AD-A066 682 FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO F/G 11/6
METHOD OF MANUFACTURE OF BLADES,(U)
JAN 78 S Z FIGLIN, V V BOYTSOV, A V BAKHAREV
UNCLASSIFIED FTD-ID(RS)T-2337-77 NL

| OF |
AD
A066882

END
DATE
FILMED
5-79
DDC

AD A066682

FTD-ID(RS)T-2337-77

# FOREIGN TECHNOLOGY DIVISION


DDC
APR 2 1979

METHOD OF MANUFACTURE OF BLADES

by

S. Z. Figlin, V. V. Boytsov, et al.


Approved for public release;
distribution unlimited.

11 17 108

ACCESSION for
NTIS White Section
DDC Buff Section
UNANNOUNCED
JUSTIFICATION
BY
DISTRIBUTION/AVAILABILITY CODES
Dist. AVAIL. and/or SPECIAL
A

# EDITED TRANSLATION

FTD-ID(RS)T-2337-77 12 January 1978

MICROFICHE NR: FTD-78-C-000103

METHOD OF MANUFACTURE OF BLADES

By: S. Z. Figlin, V. V. Boytsov, et al.

English pages: 4

Source: USSR patent No. 260382, 20 May 1970, pp. 1-2.

Country of origin: USSR
Translated by: Robert Allen Potts
Requester: ASD/FTD/ETID
Approved for public release; unlimited.

THIS TRANSLATION IS A RENDITION OF THE ORIGINAL FOREIGN TEXT WITHOUT ANY ANALYTICAL OR EDITORIAL COMMENT. STATEMENTS OR THEORIES ADVOCATED OR IMPLIED ARE THOSE OF THE SOURCE AND DO NOT NECESSARILY REFLECT THE POSITION OR OPINION OF THE FOREIGN TECHNOLOGY DIVISION.

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.



78 11 17 108

## U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

| Block | Italic | Transliteration | Block | Italic | Transliteration |
|---|---|---|---|---|---|
| А а | *А а* | A, a | Р р | *Р р* | R, r |
| Б б | *Б б* | B, b | С с | *С с* | S, s |
| В в | *В в* | V, v | Т т | *Т т* | T, t |
| Г г | *Г г* | G, g | У у | *У у* | U, u |
| Д д | *Д д* | D, d | Ф ф | *Ф ф* | F, f |
| Е е | *Е е* | Ye, ye; E, e* | Х х | *Х х* | Kh, kh |
| Ж ж | *Ж ж* | Zh, zh | Ц ц | *Ц ц* | Ts, ts |
| З з | *З з* | Z, z | Ч ч | *Ч ч* | Ch, ch |
| И и | *И и* | I, i | Ш ш | *Ш ш* | Sh, sh |
| Й й | *Й й* | Y, y | Щ щ | *Щ щ* | Shch, shch |
| К к | *К к* | K, k | Ъ ъ | *Ъ ъ* | " |
| Л л | *Л л* | L, l | Ы ы | *Ы ы* | Y, y |
| М м | *М м* | M, m | Ь ь | *Ь ь* | ' |
| Н н | *Н н* | N, n | Э э | *Э э* | E, e |
| О о | *О о* | O, o | Ю ю | *Ю ю* | Yu, yu |
| П п | *П п* | P, p | Я я | *Я я* | Ya, ya |

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ë in Russian, transliterate as yë or ë.

## RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

| Russian | English | Russian | English | Russian | English |
|---|---|---|---|---|---|
| sin | sin | sh | sinh | arc sh | $\sinh^{-1}$ |
| cos | cos | ch | cosh | arc ch | $\cosh^{-1}$ |
| tg | tan | th | tanh | arc th | $\tanh^{-1}$ |
| ctg | cot | cth | coth | arc cth | $\coth^{-1}$ |
| sec | sec | sch | sech | arc sch | $\operatorname{sech}^{-1}$ |
| cosec | csc | csch | csch | arc csch | $\operatorname{csch}^{-1}$ |

| Russian | English |
|---|---|
| rot | curl |
| lg | log |

2337

# METHOD OF MANUFACTURE OF BLADES

Authors of Invention: S. Z. Figlin, V. V. Boytsov, A. V. Bakharev, Yu. I. Kaplin, S. A. Kas'yanov, Yu. Ye. Rybkin, A. S. Nikishov, V. M. Arzhakov, O. A. Nikishov, L. G. Vertyukova, and L. P. Rink.

