

Preparation of Polyol Esters

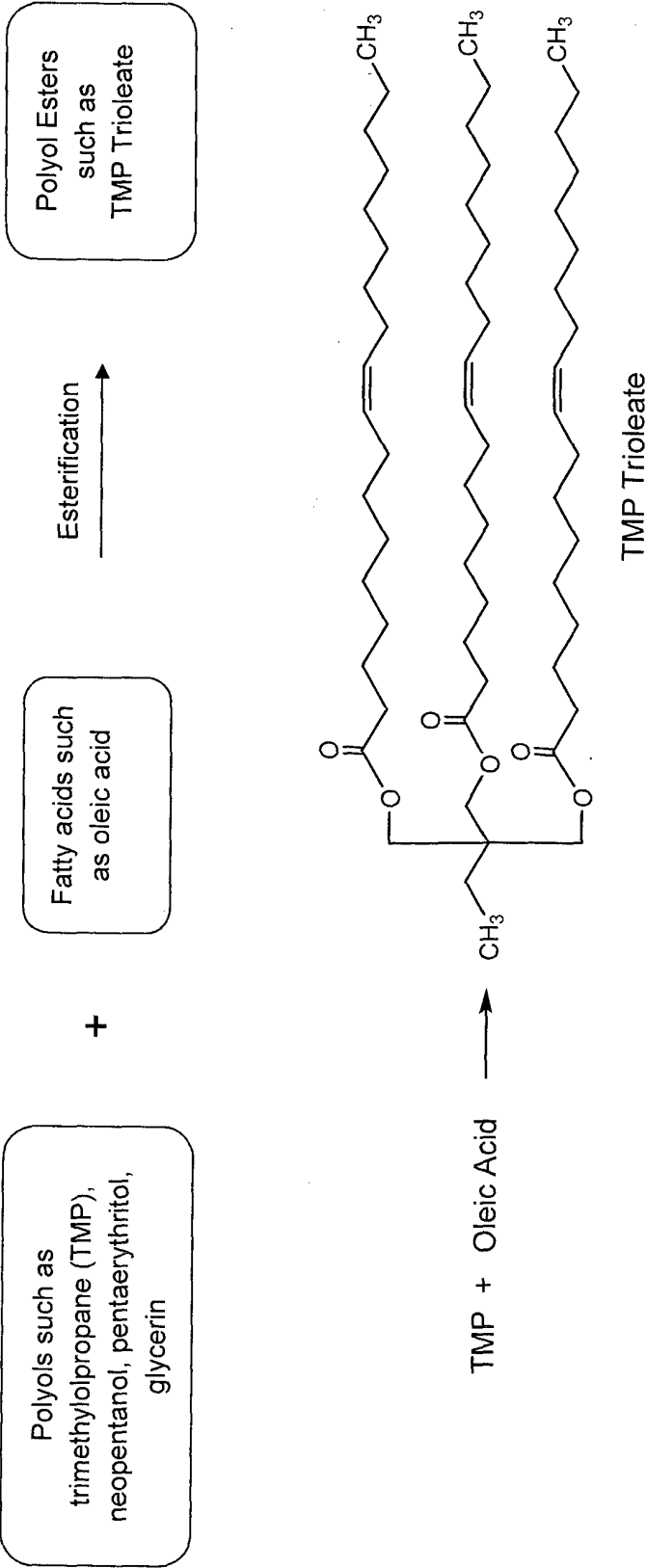


Figure 1

Production of Ester Polyols

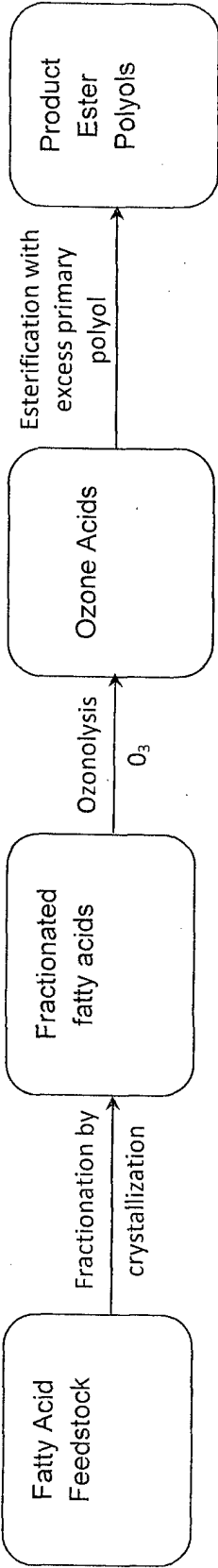


Figure 2

