

Nov. 10, 1959

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2,911,959

INTERNAL COMBUSTION ENGINES OF THE COMPRESSION IGNITION TYPE

Filed June 28, 1957

2 Sheets-Sheet 1

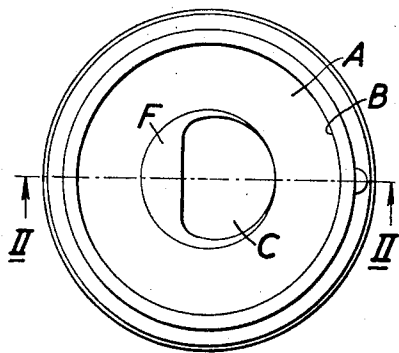


FIG. 1.

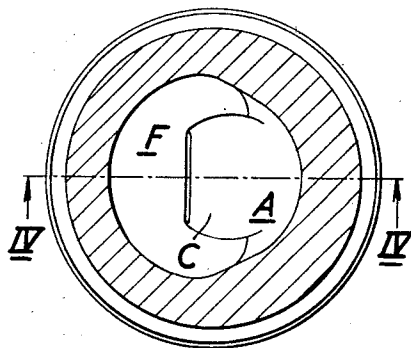


FIG. 3.

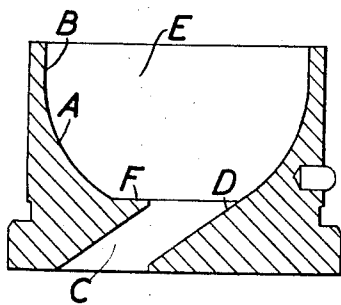


FIG. 2.

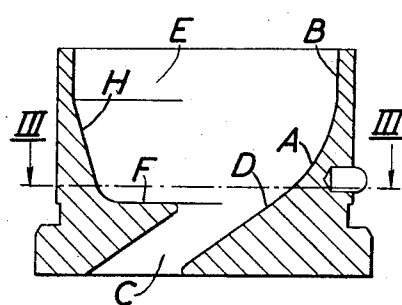


FIG. 4.

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2 Sheets-Sheet 2

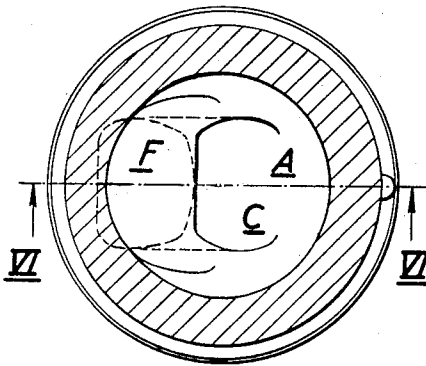


FIG. 5.

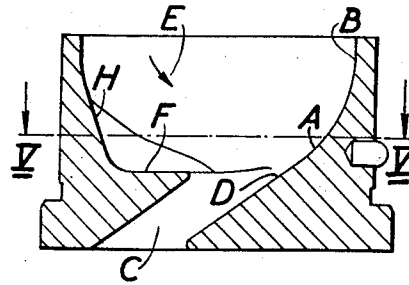


FIG. 6.

