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HEAT-RESISTANT EQUIPMENT FOR BENDING SHAPED MATERIAL WITH ELECT--ETC(U)
JAN 77 I V KORCHAGINA, V G BORISOV

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HEAT-RESISTANT EQUIPMENT FOR BENDING SHAPED MATERIAL WITH ELECTRICAL HEATING

By

I. V. Korchagina, V. G. Borisov

FOREIGN TECHNOLOGY DIVISION

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EDITED TRANSLATION

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HEAT-RESISTANT EQUIPMENT FOR BENDING SHAPED MATERIAL WITH ELECTRICAL HEATING

By: I. V. Korchagina, V. G. Borisov

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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

*<u>ye</u> initially, after vowels, and after ъ, ь; <u>e</u> elsewhere. When written as ё in Russian, transliterate as yё or ё. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

GREEK ALPHABET

Alpha	Α	α	α	Nu	Ν	ν	
Beta	Β	β		Xi	Ξ	ξ	
Gamma	Γ	γ		Omicron	Ο	ο	
Delta	Δ	δ		Pi	Π	π	
Epsilon	Ε	ε	ϵ	Rho	Ρ	ρ	ϱ
Zeta	Ζ	ζ		Sigma	Σ	σ	ς
Eta	Η	η		Tau	Τ	τ	
Theta	Θ	θ	ϑ	Upsilon	Υ	υ	
Iota	Ι	ι		Phi	Φ	φ	ϕ
Kappa	Κ	ϰ	κ ϰ	Chi	Χ	χ	
Lambda	Λ	λ		Psi	Ψ	ψ	
Mu	Μ	μ		Omega	Ω	ω	

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

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

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rot	curl
lg	log

GRAPHICS DISCLAIMER

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HEAT-RESISTANT EQUIPMENT FOR BENDING SHAPED MATERIAL WITH ELECTRICAL HEATING

I. V. Korchagin, V. G. Borisov

The improvement of airplanes has lead to expanded use in designs of shaped material of high-strength alloys which, as a rule, are hard to work. This has made it necessary to develop and implement new forming processes. One of the most promising forming processes for shaped parts, which drastically reduces labor sent in bending and finishing operations and which increases the precision of the part, is bending with tension using electrical contact heating of the billet.

Optimal temperature forming intervals are: for aluminum and magnesium alloys 200-400°C, titanium alloys OT4 500-700°C, VT14 600-750°C, VT20 700-900°C, high-strength stainless steels 800-900°C*.

[FOOTNOTE: PTM-1295, 1970. END FOOTNOTE]

The use of hot forming with electrical contact heating of the billet to the indicated temperature intervals imposes certain requirements on technological bending equipment. The material used in the equipment must have the following properties:

a) heat resistance, i.e., high mechanical strength under compression and bending, the result of the system of forces of the action of the billet on the mandrel;

b) retention of electrical insulation at normal and elevated temperatures, since heating is accomplished by including the billet in a low-voltage electrical circuit with a high current force;

c) low heat conductivity - to reduce thermal losses, reduce the power of the required current, and assure a more even temperature field in the billet;

d) low heat expansion coefficient, which assures dimensional stability of the equipment;

e) a low friction coefficient;

f) resistance of surface to abrasion.

On the basis of analyzing existing heat and electrical insulating materials a group of materials interesting from the standpoint of use in bending equipment was selected and classified, delineating the temperature ranges of application.

Thus, at forming temperatures above 700°C pyrocerams and high-strength ceramics can be used as heat-resistant and electrical insulating liners. However, the specifics of the technological process of producing and working parts made of pyrocerams and high-strength ceramics make it necessary to have the cooperation of the industries which produce parts of the indicated materials. Hence, in developing equipment designs it is specified that parts of pyrocerams and ceramics be universal.

The variation of the bending punch shown in Fig. 1 was designed for bending shaped material of T- and X-section and for bending strips.

The bending punch is made in the form of an insert for metal base 3 to cover the fitting. The insert consists of a metal housing, whose contour is equidistant to the bending contour and is separated from the latter by the diameter of steel rollers 1.

The working contour is formed by pyroceram (ceramic) rollers 1, placed close together in race 2. The race is secured to the housing by screws. To prevent the rollers from falling out of the ends clamp strips are provided.

In the process of forming shape 4 the rollers are pressed to the contour of the metal housing, and during the bending and extension process the parts are able to turn freely about the axis. Because of the very smooth surface of the pyroceram and ceramic rollers and because they are capable of rotation, friction during the forming process is considerably reduced.

