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(54) **BLADE MOUNTING RING FOR A TURBOCHARGER ON AN INTERNAL COMBUSTION ENGINE**

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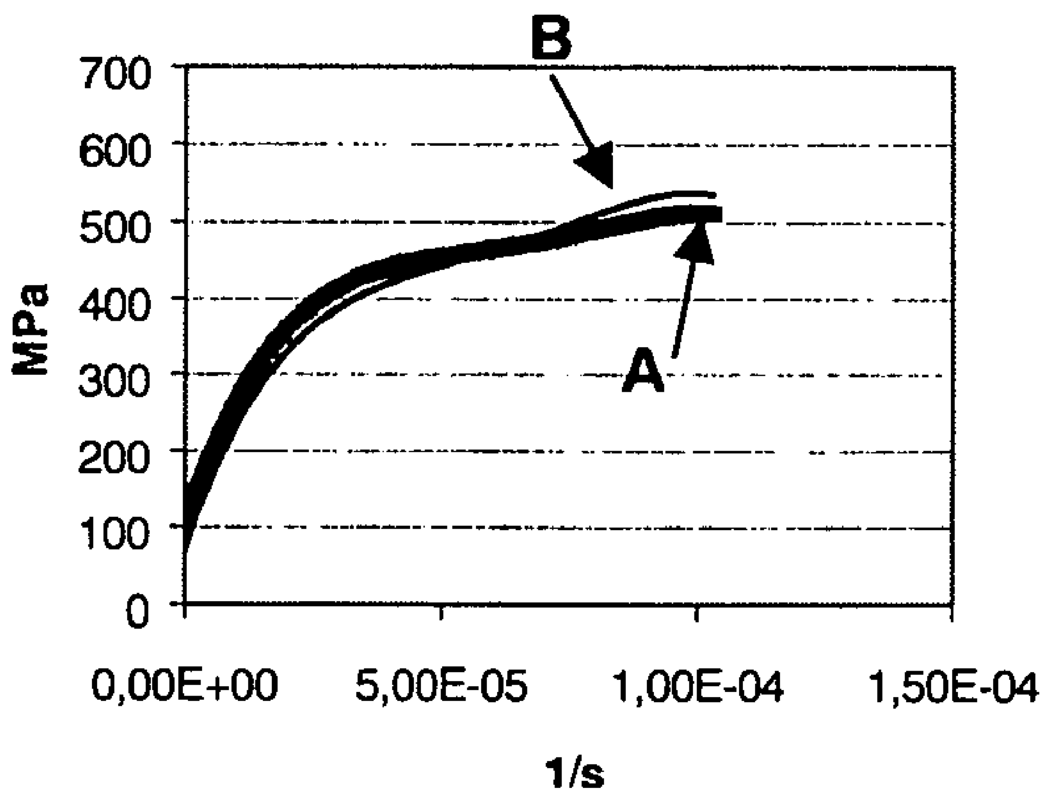
(57) **ABSTRACT**

The invention relates to a blade mounting ring for a turbocharger with variable turbine geometry and turbine blades which may be adjusted in the blade mounting ring on an internal combustion engine for a motor vehicle, comprising an austenitic iron matrix alloy with a sulphur component to achieve a solid lubrication effect on the bearing surfaces thereof with a material embodiment suitable for high performance engines. The above is achieved by means of a blade mounting ring with a proportion of 1 to 6 wt. % of an alloying element or several of the elements from tungsten (W), cobalt (Co), niobium (Nb), rhenium (Re), molybdenum (Mo), tantalum (Ta), vanadium (V), hafnium (Hf), yttrium (Y), zirconium (Zr) or similar.



