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ROTARY ENGINE APPARATUS

Filed March 10, 1964

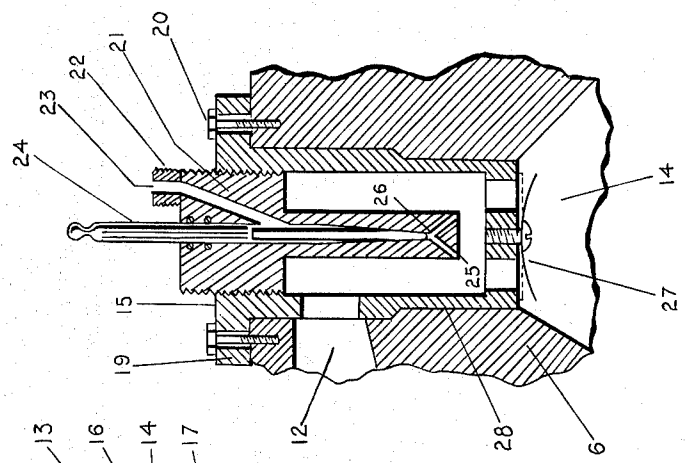


Fig. 3

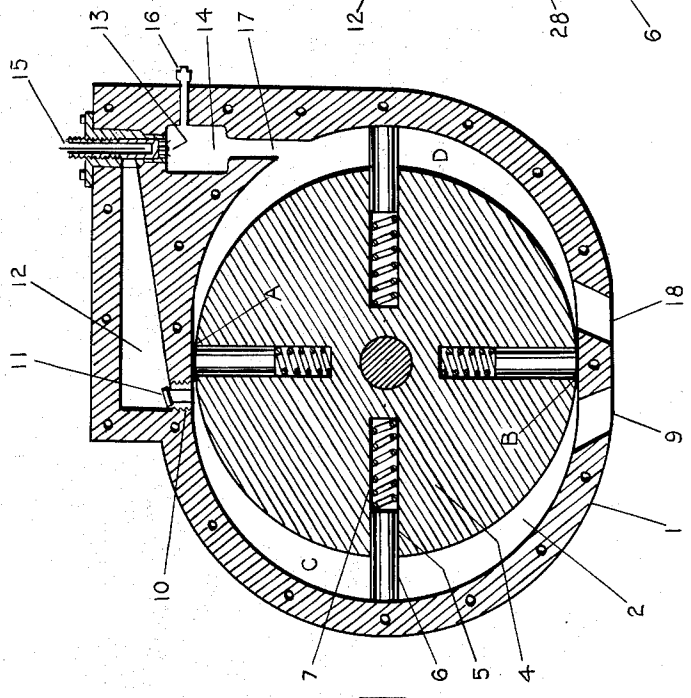


Fig. 2

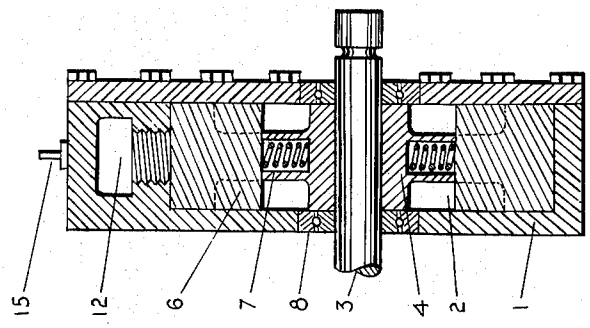


Fig. 1

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ROTARY ENGINE APPARATUS

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This invention is a continuation-in-part of my prior application Serial Number 129,684, which was filed August 7, 1961, now Patent Number 3,150,646.

This invention relates to internal combustion engines of the rotary type. Specifically, these improvements concern the counterbalancing of the rotors in engines of this class which employ sliding vane type pistons or impellers in their operations.

The structure of my prior case employs a round, sliding vane type rotor which is eccentrically mounted in a circular rotor chamber of a larger diameter. The sliding vanes extend an unequal distance outward from this rotor when they engage the inner peripheral surfaces of the rotor chamber and thus exert an unequal force from the rotor axis.

To compensate for the unequal force distribution it was necessary to provide my prior structure with a second rotor chamber. This second chamber is positioned so that its eccentric mounting is diametrically opposed from the eccentric mounting of the first chamber. The opposed mountings insure that the unequal forces exerted by the sliding vanes of one rotor are equalized by the unequal forces exerted by the sliding vanes of the rotor in the opposed chamber.

The primary improvement of this invention is that it provides for a rotary engine a self compensating sliding vane type rotor which will maintain itself in a constant state of balance during all engine operating speeds.