Two-Step Conversion of Ozone Acids to Ester Polyol Esters for Lubricant Base Oil

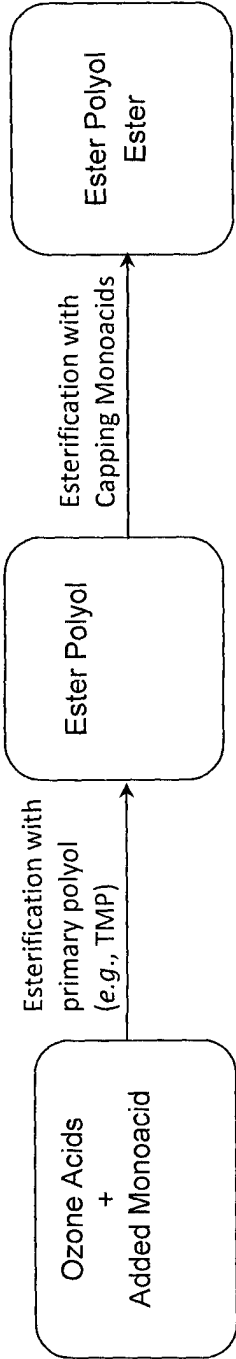
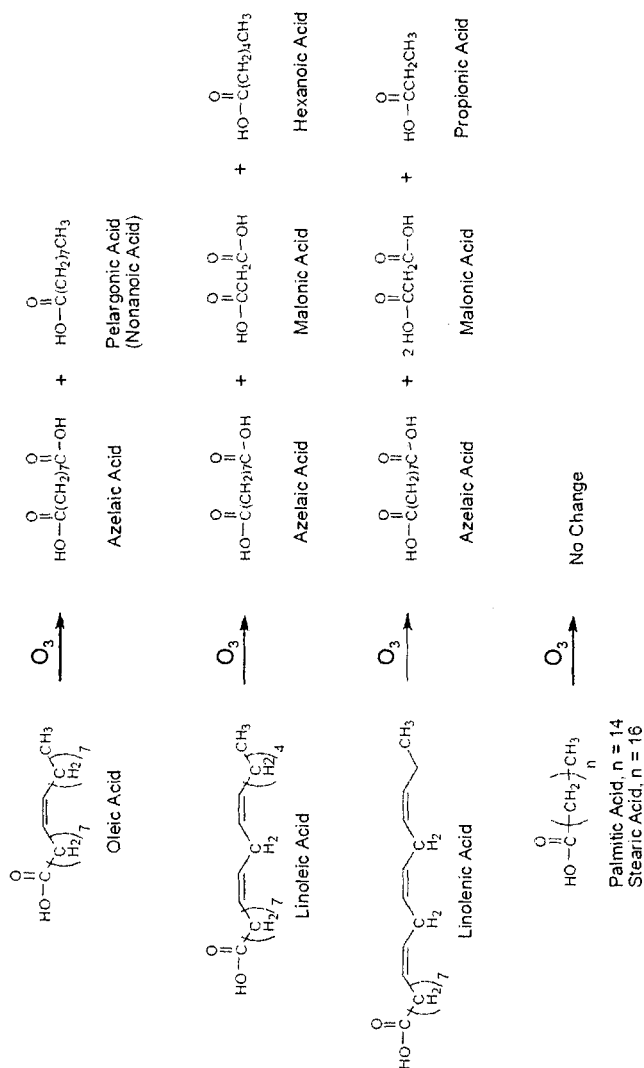


