POWDER METALLURGY INDUSTRY, ECONOMICS, AND ORGANIZATION OF PRODUCTION

A VACUUM CHAMBER FOR THE PA-803 HOT-PRESSING PRESS

M. M. Kulakov, A. E. Aleksanov, V. I. Strel'ov, S. I. Faifer, S. M. Zhdanov, and V. G. Lisovets

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The PA-803 40-ton hydraulic hot-pressing press is at present widely used in industry. When parts from refractory materials are produced in this press, to minimize heat losses its working space is protected by graphite shields, which in turn are surrounded by asbestos insulation. Into the working zone — the space containing the die and the heating element — is supplied nitrogen to generate a protective atmosphere. With the existing design of the press, however, oxygen from the surrounding atmosphere cannot be completely prevented from entering the working zone during hot pressing. As a result, the surface of the graphite components rapidly char, become porous, and crumble, which may lead to contamination of parts being pressed. In view of this, the potentialities of the press cannot be fully utilized, and refractory materials of low oxidation resistance cannot be pressed in it.

A description is given below of a special chamber for the PA-803 press, which enables the latter to be employed for the hot pressing of parts in a vacuum or in any controlled atmosphere.

Figure 1 shows a cross section through the vacuum chamber of the press. The chamber consists of the water-cooled stainless steel body 10, the compensator 5 with a bellows unit, and the flange 2, which forms the base of the body when the latter is hermetically sealed. The lower water-cooled contact plate 12 and its graphite cone are insulated from the moving cross-bar 1 and sealed with rubber washers. To the compensator, through the upper contact plate 9, is attached the body of the chamber by means of studs. To maintain the body at the required height above the lower cross-bar, the chamber is provided with the supports 8, which act also as guides for the body during its upward travel in the course of pressing. The compensator, having the potential of the contact plate, is insulated from the upper cross-bar 7 by a ring housing the device 6, which sends a signal to the control desk when pressing begins. When the die 3 and the punch are replaced, the main rod 4 remains centered in the upper cone, the same rod being used for pressing parts of various diameters. The heating element 11 is in the form of a cylinder with slightly thicker ends to make good contact with the current supplying cones. For measuring the pressing temperature, the shields and the heating element are provided with openings, while the body has an inspection window with a protecting cover.

The diagram in Fig. 2 helps to explain the operation of the modified press. Initially, while the die is still outside the chamber 5, the middle cross-bar is in its lowest position. The distance between the upper and middle cross-bars can be regulated by means of stops mounted on columns. The supports hold the body on the column stops, and a gap forms between the body and the system of shields. The powder to be pressed is poured into the die, which, depending on the compact diameter and height, may be single- or double-ended. To increase the productivity of the hot-pressing process, it is in many cases possible to employ dies possessing more than one cavity, two tablets separated by graphite plates being pressed in each cavity. The die and punches are made of MPG-6 and MG-3 graphite grades. The poured powder is first densified, after which the heating element is put on the die and, together with it, placed in the centering grooves in the lower disk of the system of shields (Fig. 1). The hydraulic drive 8 is switched on, and the flange with the shields rises up to the body and lifts it slightly above the initial position of the supports, thereby sealing the chamber. The chamber is evacuated with the mechanical pump 1 through the water-cooled trap 4, a valve, and a by-pass line, and then with the high-vacuum unit 2 to a residual pressure of \( 2 \times 10^{-5} \) mm Hg. The pressure in the system is measured with the thermocouple and ionization gauges 3.

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Fig. 1. Vacuum chamber. For description see text.

Fig. 2. Operating diagram of press. For description see text.