

R.N. Pyatak, graduate student

OPTIMIZATION OF PARAMETERS FOR MECHANISMS OF MOVING ELECTRODES AT ARC STEEL-SMELTING FURNACES WITH HYDROMECHANICAL DRIVE

Zaporozhe state engineering academy, Ukraine

The results of the researches of the basic design and power parameters for mechanisms moving electrodes arc steel furnaces with hydromechanical drive have been presented. On base of the researches a nomogram, permitted to optimize this mechanism with an analogue and digital control system, that significantly affects the quality control of the adjusting of arc steel-smelting process, have been got.

Keywords: steel furnace, a mechanism for moving of electrodes, hydromechanical drive, control system, optimization

The important indexes of quality work of mechanisms for moving of electrodes at arc steel-smelting furnaces are accuracy, sensitivity, fast-acting and stability to autooscillations. The results of researches, related with influence of parameters of moving mechanisms of electrodes (MME) at arc steel-smelting furnaces (ASSF) on their fast-acting and stability to autooscillations, and also their static descriptions have been presented in works [1-4].

The task of the present researches is determination of optimal constructive and power parameters of MME for ASSF with a hydromechanical drive.

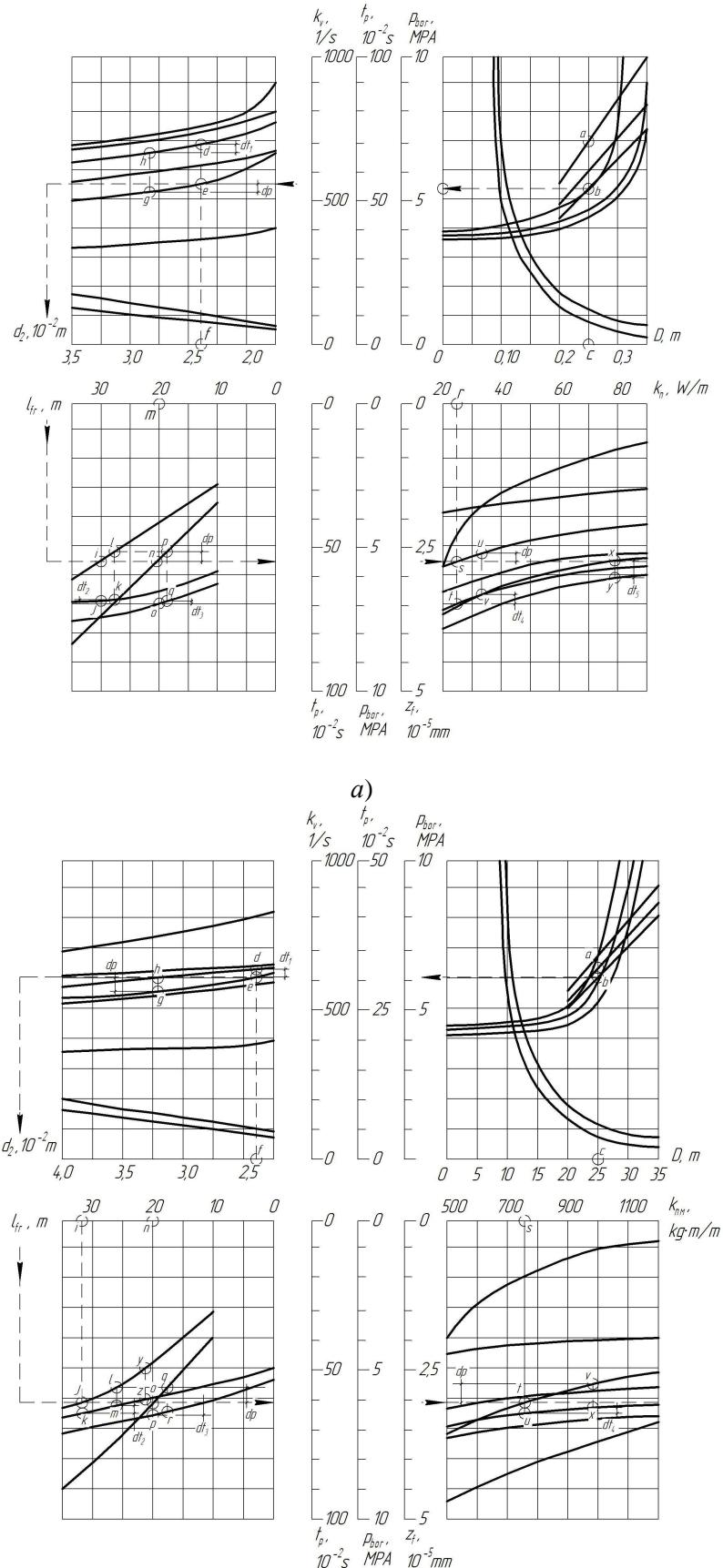
For the solution of tasks for optimization of MME parameters for ASSF applied a variation calculation, allowing to optimize next functionals for the analog system of adjusting (ASA) and digital control system (DCS).

