Loading by detonating a sheet explosive charge is widely used in practice in explosive experiments. This includes, for example, hardening and explosive welding [1], and the investigation of spallation damage in metals [2-4]. Combining this simple method for loading with a calculation of the flow of the stressed material has provided comparative results on the spallation damage in a number of metals and polymers, which, in their turn, can be compared with results obtained with other conditions of pulsed mechanical loading (detonation of a block explosive, impact by a plate).

The setup of the experiments involving loading of plates by a detonation of a sheet charge of plastic explosive and the wave propagation that is realized with such a scheme are presented in [2]. The metal samples studied were cut out of corresponding rod-shaped materials and plastics were cut out of sheets. The dimensions of the stressed surfaces were chosen sufficiently large in order to eliminate the effect of lateral loading and the initial nonstationary loading zone on the process of spallation. The loading charge was initiated by a linear detonation wave generator consisting of a perforated plastic explosive [5]. After loading, the nature of the spallation damage was observed visually and the thickness of the spalled layer was measured.

The flow field in the detonation products and in the stressed materials was computed numerically by the method of characteristics. The computational method used is described in detail in [6, 7]. The expansion isentropes of the detonation products were assumed to follow a cubic polytropic curve, the equation of state of the materials investigated without taking into account the effects of strength and change in entropy along the shock-wave front were assumed to be known linear $D-u$ relations between the wave and mass velocities, and, in addition, it was assumed that they could be extrapolated to negative pressures. In the calculations, we determined the maximum negative pressure $p$ in a plane corresponding to fracture failure and the pressure gradient $\Delta p/\Delta l$ in the stretching pulse, whose shape in this case was nearly triangular. These parameters, characterizing the failure-inducing stretching pulse, were successfully compared in [8] in stressing a number of metals by detonating a block explosive.
Figure 1 shows the computed dependence of the velocity of the free surface of an aluminum plate loaded by the detonating sheet charge as a function of the dimensionless thickness of the plate $h_2/h_1$ ($h_1$ is the thickness of the explosive layer, $h_2$ is the thickness of the aluminum plate) and the results of measurements of the velocities of thin artificial spalls (AMts aluminum alloy 1 [2], AMg aluminum alloy 2 [3]). The satisfactory agreement between the computed and experimental results indicates the possibility of using the computational method used for plastic metals and polymers. In the case when metals that have significant shearing strength are stressed, the shock wave propagating through the material will be more intensely damped and the calculation can only estimate the upper limit for the amplitude of the shock wave reaching the free surface of the plate.

Figure 2 shows the results of experiments with Adl aluminum ($h_3$ is the thickness of the first spalled layer (the average value of the thickness determined by not less than 10 measurements), measured here for values of $h_2$ equal to 2 mm (1), 4 mm (2), 8 mm (3), 12 mm (4) and in the absence of visually observable separation (5)), indicating the existence of a scale effect for spallation of aluminum, also observed in experiments on the collision of aluminum plates [9, 10]. A similar effect was also observed for other materials investigated in this work. The values of $h_3$ obtained by linear extrapolation, corresponding in Fig. 2 to the absence of visually observable separation of layers, correspond to sections that are more susceptible to spallation. This is supported by a more detailed examination of microsections using a microscope. In Fig. 3a ($h_1 = 0.34$ mm, $h_2 = 8$ mm), a spallation damage zone that has already been completely formed is observed in the sample, although separation of layers, i.e., spallation, occurs only with subsequent increase in the load intensity [Fig. 3b ($h_1 = 0.37$ mm, $h_2 = 8$ mm)].

The starting data used in the calculations and the range of the measured values of $h_1$ and $h_2$ are presented in Table 1 ($\rho$ is the density, $c_0$ and $\lambda$ are the coefficients in linear D-u relations), and the results of a numerical analysis of the experimental data are presented in Fig. 4 (the numbers in Fig. 4 correspond to the numbers of the materials in Table 1) in the variables $\sqrt{\Delta p/\Delta T}$, $p$. The choice of variables stems from an attempt to systematize the results obtained using the energy criteria for spallation damage presented in [11], which consist of an energy balance equation for failure. In application to the results of the present work, the