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(71) Applicant: **Santiyanont, Chanchai**
**Bangkok 10250 (TH)**

(72) Inventor: **Santiyanont, Chanchai**
**Bangkok 10250 (TH)**

(74) Representative: **Pratt, David Martin et al**
**Withers & Rogers LLP**
**Goldings House,**
**2 Hays Lane**
**London SE1 2HW (GB)**

(54) **Rotary fluid motor**

(57) A fluid motor having a fixed cylindrical casing, supporting a rotor having an output shaft extending rotatably and coaxially in the casing. The rotor includes piston chambers and reciprocable pistons in the piston chamber. A piston rod of each piston is connected to a crankshaft connected to the rotor for rotation therewith. The casing has inlet and outlet ports communicating with the piston chambers during rotation of the rotor to admit compressed fluid through the inlet-port and discharge from the outlet-port. A drive train synchronizes rotation of the crankshafts and the output shaft, a gear tooth ratio of an annular gear to pinion gears on the crankshafts is preferably twice the number of pistons in each rotor block.

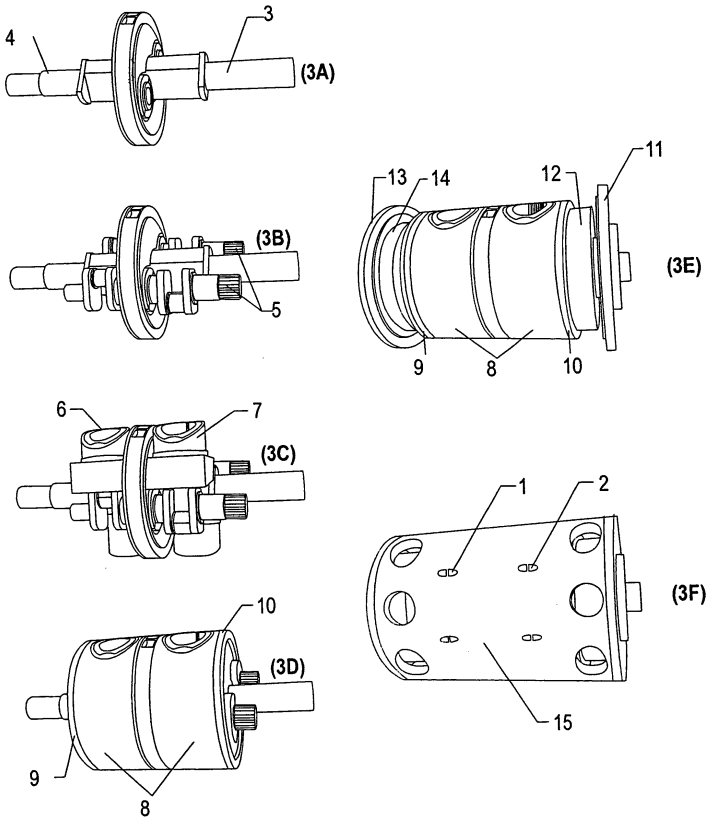


FIG. 3

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## Description

### FIELD OF THE INVENTION

**[0001]** The present invention relates generally to fluid machinery and, more specifically, to a rotary fluid motor of the type including reciprocating pistons, which rotate around its axis of rotation.

### DESCRIPTION OF THE PRIOR ART

**[0002]** Refer to my prior inventions ;
**[0003]** Patent No.: 16130 (Thailand) INTERNAL COMBUSTION ROTARY ENGINE,
**[0004]** Patent No.: US 6,536,383 B2 INTERNAL COMBUSTION ROTARY ENGINE,
**[0005]** Patent No.: US 6,813,989 B2 ROTARY COMPRESSOR OR PUMP,
**[0006]** Patent No.: EP 1 085 182 B1 INTERNAL COMBUSTION ROTARY ENGINE,
**[0007]** Patent No.: 3377968 (Japan) INTERNAL COMBUSTION ROTARY ENGINE,
**[0008]** Application No. 095096 (Thailand) ROTARY FLUID MOTOR
**[0009]** Alternative embodiments envision the use of the invention as a fluid motor. A fluid motor has the same structure as that of the rotary internal combustion engine, including cylindrical casing, a rotor with an output shaft as its axis in the cylindrical casing and crankshafts, pistons, piston chambers within the rotor. Each piston chamber undergoes downward movement by pressured-fluid through inlet-port and is discharged through outlet-port.

### SUMMARY OF THE INVENTION

**[0010]** A fluid motor comprising: a casing defining a cylindrical chamber; a rotor with input shaft as the axis is in the said cylindrical chamber, crankshaft with pinion gear at the rear end in the rotor; piston chamber and piston in the rotor exists; drive train is provided to synchronize the rotation of the input shaft and the crankshaft.

### BRIEF DESCRIPTION OF THE DRAWING

**[0011]** The above and other objects and advantages of the present invention will be understood with reference to the following detail description of embodiment thereof which is illustrated, by way of example, in the accompanying graphics; in which:

FIG. 1 is a diagrammatically illustrate inlet-port and outlet-port position of first block of rotary fluid motor,
FIG. 2 is a diagram of inlet-port and outlet-port position of second block of rotary fluid motor,
FIG. 3 is a perspective assembly view of the rotary fluid motor,
FIG. 3A is a perspective exploded view of the rotary fluid motor
FIG. 4 is a sectional view of front end plate of casing, screw gear chamber, and crankshaft front mounting plate and its' exploded view,
FIG. 5 is a sectional view of rear end plate of casing, drive train chamber and crankshaft rear mounting plate and its' exploded view,
FIG. 6 is an exploded perspective view of piston chamber base and cylindrical shape valve and detail of a connection spring stem and coil spring of cylindrical valve,
FIG. 7 is a perspective view showing interior details of the cylindrical shape valve and side view of FIG. 6,
FIG. 8 is rear view of fluid motor,
FIG. 9 is front view of fluid motor,
FIG. 10 is a perspective view of an annular body of the rotor,
FIG. 11 is a perspective view of a crankshaft middle mounting plate,
FIG. 12 is a perspective view of a crankshaft front mounting plate,
FIG. 13 is a perspective view of a crankshaft rear mounting plate,
FIG. 14 is a perspective view of output shaft and crankshaft mounting arm,
FIG. 15 diagrammatically illustrate inlet-stroke of the first rotary motor block and the concurrent outlet-stroke of the second rotary motor block,
FIG. 16 illustrate the outlet-stroke of the first rotary motor block and the concurrent inlet-stroke of the second rotary pressurizing motor block,

### DETAILED DESCRIPTION

**[0012]** The illustrated fluid motor comprises a casing formed of a pair of end plate 11, 13 and outer cylinder 15 securely assembled as shown to enclose a cylindrical rotor. Outlet-port 2 and inlet-port 1 extend through the outer cylinder 15 to provide communication with the piston chamber.
**[0013]** The cylindrical rotor includes two annular bodies 8 having a cylindrical outer surface matching the cylindrical inner surface formed by outer cylinder 15 and has output shaft 3 as axis. The rotor includes front-mounting plate of crankshaft 9 (with it's cover), and rear-mounting plate of crankshaft 10 secured against the annular bodies 8. Between two annular bodies 8 of the rotor is crankshaft middle mounting plate that comprises output shaft arm mounting plate 43 and its cover 44 (detail of plate 43 and its cover 44 are shown in FIG.11). The output shaft 3 is rotably mounted and extend through the casing by sleeve bearing mounted in the end plates 11, 13 of the casing.
**[0014]** The axis of output shaft 3 and the axis of rotor are the same axis (or concentric) and rotate together.
**[0015]** As shown in FIG.14, a crankshaft-mounting arm 56 is fixedly secured on the output shaft 3 for bodily rotation with it. A crankshaft-mounting arm 56 includes bearing housing 53, 55 and bearing 54. Piston chambers

are fixedly secured with piston chamber bases 27 inside annular body of rotor 8. Each piston chamber axially extends to the outer surface of annular bodies of rotor 8, and wrapped by its cylindrical shape valve 7. In FIG.10, seal 42 is inserted in rotor annular bodies 8 to protect lube oil leak from cylindrical shape valve 7. Axis of each piston chamber is preferably uniformly spaced from output shaft axis in the direction of rotor rotation. The cylindrical shape valve 7 is slightly movable along the axis of its piston chamber. The curved end of the valve is pressed with inner cylindrical surface of outer cylinder of casing 15 by coil springs 31 to fluid tight. As shown in FIG.6, the coil springs 31 is seated in spring stem 32 that mounted on piston chamber bases 27 and lower end of cylindrical shape valve 7 to prevent cylindrical valve from moving. At the outer surface of piston chamber base 27 has ring-seal 28 covered to prevent lube oil leak from cylindrical valve 7. Key 29 with spring is mounted in keyway 30, 34 on outside of each piston chamber and inside of its cylindrical shape valve 7 respectively. As shown in FIG.7, opening valve 35 and closing valve 36 are formed at the curve end of cylindrical shape valve 7, opening valve 35 to locate the start opening position of outlet-port and inlet-port, and closing valve 36 to locate the start closing position of outlet-port and inlet-port. A piston 6, normally of cylindrical shape similar to conventional construction, is reciprocating in each piston chamber. A piston rod is pivotally connected to each piston 6 and rotatively connected to its corresponding crank of crankshaft 5 by bearing 54. The fluid motor has two motor blocks, the first and the second block, and each block has two pistons. The first motor block, piston chamber bases 27 are fixedly secured on crankshaft front mounting plate 9 and cover of output shaft arm mounting plate 44. The second motor block, piston chamber bases 27 are fixedly secured on crankshaft rear mounting plate 10 and output shaft arm mounting plate 43.

