# United States Patent

[11] **3,572,985**


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[33] **Germany**
[31] **P 16 01 832.9**


[54] **ROTARY PISTON MACHINE**
**5 Claims, 29 Drawing Figs.**


[52] **U.S. Cl.** ..... **418/138,** 418/6, 418/212
[51] **Int. Cl.** ..... **F01c 19/00,** F01c 11/00
[50] **Field of Search** ..... 103/144; 230/157; 123/165 (A), 165 (C); 91/124; 418/6, 138, 212



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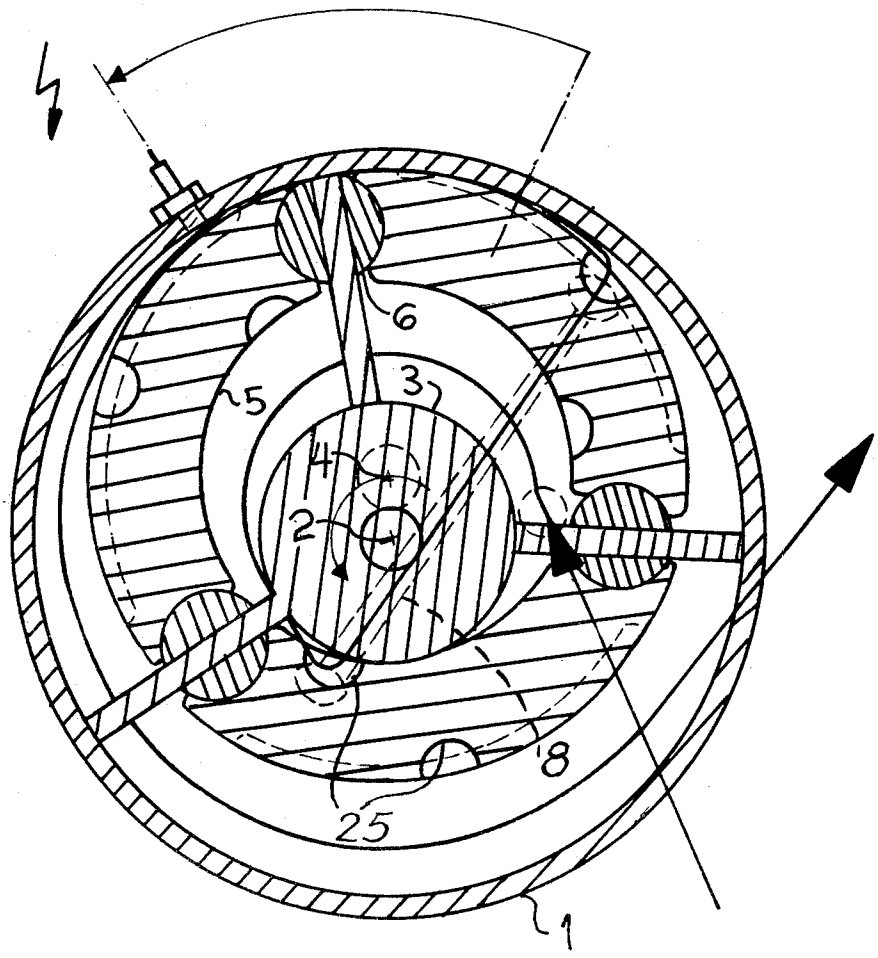
*Primary Examiner*—Mark M. Newman
*Assistant Examiner*—Wilbur J. Goodlin
*Attorney*—Allison C. Collard



**ABSTRACT:** A rotary piston machine which serves as the drive for fuel carburetor motors, or as a functional element for a motor, in a steam engine, as a compressor and pump. The machine is constructed in a hollow cylindrically-shaped housing and includes an axially hinged winged-shaped piston pivoted on a first axis and having at least two extending arms for sliding contact against the internal walls of the housing, a plurality of cylindrically-shaped rotary piston segments equal in number to the rotor arms and having perforated ends, and coupling joints slidably disposed on the extending wing-shaped piston arms. The sprockets are pivotably coupled within the perforated ends of the rim segments to the wing-shaped piston arms to close the segments around the hinged wing-shaped piston to form a second axis displaced parallel with respect to the first axis.

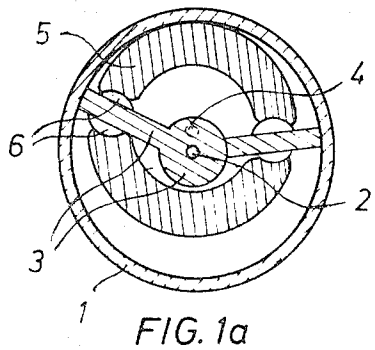



FIG. 1a

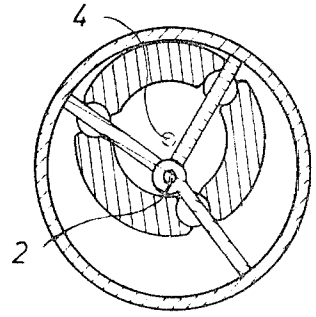



FIG. 1b

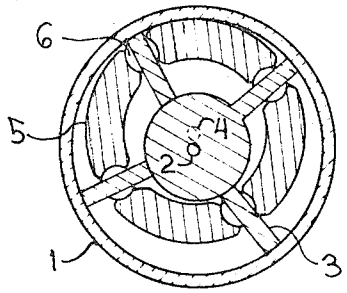



FIG. 1c

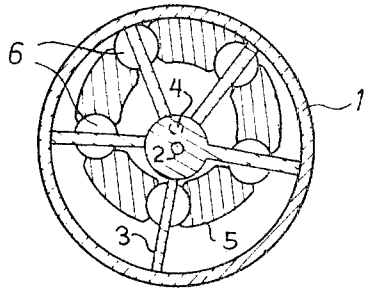



FIG. 1d

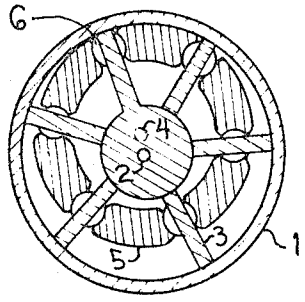



FIG. 1e

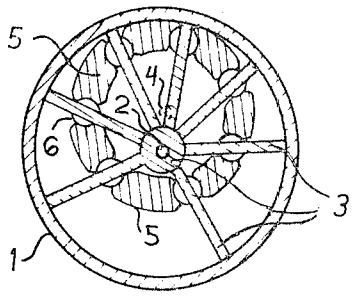



FIG. 1f

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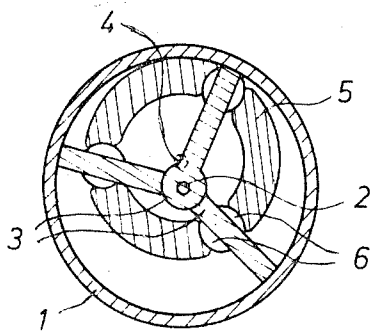


