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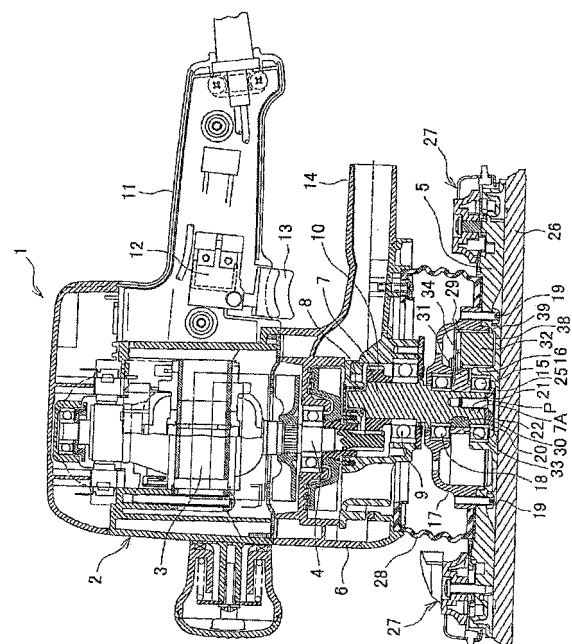
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(54) **Orbital sander**

(57) In an orbital sander, a main body (2) including a motor (3) is provided with a spindle (7) that is rotatable by driving the motor (3) and an eccentric shaft (7A) that is positioned eccentrically with respect to the center of rotation of the spindle (7) and that performs circular orbital motion along with rotation of the spindle (7), and a portion of the eccentric shaft (7A) that projects downward from the main body (2) is provided with a base (5) coupled via two bearings that are upper and lower bearings (18), (15) and a balancer (29) projecting to a side opposite the side of eccentricity of the eccentric shaft (7A). A center of gravity P of the base (5) is positioned between the two upper and lower bearings (18), (15).

FIG. 1



Description

Field of the Invention

[0001] The present invention relates to an orbital sander including a base that is provided below a main body including a motor and that performs orbital motion through rotation of the motor.

Description of the Related Art

[0002] In an orbital sander, as described in Japanese Patent Application Publication No. H06-226709, a rotary shaft projects below a main body including a motor, and a base is coupled via two bearings that are upper and lower bearings to an eccentric shaft provided at the lower end of the rotary shaft. By driving the motor to rotate the rotary shaft in order to cause the base to perform orbital motion (circular orbital motion), it is possible to grind a material to be ground with sanding paper or the like provided in a tensioned state on the bottom surface of the base.

[0003] In the orbital sander, a balancer is provided at the lower end of the eccentric shaft to project to a side opposite the side of eccentricity of the eccentric shaft. The balancer rotates along with the orbital motion of the base to produce a centrifugal force in order to reduce vibration of the main body.

[0004] In the orbital sander according to Japanese Patent Application Publication No. H06-226709, with the balancer positioned at the lower end of the eccentric shaft, the center of gravity of a portion that performs eccentric motion, which includes the base, is positioned below the lower end of the lower bearing. Therefore, the centrifugal force produced along with the orbital motion of the base is supported in a cantilever manner, which may cause inclination (backlash in random directions) between the eccentric shaft and the base to produce vibration.

[0005] With the balancer projecting significantly in the radial direction of the eccentric shaft, a coupling portion between the eccentric shaft and the base is increased in size, which may hinder a reduction in overall size.

[0006] Further, the balancer is made of a single material such as die-cast zinc or sintered iron, and accordingly the overall weight of the balancer is heavy, and the degree of freedom in designing the position of the center of gravity and the weight is low. Therefore, the size of the balancer is increased to produce a centrifugal force required to reduce vibration along with the size of the orbital sander, which may incur an increase in weight.

SUMMARY OF THE INVENTION

[0007] It is therefore an object of the present invention to provide an orbital sander in which inclination between an eccentric shaft and a base due to orbital motion of the base is effectively suppressed to reduce vibration.

[0008] In order to achieve the foregoing object, the in-

vention according to a first aspect provides an orbital sander in which a main body including a motor is provided with a rotary shaft that is rotatable by driving the motor and an eccentric shaft that is positioned eccentrically with respect to a center of rotation of the rotary shaft and that performs circular orbital motion along with rotation of the rotary shaft, and a portion of the eccentric shaft that projects downward from the main body is provided with a base coupled via two bearings that are upper and lower bearings and a balancer projecting to a side opposite a side of eccentricity of the eccentric shaft, in which a center of gravity of the base is positioned between the two upper and lower bearings.

[0009] The phrase "between the two upper and lower bearings" refers to a range between the respective centers of the bearings. The term "rotary shaft" refers to a spindle as the final rotary shaft for a product with speed reduction through gears, and to a motor shaft for a product with no speed reduction through gears (so-called "motor direct drive").

[0010] A second aspect of the present invention provides the orbital sander according to the first aspect, in which the balancer is provided above the lower bearing.

[0011] A third aspect of the present invention provides the orbital sander according to the second aspect, in which an outer portion of the balancer is formed to be bent downward.

[0012] A fourth aspect of the present invention provides the orbital sander according to any one of the first to third aspects, in which the balancer is connected using a key to a portion of the eccentric shaft located between the two upper and lower bearings, and a clearance is provided between upper and lower ends of the key and the two upper and lower bearings, respectively.

