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(54) **ROTARY DISPLACEMENT COMPRESSOR.**

(57) In conventional compressors, it has been difficult to satisfy, by a single compressor, both large pressure ratio and large increase/decrease ratio of a working quantity per unit time. Since each compressor has its merits and demerits, there is a limit to utilizing a single compressor over a wide range of applications and a suitable compressor must be selected in accordance with an intended application. Therefore, the present invention makes it possible to take the advantage of a variable displacement that its pressure ratio is great and the advantage of a turbo type that a working quantity per unit time is great. Thus, the present invention makes it possible for a compression apparatus or an internal combustion engine of vehicles to carry out an efficient operation.

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SPECIFICATION

ROTARY DISPLACEMENT COMPRESSOR

[TECHNICAL FIELD]

The present invention relates to a compressor which can be applied to an internal combustion engine and a pressurizing or reducing apparatus by utilizing a pressure difference generated in working of the compressor.

[BACKGROUND ART]

Compressors heretofore used include a variable volume system and a turbo system. Among them, in the variable volume system, a pressure ratio in compression after suction of pressure fluid can be set large but an inertia of working weight of a mechanical system is large. Therefore, there is a disadvantageous aspect to utilize when increasing an action amount per unit time. On the other hand, the turbo system is utilized for a turbo charger or the like of the internal combustion engine. The action amount per unit time can be increased, but at the time of low speed operation, the pressure ratio cannot be set large resulting in a so-called turbo-lag. Therefore, the turbo system is also disadvantageous to increase enough difference in pressure ratio for utilizing it as some energy.

The compressor applied to the internal combustion engine, if it is of the variable displacement system, can increase the pressure ratio, and therefore, even at the time of low speed operation, a high torque can be obtained. However, in the case where the compressor is of a reciprocating type, a working rotational inertia weight is large, it is disadvantageous to obtain a high rotational speed. Furthermore, in the internal combustion engine of the turbo system, the rotational speed can be increased but a large pressure ratio at the time of low speed operation cannot be increased. Therefore, the torque produced at the time of low speed operation is small and there is some defects in low speed operation.

In conventional compressors, it has been difficult to satisfy, by a single compressor, both large pressure ratio and a large increase/decrease ratio of a working quantity per unit time. Since each compressor has its merits and demerits, there is a limit to utilizing a single compressor over a wide range of applications and a suitable compressor must be selected in accordance with an intended application.

Therefore, the object of this invention is to make it possible to take the advantage of a variable displacement that its pressure ratio is great and the advantage of a turbo type that a working quantity per unit time is great.

[DISCLOSURE OF INVENTION]

For achieving the aforesaid object, a compressor according to the present invention characterized in that an intake path and a discharge path are connected to a housing; a sun gear is provided in the central portion of said housing and a plurality of planet gears meshed therewith being provided; a partitioning liner rotatably mounted in the center of said sun gear to divide the interior of said housing into a plurality of closed chambers is provided; a radially extending arm is provided on said planet gear; and an extreme end of said arm is movably connected in a radial direction of said partitioning liner.

[BRIEF DESCRIPTION OF DRAWINGS]

Fig. 1 is a schematic plan view showing an example wherein a mechanism of a compression device according to the present invention is incorporated in the internal combustion engine; Fig. 2 is an exploded view of a part of a planet gear mechanism and a partitioning liner; Fig. 3(a) is a schematic plan view showing an assembly of a sun gear and planet gears; Fig. 3(b) is a schematic view showing a position of a pin when the planet gears revolve; Fig. 4(a) to Fig. 4(h) are respectively schematic plan views showing strokes of suction, compression, combustion and scavenging of air by chambers; Fig. 5 is a diagram showing a variation of pressure of the chambers in the strokes shown in Fig. 4; Fig. 6 is a schematic plan view showing an example in which three partitioning liners are provided. Fig. 7 is a schematic plan view showing an example of a compression device for air; Fig. 8(a) to Fig. 8(h) are respectively schematic plan views showing strokes of suction, compression and exhaust of air; Fig. 9 is a schematic plan view of an example in which a plane shape of a partition liner has a sectoral-shape; Fig. 10 is a schematic plan view of an example of a compression device with three partitioning liners; Figs. 11(a) and (b) are respectively cutaway perspective views showing an example of the housing; Fig. 12(a) is a plan view of a partitioning liner utilized for the housing of Fig. 11(a); Figs. 12(b) and (c) are respectively plan views of a partitioning liner of which upper and lower portions are placed one over the other; Fig. 13 is a perspective view in which two partitioning liners of Fig. 12 are placed one over the other; Fig. 14 is a perspective view of a planet gear mechanism incorporated in the partitioning liner of Fig. 13; Fig. 15 is a sectional view of a housing in which partitioning liners and the planet gear mechanism are incorporated; Fig. 16 is a sectional view when incorporated in the housing; Figs. 17 and 18 are respectively sectional views showing another examples; Fig. 19 is a schematic plan view of the planet gear mechanism of Fig. 18; Fig. 20 is a cutaway perspective view; and Fig. 21

is a sectional view of an example showing only the upper side of an arrangement of the planet gear mechanism.

Further, Fig. 22 is a cutaway view showing a further construction example of a housing; Fig. 23 is a view showing the principle of a gear train in the case of 8-air chamber system; Fig. 24 is a schematic solid model thereof; Fig. 25 is a perspective view of a partitioning liner; Fig. 26 is a stroke view by rotation of a partitioning liner; Fig. 27 is a view showing the principle of a gear train in the case where an output shaft is directly coupled to a sun gear; Fig. 28 is its schematic solid model; Fig. 29 is a stroke view by rotation of a partitioning liner. Fig. 30 is a longitudinal sectional view showing the construction in the case where an output is removed from the sun gear; Fig. 31 is a view showing the other operating principle of the partitioning liner; Fig. 32(a) is a plan view showing an arrangement of a gear train and a crank shaft; Fig. 32(b) is a side view; and Fig. 33 is a cutaway view showing a connecting construction between a partitioning plate and a planet gear.

[BEST MODE FOR CARRYING OUT THE INVENTION]

Features of the present invention will be described in detail in connection with embodiments shown in the drawings.

Fig. 1 is a schematic view showing an example in which a compressor of the present invention is utilized for a combustion chamber of the internal combustion engine.

In the figure, an intake pipe 1a to which air for combustion and fuel are supplied and an exhaust pipe 1b for discharging combustion gases are provided on a housing 1, and an ignition plug 1c is mounted at approximately intermediate position between the intake pipe 1a and the exhaust pipe 1b. The housing 1 has its inner peripheral wall formed into a approximately precise round, within which a sun gear 2 having an output shaft (not shown) projected externally of the housing 1 is coaxially arranged, and four planet gears 3a to 3d meshed with the sun gear 2 are incorporated. Two partitioning liners 4 and 5 are mounted in the center portion of the sun gear 2 so that they may rotate around the sun gear 2 by means of a pivot 2a.

Fig. 2 is an exploded perspective view of the sun gear 2, the planet gear 3a (3b - 3c are not shown) and one partitioning liner 4 in the housing 1. An arm 6 extending in a radial direction is fixed to the shaft portion of the planet gear 3a, and a pin 6a in parallel to the rotational axis of the planet gear 3a is projected from the distal end of the arm 6. On the other hand, the partitioning liners 4 and 5 rotate while sliding along the inner peripheral wall of the housing 1 and the upper and lower inner peripheral walls in the axial direction (perpendicular to paper surface in Fig. 1) to thereby, in case of Fig. 1, divide the interior of the housing 1 into four closed chambers. The partitioning liners 4 and 5 are provided with radially extending slots 4a and 5a, and the pin 6a of the arm 6 provided on each of the planet gears 3a to 3d is movably inserted into the slots 4a and 5a, as shown in Fig. 1.

Fig 3(a) is a schematic view showing the construction of a single planet gear 3a and the sun gear 2, and Fig 3(b) is a view for explaining a position of the pin 6a when the planet gear 3a revolves.

In the figures, the planet gear 3a is held by a connecting rod 2b rotatably mounted on the shaft of the sun gear 2 and revolves around the sun gear 2 while being rotated on its axis. The radius ratio between these gear is sun gear : planet gear = 2 : 1, and the planet gear 3a rotates twice during one revolution. Accordingly, a position A of the pin 6a changes as shown in Fig. 3(a) when the planet gear 3a revolves clockwise around the sun gear 2. This figure is taken when the angle of revolution of the planet gear 3a is 45°, and the position A of the pin 6a moves around the sun gear 2 while depicting a cycloid curve.

As shown in Fig. 1, four planet gear 3a to 3d are arranged around the sun gear 2 by the connecting rod 2b so that a center angle formed by respective positions is 90°. One pair of radial planet gears 3a and 3c and other pair of planet gears 3b and 3d are combined with one partitioning liner 4 and the other partitioning liner 5, respectively. That is, the pin 6a of the planet gear 3a and 3c is inserted into the slot 4a of one partitioning liner 4, and pin 6a of other planet gear 3b and 3d is inserted into the slot 5a of the partitioning liner 5. Therefore, the partitioning liner 4 is operatively connected to the planet gears 3a and 3c, and the other partitioning liner 5 is operatively connected to the planet gears 3b and 3d, thus changing their attitude.

Further, as shown in Fig. 1, the interior of the housing 1 is divided into four chambers 8 to 11 by two partitioning liners 4 and 5. The chambers 8 to 11 are rotated and moved within the housing 1 by the rotation of the partitioning liners 4 and 5, and if this rotation and movement are adjusted to the cycles of suction, compression, combustion and scavenging, it can be used as the internal combustion engine. This will be described with reference to Figs. 1 and 4.

In Fig. 4(a), the chamber 8 is communicated with the intake pipe 1a to assume a state capable of performing a suction stroke, the chamber 9 corresponds to a plug 1c to assume a state capable of performing combustion; and the chamber 10 is communicated with the exhaust pipe 1b to assume a state capable of performing scavenging. From that time, when combustion and explosion occur within the chamber 9 by the ignition of the plug 1c, combustion gas within the chamber 9 expands, and the partitioning liners 4 and 5 transits to a state shown in Fig. 4(b). That is, when each of the planet gears 3a to 3d revolves clockwise around the sun gear 2 through 45°, the chamber 11 assumes a suction stroke; the chamber 8 assumes a compression stroke; the chamber 9 assumes an expansion stroke and the chamber 10 assumes a scavenging stroke. When each of the planet gears 3a to 3d revolves through 45°, the chamber 11 almost completes its suction and shifts to a compression stroke, the chamber 8 shifts to an explosion and expansion stroke, the chamber 9 terminates expansion and shifts to a scavenging stroke, and the chamber 10 terminates scavenging and shifts to a suction stroke, as shown in Fig. 4(c).

As described above, the chambers 8 to 11 carry out the stroke of suction, compression, expansion and scavenging in order, and repeat each stroke as shown in Fig. 4(d) to (h). It is noted of course that at the start, a driven rotation is applied to the sun gear 2 by an external driving device (for example, as a cell motor).

Fig. 5 is a diagram showing pressure variations in the chambers 8 to 11 during respective stroke, in which the axis of abscissa indicates angle of revolution from Figs. 4(a) to 4(h) of the planet gear 3a, and axis of ordinate indicates pressure in the chambers 8 to 11. In the diagram, reference numerals 8, 9, 10, and 11 designate internal pressures of the chambers 8 to 11 corresponding to these numbers.

As apparent from the diagram, during one rotation of the partitioning liners 4 and 5, the chambers 8 to 11 rotate while being attended by change in pressure due to the change in volume thereof. The change in volume of the chambers 8 to 11 is made possible since rotation of the planet gears 3a to 3d is connected by link to the partitioning liners 4 and 5 by the arm 6. As previously mentioned, the volume of the chambers 8 to 11 is varied by the change of attitude of the partitioning liners 4 and 5 in the strokes shown in Fig. 4 and the function as a compressor is obtained.

In the example shown in Fig. 1, the interior of the housing 1 is divided into four chambers 8 to 11 by two partitioning liners 4 and 5. Therefore, four combustion and explosions are carried out at intervals in which angle of revolution of the planet gears 3a to 3d is 90°, which forms a rotational output of the engine. On the other hand, the number of the partitioning liners can be increased or decreased to vary the number of chambers. For example, in the example of Fig. 6, three planet gears 3a to 3c are arranged around the sun gear 2, and three partitioning liners 12a, 12b and 12c are connected to these planet gears 3a to 3c. The interior of the housing 1 is divided into three chambers 13a, 13b and 13c. In this example, the partitioning liners 12a to 12c are made wider in the circumferential direction than that of the case shown in Fig. 1 to enlarge the width of maximum and minimum values of the volume ratio. It is of course possible to reduce the number of chambers and conversely increase the number of partitioning liners to increase the of chambers.

Fig. 7 shows examples of a pressurizing machine or a reducing machine.

In the figure, an intake pipe 20a and an exhaust pipe 20b are provided in a housing 20 whose inner peripheral wall is approximately precise round; a sun gear 21 is arranged in the center of the housing 20; and two planet gears 22 and 23 are arranged therearound. On the sun gear 21 are mounted two partitioning liners 24 and 25 whose distal ends contact the inner peripheral surface of the housing and slide. Similarly to the previous embodiment, arms 22b and 23b are fixed to the planet gears 22 and 23, and pins 22b and 23b provided at the ends of the arms of the 22a and 23a are mounted so that the pins 22b and 23b are inserted into slots 24a and 25a of the liners 24 and 25 whereby the planet gears 22 and 23 and the partitioning liners 24 and 25 are connected.

Two planet gears 22 and 23 and two partitioning liners 24 and 25 are combined whereby the interior of the housing 20 is divided into two chambers 26 and 27 by the partitioning liners 24 and 25. The radius ratio between the gear 21 and planet gears 22 and 23 is 1 : 1 : 1, and a planet gear mechanism is constructed by gears having the same diameter.

With the above-described arrangement, when the planet gears 22 and 23 are revolved clockwise around the sun gear 21, the sucked air can be compressed and discharged by the change in volume of the chambers 26 and 27. This will be described with reference to Fig. 8.

In Fig. 8(a), the chamber 26 terminates its exhaust stroke and is about to shift to suction stroke, and chamber 27 completes its suction stroke and shifted to exhaust stroke. When the planet gears 23 and 24 clockwise revolve by 45°, the Fig. 8(b) state assumes, and chamber 26 is in the suction stroke and the other chamber 27 is in the exhaust stroke. The chambers 26 and 27 change in volume due to a difference in rotational angular speed of the partitioning liners 24 and 25, and the chamber 26 gradually increases in volume while conversely the chamber 27 reduces its volume. When the planet gears 22 and 23 revolve by 90° as shown in Fig. 8(c), the partitioning liners 24 and 25 are aligned in a diametric direction and the chambers 26 and 27 will be the same volume. Further, when the planet gears 23 and 24 continue its revolution to assume the state shown in Fig. 8(d), the chamber 26 will be approximately maximum volume value to almost complete the suction stroke while the other chamber 27 will be approximately minimum volume value to complete before long. The chamber 26 shifts from that state to an exhaust stroke of sucked air, and the chamber 26 comes into communication with the exhaust pipe 20a as shown in Fig. 8(e). It is noted that at that time, the chamber 26 is communicated with the intake pipe 20a as well as the exhaust pipe 20b.

When the planet gears 22 and 23 further continue their revolution to assume the state shown in Fig. 8(f), the chamber 26 starts to gradually reduce its volume, and conversely the chamber 27 increases its volume. As shown in Figs. 8(f) to (h), the chamber 26 gradually reduces its volume into a minimum in the stage of exhaust whereas the chamber 27 on the intake side changes its volume until it becomes maximum. Accordingly, the air sealed in the chamber 26 is compressed by reduction in volume and discharged out of the exhaust pipe 20b.

In this manner, if a driving force is applied so that the planet gears 22 and 23 revolve by adequately providing the partitioning liners 24 and 25 within the housing 20, suction of air from the intake pipe 20a, compression and transfer of air due to the change in volume of the chambers 26 and 27 and discharge of compression air to the exhaust pipe 20b are carried out, thus it can be utilized as a compressor.

As shown in Fig. 8(e), when the chamber 26 enters its exhaust stroke, the chamber 26 is communicated with the exhaust pipe 20a as well as the intake pipe 20b. On the other hand, if the partitioning liners 24 and 25 are formed into a sectoral shape as shown in Fig. 9, an opening degree of flow passage between the intake pipe 20a and the exhaust pipe 20b can be adjusted. As shown in Fig. 10, when a center angle of 120° is provided around the sun gear 21 and three planet gears 28a to 28c are provided on which partitioning liners 29a to 29c are mounted, the interior of the housing 20 is divided into three chambers 30a to 30c. Even in this case, when the planet gears 28a to 28c are revolved, air is sucked from the intake pipe 20a and compressed due to the change in volume of the chambers 30a to 30c. An exhaust cycle can be further carried out.

