

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number:

0 399 400
A1

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: **90109458.1**

(51) Int. Cl.⁵: **B22F 3/26, B22F 7/00,**
F01L 1/14

(22) Date of filing: **18.05.90**(30) Priority: **26.05.89 IT 6740189**

(43) Date of publication of application:
28.11.90 Bulletin 90/48

(64) Designated Contracting States:
DE ES FR GB SE

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(54) **Process to manufacture a sintered metallic product and product thus obtained.**

(57) The process essentially consists in carrying out, successively, the following main operations :

- to manufacture a sintered substratum (12) which consists of a first metallic material with pores occupied by a second metallic material (10) .
- to lay at least one part of the sintered substratum (12) with a predetermined amount of a third pulverized "noble" metallic material (13); and
- to sinter the predetermined amount of the third material until a required degree of porosity is obtained.

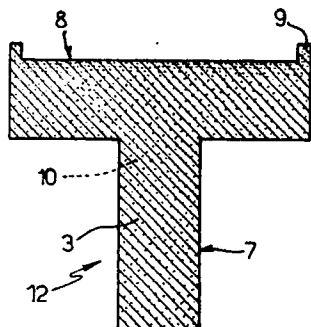


Fig.5

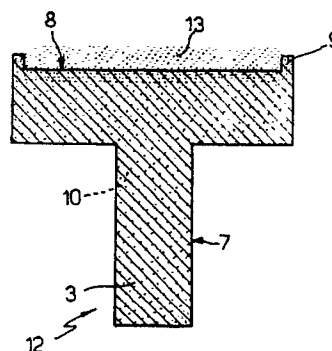


Fig.6

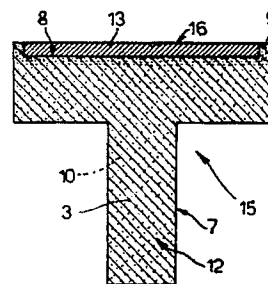


Fig.8

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PROCESS TO MANUFACTURE A SINTERED METALLIC PRODUCT AND PRODUCT THUS OBTAINED

The present invention relates to a process to manufacture a sintered metallic product and to the product thus obtained. Particularly, but not exclusively, the aforesaid invention consists of a lifter head for an internal combustion engine.

Preferably, lifter heads consist of a first base material layer which, in use, is joined to a respective shank by means of a conventional operation (welding, brazing, mechanical junction, etc.) and of a second layer, bound up with the first layer, which consists of a material so-called "noble" owing to its particular resistance to the abrasion resulting from the percussion, rolling and slip stresses owing to the cam which, in use, acts upon it.

Processes (plasma spray, transferred arc plasma, laser alligation, etc.) able to lay a base metallic material substratum with a layer of "noble" metallic material are known.

Although widely used, these processes are not without drawbacks. Actually the "noble" material laid onto the metallic substratum is prevented from undergoing the thermal contraction during the temperature decreasing phase. Therefore it is subject to internal tensile stresses and consequently susceptible of cracking .

The object of the present invention is to conceive a process and to manufacture a product able to obviate the aforesaid drawbacks of known processes and products .

Said object is attained according to the present invention by a process to manufacture a sintered metallic product, characterized by presenting, successively, the following main operations :

- to manufacture a sintered substratum consisting of a first metallic material with pores occupied by a second metallic material ;
- to lay at least one part of said sintered substratum with a predetermined amount of a third pulverized "noble" metallic material; and
- to sinter the predetermined amount of the third material until a required degree of porosity is obtained .

Said object is also attained according to the present invention by a sintered metallic product, characterized by comprising :

- a sintered substratum which consists of a first metallic material with pores occupied by a second metallic material; and
- a filling which consists of a third "noble" metallic material sintered on said substratum .

The present invention will be more apparent from the description of a preferred embodiment thereof given hereinafter by way of non-limiting example with reference to the accompanying drawings, in which figures 1 to 8 illustrate the succes-

sive phases of the process, and figure 8 particularly illustrates a section of an example of a product manufactured in accordance with the process of the present invention .

5 In figure 1 the reference numeral 1 indicates a mould provided with a cavity filled with a first metallic material 3, and the reference numeral 5 indicates a countermould presenting an annular recess 6 around it. According to the present invention, the material 3 essentially consists of a mixture of preliminarily premixed iron-base powders .

