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ROTARY COMBUSTION ENGINE

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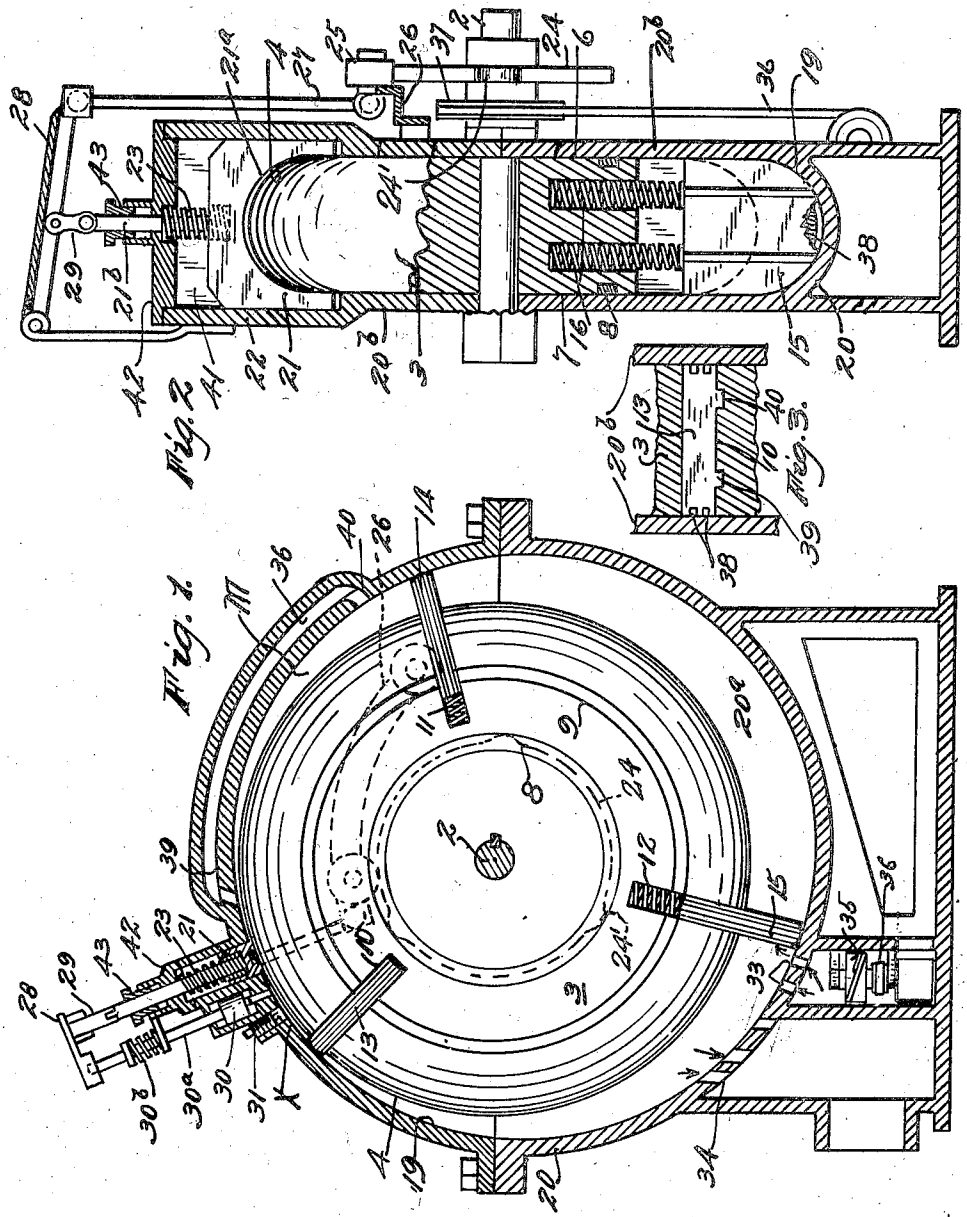


Fig. 2.

