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**Datasheet for the decision  
of 28 October 2008**

**Case Number:** T 1123/05 - 3.2.04

**Application Number:** 99933989.8

**Publication Number:** 1101029

**IPC:** F02F 3/00

**Language of the proceedings:** EN

**Title of invention:**

One-piece integral skirt piston and method of making the same

**Applicant:**

Federal-Mogul Corporation

**Opponent:**

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**Headword:**

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**Relevant legal provisions:**

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**Relevant legal provisions (EPC 1973):**

EPC Art. 56, 92(1), 111(1), 114(2)

**Keyword:**

"Inventive step - main, auxiliary request 3 (no)"

"Late-filed requests - auxiliary requests 1, 2 (not admissible)"

**Decisions cited:**

G 0010/93

**Catchword:**

-



Case Number: T 1123/05 - 3.2.04

**D E C I S I O N**  
of the Technical Board of Appeal 3.2.04  
of 28 October 2008

**Appellant:** Federal-Mogul Corporation  
26555 N.W. Highway  
Southfield  
Michigan 48034 (US)

**Representative:** Fuchs  
Patentanwälte  
Postfach 46 60  
D-65036 Wiesbaden (DE)

**Decision under appeal:** Decision of the Examining Division of the  
European Patent Office posted 29 March 2005  
refusing European application No. 99933989.8  
pursuant to Article 97(1) EPC.

**Composition of the Board:**

**Chairman:** M. Ceyte  
**Members:** M. Poock  
C. Heath

## Summary of Facts and Submissions

I. This appeal is against the decision of the Examining Division of 29 March 2005 in which European patent application No. 99 933 989.8 was refused because the subject-matter of claims 1 and 9 of a main and auxiliary request did not involve an inventive step.

II. The following documents were cited:

D1: WO-A-8 002 308,  
D2: US-A-5 144 923,  
D3: Patent Abstracts of Japan 63138141.

The Examining Division held that the skilled person would use any common joining method employed in the field of piston production when he looks for alternative solutions for joining the upper and lower piston crown parts of document D1. As an example, reference was made to documents D2 and D3 which disclosed friction welding of these parts.

III. The Applicant lodged the appeal against this decision on 24 May 2005 and paid the prescribed appeal fee simultaneously. The statement setting out the grounds of appeal was received on 28 July 2005.

IV. In the appeal proceedings, in addition to the documents cited in the decision, the Board referred to the following document:

D5: US-A-5 150 517.

With the summons to the oral proceedings, it was emphasised that any further submissions should reach the Board at least one month before the date of the oral proceedings, and that the requirements of Article 12 and 13 of the Rules of Procedure of the Boards of Appeal (RPBA) would be strictly applied.

- V. Oral proceedings took place on 28 October 2008 in which a new main and three auxiliary requests were submitted.
- VI. The Appellant (Applicant) requested that the decision under appeal be set aside and a patent be granted based on the main or one of the auxiliary requests 1 or 2 as filed during the oral proceedings, or auxiliary request 3, filed as auxiliary request 1 with letter dated 20 November 2007.
- VII. Claim 1 of the main request reads as follows:

"A method of making a one-piece piston (20) having a crown (22) and an integral skirt (24, 26) comprising the steps of: forming an upper crown (28) from a first material having an upper surface (32) connected to a lower surface (34) by an outer annular sidewall (36) and a first collar (44) radially inwardly spaced from said outer annular sidewall (36) extending downwardly from a lower surface (42) of said upper crown (28) and presenting a plain joining bottom face (66); forming a lower crown (30) from a second material having a second collar (64) extending upwardly and presenting a plain joining top face (68) of said lower crown (30) and first and second pin bosses (52, 54) projecting downwardly from said second collar (64) for receiving a wrist pin; forming a first skirt rib (24) extending

from a first outer surface (56) of said first pin boss (52) to a first corresponding outer surface (58) of said second pin boss (54); forming a second skirt rib (26) extending from a second outer surface (60) of said first pin boss (52) to a second corresponding outer surface (62) of said second pin boss (54), wherein first and second skirt ribs (24, 26) formed as one piece with said pin bosses (52, 54); bringing the aligned joining face (66) of the upper crown (28) into engagement with the joining face (68) of the lower crown (30) and friction-welding the first and second collars (44, 64) together to produce a permanent friction-weld joint across the plain joining faces (66, 68) in such manner as to secure the upper crown (28) intimately to the lower crown (30) to provide a resultant unified one-piece construction of the joined crowns (28, 30), and wherein during the step of friction welding, forming resultant flashings (72, 74) of material at the joining faces (66, 68) extending circumferentially about the connecting collars (44, 64) and projecting radially outwardly of the connecting collars (44, 64) toward said skirt ribs".