10 Figure 2 shows how the countermould 5 cooperates with the mould 1 to compact the metallic material 3 in order to obtain (figure 3) a matrix 7 with a concave housing 8 laterally delimited by an annular projecting part 9 .

15 Figure 4 shows how the housing 8 is filled with a second metallic material 10 which, in accordance with the present invention, consists of compacted copper or of a mixture of copper-based powders .

20 In figure 5, the matrix 7, which consists of the first material 3 and contains the second material 10 in its own housing 8, is subjected to sintering, preferably at a temperature of about 1120° C and in the presence of hydrogen, until the second material (copper or copper-base powders) diffuses into the first material (compacted mixture of iron-base powders) and completely impregnates it, that is to say, substantially occupying all the pore that the matrix 7 presented at the end of the compacting illustrated in figure 2 . In this way, we obtain a substratum 12 which essentially consists of an iron matrix (first material), the pores of which are completely saturated with copper (second material) .

25 Actually, as it is well known in the field of sintered materials, the fusion (or rather the diffusion and then the fusion) of the copper powder into the iron matrix enables to obtain a substratum substantially with no porosity whatsoever ; moreover the copper which is in the pores of the iron matrix favours the adhesion of subsequent fillings, according to the description hereinafter .

30 In figures 6, the housing 8 of the substratum 12 is filled with a third "noble" metallic material 13, and particularly able to resist abrasion stresses such as percussion, rolling, slip, etc.

35 Then the material 13 (see figure 7) is tamped and/or compacted by means of the mould 1 and a countermould 14 and then sintered .

40 In particular, during this latter sintering phase the mould 1 as well, as the countermould 14, are kept at a temperature substantially identical to the sintering temperature of the material 13 . In this

way, we obtain a product 15 (figure 8) without residual tensile stresses and therefore not susceptible of cracking .

Moreover, thanks to the presence of the copper which was impregnated the pores of the matrix 7, all the metallic material 13 stays within the housing 8 so as to fix a filling 16 which substantially consists of "noble" material only .

Preferably, the sintering of the "noble" material 13 is carried out so as to control the porosity of the filling 16, in order to be able to impregnate it later with lubricating oil (according to a conventional method) and therefore to make it self-lubricating .

The advantages of the process and the product provided in accordance with the present invention are therefore apparent from an examination of their characteristics .

In case the product 15 should be used as a lifter head for an internal combustion engine, it would fit all the best service requirements, such as :

- a good abrasion resistance of the filling 16, which entirely consists of self-lubricating noble material ; actually this noble material could not migrate into the substratum 12 during the respective sintering , the pores of the matrix 7 being impregnated by the second metallic material .
- a strong substratum 12 which can be conveniently joined to a respective support shank; and
- no predisposition whatsoever to cracking, thanks to the gradual and simultaneous cooling of the substratum 12 and the filling 16 .

Therefore it is reasonable to think that the sintered product obtained in accordance with the present invention also permits to make maintenance less frequent .

Finally, it is apparent that modifications can be brought about to the phases of the process and to the product 15 but without leaving the scope of the present invention .

Claims

1. Process to manufacture a sintered metallic product, characterized by presenting, successively, the following main operations :

- to manufacture a sintered substratum (12) which consists of a first metallic material (3) with pores occupied by a second metallic material (10) .
- to lay at least one part of said sintered substratum (12) with a predetermined amount of a third pulverized "noble" metallic material (13), and
- to sinter said predetermined amount of said third metallic material (13) until a required degree of porosity is obtained .

2. Process as claimed in claim 1, characterized in that said manufacturing of said sintered substra-

turn (12) essentially comprises the following phases :

- to provide a porous matrix (7) by compacting powders of said first metallic material (3) .
- to lay at least one part of said porous matrix (7) with a layer of said second metallic material (10) and
- to sinter said porous matrix (7) and said layer of said second metallic material (10) in order to obtain said substratum (12) .

3. Process as claimed in claim 1 or 2, characterized in that said sintering of said third metallic material (13) is carried out by substantially keeping a support body (5, 14) of said substratum (12) and third material (13) at a temperature identical to the sintering temperature of said third material (13) and in order to determine, once sintering is over, the same decrease of temperature in said substratum (12) and in said third material (13) .

4. Process as claimed in anyone of the previous claims, characterized by presenting, at the end of said sintering of said third material (13), an impregnation of a filling which consists of said third material (13) with lubricating oil .

