VAPORIZER FOR DIESEL ENGINES

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The present invention relates to improvements in vaporizers for diesel engines.

Such vaporizers are well known in various variations, but have the drawback that if the speed of the engine is increased, the specific consumption also increases, so that if the efficiency has to be kept within reasonable limits, the number of the revolutions of the engine must be relatively low. A further disadvantage of the known vaporizers is that they are expensive and their life is short.

The invention is suitable to minimize or to eliminate these drawbacks. The main feature of the invention is that the vaporizer consists of two cylinders, one situated within the other in such a way that the gas oil or other fuel streams through channels formed in the annular space between the said two cylinders. Thus it is attained that the fuel engages the walls of the vaporizers along large surfaces and flows through channels whose cross sectional area is large enough for enabling the fuel to stream slowly. Consequently, the fuel itself which is to be atomized, efficiently cools the vaporizer, and, on the other hand, the fuel is well preheated, so that its viscosity is decreased, allowing a very good atomization and thereby a low specific consumption.

Thus, by the use of the vaporizer according to the invention, a quick and thorough combustion is attained, and this at high speeds as well.

Other details and advantages of the invention are described in the following specification which refers to the enclosed drawings illustrating some forms of the invention shown by way of example. In these drawings:

Fig. 1 is a longitudinal sectional view of the first embodiment of the invention;

Fig. 2 shows one part in section of the vaporizer according to Fig. 1.

Fig. 3 is a cross section along the line III—III of Fig. 2 and

Figs. 4 and 5 are a sectional view and plan view respectively of another component part, shown on a larger scale.

Fig. 6 is the side view of the piston of the vaporizer.

Fig. 7 is the side view of another form of the cylinder shown in Fig. 2 and

Fig. 8 shows a modified form of the part illustrated in Fig. 5.

Finally:

Fig. 9 is the longitudinal section of a device suitable for the mass production of the vaporizer, according to the invention.

Referring now to Figs. 1 to 6 a cylinder 2 having thick walls is situated within a thin-walled cylinder 1, the former cylinder accommodating the piston 3 (a fuel pressure operated valve) of the vaporizer which may be moved up and down. The inner cylinder 2 is provided with feathers or ribs 4, the outer surfaces of which engage the inner circular surface of cylinder 1. The ribs 4, at their upper and lower ends, are shorter than cylinder 2 (Fig. 2), so that at the two edges of this cylinder an annular space is formed.

Under piston 3 there is a disc 5 provided with an atomizing nozzle 10, the disc having ribs 6 on its outer surface which also engage the inner surface of cylinder 1. The function of the vaporizer is as follows:

The gas oil or other fuel is pressed into the channels formed between ribs 4, for which purpose advantageously a cam driven pump is used. From the said channels, the fuel flows through the lower annular space into the shorter conduits between ribs 6, and then it streams into an annular space 7 situated under the disc 5 and formed by two opposite grooves machined in the disc and in the bottom of cylinder 1 respectively. From the annular space 7 the gas oil is streaming in an upward direction through bores 8 of the disc and comes into a further annular space 9, situated under the piston, which is lifted by the pressure of the oil, so that the oil may stream again downward through the nozzle 10 and through the central opening 11 in the bottom of cylinder 1. Thus the fuel is sprayed into the cylinder of the engine (not shown in the drawing).

By the use of a separate outer cylinder 1 on the inner cylinder guiding the piston 3 and by forming channels between the two cylinders for leading the gas oil, it is attained that the oil is well preheated before it is atomized and the walls of the vaporizer are efficiently cooled.

Thus the viscosity of the oil is decreased ensuring a good atomization and there are no hot parts in the vaporizer on which cracking of the oil might occur, so that local overheating, seizures or other breakdowns are eliminated. A seizing by overheating is surely avoided by the inner cylinder not receiving direct heat from the combustion chamber, and becoming by no means hotter than the streaming gas oil. Thus a close fit, i.e., a good guiding of the piston is made possible, so that the life of the gliding surfaces and of the seat of the piston is increased and the quantity of the leaking oil is minimized, making the engine more elastic.

According to the invention the cooling becomes even more efficient by the formation of the inner cylinder 2 into a rod filler. In this embodiment of the invention (Fig. 7) the fuel pressed into the intake grooves 12 is forced to stream along the inner surface of the cylinder 1 into the outlet grooves 13, thus ensuring a very good heat exchange. In this embodiment of the invention, the oil is efficiently filtered directly before atomization, and the vaporizer is washed by the oil along all its important surfaces.

In the bottom part of the inner cylinder 2 vertical bores 14 may be provided (the drawing shows two such bores) which accommodate connecting pins of the disc 5, not illustrated in the drawing. This construction makes it possible to grind disc 5 on the seat of the bottom of the outer cylinder, without dismounting the parts, because simple turning of the cylinder will suffice for the purpose.

