

Preparation of Polyol Esters

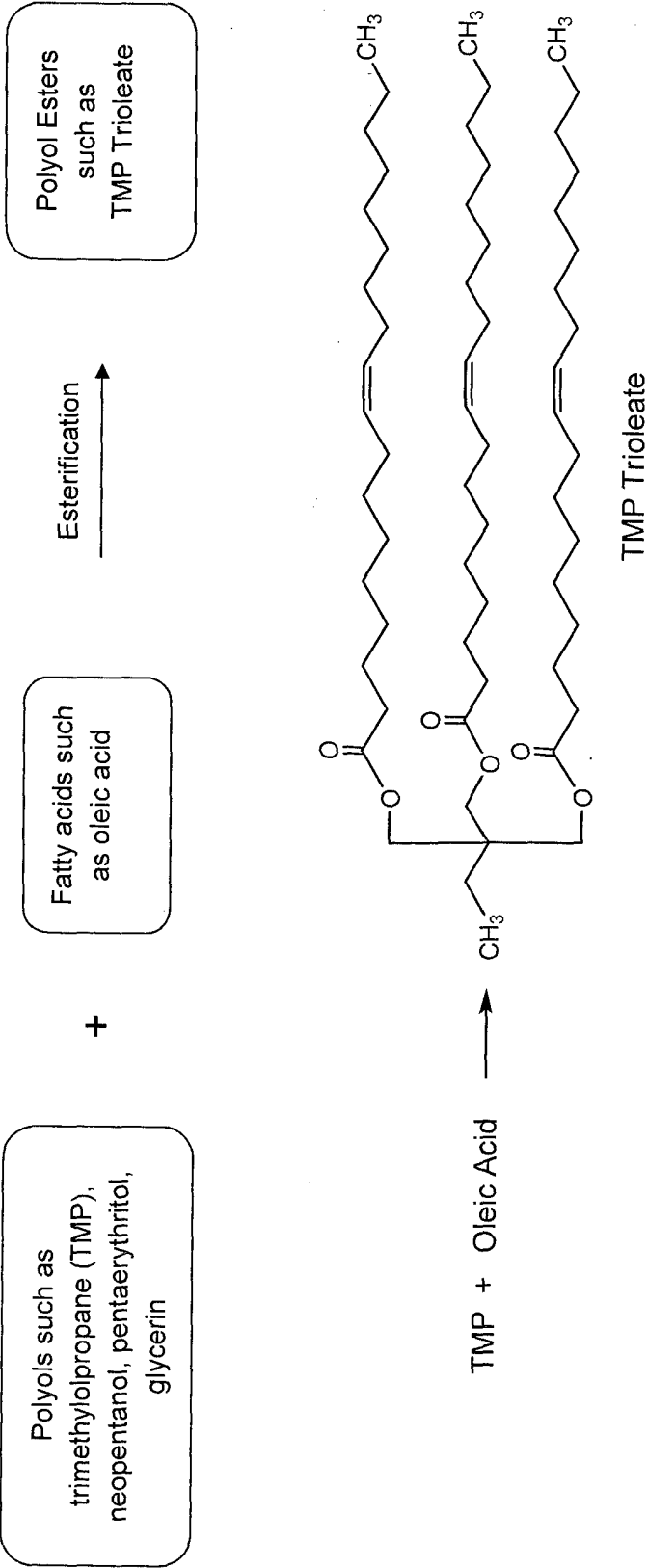


Figure 1

Production of Ester Polyols

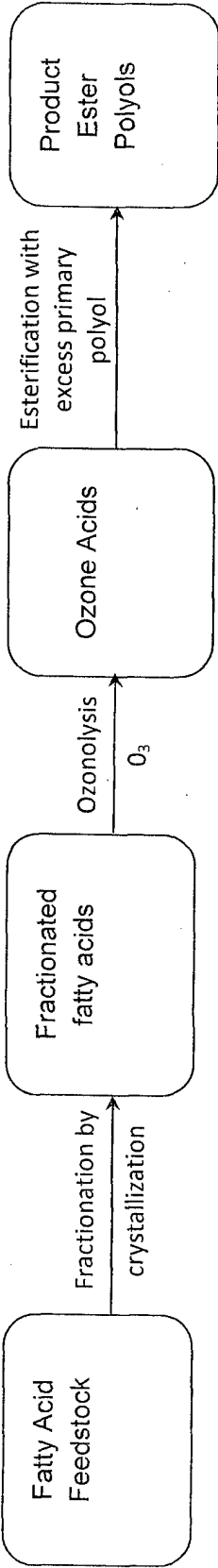


