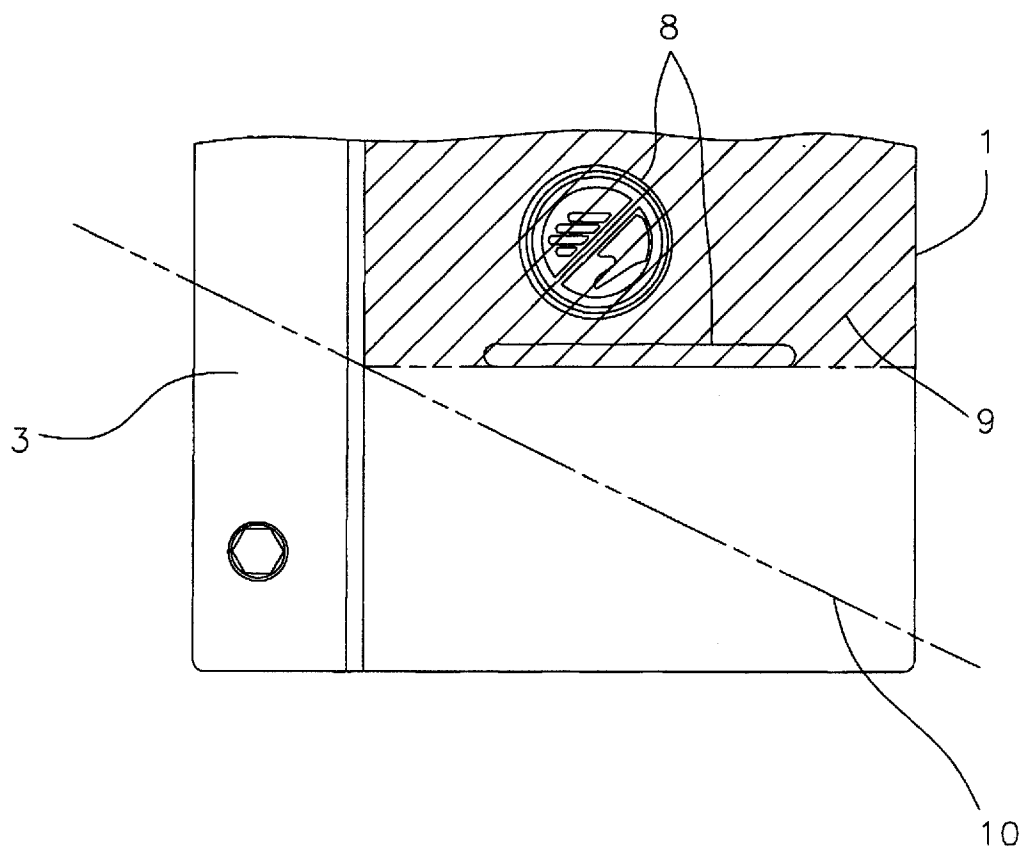
[Fig. 2]



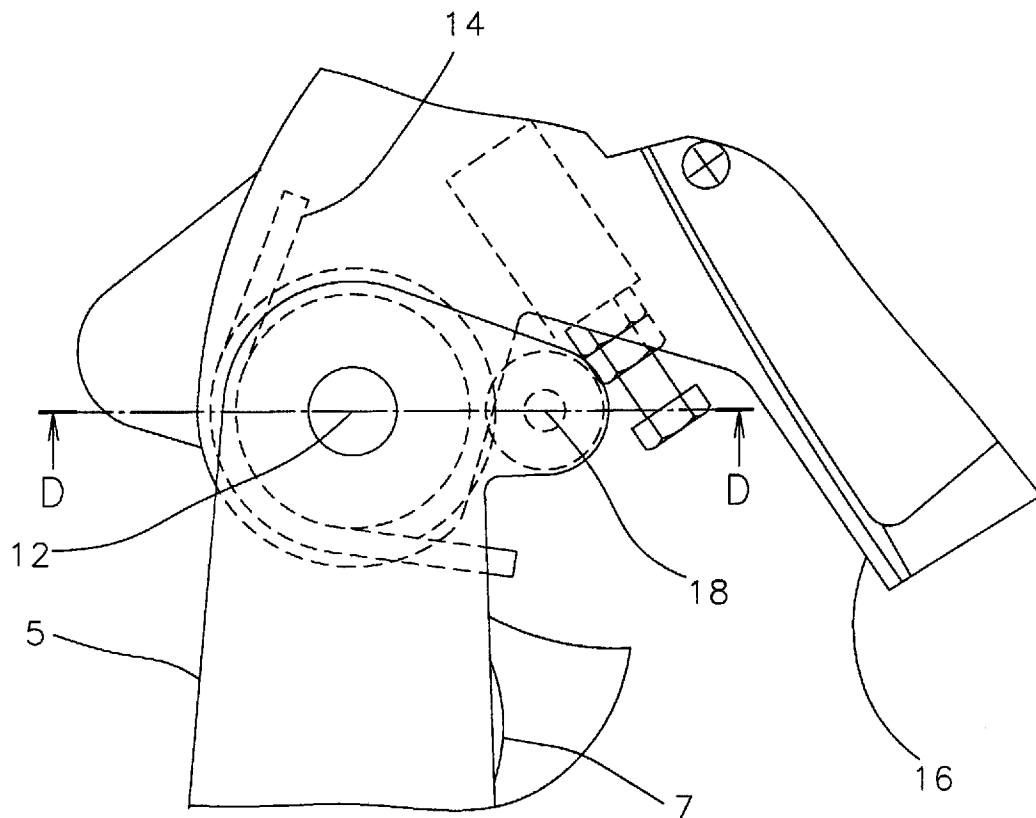
[Fig. 3]

