July 26, 1938. W. CHISHOLM 2,124,542

ROTARY ENGINE

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FIG. 1.

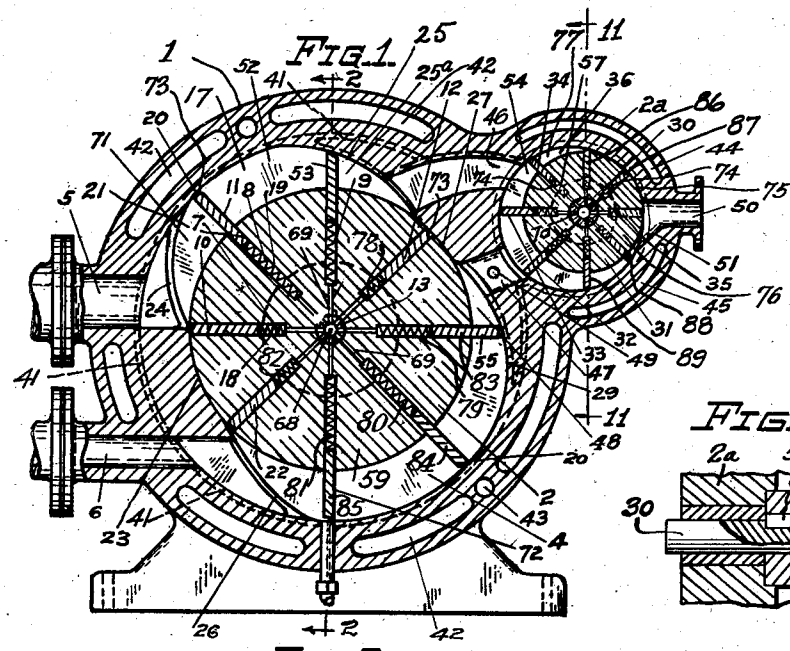


FIG. 10.

FIG. 2.

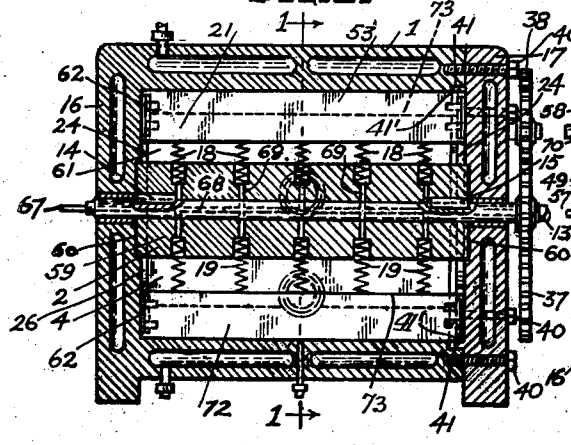


FIG. 3.

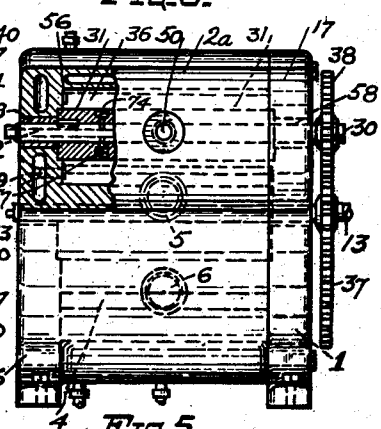


FIG. 4.

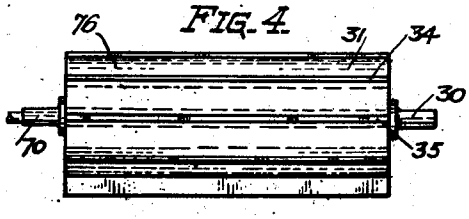
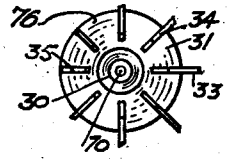


FIG. 5.



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Fig. 6.

