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(71) Applicant: **Calsonic Kansei Corporation**
Tokyo 164-8602 (JP)

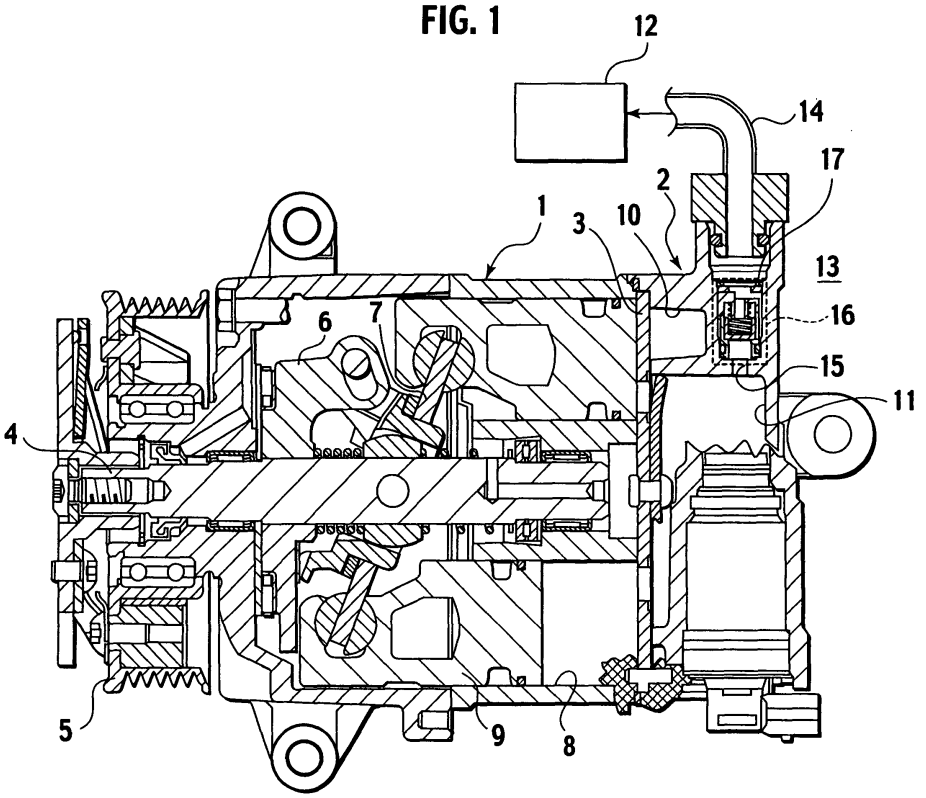
(72) Inventor: **Higashihara, Shinichiro**
Tokyo 164-8602 (JP)

(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser
Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) Discharge structure of compressor, with non-return valve

(57) A discharge structure (13, 31, 38) having a non return valve (16) applied to a compressor, is provided with: an inflow opening (25) for being linked with a discharge port (15) of the compressor; an outflow opening (21) ; a main body (22) in which the inflow opening (25) links with the outflow opening (21); a valve body (23) being movable relatively to the main body (22) so as to open and close the outflow opening (21); and an elastic body (24) configured to urge the valve body (23) to close the outflow opening (21) in a steady state and deform to allow movement of the valve body (23) to open the outflow opening (21) when a fluid pressurized by the compressor presses the valve body (23).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

[0001] The present invention relates to a discharge structure of a compressor for compressing and discharging a fluid, a nonreturn valve therefor and a compressor therewith.

DESCRIPTION OF THE RELATED ART

[0002] A compressor is used for compressing and discharging various fluids such as a coolant and in general applied to an air-conditioner and such. The compressor is provided with a discharging valve. Open and close movement of the discharging valve may cause pulsating flow of the fluid. In a case where a nonreturn valve is applied to the discharging valve, pulsation may get worse.

[0003] Japanese Application Laid-open No. H11-315785 in paragraphs 0035 through 0040 discloses an art of a compressor which reduces such pulsation. The compressor is provided with a throttle formed in a unitary body with a discharge port of a housing, which contributes to reduction of pulsation.

SUMMARY OF THE INVENTION

[0004] According to the aforementioned art, since the throttle is formed in a unitary body with the housing, the housing is unavoidably large-sized and freedom of design is decreased.

[0005] The present invention is intended for providing a discharging structure of a compressor for compressing and discharging a fluid, a nonreturn valve therefore and a compressor therewith, where a throttle is not formed in a unitary body with a housing.

[0006] According to an aspect of the present invention, a discharge structure having a nonreturn valve applied to a compressor is provided with: an inflow opening for being linked with a discharge port of the compressor; an outflow opening; a main body in which the inflow opening links with the outflow opening; a valve body being movable relatively to the main body so as to open and close the outflow opening; and an elastic body configured to urge the valve body to close the outflow opening in a steady state and deform to allow movement of the valve body to open the outflow opening when a fluid pressurized by the compressor presses the valve body.

[0007] Preferably, the main body is provided with a tubular member having a side wall, a first end and a second end, the tubular member including the outflow opening penetrating the side wall, an inflow opening at the first end and a second opening at the second end, and housing the valve body movably and the elastic body so as to urge the valve body, and a cap member covering the second end.

[0008] Preferably, the discharge structure is further provided with anti-pulsation means for reducing pulsation of a fluid generated by the compressor, the anti-pulsation means being attached to the nonreturn valve and linked with the outflow opening of the nonreturn valve.

[0009] Preferably, the anti-pulsation means is provided with a throttled through-hole. Preferably, the anti-pulsation means is provided with a throttle member including a throttled through-hole penetrating the throttle member. More preferably, the throttle member is formed in a unitary body with a retainer for fixing the nonreturn valve.

