

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.:	11/615,539	Confirmation No.	1057
Applicant(s):	Stuart N. Milligan et al.	Examiner:	Taylor II, James W
Filed:	12/22/2006	TC/A.U.:	1796
Docket No.:	34249US		

For: DRAG REDUCTION OF ASPHALTENIC CRUDE OILS

REQUEST FOR RECONSIDERATION TO OFFICE ACTION

Date: June 24, 2009

Mail Stop Amendment
Commissioner for Patents
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Office Action dated May 29, 2009 please reconsider the above-identified application based on the following claims and remarks:

Claims begin on page 2 of this paper.

Remarks/Arguments begin on page 32 of this paper.

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A method comprising: introducing a drag reducing polymer into a liquid hydrocarbon having an asphaltene content of at least about 3 weight percent and an API gravity of less than about 26° to thereby produce a treated liquid hydrocarbon, wherein said drag reducing polymer comprises at least about 25,000 repeating units, and wherein a plurality of said repeating units comprise a heteroatom, wherein said heteroatom is selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom, and/or a phosphorous atom and wherein the drag reducing polymer has a weight average molecular weight of at least 1×10^6 g/mol in order to reduce the drag in the liquid hydrocarbon.

2. (Previously Presented) The method of claim 1, wherein said liquid hydrocarbon has an API gravity in the range of from about 5° to about 25° and an asphaltene content in the range of from about 4 to about 35 weight percent, wherein said asphaltene content is determined using a pentane insolubles method.

3. (Previously Presented) The method of claim 1, wherein said liquid hydrocarbon has an API gravity in the range of from 5° to 23° and an asphaltene content in the range of from 5 to 25 weight percent, wherein said asphaltene content is determined using a pentane insolubles method.

4. (Original) The method of claim 1, wherein said liquid hydrocarbon has a sulfur content of at least about 1 weight percent.

5. (Original) The method of claim 1, wherein said liquid hydrocarbon has a nitrogen content of at least about 1,300 ppmw.

6. (Original) The method of claim 1, wherein said liquid hydrocarbon has a metal content in the range of from about 1 to about 2,000 ppmw.

7. (Previously Presented) The method of claim 1, wherein said liquid hydrocarbon comprises at least about 15 weight percent of a residuum having a boiling point of at least about 1,050°F, and wherein said liquid hydrocarbon has a Conradson carbon content in the range of from about 3.5 to about 45 weight percent.

8. (Original) The method of claim 1, wherein said liquid hydrocarbon has a sulfur content in the range of from about 1.2 to about 9 weight percent, wherein said liquid hydrocarbon has a nitrogen content of at least about 1,400 ppmw, and wherein said liquid hydrocarbon has a metal content in the range of from about 50 to about 1,500 ppmw.

9. (Original) The method of claim 1, wherein said liquid hydrocarbon is heavy crude oil.

10. (Withdrawn)

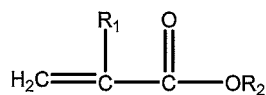
11. (Original) The method of claim 1, wherein at least about 10 percent of said repeating units comprise a heteroatom.

12. (Withdrawn)

13. (Original) The method of claim 1, wherein said heteroatom has a partial charge.

14. (Original) The method of claim 1, wherein said repeating units comprise the residue of one or more monomers selected from the group consisting of:

(A)



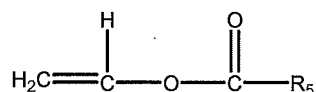
wherein R_1 is H or a C1-C10 alkyl radical, and R_2 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, an aryl-substituted C1-C10 alkyl radical, a $-(CH_2CH_2O)_x-R_A$ or $-(CH_2CH(CH_3)O)_x-R_A$ radical wherein x is in the range of from 1 to 50 and R_A is H, a C1-C30 alkyl radical, or a C6-C30 alkylaryl radical;

(B)



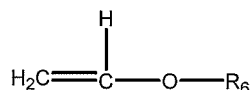
wherein arene is a phenyl, naphthyl, anthracenyl, or phenanthrenyl, R_3 is $CH=CH_2$ or $CH_3-C=CH_2$, and R_4 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, Cl , SO_3 , OR_B , or $COOR_C$, wherein R_B is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical, and wherein R_C is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical;

(C)



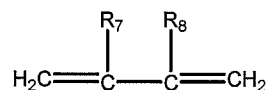
wherein R_5 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(D)



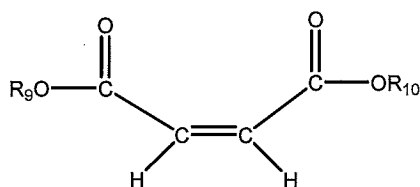
wherein R_6 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(E)



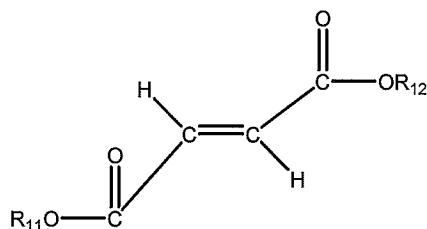
wherein R_7 is H or a C1-C18 alkyl radical, and R_8 is H, a C1-C18 alkyl radical, or Cl;

(F)