[0013] A fifth aspect of the present invention provides the orbital sander according to the fourth aspect, in which the key is disposed on a line in a direction of eccentricity of the eccentric shaft as seen from an axial direction of the eccentric shaft.

[0014] A sixth aspect of the present invention provides the orbital sander according to any one of the first to fifth aspects, in which a retainer that holds the lower bearing is fixed to a lower end of the eccentric shaft by a screw provided at the center of rotation of the rotary shaft.

[0015] In addition, preferably, as in a seventh aspect of the present invention, the balancer projects downward such that a lower end of the balancer is positioned between a center of the lower bearing and a lower surface of the base in an up-down direction. Preferably, as in a fourteenth aspect of the present invention, the balancer is formed by combining a plurality of members with each other, and for at least some of the plurality of combined members, a member located farther from a center of the rotary shaft or the eccentric shaft is formed from a material that is higher in specific gravity than a material forming a member located closer to the center.

[0016] According to the first aspect of the present invention, with the center of gravity of the base positioned

as described above, inclination between the eccentric shaft and the base along with the orbital motion of the base can be effectively suppressed to reduce generation of vibration.

[0017] According to the second aspect of the present invention, in addition to the effect of the first aspect, the lower bearing can be positioned close to the lower end of the base. Therefore, the distance between the two upper and lower bearings can be secured to suitably support the eccentric shaft at two points.

[0018] According to the third aspect of the present invention, in addition to the effect of the second aspect, the center of gravity of the balancer can be aligned with the center of gravity of the base, which enables more stable orbital motion.

[0019] According to the fourth aspect of the present invention, in addition to the effect of any one of the first to third aspects, the key does not interfere with the bearings to incline the bearings during assembly of the key, which prevents deterioration in balance.

[0020] According to the fifth aspect of the present invention, in addition to the effect of the fourth aspect, deterioration in balance due to the key can be prevented.

[0021] According to the sixth aspect of the present invention, in addition to the effect of any one of the first to fifth aspects, deterioration in balance due to the retainer can be prevented.

[0022] According to the seventh aspect of the present invention, the radial dimension of the balancer can be reduced by extending the balancer downward. Therefore, projection of the balancer in the radial direction can be suppressed to achieve a reduction in overall size.

[0023] According to the fourteenth aspect of the present invention, it is unnecessary to increase the size of the balancer and it is possible to reduce the overall weight of the balancer, and thus, the degree of freedom can be enhanced in designing the position of the center of gravity and the weight. Therefore, it is possible to effectively produce a centrifugal force required to reduce vibration without incurring an increase in weight. This is because the centrifugal force is defined by weight $\times$ turning radius $\times$ angular speed², and therefore the weight of the balancer can be reduced by providing the balancer at a position at which the turning radius of the balancer is large.

BRIEF DESCRIPTION OF THE DRAWINGS

[0024]

FIG. 1 is a longitudinal cross-sectional view of an orbital sander;

FIG. 2 is an enlarged view of a portion around an eccentric shaft in FIG. 1;

FIG. 3 is an exploded perspective view of a spindle and a base; and

FIG. 4 is a perspective view of the spindle and a balancer.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] An embodiment of the present invention will be described below with reference to the drawings.

[0026] FIG. 1 is a longitudinal cross-sectional view showing an example of an orbital sander. An orbital sander 1 includes a base 5 formed in a rectangular shape as viewed in plan and provided below a main body 2 housing a motor 3 facing downward. A spindle 7, which is a rotary shaft extending in parallel with an output shaft 4 of the motor 3, projects downward from the lower portion of a housing 6 forming the main body 2 with the upper end and an intermediate portion of the spindle 7 axially supported by a needle bearing 8 and a ball bearing 9, respectively. A gear 10 provided at the upper end of the spindle 7 meshes with a pinion of the output shaft 4. With the upper end of the spindle 7 axially supported by the needle bearing 8, the distance between the spindle 7 and the output shaft 4 can be reduced, which contributes to a size reduction. Reference numeral 11 denotes a handle provided to project from a side surface of the housing 6 and including a switch 12 and a trigger 13. Reference numeral 14 denotes a discharge nozzle that discharges dust.

[0027] As also shown in FIG. 2, a lower portion of the spindle 7 that projects from the housing 6 is formed as an eccentric shaft 7A that is eccentric with respect to the center of rotation of an upper portion of the spindle 7. The center portion of the base 5 is rotatably coupled to the lower end of the eccentric shaft 7A via a ball bearing 15 serving as a lower bearing. The ball bearing 15 is held in a cylindrical boss 16 provided to project from the center portion of the base 5.

[0028] Meanwhile, a bearing retainer 17 in the shape of a deep dish that is circular as viewed in plan is provided on the upper surface of the base 5. A ball bearing 18, which is provided above the ball bearing 15 to serve as an upper bearing that axially supports the eccentric shaft 7A, is held by an upper center portion of the bearing retainer 17. The downwardly facing opening edge of the bearing retainer 17 is fixed to the base 5 by a plurality of screws 19, 19,

[0029] Reference numeral 20 denotes a retainer attached to the lower end of the eccentric shaft 7A by a countersunk screw 21 to hold the lower end of the ball bearing 15. The countersunk screw 21 is screwed coaxially with the center of rotation of the spindle 7. A through hole 22 for the countersunk screw 21 in the retainer 20 has a stepped shape formed by a tapered portion 23 with which the head portion of the countersunk screw 21 is fitted and an equal diameter portion 24 through which the threaded portion of the countersunk screw 21 passes. This prevents the countersunk screw 21 from projecting from the lower surface of the retainer 20 while securing the thickness (strength) of the retainer 20.

