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(19)

(54) RECIPROCATING PISTON INTERNAL COMBUSTION ENGINE WITH ROTARY VALVE MEMBER

(71) We, BRITISH LEYLAND UK LIMITED, of Berkeley Square House, Berkeley Square, London W1X 6DL, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to reciprocating piston internal combustion engines. In particular it is concerned with valve means whereby a combustible fuel mixture can be directed into, and exhaust gases directed out from, a combustion chamber of the engine.

According to the present invention a reciprocating piston internal combustion engine has:

a) a cylinder block including a cylinder having at one end a combustion chamber;

b) a valve member having an end face from which extends a frusto-conical surface of reducing cross-section, the end face providing a wall of the combustion chamber;

c) means for rotating the valve member about an axis parallel to a longitudinal axis of the cylinder comprising an armature secured to the member and a solenoid adapted to generate an electromagnetic field for displacing the armature.

d) a duct within the valve member extending between a first port in the end face and a second port in the frusto-conical surface;

e) an inlet port and an outlet port in the cylinder block so disposed that, on rotation of the valve member, the second port moves successively past the inlet port and the outlet port.

Exemplary embodiments of parts of internal combustion engines, for road vehicles, according to the invention will now be described with reference to the drawings accompanying the Provisional Specification of which:

Figure 1 is a sectional elevation of a first cylinder block;

Figure 2 is a sectional elevation of a second cylinder block;

Figure 3 is a transverse sectional elevation on section III—III of Figure 1;

Figure 4 is a sectional plan view on section IV—IV of Figure 2.

Figures 1 and 3 show a cylinder block 11 on which is mounted a cylinder head 12.

Figure 2 differs in form from Figure 1 only in that cylinder header block 31 is of integral type with no separate cylinder head. Because of the similarity of the remaining components in the following description of Figure 1 the corresponding references to Figure 2 are enclosed in parenthesis.

The cylinder block 11 (31) includes cylinder bore 13(33) in which piston 14 (34) is reciprocable by a four-stroke ignition combustion cycle of known type to rotate a crankshaft by way of connecting rod 15 (35).

At the upper end, bore 13 (33) tapers to give a frusto-conical surface 16 (36). Within surface 16 (36) is mounted a valve member 17 (37) rotatable about axis 18 (38) which is parallel to the longitudinal axis of cylinder bore 13. The valve member 17 (37) has a lower end face 19 (39) which provides one wall of a combustion chamber 20 (40). The chamber 20 (40) is also bounded by a bowl 21 (41) integrally formed in piston 14 (34).

Valve member 17 (37) has a duct 22 (42) extending through it from a first part into end face 19 (39) to a second port in frusto-conical face 23 (43). In Figure 1 cylinder head 11 has two ports (of which only port 24 is shown) extending through it.

In Figure 2 integral cylinder block 31 has two ports (of which only port 44 is shown) extending through it.

Referring again to Figures 1 and 2 valve member 17 (37) has a ring gas seals 25 (45) around its base diameter.

Sleeve bearing 26 (46) provides diametral location for stem 27 (47) of the valve member 17 (37). The stem 27 (47) includes a circlip 28 (48) which serves to retain a ring 29 (49). Conical spring washer 100 (50) serves to axially load ring 29 (49) and so the

valve member 17 (37). The stem 27 (47) has bolted to it a soft iron armature 101 (51) wherewith the valve member is caused to rotate by electromagnetic means as will be hereafter described.

Spark plug 102 (52) is mounted, between the pair of ports of which port 24 (44) is one, in a duct 103 (53).

