July 27, 1948. R. K. GARNUCH 2,445,877

INTERNAL-COMBUSTION ROTARY MOTOR

Filed Nov. 15, 1946 3 Sheets-Sheet 1

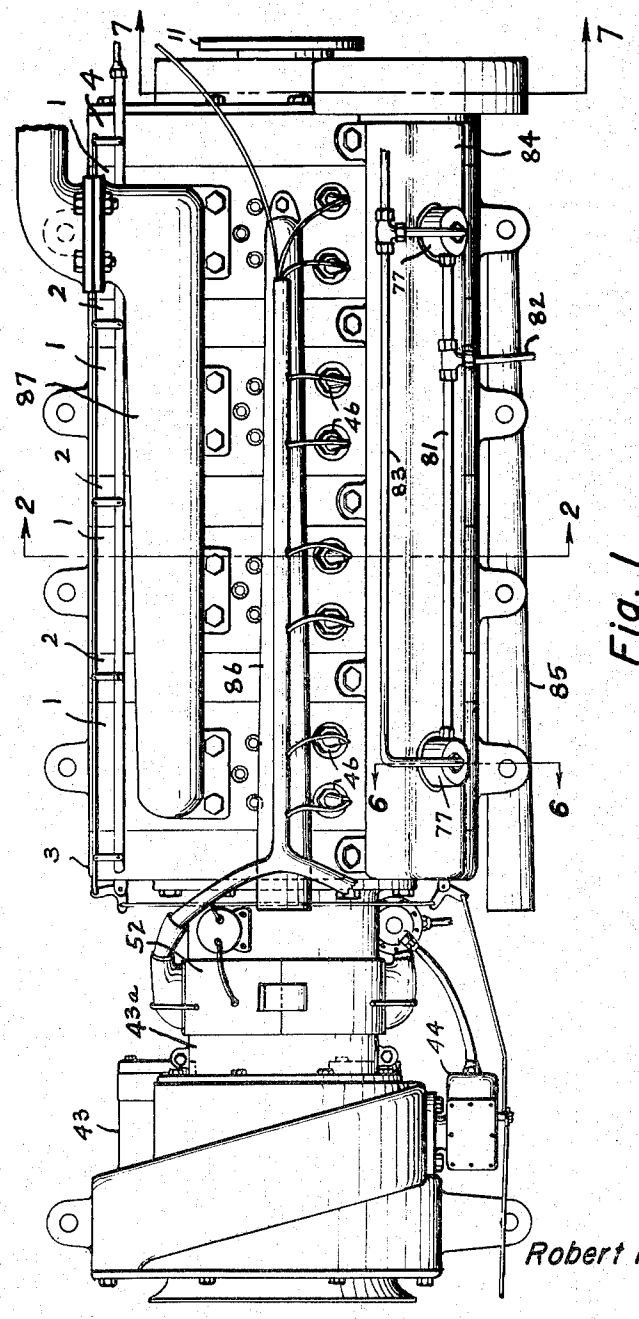


Fig. 1

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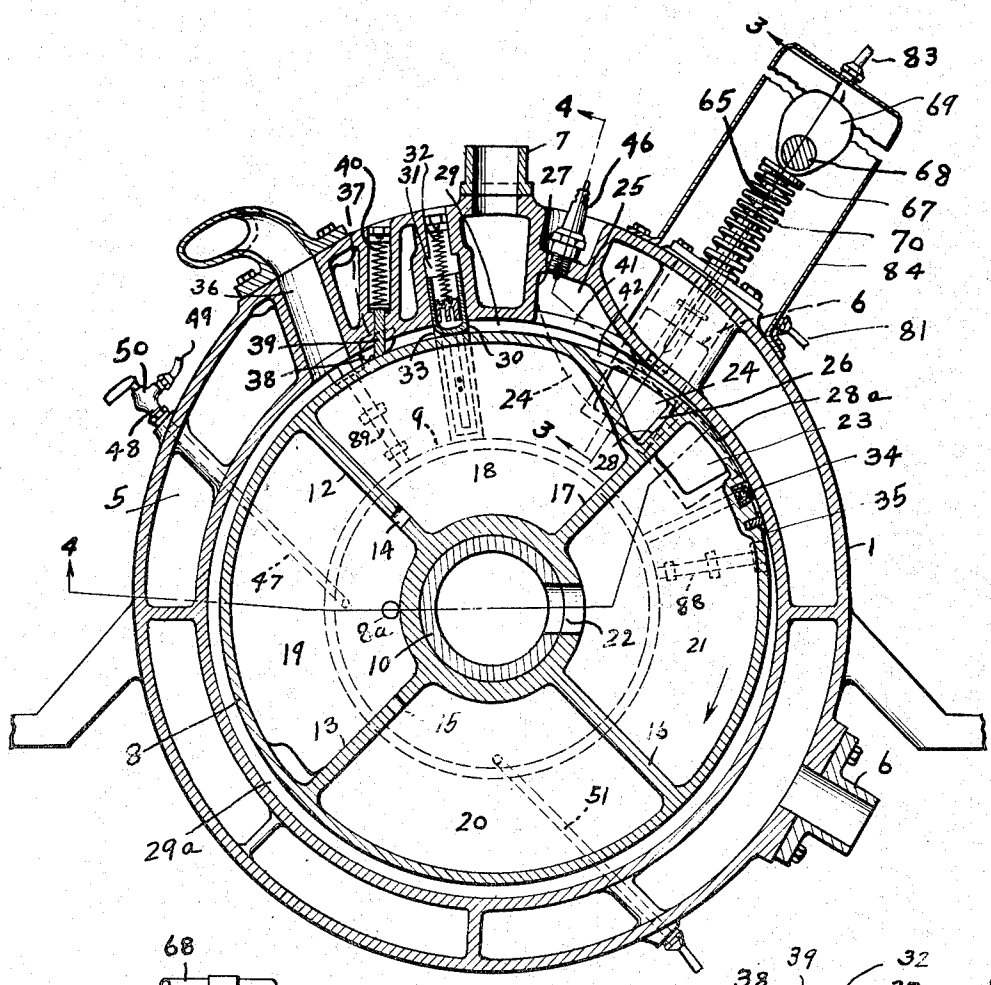


Fig. 2

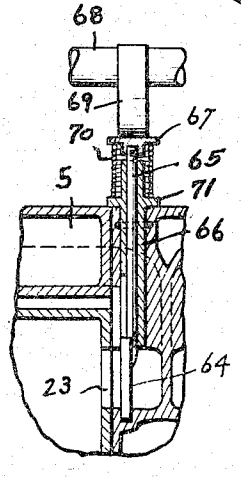


Fig. 3

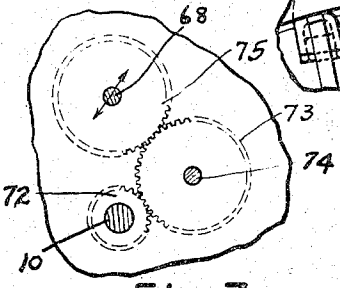


Fig. 7

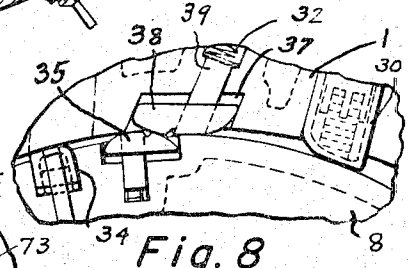


Fig. 8

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INTERNAL-COMBUSTION ROTARY MOTOR

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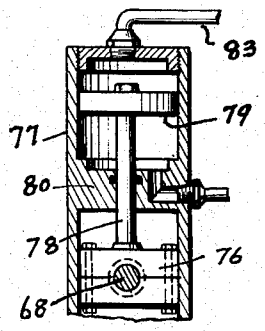