$$\begin{aligned} (p_{bor})_{exc} &= p_{bor}(d_2, d_{con}, l_{con}, k_n, k_{nm}); \quad t_{p,opt} = \min \left\{ t_p(d_2, d_{con}, l_{con}, k_n, k_{nm}, (p_{2n})_{exc}) \right\}; \\ k_{v,opt} &= \min \left\{ k_v(d_2) \right\}; \quad z_{h,opt} = \left\{ z_h(k_n, k_{nm}, \delta_h) \right\}, \end{aligned} \quad (1)$$

where $t_{p,opt}, k_{v,opt}, z_{h,opt}$ - optimal value of duration for transient time, amplification factor on speed, zone of insensitivity on moving of electrodes; $p_{bor}(d_2, d_{con}, l_{con}, k_n, k_{nm})$ and $t_p(d_2, d_{con}, l_{con}, k_n, k_{nm}, (p_{2n})_{exc})$ - spatial functions of index of stability and fast-acting for MME with analog ASA and digital DCS; $k_v(d_2)$ and $z_h(k_n, k_{nm}, \delta_h)$ - spatial functions of index of exactness and sensitiveness; $(p_{bor})_{exc}, (p_{2n})_{exc}$ - operating the border brought pressure and brought pressure.

The nomograms for optimization of MME parameters are built as an aggregate of families of the combined charts of spatial functions of adjusting (fig. 1).

The optimal variant of parameters of MME with analog ASA from the nomogram of fig. 1,a: $k_n = 1.4$ V/cm at $l_{bor} = 30$ m, other parameters: $D = 0.25$ m, $d_2 = 0.024$ m, $d_{con} = 0.032$ m. Then indexes of adjusting: $p_{con} = 5.0$ MPa; $t_a = 0.559$ s. Obviously, that as compared to an initial variant the degree of fast-acting for optimal



6)

Picture is nomogram for optimization of parameters of mechanism of moving for electrodes
 a) with using analog ASA
 б) with using digital DSC

variant rises (duration of transient falls down from 0.699 to 0.559 s, and the zone of insensitivity goes down a from $75 \cdot 10^{-9}$ to $5 \cdot 10^{-9}$ m).

Optimal parameters of MME with DSC for the nomogram of fig. 1,6 have a maximally possible value of diameter of conduit d_{con} . Optimal variant for parameters of MME with digital DSC: $d_{con} = 4$ cm at $l_{con} = 21$ cm, other parameters: $D = 25$ cm, $d_2 = 0.032$ m, $k_{nm} = 750$ kg·m/m. Then indexes of adjusting of analog ASA: $p_{bor} \approx 5.0$ MPa; $t_a = 0.3077$ s; $k_v = 800$ 1/s; $z_n = 10 \cdot 10^{-9}$ m. Obviously, that as compared to an initial variant the degree of optimal variant for fast-acting rises of (duration of transient falls down from 0.3270 to 0.3077 s), the zone of insensitivity substantially falls down a from $75 \cdot 10^{-9}$ to $10 \cdot 10^{-9}$ m.

Conclusions. Thus, nomograms, built on the basis of investigations allow to optimize the basic parameters of MME with ASA and DSC, that renders substantial influence on quality of adjusting of arc process. All of it is attained due to rational combination of main indexes for electrode holder system on the whole: sensitiveness, exactness, fast-acting and stability against self-excited oscillations of MME.

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