Figure 2

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

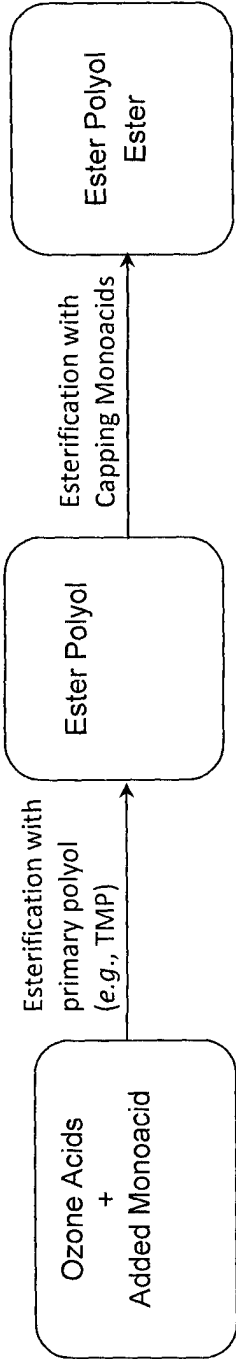
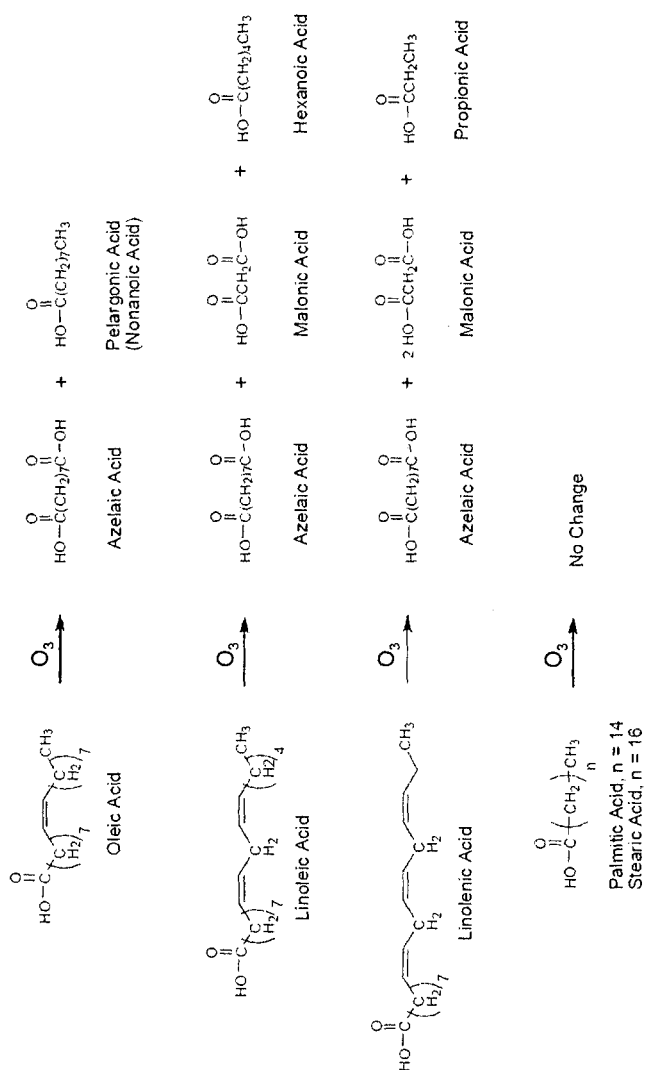


