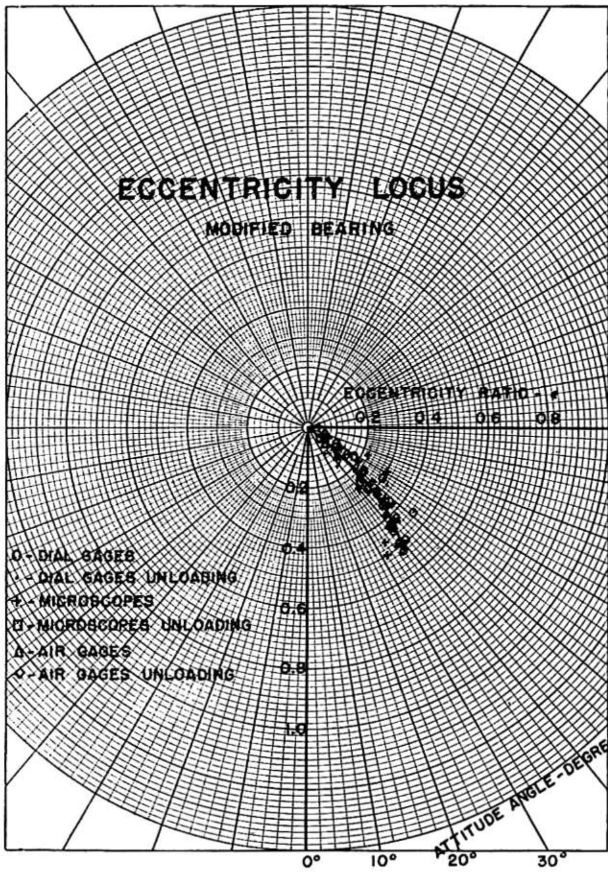

Fig. 13 Eccentricity Locus—Modified Bearing

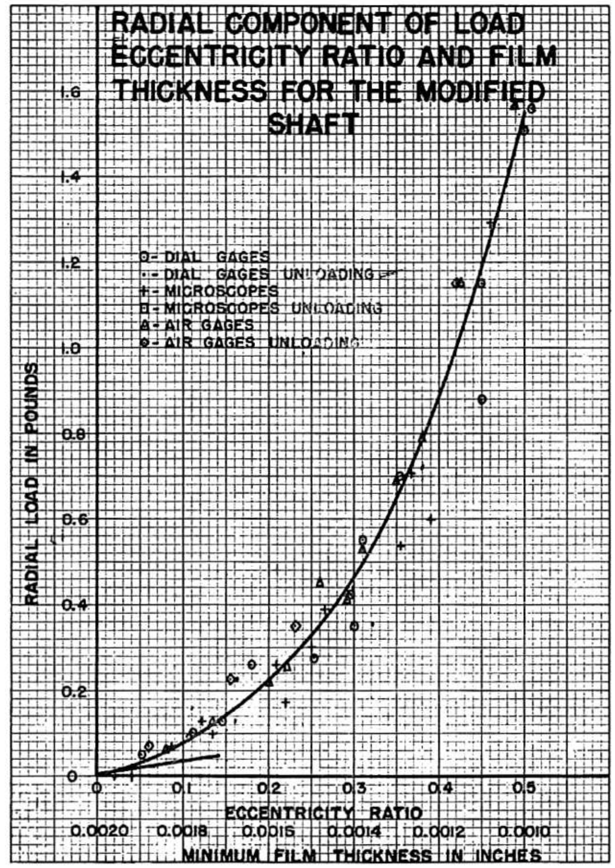

Fig. 14 Radial Component of Load Versus Eccentricity Ratio and Film Thickness for Modified Shaft

this bearing when operating in a vertical position. It was found to be 2700 cpm.

TABLE 1 COMPARISON OF RESULTS

	Threshold whirl frequency			
	Theoretical	Design, cpm	Experimental	Per cent error
Plain journal bearing		0	Whirled at all freq. down to 62 cpm (lowest measurable frequency)	
Modified journal bearing		2260–2910[a]	2700 cpm	16.9–8.1
	$f = \frac{1}{\pi}\sqrt{\frac{K_2}{M}}$	2600[b]		3.7
		2440[c]		9.6

[a] Based on theoretical calculation and references.[4,5,6]
[b] Based on calculations using graphical method for determination of bearing constant K_2.
[c] Based on calculations using algebraic equation for determination of bearing constant K_2.

4 In addition a curve of the radial-film force, viz., journal displacement, for the modified bearing was obtained experimentally. From this curve the slope at the origin was determined, Fig. 14. Based on the slope of the curve, the analysis predicted a threshold whirl frequency using a graphical method for evaluation of the slope of 2600 cpm whereas using an algebraic equation to evaluate the slope, the whirl frequency was calculated to be 2440 cpm.

5 It therefore seems reasonable to assume that this analysis can be used for other types of journal bearings operating under similar conditions provided the bearing form used possesses the requisite symmetry.

Acknowledgment

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In the main, the experimental work and calculations in this investigation are the work of B. Sternlicht. The theory and some general procedures are the work of G. F. Boeker.

Discussion

J. A. Cole[10] and C. J. Hughes.[10] During the course of some film extent experiments on a transparent sleeve bearing (1 × 1 × 0.002 in.) with a single-hole oil entry, we have observed that whirl at frequency near to half shaft speed may occur over a wide speed range but only while the film remains complete. As soon as the film breaks, as a result of increased eccentricity ratio or changed oil-supply conditions, whirl ceases.

A cyclic effect which probably is associated with the construction of the test machine has been noticed. Whirl gradually builds up, then the film breaks down, whereupon whirl ceases and the complete film is formed again, permitting the whole cycle to repeat. If the oil supply is shut off, this state of affairs continues until insufficient oil remains in, or near, the bearing to maintain a complete film.

[10] Lubrication and Wear Division, Department of Scientific and Industrial Research, Mechanical Engineering Research Laboratory, Thorntonhall, Glasgow, Scotland.