

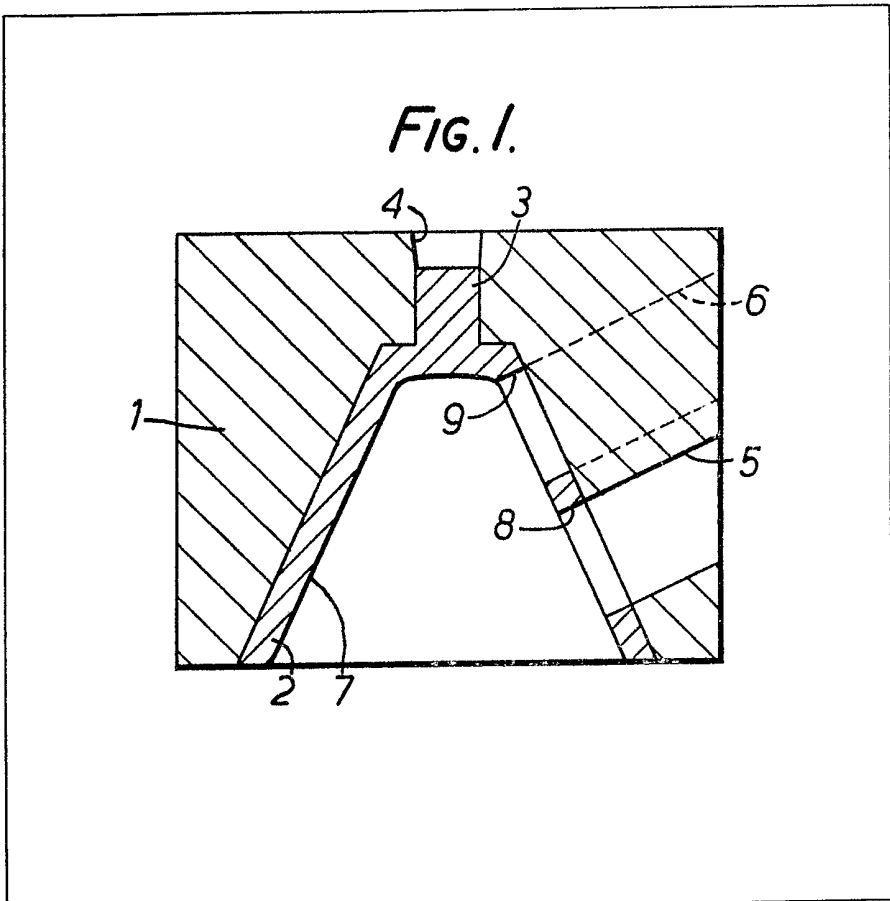
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(54) Conical rotary valves for internal combustion engines

