(b) (b) (ctrocardiogram. (a) Catheological cord. (b) Ink writer record.

me voltage give the same the

litude linearity character some s., is shown in Fig. 8. At twoid large amplitudes Reenale teresis effect similar tworomagnetic materials. The appreciable error in the linicountered in biological was

ectrocardiograms

fore, probably the best too g corder is comparison of the ith a known wave form of the ed. Electrocardiograms much orded in biological work, and a wide range of componenhave been used to check the nstrument. Fig. 9 shows the rocardiogram, as recorded to cillograph at a and by the en-

AND ACKNOWLEDGMENT

ink-writing oscillograph is in the recording of biochemic alysis of the electromechanic ument is simplified by deriving ctrical network. From the diimplitude-frequency, and tenics can be calculated. While proved by inserting a series amping cannot be achieved in a piezoelectric device because efficient of coupling, greatebtainable in a crystal.

ig and best frequency regime y equivalent. The best tree is ison of records with the wave ed potential. Such comparison with the instrument dewenter ess my gratitude to Dr Car stance in the theoretical pretion on, and to Dr. R. W. Getweets it.

Computation of Some Physical Properties of Lubricating Oils at High Pressures

I. Density

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From a survey of available data on the density of fluid lubricants as a function of pressure and temperature, the following empirical equation has been derived:

$\rho = \rho_0 (1 + ap - bp^2)_{\iota}.$

 ρ is the density at a given pressure (gage) p and temperature t; ρ_0 is the corresponding density at atmospheric pressure. The constants a and b are evaluated over a temperature range extending from 20° to 220°F and the density equation is valid over a pressure range of 50,000 lb./in.². While the equation was derived from data on mineral oils it has been found to hold equally well for animal, vegetable, and fish oils. The variation of density with pressure is independent of the nature of the oil.

when to compute the thermodynamic charcreatics of an oil at high pressure it is such that the specific volume or density be a sta function of temperature and pressure. mur, in problems of lubrication design it is messary to convert from the dynamic to immatic coefficient of viscosity, and vice and in order to do this at high pressures dynsities must be known over the range of ar involved. It is the purpose of this paper ment a practical means for calculating an over a pressure range up to 50,000 lb./in.² interatures between 20 and 220°F. These a d pressure and temperature are those only encountered in many problems of in the fields of engineering and d physics, and although data could be readily at higher pressures, provided the temperature was also raised so that the remain fluid, the investigation would mome one of academic interest rather than importance.

¹ to be defined at a person of the second second

1 Now, J. Wash. Acad. Sci. 24, 516 (1934).

Now and M. R. Fenske, Ind. and Eng. Chem. 27,

at 104°F and 167°F at pressures up to 50,000 lb./in.², and then fractionated the oil into narrowboiling cuts and obtained data on ten of these cuts.

The striking result of all these investigations is the fact that, within the range of experimental error, all of the oils have the same compressibility. Thus the oils studied in Europe by Hyde, who used the moving piston type of apparatus to make his measurements, showed the same behavior in this respect as the oils studied in this country by Dow who used the sylphon apparatus. Furthermore, the work of Dow included extreme types of oils such as a typical Pennsylvania oil which is noted for its high paraffinicity and low temperature coefficient of viscosity, and a typical Gulf Coast oil which is characterized by the fact that it contains large amounts of naphthenic and aromatic types of molecules and has a relatively high temperature coefficient of viscosity. The work of Dow and Fenske, moreover, shows that the generality in regard to compressibility may be extended to narrow-boiling fractions which vary considerably in boiling point and molecular weight. This insensitivity of compressibility, within the range of experimental error, among the wide variety of oils studied is strikingly different from other properties that have been studied under pressure, as, for example, viscosity.4

From an experimental standpoint, therefore, ⁴ R. B. Dow, J. App. Phys. 8, 367 (1937).

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Hude, Proc. Roy. Soc. A97, 240 (1920).