# United States Patent

[11] **3,612,735**


[72] Inventor **Anthony Graham**
**Go Home Bay, via Penetang, Ontario, Canada**



[21] Appl. No. **839,442**
[22] Filed **July 7, 1969**
[45] Patented **Oct. 12, 1971**
**Continuation-in-part of application Ser. No. 743,234, July 8, 1968, now Patent No. 3,453,992.**


[54] **ROTARY ENGINE**
**1 Claim, 2 Drawing Figs.**


[52] **U.S. Cl.** ..... **418/189,** 418/191
[51] **Int. Cl.** ..... **F02b 55/16,** F01c 1/08
[50] **Field of Search** ..... 123/13 B; 103/125; 230/150; 91/81, 87; 418/183, 191, 189, 190



[56] **References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 713,443 | 11/1902 | Jewell | 91/87 |
| 1,207,306 | 12/1916 | Lestak | 91/87 X |
| 2,690,869 | 10/1954 | Brown | 230/150 |
| 3,453,992 | 7/1969 | Graham | 123/13 B |

FOREIGN PATENTS

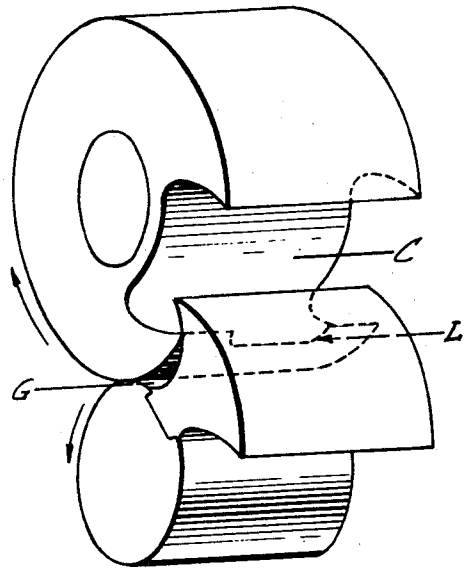
| | | | |
|---|---|---|---|
| 755 | 3/1867 | Great Britain | 91/87 |
| 289,359 | 10/1931 | Italy | 123/13 B |



*Primary Examiner*—Allan D. Herrmann
*Attorney*—John Cyril Malloy



**ABSTRACT:** A rotary-type device having a piston rotor and a ceiling rotor for companionate engagement one with the other on rotation of the same and a housing for the rotors, the piston rotor having a piston with a trailing face adapted to coact cyclically with the trailing edge of a gap in the ceiling rotor into which the piston penetrates on each rotation, with the trailing face of the piston being characterized by a curve which maintains a close labyrinth-type seal as the edge of the gap sweeps across the trailing edge of the piston, the lateral profile of the piston being characterized by a curve such that, where a first circle is defined by a first point on the edge of the ceiling rotor rotating about the center of rotation of said rotor; where a second circle is defined by a second point on the outer surface of the piston rotating about the center of rotation of the piston rotor; where the line joining centers of rotation of said rotors is of such a length that the circles overlap and the circumferences cut said line; where the circles rotate at a constant ratio of rotation in opposite directions; said face curve is the path taken by said first point from its entrance into said second circle to its intersection with said line.