[0030] A clearance hole 25 that facilitates screwing of the countersunk screw 21 is formed in a portion of the

base 5 that opposes the retainer 20. In spite of the presence of the clearance hole 25, the lower surface of the retainer 20 is set to be positioned above the lower surface of the base 5.

[0031] Further, a pad 26 generally in the same shape as the base 5 is provided on the lower surface of the base 5. Sanding paper can be provided in a tensioned state on the lower surface of the pad 26 through clamp mechanisms 27, 27 provided at both ends of the base 5 in the longitudinal direction.

[0032] Meanwhile, a rubber sleeve 28 in the shape of cylindrical bellows is provided to extend between an opening at the lower end of the housing 6 and the upper surface of the base 5 including the bearing retainer 17. The rubber sleeve 28 restricts rotation of the base 5 about the eccentric shaft 7A.

[0033] A balancer 29 is connected using a key 30 to a portion of the eccentric shaft 7A located between the ball bearings 18, 15. As also shown in FIG. 3, the balancer 29 is formed by combining two members, namely an inner member 31 connected to the eccentric shaft 7A and an outer member 32 coupled to the inner member 31.

[0034] The inner member 31 is made of aluminum (specific gravity: 2.7) with a relatively low specific gravity, and includes a tubular portion 33 externally mounted on the eccentric shaft 7A to be integrally connected to the eccentric shaft 7A using the key 30, and a pair of arms 34, 34 provided to project from the tubular portion 33 in radial directions that are different from each other. In the embodiment, the angle between the arms 34, 34 is generally 90°.

[0035] In the embodiment, as shown in FIG. 2, a clearance C is provided between the upper and lower ends of the key 30 and the ball bearings 18, 15, respectively. The clearance C prevents the ball bearings 18, 15 from being inclined during assembly of the key 30. The key 30 is disposed on a line in the direction of eccentricity of the eccentric shaft 7A as seen from the axial direction of the eccentric shaft 7A to maintain the balance.

[0036] The outer member 32 is made of brass (specific gravity: 8.4) with a higher specific gravity than the inner member 31, and has a semi-circular shape as viewed in plan. The arms 34, 34 are coupled to the upper surface of the outer member 32 by screws 35, 35 so that the outer member 32 forms a downwardly projecting portion. In this state, the lower end of the outer member 32 is positioned between the center of the lower ball bearing 15 and the lower surface of the base 5. Reference numeral 36 denotes a spacer made of a resin and interposed between each arm 34 and the outer member 32.

[0037] A portion of the outer member 32 located between the arms 34, 34 forms a thick portion 37 projecting upward with respect to both ends of the outer member 32. With the balancer 29 assembled to the eccentric shaft 7A, the outer member 32 projects to a side opposite the side of eccentricity of the eccentric shaft 7A so that the outer surface and the inner surface of the outer member 32 are close to the inner surface of the bearing retainer

17 and the outer surface of the boss 16, respectively.

[0038] With the balancer 29 disposed between the ball bearings 18, 15, the tubular portion 33 of the balancer 29 contacts the upper and lower ball bearings 18, 15 to function as a spacer that keeps the gap between the ball bearings 18, 15. A recessed portion 38 in a ring shape matching the rotational orbit of the outer member 32 is provided to be recessed in the upper surface of the base 5. The outside inwardly facing surface of the recessed portion 38 forms a rising portion 39 that closely conforms to the outer surface of the outer member 32. The opening edge of the bearing retainer 17 is connected to the rising portion 39 through spigot joint to secure the attachment precision of the bearing retainer 17.

[0039] Further, a center of gravity P of the base 5 is positioned between the ball bearings 18, 15 (between the respective centers thereof). In the embodiment, in particular, with the outer member 32 attached to the inner member 31 in the balancer 29 as described above, the balancer 29 is shaped to be bent downward as a whole. Accordingly, the center of gravity of the balancer 29 can be aligned with the center of gravity P of the base 5.

[0040] With the balancer 29 positioned above the lower ball bearing 15, the ball bearing 15 can be positioned close to the lower end of the base 5.

[0041] In the orbital sander 1 configured as described above, when the trigger 13 is pressed to drive the motor 3, the output shaft 4 rotates to rotate the spindle 7 meshing with the output shaft 4. Consequently, the eccentric shaft 7A performs circular orbital motion with respect to the center of rotation of the spindle 7, which causes the base 5 to perform circular orbital motion (orbital motion) with the rubber sleeve 28 restricting rotation of the base 5. As a result of the orbital motion of the base 5, a material to be ground can be ground with sanding paper provided in a tensioned state on the lower surface of the pad 26.

[0042] During the orbital motion, the balancer 29 performs rotational motion on the side opposite the base 5, which produces a centrifugal force to reduce vibration along with the orbital motion of the base 5. In the embodiment, in particular, the center of gravity P of the base 5 is positioned between the ball bearings 18, 15. Thus, a centrifugal force produced on the base 5 along with the orbital motion can be supported at two points, which effectively suppresses inclination (backlash in random directions) between the eccentric shaft 7A and the base 5. The outer member 32 is made of brass, which has a higher specific gravity than the inner member 31. Thus, a centrifugal force required to reduce vibration can be produced effectively.

