US006250263B1

(12) **United States Patent**
Sisco

(10) **Patent No.: US 6,250,263 B1**
(45) **Date of Patent: Jun. 26, 2001**

Mark Sisco
08-11-344

(54) **DUAL PISTON CYLINDER CONFIGURATION FOR INTERNAL COMBUSTION ENGINE**

(76) Inventor: **Mark Sisco**, P.O. Box 255, Exeter, CA (US) 93221

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/301,445**

(22) Filed: **Apr. 28, 1999**

(51) **Int. Cl.**[7] **F02B 75/02**
(52) **U.S. Cl.** ..... **123/51 R**; 123/51 BA
(58) **Field of Search** ..... 123/51 R, 51 BA

(56) **References Cited**

U.S. PATENT DOCUMENTS

530,523	*	12/1894	Hirsch	123/51 R
952,706	*	3/1910	Lucas	123/51 BA
1,090,650	*	3/1914	Richardson	123/51 BA
1,533,004		4/1925	Henry .	
2,085,270	*	6/1937	Pavlecka	123/51 BA
2,886,018	*	5/1959	Cuddon-Fletcher	123/51 R
2,896,596		7/1959	Abraham .	
3,485,221		12/1969	Feeback .	
4,037,572		7/1977	Franz .	
4,244,338		1/1981	Rassey .	
4,363,295		12/1982	Brandly .	
4,554,894		11/1985	Johnson .	
4,685,428		8/1987	Inagaki et al. .	
4,759,319		7/1988	Merritt .	
4,773,358		9/1988	Heath .	
5,133,306		7/1992	Honkanen .	
5,477,818		12/1995	Ascari et al. .	
5,477,820		12/1995	Rao .	
5,542,382		8/1996	Clarke .	
5,560,326		10/1996	Merritt .	
5,560,327		10/1996	Brackett .	
5,596,955		1/1997	Szuba .	
5,622,143		4/1997	Fuoss et al. .	

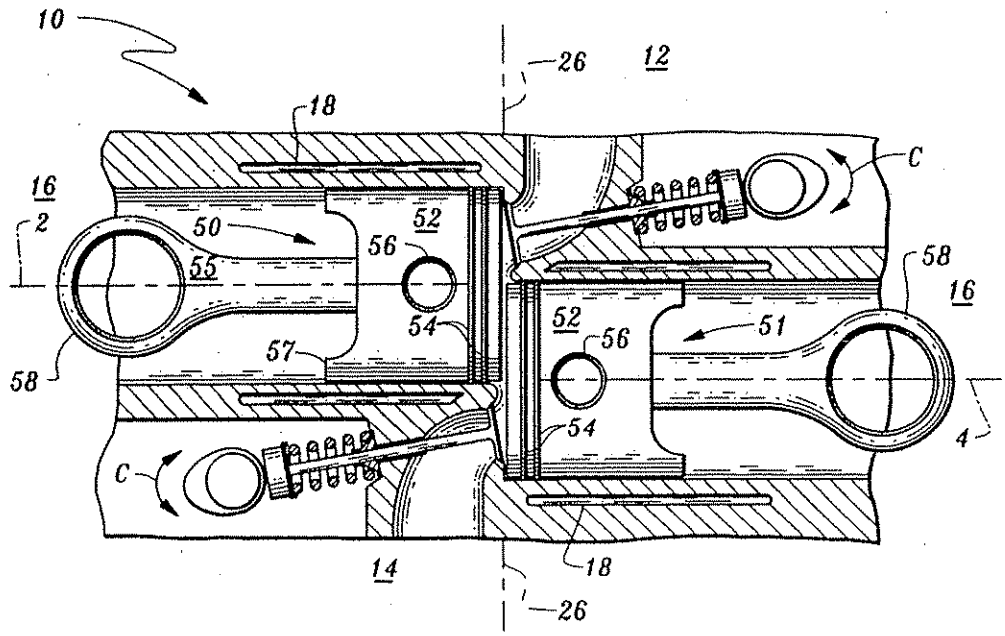
* cited by examiner

Primary Examiner—Marguerite McMahon
Assistant Examiner—Jason Benton
(74) *Attorney, Agent, or Firm*—Heisler & Associates