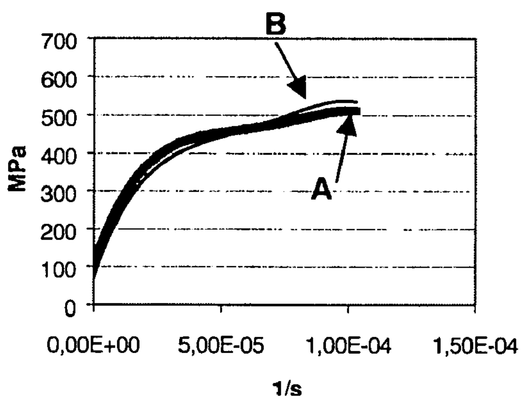


Fig. 1a

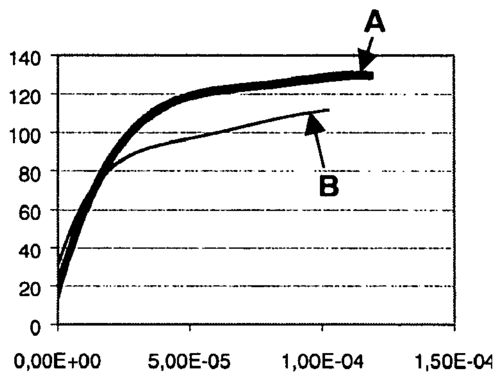


Fig. 1b

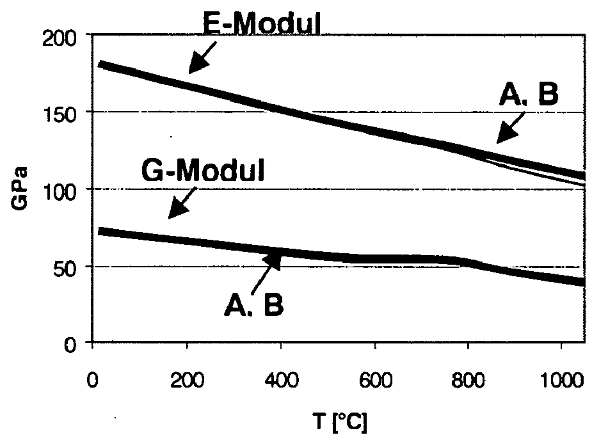


Fig. 2

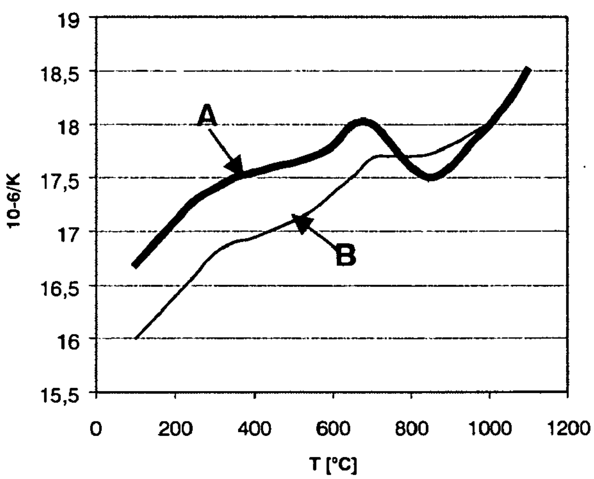


Fig. 3

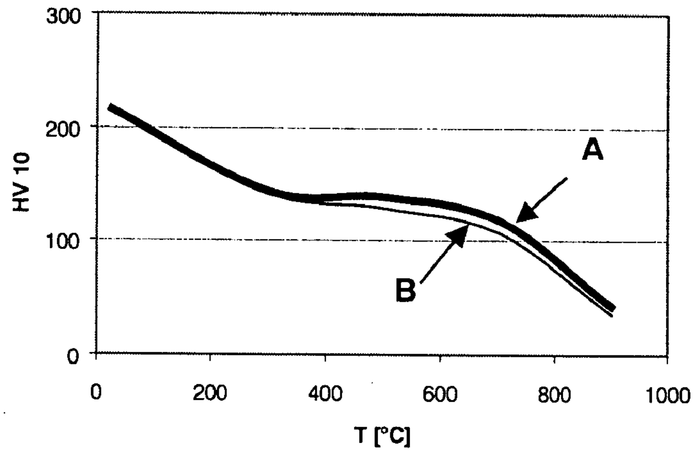


Fig. 4

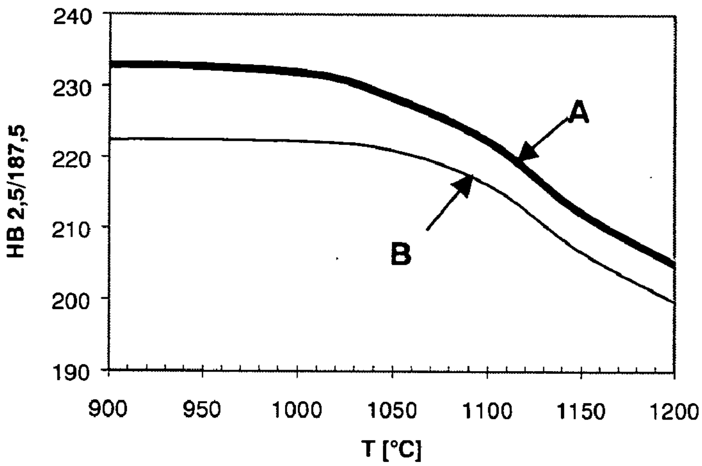


Fig. 5

	E	$R_{p0,2}$	R_m	ρ	λ
	[GPa]	[MPa]	[MPa]	[g/cm3]	[W/mK]
A	183	377	506	7,7	10,4
B	183	330	463	7,74	10,5

Fig. 6

BLADE MOUNTING RING FOR A TURBOCHARGER ON AN INTERNAL COMBUSTION ENGINE

[0001] The invention relates to a blade mounting ring on a turbocharger having turbine blades adjustable in the blade mounting ring according to the preamble of Patent claim **1**.

[0002] With modern high-performance engines, extremely high demands are made of the material on a blade mounting ring, such as that used as component **38** in a turbocharger according to U.S. Pat. No. 4,643,640, for example, which is to remain functional for a long time. Accordingly, a suitable material must have a sufficient creep resistance, a high dimensional stability, which prevents thermal deformation of the blade mounting ring even at high temperatures, a high wear resistance and adequate oxidation resistance. If deformation, creep or heavy oxidation occurs on a generic blade mounting ring, it can result in locking of the turbine guide vanes, i.e., the turbocharger cross section can no longer be adapted to the driving performance of the engine by adjusting the guide vanes.

