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(54) **CYLINDER HEAD**

ZYLINDERKOPF

TÊTE DE CYLINDRE

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Description

[0001] The invention relates to a cylinder head of a reciprocating engine.

[0002] In large diesel engines the fuel injector is disposed in the injector sleeve, which, in turn, is disposed in a bore in the cylinder head. The fuel injector and the injector sleeve are cooled by cooling liquid which is fed into a cooling liquid space surrounding the injector sleeve. Typically the lower and upper portions of the injector sleeve are attached to the cylinder head by shrink-fit connections such that the cooling liquid space is between the connections. The shrink-fit connections prevent leakage of cooling liquid from the cooling liquid space.

[0003] During the engine operation the cylinder head deflection due to firing pressure can cause relative movements between the cylinder head and the injector sleeve especially in the lower shrink-fit connection, in which the thermal expansion reduces the initial press force. These movements may result in the fretting at the contact area of the lower shrink-fit connection, which can cause cooling liquid leakages into the fuel injector housing.

[0004] DE29803618U1 discloses a cylinder head of a reciprocating engine, with a spark plug disposed in a sleeve, whose upper portion is attached to the cylinder head by a screwed connection, which determines a vertical compression of an annular seal against the cylinder head.

[0005] The object of the present invention is to provide an improved cylinder head for a reciprocating engine.

[0006] The object of the present invention can be achieved by a cylinder head according to claim 1.

[0007] The cylinder head according to the invention comprises a body having a bore for receiving an injector sleeve, in which a fuel injector can be inserted, an injector sleeve inserted in the bore, and a cooling liquid space surrounding the injector sleeve. The injector sleeve comprises a lower portion that is below the cooling liquid space and an upper portion that is above the cooling liquid space. The upper portion is attached to the body. An annular seal is arranged between the lower portion of the injector sleeve and the body and the lower portion of the injector sleeve is mechanically uncoupled from the body.

[0008] According to the invention the upper part of the injector sleeve is attached to the body of the cylinder head by a shrink fit and the lower portion of the injector sleeve is mechanically uncoupled from the body. The connection of the upper portion keeps the injector sleeve in its position in the bore and the lower portion of the injector sleeve can freely follow the movements of the cylinder head as the combustion pressure deflects the cylinder head lower part (i.e. flame plate). The annular seal prevents cooling liquid leakages from the cooling liquid space. Like this, a reliable sealing arrangement can be accomplished. Additionally, the design according to the invention can be used both in new cylinder heads and as a repair solution in old ones.

[0009] In the following the invention will be described by way of an example with reference to the accompanying drawings, in which

Fig. 1 is a cross sectional view of a cylinder head according to an embodiment of the invention,
Fig. 2 is a cross sectional view of cylinder head of fig. 1 with an injector inserted in an injector sleeve, and
Fig.3 is an enlargement of a Fig.2 detail.

[0010] The drawing shows a cylinder head 1 of a reciprocating engine. The engine is a large diesel engine, which can be used as a main and/or an auxiliary engine in ships and/or in power plants for generation of electricity and/or heat. The engine is a medium speed, four-stroke engine. The maximum rotational speed of the engine is 300-1200 rpm. Cylinders 7 of the engine can be arranged in a single bank or in two banks in a V-configuration. Typically, the engine has 6-20 cylinders. The cylinder bore is typically 16-64 cm. Each cylinder is provided with a separate cylinder head 1.

[0011] The cylinder head 1 comprises a body 2 having a lower surface 3 that forms an upper surface of a combustion chamber 7 of the cylinder. The body 2 is provided with a bore 4 for receiving an injector sleeve 5, in which a fuel injector 6 can be inserted. The injector sleeve 5 is inserted in the bore 4. The fuel injector 6 is inserted in the injector sleeve 5. The fuel injector 6 is mechanically uncoupled from the injector sleeve 5. The internal diameter of the sleeve 5 is greater than the external diameter of the injector 5. The fuel injector 6 faces the inner surface of the injector sleeve.