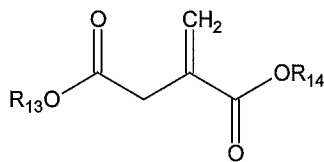
wherein R_9 and R_{10} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(G)



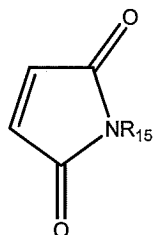
wherein R_{11} and R_{12} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(H)



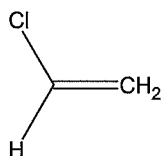
wherein R_{13} and R_{14} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(I)



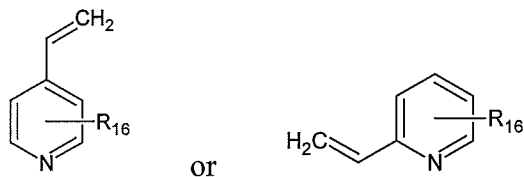
wherein R_{15} is H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(J)



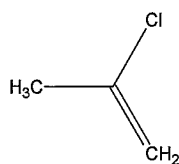
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(K)



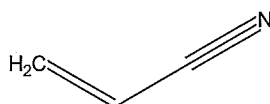
wherein R_{16} is H, a C1-C30 alkyl radical, or a C6-C20 aryl radical;

(L)



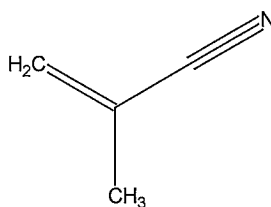
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(M)



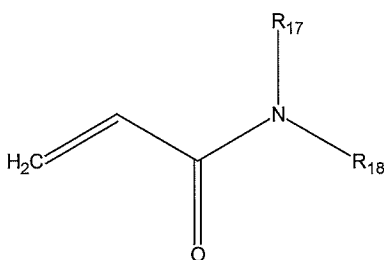
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(N)



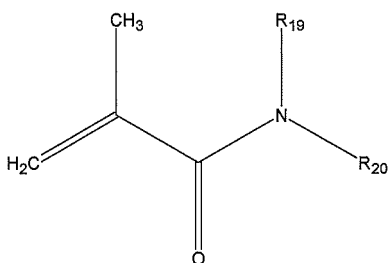
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(O)



wherein R_{17} and R_{18} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(P)



wherein R_{19} and R_{20} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals.

15. (Original) The method of claim 1, wherein said drag reducing polymer comprises repeating units of the residues of C4-C20 alkyl, C6-C20 substituted or unsubstituted aryl, or aryl-substituted C1-C10 alkyl ester derivatives of methacrylic acid or acrylic acid.

16. (Original) The method of claim 1, wherein said drag reducing polymer is a homopolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers.

17. (Original) The method of claim 1, wherein said drag reducing polymer comprises the residue of at least one monomer having at least one heteroatom and the residue of at least one monomer having no heteroatoms.

18. (Original) The method of claim 1, wherein said drag reducing polymer is a copolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers and the residues of at least one other monomer.

19. (Original) The method of claim 1, wherein said drag reducing polymer is a copolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers and the residues of butyl acrylate monomers.

20. (Original) The method of claim 1, wherein said treated liquid hydrocarbon comprises in the range of from about 0.1 to about 500 ppmw of said drag reducing polymer.

21. (Previously Presented) The method of claim 1, wherein said drag reducing polymer has a Hansen solubility parameter of at least about $17 \text{ MPa}^{1/2}$.

22. (Previously Presented) The method of claim 1, wherein said liquid hydrocarbon has a Hansen solubility parameter of at least about $17 \text{ MPa}^{1/2}$.

23. (Original) The method of claim 1, wherein said drag reducing polymer has a Hansen solubility parameter within at least about 20 percent of the solubility parameter of said liquid hydrocarbon.

24. (Original) The method of claim 1, wherein said liquid hydrocarbon is a component of a fluid mixture that further comprises a non-hydrocarbon fluid and/or a non-liquid phase, wherein said fluid mixture comprises at least about 50 weight percent of said liquid hydrocarbon.

25. (Currently Amended) A method comprising: introducing a drag reducing polymer into a liquid hydrocarbon having an asphaltene content of at least about 3 weight percent, wherein said asphaltene content is determined using a pentane insolubles method, and an API gravity of less than about 26° to thereby produce a treated liquid hydrocarbon, wherein said drag reducing polymer includes at least one repeating unit having at least one heteroatom, wherein said heteroatom is selected from the group consisting of an oxygen atom, a nitrogen atom, a sulfur atom, and/or a phosphorus atom, ~~and~~ wherein the viscosity of said treated liquid hydrocarbon is not less than the viscosity of said liquid hydrocarbon prior to treatment with said drag reducing polymer and wherein the drag reducing polymer has a weight average molecular weight of at least $1 \times 10^6 \text{ g/mol}$ in order to reduce the drag in the liquid hydrocarbon.

26. (Original) The method of claim 25, wherein said liquid hydrocarbon has an API gravity in the range of from about 5° to about 25° and an asphaltene content in the range of from about 4 to about 35 weight percent.

27. (Original) The method of claim 25, wherein said liquid hydrocarbon has a sulfur content of at least about 1 weight percent.