5. Sintered metallic product characterized by comprising :

- a sintered substratum (12) which consists of a first metallic material (3) with pores occupied by a second metallic material (10) ; and
- a filling (16) which consists of a third sintered "noble" metallic material on said substratum (12) .

6. Product as claimed in claim 5, characterized in that said sintered substratum (12) presents a housing (12) within which said filling (16) is contained .

7. Product as claimed in claim 5 or 6, characterized in that said first metallic material (3) essentially consists of a mixture of iron-base powders .

8. Product as claimed in anyone of claims 5 to 7, characterized in that said second metallic material (10) essentially consists of compacted copper or of a mixture of copper powders .

9. Product as claimed in anyone of claims 5 to 8, characterized in that said filling (16) of said third metallic material (13) is impregnated with lubricating oil .

10. Product as claimed in anyone of claims 5 to 9, characterized by presenting the structure of a lifter head for an internal combustion engine .

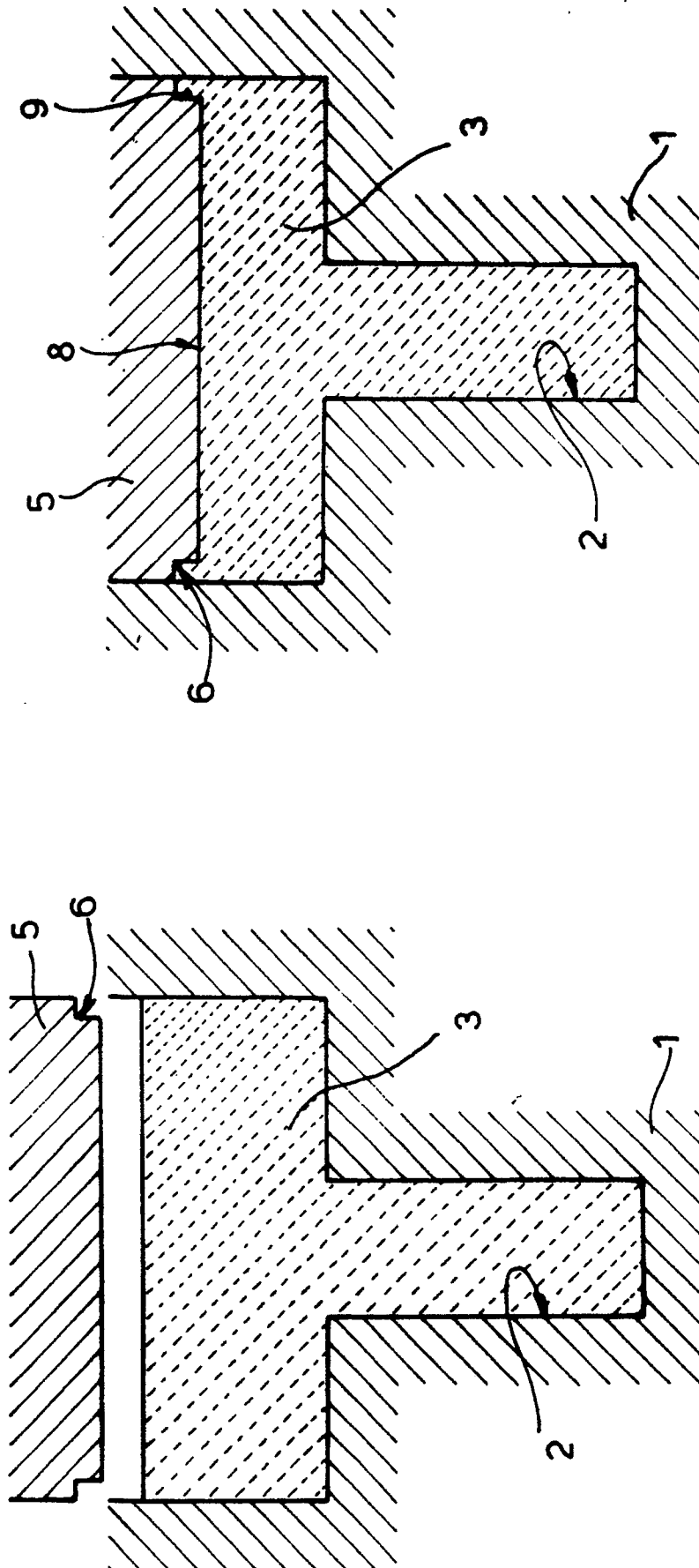


Fig. 2

Fig. 1

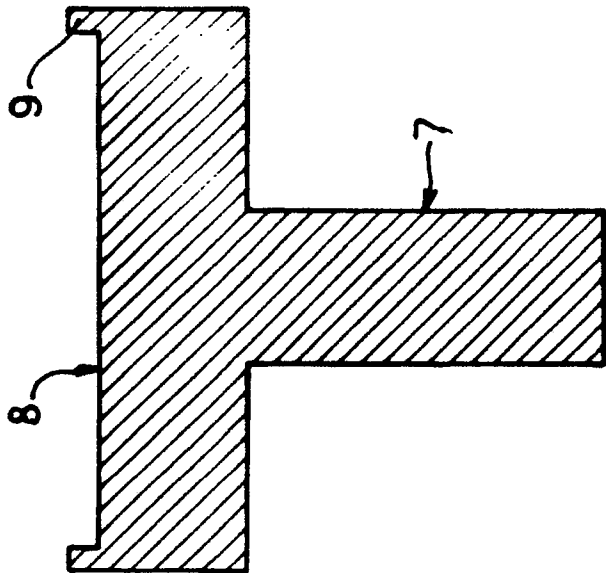


Fig. 3

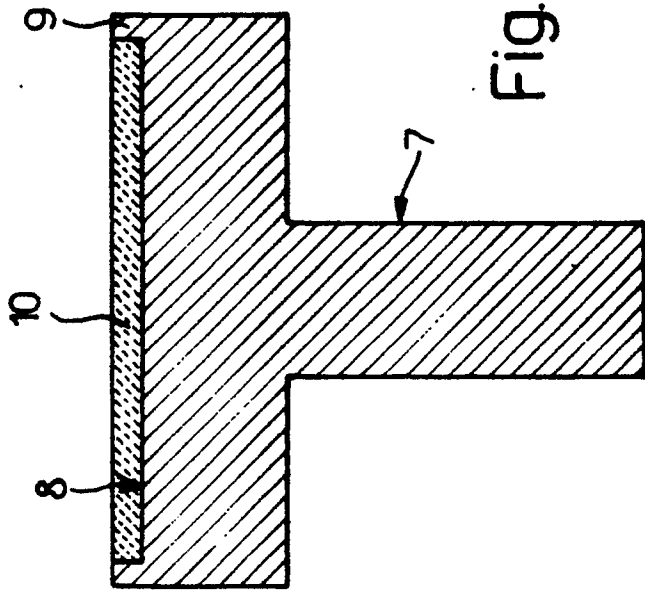


Fig. 4

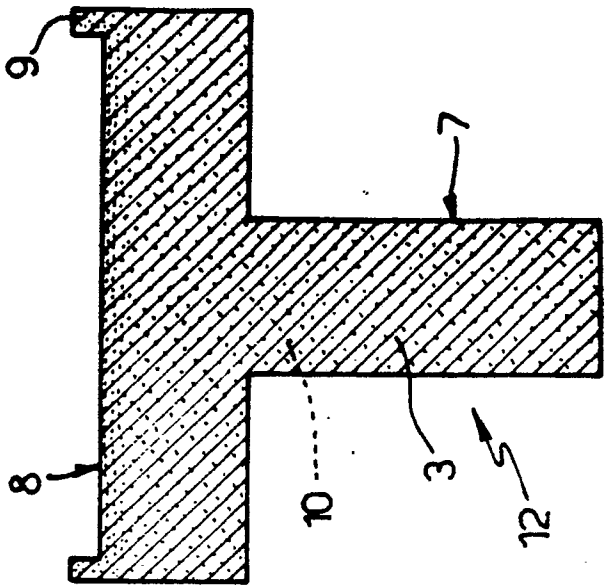


Fig. 5

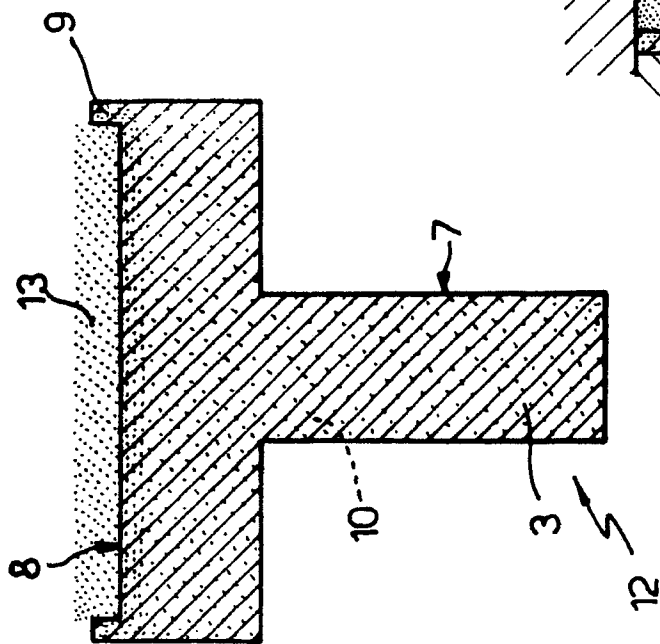


Fig. 6

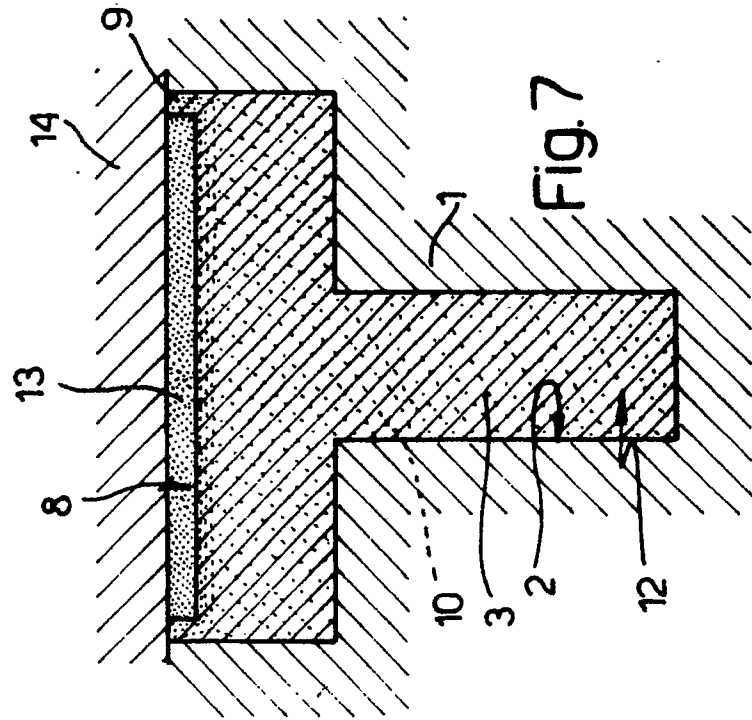


Fig. 7