The design for the rollers is simple and universal. The rollers can be used repeatedly for punches of different shapes and dimensions.

The bending punch (in Fig. 2) designed for forming consist of spacing blocks 1 of refractory ceramic assembled on metal rim 2.

When the number of formed parts is very great a shop can be organized at the enterprise itself to produce ceramic blocks. The shop must have grinding equipment, mixers for mixing the ingredient elements, a hydraulic press, racks for drying ceramic blocks at normal temperature, and a furnace for annealing.

The components making up the composition of the given ceramic (grog, highly refractory clay) are abundant, and production technology and equipment required to obtain the ceramic blocks are very simple.

The ceramic blocks can be joined to the metal rim by a thermocement*.

[FOOTNOTE: Production and use of thermocement Ts27. Regulation No. 986-71. VIAM, 1971. END FOOTNOTE]

This thermocement is recommended for joining metal parts, pyroceram, ceramics, and glass plastics which work for long periods at temperatures up to 950°C. The ceramic blocks are also secured to the rim by screws.

In the case of forming with heat the fitting can also be metal, provided that the working surface is protected by a high-temperature oxide or pyroceram coating.

Figure 3 shows a variation of a metal bending punch for forming part 4, whose working surface 1 is covered by zirconium dioxide and is insulated from base 3 by an asbestos cement layer 2.

The bending punch s designs presented here represent some developed variations of standard designs for bending equipment.

Submitted 19 May 1972

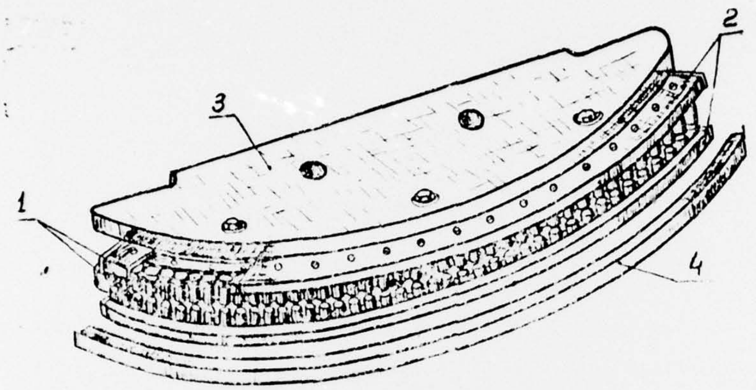

Fig. 1. Wrapping-on system.

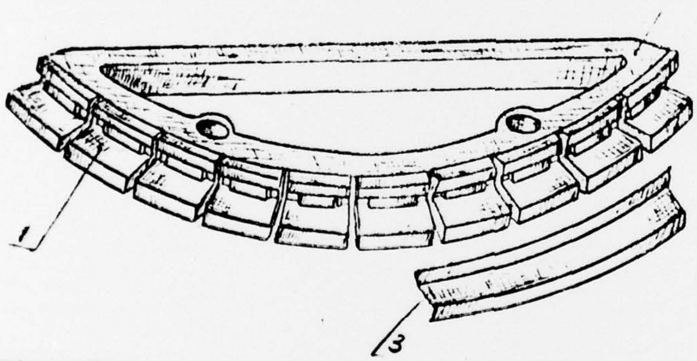

Fig. 2.

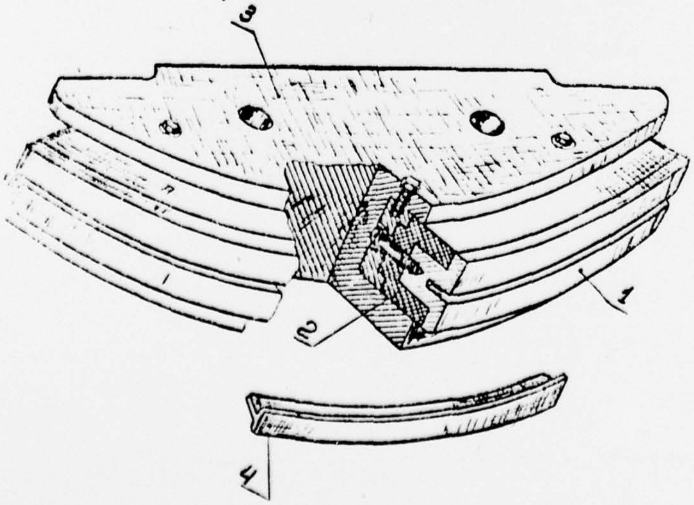

Fig. 3.

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