FIG. 3

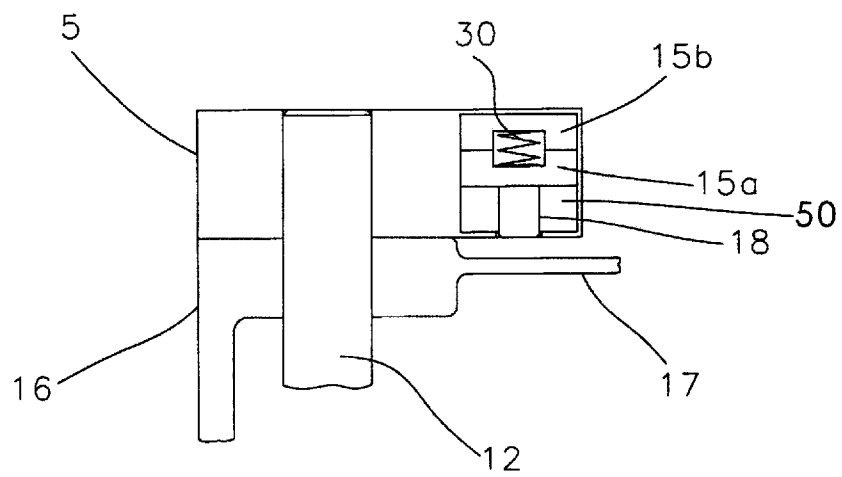
[Fig. 4]

FIG. 4

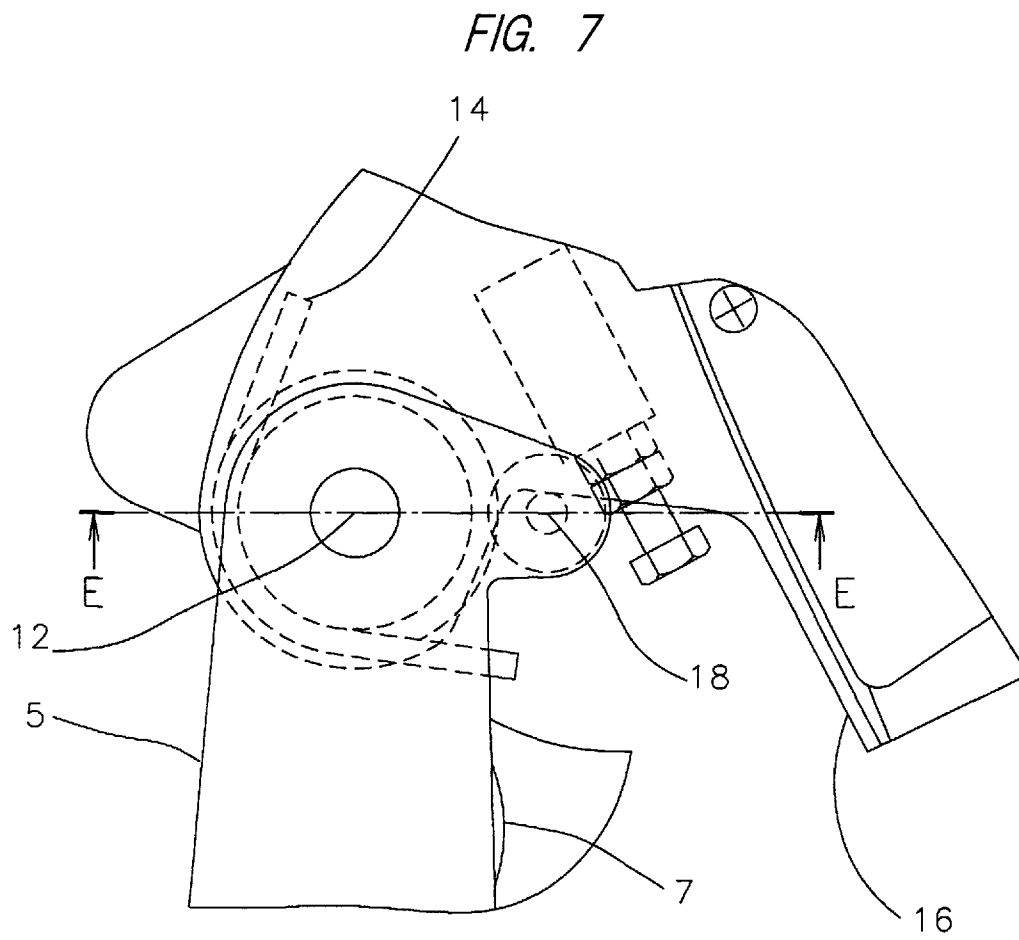
[Fig. 5]