Figure 3 shows a second valve member 104 mounted in a cylinder bore 105 adjacent bore 13. Valve member 104 has an iron armature 106 similar to armature 101. The armatures 101, 106 are caused to rotate by magnetic fields generated by the passage of current through solenoids 107, 108. The timing and amplitude of these currents is controlled by a computer means adapted to regulate the amplitude and period of current flow. Figure 4 shows the relationship of duct 42 (Figure 2) in valve member 37 to the pair of ports in block 31 and duct 53 (containing spark plug 52). Outline bores A, B on either side of bore 33 are shown to indicate port relationship. Port 44, an exhaust port, opens into gallery 54. A corresponding exhaust port B^1 opens into gallery 54 to provide siamesed exhaust outlets from bore 33 and bore B.

Port 56 opens into gallery 57 which opens into inlet manifold 58 bolted onto the side of the block 31. A corresponding inlet port A^1 opens into gallery 57. Inlet port 56 and port A^1 provide siamesed inlets for fuel mixture for bore 33 and bore A.

Exhaust manifold 55 is common to all exhaust galleries in the engine block 31. Likewise inlet manifold 58 is common to all inlet galleries in the block 31.

Taking Figures 2 and 4 starting of the engine is carried out in a conventional manner by cranking with an electrically powered starter motor. The computer means operates to cause rotation of valve members in bores 33, A and B. Typically valve member 37 in bore 33 rotates to align the end of duct 42 adjacent frusto-conical surface 43 with inlet port 56. Downward movement of piston 34 results in fuel mixture, fed to gallery 57 by way of inlet manifold 58, being drawn through duct 42 into combustion chamber 40 which in turn opens by way of gallery 54 into exhaust manifold 55 bolted onto the side of the cylinder block 31. Continued rotation of valve member 37 in direction of arrow C causes the duct 42 to be progressively isolated from inlet port 56 and linked to duct 53 containing the spark plug. In the course of this rotation the piston 34 rises to compress the fuel charge which is ignited in known manner by spark plug 52. Subsequent burning and expansion of the fuel mixture drives the piston 34 downwardly to drive the engine crankshaft by way of connecting rod 35.

Continuing rotation of valve member 37 progressively aligns duct 42 with the exhaust port 44. Subsequent upward movement of the piston 34 after the power stroke causes exhaust gases to be swept out of the cylinder through duct 42 to port 44 and so the gallery 54 and exhaust manifold 55. This cycle is repeated for each cylinder within block 31.

WHAT WE CLAIM IS:—

1. A reciprocating piston internal combustion engine having:

a) a cylinder block including a cylinder having at one end a combustion chamber;

b) a valve member having an end face from which extends a frusto-conical surface of reducing cross-section, the end face providing a wall of the combustion chamber;

c) means for rotating the valve member about an axis parallel to a longitudinal axis of the cylinder comprising an armature secured to the member and a solenoid adapted to generate an electromagnetic field for displacing the armature.

d) a duct within the valve member extending between a first port in the end face and a second port in the frusto-conical surface;

e) an inlet port and an outlet port in the cylinder block so disposed that, on rotation of the valve member, the second port moves successively past the inlet port and the outlet port.

2. An internal combustion engine as claimed in Claim 1 including a plurality of said cylinders and valve members the inlet port of each cylinder being linked to an inlet manifold; the outlet port of each cylinder being linked to an exhaust manifold.

3. An internal combustion engine as hereinbefore described with reference to and as illustrated by Figures 1 and 3 of the drawing accompanying the Provisional Specification.

4. An internal combustion engine as hereinbefore described with reference to and as illustrated by Figures 2 and 4 of the drawing accompanying the Provisional Specification.