Fig. 11 shown an example of a housing. The housing 1 for the internal combustion engine described in connection with Fig. 1 will be described hereinafter.

The housing 1 of Fig. 11(a) is in the form of a flat cylindrical configuration, and partitioning liners received therein can be a flat plate form adjusted to the upper and lower inner walls of the housing 1. The housing 1 shown in Fig. 11(a) is formed in its central portion with a flat functional chamber 40a and formed therearound with a pressurizing chamber 40 whose section is approximately circular.

A partitioning liner incorporated in the housing 1 shown in Fig. 11(b) has a structure as shown in Fig. 12(a). This partitioning liner 41 is provided with an annular base 41a received in the functional chamber 40a of the housing 1 and liner portions 41b provided at two locations in the outer periphery thereof. The base 41a has a diametric stay 41c, which is bored a slot 41d. The liner portion 41b has a shape which slides along the inner peripheral wall surface of the pressurizing chamber 40b of the housing 1 so that air is sucked into the pressurizing chamber 40 by the travel of the liner 41c and air is compressed, and exhaust to the outside is effected.

As shown in Fig. 12(b) and 12(c), the partitioning liner 41 has, as a pair of parts, those in which the liner portion 41b is deviated up and down with respect to the base 41a, which are superposed above and below and incorporated into the housing 1. In this combination, the bases 41a of the upper and lower partitioning liners 41 are respectively coincided and the respective stays 41c are perpendicular to each other. Since the liner portion 41b is deviated up and down with respect to the base 41a, when a pair of partitioning liners 41 are placed one above the other, the liner portion 41b can be registered with the center in a vertical direction of two bases 41a.

Fig. 14 is a perspective view showing an example of construction of the sun gear 2 and four planet gears 3a to 3d described in connection with Fig. 1. In the illustrated example, a disc 6b in place of the arm 6 shown in Fig. 1 is provided on each of the planet gears 3a to 3d, and a pin 6a is fixed to the disc 6b. Since the pin 6a of the planet gears 3a and 3c positioned in front of and the back of the sun gear 2 is closest to the peripheral surface of the sun gear 2 in the drawing, the pin 6a is at invisible position in the drawing. These sun gear 2 and planet gears 3a to 3d are incorporated into the partitioning liner 41 shown in Fig. 13 and integrated by inserting the pin 6a into a slot 41d of the corresponding partitioning liner 41.

Fig. 15 is a sectional view showing a detailed construction of the housing 1. This is in form of a cylindrical configuration obtained by vertically extending the functional chamber 40a shown in Fig. 11(b), and a pressurizing chamber 40 having a circular section is annularly provided in periphery thereof.

Fig. 16 is a longitudinal sectional view showing the state where a planet gear mechanism including the partitioning liner 41 is received into the housing 1 shown in Fig. 15. In this example, the sun gear 2 and planet gears 3a, 3c and the sun gear 2 and planet gears 3b, 3d are connected to two upper and lower partitioning liners 41, respectively. That is, the planet gear mechanisms are divided and arranged above and below the partitioning liners 41 so that when the pressurizing chamber 40b is utilized as a combustion chamber, rotation to output shaft P is obtained by revolution of these planet gears 3b and 3d.

Fig. 17 shows an example in which the pressurizing chamber 40b is provided in the interior central portion instead of in the exterior, and other structures are similar to those shown in Fig. 16.

In Fig. 18, two planet gears 42a, 42b and 44 are provided, and an internal gear 43 meshed with the planet gear 42b is fixed to the housing 1. An output is transmitted from the planet gear 42b to the sun gear 2 to provide an output to the output shaft P. Fig. 19 is a plan view showing an outline of the planet gear mechanism shown in Fig. 18. The planet gear 44 to which a rod in charge of operation of the disc having the partitioning liner fixed thereto is fixed is operatively connected by two sides of the planet gear 42b. Fig. 20 shows the gear arrangement of Fig. 19 in a solid form. The figure shows an upper half from the disc having the partitioning liner of Fig. 18 fixed thereto.

In Fig. 21, a gear arrangement portion is arranged and set only at the upper part of the pressurizing chamber, where an output is set to the internal gear 43.

Fig. 22 is a cutaway view showing a further layout of the housing 45.

The housing is provided in its periphery with a pressurizing chamber 40b along with the sliding liner portions of partitioning liners 45a and 45b, similarly to the case of Fig. 15. It is noted that stays of the partitioning liners 45a and 45b are not shown in the drawing. Seal plate rings 46a, 46b and 46c are incorporated between the partitioning liner 45a and the housing 45, between the partitioning liners 45a and 45b and between the partitioning liner 45b and housing 45, respectively, in order to provide a seal relative to the chamber provided with the sun gear and another members. A pressure leak in strokes of combustion, compression and scavenging can be prevented by these seal plate rings 46a to 46c, and flowing of gases into the chamber of the sun gear can be also prevented. Two or more seal plate rings 46a to 46c can be incorporated in respective seal surface, and even in high pressure and high output engines, sufficient seal can be provided.

Fig. 23 is principle view in case of 8-air chamber system in place of the aforesaid 4-air chamber system.

Eight planet gears 48 are incorporated around a sun gear 47, and are meshed with an internal gear 49. An arm 48a is fixed to the planet gear 48. The pin provided at the distal end of the arm 48 is connected to the partitioning liner to thereby rotate and drive it, similarly to the previously mentioned embodiment. Fig. 24 shows a gear mechanism in a solid form. The sun gear 47 is fixed to a chamber provided at the lower part of the housing as shown in Fig. 22, for example, maintaining a rest even during driving. A revolution of the planet gear 48 or rotation of the internal gear 49 is changed into an output.

The partitioning liners 41 employed in the 8-air chamber system comprise a combination of such two liners as described in connection with Fig. 13, and eight liner portions 41b are provided in the annular base 41a as shown in Fig. 25. Stays 41c are extended toward the liner portions 41b, and a slot 41d into which a pin (not shown) provided on an arm 48 of the planet gear 48 is fitted is bored.

In the 8-air chamber system, since there are two plug ignition points, 16 times-combustion-explosion behavior is obtained per one revolution of the planet gear 48. Therefore, an air chamber formed by the liners 41b adjacent to each other carries out two times of 4-cycle combustion stroke during one round of the pressurizing chamber 40b. Accordingly, the number of teeth of the planet gear 48 is set so that the planet gear 48 rotates on its axis four times during one revolution thereof around sun gear 47. This will be described with reference to a stroke view shown in Fig. 26.

As shown in the figure, the pressurizing chamber 40b is divided into air chambers A to H by eight liner portions 41b, and ignition plugs J1 and J2 are provided at two locations. Mixture intakes K1, K2 and combustion air exhaust ports L1, L2 are respectively connected to two locations.

The combustion stroke of the air chamber A will be described. The air chamber A is in the state immediately after the termination of scavenging to the mixture exhaust port L2 and is about to close the mixture exhaust port L2. With the clockwise revolution of each of the planet gears 48, the air chamber A is communicated with the mixture intake K1 and shifts to a stroke in which a mixture is supplied, as shown in Fig. 26(b). Thereafter, as shown in Fig. 26(c) the air chamber A gradually expands, and the succeeding liner portion 41b with respect to the rotational direction is about to close the mixture intake K1. In Fig. 26(d), the air chamber A is the form of a closed space. In that state, the succeeding air chamber H is in a suction stroke, and the air chamber A is compressed by expansion of volume thereof. In

Fig. 26(e), the air chamber A is compressed to its minimum volume and ignited by the ignition plug J1 for explosion and combustion, and the air chamber A expands as shown in Fig. 26(f).

After the combustion and explosion, the air chamber A reaches the combustion exhaust port L1 as shown in Fig. 26(g) to assume scavenging start state, and is in a scavenging stroke in Fig. 26(h). In Fig. 26(i), the scavenging is almost completed and the volume of the air chamber A is minimum, after which the air chamber A again begins to be communicated with the mixture intake K2 and is in a suction stroke in Fig. 26(j). After the stroke of Figs. 26(k) and (l), the air chamber A reaches a portion of the ignition plug J2 as shown in Fig. 26(m) by the combustion and expansion of the air chamber F, where the second combustion and explosion occur. After the combustion and explosion, the air chamber A expands as shown in Fig. 26(n) and further rotates clockwise, and when reaching a stroke as shown in Fig. 26(o), scavenging stroke of FIG,26(P) is terminated to complete one cycle.

Behavior exactly similar to that of the air chamber A appears in other air chambers B to H, and the partitioning liners 41 rotate while continuing two combustion and explosions at one cycle. This rotational output can be transferred outside as an output by the revolution of the planet gear 48 or rotation of the internal gear 49 externally thereof.

Fig. 27 is a principle view in which a rotational output is transferred from only the sun gear, and Fig. 28 is a schematic view of a solid model thereof.

In the figures, eight planet gears 51 are provided around a sun gear 50, and an internal gear 52 is arranged externally thereof. The internal gear 52 is fixed to the housing 1 of Fig. 15 or to the housing 45 of Fig. 22, and maintains a rest state even during driving. An arm 51a provided at the end thereof with a pin in relation to the partitioning liner 41 is provided on the planet gear 51. The 8-air chamber system shown in Fig. 25 is incorporated without modification in the partitioning liner 41.

Fig. 29 is a stroke view in the case of a construction corresponding to the principle view of Fig. 27. As the behavior of eight air chambers A to H is exactly the same as that described in Fig. 26, detailed description of which will not be made. Fig. 30 is a longitudinal sectional view of a specific structural example, in which an output shaft 50a is fixed to a sun gear 50, and a gear train including the vertically arranged sun gear 50 is directly included in an output system. Such a structure is similar to that shown in Fig. 18 in its output mode and is different from that of Fig. 16. However, comparing with that shown in Fig. 18 by employment of eight-air chamber system, the number of required gears is considerably reduced and the construction is simple. Therefore, reduction of mechanical loss such as sliding friction can be expected.

Figs. 31 to 33 show another construction example of partitioning liners.

The partitioning liners have been already described with reference to Figs. 12 and 13, in which the stay 41c is radially provided on the annular base 41a, and the planet gears are disposed in the slot 41d bored in the stay 41c. In the illustrated example, a crank mechanism is utilized instead.

In the figures, a planet gear 54 is provided around a sun gear 53, and a crank rod 55 is turnably mounted on the planet gear 54. As shown in Fig. 33, a partitioning liner 56 is arranged coaxially with the sun gear 53, and a pin 55a of the crank rod 55 is inserted therein. The partitioning liner 56 is provided with the required number of liner portions 56a or the like in the periphery thereof, in exactly the same manner as that of the previous example. The crank shaft 55 can be connected to the planet gear 54 as described above to thereby control the rotational speed of the partitioning liner 56.

Of course, the compressor according to the present invention such as a 12-air chamber system or 16-air chamber system which are less in variation of output shaft torque in place of the 8-air chamber system can be utilized for a multi-air chamber system.

As described above, when the compressor of the present invention used, problems encountered in the turbo system and volume system can be considerably improved, and merits of two conventional systems can be utilized. Thereby, difficulties with respect to consistency such that the pressure ratio at the time of low speed operation is obtained which has been difficult in prior art are overcome, and the range of uses of a single compressor can be set extensively.

[INDUSTRIAL APPLICABILITY]

The present invention can be utilized for a compressor of which object is air and a compression apparatus of a variable volume system such as a combustion device of an automobile internal combustion engine or the like.

CLAIMS

1. A rotary displacement system compressor characterized in that

an intake path and an exhaust path are connected to a housing;

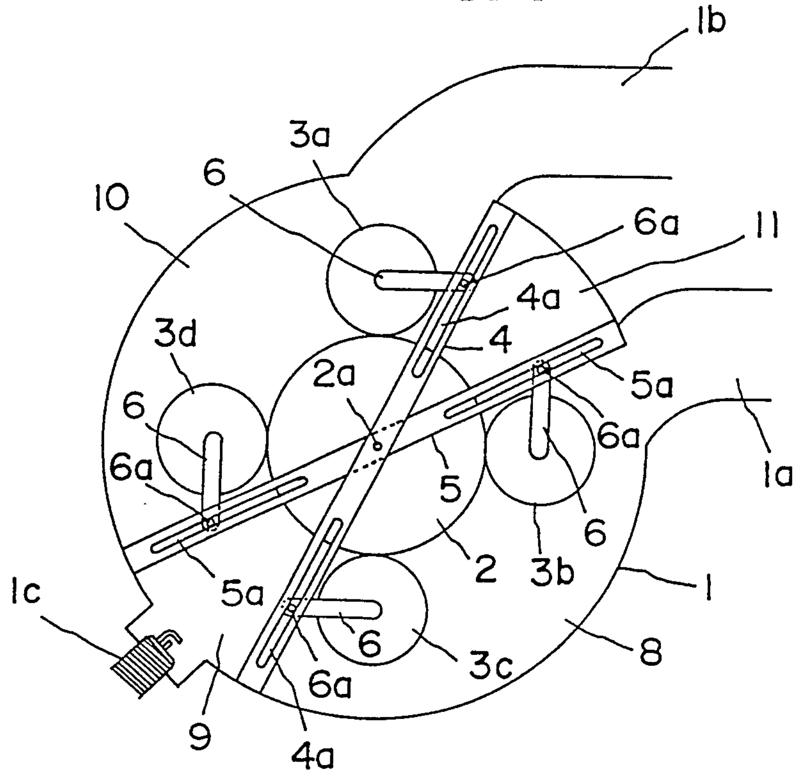
a sun gear is provided in the central portion of said housing, a plurality of planet gears meshed with said sun gear being provided;

partitioning liners rotatably mounted in the center of said sun gear to divide the interior of said housing into a plurality of closed chambers are provided;

a radially extending arm is provided on said planet gear; and

the distal end of said arm is connected radially movably of said partitioning liners.

FIG. 1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3a
6
10
6a
11
4a
4
3d
2a
5a
6
6a
6a
1a
5
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3b
1
1c
5a
6
3c
8
9
6a
4a

