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(54) **ADJUSTABLE STROKE DEVICE WITH CAM**

(57) An adjustable stroke device for a random orbital machine has a housing with a central axis and a wall defining a cavity. At least one counterweight is movably disposed at least partially within the cavity. A mounting assembly is disposed at least partially within the cavity. The mounting assembly has a workpiece attachment mechanism. A stroke adjuster couples the at least one counterweight with the mounting assembly. The stroke adjuster enables the at least one counterweight and mounting assembly to move with respect to one another such that a distance between the at least one counterweight and the mounting assembly may be variably adjusted which, in turn, variably adjust a stroke radius of the workpiece attachment mechanism with respect to the central axis of the housing. The stroke adjuster has an adjuster ring that engages and disengages the cam mechanism to enable variable adjustment of the stroke distance.

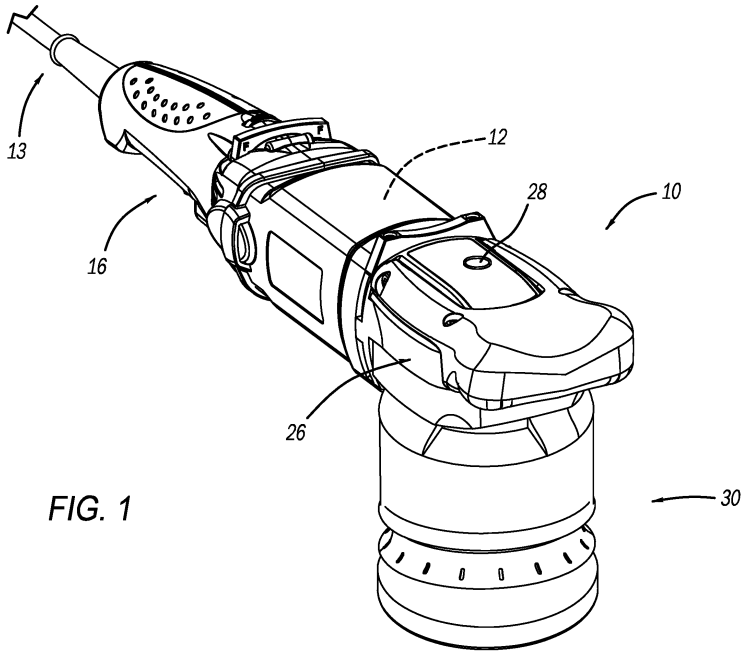

FIG. 1

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Description

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Application No. 63/594,228, filed on October 30, 2023. The entire disclosure of the above application is incorporated herein by reference.

FIELD

[0002] The present disclosure relates to adjustable orbital devices including, but not limited to polishers, buffers, sanders and massagers.

BACKGROUND

[0003] The present disclosure relates to an apparatus for adjusting the stroke of random orbital machine, such as, but limited to, polishing machines, sanding machines and massaging machines. The adjustability allows the user to define the stroke of the random orbital machine and adjust it between a maximum definitive stroke setting and a minimum 0 orbital setting.

[0004] Polishing machines and sanding machines are routinely used in the automotive detailing industry and home building industry to correct imperfections in the paint or drywall and to apply polishes and waxes. There are three primary machines used, including rotary buffers, random orbital machines, and dual action machines. Each tool has its place, as the manner in which the pad spins on each machine is unique and used for different purposes.

[0005] Rotary buffers are the fastest and most effective machine for removing paint defects in a controlled manner with good results. The drive unit used in a rotary buffer is directly connected to the pad and each one is in axial alignment with each other. In order to correct paint scratches, the rotary buffer is commonly used to remove enough paint surrounding the scratches to make the surface level. Removing scratches, however, requires more skill and control of the machine than a typical hobbyist possesses. For this reason, rotary buffers are commonly avoided by average users as it is very easy to remove too much paint and damage the finish by causing swirl marks or by burning the paint.

[0006] Random orbital machines were introduced in order to meet the needs of an average user, as they require less experience and control to operate. A random orbital machine uses a gear case that employs two unique mechanisms which move a pad attached to a backing plate. Unlike a rotary buffer, random orbital machines place the central rotational axis of the pad and the backing plate offset from the driveshaft of the machine. This offset is commonly referred to as the "stroke". As a result, the backing plate and pad orbit the driveshaft in a circular motion. At the same time, the pad randomly spins, as it is mounted on an idle bearing. This random spinning varies with pressure applied on the pad and is not directly powered. The result is a polishing action that will not burn or cut through the paint as it will not produce the heat from a powered spinning action. Random orbital machines are, therefore, much safer and dramatically less likely to cause swirls or burn through the paint.

[0007] Similar to random orbital machines, dual action machines place the central rotational axis of the pad and the backing plate offset from the driveshaft. As a result of this stroke, the backing plate and pad orbit the driveshaft in a circular motion. However, with a dual action machine the spinning of the pad is directly powered.

[0008] At the heart of a random orbital machine is the machine's stroke. The stroke is determined by the offset between the driveshaft axis and the backing axis. A longer offset or stroke places the backing plate rotational axis farther away from the driveshaft axis. Multiplying the offset by two produces the stroke diameter. The "stroke" is, therefore, a term that identifies the diameter of the path the backing plate travels as it orbits around the driveshaft.

[0009] A majority of random orbital machines are small stroke machines, which mean they use a stroke length that measures somewhere between approximately 6 mm - 12 mm. A small stroke machine limits the movement of the pad to a smaller and tighter orbit. This results in a smoother action. A small stroke machine is also easier to control because the backing plate orbits around the driveshaft rotational axis in a tighter path. There are less vibrations and movement making the machine easier to hold due to the smoother action.

[0010] A large stroke machine delivers increased orbits per minute (OPM) of backing plate motion using the same rotations per minute (RPM), as the orbit of the backing plate and the pad around the drive shaft is increased. A large stroke also increases movement of the pad which helps spread out polishing compounds and treats a larger surface area. It also accomplishes more cutting action into the paint which allows for scratches and paint defects to be corrected. Small stroke machines typically only polish the paint and do not cut into it, and, therefore, are not able to remove surface defects.

[0011] One method of addressing the deficiencies of a small stroke has been to increase the RPM of the machine. While this increases the rotation of the motor, the machine stroke stays the same. There are also longevity issues associated with increased RPM for the motor and increased OPM for the pad. Increasing the RPM puts more strain on the motor, while increased OPM burns out a pad faster.