[0012] The body 2 comprises a cooling liquid space 8 for cooling liquid. The cooling liquid space 8 can be implemented in the form of a cooling water jacket, a cavity or a cooling channel. The cooling liquid space 8 surrounds the injector sleeve 5. The injector sleeve 5 comprises a lower portion 9 that is below the cooling liquid space 8. Further, the injector sleeve has an upper portion 10 that is above the cooling liquid space 8. The lower portion 9 of the injector sleeve is below the lowermost edge between the cooling liquid space 8 and the bore 4. The upper portion 10 is above the uppermost edge between the cooling liquid space 8 and the bore 4. In case the body 2 comprises two or more cooling liquid spaces that surround the injector sleeve 5, the lower portion of the injector sleeve is below the lowermost cooling liquid space and the upper portion above the uppermost cooling liquid space.

[0013] An upper portion 10 of the injector sleeve 5 is attached to the body 2. The upper portion 10 is attached to the body 2 by a shrink fit. The lower portion 9 of the injector sleeve is mechanically uncoupled from the body 2. An annular seal 13, for example an O-ring, is arranged between the lower portion 9 of the injector sleeve and the body 2. The annular seal 13 is arranged between the

outer diameter of injector sleeve 5 and the bore 4. The annular seal 13 prevents cooling liquid leakages from the cooling liquid space 8 into the injector housing. The annular seal 13 can be made of perfluoroelastomer (FFKM). Thus, the annular seal 13 can be used in high temperature conditions, up to 270°C. The outer surface of the injector sleeve 5 comprises an annular groove 14, in which the annular seal 13 is placed. The annular groove 14 is in flow connection with the cooling liquid space 8 through a gap 15 between the injector sleeve 5 and the body 2. With this solution the annular seal 13 stays wet, which increases its lifetime. The portion of the injector sleeve 5, which is below the annular seal 13, is mechanically uncoupled from the body 2.

[0014] The bore 3 comprises an annular shoulder 16, to which a lower end 11 of the injector sleeve is supported. Also the fuel injector 6 is supported to the annular shoulder 16. A sealing ring 17 is arranged between the annular shoulder 16 and the fuel injector 6. The sealing ring 17 prevents the entering of combustion gases into the injector sleeve 5.

[0015] A clearance 18 is provided between the bore wall and the lower portion 9 of the injector sleeve. The clearance 18 enables the movements of the injector sleeve 5 in relation to the body 2 during the engine operation. The size of the clearance in engine working conditions is at most 40 μm. In installation conditions there can be a slight interference between the lower portion of injector sleeve and the bore. In the engine working conditions (temperature) the temperature difference between the injector sleeve and the bore is such that the bore 4 is expanding more than the injector sleeve 5 and no interference exists. Drive fit H7/m6 can be used between the body and the lower portion 9 of the injector sleeve. The clearance is provided between the body 2 and the injector sleeve portion that is below the annular seal 13.

[0016] The edge between the cooling liquid space and the lower portion of the bore is provided with a chamfer 19. The dimensions of the chamfer 19 can be 2x20°.

Claims

1. A cylinder head (1) of a reciprocating engine, the cylinder head (1) comprising:

   - a body (2) having a bore (4) for receiving an injector sleeve (5), in which a fuel injector (6) can be inserted,
   - an injector sleeve (5) inserted in the bore (4) and
   - a cooling liquid space (8) surrounding the injector sleeve (5),

   which injector sleeve (5) comprises a lower portion (9) that is below the cooling liquid space (8) and an upper portion (10) that is above the cooling liquid space (8), which upper portion (10) is attached to the body (2),

   an annular seal (13) being arranged between the lower portion (9) of the injector sleeve and the body (2), and the lower portion (9) of the injector sleeve being mechanically uncoupled from the body (2), **characterized in that** the upper portion (10) of the injector sleeve is attached to the body (3) by a shrink fit.

2. The cylinder head (1) according to claim 1, **characterized in that** a clearance (18) is provided between the body (2) and the lower portion (9) of the injector sleeve.