FIG. 5

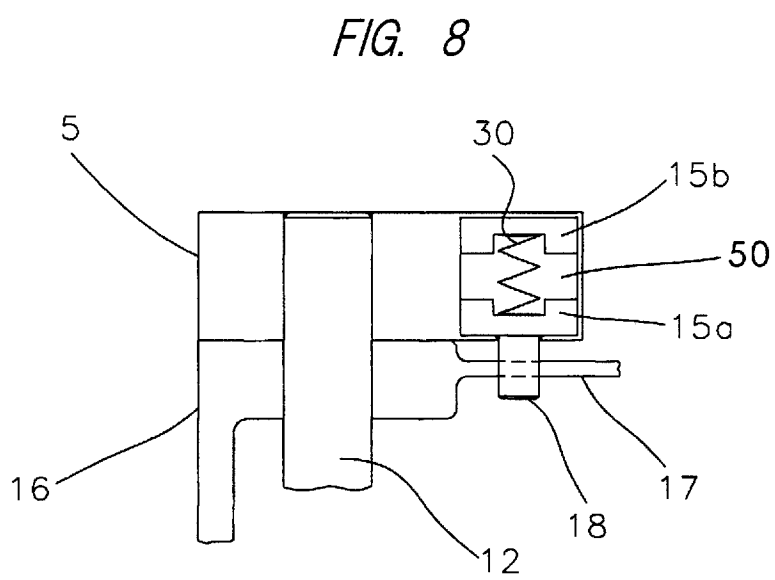
[Fig. 6]

FIG. 6

[Fig. 7]

