ABSTRACT OF THE DISCLOSURE

An internal combustion engine in which the cylinders thereof are axially aligned paralleled to the axis of a rotating driven shaft. The shaft mounts a rotating valve having induction and exhaust passages which simultaneously communicate with opposed pairs of cylinders in which the pistons are axially aligned and instantaneously performing an identical portion of a firing cycle with lines of action in opposite senses along the common axis.

This application is a continuation of my copending application, Ser. No. 648,554, filed June 26, 1967, now abandoned.

This invention relates generally to the field of internal combustion engines, and more particularly to an improved form of cam engine in which the pistons are fixedly mounted upon one end of a connecting rod, and the opposite end thereof engages a cam on a driven shaft to impart rotary motion thereto.

It is among the principal objects of the present invention to provide in an engine of the above described class a compact configuration obtained by placing the axes of the cylinders in parallel relation with respect to the principal axis of the motion output shaft, whereby the engine may be particularly suited for use in small boats, aircraft and the like.

Another object of the invention lies in the provision of a cam engine in which the pistons execute a normal four-cycle function during the revolution of the driven shaft without resort to gear reduction means.

Another object of the invention lies in the provision of an improved internal combustion engine in which the pistons thereof are supported for operation without side reaction through contact with the cylinder walls, and can be operated with the output shaft thereof either vertically or horizontally positioned.

Yet another object of the invention lies in the provision of an improved internal combustion engine in which induction and exhaust functions are performed by a single rotating disc valve mounted directly upon the driven shaft for rotation therewith.

Still another object of the invention lies in the provision of an internal combustion cam engine which, because of the relative reciprocation of the component parts is inherently in balance, without resort to counter weights, vibration dampers, and the like.

A further object of the invention lies in the provision of an internal combustion engine of the class described which may be conveniently fabricated using a minimum number of parts, whereby the total cost of production on a volume basis, may be materially less than that encountered in the manufacture of conventional internal combustion engines.

A feature of the invention lies in the ready adaptability of the disclosed embodiment to fuel injection diesel operation or carburetion.

Another feature of the invention lies in the ready adaptability of the disclosed embodiment to either air or liquid cooling.

Still another feature of the invention lies in the high torque available at low operational speeds, effective engine displacement considered.

Another feature of the invention lies in the elimination of timing gears and valve springs in a four cycle engine. These objects and features, as well as other incidental ends and advantages, will move fully appear in the progress of the following disclosure, and be pointed out in the appended claims.

In the drawing, to which reference will be made in the specification, similar reference characters have been employed to designate corresponding parts throughout the several views.

FIGURE 1 is a side elevational view of an embodiment of the invention.

FIGURE 2 is a schematic top plan view showing the moving components of the embodiment.

FIGURE 3 is a schematic side elevational view as seen from the lower portion of FIGURE 2.

FIGURE 4 is a schematic and elevational view thereof, as seen from the right hand portion of FIGURE 3.

FIGURE 5 is a transverse sectional view as seen from the plane 4-4 in FIGURE 3.

In accordance with the invention, the device, generally indicated reference character 10, comprises broadly a frame element 11, a motion output shaft element 12, a plurality of cylinder and piston assemblies 13, and rotary valve element 14.

The frame element 11, as best seen in FIGURE 1 in the drawing, includes a base plate 16 for mounting the device 10 on a horizontal surface (not shown). Extending upwardly from the base plate are a plurality of central support members 17 which interconnect with first and second centrally disposed plates 18 and 19 which are interconnected by longitudinally extending bolts 20. The plates 18 and 19 are of solid configuration, and form on the interior portions thereof cylinder heads or manifolds for the assemblies 13, as will more fully appear hereinafter.

Extending longitudinally from the plates 18 and 19 are support rods 21a, the outer ends of which engage first and second end plates 22 and 23, respectively. The end plates define generally centrally located openings in which main bearings 24 and 25 are positioned to support the shaft element 12. These bearings handle radially directed loads, that is to say the weight of the shaft element 12, separate thrust bearings being provided to absorb power impulses.

A subframe 26 is supported on rods 27 interconnected with the plate 22 to support the fixed portions of a distributor or magnet 28, the rotor portion thereof being driven directly by the end of the shaft element 12.

The shaft element 12 includes the main shaft 29, a first end 30 communicating with the above mentioned distributor 28, and a second end 32 which supports a combined flywheel and starter ring gear 33 of well-known type. Intermediates to ends 30 and 32 are a pair of ribbed barrel cams 34 and 35 each including opposed cam faces 36 and 37. Each cam 34-35 includes two symmetrically disposed high points 38 and corresponding low points 39 which may be modified too for dwell areas. Thrust bearings 40 and 41 transmit thrust directly to the plates 18 and 19, as do radical bearings and, respectively, whereby, in conjunction with the bearings 24 and 25, the shaft 29 is limited to pure rotation about its own axis.

The cylinder and piston assemblies 13 are best understood from a consideration of FIGURES 2 and 3. Each assembly includes a cylinder sleeve 46 having an exposed surface 47 for air or liquid cooling (not shown). The inner ends 48 of the sleeves 46 are connected to one of the plates 18-19 which, as has been mentioned, functions as a cylinder head or manifold. The outer ends 49...
thereof are connected to a supporting plate 50–51 by bolts 51a, respectively. The plates 50–51 are similar, each being provided with corresponding openings for the sleeves 46, as well as openings 53 which form bearings for sliding guide rods 54. The pistons 55 are provided with conventional piston rings 56 for forming a seal with the inner surface of the sleeves 46, and are rigidly connected to connecting rods 57 in any suitable manner, but preferably not including conventional cup pins since no relative pivotal movement is required between the rods and pistons, the rods 57 being connected to alignment plates 58 which also mount the guide rods 54, and the cam follower mounts 59 are provided with roller bearings 60 which coat with the cam faces 36–37 on the cam 2.

