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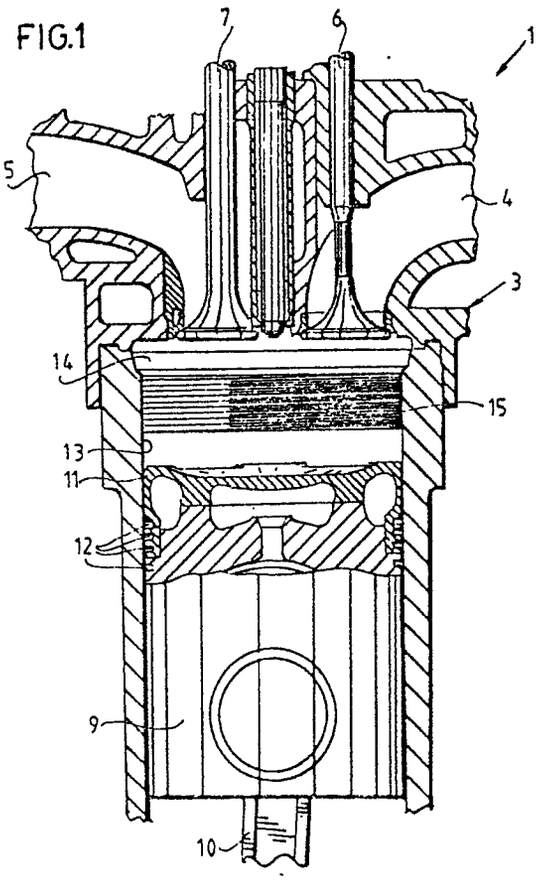
(54) Piston combustion engine.

(57) Piston combustion engine comprising an engine block with at least one cylinder, a cylinder head provided with inlet and exhaust channels and closing off said cylinder at one end, and a piston accommodated in said cylinder which is guided reciprocally between a top dead centre close to said cylinder head and a bottom dead centre at a stroke length therefrom, said piston bearing a number of piston rings that are in sliding contact with the inner wall of said cylinder. At least a portion of said inner wall of said cylinder between said cylinder head and the level of the uppermost piston ring at the top dead centre of said piston, has a greater surface roughness relative to that of the surface of the peripheral wall of said piston above the uppermost piston ring.

FIG.1



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PISTON COMBUSTION ENGINE

The invention relates to a piston combustion engine comprising an engine block with at least one cylinder, a cylinder head provided with inlet and exhaust channels and closing off the cylinder at one end, and a piston accommodated in the cylinder which is guided reciprocally between a top dead point close to the cylinder head and a bottom dead point at a stroke length therefrom, the piston bearing a number of piston rings that are in sliding contact with the inner wall of the cylinder.

Between the piston rings and the cylinder wall an unbroken, thin film of oil has to be present during operation in order to prevent wear. In the case of engines which have been in use for a longer period, axially extending worn patches are often visible in the part of the cylinder wall over which the piston rings run, and these are evidently the consequence of lack of sufficient oil.

The invention has for its object to provide a piston combustion engine of the kind set forth in the preamble, in which these symptoms of wear do not occur or only do so to a much lesser degree.

According to the invention this is achieved in that at least a portion of the inner wall of the cylinder, between the cylinder head and the level of the uppermost piston ring at the top dead point of the piston, has a greater surface roughness relative to that of the surface of the peripheral wall of the piston above the uppermost piston ring.

It is assumed that the apparent lack of lubricant on the cylinder wall is caused by contamination of, and particularly carbon deposition on, the surface of the piston peripheral wall above said uppermost piston ring. This con tamination arises as a result of imperfect combustion. This contamination diminishes the tolerance between the piston and the cylinder wall, so that with expansion of the piston as a result of higher temperatures, for example during full-load operation, it is possible that this deposited layer of carbon exerts a scraping effect on the oil film.