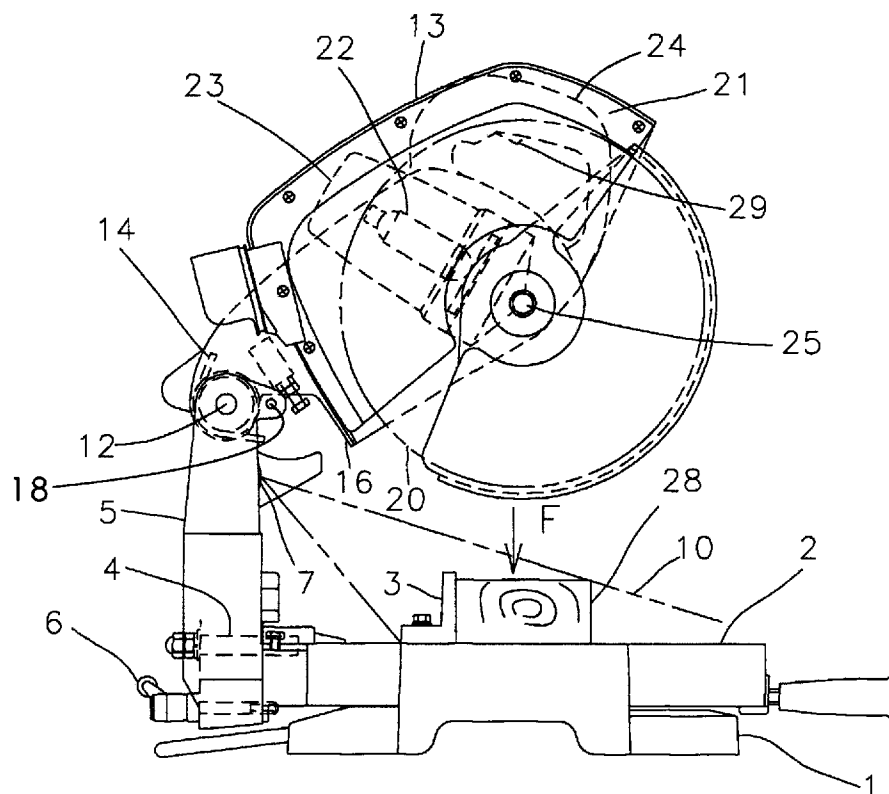


[Fig. 8]



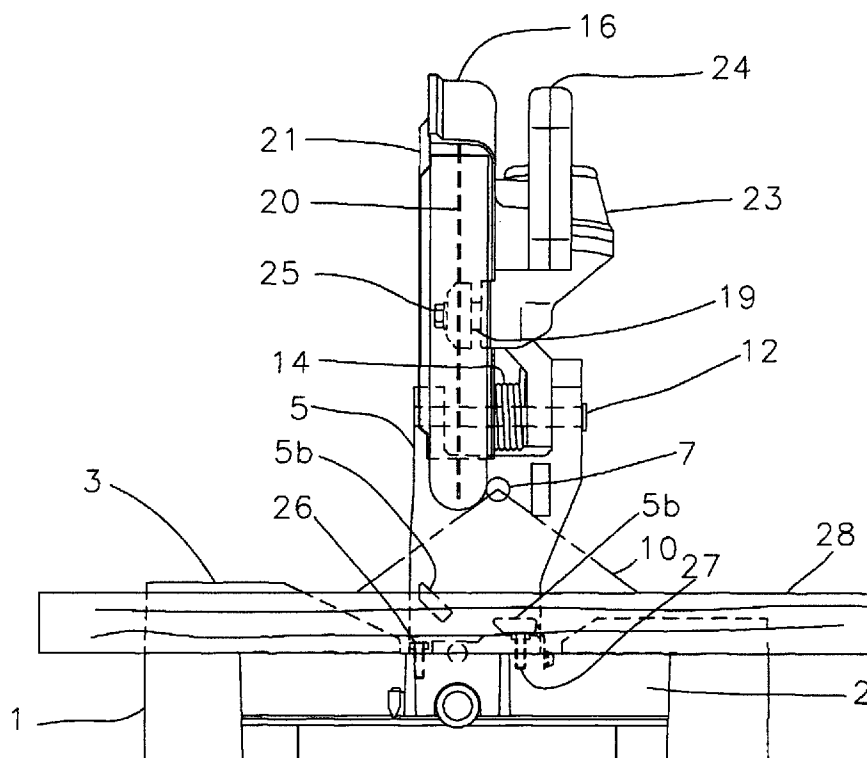
[Fig. 9]

