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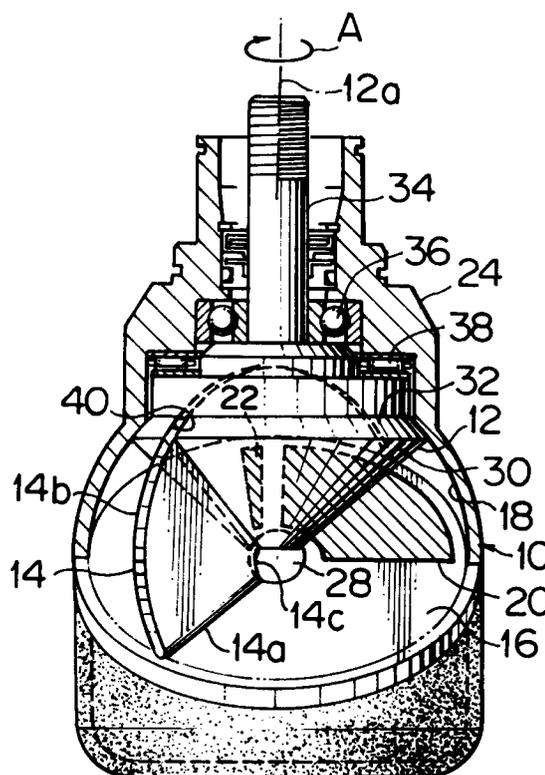
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54 **Rotary compressor.**

57 Disclosed is a rotary compressor which includes a housing (10) having a disc wall (16) and a semi-spherical wall (18), an inlet port (20) and an outlet port (22) provided on the disc wall (16), a rotor (12) comprising a conical portion (30) slidably engaging the disc wall (16) at a position between the inlet port (20) and outlet port (22) and a partial spherical portion (32) provided on the bottom of the conical portion (30), and a semicircular vane (14) slidably inserted into an expanding slot (40) defined in the rotor (12) and extending through the center line (12a) of the rotor (12). Since the conical portion (30) of the rotor (12) is rotated and the disc wall (16) of the housing (10) is fixed, a rotation prevention mechanism, which is required in a conventional rotary compressor, is not necessary. Therefore, the structure of the rotary compressor is simplified and the number of parts is small. A miniaturized and light-weight rotary compressor can be manufactured inexpensively.

FIG. 1B



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The present invention relates to a rotary compressor, and more particularly to a new type rotary compressor having a semi-spherical housing and a rotor and a vane slidably operating in the housing.

A rotary compressor is disclosed in JP-B-SHO 55-4956 as a swash plate pump. Although the disclosed swash plate pump is different from a rotary compressor according to the present invention in structure and operation, the swash plate pump is briefly explained herein in order to clarify the difference between the swash plate pump and the rotary compressor according to the present invention and to facilitate understanding of the present invention.

As shown in FIG. 11, the swash plate pump includes housing 1, partition plate 2, passive swash plate 3, and drive means 4 including drive swash plate 5. Housing 1 has spherical wall 6 and conical portion 7 projected from the spherical wall. Inlet port 8a and outlet port 8b are provided in conical portion 7. Partition plate 2 has arc portion 2a which slidably engages spherical wall 6 having a closing-up effect between the arc portion and the spherical wall, and a through hole (not shown) for passing a fluid therethrough. Passive swash plate 3 is driven in a condition that the passive swash plate is brought into contact with spherical wall 6, conical portion 7 and partition plate 2 while having a closing-up effect between the passive swash plate and them. Drive means 4 drives passive swash plate 3 via shoe 9 or a spring member which is a sliding member.

Expanding slot 7a extending through the center line of conical portion 7 is provided in the conical portion. Partition plate 2 is placed slidably in expanding slot 7a. Passive swash plate 3 and partition plate 2 engage each other. Passive swash plate 3 driven by drive means 4 swings partition plate 2 while engaging spherical wall 6 of housing 1. The contact line of passive swash plate 3 and conical portion 7 moves around the surface of the conical portion.

As described above, in the conventional rotary compressor (swash plate pump), conical portion 7 is fixed and the contact line of passive swash plate 3 with the surface of the conical portion is moved around the conical portion. Passive swash plate 3 must be swung without rotational motion. Therefore, there exists a so-called crank mechanism, and the realization of a miniaturized and light-weight rotary compressor is difficult. Further, since a through hole is provided on partition plate 2, the inlet side and the outlet side communicate with each other one time per one rotation. Therefore, it is difficult to obtain both high pressure and a large amount of the discharged fluid. Thus, in the conventional rotary compressor, the structure is complicated, there are many parts and the compressor

lacks compactness.

Accordingly, it would be desirable to provide a rotary compressor having a relatively simple structure, having relatively few parts, and which is compact, inexpensive, and excellent in compression property.

A rotary compressor according to the present invention is herein provided. The rotary compressor includes a housing having a disc wall and a semi-spherical wall, an inlet port and an outlet port provided on the disc wall, a rotor provided in the housing and a semicircular vane. The inlet port and outlet port are disposed close to each other. The rotor comprises a conical portion and a partial spherical portion provided on the base of the conical portion. The side surface of the conical portion slidably engages the disc wall at a position between the inlet port and outlet port. The rotor has an expanding slot extending through its center line. The semicircular vane is slidably inserted into the expanding slot. The vane has a chord portion slidably engaging the disc wall and an arc portion slidably engaging the semi-spherical wall. The disc wall of the housing is inclined relative to the axis of the rotor.

In the rotary compressor according to the present invention, when the rotor is rotated, the semicircular vane inserted into the expanding slot of the rotor rotates together with the rotor. The chord portion of the vane slidably engages the disc wall of the housing and the arc portion of the vane slidably engages the semi-spherical wall of the housing during the rotation. Since the disc wall of the housing is inclined relative to the axis of the rotor, the vane is swung along the expanding slot during the rotation. The vane engages the disc wall and the semi-spherical wall of the housing and the conical portion of the rotor engages the disc wall at a position between the inlet port and outlet port. Therefore, a plurality of packets are formed by the vane, the housing and the side surface of the conical portion of the rotor. Each of the plurality of packets communicates with the inlet port or the outlet port as the rotor and vane are rotated. When a packet communicates with the inlet port, the fluid supplied through the inlet port is sucked into the packet. Then, the capacity of the packet is decreased as the rotor and vane are rotated, and the fluid in the packet is compressed. When the packet communicates with the outlet port, the compressed fluid in the packet is discharged from the outlet port.

Thus, in the rotary compressor according to the present invention, the conical portion of the rotor rotates and the disc wall of the housing (this corresponds to the passive swash plate of the conventional swash plate pump aforementioned) is fixed. Therefore, the drive swash plate, passive

swash plate and sliding member, which are necessary in the conventional rotary compressor, are not necessary in the rotary compressor according to the present invention. The structure of the rotary compressor according to the present invention is relatively simple, and the number of the parts is few. As a result, the rotary compressor can be compact, light-weight, and inexpensively produced. Furthermore, the capacity of the rotary compressor per one rotation can be increased as compared with the conventional swash plate pump.

A preferred exemplary embodiment of the invention will now be described with reference to the accompanying drawings, which is given by way of example only, and is not intended to limit the present invention.

FIG. 1A is an elevational vertical sectional view of a rotary compressor according to an embodiment of the present invention.

FIG. 1B is a right side vertical sectional view of the rotary compressor shown in FIG. 1A.

FIG. 1C is a cross sectional view of the rotary compressor shown in FIG. 1A.

FIG. 2A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of a vane is zero degree.

FIG. 2B is a right side vertical sectional view of the rotary compressor shown in FIG. 2A.

FIG. 2C is a cross sectional view of the rotary compressor shown in FIG. 2A.

FIG. 3A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of the vane is 45 degrees.

FIG. 3B is a right side vertical sectional view of the rotary compressor shown in FIG. 3A.

FIG. 3C is a cross sectional view of the rotary compressor shown in FIG. 3A.