Figure 3

OZONE ACIDS



Specific Oxidation Acids formed by Oxidative Cleavage of Fatty Acids (Note that malonic acid will undergo decarboxylation to form acetic acid and carbon dioxide under oxidative ozonolysis conditions)

FIGURE 4

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Structures of TMP Trioleate, Ester Polyol Lubricant Base Oil Precursor, and Ester Polyol Ester Lubricant Base Oil

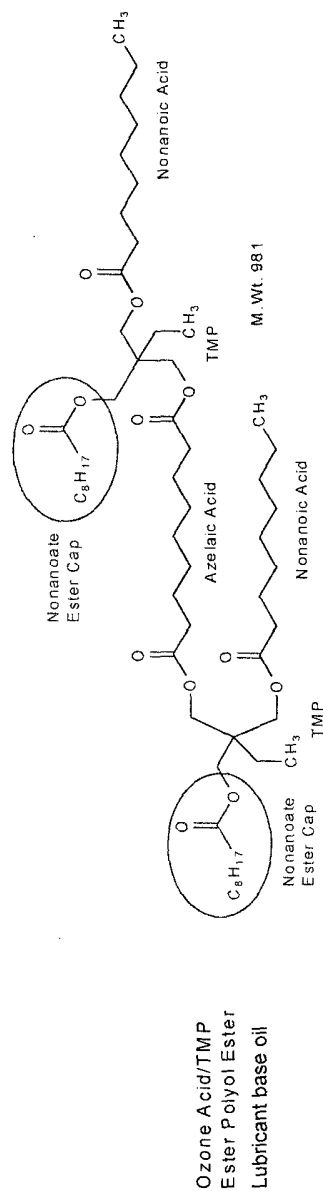
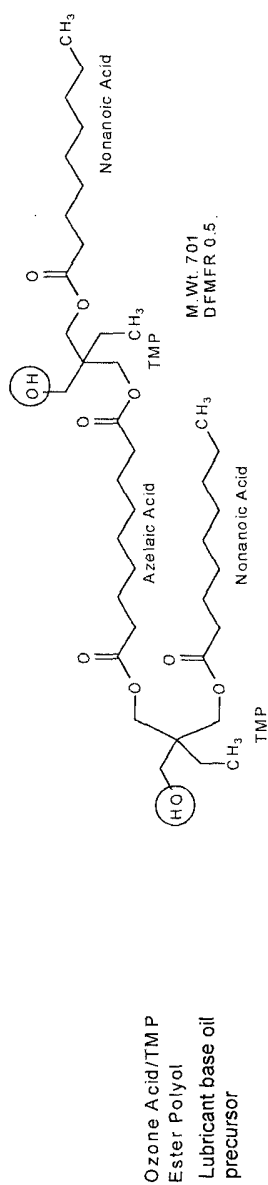
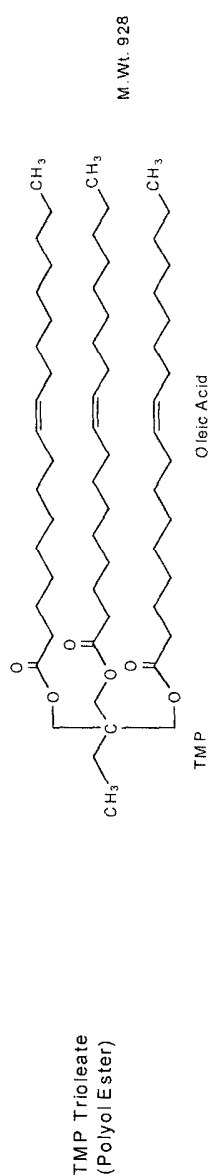
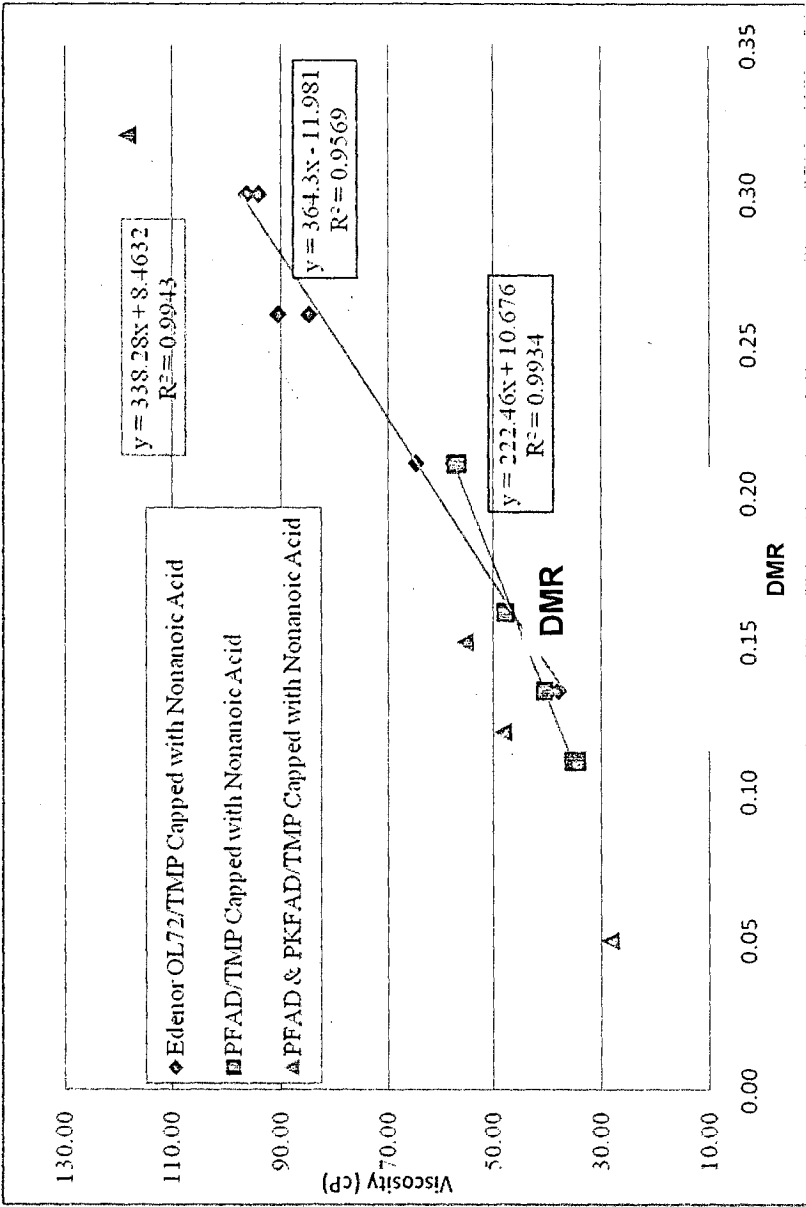
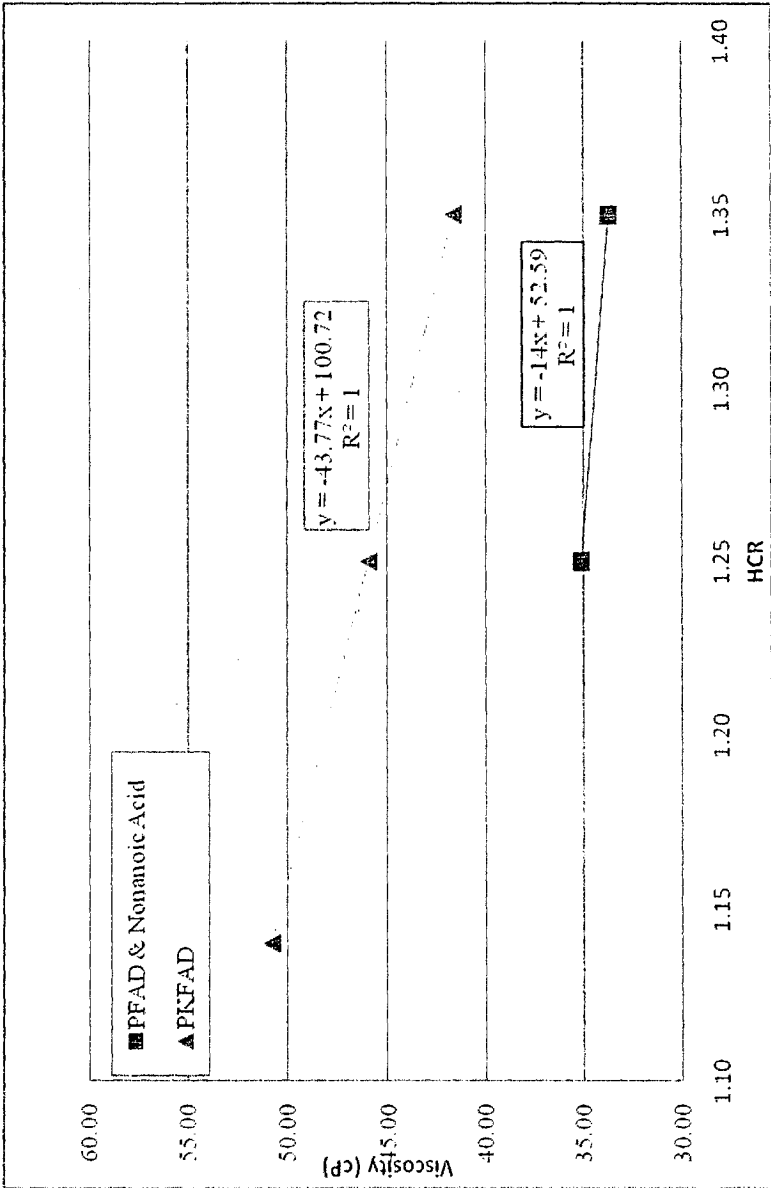