FIG. 9



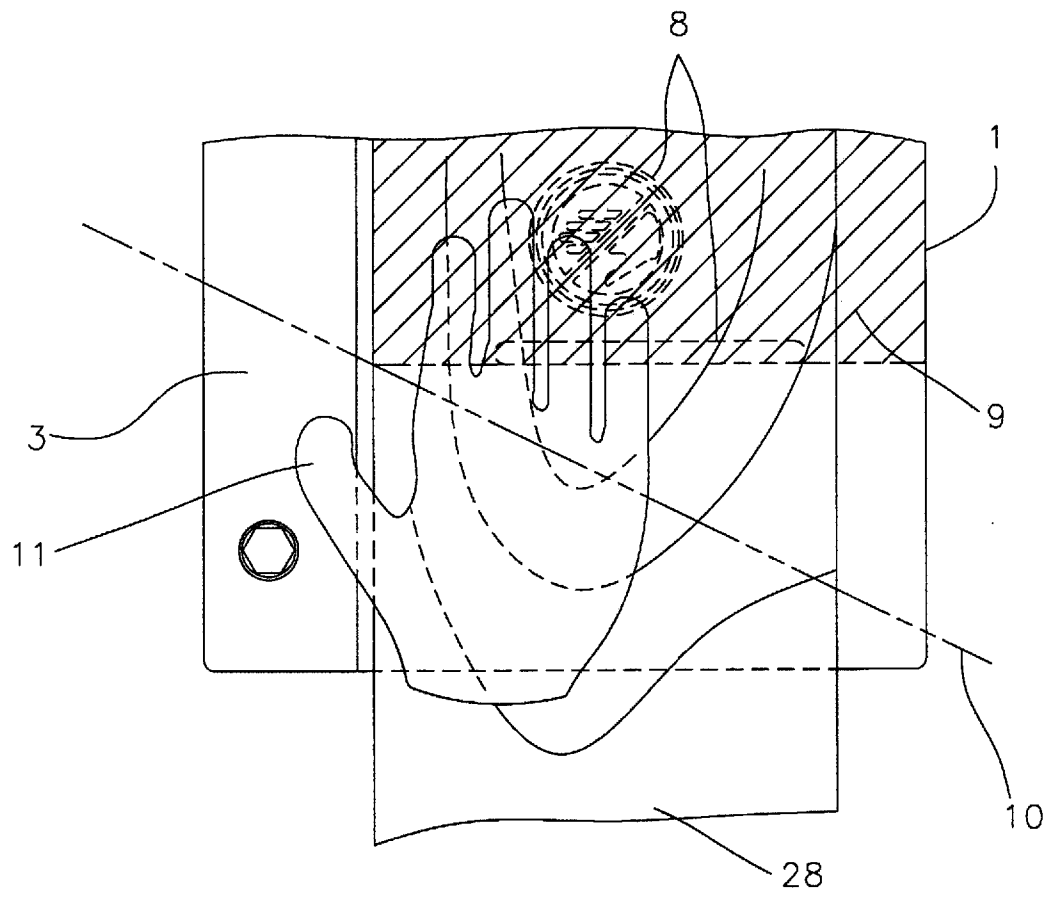
[Fig. 10]

FIG. 10



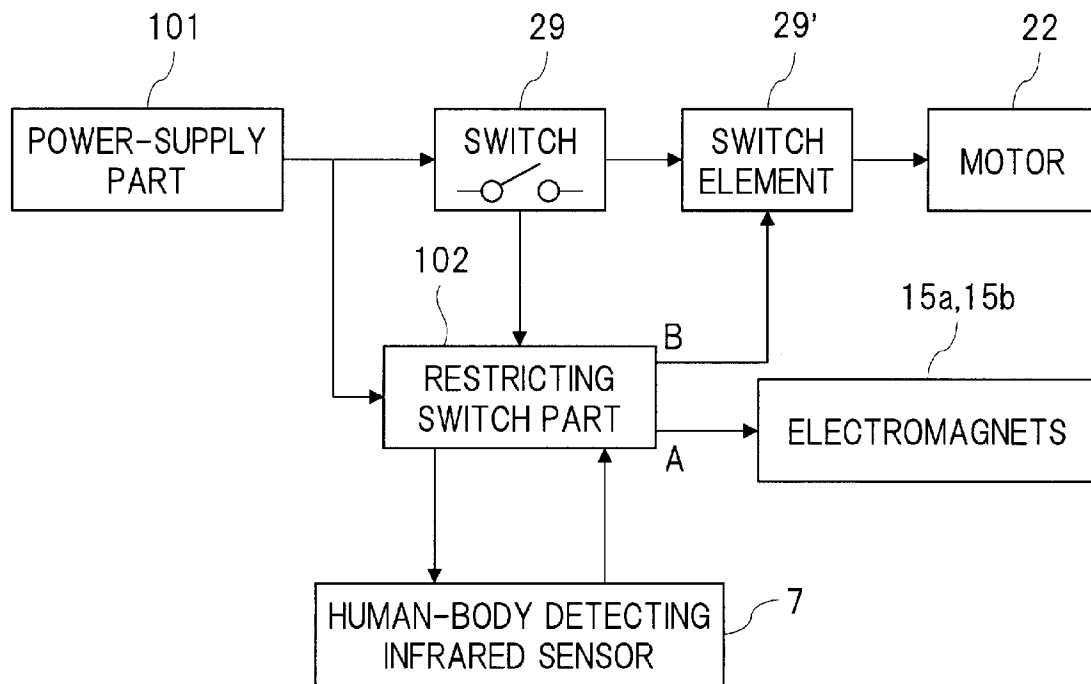
[Fig. 11]