A particular arrangement for the rotary engine's components is employed to accomplish this improvement. This arrangement requires the use of a balanced rotor wheel, an even number of sliding vanes which are to be positioned about the rotor in diametrically opposed pairs, and an elliptical shaped rotor chamber in which the rotor assembly is coaxially positioned. This arrangement insures that all forces are equal and opposite as they act from the axis of the assembly. These equal forces maintain the rotor assembly in a constant stable condition.

The manner through which the counterbalancing is obtained will be more fully understood by reference to the accompanying drawing. The illustrations of the drawing are as follows:

FIGURE 1 illustrates a side elevation of a single rotor engine apparatus.

FIGURE 2 illustrates the apparatus rotor chamber and the positioning of ports, chambers and components therein.

FIGURE 3 illustrates a suitable mechanism for entering a liquid fuel into the apparatus.

Referring to FIGURES 1 and 2, an apparatus outer casing or housing **1** is sectioned and formed so as to provide an elliptical shaped rotor chamber **2** and to encase in this chamber **2** a shaft **3** and a rotor **4**. The rotor **4** is to be machined, keyed or otherwise affixed to the shaft **3** and the shaft then mounted in bearings **8** contained in the sides of the housing **1**, the mounting to provide a common axis for the chamber **2**, the shaft **3** and the rotor **4**.

The rotor **4** is provided with an even number of impeller vanes **6** which are slideably contained in slotted openings **5**. The openings **5** are equidistantly spaced about the outer circumference of the rotor and arranged so as to permit the impeller vanes **6** to slide toward and away from the common axis. The illustrated compression springs **7** are a suitable means for maintaining the outward extremities of the vanes **6** against the inner peripheral wall of the chamber **2**.

The diameter of the rotor **4** corresponds to the short diameter of the elliptical chamber **2** thereby providing slideable contacts between the rotor **4** and the inner peripheral surfaces of the chamber **2** at points A and B. The slideable contacts at A and B divide the chamber **2** into two diametrically opposed and equal compartments C and D. The impeller vanes **6** further divide these compartments C and D into cavities which constantly change shape and cubic displacement as the vanes **6** pass through them during a rotation cycle of the rotor **4**.

The important and critical feature of this invention is that, when these cavities change their shape and cubic displacement in one compartment, C or D, they maintain an exact proportion with the diametrically opposed cavity in the opposite compartment.

An intake port **9** is provided in an extremity of compartment C and a check valve opening **10** is contained in the opposite extremity of this compartment. The check valve opening **10** contains a suitable check valve means **11** through which communication with an air receiver chamber **12** is had.

Atmospheric air is drawn into the rotor chamber compartment C by suction forces created behind each impeller vane **6** as it passes through and away from the intake port **9**. This drawn in atmospheric air is forced toward the point A by the next following impeller vane **6** and the eccentric contour, existing between the rotor **4** and the rotor chamber **2**, serves to compress and to pass the drawn in air from the compartment C, through the check valve **11** and into the air receiver chamber **12**.

The air receiver chamber **12** is communicated with a combustion chamber **14** through a bore **13**. This arrangement allows the compressed air to flow from the air receiver chamber **12**, through the bore **13**, into the combustion chamber **14** and to be re-entered into the compartment D through the thrust tube **17**.

A suitable fueling mechanism **15** (detailed in FIGURE 3) is provided. This mechanism has an outer housing **19** which is adapted to be press fitted into the bore **13** between the air receiver chamber **12** and the combustion chamber **14**. The mechanism may be held firmly in place by cap screws **20**. A needle valve casement **21** is suitably mounted within the housing **19** in a manner which extends a needle valve seat **26** and fuel orifices **25** to a position in close proximity with the combustion chamber check valve **27**. A pressured fuel line (not illustrated) attached to the fitting **22** forces fuel into the duct **23**. Thus, when the needle valve **24** is disengaged from the needle valve seat **26**, fuel is forced through the fuel orifices **25** and sprayed into the area surrounding check valve **27**.

The engine is started by directing an electric current through an ignition device **16** and turning the shaft **3** with a starting motor or a crank. Turning the shaft **3** starts the flow of air through the apparatus as hereinabove described. After starting the flow of air through the apparatus, a pressure applied to unseat the needle valve **24** causes fuel to enter the air stream. The spraying of the fuel into the air stream forms a carburetted fuel-air mixture which is carried into the combustion chamber **14** where it is ignited by the ignition device **16**.

The explosive force created by the ignition of the fuel-air mixture acts to close the check valve **27**, thereby directing the explosive force through the thrust tube **17**. The opening of the thrust tube **17** is aligned so as to direct the force of the explosion onto the exposed part of the reverse side of the impeller vanes **6**. The explosive forces drive the impeller vane **6** away from the thrust tube **17**, which, in turn, causes the shaft assembly to rotate.