With the measure according to the invention is achieved that the contamination is preferably deposited on the rougher portion of the cylinder wall over which the piston rings do not move, and not on the piston. It has been found that this step results in any case in a substantial reduction of the above-mentioned wear.

An additional advantage of the measure according to the invention is that the rougher portion of the cylinder wall will act as a per se known labyrinth, so that the gases encounter an extra resistance during flow between the rougher portion of the cylinder wall and the periphery of the piston. So called "blow-by" is reduced as a result.

Furthermore, as a result of the carbon deposition on the rougher portion of the cylinder wall, which deposition has a heat insulating effect, the generation of the heat of the gases on the cylinder lining will diminish. Combustion can take place at relatively higher temperatures as a result, which has a positive effect on the combustion, which in turn will result in the exhaust gases containing less unburnt particles.

Larger carbon particles which are deposited on the peripheral wall of the piston as well as on the cylinder wall will be broken as a result of the movements of the piston. The rough surfaces caused by this can have a scraping effect on the deposits, so that the clearance between the cylinder and the piston remains sufficient.

The less smooth forming of the upper portion of the inner wall of the cylinder with which the piston rings do not come into contact can be realised in various ways. For example by etching, knurling or by applying grooves. Preferably however, a fine screw thread is formed in the said portion of the inner wall of the cylinder.

It has been found that a screw thread with a depth in the order of 1 mm has favourable results.

When the portion of the inner wall of the cylinder with greater surface roughness in the direction of the cylinder head ends at a distance from the cylinder head, the part of the inner wall of the cylinder adjacent to the cylinder head remains relatively smooth, so that the gas turbulences in the combustion space that are favourable for good combustion are not inhibited.

A further favourable development of the engine in accordance with the invention is characterized by the portion of the inner wall of the cylinder with a greater surface roughness being formed by at least a part of the inner wall of a ring arranged for detachment in the engine block. The ring can be manufactured relatively simply and formed with a suitable surface roughness on its inner surface, so that extra costs entailed by application of the invention remain limited. During maintenance work whereby the lining has to be cleaned, the ring can easily be replaced. This work can as a result be performed quickly so that in this respect the invention does not increase costs, or hardly does so.

Another favourable embodiment is obtained when the portion of the inner wall of the cylinder with the greater surface roughness has an inner diameter different from the nominal cylinder diameter. In this way the roughened portion does not obstruct fitting of the piston in the cylinder and particularly the passage of the piston rings, or only does so to a lesser extent. For the preferred depo-

sition of the carbon particles on the rougher portion of the cylinder wall instead of on the piston, it is not necessary for the rougher portion to have the same nominal diameter as the cylinder.

The invention will be further elucidated in the following description with reference to an embodiment shown in the drawings.

In the drawings:

Fig. 1 shows a partial cross-section of a piston combustion engine according to the invention,

Fig. 2 shows a detail section of the engine of Fig.1,

Fig. 3 is a detail section corresponding to Fig. 2 of an engine according to the invention in a slightly altered embodiment.

Engine 1 comprises an engine block in which at least one cylinder bush 2 is mounted. Cylinder 2 is closed off at its top end by a cylinder head 3. Cylinder head 3 is provided with an inlet channel 4 and an exhaust channel 5, which can be opened and closed using an inlet valve 6 and an exhaust valve 7 respectively. Further mounted into cylinder head 3 is an injector 8 with which fuel can be injected into the cylinder.

Fitted in cylinder 2 is a piston 9 which is connected in the known manner to a crankshaft via a drive rod 10. Because of the connection to the crankshaft, piston 9 can move reciprocally between a top dead centre and a bottom dead centre.

Fig. 2 shows piston 9 at the top dead centre. The piston 9, and particularly the piston bottom 11, leaves a combustion space 14 in the cylinder. Piston 9 is provided with a number of piston rings 12, which make sliding contact with the inner wall 13 of the cylinder. These piston rings 12 ensure sealing of the piston 9 in the cylinder 2 and the scraping off to the minimum necessary thickness of a film of lubricating oil formed on the inner wall 13 of the cylinder.