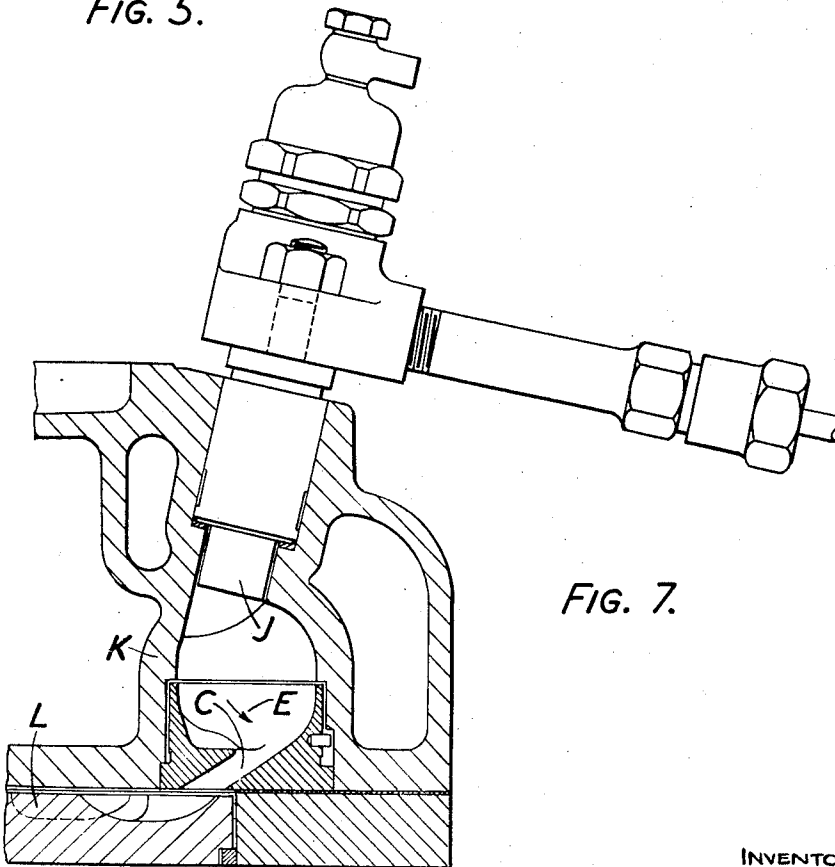


FIG. 7.

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INTERNAL COMBUSTION ENGINES OF THE COMPRESSION IGNITION TYPE

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Application June 28, 1957, Serial No. 668,704

Claims priority, application Great Britain July 5, 1956

8 Claims. (Cl. 123—32)

This invention relates to internal combustion engines of the compression ignition liquid fuel injection type including a combustion pocket into which at least a substantial proportion of the air charge is forced during each compression stroke through a transfer passage in such manner that the charge is caused to rotate in the pocket about an axis, the fuel being injected into the rotating air charge in the pocket, and is a modification of the invention described and claimed in United States of America patent application No. 539,212, now Patent 2,821,177 issued Jan. 28, 1958.

In that specification an internal combustion engine of the kind referred to is claimed, in which the part of the surface of the combustion pocket through which the mouth of the transfer passage opens, is formed as a flat or approximately flat area of substantial dimensions.

This arrangement simplifies the machining of the transfer passage as is described in the specification, and combustion conditions tend also to be improved but the latter advantage can be obtained without the transfer passage actually opening through a flat surface.

According to the present invention in an internal combustion engine of the kind referred to the surface of the combustion pocket over which circumferential portions of the rotating charge travel immediately before passing over the opening from the transfer passage is flat, and at an appropriate acute angle to the transfer passage, the surface over which circumferential portions travel immediately before passing over the flat surface is at an obtuse angle to the flat surface to impart to circumferential portions of the rotating charge a substantial component velocity parallel to the flat surface, and the surface of the pocket over which the circumferential portions of the rotating air charge travel immediately after passing over the mouth of the transfer passage is of curved form.

The flat surface provides a change in the surface of the combustion pocket at a point just in advance of the mouth of the transfer passage in the direction of the rotation of the charge, and this change is believed to produce some turbulence in the charge which causes more efficient mixing and more efficient burning.

Conveniently, the surface of the pocket over which the circumferential portions of the rotating charge travel immediately after passing over the mouth of the transfer passage is of approximately spherical form, and preferably the side of the transfer passage adjacent this spherical part of the surface merges into the spherical surface.

The part of the surface of the pocket over which the rotating charge travels immediately before it travels over the flat surface may for example be of approximately frusto-conical or of approximately spherical form.

The invention also includes a hot plug for an internal combustion engine as defined, which hot plug defines at least that part of the surface of the combustion pocket through which the mouth of the transfer passage opens and the part of the surface surrounding the mouth.

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The invention may be carried into practice in different ways; and the accompanying drawings show three specific embodiments by way of example, each of which consists of a hot plug which may replace the hot plug shown in either of Figures 1 and 3 of United States of America patent application No. 539,212.

In the accompanying drawing:

Figure 1 is a plan view of one of the hot plugs to be described by way of example;

Figure 2 is a section on the line II—II in Figure 1;

Figure 3 is a section on the line III—III in Figure 4 of a second plug;

Figure 4 is a section on the line IV—IV in Figure 3;

Figure 5 is a section on the line V—V in Figure 6 of the third plug;

Figure 6 is a section on the line VI—VI in Figure 5, and

Figure 7 is a section through a part of the cylinder head of an engine having a cylinder L, a combustion pocket K and a fuel injector nozzle M, showing the disposition of the plug in relation to these components.

Since apart from the shape of the hot plug the arrangement may be the same as that shown and described in United States of America patent appln. No. 539,212, no further description will be made of other parts of the engine.

In United States of America patent appln. No. 539,212 the hot plug defined the lower portion of the combustion pocket and was formed with a frusto-conical interior with a flat bottom face through which the transfer passage opened at an appropriate acute angle.

