United States Patent

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[54] **ROTARY VALVE ENGINE**
1 Claim, 7 Drawing Figs.

[52] U.S. Cl. 123/190
[51] Int. Cl. F01l 7/02
[50] Field of Search ..... 123/190(A), 190(A1), 190(A2), 190(A3), 190(B), 190(B1), 190(B2), 190(B3), 190(B4), 190(P1)

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ABSTRACT: A rotary-valve engine in which there are provided rotary bodies each of a circular shape in section and a notch on one part thereof, the rotary bodies are each disposed in opposite to the intake and exhaust ports of the cylinder of the engine, and the rotary bodies make rotation thereby alternately opening and closing the intake and exhaust ports at desired time intervals.

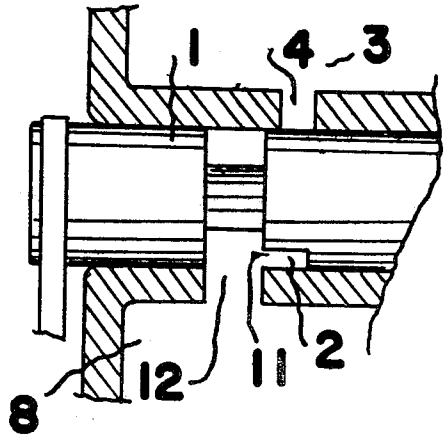


FIG. 1.

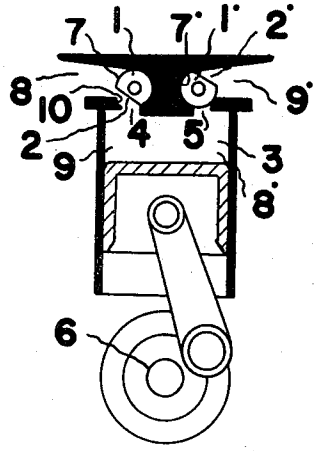


FIG. 2.

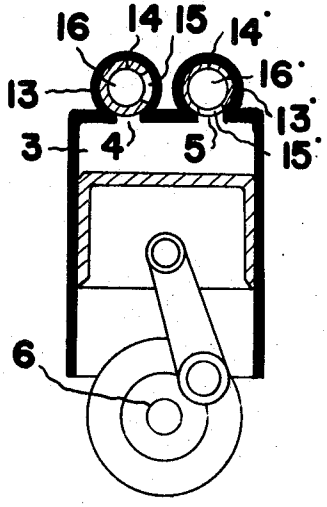
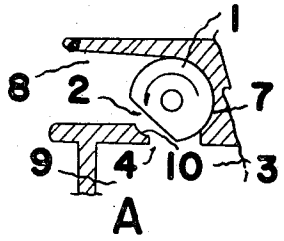
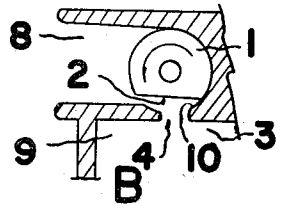


FIG. 3.





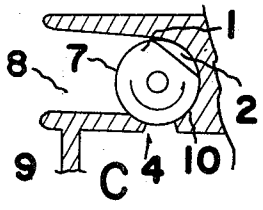


FIG. 4.

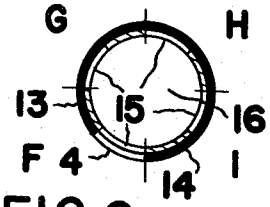


FIG. 5.

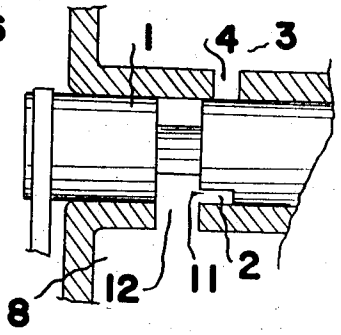
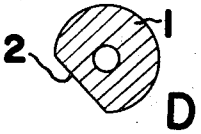


FIG. 6.