As is shown particularly in Fig. 2, a portion 15 of inner wall 13 of cylinder 2 is provided at its upper end, that is, at a location between cylinder head 3 and the level of the uppermost piston ring 12 at the top dead centre of piston 9, with a fine screw thread. As a result, this portion of inner wall 13 has a greater surface roughness than the surface of peripheral wall 17 of piston 9 above the uppermost piston ring 12.

During operation of engine 1 damaging contamination occurs, in particular as a consequence of carbon deposition. This carbon, which is formed during the combustion process, also penetrates into the slit 16 betweeen the surface 17 of the piston and the opposite part of the peripheral wall 13. Since according to the invention the cylinder wall at this location has a greater surface roughness than the piston wall 17, the contamination will preferably adhere to the cylinder wall. Piston 9 will thus remain to a large extent free from contamination.

As is shown in the Figures, the portion 15 of the inner wall of cylinder 2 with a greater surface roughness in the direction of cylinder head 3 ends at a distance from cylinder head 3. The part of the cylinder wall which in top position of piston 9 forms the side boundary of combustion chamber 14, remains smooth, so that the turbulences of the gases in the combustion chamber 14 that are desirable for a good combustion, are not inhibited.

In Fig. 3 the parts corresponding to those shown in Fig. 2 are designated with the same reference numerals. As is shown in Fig. 3, this embodiment has a releasable ring 20 fitted in the top of the cylinder. A portion of the inner wall of this ring 20 is provided with the greater surface roughness 21. Portion 21 has a larger inner diameter than the nominal cylinder diameter. As a result the slit between the outer surface 17 of the piston and the rough wall portion 21 is bigger, so that during fitting of piston 9, the piston rings 12 can pass through more easily.

The roughened carbon deposition surface can also be wholly or partly situated on a smaller diameter than the cylinder diameter, above the part of the cylinder wall over which the piston moves. As a result of the preferred deposition of carbon on the roughened surface, less or no carbon deposition onto the piston will be thereby achieved.

Claims

1. Piston combustion engine comprising an engine block with at least one cylinder, a cylinder head provided with inlet and exhaust channels and closing off said cylinder at one end, and a piston accommodated in said cylinder which is guided reciprocally between a top dead centre close to said cylinder head and a bottom dead centre at a stroke length therefrom, said piston bearing a number of piston rings that are in sliding contact with the inner wall of said cylinder, **characterized** in that at least a portion of said inner wall of said cylinder between said cylinder head and the level of the uppermost piston ring at the top dead centre of said piston, has a greater surface roughness relative to that of the surface of the peripheral wall of said piston above the uppermost piston ring.

2. Piston combustion engine as claimed in claim 1, **characterized** in that in the portion of the cylinder wall of the cylinder a fine screw thread is formed.

3. Piston combustion engine as claimed in claim 2, **characterized** in that the screw thread has a depth in the order of 1 mm.

4. Piston combustion engine as claimed in any of the preceding claims, **characterized** in that the portion of the inner wall of the cylinder with greater surface roughness in the direction of the cylinder head ends at a distance from said cylinder head.

5. Piston combustion engine as claimed in any of the preceding claims, **characterized** in that the portion of the inner wall of the cylinder with greater surface roughness is formed by at least a part of the inner wall of a ring fitted releasably in the engine block.

6. Piston combustion engine as claimed in any of the preceding claims, **characterized** in that the portion of the inner wall of the cylinder with the greater surface roughness has an inner diameter different from the nominal cylinder diameter.