Fig. 6

Fig. 4

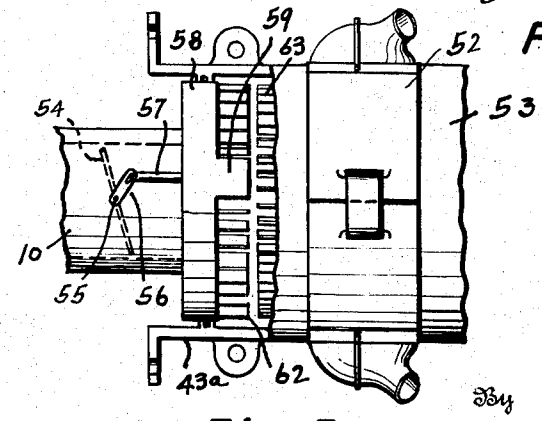


Fig. 5

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INTERNAL-COMBUSTION ROTARY MOTOR

Robert K. Garnuch, Houston, Tex.

Application November 15, 1946, Serial No. 710,169

6 Claims. (Cl. 123—14)

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This invention relates to an internal combustion rotary motor.

An object of the invention is to provide a motor of the character described having a novel arrangement of the combustion chamber therein.

Another object of the present invention is to provide an internal combustion rotary motor having an internal combustion chamber and a compression chamber associated therewith the volume of which gradually increases, as the rotor revolves throughout a major portion of the rotation of the rotor.

It is another object of the present invention to provide a motor of the character described equipped with a novel type of lubricating means.

It is a further object of the present invention to provide a motor of the character described equipped with means for scavenging the external surface of the rotor and the internal walls of the motor casing.

A still further object of the invention is to provide an internal combustion rotary motor wherein the motive fuel passes through the rotor into the combustion chamber to preheat the fuel and cool the rotor.

A still further feature of the present invention resides in the provision of means for controlling the intake of the motive fuel for controlling the ratio of the explosions with relation to the rotations of the rotor.

Other objects and advantages will be apparent from the following specification which is illustrated by the accompanying drawings, wherein:

Figure 1 is a plan view of the motor.

Figure 2 is an enlarged, cross, sectional view taken on the line 2—2 of Figure 1.

Figure 3 is a fragmentary sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a fragmentary sectional view taken on the line 4—4 of Figure 2.

Figure 5 is a fragmentary, plan view, partly broken away as viewed on the line 5—5 of Figure 4.

Figure 6 is an enlarged, fragmentary, sectional view taken on the line 6—6 of Figure 1.

Figure 7 is an elevational view, partly in section, of the valve controlling gearing taken on the line 7—7 of Figure 1, and

Figure 8 is a fragmentary, end view of a rotor showing also the coacting part of the corresponding casing 1.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numerals 1 designate similar rotor casings, four being

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shown in assembled relation and which are separated by the similar partitions 2 and which are enclosed by similar end caps 3 and 4. This assembly constitutes the motor case. This motor case has the connected water circulating chambers which are indicated throughout by the numeral 5. There is an inlet 6 and a discharge 7 providing for the circulation of a cooling fluid throughout the motor case and the partitions thereof.

Within each rotor casing 1 there is a rotor 8. These rotors are of similar construction. Each rotor is sealed, on each side, from the adjacent parts of the case, by means of the annular seal rings 9, 9.

The rotors 8 are splined, or otherwise secured to, the shaft 10. That portion of the shaft extending through the rotors is hollow, as shown in Figures 2 and 4, and as illustrated in Figure 1, the closed end of the shaft has a flange 11 thereon for connection to the shaft, or other part to be driven. Each rotor is hollow and is provided with the longitudinal radial partitions 12 and 13, provided with breather openings 14 and 15 therein, as well as the solid partitions 16 and 17. Between the partitions 12 and 13 each end wall of each rotor has the breather openings 8a.

Each rotor is, therefore, divided into the internal chambers 18, 19 and 20 which are connected by the perforations 14 and 15 and the chamber 21 which is closed.

The hollow shaft 11 and each rotor hub are provided with the fuel inlet port 22 through which the motive fluid is admitted into the corresponding closed chamber 21.

The end walls of each chamber 21 are provided with the outlet ports 23, 23 and the motor case is provided with channels 24, 24 whose inner ends register with the corresponding outlet ports 23 with each rotation of the corresponding rotor.