28. (Original) The method of claim 25, wherein said liquid hydrocarbon has a nitrogen content of at least about 1,300 ppmw.

29. (Original) The method of claim 25, wherein said liquid hydrocarbon has a metal content in the range of from about 1 to about 2,000 ppmw.

30. (Previously Presented) The method of claim 25, wherein said liquid hydrocarbon comprises at least about 15 weight percent of a residuum having a boiling point of at least about 1,050°F, and wherein said liquid hydrocarbon has a Conradson carbon content in the range of from about 3.5 to about 45 weight percent.

31. (Original) The method of claim 25, wherein said liquid hydrocarbon has a sulfur content in the range of from about 1.2 to about 9 weight percent, wherein said liquid hydrocarbon has a nitrogen content of at least about 1,400 ppmw, and wherein said liquid hydrocarbon has a metal content in the range of from about 50 to about 1,500 ppmw.

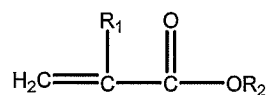
32. (Original) The method of claim 25, wherein said liquid hydrocarbon is heavy crude oil.

33. (Previously Presented) The method of claim 25, wherein said drag reducing polymer comprises at least about 25,000 repeating units.

34. (Previously Presented) The method of claim 33, wherein at least about 10 percent of said repeating units comprises a heteroatom.

35. (Original) The method of claim 25, wherein said repeating unit comprises the residues of one or more monomers selected from the group consisting of:

(A)



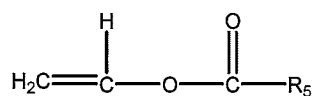
wherein R_1 is H or a C1-C10 alkyl radical, and R_2 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, an aryl-substituted C1-C10 alkyl radical, a $-(\text{CH}_2\text{CH}_2\text{O})_x-\text{R}_A$ or $-(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_x-\text{R}_A$ radical wherein x is in the range of from 1 to 50 and R_A is H, a C1-C30 alkyl radical, or a C6-C30 alkylaryl radical;

(B)



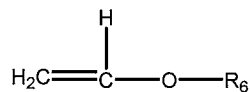
wherein arene is a phenyl, naphthyl, anthracenyl, or phenanthrenyl, R_3 is $\text{CH}=\text{CH}_2$ or $\text{CH}_3-\text{C}=\text{CH}_2$, and R_4 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, Cl, SO_3 , OR_B , or COOR_C , wherein R_B is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical, and wherein R_C is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical;

(C)



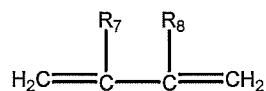
wherein R_5 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(D)



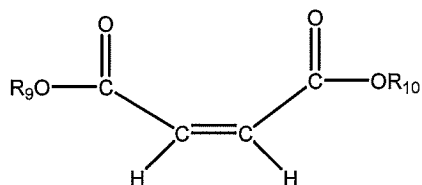
wherein R_6 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(E)



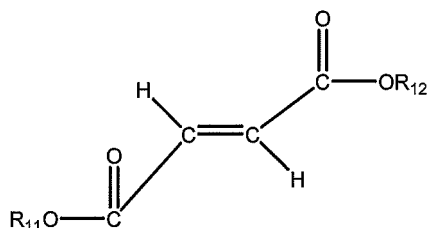
wherein R_7 is H or a C1-C18 alkyl radical, and R_8 is H, a C1-C18 alkyl radical, or Cl;

(F)



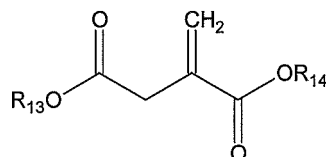
wherein R_9 and R_{10} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(G)



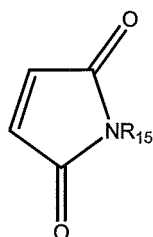
wherein R_{11} and R_{12} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(H)



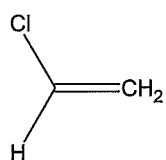
wherein R_{13} and R_{14} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(I)



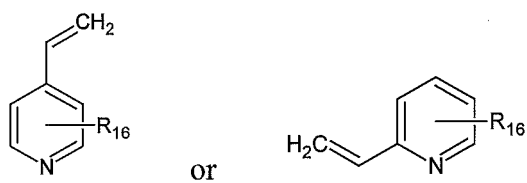
wherein R_{15} is H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(J)



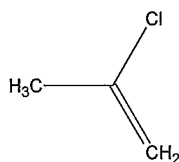
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(K)



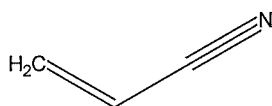
wherein R_{16} is H, a C1-C30 alkyl radical, or a C6-C20 aryl radical;

(L)



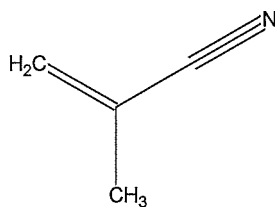
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(M)



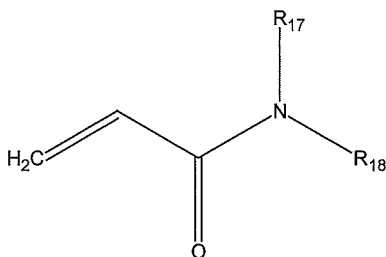
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(N)



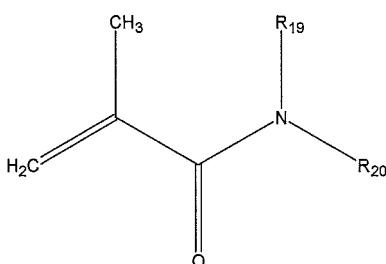
;

(O)



wherein R_{17} and R_{18} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(P)



wherein R_{19} and R_{20} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals.

