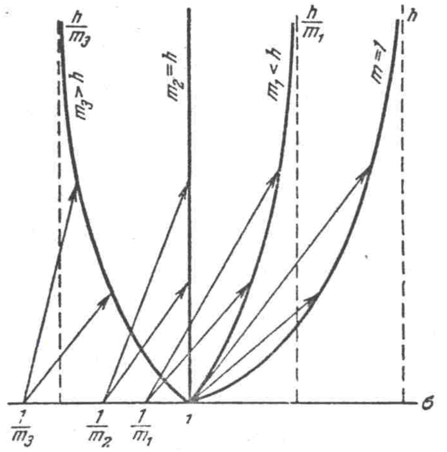

FIG. 4. Shock adiabats of samples with different initial porosity $m_3 > h$, $m_2 = h$, $m_1 < h$, and $m = 1$. The initial relative densities are $1/m_3$, $1/m_2$, $1/m_1$ and 1; the limiting compressions are h/m_3, h/m_2, h/m_1 and h and are denoted by dashed vertical lines; for $m_2 = h$ the vertical line and the dynamic adiabat coincide with the ordinate axis.

above the "solid" ones. Their equation for constant γ is similar to (4), in which v_0 in the denominator is replaced by v_{00}. Obviously, in this case the pressures become infinite at specific volumes $v = m(v_0/h)$—at the limiting degrees of compression $\sigma = h/m$.

A schematic diagram of the compression of porous samples, taken from [87], under the assumption that h is constant, is shown in Fig. 4. The abscissas show the degrees of compression and the ordinates the pressures.

If the porosity m is smaller than h, shock compression increases the density. When $m > h$, the final density of the medium decreases with increasing pressure, remaining always smaller than the normal density of the solid substance. If $m = h$, any pressure reduces a porous medium only to the normal density of the solid state. In this case the shock adiabat is represented by a vertical line coinciding with the pressure axis. The configuration of porous adiabats is a very sensitive indicator of the thermodynamic characteristics of the medium.

Comparison of the adiabats of the solid substances and of the substance which has low porosity in the initial state makes it possible to determine the parameter γ experimentally. As follows from Fig. 3, for compression to an equal volume, the difference in the thermal pressures ΔP_t is explained by the difference in the heat energies

$$\Delta E_t = \frac{1}{2}\left[P_2(v_{00} - v) - P_1(v_0 - v_1)\right].$$

The sought value of $\gamma(v_1)$ is obtained from the ratio $v_1 \Delta P_t(v_1)/\Delta E_t(v_1)$.

The development of dynamic methods started independently in the USA in 1944 by Goranson (see [21,28]) and in the Soviet Union in 1947—48 by the author of

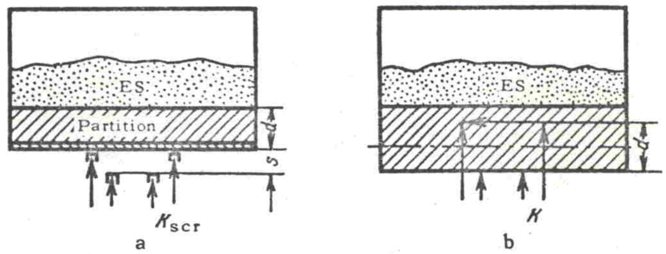

FIG. 5. Scheme for measuring: a) mass and b) wave velocities in partitions. S — for measurement of the velocity of the free boundary; d — base of measurement of wave velocity; K — contact making pickups; K_{scr} — pickup with a screen protecting the contacts from prior closing by the shock wave in air.

this review, Tsukerman, Krupnikov, and Kormer (see [36,38]). Research of similar character was undertaken by Baum, Stanyukovich, and Shekhter [33].

To carry out measurements with the aid of shock waves, the experimenters had to determine their wave and mass velocities. Registration of wave velocities with pickups placed on the path of the wave motion does not entail any difficulty in principle. Direct observation of mass velocity, on the other hand, is in most cases impossible. Up to the relatively low pressures of some several hundred thousand atmospheres, which are produced when detonation waves are reflected from partitions, the mass velocities were determined from the velocity of motion of the free boundary of the partition—after the emergence of the shock wave from the latter [28,36] (Fig. 5).

Layers adjacent to the free surface go into motion under the influence of two different processes—shock transition from the state $P_0 = 0$, v_0 into the state P_1, v_1 (see Fig. 2) and subsequent isentropic expansion in the reflected rarefaction wave to a state $P = 0$, $v_0' > v_0$.

In spite of the difference in the processes, we can assume with good approximation that so long as $U \ll D$

$$W = 2U. \tag{5}$$

The registration of higher pressures calls for introducing calculated corrections to take into account the deviation from the doubling law.

A method whose starting premises are perfectly rigorous is the "deceleration" method developed in the Soviet Union by the authors of [36] in the late Forties to obtain and to investigate the pressure of several million atmospheres. The experimentally measured quantities in the decleration method are the velocity W_s of a striker accelerated by the explosion products until it strikes a target of the investigated material, and the velocity D of the shock wave in the target (Fig. 6).

The deceleration of the striker by the investigated partition produces two waves of equal pressure, propagating in both sides of the collision surface. The velocity U of this surface after the shock is the