Each rotor casing 1 is provided with an inside transverse pocket 25 extending the full width thereof, as more clearly shown in Figures 2 and 4, and which the corresponding channels 24 enter.

The rotors turn, in the present illustration, in the direction indicated by the arrow in Figure 2.

Each rotor is provided with an external transverse pocket 26 which extends the full width thereof, as shown in Figure 4, and these pockets 25 and 26 register, successively, with each rotation of the rotor to form an explosion chamber having the opposing radial end walls 27 and 28 which form abutments against which the explosive force may effectively act to cause rotation of the rotor.

As the rotor turns, upon registration of the outlet ports 23 with the inner ends of the channels 24, an explosive charge will enter the corresponding combustion chamber formed by the pockets 25 and 26.

The inner wall of the motor case is cylindrical and the outer wall of each rotor is approximately cylindrical; but, at one side, each rotor has a cam shaped portion 28a, which is in close contact with the inner wall of the case. At other points each rotor is spaced from the inner wall of the case thus providing an arcuate space about each rotor, which is separated into a compression chamber 29 and an exhaust chamber 29a as later explained.

Spaced behind each pocket 25 of the motor case there is a U-shaped sealing member designated generally by the numeral 30 and which embraces the corresponding rotor. Each sealing member is mounted to move radially in a transverse inside slot 31 in the corresponding casing 1 and is maintained in close contact with the periphery of the corresponding rotor by means of a pressure spring 32. The arms of the sealing member closely embrace the corresponding rotor and extend inwardly to the corresponding seal rings 9 and are countersunk in radial side grooves 33 in the adjacent end walls of the corresponding rotor casings 1. The sealing member 30 thus forms the rear wall of the compression chamber 29.

Embracing the cam 28 and countersunk into the rotor there is a U-shaped seal 34 in constant contact with the inner wall of the corresponding rotor casing and whose arms extend inwardly to the corresponding seal rings 9, as shown in Figure 2, and in front of each seal 34 and countersunk into the corresponding rotor there is a transverse scraper blade 35 which moves in contact with the inner wall of the corresponding rotor casing 1, as the rotor turns, and which scavenges said inner wall and keeps the same cleansed of carbon and foreign matter which adhere to said wall. This foreign matter is discharged, with the exhaust, out through an exhaust pipe 36 which connected into the exhaust chamber 29a between the rotor and its casing 1.

In front of the exhaust pipe 36, leading from each rotor casing, and between said exhaust pipe and the sealing member 30, there is a transverse inside seat 37 in which there is located a scraper blade 38 extending the full width of the corresponding rotor. This blade is fixed to a radial stem 39 which works in a bearing in the corresponding casing and operating against said stem there is a compression spring 40, housed within the corresponding casing, and which holds said blade 30 yieldingly against the periphery of the corresponding rotor to scavenge said periphery and remove all deposits of carbon or other foreign matter therefrom which passes through the corresponding exhaust pipe 36. The blades 35 and 38 are shaped so that they will readily pass each other without interlocking. The pocket 25 is provided with one or more circumferential bars or tracks 41 to support the blade 35 as it passes by said pocket and the pocket 26 has one or more circumferential tracks or bars 42 to support the blade 38 when the pocket 26 comes opposite said blade to prevent said blade from dropping into said pocket 26.

In front of the motor about the forward end of the shaft 10 there is a conventional type of supercharger 43 whereby the motive fuel delivered from the carburator 44 into said shaft is forced through the shaft and ports 22 into the respective chambers 21 and thence into the explosion chambers.

Between the supercharger and the motor there is a conventional distributing means indicated generally by the numeral 45 whereby the electrical current is distributed to the sparkplugs 46 with which the respective explosion chambers are equipped, two plugs being shown for each chamber, as shown in Figure 4.

The motive fluid in passing through the rotors is heated and the rotors are correspondingly cooled.

As illustrated in Figure 2, there are oil inlet passageways 47 with a suitable connection 48 at the outer end of each for the connection of an oil conducting hose or pipe thereto and each connection 48 is equipped with a control valve 50 for controlling the supply of lubricant. The passageways 47 terminate between the ends of the rotors and the adjacent stationary parts of the motor case and the lubricant introduced through the passageways 47 will be distributed, by centrifugal force, throughout the contracting areas between the rotors and the case. There are corresponding overflow passageways 51 leading outwardly through the motor case through which an over supply of lubricant may be drained from the motor.