36. (Original) The method of claim 25, wherein said drag reducing polymer comprises repeating units of the residues of C4-C20 alkyl, C6-C20 substituted or unsubstituted aryl, or aryl-substituted C1-C10 alkyl ester derivatives of methacrylic acid or acrylic acid.

37. (Original) The method of claim 25, wherein said drag reducing polymer is a homopolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers.

38. (Original) The method of claim 25, wherein said drag reducing polymer is a copolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers and the residues of at least one other monomer.

39. (Original) The method of claim 25, wherein said drag reducing polymer is a copolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers and the residues of butyl acrylate monomers.

40. (Original) The method of claim 25, wherein said treated liquid hydrocarbon comprises in the range of from about 0.1 to about 500 ppmw of said drag reducing polymer.

41. (Original) The method of claim 25, wherein said drag reducing polymer has a solubility parameter within at least about 20 percent of the solubility parameter of said liquid hydrocarbon.

42. (Original) The method of claim 25, wherein said liquid hydrocarbon is a component of a fluid mixture that further comprises an non-hydrocarbon fluid and/or a non-liquid phase, wherein said fluid mixture comprises at least about 50 weight percent of said liquid hydrocarbon.

43. (Withdrawn)

44. (Withdrawn)

45. (Withdrawn)

46. (Withdrawn)

47. (Withdrawn)

48. (Withdrawn)

49. (Withdrawn)

50. (Withdrawn)

51. (Currently Amended) A method comprising: introducing a drag reducing polymer into a liquid hydrocarbon having an asphaltene content of at least about 3 weight percent, wherein said asphaltene content is determined using a pentane insolubles method, and an API gravity of less than about 26° to thereby produce a treated liquid hydrocarbon, wherein said drag reducing polymer comprises at least about 25,000 repeating units, and wherein said drag reducing polymer has a Hansen solubility parameter of at least about 17 MPa^{1/2} and wherein the drag reducing polymer has a weight average molecular weight of at least 1 X 10⁶ g/mol in order to reduce the drag in the liquid hydrocarbon.

52. (Previously Presented) The method of claim 51, wherein said drag reducing polymer has a Hansen solubility parameter in the range of from about 17.5 MPa^{1/2} to about 23 MPa^{1/2}.

53. (Previously Presented) The method of claim 51, wherein said liquid hydrocarbon has a Hansen solubility parameter in the range of from about 17.1 MPa^{1/2} to about 24 MPa^{1/2}.

54. (Previously Presented) The method of claim 51, wherein said liquid hydrocarbon has a Hansen solubility parameter within at least about 20 percent of the solubility parameter of said drag reducing polymer.

55. (Previously Presented) The method of claim 51, wherein said liquid hydrocarbon has a Hansen solubility parameter within at least 4 MPa^{1/2} of the solubility parameter of said drag reducing polymer.

56. (Original) The method of claim 51, wherein said liquid hydrocarbon has a sulfur content of at least about 1 weight percent.

57. (Original) The method of claim 51, wherein said liquid hydrocarbon has a nitrogen content of at least about 1,300 ppmw.

58. (Original) The method of claim 51, wherein said liquid hydrocarbon has a metal content in the range of from about 1 to about 2,000 ppmw.

59. (Original) The method of claim 51, wherein said liquid hydrocarbon comprises at least about 15 weight percent of a residuum having a boiling point of at least about 1,050°F, and wherein said liquid hydrocarbon has a Conradson carbon content in the range of from about 3.5 to about 45 weight percent.

60. (Original) The method of claim 51, wherein said liquid hydrocarbon is heavy crude oil.

61. (Original) The method of claim 51, wherein said drag reducing polymer comprises repeating units of the residues of C4-C20 alkyl, C6-C20 substituted or unsubstituted aryl, or aryl-substituted C1-C10 alkyl ester derivatives of methacrylic acid or acrylic acid.

62. (Original) The method of claim 51, wherein said drag reducing polymer is a copolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers and the residues of at least one other monomer.

63. (Currently Amended) A method comprising: introducing a drag reducing polymer into a liquid hydrocarbon having an asphaltene content of at least about 3 weight percent, wherein said asphaltene content is determined using a pentane insolubles method, and an API gravity of less than about 26° to thereby produce a treated liquid hydrocarbon, wherein said drag reducing polymer comprises at least about 25,000 repeating units, and wherein said drag reducing polymer has a solubility parameter within at least about 20 percent of the Hansen solubility parameter of said liquid hydrocarbon and wherein the drag reducing polymer has a weight average molecular weight of at least 1×10^6 g/mol in order to reduce the drag in the liquid hydrocarbon.