FIG.1

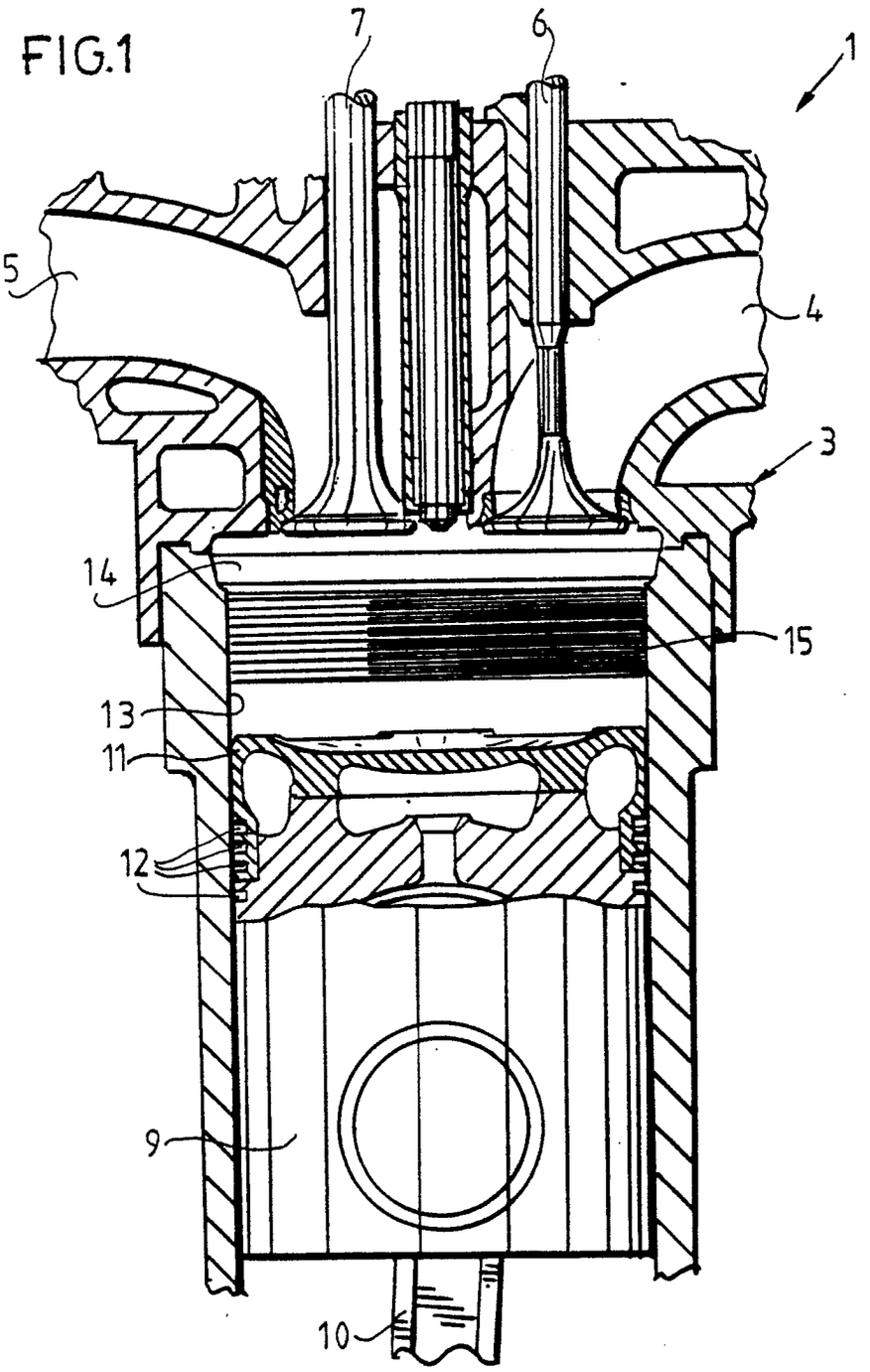