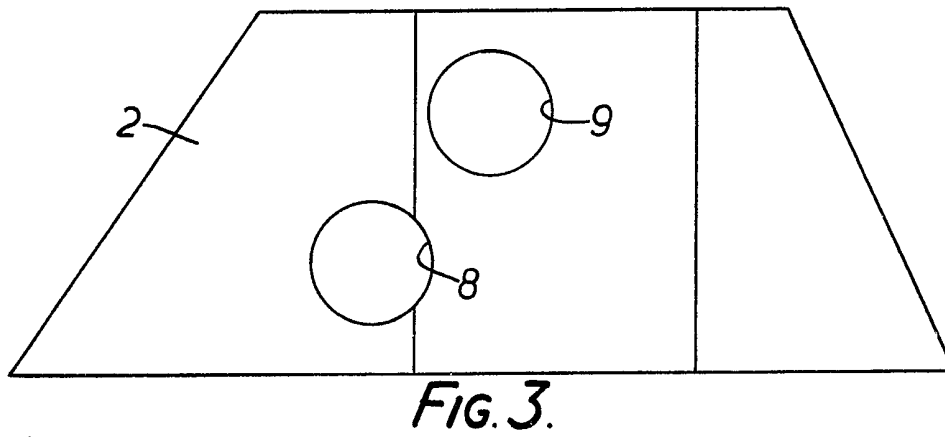
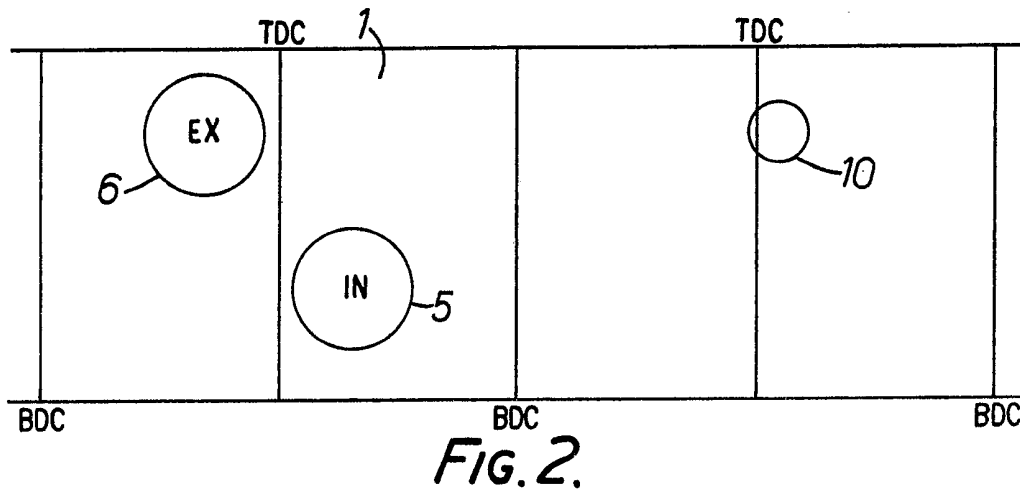
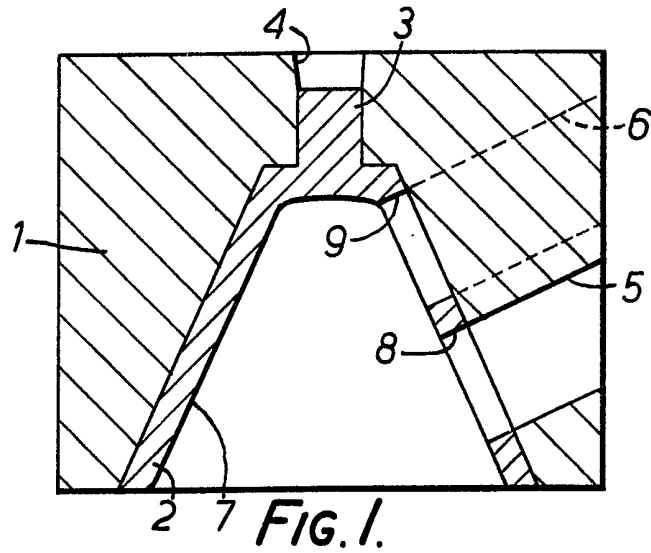
(57) An inlet passage (5) and an exhaust passage (6) lead through the housing (1) and open at circumferentially displaced positions in the space which receives the valve member (2). There is also a cavity communicating with this space which will enclose a spark plug. The valve

member (2) incorporates ports (8 and 9) which will communicate with the passages (5 and 6) as the valve member is rotated by a drive mechanism connected to a spigot (3) in such a manner that the inlet port (5), the cavity incorporating the spark plug, and the exhaust port (6) will register in a predetermined sequence with the conical chamber (7) defined within the valve member (2).



