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GB 1504783
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GB 967126
GB 837597
GB 544300
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(54) **Improvements in or relating to reciprocating internal combustion engines**

(57) A reciprocating internal combustion engine comprising an annular combustion chamber 9 adapted to produce a swirl of gas around the chamber during the compression stroke whereby efficient fuel/air mixing is facilitated.

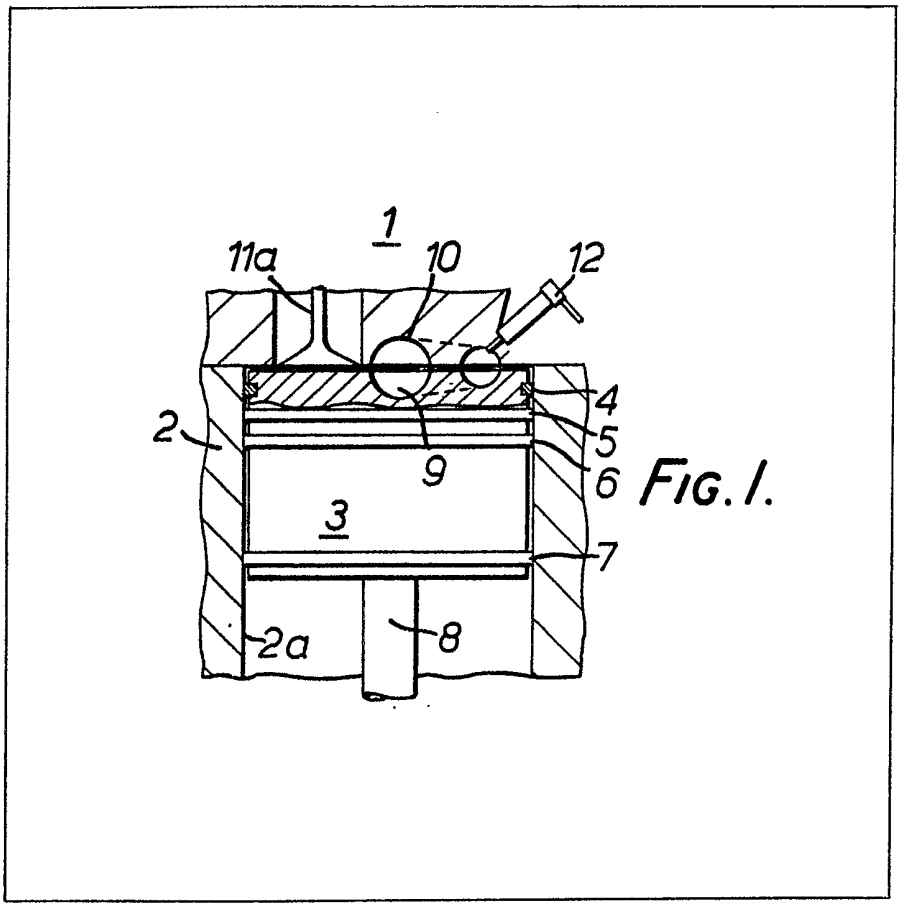

FIG. 1.

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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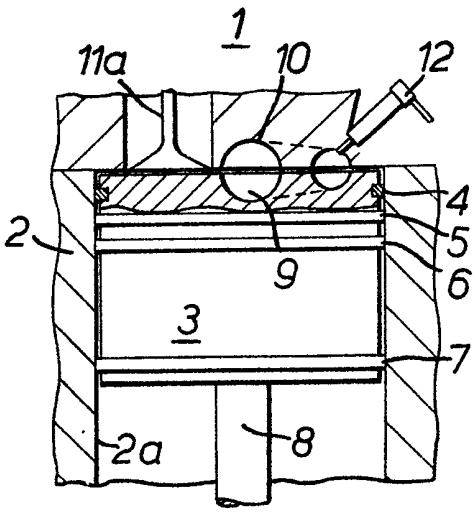


FIG. 1.

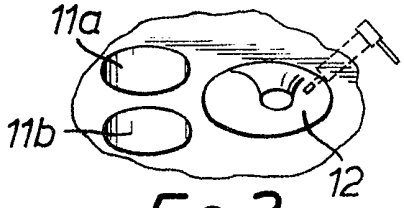
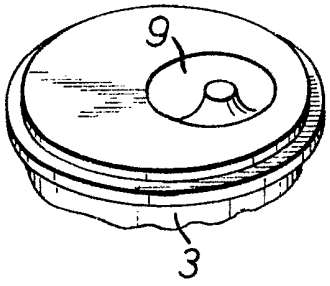


FIG. 2.



