

High Temperature Metallic Gasket

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This invention relates generally to gaskets and more particularly to high temperature metallic gaskets.

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In general, gaskets comprise a base sheet of uniform thickness which may be of metal or of a fibrous composition held together by a suitable bonding agent, and a deformable elastomer coat or bead which may cover all or only selected areas of the sheet. In use, the coat or bead deforms or spreads under pressure of forcing together the components between which the gasket material lies and provides a fluid tight seal between the parts.

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At present, gaskets designed to function at high temperatures are manufactured from two or three ply laminates consisting of one or two metal sheets and one or three asbestos sheets. However, these laminates are expensive to manufacture and require excessive labor and material. Also the use of asbestos has become increasingly regarded as toxic and unsafe to handle.

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U.S. Patent 4,544,169 issued to David A. Cobb, et al. on October 1, 1985 discloses a high temperature resistant gasket assembly including a first metallic sheet, a second metallic sheet and a wire located therebetween to surround the shape of the opening to be sealed. The wire can also be partially embedded into one of the sheets.

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U.S. Patent 2,289,620 issued to Wilburn F. Bernstein on July 14, 1942 discloses a cylinder head gasket comprised of a sheet of metal blanked to conform to a combustion opening, metal particles deposited on and intimately joined to the face of said gasket about the combustion openings to provide a porous roughened surface and a coating of a heat convertible synthetic resin covering and anchored to the porous surface of the metal particles to seal the space between the cylinder head and block.

The U.S. Patent 3,193,920 issued to Robert D. Culberson, et al. on July 21, 1965 discloses hard metal pressure seals for electron tubes wherein the hard metal sealing rings are plated with a soft ductile metal. A soft metal gasket is placed between the two soft metal clad surfaces on each of the hard metal rings. Force is applied to the hard metal rings until the gasket yields and deforms. The gasket then adheres to the plated surfaces making a permanent sealed unit.

Normally, high temperature applications make severe demands on gaskets. Many gasket materials are simply unable to meet such demands, and those which are tentatively able to do so have quite brief useful lives.

These problems as mentioned above complicate the structures, increase cost and use toxic materials which are unsafe to handle.

The present invention is directed to overcoming one or more of the problems as set forth above.

According to the invention a metallic gasket for use at pressures up to 27,560 kPa and at temperatures up to 815°C comprises a metallic sheet, which resists deformation under pressure loading up to 27,560 kPa at temperatures of up to 815°C, having at least one opening therethrough and opposite sides; at least a pair of seals each being connected to a portion of the sheet circumferentially around the opening on each side of the sheet, the seals being formed of a metallic material with a Rockwell B hardness range of from 40 to 60, and having sufficient

ductility to sealingly conform to a surface to be sealed when a compressive load of between 20,670 and 27,560 kPa is applied thereto at a temperature of between 300°C and 815°C, the pair of seals having a thickness which falls
5 within the range of from .10 mm to .30 mm and a width having a range of from 1 mm to 3 mm.

Fig. 1 is a view of a portion of a gas turbine engine showing two embodiments of the present invention.

Fig 2. is a top view of one embodiment of the
10 present invention.

Fig. 3. is an enlarged sectional view taken along line III-III of Fig. 2.

Fig. 4 is a top view of another embodiment of the present invention.

~~Best Mode of Carrying Out the Invention~~

5 Referring to the drawings, and more specifically to Fig. 1, two separate embodiments of metallic gaskets 10,10' are shown for sealing two types of joints 12,12' of a gas turbine engine 18.

10 The engine 18 includes an outer case 20 having a plurality of bosses, two of which are shown at 22 and 24, attached thereto. The boss 22 has a through bore 26 and a threaded portion 28 of the bore 26. Each of the bosses 22,24 has a relative flat first sealing surface 34,34' which has a surface
15 finish ranging between 2 mu and 500 mu. A cap 36 is threadably attached to the threaded portion 28 and has a hex head 38 and a relatively flat second sealing surface 40 which has a surface finish ranging between 2 mu and 500 mu.

20 The boss 24 has a through bore 26' and a plurality of threaded bores 44 circumferentially positioned about the bore 26'. A cover 50 has a plurality of through bores 52 therein which geometrically coincide with the plurality of threaded
25 bores 44 in the boss 24. The cover 50 further has a relatively flat second sealing surface 54 which has a surface finish ranging between 2 mu and 500 mu. The cover 50 is attached to the boss 24 by a plurality of fasteners 56.

30 One embodiment of the metallic gasket 10 is sealingly disposed at the joint 12 between the surfaces 34 and 40. As best shown in Fig. 2 and Fig. 3, the metallic gasket 10 includes a base sheet 60 having opposite sides 62,64, and an opening 66
35 therethrough and a pair of metallic seals 70. The

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base sheet 60 is substantially non-compressible and is made of materials such as 300 series stainless or a nickel chromium based alloy such as "Inconel" which is a registered trade name of International Nickel Co. Inc. The sheet 60 resists deformation under pressure loading of between 20,670 kPa to 27,560 kPa at elevated temperatures ranging from 300°C to 815°C. The metallic seals 70 are each connected to a portion of the respective sides 62, 64, of the sheet 60 circumferentially around the opening 66 which in this example is round but could be elliptical or of any configuration and are made of a soft ductile metallic sealing material such as silver, nickel or copper based alloys. Pure silver, nickel and copper can also be used as the metallic seals 70. The metallic sealing material has a hardness range of from 40 to 60 Rockwell B and deforms under pressure loading of between 20,670 kPa to 27,560 kPa. The metallic sealing material has a melting temperature higher than the elevated temperature.