Figure 3

## 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

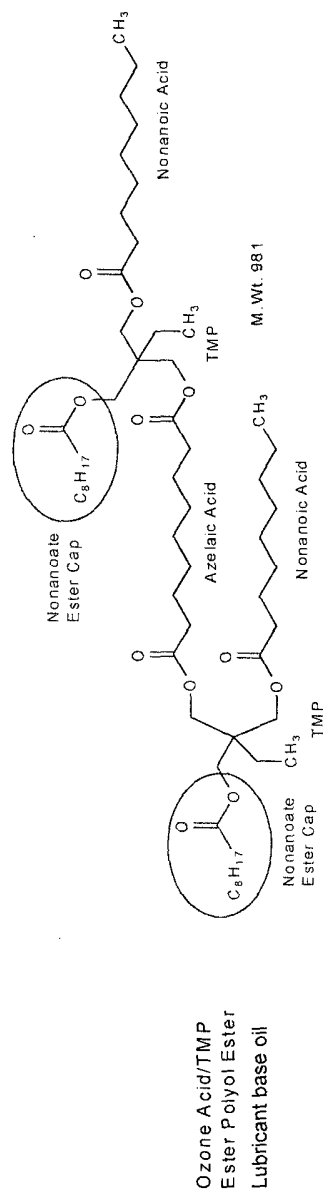
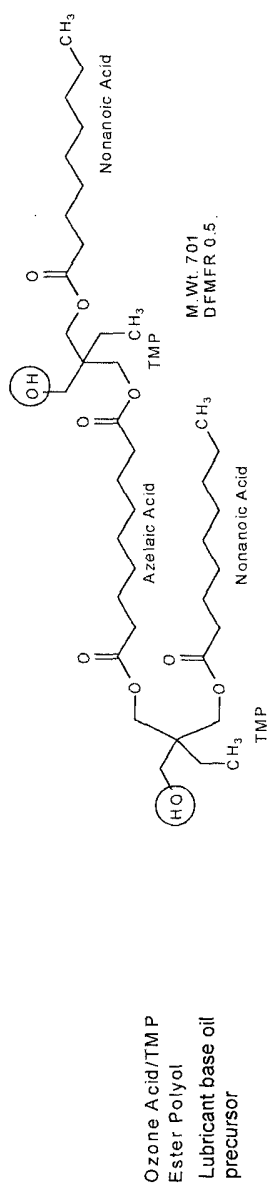
