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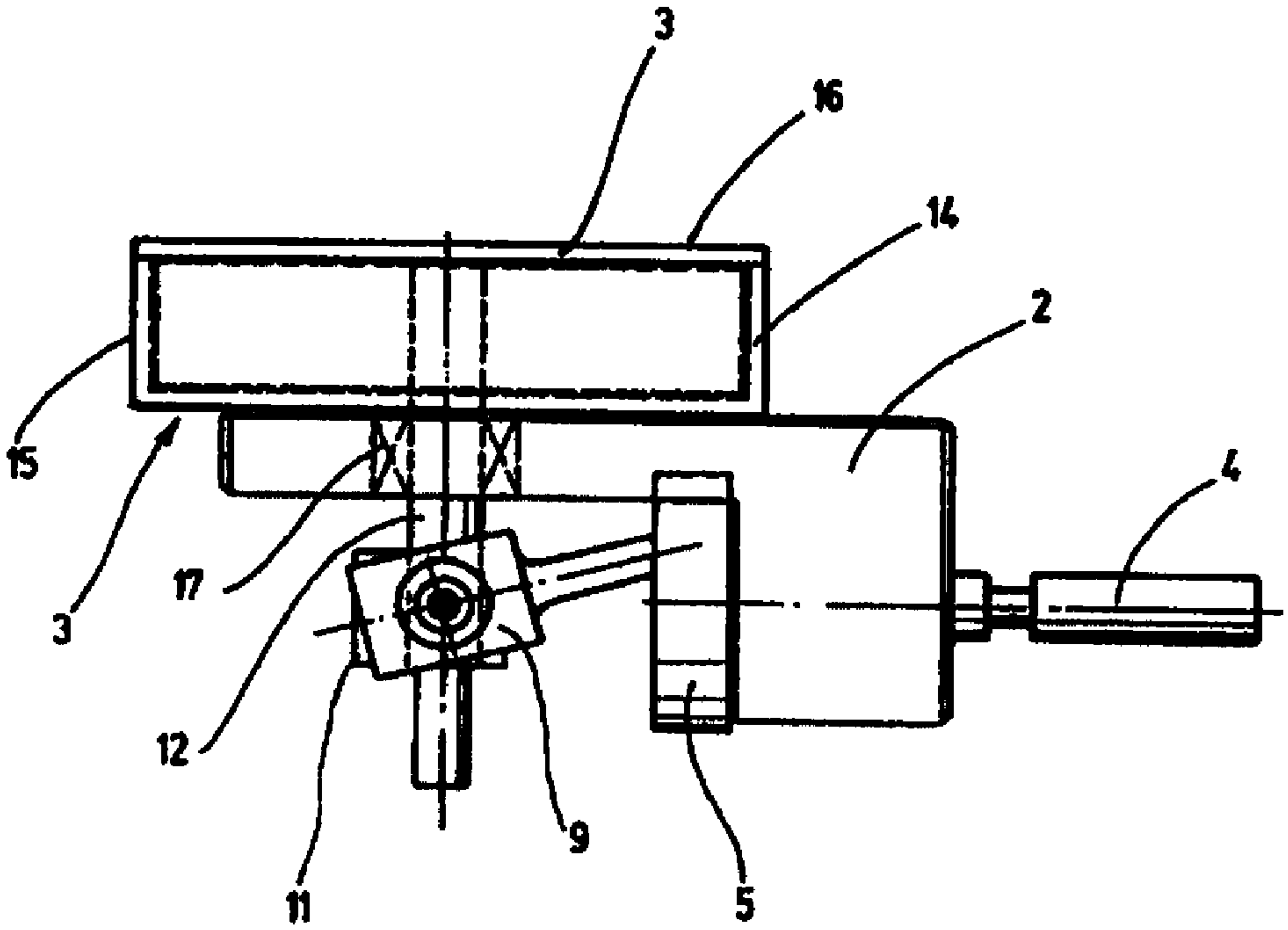
(54) **DISPOSITIF POUR LE TRANSPORT D'UN MILIEU OU POUR L'ENTRAINEMENT A TRAVERS UN MILIEU**

(54) **DEVICE FOR CONVEYING A MEDIUM OR PROPULSION THROUGH A MEDIUM**



(57) L'invention concerne un dispositif pour le transport d'un milieu, en particulier d'un gaz ou d'un liquide, comprenant une unité piston/cylindre telle que le milieu soit aspiré par un déplacement du piston et soit refoulé, à la fois, par déplacement du piston en sens contraire, et par actionnement d'un système de vanne, caractérisé en ce que le déplacement du piston est guidé au moyen d'une portée (palier de précision) et en ce que la portée (palier de précision) se trouve à l'extérieur du cylindre (chambre du cylindre, chambre d'explosion).

(57) The invention relates to a conveyor device for a medium, especially for a gas or liquid, comprising a piston/cylinder unit, whereby the medium is suctioned by means of the movement of a piston and conveyed by means of an opposite piston movement in addition to being based on a valve device function. The movement of the piston is carried out by means of a bearing (precision bearing) and the bearing (precision bearing) is located outside the cylinder (cylinder chamber, combustion chamber).

Abstract

The invention concerns a conveyor device for a medium, in particular for a gas or a liquid, with a piston/cylinder unit, whereby the medium is aspirated by means of a piston movement and is conveyed as a result of the function of a valve device. It is provided that the movement of the piston is guided via a bearing (precision bearing) and that the bearing (precision bearing) is situated outside of the cylinder (cylinder chamber, combustion chamber)

Device for the Conveyance of a Medium or for Propulsion by Means of a Medium

Description

The invention concerns a device for the conveyance of a liquid or gaseous medium or for propulsion by means of a medium according to the pre-characterizing portion of Claim 1.

Devices of this kind are known for example as compressors. The known compressor has a piston/cylinder unit in which the piston is moved up and down by means of a piston rod and a crank gear. A valve arrangement which is made up of two check valves which are assigned to the cylinder unit cause ambient air to be drawn into the cylinder space during the downward movement of the piston and during the subsequent upward movement of the piston cause the air which was aspirated to be expelled as propulsion air. During the aspiration process, one valve is activated, and during the expulsion process, the other valve is activated. The up and down movement of the piston is realized through the drive of the crank gear by means of a drive unit, for example an electric motor.

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The drawback is that in order to avoid the seizing of the piston, the sliding surface of the piston at the interior wall of the cylinder must be provided with a lubricant, for example a thin film of oil. The result of this is that the propulsion air can be contaminated by oil residues, which is particularly problematic in the food goods industry in which compressed air generated by means of a compressor is used. However, it is also necessary in other branches of industry for pure propulsion air to be provided which does not have any lubricant residues.

An internal combustion engine which has a piston which can be moved on an oscillating basis in a combustion chamber whereby the piston is guided by a bearing arranged outside of the combustion chamber is disclosed in Fr 15 56 723. Contiguous with the combustion chamber are first and second cylinder walls each of which are turned toward a face of the piston whereby at least one check valve is arranged in the each of the cylinder walls. the exhaust gases are carried off from the combustion chamber through the check valves. Aspiration of the fuel into the combustion chamber takes place through openings which are situated in side walls which seal the ignition chamber laterally. As a result of this valve arrangement, the ignition chamber requires a relatively large amount of space. In addition, an arrangement of several valves with large valve surfaces is not possible as a result of the small cylinder wall surface so the flow losses are high.

The object of the invention is to create a device of the type referred to above which does not have these drawbacks.

To solve this object, a device with the features of Claim 1 is proposed. It is distinguished in that the piston is occupied by at least one check valve. Because each of the two cylinder walls is occupied by a check valve, a first check valve can be opened by a corresponding piston movement and the medium can be suctioned into the cylinder space. Afterward the piston is then moved back so that the conveyed medium flows through the piston and then — in a further piston stroke — it escapes through a second check valve in the other cylinder wall. Since the direction of flow of the medium in the cylinder space in which the piston moves does not have to be reversed, this is advantageous in the case of resonance charging. In addition, only one valve is necessary in each of the cylinder walls so large valve surfaces can be realized as a result of which flow losses are reduced.

It is particularly advantageous in the device according to the invention that the bearing for guiding the movement of the piston is situated outside of the cylinder. As a result of this design it is possible to guide the piston in the bearing optimally so that it passes through a precisely defined, exact path of movement and at the same time maintaining an extremely small separating distance from the interior wall of the cylinder. Therefore lubrication of the piston in the cylinder can

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be omitted. Additional sealing means, for example metal washers — as are frequently employed in known conveyor devices and are arranged in the gap between the piston and the interior wall of the cylinder — can be omitted. In addition, it is not a problem if the bearing contains a lubricant such as bearing grease or the like, since it is arranged outside of the cylinder and accordingly no residue of the lubricant or the like can gain admission into the cylinder and thus into the propulsion medium.

According to a further development of the invention it is provided that the piston performs a sub-circle movement around a pivot point. More particularly it is provided that the piston is configured on a pivoted part so that it can perform the above mentioned sub-circle movement.

The above mentioned pivoted part preferably has the bearing with the piston offset radially from the pivot point. Consequently the pivoted part performs an oscillating movement for back and forth movements of the piston, with the piston which is situated offset radially to the outside with respect to the pivot point of the pivoted part passing through a sub-circle path. Since the pivoted part is guided precisely by means of the bearing arranged outside of the cylinder, the piston moves along an exact, defined path which prevents unacceptable friction forces with respect to the inner wall of the cylinder from occurring.

Additional advantageous embodiments are found in the remaining subclaims.

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The drawings illuminate the invention on the basis of exemplary embodiments.

Figure 1 shows	a perspective view (diagonally from above) of a conveyance device,
Figure 2 shows	a perspective view diagonally on the underside of the conveyance device,
Figure 3 shows	a side view of the conveyance device (partially sectioned),
Figures 4 through 9 shows	top views of a piston/cylinder unit of the conveyance device in various piston positions,

Figure 10 shows	a side view of an exemplary embodiment of an internal combustion engine (partially sectioned),
Figures 11 and 12 show	a top view of a piston component arranged in a combustion chamber in different piston positions,
Figure 13 shows	a top view of an exemplary embodiment of a first pressure plate,
Figure 14 shows	a side view of an exemplary embodiment of a connection plate.

Figure 1 shows a conveyance device 1 which — according to the present exemplary embodiment — is configured as a compressor. It has a housing 2 and a piston/cylinder unit 3. In housing 2, a drive shaft 4 is rotatably borne, onto which a not-depicted drive unit, for example an electric motor, can be coupled. At the free end of drive shaft 4, a crank disk 5 is arranged so as not to rotate so that a cam 6 (Figure 2) is formed. In an eccentrically situated receiving depression 7, a fork piece 8 is borne so as to pivot, the arms 9 of which are connected to a block piece 11 so as to pivot around an axis 10 which in Figure 2 runs horizontally. The block piece 11 is connected to a piston shaft 12 so as not to rotate.

Piston/cylinder unit 3 has a cylinder 14 which has a circular hollow cylindrical lower part 15 and a cylinder cover 16. Cylinder cover 16 is configured as a circular-shaped plate which is screwed to the pot shaped lower part 15 using suitable means such as machine screws. In housing 2, a precision bearing 17 (Figure 3) is arranged which carries piston shaft 12 precisely rotatable and also in precise axial position.