FIG. 2a

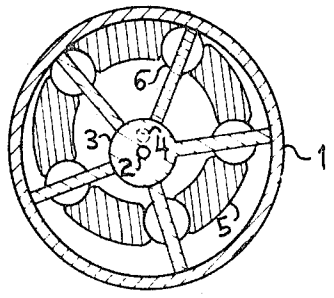


FIG. 2b

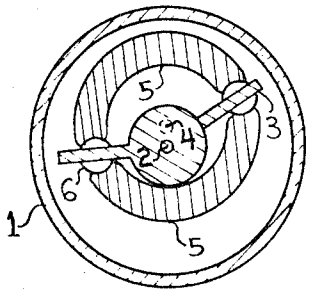


FIG. 3a

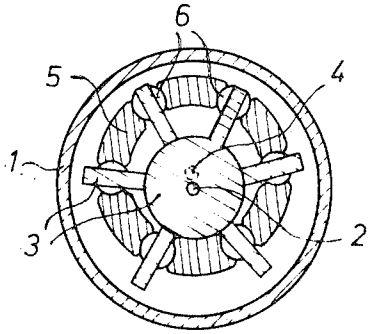


FIG. 3b

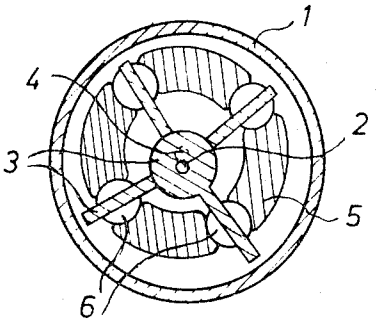


FIG. 4a

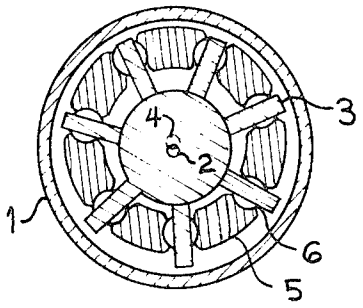


FIG. 4b

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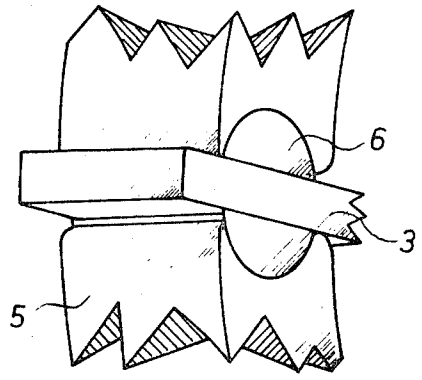


FIG. 6

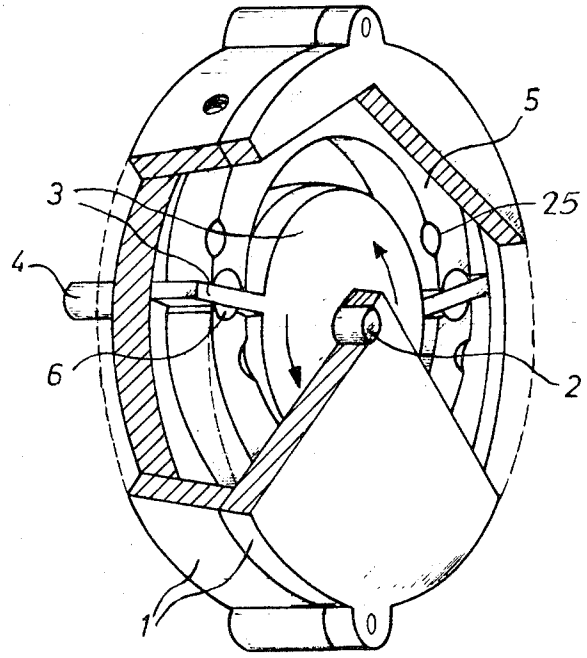


FIG. 7

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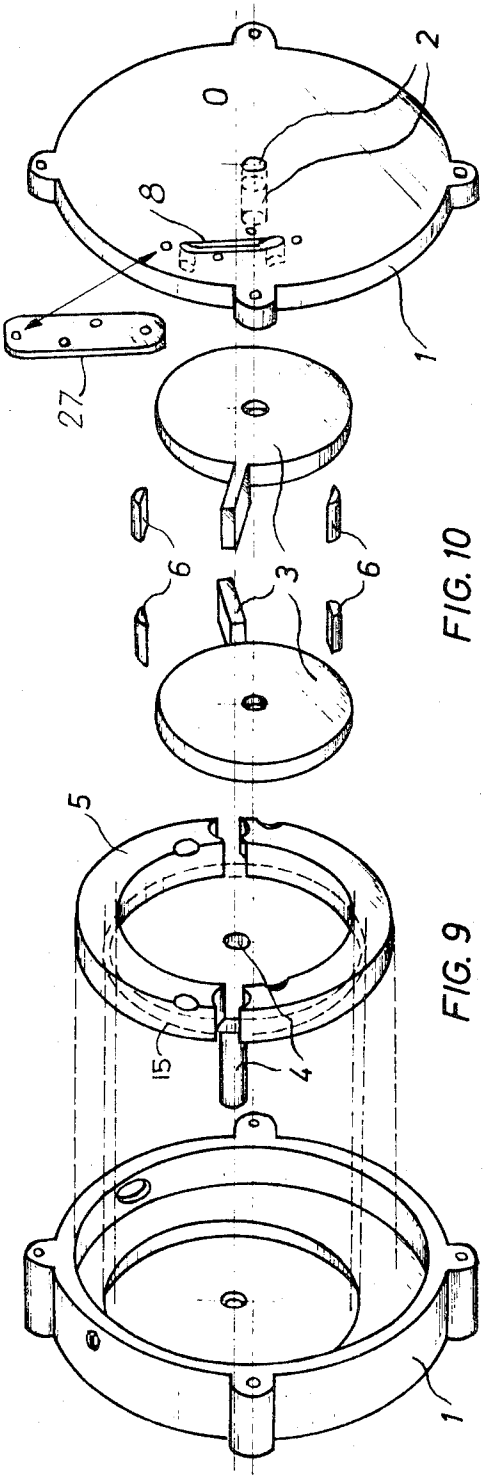