(57) **ABSTRACT**

An internal combustion engine **10** is provided having at least one pair of cylinders **30**, **31** which overlaps to form one enclosure **20**. The two cylinders **30**, **31** have central axes **2**, **4** which are offset. The reciprocally-offset cylinders **30**, **31** are joined to form the enclosure **20** with a centerline **26** perpendicular to the lateral central axes **2**, **4** of the two cylinders **30**, **31**. Each cylinder **30**, **31** is of generally uniform cross-section. The cylinders **30**, **31** have central axes **2**, **4** that are preferably generally parallel but not axially-aligned. The cylinders **30**, **31** are connected to form an open cylinder connection pathway **42**. Separate pistons **50**, **51** are disposed within each cylinder **30**, **31** with their crowns **52** facing each other and oriented toward the centerline **26**. The crowns **52**, in combination with the cylinder walls **32**, form a shared combustion chamber **40** with shared intake valve **70**, exhaust valve **90** and a means for ignition of combustible mixtures. The cylinders **30**, **31** are reciprocally and vertically offset by a distance G such that the cross-sectional projection of each cylinder **30**, **31** only partially overlaps the cross-sectional projection of the opposing cylinder **30**, **31** by a distance H. The offset non-overlapping portion H provides sufficient surface **46** to mount intake and exhaust valves **70**, **90** adjacent to the cylinders **30**, **31** within the same cylinder block **22**, **24**.

