An experimental study was made of some schemes for flow around multiwedge bodies at supersonic flow velocities. On the basis of data on the distribution of the pressure, on visualization of the flow, and on optical measurements, an analysis was made of the structure of the flow. Zones of breakaway of the flow were observed at the lateral surfaces of the lobes. In the nose part of a multiwedge body there is a three-dimensional configuration of attached plane shock waves, going over into a combined detached nonaxisymmetric wave directed toward the base of the body.

After the first articles [1-3] with the solution of the problem of the decrease in the resistance and the increase in the lifting force, there appeared a number of publications [4-17], devoted to the investigation of flow around three-dimensional conical and nonconical bodies with attached shock waves, developing this tendency. These investigations showed that flow around an element of a pyramidal body with plane surfaces, with a special choice of the geometry and of the Mach number, will take place with a plane shock wave located at the leading edges. The possibility of the realization of a flow with reflected shock waves, normal to the faces of the pyramidal body due to the choice of the form of the leading edge, was pointed out in [5].

In accordance with exact solutions obtained for flow schemes with regular [4] and Mach [6] interactions of the shock waves, pyramidal bodies of star-shaped cross section were constructed. Experimental confirmation of the proposed interactions of the shock waves and an analysis of possible flow schemes are given in [11-13] for models of the elements of a star-shaped body and of V-shaped airfoils, from which pyramidal bodies can be built up.

The flow schemes considered in [1-6] were calculated for a weak plane shock wave. The flow in a two-faced angle with a plane shock wave, corresponding to a strong shock wave at a wedge in a plane perpendicular to the leading edges, has been obtained theoretically [9] and experimentally [10]. The realization of flow in an angle with four plane shock waves intersecting along a single straight line has also been demonstrated; here shock waves reflected from this line in a direction perpendicular to it correspond to a strong shock wave reflected from a wall.

In [1-13] a study was made of flow around bodies of star-shaped cross section, having the property of homothety. For practical use of a pyramidal body as the nose part of a flying apparatus, its form must be changed in such a way that it can be connected to a fuselage in the form of a body of revolution, retaining the effect of the splitting of the shock wave into a system of interacting shock waves. In this case, bodies are obtained, the form of whose transverse cross sections are not similar, while the base is close to circular. The windward surface of a multiwedge body with swept-back leading edges of the lobes $\chi$ is made up of elements of the planes

$$xx_0 - yy_0 \pm zz_0 = 0$$

$$x_0 = \cos \frac{2n\pi}{n} - \tan \delta \tan \chi \cos \left(\frac{2m+4}{n}\right) \pi, \quad y_0 = \sin \frac{2n\pi}{n} - \tan \delta \tan \chi \sin \left(\frac{2m+4}{n}\right) \pi, \quad z_0 = \tan \delta \sin \frac{n}{n} \pi$$

Here $\delta$ is the angle formed by the line of intersection of the planes of adjacent lobes and the axis of the body; $n$ is the number of lobes. The upper and lower signs in front of the terms of an equation relate
respectively, to the right- and left-hand surfaces of a lobe (along the direction of the flow) with respect to the plane of its symmetry. The surface of a lobe in the length $L \tan \delta \tan \chi - L$ ($L$ is the length of the model), in addition to the windward part, is formed by the lateral wall

$$x \sin (\delta m + 1) \frac{\pi}{2n} + y \cos (\delta m + 1) \frac{\pi}{2n} - L \tan \delta \cos \frac{\pi}{2n} = 0,$$

$$m = 0, 1, 2, \ldots, (n - 1)$$

In accordance with the construction of a multiwedge body, its axis and the planes of the lateral walls of the lobes are parallel.

To solve the problem of flow around conical nonaxisymmetric bodies, successful use has been made of a number of methods, for example, exact solutions [3, 4], hypersonic approximations [19], and numerical solutions [7]. For multiwedge bodies, as a result of the complex structure of the flow with a transition from a system of interacting shock waves to a single detached wave, and with the presence of a breakaway zone, up to the present time there are no theoretical solutions.

Tests were made of models of multiwedge bodies with the parameters $n = 3, 4, 6, 8; \chi = 0, 20, 40, 60,$ and $77^\circ 30'; \delta = 12^\circ 30'$ (20 models). The leading edges of the lobes were made sharp to achieve flow with an attached shock wave. The length of the models $L = 180$ mm. Drainage openings with a diameter of 0.7 mm were arranged in cross sections perpendicular to the axis of the multiwedge body. To monitor the position of the models with respect to the angle of bank, several symmetrical openings were made in the surfaces of adjacent lobes. The experiments were made in an aerodynamic tube at Mach numbers of 2.5, 4, 6, and 7.8 and Reynolds numbers of $4.2 \cdot 10^8$, $2 \cdot 10^8$, respectively (the Re number is referred to the length of the model). The value of the pressure at the drainage points was recorded with a GRM-2 instrument. The mean-square error in measurement of the coefficient of the pressure $C_p$, taking account of the inaccuracy in determination of the Mach number, did not exceed 3%.

During the course of the experimental investigations, the main stress was laid on study of the flow in the rear part. The drainage of the models in the length $0 - L \tan \delta \tan \chi$ was more widely spaced in view of the fact that the flow around the leading part is analogous to that around pyramidal bodies [11-13]. The results of the investigations were brought down to three-dimensional representations of the distribution of the coefficient of the pressure over the windward and lateral surfaces of the body. Qualitatively, the results of tests for a number of models are similar to the data for a multiwedge body (Fig. 1, $n = 6, \chi = 0, M = 4$, shows half of a lobe; 1 is the axis of the body; 2 is the line of intersection of the planes of the windward sides; 3 is the line of intersection of the planes of the windward and lateral sides; 4 is the line of intersection of the planes of the lateral side; 5 is a side of the polygon at the base of the body). In the region bounded by the leading edge of a lobe, the line of intersection of the surfaces of the windward sides, and Mach lines (dotted lines), constructed from the flow parameters behind the first and the reflected shock waves, the representation of the distribution of the coefficient of the pressure consists of two zones of constant pressures with a stepwise transition from one to the other, along the wake of the reflected shock wave (double dotted line).