FIG. 2

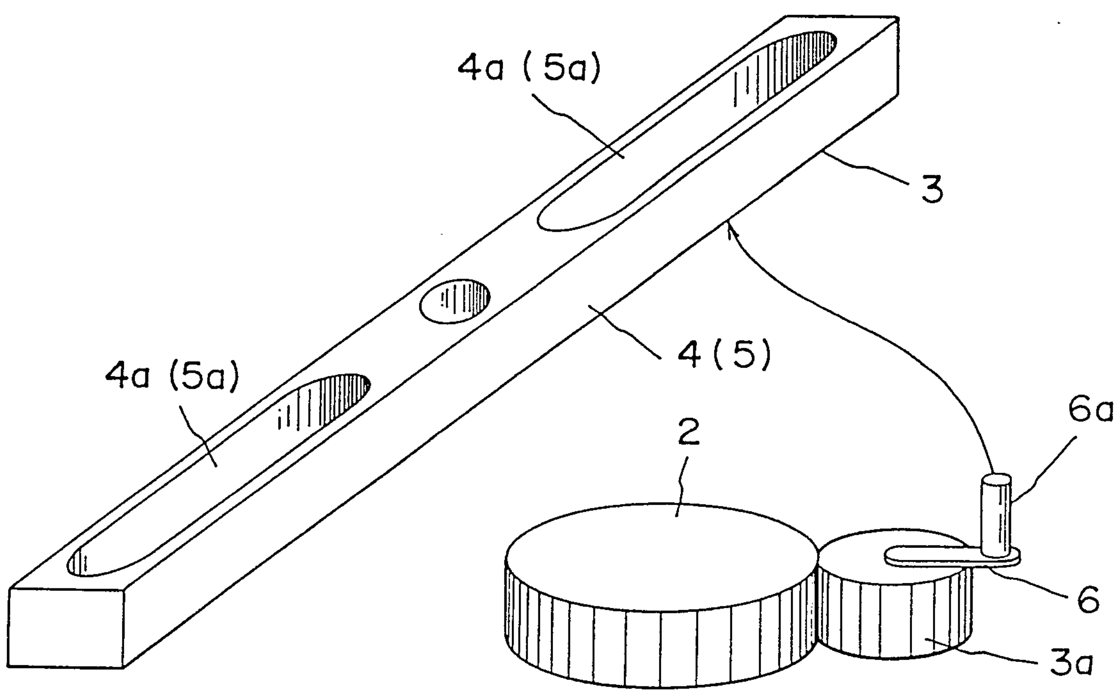

4a (5a)
3
4a (5a)
4 (5)
6a
2
6
3a

FIG. 3

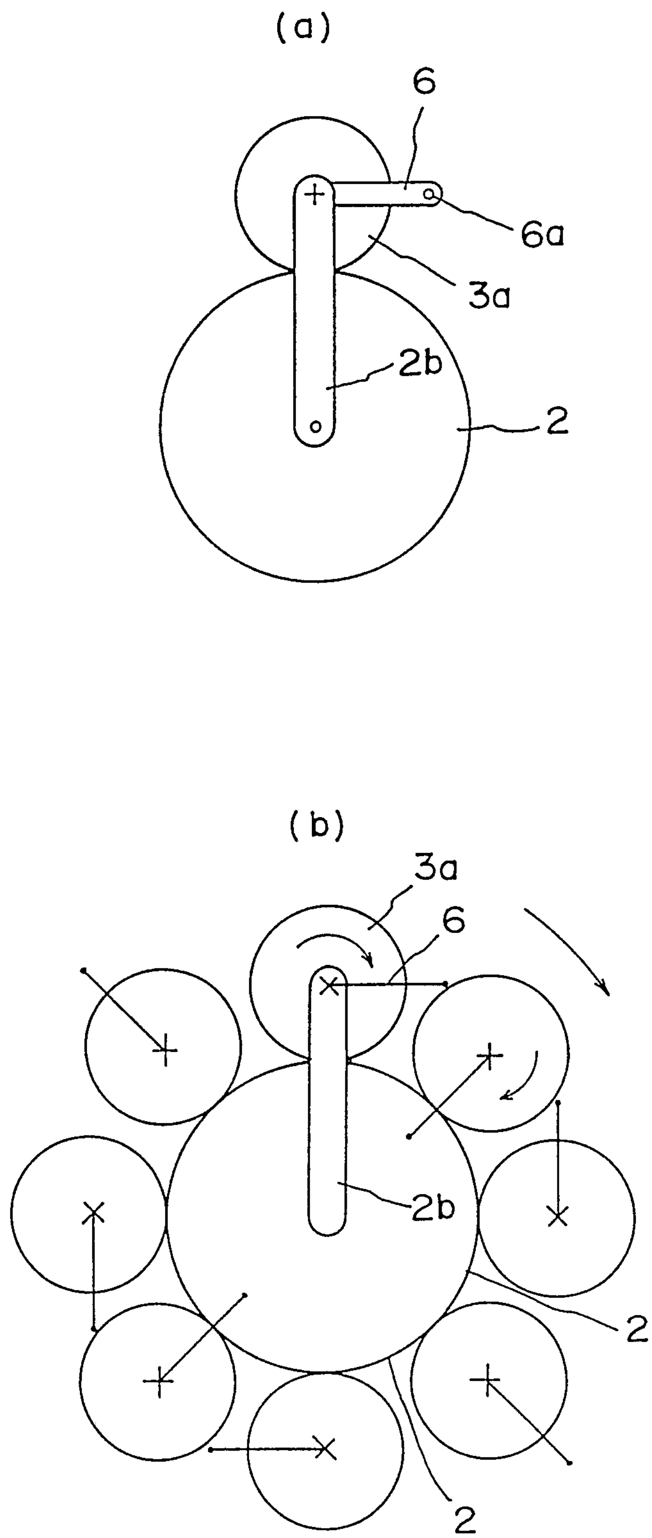


FIG. 4

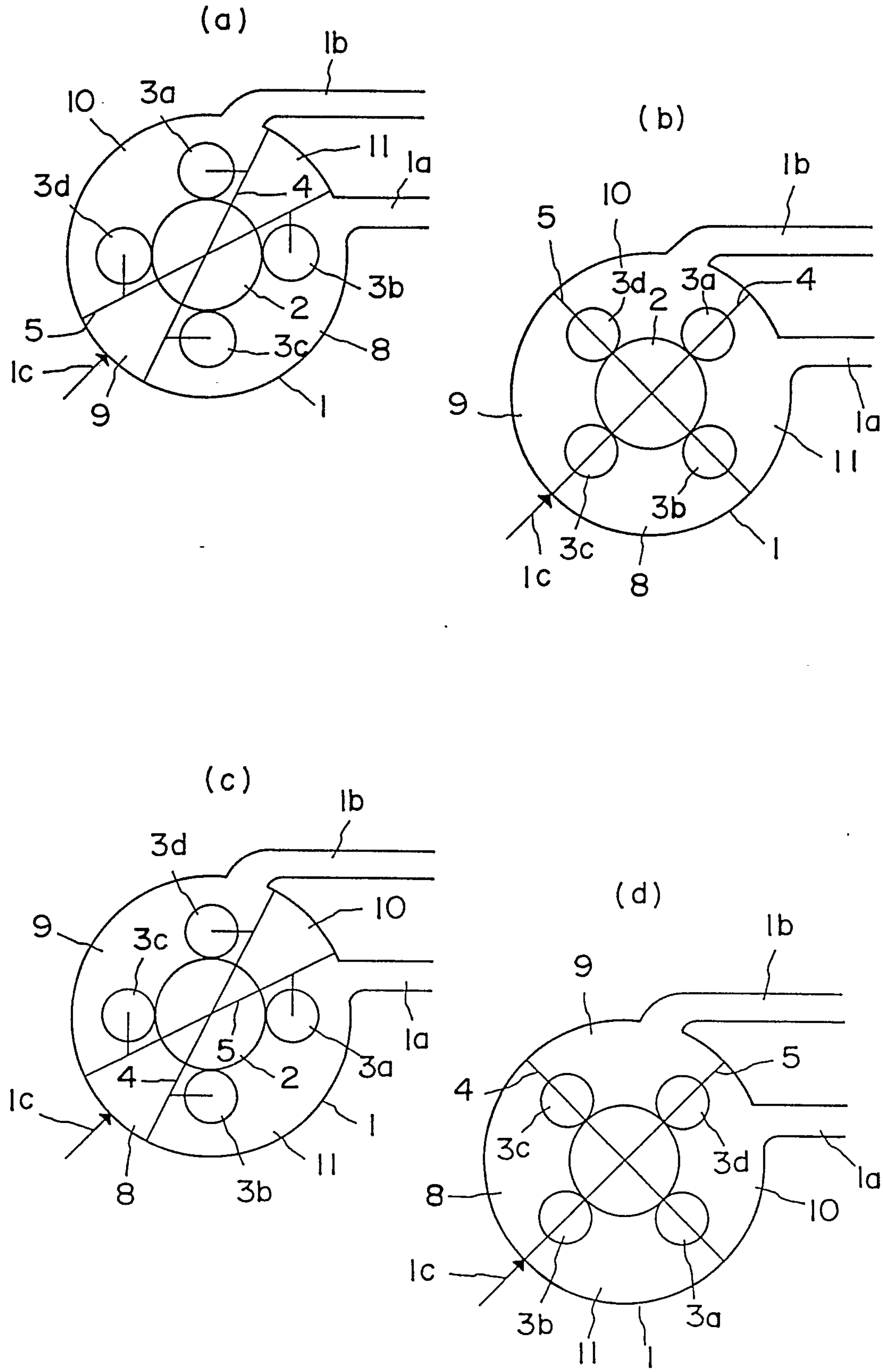

(a)
1b
10
3a
11
1a
3d
4
3b
2
5
3c
8
1c
9
1
(b)
1b
10
5
3d
2
3a
4
9
1a
11
3b
1
1c
3c
8
(c)
1b
3d
10
9
3c
1a
5
2
3a
4
1c
1
11
8
3b
(d)
1b
9
5
4
3c
3d
1a
8
10
1c
3b
3a
11
1

FIG. 4

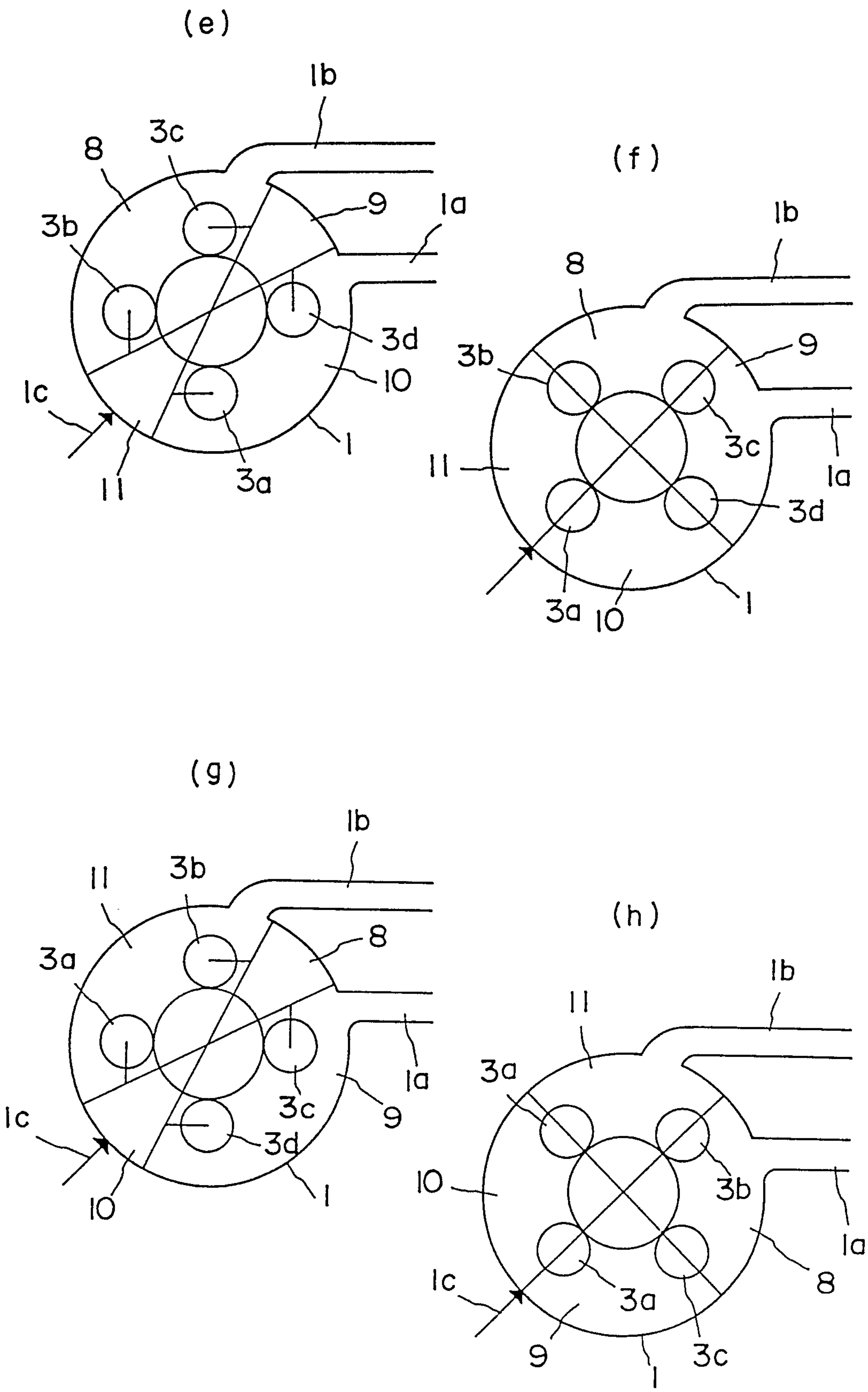

(e)
1b
8
3c
9
1a
3b
3d
10
1c
1
11
3a
(f)
1b
8
9
3b
3c
11
1a
3d
3a
10
1
(g)
1b
11
3b
8
3a
1a
3c
9
1c
3d
1
10
(h)
1b
11
3a
3b
10
1a
8
1c
3a
9
3c
1

FIG. 5

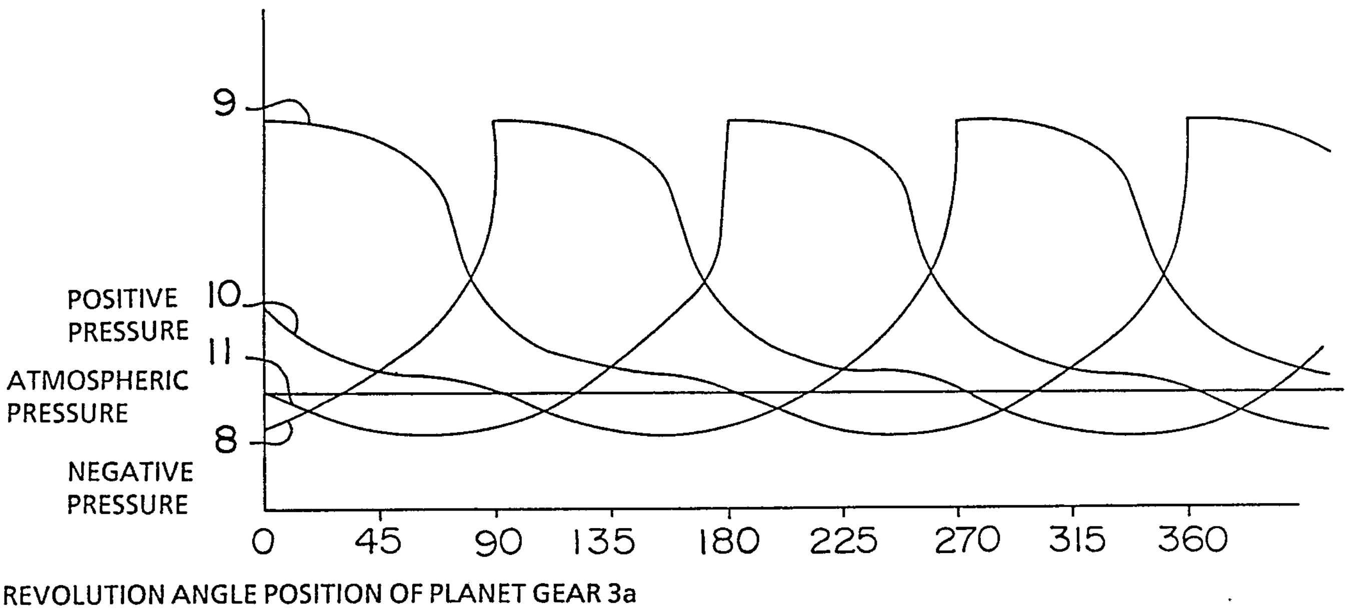

9
10
11
8
POSITIVE PRESSURE
ATMOSPHERIC PRESSURE
NEGATIVE PRESSURE
0
45
90
135
180
225
270
315
360
REVOLUTION ANGLE POSITION OF PLANET GEAR 3a