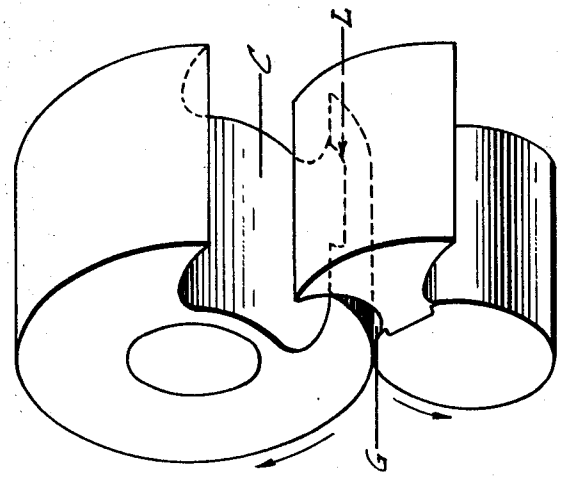



Fig. 2

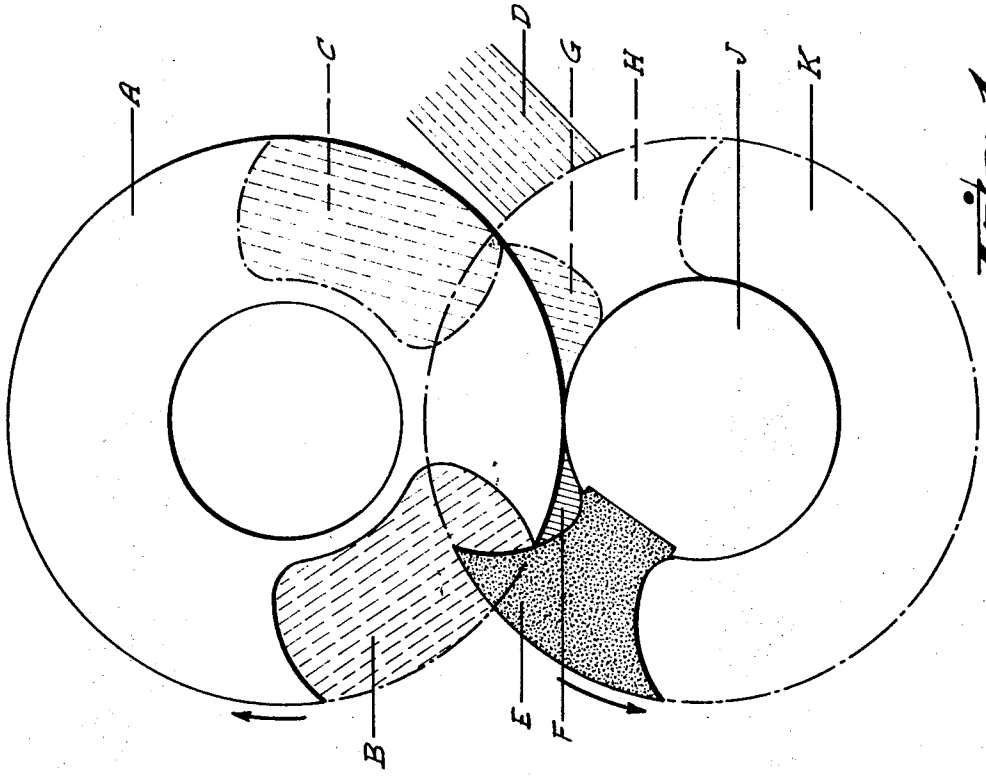



Fig. 1

INVENTOR.
ANTHONY GRAHAM
BY John Cyril Malloy
ATTORNEY.

# ROTARY ENGINE

This is a continuation-in-part of application Ser. No. 743,234 filed July 8, 1968, now U.S. Pat. No. 3,453,992 issued July 8, 1969.

This invention constitutes an improvement and a continuation application for Letters Patent on an improvement especially for use with my improved rotary-type device disclosed and claimed in my U.S. Pat. No. 3,453,992 dated July 8, 1969 for Rotary Type Device and especially constitutes an improved means for excluding exhaust gases from the working chamber of a rotary-type engine when the fresh charge is admitted.

It will be appreciated that in rotary-type engines it is important to have a small amount of gas present so that there is in effect little or no gas present in the working chamber at the time when the fresh charge is introduced so that there is maximum room for the fresh charge and the maximum amount of fresh charge may be introduced into the working chamber. This contributes to maximal engine output. Also, because a fresh charge is in this manner not mixed with burned charge from the previous expansion stroke, there is a relatively higher percentage of oxygen in the charge during combustion, which in turn is conducive to more complete combustion and a corresponding reduction in noxious emission gases, it having been found that incomplete combustion results in part from inefficient scavenging among other things.

It is, accordingly, an object of this invention to provide an improved rotary engine or rotary device configured and defined to reduce noxious emission products.

It is another object of this invention to provide a rotary engine which includes a relatively long expansion stroke relative to conventional designs which provides for more complete combustion and which includes improved scavenging means. The reader is referred to the description and drawings of U.S. No. 3,453,992 dated July 8, 1969 which are incorporated herein by reference and made a part hereof.

FIG. 1 is a partial elevation view illustrating the intermating relation of the piston relative to the gap of the sealing rotor; and

FIG. 2 is a perspective view of the sealing rotor in relation to the piston rotor of FIG. 1.

Referring to FIG. 1, it is seen that an oppositely turning sealing rotor A is illustrated in relation to a piston rotor provided with a piston E. The sealing rotor is provided with a gap B in the periphery in the position designated by the letter B; for purposes of description hereinafter, this gap is also shown in the position C.

As will be apparent from my patent and the other patents in the art, it is conventional to provide a stator or housing with chambers to accommodate the rotors and to provide axes or rotation for them so that the outer abutment-type sealing rotor or rotary valve A is adapted for close tolerance rotation to effect a labyrinth-type seal with the stator walls. The piston rotor is configured to mate with the sealing rotor and includes a toroidal recess in the piston rotor periphery and into which a radially extending piston E extends. By suitable drive means the rotors rotate preferably in opposite directions of rotation at a common ratio of rotation. The profile of the piston face which provides the smooth sealing passage of the sweeping surface of the leading piston face and the gap edge is described in my copending patent application, now U.S. Pat. No. 3,453,992. In this improvement the configuration of the trailing edge of the piston is constructed similar to the leading edge of the piston element in my copending patent and FIGS. 1 and 2 illustrate the cooperation of the trailing or rear face of the piston and the trailing gap edge to exclude exhaust gases from the working chamber just prior to the injection of fresh fuel-air mixture. Referring to these sketches, the operation will be described.