FIG. 4A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of the vane is 90 degrees.

FIG. 4B is a right side vertical sectional view of the rotary compressor shown in FIG. 4A.

FIG. 4C is a cross sectional view of the rotary compressor shown in FIG. 4A.

FIG. 5A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of the vane is 135 degrees.

FIG. 5B is a right side vertical sectional view of the rotary compressor shown in FIG. 5A.

FIG. 5C is a cross sectional view of the rotary compressor shown in FIG. 5A.

FIG. 6A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of

the vane is 180 degrees.

FIG. 6B is a right side vertical sectional view of the rotary compressor shown in FIG. 6A.

FIG. 6C is a cross sectional view of the rotary compressor shown in FIG. 6A.

FIG. 7A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of the vane is 225 degrees.

FIG. 7B is a right side vertical sectional view of the rotary compressor shown in FIG. 7A.

FIG. 7C is a cross sectional view of the rotary compressor shown in FIG. 7A.

FIG. 8A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of the vane is 270 degrees.

FIG. 8B is a right side vertical sectional view of the rotary compressor shown in FIG. 8A.

FIG. 8C is a cross sectional view of the rotary compressor shown in FIG. 8A.

FIG. 9A is a schematic elevational vertical sectional view of the rotary compressor shown in FIG. 1A, showing the state when the rotational angle of the vane is 315 degrees.

FIG. 9B is a right side vertical sectional view of the rotary compressor shown in FIG. 9A.

FIG. 9C is a cross sectional view of the rotary compressor shown in FIG. 9A.

FIG. 10A is an enlarged perspective view of a rotor of the rotary compressor shown in FIG. 1A.

FIG. 10B is a perspective view of the rotor shown in FIG. 10A.

FIG. 11 is a vertical sectional view of a conventional swash plate pump.

FIGS. 1A to 1C illustrate a rotary compressor according to an embodiment of the present invention. The rotary compressor includes housing 10, rotor 12 and vane 14. Housing 10 comprises disc wall 16 and semi-spherical wall 18. Inlet port 20 and outlet port 22 are provided on disc wall 16. Inlet port 20 and outlet port 22 are disposed close to each other. Housing 10 has cylindrical portion 24 on semi-spherical wall 18. Cylindrical portion 24 vertically extends upwardly from semi-spherical wall 18.

Disc wall 16 is inclined relative to the axis of rotor 12 as shown in FIG. 1A. Inlet port 20 is formed as a sector having an angle of 90 degrees, and outlet port 22 is formed as a slit, as shown in FIGS. 1B and 1C. Inlet port 20 and outlet port 22 are disposed on both sides of axis 16a which vertically extends along the inclined surface of disc wall 16. First semi-spherical recessed portion 26 is formed on disc wall 16 at the center position of disc wall 16. Ball 28 is inserted into first semi-spherical recessed portion 26.

Rotor 12 is inserted into housing 10. As shown

in FIGS. 10A and 10B, rotor 12 has conical portion 30 and partial spherical portion 32 provided on the base of the conical portion. The side surface of conical portion 30 slidably engages disc wall 16 at a position between inlet port 20 and outlet port 22, i.e., the surface of the disc wall extending along axis 16a, when rotor 12 is rotated. Rotor 12 has expanding slot 40 extending through the center line of the rotor. Rotor 12 has shaft 34 which extends upward from partial spherical portion 32 and which has an upside down T-shape. Conical portion 30, partial spherical portion 32 and shaft 34 of rotor 12 are integrally formed. Shaft 34 is inserted into cylindrical portion 24 and rotatably supported in the cylindrical portion via radial bearing 36 and thrust bearing 38. Second semi-spherical recessed portion 42 is formed on conical portion 30 of rotor 12 at the tip of the conical portion 30. Ball 28 is inserted into second semi-spherical recessed portion 42. Rotor 12 is rotatably supported on ball 28.

Vane 14 is slidably inserted into expanding slot 40 defined in rotor 12. Vane 14 is formed as a semicircular plate having chord portion 14a and arc portion 14b. Chord portion 14a of vane 14 slidably engages disc wall 16 of housing 10. Arc portion 14b of vane 14 slidably engages semi-spherical wall 18 of housing 10. Semicircular recessed portion 14c is formed on chord portion 14a of vane 14 at the center position of the chord portion 14a. Semicircular recessed portion 14c slidably engages ball 28 and vane 14 is pivotably supported on the ball 28. FIGS. 1A to 1C illustrate the state when vane 14 is rotated at an angle of 45 degrees from axis 16a in the clockwise direction.

Rotor 12 is rotated by a drive means (not shown) in the clockwise direction viewed from the upper side around its rotational axis 12a, as shown by arrow A in FIGS. 1A and 1B. When rotor 12 is rotated, semicircular vane 14 slidably inserted into expanding slot 40 of rotor 12 is rotated together with rotor 12 while chord portion 14a of vane 14 slidably engages disc wall 16 of housing 10 and arc portion 14b of vane 14 slidably engages semi-spherical wall 18 of housing 10. At the same time, vane 14 is swung along expanding slot 40 of rotor 12.

Since conical portion 30 of rotor 12 slidably engages disc wall 16 of housing 10, a plurality of packets are formed by vane 14, housing 10 and the side surface of conical portion 30, as described later in detail. Each of the plurality of packets communicates with inlet port 20 or outlet port 22 as rotor 12 and vane 14 are rotated. When a packet communicates with inlet port 20, the fluid supplied through the inlet port is sucked into the packet. Thereafter, the capacity of the packet is decreased as rotor 12 and vane 14 are rotated, and the fluid in the packet is compressed. When the packet com-

municates with outlet port 22, the compressed fluid in the packet is discharged from the outlet port. Thus, in the rotary compressor according to the present invention, conical portion 30 of rotor 12 is rotated and disc wall 16 is fixed.

Referring to FIGS. 2A to 9C, the operation of the rotary compressor will be explained in more detail.

FIGS. 2A to 2C illustrate the condition where chord portion 14a of vane 14 coincides with axis 16a vertically extending along the inclined surface of disc wall 16. The rotational angle of vane 14 of this state is referred to as zero degree in this embodiment. FIG. 3 to FIG. 9 show the conditions for rotational angles 45, 90, 135, 180, 225, 270 and 315 degrees, measured in a clockwise direction from the condition of FIG. 2.

As shown in FIGS. 2A to 2C, two packets are formed in the condition of the rotational angle of vane 14 of zero degree. One of the packets (hereinafter, referred to as a first packet P1) communicates with outlet port 22, and the other (hereinafter, referred to as a second packet P2) communicates with inlet port 20.

When vane 14 is rotated by 45 degrees in the clockwise direction from the above condition, as shown in FIGS. 3A to 3C, the capacity of first packet P1 decreases, and the fluid in the first packet is discharged from outlet port 22. The capacity of second packet P2 increases, and the second packet communicating with a part of inlet port 20 sucks the fluid through the inlet port. Further, a third packet P3, which communicates with the remaining part of inlet port 20, is newly formed. This state shown in FIGS. 3A to 3C is the same as that shown in FIGS. 1A to 1C.

When vane 14 is further rotated by 45 degrees in the clockwise direction from the above condition, as shown in FIGS. 4A to 4C, the capacity of first packet P1 further decreases, and the fluid in the first packet is discharged from outlet port 22. The communication of second packet P2 with inlet port 20 is stopped, and the operation of the suction is finished. At that time, the capacity of second packet P2 reaches a maximum state. Third packet P3 communicates with the whole of inlet port 20, and the fluid is sucked into the third packet P3.

As shown in FIGS. 5A to 5C, when vane 14 is further rotated by 45 degrees in the clockwise direction from the above condition, the capacity of first packet P1 further decreases, and the fluid in the first packet is discharged from outlet port 22. The capacity of second packet P2 decreases, and the fluid in the second packet is compressed. The capacity of third packet P3 increases, and the fluid is sucked thereinto through inlet port 20.