[0010] Preferebly, a compressor is provided with a tubular flow port, the discharge structure housed in the tubular flow port, a deflection plate including a through-hole penetrating the deflection plate, the deflection plate being attached to the cap member; a flow path formed between the tubular member and the tubular flow port; and a radial flow path defined by the cap member and the deflection plate, wherein the through-hole, the radial flow path and the flow path are linked with the outflow opening.

[0011] Preferably, the through-hole is smaller in cross section than the flow path and the radial flow path. The radial flow path is smaller in cross section than the flow path and the through-hole. More preferably, the deflection plate is formed in a unitary body with a retainer for fixing the nonreturn valve.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a cross-sectional view of a compressor provided with a discharge structure in accordance with a first embodiment of the present invention;

Figs. 2A and 2B are cross-sectional views of the discharge structure in accordance with the first embodiment;

Fig. 3 is an exploded perspective view of a nonreturn valve applied to the discharge structure in accordance with the first embodiment;

Fig. 4 is an assembled perspective view of the nonreturn valve showing a state in which the nonreturn valve is closed;

Fig. 5 is an assembled perspective view of the nonreturn valve showing a state in which the nonreturn valve is opened;

Fig. 6 is an explanatory drawing showing anti-pulsation means applied to a second embodiment of the present invention;

Fig. 7 is a cross-sectional view of a discharge structure in accordance with the second embodiment; and

Fig. 8 is an explanatory drawing showing anti-pulsation means applied to a third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0013] Certain embodiments of the present invention will be described hereinafter with reference to accompanying drawings.

[0014] Reference is now made to Fig. 1 in which a compressor provided with a discharge structure in accordance with a first embodiment of the present invention is shown.

[0015] The compressor is provided with a housing 1 , a rear-housing 2 joined with a rear end (shown in the right side of Fig. 1) of the housing 1, a valve plate 3 disposed between the housing 1 and the rear-housing 2, a shaft 4 rotatably supported in the housing 1, a power transmission part 5 for transmitting power of an engine (not shown) , which is linked with a top end of the shaft 4, a rotational support body 6 fixed with the shaft 4, an inclined plate 7 supported by the rotational support body 6, plural compression chambers (cylinder bores) 8 and pistons 9 respectively reciprocating in the compression chambers 8. A suction chamber 10 and a discharge chamber 11 are formed in the rear-housing 2. The discharge chamber 11 is linked with an external coolant circuit 12. When the pistons 9 reciprocate in the compression chambers 8, repeatedly coolant gas is sucked from the suction chamber 10, compressed to a predetermined pressure in the compression chambers 8 and then discharged to the discharge chamber 11. The discharged high-pressure coolant gas is further discharged out of the discharge chamber 11 to circulate through the external coolant circuit 12 and returns to the suction chamber 10.

(FIRST EMBODIMENT)

[0016] The first embodiment of the present invention will be described hereinafter with reference to Figs. 1 through 5.

[0017] A discharge structure 13 is provided with a tubular flow port R so as to link the discharge chamber 11 with a connection end of a discharge pipe 14. An aperture 15, a nonreturn valve 16 and anti-pulsation means 17 are coaxially arranged in this order on an axis defined by the tubular port R, the discharge chamber 11 and the discharge pipe 14. The aperture 15, the nonreturn valve 16 and the anti-pulsation means 17 form a fluid discharge path. The aperture 15 links the discharge chamber 11 with the nonreturn valve 16. The anti-pulsation means 17 is linked with an outflow end of the nonreturn valve 16.

[0018] The anti-pulsation means 17 is throttle means for throttling a flow of the coolant gas. The throttle means is provided with a throttle member 19 having a throttled through-hole 18 substantially at a center thereof. The throttle member 19 is disposed between the nonreturn valve 16 and a retainer (C-ring) 20 for fixing the nonreturn valve 16.

[0019] The nonreturn valve 16 is provided with outflow openings 21, a main body 22, a valve body 23 which is movable relatively to the main body 22 so as to open and close the outflow openings 21 and an elastic body 24. The elastic body 24 urges the valve body 23 to close the outflow openings 21 in a steady state and deforms to allow movement of the valve body 23 to open the outflow openings 21 when a fluid pressurized by the compressor presses the valve body 23. The main body 22 is provided with a tubular member 26, a first end (a lower end shown in Fig. 3) of which has an inflow opening 25 at a first end and a second end (an upper end shown in Fig. 3) of which is an opened end, and a cap member 27 which is detachably attached to and covers the second end. The inflow opening 25 is linked with the discharge chamber 11 via the aperture 15. The outflow openings 21 are formed on and penetrate a side wall of the tubular member at substantially even intervals (at every 90 degrees in the present embodiment) . An O-ring 45 is fitted on an outer periphery of the tubular member 26 near to the inflow opening 25 to seal a clearance between the tubular member 26 and the tubular flow port R.

[0020] The valve body 23 is housed in the tubular member 26 to be movable between an open position shown in Fig. 2A and a close position shown in Fig. 2B. The elastic body 24 is housed in the tubular member 26 and disposed between the valve body 23 and the first end of the tubular member 26 to urge the valve body 23 toward the close position in a steady state.

[0021] As accompanying the axial movement of the valve body 23, the valve body 23 opens the outflow openings 21 when in the open position shown in Fig. 2B; and closes the outflow openings 21 when in the close position shown in Fig. 2A. The cap member 27 is composed of a disk 28 attached to the second end (the upper end shown in Fig. 3) of the main body 22, a spring supporter 29 projecting toward the first end and disposed at a center of the disk 28 and plural (four in the present embodiment) projections 30 formed on an outer periphery of the disk 28 at even intervals. The projections 30 respectively project outward and upward so as to form flow paths therebetween. The projections 30 further project downward so as to be capable of latching with the outflow openings 21 of the main body 22.