It can be seen from Figures 4 through 6 that the piston component 18 of piston/cylinder unit 3 is carried in cylinder 14 so as to be capable of rotary motion around piston shaft 12 along a sub-circle motion. As this occurs, piston component 18 has a first piston 19 and a second piston, both of which are offset radially to the outside with respect to pivot point 20 of piston component 18. Pivot point 21 is situated on the axis of rotation of piston shaft 12. Piston component 18 has a circular middle part 22 from which first and second pistons 19, 20 extend outward like wings, with piston 19, 20 extending to the inner side of cylinder 14. The side surface 24 of the particular piston 19, 20 is therefore convexly curved corresponding to the interior curvature of the interior side 23. The interior side is situated across from side surface 24 with extremely little play [but] without contact such that in effect a seal is created. As can be seen in Figures 4 through 6, no separate sealing means are provided in this area because they are not necessary. The sealing of the gap between side surface 24 of the particular piston 19, 20 and the interior wall of cylinder 14 takes place exclusively with the help of the low degree of play between the two components and relatively large arc length of side surface 24 which is configured in this exemplary embodiment as an arc. In the interior of piston/cylinder unit 3 are cylinder walls 25, 26, 27, and 28 which are arranged in fixed manner. Cylinder walls 25 through 28 are connected pressure sealed with bottom 29 of lower part 15 and also pressure sealed with interior side 23. The particular interior side 30 of each cylinder wall 25 through 28 is located with little play across from the exterior periphery 31 of the middle part 22 so that while a movement of piston portion 18 can take place around pivot point 21, a seal is nevertheless formed between said two surfaces. Here, too, separate sealing means can be omitted. In corresponding manner, each piston 19, 20 is arranged with only very little play across from the interior side of bottom 29 and of interior side of cylinder cover 16 so that in total a situation evolves in which the two pistons 19, 20 because of the bearing of piston component 18 can be moved by means of precision bearing 17 without contact, but so as to form a seal in the particular cylinder space 32, 33. Cylinder space 32 is situated between cylinder walls 25 and 26; cylinder space 33 is situated between cylinder walls 27 and 28. As a result of the seal realized through the extremely thin gap between side surfaces 24 of the particular piston 19, 20 and the exterior periphery 31 of middle portion 22, cylinder spaces 32, 33 are separated from each other through piston 19 or 20.

It can be further seen in Figures 4 through 6 that cylinder walls 25 through 28 are occupied by holes 34 in which check valves 35, 36, 37, and 38, which are provided with coil springs, are located. Alternatively, tongue [= Zungen-] or diaphragm valves or the like can also be used. Furthermore the two pistons 19 and 20 are occupied by passage holes 39 in which check valves 40, 41, 42, and 43 are arranged. According to Figure 1, cylinder cover 16 is occupied by medium inlet opening 44 and medium outlet opening 45. These two openings can be recognized — for the sake of clarity — with dashed line in Figures 4 through 6 as well. They are arranged such that medium inlet opening is located between the two cylinder walls 25 and 27, and the medium outlet opening 45 is located between cylinder walls 26 and 28 and between the exterior periphery 31 and interior side 23 of hollow circle cylindrical lower part 15. Consequently chambers are formed in these areas with the chamber associated with the medium inlet opening 44 forming an aspiration chamber 46 and the chamber associated with the medium outlet opening 45 forming an expulsion chamber 47.

[The exemplary configuration] functions as follows:

If drive shaft 4 is rotated by means of a suitable drive (not depicted) in accordance with arrow 48 (Figure 4), gear disk 5

- acting as a cam — carries fork piece 8 with it in corresponding manner, as a result of which block piece 11 is brought into an oscillating back and forth rotating motion, i.e., piston component 18 carries out a pivoting movement around piston shaft 12, thus around pivot point 21. Consequently the particular piston 19 or 20 shifts during this movement within cylinder space 32 or 33 such that — using Figure 4 as a starting point — piston 19, for example, initially is opposite cylinder wall 25, then moves in the direction toward cylinder wall 26 (Figure 5), and finally is across from cylinder wall 26 with very little separating distance (Figure 6). The further movement then takes place in reversed manner, i.e., piston 19 moves back in the direction toward cylinder wall 25. Corresponding [action] applies to piston 20 which moves back and forth between cylinder walls 27 and 28. The result of this oscillating movement is that — using the depiction of Figure 4 as a starting point — piston 19 moves away from cylinder wall 25 as a result of which it draws air into cylinder space 32 through medium inlet opening 44 and aspiration chamber 46 as check valve 35 opens. When piston 19 reaches the position according to Figure 6, the aspiration phase is terminated and piston 19 moves back such that the air which was aspirated into cylinder space 32 is slightly compressed such that the two check valves 40 and 41 in piston 19 open automatically through inertia as a result of which the air volume in effect is moved to the other side of the piston, i.e., it flows through passage hole 39. When piston 19 now moves during the next piston stroke again in the direction of cylinder wall 26, the air volume is transported from there to medium outlet opening 45 as check valve 36 opens into the expulsion chamber 47. During the last mentioned transport movement, a aspiration process takes place at the same time on the other side of piston 19. It remains to be stated that check valves 40, 41 in the piston close again on their own with the aid of inertia. Corresponding processes take place in the case of piston 20, i.e., conveyor device 1 as a result of the two pistons 19 and 20 is able to provide a high flow rate.

Figures 7 through 9 show another exemplary embodiment of a conveyor device which differs from the above mentioned exemplary embodiment only with respect to the arrangement of the check valves; as a result, only this change will be treated below. It can be seen that cylinder walls 25 through 28 each are occupied by two holes 34 in which check valves 51, 52, 53, 54, 55, 56, 57, and 58 are arranged. Check valves 51 and 52 or 53 and 54 or 55 and 56 or 57 and 58 are situated with flow directions opposite to each other so that in each case one check valve forms an aspiration valve and the other check valve forms a pressure valve. In other respects, the same parts — to the extent visible — are provided with the same reference characters as in Figures 1 through 6.

To this extent reference is made to their description.

[The exemplary embodiment] according to Figures 7 through 9 function as follows:

When piston 19 carries out a counterclockwise movement, check valve 51 opens so that air is suctioned from aspiration chamber 46 into cylinder space 32. If piston 19 then moves in a clockwise direction, the air which was drawn in is fed through check valve 52 to a pressure line 59, indicated only by dashed lines, which is connected there and which leads to medium outlet opening 45. Corresponding processes apply for the additional pairs of check valves with their associated cylinder walls 26, 27, and 28, so that in total four cylinder spaces are in effect formed. Each aspiration takes place through medium inlet opening 44 and each expulsion takes place through medium outlet opening 45, with corresponding suction or pressure lines, which are not represented in the drawings, being used.

Finally it should be noted that it is possible with conveyor device 1 to convey several different media at the same time. In this case, each piston 19 and 20 with its associated cylinder space forms a separate unit. A medium inlet opening 44 and a medium outlet opening 45 are then assigned to each of cylinder spaces 32 and 33. It is also easily possible to provide more than two pistons. Depending on the number of pistons, it is possible to convey the same number of media. In a preferred embodiment variant of the conveyor device in which it has several pistons it is provided that the medium quantity conveyed through a sweep of the individual pistons is equally large. As a result, the conveyor device advantageously can be utilized as a metering pump, for example for filling liquid food products, for example milk.

It is furthermore clear that the passage holes 39 also serve to cool the pistons. If a medium flows from aspiration chamber 46 through the passage holes, the particular piston 19 or 20 is cooled through this aspirated medium. In Figures 4 and 6, it can also be seen that there is no so-called harmful space between piston 19 or 20 and its associated cylinder walls 26 to 28 — to the extent piston 19 or 20 is at its terminal position. That is, the piston is situated in its terminal position across from the particular cylinder wall with very little separating distance. This ensures that the conveyed medium is fully pressed out of conveyor device 1 or in the aspiration process, a volume of a medium is aspirated which corresponds to the volume of the space which is formed between the face of the piston and the adjacent cylinder wall. This improves on the one hand the effectiveness of the conveyor device. On the other hand, such high pressures can be generated since the medium is driven completely out of the cylinder space.

The piston component 18 is driven such that with a 90° turn of the drive shaft, pistons 19 and 20 each pass through onehalf of a piston stroke. Since pistons 19 and 20 are firmly attached to the middle portion 22, with each back and forth movement of pistons 19 and 20, a constant quantity of a medium is conveyed. Thus a sinusoidal drive is provided here as a result of which a harmonic run of the conveyor device can be realized.

Since pistons 19 and 20 do not require any lubrication with respect to cylinder 14, conveyor device 1 can be utilized particularly advantageously for liquids which are not self-lubricating such as benzene, for example, which is known to have essentially no lubricating properties.

If large volumes are to be conveyed, it is also possible to configure pistons 19 and/or 20 and the associated cylinder walls with a diagonal orientation. That is, in a top view on the piston, it has a parallelogram-shaped or rhomboidal contour. Accordingly the faces of the piston are enlarged so that in cross section larger passage holes are present and thus larger check valves can be utilized.

In association with Figure 3 it should also be mentioned that it is also possible to replace the drive, consisting of gear disk 5, fork piece 8, and block piece 11 with a known gear drive such as is used, for example, in a windshield wiper drive.

By this means it is possible to drive several conveyor devices 1, whereby it is preferable to provide that only one gear drive is provided for all conveyor devices, with the conveyor devices being connected via a connecting rod. It can also be provided that at least two piston/cylinder units 3 are arranged one over the other. Drive is provided for them jointly through drive shaft 4. For this purpose it is provided that piston shaft 12 of the two piston/cylinder units 3 is configured so as to be continuous. Thus a piston shaft 12 is provided to which two piston components are arranged one above the other.

Finally it should be noted that it is easily possible to operate conveyor device 1 as a motor. Preferably it is provided that cylinder spaces 32 and 33 each encompass an ignition device so that an internal combustion engine is formed, the drive force of which can be tapped at drive shaft 4.

In an exemplary embodiment of the conveyor device not depicted in the figures, the medium which is to be conveyed is aspirated upon a corresponding piston movement through at least one medium inlet opening for each into cylinder spaces 32, 33. The medium inlet openings can be accommodated either in the pot-shaped lower portion 15 of cylinder 14 or in cylinder cover 16 and open into the particular cylinder space. In addition, at least one medium outlet opening is associated with each cylinder space, with the medium outlet openings likewise being arranged either in lower portion 15 or in cylinder cover 16 of cylinder 14. When the conveyor device is used in pump or motor operation, a check valve is provided in each of the medium inlet and outlet openings to establish the flow direction of the medium in one direction. The arrangement of the medium inlet and outlet openings in the side walls of the cylinder, i.e., in the lower part and in the cylinder cover, is advantageous particularly in the case of the use of the conveyor device described with reference to Figures 1 through 9 in modified form as an internal combustion engine since valves can be omitted because here the piston releases the inlet and outlet opening(s) in the cylinder cover or in the lower part of the cylinder in the course of its back and forth path.

In all exemplary embodiments of the conveyor device, the particular outlet opening through which the medium is expelled from the cylinder space through a corresponding piston movement can be connected to a pressure line which leads directly to the consumer. In this embodiment variant, an expulsion chamber 47, described with the aid of Figures 4 through 9, which is arranged within cylinder 14 is omitted.

Common to all exemplary embodiments of the conveyor device is that as a result of the extremely small separating distances between the side surface of the particular piston and the interior wall of the cylinder and between the exterior periphery of the middle portion, to which at least one piston is connected, and the interior side of the particular cylinder wall 25 to 26, a seal is created without a separate sealing means having to be used. As a result of the precise movement of the piston with the aid of precision bearing 17, it can be ensured that the piston or pistons in the operation of the conveyor device do not contact the interior wall of the cylinder and/or the interior side of the particular cylinder wall so that lubrication of these areas can be omitted.

