For each batch the time $\tau_1$ was read off from the upper scale and the time $\tau_2$ from the lower scale. The position of each batch number on a scale represents the time of the completion of the relevant operation in the processing of that batch. In the construction of the cyclogram the following rule was applied: Before the sintering of a batch of parts can commence, the pressing of this batch and the sintering of the preceding batch must be completed. Preparatory and finishing times are included in $\tau_1$ and $\tau_2$. Because of this, in the cyclogram the press operates continuously, and breaks in the operation of the furnace occur when a batch of parts is discharged from it before the pressing of the next batch is completed.

Using the above-described algorithm, we obtain for this particular case the following optimum sequence of batches: 6, 4, 1, 2, 5, and 3. A cyclogram for the production of parts in this order is shown in Fig. 2. Compared with that of Fig. 1, this cyclogram gives much shorter operational stoppages, decreasing the total idle time by 14.5%.

The algorithm under consideration is based on a program compiled in the FORTRAN algorithmic language. The program is intended for use by the planning and materials flow control services of engineering enterprises.

LITERATURE CITED

MORPHOLOGY, MICROHARDNESS, AND GRINDING ABILITY OF SINGLE-CRYSTAL POWDERS

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In the work described below, single crystals of titanium and tantalum carbides were produced by mass crystallization from solutions in an Al melt [1, 2]. To separate them out of the solvent metal matrix, the latter was dissolved in HCl.

The results of chemical and x-ray diffraction analyses of the carbides are given in Table 1. The degrees of perfection of the crystals were determined by the Debye and Laue methods and by dislocation etching. Powder photographs taken in VRS-3 camera ($143 \times 25$ mm) revealed that the single crystals were sufficiently homogeneous. At large angles the $K_\alpha_1$ and $K_\alpha_2$ doubles were resolved, which was indicative of the absence of stress. In Laue photographs there were no diffuse reflections, which was evidence that the crystals had no small-angle boundaries.

The density of dislocations (determined from examinations of etch pits on the octahedron faces) was $10^2$-$10^3$ cm$^{-2}$. TiC crystals were etched for 1-2 min in a 10 ml H$_2$SO$_4$ + 1 ml HNO$_3$ solution at the NO$_2$ vapor evolution temperature, and TaC crystals for 0.5-1 min in a 10 ml HNO$_3$ + 1 ml HF + 0.5 ml lactic acid solution at 60-70°C.

The effect of changes in the rate of cooling of the solution melts on the morphology of the carbide was studied by optical and scanning electron microscopy methods. It was found that, with both TiC and TaC crystals, decreasing the rate of cooling $\nu$ from $\leq 50$ to 2 deg C/h produced a transition from skeletal growth forms to octahedra (Fig. 1).
TABLE 1. Results of Chemical and X-Ray Analyses of TiC and TaC Single Crystals

| Car- | Calc. ant., | C | Chem. analysis data, | Formula | Lattice constant, Å |
| bide | % | | | from chem. | data | data |
| | | | | analysis data | | |
| | M | C | M | C | 2M+C | | |
| TiC | 79.95 | 20.05 | 80.20 | 19.70 | 99.90 | TiC₀.₉₈ | 4.327₄ | 4.328±0.002 |
| TaC | 93.78 | 6.22 | 93.25 | 6.21 | 99.46 | TaC₁.₀ | 4.454₄ | 4.454±0.002 |

Fig. 1. Growth shapes of TiC and TaC crystals: a) TaC block aggregates; b) TiC crystal aggregates; c) TaC cubooctahedron with unevenly developed faces; d) TiC cubooctahedron; e) TaC octahedron; f) slip bands on (111) face of deformed TaC single crystal.

Fig. 2. Variation of TaC single-crystal size with cooling rate (v, deg C/h).

Fig. 3. Variation of grinding ability A and strength P of single grain with grain size number for TiC and TaC single-crystal powders: 1, 4) grinding ability and strength of single TaC grain (solid line and circles), respectively; 2, 3) grinding ability and strength of single TiC grain (dotted line and crosses), respectively.

Cooling at a rate of not less than 50 deg C/h gave rise to the formation of dendritic TiC lamellas, hollow TaC pyramids, TaC block aggregates (Fig. 1a), and TiC lamellas with rhombododecahedron faces; cooling at a rate of 10-15 deg C/h, to the formation of twins, crystal aggregates with faces showing emerging growth macrosteps (Fig. 1b), and cubooctahedra with unevenly developed faces (Fig. 1c); cooling at a rate of about 5 deg C/h, to the formation of cubooctahedra (Fig. 1d); and cooling at a rate of the order of 2 deg C/h, to the appearance of octahedra (Fig. 1e).