[0022] When assembling the nonreturn valve 16, first the valve body 23 is inserted into the second end of the main body 22. Second one end of the elastic body 24 is made to abut on the valve body 23 and another end is engaged with the spring supporter 29. In this state, the disk 28 is installed on the second end of the main body 22 and the projections 30 are latched with the outflow openings 21 of the main body 22.

[0023] The cap member 27 is provided with a vent at a center thereof for ventilation of gas between the valve body 23 and the cap member 27, thereby the valve body 23 is capable of smoothly moving .

[0024] In accordance with the first embodiment, in a case where discharge pressure of the fluid pressurized by the compressor is relatively low, the outflow openings

21 formed on the side wall of the tubular member 26 are closed as shown in Figs. 2A and 4 because the elastic body 24 steadily urges the valve body 23 toward the close position. Therefore, the fluid in the side of the discharge pipe 14 relative to the nonreturn valve 16 is prevented from flowing backward to the discharge chamber 11. In a case where the discharge pressure is sufficiently high, the fluid presses the valve body 23 to the open position against a repulsive force of the elastic body 24 as shown in Figs. 2B and 5. Thereby, the fluid in the discharge chamber 11 of the rear-housing 2 is capable of flowing through the aperture 15 and the inflow opening 25 and out of the outflow opening 21. The fluid further flows through a flow path between the outer periphery of the tubular member 26 and the inner periphery of the tubular flow port R and splittingly flows through the flow paths formed between the projections 30. The split fluid gathers above the center of the disk 28 and flows out of the throttled through-hole 18. In the course of flowing, the pulsation of the fluid is twice reduced at the aperture 15 and the throttled through-hole 18 because both the aperture 15 and the throttled through-hole 18 are throttled. After the reduction of the pulsation, the fluid flows through the retainer 20 and the discharge pipe 14 and is delivered to the external coolant circuit 12.

[0025] As being understood from the above description, the discharge structure 13 in accordance with the first embodiment is capable of doubly reducing the pulsation of the fluid by means of both the aperture 15 and the throttled through-hole 18. Because the discharge structure 13 by itself has the throttle member 19 with the throttled through-hole 18, unlike the prior art, the housing 1 of the compressor is not necessary to have any anti-pulsation means. This leads to avoidance of large-sizing and increase in freedom of design. Moreover, because the throttle member 19 is disposed adjacent to the nonreturn valve 16, alignment of the nonreturn valve 16 is unnecessary to be accomplished with high precision.

[0026] Moreover, the discharge chamber 11, the aperture 15, the nonreturn valve 16 and the anti-pulsation means 17 are coaxially arranged in this order on the axis from the discharge chamber 11 to the discharge pipe 14, thereby the flow path defined by the aperture 15, the nonreturn valve 16 and the anti-pulsation means is formed to be a simple structure. This leads to saving a space in the rear-housing for housing these members. Furthermore, the fluid flows along the axis in a substantially linear way, thereby flow resistance except for those by the aperture 15 and the throttle member 19 can be reduced.

[SECOND EMBODIMENT]

[0027] A second embodiment of the present invention will be described hereinafter with reference to Figs. 6 and 7. In the following description, substantially the same elements as any of the aforementioned elements will be referenced with the same numerals and the detailed descriptions thereof will be omitted.

[0028] A discharge structure 31 in accordance with the second embodiment differs from the aforementioned discharge structure 13 in accordance with the first embodiment mainly in that anti-pulsation means 32 is provided with a throttle member 33 formed in a unitary body with a retainer for fixing the nonreturn valve 16. The other members are substantially the same as those of the first embodiment.

[0029] The throttle member 33 has a throttled through-hole 34 substantially at a center thereof. The throttle member 33 is further provided with plural latching pieces 35 projecting from an outer periphery thereof toward that where the fluid is discharged, which are capable of latching with the rear-housing 2. The latching pieces 35 form flow paths therebetween. The throttle member 33 is further provided with a columnar member 36 so as to keep a gap 37 between the throttle member 33 and the nonreturn valve 16. The fluid out of the nonreturn valve 16 flows through the gap 37 to gather below the center of the throttle member 33 and flows out of the throttled through-hole 34. In the course of flowing, the pulsation of the fluid is reduced at the throttled through-hole 34. After the reduction of the pulsation, the fluid flows through the discharge pipe 14 and is delivered to the external coolant circuit 12.

[0030] Instead of providing the throttle member 33 with the columnar member 36, the projections 30 may be used to keep the gap between the throttle member 33 and the cap member 27.

[0031] Like the aforementioned first embodiment, the discharge structure 31 in accordance with the second embodiment is capable of reducing the pulsation of the fluid by means of the throttled through-hole 34 formed in the throttle member 33. Because the discharge structure 31 by itself has the throttle member 33, unlike the prior art, the housing 1 of the compressor is not necessary to have any anti-pulsation means. This leads to avoidance of large-sizing and increase in freedom of design. Moreover, because throttle member 33 is disposed adjacent to the nonreturn valve 16, alignment of the nonreturn valve 16 is unnecessary to be accomplished with high precision.

[0032] Moreover, because the throttle member 33 is formed in a unitary body with the retainer for fixing the nonreturn valve 16, installation of these members can be accomplished at once.

[0033] Though the aforementioned descriptions are given to the first embodiment, in which the throttle member 19 is individually provided, and the second embodiment, in which the throttle member 33 is provided as a unitary body with the retainer, the present invention is not limited to these embodiments. For example, any throttle member may be provided in a manner of a unitary body with the nonreturn valve or with the rear-housing.