It has been found through experimentation that the best combination of thickness and width of the metallic seal 70 ranges from .10 mm to .30 mm and from 1 mm to 3 mm respectively. The metallic seal 70 can be connected to the base sheet 60 by a wide variety of manufacturing processes such as spray coating or plating in which the metallic seals are built up in layers to provide the predetermined width and thickness. The metallic seals 70 may also be formed in a washer like configuration and adhesively connected to the base sheet 60.

The second embodiment of the metallic gasket 10' is best shown in Fig. 4 sealingly disposed at the joint 12' between surfaces 34' and 54. The second embodiment is substantially identical to the metallic

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gasket 10 in both construction and function. In this embodiment the base sheet 60 further includes a plurality of through bores 72. These bores 72 are positioned to geometrically correspond to the plurality of threaded bores 44 in the boss 24.

The engine 18 in this particular application although shown as a gas turbine engine could also be any conventional internal combustion engine or any device requiring a high temperature seal.

Industrial Applicability

The metallic gasket 10 is used to seal the joint 12 between the cap 36 and the boss 22. The metallic gasket 10 is positioned on the flat surface 34 of the boss 22 and surrounds the bore 26. A portion of the cap 36 is inserted through the opening 66 in the gasket 10 and threaded into the threaded portion 28 of boss 22. The sealing surface 40 on the cap 36 and the flat sealing surface 34 on boss 22 engage with the metallic seals 70 on respective sides of the gasket 10 as the cap 36 is tightened in the boss 22. The cap 36 is tightened sufficiently to generate a predetermined compressive load between the surfaces 40,34. The compressive load crushes the seals 70 causing the ductile metallic material to conform to the flat surface 40 and the sealing surface 34 finish topography on the cap 36 and boss 22 forming a positive fluid tight seal.

The metallic gasket 10' is used to seal the joint 12' between the cover 50 and the boss 24. The metallic gasket 10' is positioned on the flat surface 34' of the boss 24 and surrounds the bore 26' in the boss 24. The bores 72 in the base sheet 60 are positioned to align with the threaded bores 44 in the boss 24. The cover 50 is positioned to align the

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bores 52 with the respective bores 72 and threaded bores 44 in the base sheet 60 and boss 24. The fasteners 56 are inserted through the bores 52, 72 and are threaded into the threaded bores 44. The fasteners 56 are tightened sufficiently to generate a predetermined compressive load between the surfaces 54, 34'. The compressive load causes the ductile material to conform to the finish topography of the respective surfaces 54, 34'.

10 The metallic gasket 10, 10' discussed above provides an economical, reusable, asbestos free sealing gasket for use in high pressure high temperature applications. The substantially non-compressible metallic sheet 60 provides a stable supporting base which retains its shape under high pressure and temperature while the ductile material of the seals crushes to conform to the finish topography of the respective surfaces 40, 54, 34, 34'. The thickness of the base sheet 60 can be varied to compensate for tolerance stack-ups and other variation in manufacturing and assembly procedures without affecting the sealing effect of the metallic seals' 70 ability to crush and conform to the surface finish topography of the components being sealed. Thus, the metallic gasket 10, 10' overcomes the use of toxic materials, complicated structures and limited life of prior art high temperature high pressure gaskets.

Other aspects, objects and advantages of this invention can be obtained from a study of the drawings, the disclosure and the appended claims.

**CLAIMS**

1. A metallic gasket for use at pressures up to 27,560
5 kPa and at temperatures up to 815°C comprising a metallic
sheet, which resists deformation under pressure loading up
to 27,560 kPa at temperatures of up to 815°C, having at
least one opening therethrough and opposite sides; at least
10 a pair of seals each being connected to a portion of the
sheet circumferentially around the opening on each side of
the sheet, the seals being formed of a metallic material
with a Rockwell B hardness range of from 40 to 60, and
having sufficient ductility to sealingly conform to a
surface to be sealed when a compressive load of between
15 20,670 and 27,560 kPa is applied thereto at a temperature
of between 300°C and 815°C, the pair of seals having a
thickness which falls within the range of from .10 mm to
.30 mm and a width having a range of from 1 mm to 3 mm.
- 20 2. A gasket according according to claim 1, wherein the
sheet is made from stainless steel.
3. A gasket according to claim 1, wherein the sheet is
made from a nickel chromium based alloy.
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4. A gasket according to any one of the preceding claims,
wherein the metallic material has a melting temperature
higher than 815°C.
- 30 5. A gasket according to any one of the preceding claims,
wherein the seals are of a material selected from the group
consisting of silver, nickel and copper.
- 35 6. A gasket according to any one of claims 1 to 4,
wherein the seals are of a material selected from the group
consisting of silver, nickel and copper based alloys.



7. A gasket according to any one of the preceding claims, wherein the metallic material is connected to the metallic sheet by a spraying process.

5 8. A gasket according to any one of claims 1 to 6, wherein the metallic material is connected to the metallic sheet by a plating process.

10 9. A gasket according to any one of claims 1 to 6, wherein the seals are formed washers adhesively connected to the metallic sheet.

10. A gasket substantially as described with reference to the accompanying drawings.

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11. A joint comprising two surfaces having a surface finish in the range of 2mm to 500mm and, under a compressive load between the surfaces, a gasket according to any one of the preceding claims, the compressive load causing the seals to conform to the surface finish topography of the two surfaces.

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