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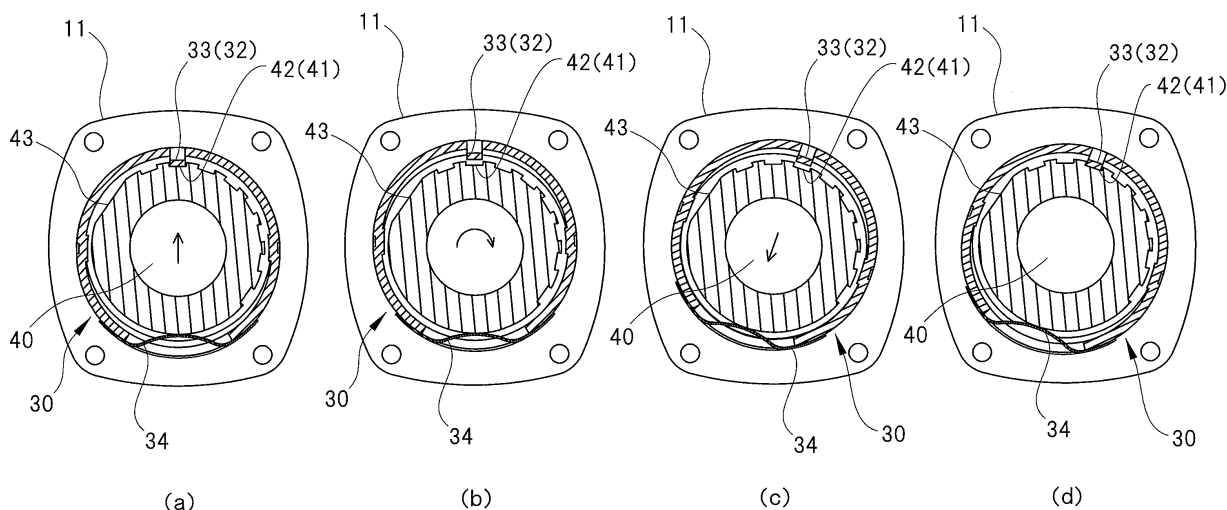
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(54) **GRINDER**

(57) A grinder 1 includes an attachment base 41 provided on a main body 5, which is rotatably retaining a spindle 20, and surrounding the spindle 20; a mating portion 32 provided on the wheel guard 30 and mated with the attachment base 41; a recessed portion provided on the attachment base 41; a protruding portion provided on the mating portion 32; and a plate spring disposed between the attachment base 41 and the mating portion

32, and when the wheel guard 30 is displaced in the radial direction of the spindle 20 against bias of the plate spring, mating between the recessed portion and the protruding portion is cancelled, and the wheel guard 30 is turnable in the circumferential direction of the spindle 20. As a result, the possibility that fixation of the wheel guard is cancelled against the intention of an operator is reduced as much as possible.

FIG. 5



Description

TECHNICAL FIELD

[0001] The present invention relates to a grinder to which a rotating tool is attached.

BACKGROUND ART

[0002] A grinder is provided with a spindle, which is subjected to a rotary drive, and various rotating tools are attached to the spindle depending on purposes and uses. For example, a disk-shaped grinding stone, a brush, a cutter, etc. are attached to the spindle of the grinder. The grinding stone to be attached to the spindle of the grinder includes a grinding stone for polishing and a grinding stone for cutting. The brush to be attached to the spindle of the grinder includes a wire brush and a wireless brush. The cutter to be attached to the spindle of the grinder includes a diamond cutter. In the below explanations, various rotating tools attached to the spindle may be collectively referred to as "wheel".

[0003] The grinder as described above is required to attach a wheel guard that covers 1/2 or more the outer circumference of the wheel. Moreover, when the grinder is used, the attachment position of the wheel guard has to be changed depending on purposes and uses.

[0004] Therefore, Patent Document 1 describes a grinder in which the attachment position of the wheel guard can be changed without using a tool such as a wrench or a screwdriver. In the grinder described in Patent Document 1, the wheel guard is turnably attached to a packing gland. The packing gland is provided with a retaining groove, and a set ring of the wheel guard is provided with a rib, which is mated with the retaining groove. Furthermore, between the packing gland and the set ring, a coiled spring, which prevents the rib mated with the retaining groove from falling, is disposed.

[0005] In the grinder described in Patent Document 1 provided with the above described structure, when the wheel guard is pushed up to the axial-direction upper side of the spindle against bias of the coiled spring, the mating between the retaining groove and the rib is cancelled. Therefore, fixation of the wheel guard is cancelled, and the attachment position of the wheel guard can be changed. Then, when push-up with respect to the wheel guard is cancelled, the rib is mated with the retaining groove again by the bias of the coiled spring. Therefore, the wheel guard is fixed at a new attachment position.

RELATED ART DOCUMENT

PATENT DOCUMENT

[0006] Patent Document 1: Japanese Utility Model Application Publication Laid-Open No. H6(1994)-36764

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007] In the grinder described in Patent Document 1, when the wheel guard is pushed up to the axial-direction upper side of the spindle, the fixation of the wheel guard is cancelled. Herein, in many cases, the wheel attached to the grinder is retained approximately parallel to the surface of an object such as stone, concrete and wood and is pushed against the object surface. At this point, if the wheel guard contacts the object surface for some reason, the force which is upward in the axial direction of the spindle is applied to the wheel guard. In other words, the force that acts to cancel the fixation of the wheel guard is applied to the wheel guard. Therefore, the fixation of the wheel guard may be cancelled against the intention of the operator who is using the grinder.

[0008] An object of the present invention is to reduce, as much as possible, the possibility that the fixation of the wheel guard is cancelled against the intention of the operator.

MEANS FOR SOLVING THE PROBLEMS

[0009] A grinder of the present invention is provided with a spindle to which a rotating tool is attached and a wheel guard covering the rotating tool attached to the spindle, and the grinder includes: an attachment base provided on a main body rotatably retaining the spindle, the attachment base surrounding the spindle; a mating portion provided on the wheel guard and mated with the attachment base; a recessed portion provided on either one of the attachment base and the mating portion; and a protruding portion provided on the other one of the attachment base and the mating portion. Then, when the wheel guard is displaced in a radial direction of the spindle, mating between the recessed portion and the protruding portion is cancelled, and the wheel guard is turnable in a circumferential direction of the spindle.