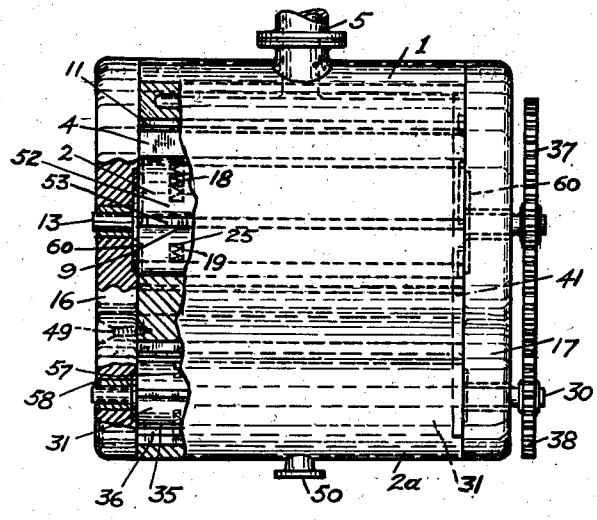


Fig. 7.

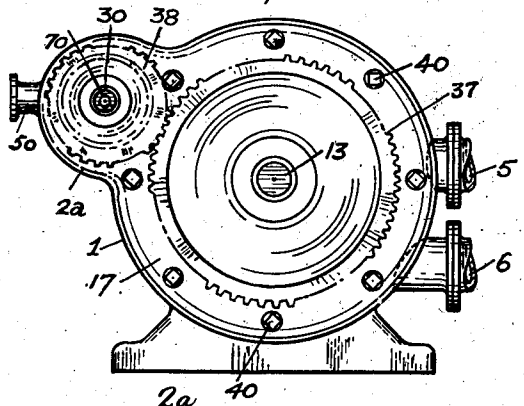


Fig. 8.

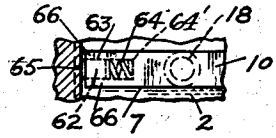


Fig. 9.

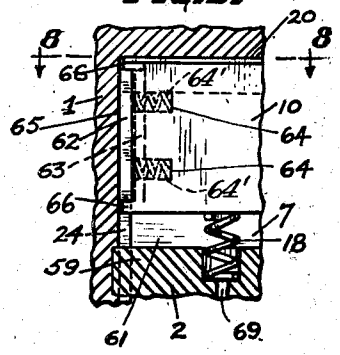
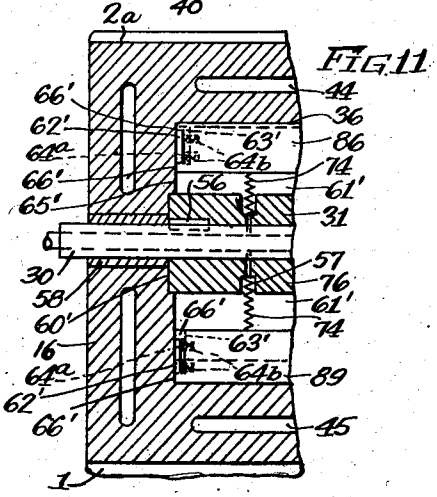


Fig. 11



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UNITED STATES PATENT OFFICE

2,124,542

ROTARY ENGINE

William Chisholm, Toronto, Ontario, Canada

Application November 9, 1933, Serial No. 697,324

10 Claims. (Cl. 123—16)

The present invention relates to rotary engines, and particularly to the non-pulsation type of engine, and to this end certain combinations and arrangements of parts are used to produce a continually firing engine which in turn produces a very smoothly operating motor with practically no vibrations during any part of its revolution.

The engine in hand is provided with a rotor having outwardly extending reciprocating vanes therein and a similarly constructed feed-valve connected with the main chamber of the engine for supplying gas to same; also certain novel means for supplying lubrication to the engine which will be described herein. Other advantages, and the nature and construction of the engine will be further described below as the specification proceeds.

In the accompanying drawings forming a part of this specification I have shown a complete embodiment of the invention adapted to accomplish the purpose in hand, in which:

Figure 1 is a transverse section through the rotary engine, taken on line 1—1 of Figure 2.

Figure 2 is a longitudinal section of the engine taken on line 2—2 of Figure 1.

Figure 3 is a side elevation of the engine partly in section taken from the right as seen in Figure 1.

