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COMBUSTION CHAMBER FOR COMPRESSION IGNITION INTERNAL-COMBUSTION ENGINES

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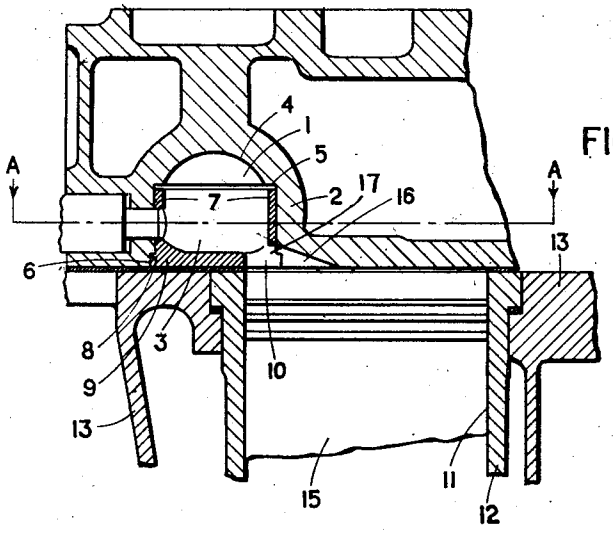


FIG. 1.

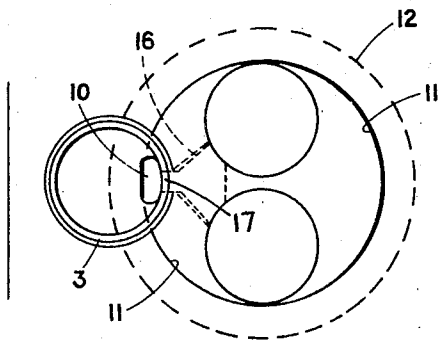


FIG. 2.

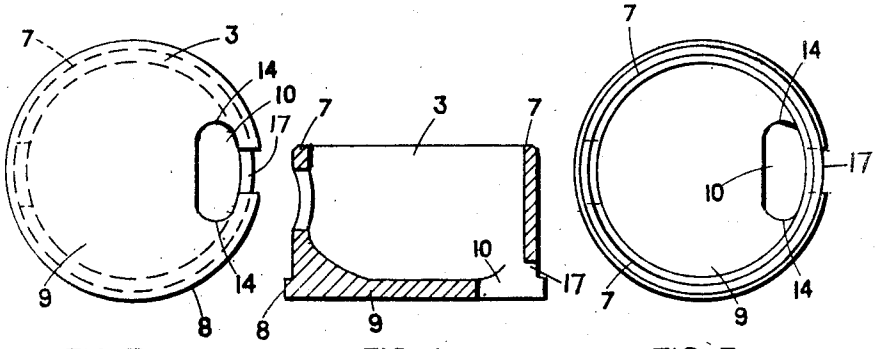


FIG. 3. FIG. 4. FIG. 5.

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COMBUSTION CHAMBER FOR COMPRESSION IGNITION INTERNAL-COMBUSTION ENGINES

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3 Claims. (Cl. 123—33)

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This invention relates to compression ignition internal combustion engines of the liquid fuel injection type in which substantially the whole of the charge is forced during the compression stroke into a pocket constituting the combustion chamber. It is well known that the completeness of combustion in such an engine depends among other things, upon the state of turbulence of the compressed gaseous charge immediately before and after fuel injection has taken place. With this end in view various forms of combustion chambers have been proposed situated in the cylinder head wherein the turbulence has been controlled to give what is known as a two-way swirl. Such a combustion chamber as proposed, whilst permitting the desired turbulence has the disadvantage of being difficult to manufacture entailing either a complicated tooling out operation through the restricted access afforded by the throat or neck which, in many cases is inclined or tangentially disposed; and to overcome these difficulties combustion chambers have been formed as a separate unit comprising one or more parts to facilitate the accurate formation of the chamber space therein. The unit has been inserted into a through bore in the cylinder head as a plug fitting. To simplify the machining or tooling of the cylinder head, combustion chambers have been formed therein by means of a simple parallel walled bore closed at one end and fully open at the other, formed directly and wholly in the cylinder head from the underside.

The chief object of the present invention is to provide a new or improved construction of forming a combustion chamber which will combine the manufacturing advantages of a simple bore with complete combustion afforded by the turbulence given by the two-way swirl.

According to the invention the combustion chamber is afforded by a simple bore in the cylinder head leading from the underside thereof, the lower end of said bore being closed by means of a flame cup having an oval or similar shaped aperture in its base to afford the vertical or main throat leading from the combustion chamber to the cylinder and a secondary aperture to afford a horizontal or turbulent throat. The flame cup will be a loose fit in the bore and the latter will be recessed to accommodate the walls of the flame cup. Said walls may be parallel or tapered whilst the outer surface or base of the cup will be substantially flush with the underside or face of the head and similarly the interior of the base of the cup may be shaped as desired. The aperture or orifice in the flame cup forming the

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throat is afforded by removing or cutting away the area or part of the area of the base of said cup which overlaps the cylinder bore and in this connection the underside of the wall of the flame cup may be radiused over a length equal to the width of the aperture.

Alternatively the throat may be formed by an elliptical or similar shaped bore leading through the base of the flame cup which overlaps the cylinder bore.

