

- ☐ Description : paged to paged
☒ Claim(s) : paged to paged
☐ Drawing(s) : paged to paged
☒ Abstract : paged to paged

INDUSTRIAL OILS

This invention relates to industrial oils and particularly to industrial oils based on vegetable oils.

Industrial oils, e.g. hydraulic fluids and lubricating oils have hitherto been largely based on mineral oils. Despite the wide availability of vegetable oils and the apparent attractions of using such renewable and environmentally-friendly source materials, the use of vegetable oils as industrial oil base fluids has been highly restricted. They have not found wide applicability in high-performance modern usages. Rape seed oil and castor oil, for example, have been and are used in lubricants in limited specific applications.

Accordingly, in one aspect the invention provides an industrial oil comprising palm olein as base fluid together with an anti-oxidant and an anti-wear additive.

In another aspect the invention provides the use as an industrial oil of a palm olein-based formulation of the immediately-preceding paragraph.

The formulation may optionally include a corrosion inhibitor and/or a crystallisation retarder, the nature and function of the latter being described below.

Thus, an oil of the invention may comprise the following constituents by weight:

base fluid - palm olein	30.00	to	99.50%
anti-oxidant	0.25	to	5.00%
anti-wear agent	0.25	to	3.00%
corrosion inhibitor	0	to	1.00%
crystallisation retarder	0	to	2.00%
other base fluids	0	to	60.00%



As indicated above, in addition to the palm olein base fluid in the formulation, any balance of the formulation may be made up using other base fluids, preferably synthetic or mineral oils, i.e. refined petroleum fractions. Suitable synthetic base fluids include, for example, polyalpha olefins, synthetic esters e.g. polyol or dibasic acid esters and polyglycols. Other base fluids derived from vegetable oil sources may also be incorporated in the formulation.

Suitable anti-oxidants include amines, phenols or phosphite-based additives well known per se in the lubricant art.

Suitable anti-wear agents include amine phosphates, triphenylphosphorothionate and zinc dialkyl dithiophosphates.

Suitable corrosion inhibitors include thiazole derivatives, sarcosines, amine phosphates and carboxylic acid salts.

Other desired additives may be included depending on the intended end use of the oil and the environment of use. Additives which may be included dependent on the environment of use include thickeners and pour point depressants. Specific end uses are as lubricant for the chain and bar of a chain saw, as a gear oil and as a hydraulic fluid. The latter use has many applications, e.g. in car dampers, motor cycle forks, injection moulding machinery and the hydraulics of earth-moving machinery, dumper trucks and the like.

Where the oil is intended as a chain saw chain and bar lubricant, it preferably includes a tackifier in the formulation. This is preferably present in an amount of from 3 to 20% by weight. Examples of suitable tackifier(s) are polyisobutylenes, polymethyl alcohols with or without carrier oils.

Where the oil is intended as a gear oil, the formulation preferably includes the following additives:

This Sheet Has Been Replaced



thickener	2.00	to	30%	by weight
extreme pressure additive	0.25	to	2%	by weight
metal passivator	0.01	to	1.0%	" "
anti-foam agent	0	to	0.05%	" "

Examples of thickeners include polyisobutylenes, polymethacrylates, hydrogenated or blown vegetable oils, esters and diesters.

Examples of extreme pressure additives include sulphides based on fatty acid glycerides/esters, sulphur carriers and dialkylpentasulphides.

Examples of metal passivators include sulphur-nitrogen heterocyclics, sulphonates and tolytriazole derivatives.

Examples of anti-foam agents include silicone fluids and organic polymers.

Other possible gear oil additives are demulsifiers, e.g. ethoxylated fatty alcohols and tackifiers, e.g. natural polymers in vegetable oil carriers which may be used in amounts of from 0.01 to 1.0 and from 0.10 to 3.00% respectively.

Where the oil is intended as a hydraulic fluid, it preferably contains an anti-foam agent, e.g. silicone fluids, in an amount of from 1 to 500 parts per million by weight.

Other possible hydraulic fluid additives are metal passivators and demulsifiers, which may be as specified above.

