One of the main characteristics of the quality of a stuffing-box packing is the coefficient of side pressure $k$ which represents the ratio of the pressure of the packing on the shaft or box wall $p_x$ to the axial pressure $p_y$:

$$ k = \frac{p_x}{p_y} $$

For packings impregnated with lubricants this coefficient is practically unity [1] while for non-impregnated packings it is smaller than unity.

Information on the coefficient of side pressure found in the literature is scarce and limited to two or three packing materials [2, 3].

At present Ftoroplast-4 (Teflon) is increasingly used for packings. It is used in the solid form, or in the form of split rings, chips, material woven from ribbon or thread, or in combination with other materials [4-9]. Information on the coefficient of side pressure for Ftoroplast-4 is practically nonexistent.

In this paper we give the results of an investigation of the side pressure for packings made from chips of Ftoroplast-4.

The experiments were carried out on the apparatus shown in Fig. 1. It consists of stuffing box 2, which rests on base 5, and the rod 3 which imitates the shaft. The bottom gland 2 was arranged above the packing and the entire device was placed between the cross bar and the ram of a hydraulic press. The load applied by the gland was measured with a (DS-5) compression dynamometer. The side pressure of packing 4 on the shaft and the stuffing-box wall was determined from the stresses developed in the elastic elements 6 and measured by means of resistance strain gauges and an ISD-2 device [10].

The investigated packing rings had the following dimensions: 1) $D_{ex} = 85$ mm, $D_{in} = 50$ mm, $h_k = 10-12$ mm; 2) $D_{ex} = 70$ mm, $D_{in} = 50$ mm, $h_k = 6-8$ mm. The height of the entire packing was varied: $2h_k$, $5h_k$, $8h_k$, and $9h_k$.

The material of the stuffing box and shaft was St. 3 steel. The surface finish of the box was of the 6th class and the finish of the shaft was of the 8th class.

The device was calibrated by means of a hemp packing ring impregnated with a lubricant for which $k$ was practically unity.

The coefficient of side pressure was calculated from Eq. (1) for various heights of the packing. The tests showed that the presence of a lubricant on the sealing surfaces of the Ftoroplast-4 packing has no marked effect on $k$, which was practically the same for the shaft and for the box wall; a difference is observed only with packing heights below 10 mm (in this case the coefficient of side pressure for the box wall is 10-15% lower for the shaft than for the box).
Fig. 2. Dependence of the coefficient of side pressure $k$ on the side pressure $P_X$ for various packing sizes: a) with a packing width of 17.5 mm; b) packing width 10 mm ($h$ = packing height in m).

The experimental results (Fig. 2) show that the coefficient of side pressure increases with increasing packing width and side pressure $P_X$ with the exception of the pressure range of about $3 \cdot 10^6 - 7 \cdot 10^6$ N/m$^2$, and decreases with increasing packing height. This is apparently due to the fact that at given pressures the material of the packing becomes compressed by filling the cavities. It is possible that with further increase of pressure, when all the cavities are filled, the Ftoroplast reaches the state of flow, whereupon coefficient $k$ will increase at a higher rate.

The mathematical processing of the data was carried out by a method based on the principle of variable units of measurement [10]. The dependence of the coefficient $k$ on the other physical quantities was determined from the equation

$$
\ln k = \frac{\ln \left( \frac{B b^n \gamma_p^m \gamma_0^{\alpha}}{B' b^n \gamma_p^m \gamma_0^{\alpha}} \right)}{\ln \left( \frac{B' b^n \gamma_p^m \gamma_0^{\alpha}}{B' b^n \gamma_p^m \gamma_0^{\alpha}} \right)},
$$

where $b$ is the width of the packing in m, $h$ is the height of the packing in m; $P_X$ is the side pressure of the packing in N/m$^2$; and $B$, $B'$, $n_1$, $n_2$, $n_3$, $n_4$, $n_5$ are the coefficients and exponents, determined by processing the experimental results.

By multiplying the numerator and denominator of the right-hand side of Eq. (2) by the appropriate number, all the exponents can be changed in such a manner that one of these characteristics takes a certain specified value. Thus, Eq. (2) could be written in the following form

$$
\ln k = \frac{\ln \left( \frac{A b^m \gamma_p^m h} {A' b^m \gamma_p^m h} \right)}{\ln \left( \frac{A b^m \gamma_p^m h} {A' b^m \gamma_p^m h} \right)},
$$

The exponents and the coefficients of Eq. (3) were determined in turn. At first we determined the exponent $m_3$, using for this purpose sets of tests in which only $h$ was varied.

For tests of these series, Eq. (3) was written as follows:

$$
\ln k = \frac{\ln (C h)}{\ln \left( C' h^{m_3} \right)}
$$

and

$$
\ln k = \frac{\ln C}{\ln \left( C' h^{m_3} \right)} + \frac{1}{\ln \left( C' h^{m_3} \right)} \ln h,
$$

where $C$ and $C'$ are constant coefficients for each of the test series.