[0012] In sum, both long stroke and short stroke machines have their place in the industry. Therefore, what is needed is a machine that can be adjusted by the user without special tools or disassembly of the machine. Finally, what is needed is a compact, simple, and effective method to adjust the stroke of a machine based on the needs of the user.

SUMMARY

[0013] According to the disclosure, an adjustable stroke device for a random orbital machine comprises a housing having a central axis and a wall that defines a cavity. The housing includes a drive hub and cover. At least one counterweight is movably disposed at least partially within the cavity. A mounting assembly is disposed at least partially within the cavity. The mounting assembly includes a workpiece attachment mechanism. A stroke adjuster couples the at least one counterweight with the mounting assembly. The stroke adjuster enables the at least one counterweight and mounting assembly to move with respect to one another such that a distance between the at least one counterweight and the mounting assembly may be variable adjusted which, in turn, variable adjust the stroke radius of the workpiece attachment mechanism with respect to the central axis of the housing. The stroke adjuster includes an adjuster ring and a cam mechanism. The adjuster ring engages the cam mechanism to enable the variable adjustment of the distance. The adjuster ring surrounds the wall of the housing. The adjuster ring is axially movable and rotatable around the central axis. The counterweight engages the cam mechanism which moves the counterweight in response to cam movement. The mounting assembly, including a bearing carriage, engages the cam mechanism. The mounting assembly moves in response to cam movement. The workpiece attachment mechanism further includes a spindle coupling with the bearing carriage. A locking mechanism is associated with the mounting assembly and counter balance to lock the drive in a rotational only position. At least one projection on the stroke adjuster ring engages at least one cutout on the cam mechanism to engage the variable adjustment. Preferably the cam mechanism is a cam plate adjacent a drive hub. The counterweight and mounting assembly are fully disposed in the cavity.

[0014] According to a second embodiment, a rotating tool comprises a housing and the motor, the motor includes a drivetrain. An adjustable stroke device is coupled with the drivetrain. The adjustable stroke device comprises a housing having a central axis and a wall that defines a cavity. The housing includes a drive hub and cover. At least one counterweight is movably disposed at least partially within the cavity. A mounting assembly is disposed at least partially within the cavity. The mounting assembly includes a workpiece attachment mechanism. A stroke adjuster couples the at least one counterweight with the mounting assembly. The stroke adjuster enables the at least one counterweight and mounting assembly to move with respect to one another such that a distance between the at least one counterweight and the mounting assembly may be variably adjusted which, in turn, variably adjusts the stroke radius of the workpiece attachment mechanism with respect to the central axis of the housing. The stroke adjuster includes an adjuster ring and a cam mechanism. The adjuster ring engages the cam mechanism to enable the variable adjustment of the distance. The adjuster ring surrounds the wall of the housing. The adjuster ring is axially movable and rotatable around the central axis. The counterweight engages the cam mechanism which moves the counterweight in response to cam movement. The mounting assembly, including a bearing carriage, engages the cam mechanism. The mounting assembly moves in response to cam movement. The workpiece attachment mechanism further includes a spindle coupling with the bearing carriage. A locking mechanism is associated with the mounting assembly and counter balance to lock the drive in a rotational only position. At least one projection on the stroke adjuster ring engages at least one cutout on the cam mechanism to engage the variable adjustment. Preferably the cam mechanism is a cam plate adjacent a drive hub. The counterweight and mounting assembly are fully disposed in the cavity.

[0015] Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

[0016] The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

FIG. 1 is a perspective view of a rotating tool according to the disclosure.

FIG. 2 is a perspective view partially in cross-section of the tool of FIG. 1.

FIG. 3 is an exploded view of the adjustable stroke device.

FIG. 4 is a cross-section view of FIG. 1 along line 4-4 thereof.

FIG. 5 is a cross-section view like FIG. 4 of the stroke adjuster.

FIG. 6 is a cross-section view like FIG. 5 after rotation.

FIG. 7 is a cross-section view of the stroke adjuster device.

FIG. 8 is a cross-section view along line 8-8 thereof.

DETAILED DESCRIPTION

[0017] Example embodiments will now be described more fully with reference to the accompanying drawings.

[0018] Turning to the figures, a tool is illustrated with an adjustable stroke device and is designated with the reference numeral 10. The tool includes a motor 12, a power source 14 and a switch 16 to activate and deactivate the power source. The power source is shown as a cord but could be rechargeable batteries. The motor includes a pinion 18 positioned inside the head housing

26 of the tool. The drivetrain head housing 26 includes a cavity to house a drivetrain 22. The drivetrain 22 includes a bevel gear 24 meshing with the pinion 18. The bevel gear 24 is coupled with the adjustment stroke device 30 that is mounted at the bottom of the head housing 26.

[0019] The adjustment stroke device 30 includes a drive hub 34, a workpiece mounting assembly 36, a counterbalance mechanism 38, a stroke adjustment mechanism 40 and a cover 42. The drive hub 34 and cover 42 form a housing that defines a cavity.

[0020] The drive hub 34 includes a body 44 includes pair of slot 46, cutouts 56, and a pair of wall wings 48. A driveshaft 50 couples with a boss 52 extending from the body 44. The driveshaft 50 passes through and is received by a bearing 54 in the drivetrain head housing 26. Ultimately, the driveshaft 50 is rotatably coupled with the bevel gear 24 to provide rotation to the drive hub 34.

[0021] A stop pin 28 is biased on the head housing 26. The stop pin 28 engages an aperture in the bevel gear 24 to prohibit rotation of the drivetrain during changing of the stroke adjuster device 30. Also, the head housing 26 includes a handle portion 32.

[0022] The wings 48 have a flat wall surface 58 opposing one another. The wall surfaces 58 guide the counterbalance mechanism 38 and workpiece mounting assembly 36 during movement.

[0023] The stroke adjustment mechanism 40 includes an adjuster cup 64 and a cam plate 66. The cup 64 is positioned around the drive hub 34 and cover 42 as illustrated in FIG. 1. The cup 64 includes at least one, preferably 4, projections 62 for engaging the cam plate cutouts 60 and drive hub cutouts 56. The cam plate 66 includes arcuate cam slots 68. The cup 64 is manually manipulated, and pulled axially downward and rotated against a force of a spring 70. The spring 70 seats in a spring bearing ring 71. As this occurs, the stop pin 28 engages the gear aperture stopping rotation of the shaft. This enables the user to move the adjustable stroke mechanism 40 between operating positions. The cam plate 66 is nested on the drive hub body 44 along boss 52. This enables rotation of the stroke adjustment mechanism 40 and the drive hub 34 as explained later.