64. (Previously Presented) The method of claim 63, wherein said drag reducing polymer has a solubility parameter within at least about 18 percent of the Hansen solubility parameter of said liquid hydrocarbon.

65. (Previously Presented) The method of claim 63, wherein said drag reducing polymer has a Hansen solubility parameter in the range of from about $17.5 \text{ MPa}^{1/2}$ to about $23 \text{ MPa}^{1/2}$.

66. (Previously Presented) The method of claim 63, wherein said liquid hydrocarbon has Hansen a solubility parameter in the range of from about $17.1 \text{ MPa}^{1/2}$ to about $24 \text{ MPa}^{1/2}$.

67. (Previously Presented) The method of claim 63, wherein said drag reducing polymer has a Hansen solubility parameter within at least $4 \text{ MPa}^{1/2}$ of the solubility parameter of said liquid hydrocarbon.

68. (Original) The method of claim 63, wherein said liquid hydrocarbon has a sulfur content of at least about 1 weight percent.

69. (Original) The method of claim 63, wherein said liquid hydrocarbon has a nitrogen content of at least about 1,300 ppmw.

70. (Original) The method of claim 63, wherein said liquid hydrocarbon has a metal content in the range of from about 1 to about 2,000 ppmw.

71. (Previously Presented) The method of claim 63, wherein said liquid hydrocarbon comprises at least about 15 weight percent of a residuum having a boiling point of at least about 1,050°F, and wherein said liquid hydrocarbon has a Conradson carbon content in the range of from about 3.5 to about 45 weight percent.

72. (Original) The method of claim 63, wherein said liquid hydrocarbon is heavy crude oil.

73. (Original) The method of claim 63, wherein said repeating units comprise the residue of one or more monomers selected from the group consisting of 2-ethylhexyl methacrylate, styrene or its derivatives, butadiene or its derivatives, acrylates, methacrylates, and combinations thereof.

74. (Original) The method of claim 63, wherein said drag reducing polymer comprises repeating units of the residues of C4-C20 alkyl, C6-C20 substituted or unsubstituted aryl, or aryl-substituted C1-C10 alkyl ester derivatives of methacrylic acid or acrylic acid.

75. (Original) The method of claim 63, wherein said drag reducing polymer is a copolymer comprising repeating units of the residues of 2-ethylhexyl methacrylate monomers and the residues of at least one other monomer.

76. (Withdrawn)

77. (Withdrawn)

78. (Withdrawn)

79. (Withdrawn)

80. (Withdrawn)

81. (Withdrawn)

82. (Withdrawn)

83. (Currently Amended) A method comprising: introducing a drag reducing composition into a liquid hydrocarbon having an asphaltene content of at least 3 weight percent, wherein said asphaltene content is determined using a pentane insolubles method, and an API gravity of less than 26° to thereby produce a treated liquid hydrocarbon, wherein said drag reducing composition comprises a continuous phase and a plurality of drag reducing polymer particles dispersed in said continuous phase, wherein at least a portion of said polymer particles are copolymers comprising residues of 2-ethylhexyl methacrylate monomers and residues of n-butyl acrylate monomers and wherein the drag reducing polymer has a weight average molecular weight of at least 1×10^6 g/mol in order to reduce the drag in the liquid hydrocarbon.

84. (Previously Presented) The method of claim 83, wherein said polymer particles comprise residues of 2-ethylhexyl methacrylate and residues of n-butyl acrylate in a weight ratio of about 4:1 2-ethylhexyl methacrylate-to-n-butyl acrylate.

85. (Previously Presented) The method of claim 83, wherein said drag reducing composition comprises said polymer particles in an amount in the range of from about 10 to about 60 weight percent based on the total weight of said drag reducing composition.

86. (Previously Presented) The method of claim 83, wherein said polymer particles have a weight average molecular weight of at least 1×10^6 g/mol.

87. (Previously Presented) The method of claim 83, wherein said polymer particles have an average particle size in the range of from about 10 to about 500 nm.

88. (Previously Presented) The method of claim 83, wherein said polymer particles have a Hansen solubility parameter in the range of from about $17.5 \text{ MPa}^{1/2}$ to about $23 \text{ MPa}^{1/2}$.

89. (Previously Presented) The method of claim 83, wherein said liquid hydrocarbon has an API gravity in the range of from about 5° to about 25° and an asphaltene content in the range of from about 4 to about 35 weight percent.

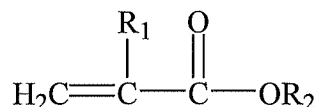
90. (Previously Presented) The method of claim 83, wherein said liquid hydrocarbon has a sulfur content of at least 1 weight percent, wherein said liquid hydrocarbon has a nitrogen content of at least 1,300 ppmw, wherein said liquid hydrocarbon has a metal content in the range of from about 1 to about 2,000 ppmw.

91. (Previously Presented) The method of claim 83, wherein said liquid hydrocarbon comprises at least 15 weight percent of a residuum having a boiling point of at least $1,050^\circ\text{F}$, and wherein said liquid hydrocarbon has a Conradson carbon content in the range of from about 3.5 to about 45 weight percent.

92. (Previously Presented) The method of claim 83, wherein said liquid hydrocarbon is heavy crude oil.

