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Keller(10) **Pub. No.: US 2013/0000590 A1**(43) **Pub. Date: Jan. 3, 2013**(54) **METHOD FOR PRODUCING A PISTON FOR
AN INTERNAL COMBUSTION ENGINE AND
PISTON THAT CAN BE PRODUCED BY
MEANS OF SAID METHOD****Publication Classification**(51) **Int. Cl.**
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(52) **U.S. Cl.** 123/193.1; 29/888.04(75) **Inventor: Klaus Keller, Lorch (DE)**(73) **Assignee: MAHLE INTERNATIONAL GMBH,
Stuttgart (DE)**(21) **Appl. No.: 13/516,797**(22) **PCT Filed: Dec. 17, 2010**(86) **PCT No.: PCT/DE2010/001483**

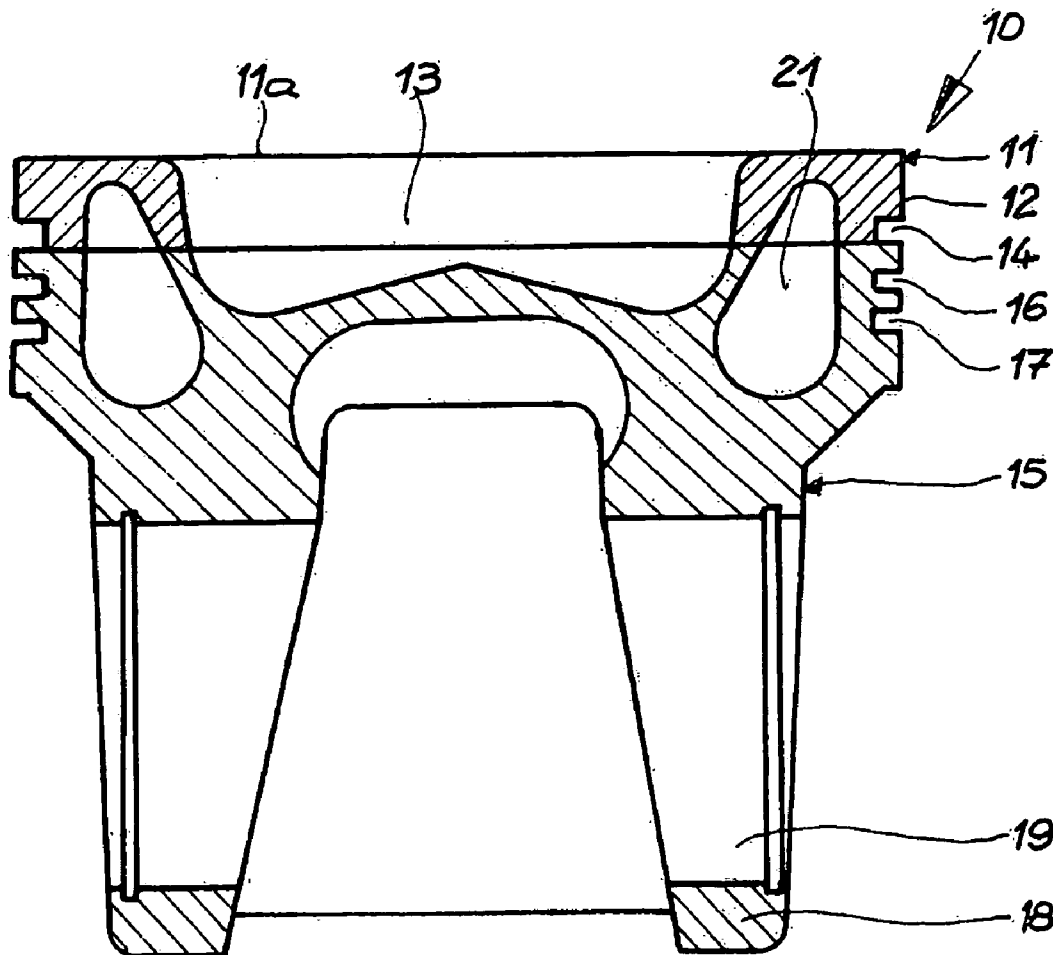
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(57) **ABSTRACT**

The present invention relates to a method for producing a piston (10) from an upper piston part (11, 111, 211) and a lower piston part (15). A strip- or plate-shaped semifinished product (22) made of a metal material is provided, from which an annular upper piston part (11, 111, 211) or an annular blank (25) is stamped out, which blank is finished to form an upper piston part (11, 111, 211), wherein the upper piston part (11, 111, 211) is connected to a lower piston part (15) to form a piston (10).