**[0016]** FIG.4, between front end plate of casing 13 and crankshaft front mounting plate cover 9 is screw gear chamber 14, which enclose screw gear 4. The screw gear 4 is formed on the front end of output shaft 3 for driving lube oil pump.

**[0017]** A drive train is provided to synchronize the rotation of the output shaft 3 and both of the crankshafts 5. As shown in FIG.5, the drive train includes an annular gear-carrying cap 22 in drive train chamber 12. The drive train chamber 12 is between rear end plate of casing 11 and crankshaft rear mounting plate 10. A sleeve carry the output shaft is formed at the center of annular gear-carrying cap 22 with one end of this sleeve fixedly secured to rear end plate of casing 11. An annular gear 23 is fixed to the annular gear-carrying cap 22. The annular gear 23 mesh with pinion gears formed on the rear end of both crankshafts 5. The drive train shall specify the gear teeth ratio of annular gear to pinion gear to be appropriate to rotary fluid motor efficiency preferably twice the number of pistons in each motor block. For example, in a typical two-piston rotary pressurizing motor the gear teeth ration of annular gear to pinion gear shall be 4:1 so that when the output shaft rotates one round clockwise, the crankshafts will rotate four rounds. Similarly, the gear teeth ration of 3, 4, 6, 8 pistons rotary pressurizing motor shall be 6:1, 8:1, 12:1 and 16:1 respectively.

**[0018]** As output shaft 3 and crankshafts 5 concurrently rotate, the pistons 6 reciprocate in their piston chamber due to the rotation of crankshaft 5. The reciprocation of the pistons is synchronized to receive pressured-fluid through inlet-port 1 (inlet-stroke) and discharge from outlet-port 2 (outlet-stroke).

**[0019]** As an example, operation sequence of the rotary pressurizing motor as shown in FIG. 15 and FIG. 16 illustrates two sets piston of motor block. Each block comprises two-pistons.

**[0020]** During inlet-stroke of the first motor block (Fig. 15 position 57, 58, 59), piston chamber No. 1 & 2 passes through the inlet-port while the piston moves down by the pressured-fluid into its piston chamber. When the piston complete it downward-stroke, the inlet-stroke is also complete. At the same time the second motor block is operated in outlet-stroke (Fig.15 position 60, 61, 62).

**[0021]** Outlet-stroke of the first motor block (Fig.16 position 63, 64) occurs when piston chamber No. 1 & 2 continues moving around the output shaft while the crankshaft drives piston No. 1 & 2 move up to discharge fluid. At the same time the second motor block is operating in inlet-stroke (Fig.16 position 65, 66).

**[0022]** Piston chamber No.1 and No.2 make the first motor block while piston chamber No.3 and No.4 make the second piston chamber set. The movement of each pair of piston must be balanced in order to maximize the output-power. However, this does not limit variation of the invention. Depending on the capacity required, the rotary pressurizing motor might comprise a plurality of motor block preferably. Again, one motor block may comprise a plurality of pistons and piston chambers preferably at least two for the same requirement for balancing. Moreover, the inlet stroke of each piston will substantially twice to no. of piston in each motor block that are six, eight, twelve and sixteen for 3, 4, 6, 8 pistons motor block.

## Claims

**1.** A rotary fluid motor comprising:

a fixed cylindrical casing,

a rotor in said casing, said rotor having an output shaft extending rotatably and co-axially in said casing, said rotor including a plurality of piston chambers and respective pistons in said piston chambers, said pistons being reciprocable in said chambers along lines spaced radially from an axis of rotation of said output shaft and said pistons each having a piston rod connected to a crankshaft connected to said rotor for rotation therewith,

said casing having fluid inlet-ports and outlet-ports communicating with said piston chambers during rotation of said rotor to admit pressured-fluid through said inlet-port and discharge from outlet-port,

a valve member on said piston chamber to provide respective communication between said inlet and outlet ports and said piston chamber, said valve member having cylindrically shaped end corresponding to said cylindrical casing to close said ports when said valve member is closed,

a drive train synchronizing rotation of the said crankshaft and said output shaft, the gear teeth ratio of annular gear to pinion gear to be appropriate to engine efficiency preferably twice the number of pistons in each engine block, two, three, four, five, six piston engine shall be 4:1, 6:1, 8:1, 10:1, 12:1 respectively, and

said pistons undergoing reciprocal movement in said piston chambers in synchronism in which the pistons all have the same stroke position in said chambers.

**2.** The rotary fluid motor of claim 1, wherein said rotor includes a plurality of blocks each including a plurality of said pistons and piston chambers.

**3.** The rotary fluid motor of claim 2, wherein said piston chambers and said pistons are arranged in said blocks in pairs in opposition to one another.

**4.** The rotary fluid motor of claim 1, comprising a crank arm connected to said rotor, said piston rods being connected to respective ends of said crank arm.

**5.** The rotary fluid motor of claim 2, wherein each said block includes a mounting plate rotatably supporting one end of the crankshafts of the pistons in said block, and a middle mounting plate disposed between adjacent blocks to rotatably support opposite ends of the crankshafts of the pistons in the adjacent blocks.

**6.** The rotary fluid motor of claim 5, wherein said valve casings are secured to said mounting plates.

**7.** The rotary fluid motor of claim 1, wherein each piston has a curved end corresponding in shape to the cylindrical casing.