As shown in FIGS. 6A to 6C, when vane 14 is further rotated by 45 degrees in the clockwise

direction from the above condition, that is, when the vane is rotated by 180 degrees from the condition of FIGS. 2A to 2C, first packet P1 disappears. Second packet P2 communicates with outlet port 22. Namely, this condition is equivalent to the condition in which the first packet P1 and second packet P2 of FIG. 2 become the second packet P2 and third packet P3 of FIG. 6, respectively. This is due to the fact that the structure of the rotary compressor of this embodiment is substantially symmetric relative to axis 16a vertically extending along the inclined surface of disc wall 16.

FIGS. 7A to 7C, 8A to 8C and 9A to 9C shows the states equivalent to those shown in FIGS. 3A to 3C, 4A to 4C and 5A to 5C, respectively, other than the packet numbers. A fourth packet P4 newly formed in FIGS. 7A to 7C, 8A to 8C and 9A to 9C is equivalent to the third packet P3 shown in FIGS. 3A to 3C, 4A to 4C and 5A to 5C.

When vane 14 is further rotated by 45 degrees in the clockwise direction from the condition shown in FIGS. 9A to 9C, the rotary compressor returns to the condition shown in FIGS. 2A to 2C. The similar operation is repeated.

Thus, in the rotary compressor of this embodiment, since conical portion 30 of rotor 12 is rotated and disc wall 16 of housing 10 is fixed, a rotation prevention mechanism, which is required in the conventional rotary compressor, is not necessary. Therefore, the structure of the rotary compressor of this embodiment is simplified and the number of parts is small, as compared with those of the conventional rotary compressor. Moreover, the miniaturized and light-weight rotary compressor of the present invention can be manufactured inexpensively.

Claims

1. A rotary compressor comprising:

a housing (10) having a disc wall (16) and a semi-spherical wall (18);

an inlet port (20) and an outlet port (22) provided on said disc wall (16);

a rotor (12) provided in said housing (10), said rotor comprising a conical portion (30) and a partial spherical portion (32) provided on the bottom of said conical portion (30), the side surface of said conical portion (30) slidably engaging said disc wall (16) at a position between said inlet port (20) and outlet port (22), said rotor (12) having an expanding slot (40) extending through the center line (12a) of said rotor (12);

a semicircular vane (14) slidably inserted into said expanding slot (40) of said rotor (12), said vane (14) having a chord portion (14a)

slidably engaging said disc wall (16) and an arc portion (14b) slidably engaging said semi-spherical wall (18).

5 2. The rotary compressor as recited in claim 1, wherein a first semi-spherical recessed portion (26) is formed on said disc wall (16) at the center position thereof, a second semi-spherical recessed portion (42) is formed on said conical portion (30) of said rotor (12) at the tip thereof, a ball (28) is inserted into said first semi-spherical recessed portion (26) and said second semi-spherical recessed portion (42), a semicircular recessed portion (14c) engaging said ball (28) is formed on said chord portion (14a) of said vane (14) at the center position of said chord portion (14a), said rotor (12) is rotatably supported on said ball (28) and said vane (14) is pivotably supported on said ball (28).

3. The rotary compressor as recited in any preceding claim, wherein said rotor (12) has a shaft (34) extending outward from said partial spherical portion (32).

4. The rotary compressor as recited in claim 3, wherein said housing (10) has a cylindrical portion (24) provided on said semi-spherical wall (18) for supporting said shaft (34) inserted into said cylindrical portion (24).

5. The rotary compressor as recited in claim 3 or 4, wherein said shaft (34) is supported in said cylindrical portion (24) via a radial bearing (36) and a thrust bearing (38).

6. The rotary compressor as recited in any preceding claim, wherein said inlet port (20) and said outlet port (22) are disposed close to each other on said disc wall (16).

7. A rotary compressor comprising:

a housing (10) having a disc wall (16) and a semi-spherical wall (18), the disc wall (16) having a semi-spherical recessed portion (26) formed at the center position thereof, and the semi-spherical wall (18) having a cylindrical portion (24) extending therefrom;

an inlet port (20) and an outlet port (22) provided on said disc wall (16), said inlet port (20) and outlet port (22) being disposed close to each other;

a rotor (12) provided in said housing (10), said rotor (12) comprising a conical portion (30) having a semi-spherical recessed portion (42) formed at the tip thereof, a partial spherical portion (32) provided on the base of said

conical portion (30), a shaft (34) having a longitudinal axis (12a) extending outward from said partial spherical portion (32), and an expanding slot (40) extending through the center line (12a) of said rotor (12), wherein the side surface of said conical portion (30) of said rotor (12) slidably engages said disc wall (16) at a position between said inlet port (20) and said outlet port (22), said disc wall (16) being inclined relative to the axis (12a) of said rotor shaft (34), and wherein the shaft (34) is rotatably supported within the cylindrical portion (24) of said housing (10);

a semi-circular vane (14) slidably inserted into said expanding slot (40) of said rotor (12), said vane (14) having a chord portion (14a) slidably engaging said disc wall (16) and an arc portion (14b) slidably engaging said semi-spherical wall (18), said chord portion (14a) having a semi-circular recessed portion (14c) formed at its center; and

a ball (28) inserted into each of said semi-spherical recessed portion (26) of disc wall (16) of said housing (10), said semi-spherical recessed portion (42) of said conical portion (30) of said rotor (12), and said semi-circular recessed portion (14c) of said vane (14), wherein said rotor (12) is rotatably supported on said ball (28), and said vane (14) is pivotably supported on said ball (28).

8. The rotary compressor as recited in one of claims 1 to 7, further including at least one radial bearing (36) and at least one thrust bearing (38) disposed between said rotor (12) and said cylindrical portion (24) of said housing (10) for rotatably supporting said rotor (12) within said housing (10).
9. The rotary compressor as recited in one of claims 1 to 8, wherein said disc wall (16) is inclined relative to the axis (12a) of said rotor shaft (34) and preferably at an angle of 45 degrees relative to said axis (12a).
10. The rotary compressor as recited in one of claims 1 to 9, wherein the inlet port (20) is formed as a sector having an angle of 90 degrees.
11. The rotary compressor as recited in one of claims 1 to 10, wherein the outlet port (22) is formed as a slit in said disc wall (16).
12. A rotary compressor comprising:
 - a housing (10) having a disc wall (16) and a semi-spherical wall (18), the disc wall (16) having a semi-spherical recessed portion (26)

formed at the center position thereof, and the semi-spherical wall (18) having a cylindrical portion (24) extending therefrom;

an inlet port (20) and an outlet port (22) provided on said disc wall (16), said inlet port (20) and outlet port (22) being disposed close to each other, said inlet port (20) being formed as a sector having an angle of 90 degrees, and said outlet port (22) being formed as a slit in said disc wall (16);

a rotor (12) provided in said housing (10), said rotor (12) comprising a conical portion (30) having a semi-spherical recessed portion (42) formed at the tip thereof, a partial spherical portion (32) provided on the base of said conical portion (30), a shaft (34) having a longitudinal axis (12a) extending outward from said partial spherical portion (32), and an expanding slot (40) extending through the center line (12a) of said rotor (12), wherein the side surface of said conical portion (30) of said rotor (12) slidably engages said disc wall (16) at a position between said inlet port (20) and said outlet port (22), said disc wall (16) being inclined at an angle of 45 degrees relative to the axis (12a) of said rotor shaft (34);

a semi-circular vane (14) slidably inserted into said expanding slot (40) of said rotor (12), said vane (14) having a chord portion (14a) slidably engaging said disc wall (16) and an arc portion (14b) slidably engaging said semi-spherical wall (18), said chord portion (14a) having a semi-circular recessed portion (14c) formed at its center;

a ball (28) inserted into each of said semi-spherical recessed portion (26) of disc wall (16) of said housing (10), said semi-spherical recessed portion (42) of said conical portion (30) of said rotor (12), and said semi-circular recessed portion (14c) of said vane (14), wherein said rotor (12) is rotatably supported on said ball (28), and said vane (14) is pivotably supported on said ball (28); and

at least one radial bearing (36) and at least one thrust bearing (38) disposed between said rotor (12) and said cylindrical portion (24) of said housing (10) for rotatably supporting said rotor (12) within said housing (10).