20 Claims, 4 Drawing Sheets



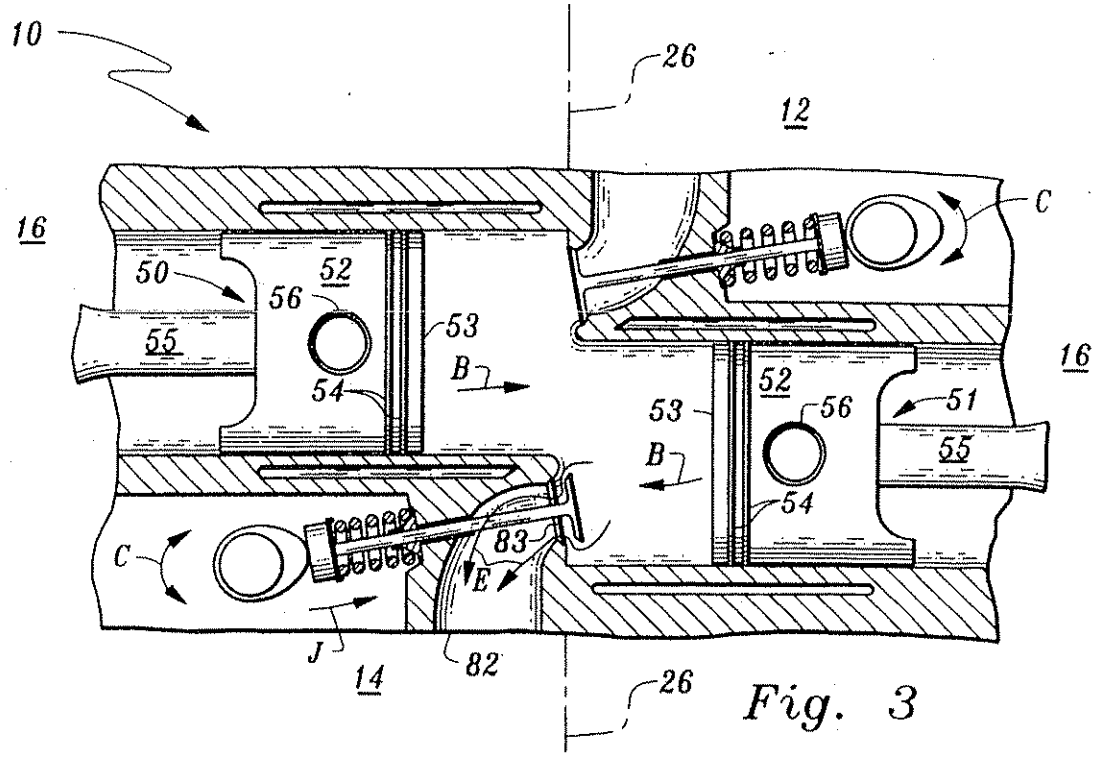

10
26
12
16
C
50
52
56
53
55
B
54
16
52
53
56
51
B
55
54
C
83
E
J
14
82
26

Fig. 3

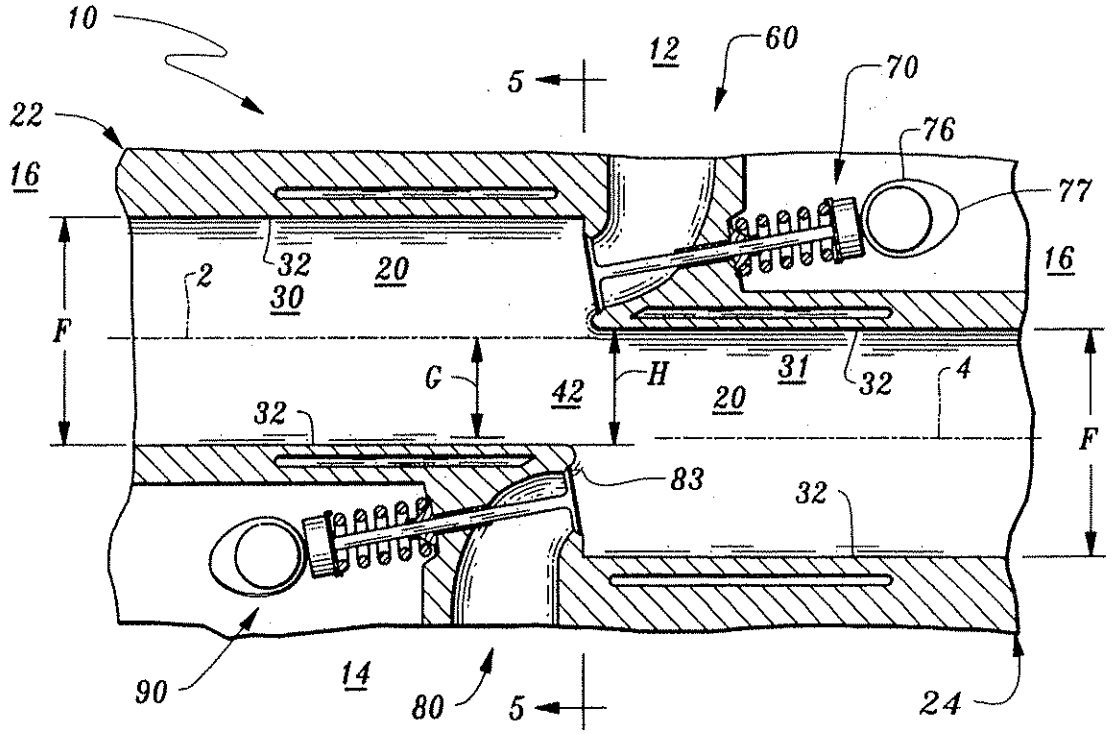

10
12
60
5
70
22
76
16
77
16
32
20
2
30
F
C
42
H
31
32
4
20
32
F
83
32
90
14
80
5
24

Fig. 4

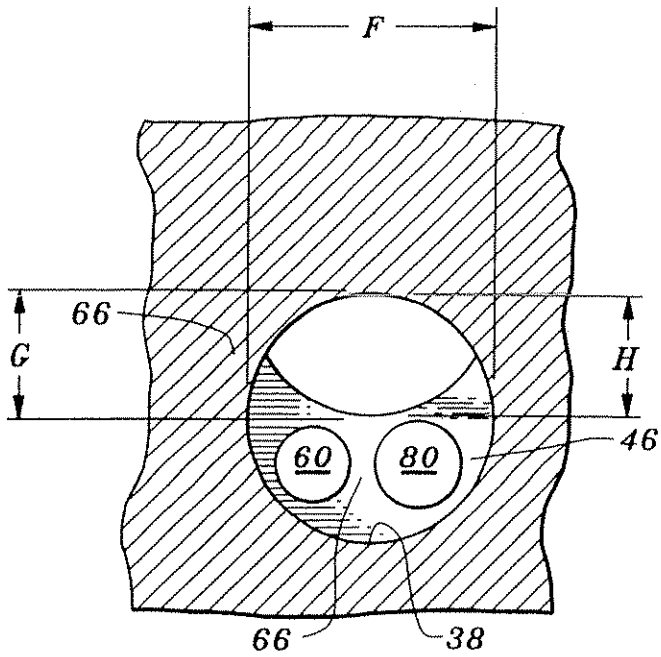


Fig. 7

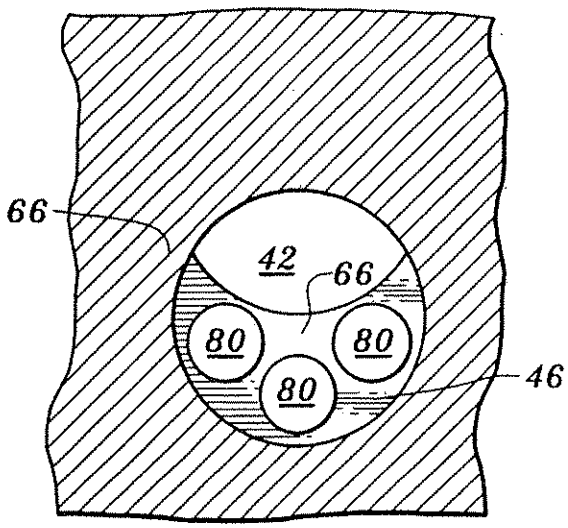


Fig. 8

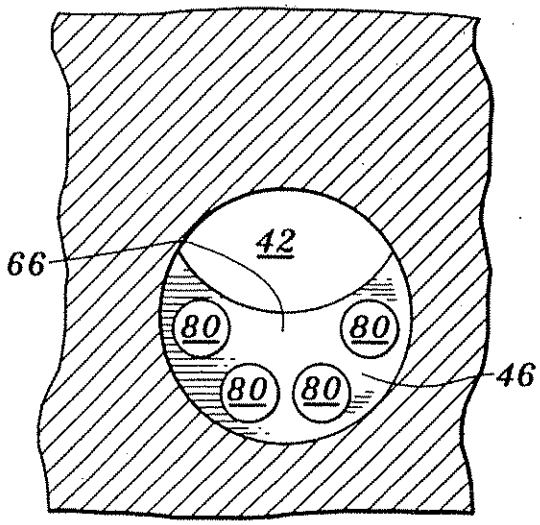


Fig. 9

SUMMARY OF THE INVENTION

The present invention provides an internal combustion engine with at least two cylinders that are disposed within the cylinder blocks. The cylinders have separate crank ends and separate face ends. One cylinder penetrates a first portion of the cylinder block; the other cylinder penetrates a second portion of the cylinder block. The two cylinders are joined at least partially in an overlapping manner, placing the cylinders in juxtaposition. The central axes of the opposing cylinders are offset from each other.

Separate pistons are disposed in the corresponding cylinders. The pistons are oriented so that their crowns face each other, hence, a shared combustion chamber is defined by the side walls of both cylinders in combination with the crowns of the opposing pistons. The offset between the central axes of opposing cylinders provides sufficient surface on face ends of the cylinders to mount intake and exhaust valve assemblies while still allowing both cylinders to communicate across an open cylinder connection pathway.

As proposed, the present invention eliminates the need for a separate cylinder head, as required in previous horizontally-opposed engine configurations. In the present invention, the cylinder block, in effect, acts as a "cylinder head."