As indicated above, a crystallisation retarder may be included in the formulations. This is preferably an ester additive and may be used in an amount up to 0.24% by weight, preferably from 0.04 to 0.18% by weight.



Preferably, the ester additive is an ester of sorbitan and stearic acid. For example, it may be sorbitan monostearate, sorbitan tristearate or poly-oxyethylene sorbitan tristearate, sorbitan tristearate being particularly preferred. Alternatively, it may be, for example, a polyglycerol ester.

Palm olein is a liquid fraction derivative obtained when the palm oil is fractionated into solid and liquid fractions. It typically has Iodine Values (IV) in the range from about 55 to 67. Iodine Value is an indication of the degree of unsaturation. See Institute of Petroleum method IP84 for a detailed explanation of its measurement. Palm olein has been widely used, particularly in the Far East and South America, as a food/edible oil, particularly for frying.

It is well known that clear palm olein of IV approximately 55 becomes cloudy as its temperature drops below about 20°C. This is believed to be due to crystallisation of some of the molecules, primarily tri-glycerides, within the palm olein. It is also known that such crystallisation may be retarded by suitable additives such as, inter alia, sorbitan esters as described above.

The actual temperature and form of crystallisation depends on a number of factors including the IV of the olein used, the rate of cooling and whether the test method is isothermal or temperature programmed. For example, if test methods are equal, a specific palm olein of relatively high IV might start to become cloudy due to crystallisation at, say 15°C, whereas one of lower IV, e.g. 55, might start at 20°C. Similarly, two identical oleins may crystallise at different temperatures if subjected to different temperature regimes.

Preferably, for use in an oil of the invention, the stabilised palm olein should have an IV of at least 60 and preferably from 62 to 67. Palm oleins of lower IV have been found to be less preferable, albeit still useful, in that, even when stabilised they may undergo crystallisation causing cloudiness during normal temperature changes

This Sheet Has Been Replaced



in a tropical climate. Thus, oils of the present invention can be formulated to have useful application in relatively hot climates where minimum temperatures are unlikely normally to fall below about 12°C. Thus, for example, they may be of particular value in tropical regions of countries such as Brazil, Malaysia, Singapore, Indonesia and Thailand.

This Sheet Has Been Replaced





CLAIMS

1. An industrial oil having a composition comprising palm olein as base fluid with an anti-oxidant and an anti-wear additive.
2. An industrial oil according to Claim 1, which contains from 30 to 99.5% by weight of palm olein.
3. An industrial oil according to Claim 1 or 2, which contains from 0.25 to 5% by weight of anti-oxidant.
4. An industrial oil according to Claim 1, 2 or 3, which contains from 0.25 to 3% by weight of anti-wear agent.
5. An industrial oil according to any one of the preceding claims, in which the anti-oxidant is selected from amine-, phenol- and phosphite-based additives.
6. An industrial oil according to any one of the preceding claims, in which the anti-wear additive is selected from amine phosphates, triphenylphosphorothionates and zinc dialkyl dithiophosphates.
7. An industrial oil according to any one of the preceding claims, which contains up to 1% by weight of a corrosion inhibitor.
8. An industrial oil according to Claim 7, in which the corrosion inhibitor is selected from thiazole derivatives, sarcosines, amine phosphates and carboxylic acid salts.
9. An industrial oil according to any one of the preceding claims, which contains up to 60% by weight of other base fluid.