5. A road vehicle equipped with an engine according to any preceding claim.

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1478488 PROVISIONAL SPECIFICATION
4 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

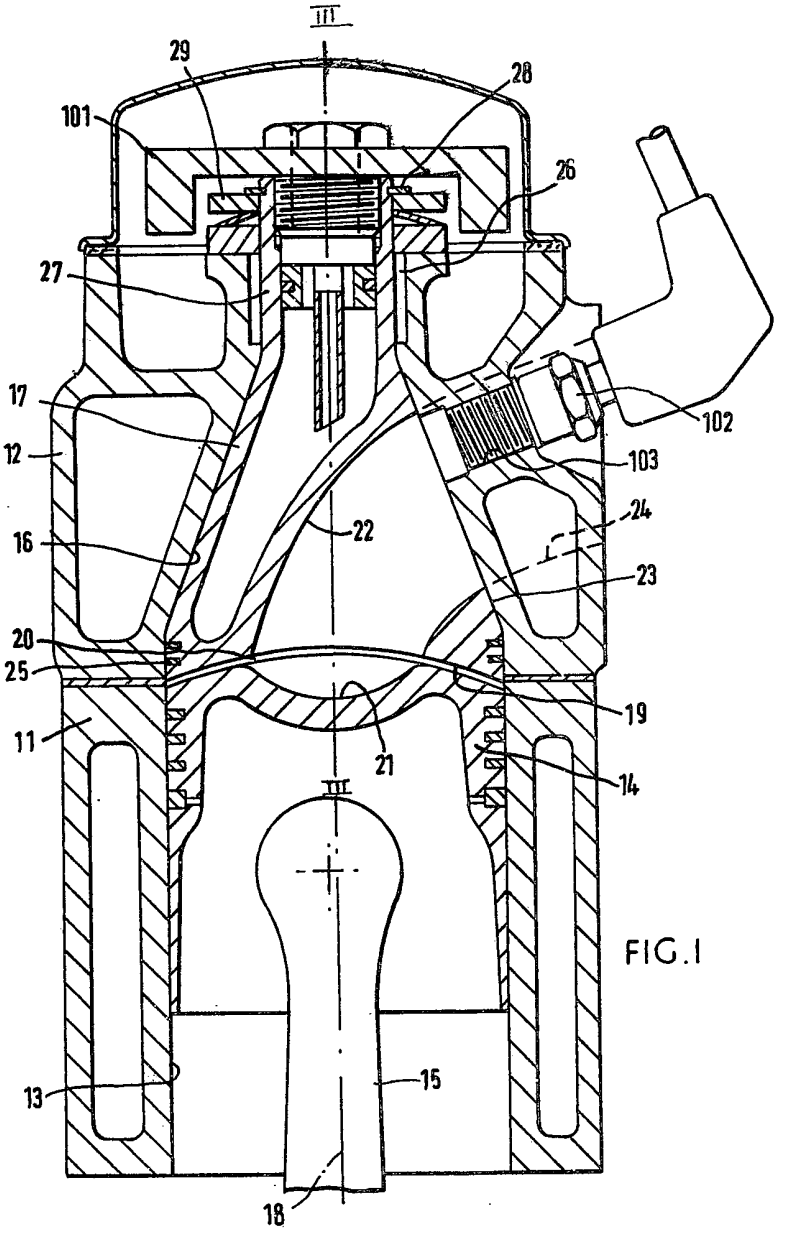

FIG.1

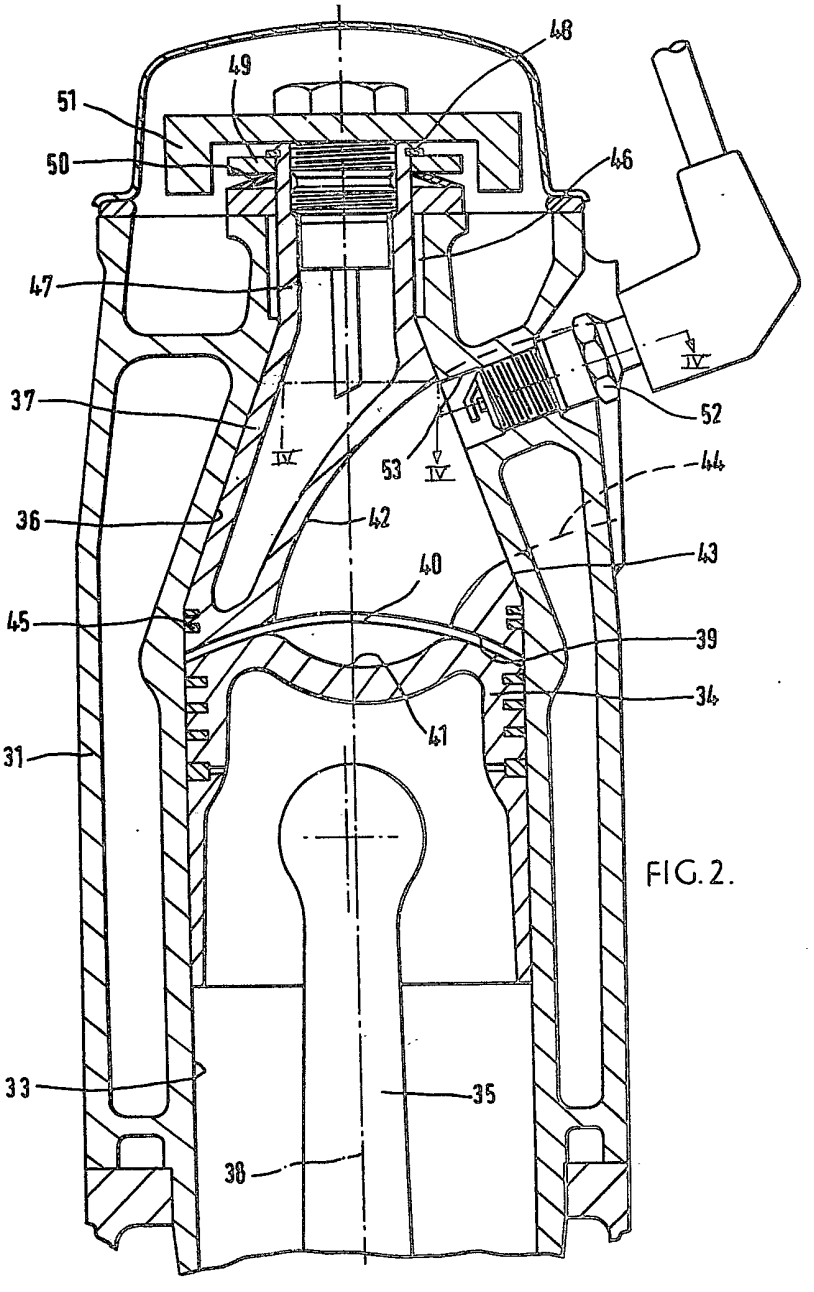
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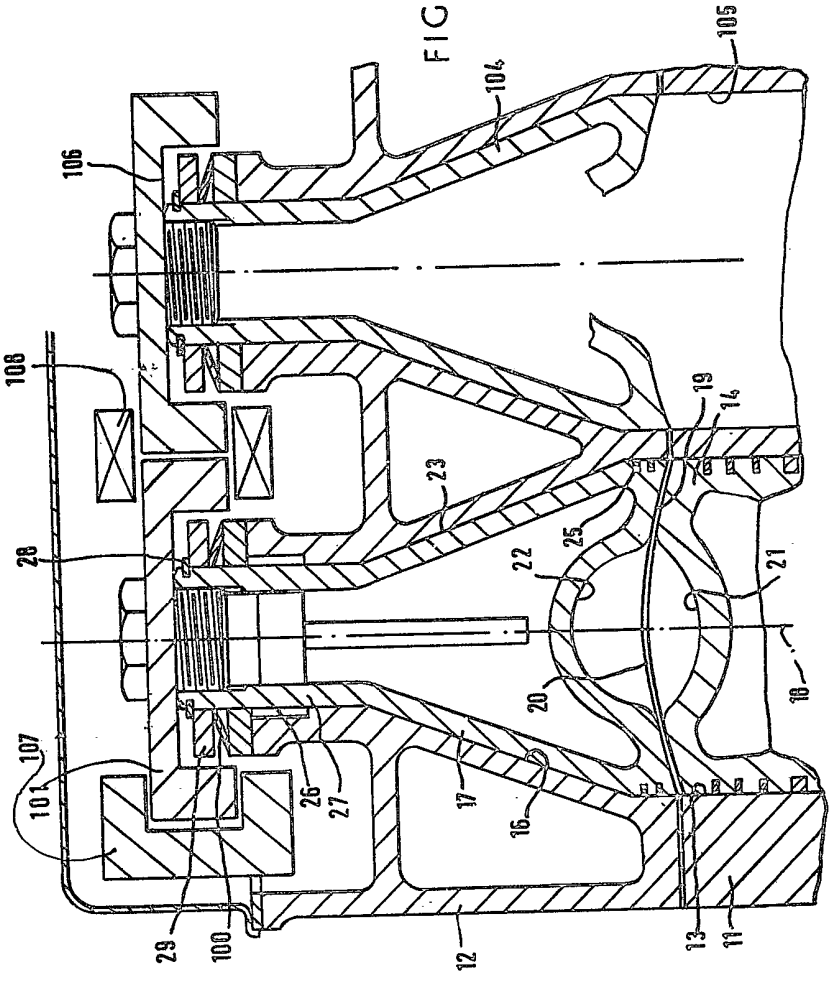
FIG. 2.