[0024] The workpiece mounting assembly 36 includes a bearing carriage 72, a U-shaped body portion 74 and a weight 75. The bearing carriage 72 receives bearings 76 and a spindle 78. The spindle 78 extends through the bearings and is retained on the U-shaped body portion 74. The spindle 78 has an external portion 80 that includes a threaded bore 81 to receive a backing plate 82 and fastener 83. The workpiece mounting assembly 36 also includes a locking gear 86. The locking gear 86 engages teeth 94 on the counterbalance mechanism 38 to lock the workpiece mounting assembly 36 in a pure rotation position.

[0025] The U-shaped body portion 74 includes a pin 88. The pin 88 is received in one of the cam slots 68 and one of the drive hub slots 46. The pin 88 is also fixed in the weight 75 on the side of the body 44. Thus, the workpiece mounting assembly 34 is moved with respect to the counterbalance mechanism 38 upon rotation of the stroke adjustment mechanism 40.

[0026] The counterbalance mechanism 38 includes a body 90 with a step portion 92. The body 90 has an overall U-shape with the step 92 extending from the web. The inner surface of the body 90 includes a plurality of teeth 94. The teeth 94 engage with the locking gear 86 as mentioned above to position the adjustable stroke device 30 in a purely rotational position. The step 92 include a pin 98 that is positioned in the other of the cam slots 68 and drive hub slots 46. The pin 98 is positioned in the slots 68, 46 opposite of the U-shaped workpiece mounting assembly pin 88. Thus, as the stroke adjuster cup 64 is rotated, the counterbalance mechanism 38 and the workpiece mounting assembly 36 are moved away or towards one another. In the purely rotation position, the lock gear 86 engages the teeth 94.

[0027] The cylindrical cover 42 includes a base 100 that covers the bottom of the stroke adjuster 30. The spindle portion 80 extends through the cover base oval opening 102 to enable connection with the backing plate 84. The cylindrical cover wall 103 provides a substantially continuous cylindrical housing. The cover 42 is secured to the drive hub 34 via screws 104. Thus, the counterbalance mechanism 38 as well as the workpiece mounting assembly 36 are positioned inside of the cover 42 and drive hub 34 housing.

[0028] In operation, the stop pin 28 engage the bevel gear aperture and the stroke adjustment mechanism adjuster cup 64 is pulled toward the drive hub 34 and rotated. As this occurs, the projections 62, biased by spring 70, insert into the cam plate 66, cutouts 60 and the drive hub cut out 56. The adjuster cup 64 continues to turn or rotate until the next position is aligned, 8 mm stroke. As this occurs, the force on the adjustable stroke cup 64 is released and the stroke device 30 is locked into a position. The positions move from a purely rotational position to a dual action position of an 8 and 15 mm stroke.

[0029] As the cup 64 is rotated, the pins 88, 98 in the slots 46, 68 are moved. As this occurs, the workpiece mounting assembly 36 and counterbalance mechanism 38 are moved either toward one another or away from one another. In a rotary only position, the workpiece mounting assembly locking gear 86 engages the teeth 94 of the counterbalance mechanism 38. This provides rotational only movement. As the workpiece mounting assembly 36 and counterbalance 38 mechanisms are moved away from one another, the workpiece mounting assembly 36 freely rotates in the counterweight 38 and housing providing the dual action rotary and orbital movement.

[0030] Accordingly, the activation switch 16 energizes the motor which rotates the spindle 50 which, in turn, rotates the drive hub 34. This enables the backing plate 84 to be rotated with the counterbalance mechanism 38 balancing the rotational imbalance due to the spindle 78

being offset from the central axis of the spindle 50. Thus, the spindle 78 rotates the workpiece backing plate 84 at a stroke distance away from the central axis.

[0031] The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

Claims

1. An adjustable stroke device for a random orbital machine comprising:

a housing having a central axis and a wall defining a cavity;
at least one counterweight movably disposed at least partially within the cavity;
a mounting assembly disposed at least partially within the cavity, the mounting assembly including a workpiece attachment mechanism; and
a stroke adjuster coupling the at least one counterweight with the mounting assembly, the stroke adjuster enabling the at least one counterweight and mounting assembly to move with respect to one another such that a distance between the at least one counterweight and the mounting assembly may be variably adjusted which, in turn, variably adjusts a stroke radius of the workpiece attachment mechanism with respect to the central axis of the housing, the stroke adjuster including an adjuster ring and a cam mechanism, the adjuster ring engaging the cam mechanism for enabling the variable adjustment of the stroke distance.

2. The adjustable stroke device of Claim 1, wherein the adjuster ring surrounding the wall of the housing, the adjuster ring is axially movable and rotatable around the central axis.

3. The adjustable stroke device of Claim 1, wherein the counterweight engages the cam mechanism for moving the counterweight in response to cam movement.

4. The adjustable stroke device of Claim 2, wherein the mounting assembly, including a bearing carriage, engaging the cam mechanism for moving the mounting assembly in response to cam movement.

5. The adjustable stroke device of Claim 1, wherein the workpiece attachment mechanism further comprises a spindle, the spindle coupling with a bearing carriage.

6. The adjustable stroke device of Claim 2, further comprising a locking mechanism associated with the mounting assembly and counterbalance to lock the drive in a rotation only position.

7. The adjustable stroke device of Claim 1, further comprising at least one projection on the adjuster ring for engaging at least one cut out on the cam mechanism for enabling the variable adjustment.

8. The adjustable stroke device of Claim 1, where the cam mechanism further comprising a cam plate adjacent to a drive hub.

9. The adjustable stroke device of Claim 1, wherein the housing includes a drive hub and a cover.

10. The adjustable stroke device of Claim 1, wherein the counterweight and mounting assembly are fully disposed in the cavity.

11. A rotating tool comprising:

a housing and a motor, the motor including a drive train;
an adjustable stroke device coupled with the drivetrain, the adjustable stroke device comprising:

a housing having a central axis and a wall defining a cavity;
at least one counterweight movably disposed at least partially within the cavity;
a mounting assembly disposed at least partially within the cavity, the mounting assembly including a workpiece attachment mechanism; and
a stroke adjuster coupling the at least one counterweight with the mounting assembly, the stroke adjuster enabling the at least one counterweight and mounting assembly to move with respect to one another such that a distance between the at least one counterweight and the mounting assembly may be variably adjusted which, in turn, variably adjust a stroke radius of the workpiece attachment mechanism with respect to the central axis of the housing, the stroke adjuster including an adjuster ring and a cam mechanism, the adjuster ring engaging the cam mechanism for enabling the variable adjustment of the distance.