[0043] In the balancer 29, in addition, the outer member 32 projects in the up-down direction to secure a required mass as described above. Thus, the outer member 32 is not excessively large in the radial direction, and a portion around the eccentric shaft 7A including the bearing retainer 17 can be made compact.

[0044] In the orbital sander 1 according to the embodiment, as described above, the center of gravity P of the

base 5 is positioned between the two upper and lower ball bearings 18, 15. Thus, inclination of the eccentric shaft 7A along with the orbital motion of the base 5 can be effectively suppressed to reduce generation of vibration.

[0045] In the embodiment, in particular, with the balancer 29 provided above the lower ball bearing 15, the ball bearing 15 can be positioned close to the lower end of the base 5. Therefore, the distance between the ball bearings 18, 15 can be secured to suitably support the eccentric shaft 7A at two points.

[0046] With the outer portion of the balancer 29 formed to be bent downward, the center of gravity of the balancer 29 can be aligned with the center of gravity P of the base 5, which enables more stable orbital motion.

[0047] In the embodiment, further, the balancer 29 is key-connected to a portion of the eccentric shaft 7A located between the upper and lower ball bearings 18, 15, and the clearance C is provided between the upper and lower ends of the key 30 and the ball bearings 18, 15, respectively. Thus, the key 30 does not interfere with the ball bearings 18, 15 to incline the ball bearings 18, 15 during assembly of the key 30, which prevents deterioration in balance.

[0048] In addition, the key 30 is positioned on a line in the direction of eccentricity of the eccentric shaft 7A as seen from the axial direction of the eccentric shaft 7A, and the countersunk screw 21 for attaching the retainer 20 is provided at the center of rotation of the spindle 7. Thus, deterioration in balance due to the key 30 or the retainer 20 can be prevented.

[0049] The balancer 29 is coupled to the eccentric shaft 7A at a position above the ball bearing 15, and the balancer 29 projects downward such that the lower end of the balancer 29 is positioned between the center of the ball bearing 15 and the lower surface of the base 5 in the up-down direction. Thus, the radial dimension of the balancer 29 can be reduced by extending the balancer 29 downward. Therefore, projection of the balancer 29 in the radial direction can be suppressed to achieve a reduction in overall size.

[0050] In the embodiment, in particular, a portion of the base 5 that holds the ball bearing 15 is formed as the cylindrical boss 16 extending upward, and the inner surface of the outer member 32 of the balancer 29 is formed in an arcuate shape, as viewed in plan, that closely conforms to the outer surface of the boss 16. Thus, there is no wasted space in the radial direction, which contributes to a size reduction.

[0051] The outer surface of the outer member 32 of the balancer 29 is formed in an arcuate shape as viewed in plan, the recessed portion 38 in a ring shape matching the rotational orbit of the outer member 32 is formed in the upper surface of the base 5, and the outside inwardly facing surface of the recessed portion 38 forms the rising portion 39 located close to the outer surface of the outer member 32. Thus, the gap between the balancer 29 and the base 5 is not increased even if the balancer 29 is

provided with the outer member 32 projecting downward.

[0052] Further, the clearance hole 25 is formed in a portion of the base 5 that opposes the retainer 20, and the lower surface of the retainer 20 is positioned above the lower surface of the base 5. Thus, the retainer 20 and the pad 26 are prevented from contacting each other, and the retainer 20 does not project from the base 5. The clearance hole 25 also facilitates screwing of the retainer 20 or the like.

[0053] In addition, the retainer 20 is attached to the eccentric shaft 7A by the countersunk screw 21, and the through hole 22 for the countersunk screw 21 in the retainer 20 has a stepped shape formed by the tapered portion 23 with which the head portion of the countersunk screw 21 is fitted and the equal diameter portion 24 through which the threaded portion of the countersunk screw 21 passes. Thus, a reduction in size in the up-down direction can be achieved while securing the strength of the retainer 20.

[0054] Meanwhile, the balancer 29 contacts the upper and lower ball bearings 18, 15. Thus, the balancer 29 can be utilized as a spacer between the ball bearings 18, 15, and the dimension in the up-down direction can be minimized even if the two ball bearings 18, 15 are provided.

[0055] The upper ball bearing 18 is held by the bearing retainer 17, the downwardly facing opening edge of which is attached to the upper surface of the base 5, and the bearing retainer 17 is formed in the shape of a circle as viewed in plan with the inner surface of the bearing retainer 17 located close to the outer surface of the outer member 32 of the balancer 29. Thus, the ball bearing 18 can be held with a compact configuration with no wasted space in the radial direction.

[0056] Furthermore, the balancer 29 is formed by combining the inner member 31 and the outer member 32 with each other, and of both the members, the outer member 32, which is located farther from the center of the eccentric shaft 7A, is formed from a material that is higher in specific gravity than the material forming the inner member 31, which is located closer to the center. Thus, it is unnecessary to increase the size of the balancer 29 and it is possible to reduce the overall weight of the balancer 29, and thus, the degree of freedom can be enhanced in designing the position of the center of gravity and the weight, and a centrifugal force required to reduce vibration can be effectively produced.