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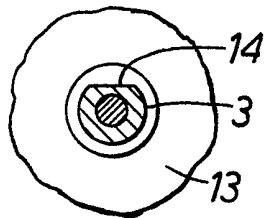
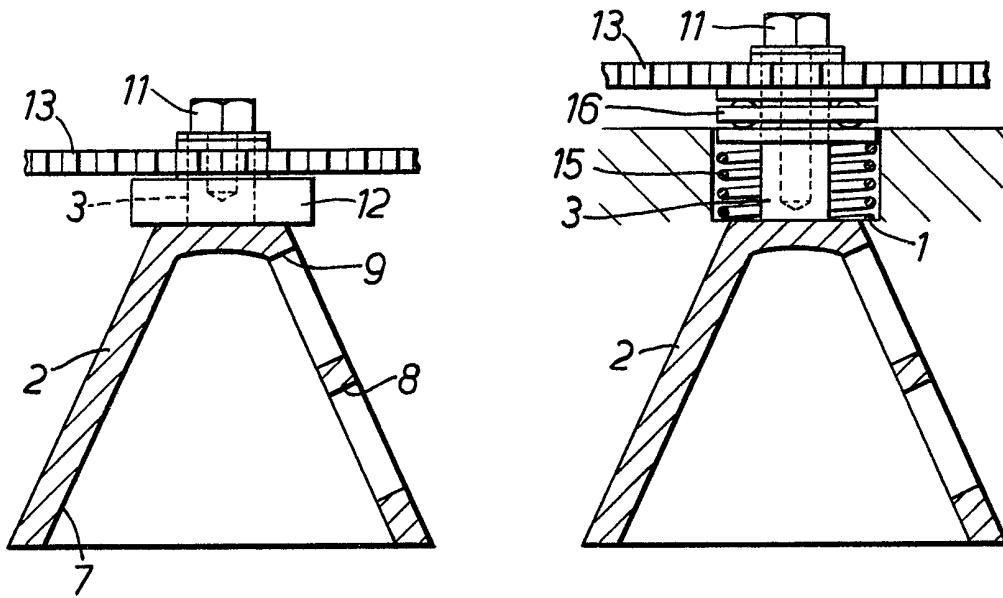


FIG. 4.

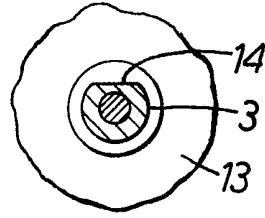


FIG. 5.

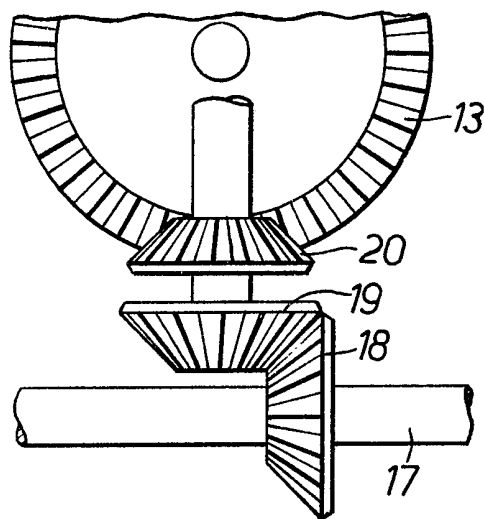


FIG. 6.

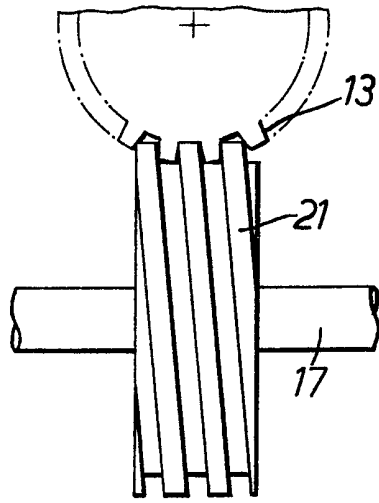


FIG. 7.

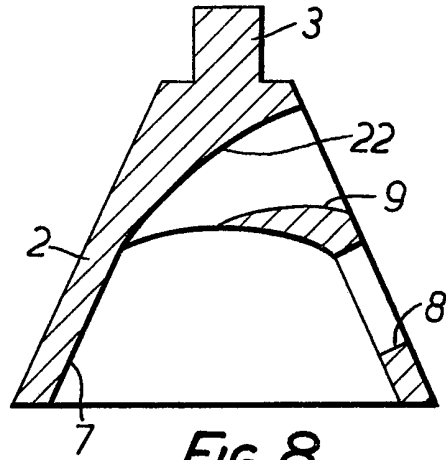


FIG. 8.