12. The rotating tool of Claim 11, wherein the adjuster ring surrounding the wall of the housing, the adjuster ring is axially movable rotatable around the central axis.

13. The rotating tool of Claim 11, wherein the counterweight engages the cam mechanism for moving the counterweight in response to cam movement.

14. The rotating tool of Claim 12, wherein the mounting assembly, including a bearing carriage, engaging the cam mechanism for moving the mounting assembly in response to cam movement.

15. The rotating tool of Claim 11, wherein the workpiece attachment mechanism further comprises a spindle, the spindle coupling with a bearing carriage.

16. The rotating tool of Claim 12 further comprising a locking mechanism associated with the mounting assembly and counterbalance to lock the drive in a rotation only position.

17. The rotating tool of Claim 11, further comprising at least one projection on the adjuster ring for engaging at least one cutout on the cam mechanism for enabling the variable adjustment.

18. The rotating tool of Claim 11, wherein the cam mechanism further comprising a cam plate adjacent a drive hub.

19. The rotating tool of Claim 11, wherein the housing includes a drive hub and a cover.

20. The rotating tool of Claim 11, wherein the counterweight and mounting assembly are fully disposed in the cavity.

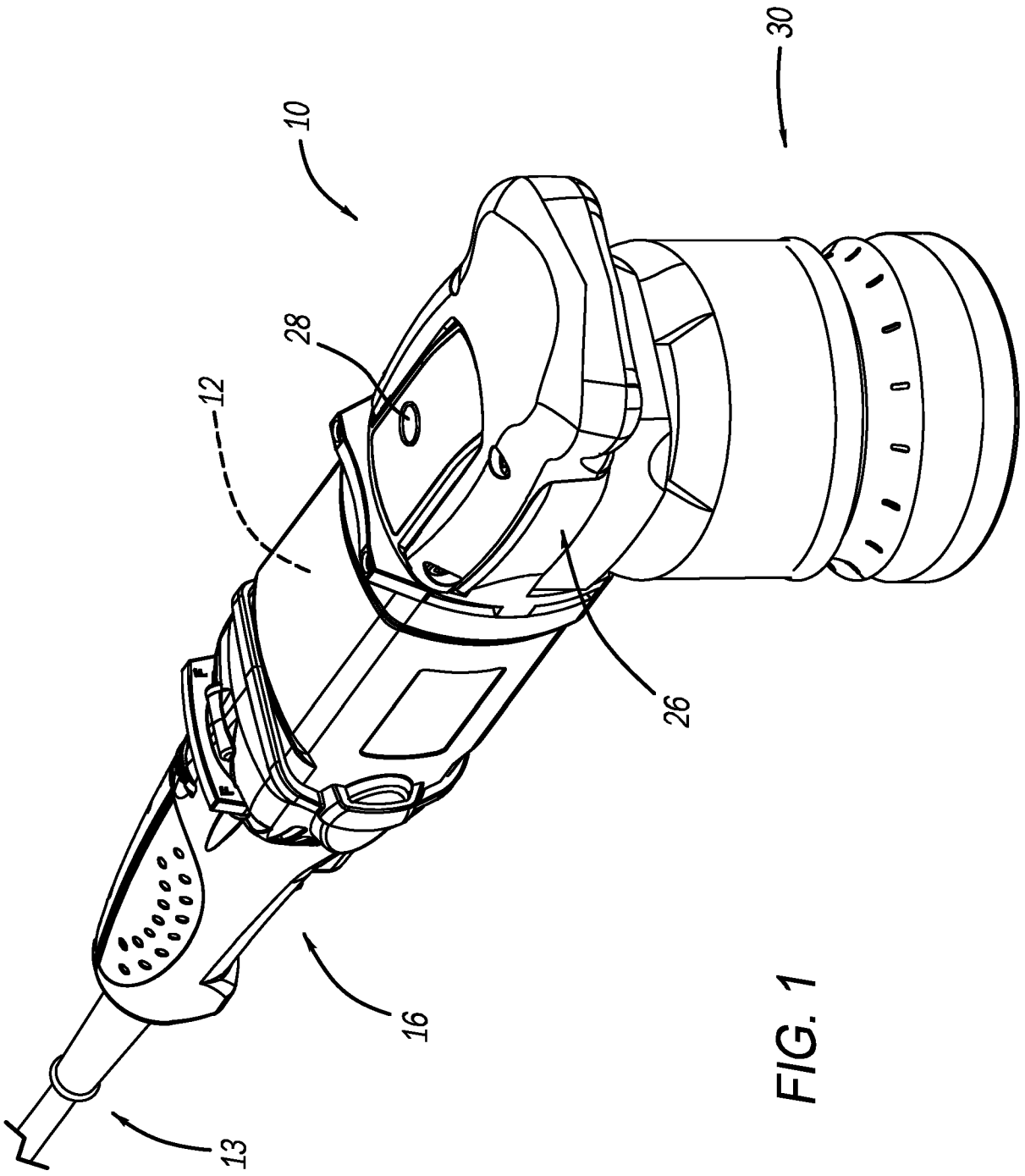

FIG. 1

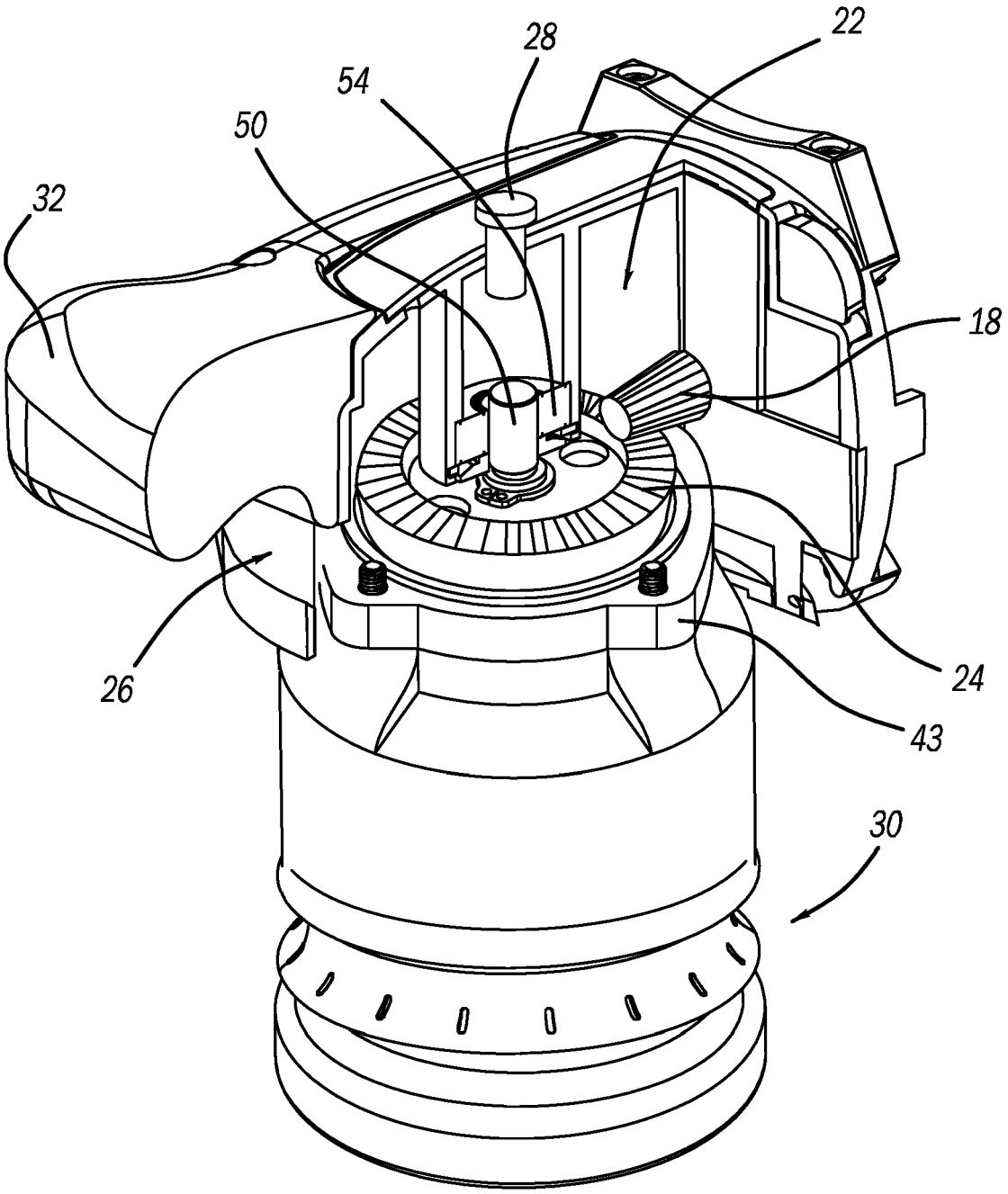

FIG. 2

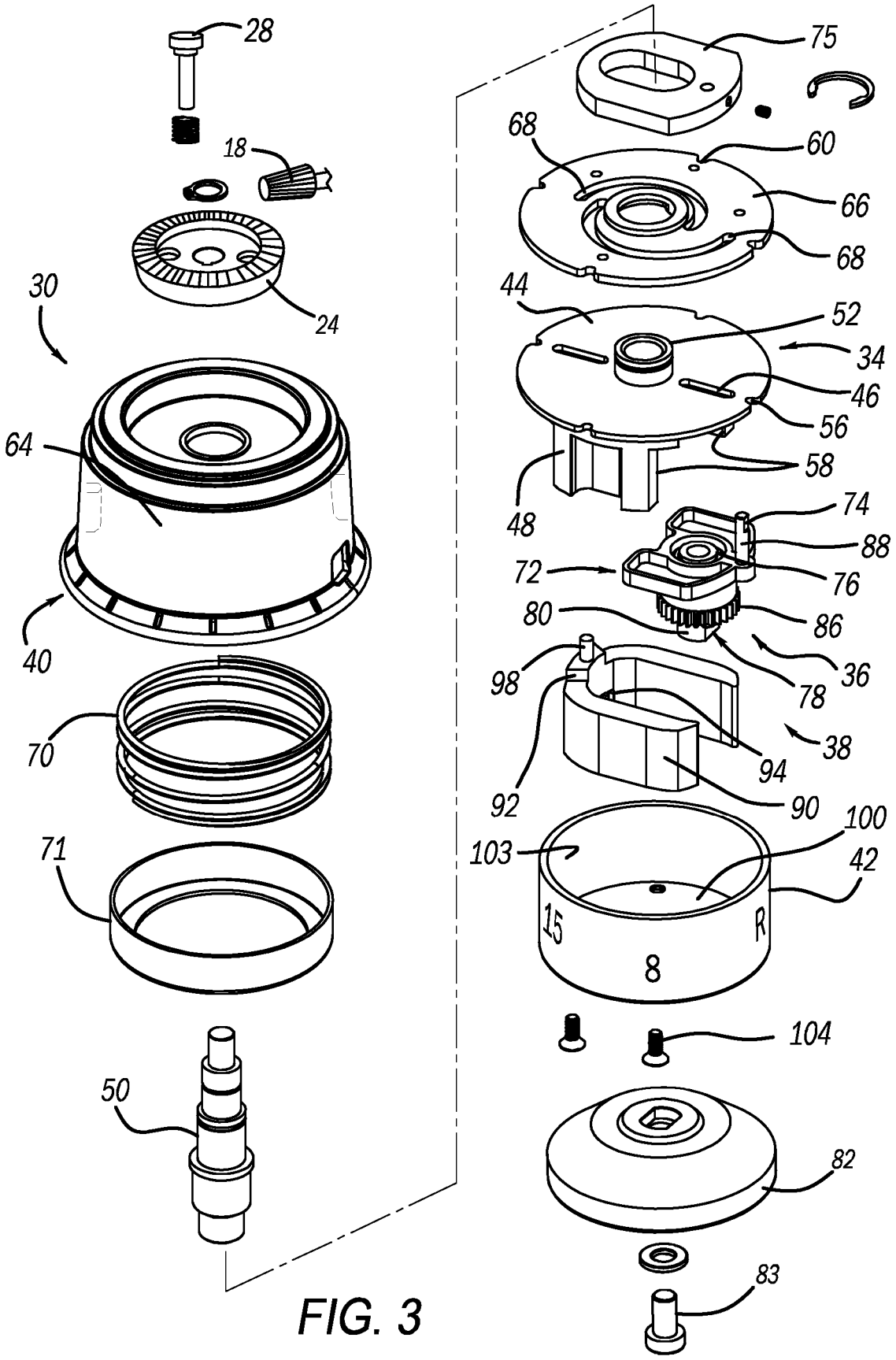
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FIG. 3