[0057] In the embodiment, in particular, the inner member 31 is provided with the pair of arms 34, 34 projecting from the center of the eccentric shaft 7A in radial directions that are different from each other, and the outer member 32 is connected to the arms 34, 34. Thus, the inner member 31 can be connected to the outer member 32 with a minimum necessary additional component and without increasing the weight of the inner member 31.

[0058] A portion of the outer member 32 that is interposed between the pair of arms 34, 34 is formed as the thick portion 37 which is thicker than other portions in the

axial direction of the eccentric shaft 7A. Thus, the position of the center of gravity and the weight can be set easily by the outer member 32 formed with the thick portion 37.

[0059] The bearings for the eccentric shaft are not limited to a ball bearing, and other types of bearings such as a needle bearing may also be used.

[0060] The material of the inner member of the balancer is not limited to aluminum, and other materials with a specific gravity of 3 or less such as a magnesium alloy (specific gravity: 1.81) and a resin (specific gravity: 1.5 or less) may also be used. For the outer member, likewise, other materials with a specific gravity of 6 or more such as die-cast zinc (specific gravity: 6.6), copper alloys other than brass such as bronze (specific gravity: 8.4), iron (specific gravity: 7.85), lead (specific gravity: 11.4), tungsten (specific gravity: 19.3), and high specific-gravity resins may also be used. By determining a material with a specific gravity of 3 or less as the low specific-gravity material and a material with a specific gravity of 6 or more as the high specific-gravity material, a magnitude relationship in specific gravity suitable to improve the degree of freedom in design can be obtained.

[0061] The structure for connection between the inner member and the outer member may be appropriately selected from insert molding, press fitting, crimping, welding, and so forth besides screwing described above. As a matter of course, the respective specific structures of the inner member and the outer member may be appropriately changed in accordance with various conditions such as a required centrifugal force. For example, the spacer may be omitted, the number of the arms may be increased or reduced, and/or the arms may be replaced with a fan-shaped coupling portion.

[0062] Further, the balancer is not necessarily composed of two members, and may be composed of three or more members combined with each other. In this case, it is sufficient to set the magnitude relationship in specific gravity by changing the materials of at least some of the combined members. For example, it is considered to determine the materials of the members such that the specific gravity of the materials of the members becomes gradually higher as the member is located farther from the center of the eccentric shaft, to change the material of a group of a plurality of members located closer to the center and the material of a group of a plurality of members located farther from the center in order to set the magnitude relationship in specific gravity, to change the materials of a plurality of members positioned between the innermost side and the outermost side with respect to the center in order to set the magnitude relationship, or the like.

[0063] Meanwhile, the inner member and the outer member themselves may be divided into a plurality of components. For example, the members may be composed of a plurality of plate-like bodies stacked in the up-down thickness direction to be connected, which enhances the degree of freedom in designing the weight or the like of each of the members.

[0064] Conversely, the balancer may be integral and undividable into a plurality of members.

[0065] Further, the retainer may be attached by a component other than the countersunk screw, and the balancer and the bearings may be supported using a structure other than key connection or the retainer.

[0066] Besides, the structure of the orbital sander is not limited to that described above, and may be changed appropriately. For example, an eccentric sleeve may be externally mounted at the lower end of a non-eccentric spindle to form an eccentric shaft, and the base may be coupled to the eccentric shaft, and a bar-like foot may be provided to extend between the housing and the base in place of the rubber sleeve. The present invention may also be applied to a random orbital sander in which the base itself rotates in addition to performing circular orbital motion. In an orbital sander in which the balancer is provided to the motor shaft, the magnitude relationship in specific gravity of a plurality of members may be set with respect to the center of the motor shaft.

[0067] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. An orbital sander in which a main body (2) including a motor (3) is provided with a rotary shaft that is rotatable by driving the motor (3) and an eccentric shaft (7A) that is positioned eccentrically with respect to a center of rotation of the rotary shaft and that performs circular orbital motion along with rotation of the rotary shaft, and a portion of the eccentric shaft (7A) that projects downward from the main body (2) is provided with a base (5) coupled via two bearings that are upper and lower bearings (18), (15) and a balancer (29) projecting to a side opposite a side of eccentricity of the eccentric shaft (7A), **characterized in that:**

a center of gravity of the base (5) is positioned between the two upper and lower bearings (18), (15).

