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METHOD OF MEASURING THE DIAMETER OF THE NOZZLE OF A GAS TURBINE--ETC(U)
AUG 77 V A RYBKO, B V VARDANYAN

UNCLASSIFIED FTD-ID(RS)T-1250-77 NL

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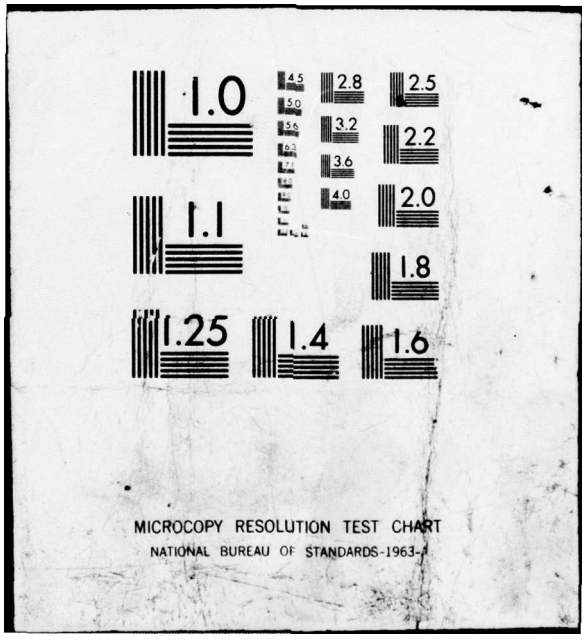
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

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METHOD OF MEASURING THE DIAMETER OF THE *NOZZLE OF A GAS TURBINE ENGINE*

by

V. A. Rybko and B. V. Vardanyan

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. The use of diacritical marks is preferred, but such marks may be omitted when expediency dictates.

GREEK ALPHABET

Alpha	A	α		Nu	N	ν	
Beta	B	β		Xi	Ξ	ξ	
Gamma	Γ	γ		Omicron	O	o	
Delta	Δ	δ		Pi	Π	π	
Epsilon	E	ε		Rho	P	ρ	
Zeta	Z	ζ		Sigma	Σ	σ	ς
Eta	H	η		Tau	T	τ	
Theta	Θ	θ		Upsilon	T	υ	
Iota	I	ι		Phi	Φ	φ	ϕ
Kappa	K	κ		Chi	X	χ	
Lambda	Λ	λ		Psi	Ψ	ψ	
Mu	M	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}
rot	curl
lg	log

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All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.

EDITED TRANSLATION

FTD-ID(RS)T-1250-77 3 August 1977

MICROFICHE NR. FTD-77-C-000953
CSP 73017265

METHOD OF MEASURING THE DIAMETER OF THE NOZZLE OF A GAS TURBINE ENGINE

By: V. A. Rybko and B. V. Vardanyan

English pages: 3

Source: USSR Patent No. 328332, 2 Feb 1972, pp 1-2.

Country of origin: USSR
Translated by: Robert D. Hill
Requester: ASD/ETID

PREPARED BY:

TRANSLATION DIVISION
FOREIGN TECHNOLOGY DIVISION
WP-AFB, OHIO.

METHOD OF MEASURING THE DIAMETER
OF THE NOZZLE OF A GAS TURBINE ENGINE

V.A. Rybko and B.V. Vardanyan

The invention belongs to the control and measuring technology.

Known is the method of measuring the dimensions of large parts, including the diameter of a nozzle of a gas turbine engine, with the use of optical tubes and graduated measures. This method consists in a comparison of the measurable dimension with the graduated measure by means of two pairs of coaxially located optical tubes with parallel axes of sighting focussed successively on the measurable part and on the scales of the parallel extended graduated measure.

However, the known method does not allow measuring the diameter of the nozzle of the gas turbine engine in the process of its operation, which changes its position in space owing to the temperature deformations.

