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TECHNICAL REPORT No. 107-45

SYNTHETIC LUBRICATING OILS

JUNE 1945

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From: Chief, U. S. Naval Technical Mission in Europe.
To : Chief of Naval Operations (OP-16-PT).

Subject: U. S. Naval Technical Mission in Europe Technical
Report No. 107-45, Synthetic Lubricating Oils -
Forwarding of.

Enclosure: (A) (HW) Copies of subject report.

1. Enclosure (A) is forwarded herewith.

H. A. Schade
H. A. SCHADE.

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TECHNICAL REPORT No. 107-45

SYNTHETIC LUBRICATING OILS

JUNE 1945

U. S. NAVAL TECHNICAL MISSION IN EUROPE

[REDACTED]

SYNTHETIC LUBRICATING OILS

1. Summary.

(a) The following information was obtained during an interrogation of Mr. Immhausen, owner, and Dr. Rossow, Chief Chemist, of the Deutsche Fettsaurewerke at Witten on 23 May 1945. This company was requested by the German Navy to prepare a substitute for Camel-Hoof oil, which was being used as a torpedo lubricant. The objection to Camel-Hoof oil was two-fold. Firstly because it was insoluble in water it left an oil streak, and secondly it possessed such a high pour point that it was unsatisfactory for cold weather or arctic operations. To overcome the latter of the two objections the Camel-Hoof oil was diluted with a light mineral oil or rape seed oil. This expedient lowered the pour point at the expense of its lubricating ability. A substitute was made which was simply a fatty acid salt of triethanolamine. The acid used was a mixture of C₆ to C₉ fatty acids of unknown composition. This salt was used in 20 to 40 percent by weight in some water soluble medium such as glycol, diglycol or glycerine. The exact composition depended upon the desired viscosity for a particular use. It is claimed that these compositions can also be used at high temperatures. No additives or stabilizers were ever used in these compositions.

(b) In addition to the above compound the Deutsche Fettsaurewerke was also working on an additive for mineral oil lubricants. The purpose of this additive, used to about 10 percent by weight of the oil, was to raise the viscosity index and lower the pour point temperature of the mineral oil. This additive was made by the esterification of pentaerythritol with a mixture of fatty acids from C₆ to C₁₀ molecular weight. The composition of the acid mixture was not known. This ester additive was not used commercially. It was, at the time of the interview, only a laboratory curiosity. For this reason no details of preparation had been decided upon. The technique used in the esterification were standard. A sample of the water soluble lubricating oil for torpedoes was obtained and forwarded to Naval Research Laboratories, Anacostia Station, Attention of Dr. Daniel Fore. This shipment was made on consignment Tag No. 4577.

2. Conclusions and Recommendations.

The claim that the triethanolamine salts of fatty acids can

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2. Conclusions and Recommendations (Cont'd.)

be used at high temperatures as a general lubricant would appear to be too broad. The instability of these compounds both to heat and oxidation would indicate that considerably more laboratory work and testing would have to be done before justifiable adoption. In addition to this objection it would appear that any copper or bronze present in the lubricated parts would be subject to preferential corrosion by the amine.

3. Details.

(a) The triethanolamine salt of the C_6 to C_9 fatty acids is made by addition of stoichiometric quantities of amine to acid mixture at room temperature. The reaction, one of neutralization, is instantaneous. The triethanolamine used in the preparation was commercial grade material purchased from Ridael de Haen or Schering-Kahlbaum, both German producers.

(b) The fatty acid esters of pentaerythritol were prepared in the laboratory both with and without a catalyst of sulfuric acid. Preparations were made using an excess of the acid as the agent for removal of by-product water and also experiments were made using toluene as drying agent. The products were the same in either case.

Prepared by:

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