FIG. 1A

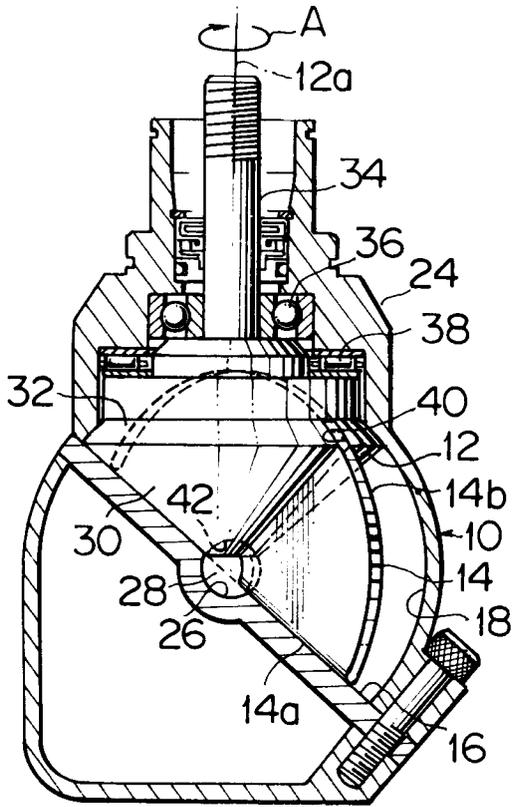


FIG. 1B

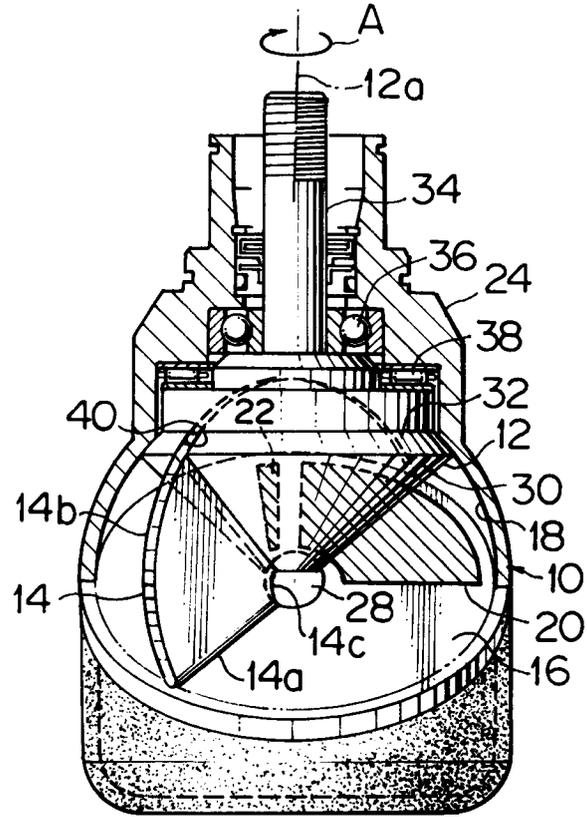


FIG. 1C

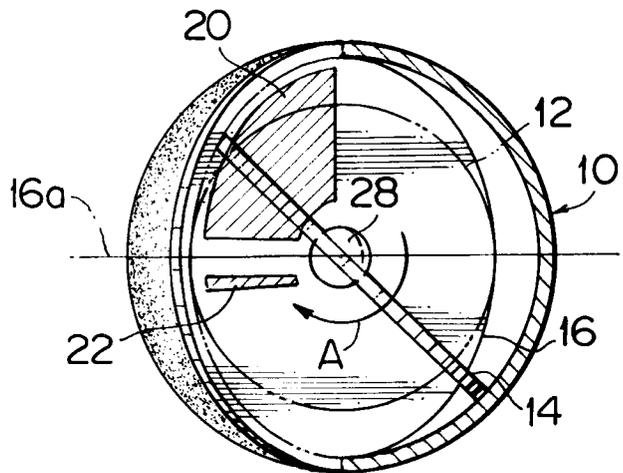


FIG. 2A

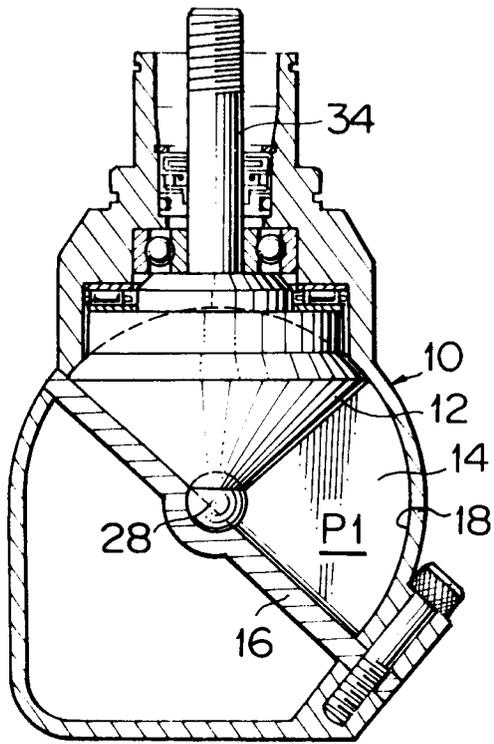


FIG. 2B

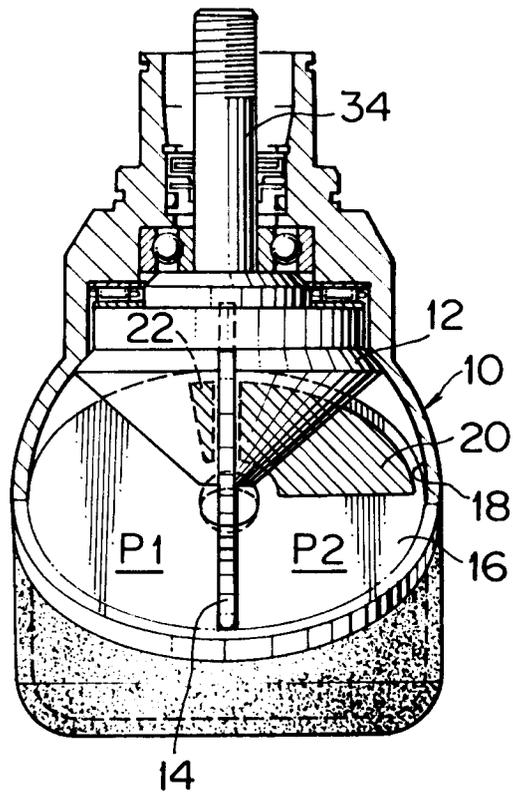


FIG. 2C

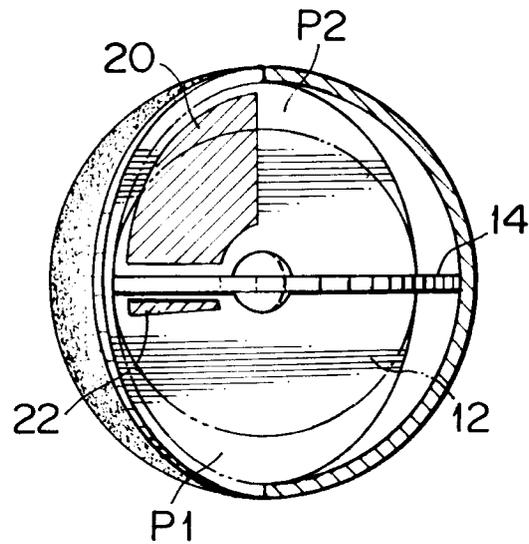


FIG. 3A

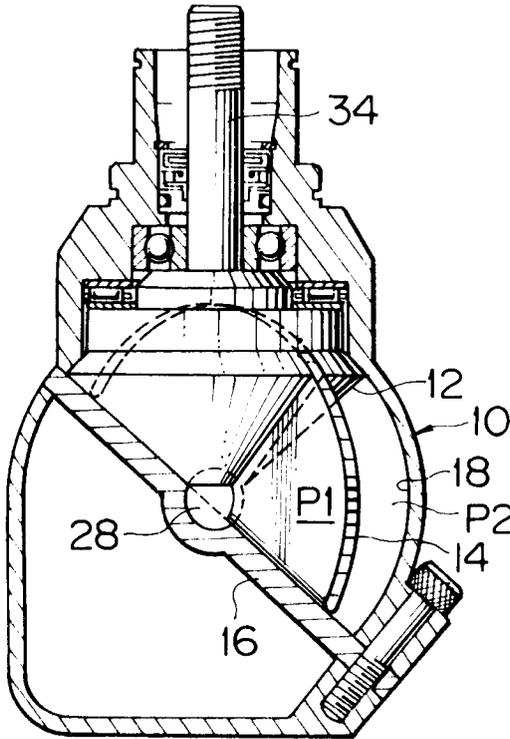


FIG. 3B

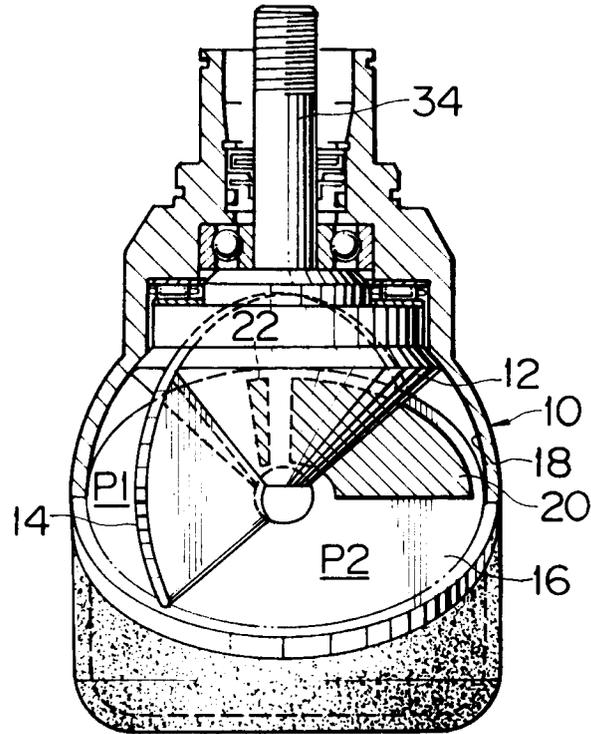


FIG. 3C

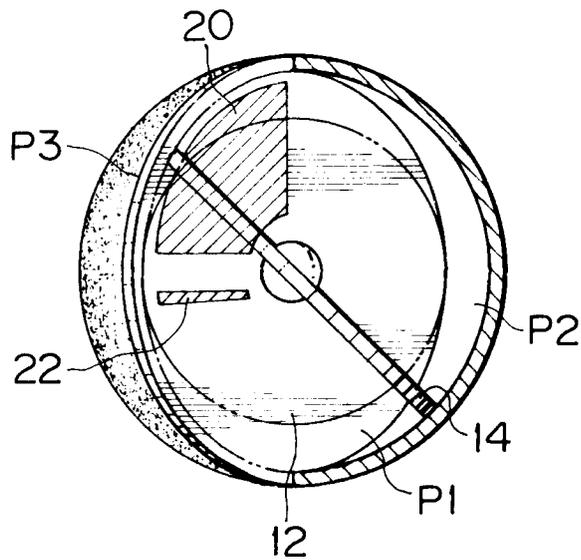