2. The orbital sander according to claim 1, wherein the balancer (29) is provided above the lower bearing (15).

3. The orbital sander according to claim 2, wherein an outer portion (32) of the balancer (29) is formed to be bent downward.
4. The orbital sander according to any one of claims 1 to 3, wherein the balancer (29) is connected using a key (30) to a portion of the eccentric shaft (7A) located between the two upper and lower bearings (18), (15), and a clearance is provided between upper and lower ends of the key (30) and the two upper and lower bearings (18), (15), respectively.
5. The orbital sander according to claim 4, wherein the key (30) is disposed on a line in a direction of eccentricity of the eccentric shaft (7A) as seen from an axial direction of the eccentric shaft (7A).
6. The orbital sander according to any one of claims 1 to 5, wherein a retainer (20) that holds the lower bearing (15) is fixed to a lower end of the eccentric shaft (7A) by a screw provided at the center of rotation of the rotary shaft.
7. The orbital sander according to any one of claims 1 to 6, wherein the balancer (29) projects downward such that a lower end of the balancer (29) is positioned between a center of the lower bearing (15) and a lower surface of the base (5) in an up-down direction.
8. The orbital sander according to claim 7, wherein a portion of the base (5) that holds the lower bearing (15) is formed in a shape of a cylinder projecting upward, and an inner surface of a portion of the balancer (29) projecting downward is formed in an arcuate shape, as viewed in plan, that closely conforms to an outer surface of the holding portion.
9. The orbital sander according to claim 7 or 8, wherein an outer surface of the projecting portion of the balancer (29) is formed in an arcuate shape as viewed in plan, a recessed portion (38) in a ring shape matching a rotational orbit of the projecting portion is formed in an upper surface of the base (5), and an outside inwardly facing surface of the recessed portion (38) forms a rising portion (39) located close to the outer surface of the projecting portion.
10. The orbital sander according to claim 6, wherein a clearance hole (25) is formed in a portion of the base (5) that opposes the retainer (20), and a lower surface of the retainer (20) is positioned above a lower surface of the base (5).
11. The orbital sander according to claim 6 or 10, wherein the retainer (20) is attached to the eccentric shaft (7A) by a countersunk screw (21), and a through hole (22) for the countersunk screw (21) in the retainer (20) has a stepped shape formed by a tapered portion (23) with which a head portion of the countersunk screw (21) is fitted and an equal diameter portion (24) through which a threaded portion of the countersunk screw (21) passes.
12. The orbital sander according to any one of claims 7 to 11, wherein the balancer (29) contacts each of the upper and lower bearings (18), (15).
13. The orbital sander according to claim 12, wherein the upper bearing (18) is held by a bearing retainer (17), a downwardly facing opening edge of which is attached to the upper surface of the base (5), and the bearing retainer (17) is formed in a shape of a circle as viewed in plan with an inner surface of the bearing retainer (17) located close to the outer surface of the projecting portion of the balancer (29).
14. The orbital sander according to any one of claims 1 to 13, wherein the balancer (29) is formed by combining a plurality of members with each other, and for at least some of the plurality of combined members, a member located farther from a center of the rotary shaft or the eccentric shaft (7A) is formed from a material that is higher in specific gravity than a material forming a member located closer to the center, wherein preferably the member located closer to the center is formed from a material with a specific gravity of 3 or less, and the member located farther from the center is formed from a material with a specific gravity of 6 or more.
15. The orbital sander according to claim 14, wherein the plurality of members includes an inner member (31) located closer to the center and an outer member (32) located farther from the center, the inner member (31) is provided with a pair of arms (34), (34) projecting from the center in radial directions that are different from each other, and the outer member (32) is connected to the arms (34), (34).
16. The orbital sander according to claim 15, wherein a portion of the outer member (32) that is interposed between the pair of arms (34), (34) is formed as a thick portion (37) which is thicker than other portions in an axial direction of the eccentric shaft (7A).