Figure 4 is a longitudinal side elevation of the rotary valve used in my invention.

Figure 5 is an end view of Figure 4, taken from the right side thereof.

Figure 6 is a plan view, partly in section, of the engine shown in Figure 1.

Figure 7 is an end elevation taken from the right as seen in Figure 3.

Figure 8 is a plan view, partly in section, of a portion of one of the vanes used taken on line 8—8 of Figure 9.

Figure 9 is a side view of the vane shown as in Figure 8, and associated parts.

Figure 10 is an enlarged side elevation, partly in section, illustrating the method of keying the rotor of the valve to its shaft, similar to that shown in Figure 3.

Figure 11 is an enlarged vertical partial section through the rotary transfer valve and its casing, taken on line 11—11 of Figure 1.

In the drawings, the numeral 1 indicates a substantially cylindrical casing which forms the body of the rotary engine, having an enlarged portion 2a, also in substantially cylindrical form; the casing 1 encloses the main rotor 2 of the engine and the rotary transfer valve 31.

The casing 1 has a chamber 4 of unsymmetrical outline and is provided with a gas inlet 5 and an exhaust outlet port 6. The rotor 2 is of substantially cylindrical shape and of solid material except for a series of preferably radial slots 7, 8, 9, 78, 79, 80, 81, 82 in which a series of blades 10, 11, 53, 12, 83, 84, 85, 22 slidably operate.

The rotor 2 has a central shaft 13, which is "keyed" thereto by the keys 14, 15 to prevent revolution of the rotor 2 on said shaft. The shaft 13 is mounted in suitable bearings in the end walls 16, 17 of the casing 1. The blades 10, 11, 53, 12, 83, 84, 85, and 22 are of flat solid material and are adapted to reciprocate in the slots 7, 8, 9, 78, 79, 80, 81, and 82, respectively, riding against, at their inner edges, springs such as 18 or 19, and on their outer ends 20, the edges of each of said blades are slightly bevelled at 73, as shown in Fig. 1 for a purpose described below.

It will be seen from Fig. 1 that the compression spring 19 forces the vane or blade 11 outwardly in a radial direction and when one of said blades are in their outermost position as 11, a portion of their lower edges 21 still remains mounted in the body of the rotor 2.

When the vanes are rotated to a position illustrated by 12, or 22, the blade is forced inwardly and compresses the springs such as 78 or 82 in their recesses. Thus the outer edge of any of the blades is always held in close contact with the irregular inner wall of the chamber 4, and the outer edges 20 of each of the blades being slightly bevelled, in each instance form a definite contact with the wall of the chamber 4 at all times during the revolution of the rotor. In order to make each of the vanes follow a definite path within the chamber 4 as the rotor 2 is revolving, means are adopted at 23, 24, 25, 26, 27, 29, to depress the vanes against the springs such as 7, or 8, during certain period of the revolution of the rotor 2. This means is at 23, 25, 27, 29, made by the inner face of the chamber 4 in the casing, while at 24 and 26 a guiding ridge is formed on each of the opposed end walls 16 and 17 of the engine, as clearly illustrated in Figs. 1 and 2 of the drawings.

It will be noted that as the rotor 2 revolves the various vanes such as 22, 10, 11, 12, all follow a definite path of travel with respect to their outer ends, as is at once understood.

In the casing 1 is also rotatably mounted on its axis 30 a rotary transfer valve 31 which is keyed at 56 to said shaft 30 in a similar manner to that mentioned with reference to the shaft 13 of the

engine rotor 2. The valve 31 is provided with a drum 76 of substantially cylindrical shape having slidably mounted therein a series of vanes 32, 33, 34, 35, 86, 87, 88, 89, very similar to those shown in the main engine chamber 4, Fig. 1. It will be noted that the outline of the interior of the valve chamber 36 is substantially circular and that the vanes such as 32, 33, reciprocate in the drum 76 of the rotary valve 31 against similar springs 74, 74 to those used in connection with the main rotor 2. The path of travel of the outer end of the blades 32, 33, is clearly illustrated in Fig. 1 of the drawings. At one end of the engine, on the shafts 13 and 30 respectively are mounted the gears 37, 38 which intermesh with each other so that the relation between the speed of the main rotor 2 and the speed of the rotary valve 31 may be held in a desired relation to each other. The main casing 1 has a removable end 17 in order to remove parts and assemble engine parts, which is held on to the main casing by means of a series of bolts such as 40, 40, as is at once understood, and said removable end 17 is provided with an inwardly projecting flange 41 thereon which engages into a complimentary recess 41' formed in the body of the casing 1 as clearly illustrated in Fig. 2.