The invention pertains to the field of shaping metals by pressure, and namely to the manufacture of turbine and compressor blades from titanium and its alloys by stamping.

There is known a method of manufacture of blades from titanium and its alloys, with which the initial blank is covered with lubricant, heated to the stamping temperature and formed in a die, heated to the same temperature. However, with such a method during stamping there appear considerable nonuniformity of deformation and considerable elastic strains in the machine and the tool, which leads

to distortion of the geometry of the blades and, as a consequence, requires special operations of calibration and heat treatment, as a result of which substantial warping of the blades occurs.

The proposed method is distinguished by the fact that as lubricant we use enamel. With this the heating temperature of the blank is selected equal to the maximum annealing temperature of the material being shaped, and deformation is accomplished with the rate of deformation not exceeding 20 mm/s.

This raises the quality of the articles and reduces the technological cycle.

The proposed method involves the following.

The initial blank is preliminarily covered with a layer of enamel or glass lubricant, then the blank is heated to a temperature insignificantly (30-50°C) exceeding the lower limit of the temperature range of stamping, and is stamped with rate of deformation not exceeding 20 mm/s in a die with heat-insulation working zone. The die is heated to the stamping temperature.

The proposed method considerably lowers the force of deforming due to the absence of partial cooling of surface layers and deeper

occurrence of softening processes in the course of deformation itself. As a result of uniformity of the temperature field of the blank in the process of deformation the homogeneity of the structure is sharply raised. There is no longer a need to compensate for losses of heat of the heated blank by raising the initial temperature of heating in the furnace. In the proposed method the temperature of heating of the blank of alloy VTZ-1 is 870-20°C. Lowering of the initial heating temperature of the blank in conjunction with preliminary covering of the blank with enamel considerably reduces the degree of interaction of the heated metal with the surrounding medium, i.e., scale of the alpha-deposited layer (saturation by hydrogen, oxygen, nitrogen etc.) is formed.

In the proposed method the first high-temperature stage of heat treatment is combined with the last deformation-sizing, which, besides economy of expenditure for heat treatment, practically eliminates the warping of blades.

OBJECT OF INVENTION

The method of manufacture of blades from titanium and its alloys, with which the initial blank is covered with lubricant, is heated to the stamping temperature and shaped in the die, heated to

the same temperature, is distinguished by the fact that for raising the quality of articles and shortening the technological cycle, as lubricant we use enamel, with this the heating temperature of the blank is selected equal to the maximum annealing temperature of the material to be deformed, and deformation is accomplished at a rate of deformation not exceeding 20 mm/s.

DISTRIBUTION LIST

DISTRIBUTION DIRECT TO RECIPIENT

| ORGANIZATION | | MICROFICHE |
|---|---|---|
| A205 | DMATC | 1 |
| A210 | DMAAC | 2 |
| B344 | DIA/RDS-3C | 8 |
| C043 | USAMIIA | 1 |
| C509 | BALLISTIC RES LABS | 1 |
| C510 | AIR MOBILITY R&D LAB/FIO | 1 |
| C513 | PICATINNY ARSENAL | 1 |
| C535 | AVIATION SYS COMD | 1 |
| C591 | FSTC | 5 |
| C619 | MIA REDSTONE | 1 |
| D008 | NISC | 1 |
| H300 | USAICE (USAREUR) | 1 |
| P005 | ERDA | 1 |
| P055 | CIA/CRS/ADD/SD | 1 |
| NAVORDSTA (50L) | | 1 |
| NASA/KSI | | 1 |
| AFIT/LD | | 1 |

| ORGANIZATION | | MICROFICHE |
|---|---|---|
| E053 | AF/INAKA | 1 |
| E017 | AF/ RDXTR-W | 1 |
| E404 | AEDC | 1 |
| E408 | AFWL | 1 |
| E410 | ADTC | 1 |
| E413 | ESD | 2 |
| | FTD | |
| | CCN | 1 |
| | ETID | 3 |
| | NIA/PHS | 1 |
| | NICD | 5 |