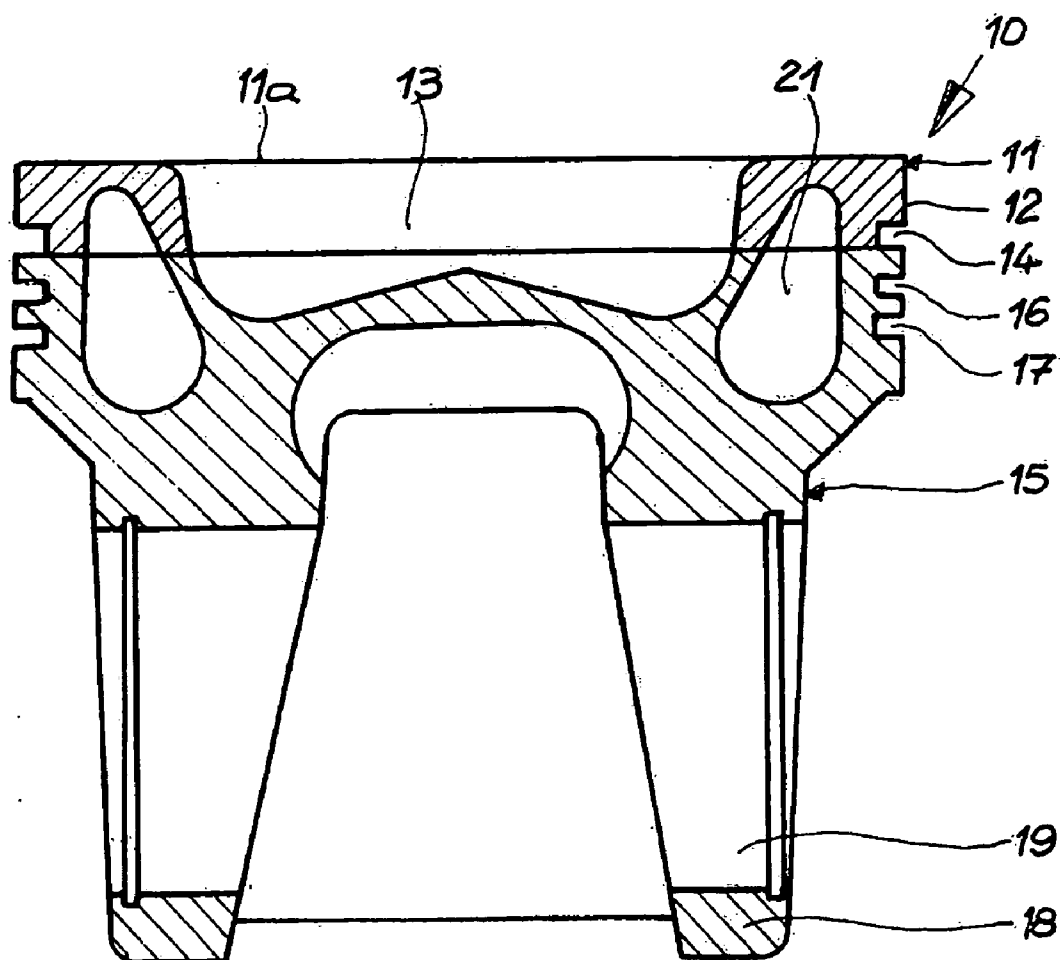


Fig. 1

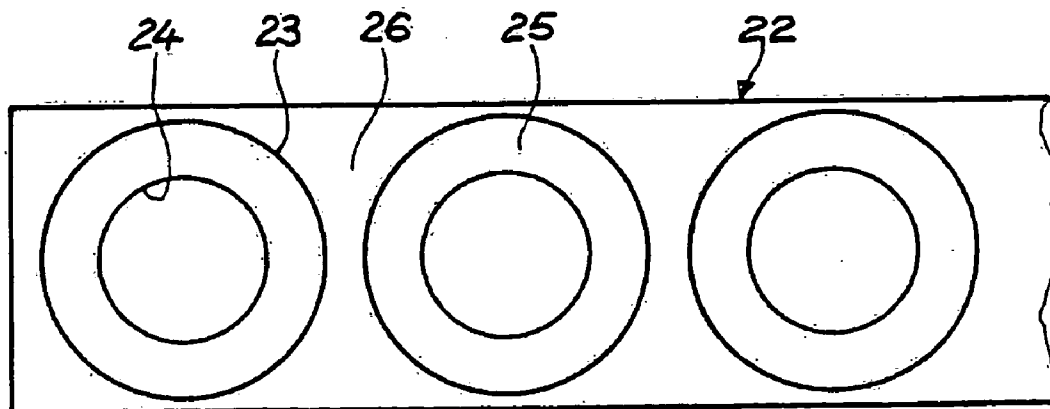
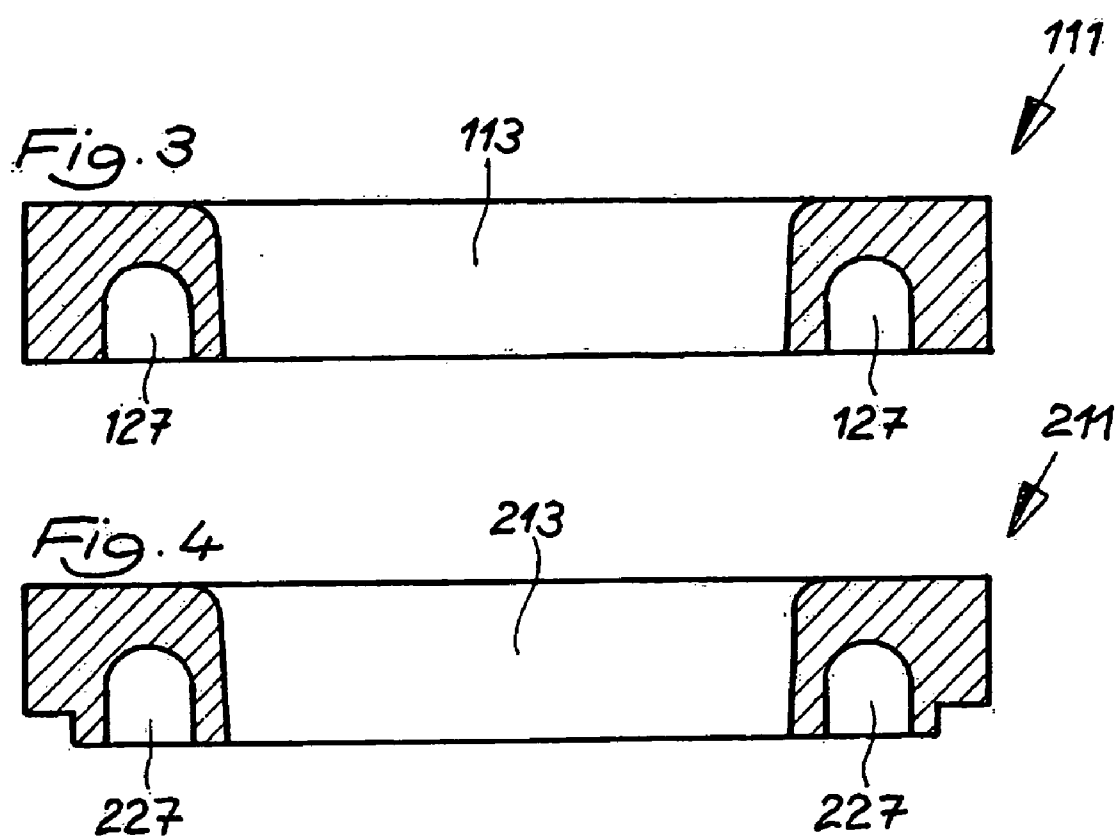


Fig. 2



**METHOD FOR PRODUCING A PISTON FOR
AN INTERNAL COMBUSTION ENGINE AND
PISTON THAT CAN BE PRODUCED BY
MEANS OF SAID METHOD**

[0001] The present invention relates to a method for the production of a piston for an internal combustion engine, as well as to a piston that can be produced by means of this method.

[0002] DE 103 11 149 A1 discloses a piston composed of an upper piston part and a lower piston part, which are fixed in place by means of a minimal number of weld points and are connected with one another by means of subsequent forging. Such pistons are characterized in that the upper piston part is produced from a particularly temperature-resistant and high-strength material, in order to prevent scaling, particularly in the region of the combustion bowl. However, production of such a piston is complicated and connected with significant costs.

[0003] The task of the present invention consists in making available a method for the production of a piston for an internal combustion engine, which method can be implemented with the least possible effort and reduced costs.

[0004] A first solution, according to the invention, consists in that a strip-shaped or plate-shaped semi-finished product made of a metallic material is made available, that a ring-shaped blank is punched out of the semi-finished product and subsequently finished to produce an upper piston part, and that the finished upper piston part is connected to a lower piston part, to produce a piston.