FIG. 11

FIG. 10

FIG. 9

FIG. 8

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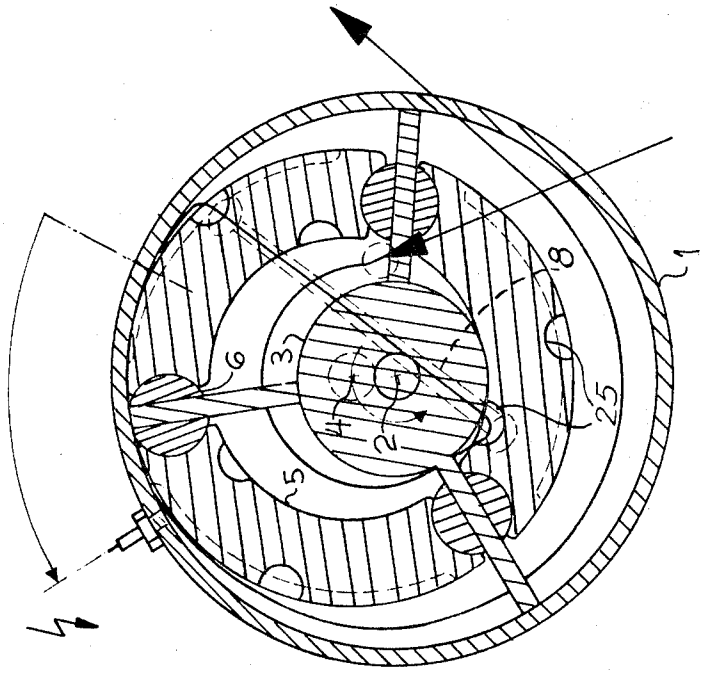


FIG. 13

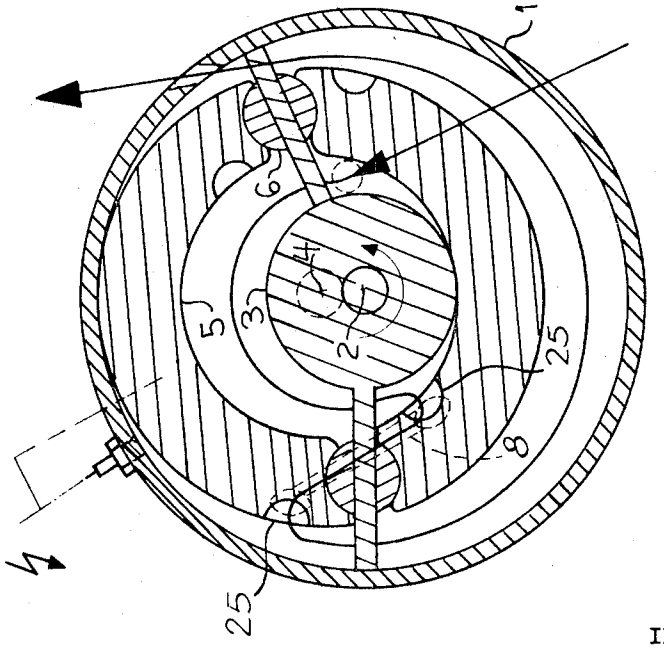


FIG. 12

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FIG. 15

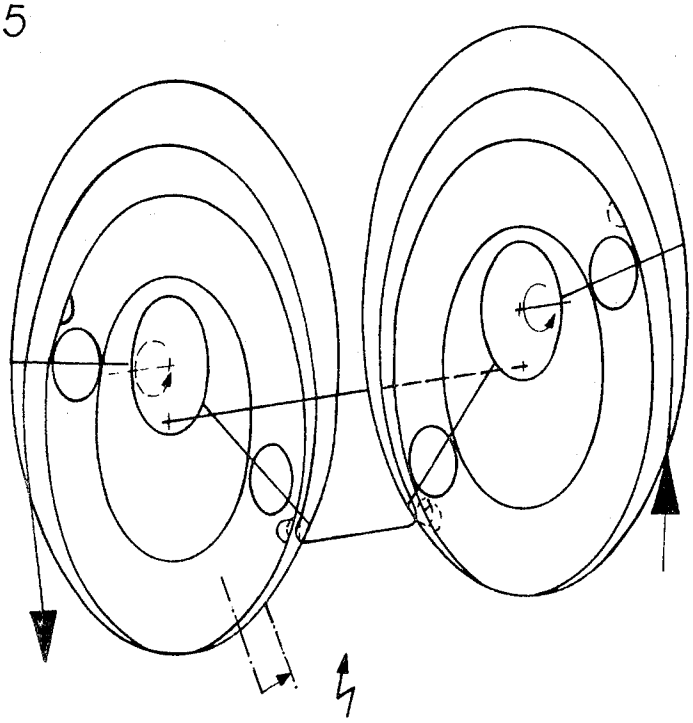
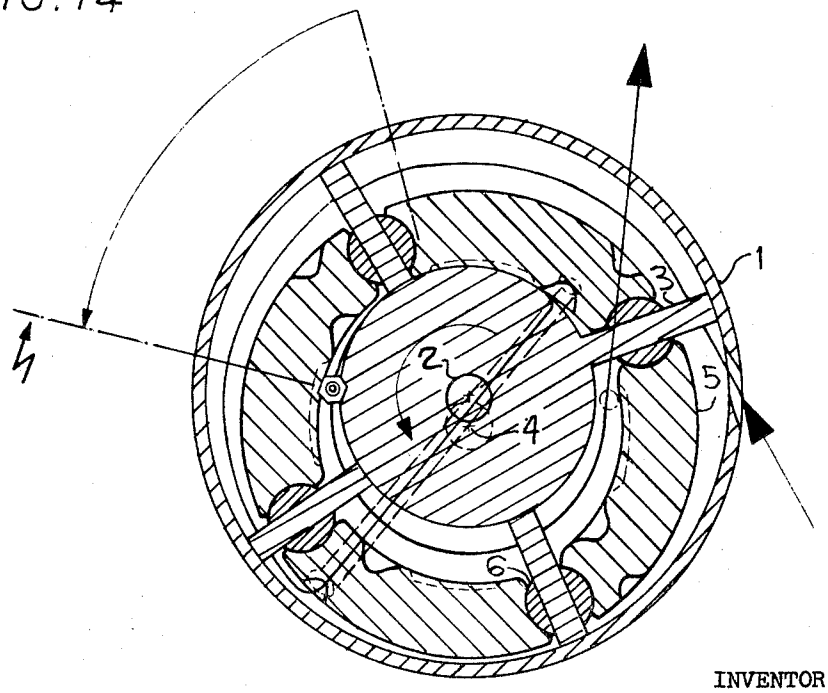