The principal idea of the present invention, i.e., to form the body of the vaporizer out of two cylinders, one housed in the other, may be further developed by making the inner cylinder 2 protrude out of the outer cylinder 1 by a distance H. In this embodiment of the invention the wall of the outer cylinder is substantially thinner than that of the inner one. By fastening this vaporizer, as it is usual, at the front, the movement of its edge 20 in the socket of the engine, the inner cylinder is pressed into the outer one, until the two upper end surfaces are within one and the same plane. This way in the inner cylinder a compression stress, whereas in the outer cylinder a tension stress is generated, and the surfaces fitting on each other are produced.

The said distance H should be large enough to produce strong forces on the fitting surfaces to prevent them from becoming loose during operation. This distance H,
3 on the other hand, should be short enough to produce only elastic deformations in the parts. In vaporizers of medium size, a suitable distance \( H \) may be about 0.04 mm.

To enable easy mass production of the vaporizer, first the two cylinders 1 and 2 are machined and then a gauge 15 is placed onto the bottom of cylinder 1 instead of the disc 5. The thickness \( E \) of this gauge is identical with the thickness \( U \) of the disc 5, subtracted from the latter the distance \( H \):

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E = U - H
\]

Now the inner cylinder 2 is put in place and is fastened by means of a screw 16 and a nut 18. The head of the screw is situated within depression 17 made for this purpose in cylinder 2. The bore 11 of cylinder 1 is larger than nozzle 10, so that a screw 16 strong enough for fixing the parts, may be introduced into said bore.

After fixing the parts according to Fig. 9, either cylinder 1 or cylinder 2 is somewhat longer than the other, and then the two upper surfaces are so ground that they will lie in the same plane; if now the parts are dismantled, the gauge 15 is removed and a disc 5 is inserted, i.e. the vaporizer is mounted in the usual manner, the inner cylinder will protrude from the outer one by the said distance \( H \).

The vaporizer according to the invention may be constructed in a manner that the piston 3 engages disc 5 by a plane surface as shown, that is, the piston is not provided with an extension penetrating into the nozzle, as it is usual in many of the known vaporizers. Thus the production of the vaporizer according to the invention is easier and cheaper than that of the known vaporizers. In consequence of the advantages disclosed in the foregoing, in particular owing to the preheating of the gas oil, atomization is much better than in known vaporizers having a plane engaging surface on the piston. However, in order to attain a still better atomization, according to the invention, inclined grooves 19 (Fig. 6) are made in the upper bearing surface of disc 5 in order to enable part of the fuel, after leaving the ribs 4, to flow directly into the annular space 9 in such a manner that a rotating movement of the fuel is produced.

The advantages of a rotating movement of the fuel are well known: e.g. the higher the speed of the engine, the larger the angle of the cone along which the fuel is atomized. Thereby the maximum number of revolutions at which the engine runs with reasonable efficiency becomes higher. Up to now, this rotating movement was produced by grooves made in the piston, or in the walls of the cylinder, which had the drawback of the packing surface of the piston losing its continuity so that leakages and seizures might occur. According to the invention, however, the inclined grooves 19 are situated in a plane surface of a stationary part, so that the advantages of the rotating movement may be made use of without any inconvenience.

The same holds true if the grooves 19 are made in the lower part of cylinder 2 instead of in the disc 5.

The number and the dimensions of the grooves 19 may be chosen in such a way that the quantity of the oil streaming through the annular space 7 is sufficient for adequate cooling of the disc 5, and the oil streaming through the grooves 19 is sufficient to make rotate the entire amount of fuel. In a borderline case, however, the entire amount of oil may be led through the grooves 19.

What I claim is:

1. In a fuel injector for diesel engines, an inner cylinder having a fuel-pressure operated valve therein, an outer cylinder enveloping said inner cylinder and spaced therefrom leaving a fuel-leading interspace around the said inner cylinder, said outer cylinder having a bottom part, a disc having a nozzle for atomizing the fuel and a bearing surface engaging the said bottom of the outer cylinder, said bottom and said disc having juxtaposed grooves therein defining an annular space, the annular space being situated around the said bearing surface, means connecting said annular space to the interspace between the cylinders, and bores in the disc crossing the whole thickness of the disc and extending from said annular space to the interior of the said inner cylinder to lead the fuel towards the said valve.

2. A fuel injector as claimed in claim 1, ribs on the outer surface of the said inner cylinder, fuel-leading channels formed by these ribs, some of these channels being closed at the bottom and others at the top, and small interspaces between the ribs and the inner surface of the outer cylinder adapted to lead the fuel from one channel into the other.

3. In a fuel injector for diesel engines, an inner cylinder having a fuel-pressure operated valve therein, an outer cylinder enveloping said inner cylinder and spaced therefrom, said outer cylinder having a bottom part, the inner cylinder protruding out of the outer cylinder before fixing in the mounting and the wall of the outer cylinder being thinner than the wall of the inner cylinder, a disc having a nozzle for atomizing the fuel and a bearing surface engaging the said bottom of the outer cylinder, said bottom and said disc having juxtaposed grooves therein defining an annular space, the annular space being situated around the said bearing surface, means connecting said annular space to the interspace between the cylinder, and bores in the disc crossing the whole thickness of the disc and extending from said annular space to the interior of the said inner cylinder to lead the fuel towards the said valve.

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