[0010] In an aspect of the present invention, the grinder is provided with an elastic body disposed between the attachment base and the mating portion, and when the wheel guard is displaced in a radial direction of the spindle against bias of the elastic body, the mating between the recessed portion and the protruding portion is cancelled, and the wheel guard is turnable in the circumferential direction of the spindle.

[0011] In another aspect of the present invention, the recessed portion is provided on an outer circumferential surface of the attachment base, the protruding portion is provided on an inner circumferential surface of the mating portion, and the elastic body is provided on the inner circumferential surface of the mating portion and at a position opposed to the protruding portion.

[0012] In another aspect of the present invention, the elastic body is a plate spring curved toward an inner side of the mating portion.

[0013] In another aspect of the present invention, the main body includes: a housing housing a drive source of the spindle; and a gear case rotatably retaining the spindle. The attachment base is integrally formed with a cover member covering an opening of the gear case.

[0014] In another aspect of the present invention, the grinder is provided with a projecting portion projecting inward from the inner circumferential surface of the mating portion, and an engaging portion projecting outward from the outer circumferential surface of the attachment base and engaged with the projecting portion.

[0015] In another aspect of the present invention, the recessed portion is provided on the attachment base, and the engaging portion is provided in a region of the attachment base excluding a region in which the recessed portion is provided.

[0016] In another aspect of the present invention, a grinder is provided with an output shaft to which a rotating tool is attached, a wheel guard covering the rotating tool, and an attachment base to which the wheel guard is attached, and the grinder includes: a recessed portion provided on either one of the wheel guard and the attachment base; and a protruding portion provided on the other one of the wheel guard and the attachment base. Then, the recessed portion and the protruding portion are mated with each other in a radial direction of the output shaft.

[0017] In another aspect of the present invention, the grinder is provided with an elastic body disposed between the wheel guard and the attachment base in the radial direction of the output shaft, and biasing either one of the protruding portion and the recessed portion toward the other one of the protruding portion and the recessed portion.

[0018] In another aspect of the present invention, the wheel guard is provided with either one of the protruding portion and the recessed portion, the elastic body, and a perpendicular part covering a radial-direction outer side of the rotating tool. The perpendicular part is provided in a side in which the elastic body is provided in relation with the output shaft.

[0019] In another aspect of the present invention, either one of the protruding portion and the recessed portion, and the elastic body are provided at symmetrical positions with respect to the output shaft.

[0020] In another aspect of the present invention, a grinder includes: an output shaft to which a rotating tool is attached; a wheel guard provided with a mating portion and a perpendicular part covering the rotating tool; and an attachment base to which the mating portion is attached. The wheel guard is movable from the mating-portion side to the perpendicular-part side, and the mating portion and the attachment base are mated with each other in a moving direction of the wheel guard.

[0021] In another aspect of the present invention, the grinder is provided with a recessed portion provided on either one of the mating portion and the attachment base, and a protruding portion provided on the other one of the mating portion and the attachment base. The recessed

portion and the protruding portion are disposed in an opposite side of the perpendicular part with respect to the output shaft.

[0022] In another aspect of the present invention, the grinder is provided with an elastic body biasing the wheel guard to the perpendicular-part side.

[0023] In another aspect of the present invention, the grinder is provided with an elastic body causing the recessed portion and the protruding portion to be mated with each other in a radial direction of the output shaft.

EFFECTS OF THE INVENTION

[0024] According to the present invention, the possibility that the fixation of the wheel guard is cancelled against the intention of the operator is reduced.

BRIEF DESCRIPTIONS OF THE DRAWINGS

[0025]

FIG. 1 a cross-sectional view showing a structure of a grinder to which the present invention is applied; FIG. 2 (a) is a bottom view of a packing gland, (b) is a lateral view, and (c) is a cross-sectional view taken along a line A-A shown in (b);

FIG. 3 (a) is a bottom view of a wheel guard, (b) is a lateral view, and (c) is a cross-sectional view taken along a line B-B shown in (b);

FIG. 4 (a) is a lateral view showing an attachment procedure of the wheel guard, and (b) is a cross-sectional view showing a mating state of an attachment base and a mating portion; and

FIGS. 5 (a) to (d) are explanatory views showing a procedure of changing the attachment position of the wheel guard.

Detailed Description of Preferred Embodiments

[0026] Hereinafter, an example of a grinder to which the present invention is applied will be explained in detail with reference to the drawings. As shown in FIG. 1, a grinder 1 according to the present embodiment is provided with a diamond grinding wheel (hereinafter, referred to as "grinding wheel 2".) serving as a rotating tool and is used in, for example, a grinding operation of planarizing the surfaces of concrete, stone, etc.

[0027] The grinder 1 is provided with a main body 5 including a housing 3 and a gear case 4. The housing 3 has an approximately cylindrical shape as a whole, and an electric motor 6 serving as a drive source is housed in the housing 3. The electric motor 6 is connected to a commercial electric-power source via an electric-power-source cord 7, which is extended from a rear end of the housing 3.

[0028] The gear case 4 has a case main body 10 and a packing gland 11 serving as a cover member, which covers an opening of the case main body 10, and is at-

tached to a distal end of the housing 3. Two bearings (a needle bearing 12 and a ball bearing 13) are provided in the gear case 4, and a spindle (output shaft) 20 is rotatably retained by these bearings. The spindle 20 is orthogonal to an output shaft 6a of the electric motor 6, and one end thereof is penetrating through the packing gland 11 and projecting to the outside. On the other hand, a bevel gear 22, which is meshed with a bevel gear 21 attached to the output shaft 6a of the electric motor 6, is attached to the other end of the spindle 20 positioned in the gear case 4. The rotation direction of the electric motor 6 is converted by 90 degrees by the above-described pair of bevel gears and is transmitted to the spindle 20 with a reduced rotation speed. In other words, the spindle 20 is subjected to rotary drive by the electric motor 6.