[0003] In the past, mainly ferritic materials with a high chromium and chromium carbide content have been used as the blade mounting rings. For mounting rings that are subject to high thermal stresses, austenitic materials containing chromium carbides are used. Such an alloy contains the amounts given in weight percent as follows, for example: C=0.4-0.7, Cr=18-21, Ni=12-14, S=0.2-0.4, Si=1.8-2.2, the remainder being iron and nonspecific alloy ingredients and/or impurities up to 3%. Such an alloy is referred to below as alloy PL 23.

[0004] The present invention relates to the problem of designing the material for generic blade mounting rings so they are reliable in operation at extremely high temperatures. A high creep resistance and a high strength at temperatures above 850° C. are desired in particular. At such high temperatures, the mobility of the turbine blades in the generic blade mounting ring should be absolutely certain.

[0005] This object is achieved by a generic blade mounting ring having an alloy composition according to the characterizing feature of claim **1**.

[0006] Especially advantageous alloys for blade mounting rings are the subject of the subordinate claims, whereby the alloys according to claims **3** and **4** have proven to be an especially good embodiment.

[0007] The invention is based on the general idea of fulfilling the strict demands of creep resistance and strength of a blade mounting ring material, in particular for high-performance engines by using an austenitic iron material having a sulfur content that yields a solid lubricant property, to which high-melting alloy elements are added, and these alloy elements should amount to a percent by weight between at least one percent by weight and up to six percent by weight.