FIG. 4A

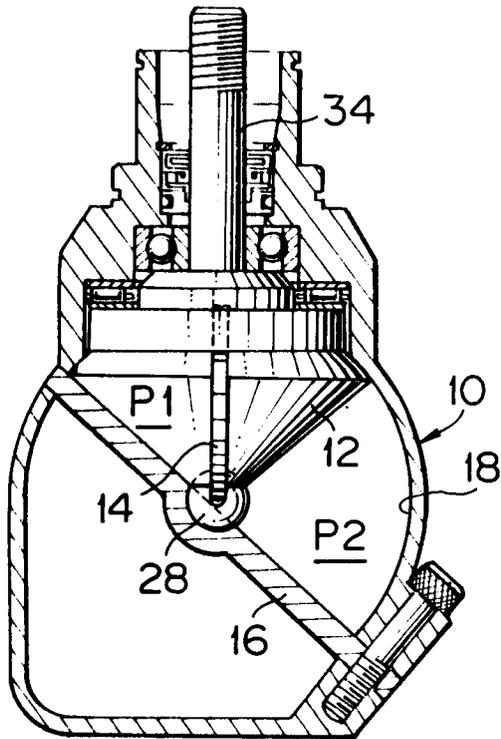


FIG. 4B

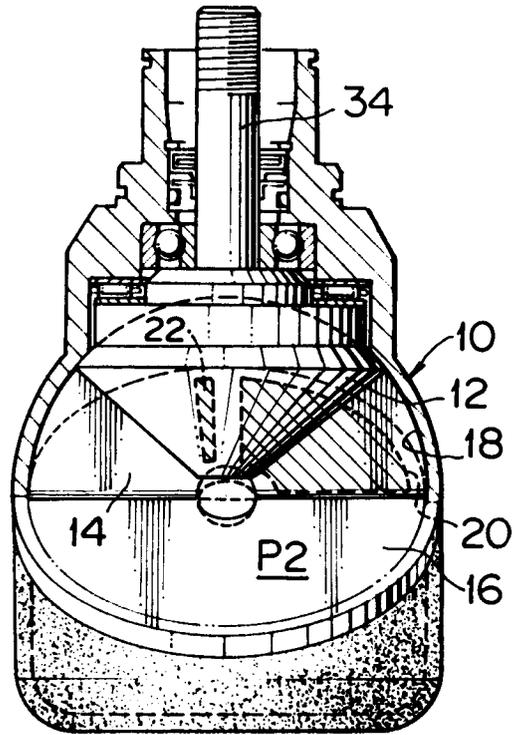


FIG. 4C

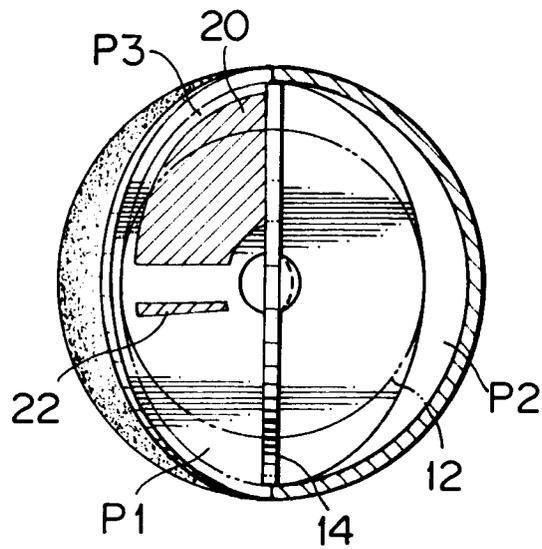


FIG. 5A

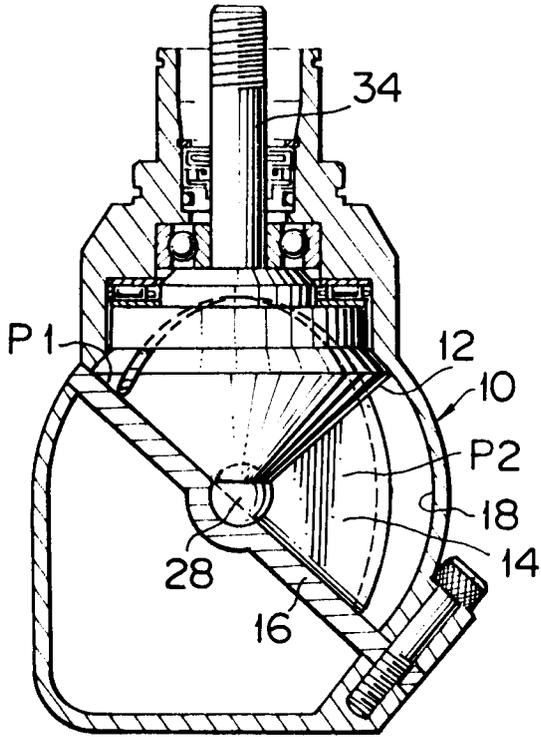


FIG. 5B

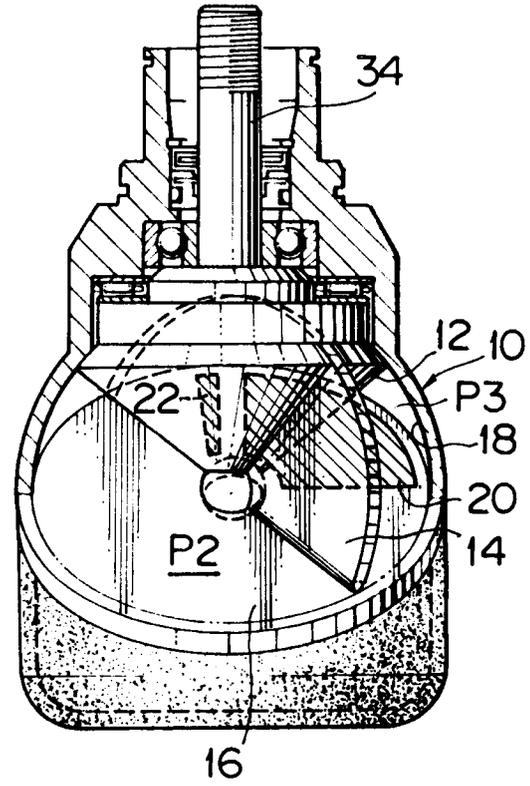


FIG. 5C

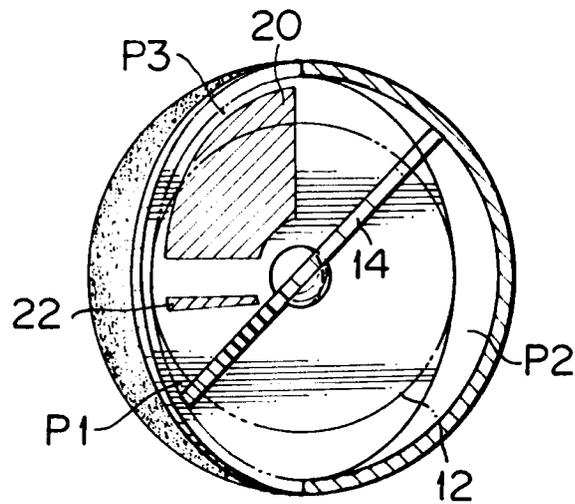


FIG. 6A

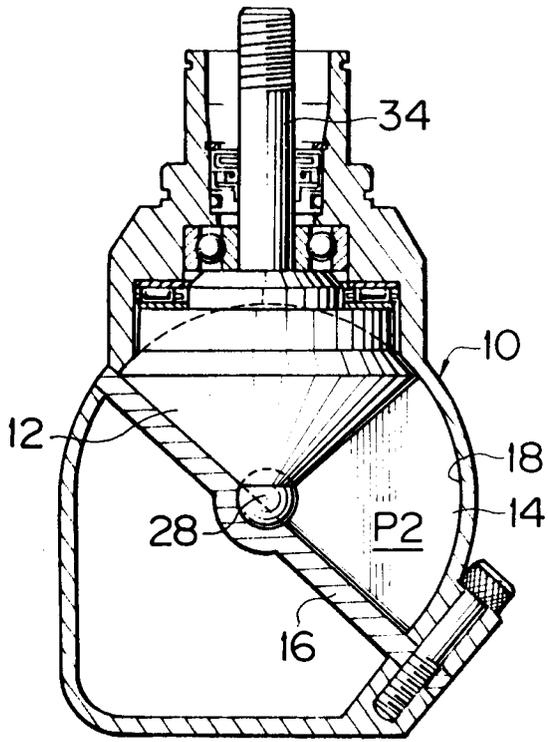


FIG. 6B

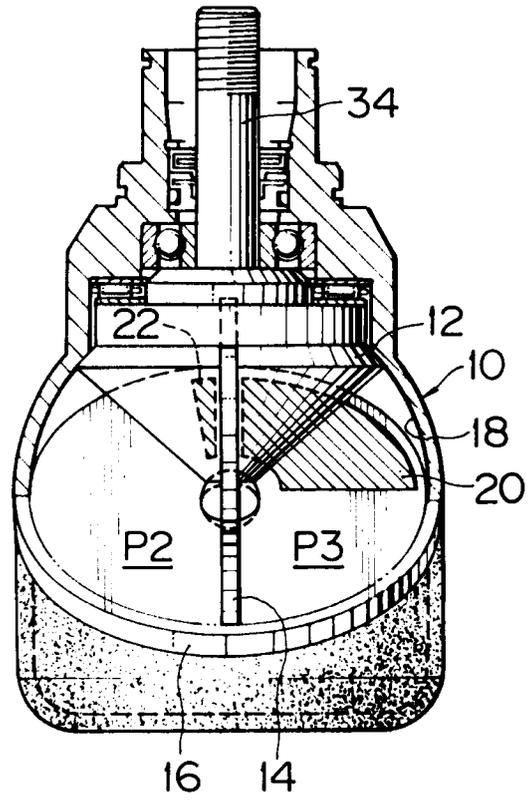


FIG. 6C