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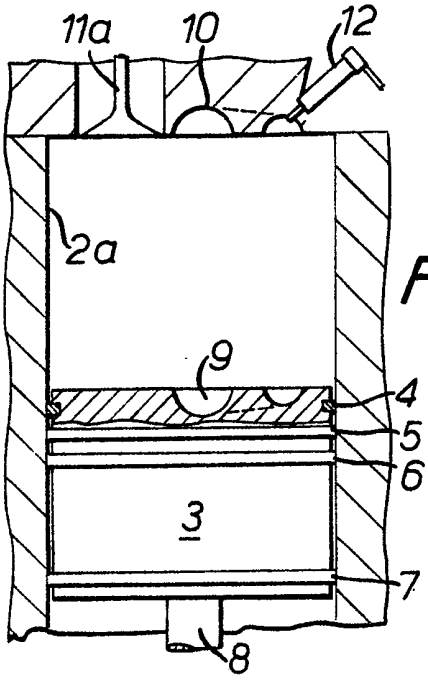

FIG. 4.

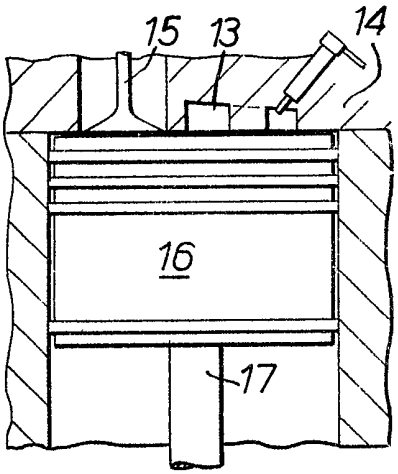

FIG. 5.

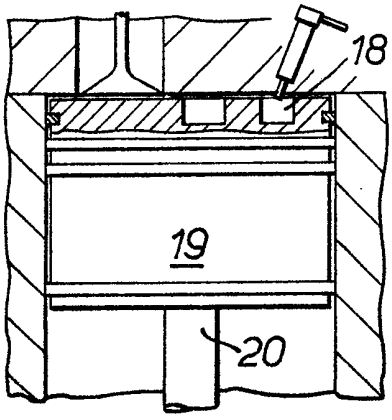

FIG. 6.

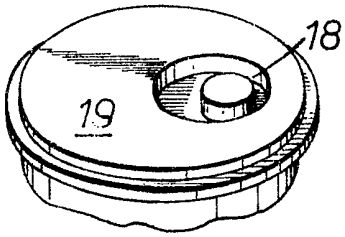

FIG. 7.

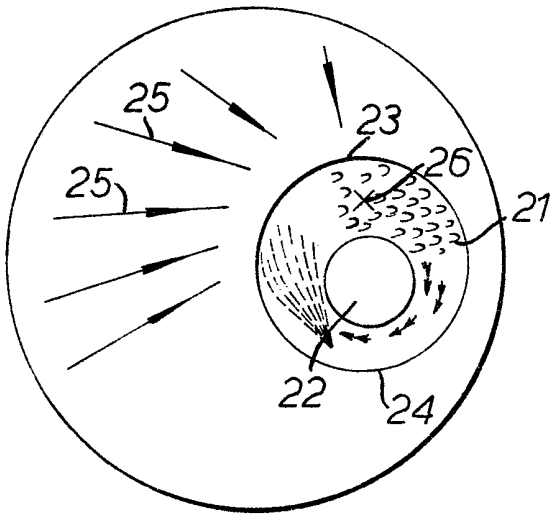

FIG. 8.

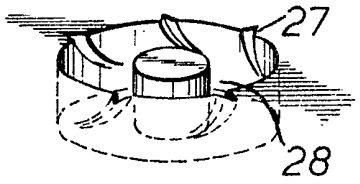

FIG. 9.

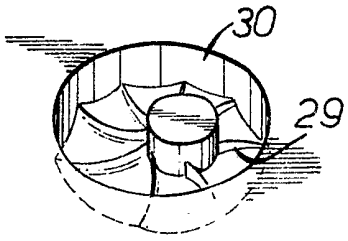

FIG. 10.

SPECIFICATION

Improvements in or relating to reciprocating internal combustion engines.