[0008] An increased creep resistance of the blade mounting ring material that can be achieved according to this invention yields a high dimensional stability of the blade mounting rings at elevated temperatures. There is good lubrication on the contact surface between the blade mounting ring and a turbine blade mounted therein, in particular due to the effect of the solid lubricant, which is attributable to the sulfur content in the bearing. With the inventive use of materials, blocking of the turbine blades, i.e., the guide vanes at high temperatures, is reliably prevented.

[0009] The drawing shows some property diagrams for inventive blade mounting ring materials. The curves labeled as A in the individual diagrams indicate a material according to claim **3** and the curves labeled as B indicate a material according to claim **4**.

EXPLANATION OF THE INDIVIDUAL DIAGRAMS

[0010] FIGS. **1***a*, **1***b*

[0011] These diagrams show the creep behavior of the alloys A and B under a step-wise load on a sample in increments of 2 MPa, a holding time of 35 seconds and a measurement of creep rate in the last five seconds of the holding time, namely in part a. for the creep behavior at 700° C. and in part b. for the creep behavior at 900° C.

[0012] FIG. **2**

[0013] The elastic modulus E and the shear modulus G of the alloys A and B are plotted as a function of temperature in this diagram.

[0014] FIG. **3**

[0015] This diagram shows the thermal expansion coefficients of alloys A and B as a function of temperature.

[0016] FIG. **4**

[0017] In this diagram, the hot hardness (in HV10) is plotted on the ordinate as a function of the temperature for alloys A and B.

[0018] FIG. **5**

[0019] The hardness (in HB 2.5/187.5) of alloys A and B after storage for two hours and air cooling as a function of temperature is plotted on the ordinate.

[0020] FIG. **6**

[0021] This figure is a table listing the following values for alloys A and B at room temperature: ρ=density, λ=thermal conductivity, R_{p02}=strain limit, R_m=tensile strength, E=elastic modulus.

[0022] All the features depicted in the description and in the following claims may be essential to the invention either individually or in any combined form.

1. A blade mounting ring of a turbocharger having a variable turbine geometry and turbine blades adjustable in the blade mounting ring on an internal combustion engine, made of an austenitic iron matrix alloy

having a sulfur content sufficient to achieve a solid lubricant effect on its bearing surfaces, and

having an amount of 1 to 6 wt % of one or more of the alloy elements tungsten (W), cobalt (Co), niobium (Nb), rhenium (Re), molybdenum (Mo), tantalum (Ta), vanadium (V), hafnium (Hf), yttrium (Y), zirconium (Zr) and/or comparable high-melting alloy elements.

2. The blade mounting ring according to claim **1**, by comprising the following alloy composition with the amounts of individual alloy elements, each given in percent by weight (wt %):

C=0.4-0.6
Cr=18.27
Nb=1.4-1.8
Ni=12-22
S=0.2-0.5
Si=2.9-3.2
W=2.4-2.8
remainder=iron
impurities and/or unspecified alloy elements up to 3.

3. The blade mounting ring according to claim **2**, by comprising the following alloy composition with amounts of the individual alloy elements, each given in percent by weight (wt %):

C=0.4-0.6
Cr=18.5-20.5
Nb=1.4-1.8
Ni=12.5-14
S=0.25-0.45
Si=2.9-3.15
W=2.4-2.8
remainder=iron
impurities and/or unspecified alloy elements up to 3.

4. The blade mounting ring
according to claim **2**, comprising the following alloy composition with amounts of the individual alloy elements, each given in percent by weight (wt %):

C=0.4-0.6
Cr=24.5-26.5
Nb=1.4-1.8
Ni=19.5-21.5
S=0.25-0.45
Si=2.9-3.15
W=2.4-2.8
remainder=iron
impurities and/or unspecified alloy elements up to 3.

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