The thickness and density of strip obtained by rolling powder freely poured in the bunker depends
upon its properties and the diameter and condition of the rolls. Consequently, for a given powder with the
optimum condition of the roll surface, these parameters depend upon the diameter of the rolls. For ex-
ample, rolling more dense strip with the same thickness may be done either on rolls of larger diameter or
on the same rolls by intensifying the rolling process.

The question of intensifying the rolling process is a real one but has not been sufficiently studied.

We have investigated the influence of magnetizing the rolls and of additional pressure on the powder
in the bunker on the properties of the strip, the power parameters and the principal angle of rolling.

Rolling was done on 166 mm diameter rolls with a working surface width of 50 mm, a rolling speed
of 1.8 m/min, and a class 5 surface on the working portion of the rolls. The distribution of pressure over
the curved compression surface, the torque on the spindle and the moment of passage are recorded on an
oscillogram by a measuring pin the length of the roll centers. Based on the values from the oscillogram,
obtained with the help of a dynamometer and strain gauges on the joint, the maximum unit pressure, the
total pressure, and the following angles were determined:

1) the angle of the start of compression \( \alpha \) was measured from the point with a unit pressure of 0.20
kN/cm\(^2\) to the line of the roll centers;

2) the neutral angle \( \gamma \), from the point of maximum unit pressure to the line of the roll centers;

3) the angle of elastic compression of the rolls \( \alpha_c \), from the line of centers to the point of intersec-
tion of the prolongation of the descending branch with the base of the curve.

In rolling strip the full pressure on the rolls is measured with a pickup placed on the clamping
screws. The primary indicators of the properties of powdered metal strip are its density and thickness.
Tests were carried out on iron powders from the Sulinsk Plant and on nickel carbonyl powder. The unit
weight and shaken-down weight are shown in Table 1.

Additional pressure on the powder is created by a rubber chamber located on the lid of the hopper and
connected with a cylinder of compressed air. The necessary pressure is produced with the help of a re-
ducer. The hopper is fastened to the working stand of the mill. The rubber chamber produces a uniform
pressure over the whole surface of the powder, producing strip with uniform density. The relationship
of the thickness and density of the strip to the pressure in the rubber chamber is shown in Fig. 1. With an
increase in the pressure in the chamber the thickness and density increase. It is obvious that due to the
additional pressure on the powder the frictional force and the unit weight of the powder increase, and as a
result the feed of powder into the compression zone increases. An increase in the density of the strip with-
out a change in the gap between the rolls is always ac-
panied by an increase in the thickness. The greatest effect is found in rolling nickel carbonyl powder.
For example, without additional pressure strip is ob-
ained with a thickness of 1.2 mm and a density of 4.84
\( \text{g/cm}^3 \), but with a pressure of 5 N/cm\(^2\) in the rubber
chamber the thickness of the strip is 1.8 mm and the
density 5.85 \( \text{g/cm}^3 \). In rolling under normal conditions

\begin{table}
\begin{tabular}{|c|c|c|c|c|}
\hline
Type of powder & Unit weight & Shaken-down wt. \\
& \text{g/cm}^3 & \text{rel. wt.} & \text{g/cm}^3 & \text{rel. wt.} \\
\hline
PZh3K & 1.90 & 0.244 & 2.34 & 0.30 \\
PZh5M & 1.80 & 0.231 & 2.24 & 0.287 \\
PNK-2 & 1.44 & 0.164 & 2.30 & 0.25 \\
\hline
\end{tabular}
\end{table}
Fig. 1. Relationship of the thickness (a) and density (b) of strip to the additional pressure on the powder in the hopper: 1) PZh5M, 2) PZh3K, PNK-2.

Fig. 2. The influence of the pressure in the chamber on the maximum unit pressure, the total pressure, and the torque on the spindle: 1) PZh3K, 2) PZh5M, 3) PNK-2.

to obtain such properties in the rolled strip would require rolls about 350 mm in diameter. Therefore the use of additional pressure on the powder is very effective.