93. (Previously Presented) The method of claim 1, wherein said repeating units comprise the residue of one or more monomers selected from the group consisting of:

(A)



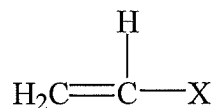
wherein R_1 is H or a C1-C10 alkyl radical, and R_2 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, an aryl-substituted C1-C10 alkyl radical, a $-(\text{CH}_2\text{CH}_2\text{O})_x-\text{R}_A$ or $-(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_x-\text{R}_A$ radical wherein x is in the range of from 1 to 50 and R_A is H, a C1-C30 alkyl radical, or a C6-C30 alkylaryl radical;

(B)



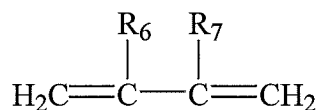
wherein arene is a phenyl, naphthyl, anthracenyl, phenanthrenyl, or pyridinyl, R_3 is $\text{CH}=\text{CH}_2$ or $\text{CH}_3\text{-C}=\text{CH}_2$, and R_4 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, Cl, SO_3 , OR_B , or COOR_C , wherein R_B is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical, and wherein R_C is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical;

(C)



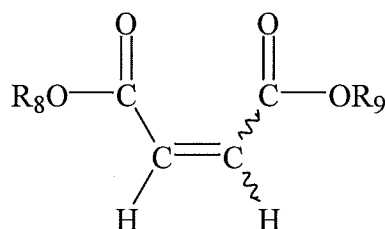
wherein X is $\text{O-C}(=\text{O})-\text{R}_5$ or O-R_5 , R_5 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(D)



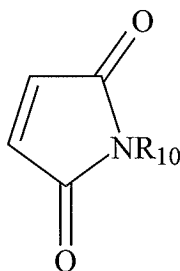
wherein R_6 is H or a C1-C18 alkyl radical, and R_7 is H, a C1-C18 alkyl radical, or Cl;

(E)



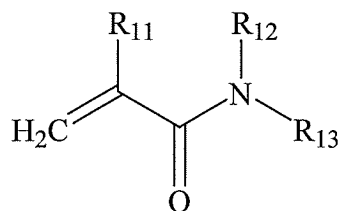
wherein the arrangement of the two ester portions around the carbon-carbon double bond may be either cis- or trans- and R_8 and R_9 are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(F)



wherein R_{10} is H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals; and

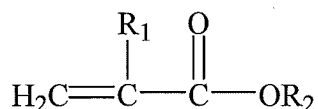
(G)



wherein R_{11} is either H or CH_3 , and R_{12} and R_{13} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals.

94. (Previously Presented) The method of claim 1, wherein said repeating units comprise the residue of one or more monomers selected from the group consisting of:

(A)



wherein R_1 is H or a C1-C10 alkyl radical, and R_2 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, an aryl-substituted C1-C10 alkyl radical, a $-(\text{CH}_2\text{CH}_2\text{O})_x-\text{R}_A$ or $-(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_x-\text{R}_A$ radical wherein x is in the range of from 1 to 50 and R_A is H, a C1-C30 alkyl radical, or a C6-C30 alkylaryl radical;

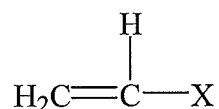
(B)



wherein arene is a phenyl, naphthyl, anthracenyl, phenanthrenyl, or pyridinyl, R_3 is $\text{CH}=\text{CH}_2$ or $\text{CH}_3\text{-C}=\text{CH}_2$, and R_4 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, Cl, SO_3 , OR_B , or COOR_C , wherein R_B is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical, and wherein R_C is H, a C1-C30 alkyl radical, a C5-C30 substituted

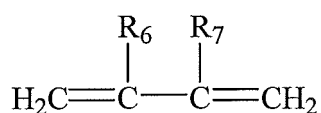
or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical;

(C)



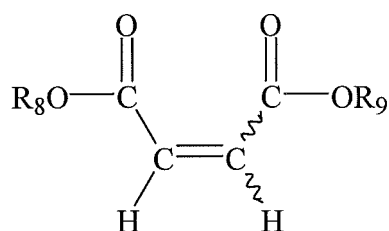
wherein X is O-C(=O)-R₅ or O-R₅, R₅ is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(D)



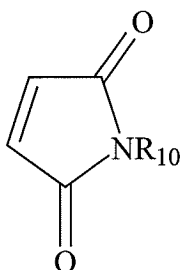
wherein R₆ is H or a C1-C18 alkyl radical, and R₇ is H, a C1-C18 alkyl radical, or Cl;

(E)



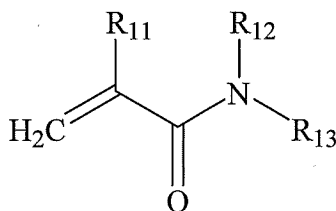
wherein the arrangement of the two ester portions around the carbon-carbon double bond may be either cis- or trans- and R₈ and R₉ are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(F)



wherein R_{10} is H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals; and

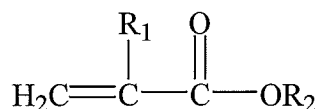
(G)



wherein R_{11} is either H or CH₃, and R_{12} and R_{13} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals.