FIG. 3.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Sheet 4

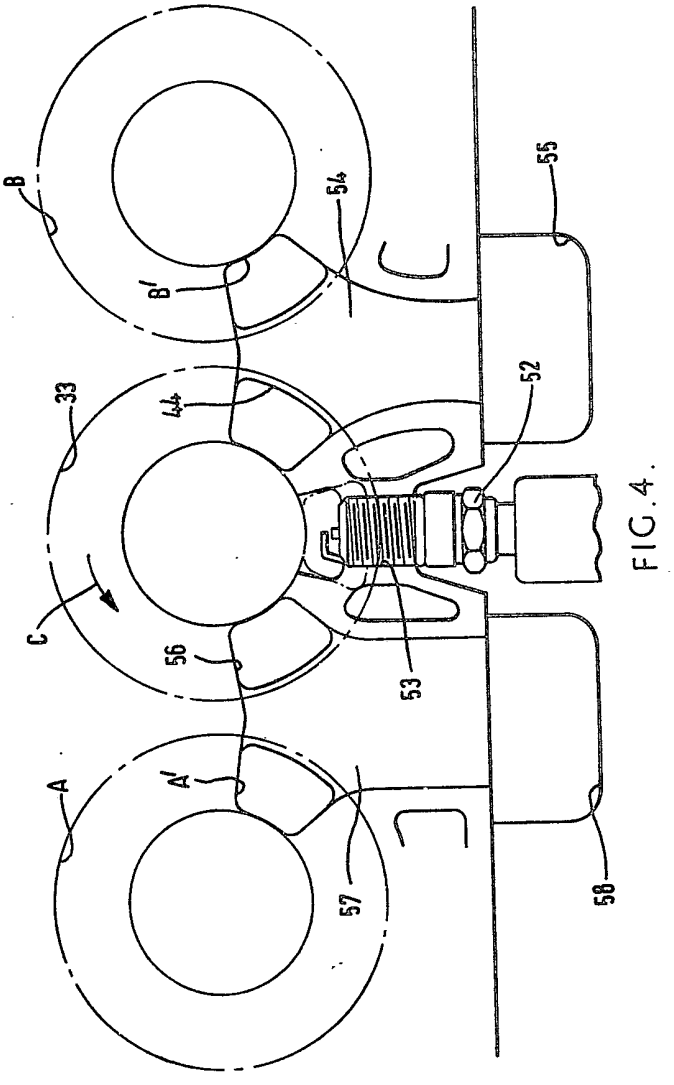

FIG. 4.