United States Patent

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[33] France
[31] 19,103

[54] **ROTATING CYLINDER ENGINE**
4 Claims, 9 Drawing Figs.

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123/44 E, 123/74 AA, 417/462
[51] Int. Cl. F02b 57/06
[50] Field of Search ..... 123/44 B,
44 C, 44 E, 44 D, 74 A, 74 B; 230/177; 103/161;
91/205; 417/462

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Attorney—Christen & Sabol

ABSTRACT: A rotary internal combustion engine having a rotor assembly provided with an inner cylinder containing a pair of opposed pistons having rollers at their outer ends bearing on an ovoid stationary surface for turning the rotor assembly.

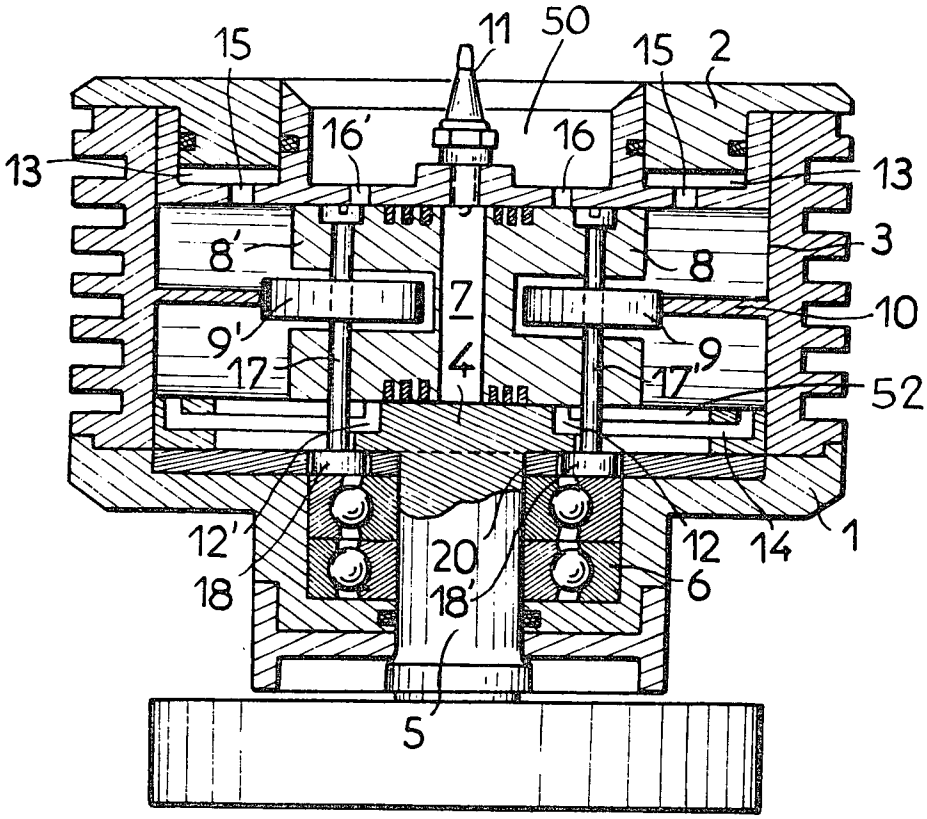


FIG.1

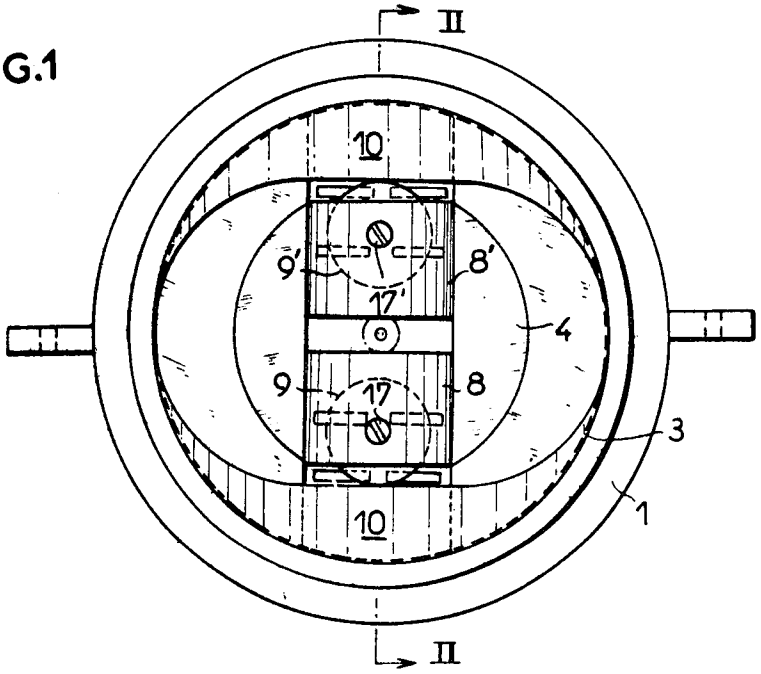

II
10
9'
8'
17'
4
9
17
8
3
1
10
II

FIG.2

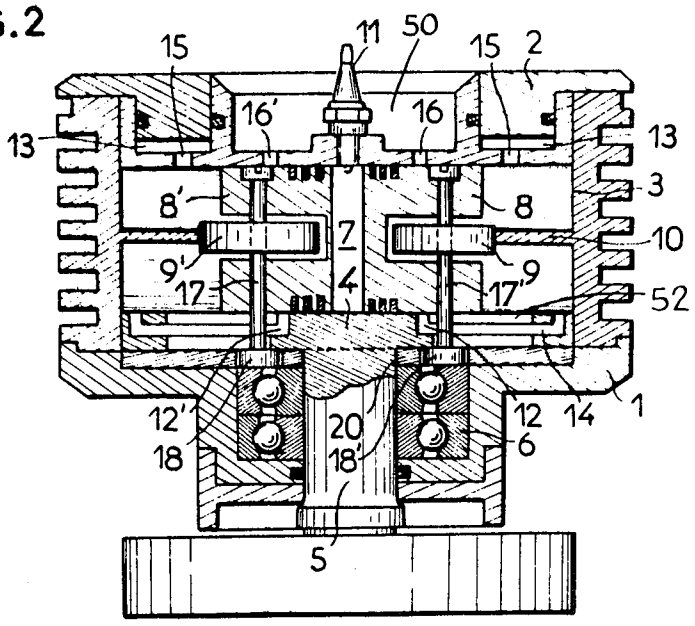

11
50
15
15
2
16'
16
13
13
3
8'
8
7
10
9'
17
4
17'
9
52
12'
20
12
14
1
18
18'
6
5