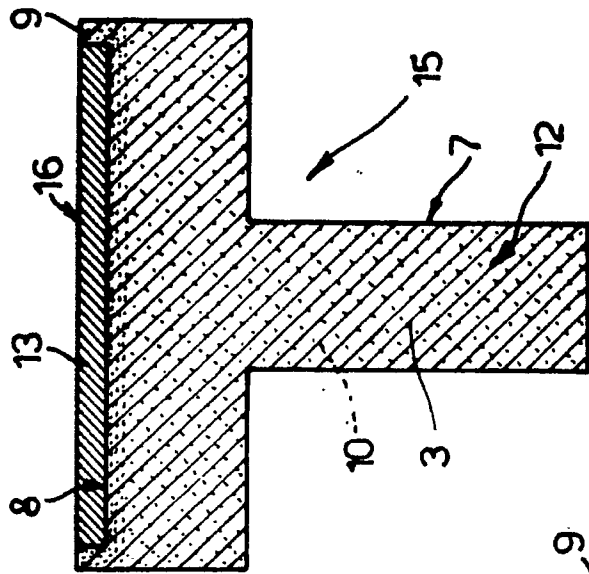


Fig. 8



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EUROPEAN SEARCH REPORT

Application Number

EP 90 10 9458

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	GB-A- 544 903 (GENERAL MOTORS) * Claim 1; page 2, lines 75-95 * ---	1-10	B 22 F 3/26 B 22 F 7/00 F 01 L 1/14
Y	GB-A- 960 479 (VARTA) * Claims 1,2,10 * ---	1-10	
A	WO-A-8 304 382 (FORD) * Claim 1; page 4, line 19 - page 8, line 9 * ---	1-10	
A	GB-A-1 106 864 (PHILIPS) * Page 1, line 57 - page 2, line 4 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B 22 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-08-1990	Examiner SCHRUIERS H.J.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			