[0005] A second solution, according to the invention, consists in that a strip-shaped or plate-shaped semi-finished product made of a metallic material is made available, that at least one surface of the strip-shaped or plate-shaped semi-finished product is finished, that a ring-shaped upper piston part is punched out of the semi-finished product and subsequently connected to a lower piston part, to produce a piston.

[0006] A piston that can be produced with this method is furthermore an object of the present invention.

[0007] The present invention is characterized in that a particularly simple method for the production of a piston, which method can be implemented with few production steps and is therefore cost-advantageous, is made available. In particular, an upper piston part can be made available, which can be obtained, in particularly simple manner, from any desired material. In this way it is possible, for example, to make available a piston having a particularly high-strength and temperature-resistant upper piston part, in simple and cost-advantageous manner.

[0008] Advantageous further developments are evident from the dependent claims.

[0009] Preferably, a semi-finished product made from a steel material is used, so that the finished piston meets the requirements during engine operation in optimal manner. In particular, a hot-rolled or cold-rolled steel material is particularly well suited.

[0010] For the case that a blank is punched out of the semi-finished product, this blank is preferably machined level along at least one surface, for example by means of lathing or grinding. The level machined surface then forms the piston crown in the finished piston.

[0011] For the case that a finished upper piston part is punched out of the semi-finished product, preferably at least one surface of the semi-finished product is machined level before punching. The level machined surface then forms the

piston crown in the finished piston. Of course, the upper piston part can be machined as needed after punching.

[0012] Depending on the requirements in an individual case, semi-finished products having a thickness of up to 15 mm can be used.

[0013] A preferred further development consists in that during punching, a circumferential lower recess is machined into the blank or into the upper piston part, and/or at least one circumferential lateral recess is machined into the blank or the upper piston part, by means of corresponding shaping of the punching tool. In the finished piston, the lower recess forms at least one part of a cooling channel. An outer recess forms part of a ring groove, for example. An inner recess can form part of a combustion bowl, for example.

[0014] The finished upper piston part can be connected with a lower piston part, to produce a finished piston, for example by means of soldering or welding. Of course, the piston can also be finished subsequently, as needed.

[0015] Exemplary embodiments of the present invention will be explained in greater detail in the following, using the attached drawings. These show, in a schematic representation, not true to scale:

[0016] FIG. 1 an exemplary embodiment of a piston according to the invention, in section;

[0017] FIG. 2 a top view of a strip-shaped semi-finished product for use in the method according to the invention;

[0018] FIG. 3 another exemplary embodiment of an upper piston part produced according to the method according to the invention, in section;

[0019] FIG. 4 another exemplary embodiment of an upper piston part produced according to the method according to the invention, in section.

[0020] FIG. 1 shows an exemplary embodiment of a piston 10. Because the invention can be used for all piston types and all piston materials, only one piston type will be used as an example in the following, to describe the present invention.

[0021] In the exemplary embodiment, the piston 10 is a two-part welded box piston, the structure of which is known as such. The piston 10 has an upper piston part 11 having a circumferential top land 12. The upper piston part 11 forms a piston crown 11a as well as part of a combustion bowl 13, and has a piston ring groove 14 below the top land 12. The piston 10 furthermore has a lower piston part 15 having two piston ring grooves 16, 17 as well as pin bosses 18 that are set back relative to the piston ring grooves 14, 16, 17. The pin bosses 18 are provided with pin bores 19 for accommodating a piston pin (now shown). The upper piston part 11 and the lower piston part 15 together form a circumferential cooling channel 21.

[0022] FIG. 2 shows an exemplary embodiment of a semi-finished product 22, here a strip-shaped semi-finished product, for use in the method according to the invention. The semi-finished product 22 consists, for example, of a hot-rolled or cold-rolled steel material of the type 42CrMo4, having a thickness of 10 mm. The cutting lines along which a ring-shaped blank or a ring-shaped upper piston part is punched out, according to the present invention, are indicated with 23, 24.

[0023] For the case that the semi-finished product 22 is used without further processing, a ring-shaped blank 25 is punched out. The blank 25 is machined level along at least one surface, for example by means of grinding or lathing. This surface forms the piston crown 11a of the upper piston part 11 in the finished piston 10. Subsequently, the finished upper piston

part **11** is connected to a lower piston part **15**, to form a piston **10**, for example by means of soldering or welding, such as friction welding, electrode welding, or laser welding. Of course, the piston **10** can also be finished subsequently, as needed.