FIG.3

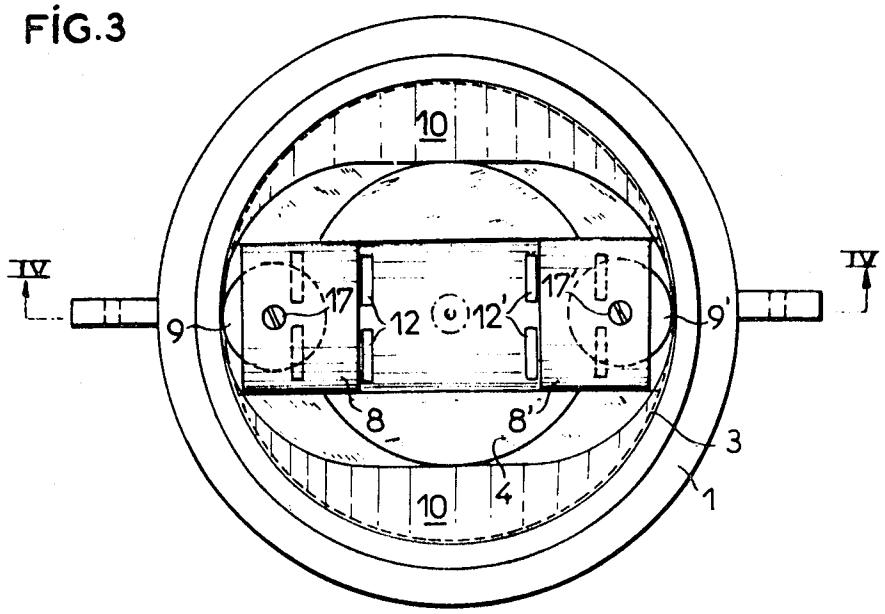

10
IV
IV
9
17
12
12'
17'
9'
8
8'
3
4
10
1

FIG.4

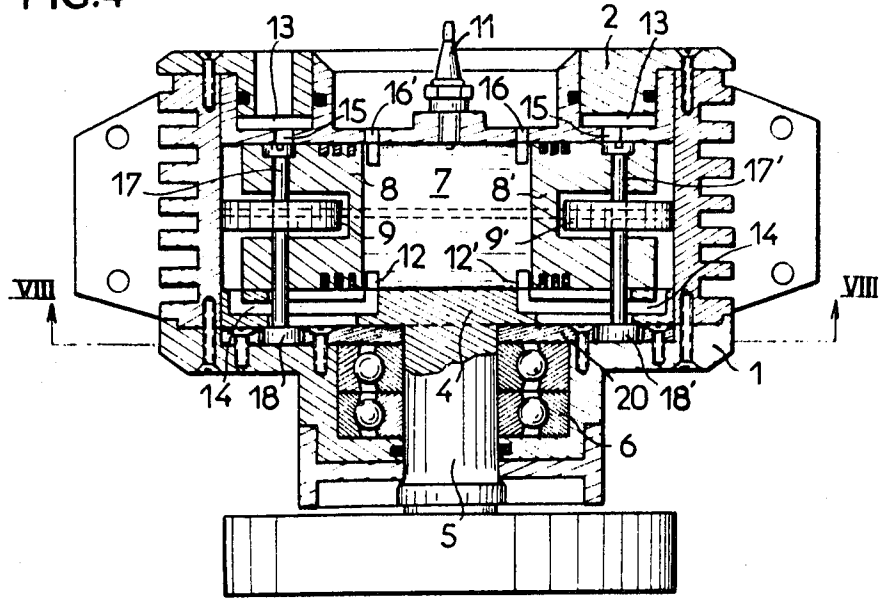

13
11
2
13
15
16'
16
15
17
8
7
8'
17'
9
12
12'
9'
14
VIII
VIII
14
18'
4
20
18'
1
6
5

FIG. 5

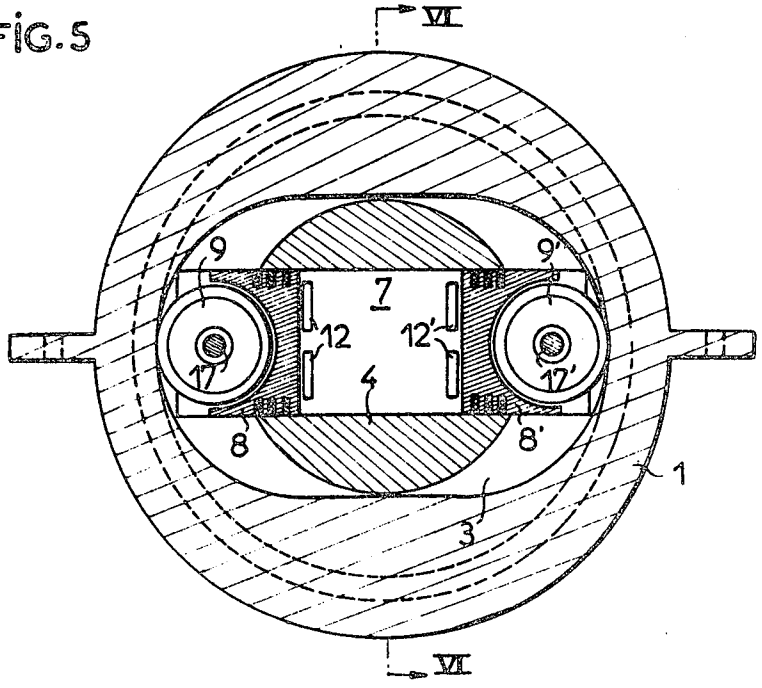


FIG. 6

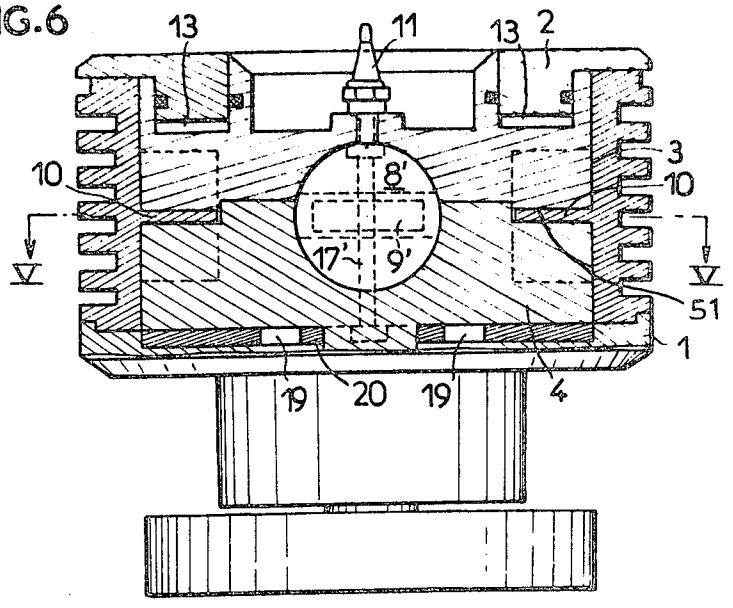


FIG.7

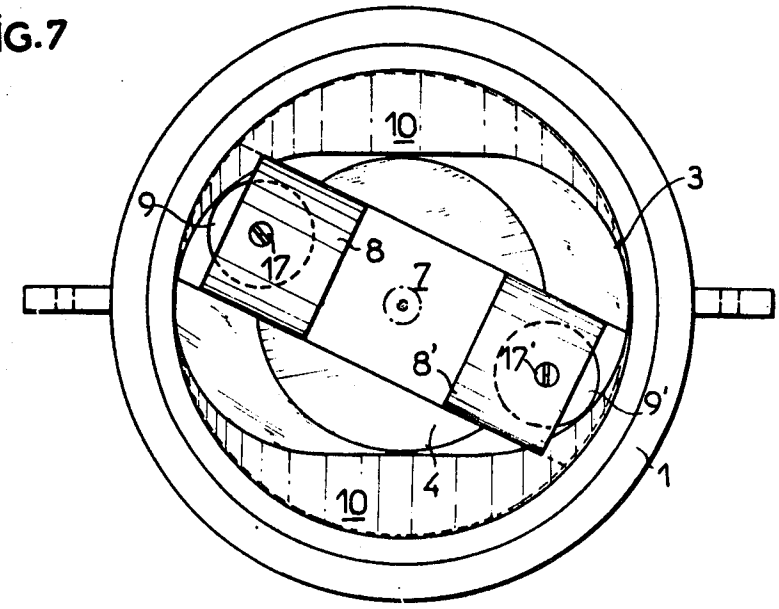


FIG.8

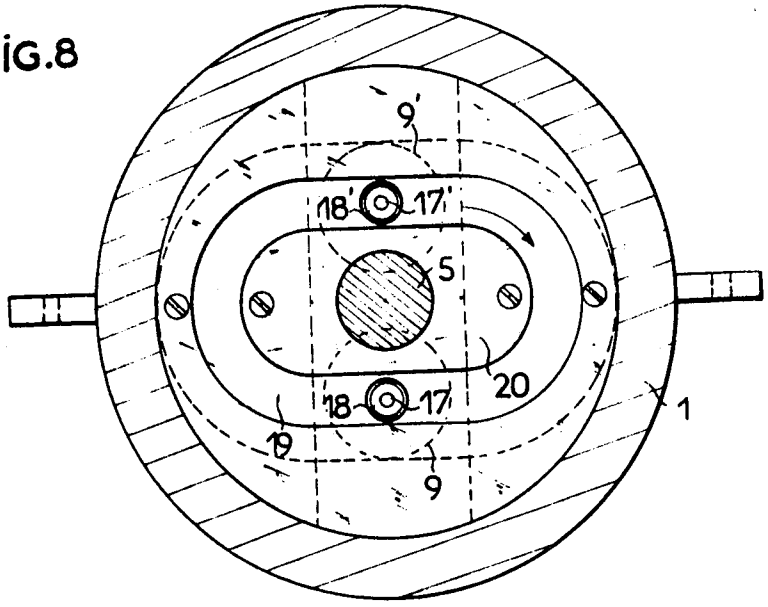
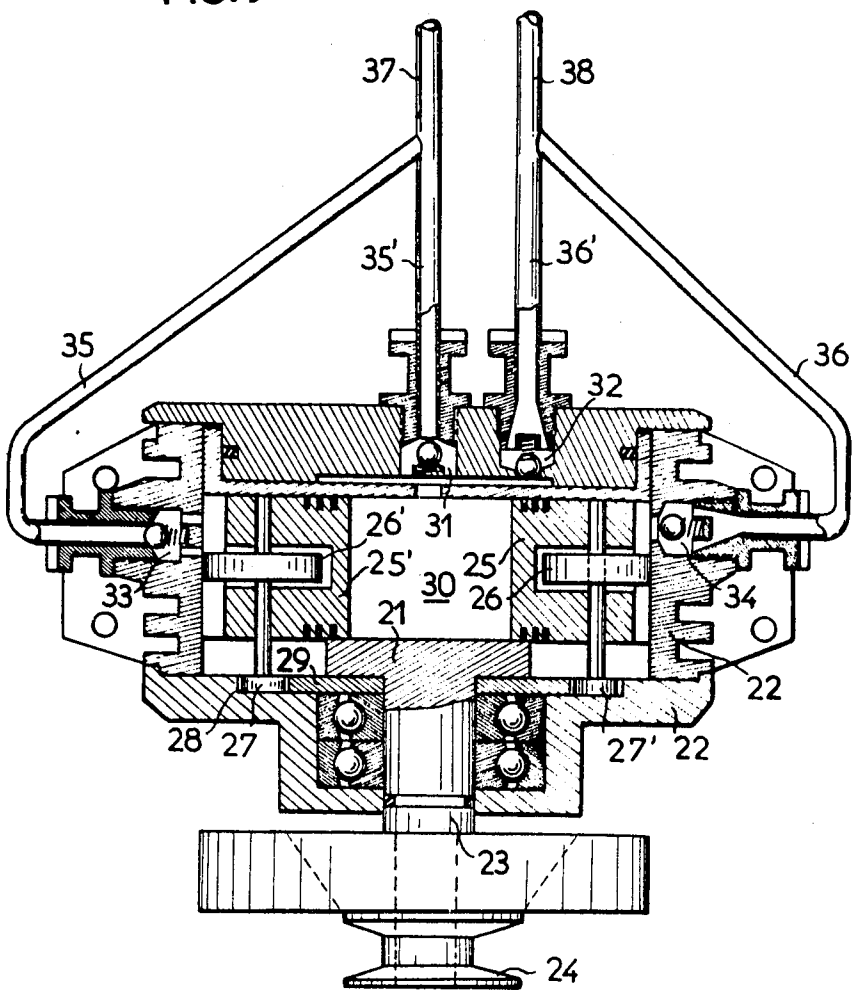


FIG. 9



ROTATING CYLINDER ENGINE

The present invention relates to improvements to engines and, more specifically, to engines of the so-called rotary type.

The engines of the type with which the invention is concerned are constituted by a cylindrical casing, within which two pistons are given a reciprocating movement; these two oppositely moving pistons are caused to rest, through a roller mounted on the outer face thereof, on a generally ovoid or