METHODS OF MANUFACTURING CRANK-CASE ENVELOPES FOR ROTARY PISTON INTERNAL COMBUSTION ENGINES WITH SINTERED METAL PLUG SUPPORT

Inventor: Jean J. L. Panhard, Paris, France
Assignee: Societe De Constructions Mecaniques Panhard & Levassor, Paris, France
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Primary Examiner—Robert D. Baldwin
Attorney—Fleet, Gipple & Jacobson

ABSTRACT
The envelope is of cast metal or alloy in which each spark-plug is mounted in a support, preferably externally cylindrical, of a sintered metal or alloy highly resistant to thermal shocks. The support is degassed in vacuum and coated by metallisation with the metal or alloy constituting the envelope. It is then placed as a core in a mould and the metal or alloy of the envelope is cast around it, so affecting a positive and durable bond between the support and the rest of the envelope. The envelope is of aluminium magnesium alloy or pig iron and the support of sintered aluminium, magnesium or nickel including 7 to 8 percent thorium respectively.

15 Claims, 1 Drawing Figure
METHODS OF MANUFACTURING CRANK-CASE ENVELOPES FOR ROTARY PISTON INTERNAL COMBUSTION ENGINES WITH SINTERED METAL PLUG SUPPORT

The present invention relates to crank-case envelopes for rotary piston internal combustion engines and to improvements in methods for their manufacture. More particularly it relates to, on the one hand, methods of manufacturing crank-case envelopes, for rotary piston internal combustion engines, of the type constituted of cast metal or alloy and of which the or each plug is mounted in a support fixed in the envelope and, on the other hand, to these envelopes themselves; and it relates more especially, because it is in this case that its application seems to be most advantageous, but not exclusively, to crank-case envelopes for automobile vehicles.

It is known that, on operating a rotary piston internal combustion engine, the crank-case is subjected to considerable thermal shocks, in the region of the one or more plugs, which causes rapid deterioration of the cast metal or alloy which constitutes it.

It is an object of the invention, especially, to provide aforesaid methods and crank-casings which respond better than up to the present to the various exigencies of practice, especially as regards the resistance of the envelopes to thermal shocks in the zone of the plugs.

According to the invention, there is provided a process of manufacturing rotary piston internal combustion engine crank-cases, constituted of cast metal or alloy and of which the or each plug is mounted in a support fixed in the envelope, wherein the plug support is constituted by a body, preferably externally cylindrical, of sintered metal or alloy resisting well thermal shocks, placing it in a mould, as a core, and casting around it the metal or alloy having to constitute the said envelope, due to which positive and lasting bonding is effected between the support and the remainder of the envelope.

Preferably, the plug support is subjected to degassing under vacuum and it is plated, by metallisation, with a thin film of a metal miscible with the metal or alloy having to constitute the said envelope.

The degassing under vacuum is effected, advantageously, under a pressure of the order of $10^{-4}$ millibars (or $10^{-2}$ pascal).

A rotary piston internal combustion engine crank-casing, constituted of a cast metal or alloy of which the or each plug is mounted in a support fixed in the envelope, is characterised in that the or each plug support is constituted by a body of sintered metal or alloy, said support being included by a casting method.

Advantageously, the crank-casing is formed of an aluminium alloy and the plug support is made essentially of sintered aluminium and it is coated, by metallisation, with a thin film of aluminium or of copper.

The invention consists of certain other features which are used preferably at the same time and of which a more explicit description will be given below.

In order that the invention may be more fully understood, a preferred embodiment of an envelope for a crank-casing according to the invention is described below purely by way illustrative and non-limiting example, with reference to the accompanying drawings, in which the single FIGURE shows a partial view in section of a crank-case envelope of a rotary piston engine constructed according to the invention.

According to the invention, in order to construct an envelope for a rotary piston engine crank-casing, which resists thermal shocks well in the region of the plugs, the procedure is as follows.

The plug support is constituted by a body, preferably externally cylindrical, of a sintered metal or alloy resisting thermal shocks well, it being placed in a mould (not shown) as a core, and there is cast around it the metal or alloy which has to constitute the said envelope.

The crank-case envelope is generally given a cylindrical shape of which the inner surface 3 permits as a cross-section a two-lobed trochoid which can cooperate with a rotary piston (not shown) with three crests.

Advantageously, before casting the envelope 1 around the support 2, the latter is subjected to degassing under vacuum, under a pressure of the order of $10^{-4}$ millibar (or $10^{-2}$ Pascal) and it is coated by metallisation, under vacuum or not, with a thin film of a metal miscible with the metal or alloy which has to constitute the said envelope.

Preferably, the crank-case envelope 1 is made of aluminium or of aluminium alloy and the support 2 substantially of sintered aluminium, coated, by metallisation, with a thin film of aluminium or of copper. More specifically, the sintered aluminium constituting the support 2 may comprise from 5 to 15 percent of aluminium and be made especially by a method described in the journal "Technica" N. 9, 1960, of Zurich by Dr. R. Akeret. According to this method, aluminium powder, of which the apparent density exceeds 1 g/cm², is converted into a semi-finished product by compression in the cold, then heated, sintered hot and subjected to hot plastic forming.