FIG. 14

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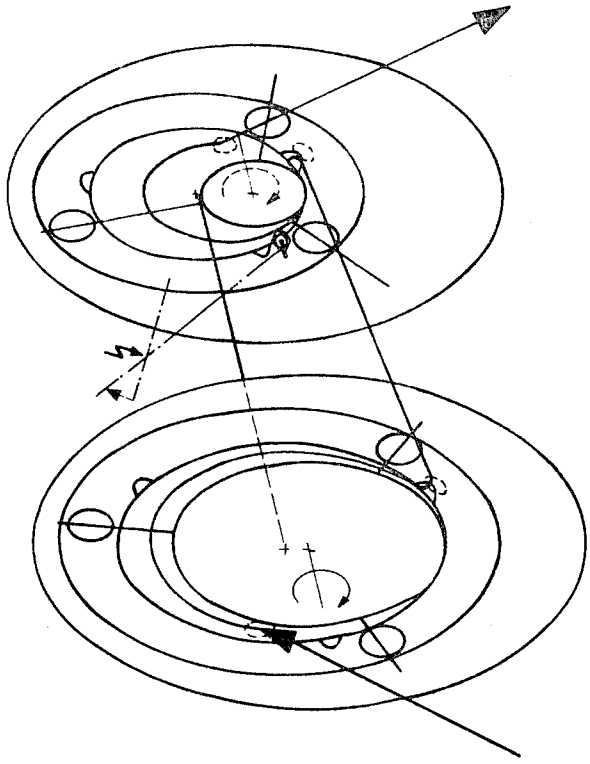

FIG. 16

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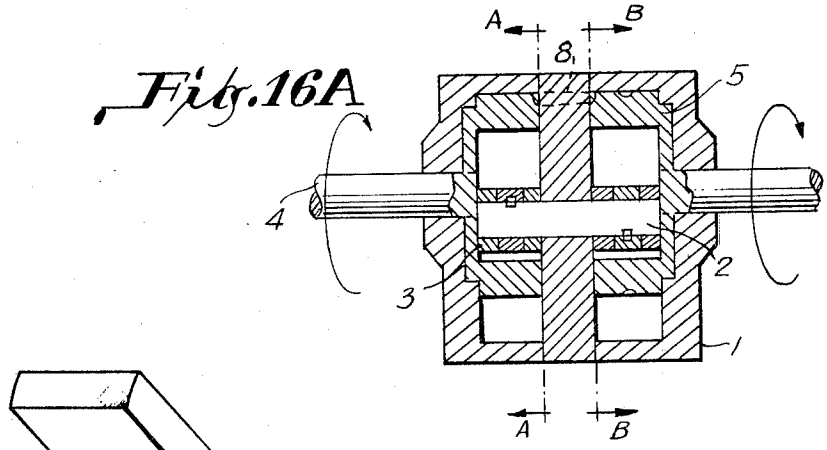
Fig. 16A



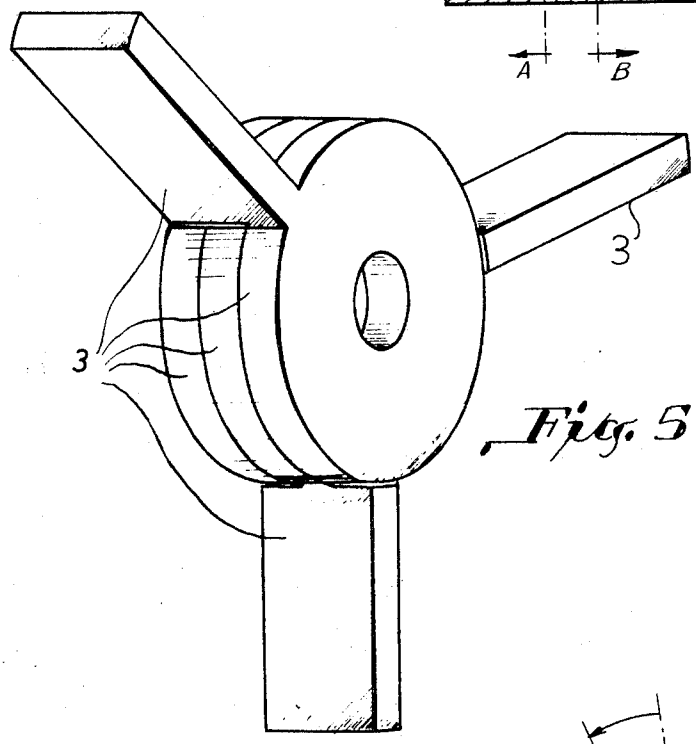
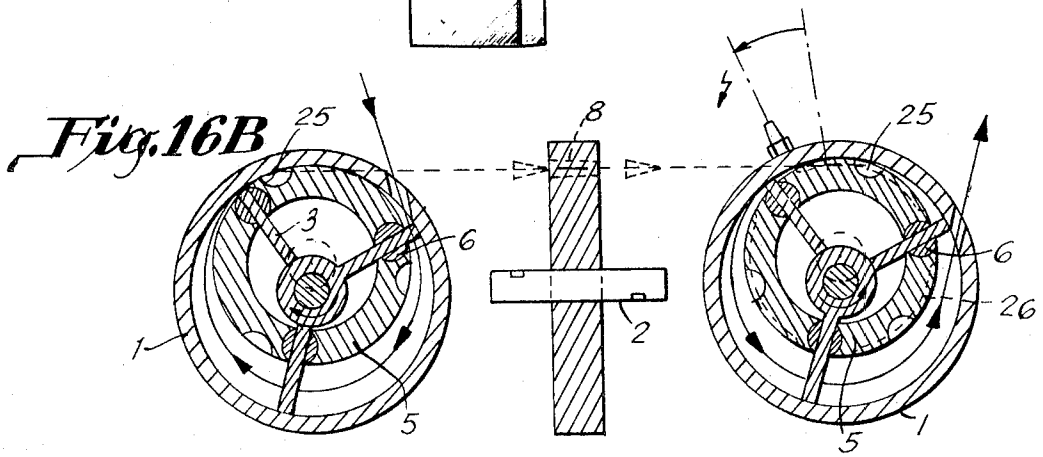