elliptical guide member which constrains said pistons to draw nearer to each other during a portion of their stroke, whereas the thrust of gases biases said pistons towards the extremities of the major axis of said guide member, thus ensuring the maximum possible space within the cylinder, which provides the requested drive impulse.

Devices of this type are known, in which the cylindrical casing is fixed, the rollers associated to the pistons b eing caused to bear on an ovoid guiding zone located on the inner periphery of a flywheel.

In other known devices, the cylindrical casing containing the pistons constitutes the rotary member or rotor of the engine, whereas the ovoid or elliptical guiding zone on which rest rollers integral with the pistons, is fixed and constitutes the engine stator.

In fact, the principle of operation of such known engines has a number of drawbacks which have not been solved to this day.

In particular, in the devices of the prior art, it has not been possible to provide a correct positioning of the piston within the cylindrical casing; indeed, said cylindrical casing, whether it constitutes the rotor or the stator has to be of a diameter corresponding to the narrowest portion of the surrounding ovoid guiding zone; the result is that, when the cylindrical casing is positioned in the direction of the widest portion of the guiding zone, the pistons, which are then at their extended relative position, are caused to emerge slightly from the cylindrical casing, which tends to cause a distorsion in the positioning of the piston within the cylinder, because, owing to the fact that the piston partly emerges from the cylinder, its contact surface with the cylinder bore is reduced.

One thus has to face problems of tightness and wear, and there may be a risk that the piston gets jammed in the cylinder.