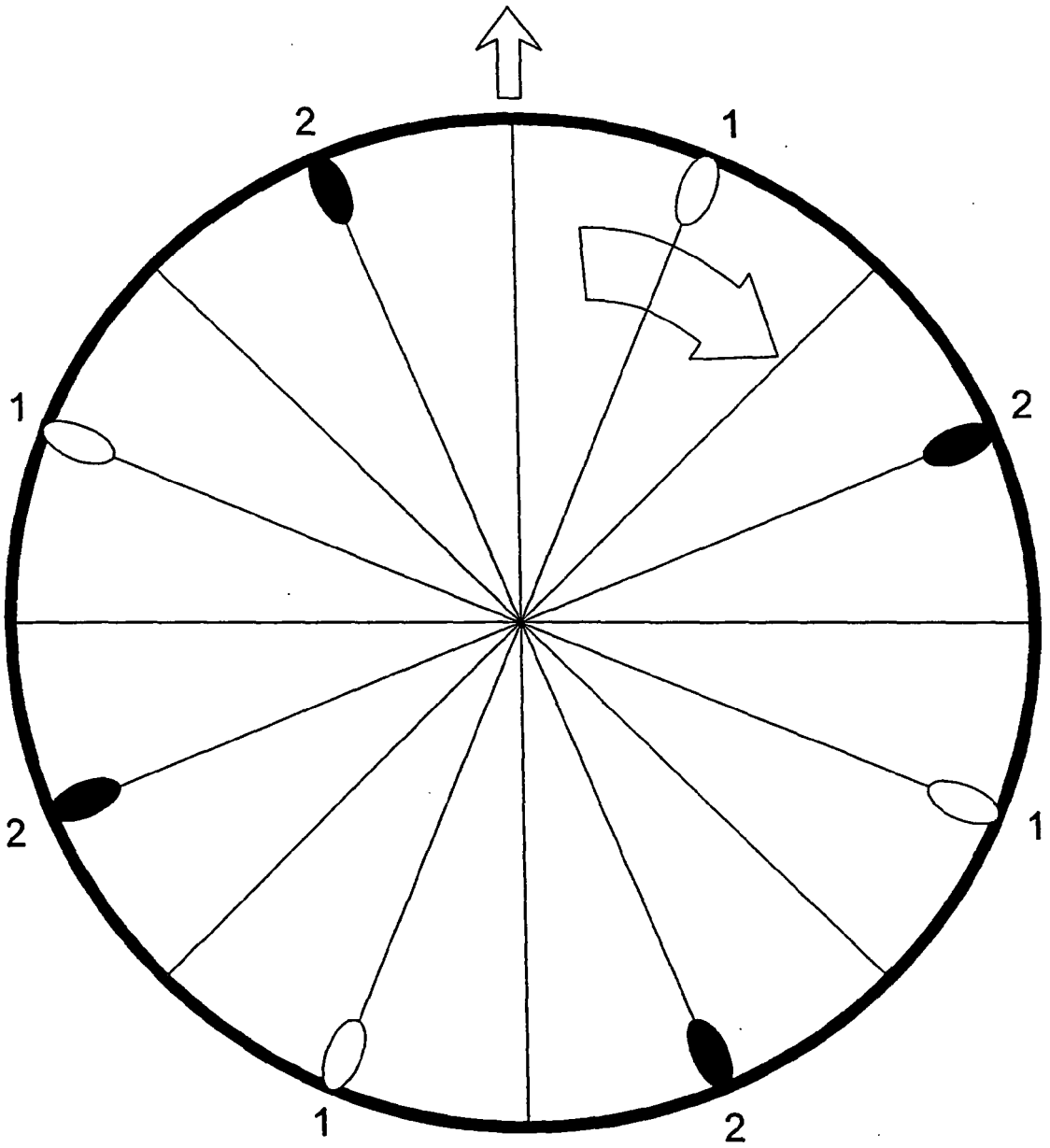


FIG. 1

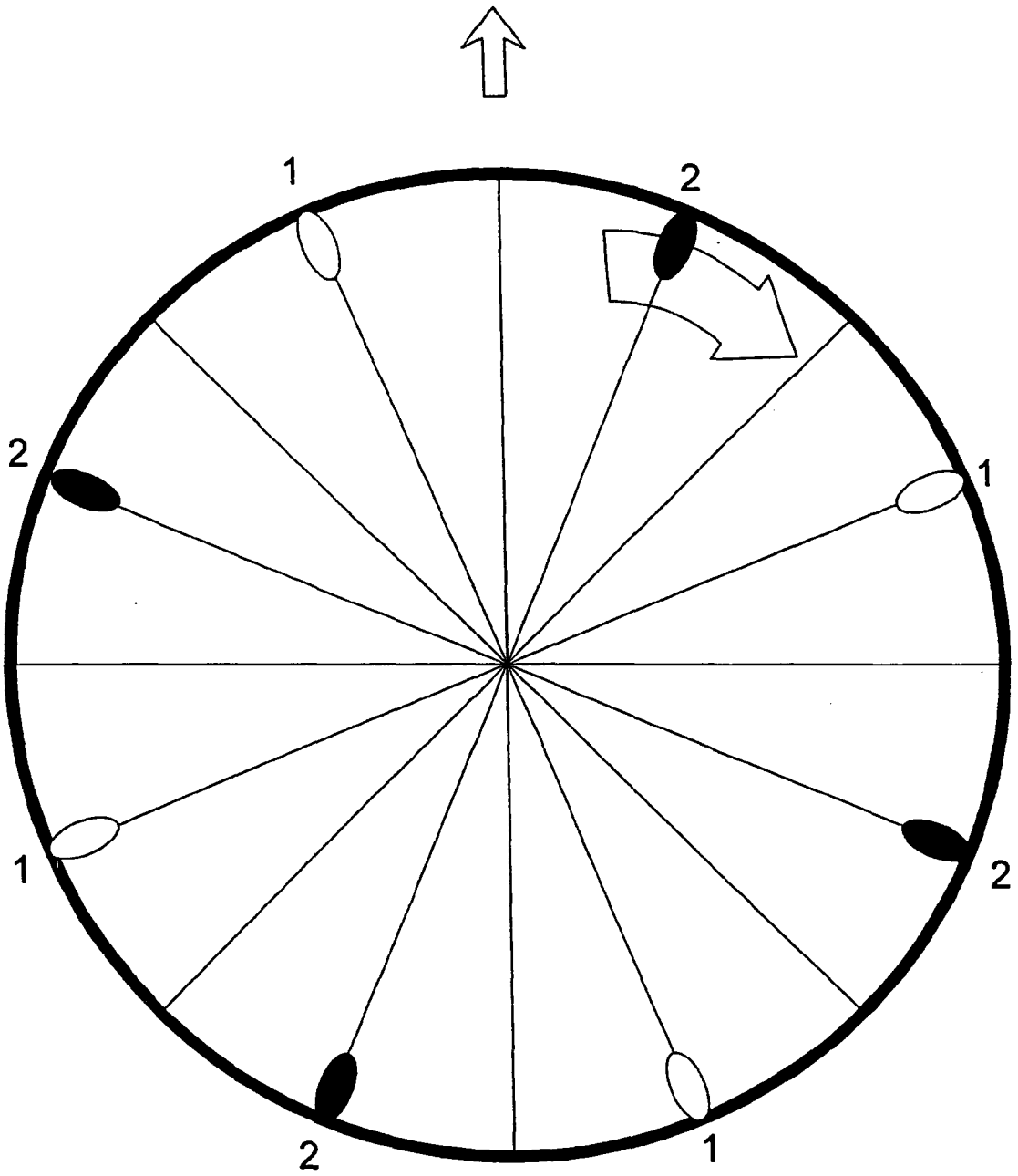


FIG. 2

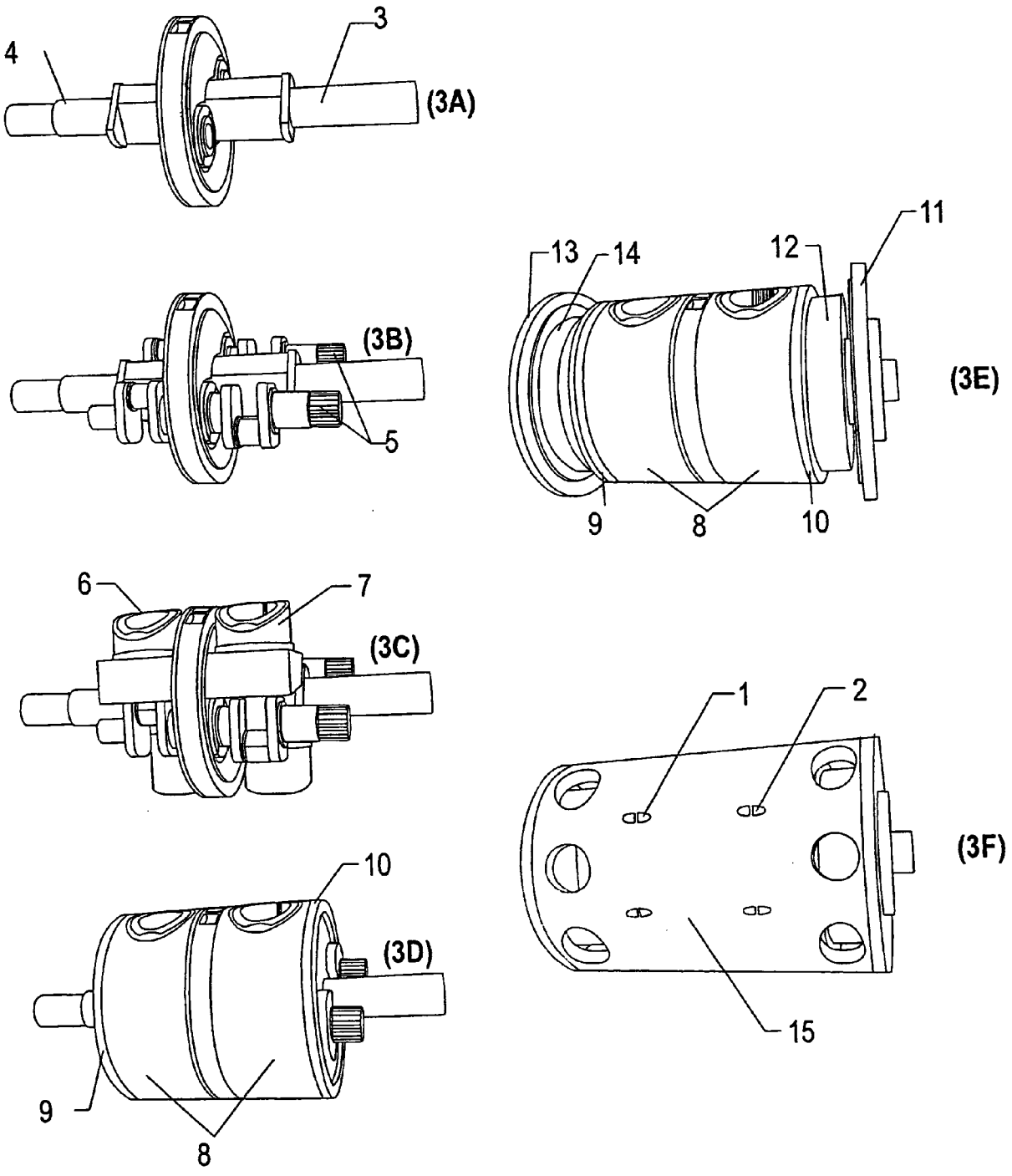


FIG. 3

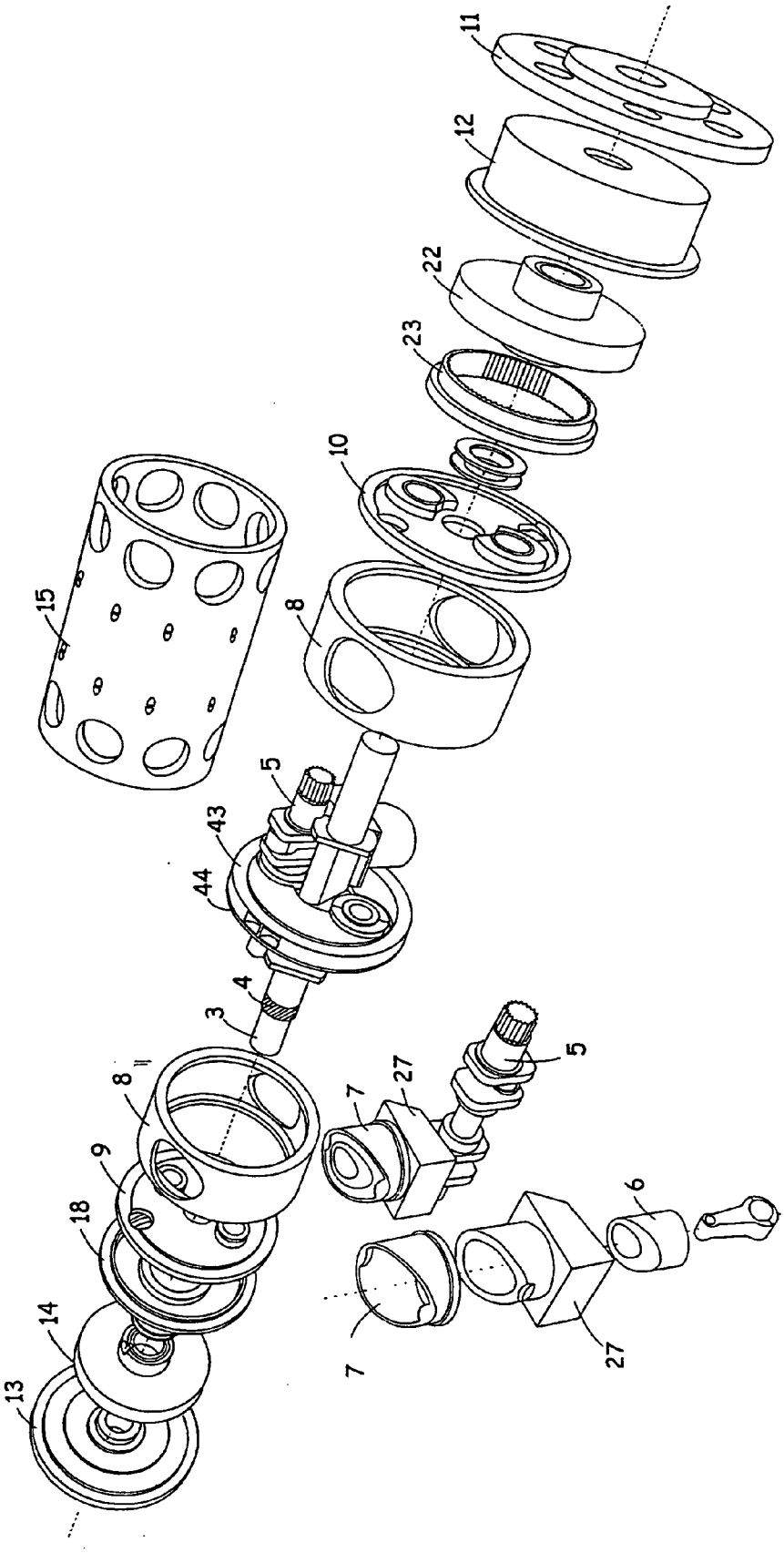


FIG. 3A

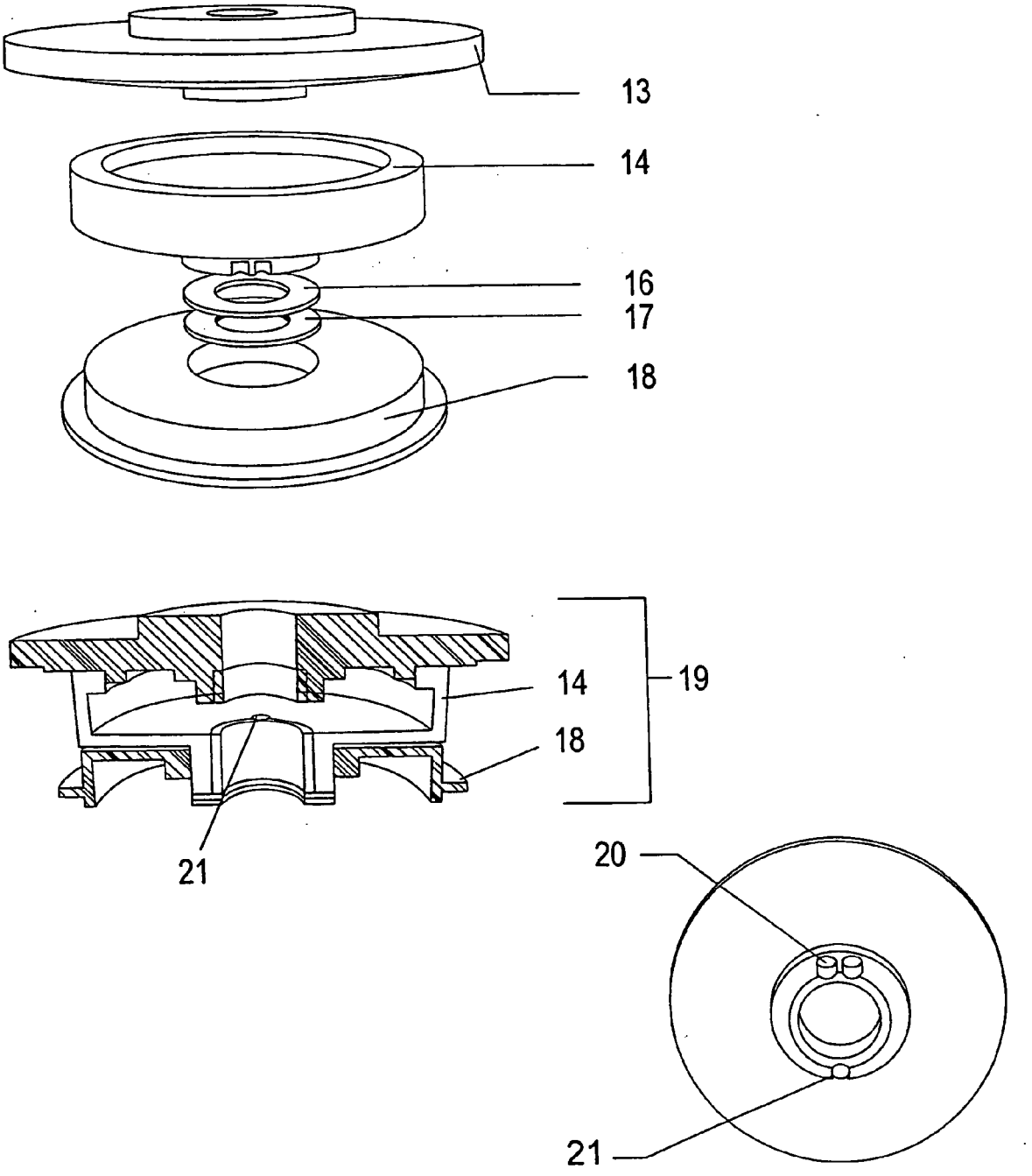


FIG. 4

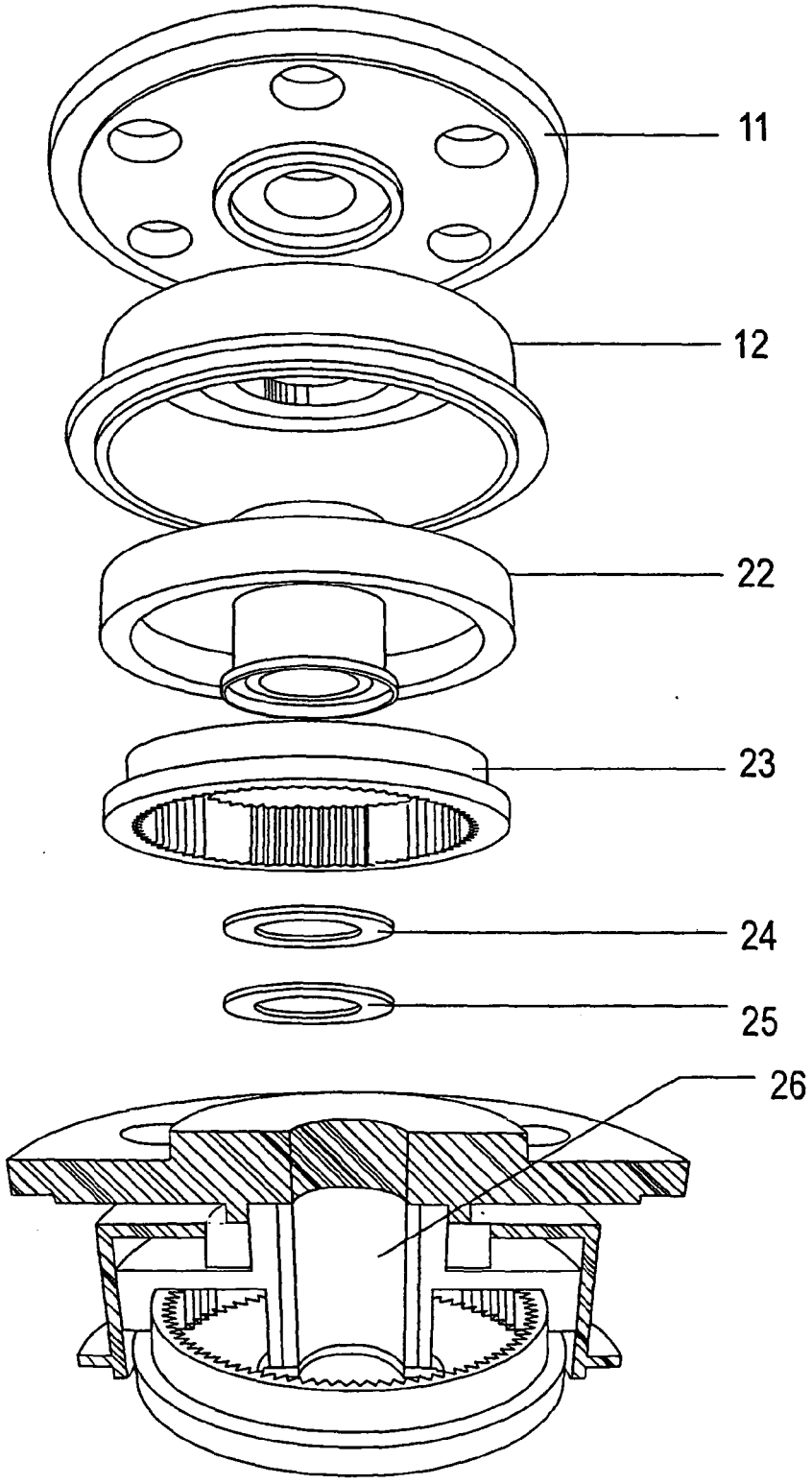


FIG. 5

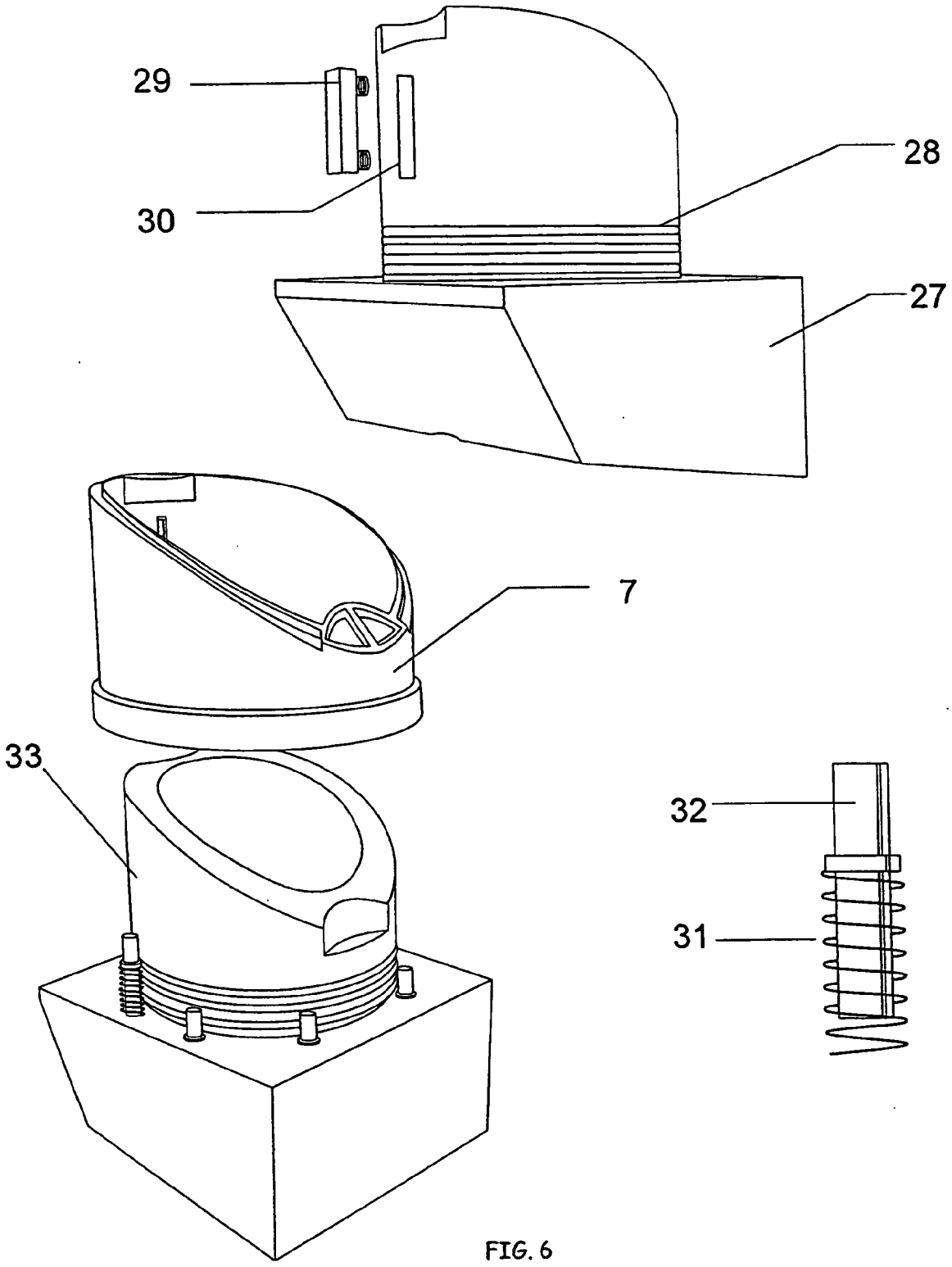