Particularly advantageous with a conveyor device described with the aid of the preceding figures is that no sliding friction is created and thus for compression of a medium almost only the pure compression work must be performed. As a result, less energy is used so that also less heat is created during operation of the conveyor device than in comparable conveyor devices known from the state of the art. Because the piston or pistons do not contact the cylinder wall, a so-called initial breakaway torque also does not occur. The torque required for starting the conveyor device from standstill as a result is slight in comparison with the known conveyor devices. It is also advantageous that as a result of the separating distance of the piston to the cylinder wall, no [sic] contact corrosion is avoided between the piston and the cylinder wall even after an extended standstill of the conveyor device. It is furthermore advantageous that the medium is conveyed through the piston and only one valve must be installed per surface so that large valve surfaces can be realized, as a result of which flow losses of the conveyor device can be reduced.

Since the flow direction of the medium in the work chamber in which the particular piston moves does not have to be reversed, this also has an advantageous effect with resonance pressure charging.

Figure 10 shows a side view of an exemplary embodiment of a device for propulsion by means of a medium, referred to in short as internal combustion engine 101, which has a housing 102 and a work unit 103. In housing 102, a driven shaft 104 is rotatably borne on which a torque generated by work unit 103 can be tapped. At the free end of driven shaft 104, a gear disk 105 is arranged which is connected to the driven shaft so as not to rotate. Borne in a receiving depression situated eccentrically to longitudinal axis of gear disk 105 or of driven shaft 104 so as to pivot is a not-depicted fork piece 107, the blades 109 of which are connected to a block piece 111 so as to pivot around an axis 110 which runs horizontally in Figure 10. The block piece 111 is connected to a piston shaft 112 so as not to rotate.

Work unit 103 comprises a pot-shaped lower portion 113 and a cover 115 which is configured as a circular plate which is screwed to the lower portion 113 with suitable fastening means such as machine screws. In housing 102 a precision bearing 117 is arranged which carries piston 112 so as to rotate precisely and also in precise axial position. In the interior space of hollow circular cylindrical lower part 113 of work unit 103 are arranged a pressure plate 119, a housing block 121, and a connecting plate 123, which are stacked one on the other, with the housing block 121 being arranged between pressure plate 119, which is arranged on the bottom of the pot-shaped lower part 113, and connecting plate 123.

Figure 11 shows a top view of a schematic diagram of an exemplary embodiment of a housing block 121 in which a recess 125 open on the edge is incorporated in which a piston component 127 is carried so as to move rotatably around the longitudinal axis of piston shaft 112 along a sub-circle movement. Piston component 127, which is fastened to piston shaft 112 so as not to rotate, has a first piston 129 and a second piston 131, both of which are offset radially to the outside of pivot point 133 of piston component 127. Pivot point 133 is situated on pivot axis (longitudinal center line) of piston shaft 112. Piston component 127 has a circular middle portion 135 from which first and second pistons 129, 131 extend radially to the outside like wings, with each piston 129, 131 extending to a side wall 137 of recess 125. Side wall 137 is configured curved, whereby the curve corresponds to an imaginary circle with pivot point 133 as the middle point and the radius r.

Side surface 139 of the particular piston 129, 131 is configured corresponding to the interior curvature of side wall 137 and therefore has a convex curvature. Side wall 137 of recess 125 faces side surface 139 of the piston without contact and with extremely little play such that in effect a seal is created there. As a result of the very thin gap between side surface 124 of piston 129, 131 and side wall 137 of recess 125 as well as the relatively long length of side surface 139 — viewed in the direction of movement of the piston, separate sealing means such as sealing disks or rings or the like are not required here. Side walls 141 of recess 125, which faces middle portion 135 of piston component 127 with an extremely small separating distance, are matched to the exterior periphery 143 of middle part 135 so that while a movement of piston component 127 around pivot point 133 can occur, a seal is nevertheless formed between the aforementioned surfaces. As a result of the very small gap height, additional seals or sealing means can also be omitted here.

As can be seen in Figure 11, the areas of recess 125 in which pistons 129 and 131 are moved back and forth are configured in the shape of an annular cutout. These annular-cutout-shaped work chambers in each of which one of pistons 129, 131 is located, are subdivided by pistons 129, 131 into a suction chamber 144 or 146 and a combustion chamber 145 or 147. Upon a movement of piston component 127 around pivot point 133 in a clockwise direction, combustion chamber 145 is reduced in size and at the same time suction chamber 144 is enlarged through a change in position of piston 129, while combustion chamber 147 is enlarged through the change of position of piston 131 and suction chamber 146 which acts with combustion chamber 147 is reduced in size.

In the base 149 of recess 125, for each of pistons 129, 131 an aspiration channel 151 and an outlet channel 153 leading to the exhaust is incorporated. Aspiration channels 151 are configured here circular in their opening area and outlet channels 153 are configured as rectangles. Naturally their configuration can be varied; for example, outlet channels 153 can have a reniform configuration in the area which opens into combustion chambers 145, 147.

Internal combustion engine 101 in addition has an ignition device 155 which comprises a sparkplug 157 for each combustion chamber 145, 147. Sparkplugs 157 which are arranged in blind holes 159 which are formed in housing block 121 are screwed into threaded holes and project into combustion chambers 145 and 147, respectively, so that a compressed fuel-air mixture in combustion chambers 145, 147 can be ignited. The structure and function of an ignition device for an internal combustion engine is generally known so that its structure need not be described in greater detail.

Figure 14 shows a side view of connector plate 123 described with the aid of Figure 10 in which aspiration channels 151' and outlet channels 153' are incorporated which open into combustion chamber 161 and expulsion chamber 163, respectively, which are depicted with dashed lines. Aspiration chamber 161 is connected to a not-depicted fuel or fuel/air mixture feed line and expulsion chamber 163 is connected to an exhaust gas pipe.

In assembled condition of work unit 103, the smooth bearing surface 165 of connector plate 123 fits on the planar back side of housing block 121, i.e. on the side of housing block 121 opposite from recess 125, whereby one of outlet channels 151' in connector plate 123 is aligned with the suction channel which opens into suction channel 144 or 146. In each of aspiration channels 151 and/or aspiration channels 151' is situated a check valve, not depicted in the figures, which makes possible a passage from suction chamber 144 prevents backflow of the fuel/air mixture drawn in from the suction chamber 144 or 146 into aspiration chamber 161. Alternatively it is naturally also possible to configure the internal combustion engine also so that no valves, in particular check valves are necessary.

Figure 13 shows a top view of an exemplary embodiment of a pressure plate 119 of work unit 103 which is formed from a flat plate. In the middle of pressure plate 119, a passage hole 167 is provided through which piston shaft 112 projects. In bearing surface 168 of pressure plate 119, with which in assembled condition of work unit 103 fits on the front side, on which recess 125 is situated, of housing block 121, there are two overflow channels 169 and 171, which are arranged offset to the outside radially toward the middle of pressure plate 119, the function of which [overflow channels] will be described in greater detail below.

The arrangement and configuration of overflow channels 169, 171, which in this exemplary embodiment are open to the edge and which in this case are formed by slot-like depressions, can be varied. In a further, not-depicted embodiment variant, overflow channels 169, 171 are configured as passage openings which penetrate pressure plate 119 at least partially. In assembled condition of pressure plate 119, the passage openings must be closed on their side directed away from the front side of housing block. To this end, a cover plate, for example, can be attached to the pressure plate, for example, by screws.

Figure 12 shows a top view of the exemplary embodiment of housing block 121 described with the aid of Figure 11. Piston component 127 here is arranged in its end position which it assumes through a clockwise rotation around pivot point 133. In the position of piston component 127 depicted in Figure 11, it is in its other end position which it assumes through a counterclockwise rotation.

Internal combustion engine 101 described with the aid of Figures 10 through 14 in this exemplary embodiment is a two cycle internal combustion engine, for example for operation with gasoline and/or diesel fuel. Naturally internal combustion engine 101 can also be operated with other fuels, for example methane. In the operation of internal combustion engine 101, piston shaft 112 and accordingly block piece 111, which is attached to it so as not to rotate, are brought into a pivoting movement through an oscillating back and forth rotating movement of piston portion 127.

As a result, fork piece 107 is moved in corresponding manner as a result of which a rotation of gear disk 105 is initiated. The torque transmitted thereby can, as stated, be tapped at the rotating driven shaft 104. In a further, not-depicted embodiment of internal combustion engine 101 it is provided that it works in four cycle operation and accordingly has a correspondingly modified design.

The two work strokes of the two cycle internal combustion engine are explained in greater detail below: Starting with the position of piston component 127 depicted in Figure 11, the first cycle of piston 129 begins as a result of a pivot movement of piston component 127 in clockwise direction around pivot point 133. As this occurs, a fuel/air mixture is aspirated from aspiration chamber 161 through aspiration channels 151, 151' into suction chamber 144 which associated with combustion chamber 145. The fuel/air mixture in combustion chamber 145 is compressed beginning with the moment in which piston 129 has passed and thus covered outlet channel 153, thus closing it. After piston 129 has reached the position depicted in Figure 12, the fuel/air mixture is ignited in ignition chamber 145 with the aid of ignition device 155. The continued movement of piston 129, i.e., the second cycle then takes place in reverse manner, that is, piston 129 now moves in counterclockwise direction back into the position depicted in Figure 11. As a result of the arrangement of outlet channel 153 and the configuration of overflow channel 169, depicted in Figure 12 in dashed lines, in pressure plate 119, overflow channel 153 is initially opened, before the fuel/air mixture which is compressed in suction chamber 144 through a pivoting movement of piston 129 in counterclockwise direction 133 can come into combustion chamber 145 through overflow channel 169. After the side surface of piston 129 turned toward combustion chamber 145 has passed the right end area of overflow channel 169, the mixture pre-compressed in suction chamber 144 streams through overflow channel 169 into combustion chamber 145 which is thereby rinsed, that is, the exhaust gases which are still in combustion chamber 145 are expelled, preferably fully, but at least in part, through outlet channel 153. Corresponding processes take place for piston 131, whereby as a result of the arrangement and configuration of the aspiration and expulsion channels in housing block 121, the fuel/air mixture is suctioned into suction chamber 145 through a piston movement, while at the same time piston 131 compresses the fuel/air mixture situated in combustion chamber 147.

From all of this it is clear that internal combustion engine 101 can also comprise only one piston or more than two pistons, for example three or four pistons. It must further be noted that pistons 129, 131 in their end positions depicted in Figures 11 and 12 do not rest with a side surface on recess 25, but rather preferably are situated with a very small separating distance from it.

In the exemplary embodiment of internal combustion engine 101 described with the aid of the figures, the drive of piston component 127 is configured in such manner that driven shaft 104 rotates by 90° when pistons 129, 131 each pass through one-half of the piston stroke. Thus a sinusoidal drive is provided here as a result of which a smooth operation of the internal combustion engine can be realized.

In connection with Figure 10 it should also be mentioned that it is also possible for the drive, consisting of block piece 111, fork piece 107, and gear disk 105, to be replaced by a known gear drive such as is used in a windshield wiper drive. In addition, it can be provided that at least two work units 103 are arranged one above the other. Their drive takes place jointly via driven shaft 104. For this purpose it is provided that piston shaft 112 is configured so as to be continuous through the two work units 103. Therefore only one piston shaft 112 is provided on which two piston components, each of which having at least one piston, are arranged one above the other.