Moreover, while the rollers associated with the outer faces of the pistons allow the latter to resume their retracted relative position, however means must be provided for returning the pistons to their extended relative position, after a 90° rotation of the rotor; indeed, during the engine operation, the pistons extension is ensured by the thrust of burnt gases and by the centrifugal force, but, at the moment of starting up the engine, one must provide a to-and-fro movement of the pistons without resorting to the thrust of gases, failing which the pistons would risk to remain at their retracted relative position, thus preventing the admission of unburnt gas and the engine start.

In the prior art, resilient devices of various and complex shapes have been provided for following the pistons during their reciprocating movements, but such resilient devices are subject to rapid wear and do not permit to obtain engines of long durability.

Finally, the gas intake and exhaust problems have not been solved to this day in a manner permitting a sound operation of such engines.

The present invention obviates the drawbacks of the prior art and provides an engine of the rotary type, capable of operating under the best and most efficient conditions.

More precisely, the present invention relates to an internal combustion engine of the type comprising a rotary member, or rotor, provided with a cylindrical inner bore within which are oppositely mounted two pistons, each of said pistons comprising a supporting roller on the outer face thereof, said rotor also comprising openings, or ports, for the admission of unburnt gases, ports for the exhaust of burnt gases and a sparking plug, said rotor being adapted to rotate about an axle serving as an output shaft mounted in a bearing which is solid with a fixed member, or stator, containing said rotor, said engine being characterized in that the rotor inner cylinder containing said pistons constitutes a single combustion chamber, in that said rotor comprises an outer annular groove located in a plane containing the bore central axis, and in that said stator comprises a rib of ovoid, or elliptical, profile located within said rotor groove and adapted to support said guide rollers provided on the pistons outer faces.

According to the above first feature of the present invention, the diameter of the rotor containing the cylinder is only slightly less than the stator inner diameter, and it nearly corresponds to the major axis of the ovoid or elliptical, cam. Accordingly, when the rotor brings the pistons to their extended relative position, said pistons remain fully located within their bores, their bearing surfaces thus corresponding to their whole periphery, with the risks of wear, distorsion or jamming which are to be feared in the engines in which the cylinders are caused to emerge, at least partly, from the cylinders.

The cam, or rib, solid with the stator inner walls, being of ovoid or elliptical shape, more deeply penetrates into the annular groove provided at the rotor periphery, in the portion thereof corresponding to its minor axis, and, during the rotor rotation, the pistons, which are caused to bear against said ovoid cam through the rollers which rest on said cam acting as a guide-rail, are thus brought back from their extended relative position to their retracted relative position.

It will be easily understood that the device according to the present invention permits to solve, both simply and efficiently, the problem of an elliptical guiding of the pistons for imparting a to-and-fro movement to them, and of the necessity of permanently maintaining the pistons within the cylinder.

According to a second feature of the invention, the axle or journal on which the piston guide-roller is mounted slightly protrudes outwardly and penetrates into a radial slot provided in the rotor along the cylinder axis, and it is moreover associated with a secondary roller located outside of the rotor and adapted to cooperate with an ovoid, or elliptical, secondary cam solid with the stator wall, so as to cause the pistons to move towards their extended relative position, when the rotor is rotating.

According to another feature of the invention, the stator is closed, on one side thereof, by a bottom piece provided with a bearing through which passes the transmission shaft solid with the rotor, and, on the other side thereof, by an annular-shaped cover, the edges of which are integral with the staton cylindrical walls, the cutaway central portion of said cover unveiling the rotor central portion.

According to another feature of the invention, the rotor central portion unveiled by the cover cutaway portion, comprises ports for the exhaust of the burnt gases and a sparking plug.

According to a further feature, said cover comprises an annular rib of quadrangular profile penetrating into an annular dish of matching profile, provided on its face in register with the rotor, each of the two intervals defined by the dish cylindrical walls being provided with a sealing joint.

According to a specific embodiment of the last mentioned feature, the bottom of said annular dish is spaced from the bottom of the rib solid with the cover and penetrating into said dish of matching profile, the space thus provided forming an annular feed chamber, which communicates, on one side, with a source of gas mixture by at least one conduit crossing the cover rib and, on the other side, with a feed port which opens into the marginal portion of the cylinder.