FIG. 11



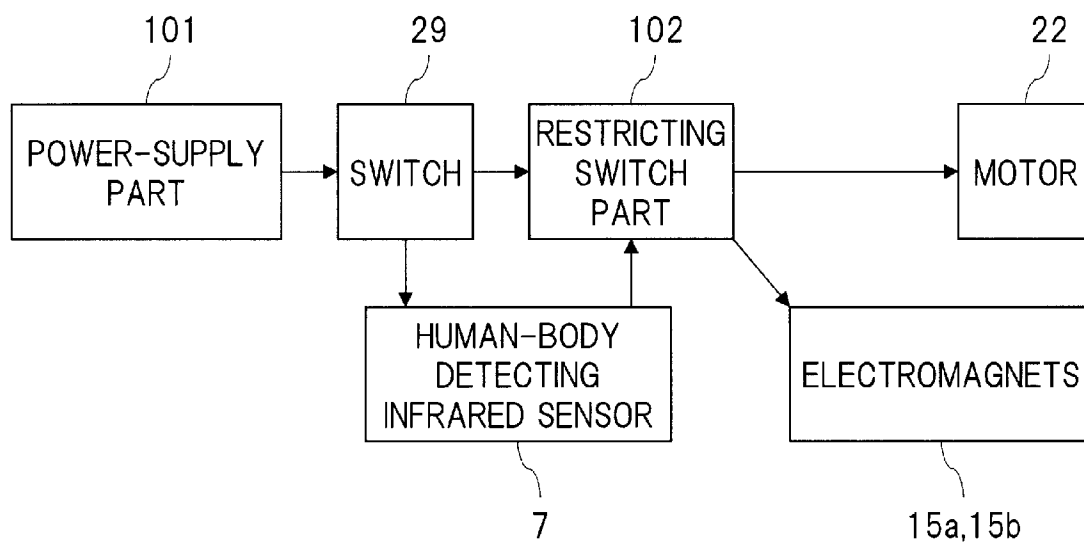
[Fig. 12]

FIG. 12



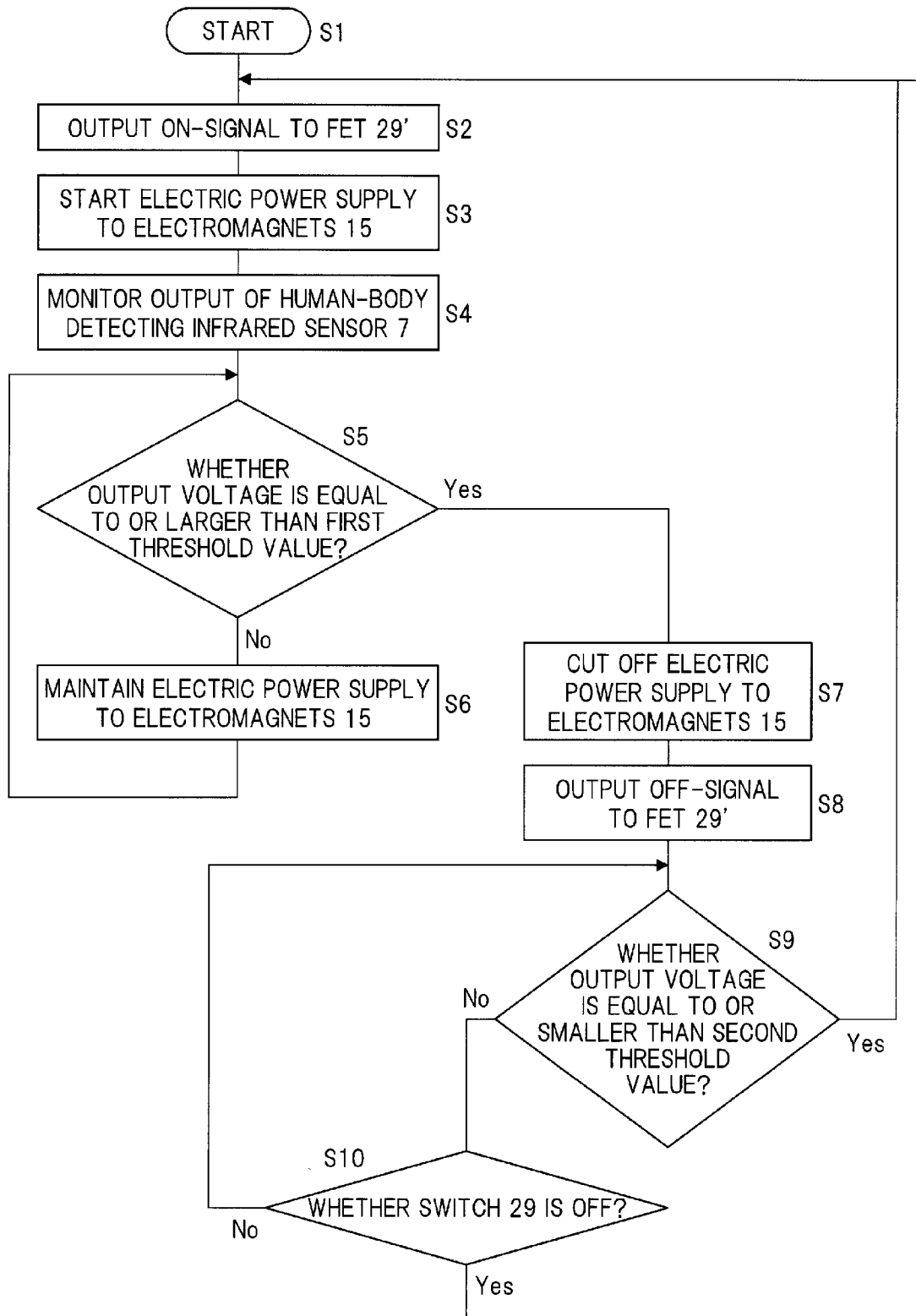
[Fig. 13]