The main casing 1 may be provided with a series of chambers such as 42, 43, for water cooling purposes, as is customary in such engines, and the valve casing may also be water-cooled at points such as 44, 45. The engine chamber 4 is connected with the valve chamber 36 by means of a fuel charging passage 46 for the purpose of admitting gas from the engine chamber to the valve chamber. There is also a fuel combustion passage 47 connecting the two chambers to each other for admitting gas from the valve chamber to the explosion chamber 48. In the explosion chamber is located a spark plug 49 of proper design, same being mounted in the end wall 16 of the engine as shown in Figs. 1, 3 and 6 of the drawings.

The outer wall of the valve chamber 36 is connected with an exhaust scavenging port 50, and the wall of said chamber is preferably sloped at 51 for a purpose which will be described later.

It is evident from what has been said that gas admitted through the gas inlet 5 will be caught up by the blade 10 and carried along in the portion 52 of the engine chamber 4 to a point illustrated by the vane 53, Fig. 1, and thereafter the said gas will be pushed along through the fuel charging passage 46 and delivered into the portion 54 of the valve chamber 36, from whence the blade 34 sweeps it in an anti-clockwise direction into the fuel combustion passage 47 and back into the explosion portion 48 of the chamber 4. The gas is exploded at this point either by a spark plug 49, or other suitable means which will be described herein, and when the engine blade reaches the position illustrated by 55, the gas will be pushed onward in a clockwise direction and eventually swept through the exhaust outlet 6. It is also seen that any exploded gas trapped between the vanes of the rotary transfer valve 31 will be caught by one of the blades such as 32, 33, and swept in an anti-clockwise direction out through the exhaust port 50 of the valve chamber 36. In this connection it is seen that the main rotor normally revolves in a clockwise direction, while the rotary valve normally revolves in an anti-clockwise direction, and as they are geared to each other by means of the gears 37 and 38 this is readily accomplished and their proportionate speed of revolution properly adjusted as required.

The rotary valve 31 is provided with recesses 57, 57 in which are springs 74, 74, similar to those used in connection with the main rotor 2, and the axis 30 of the rotor is suitably mounted in the bearings at 58, 58 of the valve casing 2a. It is seen that as rotary valve 31 rotates, the cutaway portion 51 facilitates the exhaust of gas through the port 50.

In Figure 2 it may be seen that the solid portion 59 of the rotor 2 projects at each end at 60, 60 into the end walls 16 and 17 respectively and provides a seal against the escape of any gas which may be caught at the bottom 61 of the recesses such as 7, 8, of the rotor blades such as 10, 11. Each of the blades 10, 11, is provided with plates on each end thereof as shown in Figs. 8 and 9 of the drawings at 62, 62. These plates act substantially like a piston ring in an engine to prevent the gas passing from one section 25 of the chamber 4 to any other section or portion, such as 52. The plate 62 is of rectangular cross section and is set in a recess 63 of the blades such as 10, 11, and springs 64, 64 set in two recesses 64', 64' also formed in said blades, at right angles to recess 63, tend to keep the plate or bar 62 against the surface 65 of the end walls 16 and 17 of the engine. The said plates are held in place vertically as seen in Fig. 9, as the blade 10 reciprocates in the slot 7, by means of extensions 66, 66 formed on the blade 10, as is at once understood.