Such an arrangement permits the rotating portions, corresponding to the admission of unburnt gases and to the exhaust of burnt gases respectively, to be in side-to-side relationship, said portions remaining however perfectly tight with respect to each other.

It is to be noted that the engine according to the present invention, owing to the fact that it drives the pistons simultane-

ously and in opposite directions, provides a perfectly balanced drive impulse; in addition since the various parts are symmetrically mounted, a permanent kinetic equilibrium is achieved.

According to a still further feature, the above-described rotary unit is used as a pump.

In the latter case, the assembly comprises a rotor contained in a casing constituted by the stator, said rotor being adapted to rotate about a shaft driven by an apparatus which it is appropriately coupled, said rotor comprising an inner cylindrical bore in which are mounted two pistons in opposed relationship, each of said pistons being provided, on the outer face thereof, with a roller resting on an ovoid, or elliptical, cam solid with the stator inner wall, said cam being inserted into an annular groove located on the stator outer wall and being adapted to constrain said pistons to draw nearer to each other during the rotor rotation, each of said pistons also comprising an outer secondary roller provided on a lateral extension of the axis of rotation of the rear roller, said secondary roller cooperating with an ovoid or elliptical, cam solid with the stator wall and adapted to constrain said pistons to assume an extended relative position during the rotation of said rotor, the latter also comprising at least one central port communicating with the feed and exhaust conduits provided with appropriate valves, said port opening into the cylinder.

According to an improvement, the stator, at the periphery thereof, comprises ports which communicate with the feed and exhaust conduits respectively and which are provided with appropriate nonreturn valves, said ports opening into the peripheral portion of the stator casing which contains the rotor.

It can be easily understood that the pump according to the present invention operates by suction and backflow, by reason of both the volumetric variation of the space constituted by the inside of the cylinder following the movement of the pistons actuated by the rotating rotor, and the volumetric reverse variation of the space containing the rotor.

When used as an air compressor, the present device centrifugally removes the oil from the compression chamber; it is thus possible to obtain compressed air free from impurities, which is of particular interest for feeding pneumatic control devices.

Other features of the present invention will appear from the following description, given merely by way of example, with reference to the accompanying drawing in which

FIG. 1 is a vertical cross section of an engine according to the invention, with its pistons at their retracted relative position;

FIG. 2 is a longitudinal cross section along line II—II of FIG. 1;

FIG. 3 is a vertical cross section of the engine of FIG. 1, with its pistons at their extended relative position;

FIG. 4 is a cross section along line IV—IV of FIG. 3;

FIG. 5 is a cross section along the plane of symmetry of the cylinder;

FIG. 6 is a cross section along line VI—VI of FIG. 5;

FIG. 7 is a detail view, showing the pistons at an intermediate position;

FIG. 8 is a detail view concerning the pistons outer guide-roller; and,

FIG. 9 is a cross section of an embodiment of the device according to the invention used a pump.

In the engine such as shown in FIG. 1–8, the stator is closed by a bottom 1 and removable cover 2, defining an inner chamber 3 in which is located a rotor 4; the latter is mounted on a shaft 5 which rests on the stator through a bearing 6; said shaft is extended, in known fashion, by a ventilating device.

The rotor comprises a cylindrical inner bore 7 in which can slide two oppositely directed pistons 8 and 8'; within each piston, and protruding from the outer face thereof, is mounted a rear roller 9, 9' which rests on a cam 10, forming a rail or rolling track; said cam, which is integral with the stator inner wall, has an ovoid, or elliptical, profile as shown in FIG. 5, which projects into an annular outer groove 51 in the rotor, as seen in FIG. 6, and it constrains the pistons to assume a retracted relative position 3 shown in FIGS. 1 and 2.

In the rotor median portion 50 is provided a sparking plug 11, penetrating into the single cylinder; the latter comprises lateral feed ports 12 which communicate with a gas annular intake chamber 13, located between cover 13 and the rotor, through the medium of conduit 14 which connects feed port 12 to the corresponding peripheral portion of the cylinder; an intake port 15, located at the opposite side, communicates the cylinder bottom with feed chamber 13. The unburnt gases which were sucked into the cylinder bottom when the pistons were drawing near to each other, are repelled into conduit 14 when said pistons spread apart, then are directed into cylinder 7 through ports 12 and 12', whereas the burnt gases escape through exhaust chambers 16 and 16'.

