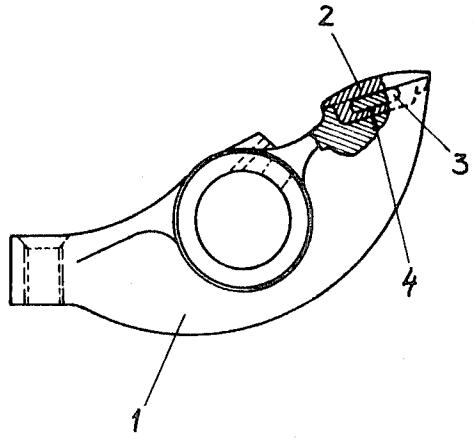
Aug. 17, 1971 R. RAVENEL 3,600,238

METHOD OF MANUFACTURING A COMPOSITE PART

Filed June 18, 1968



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United States Patent Office 3,600,238
Patented Aug. 17, 1971

3,600,238

METHOD OF MANUFACTURING A COMPOSITE PART

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Filed June 18, 1968, Ser. No. 737,992
Claims priority, application France, June 30, 1967, 112,603
Int. Cl. B22d 25/00; C21d 5/00
U.S. Cl. 148—3 7 Claims

ABSTRACT OF THE DISCLOSURE

A method of manufacturing composite bodies comprising making a first part from cast iron containing spheroidal graphite and a second part from self-hardening cast iron, casting one of the parts in or on the other part and applying heat to the combination of the two parts.

The present invention concerns the manufacture of composite bodies comprising at least two parts which are required to have different, and frequently incompatible, mechanical properties, for example machinability and increased toughness for one part, and an excellent wear resistance for the other part.

To obtain composite parts of this type, it is known to provide a cast core and to apply surfrace treatment to this core by induction or by heating, but this treatment is generally very difficult to carry out, because of the limited accessibility of the zone to be treated.

The present invention has for an object the manufacture of such composite bodies by an improved, single process.

The method according to the invention consists in making a part from cast iron or steel containing spheroidal graphite and a second part from self-hardening cast iron or steel, casting one of the parts in or on the other, and applying a heat treatment to the combination of the two parts.

The method according to the invention may be used whenever it is required to manufacture a mechanical part wherein two elements should have distinct mechanical properties which may be incompatible, for example a fork for gear boxes, but is suitable in particular for the manufacture of rocker arms, such as those used in high-speed motors, particularly in motors with overhead cam shafts.

The sole figure of the accompanying drawing is an elevational view, partly in section, of a rocker arm adapted to be made by the method according to my invention.

The rocker arm shown in the drawing comprises a readily machinable body **1** and a shoe **2** having an excellent resistance to wear.

The shoe **2** is made by casting in a lost-wax mold a mass of cast iron having one of the following compositions:

	Percent				
	Composition A	Composition B	Composition C	Composition D	Composition E
C	3.0–3.20	3.0–3.20	3.0–3.20	3.0–3.20	3.0–3.20
Si	1.9–2.20	1.9–2.20	1.9–2.20	1.9–2.20	1.9–2.20
Mn	0.70–0.90	0.70–0.90	0.70–0.90	0.70–0.90	0.70–0.90
Cr	1.10–1.30	0.60–0.80	1.10–1.30	1.10–1.30	1.10–1.30
Mo	0.30–0.80	0.30–0.80		0.30–0.80	0.30–0.80
Cu	1–1.6			0.60–1.20	
Ni		1–16	1.4–1.6	0.3–0.8	1–1.6
B		0.10			
W			0.6–1.8		
P	<0.20	<0.20	<0.20	<0.20	<0.20
S	<0.10	<0.10	<0.10	<0.10	<0.10

while controlling the percentage content of carbon and silicon of the cast iron in such a way as to obtain a laminary structure of mixed carbides and graphite. The shoe has a projection **3** provided with an anchoring aperture **4**. The shoe is then placed in a mold for the body **1** and into this mold is poured, at, for example, 1400–1450° C., a cast iron or steel containing a spheroidal graphite having the following composition:

C=3.3–3.8 percent
Si=2.0–3.0 percent
Mn=0.4–0.8 percent

The cast composite part is finally treated by heating for one or two hours at 900° C.±20° C., cooling in the furnace to 800° C.±20° C., maintaining this temperature for about fifteen minutes, and hardening in still air or in blown air.

The body **1** of the finished rocker arm has a hardness less than or equal to 100 HR_B while the shoe **2** has a hardness greater than 55–56 HR_C.

The present invention also has for its object, by way of new industrial products, composite bodies, particularly rocker arms for motors with overhead camshafts, manufactured by the described process.

Naturally the invention should not be considered as limited by the embodiment described and shown but covers, on the contrary, all variations coming within the scope of the appended claims.

I claim:

1. A method of manufacturing a composite body including an easily machinable first part and a highly wear-resistant second part, comprising the steps of:
forming said first part from cast iron containing spheroidal graphite and consisting essentially of 3.3% to 3.8% carbon, 2.0% to 3.0% silicon and 0.4% to 0.8% manganese, balance iron;
forming said second part from self-hardening cast iron consisting essentially of 3.0% to 3.2% carbon, 1.9% to 2.2% silicon, 0.7% to 0.9% manganese, up to 1.3% chromium, up to 0.8% molybdenum, up to 1.6% copper, up to 1.6% nickel, up to 1.8% tungsten, up to 0.2% phosphorus, up to 0.1% sulphur, up to 0.1% boron, balance iron;
forming a composite body from said parts by casting one composition into contact with the other;
heating said body for about 1 to 2 hours at a temperature of 900° C.±20° C.;
cooling said body to a temperature of 800° C.±20° C.;
maintaining said body at the last-mentioned temperature for about 15 minutes;
and cooling said body in air.

2. A method as defined in claim **1** wherein said second part has a chromium content of 1.1% to 1.3%, a molybdenum content of 0.3% to 0.8% and a copper content of 1.0% to 1.6%, with substantially no nickel, boron and tungsten.

3. A method as defined in claim **1** wherein said second part has a chromium content of 0.6% to 0.8%, a molybdenum content of 0.3% to 0.8%, a nickel content of 1.0% to 1.6% and a boron content of substantially 0.1%, with substantially no copper and tungsten.

4. A method as defined in claim **1** wherein said second part has a chromium content of 1.1% to 1.3%, a nickel content of 1.4% to 1.6% and a tungsten content of 0.6% to 1.8%, with substantially no molybdenum, copper and boron.

5. A method as defined in claim **1** wherein said second part has a chromium content of 1.1% to 1.3%, a molybdenum content of 0.3% to 0.8%, a copper content of 0.6% to 1.2% and a nickel content of 0.3% to 0.8%, with substantially no boron and tungsten.

6. A method as defined in claim **1** wherein said second part has a chromium content of 1.1% to 1.3%, a molyb-

denum content of 0.3% to 0.8% and a nickel content of 1.0% to 1.6%, with substantially no copper, boron and tungsten.

7. A method as defined in claim 1 wherein said first part is cast upon said second part.

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29—196.1; 148—34, 35, 127, 138