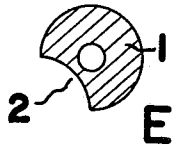
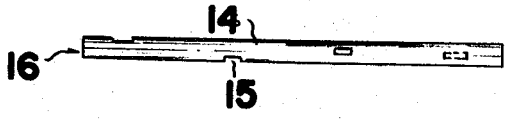


FIG. 7.



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ROTARY VALVE ENGINE

This invention relates to a rotary-valve engine in ordinary drive engines such as four-cycle gasoline engines, which has a rotary-valve mechanism incorporated instead of a vertically reciprocating valve mechanism.

A primary object of the present invention is to provide a rotary-valve engine which has removed quite many disadvantages of conventional valve mechanisms such as occurence of noises due to up-and-down movement of the valve and frequent troubles caused from complicated construction.

Increase of driving energy and rise of efficiency of the engine as well as accurate operation and low cost obtained by extreme simplification of the construction are other objects of this invention. Preferred embodiments of the present invention will now be described fully with reference to the accompanying drawings in which:

FIG. 1 is a schematic view explanatory of operation of a cylinder-type valve mechanism in the rotary-valve engine of this invention; FIG. 2 is a schematic view showing operation of a hollow cylinder-type valve mechanism; FIGS. 3-A, 3-B and 3-C inclusive show opening and closing operations of the cylinder-type valve mechanism; FIG. 4 is an illustrative view of opening and closing operations of a hollow cylinder-type valve mechanism; FIG. 5 illustrates an embodiment of the cylinder-type valve mechanism; FIG. 6 shows vertical sections of rotary cylinder-type valve mechanisms each having a notch of different configuration; FIG. 7 is a schematic front view of a hollow cylinder-type valve mechanism used in the multicylinder type engine.

Generally the valve mechanism used in a conventional drive engine such as the four-cycle gasoline engine has a construction in which the gears in direct connection to a crankshaft are meshed with cam gears, converting a motion through a cam to intermittent up-and-down movement of the valve to thereby open and close the intake and exhaust ports at definite time intervals. Such valve construction requires, a valve spring, a valve spring seat, a space adjusting screw and other accessory parts which would cause troubles, noise and consequent reduction of engine efficiency.

The present invention provides for completely removing the described drawbacks and is characterized in that a notch 2 of a desired shape is formed on the surface of a rotary body 1 of a circular cross section and the rotary body 1 is rotatably mounted on a shaft so that it may adequately face in opposite to intake and exhaust ports 4,5 connected to a cylinder chamber 3 of an engine. Said rotary body 1 is connected to a crankshaft 6 rotating in a desired cycle so that peripheral surface 7 and the notch 2 may be disposed in agreement with said intake and exhaust ports 4,5

More detailed description will now be made with respect to the embodiments of this invention with reference to the accompanying drawings. FIG. 1 shows the operation of an engine in use of a cylinder-type rotary valve in a four cycle gasoline engine. The rotary bodies 1,1′ each has on a part thereof a notch 2 or 2′ for communicating an intake chamber 8 with combustion chamber 9 over a definite period of time. The notches 2,2′ are disposed to alternately engage with the communicating ports 4 and 5 for said intake chamber 8 and exhaust chamber 9′, and said rotary bodies 1,1′ are connected to a crankshaft 6 and rotate at a desired period of speed whereby the combustion and intake chambers 9 and 8 can be communicated at time intervals as predetermined by the peripheral surface 7 and the notches 2,2′ of the rotary bodies 1,1′.

In the FIG. 1,1′ show cylindrical rotary bodies or cylinder-type rotary-valves which at a definite rotating speed are in opposite to the communicating ports 4,5 for the intake chamber 8 and the exhaust chamber 9′ and on a part of the valve is provided with the notch 2 or 2′ of a desired shape.