95. (Previously Presented) The method of claim 1, wherein said repeating units comprise the residue of one or more monomers selected from the group consisting of:

(A)



wherein R_1 is H or a C1-C10 alkyl radical, and R_2 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, an aryl-

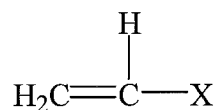
substituted C1-C10 alkyl radical, a $-(\text{CH}_2\text{CH}_2\text{O})_x\text{-R}_A$ or $-(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_x\text{-R}_A$ radical wherein x is in the range of from 1 to 50 and R_A is H, a C1-C30 alkyl radical, or a C6-C30 alkylaryl radical;

(B)



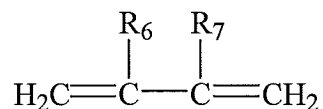
wherein arene is a phenyl, naphthyl, anthracenyl, phenanthrenyl, or pyridinyl, R_3 is CH=CH_2 or $\text{CH}_3\text{-C=CH}_2$, and R_4 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, Cl, SO_3 , OR_B , or COOR_C , wherein R_B is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical, and wherein R_C is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical;

(C)



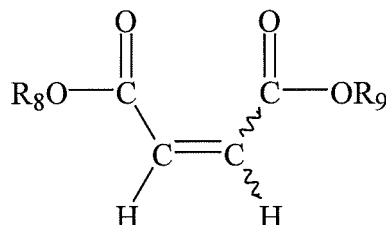
wherein X is O-C(=O)-R_5 or O-R_5 , R_5 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(D)



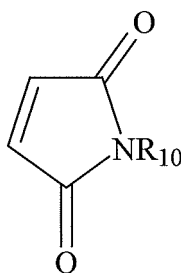
wherein R_6 is H or a C1-C18 alkyl radical, and R_7 is H, a C1-C18 alkyl radical, or Cl;

(E)



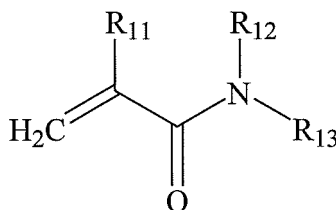
wherein the arrangement of the two ester portions around the carbon-carbon double bond may be either cis- or trans- and R_8 and R_9 are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals;

(F)



wherein R_{10} is H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals; and

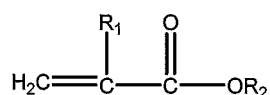
(G)



wherein R_{11} is either H or CH₃, and R_{12} and R_{13} are independently H, a C1-C30 alkyl radical, a C6-C20 substituted or unsubstituted aryl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, or heterocyclic radicals.

96. (Previously Presented) The method of claim 1, wherein said repeating units comprise the residue of one or more monomers selected from the group consisting of:

(A)



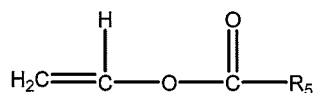
wherein R_1 is H or a C1-C10 alkyl radical, and R_2 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, an aryl-substituted C1-C10 alkyl radical, a $-(\text{CH}_2\text{CH}_2\text{O})_x\text{-R}_A$ or $-(\text{CH}_2\text{CH}(\text{CH}_3)\text{O})_x\text{-R}_A$ radical wherein x is in the range of from 1 to 50 and R_A is H, a C1-C30 alkyl radical, or a C6-C30 alkylaryl radical;

(B)



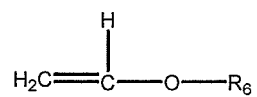
wherein arene is a phenyl, naphthyl, anthracenyl, phenanthrenyl, or pyridinyl, R_3 is CH=CH₂ or CH₃-C=CH₂, and R_4 is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, Cl, SO₃, OR_B, or COOR_C, wherein R_B is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical, and wherein R_C is H, a C1-C30 alkyl radical, a C5-C30 substituted or unsubstituted cycloalkyl radical, a C6-C20 substituted or unsubstituted aryl radical, or an aryl-substituted C1-C10 alkyl radical;

(C)



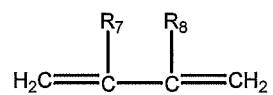
wherein R_5 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical;

(D)



wherein R_6 is H, a C1-C30 alkyl radical, or a C6-C20 substituted or unsubstituted aryl radical; and

(E)



wherein R_7 is H or a C1-C18 alkyl radical, and R_8 is H, a C1-C18 alkyl radical, or Cl.

Remarks

Claims 1, 25, 51, 63 and 83 are currently amended. Claims 2, 3, 7, 21, 22, 30, 33, 34, 52-55, 64-67, 71, 84-96 are previously presented. Claims 4-6, 8, 9, 11, 13-20, 23, 24, 26-29, 31, 32-42, 56-62, 68-70, 72-75 are original. Claims 10, 12, 43-50 and 76-82 are currently withdrawn.

Applicants initially wishes to thank examiner for the telephonic interview conducted June 11, 2009.

Claims Objections

Applicant has amended the misnumbered claims 9 and 10. Reconsideration of this objection is respectfully requested.

Claims Rejections 35 USC § 103

Claims 1-9, 11, 13-15, 17-36, 38-42, 51-75 and 83-96 are rejected under 35 USC § 103(a) as being unpatentable over Evani (US 5,159,035) in view of Schievelbein (US 6,007,702).