FIG.2

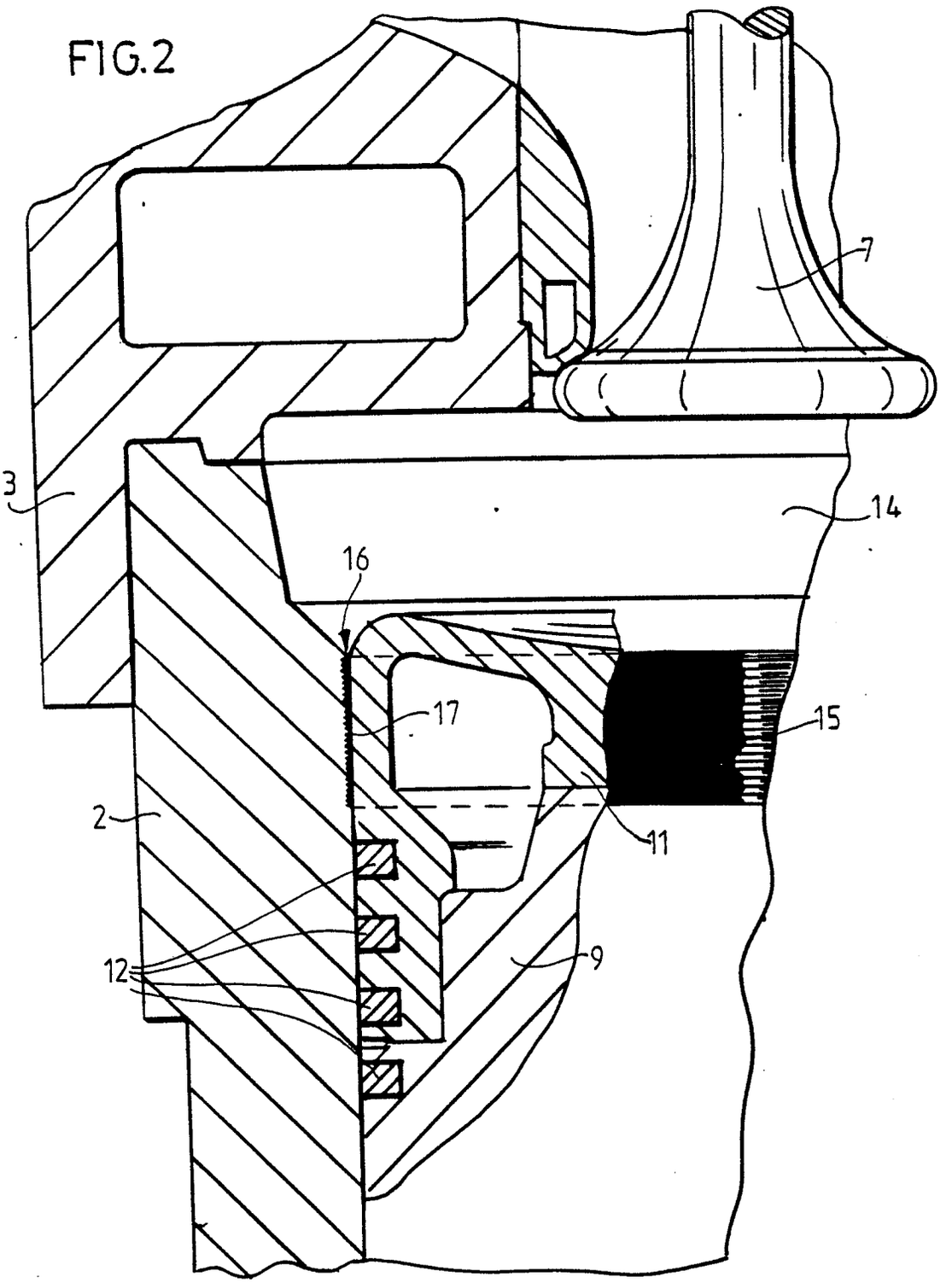

FIG.3