Fig. 5

Fig. 16B

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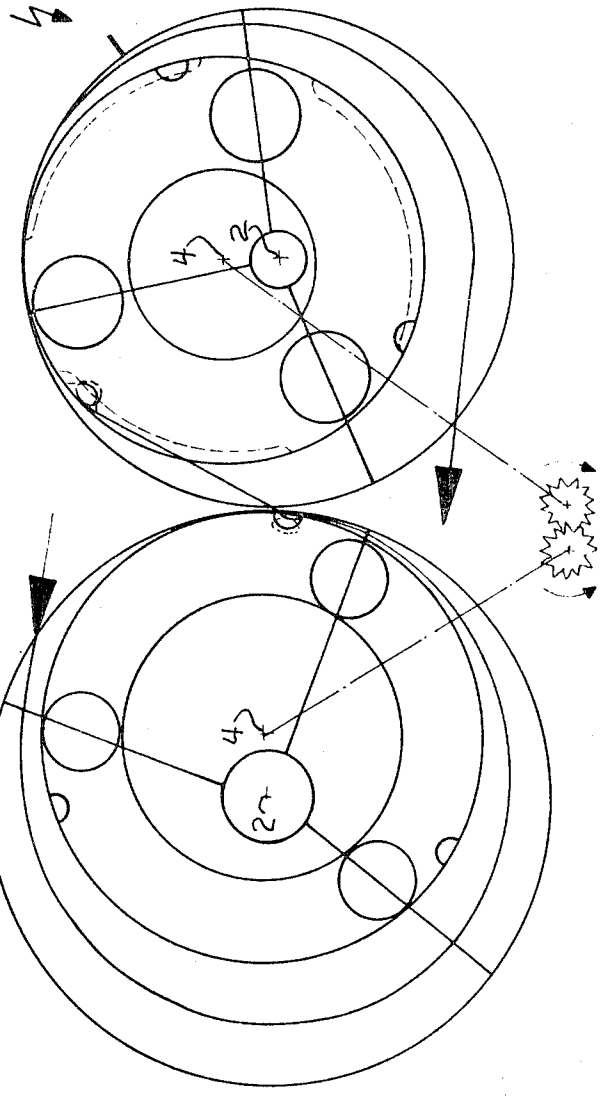

FIG. 17

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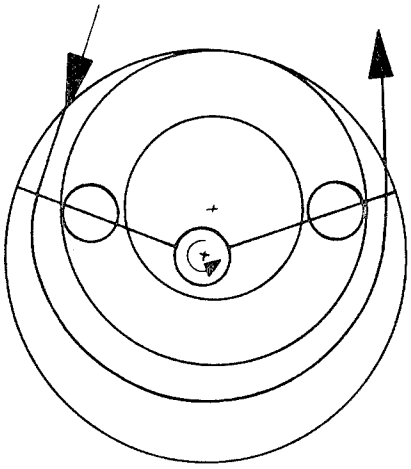

FIG. 18

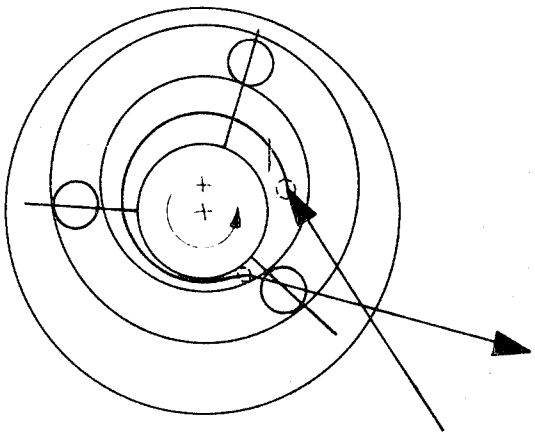

FIG. 19

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# ROTARY PISTON MACHINE

The present invention relates in general to a piston machine and more specifically to a rotary piston device which may be used for many different purposes, such as, for example, as a rotary piston motor or constructional element for gasoline carburetors; in a steam engine; or as a compressor, for example, for charging combustion devices; or as a pump.

The general advantages of the rotary piston device with respect to conventional stroke piston devices, and disc piston devices is well known. These conventional piston devices utilize different types of piston elements outside of the rotary piston device. These conventional devices are based on the eccentric movements of individual constructional elements which are not suitable for achieving the highest possible rotational speed. However, the technical differences between conventional piston devices and the rotary piston devices are not always clear and not standardized. The disadvantages of the conventional piston machines are based on the fact that the rotor is either guided eccentrically on its axis requiring a housing different from that of the cylindrical type machines such as troche drives, or the rotor is arranged with its axis eccentrically disposed with respect to the axis of the cylinder in the housing. In all of these instances, the rotor either moves away and engages the wall of the housing, or the rotor carries out a continual pivotal movement at the wall housing. In some instance, both of these movements are created. The so called clatter marks which are being created on the housing walls of the known pistons limit the number of revolutions and the performance of these machines. Moreover, a further disadvantage of conventional piston devices is that the seal formed by the engaging point between the rotor and the wall of the housing is defective since it is formed by a line, created by the pivotal movement of the rotor, instead of by a continuously even face. Further disadvantages of conventional piston machines result from the fact that because of eccentric movement of the rotor, counterweights have to be used for balancing the mass forces. However these counterweights are detrimental to the bearing load and to the overall function of the device. In other instances, the centrifugal forces which are created during the rotational movement of the rotor for sealing the moving integrated rotor parts at the wall housing are detrimental and often having a destroying effect beyond certain limitations. Furthermore, in all cases, it is technically not possible to change the ratio between the intake volume and the compression volume.