The electrical distributing system may be enclosed by a suitable housing 52, one end of which is fitted around the adjacent end of the supercharger and the other end of which is fitted around the tubular casing 53 which surrounds the shaft 10 and is anchored to the forward end cap 3 of the motor.

Mounted within the intake end of the shaft 10 between the supercharger and motor there is a disc-like valve 54 which is fixed on a transverse shaft 55 and fixed on the respective ends of the shaft 55 there are the arms, as 56, whose free ends have slidable, pivotal, connections with the rods 57, 57.

Mounted on shaft 10, to rotate therewith, there is an annular frame 58 which is in sealed relation with a surrounding fluid tight casing 43a forming the inner end of the supercharger. This frame 58 is formed with a plurality of cylinders 59, two being shown, in each of which there is mounted a piston 60 which is attached to the rear end of the corresponding rod 57 and which operate against compression springs, as 61, confined within said cylinders.

The frame 58 is provided with a series of rearwardly directed fins 62.

Behind the frame 58 and forced within the casing 43a there is a series of fins 63. The casing 43a is filled with suitable fluid and the fins 62 and 63 will cause an ebullition of said fluid and will create a pressure therein and the fluid will operate against the piston 60 in the cylinders 59 and will gradually force said pistons forward as the speed of fluid 58 increases and this will cause a gradual opening of the valve 54 so as to gradually increase the admission of motive fluid into the explosion chambers upon starting of the motor so as to allow the speed of the motor to pick up gradually and thus avoid clashing of the gearing.

Upon rotation of the shaft 10 and the rotors fixed thereon as the outlet ports 23 register with the inner ends of the channels 24 charges will be forced into the corresponding explosion chambers and upon firing of the charges the rotors will be driven forwardly. The corresponding compression chambers 29 will increase in capacity to re-

ceive the constantly expanding charges until the cam shaped portions 28a pass the corresponding exhausts 36. This will permit a complete combustion of each charge before it is exhausted. The spent gases in front of the cam shaped portions 28a, will be exhausted as the rotors turn.

Usually the rotors will be so set that the outlet ports 23 of the respective rotors will be a uniform distance apart so that the explosions in the respective explosion chambers will occur in uniform succession thus conducing to an even distribution of power delivered by the rotors to the driven shaft 10 and causing a smoother running of the motor.

Provision has been made whereby an explosion will not occur with each rotation of each rotor, that is so that there will be a multiple of rotations of each rotor for each explosion in the explosion chamber thereof. In order to accomplish this, provision has been made for closing the outlet ports 23 intermittently by the slidably mounted valve 64. These valves are mounted to slide in the motor case and are fixed to the inner ends of corresponding stems 65 which work through the radial sleeves 66 in the motor case.

The outer ends of these stems have the heads 67 fixed thereon. Mounted to rotate in suitable bearings, hereinafter referred to, there is a cam shaft 68 fixed on which there are the cams 69 arranged to ride against with heads 67. The stems 65 and the corresponding valves 64 are normally held outwardly with the valves in open position by means of strong coil springs 70 which surround the outer ends of the respective stems and are interposed between the heads 67 and the flanges 71 of the sleeves 66 but when the cams are in active position upon each rotation of a cam the corresponding valve will be forced inwardly to closed position, as indicated in Figure 3.

Fixed on the rotor shaft 10 there is a spur gear 72 which is in mesh with an idler gear 73 which is fixed on a suitable shaft 74 and this idler gear 73 is in mesh with a gear 75 which is fixed on the cam shaft 68. The gear ratio is such that the cam shaft 68 will rotate slower than the shaft 10. In the present illustration the cam shaft 68 performs one rotation while the shaft 10 is rotating twice and the gears are also timed so that the outlet ports 23 will be closed upon registration of said ports with the channels 24 every other revolution of the corresponding rotor to the end that there will be one explosion in each explosion chamber for each two rotations of the corresponding rotor; however, if it be desired that an explosion occur with each rotation of a rotor the cam shaft 68 may be adjusted outwardly so that as the cam shaft rotates its cams 69 will not operate the valves but said valves will remain open. In order to accomplish this result, the ends of the cam shafts are mounted in bearings in guides 76 in the respective cylinders 77. These guides 76 are attached to corresponding ends of piston rods 78 and on the other ends of these rods are the pistons 79. Between the guides 76 and 79 each cylinder 77 is provided with a partition 80 through which the corresponding rod 78 has a bearing.