[0029] The grinding wheel 2 is provided with a substrate 2a including a disk-shaped steel plate, and a plurality of diamond grinding stones are fixed to a surface of the substrate 2a by adhesion or another means. Moreover, an attachment hole into which the spindle 20 is inserted is provided at the center of the substrate 2a, and the grinding wheel 2 is attached to the spindle 20, which penetrates through the attachment hole. Specifically, the grinding wheel 2 is fixed to the spindle 20 by a wheel washer (s) and a lock nut(s), and rotated integrally with the spindle 20. The housing 3 is provided with an unshown switch. When this switch is operated, electric power is supplied to the electric motor 6, and the output shaft 6a of the electric motor 6 is rotated. As a result, the spindle 20 coupled to the output shaft 6a via the above-described pair of bevel gears is rotated, and the grinding wheel 2 fixed to the spindle 20 is rotated.

[0030] A wheel guard 30 covering at least 1/2 or more the outer circumference of the grinding wheel 2 is attached to the gear case 4. Hereinafter, an attachment structure of the wheel guard 30 will be explained in detail.

[0031] As shown in FIGS. 2 (a) and (c), at the center of the packing gland 11, a through hole 40 through which the spindle 20 (FIG. 1) penetrates is provided. As shown in FIGS. 2 (a) to (c), a tubular attachment base 41 is integrally formed with a lower surface of the packing gland 11. The attachment base 41 is formed around the through hole 40 so as to surround the through hole 40. Moreover, the attachment base 41 is extending to the lower side along an axis of the through hole 40. In other words, the attachment base 41 is annularly formed, and the axis of the attachment base 41 and the axis of the through hole 40 are identical. Thus, the attachment base 41 surrounds the spindle 20 (FIG. 1) projecting from the through hole 40.

[0032] On an outer circumferential surface of the attachment base 41, a plurality of recessed portions 42 are provided along the circumferential direction thereof at a constant interval. Specifically, as shown in FIGS. 2 (a) and (c), the eight recessed portions 42 are formed across about half around the outer circumferential surface of the attachment base 41. On the other hand, a relief portion 43 is formed on the outer circumferential surface of the

attachment base 41 and in the region in which the recessed portions 42 are not formed. The relief portion 43 is dented toward the inner side of the attachment base 41, and a bottom surface of the relief portion 43 is flat.

Note that, as shown in FIGS. 2 (a) and (c), the eight recessed portions 42 include a recessed portion 42a which is opposed to the relief portion 43 with the center of the through hole 40 interposed therebetween. In other words, the relief portion 43 and the recessed portion 42a are disposed at the positions, which are different by 180 degrees from each other, and are opposed to each other. Furthermore, as shown in FIG. 2 (b), at an end (grinding wheel side) of the attachment base 41 and in a region in which the recessed portions 42 are not provided, engaging portions 41a, which are projecting outward from the outer circumferential surface of the attachment base 41 and engaged with projecting portions 35 (FIG. 3) of a later-described mating portion 32, are provided. Therefore, the engaging portions 41a are provided on the attachment base 41 and in the region excluding the regions in which the recessed portions 42 are provided.

[0033] As shown in FIG. 1, the wheel guard 30 has a cover portion including a horizontal part 30a, which is extending in the radial direction of the spindle 20, and a perpendicular part 30b, which is extending in the axial direction of the spindle 20 from a rim of the horizontal part 30a, and the wheel guard 30 has an approximately fan shape when seen in a plan view (FIG. 3 (a)). In other words, the horizontal part 30a of the wheel guard 30 is parallel to the rotation plane of the grinding wheel 2. On the other hand, the perpendicular part 30b of the wheel guard 30 is at a right angle with respect to the rotation plane of the grinding wheel 2 and covers the radial-direction outer side of the grinding wheel 2.

[0034] As shown in FIG. 3 (a), an approximately circular opening 31 is formed in the horizontal part 30a of the wheel guard 30. Moreover, as shown in FIG. 3 (b), the tubular mating portion 32 extending from the rim of the opening 31 to the upper side along the axis of the opening 31 is integrally formed on the upper surface of the horizontal part 30a. Note that the horizontal part 30a and the mating portion 32 which are separated from each other may be integrated by, for example, welding.

[0035] As shown in FIGS. 3 (a) and (c), a protruding portion 33 is provided on an inner circumferential surface of the mating portion 32. Moreover, a plate spring 34 serving as an elastic body is provided on the inner circumferential surface of the mating portion 32 and at the position opposed to the protruding portion 33. Therefore, the protruding portion 33 and the plate spring 34 are disposed at the positions, which are different from each other by 180 degrees, and are opposed to each other. In other words, the protruding portion 33 and the plate spring 34 are disposed at symmetrical positions with respect to the spindle 20 shown in FIG. 1. The plate spring 34 is curved toward the inner side of the mating portion 32. Specifically, while both ends of the plate spring 34 are fixed to the inner circumferential surface of the mating

portion 32, the center of the plate spring 34 is projecting toward the center of the mating portion 32. In other words, the plate spring 34 is curved so that the longitudinal-direction center thereof is the closest to the protruding portion 33. Furthermore, on the inner circumferential surface of the mating portion 32, the pair of projecting portions 35, which are projecting inward from the inner circumferential surface, are provided. The projecting amount of the projecting portion 35 toward the radial-direction inner side of the mating portion 32 is smaller than the projecting amount of the protruding portion 33. When the projecting portions 35 and the engaging portions 41a (FIG. 2 (b)) of the attachment base 41 are engaged with each other in the top-bottom direction, the wheel guard 30 can be prevented from falling from the attachment base 41. Moreover, the plate spring 34 and the protruding portion 33 are also engaged with the engaging portions 41a in the top-bottom direction, and the wheel guard 30 can be more reliably prevented from falling from the attachment base 41.

[0036] As shown in FIG. 4 (a), the wheel guard 30 is attached to the packing gland 11 from the lower side of the packing gland 11. In other words, the attachment base 41, which is extending from the lower surface of the packing gland 11 to the lower side, is mated with the inner side of the mating portion 32, which is extending from the upper surface of the wheel guard 30 to the upper side.