FIG. 1

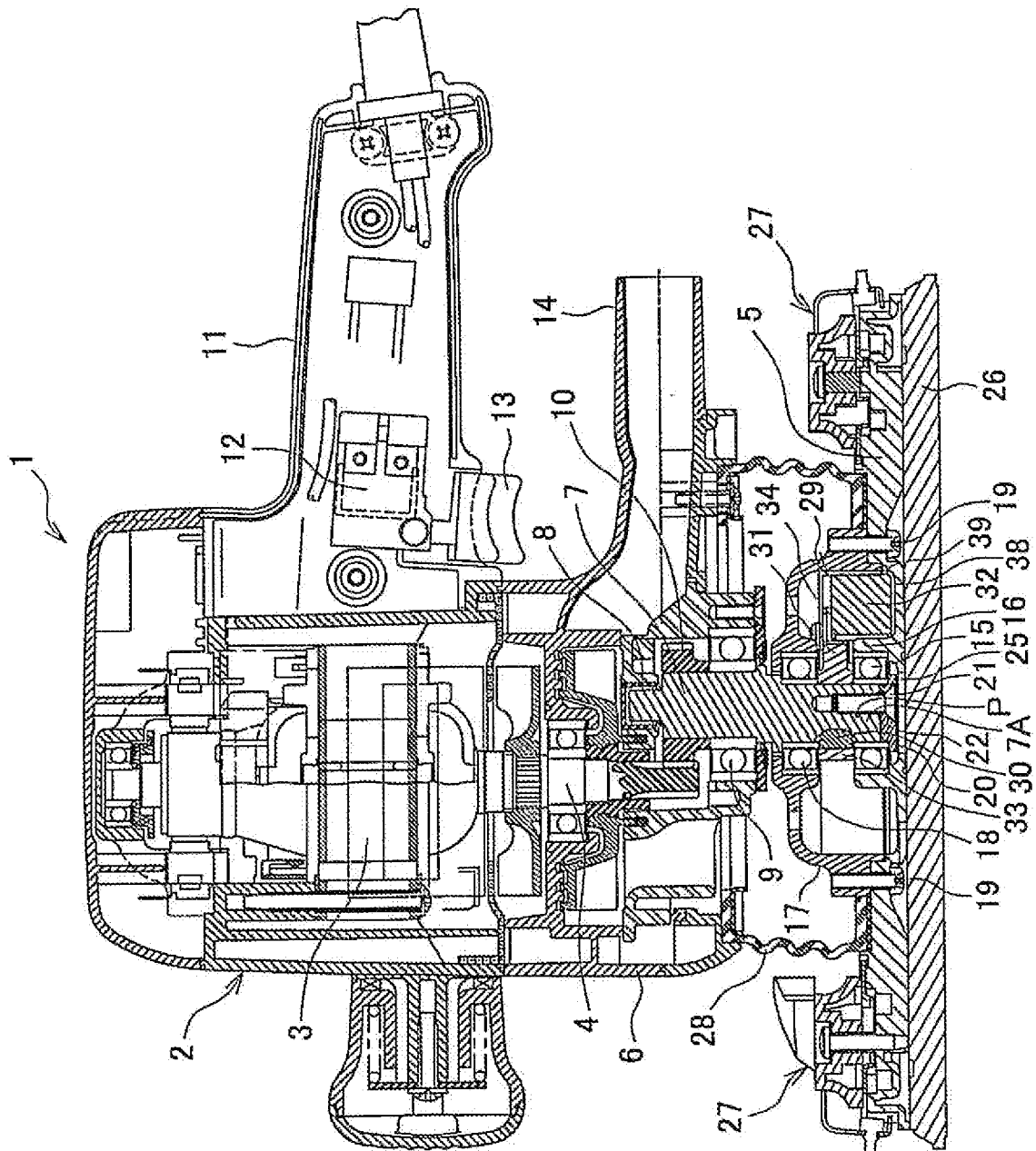


FIG. 2

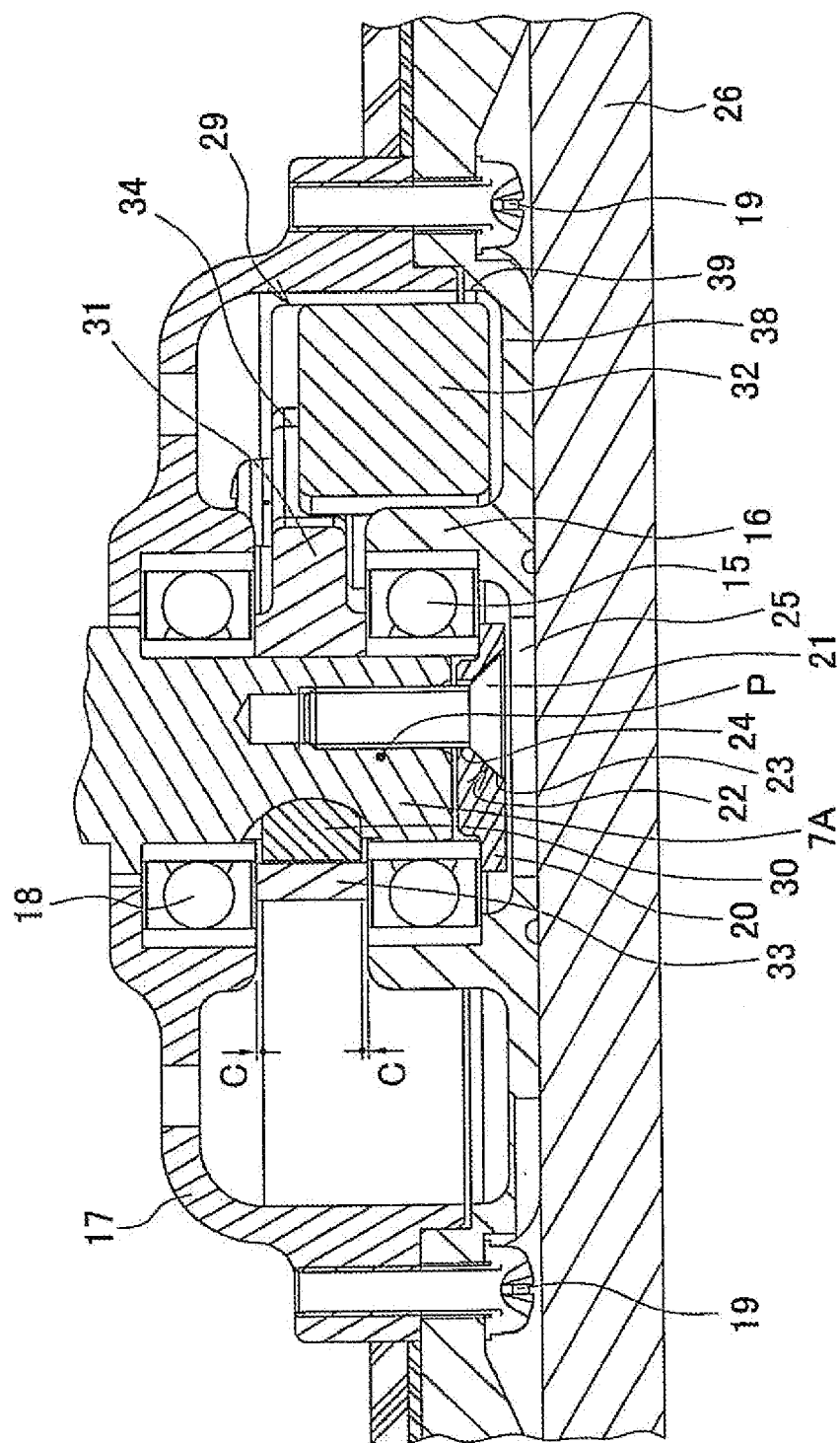


FIG. 3

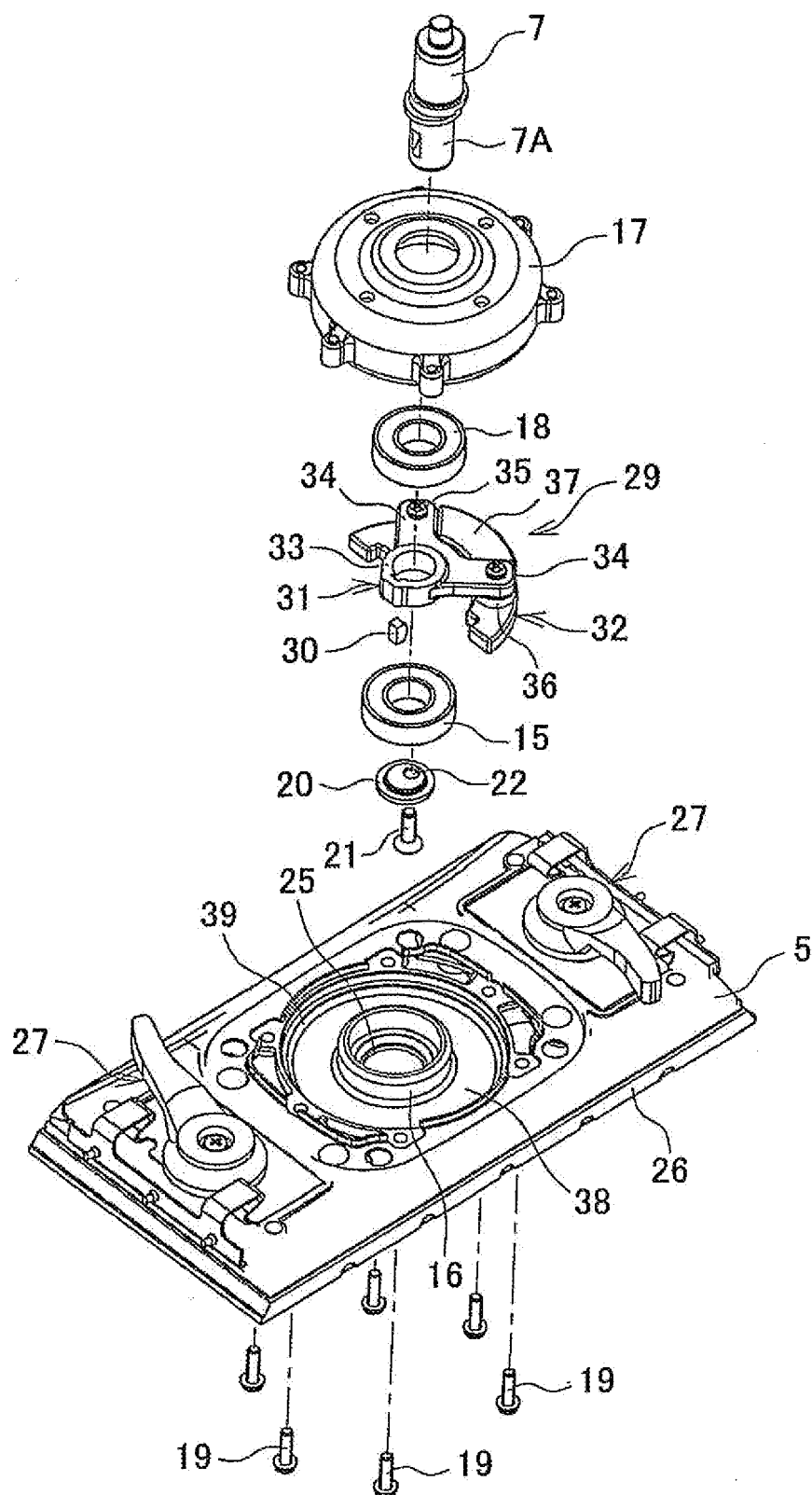
