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EFFICIENCY IN INTERFERENCE FITS

by

Mr. Khongsak Phanich

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T. Nilanidhi.
....
Dean of the Graduate School.

Thesis Committee

P. Pattabongse .... Chairman

U. Chaktohan ....

J. F. Heward ....

Thesis Supervisor ....J. F. Heward........................

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ABSTRACT

This paper presents the results of an experimental investigation on axial separating forces on shrink-fit members consist ng of short hubs and relatively long shafts.

The tests included four different materials; cast iron, mild steel, brass and aluminium. The range of surface finish used is from as turned to brasso polished; mating surface conditions from lubricated to chemically dry; and fit allowances from 0.5 to 6 mils. per inch diameter. Pure axial force and combined axial force and torsion are used for separating. The latter is carried out to see the effect of torsion. The co-efficient of friction deduced there from depends on the bore pressures. Experimental bore pressures are obtained by assuming that the test results agree well with Lamé theory within elastic range (6). For over-strained condition, the equations of Timoshenko (7) and equation of strain deduced from Maximum Shear Stress theory* using the law of compressibility are used to compare with the test results.

The main findings from the experimental work are summarized and discussed. Experimental results do not agree with Lamé theory at high co-efficient of friction. For over-strained condition, the results do not agree at all to maximum Shear Stress theory. There is a loss in grip efficiency rather than increase as predicted by theory.

Data on the derived co-efficient of friction are tabulated. A drop in slip force after the first slip was found in every tests. Samples of graphs drawn by the testing machine are also presented for each test series.

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* See Appendix

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NOTATION

C	=	A constant of integration.
D	=	Outside diameter of hub.
d	=	Nominal diameter = outside diameter of shaft
		= inside diameter of hub.
d_i	=	Inside diameter of hollow shaft.
E	=	Modulus of elasticity.
e	=	Interference inch per inch nominal diameter.
e_{max}	=	Maximum elastic interference inch per inch nominal diameter.
G	=	Modulus of rigidity.
h(subscript)	=	Belongs to hub material.
K	=	Rankin factor.
L	=	Total test length of shaft.
l	=	length of hub.
P	=	Pressure
P_i	=	Internal Pressure.
P_o	=	External Pressure.
P'	=	Internal Pressure in Elasto-Plastic Hub.
P_x	=	Pressure at Elasto-Plastic front.
P_{max}	=	Internal Pressure to bring hub to yield at bore.
P_{ult}	=	Internal Pressure to bring hub to fully plastic state
r	=	Radius from axis.
r_i	=	Internal radius of hub.

r_o	=	Outer radius of hub.
S_{us}	=	Ultimate shear strength by simple torsion.
S_y	=	Yield strength in simple tension of material.
s(subscript)	=	Belongs to shaft material.
U	=	Displacement vector.
U_{ri}	=	Deflection of hub inside radius in elasto-plastic state
U_ρ	=	Deflection of elasto-plastic front at radius ρ
σ_t	=	Tangential stress or hoop stress.
τ_{max}	=	Maximum shear stress.
σ_r	=	Radial stress.
U.T.S.	=	Ultimate tensile stress.
μ	=	Poisson's ratio.
ρ	=	Radius of elasto-plastic front.
λ	=	Radial interference.
δ, ϵ_r	=	Radial deflection.
ϵ_t	=	Tangential deflection.