FIG. 6

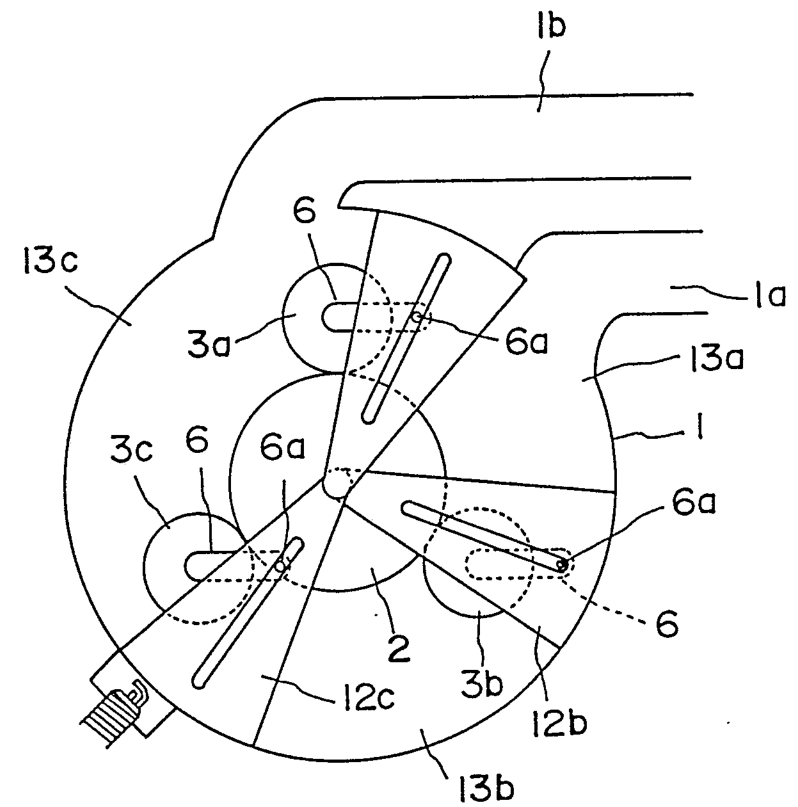

1b
6
13c
1a
3a
6a
13a
1
3c
6
6a
6a
6
2
12c
3b
12b
13b

FIG. 7

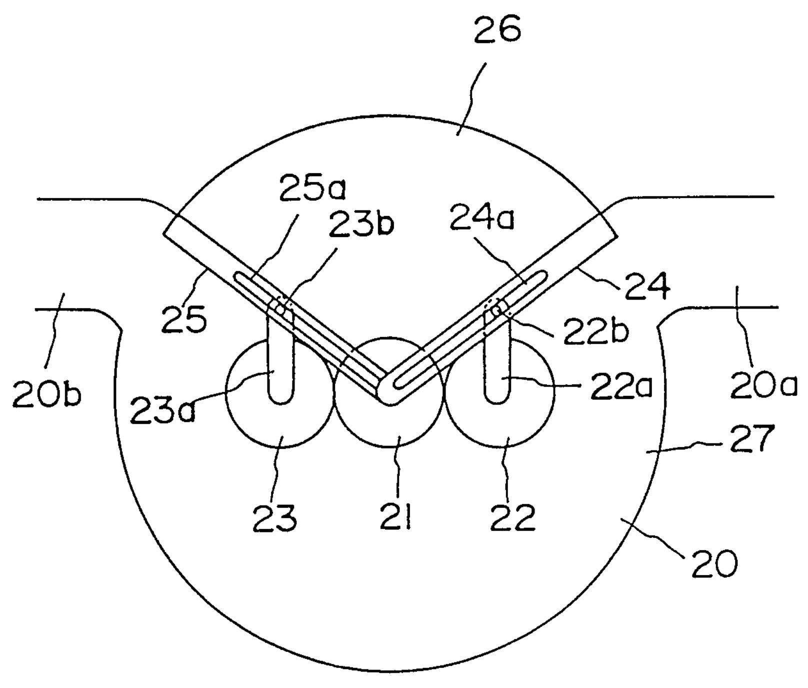

26
25a
23b
24a
24
25
22b
20b
23a
22a
20a
27
23
21
22
20

FIG. 8

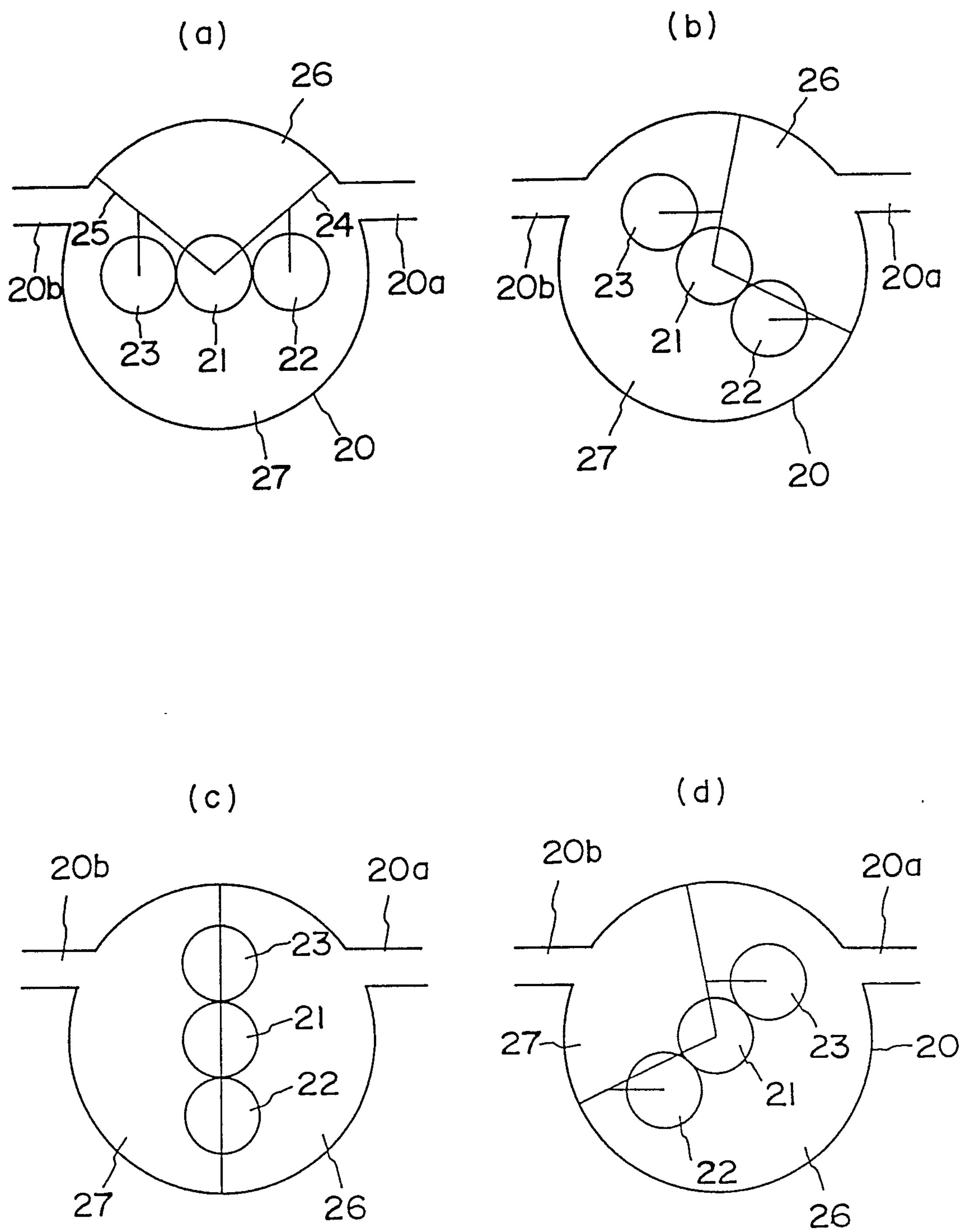
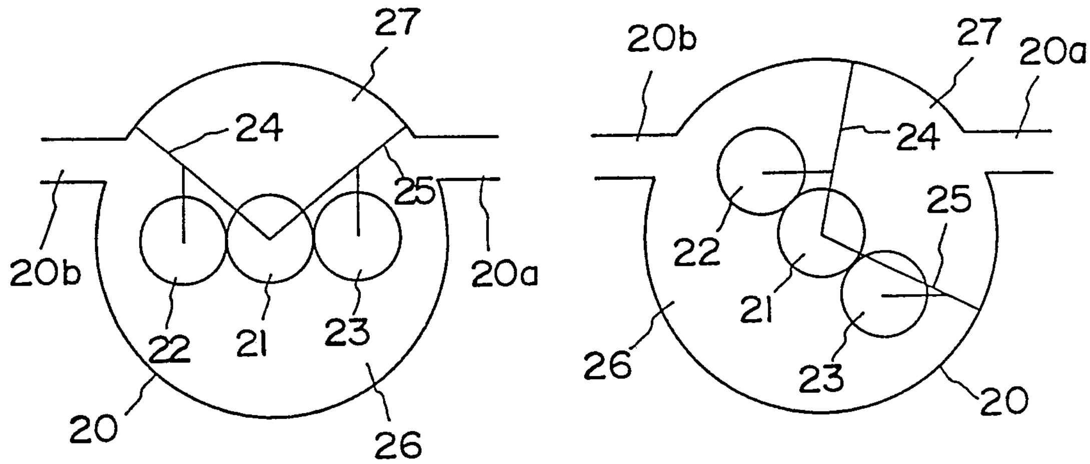

(a)
26
25
24
20b
20a
23
21
22
27
20
(b)
26
20b
23
21
22
20a
27
20
(c)
20b
20a
23
21
22
27
26
(d)
20b
20a
27
23
20
21
22
26

FIG. 8

(e)

(f)


27
24
25
20b
20a
22
21
23
20
26
20b
27
20a
24
25
22
21
26
23
20

(g)

(h)