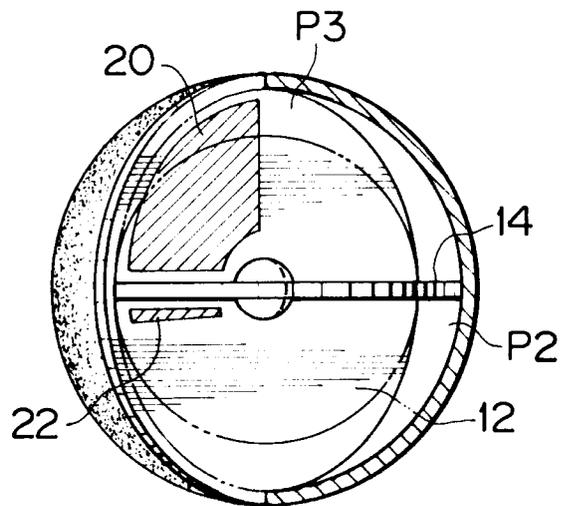


FIG. 7A

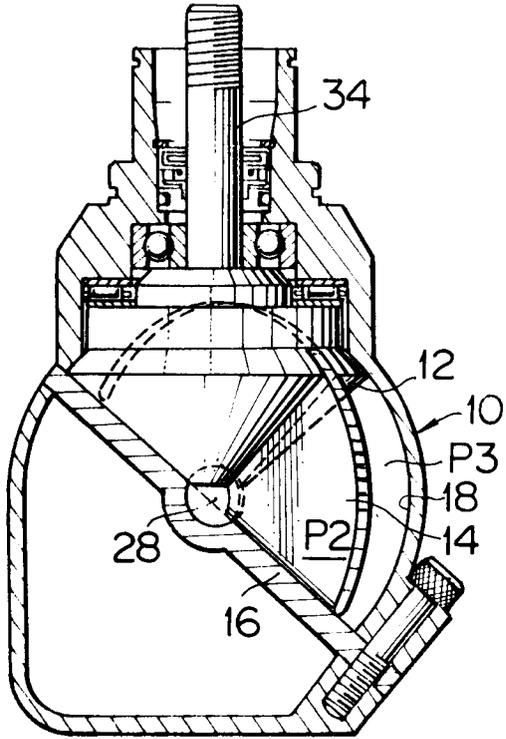


FIG. 7B

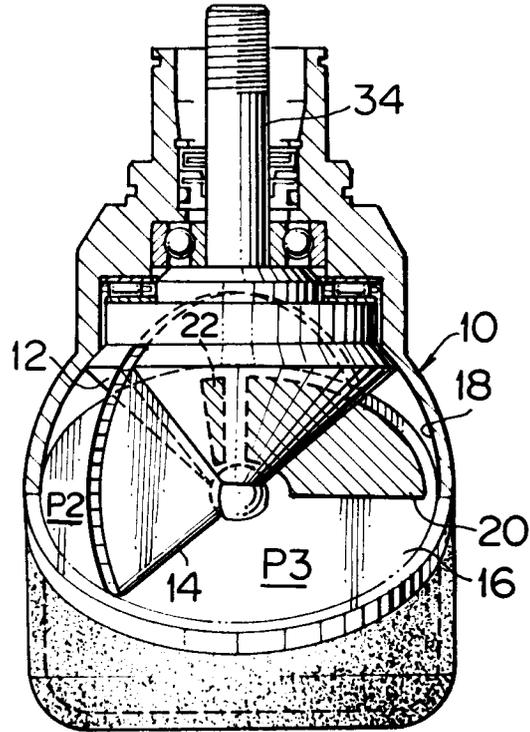


FIG. 7C

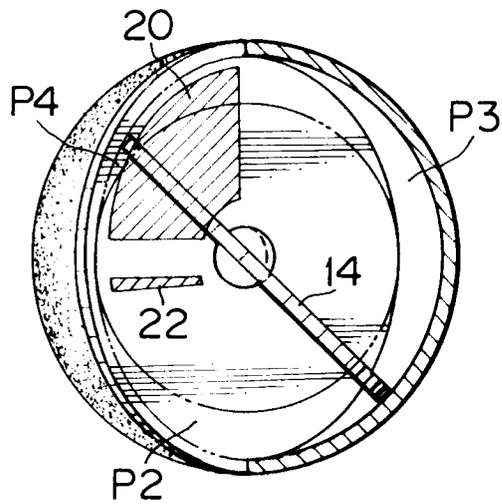


FIG. 8A

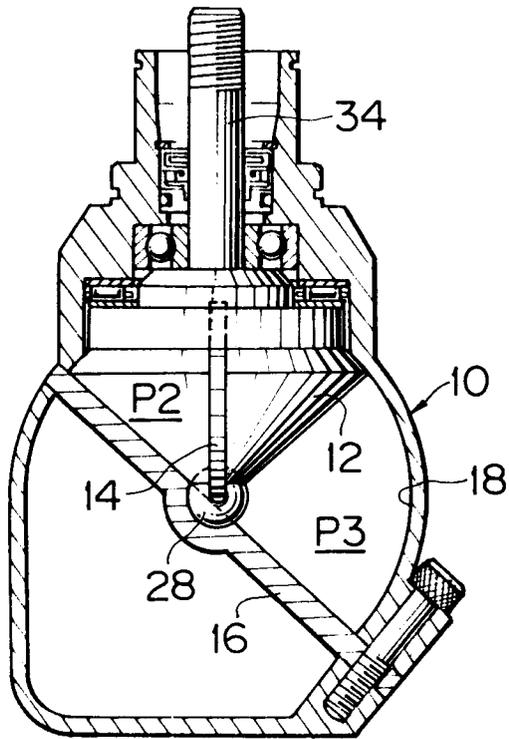


FIG. 8B

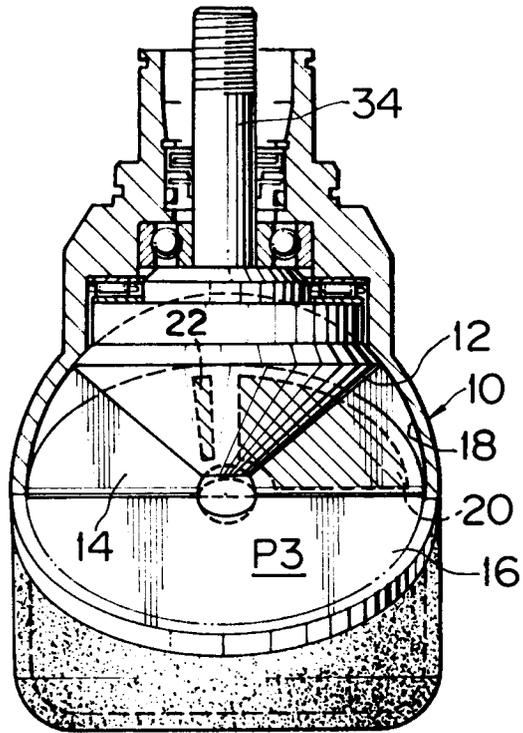


FIG. 8C

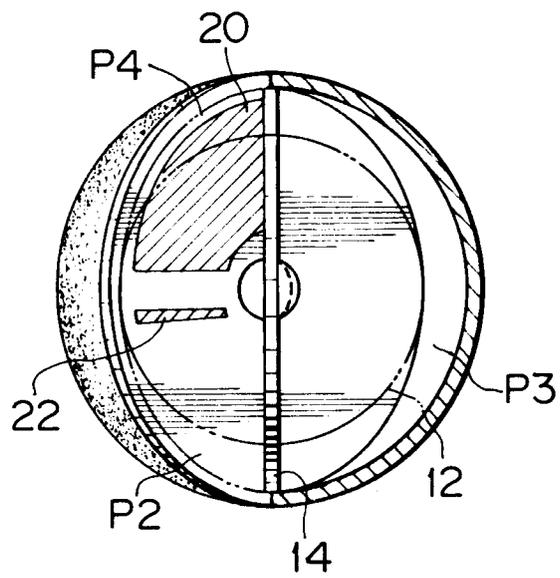


FIG. 9A

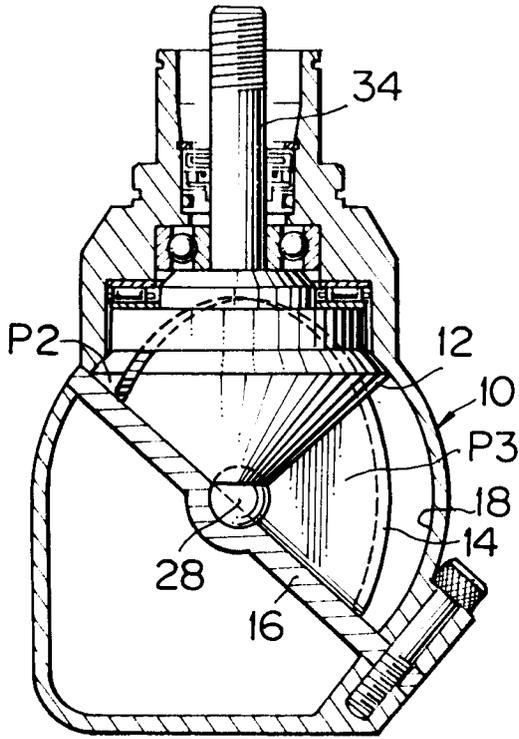


FIG. 9B

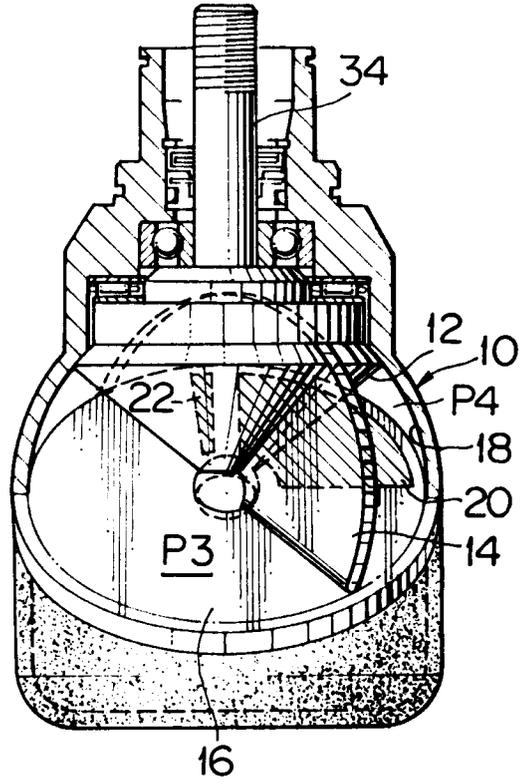