[0037] As shown in FIG. 4 (b), when the attachment base 41 is to be mated with the mating portion 32, the position of the relief portion 43 provided on the attachment base 41 and the position of the plate spring 34 provided on the mating portion 32 are aligned. When the relief portion 43 and the plate spring 34 are aligned, the position of the recessed portion 42a opposed to the relief portion 43 and the position of the protruding portion 33 opposed to the plate spring 34 automatically match. Note that it is obvious that, when the recessed portion 42a and the protruding portion 33 are aligned, the position of the relief portion 43 and the position of the plate spring 34 automatically match. In either case, when the attachment base 41 is mated with the mating portion 32, as shown in FIG. 4 (b), the plate spring 34 provided on the inner circumferential surface of the mating portion 32 is disposed between the inner circumferential surface of the mating portion 32 and the outer circumferential surface of the attachment base 41. More specifically, the plate spring 34 is disposed between the inner circumferential surface of the mating portion 32 and the bottom surface of the relief portion 43.

[0038] Then, when the mating portion 32 (wheel guard 30) shown in FIG. 4 (b) is turned counterclockwise, as shown in FIG. 5 (a), the plate spring 34 is pushed into the gap between the inner circumferential surface of the mating portion 32 and the outer circumferential surface of the attachment base 41 from the gap between the inner circumferential surface of the mating portion 32 and the bottom surface of the relief portion 43, and is bent. Then, by the elastic restoring force of the bent plate spring 34,

the wheel guard 30 is displaced (moved) from the mating-portion side to the perpendicular-part side shown in FIG. 3 (b). As a result, as shown in FIG. 5 (a), the protruding portion 33 at the position different by 180 degrees with respect to the plate spring 34 is attracted to the opposed recessed portion 42 and is mated with the recessed portion 42. Therefore, the attachment base 41 (recessed portion 42) and the mating portion 32 (protruding portion 33) are mated with each other by the bias of the plate spring 34, and the wheel guard 30 is fixed.

[0039] The position of the wheel guard 30 shown in FIG. 5 (a) is changed in a below manner. First, the wheel guard 30 is pushed (or pulled) to displace the wheel guard 30 in the radial direction (arrow direction) of the through hole 40 against the bias of the plate spring 34. In other words, the plate spring 34 is bent to displace (move) the wheel guard 30 from the perpendicular-part side to the mating-portion side shown in FIG. 3 (b). As a result, as shown in FIG. 5 (b), the protruding portion 33 is detached from the recessed portion 42. Therefore, the mating between the attachment base 41 (recessed portion 42) and the mating portion 32 (protruding portion 33) is cancelled, and fixation of the wheel guard 30 is cancelled. Note that it is obvious from the previous explanations and figures that the radial direction of the through hole 40 shown in FIG. 5 (a) and the radial direction of the spindle 20 shown in FIG. 1 are the same direction. Therefore, when the wheel guard 30 is displaced in the radial direction of the spindle 20 against the bias of the plate spring 34, the mating between the recessed portion 42 and the protruding portion 33 is cancelled, and the fixation of the wheel guard 30 is cancelled. Therefore, the wheel guard 30 is turnable in a circumferential direction of the spindle 20.

[0040] Then, while pushing (or pulling) with respect to the wheel guard 30 is maintained, the wheel guard 30 is turned by a desired angle to an arrow direction shown in FIG. 5 (b). For example, as shown in FIG. 5 (b) and (c), the wheel guard 30 is turned by the amount corresponding to a single recessed portion.

[0041] Then, when pushing (or pulling) with respect to the wheel guard 30 is cancelled, as shown in FIG. 5 (d), the protruding portion 33 is mated with the new recessed portion 42 by the bias of the plate spring 34, and the wheel guard 30 is fixed again. Note that, in order to displace the wheel guard 30 in the above described manner, a clearance is required between the inner circumferential surface of the mating portion 32 and the outer circumferential surface of the attachment base 41. Specifically, when the wheel guard 30 is displaced in the radial direction of the spindle 20, the protruding portion 33 is also displaced (moved) to the same direction by the same distance. Then, in order to detach the protruding portion 33, which is mated with the recessed portion 42, from the recessed portion 42, the moving distance of the protruding portion 33 has to exceed the mating length. Therefore, a clearance required for ensuring the moving distance exceeding the mating length is provided between the inner circumferential surface of the mating por-

tion 32 and the outer circumferential surface of the attachment base 41. In the present embodiment, a cross-sectional shape of the mating portion 32 is an approximately elliptical shape, thereby ensuring the above described clearance.

[0042] In the present embodiment, when the wheel guard 30 shown in FIG. 1 is displaced in the radial direction of the spindle 20, the mating between the recessed portion 42 (FIG. 2) provided on the packing gland 11 and the protruding portion 33 (FIG. 3) provided on the wheel guard 30 is cancelled, and the fixation of the wheel guard 30 is cancelled. In other words, even if upward force in the axial direction of the spindle 20 or downward force in the axial direction thereof is applied to the wheel guard 30, the mating between the recessed portion 42 and the protruding portion 33 is not cancelled, and the fixation of the wheel guard 30 is also not cancelled. Therefore, the possibility that the fixation of the wheel guard 30 is cancelled against the intention of an operator who is using the grinder 1 is extremely low. Furthermore, when the grinding wheel 2 shown in FIG. 1 is broken during rotation, in many cases, broken pieces of the grinding wheel 2 collide with the inner surface of the perpendicular part 30b of the wheel guard 30. At that point, outward force in the radial direction of the spindle 20 is applied to the wheel guard 30. In other words, the force that acts so as to cancel the fixation of the wheel guard 30 is applied to the wheel guard 30.

[0043] However, as shown in FIGS. 3 (a) and (c), the protruding portion 33 is disposed in the opposite side of the perpendicular part 30b with the center of the mating portion 32 interposed therebetween. Therefore, the force applied to the wheel guard 30 when the broken pieces of the grinding wheel 2 collide with the inner surface of the perpendicular part does not detach the protruding portion 33 from the recessed portion 42 (FIG. 2). In other words, the force applied to the wheel guard 30 when the broken pieces of the grinding wheel 2 collide with the inner surface of the perpendicular part may act to reinforce the mating between the recessed portion 42 and the protruding portion 33, but does not act to cancel the mating between the recessed portion 42 and the protruding portion 33. Furthermore, in order to cancel the fixation of the wheel guard 30, only the wheel guard 30 is required to be operated. Therefore, compared with the case in which a cancellation button for cancelling the fixation of the wheel guard 30 is provided, the number of parts is reduced. Moreover, the fixation of the wheel guard 30 can be easily cancelled even with a work glove (s) on, and as a result the operability is good. Furthermore, the possibility that the fixation of the wheel guard 30 is cancelled when an operation is carried out by pushing the main body 5 against the grinding wheel 2 side is extremely low.