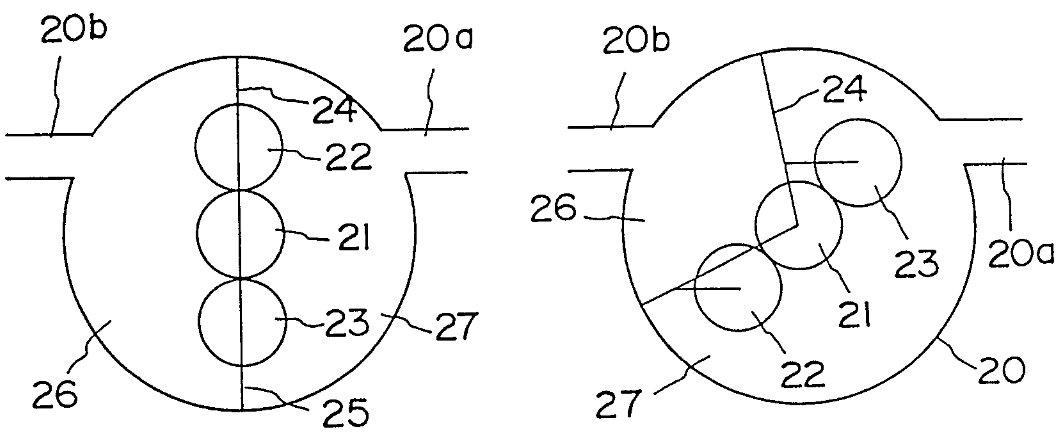

20b
20a
24
22
21
23
27
26
25
20b
24
26
23
20a
21
22
20
27

FIG. 9

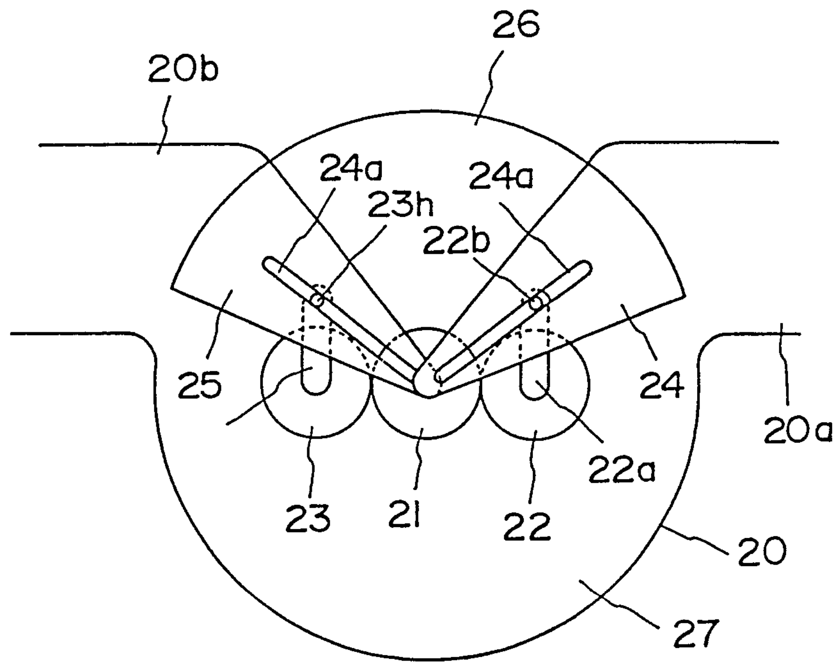

26
20b
24a
24a
23h
22b
25
24
20a
22a
23
21
22
20
27

FIG. 10

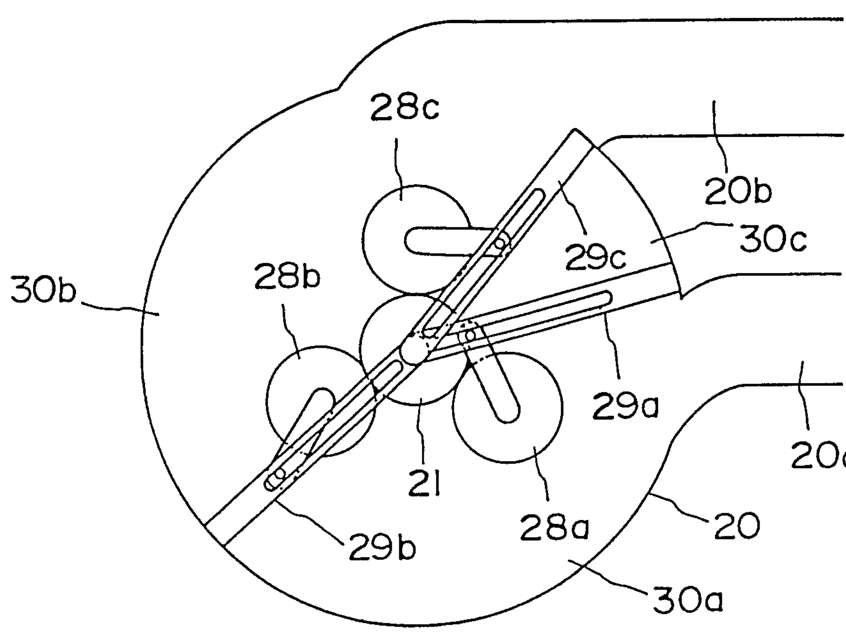

28c
20b
30c
29c
28b
30b
29a
20a
21
28a
20
29b
30a

FIG. 11

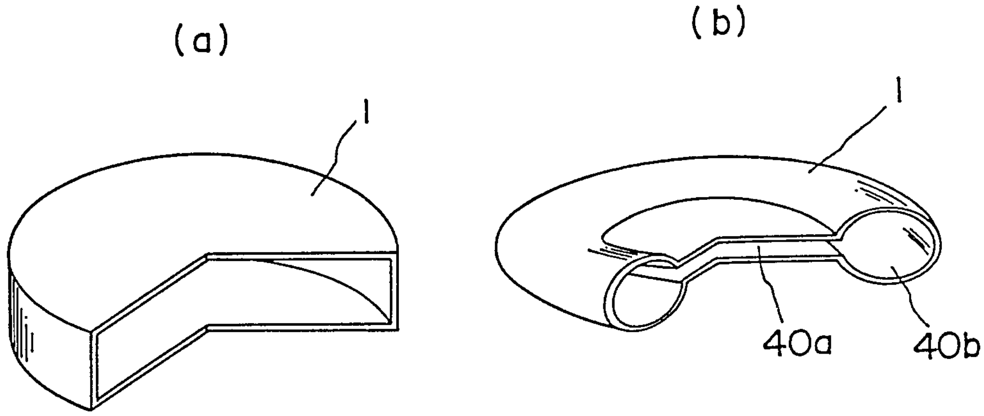

(a)
1
(b)
1
40a
40b

FIG. 12

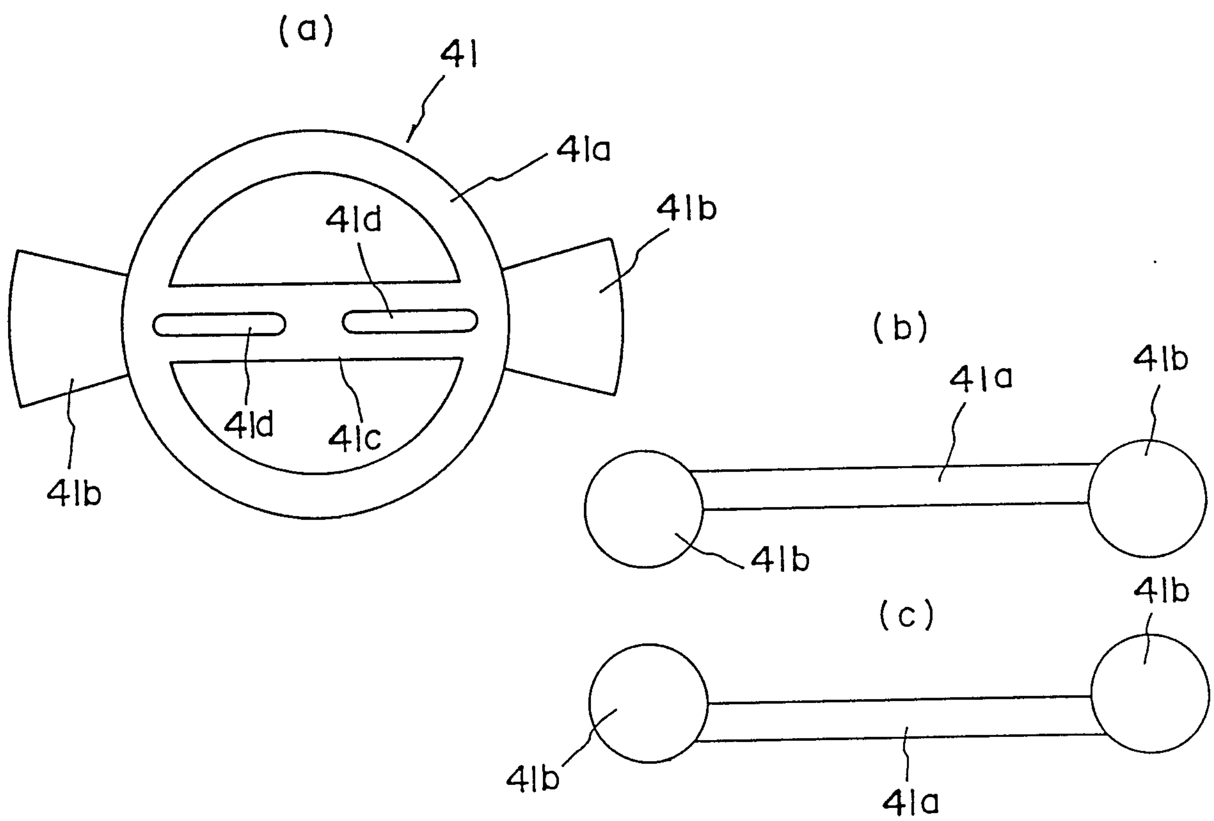

(a)
41
41a
41b
41d
41d
41c
41b
(b)
41a
41b
41b
(c)
41b
41b
41a

FIG. 13

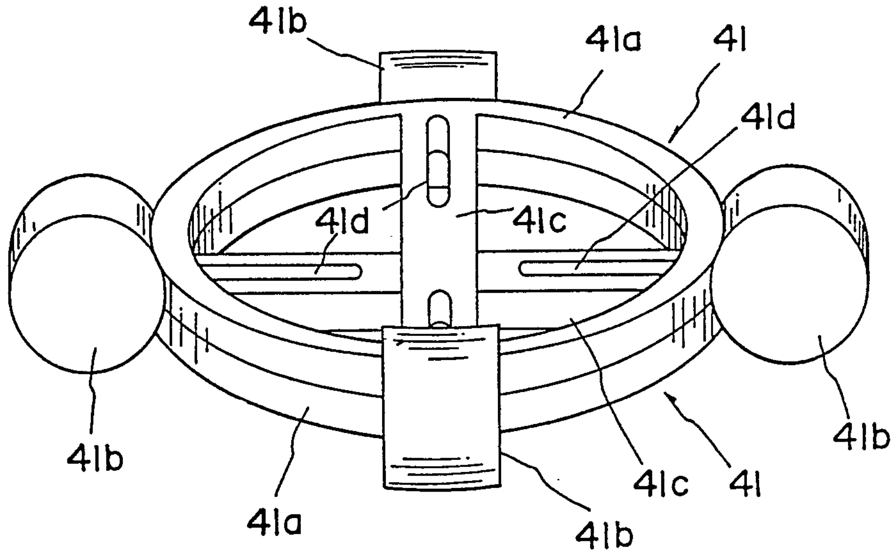

4lb
4la
4l
4ld
4ld
4lc
4lb
4lb
4lc
4l
4la
4lb

FIG. 14

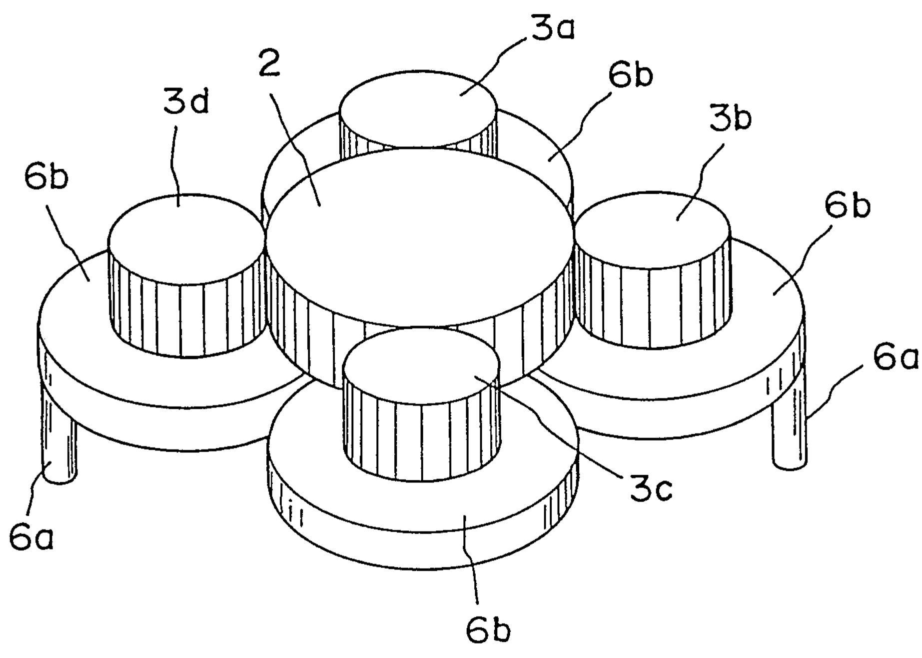

3a
2
6b
3d
3b
6b
6b
6a
3c
6a
6b

FIG. 15

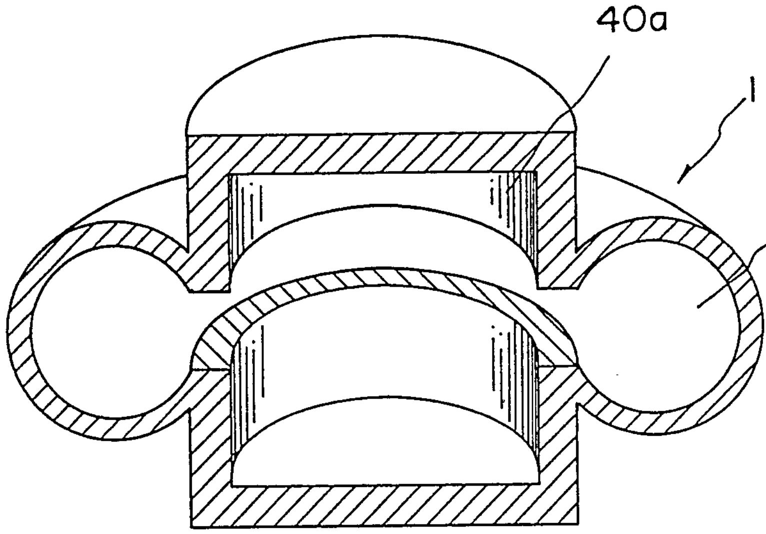

40a
1
40b

FIG. 16

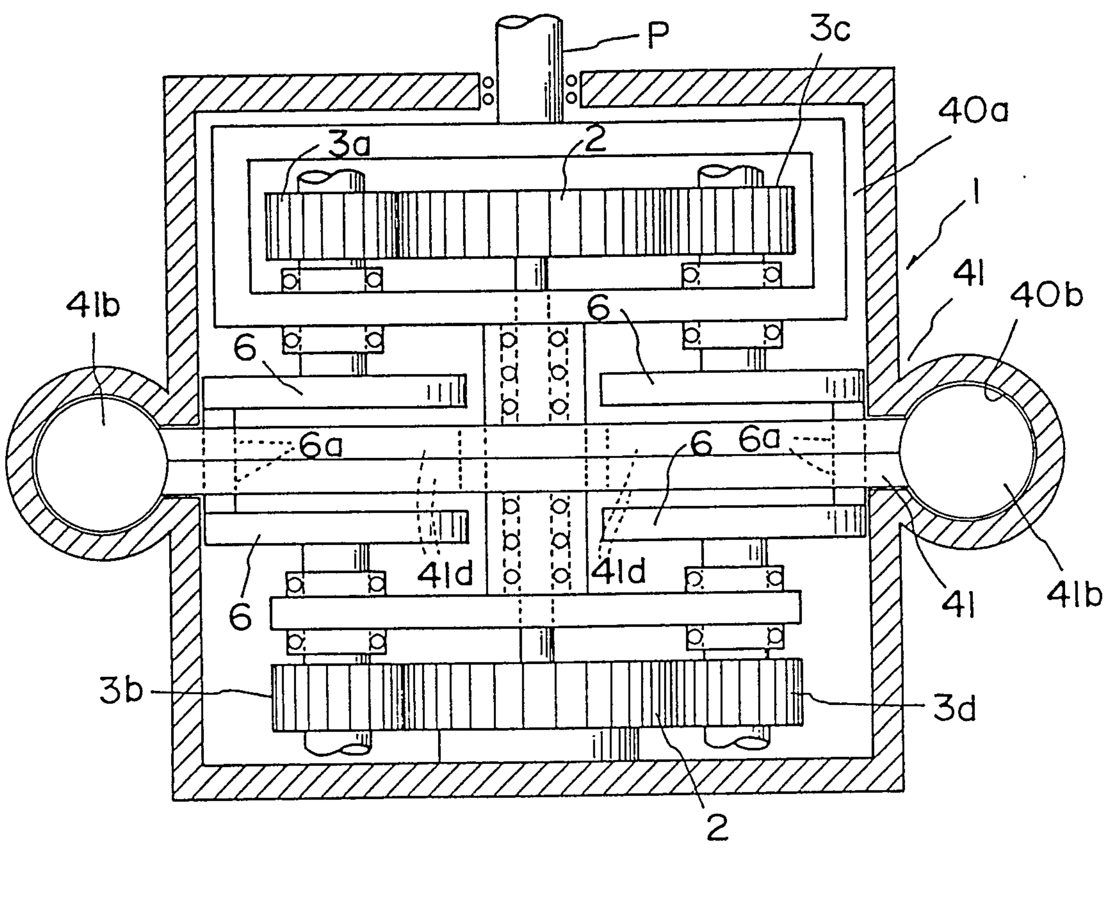

P
3c
40a
3a
2
1
41
41b
40b
