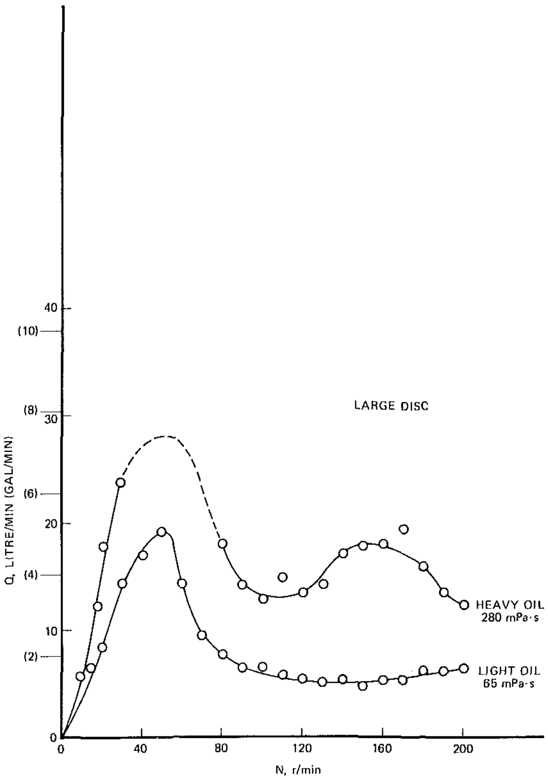

Fig. 10 Flow rate for full range of shaft speeds tested

zero flow at a positive shaft speed, as would be predicted by the straight line relationship between flow and the flow parameter, found at high shaft speeds.

This would indicate that one means of obtaining somewhat higher flows at low shaft speeds would be to weight or spring load the scraper to the disk to reduce the film thickness. This has not, however, been

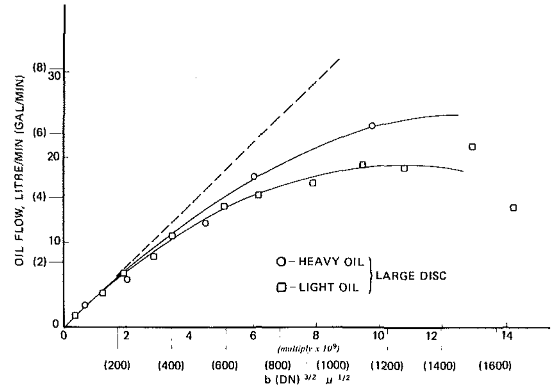

Fig. 11 Flow rate data versus flow parameter for full range of test conditions

found necessary in practice.

Although no systematic study of the effect of disk immersion depth was made, no significant change in the flow rates was found with variations as would be expected in normal operation. This range was from a minimum immersion of about 25 mm (1 in.) to a maximum of about 75 mm (3 in.).

Summary

Tests were conducted on two sizes of disk-scraper lubrication systems as used in conjunction with marine main propulsion lineshaft bearings. Emphasis was placed on obtaining flow data at the lower speed ranges to establish aids for designing lube systems to insure sufficient oil for these conditions. The tests provided consistent flow data which correlated well with a flow parameter at the lower shaft speeds.

References

1 Lemmon, D. C., and Booser, E. R., "Bearing Oil—Ring Performance," ASME Paper 59-Lub-5.
2 Gardner, W. W., "Journal Bearing Operation at Low Sommerfeld Numbers," ASLE Paper 75AM-7A-1.

DISCUSSION

T. C. Johnson[2]

The author is to be complimented for contributing to the technical literature on self-oiled journal bearings for which the oil delivery means is a disk dipping in the oil reservoir below the bearings, rotating with the shaft and provided with a scraper at the top of the disk to divert the oil lifted by the disk from the reservoir into the bearing oil inlet.

As the author points out, the disk method is more positive than the older and more frequently used method of oil rings, and the literature on disk lubrication is quite scanty.

At the low speeds expected for turning gear or creeping operation, the oil sticks to the disk in a relatively thick film which, when scraped off into the bearings, is more than enough to supply the bearing needs.

At higher speeds, the oil begins to be flung off the disk because of centrifugal force and the disk delivers less oil than at a slower speed, as shown in Fig. 10 of the paper.

The bearing oil supply needed to keep a full oil film increases almost linearly with speed; for example, a 25 × 25 bearing loaded to 160 psi (on the projected area) requires the following amounts of oil (medium turbine grade)

80 rpm	2.1 gpm
120 rpm	3.3 gpm
200 rpm	5.6 gpm

as calculated by the methods of Wilcock and Booser.[3]

It is concluded that a disk-scraper method is excellent at very slow speeds and the methods of the author can predict the expected performance but at higher speeds the disk-scraper is inadequate and progressively so as the speed increases. For such higher speeds, a trough type enclosure of the disk, as shown in U. S. Patent #3,294,457, is needed to catch the oil thrown off the disk by centrifugal force and guide it up to the bearing inlet. With such an addition, the disk lubrication method is adequate for all speeds.

Author's Closure

The review and comments by Mr. Johnson are appreciated. The question of disk-scraper operation at higher speeds is raised with the general conclusion that the performance of such a system may become

[2] General Electric Co., Schenectady, N. Y.

[3] Wilcock and Booser, *Bearing Design & Application*, McGraw-Hill, New York, 1957.

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inadequate at a sufficiently high speed. The tests reported by the author emphasized lower speed operation although some data were taken at higher speeds, as evidenced by Fig. 10. The author agrees with Mr. Johnson that some additional design considerations to redirect at least some of the oil, thrown off the disk by centrifugal force, into the bearing inlet can improve this type of system at higher speeds. This can often be incorporated into the bearing housing design and may simply consist of judiciously placed baffles.

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