FIG. 13



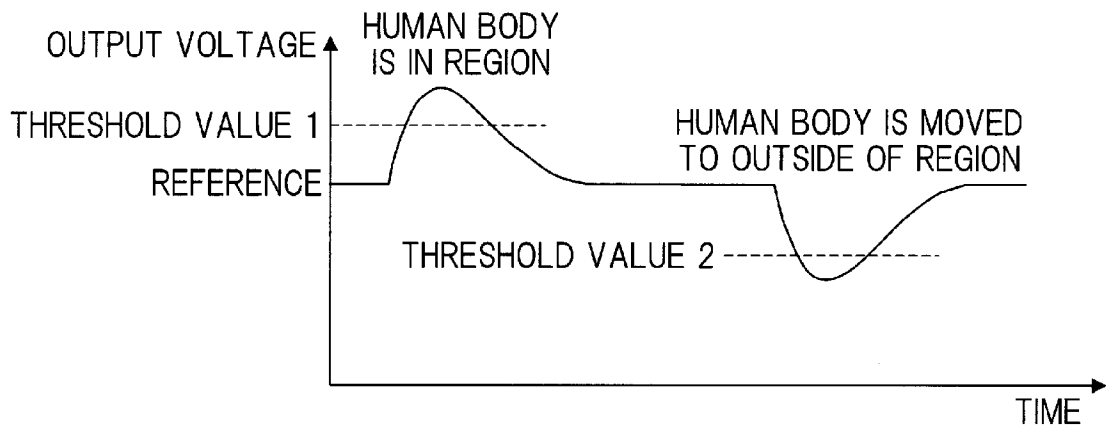
[Fig. 14]

FIG. 14



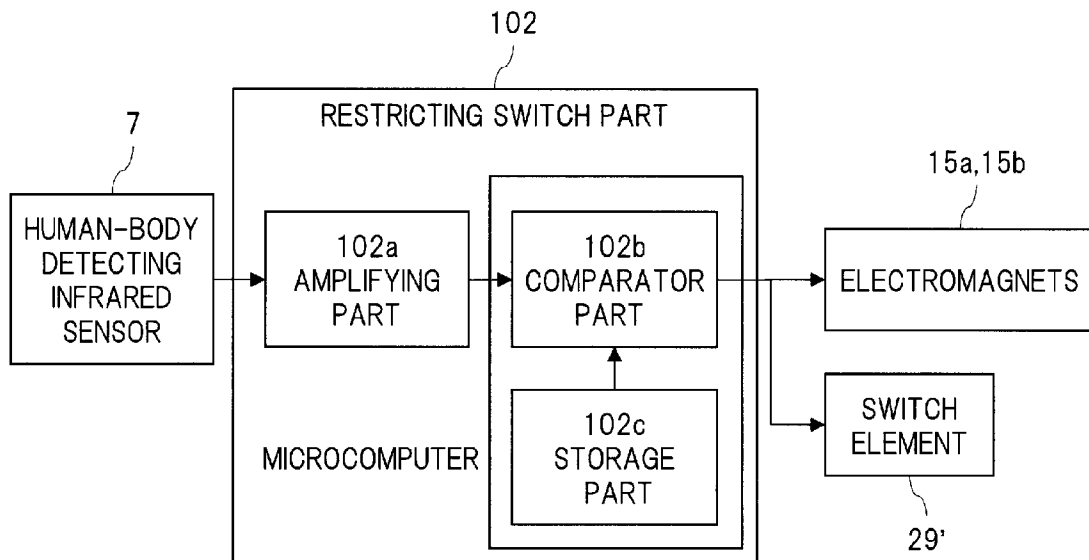
[Fig. 15]