The exhaust gases are expelled from the compartment

D by the next following impeller vane 6 as it passes the exhaust port 18.

An important result of this invention is an improvement on the concept of creating and utilizing a vacuum force of the explosion onto the exposed part of the reverse charges which are to be drawn into the combustion chamber 14.

This concept was first advanced in my referenced prior application, Serial Number 129,684.

The vacuum force is created within the respective structures by positioning the thrust tube openings 17 a linear distance in the direction of rotation from the contact point A. The drawn in atmospheric air will be forced from the compartment C and through the check valve 11 as the impeller vanes 6 pass into the contact point A as hereinbefore explained. As the rotation continues the gases which are in the compartment D will be forced ahead of each impeller vane 6 and a vacuum force will thereby be created in the area between the point A and the thrust tube opening 17.

The vacuum force is utilized in both my prior and the present structures to set up a pressure imbalancing action between the combustion chamber 14 and the air receiver chamber 12. When an impeller vane 6 passes through the opening 17 a portion of the burning gases will be drawn from the combustion chamber area below that of the air receiver chamber. Reducing the pressure allows a new charge of air and fuel to be forced into the combustion space 14 by the then greater pressure in the air receiver compartment 12.

The improvement in this concept results from the fact that there is more vacuum creating area in a shorter linear distance in an elliptical chamber than in my prior round chamber. The increased vacuum creating area of the elliptical chamber provides a more rapid vacuum build up and hence a more positive force to pull the burned gases from the combustion chamber 14.

The use of an elliptical chamber makes possible the creation of a vacuum force which is sufficient to snap open the spring type valve 27 as the impeller vane 6 passes the thrust tube opening 17. Moreover this force, being built up in a relatively short distance (which may be measured in degrees of shaft rotation), allows the new charge to be entered into the combustion chamber 14 in less degrees of shaft rotation and the combustion can therefore act on the reverse side of each impeller vane 6 for a greater length of time.

The ignition device 16 is required to ignite the initial fuel-air charge and subsequent charges may be ignited with the device 16 or may be ignited by the preceding charge. The engine operates with a substantially constant force directed into the compartment D with slight pulsations being created by the hereinabove described vacuum.

Construction of the apparatus is not complex. However, precision and balance are required in its manufacture. Care must be exercised to assure that the sidewalls of the rotor chamber 2 and the rims of the rotor 4 are machined to provide a smooth, slideable and a reasonably close fit so as to prevent compression loss. The impeller vanes 6 must be conformed to the slotted openings 5 and be balanced in size and weight. A lubrication means (not illustrated) must be provided for the bearings 8 and all other wearing surfaces.

The rotor 4 should be designed to rotate at high speeds as the power from the apparatus will depend upon kinetic energy which will be proportionate to the speed and weight of the rotor 4. Hence there is a need for precision and balance in the manufacture of the rotor 4, the slots 5, springs 7 and the vanes 6. When such precision and balance are provided and the shaft 3 is coaxially positioned in the chamber 2, the elliptical contour of the chamber 2 will automatically provide a constant counterbalance for the rotor 4 at all engine operating speeds.

It will be obvious to those familiar with this art that an apparatus can be constructed to contain a series of rotors 4 on a common shaft 3 and that the rotor assemblies of such apparatus can be counterbalanced according to the teachings set forth in this specification. The rights to all such modifications which fairly fall within the scope of the following claims are hereby reserved.

I claim:

1. The combination of a round rotor wheel mounted onto a shaft whereby said wheel and said shaft turn in unison on a common axis; an even number of slotted openings equidistantly spaced about and extended from the peripheral surface toward the axis of said wheel; an impeller vane slideably mounted within each such slotted opening; an elliptical shaped chamber having a minor diameter equal to the diameter of said wheel; openings through the sidewalls of said chamber, said shaft mounted in said openings in a manner whereby said wheel is coaxially positioned within and makes slideable contacts with the inner peripheral surfaces of said chamber at points corresponding with said minor diameter thereby forming two diametrically opposed and equal compartments in said chamber; a means for extending said impeller vanes outward from the axis of said wheel and thereby holding them slideable against the inner peripheral surfaces of said chamber; an air intake port through a wall of said chamber at a point in close proximity with one said slideable contact point and an air discharge port through a wall of said chamber at a point cooperative with the slideable contact point opposite from said first named contact point, said intake and discharge ports positioned within one of said compartments of said chamber; a thrust tube opening through a peripheral wall of said chamber a linear distance from said second named contact point and an exhaust gas port means through a wall of said chamber in close proximity with said first named contact point, said thrust tube opening and said exhaust gas port positioned in the compartment of said chamber opposite from said first named compartment; an air receiver chamber outward from said elliptical chamber and communicated therewith through a spring type check valve means positioned in said air discharge port; a combustion chamber outward from said elliptical chamber having a thrust tube extension terminating in said thrust tube opening; a bore containing a spring type check valve means in the said combustion chamber in the extremity thereof opposite from said thrust tube extension, said bore communicating said combustion chamber with said air receiver chamber; and a valve means for entering a liquid fuel within the said air receiver chamber; the said combination operative in a manner whereby said wheel rotates within said elliptical chamber; whereby the side surfaces of said impeller vanes and the rims of said wheel form a running seal with the sidewalls of said elliptical chamber; and whereby each extended impeller vane has a diametrically opposed impeller vane extended an equal distance from the axis of said wheel.

