WEAR RESISTANCE OF SHOTCLEANER BLADES

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Shotcleaning is used for forgings and castings during forging and heating as well as in foundry production.

The main working elements of shotcleaners are the impeller blades, the working life of which depends on the wear resistance of the material. According to data from the Gor'kii Automobile Plant, the number of blades used in 10 months in 1966 was 11,500 (each weighing 1 kg), which amounts to 0.1% of the material treated.

The purpose of this work was to find the most wear resistant blade material and the heat treatment providing the longest service life in order to reduce the blade expenditure per ton of material treated, i.e., reduce production costs.

The study was made with the DK-4 apparatus, which has a 10 kW motor turning at 1500 rpm, with the shaft of the wheel turning at 3000 rpm. The shot used in the tests were No. 2.5-3 (GOST 11964-66).

The blades were cast in green molds. The metal was melted in a 100-kg high-frequency electric furnace with an acid lining.

The geometrical dimensions of the blades met the VNIINMASh specifications and GOST 8665-66 standards.

The chemical composition, wear resistance, and hardness of the blade materials are given in Table 1.

The blades were heat treated in a gas-fired chamber furnace with automatic temperature control. The floor area

TABLE 1

Material	Composition, %										HRC	Composition, %	Mean wear coefficient in relation to steel 10G13L
	C	Si	Mn	Cr	Ni	P	S	V	Ti	Mo	B		
Cast iron Kh4B. .	2,4–2,7	0,90–1,20	0,60–0,90	3,50	0,10–0,30	0,10	<0,12	–	0,08–0,15	–	0,20–0,30	49–50	0,35
												58–63	0,50
Sormite No. 2V.	1,5–2,0	1,50–2,20	0,70–1,25	14,0–18,0	2,20–3,50	<0,07	<0,05	–	–	–	0,2–0,4	48–54	2,78
												56–63	6,57
Cast iron Kh20V.	1,90–2,40	0,40–1,00	0,60–0,90	20,0–25,0	–	0,10–0,18	<0,12	0,20–0,30	–	–	–	49–50	2,64
												62–65	6,42
Cast iron 1	3,25–3,50	0,50–1,25	0,30–0,50	15,0–15,5	0,25	0,04–0,08	<0,05	0,90–1,30	0,50–0,75	1,30–1,75	–	49–52	–
												61–65	20,21
Cast iron 2	1,60–2,00	0,75–1,50	0,60–1,00	1,30–1,60	0,30	0,03–0,04	0,02–0,06	0,90–1,25	0,50–0,75	1,50–1,75	–	48–51	1,23
												49–52	3,28
Steel 10G13L. . .	0,90–1,30	0,40–1,00	11,50–14,50	<0,50	<0,50	<0,10	<0,05	–	–	–	–	*HB* 180	–
													1,00

Note: The data in the numerators and denominators are before and after heat treatment. Steel 10G13L was water quenched from 1050-1100°C.

TABLE 2

Blade material	Heating conditions for quenching in oil				Tempering conditions	
	furnace temperature (°C) at time of loading	heating rate, deg/h	heating temperature, °C	holding time, min	temperature, °C	holding time, h
Cast iron KhChB . .	200	100	1050—1100	30—40	180—200	2
with boron						
with titanium . . .	300	80—100	880—900			
Cast iron 2.	700	100	1100	120	180	2

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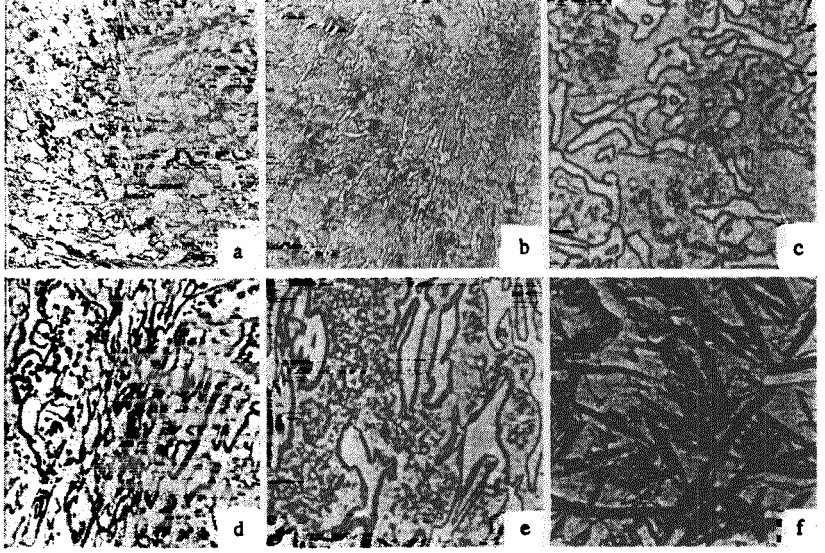

Fig. 1. Microstructure of blade materials after heat treatment (× 270): a) cast iron KhChB with boron; b) cast iron KhChB with titanium; c) Sormite 2V; d) cast iron Kh20V; e) cast iron 1; f) cast iron 2.

of the furnace was 2.2 m^2, the height of the working space 0.6 m; the charge weighed 700-750 kg; the output was 90-100 kg/h; the heating rate of the blades was 1.6 deg/min.

The blades of chromium cast iron KhChB and low-carbon chromium cast iron 2 were heat treated under the conditions given in Table 2.

The blades cast from Sormite 2V, chromium cast iron Kh20V, and cast iron 1 alloyed with chromium were heat treated under the following conditions. The furnace temperature when the blades were loaded was 700°C, the heating rate was 100 deg/h; the blades were heated to 1100°C and held 120 min, then cooled to room temperature.

The microstructure of the blade materials after heat treatment under the conditions given in Tables 1 and 2 is shown in Fig. 1.

The etchant was nital (3% nitric acid with sp. gr. = 1.19).

Wear resistance tests of the blades in the DK-4 shotcleaner in the heat treatment shop gave the following results:

1. As cast, the blades of chromium cast iron KhChB had a service life of 5 h. The heat treatment indicated in Table 2 increased the service life to 7 h.

2. The heat treated blades of cast iron 2 alloyed with chromium had a service life of 42-49 h.

3. As cast, the service life of Sormite 2V blades was 35-42 h.

4. The service life of heat treated Sormite 2V and chromium cast iron Kh20V blades was 84-100 h.

5. The service life of heat treated blades of cast iron 1 alloyed with chromium was 266-300 h (38-42 work shifts).