It will be understood that what has been just described with reference to Figs. 8 and 9 is also adapted to be used in connection with the rotor 31 of the rotary valve as illustrated in Figure 11 of the drawings. In Figure 11 it is seen that the solid portion 76 of the rotor 31 projects at 60', into the end wall 18 of the engine, and provides a seal against the escape of any gas which may be caught at the bottom 61' of the recesses which carry the rotor blades such as 86 or 89. Each of said rotor blades is provided with a plate 62' on each end thereof, as shown in Figure 11 of the drawings. These plates are like the plate 62, of Figure 9, and prevent gas passing from one valve chamber 54 (Figure 1) to adjoining chambers such as 77.

The plate 62' is of rectangular cross-section, and is set in a recess 63' of the blades 86, 89 etc., and springs 64a, 64a (set in two recesses 64b, 64b also formed in said blades), are placed at right angles to recess 63' to keep the plate 62' against the surface 65' of the end wall 16 of the casing. The said plate 62' is held in place vertically as seen in Figure 11, as the blade 86 reciprocates in its slot, by means of extensions 66', 66' formed on the blades 86, as is at once understood.

The lubricating system used with the engine in hand comprises a supply tube for oil 67, which enters through the end of the axle 13 in the main rotor, and passes through the central tube 68 which runs longitudinally through said axle. From said tube the oil passes by means of separate ducts 69, 69 to the recesses such as 7, 8, 9, thus admitting oil to the bottom 61 of the said blade recesses, thence along the sides of the said blades 10, 11 etc., into the chamber 4 of the engine, and to the working surfaces 20, 20 of the blades, and providing sufficient lubrication for the blades at their points of contact with the inner periphery of the chamber 4 of the engine.

With reference to the amount of oil sufficient to run the engine, same is controlled by the ad-

mission of a predetermined quantity through the tube 67 as is found sufficient to provide the proper lubrication for the engine. The rotary valve is lubricated in a similar fashion, through the tube 70 and ducts 57 to each of the blades such as 33, 34, to that described in connection with the rotary parts of the engine, as is at once understood.

The operation of the present non-pulsation engine is as follows:

The mixed gas and air is admitted through the gas inlet 5 into the portion 71 of the engine chamber 4 between the blades 10 and 11. As the rotor 2 revolves, the blade 10 is forced outwardly by the spring 7 against the outstanding ribs 24 formed on each of the ends 16, 17 of the engine, so that the gas which has entered the portion 71 of the chamber is confined between the said blades. It will be noted that as the blade or vane 11 advances, it produces a certain suction and tends to pull the gas from the gas inlet 5 into the engine. As the vane 11 reaches a position such as illustrated by vane 53, the portion 71 of the chamber 4 takes the form illustrated by the portion 52 of said chamber and begins to compress the charge of gas and air and when said charge is carried forward until the vane reaches the position illustrated by vane 12, the charge is still further reduced in volume as in the portion 25a. In the meantime, however, the charge has found an exit through the passage 46 into the portion 54 of the valve chamber 36. The compressed gas is then held between the vanes 33 and 34 of the rotary valve 31, which is operating in an anticlockwise direction, until the charge of gas and air reaches a point illustrated by vanes 32 and 33, and thence gains admission through the passage 47 into the explosion chamber 48 of the engine. The spark plug 49 then explodes the charge at this point of its travel.

The vane 11 then occupies the position of vane 55 and the force of the explosion pushes the vane forward in a clockwise direction and the portion of the charge which has been within the portion of the valve illustrated between vanes 32 and 33, is carried forward in said valve chamber to the exhaust port 50 and is discharged therefrom. In this connection attention is drawn to the construction of the feed valve, the outer-circumference 75 of the drum 76 of the rotor 31 being placed in close contact with the inner periphery of the valve chamber 36 for a portion of its length, so that all burned gas is completely driven out of the valve as each individual chamber between the valve vanes passes the exhaust port 50, and the flared mouth 51 of the latter aids in quick expulsion of the burned gas from the valve. After the burned gas is expelled it is evident that as the valve rotor moves forward in an anticlockwise direction and the valve vanes begin to project from their recesses in the valve drum 76, a chamber, like 77, is formed in which there is a substantial vacuum. This vacuum is of particular use when the vanes are in the position illustrated by vanes 33 and 34, as a suction effect is produced in the individual chambers, which quickly draws in the fuel through passage 46 into said chambers. This arrangement of parts prevents all back pressure in the valve, and is an important factor both as to power obtained, and smooth operation of the engine, as is readily understood. It will be further seen as there is no burned gas in the individual chambers, the proper proportion of fuel gas and air is not disturbed, and a good explosive mixture delivered to the explosion chamber.