2. A rotary engine apparatus comprising the combination of a series of round rotor wheels of uniform diameters, said wheels mounted onto a shaft whereby said wheels and said shaft turn in unison on a common axis; an even number of slotted openings equidistantly spaced about and extended from the peripheral surface toward the axis of each such wheel; an impeller vane slideably mounted within each such slotted opening; an elliptical shaped chamber for each such wheel, said elliptical chambers uniform in size and having minor diameters equal to the diameters of said wheels; openings through the sidewalls of said chambers, said shaft mounted through said openings in a manner whereby each such wheel is coaxially positioned within and make slideable contacts with the inner peripheral surfaces of its respective chamber at points corresponding to the minor diameter thereof, such mounting forming two diametrically opposed and equal compartments within each such elliptical chamber; a means for extending said impeller vanes outward from the axis of said wheels and holding them slideable against the inner peripheral surfaces of said elliptical chambers;

an air intake port through a wall of each such elliptical chamber at a point in close proximity with one of the slideable contact points therein and an air discharge port through a wall of each such elliptical chamber at a point cooperative with the slideable contact point opposite from said first named contact point; the intake and discharge ports for each such chamber being positioned within one of said compartments of the said chamber; a thrust tube opening through a peripheral wall of each such elliptical chamber a linear distance from said second named contact points and an exhaust gas port means through a wall of each such chamber in close proximity with said first named contact points, the thrust tube opening and exhaust gas ports for each such chamber being positioned in the compartment of said chamber opposite from said first named compartment; an air receiver chamber outward from each such elliptical chamber, said air receiver chamber communicated with its respective elliptical chamber through a spring type check valve means positioned in said chamber's air discharge port; a combustion chamber outward from each such elliptical chamber, each such combustion chamber having a thrust tube extension which is communicated with its respective elliptical chamber through said chamber's thrust tube opening; a bore containing a spring type check valve means in each such combustion chamber in the extremity thereof opposite from said thrust tube extension, said bores communicating each such combustion chamber with its respective air receiver chamber; and a valve means for each such receiver compartment adapted to enter a liquid fuel therein.

3. The combination of a round rotor wheel mounted onto a shaft whereby said wheel and said shaft turn in unison on a common axis; an even number of slotted openings equidistantly spaced about and extended from the peripheral surface toward the axis of said wheel; an impeller vane slideably contained within each such slotted opening; an elliptical shaped chamber having a minor diameter equal to the diameter of said wheel; openings through the sidewalls of said elliptical chamber, said shaft mounted in said openings in a manner whereby said wheel is coaxially positioned within and makes slideable contacts with the inner peripheral surfaces of said elliptical chamber at points corresponding with said minor diameter thereby forming two diametrically opposed and equal compartments in said elliptical chamber; a means for extending said impeller vanes outward from the axis of said wheel and thereby holding them slideable against

the inner peripheral surfaces of said elliptical chamber; a combustion chamber outward from said elliptical chamber having a spring type check valve means in an extremity thereof; a restricted tubular type adit communicating the said elliptical chamber with the said combustion chamber, the said adit positioned in the extremity of said combustion chamber opposite from said check valve means and entered into one of the said equal compartments of said elliptical chamber a linear distance from one of the said slideable contact points and an air receiver chamber outward from said elliptical chamber and communicated therewith through a spring type check valve means contained in a bore through a wall of said elliptical chamber in the compartment opposite from the first named compartment, said combination operative in a manner whereby the said wheel rotates within said elliptical chamber; whereby the side surfaces of said impeller vanes and the rim of said wheel form a running seal with the sidewalls of the said elliptical chamber, whereby pressurized gases are expelled through the said spring type check valve in said bore in the second named compartment as said vanes pass through said slideable contact point and into said first named compartment; and whereby a vacuum force is created in the said linear distance between said slideable contact point and said adit which is sufficient to open the said spring type valves as said vanes are passed through said adit thereby causing air to circulate from the second named compartment into the first named compartment.

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