Referring to the piston, it is seen that it is designated by the letter H which is employed to designate the piston element as it begins to penetrate into the gap in the sealing rotor A when the gap is in the companionate position shown and designated in FIG. 1 by the letter C. As the piston H effectively shuts off



an exhaust duct designated by the letter D, the flow of exhaust gases through the duct is temporarily interrupted and residual exhaust gases are trapped between the leading face of the piston H and the periphery of the sealing rotor A. Because the leading edge of the sealing rotor gap follows the leading edge of the piston in a close sweeping manner, the residual gases would be compressed between the mating parts were there not some escape route for the gases provided. Such an escape route is provided in the leading edge of the sealing rotor gap in the form of a cutout or notch L shown in FIG. 2. This cutout or passage connects the diminishing space G of FIG. 1 ahead of the advancing piston with the gap C in the sealing rotor A. After the leading edge of the sealing rotor has fully swept down the leading face of the piston, virtually all of the exhaust gas ahead of said piston has been shunted in the gap C where they remain until passage of the trailing edge of the gap across the rear piston face, as will be explained. It will be noted that the port of the exhaust duct D has been disclosed by the piston again, behind it. Once the piston has rotated a little further into the gap, the trailing edge of the gap comes close to the lower part of the rear piston face and proceeds to sweep up said rear piston face as the piston continues to revolve coordinately with it. The rear face of the piston, it will be seen, is particularly configured similarly to the configuration of the leading face described in U.S. No. 3,453,992; that is, to effect a substantial gas-type seal as the trailing gap edge sweeps across the trailing piston face. The exhaust gases which are entrapped in the sealing rotor gap are effectively excluded from the volume F shown in FIG. 1 now enlarging behind the piston. To the extent that the seal between the trailing edge of the sealing rotor and the rear face of the piston as well as between the drive shaft and the sealing rotor perimeter approaches perfection, a vacuum is created in the space enlarging behind the piston. With a slight further rotation of the piston which is now designated E for this portion of the description, a port, not shown, in the lateral wall of the working chamber, not shown, will be disclosed and a fresh charge of air-fuel mixture will be introduced into the enlarging space behind the piston through this port. Other suitable means for introducing air and fuel mixture into the space F may be provided. By having the rear face of the piston curved for sealing relation with the gap edge as in U.S. Pat. No. 3,453,992, to cooperate with the trailing edge of the sealing rotor gap, it is possible to exclude most all exhaust gases from the working chamber when the fresh charge is admitted. This has the effect of removing all gas other than the fuel mixture being introduced and to discharge partially combusted gases. It is thus seen that an improved scavenging type as the expansion chamber K revolves on rotation of the drive shaft J for the piston. It will be helpful to refer to the description of the profile of the leading face of the piston in U.S. Pat. No. 3,453,992. Generally, the trailing piston face has a lateral profile which is defined by a face curve generated thus: where a first circle is defined by a first point on the edge rotating about the center of rotation of the rotor, where a second circle is defined by a second point on the outer surface of the piston rotating about the center of rotation of the piston rotor; where the line joining centers of rotation of the rotors is of such a length that the overlap and the circumferences cut the line, where the circles rotate at a constant ratio of rotation in opposite directions, the face curve is the path taken by the first point from its entrance into said second circle to its intersection with the line. In other words, the trailing face of the piston rotor is configured such that it cooperates with the trailing gap edge of the gap in the sealing rotor which accommodates passage of the piston element in a manner similar to that of the cooperation between the leading face of the piston and the leading gap edge in U.S. Pat. Pat. No. 3,453,992.

What is claimed is:

1. In a rotary engine including a piston rotor including a radially extending piston having a trailing face, a sealing rotor having a gap in circumferential surface with a trailing edge to cyclically sweep over said piston face, said rotors having

coplanar axes and arranged for simultaneous cyclical rotation in close, labyrinth-type sealing relation with a housing and for passage of the piston through the gap companionately, said trailing piston face having a lateral profile designated by a first curve generated thus:

a. where a first circle is defined by a first point on said edge rotating about the center of rotation of said rotor;

b. where a second circle is defined by a second point on the outer surface of the piston rotating about the center of rotation of the piston rotor;

c. where the line joining centers of rotation of said rotors is of such a length that said circles overlap and the circumferences cut said line;

d. where the circles rotate at a constant ratio of rotation in opposite directions;

e. said face curve is the path taken by said first point from its entrance into said second circle to its intersection with said line;

means interconnecting said rotors for rotation of the same in opposite directions of rotation at a constant ratio of rotation to cyclically sweep said edge over said face in sealing relation, said piston having a leading piston face which is configured oppositely as a mirror image to that of the trailing face having a lateral profile defined by a face curve generated with respect to said trailing piston face, and the gap in the sealing rotor is provided with a leading edge to cyclically sweep over said leading piston face and the leading edge of the gap having a cutout for fluid flow communication between the gap and the diminishing volume between the leading piston face and the rotor on sweeping passage of said leading edge over said leading piston face.