In claim 1 of auxiliary request 1, the further feature was added that the first and second collars are circular.

In claim 1 of auxiliary request 2, the further feature was added that the upper and lower crowns are made from steel as compared with the foregoing request.

In claim 1 of auxiliary request 3, the further feature was added that the first and second skirt ribs (24,26) "are located on a generally middle region of said first

and second pin bosses (52,54) and spaced from said lower surface (34) of said upper crown (28) then lower crown (30) and upper crown (28) are engaged" as compared with the main request.

VIII. The Appellant essentially argued as follows:

(a) The new requests could not have been filed earlier because the instructions of the Appellant had arrived at the representative only very late. With the main request, an obvious inconsistency had been removed. The amendments in the first auxiliary request have a basis in the drawings as originally filed, those in the second auxiliary request on page 3, line 30 to page 4, line 2 of the description as originally filed. Auxiliary request 3 is identical to auxiliary request 1 filed with the letter of 20 November 2007.

(b) The subject-matter of claim 1 of all requests involves an inventive step.

(i) In the method known from document D1, the upper and lower crowns are welded together by a bracing process. Such process is time-consuming.

The subject-matter of claim 1 is distinguished therefrom in that the joining bottom and top faces of the upper and lower crowns are plain and that the first and second collars are friction welded across the plain joining faces in such manner as to secure the upper crown intimately to the

lower crown to provide a resultant unified one-piece construction of the joined crowns.

These differences provide for a stronger connection between the upper and lower crowns and a faster manufacture.

- (ii) For the skilled person it was not obvious to use friction welding in the manufacture of a monobloc piston, i.e. in which the skirt portion and the crown are connected by friction welding. In the method of document D1, brazing cannot simply be substituted by friction welding. More considerations are necessary to arrive at what is claimed.

The skilled person is a graduate engineer with experience in the field of piston construction and manufacture.

At least 200 welding types are known. In the field of piston manufacture, friction welding is known only for articulated pistons. Thus, a prejudice exists hindering the skilled person to use friction welding for the manufacture of pistons other than articulated pistons. In such pistons the skirt portion is articulated to the upper crown. Since the skirt portion only has to resist lateral forces, it can be produced as a lightweight part. Such part cannot resist the forces required by friction welding for pressing the upper and skirt portion together. It is not known whether a piston

according to document D3 was ever put into practice.

Friction welding is not suitable for pistons cast from iron because they contain a high amount of embedded graphite reducing the strength of the connection.

The skilled person had to recognize that the stepped joining faces of the piston of document D1 should be plain, entirely friction welded (not, as in document D1, only brazed at the inner circumferential joint line 19), and annular (as opposed to the non-circular form in document D1).

Moreover, friction welding produces flashings. In the method of document D1, they would protrude outwardly from the joining faces and thus would overlay and block, at least partially, access to the oil collection tray 52 (see Fig. 1). The improved cooling of the piston as a result of the tray capturing the throwing oil into the gallery would be greatly inhibited or lost.

Finally, according to document D1, the outer circumference of the friction weld is not accessible so that the flashings cannot be machined away.



Therefore it is concluded that the piston of document D1 by its very design precludes friction welding.

- (iii) The additional feature of claim 1 of the third auxiliary request provides for a circumferential clearance between the upper crown and the skirt. Thus, a cutting tool can be used in order to remove the flashings, if necessary.

### **Reasons for the Decision**

1. The appeal is admissible.
2. *Requests filed at the oral proceedings*
  - 2.1 Article 13(3) RPBA stipulates that amendments made after oral proceedings have been arranged, shall not be admitted if they raise issues which the Board cannot reasonably be expected to deal with without adjournment of the oral proceedings.
  - 2.2 In claims 1 and 9 of the main request, the last words were amended to "skirt ribs". This removes an obvious inconsistency in the wording of these claims because they did not define the previously used term "skirt portions". Therefore, pursuant to Article 114(2) EPC 1973, the Board admits the new main request into the proceedings.
  - 2.3 In claim 1 and 9 of auxiliary request 1, the collars were amended to be circular, and in claims 1 and 7 of

auxiliary request 2 that the upper and lower crowns are made from steel. Since the amended features were not previously claimed, in fact they were disclosed only in the drawings or in the description, the Board has doubts whether the newly claimed subject-matter of these requests has been searched for.

