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(54) **HEAD GASKET**

ZYLINDERDICHTUNGSRING

JOINT DE CULASSE DE CYLINDRE

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- **PATENT ABSTRACTS OF JAPAN, Vol. 11, No.
318, M-632; & JP,A,62 101 873 (YUUSAN
GASKET K.K.) 12 May 1987.**

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Description

[0001] The present invention relates to a gasket, and more specifically to a cylinder head gasket for internal combustion engines.

[0002] Present-day cylinder head gaskets consist in a pack of several thin metal plates, which are often riveted together. The pack may contain from three to six plates, which may have been coated with an extremely thin layer of paint, rubber or some other polymer that has been applied in the form of a solution or dispersion.

[0003] There is proposed in FR-A5-2184133 a gasket which comprises a metal band that has been coated with a layer of rubber on each side thereof. The rubber layer is applied in the form of a solution and is then heated to drive-off the solvent and form said layer. Prior publications DE-C2-3500071 and JP-A-62/101873 also teach cylinder head gaskets of this kind that are produced from different types of rubber solutions. US-A 5,110,630 describes the manufacture of a metal-rubber gasket in which a thin steel band is treated with chromate and rubber adhesive in sequence in a continuous process followed by a heat-treatment process, whereafter a rubber layer is applied. This is said to be affected by coating the adhesive layer to a desired thickness. The laminate will thus have an adhesive layer between each rubber layer and the metal surface.

[0004] In many cases, the gaskets used today present problems and especially when used with engines in which the cylinder heads and engine blocks are comprised of dissimilar materials, as is becoming more and more usual. For instance, it is becoming more usual to produce the cylinder head from an aluminium alloy and to produce the engine block from cast iron. As a result of the different thermal properties of the materials, transverse movements occur between cylinder head and motor block while the engine is running.

[0005] This increases the requirement of the gaskets to withstand the shear forces to which they are subjected as a result of thermally forced transverse movements. Hitherto, one solution has been to increase the number of metal layers in the gasket. However, this solution cannot be considered to be the final solution, for other reasons. Firstly, more complicated gaskets become more expensive, of course, since both material costs and manufacturing costs are greatly increased. A second reason has an environmental connotation. The thicker the gaskets, the more liable it is that pockets are formed which are capable of causing a higher concentration of non-combusted hydrocarbons in the exhaust gases, a consequence which is extremely problematic in view of present-day environmental requirements.

[0006] An ideal gasket material for modern internal combustion engines shall thus exhibit good properties with regard to compressibility and its ability to absorb shear forces while, at the same time, being thin and easy to manufacture cheaply, besides having an effective blow-by resistance, which is particularly important in the

present context, i.e. the gasket shall provide the best possible seal under the difficult conditions that prevail in respect of a cylinder head gasket.

[0007] The object of the present invention is to provide a cylinder head gasket which will fulfil the aforesaid high requirements that are placed on gaskets for modern engines which operate under highly advanced operating conditions.

[0008] To this end, the inventive cylinder head gasket has the characteristic features set forth in the following Claims.

[0009] The inventive cylinder head gasket is thus characterized in that it includes a laminate which comprises a thin stainless steel plate and/or heat-resistant steel plate. The plate is coated on each side with still thinner carrier-calendared rubber films which have a thickness of at least 0.05 mm and are affixed to the steel plate by vulcanization.

[0010] The stainless and/or heat-resistant steel plate will suitably have a thickness of about 0.2-0.4 mm, and each of the rubber films will preferably have a thickness of 0.05-0.20 mm. The outwardly facing surface of the rubber films will suitably have a textile-carrier structure, preferably a roughened or "pimpled" structure.

[0011] The specific combination of characteristic features defined in the Claims gives the laminate the unique combination of being compressible, having good shear-force absorbing ability and blow-by resistance (sealing ability), indicated above. It is thus important that the rubber coatings will have those specific properties and that specific structure that are exhibited by calendared rubber films, among other things homogeneity and uniformity with regard to both physical properties and dimensions, and shall be as pore-free as possible. These properties cannot be achieved with a rubber covering that has been applied in the form of a solution or in the form of a dough that has been rolled-out directly on the plate or substrate surfaces, since rubber coatings or coverings formed in this way will always include dough-forming residues or solvent residues that result in the formation of pores and other inhomogeneities and thereby give rise to weakened zones and also possible adhesive layers. It is also important that the rubber films have been applied to the plate with the aid of a calendaring carrier or vehicle which will ensure highly effective and primarily flat abutment with the surface of the plate in the absence of any tendency towards unevenness in the abutment surfaces, and which will also allow the outer surface to be given a structure that is commensurate with the carrier or vehicle chosen. The surface structure that is obtained when calendaring or vulcanizing a textile carrier, for instance with a so-called linen structure has been found especially beneficial. It has surprisingly been found that the essentially rough or "pimpled" outer surface provides improved abutment and sealing against metal surfaces. A material which possesses these qualities can also be affixed efficiently by vulcanization with regard to the mechanical strength

of the rubber-plate joins. The method of manufacturing using carriers and band-vulcanizing machines is the same as that described in our earlier patent specification published, for instance, as EP-A-594601 (WO 91/13758).