There is a common pressure line 81 entering the cylinders 77 and through which pressure may be applied to one side of the piston 79 to elevate the guides 76 and the cam shaft 68 so as to carry the cams 69 into inactive position with relation to the valve rods 65. In that position the cam shaft will rotate idly.

Pressure fluid is supplied to the line 81 through a supply line 82. There is also a line 83 connected into the outer end of each cylinder 77 and when the piston 79 is moved outwardly as explained the pressure fluid above it will be relieved through the line 83.

When it is desired to move the cam shaft 68 into position where the cams will be active to operate the valves pressure may be applied through the line 83 against the otherside of the pistons 79 and the cam shaft 68 will then be moved downwardly so that the cams will be in position to operate the valves as the cam shaft rotates.

This movement of cam shaft 68 is indicated by the arrows in Figure 7.

When pressure is applied through the line 83 against one side of the pistons 79 it may be relieved from the other side of said pistons through the line 81.

The cam shaft and cams and the gearing connecting the same with the roller shaft may be completely enclosed by the elongated housing 84 through which the outer ends of the cylinders 77 extend.

The inlet 6 may be connected into an inlet manifold 85 and the discharge outlets 7 may be connected into a discharge manifold 86.

The exhaust pipes 36 leading from the exhaust chambers 29a are connected into a common discharge manifold 87, as shown in Figure 1.

Each rotor has a radial scraper blade, as 88, countersunk therein and the walls of the rotor chambers have similar radial scraper blades 89 countersunk therein. These blades 88 and 89 are provided to remove carbon and other foreign deposits from the ends of the rotors and from the adjacent walls of the rotor chambers and this material will be gradually thrown by centrifugal force into the exhaust chamber 29a and ultimately exhausted. The forward edges of the blades 88, 89 are beveled, as is the case with the blades 35, 38, as shown in Figure 8, so that they will readily pass each other and not interlock.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. An internal combustion motor comprising, a casing having end walls and an inside annular wall, a rotor mounted to rotate therein and spaced radially inwardly therefrom, a transverse cam on the rotor which spans the space between the rotor and casing and moves in contact with the inside wall of the casing as the rotor turns, a seal carried by the casing which separates said space into a compression chamber and an exhaust chamber, said rotor having an external pocket behind the cam and the casing having an internal pocket in front of the seal, said pockets, upon registration, forming a combustion chamber to receive an explosive charge, radial partitions in the rotor providing internal chambers connected by perforations and an internal chamber which is closed, the end walls of the closed chamber being provided with outlet ports and the motor casing being provided with channels which lead to said combustion chamber and whose inner ends register with the outlet ports as the rotor turns, said rotor having an intake channel leading into the closed chamber through which motive fluid may enter said chamber and pass through said channels, upon registration of said ports therewith and means for firing the charge.

2. An internal combustion motor comprising,

a casing having end walls and an inside annular wall, a hollow rotor mounted to rotate in the casing and having a substantially circular outside wall spaced radially inwardly from the inside wall of the casing, a transverse cam on the rotor which spans the space between the rotor and casing and moves in contact with the inside wall of the casing as the rotor turns, a seal carried by the casing which separates said space into a compression chamber and an exhaust chamber, said rotor having an external pocket behind the cam and the casing having an internal pocket in front of the seal, said pockets, upon registration, forming a combustion chamber to receive an explosive charge, radial partitions in the rotor providing a closed chamber which is provided with an outlet port and the motor casing having a channel which leads to said combustion chamber and whose inner ends register with the outlet port as the rotor turns, said rotor having an intake channel leading into the closed chamber through which motive fluid may enter said chamber and pass through said channel, upon registration of said port therewith, and means for firing the explosive charge in the combustion chamber.

