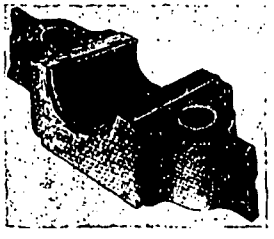
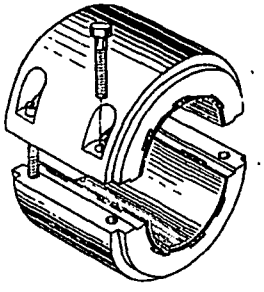
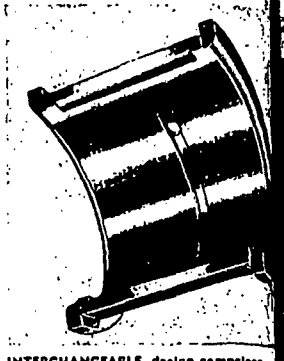
DIESEL-BEARING EVOLUTION FROM CAST-IN TO SLIP-IN



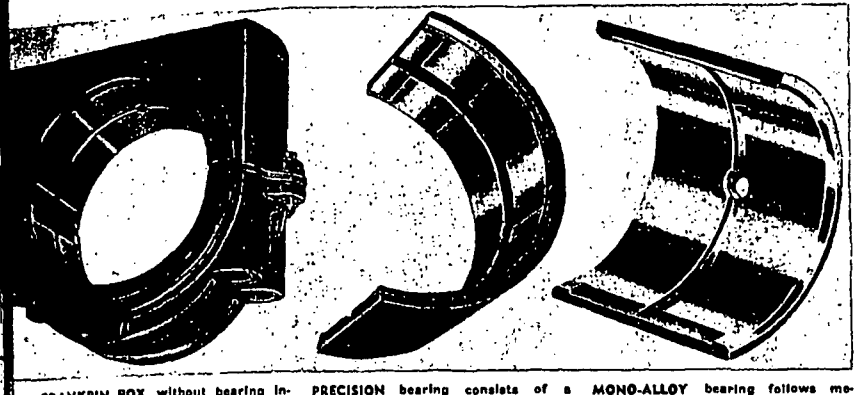
BABBITTED bearing cast in place in housing serves in slow-speed engines



INTEGRAL bearing was forerunner of some present designs. Cylinders held together by bolts were babbitted and machine-finished on outside diameter. This design reduced lining thickness, hand fitting needed for replacement. Rebabbitting could be done at factory



INTERCHANGEABLE design comprises bronze back with centrifugally cast lining; finishing stock is provided on ID for machining or scraping to fit



CRANKPIN BOX without bearing insert, babbitt being chemically bonded directly to box. Used occasionally

PRECISION bearing consists of a backing and thin lining machined for interchangeable fit before assembly

MONO-ALLOY bearing follows mechanical features of precision-insert design but is made of a single metal

For Top-notch Diesel Operation Know Your Sleeve-Bearing Fundamentals

To meet today's heavier demands, improved bearings have been developed. Here's the way they came into use, the reasons why, and an explanation of their mechanical construction features*

CONDITIONS IN DIESEL ENGINES make life tough for bearings. To meet these ever more severe demands, bearing designs have undergone radical changes since Isaac Babbitt introduced the bearing alloy now known by his name.

The early idea was to apply a generous quantity of a high-tin alloy directly to a cast-iron or bronze housing. Because chemical bonding was unknown, mechanical means of making the lining stay in the housing had to be used. Methods included tapping large holes with coarse threads, and tapping and screwing-in flat-head screws, but the common procedure involved casting or machining dovetail grooves into the housing (see above). In large diesels, lining sometimes reached a thickness of 1½ in., or more.

In spite of casting difficulties, such bearings worked rather well where unit loads were low and speeds slow. Nevertheless, wear eventually reached a point where the babbitt had to be recast and brought to a fit, an operation requiring time, equipment and skill, and success was not always sure.

