The most economically efficient method of mining is the open-cut system. This devolves much importance onto continuous mine transportation equipment, including rotary excavators for stripping and extraction. Little experience has been gained in the USSR in the planning and use of rotary excavators, and the laws governing excavation by rotary cutting heads have been little studied.

To establish an efficient type of cutting band for the shovels of rotary strippers, to determine the best operational conditions for their cutting heads, and to improve the method of determining the rated cutting force and the power of the rotor drive-motor, during 1960-1964 the TsNIIS Gostransstroi Institute has been carrying out research consisting of tests on the RV-2 rotary excavators of the Chasov-Yar Refractories Products Trust and the ĖRG-350/1000 machine of the Donetsk Fifteenth-Anniversary LKSMU Factory. Below we give the chief results of these tests.

All known types of rotary bucket excavators can be divided into three main groups, according to the shapes of their cutting bands: these are rectangular, trapezoidal and arched. The choice of bucket configuration, including the shape of the cutting band, is based on the requirement of minimum wear of the cutting edges, optimum bucket-discharge conditions, and reduction of weight of metal. Frequently no attention is paid to the power consumption indices of the rotor wheel, which depend on the offcut fragments, the physical properties of the ground, and the shape of the cutting head. When the cutting elements of the bucket are introduced to the face, the ground in contact with them is subjected to complex stresses and experiences first elastic and later, after some limiting

\[
\frac{f'}{f} \%
\]

\[
K_f + \frac{1}{\theta}
\]

\[
\text{kg-f/cm}^2
\]

\[
\frac{s}{b}
\]

Fig. 1. Specific cutting force $K_f$ and ratio $f'/f$, plotted versus $s/b$ for various types of bucket: 1) arched; 2) trapezoidal; 3) rectangular; 4) lug-shaped.
value, plastic deformation by compression (crumpling), shear (slicing), and tension (detachment). The cutting process also comprises filling of the bucket with fragments broken from the solid ground, accompanied by friction of these fragments rubbing against the face and bucket.

In moist clay soils the resistance due to friction during filling of the bucket is heightened owing to clogging, a defect to which rectangular buckets are especially prone. The most energy-consuming deformation is compression and subsequent crumbling of the ground by the cutting elements of the bucket. According to data from the Mining Institute of the Siberian Branch of the USSR Academy of Sciences [1], the ultimate compressive strength of loamy and sandy ground is greater than the ultimate shear and break-off strengths by factors of 6-9 and 10-14, respectively. Similar results were obtained by Fedorov [2], who tested the cutting of heavy loam in a conduit by elementary cutting heads and perimeters of various shapes. By correlation analysis of the experimental data, he established that in these conditions, for a given cross-sectional area of the offcuts, the specific cutting force is a function of the area of crumpling of the ground, which depends on the shape of the cutting elements of the shovel. It is given by

\[ K_f = 0.5 + 0.06 \frac{f'}{f} \]

where \( K_f \) is the specific cutting force in kg-force/cm², and \( f'/f \) is the ratio of the crumpling area of the ground to the cross-sectional area of the offcuts, expressed as a percentage.

The numerical coefficients in (1) are correct for cohesive soils such as loams of Categories II-III. When the crumpling area of the soil is reduced to a minimum, the specific cutting force will approach a value equal to 0.5 kg-force/cm², which corresponds to separation of offcuts from the solid ground only by the least energy-consuming deformations, namely, shear and break-off.