The expanded charge in the explosion chamber 48 next passes along through the chamber 4 to the exhaust outlet 6 and as the vane 11 takes the position illustrated by 72 it is seen that the exploded gas is completely expelled into the exhaust outlet, when the vane reaches the position illustrated by vane 22.

It will be seen that there is always a compressed charge of gas and air in the passage 46 ready to be taken up by the vanes of the rotary valve and delivered into the explosion chamber 48. Said charges are fed so quickly into the explosion chamber in successive volumes, such as are contained in the valve chamber 36 between the successive vanes of the rotary valve, that each explosion follows the preceding one so quickly that the first one has not completely lost its effect before the next one takes place, thereby having the effect of a continuous push against the vanes in the chamber 4 of the engine. This has the effect of producing an engine without any noticeable pulsation in its operation. This type of engine may be called a non-pulsating engine.

It is of course noted that the gears 37 and 38 which are on the respective shafts 13 and 30 are intermeshed, so that the rotation of the engine rotates the rotary transfer valve, and the respective speeds at which the engine and the rotary valve are required to be driven in accordance with the respective size of the engine and valve, can be readily attained by changing the relative size of the gears 37 and 38 as is readily understood.

As explained in the specification above, the engine and valve may be water-cooled in any manner desired, such as that described, and the engine may be lubricated by any system of lubrication besides that described herein.

Attention is drawn to the fact that, while the sparkplug 49 normally explodes the charge of gas in the explosion chamber there always remains in the passage 47 a certain quantity of burning gas at a high temperature, and that this burning gas may be used to ignite a fresh quantity of un-burned gas if required. It will be noted that when an explosion takes place in the explosion chamber 48, the clockwise operation of the engine rotor and vane 12 will sweep forward the burned gas into the exhaust port in the chamber 4. The same is true with reference to the operation of the valve chamber contained between vanes 32, and 33, the gas contained between said vanes being swept forward by the rotation of the rotor to the outlet 50. When a fresh supply of gas is brought forward by the movement of the vanes 34 and 33 of the valve, this may be ignited by the heated gas which has remained in the passage 47 between the valve and the engine chambers so that when the engine is in full operation the sparkplug can be disconnected if desired, the succeeding charges of gas being ignited by the heated burning gas in the passage 47. This is believed to provide quite an important feature in my invention since after the engine has been started and thoroughly warmed up by the use of the sparkplug it is optional whether the latter is used or not in order to keep the engine in operation thereafter.

From the above description it is seen that I have produced an engine that is practically non-pulsative in its rhythmic operation.

I claim:

1. In an engine, a casing having an engine rotor chamber and a rotary valve chamber therein,

an inlet port in the latter, an engine rotor, and a rotary valve provided with a drum, each mounted in one of the casing chambers, a fuel charging passage and a combustion passage connecting the engine and valve chambers, said fuel charging passage being connected to the valve inlet port, a number of vanes mounted in the engine rotor, a plurality of vanes mounted in the rotary valve equal to at least half the number of those in the engine rotor, said engine and valve vanes forming with the casing and the fuel combustion passage individual explosion chambers therebetween, a number of individual valve chambers formed by the vanes of the rotary valve and the casing, a scavenging port in the valve adjacent to the valve drum and located in a position with respect to the combustion passage, the charging passage and the drum of the valve, so as to permit the burned gases of the individual valve chambers to be completely expelled therefrom, and means for reducing the size of the valve chambers to zero thus excluding burned gases from said chambers before they are recharged with fuel.