As best seen in FIGURES 2 and 5, the portions of the plates 18–19 which function as cylinder heads, and indicated by reference character 62 are provided with a single port 63 through which unburned gasses pass into the cylinder, and exhaust gasses are removed. The ports 65 are aligned for opposed cylinders, as best seen in FIGURE 3 in the drawing. As seen in FIGURE 2, spark plug openings 64 may be provided for each cylinder, but, as will more fully appear, one spark plug may be used to simultaneously fire two cylinders where desired.

The rotary valve element 19 is best understood from a consideration of FIGURE 5, and includes a generally rectangularly shaped valve housing 66 having first, second, third and fourth ports 67, 68, 69 and 70, respectively.

Carburetors, one of which is indicated by reference character 71 communicate with ports 68 and 70, and, if desired, ports 67 and 69 may be provided with muffler means (not shown). A rotary valve body 72 is mounted on the shaft 29, and fixed relative thereto by keying means 74, so as to be disposed within a circular chamber 74a in the housing 66. The body 72 is bounded by a curved peripheral surface 75 and a pair of planar surfaces 76 which form means for sealing the ports 63 during the compression and power strokes of any given piston.

Referring to FIGURE 5, the body 72 is divided into an intake quadrant 77 a compression quadrant 78, a power quadrant 79 and an exhaust quadrant 80. These quadrants are serially presented to each pair of opposed cylinder and piston assemblies as the shaft 29 rotates, to permit the opening of the cylinder for the induction of a combustible mixture, the subsequent closing of the cylinder for compression and power strokes, and the later opening of the ports 63 to permit the burned gasses to be exhausted.

For convenience in location of the ports 67–70, the channel 81 providing for induction of gasses includes a peripherally opened portion 82 and a radially opened portion 83 which together extend over an arcuate distance of slightly less than 180 degrees. The exhaust channel 84 is both peripherally and radially open over the same arcuate distance, that is to say slightly less than 90 degrees.

From a consideration of FIGURES 2, 3, and 5, it will be apparent during the revolution of the main shaft 29 through 360 degrees, each of the cylinder and piston assemblies have completed a single four stroke cycle of operation, and with two cylinders firing simultaneously in opposite directions along a common axis, four power strokes will be obtained for each revolution. As the device operates, the reciprocating masses are at all times equally balanced, so that axial vibration is practically non-existent. The valve body 72 is most conveniently balanced by milling areas as indicated by reference character 85, or if desired, suitable counter weights (not shown) may be employed. Through holes 85a connect between opposed cylinders to provide equal compression in those cylinders during the combustion or power stroke.

Where diesel operation is preferable, the carburetors 71 may be substituted by suitable fuel injection means (not shown) timed to operate simultaneously with the alignment of the valve body 72 with the ports 63. Where the device is gasoline operated, lubrication is best accomplished by mixing lubricating oil with the fuel as is normally done in the operation of two cycle engines.

It will be observed that by virtue of the presence of the guide rods 54, and the reciprocating plates 58, there is substantially no side wall reaction between the pistons and the cylinder walls, all side wall reaction being absorbed by the rods within respective bearings.

I wish it to be understood that I do not consider the invention limited to the precise details of structure shown and set forth in this specification, for obvious modifications will occur to those skilled in the art to which the

I claim:

1. In a cam type internal combustion engine having a relatively stationary frame element, a motion output shaft having a principal axis supported for rotation in said frame element, barrel cams mounted upon said shaft, and cylinders surrounding said shaft and having principal axes parallel to that of said shaft, improved valving means comprising: a valve housing having first, second, third and fourth ports, carburetors communicating with two oppositely disposed ports, exhaust means communicating with the other two of said ports, a rotary valve body mounted on said motion output shaft and disposed within said housing, said body being bounded by a curved peripheral surface and a pair of parallel planar surfaces, said last mentioned surfaces sealing said ports during compression and power strokes in any given cylinder, said body including intake, compression, power and exhaust quadrants serially presented to coaxially aligned cylinders as said shaft rotates.

2. Structures in accordance with claim 1 in which said body includes a peripherally opened portion and a communicating radially opened portion which together extend over substantially 180 degrees.

3. Structure in accordance with claim 1, said cylinders being arranged in coaxially aligned pairs on opposite sides of said valve housing and including a pair of plates connected thereto in direct communication with said valve housing to serve as intake and exhaust manifold therefor.

4. Structure in accordance with claim 1, said cylinders being arranged in coaxially aligned pairs on opposite sides of said valve housing and including a first pair of plates connected thereto in direct communication with said valve housing to serve as intake and exhaust manifold therefor, all of said cylinders being interconnected to one of a second pair of plates lying in a plane perpendicular to the principal axes of said cylinders, a plurality of guide rods aligned in mutually parallel relation for reciprocation through said first and second pair of plates, a third pair of plates mounted upon said guide rods for reciprocation therewith, pistons arranged for reciprocation in said cylinders, and piston rods interconnecting said pistons to one of said third pair of plates; and cam follower means carried by said third pair of plates engaging said barrel cams; whereby said pistons move without substantial side reaction against the inner walls of said cylinders, said side reaction being substantially carried by said guide rods.

References Cited

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