The described notch 2 or 2′ is formed in a predetermined position on the rotary body 1 or 1′, the shape of said notch being variable in proportion of the angular speed of the rotary body 1 or 1′ and that of the crankshaft 6 and in a size that opening and closing of the communicating ports 4,5 are adapted for the operation of the engine.

Now in a four-cycle engine in which the rotational velocity of the crankshaft 6 is given as 2 in ratio and that of the rotary body 1,1′ as 1 and the range of the notch is made one fourth the entire periphery thereof, said notch communicates the intake chamber 8 to the combustion chamber 9 at a time interval corresponding to a stroke of four-stroke operations of the synchronizing the time interval with the suction stroke or the exhaust stroke it is possible to make a valve operation as desired.

While I have described the rotary body 1 or 1′ having circular configuration insection, the above-mentioned rotary body 1 or 1′ may have any modified shape for example a tapered shape and the like. In the figure, numerals 4 and 5 are the ports communicating the intake, chamber 8 and the exhaust chamber 9′ to the combustion chamber 9. Further, numeral 4 is an intake port, 5 an exhaust port, 8 a fuel supply chamber communicating to the carburettor, 9 a combustion chamber or a cylinder chamber, 9′ an exhaust chamber, 8′ a flow-out chamber for the exhaust stroke. The described communicating port or the suction port 4 and the exhaust port 5 has its periphery 10 formed in the same curvature as the peripheral surface of the rotary body 1 so that the suction port and the exhaust port may be tightly closed with the peripheral surface 7.

Operation of the rotary valve of the above-mentioned construction will now be explained with respect to the suction stroke. In FIG. 3-A, there is shown a valve mechanism in operation where the engine stroke is shifting to the suction stroke and the notch 2 of the rotary body 1 communicates the cylinder chamber 9 and the fuel supply chamber 8, and in FIG. 1-B a valve mechanism in operation when it is entirely opened with progress of the suction stroke.

In this situation the working fluid is introduced from the fuel chamber 8 to the cylinder chamber 9 through the suction port 4.

FIG. 1-C shows a valve operation when the suction stroke is finished and the cycle is shifting to the stage of compression stroke where the peripheral surface 7 of the rotary body 1 is fitted to the peripheral edge 10 of the suction port 4 thereby closing the cylinder chamber 9 completely. Therefore, the movement of a fluid is completely obstructed, while the same state being left unchanged until subsequent suction stroke so that by this operation it is possible to displace in location the notch 2′ of the rotary body fitted to the exhaust port 5 thereby to use it as suction valve.

Further, in FIG. 6 is shown a notch 2 of the cylinder 1, or 1′ of a modified type in which for providing an area of a notch particularly large the depth of the cylinder has been varied without changing the size in proportion to the peripheral surface of the cylinder.

Furthermore, this change can be appropriately determined according to the proportion of the angular velocity of the rotary body 1 and that of the crankshaft 6 as well as the amount of fuel consumption.

This modified type provides for the one end of the notch 2 at a location as determined on the rotary body 1 is communicated to a recessed part and 12 along the peripheral surface of the rotary body, said recessed part and combustion chamber 8 being associated in operation, and the fuel gas is always filled in the notch whereby the suction efficiency of a fuel is raised so much that the notch and the suction port 4 effect the suction and the suction port is closed with the rotation of the rotary body 1 by means of the peripheral surface 7 for a period of time as predetermined. Next is shown in FIG. 2 another embodiment of a rotary valve engine of this invention in which an outer cylinder 13,13′ is securely provided on the upper part of the suction and exhaust ports 4 and 5 which are communicated to the cylinder chamber 3. In the interior of the outer cylinder is rotatably provided a hollow cylinder-type rotary body 14 or 14′, a passage hole 15,15′ in a fixed position on the rotary body 14 or 14′. Said hollow cylinder-type rotary body in turn is connected the crankshaft 6 in making a desired periodic rotation and by which the hollow part 16,16′ of the rotary body and the suction and exhaust ports 4,5 are commu-

nicated or closed at desired time intervals. In this embodiment, the outer cylinder **13** and **13'** is formed integral with the cylinder body in opposite to the suction and exhaust ports **4,5** and in which is rotatably housed a hollow cylinder-type rotary bodies **14,14'** having passage holes **15,15'**.