3. The cylinder head (1) according to claim 2, **characterized in that** a size of the clearance (18) is at most 40 μm.

4. The cylinder head (1) according to claim 1, **characterized in** an outer surface of the injector sleeve (5) comprises an annular groove (14), in which the annular seal (13) is placed.

5. The cylinder head (1) according to claim 4, **characterized in** the annular groove (14) is in flow connection with the cooling liquid space (8).

6. The cylinder head (1) according to claim 1, **characterized in that** the bore (3) comprises an annular shoulder (16), to which a lower end (11) of the injector sleeve (5) is supported.

7. The cylinder head (1) according to claim 6, **characterized in that** a sealing ring (17) is arranged between the annular shoulder (16) and the injector (6).

8. The cylinder head (1) according to claim 2 or 3, **characterized in that** the clearance (18) is provided between the body (2) and the injector sleeve portion that is below the annular seal (13).

9. The cylinder head (1) according to claim 1, **characterized in that** an edge between the cooling liquid space (8) and a lower portion of the bore is provided with a chamfer (19).

10. The cylinder head (1) according to claim 1, **characterized in that** the injector sleeve (5) is a one-piece part.

Patentansprüche

1. Zylinderkopf (1) eines Kolbenmotors, wobei der Zylinderkopf (1) Folgendes umfasst:

   - einen Körper (2) mit einer Bohrung (4) zur Auf-

nahme einer Injektorhülse (5), in die ein Kraftstoffinjektor (6) eingesetzt werden kann,
- eine Injektorhülse (5), die in die Bohrung (4) eingesetzt ist, und
- einen Kühlflüssigkeitsraum (8), der die Injektorhülse (5) umgibt,
wobei die Injektorhülse (5) einen unteren Abschnitt (9), der sich unter dem Kühlflüssigkeitsraum (8) befindet, und einen oberen Abschnitt (10), der sich über dem Kühlflüssigkeitsraum (8) befindet, umfasst, wobei der obere Abschnitt (10) an dem Körper (2) angebracht ist,

wobei zwischen dem unteren Abschnitt (9) der Injektorhülse und dem Körper (2) eine ringförmige Dichtung (13) angeordnet ist und der untere Abschnitt (9) der Injektorhülse mechanisch von dem Körper (2) entkoppelt ist, **dadurch gekennzeichnet, dass** der obere Abschnitt (10) der Injektorhülse durch eine Schrumpfpassung an dem Körper (3) angebracht ist.

2. Zylinderkopf (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** zwischen dem Körper (2) und dem unteren Abschnitt (9) der Injektorhülse ein Zwischenraum (18) bereitgestellt ist.

3. Zylinderkopf (1) nach Anspruch 2, **dadurch gekennzeichnet, dass** die Größe des Zwischenraums (18) höchstens 40 μm beträgt.

4. Zylinderkopf (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Außenfläche der Injektorhülse (5) eine ringförmige Nut (14) umfasst, worin die ringförmige Dichtung (13) angeordnet ist.

5. Zylinderkopf (1) nach Anspruch 4, **dadurch gekennzeichnet, dass** die ringförmige Nut (14) in einer Fließverbindung mit dem Kühlflüssigkeitsraum (8) steht.

6. Zylinderkopf (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Bohrung (3) eine ringförmige Schulter (16) umfasst, an der ein unteres Ende (11) der Injektorhülse (5) getragen wird.

7. Zylinderkopf (1) nach Anspruch 6, **dadurch gekennzeichnet, dass** zwischen der ringförmigen Schulter (16) und dem Injektor (6) ein Dichtungsring (17) angeordnet ist.

8. Zylinderkopf (1) nach Anspruch 2 oder 3, **dadurch gekennzeichnet, dass** der Zwischenraum (18) zwischen dem Körper (2) und jenem Injektorhülsenabschnitt, der sich unter der ringförmigen Dichtung (13) befindet, bereitgestellt ist.