The internal combustion engine in advantageous manner can be used in combination with a conveyor device for a liquid or gaseous medium. In one embodiment variant it is provided that the conveyor device comprises at least one piston component, which can pivot around an axis, with at least one piston fasten thereto, with the piston component of conveyor device being connected to piston shaft 112 of the internal combustion engine so as not to rotate. The unit formed by internal combustion engine and conveyor device is distinguished by a simple, compact, and inexpensive construction. Furthermore it is advantageous that the pivoting movement of piston shaft 112, which is generated by the internal combustion engine, does not have to be converted into a rotary movement in order to drive the conveyor device, but rather that the drive torque introduced on piston shaft 112 can be used directly and thus with little loss. In this embodiment variant, driven shaft 104 depicted in Figure 10 preferably is needed only as a pace-setter and as stroke limiter for the piston component of the internal combustion engine and that of the conveyor device. As a result of the internal combustion engine and the conveyor device being arranged left and right of block piece 111 and of gear disk 105, the influence of the heat radiated from the two devices onto the other parts is reduced to a harmless quantity.

In summary it should be noted that through the defined guidance of the piston movement outside of the combustion chamber with the aid of at least one bearing, the path of movement of the at least one piston of the internal combustion engine can be guided so precisely that any possibility of contact of the piston with one of the walls delimiting the combustion chamber can be excluded. The sealing of the combustion chamber, in particular the gap between the side surface 139 of the piston and the side wall 137 (combustion chamber wall) of the combustion chamber is possible solely on the basis of the small separating distance between these two surfaces. That is, no separate seals such as are used in internal combustion engine known in the state of the art are used. Furthermore, lubrication of the piston can be omitted since it does not slide on the combustion chamber wall. A further advantage resulting from the piston(s) not contacting the combustion chamber wall is that the overflow, suction, and exhaust channels or slits can be configured practically at will. Internal combustion engine 1 is also distinguished by a simple and thus inexpensive construction. As a result of the above-described configuration, sliding friction between piston(s) of the internal combustion engine and the combustion chamber wall is avoided, so that the internal combustion engine can be started, preferably even in the cold, with low forces.

Claims

1. Device for conveying a liquid or gaseous medium or for providing drive by means of a medium, having a piston/cylinder unit, whereby the movement of the piston is guided by means of a bearing located outside of the cylinder whereby a first cylinder wall (25 through 28) turned toward a first face of piston (19, 20) and a second cylinder wall (25 through 28) turned toward the other, second face of the piston (19, 20) are occupied by at least one check valve (35 through 38, 51 through 58) characterized in that the piston (19, 20) is occupied by at least one check valve (40 through 43).

2. Device according to Claim 1 characterized in that the medium is aspirated by means of a piston movement and is conveyed by means of an opposing movement of a piston and as a result of the function of a valve device.

3. Device according to one of the preceding claims characterized in that the piston (19, 20) carries out a sub-circle movement around a pivot point (21).

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4. Device according to one of the preceding claims characterized in that the piston (19, 20) is formed on a rotating portion, preferably in one piece.

5. Device according to one of the preceding claims characterized in that the rotating portion is guided by the bearing and that the piston (19, 20) lies radially offset from pivot point (21).

6. Device according to one of the preceding claims characterized in that the piston (19, 20) carries out an oscillating movement.

7. Device according to one of the preceding claims characterized in that at least one of the first and second cylinder walls (25 through 28) is occupied by at least two check valves (35 through 38, 51 through 58) which have passage directions opposite to each other.

8. Device according to one of the preceding claims characterized in that the separating distance between the side surface (24) of the piston (19, 20) and the interior wall of the cylinder (14), in particular during operation of the device, is extremely small.

9. Device according to one of the preceding claims characterized in that the piston (19, 20) is conducted in the cylinder chamber (32, 33) without a seal with respect to the cylinder wall.

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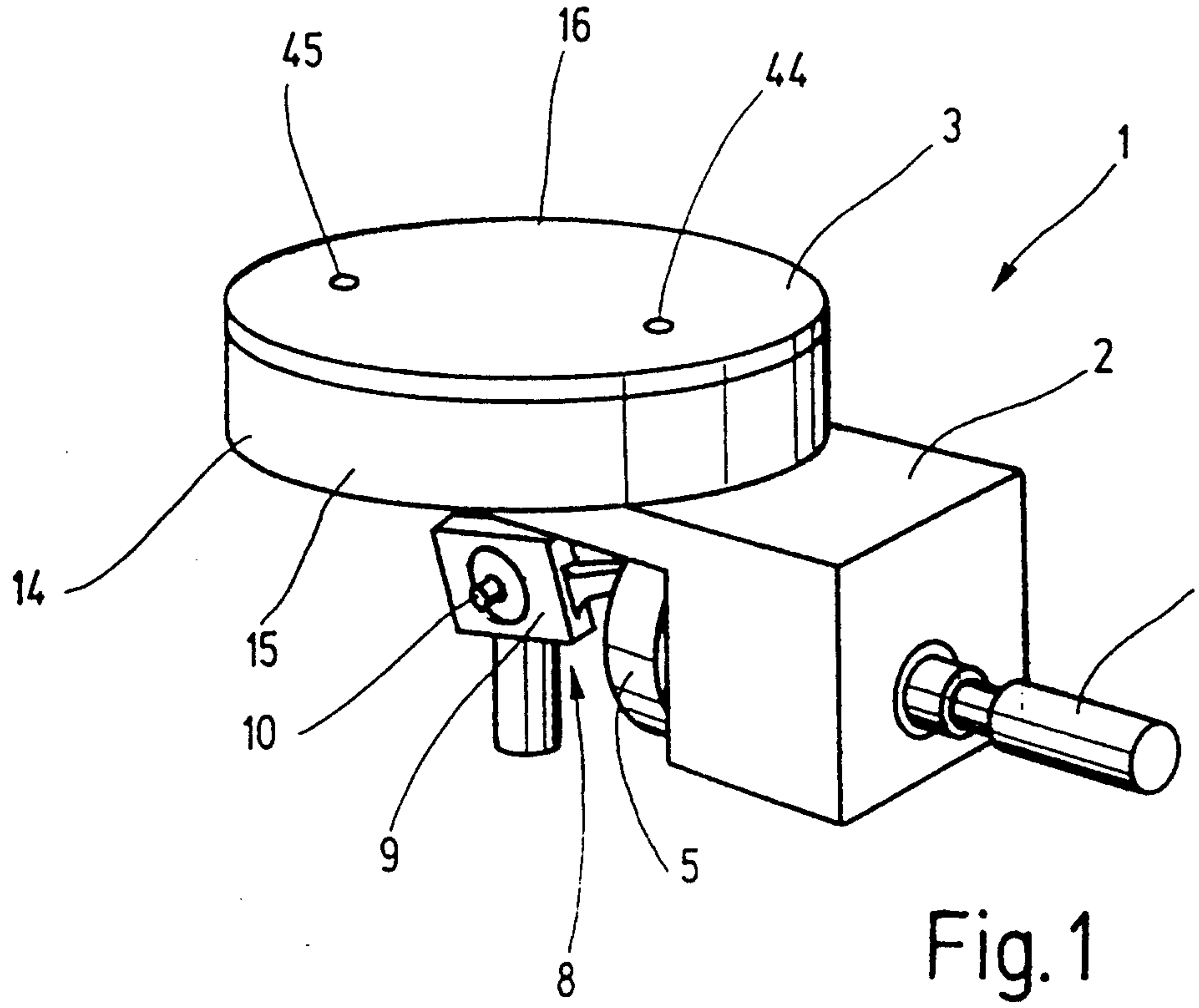