The hollow cylinder-type rotary bodies as above described rotate in association with the rotation of the crankshaft **6** in an angular velocity as predetermined and the passage hole **15** or **15'** in a fixed position is communicated to the hollow part **16** or **16'**. This passage exercises a similar operation as the notch **2** on the above-mentioned rotary valve with its shape and position being defined in the same sense. Also the end portion of the hollow part **16** or **16'** of the above described construction is communicated to the suction port **4** or the exhaust port **5** by the position of movement due to its rotation with the passage hole **15** provided in the hollow cylinder-type rotary body **14** or **14'** thereby to suction or exhaust a gas into or from the cylinder. Thus the shape and operation of each mechanism in the above-mentioned operation is similar to the solid cylinder-type rotary-valve engine, by which operation is opened or closed a valve at desired time intervals for adequate use in the four-cycle gasoline engine and the like.

FIG. **4** shows a valve operation at each engine stroke of said hollow cylinder-type rotary valve in which F shows a suction stroke, G a compression stroke, H an explosion stroke and I a suction stroke respectively. The passage hole **15** connected to the suction port **4** during the suction stroke is closed by the outer cylinder in the other stroke, thus the hollow part **16** and the cylinder chamber **3** being out of communication. With the progress of its operation, the passage hole **15** returns to its suction position and in agreement with the suction port **4** urgest the suction of the air. In this case the rotational velocity of the hollow cylinder-type rotary body **14** and the crankshaft retains a proportion of one to two and the area covered by the peripheral part of the suction port **4** and the passage hole **15** corresponds to the bore defined by one-eight the total periphery thereof. Accordingly the tine of opening corresponds to a period of the time one-fourth the rotation of a crankshaft. Such construction can readily be applied to the exhaust valve in which the objective can be attained only by varying the phase of the passage hole **15** of the hollow cylinder-type rotary body for suction of air and the exhaust passage hole **15'** by 270°.

The rotary valve as hereinbefore described may not only be of a cylindrical-type or hollow cylinder-type but also it may be of any modified type such as a tapered rotary body or a notched rotary disc which is combined with a perforated plate covering the suction and exhaust ports.

FIG. **7** shows a multicylinder-type gasoline engine of a lineal arrangement provided with a hollow cylinder-type rotary body common to all cylinders, in which the suction and exhaust ports respectively provided at each cylinder are closed or communicated by means of the hollow cylinder-type rotary body having each a passage hole **15** in a fixed position.

It will be understood that the suction and exhaust air ports of each cylinder in parallel arrangement by linearly arranged and may have at desired positions passage holes or notches in one of the rotary bodies thereby to operate as suction and exhaust air valves.

The rotary engine of this invention thus can eliminate the drawbacks of the known reciprocal valve mechanism involving frequent troubles due to complicated construction, undesired operation and noise, and simplifying the construction and lessen the cost of manufacture by small volume, raise the engine efficiency of operation.

I claim:

1. A rotary-valve engine in which there are provided rotary bodies each of a circular shape in section and a notch on one part thereof, the rotary bodies are each disposed in opposite to the intake and exhaust ports of the cylinder of the engine, and the rotary bodies make rotation thereby alternately opening and closing the intake and exhaust ports at desired time intervals, a notch being provided in fixed position of a rotary body in communication with a hollow part formed along the peripheral surface of said rotary body and said hollow part communicating with a combustion chamber so as to always fill the mixture in said notch.