[THIRD EMBODIMENT]

[0034] A third embodiment of the present invention will

be described hereinafter with reference to Fig. 8. In the following description, substantially the same elements as any of the aforementioned elements will be referenced with the same numerals and the detailed descriptions thereof will be omitted.

[0035] A discharge structure 38 in accordance with the third embodiment is provided with a deflection plate 39 on the cap member 27 at an outflow side relative to the cap member 27 as shown in Fig. 8. The deflection plate 39, the disk 38 and the projections 30 define throttled ports 40 to function as anti-pulsation means.

[0036] Moreover,in the dischargestructure and/or the compressor in accordance with the present embodiment, a flow path 42 is formed between the tubular member 26 and the tubular flow port R; radial flow paths 41 are defined by the cap member 27 and the deflection plate 39; and a central through-hole 44 is formed in the deflection plate 39.

[0037] The central through-hole 44 of the deflection plate 39 may be smaller in cross section than the flow path 42 and the radial flow paths 41. The radial flow paths 41 are smaller in cross section than the flow path 42 and the central through-hole 44 of the deflection plate 39.

[0038] Moreover, the deflection plate 39 may be formed in a unitary body with the retainer 20 or the nonreturn valve 16.

[0039] The present invention can be applied to wide uses such as air-conditioners for vehicles, machines for commercial use and industrial machines, because the present invention provides a compact compressor which may be applied to general use and has facility with respect to installation.

[0040] Although the invention has been described above by reference to certain embodiments of the invention, the invention is not limited to the embodiments described above. Modifications and variations of the embodiments described above will occur to those skilled in the art, in light of the above teachings.

Claims

1. A discharge structure (13, 31, 38) having a nonreturn valve (16) applied to a compressor, comprising:

   an inflow opening (25) for being linked with a discharge port (15) of the compressor;
   an outflow opening (21);
   a main body (22) in which the inflow opening (25) links with the outflow opening (21);
   a valve body (23) being movable relatively to the main body (22) so as to open and close the outflow opening (21); and
   an elastic body (24) configured to urge the valve body (23) to close the outflow opening (21) in a steady state and deform to allow movement of the valve body (23) to open the outflow opening (21) when a fluid pressurized by the compressor presses the valve body (23).

2. The discharge structure (13, 31, 38) of claim 1, wherein the main body (22) comprises;
   a tubular member (26) having a side wall, a first end and a second end, the tubular member (26) including the outflow opening (21) penetrating the side wall and an inflow opening (25) formed at the first end, and housing the valve body (23) movably and the elastic body (24) so as to urge the valve body (23), and
   a cap member (27) covering the second end.

3. The discharge structure (13, 31, 38) of claim 1, further comprising:

   anti-pulsation means (17, 32) for reducing pulsation of a fluid generated by the compressor, the anti-pulsation means being linked with the outflow opening (21).

4. The discharge structure (13, 31, 38) of claim 3, wherein the anti-pulsation means (17, 32) is throttle means for throttling a flow of the fluid.

5. The discharge structure (13, 31, 38) of claim 3, wherein the anti-pulsation means (17, 32) comprises a throttle member (19, 33) including a throttled through-hole (18, 34) penetrating the throttle member (19, 33).

6. The discharge structure (13, 31, 38) of claim 5, wherein the throttle member (19, 33) is formed in a unitary body with a retainer (20) for fixing the nonreturn valve (16).

7. A compressor comprising:

   a tubular flow port (R);
   the discharge structure (13, 31, 38) according to claim 6, the discharge structure (13, 31, 38) being housed in the tubular flow port (R);
   a deflection plate (39) including a through-hole (44) penetrating the deflection plate (39), the deflection plate (39) being attached to the cap member (27);
   a flow path (42) formed between the tubular member (26) and the tubular flow port (R); and
   a radial flow path (41) defined by the cap member (27) and the deflection plate (39),
   wherein the through-hole (44) , the radial flow path (41) and the flow path (42) are linked with the outflow opening (21).

8. The compressor of claim 7, wherein the through-hole (44) is smaller in cross section than the flow path (42) and the radial flow path (41).

9. The compressor of claim 7, wherein the radial flow path (41) is smaller in cross section than the flow path (42) and the through-hole (44).

10. The compressor of any one of claims 7 through 9, wherein the deflection plate (39) is formed in a unitary body with a retainer (20) for fixing the nonreturn valve (16).