In order to control the air movement into the combustion chamber, the underside of the cylinder head may be grooved or recessed to match the throat in the flame cup so that when the piston is moving up, the air movement is vertical and runs around the chamber in one direction, but towards the end of the stroke the air movement becomes horizontal due to squish effect and the grooved recess directs the air across the bottom of the flame cup chamber. This results in the chamber swirl reversing or becoming confused with beneficial results to the mixing of air and injected fuel.

The base of the flame cup will be slightly larger than the overall diameter of the walls to fit in a suitable recess formed in the underside of the cylinder head around the bore into which the flame cup is inserted and an added advantage of the flame cup is that the cylinder head gasket and the joining of the cylinder bore and cylinder liner are protected from the flames and heat of combustion.

In order that the invention may be clearly understood and readily carried into effect the same will now be more fully described with reference to and by the aid of the accompanying drawings, wherein:

Figure 1 is a part sectional elevation of a flame cup constructed in accordance with the invention placed in position in the cylinder head of a compression ignition engine.

Figure 2 is a diagrammatic plan view showing the relationship of the flame cup with the cylinder head and bore.

Figures 3, 4 and 5 are an inverted plan, sectional elevation and plan view respectively of a flame cup.

Referring to the drawings, the combustion chamber 1 is formed in the cylinder head 2 by a bore from the underside thereof within which is fitted a steel flame cup 3, a loose or comfortable fit in said bore and suitably pinned or pegged (not shown) to prevent its rotation therein.

The bore of the combustion chamber 1 is dome-shaped at its upper end 4 and recessed at two

places 5 and 6, at 5 to receive the walls 7 of the flame cup 3 and at 6 to receive the peripheral flange 8 on the base 9 of the cup 3. The flame cup constitutes a combustion chamber liner in the head 2 and is made a loose fit in the bore so that it will not readily transfer its heat through the water cooled metal surrounding it. The throat 10 leading from the combustion chamber 1 to the cylinder is constituted or formed by an elliptical or similar shaped bore in the base 9 of the flame cup which overlaps the cylinder block 13 in the usual manner. The substantially oval shaped aperture 10 in the base of the flame cup 3 cuts through the vertical wall to form a secondary aperture 17, which constitutes a horizontal turbulent throat. Both apertures 10 and 17 are formed by one and the same opening in the flame cup but in operation the oval shaped aperture 10 which affords the main throat admits gases moving in a vertical direction while the secondary aperture 17 affording the horizontal turbulent throat, admits gases moving in a horizontal direction. The area and shape of the throat 10, viewed in elevation of the cup, may be calculated and formed as desired or expedient although in the preferred form the entrance to the combustion chamber will be an elongated slot substantially as shown and rounded at each end 14 when viewed in plan, whilst the maximum opening of the throat 10 will be in a vertical direction e. g. the depth or area which the flame cup 3 overlaps the cylinder wall 11.

In order to afford a lead into the throat for the compressed air when the piston 15 (see Figure 1) is approaching top dead centre, the cylinder head 2 adjacent to the throat 10 is recessed or grooved at 16 to finally direct the air movement across the bottom of the chamber to set up turbulence by reversing the swirl of the vertically driven air during the earlier portions of the compression stroke of the piston.

The combustion chamber 1 and recess or groove 16 associated therewith will be arranged in the cylinder head 2 in such a position that valves, valve seats and ports indicated in Figure 2, can be of a maximum efficient area.

It will be seen that this invention provides a cylinder head having a combustion chamber which is simple and cheap to manufacture which at the same time enables the full advantages of controlled turbulence to be used.

I claim:

1. In an internal combustion engine of the compression ignition type, a combustion chamber having a bore in the cylinder head leading from the underside thereof, the lower end of said bore being closed by a flame cup, said cup having vertical interior walls and having a substantially oval shaped aperture in its base to afford the main vertical throat leading from the combustion chamber to the cylinder, the said aperture extending through the vertical wall of the flame cup to form a secondary aperture in the wall adjacent to the base of said flame cup to provide a horizontal turbulent throat, said secondary aperture leading from the combustion chamber to the cylinder through the vertical main throat, said flame cup having a loose fit in the bore, and said bore being recessed to accommodate the walls of the flame cup.

2. In an internal combustion engine of the compression ignition type, a combustion chamber having a bore in the cylinder head leading from the underside thereof, the lower end of said bore being closed by a flame cup, said cup having vertical interior walls and having a substantially oval shaped aperture in its base to afford the main vertical throat leading from the combustion chamber to the cylinder through the base of the flame cup which overlaps the cylinder bore, the said aperture extending through the vertical wall of the flame cup to form a secondary aperture in the wall adjacent to the base of said flame cup to provide a horizontal turbulent throat, said secondary aperture leading from the combustion chamber to the cylinder through the vertical main throat, said flame cup having a loose fit in the bore, and said bore being recessed to accommodate the walls of the flame cup.

3. In an internal combustion engine of the compression ignition type, a combustion chamber having a bore in the cylinder head leading from the underside thereof, the lower end of said bore being closed by a flame cup, said cup having vertical interior walls and having a substantially oval shaped aperture in its base to afford the main vertical throat leading from the combustion chamber to the cylinder through the base of the flame cup which overlaps the cylinder bore, the said aperture extending through the vertical wall of the flame cup to form a secondary aperture in the wall adjacent to the base of said flame cup to provide a horizontal turbulent throat, said secondary aperture leading from the combustion chamber to the cylinder through the vertical main throat, said horizontal turbulent throat being provided with lead means for the compressed air from the cylinder, said lead means including a groove formed in the underside of the cylinder head, said flame cup having a loose fit in the bore, and said bore being recessed to accommodate the walls of the flame cup.

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