[0044] The present invention is not limited to the above described embodiment, and various modifications can be made without departing from the gist thereof. For example, the plate spring 34 serving as the elastic body

can be replaced by a coiled spring, rubber, or the like. Moreover, the protruding portion 33 is only required to be provided on either one of the attachment base 41 and the mating portion 32, and the recessed portion 42 is only required to be provided on the other one of the attachment base 41 and the mating portion 32. Therefore, the protruding portion 33 can be provided on the attachment base 41, and the recessed portion 42 can be provided on the mating portion 32. Moreover, the protruding portion 33 is only required to be provided on either one of the wheel guard 30 and the attachment base 41, and the recessed portion 42 is only required to be provided on the other one of the wheel guard 30 and the attachment base 41. Furthermore, the number and disposition of the recessed portion 42 and the protruding portion 33 can be appropriately changed as necessary.

Reference Signs List

[0045]

1	GRINDER
2	GRINDING WHEEL
2a	SUBSTRATE
3	HOUSING
4	GEAR CASE
5	MAIN BODY
6	ELECTRIC MOTOR
6a	OUTPUT SHAFT
7	ELECTRIC-POWER-SOURCE CORD
10	CASE MAIN BODY
11	PACKING GLAND
12	NEEDLE BEARING
13	BALL BEARING
20	SPINDLE
21	BEVEL GEAR
22	BEVEL GEAR
30	WHEEL GUARD
30a	HORIZONTAL PART
30b	PERPENDICULAR PART
31	OPENING
32	MATING PORTION
33	PROTRUDING PORTION
34	PLATE SPRING
35	PROJECTING PORTION
40	THROUGH HOLE
41	ATTACHMENT BASE
41a	ENGAGING PORTION
42, 42a	RECESSED PORTION
43	RELIEF PORTION

Claims

1. A grinder provided with a spindle to which a rotating tool is attached and a wheel guard covering the rotating tool attached to the spindle, the grinder comprising:

- an attachment base provided on a main body rotatably retaining the spindle, the attachment base surrounding the spindle;
 a mating portion provided on the wheel guard and mated with the attachment base;
 a recessed portion provided on either one of the attachment base and the mating portion; and
 a protruding portion provided on the other one of the attachment base and the mating portion, wherein when the wheel guard is displaced in a radial direction of the spindle, mating between the recessed portion and the protruding portion is cancelled, and
 the wheel guard is turnable in a circumferential direction of the spindle.
2. The grinder according to claim 1, comprising an elastic body disposed between the attachment base and the mating portion,
 wherein when the wheel guard is displaced in a radial direction of the spindle against bias of the elastic body, the mating between the recessed portion and the protruding portion is cancelled, and
 the wheel guard is turnable in the circumferential direction of the spindle.
3. The grinder according to claim 2,
 wherein the recessed portion is provided on an outer circumferential surface of the attachment base, the protruding portion is provided on an inner circumferential surface of the mating portion, and the elastic body is provided on the inner circumferential surface of the mating portion and at a position opposed to the protruding portion.
4. The grinder according to claim 3,
 wherein the elastic body is a plate spring curved toward an inner side of the mating portion.
5. The grinder according to any of claims 1 to 4,
 wherein the main body includes:
 a housing housing a drive source of the spindle;
 and
 a gear case rotatably retaining the spindle, and
 the attachment base is integrally formed with a cover member covering an opening of the gear case.
6. The grinder according to any of claims 1 to 5, comprising:
 a projecting portion projecting inward from the inner circumferential surface of the mating portion; and
 an engaging portion projecting outward from the outer circumferential surface of the attachment base and engaged with the projecting portion.
7. The grinder according to claim 6,
 wherein the recessed portion is provided on the attachment base, and
 the engaging portion is provided in a region of the attachment base excluding a region in which the recessed portion is provided.
8. A grinder provided with an output shaft to which a rotating tool is attached, a wheel guard covering the rotating tool, and an attachment base to which the wheel guard is attached, the grinder comprising:
 a recessed portion provided on either one of the wheel guard and the attachment base; and
 a protruding portion provided on the other one of the wheel guard and the attachment base, wherein the recessed portion and the protruding portion are mated with each other in a radial direction of the output shaft.
9. The grinder according to claim 8, comprising an elastic body disposed between the wheel guard and the attachment base in the radial direction of the output shaft, and biasing either one of the protruding portion and the recessed portion toward the other one of the protruding portion and the recessed portion.
10. The grinder according to claim 9,
 wherein the wheel guard is provided with either one of the protruding portion and the recessed portion, the elastic body, and a perpendicular part covering a radial-direction outer side of the rotating tool, and the perpendicular part is provided in a side in which the elastic body is provided in relation with the output shaft.
11. The grinder according to claim 10,
 wherein either one of the protruding portion and the recessed portion, and the elastic body are provided at symmetrical positions with respect to the output shaft.
12. A grinder comprising:
 an output shaft to which a rotating tool is attached;
 a wheel guard provided with a mating portion and a perpendicular part covering the rotating tool; and
 an attachment base to which the mating portion is attached,
 wherein the wheel guard is movable from the mating-portion side to the perpendicular-part side, and
 the mating portion and the attachment base are mated with each other in a moving direction of the wheel guard.

13. The grinder according to claim 12, comprising:

a recessed portion provided on either one of the mating portion and the attachment base; and
a protruding portion provided on the other one of the mating portion and the attachment base, wherein the recessed portion and the protruding portion are disposed in an opposite side of the perpendicular part with respect to the output shaft.

14. The grinder according to claim 13, comprising an elastic body biasing the wheel guard to the perpendicular-part side.

15. The grinder according to claim 13, comprising an elastic body causing the recessed portion and the protruding portion to be mated with each other in a radial direction of the output shaft.