The problems associated with gas transfer control devices in known rotary piston apparatus makes them completely unsatisfactory in mechanical operation and function. This is particularly true with respect to internal combustion engines.

The operation of gas overflow or gas transfer from the compression chamber to the combustion chamber (expansion chamber) is usually handled in such a manner that the inlet port and the outlet port of the overflow channel are permanently open, similar to the carburetor and the exhaust in an engine (see German Pat. No. 248,070, and U.S. Pat. No. 3,181,510). However, this operation is disadvantageous because no substantial precompression force is available. There are more disadvantages inherent in the known engines where the piston is not sealed with respect to its housing, although by design, such a configuration increases the danger of a carburetor fire. In other known engines, the operation of the gas overflow from the compression chamber to the combustion chamber (expansion chamber) is carried out in the following manner. A control disc acts as a seal at the overflow channel. However, to seal the control disc with respect to the other engine parts creates different problems and requires additional mechanical parts which render the device expensive. Furthermore, an engine of that type is subject to frequent breakdowns.

Finally, it should be noted that the technical complexity of conventional devices render them impractical and expensive, because of the differences between the constructional elements for disc and rectangular profile, and particularly due to the fact that the rotor requires special mechanical control and constant maintenance. Devices similar to the ones described above failed to operate properly because it was found to be impossible to develop a multisectional rotor, essential for the proper functioning of the device. A multisectional rotor should provide constant contact faces unto the housing walls without transmitting centrifugal forces during axial movement of the rotor.



It is therefore an object according to the present invention to provide an improved rotary piston device which overcomes the above-mentioned disadvantages of conventional piston devices.

It is a further object according to the present invention to provide an improved rotary piston device which includes a rotor which is displaced by the simple movement of two elements around their own axis.

It is still a further object according to the present invention to provide an improved rotary piston device which is simple in design, easy to construct, and inexpensive in cost.

Other objects and features of the present invention will become apparent from the following detailed description considered in connection with the accompanying drawings which disclose several embodiments of the invention. It is to be understood however that the drawings are designed for the purpose of illustration only and not as a definition of the limits of the invention as to which reference should be made to the appended claims.

In the claims wherein similar reference characters denote similar elements throughout the several views:

FIGS. 1*a*—1*f*, FIGS. 2*a* and 2*b*, FIGS. 3*a* and 3*b*, and FIGS. 4*a* and 4*b* are various perspective views of two part, to seven part rotors having different dimensional rations;

FIGS. 5 and 6 are side views of two part, to seven part rotors in accordance with subject invention;

FIGS. 7—11 are perspective views of the inventive device showing the housing partly in cross section;

FIG. 12 illustrates the operation of the invention in the embodiment of a rotary piston in a gasoline carburetor, having a two part rotor shown in cross section;

FIG. 13 is an axial section of the invention in the embodiment of a rotary piston in a gasoline carburetor, having a three part rotor;

FIG. 14 is a cross-sectional view of the invention in the embodiment of a rotary piston in a gasoline carburetor, having a four part rotor, utilizing the outer chamber as the intake chamber, and the internal chamber as a combustion chamber;

FIG. 15 is a schematic view, showing the invention as a constructional element of a rotary piston in a gas carburetor with two elements arranged side by side;

FIG. 16 is a further embodiment of FIG. 15;

FIGS. 16A—16B further depict FIG. 16 more clearly where 16A shows a motor with two housings, in which the left housing is the compression chamber, and the right housing is the combustion chamber. FIG. 16B shows the views A and B of FIG. 16A;

FIG. 17 is another embodiment whereby the elements are connected in series with respect to each other;

FIG. 18 is still another embodiment of the invention in a steam engine having a two part rotor; and

FIG. 19 is a further embodiment of the invention in a steam engine having a three part rotor.

Referring to FIGS. 1*a*—1*f*, FIGS. 2*a* and 2*b*, FIGS. 3*a* and 3*b*, and FIGS. 4 and 4*b*, there is shown a rotor 3 which is disposed inside of a hollow cylindrical housing 1. Rotor 3 includes an axis 2 corresponding to the axis of housing 1 and is a rotary disclike cylindrical member held together in the center by a pivotable hinge. The rotor includes at least two extension arms having rectangularly shaped profiles. The rotor also includes cylindrical rim segments 5 which are guided around the cylindrical axis of rotor 3. Rim segments 5 include an axis 4 which is displaced parallel with respect to rotor axis 2. The casing of rim segments 5 encompass the center of rotor 3 and are perforated at their ends to receive the rotor extensions and

the guides thereof. It should be noted that the aforementioned elements form a rotatably movable unit. This unit seals the chambers formed inside and outside of the rim segments which are formed by the axial displacement. During the rotary movement of the rotor, the volume of these chambers is axially increased and decreased in sections. Intermittent connections can be made between the chambers because of the groovelike indentations 26 of the rim segments 5.

Rotor 3 and its extension arms extend principally to the internal face or walls of housing 1. Due to the central axial location of rotor 3, the rotor extension arms slide during each phase of the rotary movement, constantly along the internal contact face or walls of the housing. Rotor 3 is guided constantly and pivotably within rim segments 5 by means of segmentlike profiled joints 6, which are retained within perforated ends of the rim segments for sliding contact both sides of the rotor extension arms so as to guarantee a constant contact face with the internal face of the housing during each phase of the rotary movement of the rotor. In order to connect the segments of rim 5 to axis 4, the casing is provided with a cylindrical bottom part 15 (FIG. 9) which is inserted on the inside of one of the assembled housing parts of housing 1, for rotary movement. Cylindrical bottom part 15 of rim segments 5 form a part of the side face inside of one end of the housing so that it forms an even face with the housing so that axis 4 extends rearwardly out of the end of housing 1. Likewise, axis 2 of rotor 3 is guided through the other end of the housing so that the housing pivotably supports rotor 3.