Fig. 3.

Fig. 1.

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ROTARY COMBUSTION ENGINE

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4 Claims. (Cl. 123—16)

This invention is a rotary, combustion engine.

An object of the invention is to provide a rotary engine of extremely simple construction and low cost of manufacture, and which is of very compact and light structure and having in view the production of as high power efficiency as is consistent with safety in the reduction of the weight of the engine in comparison with other types of motors of the same weight.

An object is to provide a rotary, liquid-fuel engine with an operating cycle of air compression and in which the compressed air charge is enriched by a spray of liquid fuel; the fuel charged air being then ignited for the production of expansive force on a vane face having a circular orbit; there being no scavenging period in the cycle of the engine.

The invention consists of certain advancements in this art as set forth in the ensuing disclosure and having, with the above, additional objects and advantages as hereinafter developed, and whose construction, combination and details of means, and the manner of operation will be made manifest in the description of the herewith illustrative embodiment; it being understood that modifications, variations and adaptations may be resorted to within the scope, principle and spirit of the invention as it is more directly claimed hereinbelow.

Figure 1 is a vertical, trans-axial section of the engine; the rotor thereof being in side elevation.

Figure 2 is in axial section; certain parts being shown in elevation.

Figure 3 is a detail section of a portion of the rotor and one of its piston elements; the latter in end plan.

Suitably fixed on a power-take-off shaft 2 there is a thick, discoidal rotor 3 having a transversely half-round or semi-circular cross-section rim or periphery 4 and parallel flat side faces 6—7 in which are sunk a set of suitable packing rings 8—8. The rotor is here shown as having three equally, angularly spaced, radial pockets 10, 11, and 12 opening from side to side of the rotor and in these pockets are slidable radial vanes 13, 14, and 15 turning about the rotor axis and whose side edges are about flush with the sides of the rotor and whose outer ends are of semicircular form to correspond with the rim 4 of the rotor.

The inner ends of the several vanes 13, 14, and 15 are severally supported on expansion springs 16, sunk in the rotor, which tend to constantly thrust the pistons outward toward the semicircularly concaved inner surface 19 of a rotor shell 20 of circular form providing a chamber for the rotor in which the maximum diameter of the circular face 19, as to the axis of the shell 20 is materially larger than that of the rotor 3 so that when the rotor shaft 2 is positioned in the shell eccentric to the center of the shell there is formed crescent-shaped space 20^a, Fig. 1, between the rotor and the wall of the shell. At that side of the rotor 3 nearest to the wall of the shell there is preferably provided a good running clearance so as to avoid friction of contact between the rotor and the wall surface 19 (whose transverse section is semicircular, as stated above).

At or near the locale of proximity of the rotor rim to the shell wall 19 there is provided a retractile abutment 21 slidably guided in suitable ways 22 provided in the side walls 20^b of the shell 20 so as to move radially as to the center of the rotor 3 by inward pressure of a spring device 23 whose function is, further, to hold the inner, concaved end 21^a of the abutment 21 firmly engaging the half-round rim of the rotor.

Means are provided for the quick retraction of the abutment 21 just as it is approached by each of the radial pistons above mentioned and for the rapid return of the abutment to its inner position of rest on the rim of the rotor. Such means here includes a cam 24, fixed on shaft 2, engaging a roller 25 on the outer end of a lever 26 suitably pivoted on near wall portion 20^b of the shell 20, and having a push-rod 27 connected to an arm 28 suitably supported for oscillating motion with and by the cam actuated push rod 27.

The arm 28 is suitably connected as by a link 29 to the stem 21^b of the abutment 21 and the cam 24 is provided with a circular rim having spaced lift points 24′ so designed that as each vane turns to the left, Fig. 1, in its orbit in the shell 20, the abutment is pulled out by the arm 28, as the push rod 27 is pressed outward by its cam, just far enough to let the slightly projecting outer end of the near piston go by without interference from the abutment; the arm 28 pulling outward on the abutment to overcome the inward, seating action of the main spring 23.