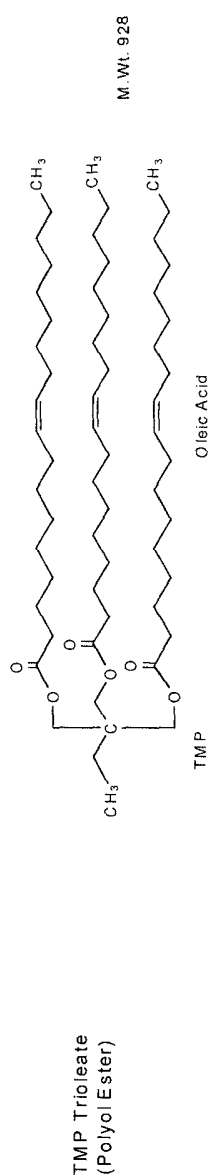
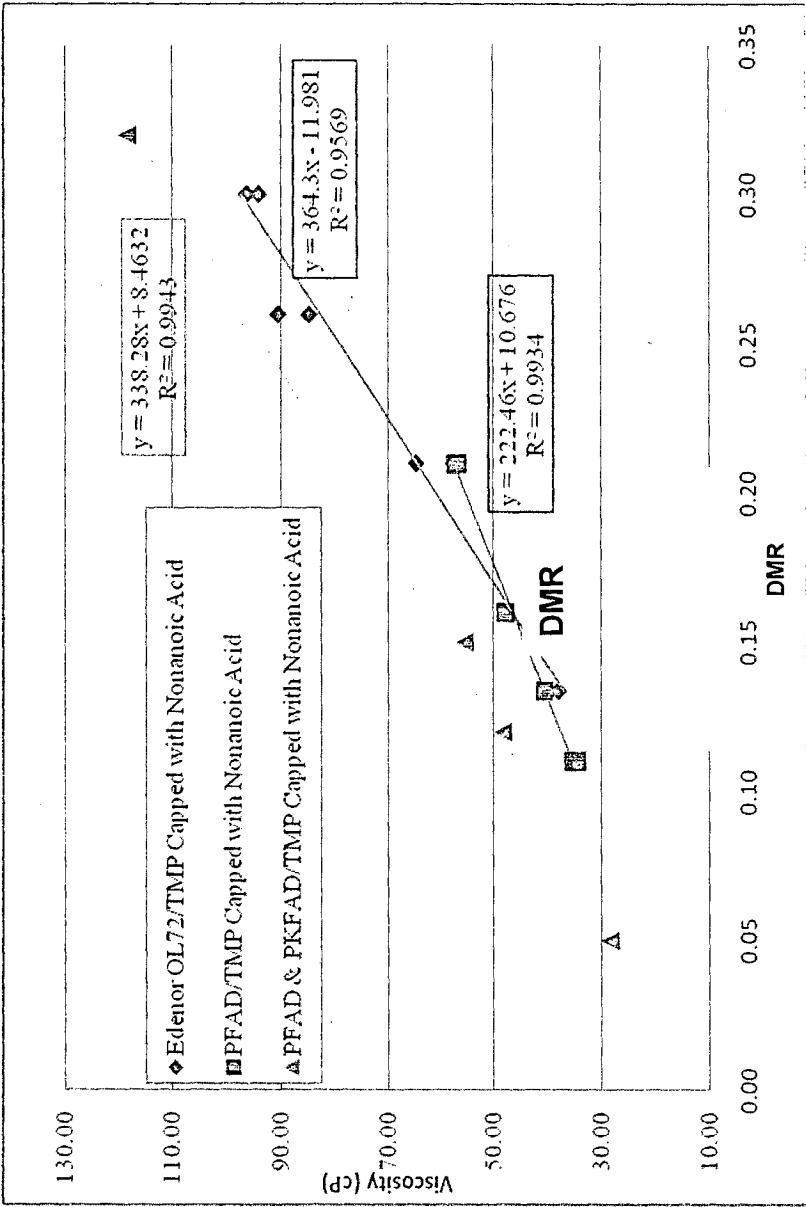
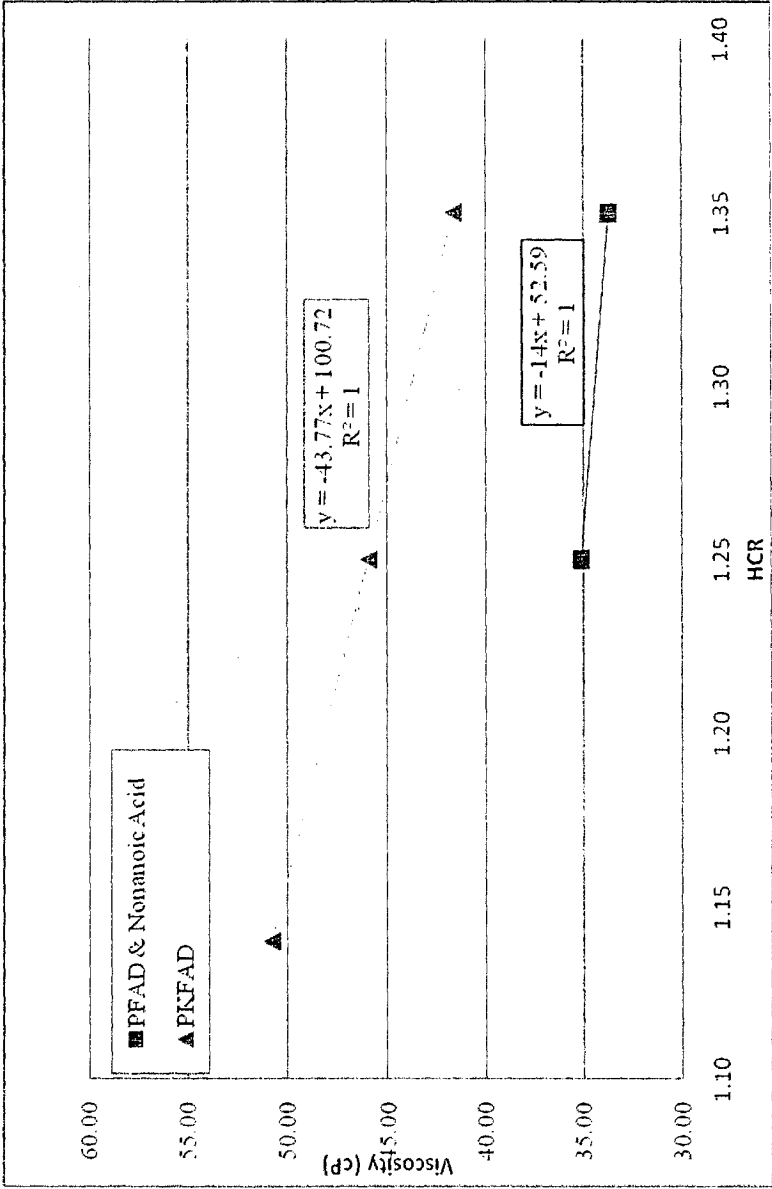