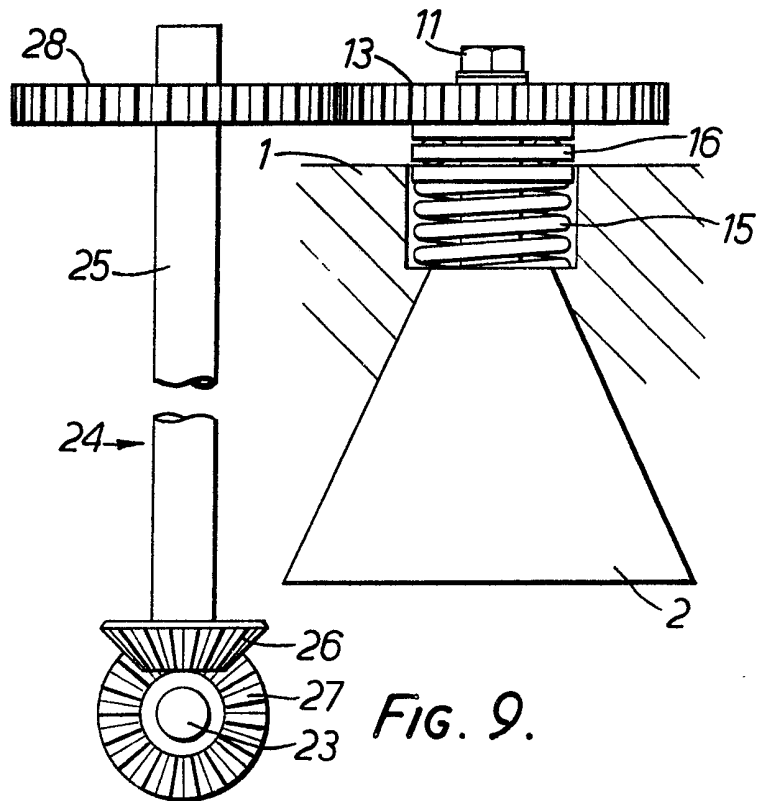


FIG. 9.

SPECIFICATION

Improvements relating to valve assemblies for internal combustion engines

5 The more conventional form of valve assembly for an internal combustion engine incorporates poppet valves and a cam shaft for operating valves in a predetermined sequence. Such an assembly involves a large number of parts which have to be accurately machined and assembly of these parts is quite involved. Furthermore, after a period of use, it may well be necessary to regrind the surfaces of the poppet valves and valve seats to remove deposits or pitting so as to ensure adequate sealing.

10 It is an object of this invention to provide a valve assembly which is of simplified construction and avoids the need for using poppet valves and camshafts.

15 Accordingly this invention provides a valve assembly for the combustion chamber of an internal combustion engine comprising a housing provided with inlet and outlet ports for combustion gases and a cavity for enclosing a spark plug, the ports and cavity communicating with a generally conically shaped space opening out in the direction of the cylinder of the engine, and a rotary hollow valve member which is received in and mates with said space, opens out in the direction of the cylinder of the engine, and incorporates one or more portholes which will register with the ports and cavity as the valve member rotates, in a predetermined sequence.

20 As the rotary valve member rotates it will sequentially allow communication of the ports with the space within the hollow valve member and also, at a predetermined instant, uncover the spark plug to allow combustion to take place. The design of the rotary valve member is such that no pockets are present since the hollow space within the valve member flares in a regular manner out towards the cylinder of the engine. The rotation of the valve member creates substantial turbulence which ensures good mixing of the fuel/air mixture so that excellent combustion may be expected.

25 Furthermore the conical form of the hollow space within the valve member creates amplification of the explosion by a "megaphone" effect. Because of these characteristics it is possible to run the engine on a leaner mixture than with conventional valve assemblies so that good fuel consumption can be achieved. It is possible to increase the power output of the engine by reducing the volume of the hollow space within the valve member, thus increasing the compression of the fuel before combustion and this may require modification of the internal design of the valve member. In this case a lower increase in fuel consumption would be expected, to compensate for the advantages of increased power.

