UDC 621.965.01

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FOUNDATION OF CHOICE OF TECHNICAL PARAMETERS FOR GUILLOTINE SCISSORS OF ROLLING MILL

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Calculation dependences of cutting process on the guillotine scissors of profiled mill «325» stick diameter a 22 mm which are got by means of imitation of process of cutting of rent with the use of graphics editor are given. The graphs of dependence of cutting effort are built from the angle of slope of knife and coefficients which allow to expect easily quantity of stick which cut simultaneously are also got, for the concrete angle of knife slope and diameter of stick.

Keywords: rolling mill, guillotine scissors, cutting efforts, angle of knife slope

Introduction. Capacity of the section-rolling mills on the whole and them main factors (productivity, expense of electric power and other) largely depend on efficiency of work of scissors of the cold cutting of the finish steel. Practice of their exploitation showed that most effective are scissors with one sloping knife. However and they yet are distant from structural perfection and not answer modern requirements an incomplete measure in relation to quality of cut rent.

In this connection there is a necessity of development of mechanism of cutting of construction which answers modern technological and operating requirements.

Analysis of problem

From the theory of cutting [1-2], it is known that mentioned technological process is characterized by four stages:

– pressing down of metal, which cut knives, and contraction parts of its surface which does not run into knives;

– penetration of knife on a depth which is evened $\varepsilon_{not}\cdot\delta$, where ε_{not} - a coefficient of notch; δ - a thickness of metal which cut; thus in the place of the most loading a capacity for deformation of grains of metal is closed and there is appearance of crack, which begins from the side of mobile knife;

– beginning of formation of crack under an overhead knife after the further deepening of crack above a bottom knife;

– meeting of two cracks, which begins after penetration of mobile knife on the depth of tearing ε away $\varepsilon_{not}\cdot\delta$, which characterizes beginning of chip, which takes place in relation to some crooked surface.

The analysis of construction shows that the angle of knife slope can be increased, due to insignificant treason of construction of railhead. For the foundation of the offered treason, there is a necessity to do the estimation of influence of two main factors: diameter of stick, that cut, and cutting angle, – on effort of cutting.

Purpose of work. For the improvement of process of cutting of high quality rent (stick), on scissors by effort 500 t of the of profiled mill «325» a task to execute analytical researches of influence of treason of angle of knife slope on the area of cut of stick which cut simultaneously, and to execute research of influence of size of angle on force of cutting.

Realization of task. During cutting of sheet-metal, according to work [1], on scissors with one sloping knife resistance to cutting is carried out by not all area of cut of sheet, as on cutting by parallel knives, and only some small part its as a triangle. Obviously, that due to faceting of knife of cutting effort diminishes considerably. Except for that, during penetration of knife place is taken in the metal of cutting (change) not on all cut of triangle, but only on part of its as a trapezoid, that it is related to that there of metal in the tops of triangle is tearing (chip).

Thus, the area of trapezoid which does resistance to cutting is evened:

$$F = \frac{2 - e_n \cdot e_n \cdot h^2}{2\,\mathrm{tg}\alpha}\ , \qquad (1)$$

where e_n – a coefficient of notch which equals the relation of depth of penetration of knives at the end of cutting to the initial height of cut of metal; h – a height of metal, that cut.

Cutting efforts determine as

$$P = \tau_{ave} \cdot F\ , \qquad (2)$$

where τ_{ave} – average resistance to cutting (to the change) on the cut of trapezoid.

In connection with the imperfection of construction of knives and materials, from what of them make, there is a necessity of introduction of coefficients which enable to compensate all these defects. Entering the coefficients k_1, k_2 and k_3, we get a calculation formula for determination of cutting effort:

$$Đ = \cdot \frac{k_1 \cdot k_2 \cdot k_3 \ \ 2 - e_n \ \cdot e_n \cdot h^2 \cdot \sigma_B}{2\,\mathrm{tg}\alpha} \qquad (3)$$

where k_1 – a coefficient of properties of material, for steel 3 we accept k_1 = 1,0; k_2 – a coefficient of increase of effort after dulling of knives, k_2 = 1.2-1.3; k_3 – a coefficient of increase of effort in back lash between knives during their protracted use.

During cutting of the shaped rent (rectangular, square, round transversal cut) it is expedient to use knives, which have structural implementation with brooks which have a form of transversal section of rent that cut [2]. Then cutting will be executed on all area of cutting knife edge, but not on a trapezoid. At this case a formula (3) assumes an air:

$$Đ = k_1 \cdot k_2 \cdot k_3 \cdot S \cdot \sigma_B\ , \qquad (4)$$

where S – an area of transversal cut of rent during cutting; σ_B – time resistance to destruction, for steel 3 σ_B = 460 H/mm^2.

For being of maximal effort of cutting which arises up on the cut of round stick, it is necessary to calculate areas which are cut for the different angles of slope of overhead knife – 0°, 2°, 4°, 6° and 8°. Such operation it is expedient to execute in a graphics editor «Compass Chart» which will allow to carry out the automatic miscalculation of all areas of cut, executing the imitation of cutting with a step a 10 mm.

On the set maximal effort of cutting, treason of angle of slope of knife will allow will increase the quantity of stick which cut simultaneously, not changing the

set power of scissors, in relation to attitude toward a angle 0° will increase in 1.14 times for a angle 2°, in 1.45 times - for a angle 4°, in 1.78 times – for a angle 6° and in 1.94 times – for a angle 8°.

Having making value of coefficients and passport data of scissors easily to get the calculation values of quantity of stick which cut simultaneously, for any metal of round transversal cut on guillotine scissors with possibility of choice of angle of knife slope and cutting effort.

Conclusions. Dependence which allows to choice the technological parameters of cutting round rent and to optimize the power parameters of cutting process, depending on the angle of slope of overhead knife, without application of bulky and difficult theoretical calculations is got.

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