FIGURE 5



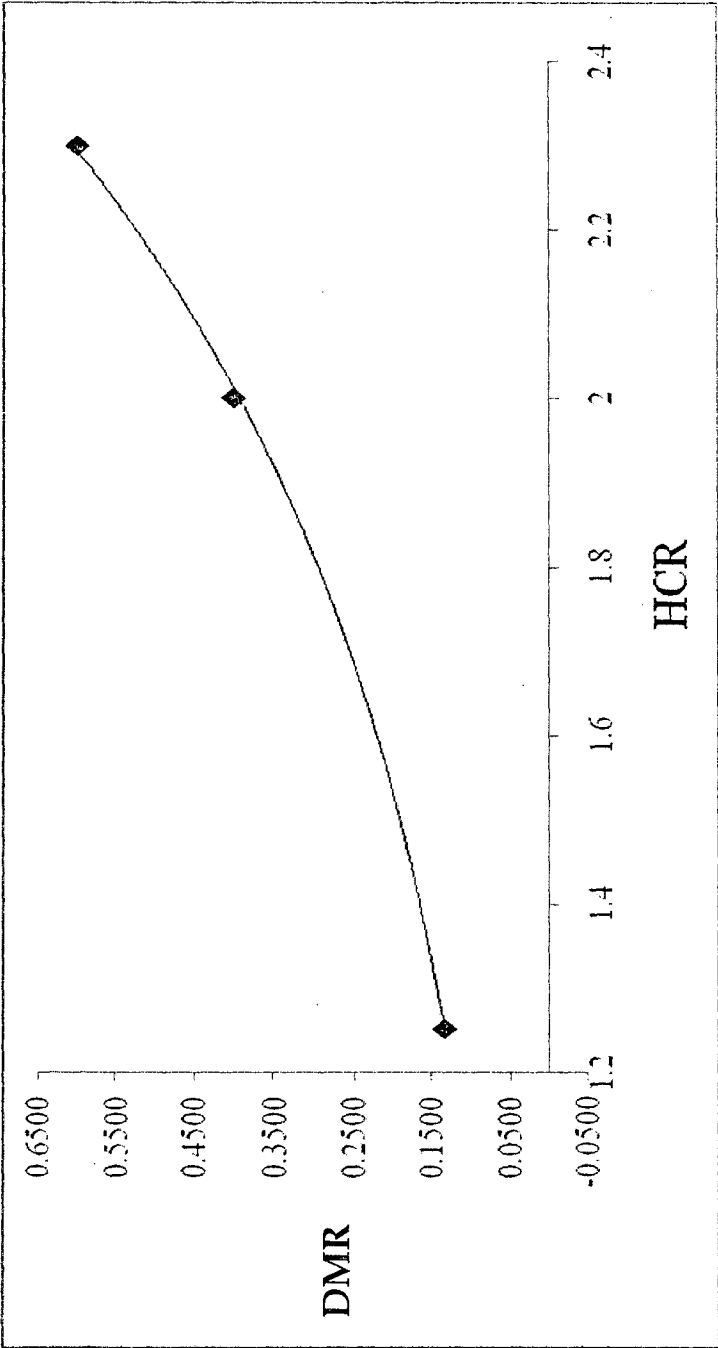
Polyol Ester Polyol Viscosities versus DMR at HCR of 1.25 after Capping with Nonanoic Acid