2. In an engine, a casing having an engine rotor chamber and a rotary valve chamber having an inlet and exhaust port therein, an engine rotor and a rotary valve mounted in said chambers respectively, a fuel charging passage connecting the engine chambers and the valve inlet port, a combustion passage connecting the engine and valve chambers, a plurality of vanes mounted in the engine rotor, a plurality of vanes mounted in the rotary valve equal to at least half the number of those in the engine rotor, said engine and valve vanes forming with the casing and the fuel combustion passage explosion chambers therebetween, a number of individual valve chambers formed by the vanes of the rotary valve and the casing, a number of indwardly bossed ribs on the ends of the casing adapted to form guiding ridges for the engine and rotary valve vanes, and means for completely expelling burned gas from each individual valve chamber, and means for reducing the size of each valve chamber to zero for the purpose of excluding burned gases from said chambers before being recharged with fuel.

3. In a rotary engine having fuel charging and explosion means therein, a casing having a rotary valve chamber and an engine chamber formed therein, valve inlet and exhaust ports in that part of the casing forming the rotary valve chamber, an engine chamber exhaust port in the casing for expelling the major portion of the burned gases from the engine, a rotary transfer valve comprising a drum, with a portion of its periphery in contact with the inner wall of the casing, eccentrically mounted in the rotary valve chamber, a plurality of spring-actuated vanes slidably mounted in the rotary valve drum, forming with the walls of the casing individual chambers therebetween, and adapted to expel the burned gases from said chambers through the first-mentioned exhaust port, and a number of inwardly bossed ribs in the valve chamber and formed on the ends of the casing, adapted to form guiding ridges for the vanes, the aforesaid rotary valve drum being adapted to coact with the inner wall of the casing, the bossed ribs, and the spring-actuated vanes to reduce the size of the individual valve chambers to zero, for the purpose of excluding burned gases therefrom before the said valve chambers are recharged with fuel.

4. In a rotary engine having a fuel charging and explosion means therein, a casing having a rotary valve chamber and an engine chamber formed therein, a valve chamber exhaust port, a valve fuel inlet port and a combustion port formed in the casing, an engine chamber exhaust port in the casing for expelling the major portion of the burned gases from the engine, a rotary transfer valve comprising a drum, with a portion of its periphery in contact with the inner wall of the casing, eccentrically mounted in the rotary valve chamber, a plurality of spring-actuated vanes slidably mounted in the rotary valve drum, forming with the walls of the casing individual chambers therebetween, and adapted to expel the burned gases from said chambers through the first-mentioned exhaust port, a number of inwardly bossed ribs formed on the ends of the casing, adapted to form guiding ridges for the vanes, where they pass the mouths of the above-mentioned valve ports, the aforesaid rotary valve drum being adapted to coact with the inner wall of the casing, the bossed ribs, and the spring-actuated vanes to reduce the size of the individual valve chambers to zero for the purpose of excluding burned gases therefrom before the said valve chambers are recharged with fuel.

5. In an engine, a casing having an engine rotor chamber provided with a fuel inlet, and an exhaust port, and a rotary valve chamber provided with an inlet and exhaust port therein, an engine rotor mounted in the first named chamber, a rotary transfer valve comprising a drum with a portion of its periphery in contact with the inner wall of the casing, eccentrically mounted in the rotary valve chamber, a plurality of spring-pressed, slidably mounted vanes in the engine rotor, a plurality of spring-pressed, slidably mounted vanes in the rotary valve, equal to at least half the number of those in the engine rotor, said egnine and valve vanes, forming with the walls of the casing individual chambers therebetween and adapted to expel burned gases from said chambers, a number of inwardly bossed ribs formed on the ends of the casing adapted to form guiding ridges for the vanes, a fuel passage connecting the engine rotor chamber and the rotary valve chamber, a combustion passage joining the engine rotor and the rotary valve chambers forming with the engine rotor, the rotary valve, and their vanes, a combustion chamber for the engine, the aforesaid rotary valve being adapted to coact with the inner wall of the casing, the bossed ribs, and the spring-actuated vanes of the valve, to reduce the size of the individual valve chambers to zero for the purpose of excluding burned gases therefrom, before said valve chambers are recharged with fuel.