30 In the preferred arrangement a rotary mounting member passes through the housing and is attached to the valve member and maintains the valve member in close contact with the walls of the space in which the valve member is received.

65 This mounting member could include a bearing which bears on the housing. Alternatively, and preferably, the mounting member is spring biased away from the housing, so as to maintain the valve member in close contact with the walls of the space within the housing. Thus the spring could be a coil spring which acts on a thrust bearing forming part of the mounting member.

70 The valve member can be secured to a drive member for imparting rotation to the valve member. This drive member may be a sprocket for a chain drive, or a gear wheel. In the latter case a worm gear or bevel gear secured to a drive shaft may be provided to drive the gear wheel.

75 For a single cylinder engine it may be possible to provide a single porthole only in the valve member which will, in sequence, uncover the two ports and the cavity for a spark plug. For a multi-cylinder engine, however, it would usually be necessary to construct the valve assembly so that one porthole is positioned to align with one of the ports and the spark plug cavity during rotation, whilst the other porthole is positioned to align with the other port during rotation.

80 The invention may be performed in various ways and preferred embodiments thereof will now be described with reference to the accompanying drawings, in which:—

85 Figure 1 is a general representation of the valve assembly of this invention;

90 Figures 2 and 3 are diagrammatic illustrations of the housing and valve member of the assembly shown in Figure 1;

95 Figures 4 and 5 illustrate two possible forms of mounting member for supporting and driving the valve member;

100 Figures 6 and 7 illustrate alternative forms of drive member for operating the mounting members; and

105 Figure 8 illustrates a modified form of valve member providing for high compression.

The general construction and operation of the valve assembly may be appreciated most readily from Figures 1 to 3. The valve assembly comprises a housing 1 which will form part of, or be attached to, the cylinder head of an engine, and a rotary valve member 2. The housing 1 has a generally conical formed space machined therein which accepts the valve member which is machined to a complementary shape. A spigot 3 passes through passageway 4 in the housing 1 and provides means for supporting and rotating the valve member 2. Inlet and exhaust ports 5, 6 are provided in the wall of the housing for the combustion gases and open onto the conical slope of the space within the housing 1. The inside of the valve member 2 is machined to provide a cavity 7 of generally conical form which is able to communicate with the ports by means of portholes 8 and 9 formed in the wall of the valve chamber. A cavity (not shown in Figure 1) is also machined into the housing 1 and will enclose a spark plug, this cavity being so positioned that it will be uncovered by the porthole 9 as the valve member 2 rotates. Figures 2 and 3 graphically

illustrate how the portholes 8 and 9 sequentially uncover and cover the ports 5 and 6 and the cavity 10 which will house the spark plug. Figure 2 represents the internal surface of the cavity within the housing 1 whilst Figure 3 illustrates the external surface of the valve member 2. As the valve member 2 moves across the internal surface of the housing 1 the porthole 9 will initially uncover the exhaust port 6 to allow the spent combustion gases to be exhausted as the piston approaches the top dead centre (tdc). After the body of the valve member 2 has covered over the exhaust outlet port 6 again the porthole 8 will commence to uncover the inlet port 5 for the fuel/air mixture as the cylinder approaches the bottom dead centre position (bdc). Subsequently the inlet port 5 will be closed off again by the wall of the valve member 2 and, in time, the porthole 9 will uncover the cavity 10 and the spark plug in that cavity will be fired to cause combustion of the mixture within the valve member 2. The spark plug will be covered again fairly promptly so that it will be protected from the major effects of the explosion. Thus plug fouling is reduced and it would be possible to use a soft plug.

One form of mounting and drive arrangement for the valve member 2 is shown in Figure 4. A stud nut and washer assembly is screwed into the spigot 3 to secure a bearing member 12 and a gear wheel 13. Since the gear wheel 13 is fixed vertically by other parts of the drive mechanism tightening of the nut 11 tends to draw the valve member 2 up into close contact with the internal surface of the space within the housing 1. A driving flat 14 on the spigot 3 ensures that the position of the gear wheel 13 relative to the valve member 2 is fixed.