FIG. 6

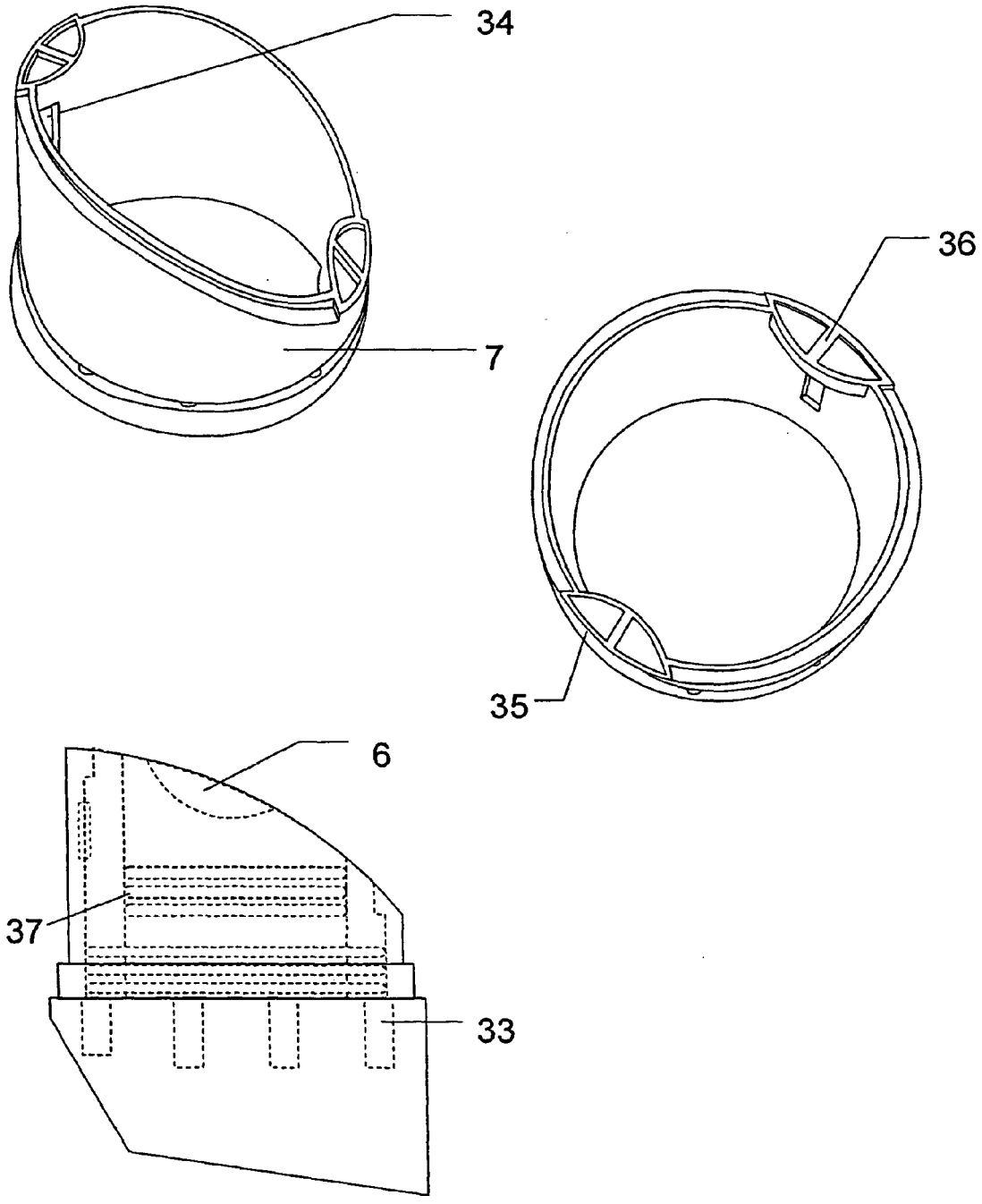


FIG. 7

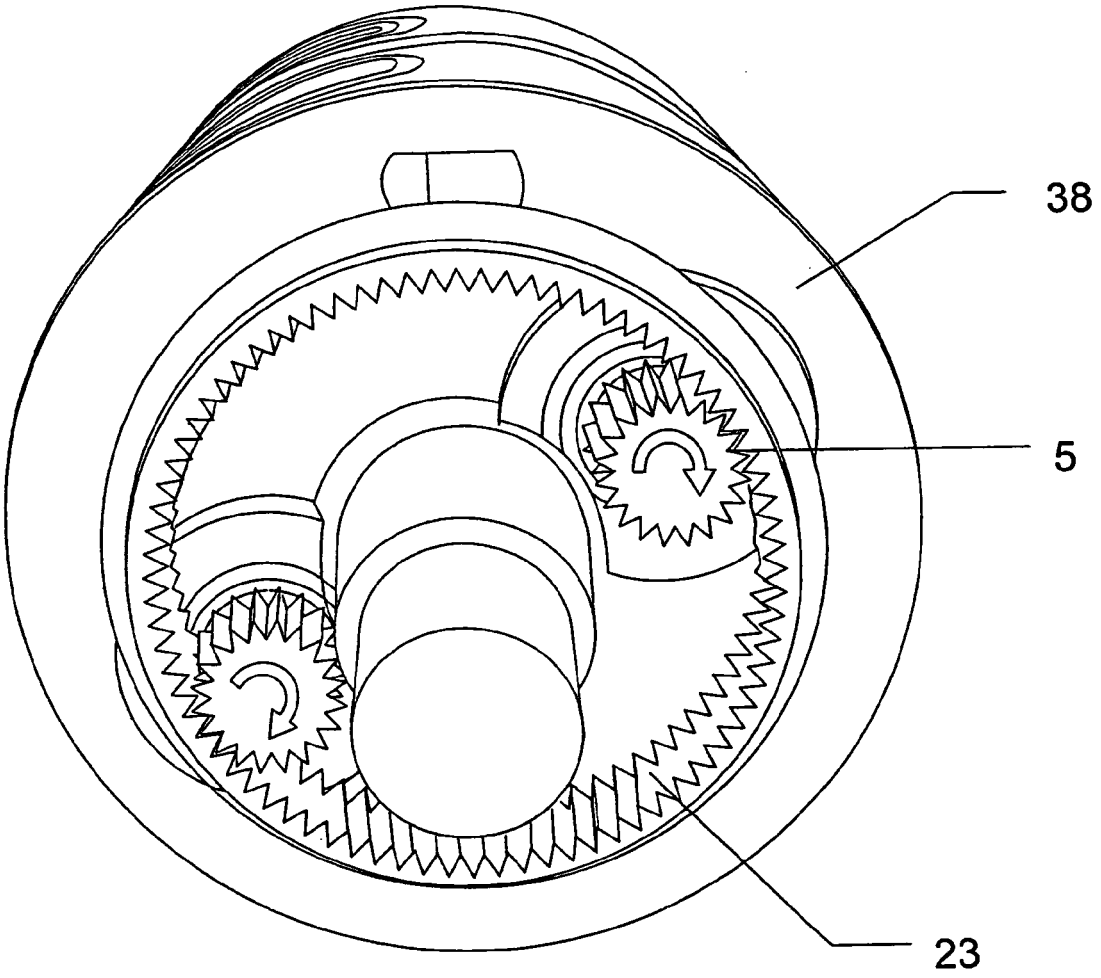


FIG. 8

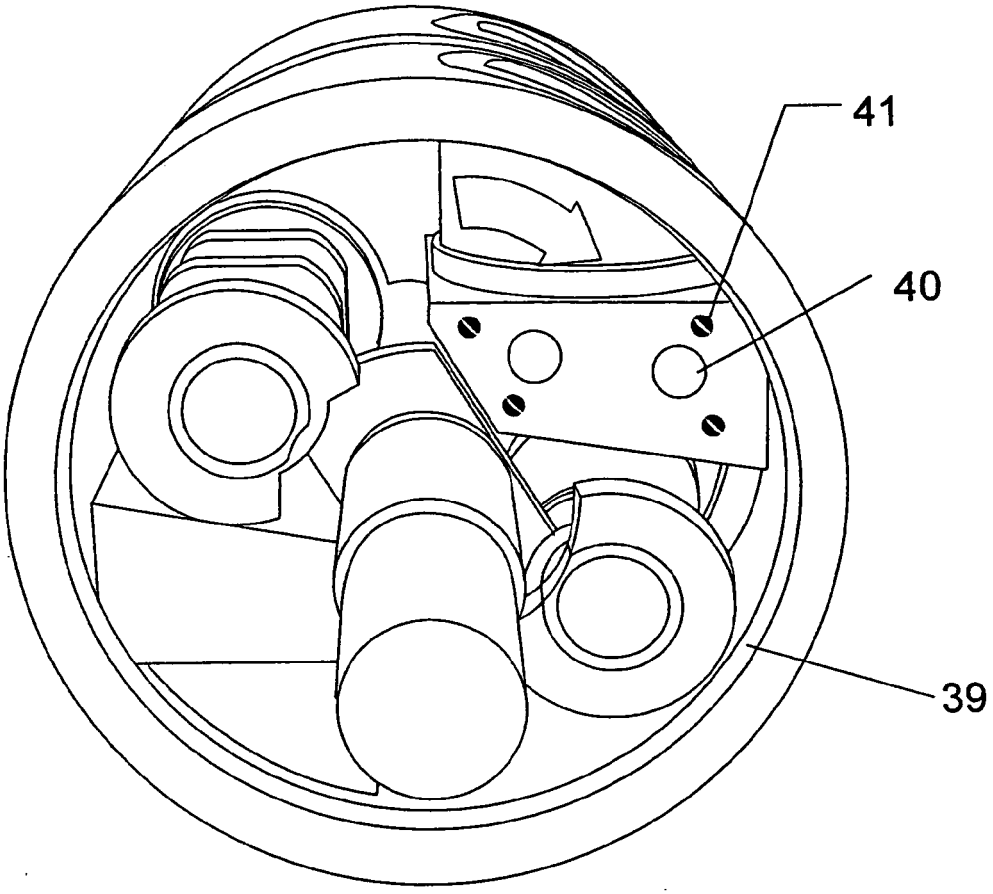


FIG. 9

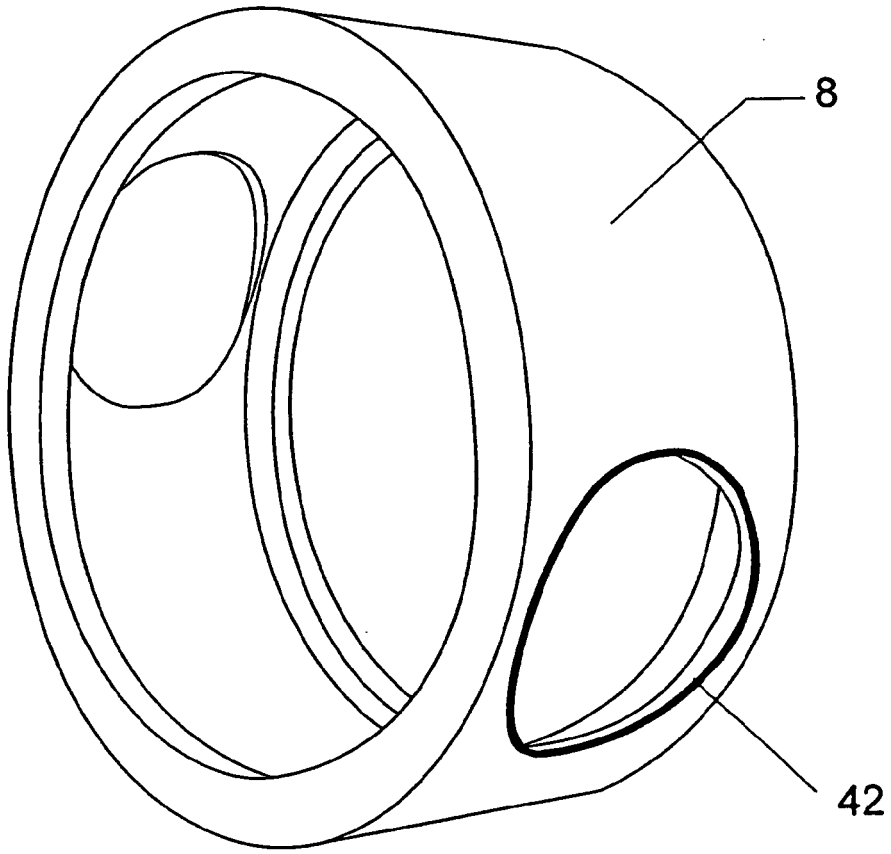


FIG. 10

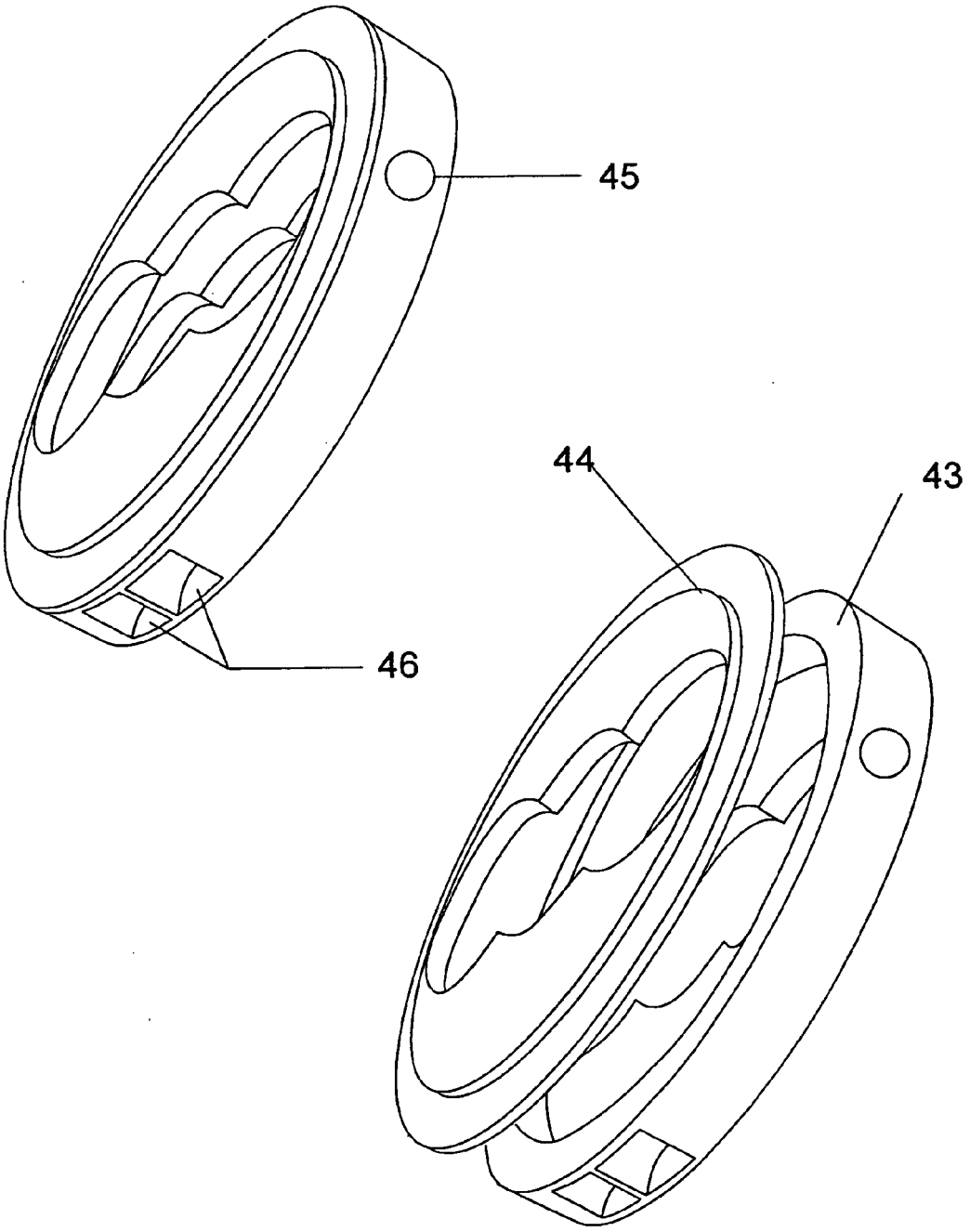


FIG. 11

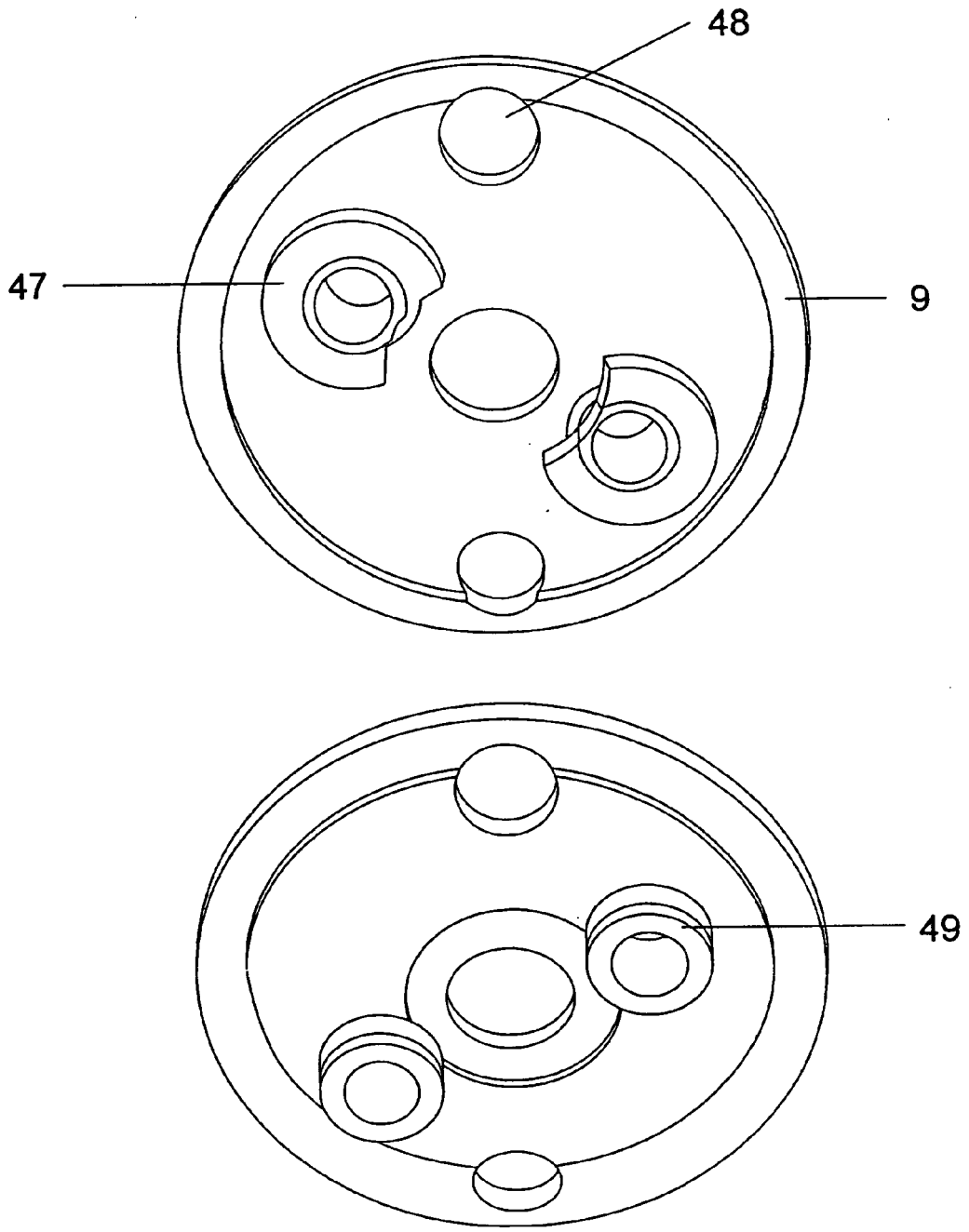


FIG. 12

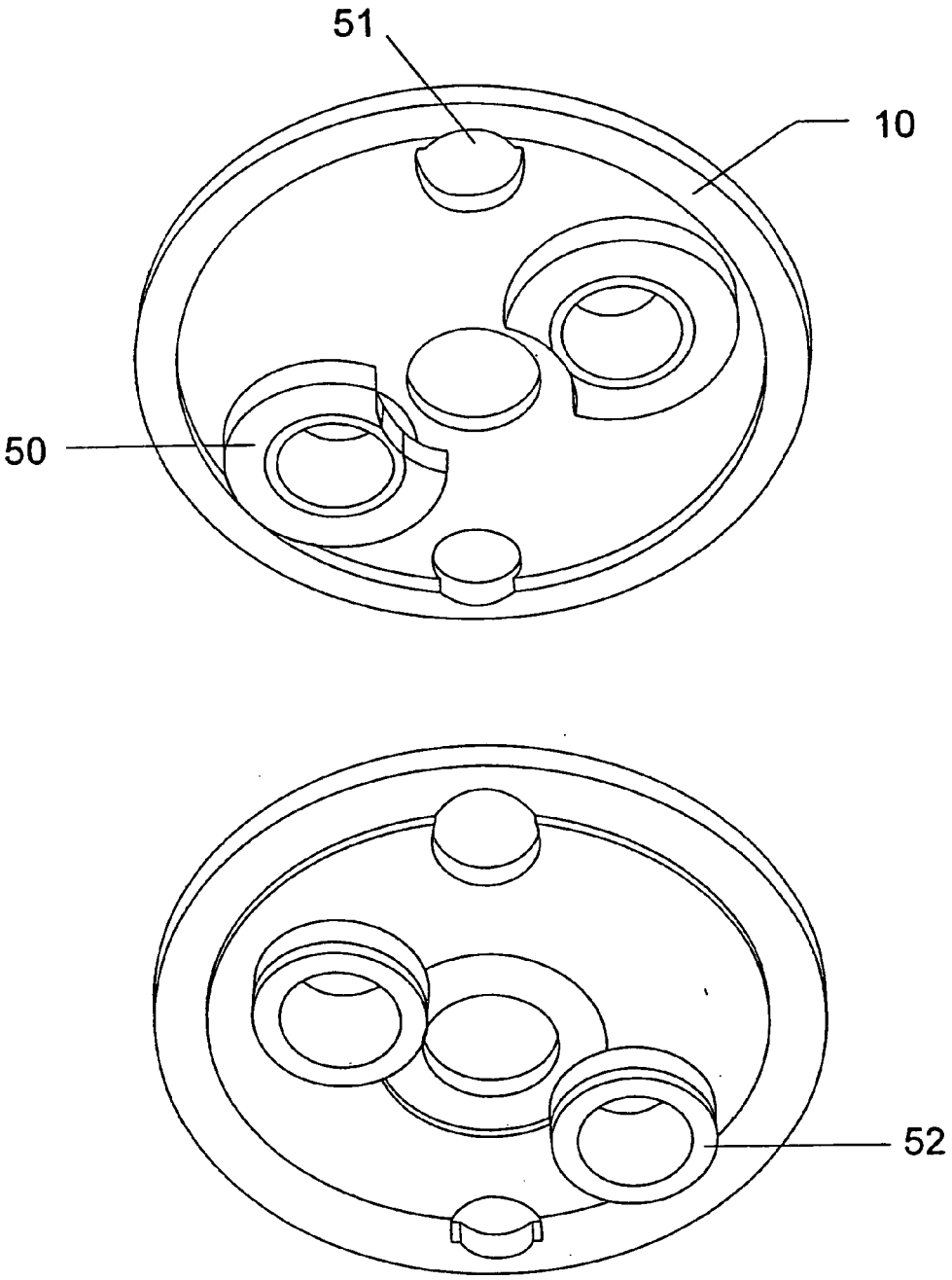