Fig. 1

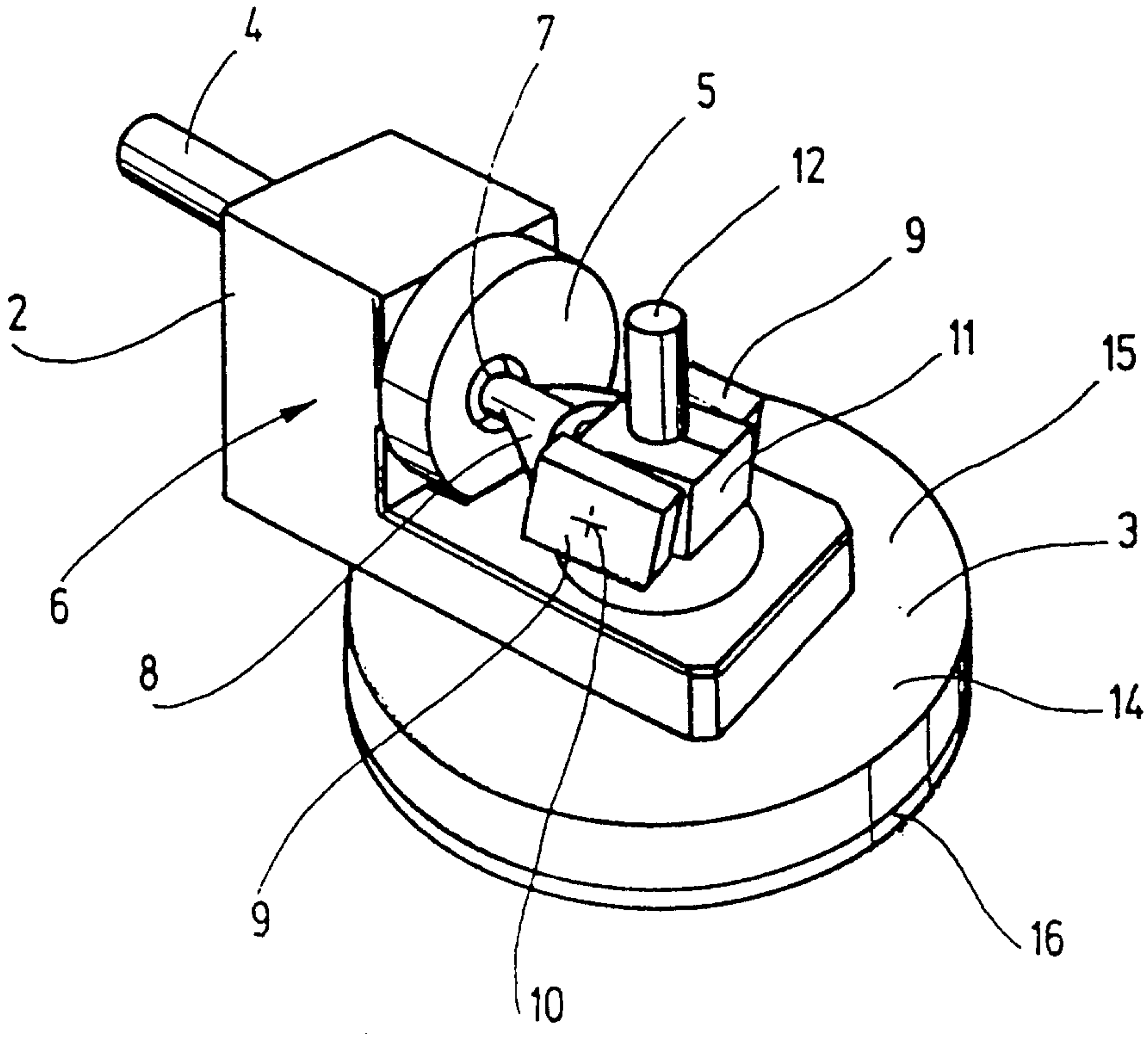

Fig. 2

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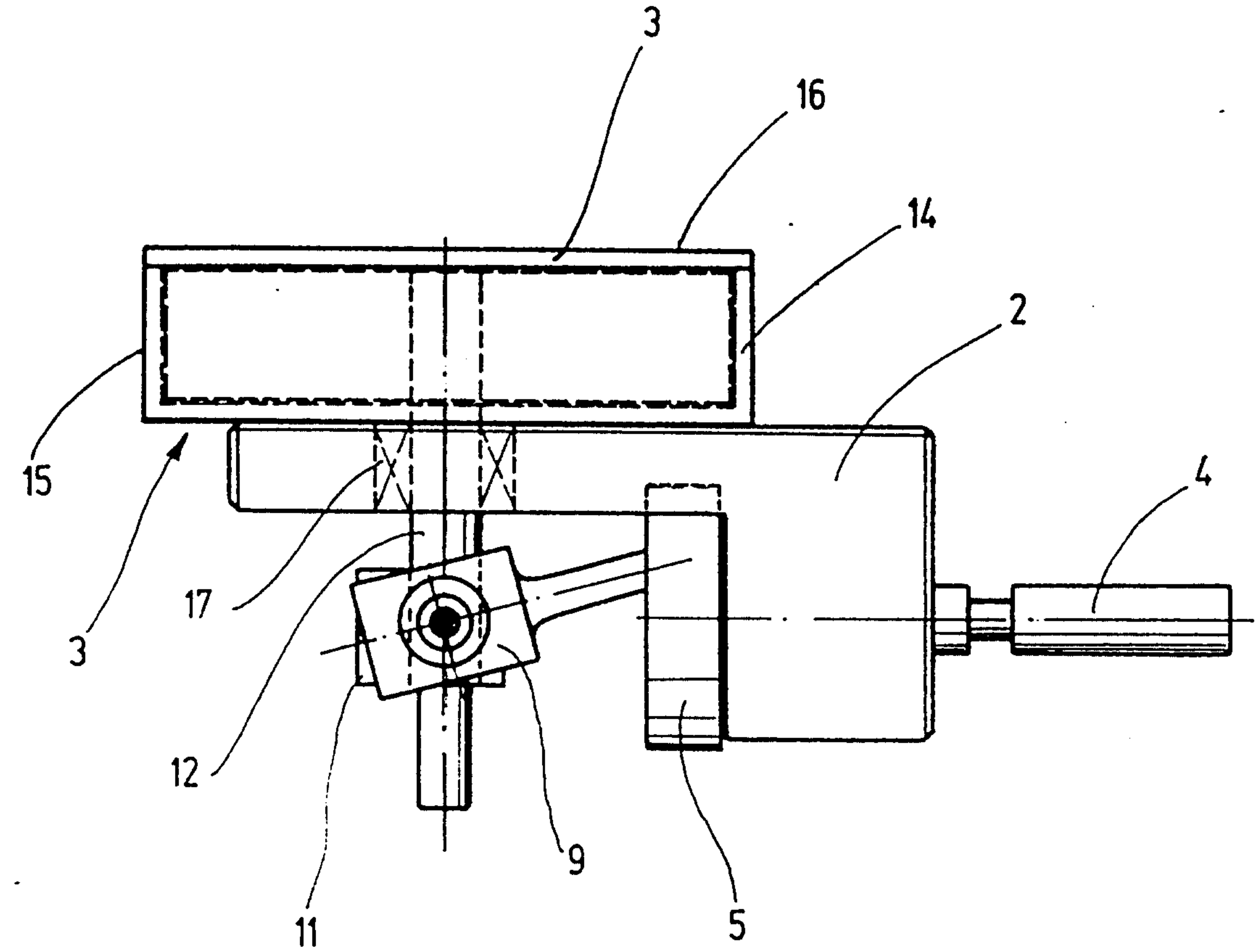

Fig. 3

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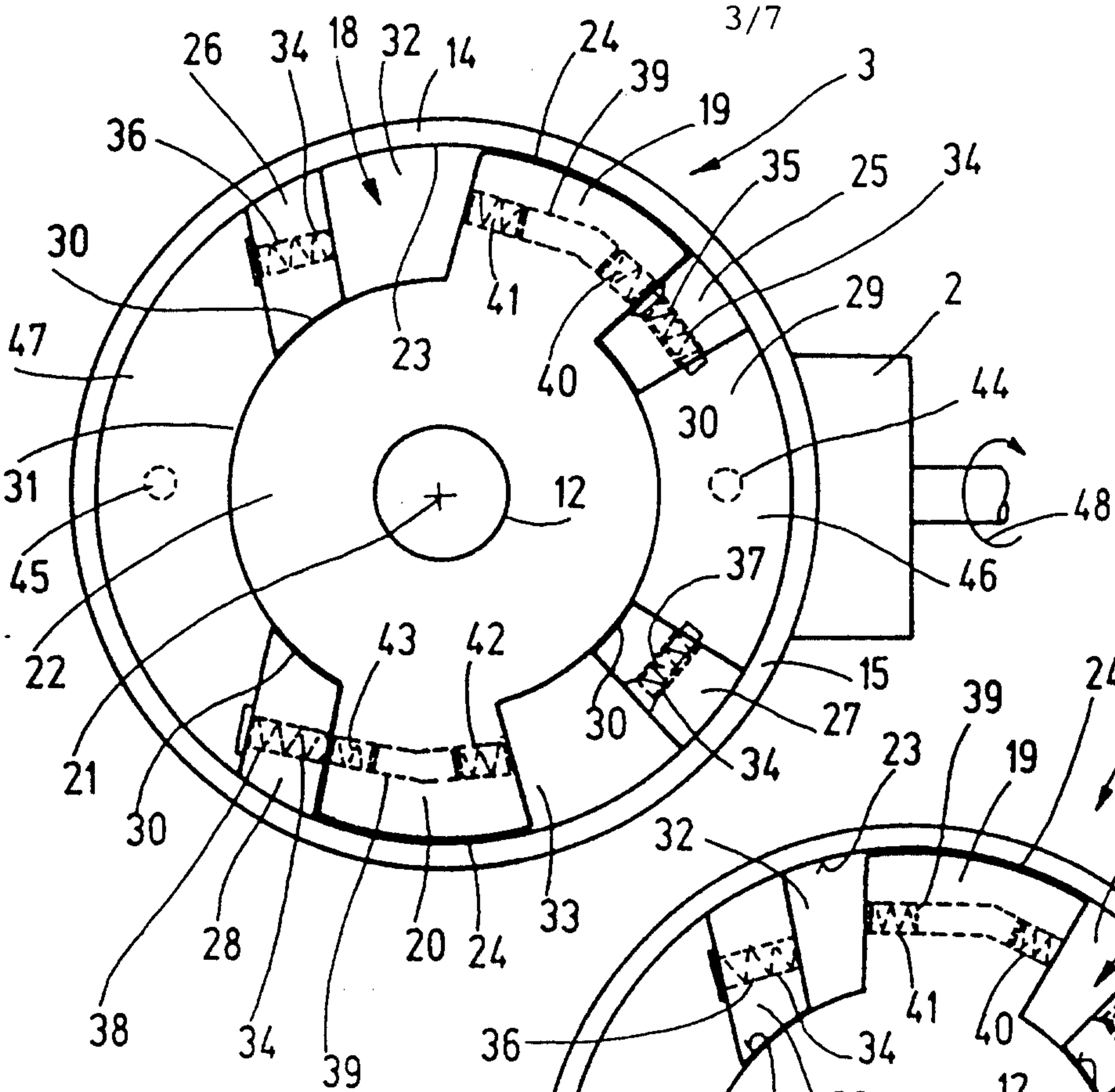

