ROTARY OIL SEALS

BY

LIEUTENANT D. H. CAMERON, R.N., A.M.I.MECH.E.

The *Journal of Naval Engineering* published an article (Vol. 9, No. 4 : October, 1956) entitled ' Rotary Oil Seals ', in which it stated that further tests were being made at the Admiralty Engineering Laboratory, West Drayton. These varied from the original tests by using eccentric shafts, eccentric housings and, finally, low temperatures down to —40 degrees F.

Results of the eccentric shaft trials showed that seals tend to fall into two categories depending upon the resilience of the seal lips :—

(*a*) Seal lip is sufficiently flexible to maintain permanent contact on the shaft

(*b*) Seal lip not being flexible, thereby not maintaining permanent contact.

This ' permanent contact ' is known as radial pressure and is vitally important to the efficiency and life of an oil seal. If contact is permanent, there will be no initial increase in leakage compared with concentric shaft trials, although track wear and torque will be greater. If there is not permanent contact, oil leakage will take place and seal will fail. However, should the radial pressure in either case be too great, frictional temperatures will be generated and may rise higher than that which the sealing material can withstand (300 degrees F.), thereby causing the seal to become hard and a considerable amount of power to be lost.

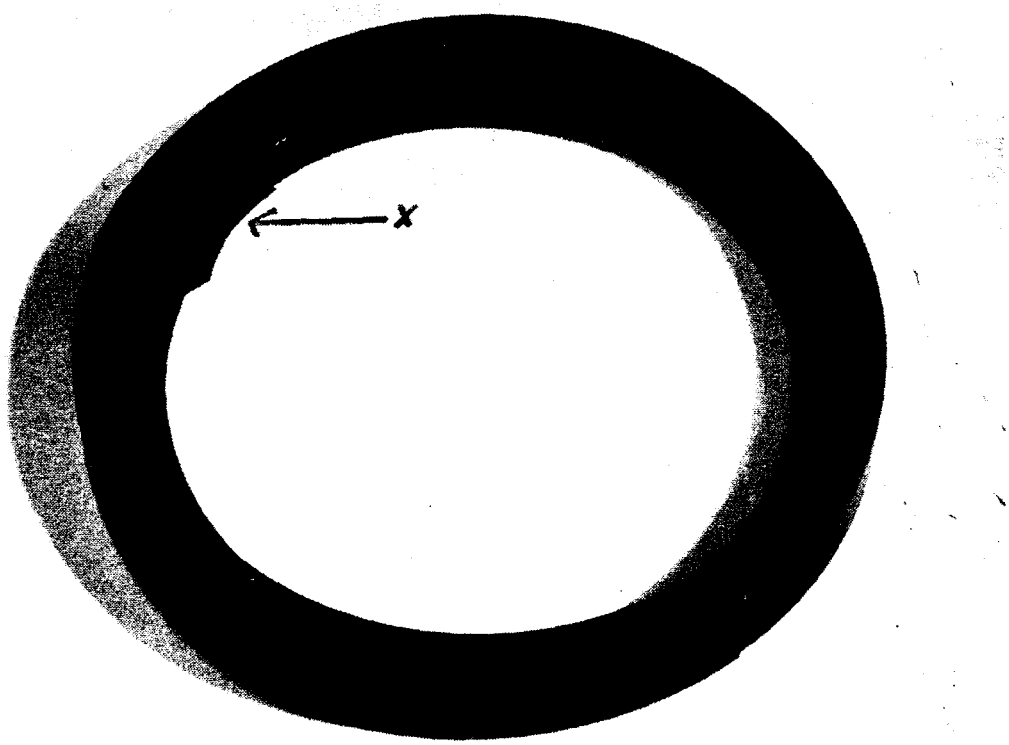

FIG. 1—' X ' INDICATES LIP FRACTURE WHEN SEAL IS SUBJECTED TO SHOCK AT —40 DEGREES F.

The amount of shaft eccentricity or whip which can safely be withstood by the majority of manufacturers' seals varies according to the speed of the shaft, a rough guide being :—

R.P.M.	*Eccentricity*
0— 500	0·010 in.
500—1,000	0·006 in.
1,000—2,000	0·002 in.
3,000 or over	0·001 in.

Trials showed that the concentricity of the seal housing is not so important as that of the shaft, particularly when using ' metal-insert ' type of seals. A general guide for maximum eccentricity of housing using metal-insert seals is 0·005 in.

Low temperature trials showed that the standard rotary oil seal when subjected to low temperatures increases the torque on the shaft—the friction on the seals increasing 300 per cent when the temperature is lowered from ambient to—40 degrees F. Such seals when subjected to shock at this temperature easily break (FIG. 1). Manufacturers may supply seals for such conditions which, however, will not be so efficient when subjected to work under higher temperatures. Research continues by seal manufacturers to try to produce the perfect seal for every condition of operation.