6. In an engine, a casing having an engine rotor chamber, and a rotary valve chamber with an inlet and exhaust port therein, an engine rotor mounted in the first named chamber with a number of vanes mounted therein, forming with the casing individual engine chambers therebetween, a fuel charging passage connecting the engine chamber and the valve inlet port, a fuel combustion passage connecting the engine and valve chambers, a rotary transfer valve comprising a drum, eccentrically mounted in the valve chamber with a portion of said drum in contact with the inner periphery of the valve chamber, a plurality of vanes mounted in the rotary valve equal to at least half the number of those in the engine rotor, forming with the casing individual chambers therebetween, a number of inwardly bossed ribs on the ends of the casing adapted to form guiding ridges for the engine and rotary valve vanes, means for completely ex-

pelling burned gas from each individual chamber of the engine and rotary valve, and reducing the size of both the engine and valve chambers to zero.

7. In an engine, a casing having an engine rotor chamber provided with an inlet and exhaust port, and a rotary valve chamber therein, an engine rotor mounted in the first named chamber, a rotary transfer valve comprising a drum eccentrically mounted in the valve chamber with a portion of said drum in contact with the inner periphery of the valve chamber, a plurality of vanes mounted in the rotary valve forming with the casing individual chambers therebetween, a valve fuel inlet port, a valve combustion port and a valve exhaust port formed in the casing walls, a fuel charging passage connecting the engine chamber, and the valve inlet port, a fuel combustion port, and means for excluding burned gases from each of the valve chambers before being recharged with fuel.

8. In an engine, having a casing, an engine rotor chamber and a rotary valve chamber therein, inlet and exhaust ports in both chambers, an engine rotor and a rotary valve mounted in said respective chambers, a fuel combustion passage between the two chambers, a fuel charging passage connecting the engine chamber and the valve inlet port, a number of vanes mounted in the engine rotor, a plurality of vanes mounted in the rotary valve equal to at least half the number of those in the engine rotor, said engine and valve vanes forming with the casing and the fuel combustion passage a number of individual explosion chambers therebetween, a number of individual valve chambers formed by the rotary valve vanes and the casing, means in the valve chamber for completely expelling any entrapped exploded gas from the individual valve chambers, and for preventing same from entering the valve chambers before the latter are recharged with fuel.

9. In an engine, having a casing, an engine rotor chamber and a rotary valve chamber therein, inlet and exhaust ports in both chambers an engine rotor and a rotary valve mounted in said respective chambers, a fuel charging passage connecting the engine chamber and the valve inlet port, a fuel combustion passage connecting the engine and valve chambers, a number of vanes mounted in the engine rotor, a plurality of vanes mounted in the rotary valve equal to at least half the number of those in the engine rotor, said engine and valve vanes respectively forming with the casing a number of individual engine and valve chambers therebetween, each of which when cooperating with the fuel combustion passage in turn are adapted to form an explosion chamber for the engine, means in the valve chamber for completely expelling any exploded gas from each of the valve chambers, and for preventing same from entering said valve chambers before being recharged with fuel.

10. In a rotary engine having fuel charging and explosion means therein, a casing having a rotary valve chamber and an engine chamber formed therein, valve inlet and exhaust ports in the casing, an engine rotor in the engine chamber, an engine chamber exhaust port in the casing for expelling the major portion of the burned gases from the engine, a rotary transfer valve comprising a drum, with a portion of its periphery in contact with the inner wall of the casing, eccentrically mounted in the rotary valve chamber, a plurality of spring-actuated vanes slidably mounted in the engine rotor, forming with the walls of the casing individual chambers therebetween, and adapted to expel the burned gases from said chambers through the engine chamber exhaust port, a plurality of spring-actuated vanes, equal to at least half the number of those in the engine rotor, slidably mounted in the rotary valve drum, and forming with the casing a number of individual valve chambers therebetween, and a number of inwardly bossed ribs formed on the ends of the casing, adapted to form guiding ridges for the engine and valve vanes, the aforesaid valve drum being adapted to coact with the inner wall of the casing, the bossed ribs, and the spring-actuated vanes of the valve to reduce the size of the individual valve chambers to zero, for the purpose of excluding burned gases therefrom before the said valve chambers are recharged with fuel.

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