FIG. 1

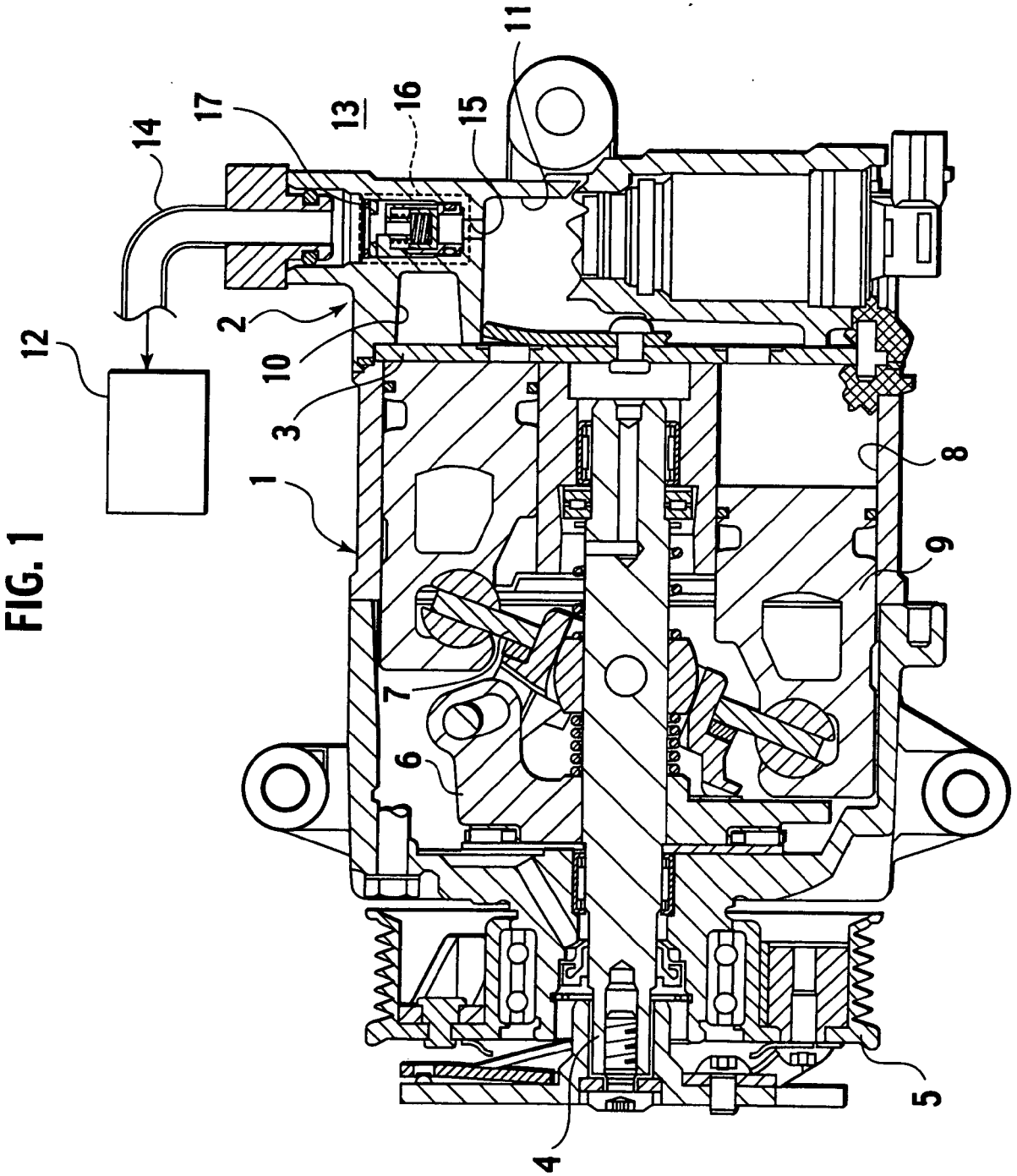

FIG. 2B

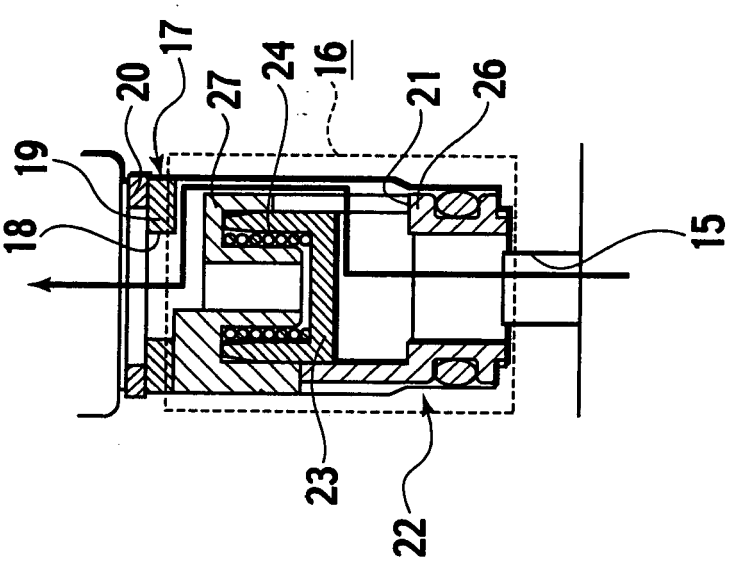
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FIG. 2A

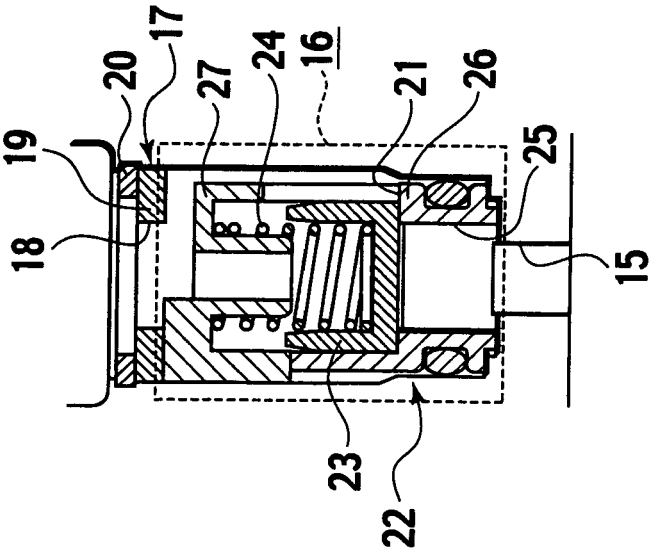
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FIG. 3