6
6
6a
6a
6
41d
41d
6
6
41
41b
3b
3d
2

FIG. 17

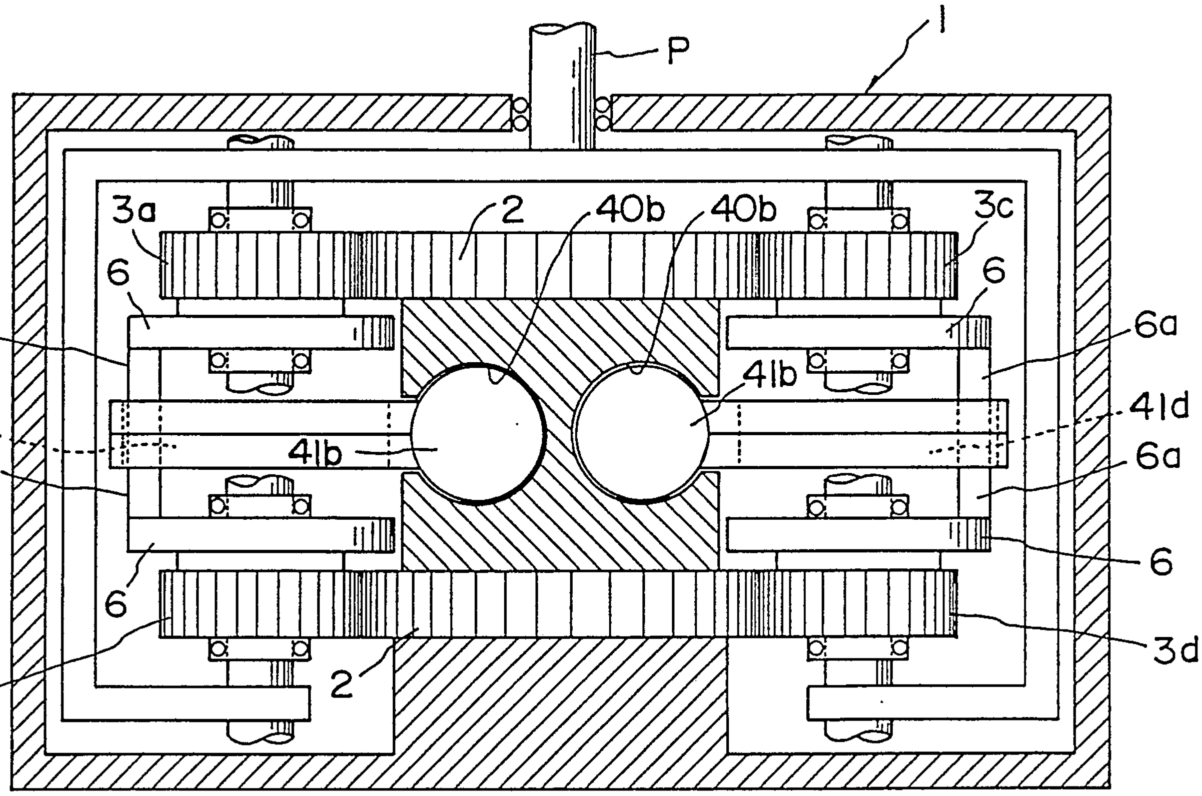

P
1
3a
2
40b
40b
3c
6
6
6a
6a
41d
41b
41b
41d
6a
6a
6
6
3b
2
3d

FIG. 18

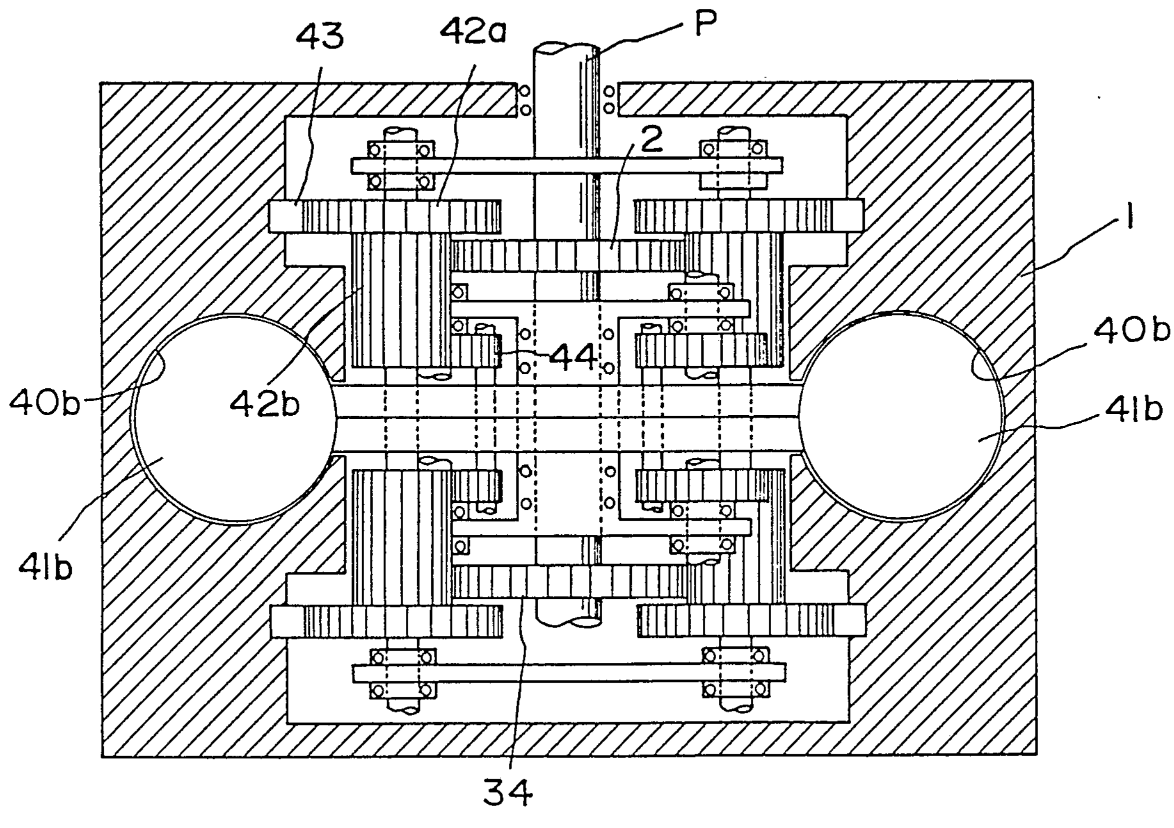

43
42a
P
2
1
44
40b
42b
40b
41b
41b
34

FIG. 19

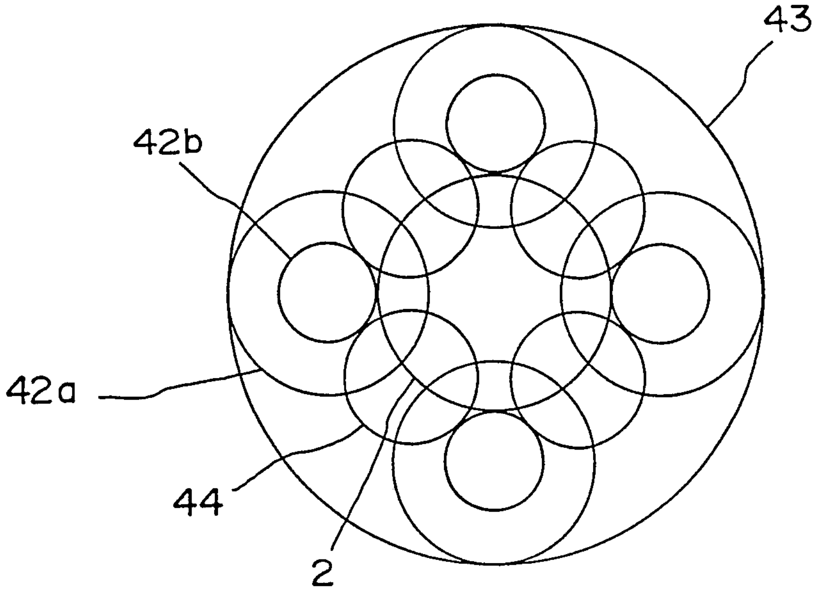


FIG. 20

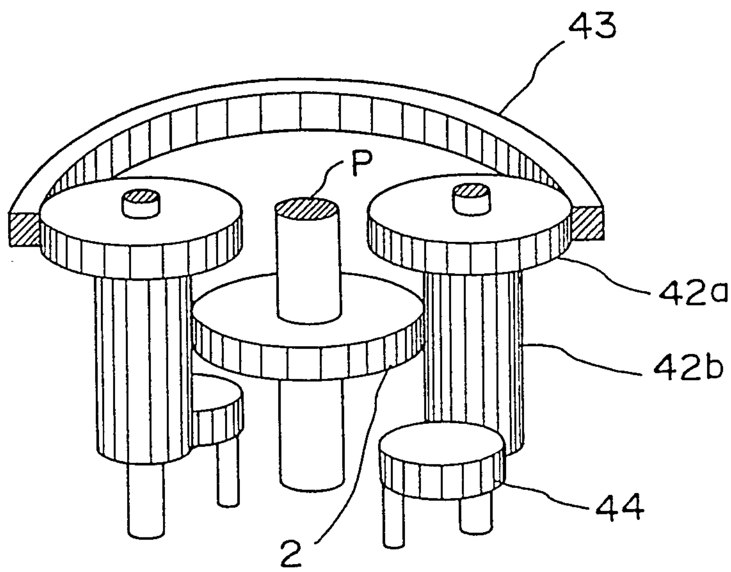


FIG. 21

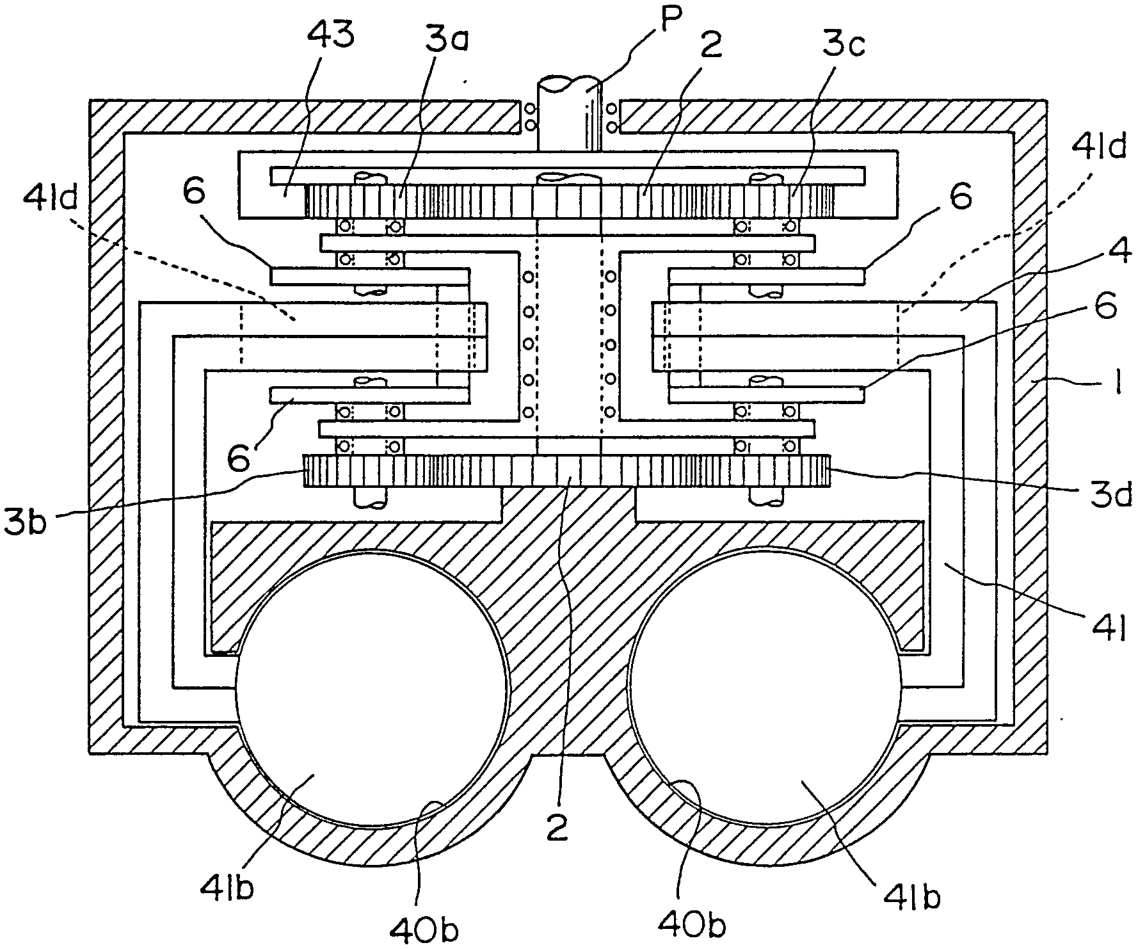


FIG. 22

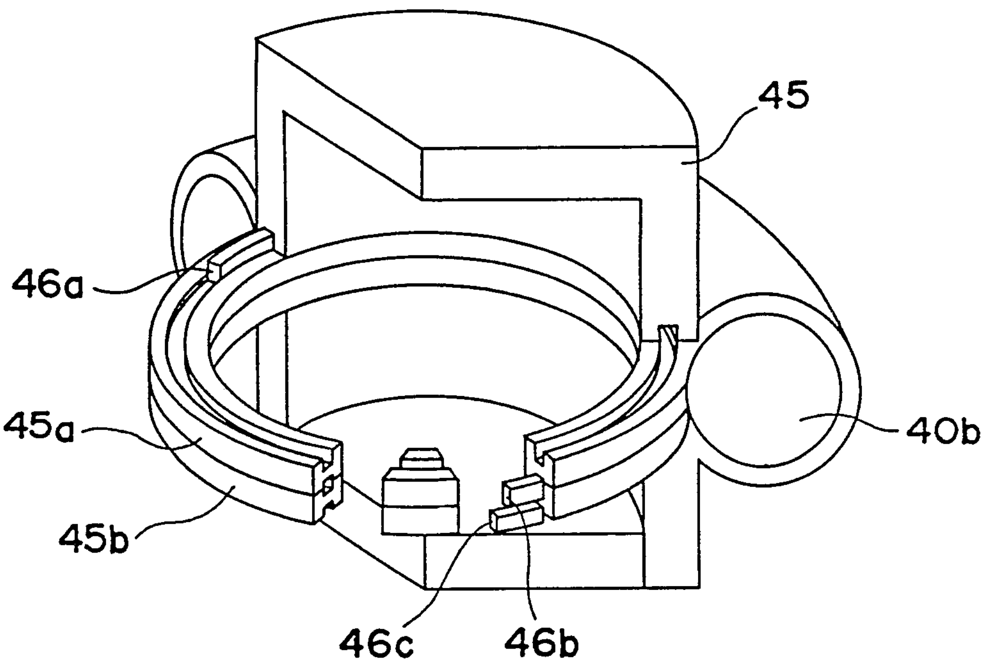


FIG. 23

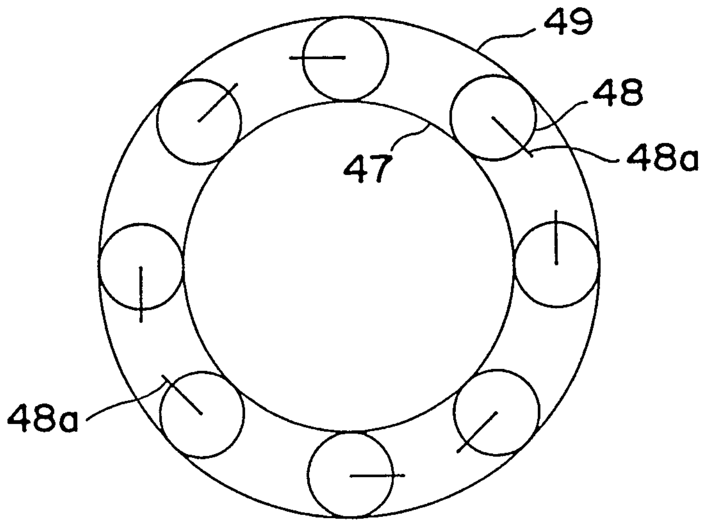


FIG. 24

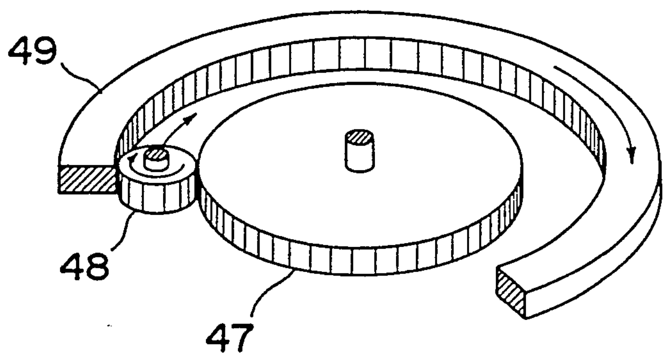


FIG. 25

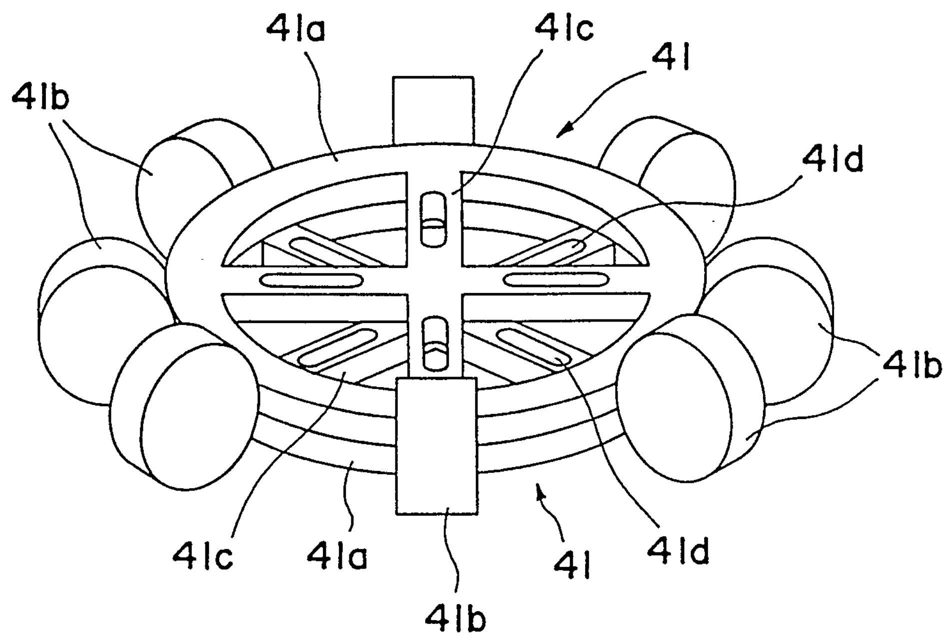


FIG. 26

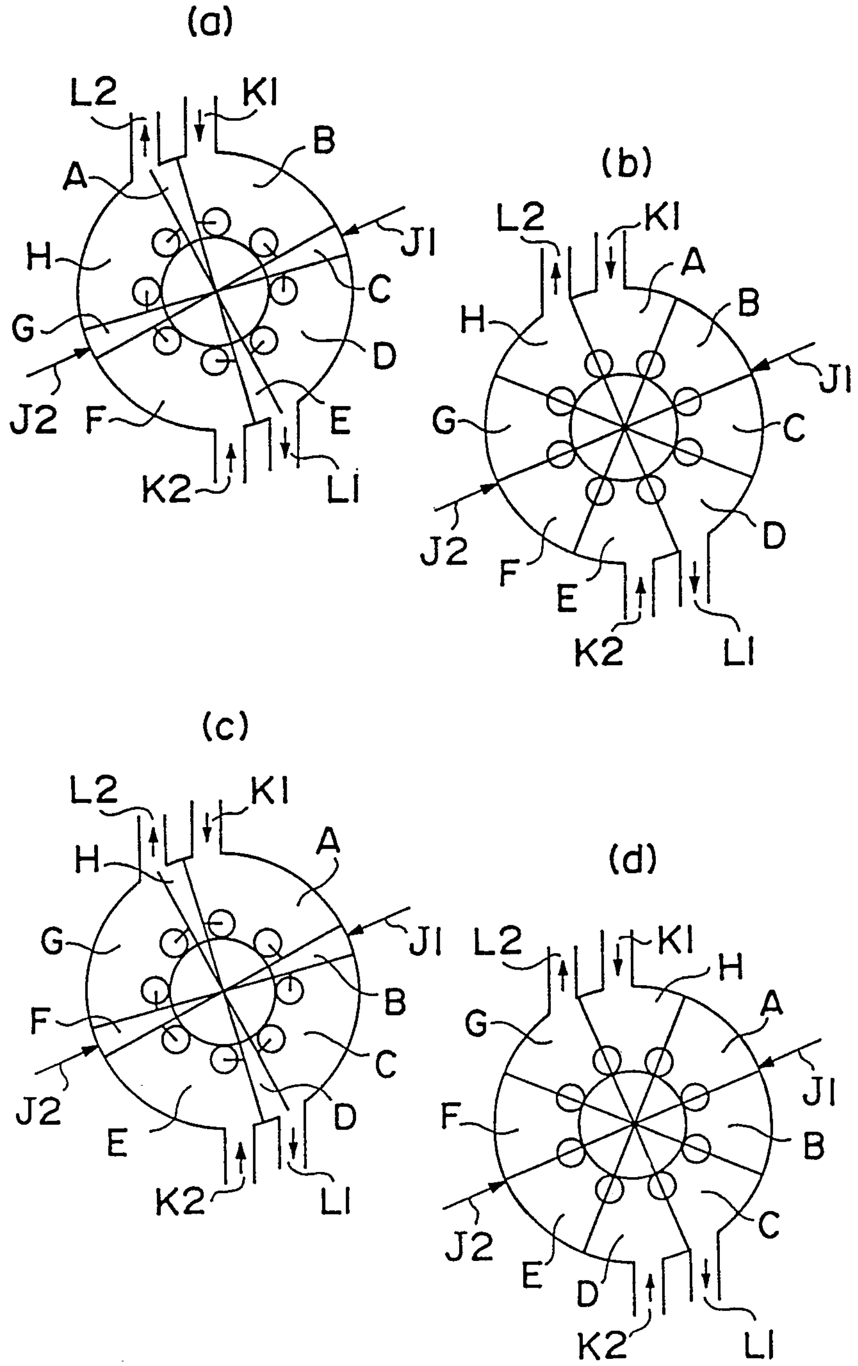

(a)
L2
K1
B
A
J1
H
C
G
D
J2
F
E
K2
L1
(b)
L2
K1
A
B
H
J1
G
C
J2
D
F
E
K2
L1
(c)
L2
K1
A
H
J1
G
B
F
C
J2
D
E
K2
L1
(d)
L2
K1
H
A
G
J1
F
B
J2
C
E
D
K2
L1