[0024] However, the semi-finished product **22** can be processed further before being punched, in that at least one of its surfaces **26** is machined level, for example by means of grinding or lathing. Subsequently, a ring-shaped upper piston part **11** is punched out. The level machined surface **26** forms the piston crown **11a** of the upper piston part **11** in the finished piston **10**. Subsequently, the finished upper piston part **11** is connected to a lower piston part **15**, to form a piston **10**, as described above. FIG. **3** shows an exemplary embodiment of a ring-shaped upper piston part **111** punched out of a semi-finished product **22**. The upper piston part **111** has a circumferential lower recess **127** that forms part of a circumferential cooling channel in the finished piston; see the cooling channel **21** in FIG. **1**. The recess **127** is formed in that the punching tool is provided with a corresponding embossing shape, in known manner. Therefore the recess **127** is formed at the same time with the punching process. The central opening **113** of the ring-shaped upper piston part **111** forms part of a combustion bowl in the finished piston; see the combustion bowl **13** in FIG. **1**. Of course, the same holds true analogously also for production of a blank from the semi-finished product **22**.

[0025] FIG. **4** shows another exemplary embodiment of a ring-shaped upper piston part **211** punched out of a semi-finished product **22**. The upper piston part **211** also has a circumferential lower recess **227** that forms part of a circumferential cooling channel in the finished piston; see the cooling channel **21** in FIG. **1**. The upper piston part **211** furthermore has a circumferential outer recess **228** that forms part of a piston ring groove in the finished piston; see the piston ring groove **14** in FIG. **1**. The recesses **227** and **228** are formed in that the punching tool is provided with corresponding embossing shapes, in known manner. Therefore the recesses **227** and **228** are formed at the same time with the punching process. The central opening **213** of the ring-shaped upper piston part **211** forms part of a combustion bowl in the finished piston; see the combustion bowl **13** in FIG. **1**. Of course, the same holds true analogously also for production of a blank from the semi-finished product **22**.

1. Method for the production of a piston (**10**) for an internal combustion engine, comprising the following method steps:

- (a) making available a strip-shaped or plate-shaped semi-finished product (**22**) made of a metallic material,

- (b) punching a ring-shaped blank (**25**) out of the semi-finished product **22**,

- (c) finishing the blank (**25**) to produce an upper piston part (**11**, **111**, **211**),

- (d) connecting the upper piston part (**11**, **111**, **211**) to a lower piston part (**15**), to produce a piston (**10**).

2. Method for the production of a piston (**10**) for an internal combustion engine, comprising the following method steps:

- (a) making available a strip-shaped or plate-shaped semi-finished product (**22**) made of a metallic material,

- (b) finishing at least one surface (**26**) of the strip-shaped or plate-shaped semi-finished product (**22**),

- (c) punching a ring-shaped upper piston part (**11**, **111**, **211**) out of the semi-finished product (**22**),

- (d) connecting the upper piston part (**11**, **111**, **211**) to a lower piston part (**15**), to produce a piston (**10**).

3. Method according to claim **1**, wherein a semi-finished product (**22**) made from a steel material is used.

4. Method according to claim **3**, wherein a semi-finished product (**22**) made from a hot-rolled or cold-rolled steel material is used.

5. Method according to claim **1**, wherein the blank (**25**) is machined level along at least one surface in step (c).

6. Method according to claim **2**, wherein at least one surface (**26**) of the semi-finished product (**22**) is machined level in step (b).

7. Method according to claim **2**, wherein after step (c), the upper piston part (**11**, **111**, **211**) is finished.

8. Method according to claim **1**, wherein a semi-finished product (**22**) having a thickness of up to 15 mm is used.

9. Method according to claim **1**, wherein during punching, a circumferential lower recess (**127**, **227**) is machined into the blank (**25**) or into the upper piston part (**11**, **111**, **211**).

10. Method according to claim **1**, wherein during punching, a least one circumferential lateral recess (**228**) is machined into the blank (**25**) or into the upper piston part (**11**, **111**, **211**).

11. Method according to claim **10**, wherein the at least one circumferential lateral recess (**228**) is formed on the outer or inner circumference of the blank (**25**) or of the upper piston part (**11**, **111**, **211**).

12. Method according to claim **1**, wherein the upper piston part (**11**, **111**, **211**) and the lower piston part (**15**) are connected with one another by means of welding or soldering.

13. Piston (**10**) for an internal combustion engine, which can be produced by means of a method according to claim **1**.

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