The height of rim segments 5, the lengths of joints 6, and the height of rotor 3 at its center and on each end of its extensions correspond to the height of the internal cylinder formed by the inside of housing 1. The power transmission may be coupled out of the apparatus on axis 4 if axis 2 of rotor 3 is secured or affixed to housing 1. Likewise, the power transmission may also be coupled out of rotor axis 2 if rim segment axis 4 is secured or affixed to housing 1. The radially arranged perforations on the ends of rim segments 5 which serve to receive the rotor arms and joints 6 are displaced by the degree of the angle which results from axis 4 and 360/N, where N is the number of the rotating arms of the rotor.

When the invention is used in the embodiment of a rotary piston motor for gasoline carburetors, the distance between the center of the axis of rotor 3 and the center of the axis of rim 5 constitutes the difference between the outer radius of the rim casing and the inner radius of housing 1. The radius of the center of the rotor compares substantially to the difference between the outer radius of the rim casing and the width of the rim casing. Furthermore, rim 5 comprises bevels 25 on the face opposite to the bottom face at defined places at the inner and outer casing face. Also, the rim may comprise at the face, adjacent to the bottom thereof, a groovelike indentation 26 outside of the bevel 25 at the outer casing face, so that in a defined axial position, the beveled face of the outer casing face and the beveled face of the inner casing face and the perforations which are arranged at the bottom correspond in a turntable fashion with two perforations in each sidewall of the housing parts connected by an overflow chamber (see FIG. 11). The overflow chamber is provided in the outer face of the housing wall in form of a groove and is closed with a cover plate 27. The number of beveled faces in the casing, or the perforations on the bottom of rim 5 are defined by the number of the rotor parts which are displaced in the measurements of their uniformity in a degree which results at axis 4 of rim 5 from 360/the number of the rotor parts.

The chamber, which is located outside of rim 5, is sufficient for the operation of the device, for the embodiment of the invention which serves as, a constructional element of a rotary piston motor for gasoline carburetors, a steam engine, a compressor, and a pump. Therefore such a constructional element does not include a beveled face at the inner face of the casing of rim 5 or employ perforations at the bottom thereof or perforations at the sidewall of housing 1, even though the basic construction remains the same. In this embodiment, the overflow chamber is connected to the chamber outside of rim 5 of the construction element which in turn is connected with further constructional elements in a nonpositive side-by-side arrangement, or in series with respect to each other. In this embodiment, the inner chambers may be used instead of the outer chambers if required. In the steam engine, the compressor, and in the pump arrangements, beveled faces or perforations in rim 5, or in the sidewalls of housing 1 are not necessary, since an overflow chamber is not needed.

It should also be noted that no particular measurement ratios are needed for the radius of the rotor center or the width of rim 5 for the constructional element of a rotary piston motor for gasoline carburetors, in the steam engine, in the compressor and in the pump arrangements.

Depending on the purpose of use and the arrangement of the device, the inlet and outlet perforations of housing 1 can be arranged differently. Also, in certain embodiments, it may be necessary to include groovelike indentations 26 on the casing face of rim 5 between the extensions. These grooves correspond to depressions which are commonly found in conventional rotary and disc type piston motors. Outfitting the device with conventional sealing elements, such as piston rings, etc., and sliding or roller bearings is commonly known. On the other hand, these conventional sealing means do not create any problems, because of the simplicity of the invention whereby each type of contact line is replaced by constant contact faces, so that conventional sealing parts of the aforementioned parts may be readily used for the subject invention. Since these sealing means are commonly known and do not constitute a part of the subject invention, they have not been shown in the drawings. Likewise, the water jacket encompassing the piston housing for cooling the device was also omitted, as well as the drive elements, the spark plugs, and the carburetor, so as to provide a better understanding of the invention.

FIG. 7 shows a schematic view of the entire invention with housing 1 in cross section. FIGS. 8—11 show an exploded view of the individual parts of one rotary piston motor for gasoline carburetors with a two part rotor 3, so that power transmission is carried out via rim axis 4. Axis 2 of rotor 3 is mounted fixedly in housing 1. In this particular embodiment, the inner chamber is the intake chamber while the outer chamber serves as the combustion chamber. These views also show that the beveled faces at rim 5 serve to control the overflow chamber located in the housing part which carries rotor axis (see FIG. 11) 2. The two circularlike arrows in FIG. 7 indicate the rotary movement of rotor 3. The reference characters of the various elements correspond to the ones previously mentioned in the specification.

FIG. 12 shows another embodiment of the invention in a rotary piston motor for gasoline carburetors having a two part rotor shown in axial section by using the inner chamber as an intake chamber, and the outer one as the combustion chamber. The arrow at the axis of the rotor indicates the direction of movement of the rotor. The arrows which are only interrupted by the two extensions of the rotor indicate the direction of the gas movement from the intake chamber to the outlet chamber. The working phases of "intake" and "compression" within the confines of the chamber inside of the rim can be seen, as well as the "overflow" of the gas from this chamber to the chamber outside of the rim in which the "combustion" as well as the "exhaust" phases take place. The inlet consists of a perforation in the sidewall of one of the two housing parts. There are two ignition firings per axial movement. The drawing shows the axial position shortly before ignition since the overflow channel is still opened on the beveled face of the rim.

FIG. 13 shows still a further embodiment of the invention in a rotary piston motor for gasoline operation having a three part rotor, shown in axial section, by using the inner chamber as intake chamber and the outer one as a combustion chamber. In contrast to the operation of all the aforementioned embodiments, this particular embodiment comprises a

further operational step, namely a "post compression" stage which follows shortly after the initial "compression" stage. The "post compression" stage is achieved by changing the overflow chamber. The rim is thus provided with a groove on its outer face, between the rotor extensions, which is similar to the depressions found in rotary and disc type pistons. For each axial movement of the rotor, 3 ignitions take place. An axial position of approximately a 60° angle is shown in the drawing prior to ignition.

FIG. 14 shows the subject of the invention utilized as a rotary piston motor in a fuel carburetor having a four part rotor (axial section) wherein the outer chamber is employed as the intake chamber, and the inner one as a combustion chamber. The operation of this device corresponds to the operation of the above-described devices.