The arm 28 has the further purpose of forming a means for actuating an injection device 30 of any suitable type arranged in the shell wall rim just beyond the abutment in the direction of rotor rotation and by which a liquid fuel of suitable or preferred kind may be injected into the small crevice formed between the rotor

rim, the effective abutment, the wall of the shell and the face of a vane as 13 when this is at position shown in Fig. 1, when the fuelized air charge in the crevice is ready to be fired as by a timed spark device having a spark plug 31. As here shown the injection device includes a piston having a rod 30a operatively pressed to the arm 28 as by a suitable expansion spring 30b.

Near the bottom of the shell 20 air inlet holes 33 are provided and so arranged that air will be inducted into the chamber 20a by the proximate, passing vane (15) while burnt gases are being forced out of exhaust holes 34 in the shell wall by the vane (13) moving downwardly from the ignition space X, Fig. 1; the exhaust ports or holes 34 being uncovered first by each downwardly moving piston before it reaches the air inlet ports 33; which are farther along in the orbit of vane movement.

Preferably air is forced to the inlet ports 33 under some pressure to offset possible gas pressure back of the passing vane and this is accomplished as by means of a fan 35 or other suitable means. The fan is shown as mounted in the base of the engine shell 20 and may be driven by a belt 36 taking power from a wheel 37 fixed on the power shaft 2.

A charge of air taken between two adjacent vanes, as 14—15, in the position shown in Fig. 1, at the maximum volume of the segment of the crescent chamber 20a, will then be gradually compressed as these vanes move up toward the ignition space X; maximum compression being obtained when two vanes take the position of 13 and 14 as to the ignition space X.

For the purpose of reducing back pressure on the vane (14) coming up to the ignition space just as the charge is fired at X to create driving pressure on the near vane (13), there is provided a by-pass 39 having an inlet port near the abutment 21 and an outlet port 40 at such a position to the right, Fig. 1, that as the vane (13) at the ignition space X starts its power stroke the vane (14) to the right will run past the port 40 and the compressed air in front of the vane (14) will be released from further compression against the effective or inwardly seated abutment 21 and will be permitted to flow from port 40 into the space between the upcoming, adjacent vanes (14 and 15). This transfer of air from in front of the vane (14) by way of the by-pass 38 is in effect a two-stage compression in the engine since the transferred air is added to that between the vanes (14 and 15) in a position below and coming up to the port 40.

The abutment 21 is retracted by cam action just as a vane approaches it and at which time the air between the two uppermost vanes at position of 13 and 14 is at about maximum pressure in the small segment of space in the shell at M. Just as the vane clears the retracted abutment the latter is released by the relative cam part 24' and thrust inward by its spring 23 and the injector 30 forces liquid fuel into the compressed air between the abutment and the vane 13 at position X, that is, the ignition space, and the expansive effort of the gas between the effective abutment and the near vane 13 drives this to the left; the area of the face of the vane 13 increasing to the pressure as the vane moves toward the exhaust ports 34. As a vane sweeps past the air inlet ports 33 a fresh charge of air is inducted and its compression starts as soon as the near vane passes beyond the inlets and up toward the compression space M.

Each vane, as 13, is provided with suitable packing 38 along its sides and around its outer convex end so as to make a tight seal on the near surface of the shell wall. Each vane is also provided with a guide device such as ribs or beads 39 working in respective grooves 40 therefor in the near face of the pocket, as 10, Fig. 3, in which the vane reciprocates as its outer end follows the shell surface 19, which is relatively eccentric to the rotor.

The abutment 21 works in a shell recess 41 closed by a cap 42 with a packing gland 43 through which the stem 21b slides.

The cam 24 acts to relieve the push rod and arm 28 just as a vane clears the retracted abutment 21 so that the main spring 23 can at once press the abutment inward to close off the ignition space X, and as this takes place the fuelized charge is fired by the spark plug 31.