FIG. 13

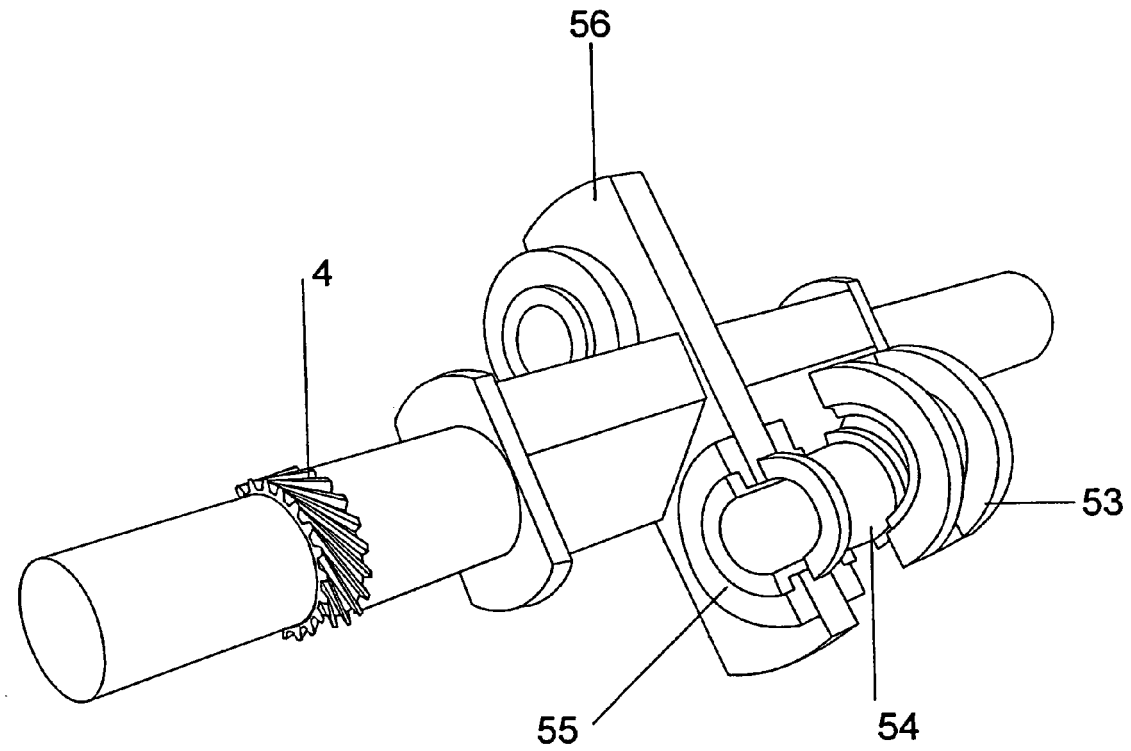


FIG. 14

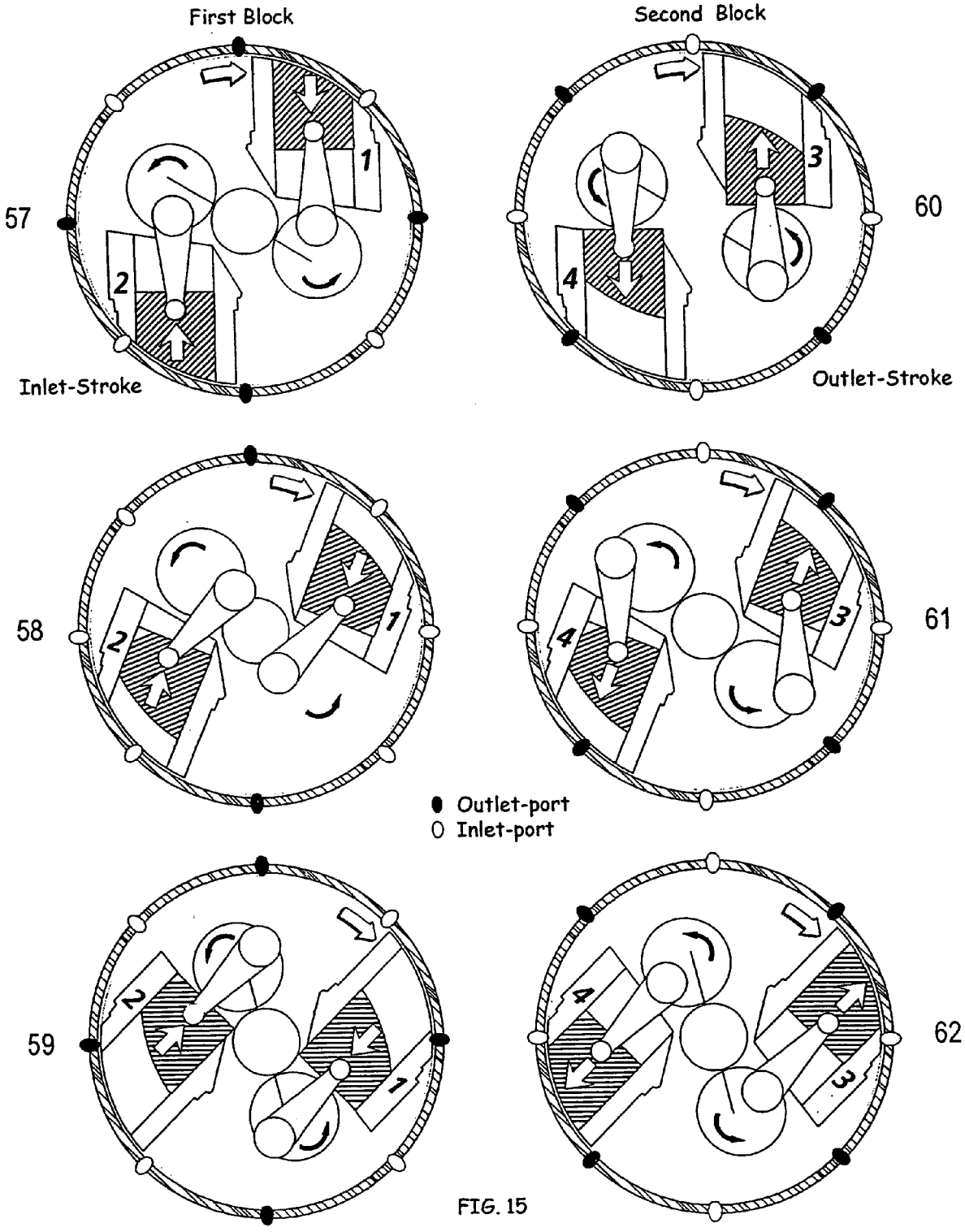
First Block
Second Block
57
60
1
2
3
4
Inlet-Stroke
Outlet-Stroke
58
61
59
62
Outlet-port
Inlet-port

FIG. 15

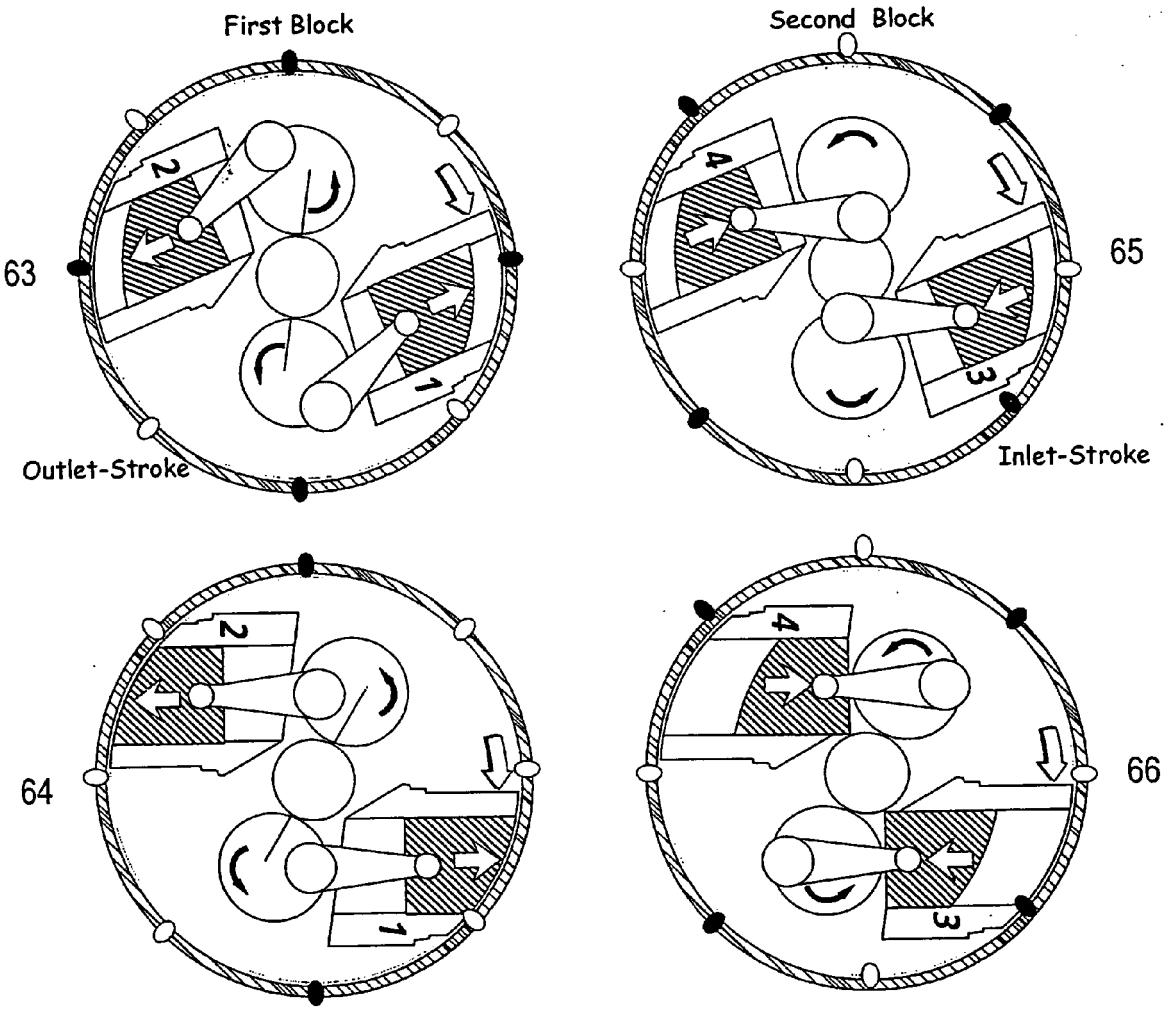
First Block
Second Block
63
65
64
66
Outlet-Stroke
Inlet-Stroke
1
2
3
4

FIG. 16

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 05 25 6509

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| D,X | EP 1 085 182 A (SANTIYANONT, CHANCHAI) 21 March 2001 (2001-03-21) * paragraphs [0016] - [0019] * * paragraphs [0024], [0025] * * figures 1-22 * | 1-7 | F01B5/00 F01B13/04 |
| D,X | US 2003/154936 A1 (SANTIYANONT CHANCHAI) 21 August 2003 (2003-08-21) * claim 1 * * figure 13 * | 1-7 | |
| D,X | US 2002/056420 A1 (SANTIYANONT CHANCHAI) 16 May 2002 (2002-05-16) * paragraphs [0039] - [0042] * * claims 9,11 * * figures 16,17 * | 1-7 | |

TECHNICAL FIELDS SEARCHED (IPC)

F01B

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| The Hague | 22 March 2006 | Matray, J-F |

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 05 25 6509

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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22-03-2006

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| | | JP 2000097038 A | 04-04-2000 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82