9. Zylinderkopf (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** eine Kante zwischen dem Kühlflüssigkeitsraum (8) und einem unteren Abschnitt der Bohrung mit einer Abschrägung (19) versehen ist.

10. Zylinderkopf (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Injektorhülse (5) ein einstückiges Teil ist.

Revendications

1. Tête de cylindre (1) d'un moteur à va-et-vient, la tête de cylindre (1) comprenant :

- un corps (2) ayant un perçage (4) pour recevoir un manchon d'injecteur (5) dans lequel un injecteur de carburant (6) peut être inséré,
- un manchon d'injecteur (5) inséré dans le perçage (4), et
- un espace de liquide de refroidissement (8) entourant le manchon d'injecteur (5),
lequel manchon d'injecteur (5) comprend une partie inférieure (9) qui est en-dessous de l'espace de liquide de refroidissement (8) et une partie supérieure (10) qui est au-dessus de l'espace de liquide de refroidissement (8), laquelle partie supérieure (10) est attachée au corps (2), un joint d'étanchéité annulaire (13) étant disposé entre la partie inférieure (9) du manchon d'injecteur et le corps (2), et la partie inférieure (9) du manchon d'injecteur étant découplée mécaniquement du corps (2),
caractérisée en ce que la partie supérieure (10) du manchon d'injecteur est attachée au corps (3) grâce à un ajustage fretté.

2. Tête de cylindre (1) selon la revendication 1, **caractérisée en ce qu'**un espacement (18) est fourni entre le corps (2) et la partie inférieure (9) du manchon d'injecteur.

3. Tête de cylindre (1) selon la revendication 2, **caractérisée en ce qu'**une taille de l'espacement (18) est de 40μm tout au plus.

4. Tête de cylindre (1) selon la revendication 1, **caractérisée en ce qu'**une surface extérieure du manchon d'injecteur (5) comprend une rainure annulaire (14) dans laquelle le joint d'étanchéité annulaire (13) est placé.

5. Tête de cylindre (1) selon la revendication 4, **caractérisée en ce que** la rainure annulaire (14) est en connexion fluidique avec l'espace de liquide de refroidissement (8).

6. Tête de cylindre (1) selon la revendication 1, **caractérisée en ce que** le perçage (3) comprend un épau-

lement annulaire (16) par lequel une extrémité inférieure (11) du manchon d'injecteur (5) est supportée.

7. Tête de cylindre (1) selon la revendication 6, **caractérisée en ce qu'**une bague d'étanchéité (17) est disposée entre l'épaulement annulaire (16) et l'injecteur (6).

8. Tête de cylindre (1) selon la revendication 2 ou 3, **caractérisée en ce que** l'espacement (18) est fourni entre le corps (2) et la partie de manchon d'injecteur qui est en-dessous du joint d'étanchéité annulaire (13).

9. Tête de cylindre (1) selon la revendication 1, **caractérisée en ce qu'**un bord entre l'espace de liquide de refroidissement (8) et une partie inférieure du perçage est doté d'un chanfrein (19).

10. Tête de cylindre (1) selon la revendication 1, **caractérisée en ce que** le manchon d'injecteur (5) est un élément d'une seule pièce.