FIG. 9C

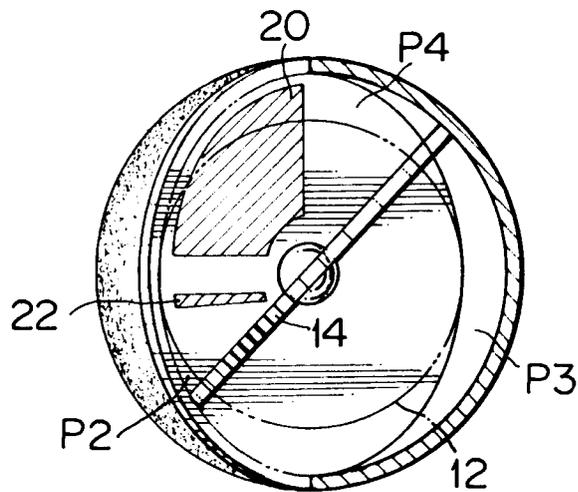


FIG. 10A

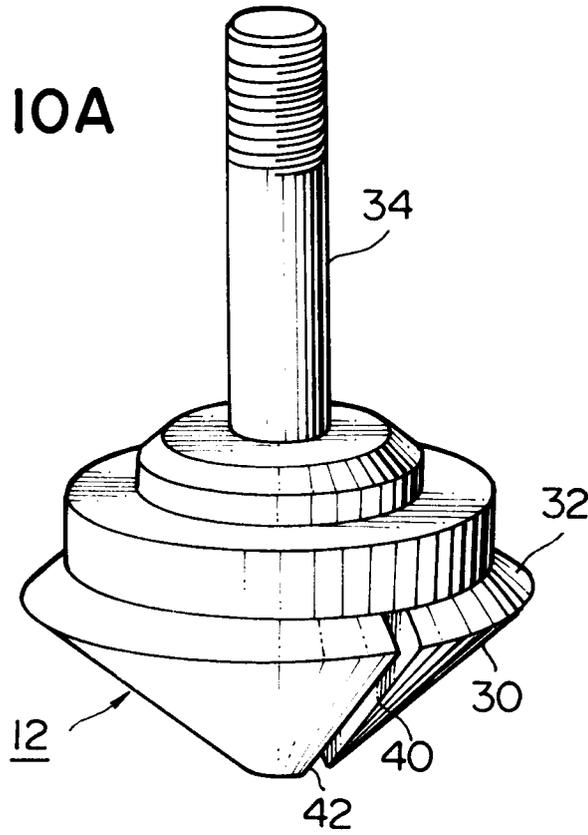


FIG. 10B

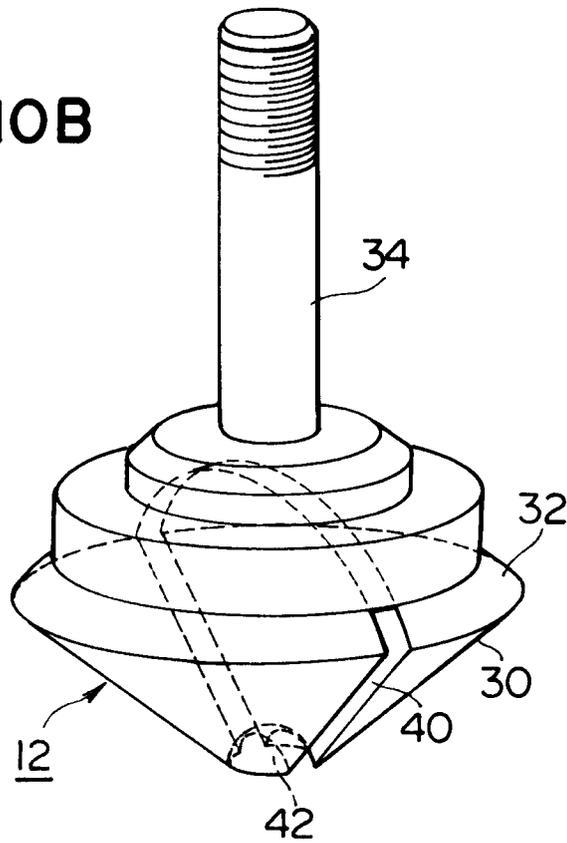
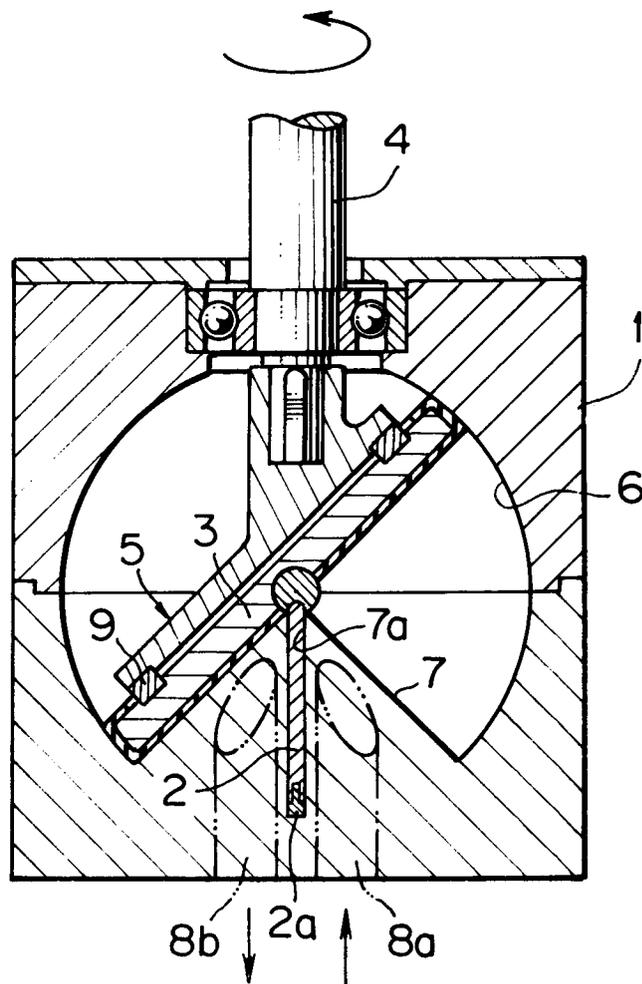


FIG. 11
PRIOR ART





DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	GB-A-573 278 (BRIDGLAND) * the whole document * ---	1-12	F04C21/00
A	US-A-1 881 575 (HERZOG) * the whole document * ---	1-12	
A	DE-A-3 634 094 (ROBERT BOSCH GMBH) * the whole document * ---	1-12	
A	GB-A-923 833 (THE FLO-MOTIVE CO.) * the whole document * ---	1-12	
A	US-A-2 311 334 (FULTON) ---		
A	US-A-1 484 212 (FEAR) -----		
The present search report has been drawn up for all claims			
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F04C F01C
Place of search	Date of completion of the search	Examiner	
THE HAGUE	12 OCTOBER 1992	DIMITROULAS P.	
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