Hence, the present invention provides a novel dual piston engine configuration that retains the known advantages of engines with shared combustion chambers yet, for equivalent engine power or efficiency, reduces overall size, simplifies manufacturing and assembly and enhances reliability.

OBJECTS OF THE INVENTION

Accordingly, a primary object of the present invention is to provide an opposed dual piston/cylinder internal combustion engine with cylinder pairs that are offset such that shared intake and exhaust valve assemblies may be immediately adjacent to each cylinder, thereby reducing the size and weight of the engine for equivalent power and fuel efficiency.

Another object of the present invention is to provide a dual cylinder shared combustion chamber internal combustion engine which will minimize the probability of pressure leaks from the shared combustion chamber, thereby increasing the reliability and efficiency of the engine while reducing the probability of engine failure.

Another object of the present invention is to provide an internal combustion engine with a shared combustion chamber whose geometric configuration enhances swirl of the combustible mixture, thereby providing more complete combustion and lowering pollutant levels caused by incomplete combustion.

Another object of the present invention is to provide an internal combustion engine with a shared combustion chamber whose compression ratio and power density can be increased by mounting the intake and exhaust valves facing the pistons within the cylinders, thereby reducing the distance between the crowns of the piston heads when they converge to their closest point prior to ignition.

Another object of the present invention is to provide an internal combustion engine with a shared combustion chamber that is easily assembled or disassembled for maintenance or overhaul.

Another object of the present invention is to provide an internal combustion engine with a combustion chamber shared between two facing pistons where the piston and cylinder's configuration may be replicated to create engines with multiple banks of piston and cylinder pairs to address varying power requirements for a particular engine application.

Another object of the present invention is to provide an internal combustion engine with a shared combustion chamber of simple and reliable manufacture from commonly available materials and components.

Another object of the present invention is to provide an internal combustion engine with a lower top-to-bottom profile, thereby allowing vehicles to be designed with corresponding lower profiles, providing lower aerodynamic drag and resulting in increased engine efficiency.

Another object of the present invention is to provide an internal combustion engine that is inherently balanced and hence, has low vibration while running.

Other further objects of the present invention will become apparent from a careful reading of the included drawing figures, the claims and the detailed description of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a cross-sectional side elevation of an engine block featuring an offset dual piston/cylinder shared combustion chamber according to this invention showing the cylinder blocks, cylinders and valve assemblies in section and the pistons not in section and with the pistons at top dead center and both intake and exhaust valves closed.

FIG. **2** is that view shown in FIG. **1** but during the engine's induction stroke with the pistons shown diverging from a central plane and with an intake valve opened to allow a combustible mixture to enter the shared combustion chamber.

FIG. **3** is that view shown in FIG. **1** during the engine's exhaust stroke with the pistons shown converging toward a central plane with the intake valve closed and the exhaust valve opened to allow the combustion products to be expunged from the shared combustion chamber.

FIG. **4** is a cross-sectional side elevation of this invention showing the cylinder blocks and valve assemblies, with the piston assemblies removed for clarity.

FIG. **5** is a cross-sectional end view of the present invention taken along line **5**—**5** of FIG. **4** and depicting the overlapping and offset cylinder bores with one valve and port included in each cylinder.

FIG. **6** is an alternative embodiment of that which is shown in FIG. **5**, showing two valve ports per cylinder.

FIG. **7** is an alternative embodiment of that which is shown in FIG. **5**, where the diameter of one valve port is greater than that of another valve port.

FIG. **8** is an alternative embodiment of that which is shown in FIG. **5**, showing three valve ports per cylinder.

FIG. **9** is an alternative embodiment of that which is shown in FIG. **8**, showing four valve ports per cylinder.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, wherein like reference numerals represent like parts throughout the various drawing figures, reference numeral **10** is directed to an internal combustion engine. The engine **10** has opposed and axially offset cylinders **30**, **31** (FIG. **4**) which together define a single enclosure **20**. Facing piston assemblies **50**, **51** (FIGS. **1**–**3**) reciprocate within the cylinders **30**, **31** to work with a

7. The engine of claim 5 wherein at least one of said ports at least partially faces at least one of said cylinders.

8. The engine of claim 7 wherein each said port at least partially faces at least one of said cylinders.

9. The engine of claim 1 wherein said pistons travel into a majority of a space defining said pathway when said pistons are at a point closest to said face ends of said cylinders.