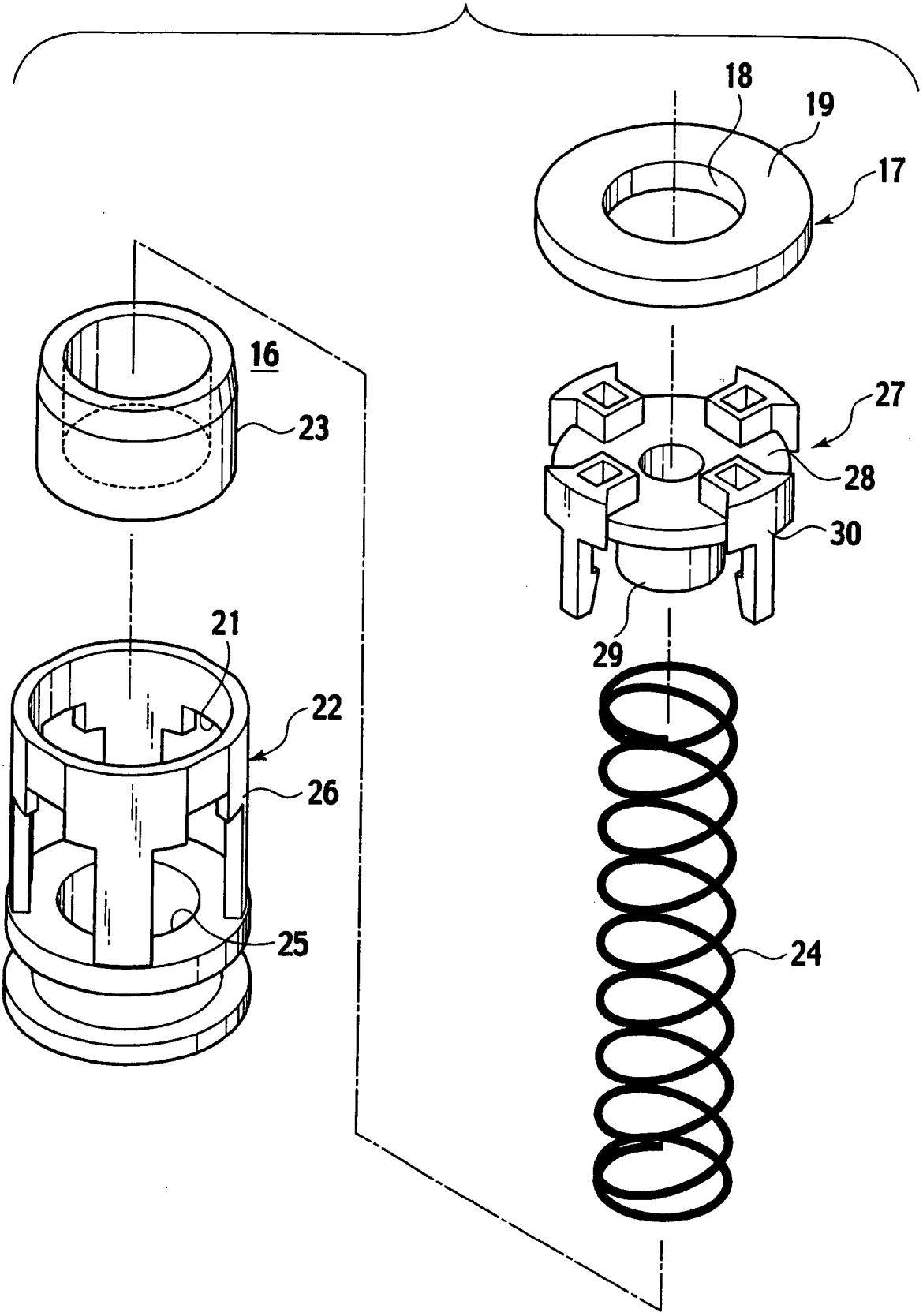


FIG. 4

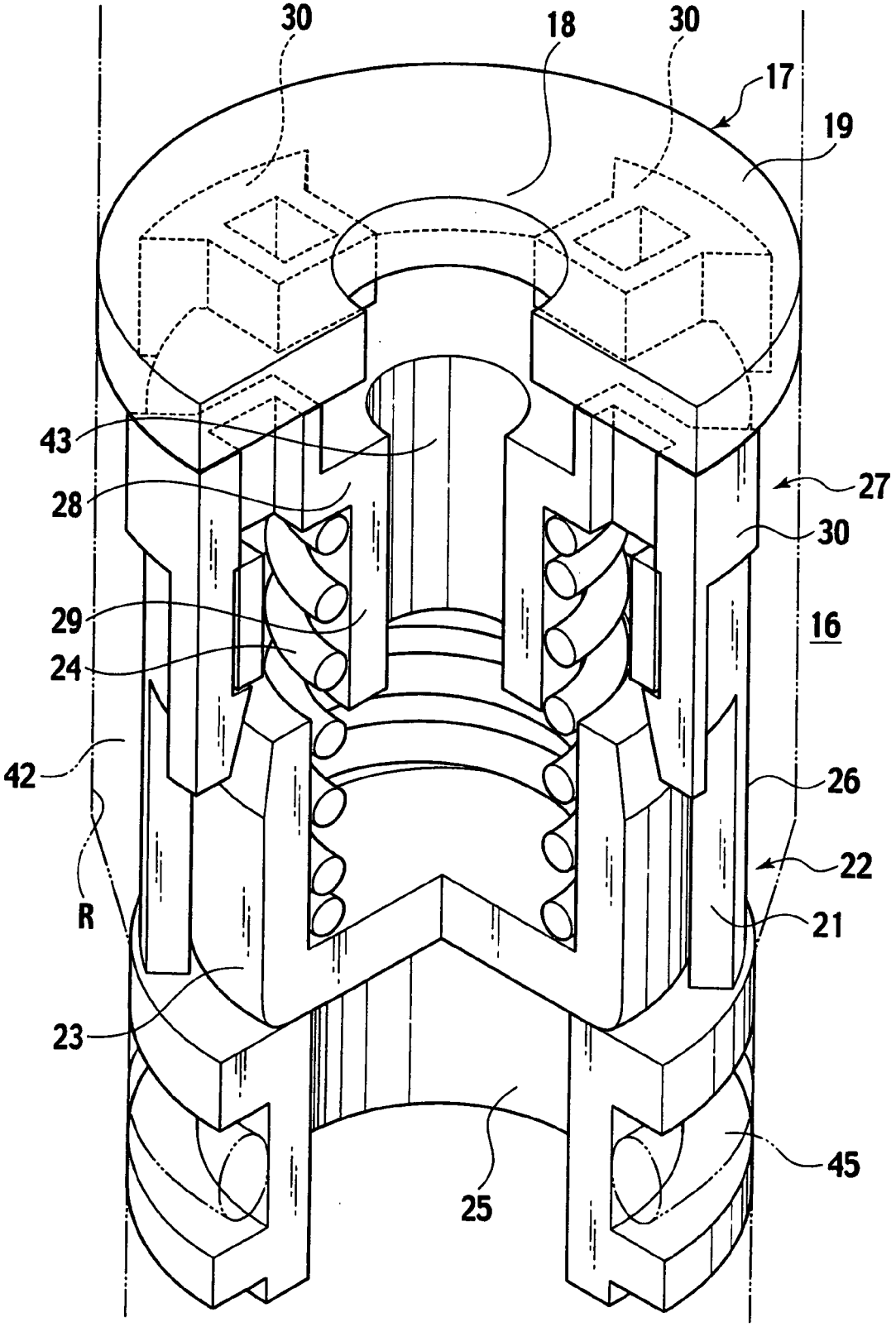


FIG .5

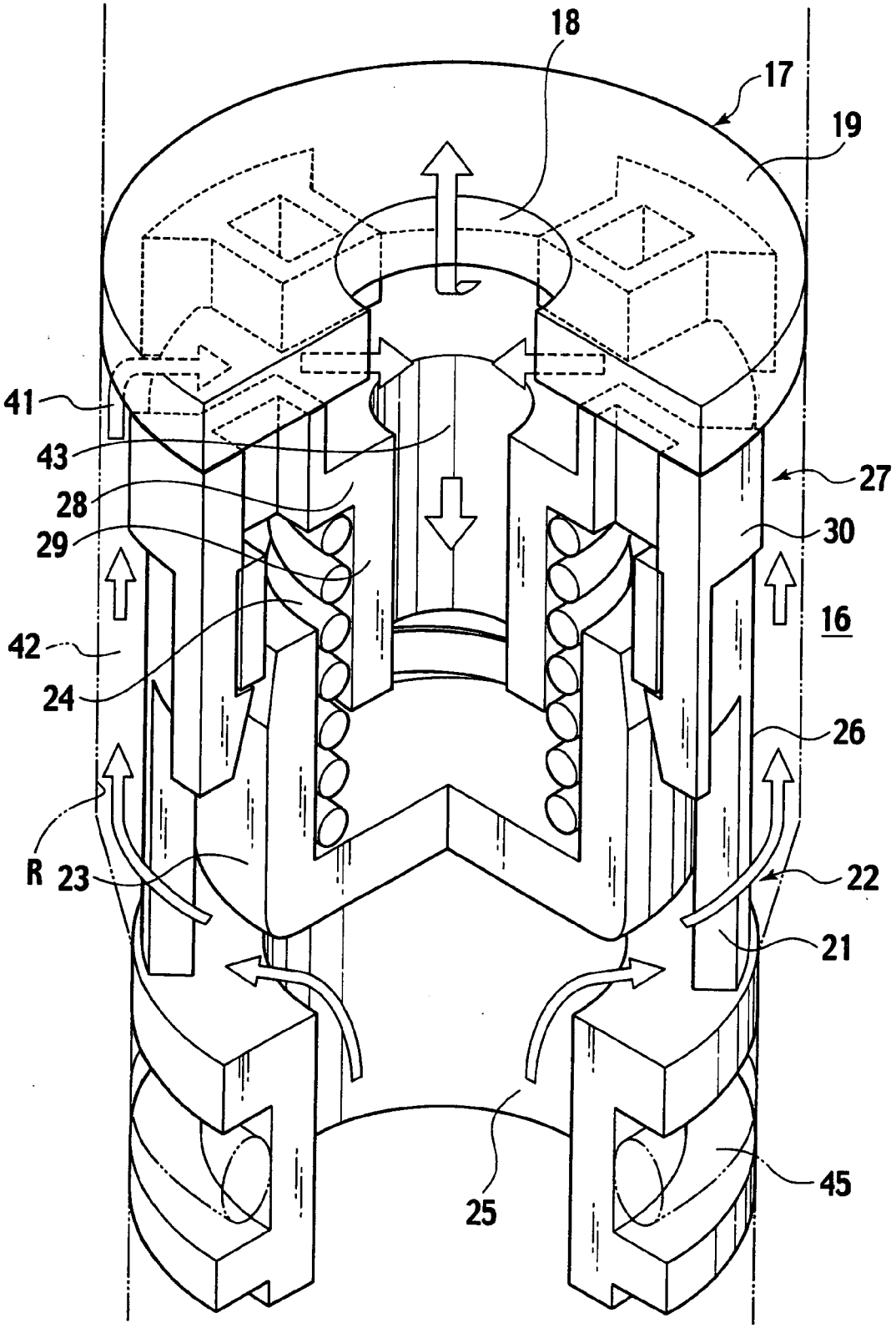


FIG. 6

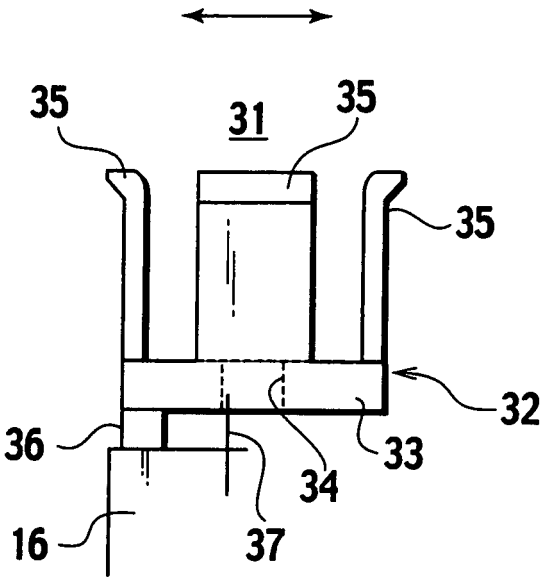


FIG. 7

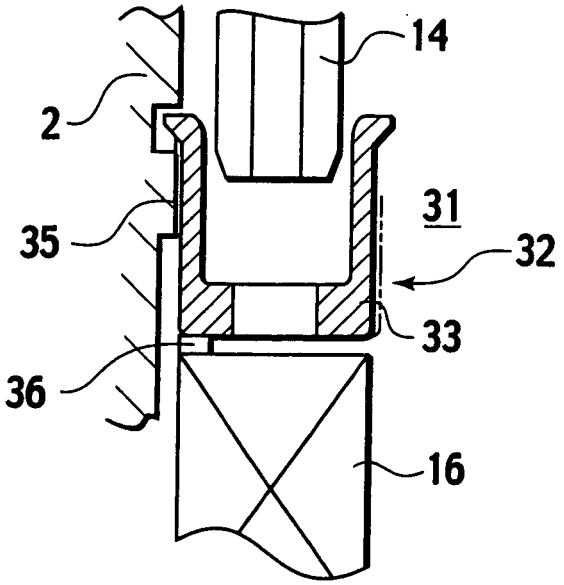
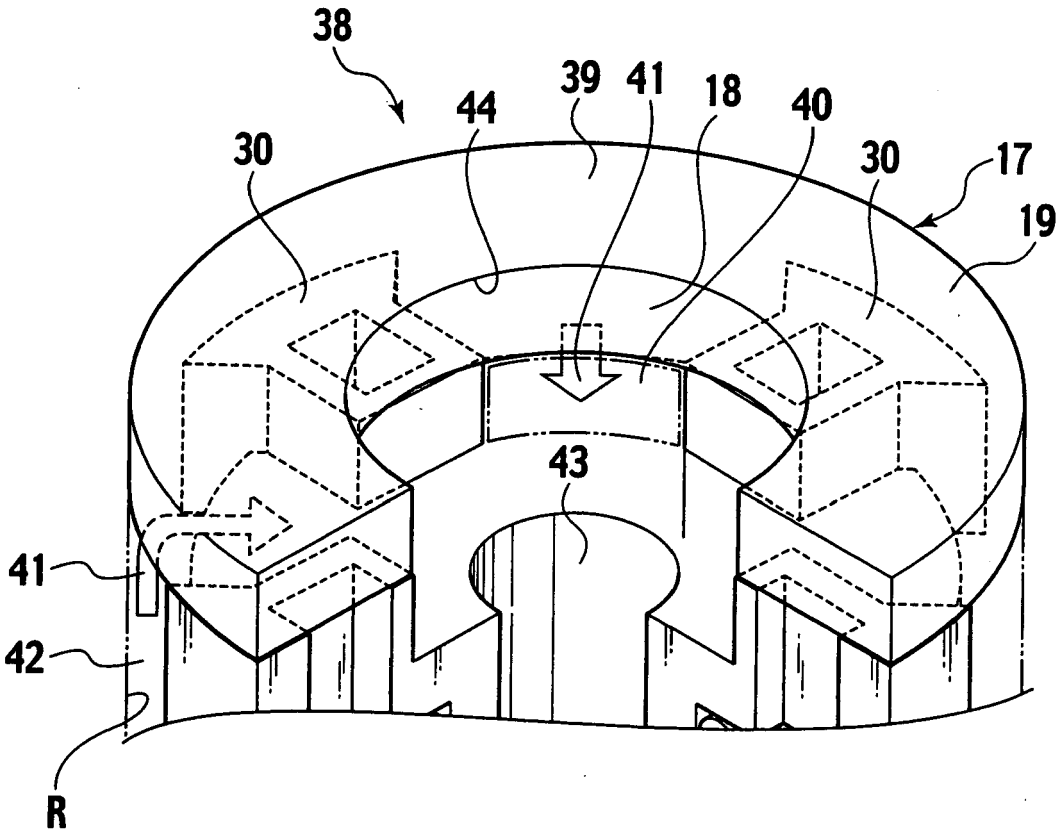


FIG. 8



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EUROPEAN SEARCH REPORT

Application Number
EP 05 02 3873

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 A	US 2002/192091 A1 (COOK JAMES E) 19 December 2002 (2002-12-19) * abstract; figures 1,2,6,7,12 * * paragraphs [0024] - [0030] *	1-3 1-10	F04B39/00 F04B39/10 F04B39/12 F04B53/10
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TECHNICAL FIELDS SEARCHED (IPC)

F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 January 2006	Pinna, S

CATEGORY OF CITED DOCUMENTS

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16-01-2006

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