- 2.3.1 Under Article 92(1) EPC 1973, the Search Division shall draw up the European Search Report on the basis of the claims with due regard to the description and the drawings. However, the Board does not know to which extent the description and the drawings had been taken into account, and in particular whether the search covered these particular features at all.
- 2.3.2 According to Article 111(1) second sentence EPC 1973, the Board could search and examine this new subject-matter or remit the case to the Examining Division for further prosecution, in particular to decide if any additional searches are required. Since proceedings before the Boards of Appeal *in ex-parte* cases are primarily concerned with examining the contested decision (see G 10/93, reasons 4; OJ EPO 1995, 172), the second alternative would appear more appropriate. In either case, the oral proceedings would need to be adjourned.
- 2.3.3 Hence, different from the main request, auxiliary requests 1 and 2 raise new issues which the Board cannot reasonably be expected to deal with without adjournment of the oral proceedings. Consequently and in accordance with Article 114(2) EPC 1973, auxiliary requests 1 and 2 were not admitted into the proceedings.

2.3.4 Auxiliary request 3 is identical to auxiliary request 1 filed with letter of 20 November 2007 and, therefore, is already in the proceedings.

3. *Main request - inventive step*

3.1 The closest prior art method is known from document D1. The collars of the upper and lower crowns 18, 20 (see Fig. 1) are joined at their contact faces as can be seen in Figure 1 at reference sign 19. These contact faces are divided by a step but, nevertheless, each of them is plain.

3.2 The subject-matter of claim 1 is distinguished from this method by the use of friction welding for joining the collars of the upper and lower crowns, wherein resultant flashings are formed.

This reduces the time necessary for the production of a one-piece piston and provides for a stronger connection between the upper and lower crowns.

In view of these effects, the problem can be formulated as providing a method of making a one-piece piston from an upper and lower crown having a stronger connection between these parts and is more suitable for mass production.

3.3 Obviousness of the solution

3.3.1 The advantages of friction welding are generally known to the relevant skilled person, i.e. a graduate engineer with experience in the construction of pistons and with the manufacture thereof. They include fast

joining times, strong connections and limited heat affected zones so that grain growth in the engineered materials can be avoided. Moreover, this skilled person knows this welding technique in the field of pistons for combustion engines, in particular for joining the upper and lower crowns of a piston (see, e.g. D2: col. 3, l. 35-39, D3: abstract, D5: col. 2, l. 46-54).

- (a) Document D3 demonstrates that friction welding is not only used for pistons of the articulated type. Thus, the Board does not share the Appellant's view that a prejudice hindered the skilled person to use friction welding for the manufacture of pistons other than articulated pistons.
  
- (b) The Board does neither share the Appellant's view that friction welding is not suitable for pistons cast from iron because they contain a high content of embedded graphite. Even if the material of the piston of document D1 had a high content of graphite, this would not hinder a strong connection because the high temperatures in the heat affected zones would burn this graphite. Moreover it should be noted that claim 1 does not specify the material of the piston.

3.3.2 For the substitution of brazing by friction welding, the skilled person might have to adjust the geometry of the upper and lower collars such that friction welding could be carried out. This does not require inventive considerations.

- (a) If, for example, the geometry of the contact faces (stepped form or non-circular form) should impede

friction welding, it would not require more than practical considerations to adjust these geometries (by removing the step and/or providing a circular joining face) to the requirements of the friction welding technique. The substitution of brazing by friction welding in the method of D1, results in a piston in which the upper crown is secured intimately to the lower crown by their collars to provide a resultant unified one-piece construction.

- (b) During the step of friction welding, flashings of material are formed at the joining faces extending circumferentially about the connecting collars and projecting radially outwardly towards said skirt portions.

It is true, that these flashings might interfere with the oil circulation described on page 4, lines 16 to 20 of document D1. However, since the disadvantages thereof are evident to the skilled person, it does not require inventive considerations to remove these flashings in order to ensure this oil circulation, if necessary.

- 3.3.3 Hence, the Board concludes that the subject-matter of claim 1 of the main request does not involve an inventive step as required by Article 56 EPC 1973.

The main request is therefore not allowable.

4. *Auxiliary request 3 - inventive step*

The added feature of claim 1 is also known from document D1. The skirt ribs 20, 20a, 20b are connected to the first and second pin bosses 15. As can be best seen in Figure 2, the skirt ribs are located on a generally middle region of these pin bosses. In Figure 1 it can be seen that the skirt ribs are spaced from the lower surface of the upper crown.

Thus, it is concluded that the subject-matter of claim 1 does not involve an inventive step for the same reasons as set out above for the main request. Consequently, auxiliary request 3 is also not allowable.

**Order**

**For these reasons it is decided that:**

The appeal is dismissed.

The Registrar:

The Chairman:

G. Magouliotis

M. Ceyte