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(54) **A split bearing arrangement and a method of manufacturing a split bearing arrangement**

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Description

TECHNICAL FIELD

[0001] The invention relates to a split bearing arrangement for reciprocating engines, such as for example internal combustion engines, and to a method of manufacturing the split bearing arrangement.

[0002] Such a split bearing arrangement is known from WO 2010/022420 A.

BACKGROUND

[0003] A known split bearing arrangement comprises an engine block and an engine bedplate which are pressed together into a connected and attached split bearing arrangement. In said known bearing arrangement, dowel holes are drilled in the engine bedplate and in the engine block, whereby steel pins are pressed into these holes for guiding and aligning the engine bedplate and the engine block to each other when the engine bedplate and the engine block are pressed and attached together. This solution involves multiple dowel holes and comprises multiple steel pins. Thus, this solution provides both a time consuming manufacturing and an expensive split bearing arrangement. Further, this solution is restricted to use relatively high mounting forces when disassembling and reassembling the engine block and the engine bedplate, whereby damages to the dowel holes, the steel pins, the engine bedplate and the engine block may occur. This provides an increased friction within the split bearing arrangement when reassembling the engine bedplate and the engine block after a first pressing and disassembling. This friction within the split bearing arrangement is specifically the crank bore friction provided due to a relatively inaccurate repositioning of the engine bedplate to the engine block after a first pressing and disassembling.

[0004] EP1075605 shows a solution for a split bearing arrangement comprising a bearing block and a bearing cover providing a material anchoring which is intended to be able to absorb high transverse loads in the split bearing arrangement. The bearing cover is made of an iron material and is clampably arranged relative to the bearing block and has sharp-edged pointed projections which protrude above a clamping surface of the bearing cover and which, in an initial mounting of the bearing cover with a particular required force, is capable of being pressed into an opposite clamping surface of the bearing block which is made of a light metal, wherein grooves are provided in the clamping surface of the bearing cover, and wherein these grooves are located in the clamping surface of the bearing cover to receive material of the bearing block that is displaced when the projections of the bearing cover are pressed into the bearing block. This solution leads to a relatively short manufacturing tool lifetime since it involves time consuming drilling operations in the cast iron and since it involves manufacturing of multiple sharp-edged pointed projections which are located across through-holes for screws in the bearing cover. This type of split bearing arrangement provides a heavy and bulky construction. When disassembling and reassembling the bearing block and the bearing cover, damages may occur. It is especially an imminent risk of damages occurring to the bearing block after the first pressing and disassembling. This since the bearing block is made of light metal and since displaced material after the first pressing is pressed out from the clamping surface of the bearing block and may be damaged. Furthermore some material may be displaced within the through-holes after the first pressing which may cause problems when reassembling the bearing block and the bearing cover using the through-holes for screws. This will provide an increased friction within the split bearing arrangement when reassembling the bearing block and the bearing cover after the first pressing and disassembling. Several manufacturing tools and manufacturing process steps are needed to manufacture the sharp-edged pointed projections for this split bearing arrangement. Further, this present example is restricted to a relatively time consuming and expensive assembly, installation, and maintenance.

[0005] Further, these known examples lack robustness and accuracy regarding the reassembly of the engine bedplate and the engine block after the first pressing, and mainly these known examples lack robustness and accuracy for the second, third, fourth and all future disassemblies and reassemblies of the engine bedplate and the engine block. This since the engine bedplate and the engine block will not be accurately positioned and guided back to the original first position from the first pressing due to material damages and/or poor guiding.

[0006] These known examples involves a relatively imminent risk for dirt being provided in the split bearing arrangement which also increases the friction within the split bearing arrangement and decreases the efficiency and capacity of the reciprocating engine.

SUMMARY OF INVENTION

[0007] There is thus a need for an improved split bearing arrangement with improved material anchoring which also provides an improved guiding and positioning of the split bearing arrangement removing the above mentioned disadvantages.

[0008] Further, there is also a need for an improved method of manufacturing of the split bearing arrangement removing the above mentioned disadvantages.

[0009] The present invention relates to the field of split bearing arrangements for reciprocating engines. The split bearing arrangement is located in an engine assembly.

[0010] The present invention provides an inventive split bearing arrangement, which improves the accuracy when reassembling the split bearing arrangement after the first pressing and disassembling, whereby friction

within the split bearing arrangement is relatively low. It is desirable to reduce friction within the crank bore of the split bearing arrangement.

[0011] The object of the present invention is to suggest an improved split bearing arrangement with improved guiding and positioning of an engine bedplate and an engine block after the first pressing and disassembling of the engine block and the engine bedplate, and an easy to implement method of manufacturing the split bearing arrangement improving the accuracy when both manufacturing the split bearing arrangement and the accuracy when reassembling the split bearing arrangement after the first pressing and disassembling of the engine block and the engine bedplate. The engine block comprises several block sections and the engine bedplate comprises several bedplate sections.

[0012] The present invention is defined by the appended independent claims. Various examples of the invention are set forth by the appended dependent claims as well as by the following description and the accompanying drawings.

[0013] With the above description in mind, then, an aspect of the present invention is to provide an improved solution of improving the handling, anchoring and positioning of an engine bedplate section and an engine block section of the split bearing arrangement which seeks to mitigate, alleviate, or eliminate one or more of the above-identified deficiencies in the art and disadvantages singly or in any combination.

[0014] The object is achieved by the features of claim 1 wherein, a split bearing arrangement for reciprocating engines comprising: a bedplate section and a block section made of materials differing in hardness; the bedplate section, where at least a bedplate section clamping surface is made of an iron material, is adapted to be clampable against the block section, the bedplate section has at least one positioning protrusion located on the bedplate section clamping surface; the block section, made of a material having a hardness which is less than the hardness of the iron material of the bedplate section clamping surface, is adapted to be clampable and forcibly pressed against the bedplate section, and comprises at least one positioning groove located in a block section clamping surface formed when the bedplate section is first pressed into the block section, characterized in that the at least one positioning protrusion has two longitudinal concave surfaces, two transverse concave surfaces and a substantially flat upper surface; the block section has at least one material groove located in its block section clamping surface, the material groove is connected to the positioning groove, the at least one material groove is adapted to receive material displaced from the block section when the at least one positioning protrusion of the bedplate section is forcibly pressed into the block section; the at least one positioning groove is adapted to receive the at least one positioning protrusion after the at least first pressing. No additional parts or space are required in the inventive split bearing arrangement in order to provide an improved anchoring and positioning of the split bearing arrangement after the first pressing. The shape of the positioning protrusion enables a positioning control in both longitudinal and transverse direction. The longitudinal concave surfaces and the transverse concave surfaces are shaped such that one manufacturing tools is needed when manufacturing the positioning protrusion. The bedplate section may comprise several positioning protrusions, which may be manufactured by using one manufacturing tool during one manufacturing process step. The bedplate section clamping surface is made of an iron material which is harder than the material of the block section. The block section may be made of light metal material.

[0015] According to a further advantageous aspect of the invention, the at least one positioning groove has a shape corresponding to the at least one positioning protrusion. The positioning groove has a flat inner surface corresponding to the shape of the flat upper surface of the positioning protrusion. The shape of the positioning protrusion and the corresponding shape of the positioning groove provide a more accurate positioning when attaching the bedplate section and the block section to each other after the first pressing. The positioning protrusion is guided into a more accurate position by the corresponding shape of the positioning groove. The shape of the positioning groove enables a positioning control in both longitudinal and transverse direction.

[0016] According to a further advantageous aspect of the invention, the at least one material groove is substantially perpendicular to the at least one positioning groove. The at least one material groove can be parallel to the positioning groove. Further, the split bearing arrangement may comprise several material grooves connected to one or several positioning grooves. Further, the split bearing arrangement may comprise several positioning grooves connected to one or several material grooves.

[0017] According to a further advantageous aspect of the invention, the at least one positioning groove is arranged in the block section clamping surface of the block section in an area where the at least one positioning protrusion of the bedplate section is pressed in.

[0018] According to a further advantageous aspect of the invention, the at least one positioning groove and the at least one material groove are located outside of a block section bore between the block section bore and a longitudinal edge of the block section, such that displaced material only enters the material groove and not the block section bore.