In the arrangement shown in Figure 5 the gear wheel 13 is again secured to the spigot 3 by a stud nut and washer assembly 11 which, in this case, compresses a compression spring 15 against the housing 1 and a thrust bearing 16.

The gear wheel 13 may be driven by a drive shaft 17 through bevel gears 18, 19, 20 as illustrated in Figure 6. Alternatively the drive shaft 17 could carry a worm gear 21 which directly drives the gear wheel 13. The gears, especially the worm gear 21, may impart an upward thrust to the gear wheel 13 to aid the sealing effect of the valve member 2 against the wall of the cavity within the housing 1.

If high compression is required the volume of the space 7 within the valve member 2 may be modified as shown in Figure 8. In this case part of the upper region of the valve member 2 will be filled with metal, leaving a passageway 22 leading from the porthole 9.

A modified construction, especially for a single cylinder engine, would comprise a valve member 2 having a single porthole which will sequentially uncover each of the exhaust outlet port, fuel inlet port 5 and the spark plug cavity 10 which will be set in line.

Oil feed passageways (not shown in the drawings) will be provided for lubrication of the

mating surfaces of the valve member 2 and the cavity within the housing 1.

Figure 9 illustrates a still further form of mounting and drive arrangement for the valve member. In this construction, the normal camshaft for a conventional engine is replaced by a horizontal drive shaft 23 on which are mounted gear drives 24 for each of the gear wheels 13 for each rotary valve member 2. Each gear drive 24 comprises a vertical shaft 25 situated in the cylinder block with a lower bevel gear 26 meshing with a gear 27 on the drive shaft 23 and an upper gear 28 meshing with the gear wheel 13. The drive shaft 23 will also engage the distributor driving gear of the engine.

CLAIMS

1. A valve assembly for the combustion chamber of an internal combustion engine comprising a housing provided with inlet and outlet ports for combustion gases and a cavity for enclosing a spark plug, the ports and cavity communicating with a generally conically shaped space opening out in the direction of the cylinder of the engine, and a rotary hollow valve member which is received in and mates with said space, opens out in the direction of the cylinder of the engine, and incorporates one or more portholes which will register with the ports and cavity as the valve member rotates, in a predetermined sequence.

2. A valve assembly according to claim 1, wherein a rotary mounting member passes through the housing and is attached to the valve member and maintains the valve member in close contact with the walls of the space in which the valve member is received.

3. A valve assembly according to claim 2, wherein the mounting member includes a bearing which bears on the housing.

4. A valve assembly according to claim 2, wherein the mounting member is spring biased away from the housing.

5. A valve assembly according to claim 4, wherein the spring is a coil spring which acts on a thrust bearing forming part of the mounting member.

6. A valve assembly according to any one of claims 1 to 5, wherein the valve member is interconnected with a drive member for imparting rotation to the valve member.

7. A valve assembly according to claim 6, wherein the drive member is a sprocket for a chain drive.

8. A valve assembly according to claim 6, wherein the drive member is a gear wheel.

9. A valve assembly according to claim 8, including a drive shaft carrying a worm gear or bevel gear, for driving the gear wheel.

10. A valve assembly according to claim 8, including a drive shaft, a worm or bevel gear in driving interconnection with the drive shaft, and a further gear wheel integral with the worm or bevel gear and meshing with the gear wheel connected to the valve member.

11. A valve assembly according to any one of claims 1 to 10, wherein one porthole is positioned to align with one of the ports and the spark plug cavity during rotation, whilst the other porthole is positioned to align with the other port during rotation.

12. A valve assembly according to any one of

claims 1 to 11, wherein the valve member incorporates a single porthole which will, in sequence, uncover the two ports and the cavity for the spark plug, upon rotation.

13. A valve assembly substantially as herein described with reference to the accompanying drawings.