10. The engine of claim 1 wherein said pathway has substantially no length between said cylinders.

11. An internal combustion engine, comprising in combination:

at least two cylinders, each said cylinder having separate crank ends, separate face ends and separate central axes;

said separate face ends located closer to each other than a distance between said separate crank ends;

said face ends of said at least two cylinders having an open cylinder connection pathway there between;

at least two pistons, one piston located in each of said at least two cylinders;

each said piston configured to reciprocate within one of said cylinders;

wherein said separate central axes of said at least two cylinders are oriented offset from each other; and

wherein said face ends of each of said at least two cylinders include surfaces thereon on portions thereof which are not defined by said open cylinder connection pathway, said surfaces including a first surface facing one of said at least two cylinders and a second surface facing the other of said at least two cylinders.

12. An internal combustion engine, comprising in combination:

at least one enclosure, said enclosure including at least two cylinders, said enclosure including means to allow flow between said at least two cylinders, said flow allowing means including an open cylinder connection pathway between said at least two cylinders, said pathway passing through portions of said face ends of said cylinders separate from said face end surfaces;

each said cylinder having a separate face end, each said face end having a surface at least partially facing one of said cylinders;

at least one combustion reactant intake port located passing through at least one of the said surfaces of said face ends; and

at least one combustion product exhaust port located passing through at least one of the said surfaces of said face ends.

13. The engine of claim 12 wherein said cylinders have separate central axes spaced from each other.

14. A cylinder configuration for a piston and cylinder energy conversion device, such as an internal combustion engine, compressor or pump, comprising in combination:

at least two cylinders, each cylinder having a crank end and a face end;

said face ends adjacent each other;

each said cylinder having a substantially constant cross-sectional contour;

said face ends overlapping but offset from each other with an open cylinder connection pathway extending between said cylinders through said overlapping part of said face ends, and first and second end surfaces are provided for non-overlapping portions of said face ends, said first and second end surfaces separate from said cylinder connection pathway; and

at least one piston located within each of said at least two cylinders and adapted to oscillate within one of said at least two cylinders in which said piston is located.

15. The cylinder configuration of claim 14 wherein said first surface at least partially faces one of said at least two cylinders and said second surface aces the other of said at least two cylinders, each of said at least two cylinders having a central axis extending centrally there through.

16. The cylinder configuration of claim 15 wherein each of said central axes, are oriented offset to each other.

17. The cylinder configuration of claim 16 wherein said at least two cylinders, combined diameter is greater than an offset distance between them.

18. The cylinder configuration of claim 14 wherein said first and second end surfaces include fuel, air and exhaust ports thereon, at said cylinder configuration is part of an internal combustion engine.

19. An internal combustion engine, comprising in combination:

at least two cylinders, each said cylinder having separate crank ends, separate face ends and separate central axes;

said separate face ends located closer to each other than a distance between said separate crank ends;

said face ends of said at least two cylinders having an open cylinder connection pathway there between;

at least two pistons, one piston located in each of said at least two cylinders;

each said piston configured to reciprocate within one of said cylinders;

wherein said separate central axes of said at least two cylinders are oriented offset from each other;

wherein said separate central axes are oriented substantially parallel to each other; and

wherein said face ends of each of said at least two cylinders include surfaces thereon on portions thereof which are not defined by said open cylinder connection pathway, said surfaces including a first surface facing one of said at least two cylinders and a second surface facing the other of said at least two cylinders.

20. The engine of claim 19 wherein said surfaces includes means to enter fuel and air into an enclosure defined by said at least two cylinders together; and

wherein said surfaces includes means to remove exhaust gases out of said enclosure.

* * * * *