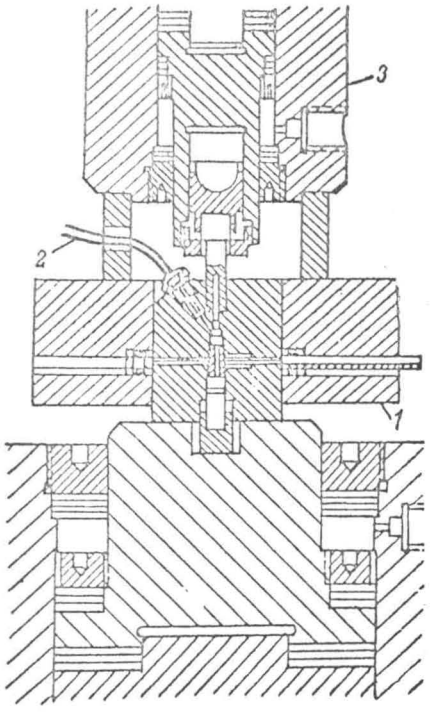

Fig. 1. High-pressure chamber for x-ray diffraction (1); with a manganin manometer (2); in the multiplier (3).

Cohn [4] was the first to propose the application of x-ray diffraction to the investigation of substances under pressure, in 1933. In 1939, Jacobs [5] determined the compressibility of two metals by this method. His apparatus made it possible to obtain a rather complete diffraction pattern of the metal, but the pressure range was narrow (up to 4500 kg/cm^2), the apparatus was cumbersome, and its operation was complicated [6].

Lawson and Riley [7], working with beryllium containers, succeeded in increasing the hydrostatic pressure up to 10,000 kg per cm^2. Unfortunately, in this case the quality of the x-ray diffraction patterns deteriorated due to the presence of a strong background and of wide dark beryllium bands. Lawson et al. [7, 8] later increased the pressure limit even more by using diamond chambers. However, in this case the pressure in the sample, essentially nonhydrostatic, had to be calculated by taking friction into account. The fact that the pressure is not well defined, and is not hydrostatic, renders this method unsuitable for determining the effect of pressure on compressibility, although it is quite convenient for the investigation of polymorphic transformations.

We investigated two metals: strontium and barium. We chose these metals because they are highly compressible and, consequently, considerable displacement of diffraction lines under the effect of pressure could be expected. Furthermore, these metals give sufficiently clear diffraction patterns when photographed in beryllium pressure chambers.

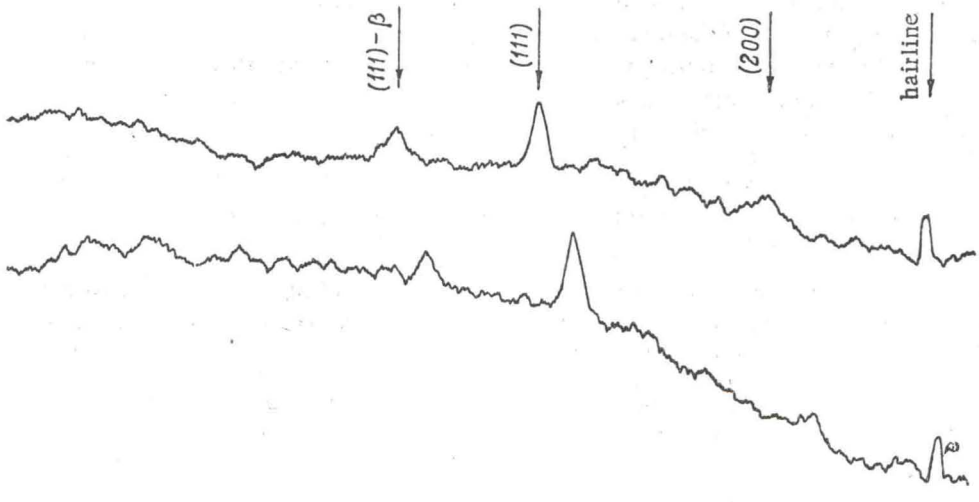

Fig. 2. Photogram of two strontium patterns obtained without pressure (upper curve), and under a pressure of 11,400 kg/cm^2 (lower curve).

Compression chambers of special construction were used for determining the compressibility of each of these metals by x-ray diffraction.

In the case of strontium, we used a compression chamber described earlier [9]. The chamber and its support are represented in Fig. 1; in this apparatus, benzine was used as the pressure-transference medium and the pressure was measured with a manganin manometer. The sample was placed in a conical beryllium container which was pressed into a steel chamber with a slit for the passage of diffracted rays. The cone-shaped chamber was, in turn, pressed into a massive steel support. The casette with the film was introduced in a special slot in the support.