FIGURE 6



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

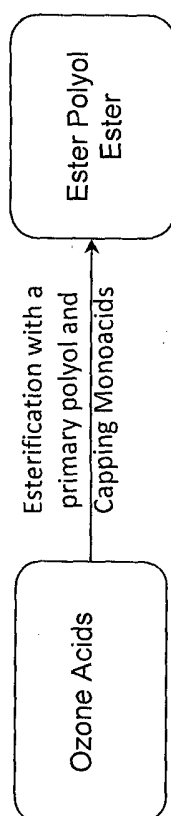
FIGURE 7



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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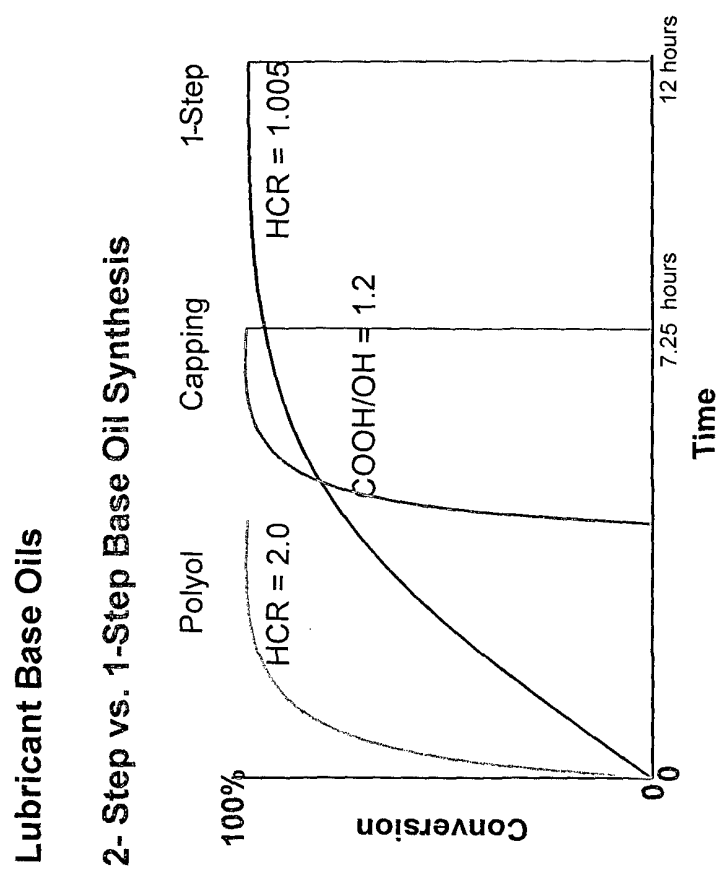


FIGURE 10