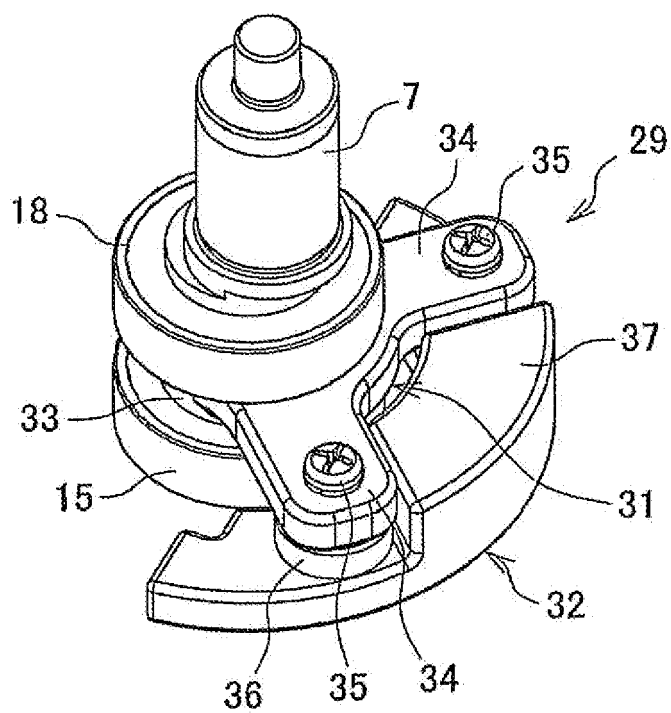


FIG. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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