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FIG. 1

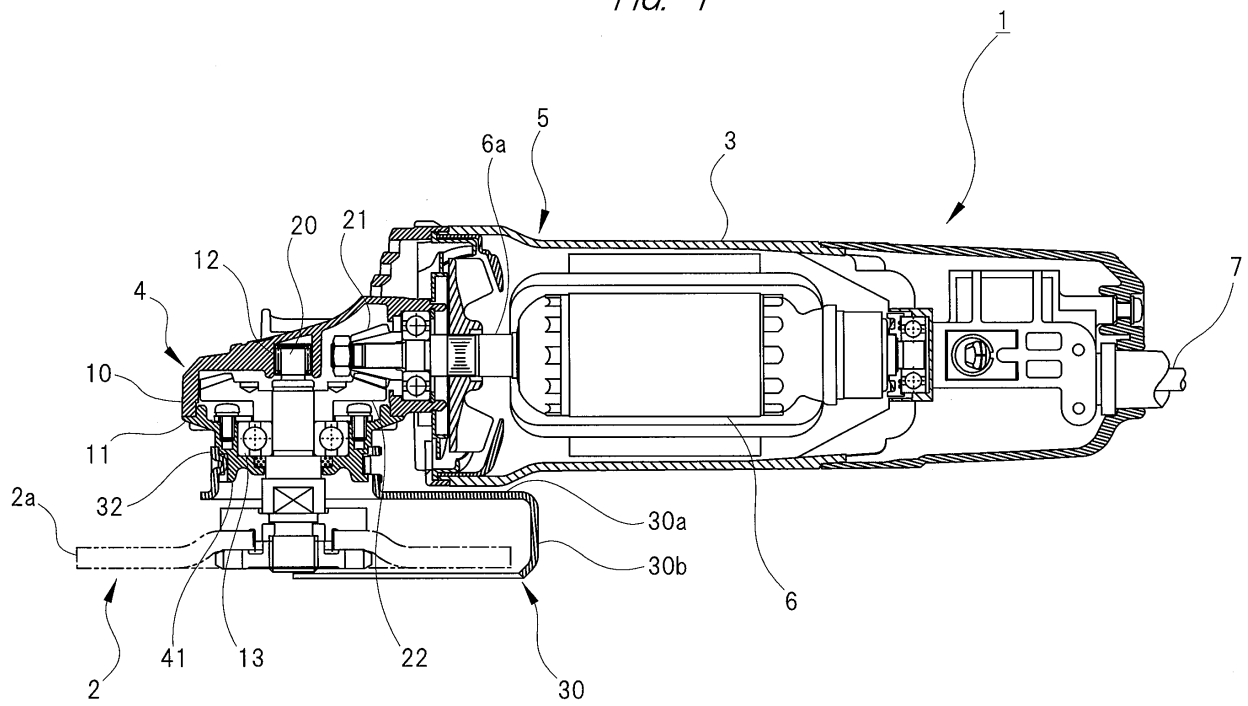


FIG. 2

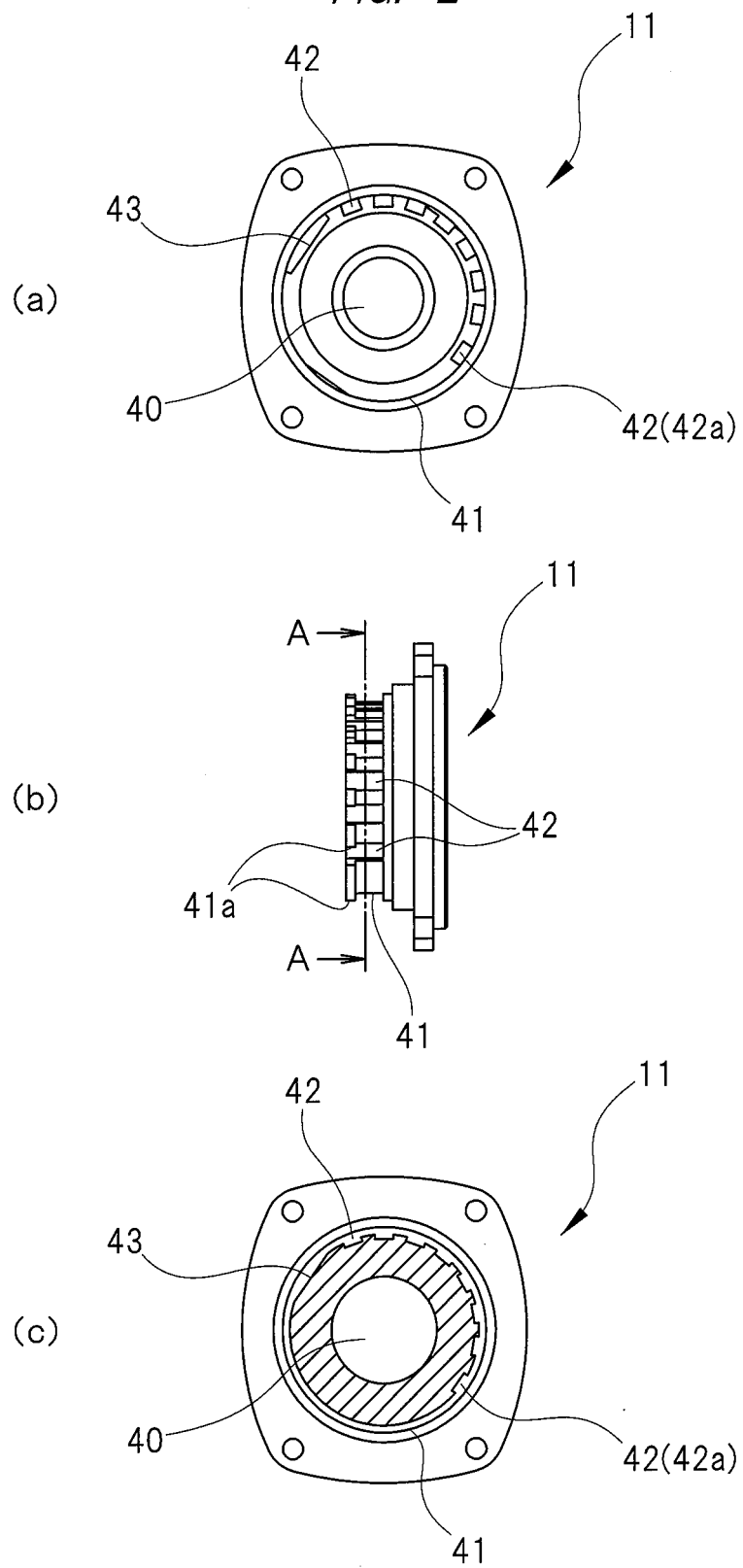


FIG. 3

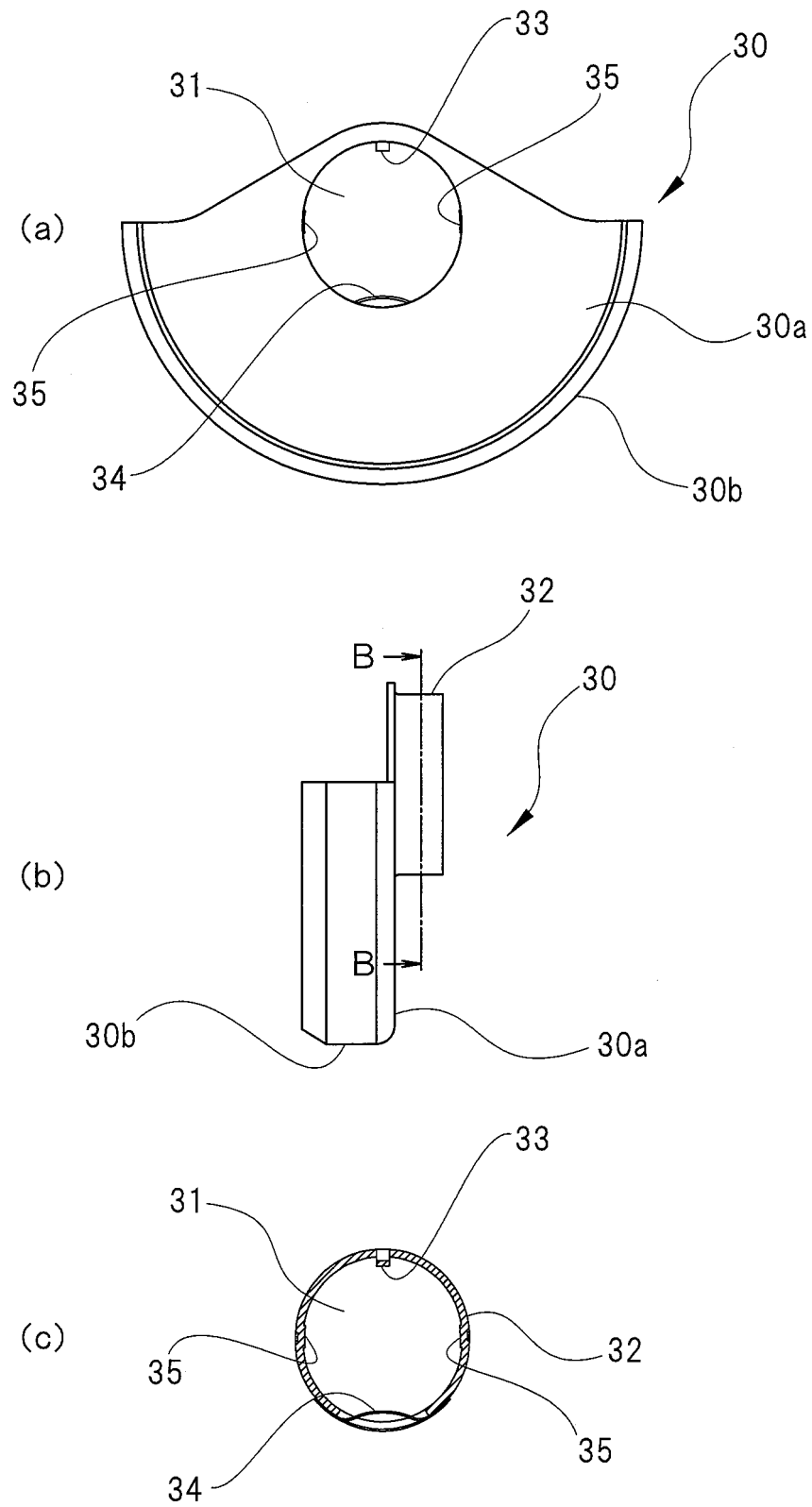


FIG. 4

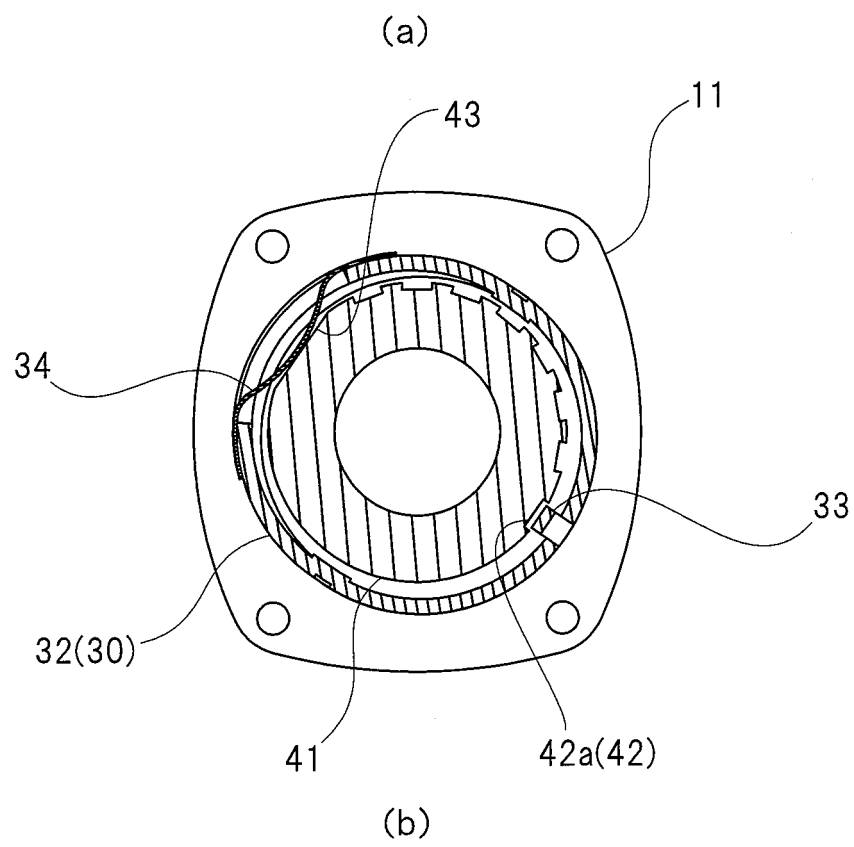
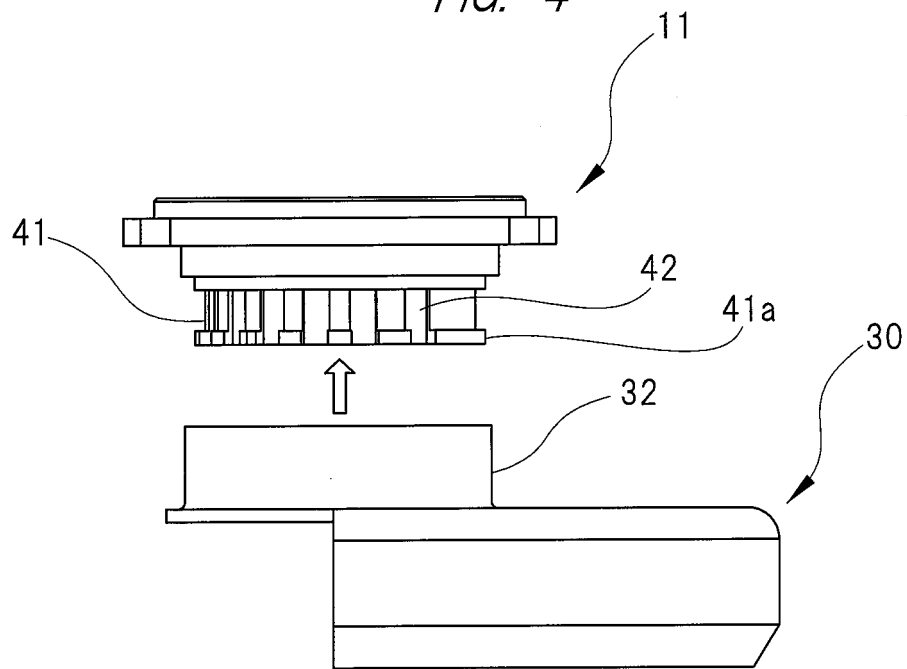
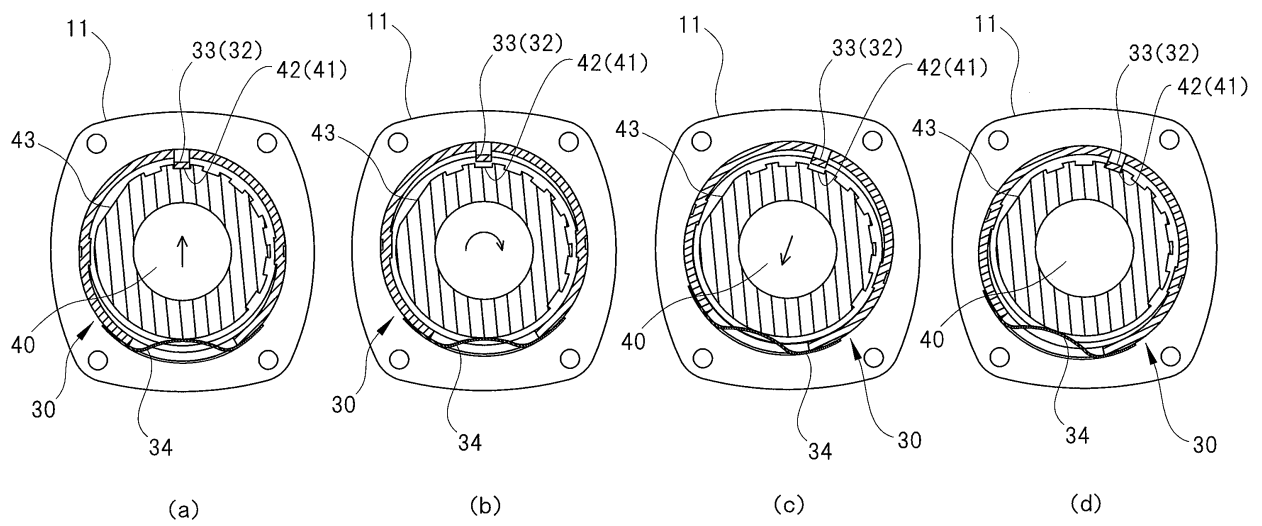


FIG. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/069709

A. CLASSIFICATION OF SUBJECT MATTER

B24B23/02(2006.01)i, B23Q11/08(2006.01)i, B24B55/05(2006.01)i

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)

B24B23/02, B23Q11/08, B24B55/05, B23Q11/06, B28D1/00

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 2010/0178857 A1 (ESENWEIN Florian), 15 July 2010 (15.07.2010), paragraphs [0033] to [0040]; fig. 1 to 4 & EP 2596906 A2 & WO 2009/059839 A1 & DE 102007052684 A1 & CN 101848790 A	8-9 1-7, 10-15
X A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 9336/1985 (Laid-open No. 127966/1986) (Mitsubishi Electric Corp.), 11 August 1986 (11.08.1986), page 3, line 20 to page 4, line 6; fig. 1 to 2 (Family: none)	8-10 1-7, 11-15

☒ Further documents are listed in the continuation of Box C.
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Date of the actual completion of the international search
03 September, 2014 (03.09.14)Date of mailing of the international search report
16 September, 2014 (16.09.14)Name and mailing address of the ISA/
Japanese Patent Office

Authorized officer

Facsimile No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2014/069709

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DE 3913898 A1 (MUSA Gocmez), 31 October 1990 (31.10.1990), entire text; all drawings (Family: none)	1-15
A	US 2006/0052041 A1 (WIKER Juergen), 09 May 2006 (09.05.2006), entire text; all drawings & WO 2004/056529 A1 & DE 10259520 A1 & CN 1729081 A	1-15
A	US 5637035 A (YEE Chungkin), 10 June 1997 (10.06.1997), entire text; all drawings & GB 2302717 A & DE 19618954 A1	1-15
A	US 2009/0029635 A1 (BOECK Cornelius), 29 January 2009 (29.01.2009), entire text; all drawings & WO 2008/058793 A1 & DE 102007041840 A1 & CN 101535000 A	1-15

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Patent documents cited in the description

- JP H6199436764 B [0006]