Yesterday's Bearings. Forerunner of some present bearings was the *integral* design, consisting of a babbitt-lined split cylinder held together by bolts. The OD was machine-finished to fit the housing. Thus main bearings could be assembled to the crankshaft and the whole laid into a bedplate bored to mate OD of bearing backings.

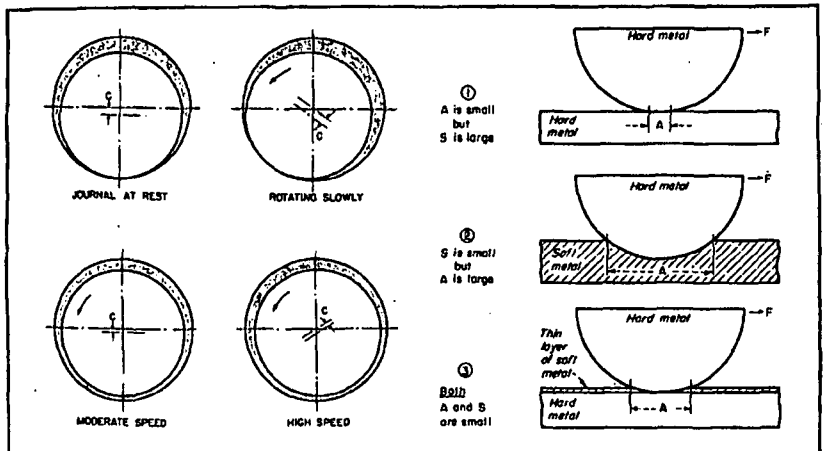
In this design, lining thickness was reduced to 1/16 to 3/8 in., depending on backing material and thickness. Dovetail grooving was less drastic, but still used in most cases. These bearings could be replaced, with some hand fitting and shimming, and rebabbitting and machining could be done by the engine builder or a bearing maker.

Next step was the *interchangeable* unit, consisting of a backing, usually bronze, with suitable lining material centrifugally or gravity cast by modern methods capable of obtaining a chemical bond between lining and backing. Allowance for finishing was made on the ID. Bedplate and corresponding mainbearing caps were bored and the bearing OD machined to fit them. Stock was usually left at the parting faces, as well, for subsequent fitting. Methods of boring the assembled bearings to fit the shaft were sometimes employed, but usually laborious hand scraping was considered best.

Resulting oil clearance was variable, and high and low spots on the bearing surface could not be avoided. Also, because bearings were finished to height by hand filing, contact of these surfaces with the corresponding half bearing was not too accurate. Linings still had to be relatively thick (1/16 to 1/4 in.) to offset inaccuracies in initial bedplate boring as well as to allow for hand scraping. When bearings of this type are put in new engines today the linings are machine bored to a truly round hole for a round shaft.

Development of methods for chemically bonding lining to backing led to occasional direct babbitting of crankpin boxes. Elimination of lining anchor-

At the 18th National Oil and Gas Power Conference of the Oil and Gas Power Division, ASME, four comprehensive papers on bearings were presented by H Cronkshaw and O W LePoe, Cleveland Graphite Bronze Co; R J Emery, National Bearing Division, American Brake Shoe Co; W R Tilli, Federal-Mogul Corp; and D B Wood, Aluminum Co of America. This article, and easier to follow, is a condensation and free adaptation of these papers.



HOW BEARING OIL FILM FORMS

Theory pictures formation of oil film as shown above: At rest, actual contact exists between shaft, bearing. When shaft starts to turn, it tends to roll to left. Speed rises, shaft drags oil into wedge-shaped space, pressure builds up, lifts shaft off bearing. At full speed, hydraulic pressure tends to push shaft to side

METALS IN DRY FRICTION

Some metal-to-metal friction usually occurs in any bearing. Frictional resistance is proportional to the real area of contact A and the shear strength S of the softer metal. As diagramed above, the desired condition of keeping both A and S small is obtained by thin film of soft metal on hard metal