Fig. 4

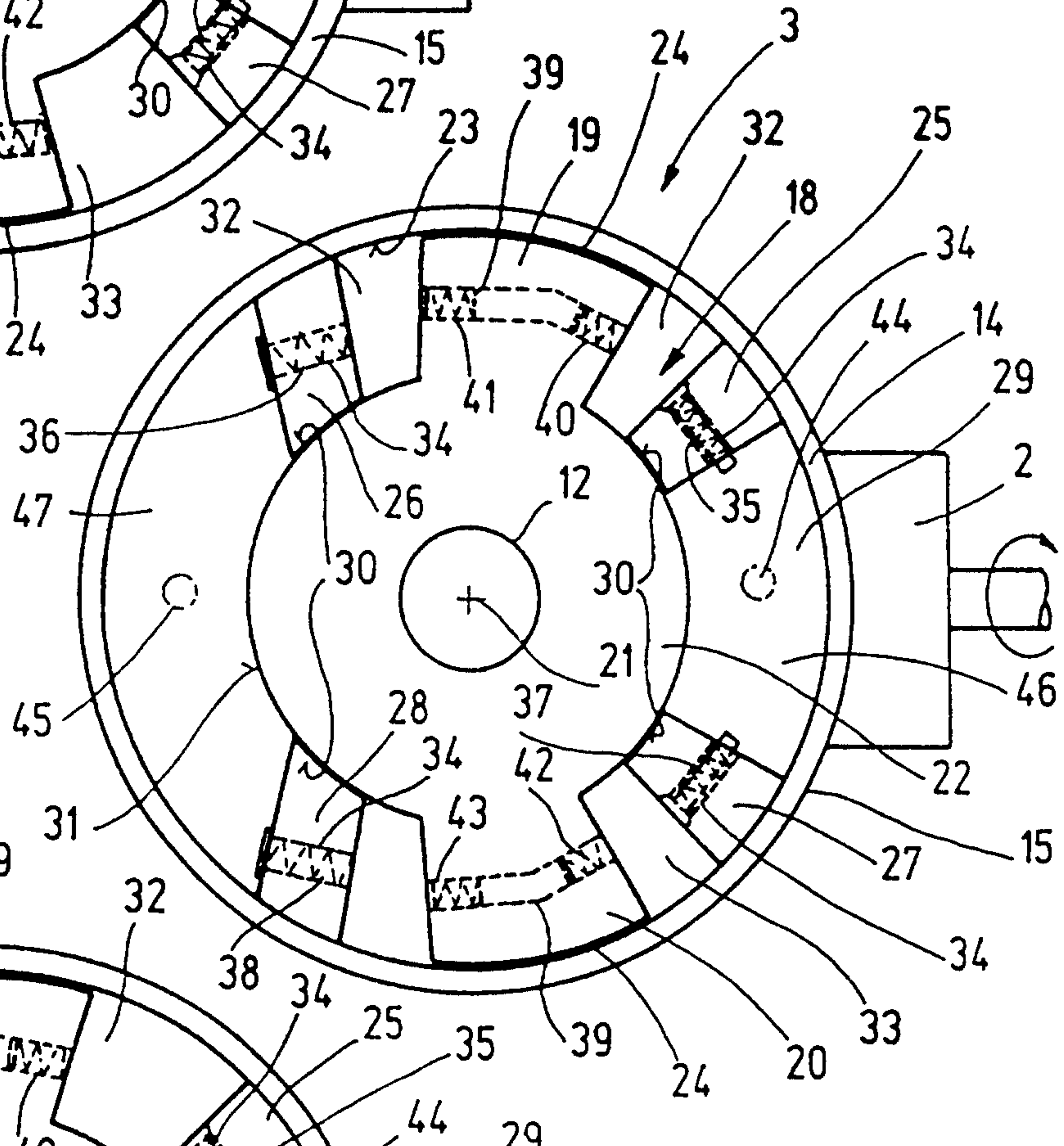

Fig. 5

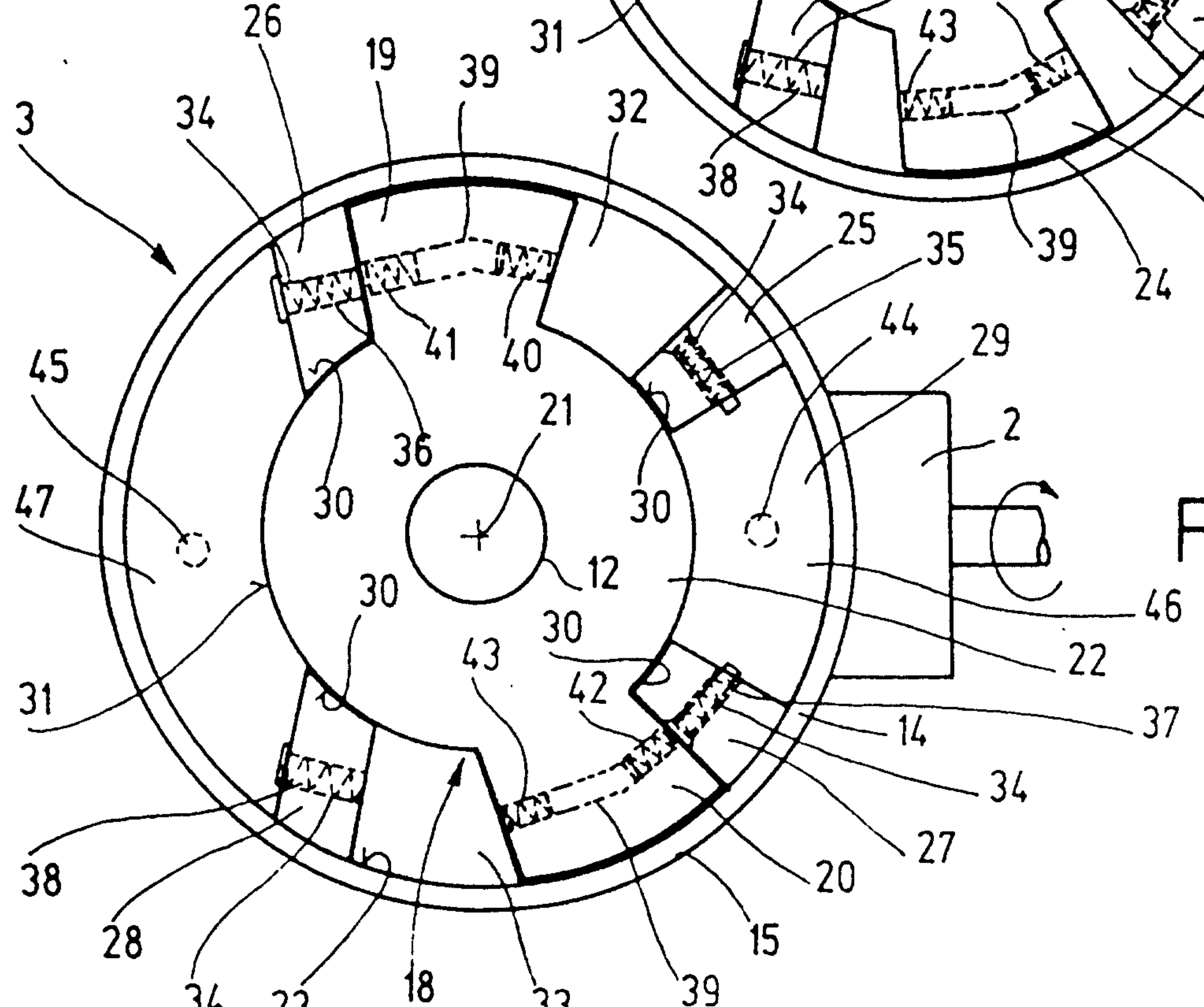

Fig. 6

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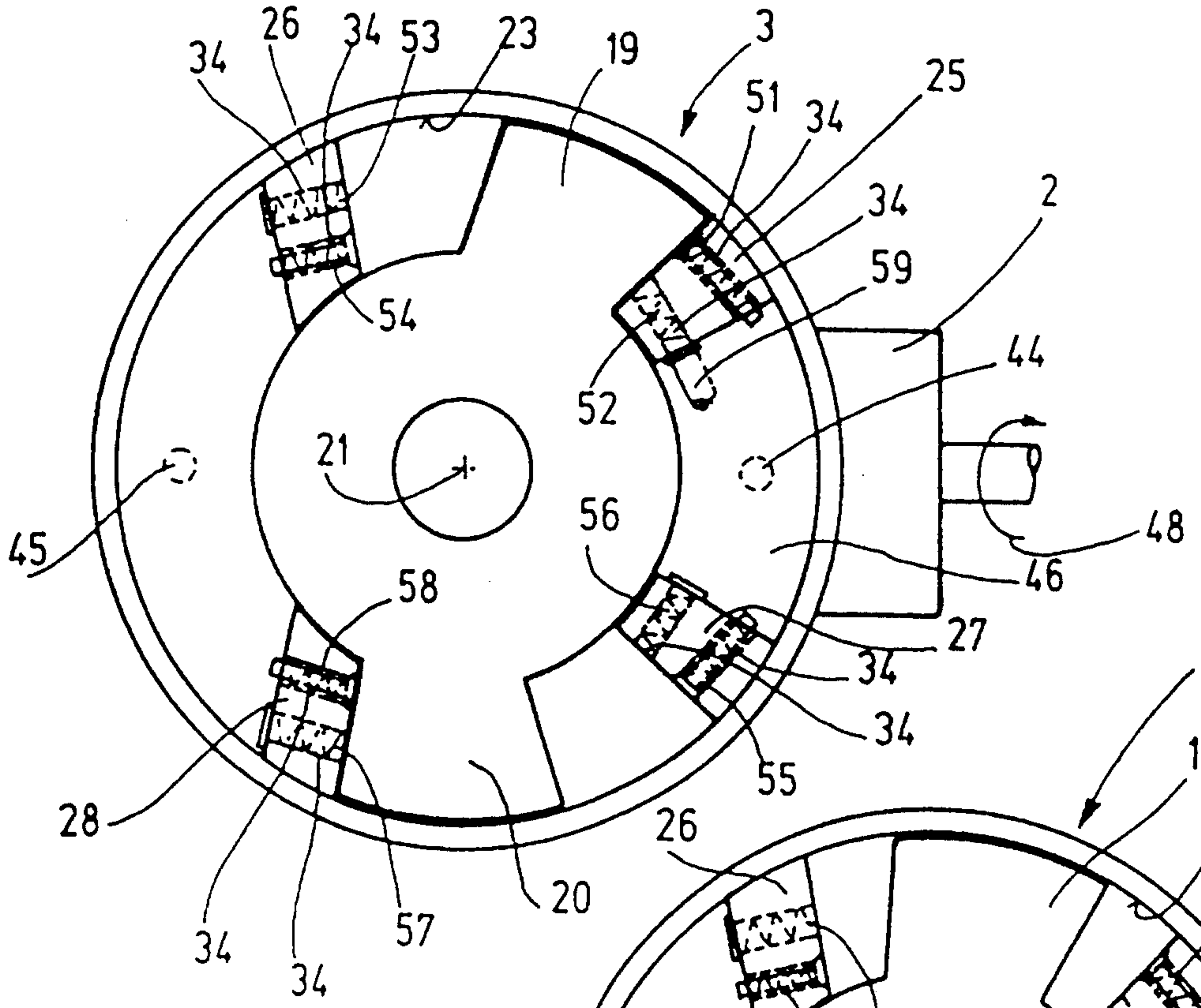