3. An internal combustion motor comprising, a casing having end walls and an inside annular wall, a hollow rotor mounted to rotate in the casing and having a substantially circular outside wall spaced radially inwardly from the inside wall of the casing, a transverse cam on the rotor which spans the space between the rotor and casing and moves in contact with the inside wall of the casing as the rotor turns, a seal carried by the casing which separates said space into a compression chamber and an exhaust chamber, said rotor having an external pocket behind the cam and the casing having an internal pocket in front of the seal, said pockets, upon registration, forming a combustion chamber to receive an explosive charge, radial partitions in the rotor providing a closed chamber which is provided with an outlet port and the motor casing having a channel which leads to said combustion chamber and whose inner ends register with the outlet port as the rotor turns, said rotor having an intake channel leading into the closed chamber through which motive fluid may enter said chamber and pass through said channel, upon registration of said port therewith, a valve for opening and closing said port, means for timing the movement of the valve with relation to the rotation of the rotor and means for firing the charge in the explosion chamber.

4. An internal combustion motor comprising, a casing having end walls and an inside annular wall, a hollow rotor mounted to rotate in the casing and having a substantially circular outside wall spaced radially inwardly from the inside wall of the casing, a transverse cam on the rotor which spans the space between the rotor and casing and moves in contact with the inside wall of the casing as the rotor turns, a seal carried by the casing which separates said space into a compression chamber and an exhaust chamber, said rotor having an external pocket behind the cam and the casing having an internal pocket in front of the seal, said pockets, upon registration, forming a combustion chamber to receive an explosive charge, radial partitions in the rotor providing a closed chamber which is provided with an outlet port and the motor casing having a channel which leads to said combustion chamber and whose inner end registers with the outlet port as the rotor turns, said rotor

having an intake channel leading into the closed chamber through which motive fluid may enter said chamber and pass through said casing channel, upon registration, of said port therewith, a valve for controlling said port, means for timing the movement of the valve in relation to the rotation of the rotor, means for rendering the valve inoperative, and means for firing the charge.

5. An internal combustion motor comprising, a casing having end walls and an inside annular wall, a tubular shaft mounted axially in the casing, a hollow rotor in the casing mounted to rotate with said shaft and having an annular external surface spaced inwardly from the annular wall of the casing, a transverse cam on the surface of the rotor which spans the space between the rotor and casing and moves in contact with the inside wall of the casing as the rotor turns, a seal carried by the casing which separates said space into a compression chamber and exhaust chamber, said rotor having an external pocket behind the cam and the casing having an internal pocket in front of the seal, said pockets, upon registration, forming a combustion chamber to receive an explosive charge and which is in communication with said compression chamber, radial partitions in the rotor providing a closed internal chamber therein, said tubular shaft providing an intake channel which terminates in an inlet port leading into said chamber, said chamber being provided with an outlet port and the motor casing being provided with a channel which leads into said combustion chamber and whose outer end registers with the outlet port as the rotor turns, an intake valve mounted in the intake channel, means for opening and closing said intake valve in harmony with the speed of rotation of said shaft and means for firing the charge in said combustion chamber.

6. An internal combustion motor comprising, a casing having end walls and an annular inside wall, a rotor fitted between said end walls and mounted to rotate within the casing and spaced radially inwardly from the annular inside wall thereof, a transverse, peripheral cam on the rotor which spans the space between the rotor and casing and moves in contact with the inside wall of the casing as the rotor turns, a seal carried by the casing which separates said space into a compression chamber and an exhaust chamber having an exhaust outlet, said rotor having an external pocket behind the cam and the casing having an internal pocket in front of the seal, said pockets, upon registration, forming a combustion chamber to receive an explosive charge, means for supplying said charge into the combustion chamber, under pressure, means for firing the charge, lubricant inlet passageways which terminate between the ends of the rotor and the adjacent ends of the casing, an overflow passageway leading outwardly through the motor casing through which an oversupply of lubricant may be drained from the motor.

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