[0019] According to a further advantageous aspect of the invention, the block section, with its at least one positioning groove and at least one material groove, is adapted to be pressed into the bedplate section, with its positioning protrusion, by means of a screwed bearing connection and/or a press tool.

[0020] According to a further advantageous aspect of the invention, the bedplate section clamping surface is made of nodular iron and the block section clamping sur-

face is made of an aluminium alloy.

[0021] According to a further advantageous aspect of the invention, the bedplate section and the block section are guided to fit in a predetermined position by the at least one positioning protrusion and the at least one positioning groove when the at least one positioning protrusion is pressed into the positioning groove after the at least first pressing.

[0022] According to a further advantageous aspect of the invention, the height of the positioning protrusion above the bedplate section clamping surface is less than 2 mm, preferably in the range of 0.2 to 1.6 mm, more preferably in the range of 0.4 to 1,1 mm, even more preferably in the range of 0.6 to 0.9 mm.

[0023] According to a further advantageous aspect of the invention, the thickness of the positioning protrusion is less than 2 mm, preferably in the range of 0.2 to 1.6 mm, more preferably in the range of 0.4 to 1.1 mm, even more preferably in the range of 0.6 to 0.9 mm.

[0024] According to a further advantageous aspect of the invention, the width of the positioning protrusion is less than 20 mm, preferably in the range of 5 to 15 mm, more preferably in the range of 8 to 13 mm.

[0025] According to a further advantageous aspect of the invention, a radius of a first concave surface of the positioning protrusion is greater than 0.5 mm, preferably in the range of 0.8 to 3 mm, more preferably in the range of 1 to 2 mm. According to a further advantageous aspect of the invention, a radius of a second concave surface of the positioning protrusion is greater than 0.5 mm, preferably in the range of 0.8 to 3 mm, more preferably in the range of 1 to 2 mm. The positioning protrusion can comprise a first radius for the two longitudinal surfaces and an equal second radius for the two transverse surfaces. Further, the positioning protrusion can comprise a first radius for the two longitudinal surfaces and a different second radius for the two transverse surfaces. Both the first and second radius of the longitudinal concave surfaces and the transverse concave surfaces are adapted such that that one manufacturing tool and process is needed when manufacturing positioning protrusions according to the invention.

[0026] According to a further advantageous aspect of the invention, the at least one positioning protrusion on the bedplate section is formed by means of cutting and/or erosion. The positioning protrusion has a shape which enables it to be formed by means of one manufacturing tool for cutting or erosion. All the positioning protrusions of the engine bedplate can be manufactured during one manufacturing session and by using one manufacturing tool. This improves the workflow of the manufacturing compared to using several manufacturing tools.

[0027] The object is further achieved by a method of manufacturing a split bearing arrangement for a reciprocating engine comprising: providing a bedplate section, where the bedplate section comprises at least a bedplate section clamping surface made of an iron material, the bedplate section being adapted to be clampable against a block section, the bedplate section comprising at least one positioning protrusion located on the bedplate section clamping surface, the at least one positioning protrusion has two longitudinal concave surfaces, two transverse concave surfaces and an substantially flat upper surface, the at least one positioning protrusion being formed by means of cutting and/or erosion; providing the block section differing in hardness from the bedplate section, the block section comprises a block section clamping surface, the block section being made of a material having a hardness which is less than the hardness of the iron material of the bedplate section clamping surface and being adapted to be clampable and forcibly pressed against the bedplate section, the block section comprising at least one material groove located in its block section clamping surface, forming at least one positioning groove located in the block section clamping surface when the at least one positioning protrusion of the bedplate section is forcibly pressed into the block section, the positioning groove being connected to the material groove, the material groove receiving material of the positioning groove of the block section, the material being displaced when the at least one positioning protrusion of the bedplate section is forcibly pressed into the block section clamping surface of the block, the at least one positioning groove being adapted to receive the at least one positioning protrusion after at least a first pressing. By manufacturing the split bearing arrangement according to the invention, the manufacturing workload can be reduced and tool lifetime can be increased. The positioning protrusion can be manufactured using one manufacturing tool during one manufacturing process step.

[0028] According to a further advantageous aspect of the invention, a vehicle comprises an engine assembly comprising a split bearing arrangement according to the invention.

[0029] Any of the advantageous features of the present invention above may be combined in any suitable way.

[0030] A number of advantages are provided by means of the present invention, for example:

- a solution which improves the guiding and positioning when matching and fitting the bedplate section and the block section to each other after the first pressing is obtained;
- an improved, accurate and more robust split bearing arrangement is obtained providing reduced friction within the split bearing arrangement and reduced fuel consumption.
- a solution which reduces the risk for cold start of the engine is obtained;
- a solution which reduces the risk for damaging the bedplate section or the block section of the split bearing arrangement is obtained;

- a solution which allows for a reduction of the amount of drilling holes needed in the split bearing arrangement is obtained, this since the material groove may be used for both displaced material after the first pressing and for transporting oil within the engine;

- an improved workflow during manufacturing, enabling a longer lifetime for manufacturing tools, of a split bearing arrangement is obtained;

- a more cost efficient and robust manufacturing process of the split bearing arrangement is obtained.

BRIEF DESCRIPTION OF THE DRAWINGS

[0031] The present invention will now be described in detail with reference to the figures, wherein:

Figure 1 shows a schematically illustration of an engine assembly comprising split bearing arrangements according to the invention

Figure 2 shows a schematically illustration of a split bearing arrangement according to the invention

Figure 3a shows a schematically illustration of a part of a bedplate section according to the invention

Figure 3b shows a schematically illustration of a part of a block section according to the invention

Figure 4 shows a schematically cross-section view illustration of a positioning protrusion of a bedplate section according to the invention

Figure 5 shows a schematically top-view illustration of a positioning protrusion of a bedplate section according to the invention

Figure 6 shows a schematically illustration of an press tool for pressing an engine bedplate to an engine block according to the invention

[0032] It should be added that the following description of the examples is for illustration purposes only and should not be interpreted as limiting the invention exclusively to these examples/aspects.

DETAILED DESCRIPTION

[0033] All the figures 1 to 6 are schematically illustrated.

[0034] The following examples of the present invention relate, in general, to the field of engine assemblies and main bearings caps in engines, in particularly, to a solution for a split bearing arrangement for a reciprocating engine, wherein the split bearing arrangement comprises a block section and a bedplate section having a positioning protrusion.

[0035] The present invention is a solution for an inventive split bearing arrangement with improved guiding and positioning of an engine bedplate and an engine block in an engine assembly.

[0036] Examples of the present invention will be described more fully hereinafter with reference to the accompanying drawings, in which examples of the invention are shown. Like reference signs refer to like elements throughout.

[0037] Figure 1 schematically shows an engine assembly 1 comprising split bearing arrangements 7 according to the invention. The engine assembly in figure 1 comprises five split bearing arrangements 7 and is a four-cylinder engine assembly. However, the engine assembly may comprise less than five or more than five split bearing arrangements 7. The number of split bearing arrangements 7 depends on the type of engine. The engine assembly comprises an engine block 2a and an engine bedplate 2b. The engine bedplate 2b comprises several main bearing caps composing a main bearing bridge, but it could just as well be a singular main bearing cap. As can be seen in figure 1, the engine block 2a and the engine bedplate 2b are adapted to be fitted and attached together in an engine assembly 1. The engine block 2a is made of an aluminum alloy. The engine bedplate 2b is made of aluminum alloy with incast iron alloy cores. The engine bedplate 2b is adapted to be attached to the engine block 2a by means of bolts or screws in bores.

[0038] Figure 2 schematically shows a split bearing arrangement 7 according to the present invention. The split bearing arrangement 7 comprises a bedplate section 3 and a block section 4. The bedplate section 3 has two bedplate section bores and the block section 4 has two corresponding block section bores.