The crank-case envelope 1 may also be constituted of a magnesium alloy, and the support 2 substantially of sintered magnesium, plated, by metallisation, with a thin film of magnesium or of aluminium facilitating the subsequent attachment of the support 2 on the cast metal of the envelope 1. The support 2 may, if necessary, be constituted of a sintered mixture of magnesium and of magnesia.

Finally, the envelope of the crank-casing may be manufactured of a ferrous alloy, for example, of grey pig iron or with spherical graphite, and the support 2 of a composite sintered material.

Among these various sintered composite materials which may be used, there may be selected nickel comprising 7 to 8 percent of thorium, in which case the support 2 is coated, by metallisation, with a thin film of copper so as to ensure a positive bonding between the ferrous alloy of the envelope and the support 2. There may also be chosen copper-alumina and copper-nickel-alumina. When the support is constituted of one of these two latter materials, there is no need to coat it with a thin film of copper, since the copper itself of the material contributes to ensuring the bonding between the ferrous alloy and the said material.

Suitable dimensions are given to the support 2 for the functions which it must perform and, before the casting of the crank-case envelope 1, it is placed at the desired spot in the mould.

After the casting of the envelope around the support 2 and by means of judicious choice of the aforesaid ma-
terials, positive bonding is ensured between the envelope and the support, the latter becoming an integral and immovable part of the envelope and being able to undergo at the same time any subsequent machining operations. There may for example be inserted in the casting a support in the form of a solid cylinder including simply a tapped hole which is used to permit its positioning with respect to the mould, which tapping is removed in the course of the final machining of the plug housing. There may also be inserted on casting a support in which the plug housing would have been rough machined.

As a result of this procedure, there is obtained a rotary piston engine crank-case envelope which responds well to the purposes for which it is intended, that is to say which resists thermal shocks well in the zone of the plugs, and this in a simple and economical manner since the sintered metal or alloy, more expensive than cast metal or alloy, is only applied in minimum quantity in the zone of the plugs at the time of casting the envelope.

As is self-evident, and as results besides already from the preceding description, the invention is in no way limited to that of its methods of application, nor to those of its methods of construction of its various parts, which have been more particularly contemplated, it embraces, on the contrary, all variations.

What I claim is:

1. Method of manufacturing a rotary piston internal combustion engine crankcase envelope having at least one plug support, said method comprising:
   forming said plug support from a body of sintered metal or alloy resistant to thermal shocks, placing said support as an insert in a mould and casting a metal or alloy to form said rotary piston crankcase envelope around a major proportion of the surface of said support so as to effect a positive and durable bond between the support and the remainder of the envelope and so that the support completely traverses the thickness of said envelope.

2. Method according to claim 1, including subjecting the plug support, prior to its placing in the mold, to coating by metallisation with a thin film of a metal miscible with the metal or alloy constituting said envelope.

3. Method according to claim 2, including, after said forming step, subjecting the plug support to degassing under vacuum.

4. Method according to claim 3, wherein the degassing under vacuum is effected under a pressure of the order of $10^{-4}$ millibar (or $10^{-5}$ pascal).

5. Method according to claim 1, wherein the crankcase envelope is of aluminium alloy and the plug support substantially of sintered aluminium and including coating said support by metallisation with a thin film of aluminium.

6. Method according to claim 1, wherein the crankcase envelope is of aluminium alloy and the plug support substantially of sintered aluminium and including coating said support by metallisation with a thin film of copper.

7. Method according to claim 5, wherein the sintered aluminium includes 5 to 15 percent alumina.

8. Method according to claim 1, wherein the crankcase envelope is of a magnesium alloy and the support substantially of sintered magnesium and including coating said support by metallisation with a thin film of magnesium.

9. Method according to claim 1, wherein the crankcase envelope is of a magnesium alloy and the support substantially of sintered magnesium and including coating said support by metallisation with a thin film of aluminium.

10. Method according to claim 8, wherein the sintered magnesium includes magnesia.

11. Method according to claim 1, wherein the crankcase envelope is of grey pig iron and the plug support of nickel comprising 7 to 8 percent of thorium, and including coating said support by metallisation with a thin film of copper.

12. Method according to claim 1, wherein the crankcase envelope is of spheroidal graphite cast iron and the plug support of nickel comprising 7 to 8 percent of thorium, and including coating said support by metallisation with a thin film of copper.

13. Method according to claim 1, wherein the crankcase envelope is constituted of grey pig iron and the plug support of copper-alumina.

14. Method according to claim 1, wherein the crankcase envelope is constituted of spheroidal graphite cast iron and the plug support of copper-alumina.

15. Method according to claim 1, wherein the crankcase envelope is constituted of grey pig iron and the plug support of copper-nickel-alumina.

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