[0012] The invention will be presented in more detail below with reference to a number of examples which describe different tests that have been carried out on the material.

Example 1

[0013] A laminate comprised of a 0.20 mm stainless steel plate and two 0.08 mm rubber layers was subjected to a compressibility test in accordance with the following:

[0014] A pack consisting in ten material samples measuring 40 x 40 mm was subjected to a pressure of 16.5 MPa with a force of 2.4 kN at room temperature. This was repeated seven times while maintaining the pressure for a period of one second. The pack of laminate samples was found to have been compressed by 16 µm, which corresponds to a specific compressibility of 2 µm/10 mPa.

Example 2

[0015] A test was carried out on a 4-cylinder, 2 litre, 16 valve SAAB 9000 fuel injection engine over a period of twenty-four hours. The engine was prepared by lowering the piston heads to receive a thinner cylinder head gasket produced from the above laminate.

[0016] The gasket was produced from one single laminate consisting in 0.08 mm rubber/0.2 mm stainless steel/0.08 mm rubber of quality Rubore RGM-1-ST.

[0017] The engine was bench-run in accordance with a test programme which simulated motor-way driving, including long periods of full load at maximum r.p.m. and maximum torque, interspersed with periods of intermediate loads and interrupted by an idling period at thirty-minute intervals.

[0018] No unfavourable effects whatsoever were observed with regard to the normal function of the gasket during the tests.

Claims

1. A cylinder head gasket for internal combustion engines, **characterized** in that the gasket comprises a laminate which consists in a thin stainless steel plate or a heat-resistant steel plate that is coated on each side with still thinner carrier-calendered rubber films which have a thickness of at least 0.05 mm and which are affixed to the steel plate by vulcanization.
2. A gasket according to Claim 1, **characterized** in

that the steel plate has a thickness of about 0.2-0.4 mm and each of the rubber films has a thickness of 0.05-0.20 mm.

3. A gasket according to Claim 1 or Claim 2, **characterized** in that the outwardly facing surfaces of the rubber films have a textile-carrier structure, preferably a roughened or pimpled structure.
4. The use of a gasket according to Claims 1-3, **characterized** in that the gasket is comprised of a plurality of laminates that have been vulcanized together.

Patentansprüche

1. Zylinderkopfdichtung für Verbrennungsmotoren, dadurch gekennzeichnet, daß die Dichtung ein Laminat aufweist, welches aus einer dünnen, nicht rostenden Stahlplatte oder einer hitzebeständigen Stahlplatte besteht, die auf jeder Seite mit immer dünneren trägerkalandrierten Gummifilm beschichtet ist, die eine Dicke von mindestens 0,05 mm haben und durch Vulkanisation an der Stahlplatte befestigt sind.
2. Dichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Stahlplatte eine Dicke von ungefähr 0,2 bis 0,4 mm hat und jede der Gummischichten eine Dicke von 0,05 bis 0,20 mm hat.
3. Dichtung nach Anspruch 1 oder Anspruch 2, dadurch gekennzeichnet, daß die nach außen gekehrten Oberflächen der Gummifilme eine Textilträgerstruktur, vorzugsweise eine aufgeraute oder gepickelte Struktur haben.
4. Verwendung einer Dichtung nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die Dichtung aus einer Vielzahl von Laminaten besteht, die zusammenvulkanisiert wurden.

Revendications

1. Joint de culasse de cylindre pour des moteurs à combustion interne, caractérisé en ce que le joint est constitué d'un feuilletage qui consiste en une mince plaque en acier inoxydable ou une plaque en acier résistant à la chaleur qui est revêtue sur chaque côté de films en caoutchouc encore plus minces, calendrés sur support, qui ont une épaisseur d'au moins 0,05 mm et qui sont fixés sur la plaque en acier par vulcanisation.
2. Joint selon la revendication 1, caractérisé en ce que la plaque en acier a une épaisseur d'environ 0,2 -

0,4 mm et chacun des films en caoutchouc a une épaisseur de 0,05 mm - 0,20 mm.

3. Joint selon la revendication 1 ou 2, caractérisé en ce que les surfaces tournées vers l'extérieur des films en caoutchouc ont une structure de support textile, de préférence une structure rendue rugueuse ou boutonneuse. 5
4. Utilisation d'un joint selon les revendications 1-3, caractérisée en ce que le joint est constitué d'une pluralité de feuillets qui ont été vulcanisés ensemble. 10

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