[0039] The bedplate section 3 and the block section 4 are made of materials differing in hardness. The bedplate section 3 comprises of material which is harder than the material of the block section 4. The bedplate section 3 comprises a first bedplate section clamping surfaces 5a and a second bedplate section clamping surfaces 5b made of an iron material, such as for example nodular iron or gray cast iron or steel. The first and second bedplate section clamping surfaces 5a, 5b are the visible part of the incast iron alloy core. The block section 4 comprises a first and second block section clamping surfaces 6a, 6b made of an aluminum alloy. The bedplate section 3 has one positioning protrusion located on the first bedplate section clamping surface 5a and one positioning protrusion located on the second bedplate section clamping surface 5b. The first and second bedplate section clamping surfaces 5a, 5b and the first and second block section clamping surfaces 6a, 6b are adapted to be clampable and pressed against each other. The bedplate section 3 and its two positioning protrusions is

adapted to be forcibly pressed into the block section 4 and its first and second block section clamping surfaces 6a, 6b, whereby one positioning groove located in the first block section clamping surface 6a is formed and one positioning groove located in the second block section clamping surface 6b is formed. The block section 4 has a first longitudinal edge 18a and a second longitudinal edge18b. The bedplate section 3 has a first longitudinal edge 19a and a second longitudinal edge19b.

[0040] Figure 3a schematically shows a part of a bedplate section 3 comprising a positioning protrusion 8 according to the invention. The positioning protrusion 8 has first longitudinal concave surface 11, a second longitudinal surface 12, a first transverse concave surface 13, a second transverse concave surface 14 and a substantially flat upper surface 15. The radius of the two concave longitudinal surfaces 11, 12 and the two transverse concave surfaces 13, 14 can be either equal or different. The positioning protrusion 8 can comprise a first radius for the two longitudinal concave surfaces 11, 12 and an equal second radius for the two transverse concave surfaces 13, 14. The positioning protrusion 8 can comprise a first radius for the two longitudinal concave surfaces 11, 12 and a different second radius for the two transverse concave surfaces 13, 14. The bedplate section 3 comprises a bedplate section bore 16a for bolts or screws. This bedplate section bore 16a is used when pressing and attaching the bedplate section 3 to the block section. The positioning protrusion 8 shown in figure 3a is located between the bedplate section bore 16a and the second longitudinal edge 19b.

[0041] Figure 3b schematically shows a part of a block section 4 according to the invention. The block section 4 has a material groove 10 located in its second block section clamping surface 6b. When the positioning protrusion 8 is first forcibly pressed into the second block section clamping surface 6b a positioning groove 9 located in the second block section clamping surface 6b is formed. The material groove 10 is formed such that it can receive material displaced from the block section 4 during pressing of the positioning protrusion into the block section 4. The material groove 10 is connected with the positioning groove 9. The material groove 10 is substantially perpendicular to the positioning groove 9. The material groove 10 may also functions as a transport channel for oil. The block section 4 comprises a block section bore 16b for bolts or screws. This block section bore 16b is used when pressing and attaching the bedplate section 3 to the block section 4. The bedplate section bore 16a and the block section bore 16b are arranged to match each other. As can be seen in figure 3b, the positioning groove 9 is located outside of the block section bore 16b between the block section bore 16b and the second longitudinal edge 18b of the block section 4. The positioning groove 9 and the material groove 10 are arranged such that displaced material only enters the material groove 10 and not the block section bore 16b.

[0042] Figure 4 schematically shows a cross-section view of a positioning protrusion 8 of a bedplate section 3 according to the invention. In the example shown in figure 4 the positioning protrusion 8 has a radius (R) which is equal for the two longitudinal concave surfaces and the transverse concave surfaces. The substantially flat upper surface of the positioning protrusion 8 has a thickness (T) which enables an accurate positioning control in both longitudinal direction and transverse direction. The thickness (T) equals the thickness of the upper flat surface of the positioning protrusion 8. The positioning protrusion 8 has a height (H) above the bedplate section clamping surface.

[0043] Figure 5 schematically shows a top-view of a positioning protrusion 8 of a bedplate section 3 according to the invention. The positioning protrusion 8 has a width (W). The width (W) equals the width of the upper flat surface of the positioning protrusion 8. The positioning protrusion 8 is located outside of the bedplate section bore 16a between the bedplate section bore 16a and a longitudinal edge 17 of the second bedplate section clamping surface 5b, the block section has a corresponding block section bore.

[0044] Figure 6 schematically shows a press tool 20 for pressing the engine bedplate 2b to the engine block 2a according to the invention, wherein in the engine block 2a is positioned on a support plate 21. The pressing of the engine bedplate 2b to the engine block 2a is done by using conventional and known methods.

[0045] The split bearing arrangement according to the invention may be used for any type of appropriate reciprocating engine in any type of appropriate vehicle in the form of, for example, a car, a truck, bus or a motorcycle.

[0046] The invention is not limited to the example described above, but may be modified without departing from the scope of the claims below.

[0047] The terminology used herein is for the purpose of describing particular examples only and is not intended to be limiting of the invention. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms "comprises" "comprising," "includes" and/or "including" when used herein, specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof.

[0048] Unless otherwise defined, all terms (including technical and scientific terms) used herein have the same meaning as commonly understood by one of ordinary skill in the art to which this invention belongs. It will be further understood that terms used herein should be interpreted as having a meaning that is consistent with their meaning in the context of this specification and the relevant art and will not be interpreted in an idealized or overly formal sense unless expressly so defined herein.

REFERENCE SIGNS

[0049]

1:	Engine assembly
2a:	Engine block
2b:	Engine bedplate
3:	Bedplate section
4:	Block section
5a:	First bedplate section clamping surface
5a:	Second bedplate section clamping surface
6a:	First block section clamping surface
6b:	Second block section clamping surface
7:	Split bearing arrangement
8:	Positioning protrusion
9:	Positioning groove
10:	Material groove
11:	First longitudinal concave surface
12:	Second longitudinal concave surface
13:	First transverse concave surface
14:	Second transverse concave surface
15:	Upper surface
16a:	Bedplate section bore
16b:	Block section bore
17:	Longitudinal edge of a bedplate section clamping surface
18a:	First longitudinal edge of a block section
18b:	Second longitudinal edge of a block section
19a:	First longitudinal edge of a bedplate section
19b:	Second longitudinal edge of a bedplate section
20:	Support plate
21:	Press tool

Claims

1. A split bearing arrangement (7) for reciprocating engines comprising:

- a bedplate section (3) and a block section (4) made of materials differing in hardness;
- the bedplate section (3), where at least a bedplate section clamping surface (5a, 5b) is made of an iron material, is adapted to be clampable against the block section (4), the bedplate section (3) has at least one positioning protrusion (8) located on the bedplate section clamping surface (5a, 5b);
- the block section (4), made of a material having a hardness which is less than the hardness of the iron material of the bedplate section clamping surface (5a, 5b), is adapted to be clampable and forcibly pressed against the bedplate section (3), and comprises at least one positioning groove (9) located in a block section clamping surface (6a, 6b) formed when the bed plate section (3) is first pressed into the block section (4);

characterized in that

- the at least one positioning protrusion (8) has two longitudinal concave surfaces (11, 12), two transverse concave surfaces (13, 14) and a substantially flat upper surface (15);
- the block section (4) has at least one material groove (10) located in its block section clamping surface (6a, 6b), the material groove (10) is connected to the positioning groove (9), the at least one material groove (10) is adapted to receive material displaced from the block section (4) when the at least one positioning protrusion (8) of the bedplate section (3) is forcibly pressed into the block section (4);
- the at least one positioning groove (9) is adapted to receive the at least one positioning protrusion (8) after the at least first pressing.

2. A split bearing arrangement (7) according to claim 1, **characterized in that** the at least one positioning groove (9) has a shape corresponding to the at least one positioning protrusion (8).

3. A split bearing arrangement (7) according to claim 1 or 2, **characterized in that** the at least one material groove (10) is substantially perpendicular to the positioning groove (9).

4. A split bearing arrangement (7) according any of the previous claims, **characterized in that** the at least one positioning groove (9) is arranged in the block section clamping surface (6a, 6b) of the block section (4) in an area where the at least one positioning protrusion (8) of the bedplate section (3) is pressed in.

5. A split bearing arrangement (7) according any of the previous claims, **characterized in that** the at least one positioning groove (9) and the at least one material groove (10) are located outside of a block section bore (16b) between the block section bore (16b) and a longitudinal edge (18b) of the block section (4).

6. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the block section (4), with its at least one positioning groove (9) and at least one material groove (10), is adapted to be pressed into the bedplate section (3), with its positioning protrusion (8), by means of a screwed bearing connection and/or a press tool.

7. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the bedplate section clamping surface (5a, 5b) is made of nodular iron and the block section clamping surface (6a, 6b) is made of an aluminium alloy.

8. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the bedplate section (3) and the block section (4) are guided

to fit in a predetermined position by the at least one positioning protrusion (8) and the at least one positioning groove (9) when the at least one positioning protrusion (8) is pressed into positioning groove (9) after the at least first pressing.

9. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the height (H) of the positioning protrusion (8) above the bedplate section clamping surface (5a, 5b) is less than 2 mm, preferably in the range of 0.2 to 1.6 mm, more preferably in the range of 0.4 to 1,1 mm, even more preferably in the range of 0.6 to 0.9 mm.

10. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the thickness (T) of the positioning protrusion (8) is less than 2 mm, preferably in the range of 0.2 to 1.6 mm, more preferably in the range of 0.4 to 1,1 mm, even more preferably in the range of 0.6 to 0.9 mm.

11. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the width (W) of the positioning protrusion (8) is less than 20 mm, preferably in the range of 5 to 15 mm, more preferably in the range of 8 to 13 mm.

12. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** a radius (R) of a first concave surface of the positioning protrusion (8) is greater than 0.5 mm, preferably in the range of 0.8 to 3 mm, more preferably in the range of 1 to 2 mm.

13. A split bearing arrangement according to any of the previous claims, **characterized in that** a radius (R) of a second concave surface of the positioning protrusion (8) is greater than 0.5 mm, preferably in the range of 0.8 to 3 mm, more preferably in the range of 1 to 2 mm.

14. A split bearing arrangement (7) according to any of the previous claims, **characterized in that** the at least one positioning protrusion (8) on the bedplate section (3) is formed by means of cutting and/or erosion.

15. A method of manufacturing a split bearing arrangement (7) for a reciprocating engine comprising:

- providing a bedplate section (3), where the bedplate section (3) comprises at least a bedplate section clamping surface (5a, 5b) made of an iron material, the bedplate section (3) being adapted to be clampable against a block section (4), the bedplate section (3) comprising at least one positioning protrusion (8) located on the bedplate section clamping surface (5a, 5b), the at least one positioning protrusion (8) has two longitudinal concave surfaces (11, 12), two transverse concave surfaces (13, 14) and an substantially flat upper surface (15), the at least one positioning protrusion (8) being formed by means of cutting and/or erosion;
- providing the block section (4) differing in hardness from the bedplate section (3), the block section (4) comprises at least a block section clamping surface (6a, 6b), the block section (4) being made of a material having a hardness which is less than the hardness of the iron material of the bedplate section clamping surface (5a, 5b) and being adapted to be clampable and forcibly pressed against the bedplate section (3), the block section (4) comprising at least one material groove (10) located in its block section clamping surface (6a, 6b),
- forming at least one positioning groove (9) located in the block section clamping surface (6a, 6b) when the at least one positioning protrusion (8) of the bedplate section (3) is forcibly pressed into the block section (4), the positioning groove (9) being connected to the material groove (10), the material groove (10) receiving material of the positioning groove (9) of the block section (4), the material being displaced when the at least one positioning protrusion (8) of the bedplate section (3) is forcibly pressed into the block section clamping surface (6a, 6b) of the block (4), the at least one positioning groove (9) being adapted to receive the at least one positioning protrusion (8) after at least a first pressing.

16. A vehicle comprising an engine assembly (1) comprising the split bearing arrangement (7) according to any of the claims 1 to 14.

Patentansprüche

1. Geteilte Lageranordnung (7) für Hubkolbenmotoren, die Folgendes umfasst:

- einen Bedplate-Teil (3) und einen Blockteil (4), die aus Materialien unterschiedlicher Härte hergestellt sind;
- der Bedplate-Teil (3), bei dem mindestens eine Bedplate-Teil-Spannfläche (5a, 5b) aus einem Eisenmaterial hergestellt ist, ist dazu ausgeführt, gegen den Blockteil (4) verspannbar zu sein, der Bedplate-Teil (3) weist mindestens einen auf der Bedplate-Teil-Spannfläche (5a, 5b) positionierten Positionierungsvorsprung (8) auf;
- der Blockteil (4), der aus einem Material mit einer geringeren Härte als die Härte des Eisenmaterials der Bedplate-Teil-Spannfläche (5a, 5b) hergestellt ist, ist dazu ausgeführt, gegen

den Bedplate-Teil (3) verspannbar zu sein und kraftschlüssig dagegen gepresst zu werden, und umfasst mindestens eine in einer Blockteil-Spannfläche (6a, 6b) positionierte Positionierungsnut (9), die gebildet wird, wenn der Bedplate-Teil (3) erstmalig in den Blockteil (4) gepresst wird;

dadurch gekennzeichnet, dass

- der mindestens eine Positionierungsvorsprung (8) zwei längs verlaufende konkave Flächen (11, 12), zwei quer verlaufende konkave Flächen (13, 14) und eine im Wesentlichen flache obere Fläche (15) aufweist;
- der Blockteil (4) mindestens eine Materialnut (10) aufweist, die in seiner Blockteil-Spannfläche (6a, 6b) positioniert ist, die Materialnut (10) mit der Positionierungsnut (9) verbunden ist, die mindestens eine Materialnut (10) dazu ausgeführt ist, aus dem Blockteil (4) verdrängtes Material aufzunehmen, wenn der mindestens eine Positionierungsvorsprung (8) des Bedplate-Teils (3) kraftschlüssig in den Blockteil (4) gepresst wird;
- die mindestens eine Positionierungsnut (9) dazu ausgeführt ist, den mindestens einen Positionierungsvorsprung (8) nach dem mindestens ersten Pressen aufzunehmen.

2. Geteilte Lageranordnung (7) nach Anspruch 1, **dadurch gekennzeichnet, dass** die mindestens eine Positionierungsnut (9) eine Form aufweist, die dem mindestens einen Positionierungsvorsprung (8) entspricht.

3. Geteilte Lageranordnung (7) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, dass** die mindestens eine Materialnut (10) zur Positionierungsnut (9) im Wesentlichen senkrecht ist.

4. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die mindestens eine Positionierungsnut (9) in der Blockteil-Spannfläche (6a, 6b) des Blockteils (4) in einem Bereich angeordnet ist, in den der mindestens eine Positionierungsvorsprung (8) des Bedplate-Teils (3) eingepresst wird.

5. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die mindestens eine Positionierungsnut (9) und die mindestens eine Materialnut (10) außerhalb einer Blockteilbohrung (16b) zwischen der Blockteilbohrung (16b) und einem längs verlaufenden Rand (18b) des Blockteils (4) positioniert sind.

6. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Blockteil (4) mit seiner mindestens einen Positionierungsnut (9) und seiner mindestens einen Materialnut (10) dazu ausgeführt ist, mit Hilfe einer Lagerschraubverbindung und/oder einem Presswerkzeug in den Bedplate-Teil (3) mit seinem Positionierungsvorsprung (8) gepresst zu werden.

7. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Bedplate-Teil-Spannfläche (5a, 5b) aus Sphäroguss hergestellt ist und die Blockteil-Spannfläche (6a, 6b) aus einer Aluminiumlegierung hergestellt ist.

8. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der Bedplate-Teil (3) und der Blockteil (4) durch den mindestens einen Positionierungsvorsprung (8) und die mindestens eine Positionierungsnut (9) in eine vorbestimmte Position geführt werden, wenn der mindestens eine Positionierungsvorsprung (8) nach dem mindestens ersten Pressen in die Positionierungsnut (9) gepresst wird.

9. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Höhe (H) des Positionierungsvorsprungs (8) über der Bedplate-Teil-Spannfläche (5a, 5b) bei weniger als 2 mm, vorzugsweise im Bereich von 0,2 bis 1,6 mm, stärker bevorzugt im Bereich von 0,4 bis 1,1 mm, noch stärker bevorzugt im Bereich von 0,6 bis 0,9 mm, liegt.

10. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Dicke (T) des Positionierungsvorsprungs (8) bei weniger als 2 mm, vorzugsweise im Bereich von 0,2 bis 1,6 mm, stärker bevorzugt im Bereich von 0,4 bis 1,1 mm, noch stärker bevorzugt im Bereich von 0,6 bis 0,9 mm, liegt.

11. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Breite (W) des Positionierungsvorsprungs (8) bei weniger als 20 mm, vorzugsweise im Bereich von 5 bis 15 mm, stärker bevorzugt im Bereich von 8 bis 13 mm, liegt.

12. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** ein Radius (R) einer ersten konkaven Fläche des Positionierungsvorsprungs (8) bei mehr als 0,5 mm, vorzugsweise im Bereich von 0,8 bis 3 mm, stärker bevorzugt im Bereich von 1 bis 2 mm, liegt.

13. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet,**

dass ein Radius (R) einer zweiten konkaven Fläche des Positionierungsvorsprungs (8) bei mehr als 0,5 mm, vorzugsweise im Bereich von 0,8 bis 3 mm, stärker bevorzugt im Bereich von 1 bis 2 mm, liegt.

14. Geteilte Lageranordnung (7) nach einem der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** der mindestens eine Positionierungsvorsprung (8) am Bedplate-Teil (3) durch Schneiden und/oder Erodieren ausgebildet wird.

15. Verfahren zur Herstellung einer geteilten Lageranordnung (7) für einen Hubkolbenmotor, das Folgendes umfasst:

- Bereitstellen eines Bedplate-Teils (3), wobei der Bedplate-Teil (3) mindestens eine aus Eisenmaterial hergestellte Bedplate-Teil-Spannfläche (5a, 5b) umfasst, wobei der Bedplate-Teil (3) dazu ausgeführt ist, gegen einen Blockteil (4) verspannbar zu sein, wobei der Bedplate-Teil (3) mindestens einen auf der Bedplate-Teil-Spannfläche (5a, 5b) positionierten Positionierungsvorsprung (8) umfasst, wobei der mindestens eine Positionierungsvorsprung (8) zwei längs verlaufende konkave Flächen (11, 12), zwei quer verlaufende konkave Flächen (13, 14) und eine im Wesentlichen flache obere Fläche (15) aufweist, wobei der mindestens eine Positionierungsvorsprung (8) durch Schneiden und/oder Erodieren ausgebildet wird;
- Bereitstellen des Blockteils (4), der sich in der Härte vom Bedplate-Teil (3) unterscheidet, wobei der Blockteil (4) mindestens eine Blockteil-Spannfläche (6a, 6b) umfasst, wobei der Blockteil (4) aus einem Material mit einer geringeren Härte als die Härte des Eisenmaterials der Bedplate-Teil-Spannfläche (5a, 5b) hergestellt ist, und dazu ausgeführt ist, gegen den Bedplate-Teil (3) verspannbar zu sein und kraftschlüssig dagegen gepresst zu werden, wobei der Blockteil (4) mindestens eine in seiner Blockteil-Spannfläche (6a, 6b) positionierte Materialnut (10) umfasst;
- Ausbilden mindestens einer in der Blockteil-Spannfläche (6a, 6b) positionierten Positionierungsnut (9), wenn der mindestens eine Positionierungsvorsprung (8) des Bedplate-Teils (3) kraftschlüssig in den Blockteil (4) gepresst wird, wobei die Positionierungsnut (9) mit der Materialnut (10) verbunden ist, wobei die Materialnut (10) Material der Positionierungsnut (9) des Blockteils (4) aufnimmt, wobei das Material verdrängt wird, wenn der mindestens eine Positionierungsvorsprung (8) des Bedplate-Teils (3) kraftschlüssig in die Blockteil-Spannfläche (6a, 6b) des Blockteils (4) gepresst wird, wobei die mindestens eine Positionierungsnut (9) dazu ausgeführt ist, den mindestens einen Positionierungsvorsprung (8) nach einem mindestens ersten Pressen aufzunehmen.

16. Fahrzeug, das eine Motoranordnung (1) umfasst, die die geteilte Lageranordnung (7) nach einem der Ansprüche 1 bis 14 umfasst.

Revendications

1. Système de palier en deux parties (7) pour moteurs à piston alternatif comprenant :

- une section de carter inférieur (3) et une section de bloc (4) constituées de matériaux présentant des duretés différentes ;
- la section de carter inférieur (3), au moins une surface de serrage (5a, 5b) de section de carter inférieur étant constituée d'un matériau ferreux, étant conçue pour pouvoir être serrée contre la section de bloc (4), la section de carter inférieur (3) comportant au moins une protubérance de positionnement (8) située sur la surface de serrage (5a, 5b) de section de carter inférieur ;
- la section de bloc (4), constituée d'un matériau présentant une dureté inférieure à la dureté du matériau ferreux de la surface de serrage (5a, 5b) de section de carter inférieur, étant conçue pour pouvoir être serrée et pressée avec force contre la section de carter inférieur (3), et comprenant au moins une rainure de positionnement (9) située dans une surface de serrage (6a, 6b) de section de bloc formée lorsque la section de carter inférieur (3) est pressée une première fois dans la section de bloc (4) ;

caractérisé en ce que

- la ou les protubérances de positionnement (8) comportent deux surfaces concaves longitudinales (11, 12), deux surfaces concaves transversales (13, 14) et une surface supérieure essentiellement plane (15) ;
- la section de bloc (4) comporte au moins une rainure à matériau (10) située dans sa surface de serrage (6a, 6b) de section de bloc, la rainure à matériau (10) étant raccordée à la rainure de positionnement (9), la ou les rainures à matériau (10) étant conçues pour recevoir du matériau déplacé de la section de bloc (4) lorsque la ou les protubérances de positionnement (8) de la section de carter inférieur (3) sont pressées avec force dans la section de bloc (4) ;
- la ou les rainures de positionnement (9) sont conçues pour recevoir la ou les protubérances de positionnement (8) après le pressage effectué au moins une première fois.

2. Système de palier en deux parties (7) selon la revendication 1, **caractérisé en ce que** la ou les rainures de positionnement (9) présentent une forme correspondant à la ou aux protubérances de positionnement (8).

3. Système de palier en deux parties (7) selon la revendication 1 ou 2, **caractérisé en ce que** la ou les rainures à matériau (10) sont essentiellement perpendiculaires à la rainure de positionnement (9).

4. Système de palier en deux parties s (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la ou les rainures de positionnement (9) sont ménagées dans la surface de serrage (6a, 6b) de section de bloc de la section de bloc (4) dans une région dans laquelle sont pressées la ou les protubérances de positionnement (8) de la section de carter inférieur (3).

5. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la ou les rainures de positionnement (9) et la ou les rainures à matériau (10) sont situées à l'extérieur d'un trou (16b) de section de bloc entre le trou (16b) de section de bloc et un bord longitudinal (18b) de la section de bloc (4).

6. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la section de bloc (4), avec sa ou ses rainures de positionnement (9) et sa ou ses rainures à matériau (10), est conçue pour être pressée dans la section de carter inférieur (3), avec sa protubérance de positionnement (8), au moyen d'un assemblage à contact par vissage et/ou d'un outil de presse.

7. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la surface de serrage (5a, 5b) de section de carter inférieur est constituée de fonte nodulaire et la surface de serrage (6a, 6b) de section de bloc est constituée d'un alliage d'aluminium.

8. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la section de carter inférieur (3) et la section de bloc (4) sont guidées de façon à s'adapter l'une à l'autre dans une position prédéterminée par la ou les protubérances de positionnement (8) et la ou les rainures de positionnement (9) lorsque la ou les protubérances de positionnement (8) sont pressées dans la rainure de positionnement (9) après le pressage effectué au moins une première fois.

9. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la hauteur (H) de la protubérance de positionnement (8) au-dessus de la surface de serrage (5a, 5b) de section de carter inférieur est inférieure à 2 mm, de préférence dans la plage de 0,2 à 1,6 mm, plus préférablement dans la plage de 0,4 à 1,1 mm, encore plus préférablement dans la plage de 0,6 à 0,9 mm.

10. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** l'épaisseur (T) de la protubérance de positionnement (8) est inférieure à 2 mm, de préférence dans la plage de 0,2 à 1,6 mm, plus préférablement dans la plage de 0,4 à 1,1 mm, encore plus préférablement dans la plage de 0,6 à 0,9 mm.

11. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la largeur (W) de la protubérance de positionnement (8) est inférieure à 20 mm, de préférence dans la plage de 5 à 15 mm, plus préférablement dans la plage de 8 à 13 mm.

12. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**un rayon (R) d'une première surface concave de la protubérance de positionnement (8) est supérieur à 0,5 mm, de préférence dans la plage de 0,8 à 3 mm, plus préférablement dans la plage de 1 à 2 mm.

13. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce qu'**un rayon (R) d'une deuxième surface concave de la protubérance de positionnement (8) est supérieur à 0,5 mm, de préférence dans la plage de 0,8 à 3 mm, plus préférablement dans la plage de 1 à 2 mm.

14. Système de palier en deux parties (7) selon l'une quelconque des revendications précédentes, **caractérisé en ce que** la ou les protubérances de positionnement (8) sur la section de carter inférieur (3) sont formées par découpe et/ou érosion.

15. Procédé de fabrication d'un système de palier en deux parties (7) pour un moteur à piston alternatif comprenant :

- fournir une section de carter inférieur (3), la section de carter inférieur (3) comprenant au moins une surface de serrage (5a, 5b) de section de carter inférieur constituée d'un matériau ferreux, la section de carter inférieur (3) étant conçue pour pouvoir être serrée contre une section de bloc (4), la section de carter inférieur (3) comprenant au moins une protubérance de po-

sitionnement (8) située sur la surface de serrage (5a, 5b) de section de carter inférieur, la ou les protubérances de positionnement (8) comportant deux surfaces concaves longitudinales (11, 12), deux surfaces concaves transversales (13, 14) et une surface supérieure essentiellement plane (15), la ou les protubérances de positionnement (8) étant formées par découpe et/ou érosion ;

- fournir la section de bloc (4), celle-ci présentant une dureté différente de celle de la section de carter inférieur (3), la section de bloc (4) comprenant au moins une surface de serrage (6a, 6b) de section de bloc, la section de bloc (4) étant constituée d'un matériau présentant une dureté inférieure à la dureté du matériau ferreux de la surface de serrage (5a, 5b) de section de carter inférieur et étant conçue pour pouvoir être serrée et pressée avec force contre la section de carter inférieur (3), la section de bloc (4) comprenant au moins une rainure à matériau (10) située dans sa surface de serrage (6a, 6b) de section de bloc ;

- former au moins une rainure de positionnement (9) située dans la surface de serrage (6a, 6b) de section de bloc lorsque la ou les protubérances de positionnement (8) de la section de carter inférieur (3) sont pressées avec force dans la section de bloc (4), la rainure de positionnement (9) étant raccordée à la rainure à matériau (10), la rainure à matériau (10) recevant du matériau de la rainure de positionnement (9) de la section de bloc (4), le matériau étant déplacé lorsque la ou les protubérances de positionnement (8) de la section de carter inférieur (3) sont pressées avec force dans la surface de serrage (6a, 6b) de section de bloc de la section de bloc (4), la ou les rainures de positionnement (9) étant conçues pour recevoir la ou les protubérances de positionnement (8) suite à au moins un premier pressage.

16. Véhicule comprenant un ensemble de moteur (1) comprenant le système de palier en deux parties (7) selon l'une quelconque des revendications 1 à 14.