This invention relates to reciprocating internal combustion engines.

It is an aim of the present invention to provide a reciprocating internal combustion engine wherein improved efficiency is afforded due to especially effective fuel/air mixing.

According to the present invention a reciprocating internal combustion engine comprises an annular combustion chamber adapted to produce a swirl of gas around the chamber during the compression stroke whereby efficient fuel/air mixing is facilitated.

According to one embodiment of the invention the engine comprises a piston having the annular combustion chamber formed in the crown thereof.

According to another embodiment of the invention the engine comprises a cylinder head having formed therein the annular combustion chamber.

According to a further embodiment of the invention the engine may comprise a cylinder head and piston wherein the annular combustion chamber is formed partly in the cylinder head and partly in the crown of the piston.

The adaptation of the said chamber which produces the said swirl may comprise helical grooves or helical vanes or the like formed in the annular wall of the said chamber.

Alternatively, the adaptation may comprise off-setting the centre of the annular combustion chamber so that the cross section of the combustion chamber varies progressively from a maximum to a minimum.

It is to be understood that the term annular when used herein is intended to include a ring like chamber of any suitable cross section, and for convenience of machining the annular combustion chamber may be circular, oval, square, trapezium shaped or rectangular in cross section.

Although an engine according to the present invention may be a two stroke or a four stroke engine utilising a carburettor it is especially contemplated that the engine may be a diesel or other engine utilising fuel injection.

Accordingly, the engine may comprise fuel injection means including a nozzle arranged to project into the combustion chamber.

Preferably, although not essentially, the nozzle is arranged to inject fuel into the chamber in a direction which corresponds with the gas swirl direction around the annular combustion chamber.

It will be readily appreciated that the engine will include inlet and exhaust ports and/or valve means and be constructed in accordance with established techniques. Thus in the case of petrol engines, spark plugs or the like together with ignition pulse generator means will be provided whereas in the case of diesel engines relying on compression ignition such equipment will not be required.

Some embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a sectional side view of a piston and cylinder head;

Figure 2 is a generally schematic perspective view of the cylinder head shown in Figure 1 as seen from the cylinder bore;

Figure 3 is a generally schematic perspective view of the crown of the piston shown in Figure 1;

Figure 4 is a sectional side view of a piston and cylinder head as shown in Figure 1 wherein the piston is positioned towards the bottom of the stroke;

Figure 5 is a sectional side view of a piston and cylinder head wherein an annular combustion chamber, of generally rectangular cross section is formed in the cylinder head;

Figure 6 is a sectional side view of a piston and cylinder head wherein a combustion chamber of generally rectangular cross section is formed in the piston;

Figure 7 is a generally schematic perspective view of the piston shown in Figure 6;

Figure 8 is a generally schematic plan view showing gas flow in the combustion chamber;

Figure 9 is a generally schematic perspective view of an annular combustion chamber including helical grooves to facilitate gas air mixing; and

Figure 10 is a generally schematic perspective view of an annular combustion chamber showing helical vanes to facilitate gas air mixing;

Referring now to Figure 1 an internal combustion engine comprises a cylinder head 1 which is bolted to a cylinder block 2 (by bolts not shown) having machined therein a cylinder which accommodates a piston 3. The piston is sealed against walls 2*a* of the cylinder by means of a sealer ring 4, a scraper ring 5 and oil sealing rings 6 and 7. The piston 3 is caused to reciprocate in the bore in the cylinder 2*a* by forces transmitted through a connecting rod 8. The piston 3 which is shown at top dead centre in Figure 1, includes an annular recess 9 which aligns with a similar annular recess 10 formed in the cylinder head 1 to define an annular combustion chamber when the piston 3 is positioned at top dead centre as shown. Valves 11*a*, 11*b* are provided to permit air to be admitted to the combustion chamber and to permit the scavenging of exhaust gases. In Figure 1 only one of these valves 11*a* is shown. At or towards the top of the compression stroke, fuel is injected into the annular combustion chamber 9, 10 through a fuel injection nozzle 12. The position of the fuel injection nozzle 12 and the valves 11*a* and 11*b* are shown more clearly in Figure 2 and the shape of the annular combustion chamber 9 and the cylinder 3 can be more clearly seen from Figure 3. The position of the piston towards the bottom of its stroke can be seen in Figure 4 and corresponding parts in Figures 1, 2, 3 and 4 bear the same numerical designations.