Fig. 7

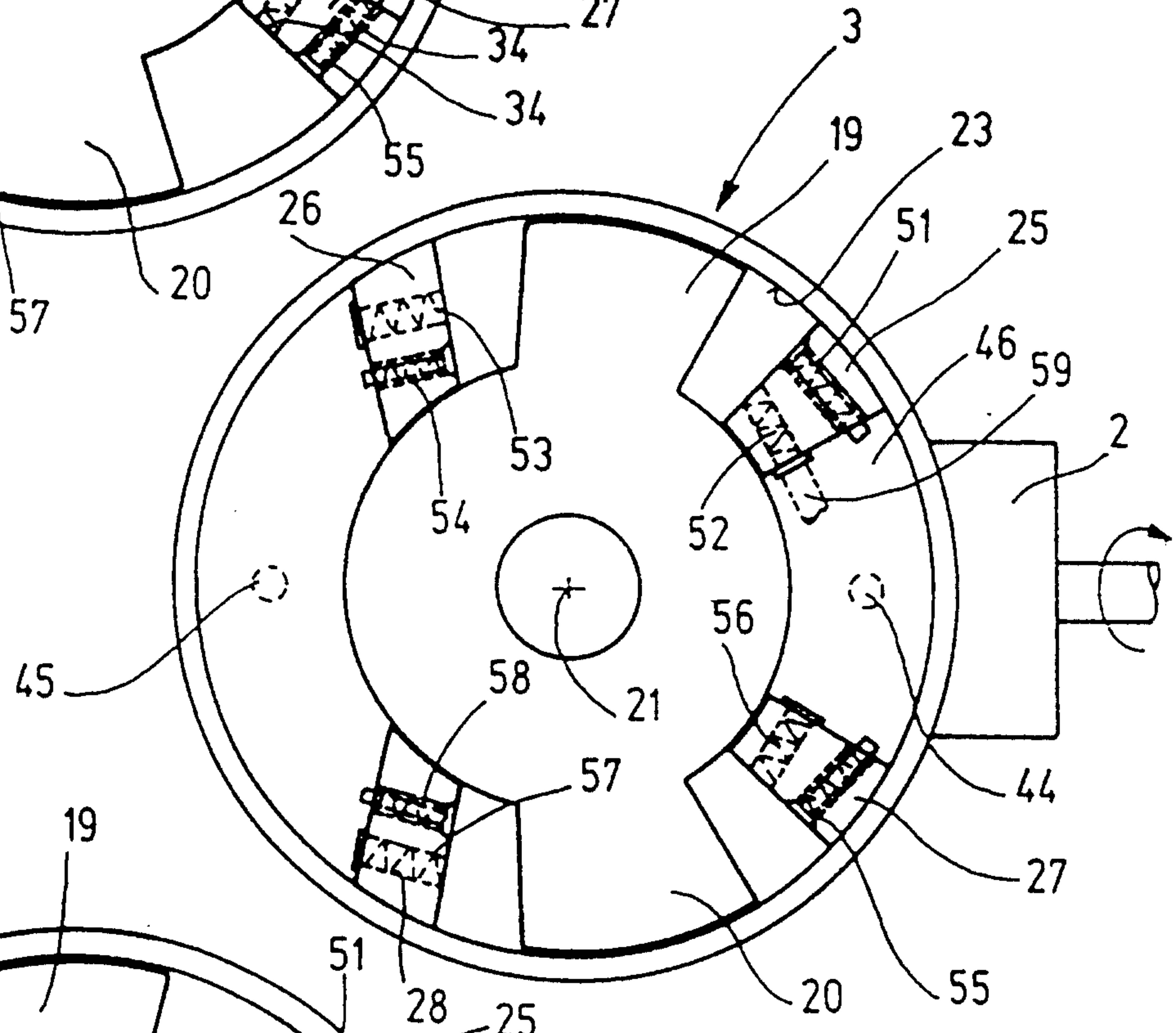

Fig. 8

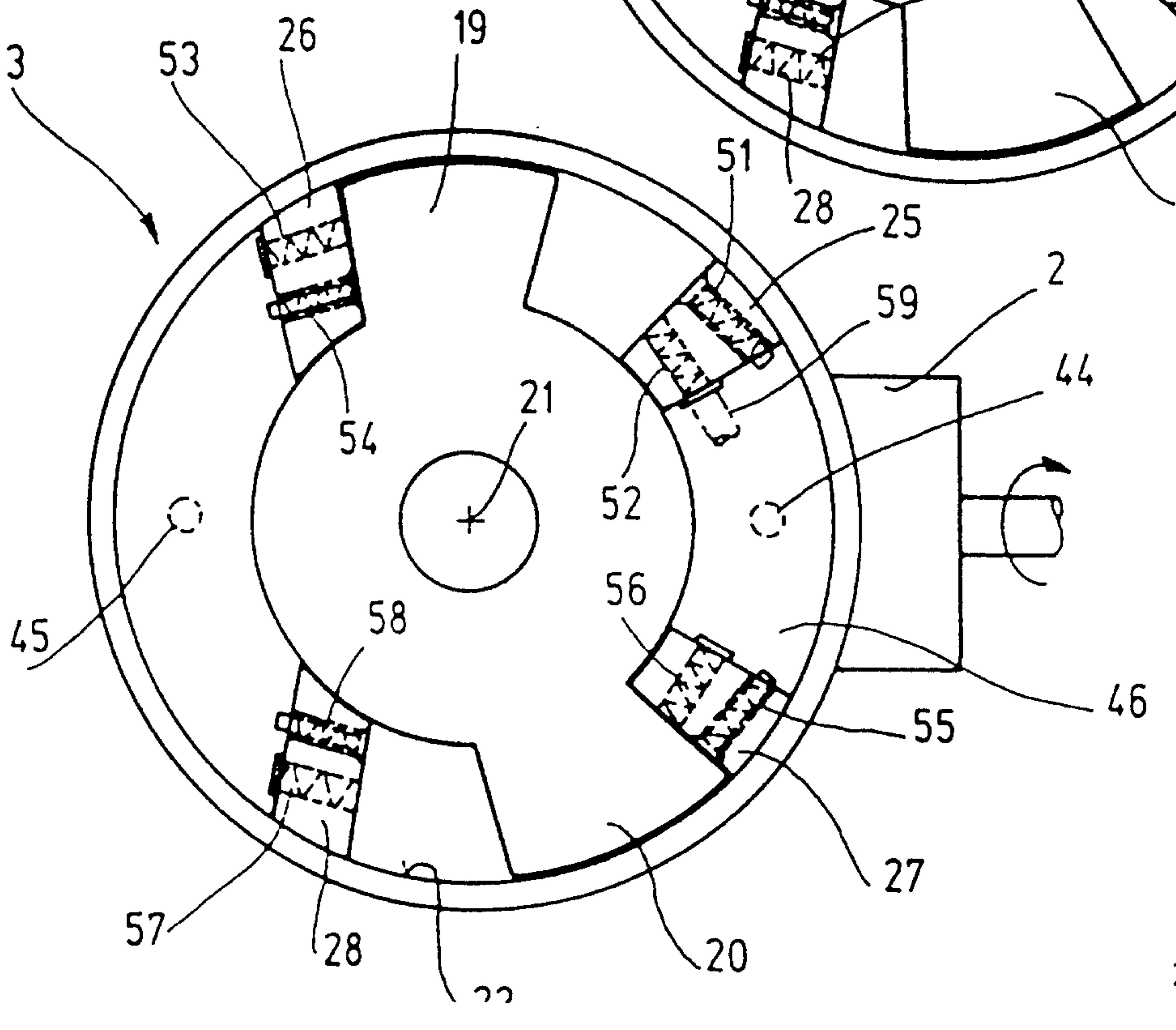

Fig. 9

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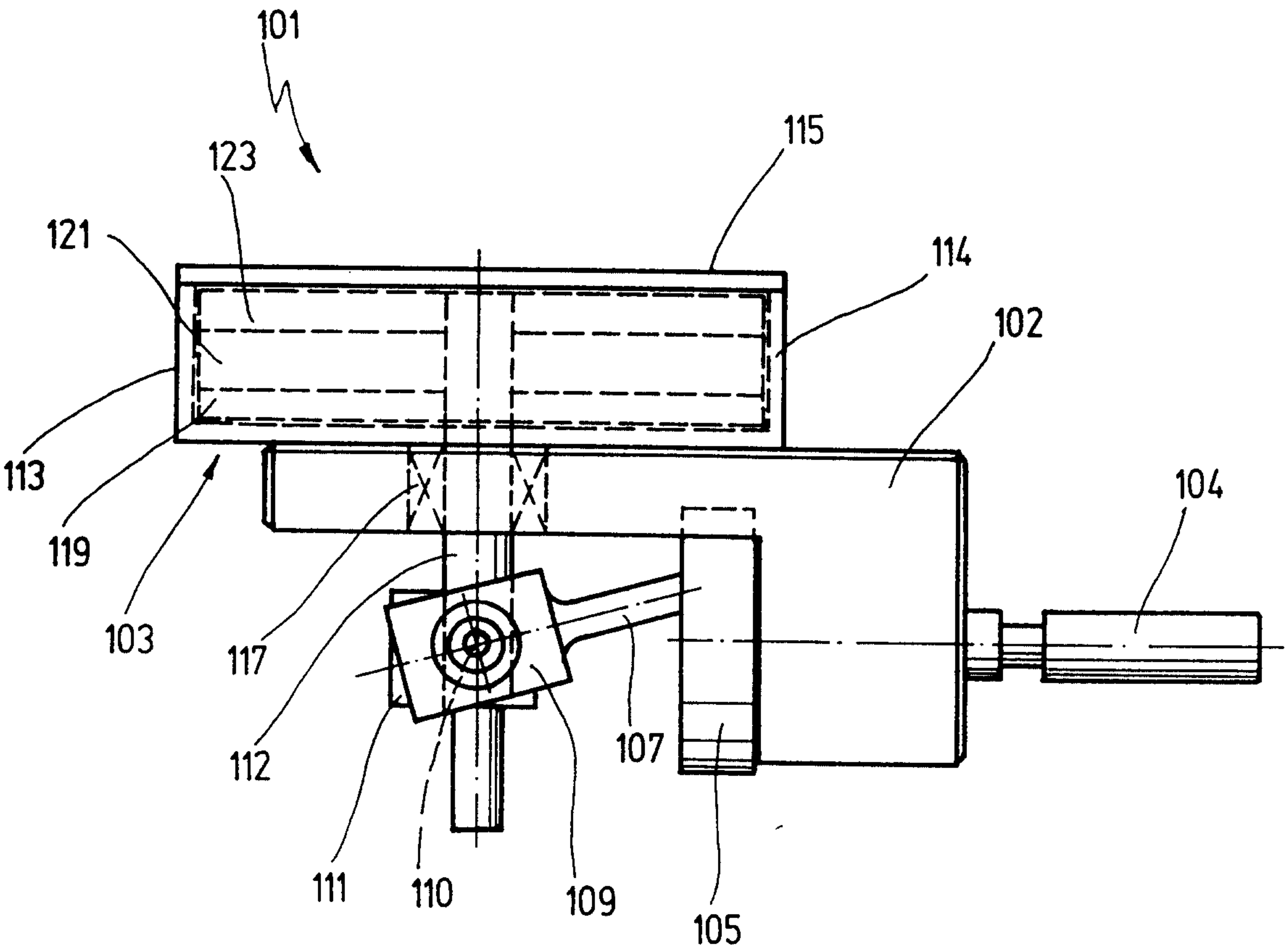

Fig. 10

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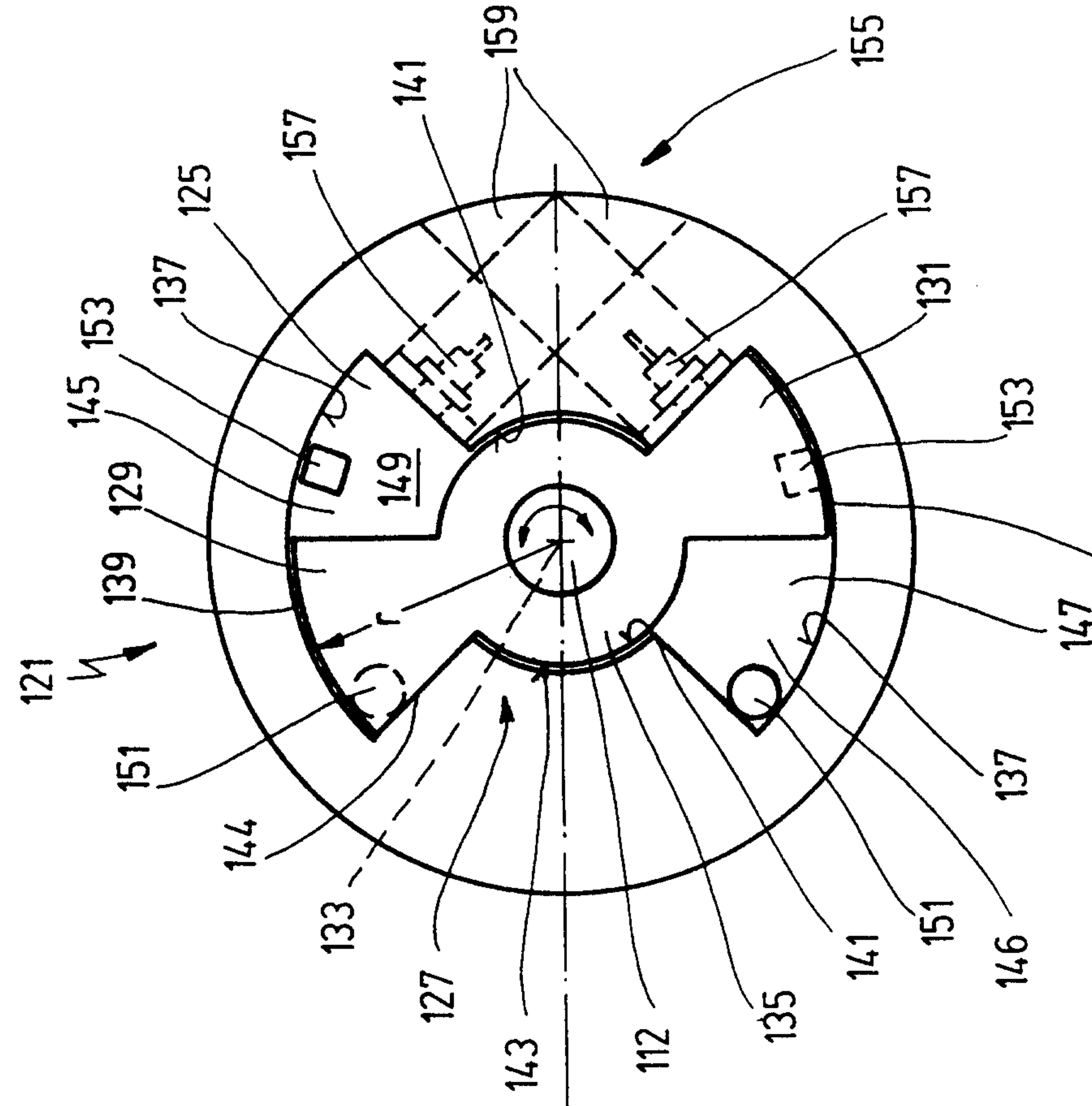