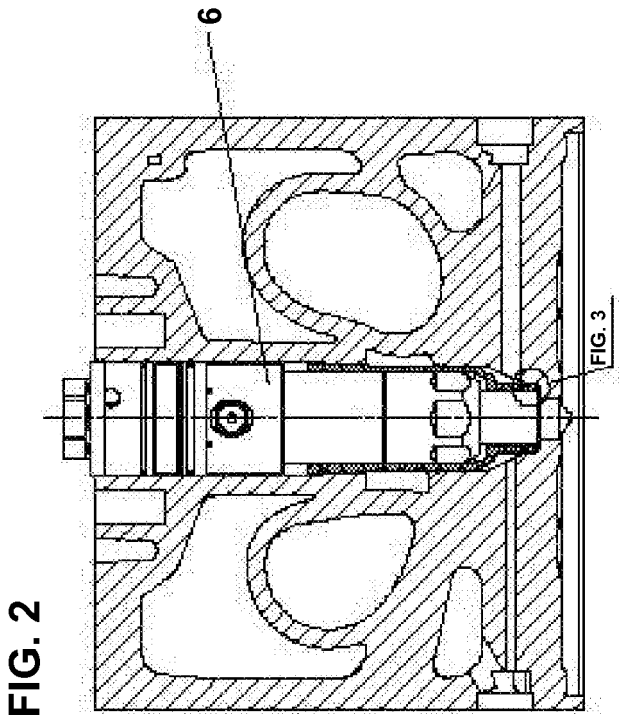

FIG. 2

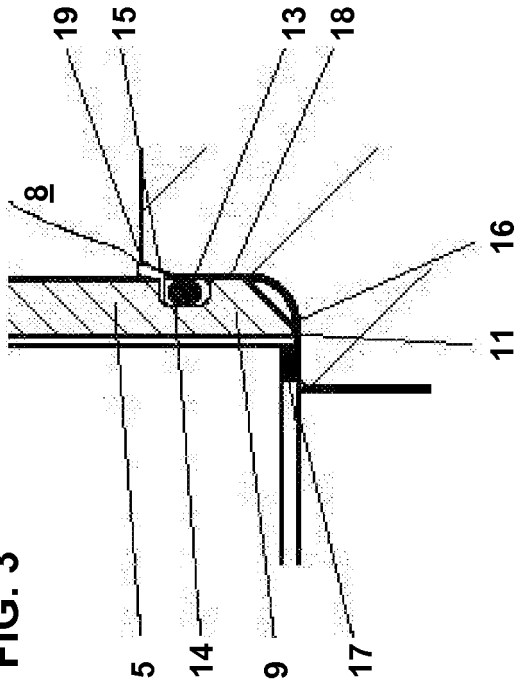

FIG. 3

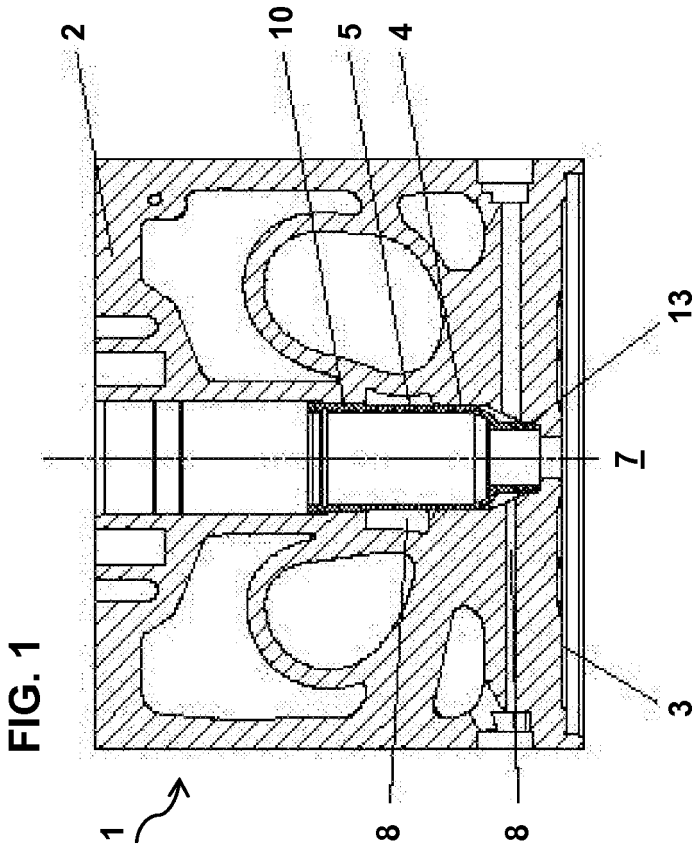

FIG. 1

REFERENCES CITED IN THE DESCRIPTION

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