What is claimed is:

1. In a rotary gas engine, a rotor disc having a circular rim of semi-circular cross-section, a shell in which the rotor is eccentrically mounted in close, but clearing contiguity at a portion of its rim; said shell having an inner circular wall surface transversely concaved complementary to the rim of the rotor, the latter forming a crescent space within said shell, and a plurality of transverse vanes freely outwardly radially slidable in the rotor and dividing said space into equilength sections whose volumes change as the rotor turns the vanes in an orbit along said space; the outer ends of the vanes being curved to match the transverse concavity of the shell wall surface, and an abutment radially slidable in the shell adjacent to the position of closest relation of the rotor rim to the shell wall and having its inner end concaved to transversely fit and bear on the rotor rim and lap on the side faces of the rotor whereby to divide the space between two adjacent vanes on opposite sides of the abutment into an air compressing pocket and a combustion chamber, means pressing the abutment yieldably inwardly against the rotor rim, and a cam device operative to retract the abutment as each vane registers therewith in position, and to effect transfer of compressed air to the combustion chamber, means to supply fuel to the said chamber, and means for igniting the fuelized air in said chamber following return of the abutment to the rotor rim.

2. A rotary gas engine including a disc-like shell having an inner, continuously circular, rim wall surface and parallel side walls, a rotor disc with a circular rim of less diameter than said rim wall surface and mounted eccentrically in the shell for rotation and forming a crescent chamber in the shell and in clearing contiguity at a portion of its rim with the shell rim wall, a plurality of equispaced, radially slidable vane forming blades in the rotor, spring means to urge the vanes outward for constant contact with said wall surface of the shell, air inlet means arranged in the shell wall near the widest part of the crescent chamber to admit air between adjacent vanes in a position on opposite sides of the air inlet; said vanes coacting to compress the entrapped air after they have both passed the air inlet and are moved by the rotor to a converging portion of the cresent chamber, a radially movable abutment, at the location of said clearing contiguity, in the shell and engaging the rim of the rotor thereat, the said abutment forming on one side and with a vane moving toward, and being nearest to it, an air

compression section in said chamber, and forming with the near vane on the opposite side of the abutment a combustion space, injecting means contiguous to said abutment to introduce a fuel charge into said combustion space, means arranged at said combustion space to ignite the charge for expansion against the said near vane, exhaust ports arranged in the shell between the location of said abutment and the said air inlet and adjacent to the latter, a by-pass leading from a point adjacent to one side of the abutment backward to the closed space at the rear of the adjacent vane approaching the abutment to step up air pressure therein and release air pressure in front of the said vane, means yieldingly thrusting the abutment against the rotor rim, and a cam device for retracting the abutment while a vane passes it and to effect a transfer of compressed air to the combustion space on the opposite side of the abutment.

3. In a rotary gas engine, a rotor having a plurality of transverse spring projected vanes bodily radially moving in and projecting from the rim thereof, a circular shell in which the rotor is eccentrically mounted in clearing contiguity at a portion thereof, a rotative shaft mounted in the shell and fixed centrically to the rotor, an abutment radially mounted, as to the rotor, in the shell for radial reciprocation at the point of nearest relation of the rotor to the shell to form on one side an air compression space in front of an approaching vane and on the other side a combustion space, and means controlling the radial motion of the abutment and including a cam fixed on said shaft and a device actuated thereby and acting on the abutment to lift it to clear a passing vane and admit compressed air from the compression space and then relieve it so as to engage the rotor while the passing piston is relatively close to the abutment, means to inject fuel into said combustion space, and means to ignite the fuel charge; said controlling means including a spring device thrusting the abutment against the rim of the rotor when relieved by the cam.

4. An engine as set forth in claim 3, and in which there is an unrestricted, air by-pass leading from a point near one side of said abutment to the space between the next approaching pair of vanes to step up air pressure therein and reduce it between the abutment and the adjacent, approaching vane of the said pair and following transfer of compressed air to the combustion chamber.

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