In the hot plug shown in Figures 1 and 2 of the present specification, the interior is partly spherical as shown at A, while at the outer end it is cylindrical as shown at B; the cylindrical sides merging gradually into the spherical sides. The transfer passage C opens into the base of the part of the combustion pocket formed in the hot plug, and merges smoothly with the spherical side A as shown at D.

In front of the mouth of the transfer passage in the direction of rotation of the air charge shown by the arrow E, the pocket is formed with a flat F, which meets the spherical surface A with a sudden change of direction.

Accordingly, the air charge is forced into the pocket through the transfer passage C, it is caused to rotate about the axis of the pocket, and the fuel is injected into it in the manner described in United States of America patent appln. No. 539,212. The spherical surface A imparts to the rotating charge a component of velocity parallel with the flat surface F, thus tending to cause any solid fuel particles to pass across the passage C, while the discontinuity between the surfaces A and F causes some local turbulence and this is believed to account for improved mixing of the fuel and air and consequent improved performance.

In the second embodiment shown in Figures 3 and 4, the arrangement is somewhat similar to that shown in Figures 1 and 2 but at the left-hand side, as shown in Figure 4 the curved part of the wall of the pocket is not spherical but frusto-conical as shown at H. The flat F is formed at the end of the frusto-conical portion, and is similar in this respect to the arrangement of Figures 1 and 2. This embodiment is believed to operate in the same way as the other, in that the conical surface H imparts to the rotating charge a component of velocity parallel to the flat surface F, while the fairly sudden change (in this case the bend is radiused at J) in direction between the surfaces H and F causes the local turbulence which improves the performance.

Either of the hot plugs described could be cast in its final shape, although it will be seen that the plug shown in Figures 1 and 2 can conveniently be machined merely

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by turning, since the shape of the inner surface of the plug is symmetrical about an axis perpendicular to the flat F. The plug shown in Figures 3 and 4 is preferably cast, but it could be manufactured by turning and milling operations.

The plug shown in Figures 5 and 6 has a frusto-conical surface H of smaller radius than that in Figures 3 and 4, and centred on the axis N rather than concentric with the spherical surface A. However the inner surface of the plug could also be formed by turning first about the axis

of the spherical surface A and then about the axis H. It will be seen that unlike the arrangement described in United States of America patent appln. No. 539,212 the mouth of the transfer passage does not open through a flat surface surrounding the passage on all sides, but one side of the passage merges smoothly into the curved sides of the combustion pocket. However, a flat surface F is provided in front of the mouth of the transfer passage in the direction of rotation of the charge.

What I claim as my invention and desire to secure by Letters Patent is:

1. An internal combustion engine of the compression ignition liquid fuel injection type including a combustion pocket into which at least a substantial proportion of the air charge is forced during each compression stroke through a transfer passage in such manner that the charge is caused to rotate in the pocket about an axis, the fuel being injected into the rotating air charge in the pocket, in which the surface of the combustion pocket over which the circumferential portions of the rotating charge travel immediately before passing over the mouth of the transfer passage is flat and at an appropriate acute angle to the transfer passage, the surface over which the circumferential portions travel immediately before passing over the flat surface is at an obtuse angle to the flat surface to impart to circumferential portions of the rotating charge a substantial component velocity parallel to the flat surface, and the surface of the pocket over which

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the circumferential portions of the rotating air charge travel immediately after passing over the mouth of the transfer passage is of curved form.

2. An internal combustion engine as claimed in claim 1 in which the surface of the pocket over which the circumferential portions of the rotating charge travel immediately after passing over the mouth of the transfer passage is of approximately spherical form.

3. An internal combustion engine as claimed in claim 2 in which the side of the transfer passage adjacent the spherical part of the surface referred to merges into the spherical surface.

4. An internal combustion engine as claimed in claim 1, in which the part of the surface of the procket over which the rotating charge travels immediately before it travels over the flat surface is of approximately frusto-conical form.

5. An internal combustion engine as claimed in claim 4, in which the part of the surface of the pocket over which the circumferential portions of the rotating charge travel immediately after passing over the mouth of the transfer passage is of approximately spherical form.

6. An internal combustion engine as claimed in claim 5, in which the side of the transfer passage adjacent the spherical part of the surface referred to merges into the spherical part of the surface.

7. An internal combustion engine as claimed in claim 1, in which the part of the surface of the procket over which the rotating charge travels immediately before it travels over the flat surface is of approximately spherical form.

8. An internal combustion engine as claimed in claim 7, in which the edge of the flat surface is circular and concentric with the spherical surface whereby they form parts of a single surface of revolution.

No references cited.