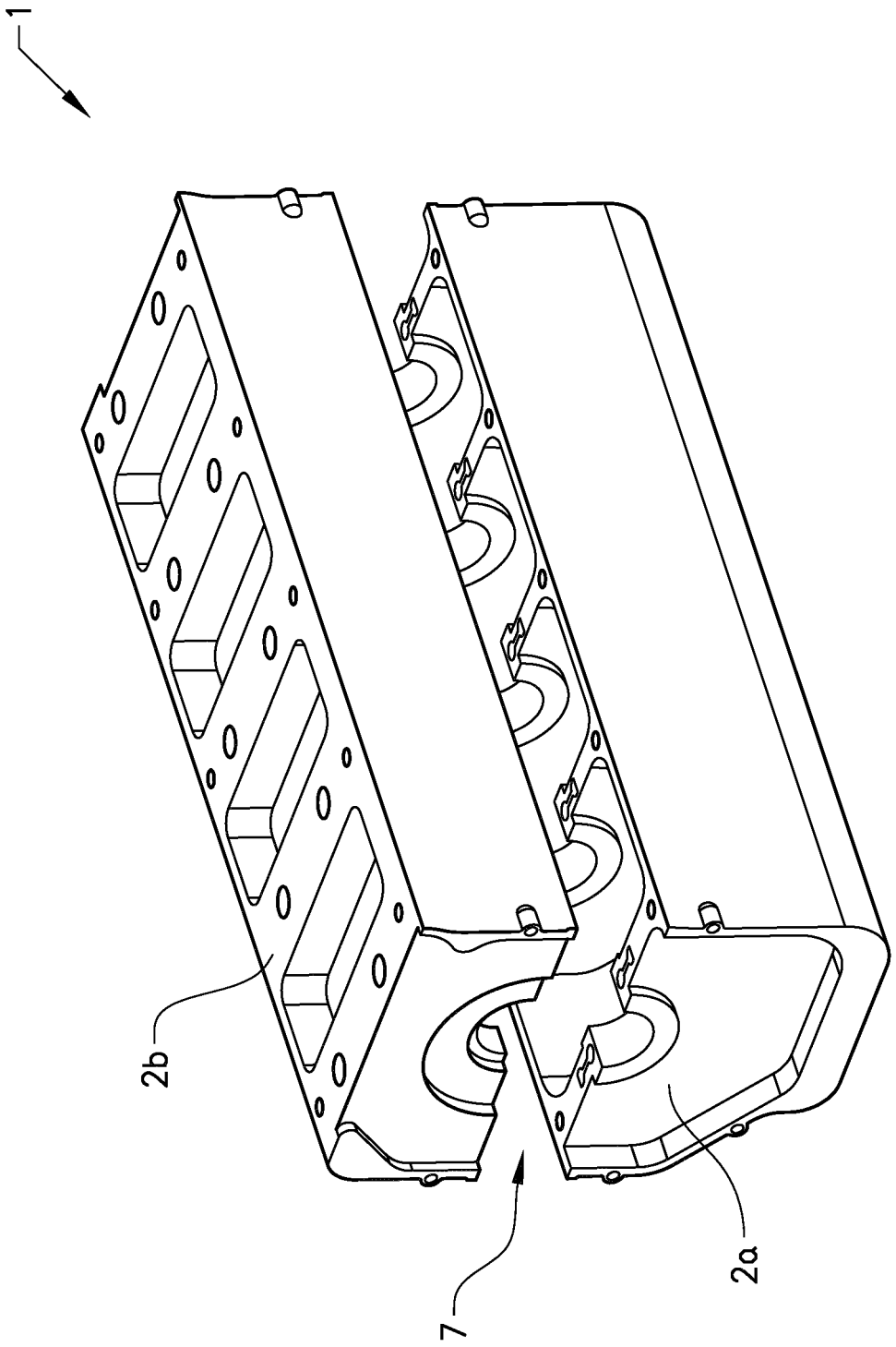


FIG. 1

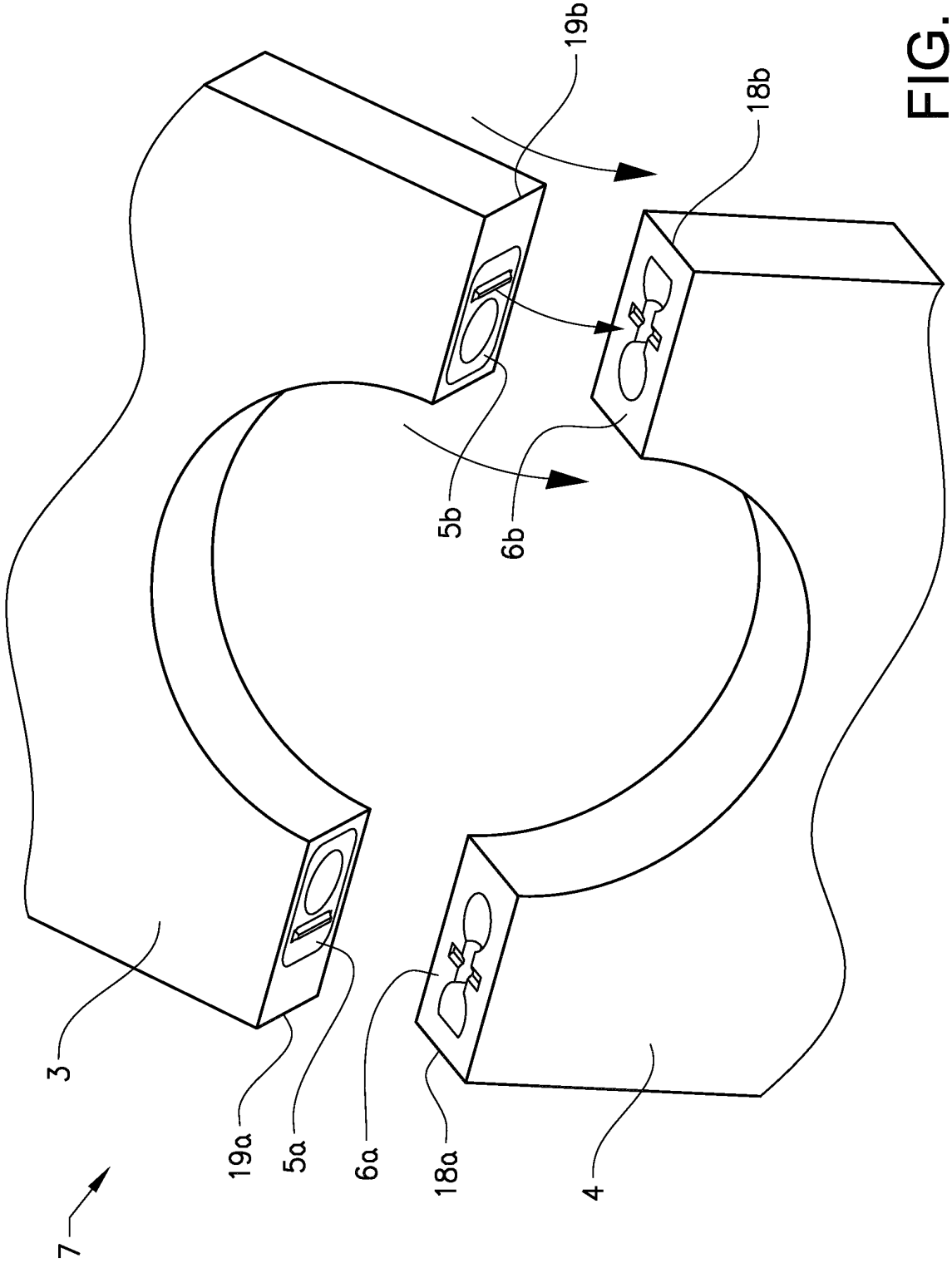


FIG. 2

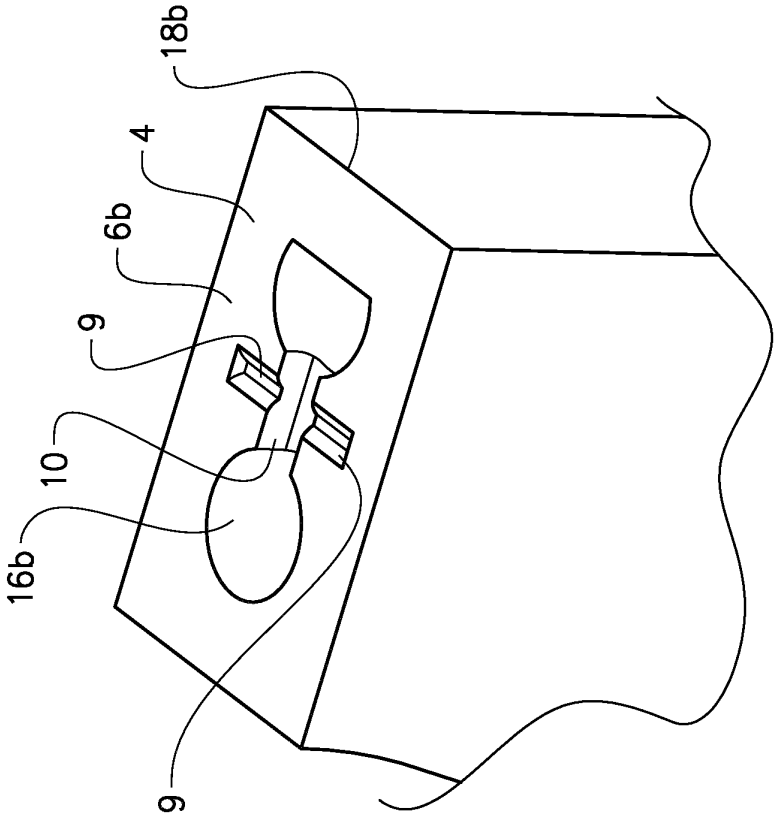


FIG. 3b

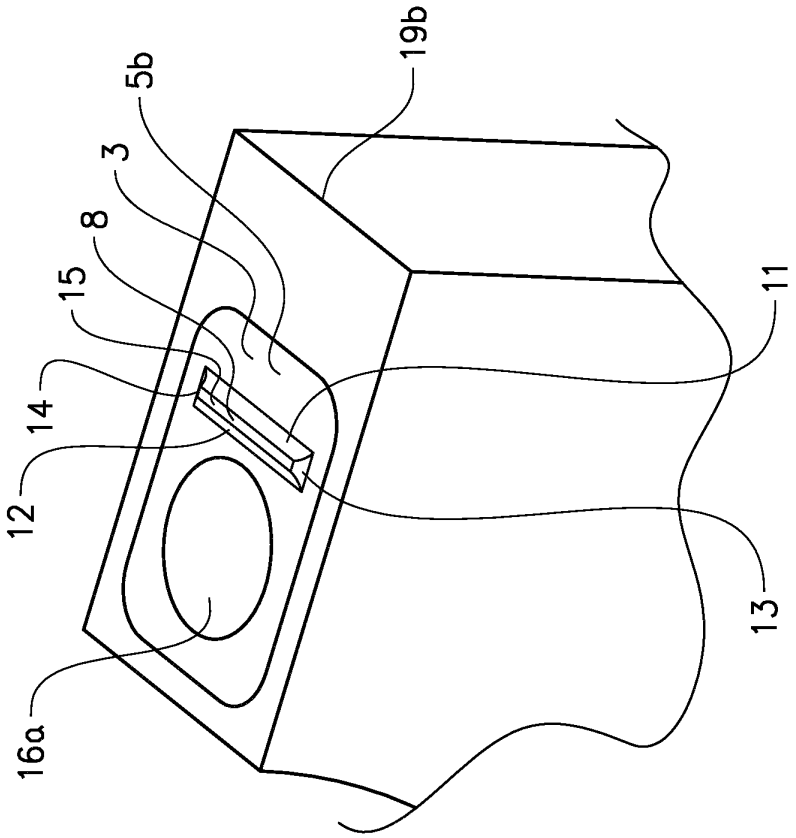


FIG. 3a

FIG. 4

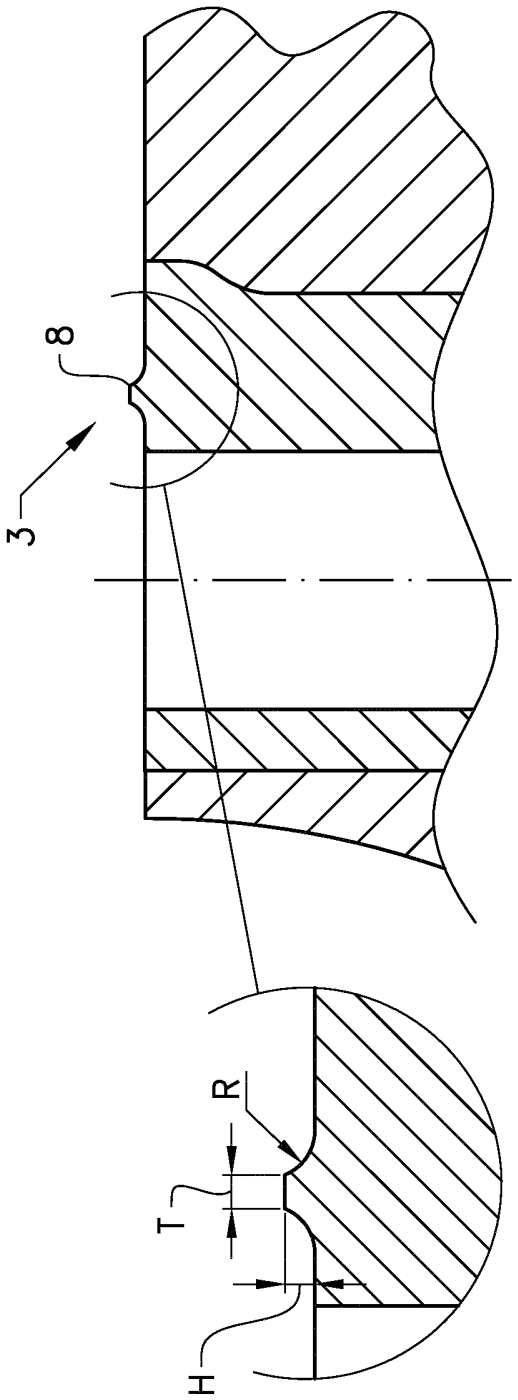