FIG. 15 shows schematically the subject invention and the operation thereof as a functional or constructional element of a rotary piston motor for fuel carburetors. This embodiment shows the side-by-side arrangement of two constructional elements to form a rotary piston motor. Each constructional element comprises a two part rotor. The rims of these rotors are connected with each other by one axis. Since the inner chamber is not needed for the operation of the device in this embodiment, the radius of the center of the center of the rotor, and the width of the casing of the rim need not be in a special relationship to each other. The dimensions of these constructional elements with respect to each other is optional and have been shown to have the same dimensions with respect to each other for the purposes of illustration only. The intake may be provided in this embodiment in the form of a perforation in the casing of the housing. The drawing shows the working phases of "intake" and "compression" outside of the rim chamber of the right constructional element. The "overflow" is shown from the right chamber to the left one. In reality, the "overflow" takes place through the axially arranged constructional elements which are arranged in series with respect to each other, so that the "combustion" and the "exhaust" stages take place in the left chamber outside of the rim. The axial position is shown prior to ignition. All the reference characters in the drawing are the same as in the aforementioned embodiment.

FIG. 16 shows schematically the subject of the invention in the form of a constructional element of a rotary piston motor for fuel carburetors. The embodiment as shown is a constructional element comprised of two elements in a side-by-side arrangement forming a rotary piston motor. Each of the two constructional elements has a three part rotor. In this particular embodiment, the two rim axes are connected with each other. However, it should be noted that only the inner chamber of each constructional element is used for the operation of the device.

FIGS. 16A and 16B show the side-by-side arrangement discussed in FIG. 16. As rotor rim 5 rotatably turns, the overflow channel 8 permits coacting between the right housing (combustion chamber) and the left housing (compression chamber). Each rotor is internally secured about shaft 2, while power is tapped off of external shaft 4.

The height ratios of both constructional elements as well as the individual constructional parts are optional and are purposely shown in different dimensions in this drawing. Their mode of operation corresponds to the aforementioned devices. The spark plug seats, the inlet, and the outlet are arranged on the sidewall of the housing.

FIG. 17 shows schematically a further embodiment of the invention as a constructional element for a rotary piston motor for fuel carburetors whereby the elements are arranged in series with respect to each other forming a rotary piston motor. Each of the two constructional elements comprise a three part rotor. Since the axes are radially disposed because of the series arrangement, a nonpositive coupling of two even axes is needed for controlling the motor. This coupling is schematically shown, so that the two rim axes are shown in the form of two connected cogged wheels, whereby the arrows indicate the counterclockwise movement of the axes involved. Moreover, the dimensions of the radius of the rotor center, and the width of the casing may be optionally established, and are shown to correspond, because the chambers within the rim are not needed for the operation of the device. In order to demonstrate the multitude of applications of the subject invention, the dimensions of the two constructional parts as well as the individual parts with respect to each other are shown having different dimensions.

The construction shown on the left side of FIG. 17, connected to the right side of the constructional element, the larger of the two elements, provides for the "intake" and the "combustion" stages of the device. Because the dimensions of the connected constructional element are optional, and in view of the theoretically unlimited intake volume, the device may serve as a compressor for charging the connected constructional element in which, after the "overflow" of the gas as shown in the drawing, the "post compression," the "combustion," and the "exhaust" stages are carried out in the overflow chamber. The operational function of the device from inlet to outlet is indicated by the arrows, showing the actual flow of the gas. As already discussed with respect to FIG. 13, groovelike indentations are provided to take care of the additional working phase of "post compression." The grooves are provided at the outer casing of the rim between the extensions of the rotor.

FIG. 18 is a schematic view of a further embodiment of the invention in the form of a steam engine, a compressor, or a pump, with a two part rotor, using the outer chamber as a working chamber. No beveled faces are needed on the rim and the overflow channel. The outer chamber serves as the working chamber and the embodiment functions similarly with respect to the previously discussed embodiment.

FIG. 19 is a schematic view of another embodiment of the invention for a steam engine, a compressor, or a pump, with a three part rotor using the inner chamber as the working chamber. Again the simplicity of the device need not be discussed in detail.

In conclusion, the improvements of the subject invention reside in the fact that the central arrangement of the rotor in the housing permits an optimal and friction free device due to the constant contact faces which maintain a complete seal.

The subject invention therefore provides a device which is simple, inexpensive and requires very little maintenance of its parts, because of its free pivotal and easy operation which results in better performance, permitting the use of circular and rectangular constructional profiles.

While only a few embodiments of the present invention have been shown and described, it will be understood that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

I claim:

1. An internal combustion rotary piston apparatus comprising;

a hollow cylindrical housing;

at least two rotary pistons, rotatably and eccentrically positioned within said housing so as to form compression and combustion chambers as said rotary pistons revolve with respect to said housing;

a plurality of wing-shaped pistons forming a chassis on which each of said rotary pistons is secured;

a shaft disposed concentrically with respect to said housing having one end fastened to said rotary pistons; and

an overflow channel having an inlet and an outlet port positioned along the inside surface of said housing so that said channel connects the compression and combustion chambers in a manner so as to cooperate with said wing-shaped pistons so that the said inlet and outlet ports of said overflow channel are opened at the time when each of said compression and combustion chambers reach a certain volume.

2. An internal combustion rotary piston apparatus as recited in claim 1, wherein each of said rotary pistons comprise at

least one notch on their outer surface and arranged in such a manner as to cooperated with said wing-shaped piston so that said inlet and outlet ports of said overflow channel are opened at a time when the compression and combustion chambers reach a certain volume.

3. An internal combustion rotary piston apparatus as recited in claim 1 comprising;

a compression chamber internally and radially disposed inside each of said rotary pistons;

a combustion chamber arranged outside and radially with respect to each of said rotary pistons; and

a plurality of bevels disposed on the outside periphery of each of said pistons in order to open said inlet port in a rotary manner shortly before one of said wing-shaped pistons reaches said port at the radial internal edge of said rotary piston.



4. An internal combustion rotary piston apparatus as recited in claim 1 additionally comprising;

a left and right housing, wherein said left housing is a compression chamber, and said right housing is a combustion chamber; and

a port connecting both housings in a manner so as to provide cooperation between the gas in said compression chamber and said combustion chamber.

5. An internal combustion rotary piston apparatus as recited in claim 1 comprising a plurality of groovelike indentations disposed at the outer radial edges of each of said pistons, so that said overflow channel acts as a connection between said combustion chamber and said compression chamber.