Fig.11

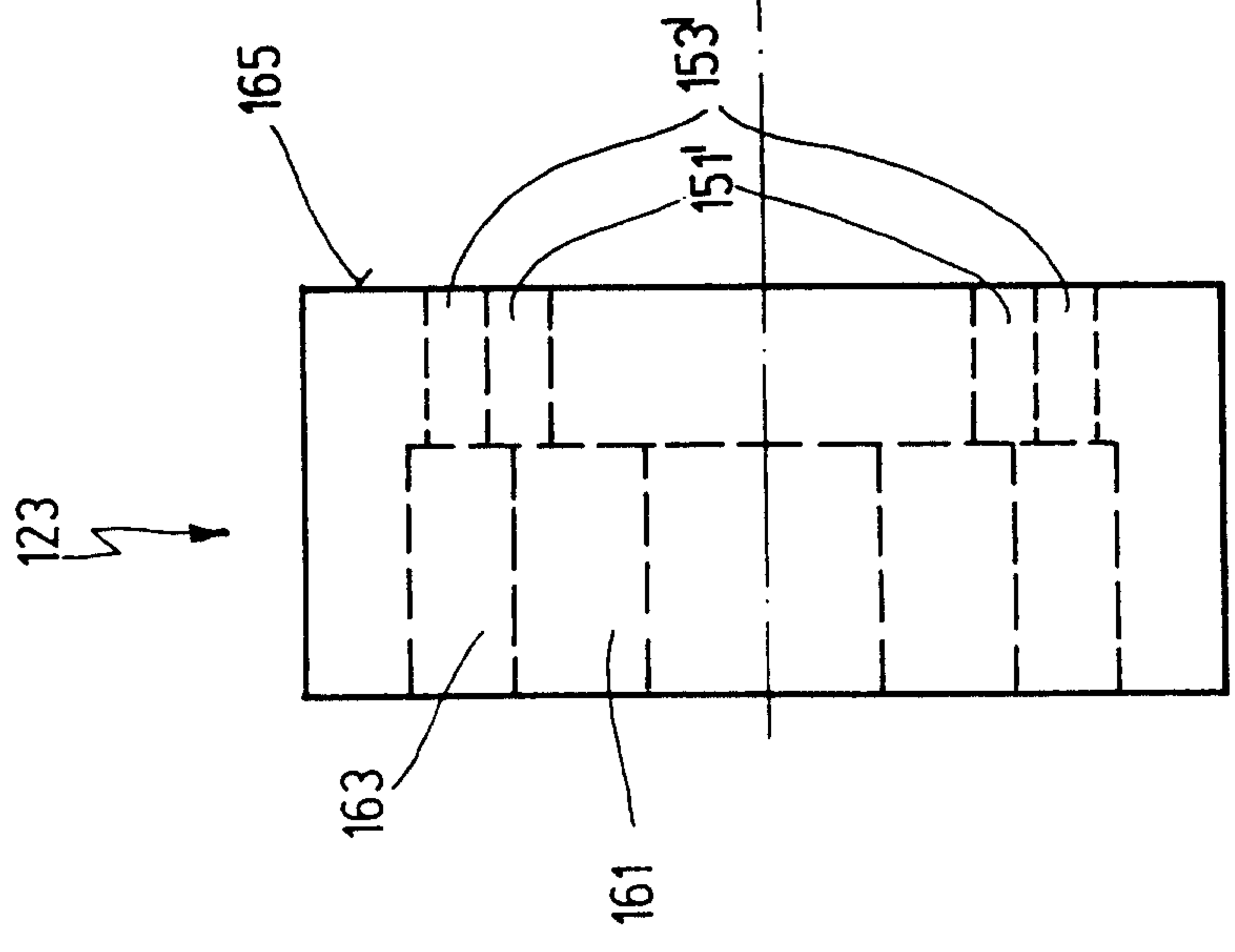

Fig.14

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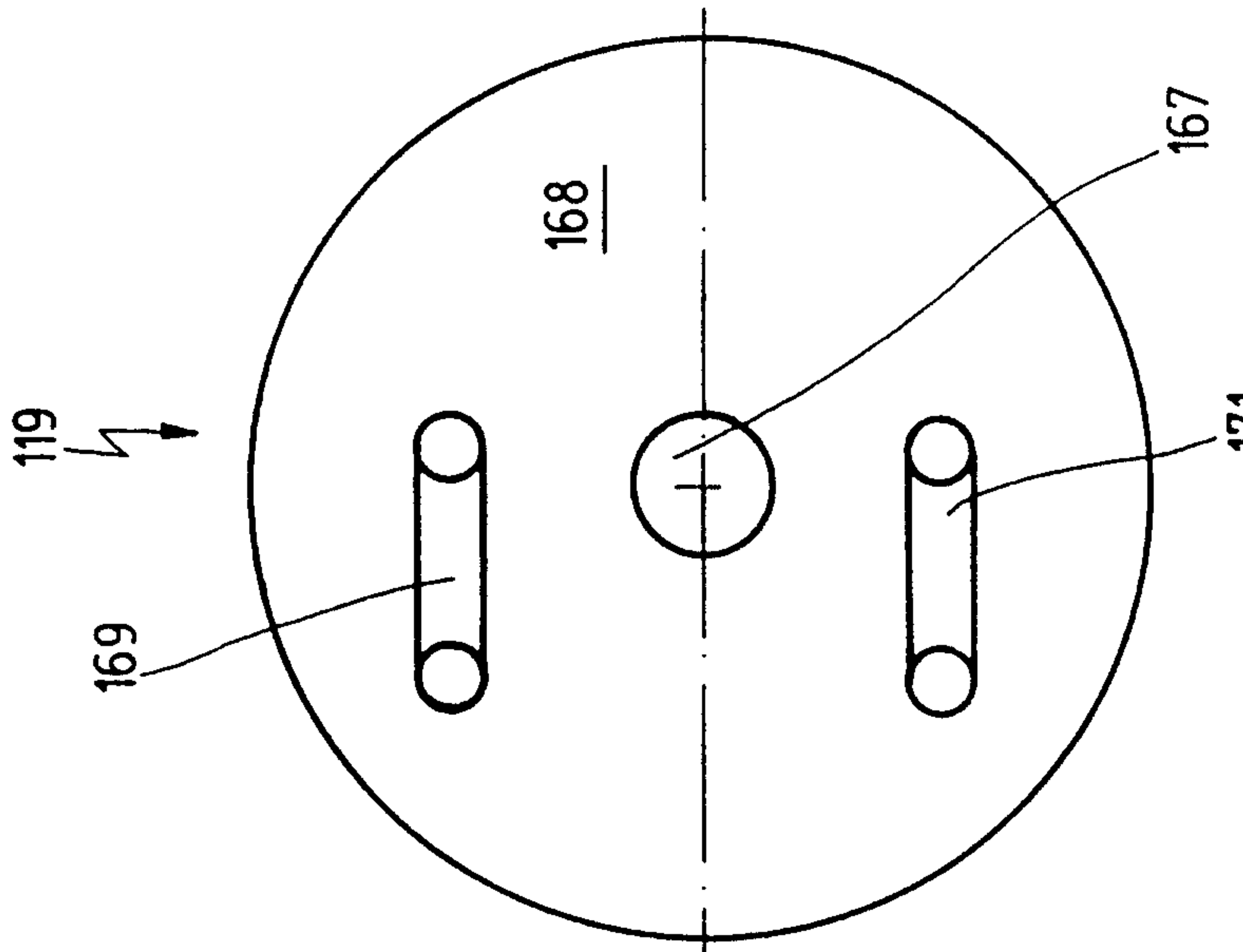

Fig. 13

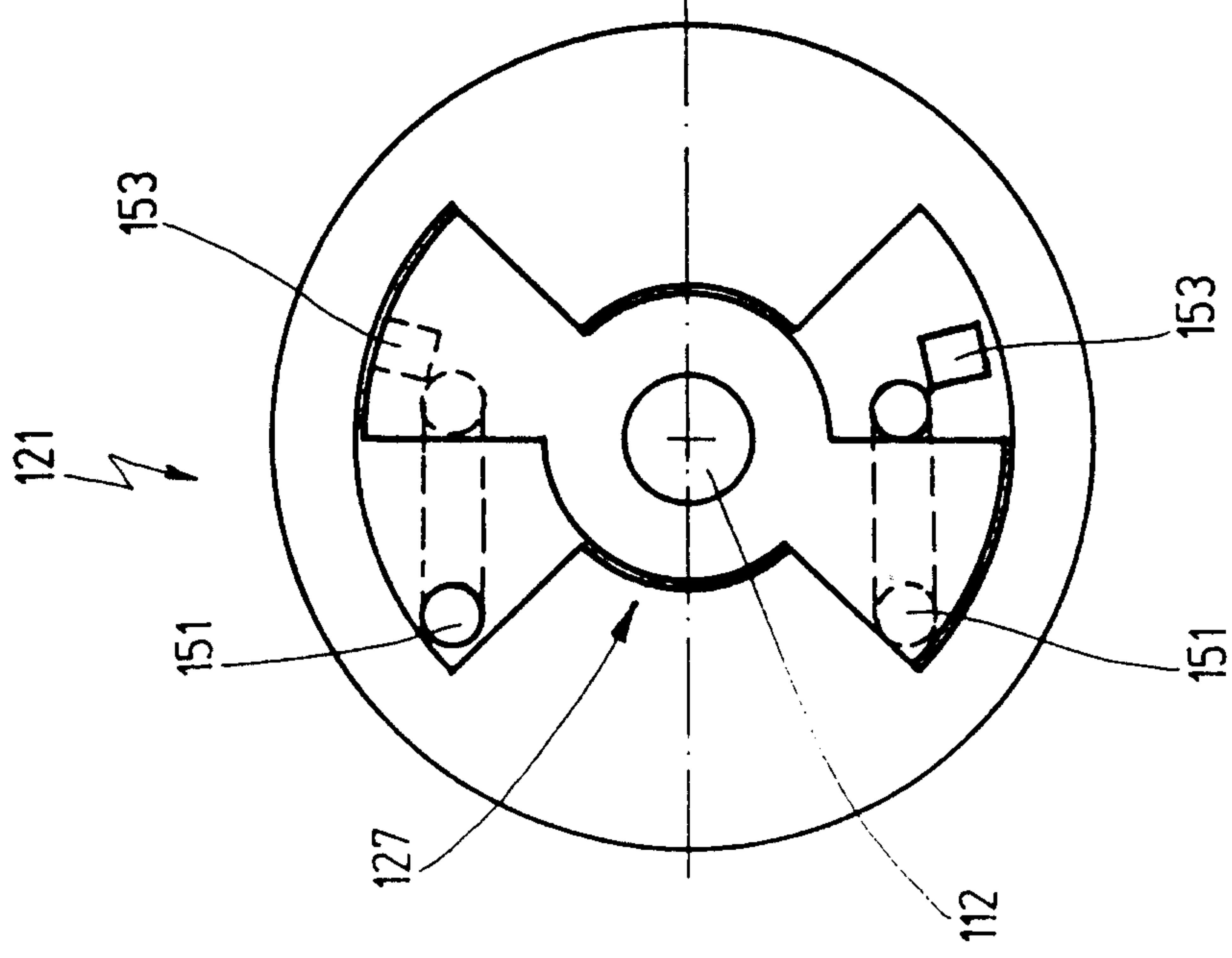

Fig. 12

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