FIG. 15



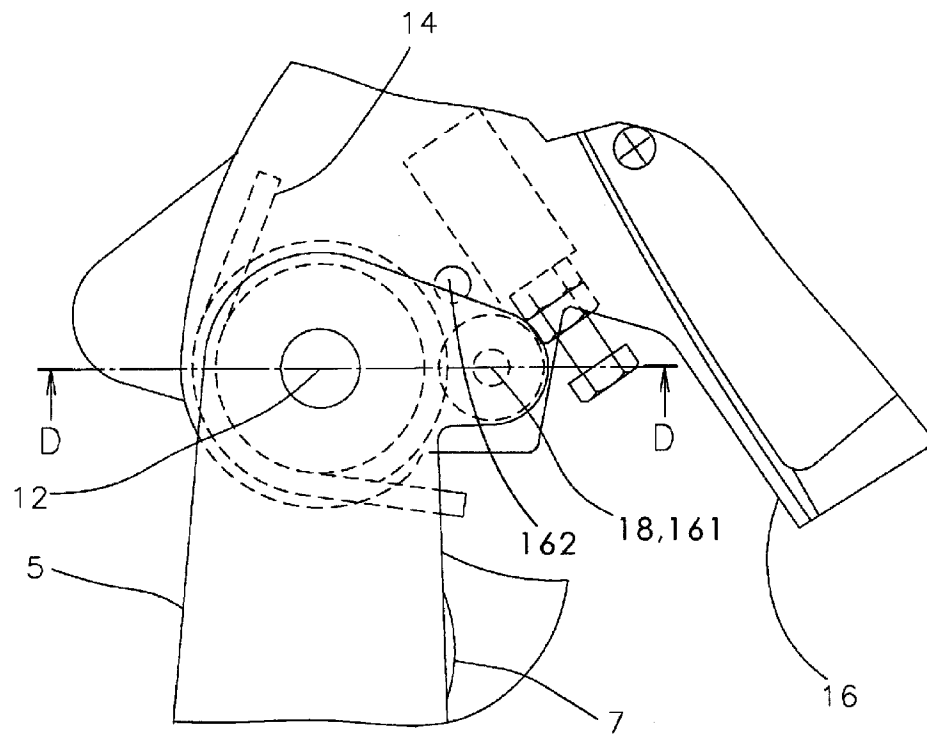
[Fig. 16]

FIG. 16



[Fig. 17]

FIG. 17



INTERNATIONAL SEARCH REPORT

International application No

PCT/JP2012/005162

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B27G19/02 F16P3/14
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 B27G F16P

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2009/040153 A1 (BOSCH GMBH ROBERT [DE]; VISEL BENJAMIN [DE]; STELLMANN GEORG [DE]; PLA) 2 April 2009 (2009-04-02) page 14, line 8 - page 17, line 14; figure 4 page 18, lines 17-27 -----	1-10
X	US 2004/040426 A1 (GASS STEPHEN F [US] ET AL) 4 March 2004 (2004-03-04) abstract -----	1
A	WO 03/006213 A2 (BLACK & DECKER INC [US]; O'BANION MICHAEL [US]; CARRIER DAVID A [US];) 23 January 2003 (2003-01-23) abstract -----	1



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Date of the actual completion of the international search

7 November 2012

Date of mailing of the international search report

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Garella, Mario

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/JP2012/005162

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2009040153	A1	02-04-2009	AT 536952 T 15-12-2011
		CN 102046315 A 04-05-2011	
		DE 102007044800 A1 02-04-2009	
		EP 2195133 A1 16-06-2010	
		ES 2376794 T3 16-03-2012	
		JP 2010538855 A 16-12-2010	
		RU 2010115258 A 27-10-2011	
		US 2011277609 A1 17-11-2011	
		WO 2009040153 A1 02-04-2009	

US 2004040426	A1	04-03-2004	NONE

WO 03006213	A2	23-01-2003	AT 489605 T 15-12-2010
		AU 2002326360 A1 29-01-2003	
		CA 2453352 A1 23-01-2003	
		CN 1547521 A 17-11-2004	
		EP 1432553 A2 30-06-2004	
		US 2004226424 A1 18-11-2004	
		US 2008078470 A1 03-04-2008	
		US 2011079124 A1 07-04-2011	
		US 2012260785 A1 18-10-2012	
		WO 03006213 A2 23-01-2003	