FIGURE 5



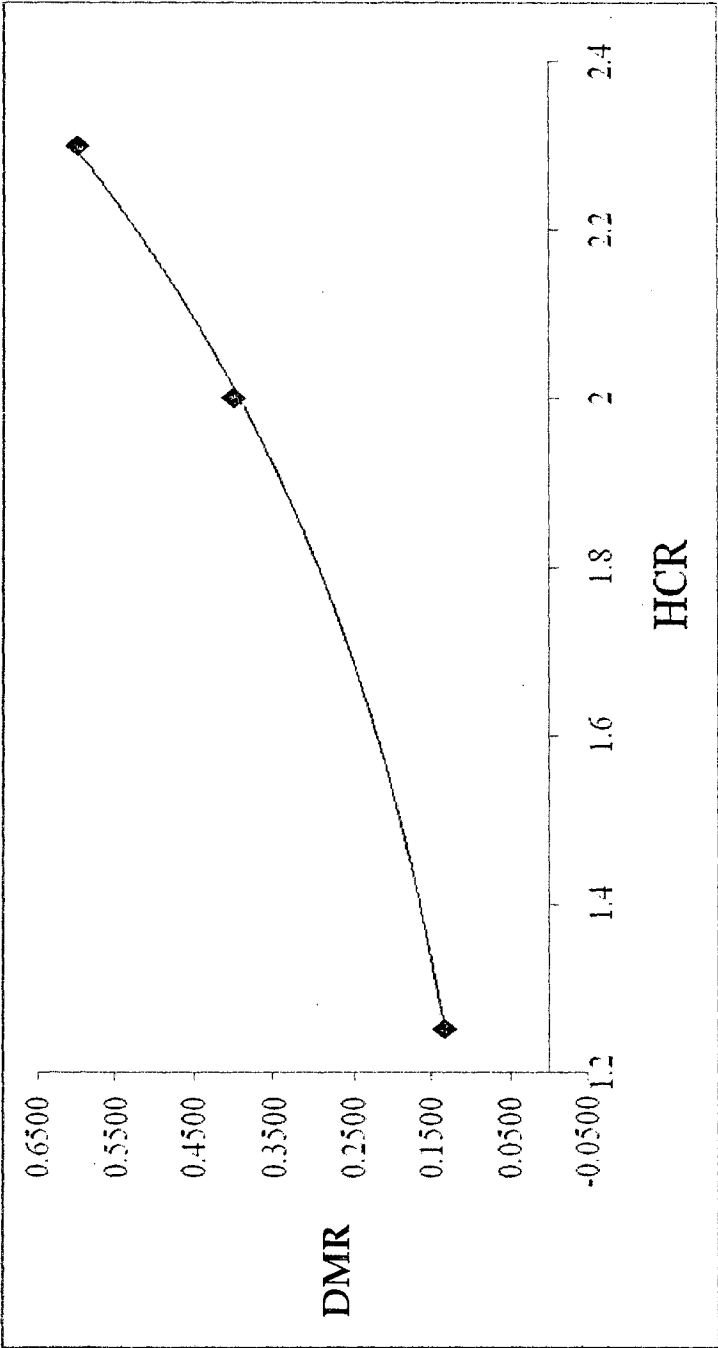
Polyol Ester Polyol Viscosities versus DMR at HCR of 1.25 after Capping with Nonanoic Acid