The proposed method differs from the known method in that for the purpose of measuring the diameter of the nozzle of the gas turbine engine during its operation, placed on the shutters of the nozzle are graduated measures, installed on the nonoperating engine are different positions of the shutters , and measured for each position is the diameter of the nozzle and movements of the graduated measures. A graph is constructed of the dependence of the diameter of the nozzle on the movement of the graduated measures; the engine is started, and recorded by means of the

optical tubes are the movements of the graduated measures with respect to time, according to which the diameter of the nozzle is determined on the graph.

Figure 1 gives a diagram of the installation of the optical tubes and graduated measures; Fig. 2 gives a graph of the dependence

$$d_{cp} = f(\delta_{zi}).$$

Figure 1 gives a test stand 1, gas turbine engine 2, graduated measures 3, and optical tubes 4.

The optical tubes are adjusted, and the axes of the ocular optical tubes are combined with the defined lines on the graduated measures (δ_{10} and δ_{20}). By changing the position of shutters of the nozzle, we measure the diameter of the nozzle $d_{cp\,i}$ and the movements of the graduated measures corresponding to it, δ_{1i} and δ_{2i}, after which the graph of the dependence $d_{cp} = f(\delta_{zi})$ is constructed, where:

$d_{cp} = \frac{\sum_{i=1}^{n} d_i}{n}$ - the mean diameter of the shutters of the nozzle of the gas turbine engine;

d_i - the diameter of the shutters of the nozzle in a defined meridional cross section;

n - quantity of measures (usually 6-8);

$\delta_{zi} = \delta_{1i} + \delta_{2i}$ - algebraic sum of the movement of the graduated measures.

Then determined on the required modes of operation is the position of the graduated measures δ_{1i} and δ_{2i}, by means of which the magnitude of the diameter of the nozzle of the operating gas turbine engine is determined on the graph.

Object of the invention

A method of measuring the diameter of the nozzle of a gas turbine engine with the use of optical tubes and graduated measures, which is distinguished by the fact that for the purpose of measuring the diameter of the nozzle of a gas turbine engine during its operation the following is done: graduated measures are placed on the shutters of the nozzle, different positions of the shutters are set on the nonoperating engine, and the diameter of the nozzle and movements of the graduated measures are measured for each position; a graph of the dependence of the diameter of the nozzle on the movement of the graduated measures is plotted, the engine is started, and recorded by means of the optical tubes are the movements of the graduated measures with respect to time, according to which the diameter of the nozzle is determined on the graph.

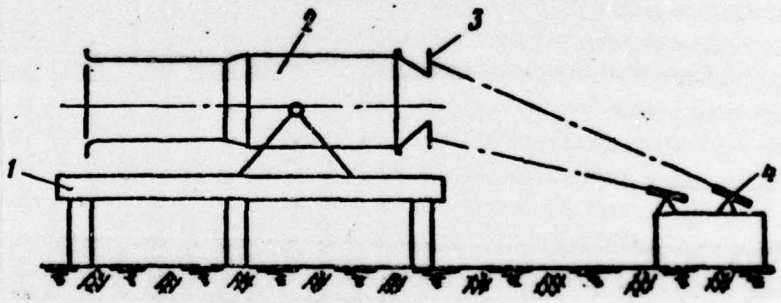

Fig. 1

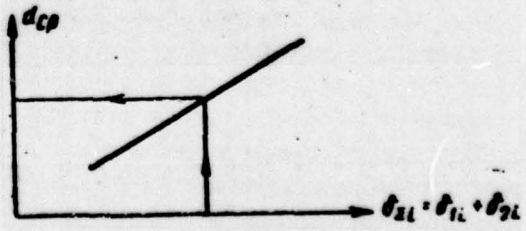

Fig. 2

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1. REPORT NUMBER FTD-ID(RS)T-1250-77	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
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7. AUTHOR(s) V. A. Rybko and B. V. Vardanyan		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Foreign Technology Division Air Force Systems Command U. S. Air Force		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE 2 Feb. 1972 13. NUMBER OF PAGES 3
14. MONITORING AGENCY NAME & ADDRESS *(if different from Controlling Office)*		15. SECURITY CLASS. *(of this report)* UNCLASSIFIED 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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