A switch (not shown) for controlling the ignition can be mounted, in known fashion, on the output shaft 5.

Rollers 9 and 9' associated to the pistons are mounted on an axle 17, 17' which protrudes beyond the rotor, the protruding portion sliding according to the to-and-fro movement of each piston in a slot 52 made in the rotor body. Axles 17 and 17' each bear a lateral roller 18, 18' encased in a groove 19 made in the stator bottom.

Thus, at the start of the engine, lateral rollers 18, 18' act as guide members for causing the pistons to spread apart, independently of the explosion force or of the centrifugal force. Such an arrangement prevents the pistons from rotating about themselves. However, the lateral rollers bear on the inner portion of groove 19 acting as a cam, only during the engine start; thereafter, the centrifugal force removes them from that cam, thus preventing their untimely wear.

Although not shown in the drawing, the rotor is provided, on both sides, with cooling fins obtained by hollowing out the mass thereof, and so shaped as to act in the manner of a compressor, for expelling the unburnt gases towards the feed port which opens into the cylinder.

Although the above description refers to a two-stroke internal combustion engine, it can be as well applied to a four-stroke engine.

FIG. 9 shows an embodiment in which the device according to the invention is used as a pump.

A rotor 21 provided with a bore rotates in a stator 22 and is driven by a shaft 23 provided with a belt-driven pulley 24, or any other driving means.

Two pistons 25 and 25' mounted in the cylinder each comprise a rear roller 26 or 26' bearing on a cam, or guide rail, of generally ovoid shape inserted into an annular groove made in the rotor periphery. Lateral rollers 27 and 27', sliding in a groove 28 provided in the bottom 29 of the stator, allow the cylinders to spread apart.

The inside of cylinder 30 constitutes a first suction and exhaust chamber, the operation of which is bound to the volumetric variations resulting from the reciprocating movement of the pistons; a suction port 31 and an exhaust port 32 in close proximity thereto, are provided with nonreturn valves.

The peripheral portion of the rotor communicating with the cylinder outer bottom beyond the piston constitutes a second suction and exhaust chamber operated by volumetric variations; said chamber communicates with suction port 33 and exhaust port 34.

The conduits leading the the suction ports 35, 35' and to the exhaust ports 36, 36' are connected to a common inlet and outlet branch 37 and 38.

What is claimed is:

1. A rotary engine comprising a rotary member, or rotor, provided with a cylindrical inner bore, two pistons oppositely mounted in said cylinder, each of said pistons comprising a roller protruding from the outer face thereof, said rotor also comprising openings, or ports, for the admission of unburnt gases, ports for the exhaust of burnt gases and a sparking plug, a fixed member or stator in which the rotor is adapted to rotate, the rotor inner cylinder containing the pistons constituting a single combustion chamber, said rotor comprising

an outer annular groove located in a plane transverse to the bore central axis, and said stator comprising a cam of ovoid profile located within said rotor groove and adapted to engage said rollers protruding from the pistons outer faces, said stator comprising a bottom piece adapted to close the stator on one side thereof and provided with a bearing, a transmission shaft solid with the rotor and adapted to pass through said bearing, and annular-shaped cover adapted to close the stator on the other side thereof, said rotor being provided with an annular-recessed gas intake portion, said cover comprising an annular portion of matching profile adapted to penetrate into said gas intake portion, and sealing means for said annular gas intake portion.

2. A rotary engine according to claim 1, wherein each piston comprises an axle adapted to receive the piston roller mounted thereon, said axle protruding outwardly, the rotor comprising radial slots along the cylinder axis in which the protrusion of said axle are adapted to penetrate, said protrusion being associated with a lateral roller located outside the rotor, the stator comprising an elliptical groove solid with the stator wall so as to cause the pistons to move towards their extended relative position when the rotor is rotating.

3. A rotary engine according to claim 1, wherein the rotor median portion unveiled by the cover cutaway portion, comprises ports for the exhaust of the burnt gases and a sparking plug.

4. A rotary engine according to claim 1, wherein the bottom of said annular gas intake portion is spaced from the bottom of the portion of the cover penetrating therein, the space thus provided forming an annular feed chamber, adapted to communicate, on one side, with a source of gas-mixture by at least one conduit crossing the annular recess and, on the other side, with a feed port which opens into the marginal portion of the cylinder.