FIG. 26

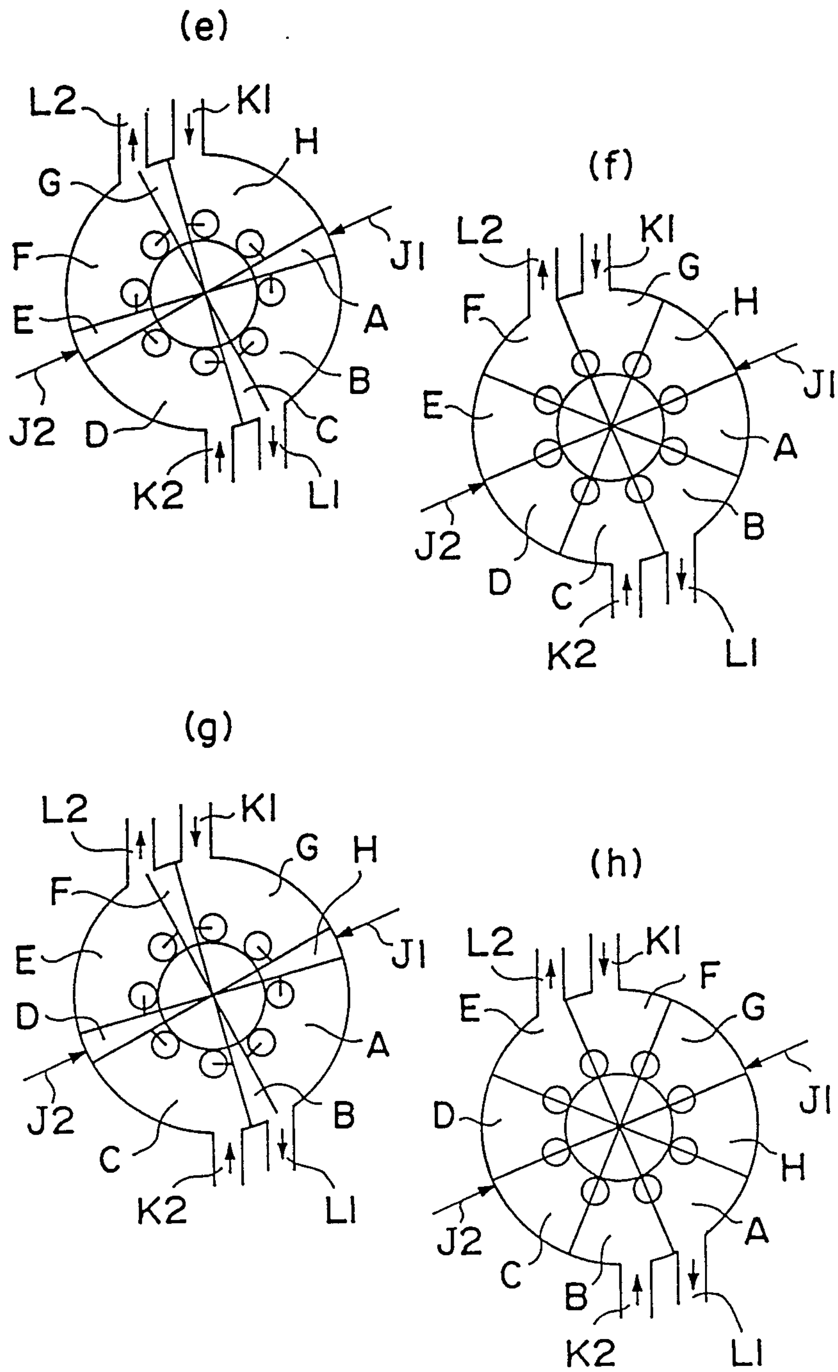

(e)
L2
KI
H
G
F
JI
A
E
B
J2
D
C
K2
LI
(f)
L2
KI
G
F
H
JI
E
A
J2
B
D
C
K2
LI
(g)
L2
KI
G
H
F
JI
E
D
A
J2
B
C
K2
LI
(h)
L2
KI
F
E
G
JI
D
H
J2
A
C
B
K2
LI

FIG. 26

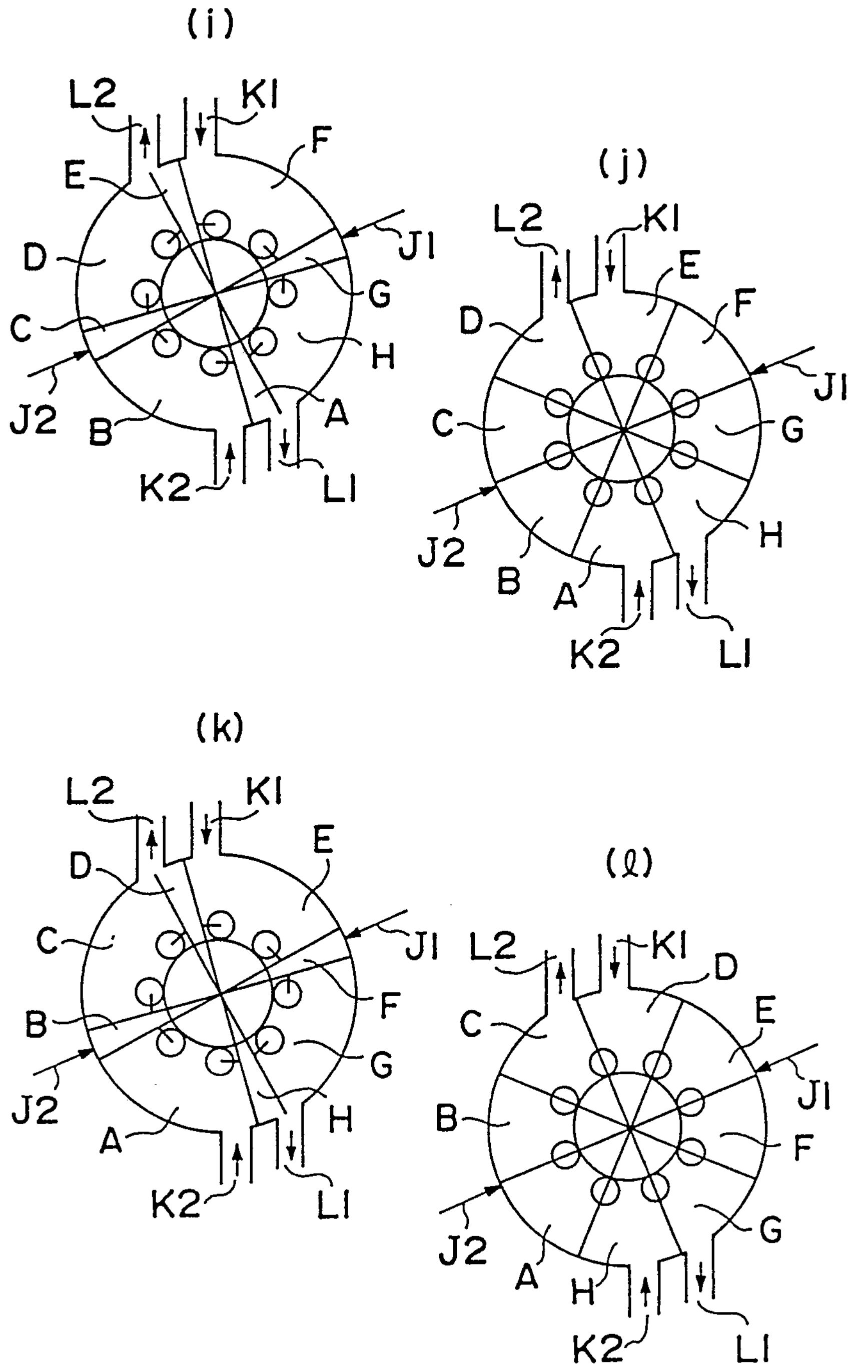

(i)
L2
K1
F
E
D
J1
G
C
H
J2
B
A
K2
L1
(j)
L2
K1
E
F
D
J1
C
G
H
J2
B
A
K2
L1
(k)
L2
K1
E
D
C
J1
F
B
G
J2
H
A
K2
L1
(ℓ)
L2
K1
D
C
E
J1
B
F
G
J2
A
H
K2
L1

FIG. 26

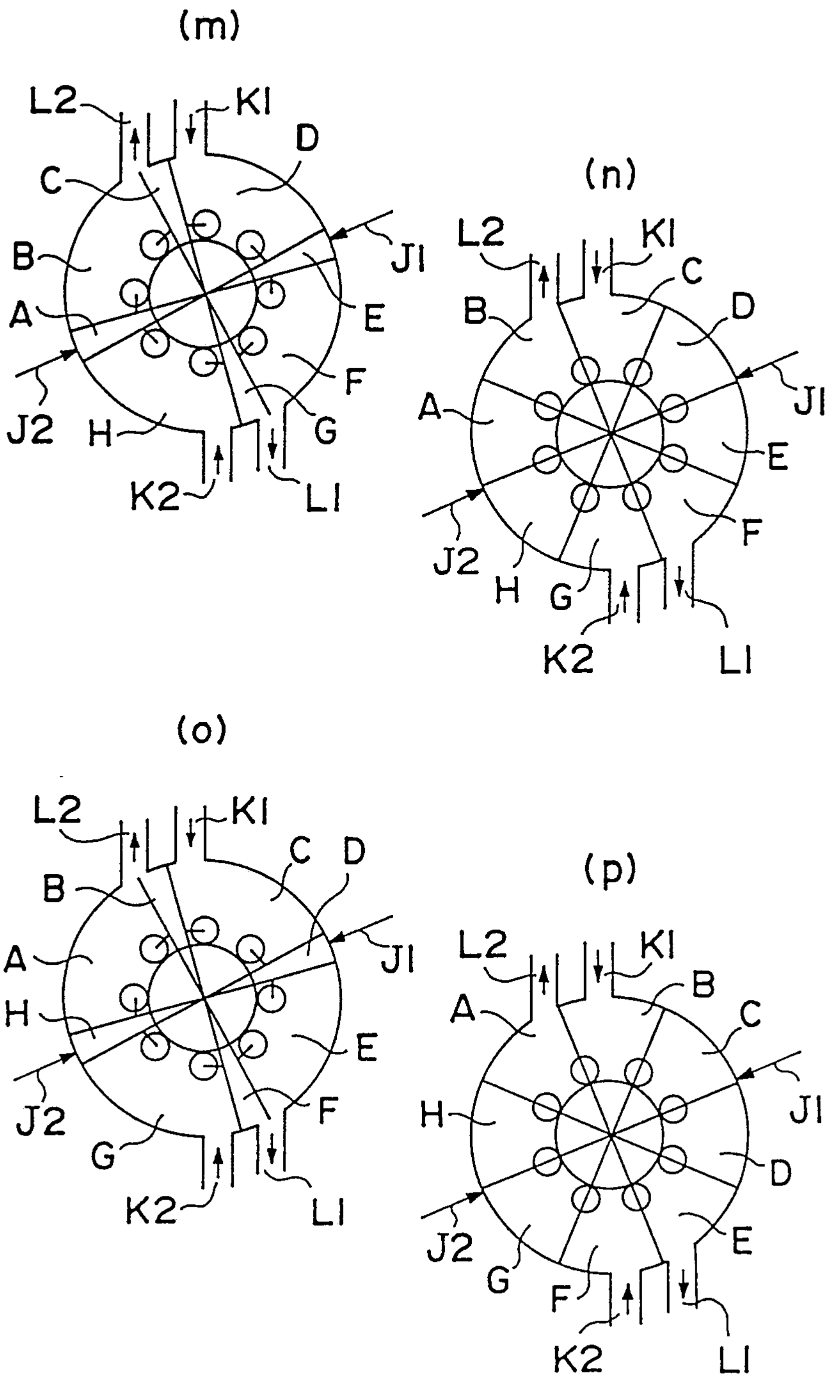

(m)
L2
K1
C
D
B
J1
A
E
F
J2
H
G
K2
L1
(n)
L2
K1
B
C
D
A
J1
E
F
J2
H
G
K2
L1
(o)
L2
K1
B
C
D
A
J1
H
E
F
J2
G
K2
L1
(p)
L2
K1
A
B
C
H
J1
D
E
J2
G
F
K2
L1

FIG. 27

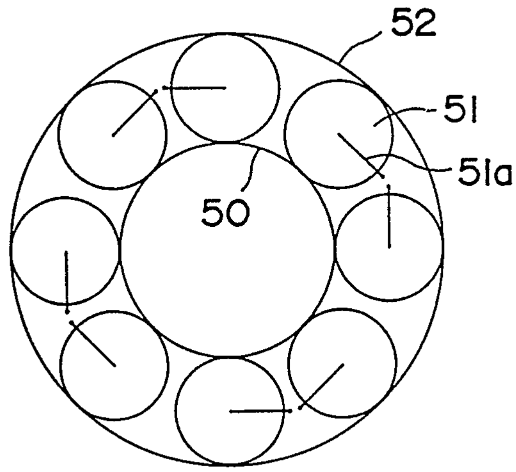


FIG. 28

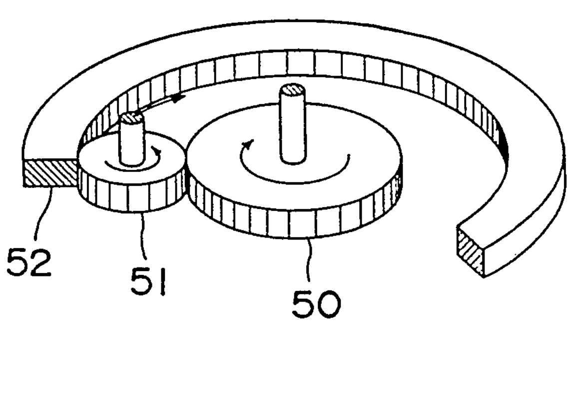


FIG. 29

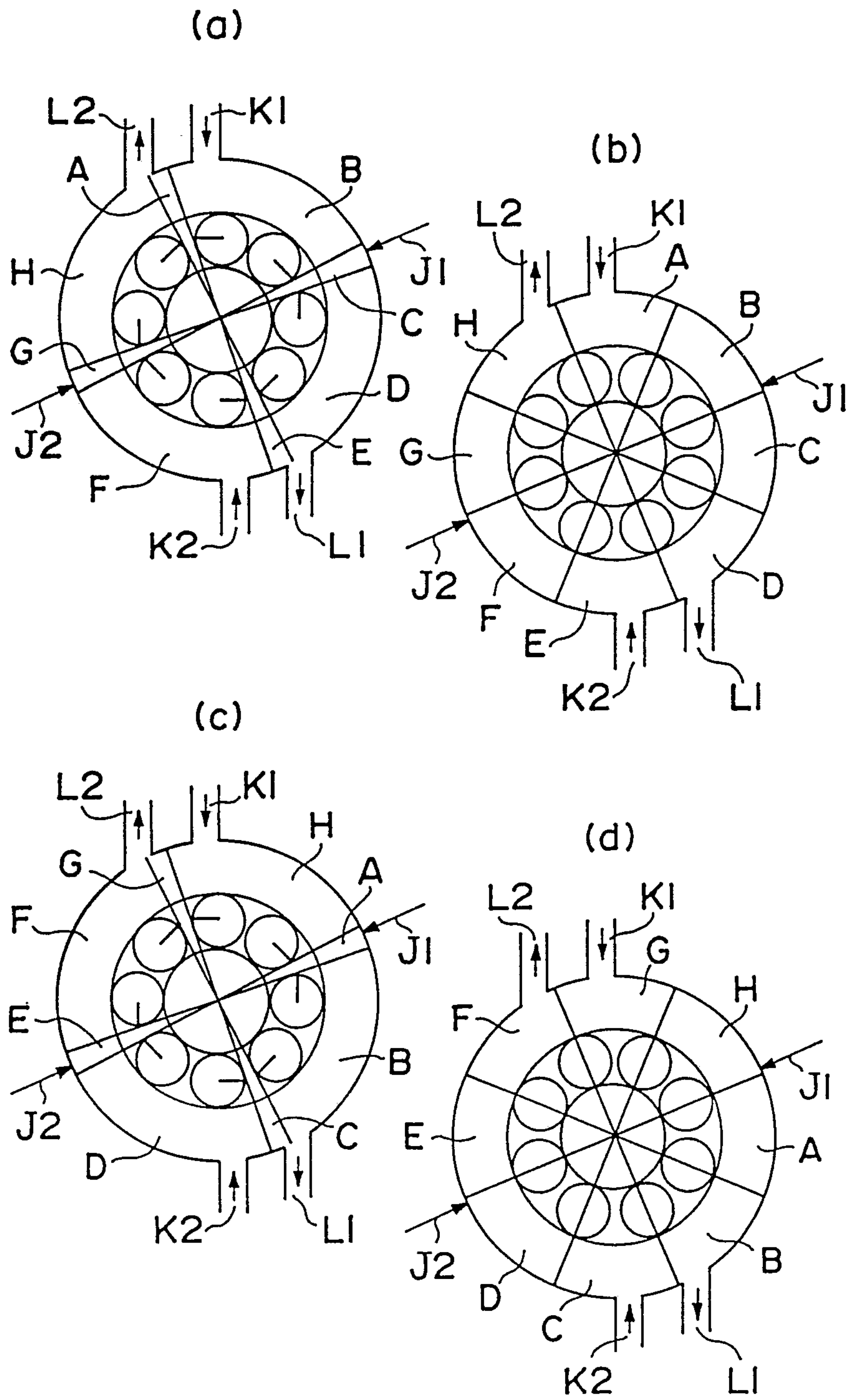

(a)
L2
K1
A
B
H
J1
C
G
D
J2
E
F
K2
L1
(b)
L2
K1
A
B
H
J1
G
C
J2
F
D
E
K2
L1
(c)
L2
K1
H
G
A
F
J1
E
B
J2
C
D
K2
L1
(d)
L2
K1
G
H
F
J1
E
A
J2
B
D
C
K2
L1