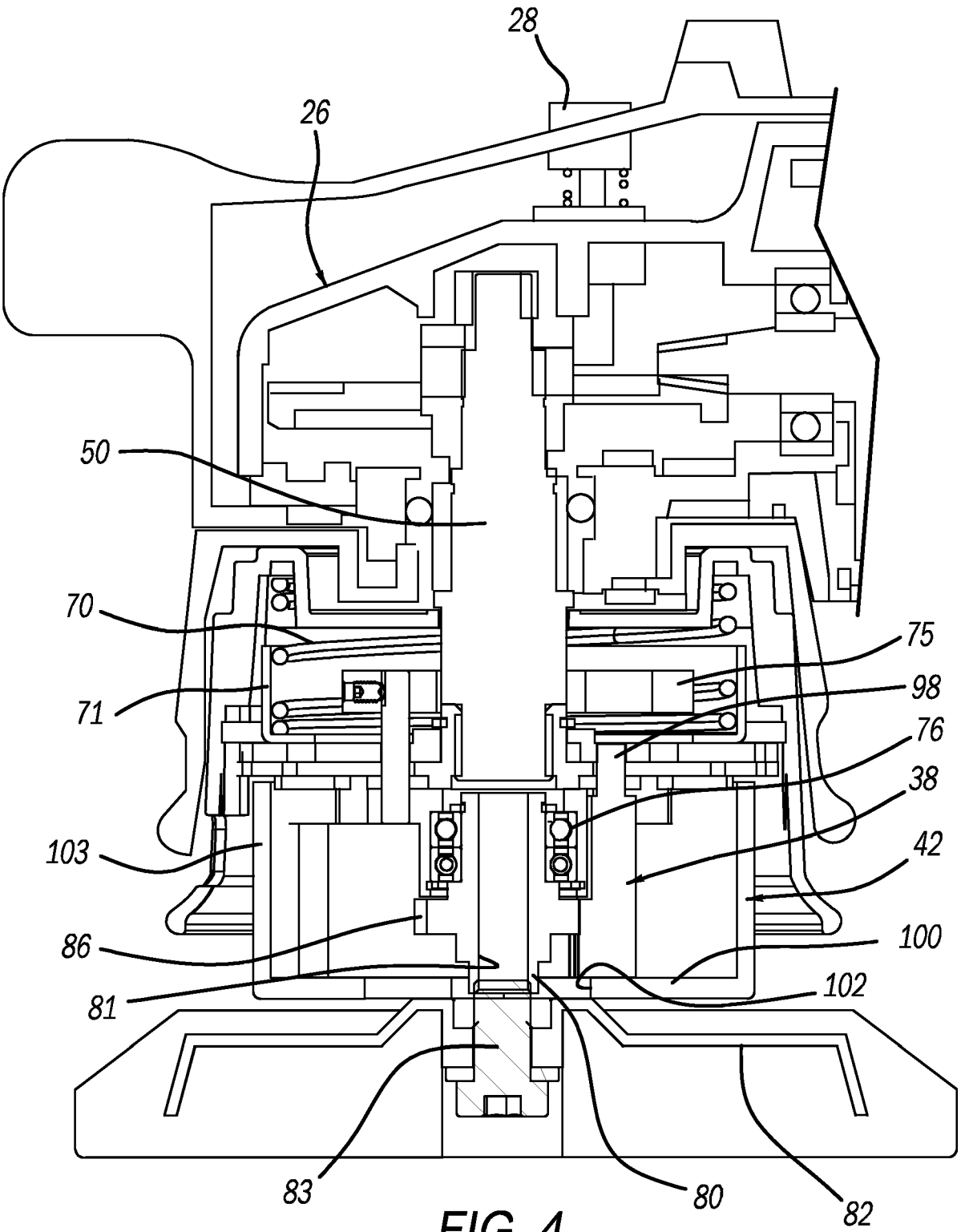

FIG. 4

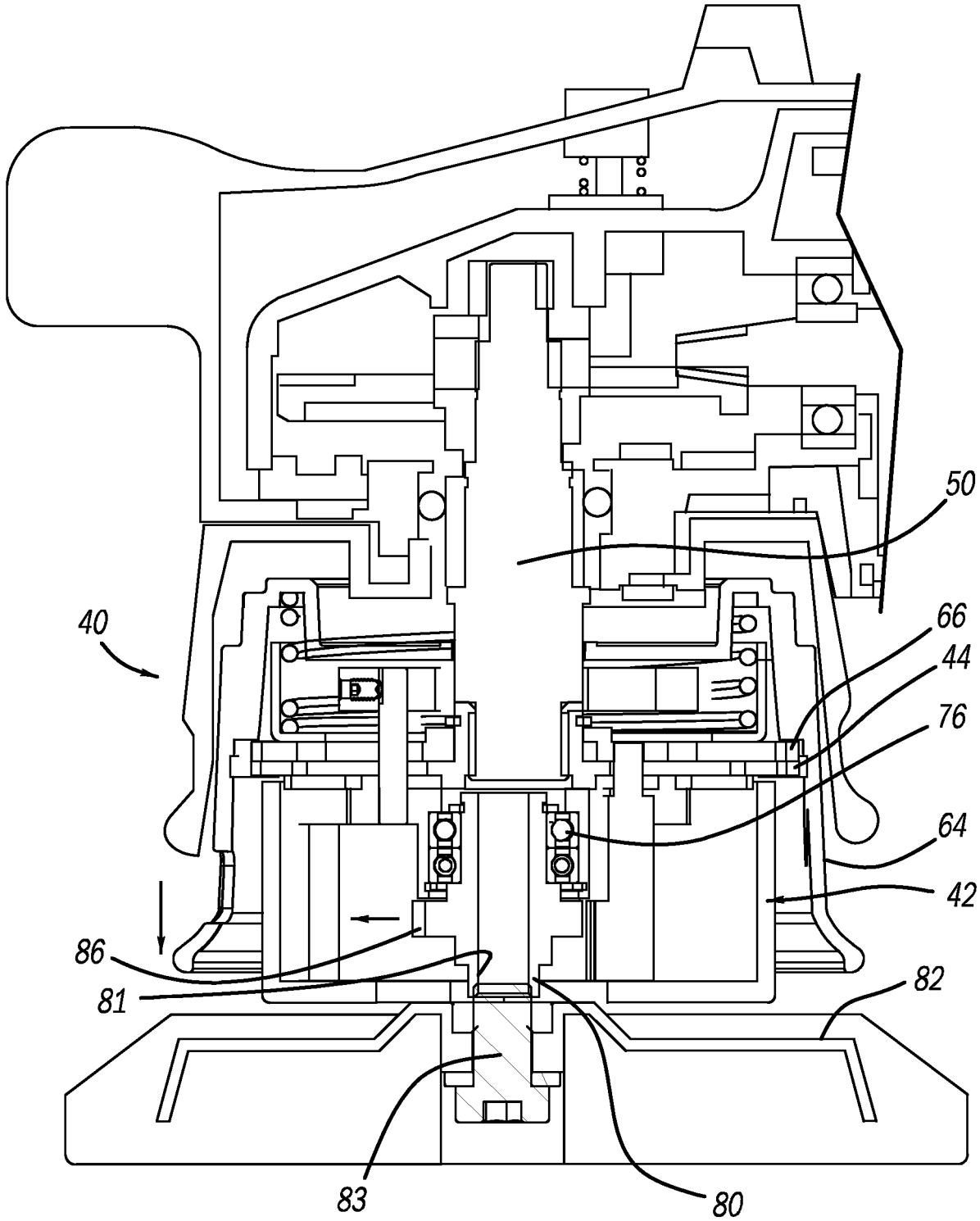

FIG. 5

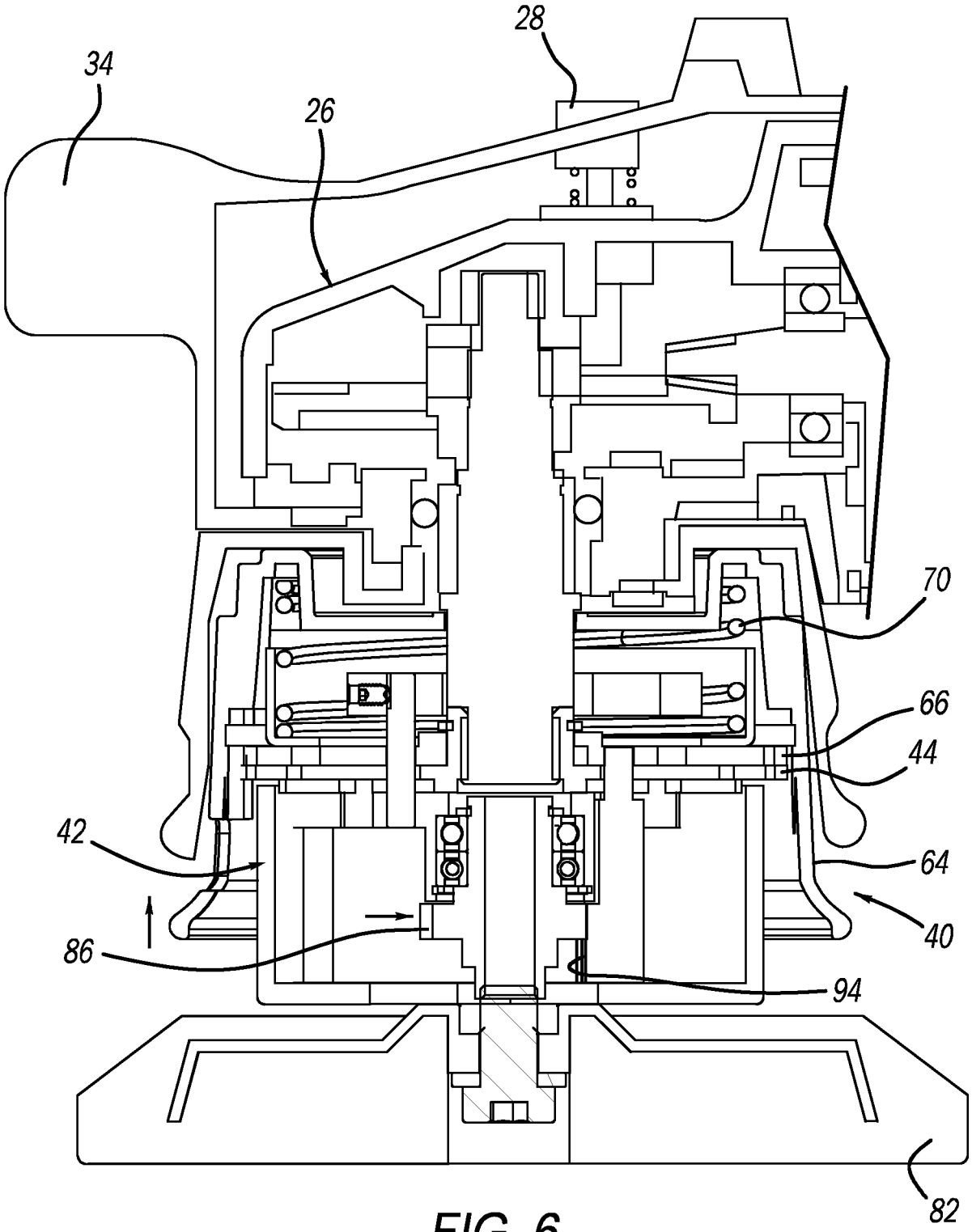

FIG. 6

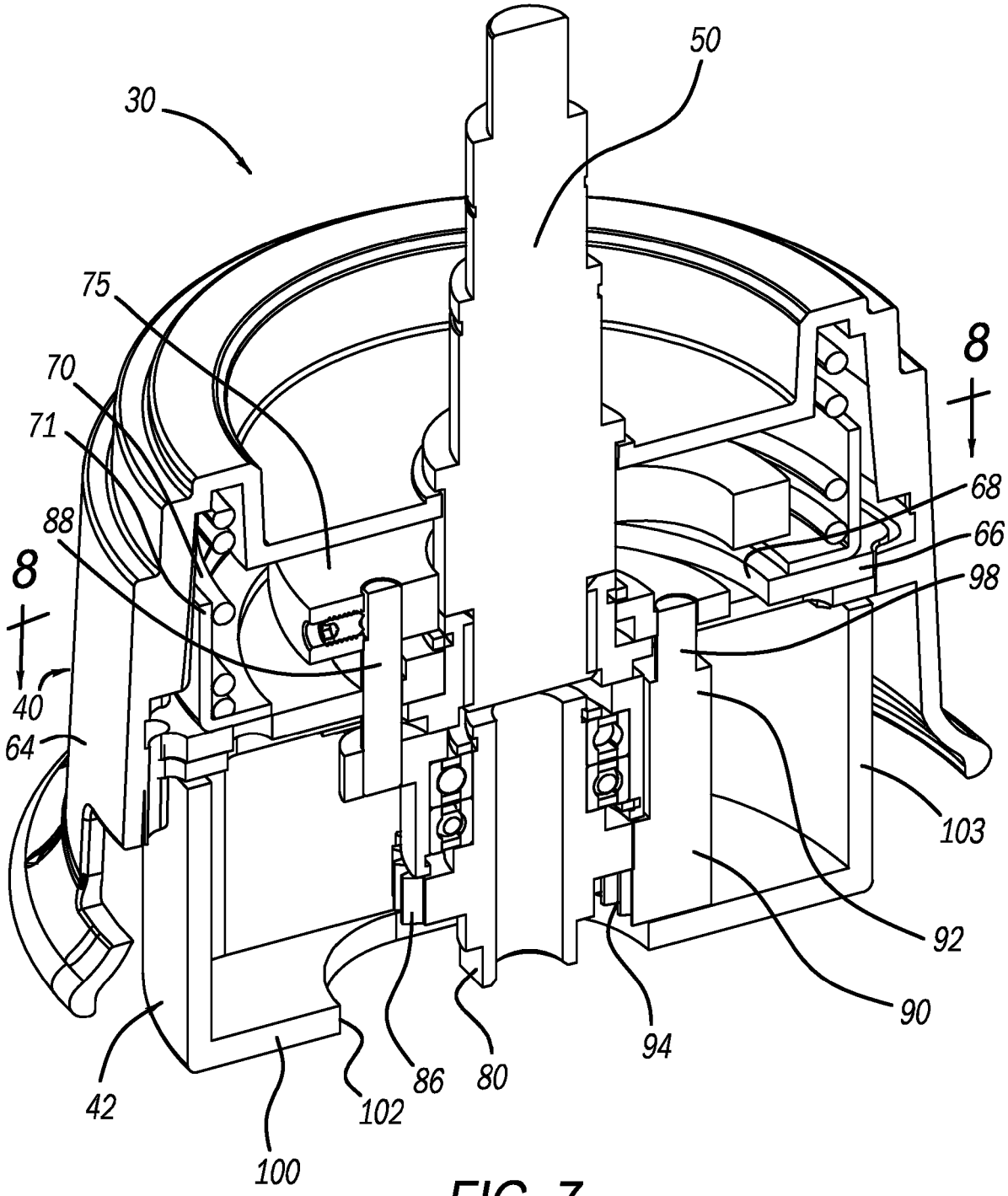

FIG. 7

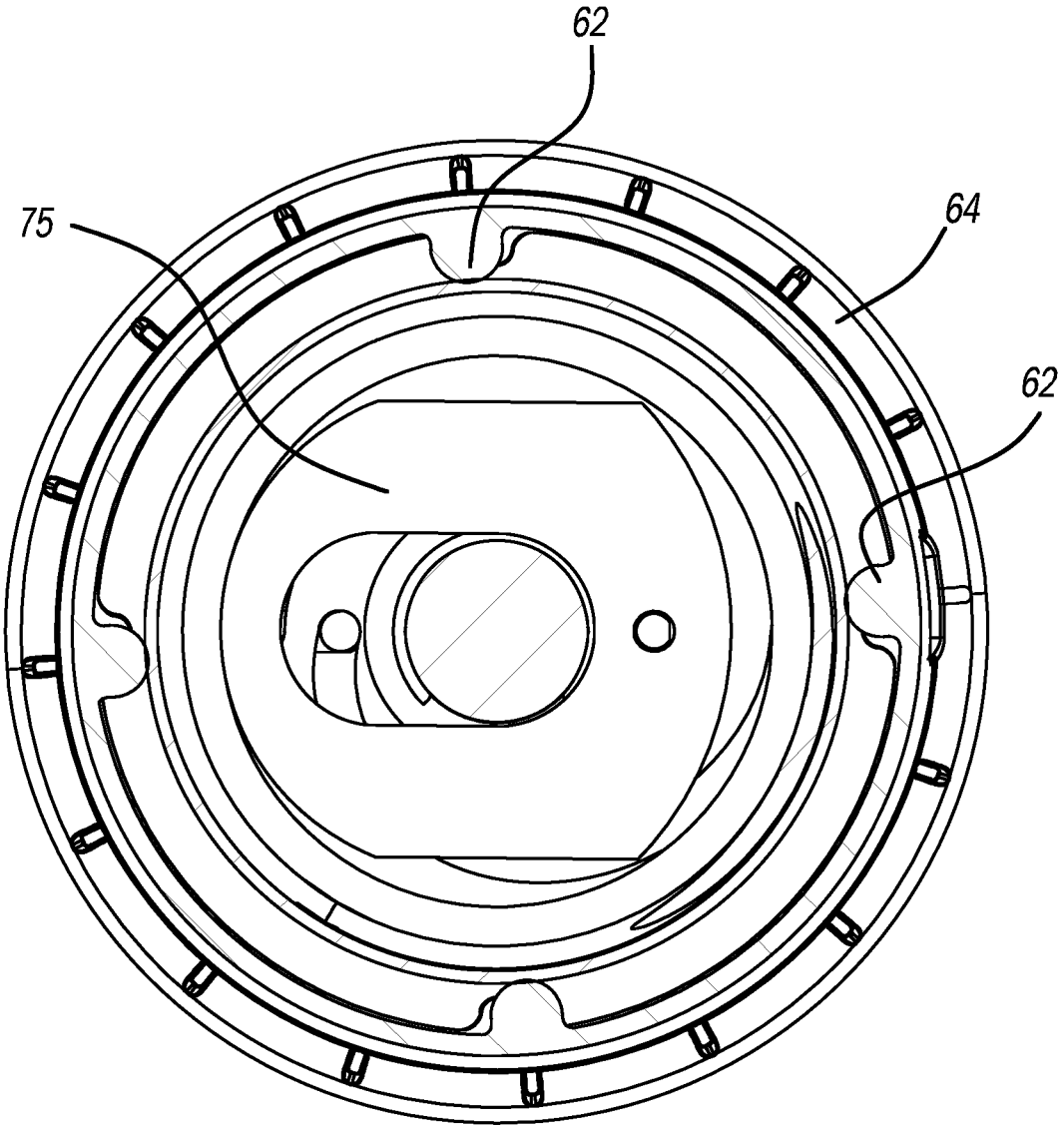

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 24 20 8700

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2022/228653 A1 (MCLAIN SCOTT S [US]) 21 July 2022 (2022-07-21) * paragraph [0032] * * figures 1-9 * -----	1-20	INV. B24B23/04 B24B41/00 ADD. B24B23/03

TECHNICAL FIELDS SEARCHED (IPC)

B24B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	20 March 2025	Bermejo, Marco

CATEGORY OF CITED DOCUMENTS

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