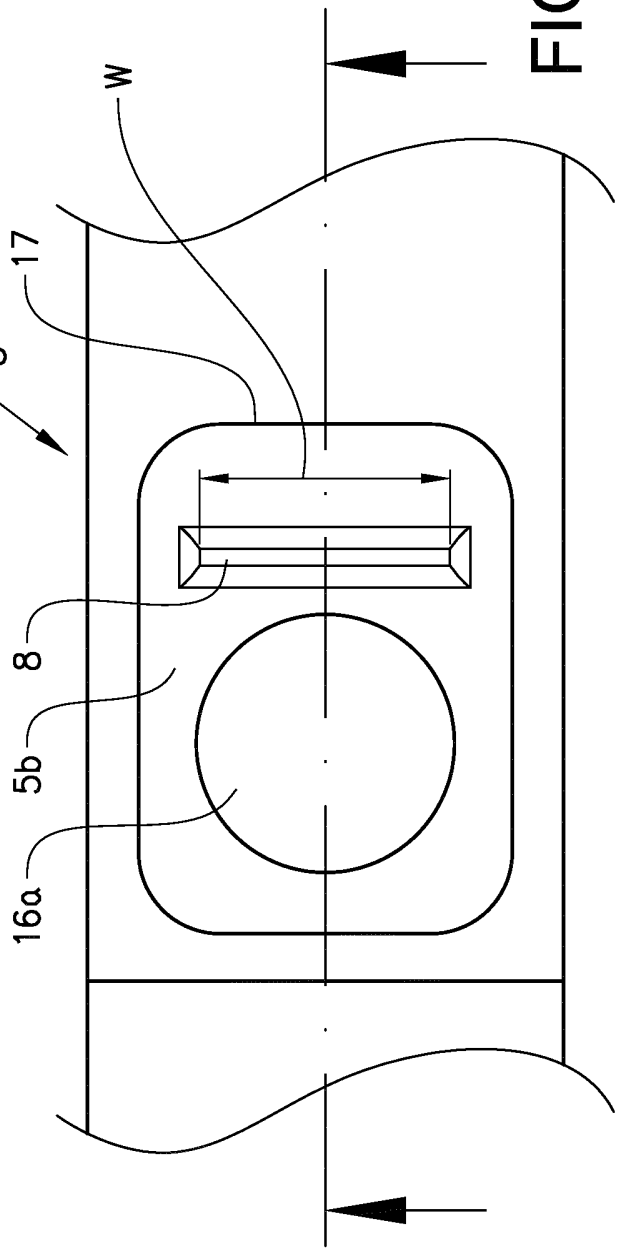


FIG. 5



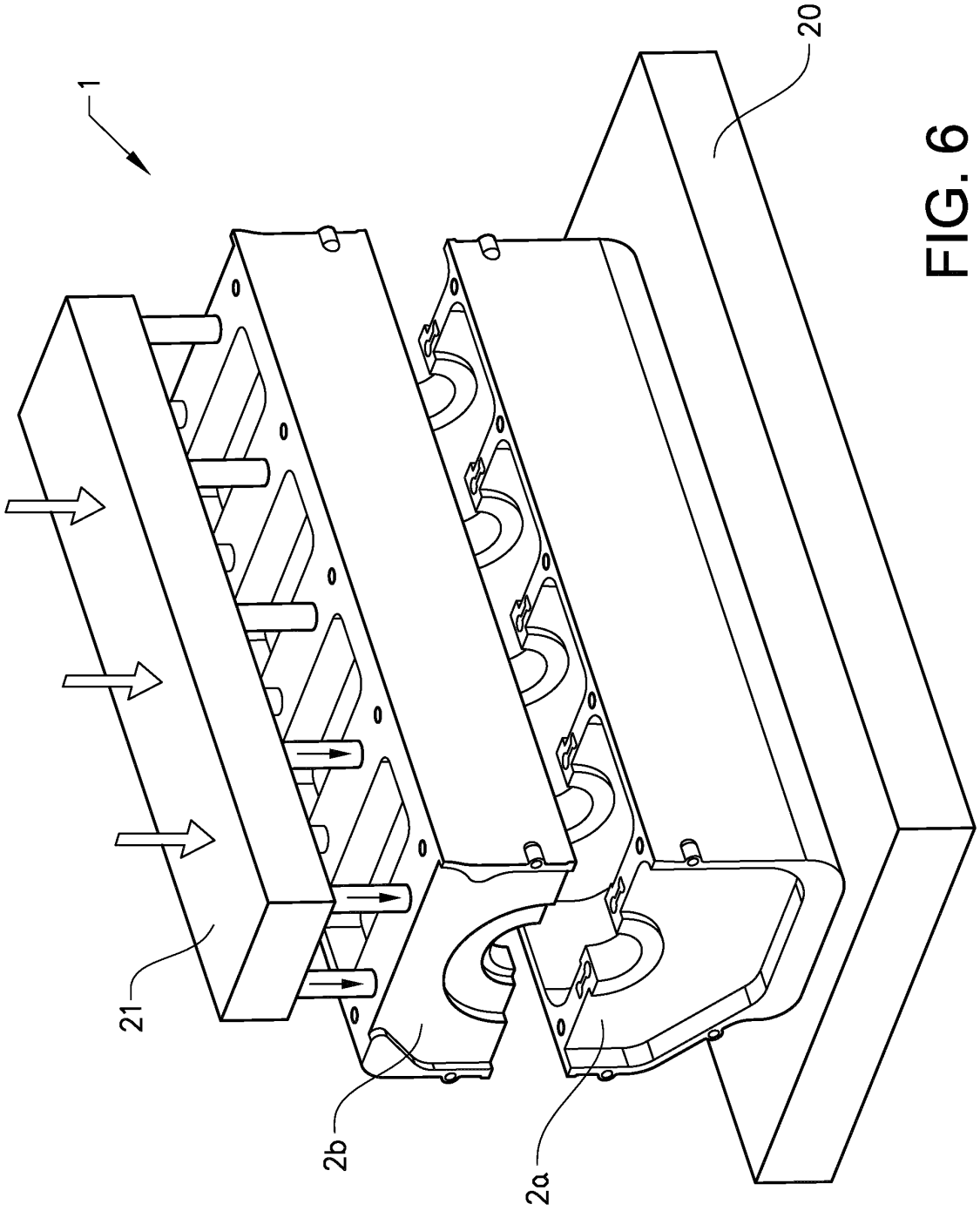


FIG. 6

REFERENCES CITED IN THE DESCRIPTION

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- EP 1075605 A **[0004]**