FIG. 29

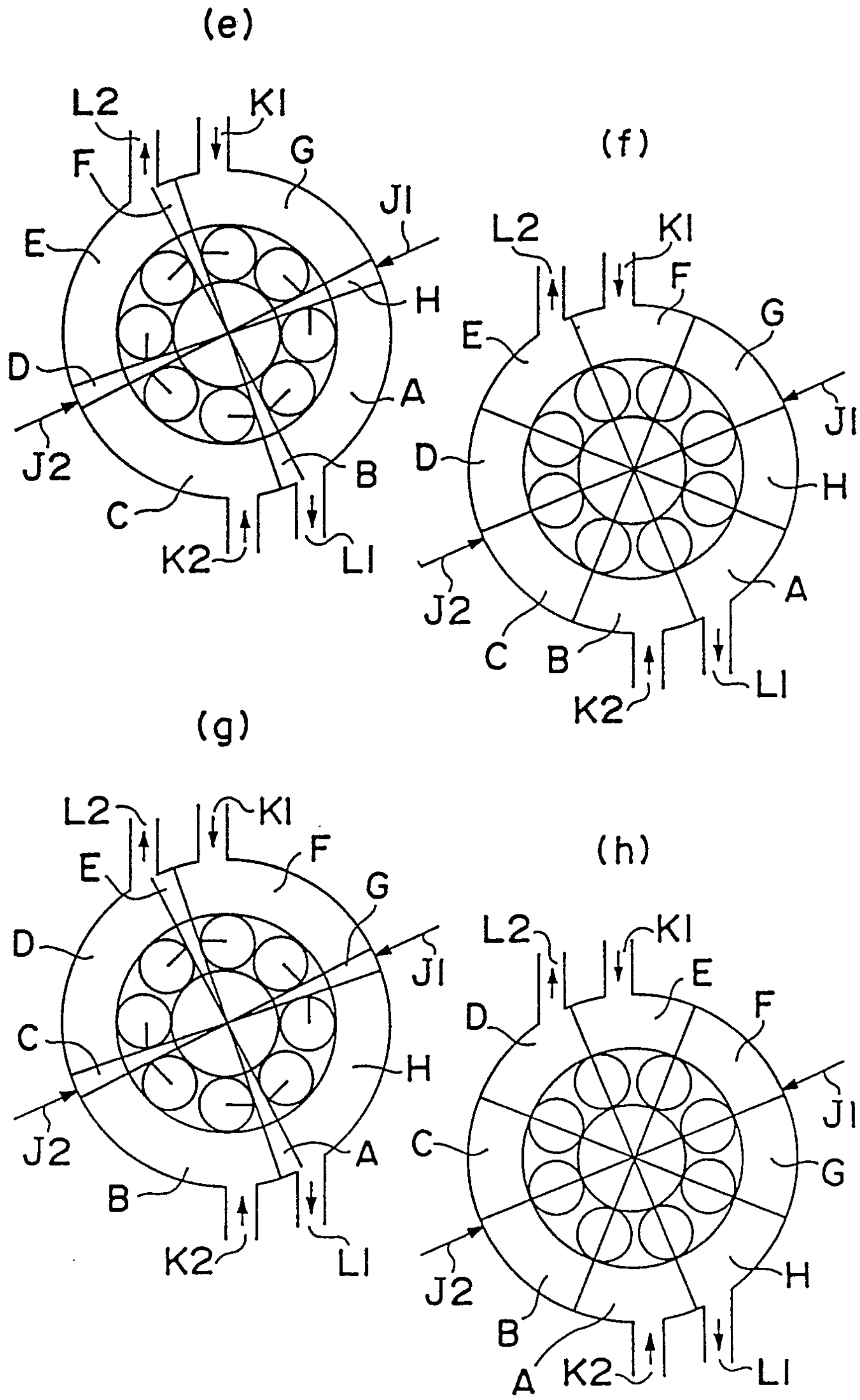

(e)
L2
K1
G
F
J1
E
H
D
A
J2
B
C
K2
L1
(f)
L2
K1
F
G
E
J1
D
H
J2
A
C
B
K2
L1
(g)
L2
K1
E
F
G
D
J1
C
H
J2
A
B
K2
L1
(h)
L2
K1
E
F
D
J1
C
G
J2
H
B
A
K2
L1

FIG. 29

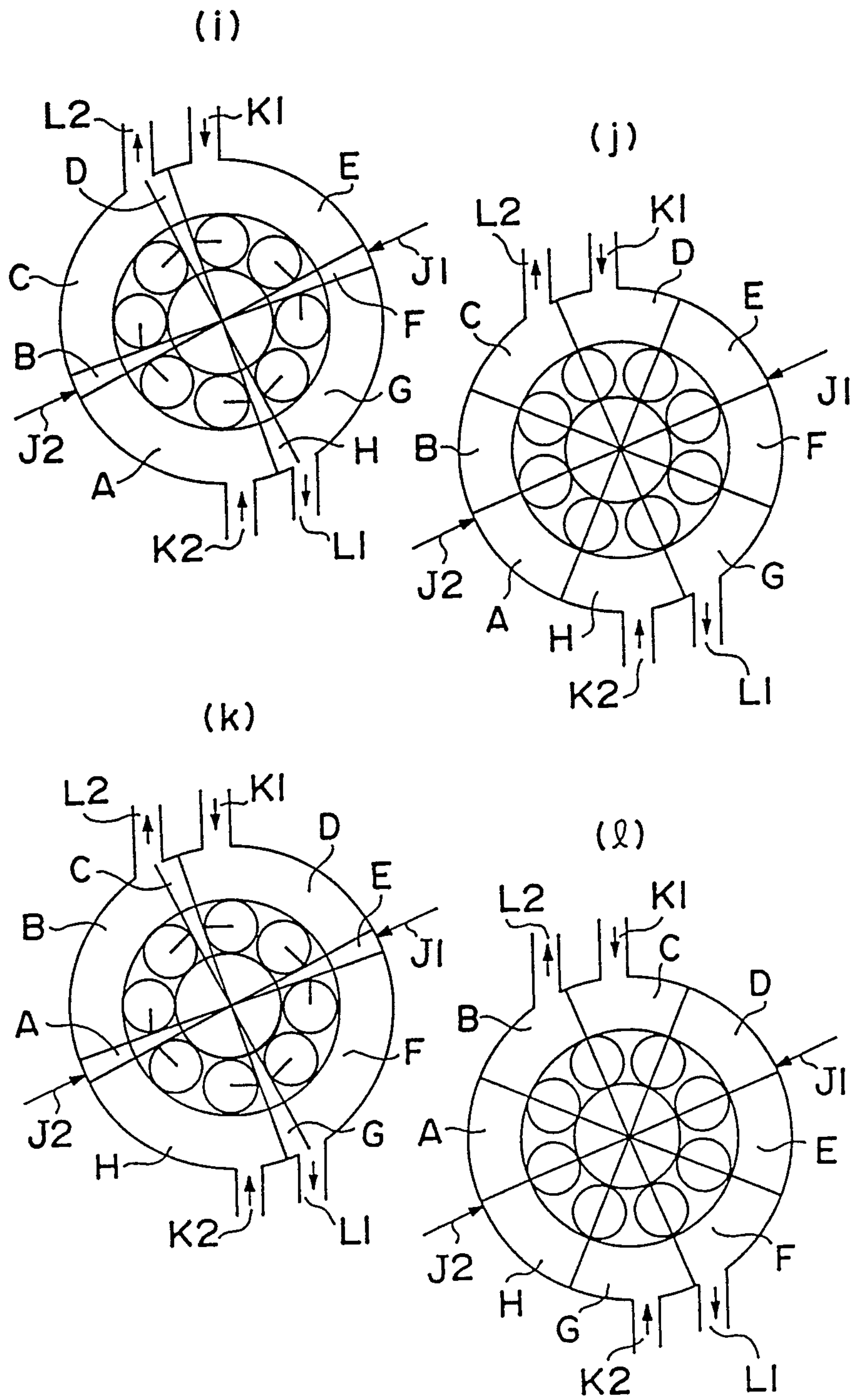

(i)
L2
KI
D
E
C
JI
F
B
G
J2
H
A
K2
LI
(j)
L2
KI
D
E
C
JI
B
F
J2
G
A
H
K2
LI
(k)
L2
KI
D
C
E
B
JI
A
F
J2
G
H
K2
LI
(ℓ)
L2
KI
C
D
B
JI
A
E
J2
F
H
G
K2
LI

FIG. 29

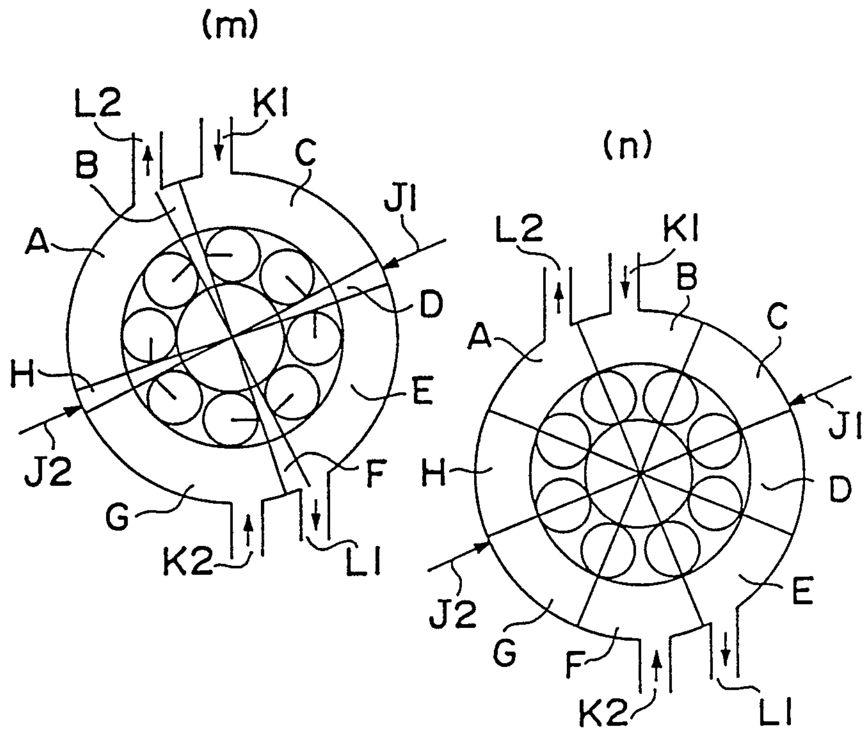


FIG. 30

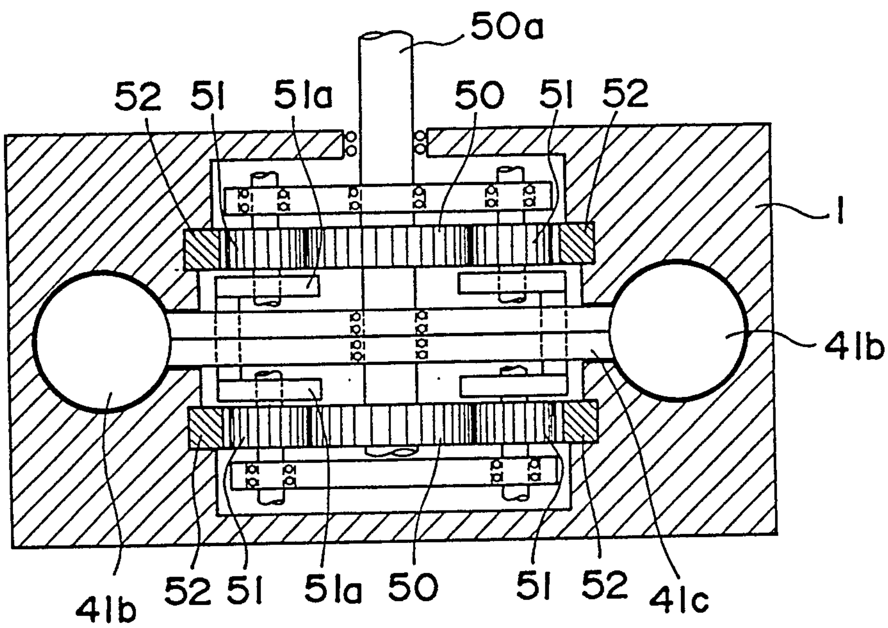


FIG. 31

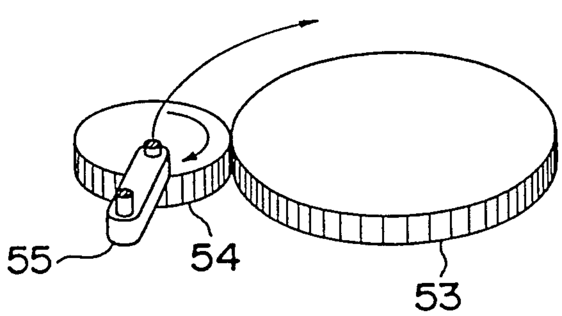


FIG. 32

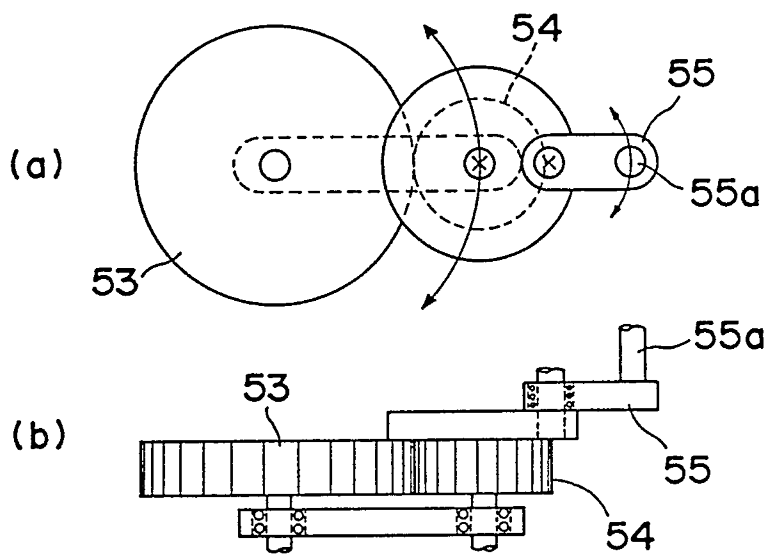
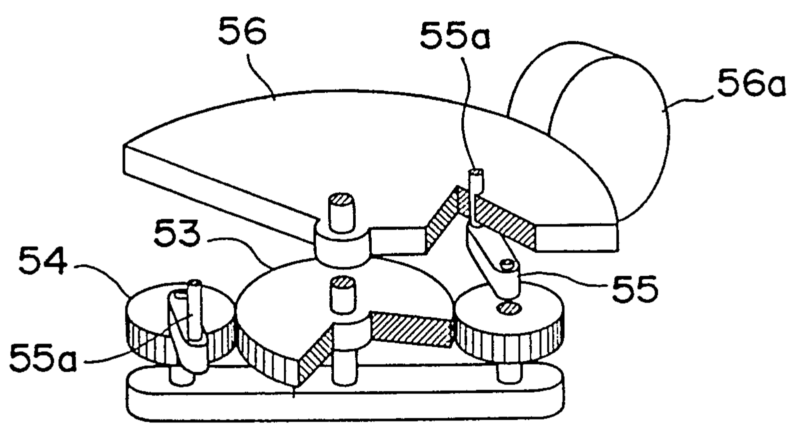


FIG. 33



INTERNATIONAL SEARCH REPORT

International Application No PCT/JP89/01213

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

Int. Cl^5 F04C18/063, F01C1/063

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC	F04C18/063 ∿ 077, F01C1/063 ∿ 077

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

Jitsuyo Shinan Koho	1926 ∿ 1988
Kokai Jitsuyo Shinan Koho	1971 ∿ 1988

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	JP, A, 55-139901 (Sanyo Electric Co., Ltd. and one other) 1 November 1980 (01. 11. 80)	1
X	JP, B2, 53-36881 (Satake Kazuo), 5 October 1978 (05. 10. 78)	1

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
January 19, 1990 (19. 01. 90)	February 5, 1990 (05. 02. 90)
International Searching Authority	**Signature of Authorized Officer**
Japanese Patent Office	