FIGURE 6



Polyol Ester Polyol Viscosities versus HCR at DMR of 0.11-0.12 after Capping with Nonanoic Acid

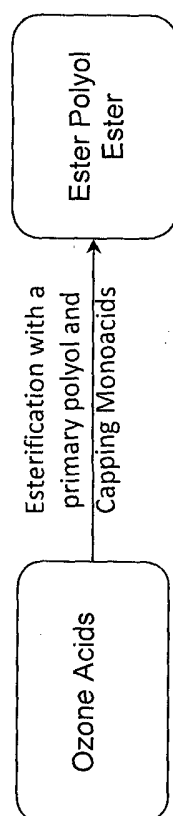
FIGURE 7



Combined DMR and HCR Required to Obtain ISO 49-58 cS Hydraulic Fluids

FIGURE 8

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One-stage Synthesis Approach of Producing an Ester Polyol Ester for Lubricant Base Oil

FIGURE 9

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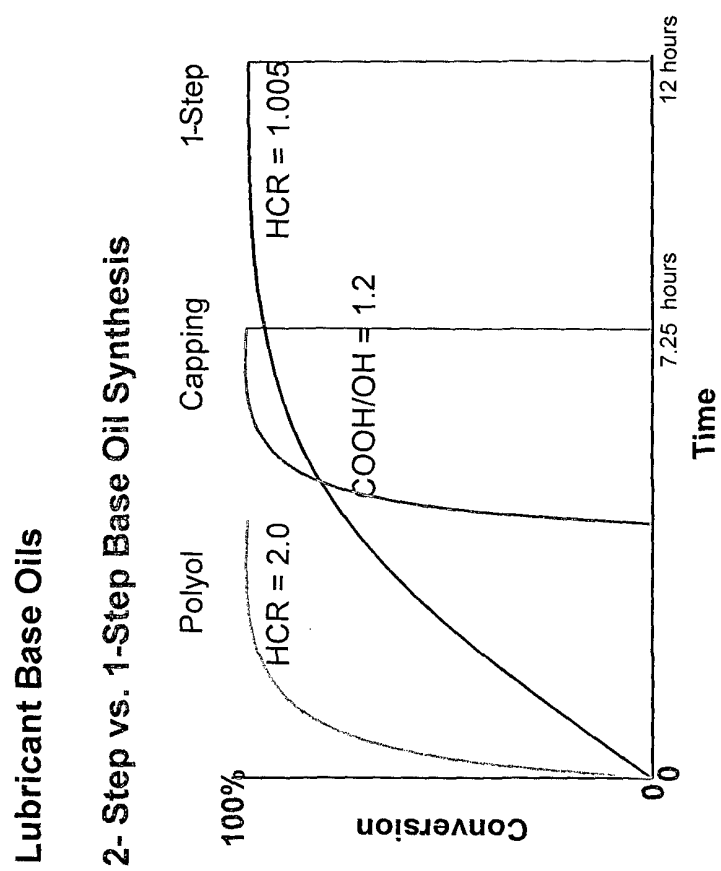


FIGURE 10