The arrangement just before described with reference to Figures 1, 2, 3 and 4 shows an annular combustion chamber formed partly in the cylinder head 1 and partly in the piston 3.

Alternatively however an arrangement may be provided as shown in Figure 5 wherein the combustion chamber is formed by a generally annular recess 13 in a cylinder head 14. The arrangement of Figure 5 is generally similar to Figure 1 and includes a valve 15, a piston 16 and an associated connecting rod 17.

Alternatively, as shown in Figure 6, an annular combustion chamber may be provided by machining an annular recess 18 in the crown of a piston 19 which is driven by a connecting rod 20. Again the general arrangement is similar to Figure 1 but in common with Figure 5 the annular combustion chamber has a generally rectangular cross section. The recess 18 in the piston crown 19 is most clearly shown in Figure 7.

It will be appreciated that the general construction of the arrangement shown in Figures 5, 6 and 7 is similar to the construction shown in Figure 1 and so further description of Figures 5, 6 and 7 is believed to be unnecessary.

With the arrangements just before described the combustion chamber is arranged to be an eccentric, or off centre annulus in which the cross section changes progressively from a maximum to a minimum. This eccentricity is introduced to produce a swirling of the gases around the annular combustion chamber. The manner in which this swirl action is brought about will now be described with reference to Figure 8.

Referring now to Figure 8 a generally annular combustion chamber 21 is shown which affords a swirl path for gases around a central boss 22. As can be seen from the drawing the boss is arranged eccentrically so that the cross section of the chamber varies from a maximum at the point 23 to a minimum at the point 24 which is diametrically opposite. In operation of an engine including a combustion chamber as shown in Figure 8, as the piston nears the top of a compression stroke air is forced across the top of the piston in the general direction of the arrows 25 as it seeks the deepest part of the chamber around region 26 so that gases are constrained to swirl around the combustion chamber in a clockwise direction. Fuel is injected into the air flow through a fuel injection nozzle as just before described and due to the swirling nature of the gases is thoroughly mixed with the air and ignited due to the heat of compression. Expansion due to initial combustion takes place in the region 26 and continues in a clockwise direction so that circulation of unused air continues as long as injection and combustion continues.

Referring now to Figure 9, as an alternative to the eccentric, (relative to the cylinder centre), combustion chamber arrangement shown in the previous drawings an annular combustion chamber having helical grooves 27 in a chamber 28 may be provided to facilitate swirling of compressed gases around the chamber.

Alternatively as shown in Figure 10 vanes 29 may be included in a combustion chamber 30 to produce a similar effect.

Various modifications may be made to the arrangement just before described without departing from the scope of the invention and for example as an alternative to the injector shown an engine may be provided in which fuel and air is fed to the annular combustion chamber through an inlet valve which, with the exhaust valve, may in one embodiment be positioned to form part of the annular chamber itself. Various other modifications may be made to the arrangement shown as will be appreciated by those skilled in the art.

CLAIMS

1. A reciprocating internal combustion engine comprising an annular compression chamber adapted to produce a swirl of gas around the chamber during the compression stroke whereby efficient fuel/air mixing is facilitated.

2. A reciprocating internal combustion engine according to claim 1 in which the engine comprises a piston having the annular combustion chamber formed in the crown thereof.

3. A reciprocating internal combustion engine according to claim 1 in which the engine comprises a cylinder head having formed therein the annular combustion chamber.

4. A reciprocating internal combustion engine according to claim 1 in which the engine comprises a cylinder head and a piston wherein the annular combustion chamber is formed partly in the cylinder head and partly in the crown of the piston.

5. A reciprocating internal combustion engine according to any one of the preceding claims in which the annular combustion chamber comprises helical grooves or helical vanes or the like formed in the annular wall of the said chamber.

6. A reciprocating internal combustion engine according to any one of claims 1 to 4 in which the centre of the annular combustion chamber is off-set so that the cross section of the combustion chamber varies progressively from a maximum to a minimum.

7. A reciprocating internal combustion engine according to any one of the preceding claims in which the engine utilises fuel injection.

8. A reciprocating internal combustion engine according to claim 7 and comprising fuel injection means including a nozzle arranged to project into the combustion chamber.

9. A reciprocating internal combustion engine according to claim 8 in which the nozzle is arranged to inject fuel into the chamber in a direction which corresponds with the gas swirl direction around the annular combustion chamber.

10. A reciprocating internal combustion engine substantially as herein described with reference to the accompanying drawings.

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