Initially, applicant has amended the independent claims to incorporate the limitation that the drag reducing polymer has a weight average molecular weight of at least 1×10^6 g/mol in order to reduce the drag in the liquid hydrocarbon. Basis for this amendment can be found in the original application as filed page 17, lines 7 -13.

Applicants' claims are not obvious over Evani in view of Schievelbein since applicants claimed element of 25,000 repeating units was not addressed and an average weight average molecular weight of at least 1×10^6 g/mol is outside the scope of the current references.

The office action initially attempts to correlate "repeating units" in applicants claim to weight average molecular weights (office action page 3-4, paragraph 8). Repeating units are separate from molecular weights and in our application mean two separate things (application as filed page 17,

lines 7 – 27). As currently amended the present claims recite a drag reducing polymer comprising at least about 25,000 repeating units and a weight average molecular weight of at least 1×10^6 g/mol.

Since the element of 25,000 repeating units was never correctly addressed, the office action has not established a prima facie case of obviousness. In addition and even more importantly this limitation cannot be found through any combination of the references.

Furthermore, Evani only discloses having weight average molecular weights from about 100,000 to about 350,000 (Column 7, lines 40-45). The office action has attempted to argue that "...at least some chains will have molecular weight of well into the millions..." (Office Action page 3-4, paragraph 8).

The possibility of creating a quantity high molecular weight polymer chains exceeding 1×10^6 g/mol created by Evani when the maximum weight average molecular weight of the polymer is 350,000 is highly improbable. Taking the teachings of Evani the quantity of polymers with a minimum of at least 1×10^6 molecular weight would be at least 8 standard deviations away, in other words less than 0.0000000002560% of all polymer chains (calculations done with -1σ of 100,000 and 1σ of 350,000). The possibility of the amount obtained from Evani would be insufficient and incapable of operating as a drag reducer for the liquid hydrocarbon as currently claimed in applications application.

It is well known in the art that to be an effective drag reducer, in liquid hydrocarbon with the properties currently claimed, ultra-high molecular weights are required. Applicants' application specifically claims that an ultra-high molecular weight drag reducer with a molecular weight with at least an **average** of 1×10^6 g/mol is required. Even if 0.0000000002560% of Evani's copolymer

had a molecular weight of 1×10^6 g/mol the amount would be insufficient to create any effect as a drag reducer.

Furthermore it is stated in Evani that deviations of the molecular weight from what is statistically possible is undesirable as these deviations would create optically dissimilar regions in the copolymer (column 7, lines 22-27). As it is stated in the MPEP § 2143.01, “[i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art being modified then the teachings of the references are not sufficient to render the claims *prima facie* obvious”.

Since use of Evani as a drag reducer would require a deviation of the molecular weight, beyond what is statistically possible, this deviation would be construed a substantial modification of Evani. Consequently, since it is expressly taught that the weight average molecular weight of Evani must be from about 100,000 to 350,000, substantial deviations from the weight average molecular weight would change the principle operation of the art and applicants claims requires a molecular weight **average** of at least 1×10^6 g/mol, applicants current claims cannot be found *prima facie* obvious to Evani.

Schievelbein does not teach the deficiencies of Evani. Most notably, Schievelbein does not teach applicants claimed element of 25,000 repeating units or an average weight average molecular weight of at least 1×10^6 g/mol.

Due to the arguments submitted above, reconsideration of the rejection is respectfully requested.

Claims 4-8, 27-31, 56-59, 68-71 and 90-91 are rejected under 35 USC § 103(a) as being unpatentable over Evani (US 5,159,035) in view of Schievelbein (US 6,007,702) in further view of Heck et alli (US 5,374,350). Heck et alli does not teach the deficiencies of Evani in view of

Schievelbein. Most notably, Heck et alli does not teach applicants claimed element of 25,000 repeating units or an average weight average molecular weight of at least 1×10^6 g/mol.

Due to the arguments submitted above, reconsideration of the rejection is respectfully requested.

Claims 16 and 37 are rejected under 35 USC § 103(a) as being unpatentable over Evani (US 5,159,035) in view of Schievelbein (US 6,007,702) in further view of Heck et alli (US 5,374,350). Heck et alli does not teach the deficiencies of Evani in view of Schievelbein. Most notably, Heck et alli does not teach applicants claimed element of 25,000 repeating units or an average weight average molecular weight of at least 1×10^6 g/mol.

Due to the arguments submitted above, reconsideration of the rejection is respectfully requested.

If any extension of time is necessary in order for this submission to be considered timely filed, the Commissioner is authorized to please appropriately charge or credit those fees to **Deposit Account Number 16-1575 of ConocoPhillips Company** and consider this a petition for any necessary extension of time.

If resolution of any remaining issues pertaining to restriction groups and election may be facilitated by a telephone conference, or if the Examiner has any questions or comments or otherwise feels it would be advantageous, the Examiner is encouraged to telephone the undersigned at (281) 293-3454.

Respectfully submitted,

Dated: June 24, 2009

By: /Richard Yuen/
Richard Yuen, Reg. No. L0278
Counsel