This Sheet Has Been Replaced





10. An industrial oil according to Claim 9, in which the other base fluid is selected from polyalpha olefins, synthetic esters, polyglycols and refined petroleum fractions.
11. An industrial oil, according to any one of the preceding claims, which contains up to 2% by weight of an ester as a crystallisation retarder for the palm olein.
12. An industrial oil according to Claim 11, in which the ester is present in an amount of from 0.04 to 0.24% by weight.
13. An industrial oil according to Claim 11 or 12, in which the ester is selected from sorbitan monostearate, sorbitan tristearate and polyoxyethylene sorbitan tristearate.
14. An industrial oil according to Claim 11, 12 or 13, in which the palm olein has an Iodine Value of at least 60.
15. An industrial oil according to Claim 14, in which the Iodine Value is from 62 to 67.
16. An industrial oil according to any one of the preceding claims, which additionally includes from 2 to 20% by weight of a tackifier.
17. An industrial oil according to Claim 16, in which the tackifier is selected from polyisobutylenes and polymethylalcohols.
18. An industrial oil according to any one of the preceding claims, which additionally includes from 0.25 to 2% by weight of an extreme pressure additive.
19. An industrial oil according to Claim 18, in which the extreme pressure additive is selected from sulphur carriers, sulphides based on fatty acid glyceride/esters and dialkylpentasulphides.

This Sheet Has Been Replaced





20. An industrial oil according to any one of the preceding claims, which additionally includes from 0.01 to 1.0% of a metal passivator.

21. An industrial oil according to Claim 20, in which the metal passivator is selected from sulphur-nitrogen heterocyclics, sulphonates and tolytriazole derivatives.

22. An industrial oil according to any one of the preceding claims, which additionally includes up to 0.05% by weight of an anti-foam agent.

23. An industrial oil according to Claim 22, in which the anti-foam agent is selected from silicone fluids and organic polymers.

24. The use as an industrial oil of a composition of any one of the preceding claims.

This Sheet Has Been Replaced



ABSTRACT

INDUSTRIAL OILS

The invention provides an industrial oil, e.g. for a chain saw chain and bar lubricant, a gear oil or a hydraulic fluid, based on vegetable oil rather than mineral oil and in which the base fluid is a palm olein.

The industrial oil comprises palm olein as base fluid with an anti-oxidant and an anti-wear additive.

This Sheet Has Been Replaced



REPLACEMENT SHEETS		80
☒ Description :	paged ... <u>6</u> to paged ... <u>5</u>	
☒ Claim(s) :	paged ... <u>6</u> to paged ... <u>8</u>	
☐ Drawing(s) :	paged ... to paged ...	
☒ Abstract :	paged ... <u>8</u> to paged ...	
DATE OF RECEIPT		<u>21-11-96</u>

INDUSTRIAL OILS

This invention relates to industrial oils and particularly to industrial oils based on vegetable oils.

Industrial oils, e.g. hydraulic fluids and lubricating oils have hitherto been largely based on mineral oils. Despite the wide availability of vegetable oils and the apparent attractions of using such renewable and environmentally-friendly source materials, the use of vegetable oils as industrial oil base fluids has been highly restricted. They have not found wide applicability in high-performance modern usages. Rape seed oil and castor oil, for example, have been and are used in lubricants in limited specific applications.

Accordingly, in one aspect the invention provides an industrial oil comprising palm olein as base fluid together with an anti-oxidant and an anti-wear additive.

In another aspect the invention provides the use as an industrial oil of a palm olein-based formulation of the immediately-preceding paragraph.

The formulation may optionally include a corrosion inhibitor and/or a crystallisation retarder, the nature and function of the latter being described below.

Thus, an oil of the invention may comprise the following constituents by weight:

base fluid - palm olein	30.00	to	99.50%
anti-oxidant	0.25	to	5.00%
anti-wear agent	0.25	to	3.00%
corrosion inhibitor	0	to	1.00%
crystallisation retarder	0	to	2.00%
other base fluids	0	to	60.00%

This is the replacement sheet

Date: 21 NOV 1996

As indicated above, in addition to the palm olein base fluid in the formulation, any balance of the formulation may be made up using other base fluids, preferably synthetic or mineral oils, i.e. refined petroleum fractions. Suitable synthetic base fluids include, for example, polyalpha olefins, synthetic esters e.g. polyol or dibasic acid esters and polyglycols. Other base fluids derived from vegetable oil sources may also be incorporated in the formulation.

Suitable anti-oxidants include amines, phenols or phosphite-based additives well known per se in the lubricant art.

Suitable anti-wear agents include amine phosphates, triphenylphosphorothionate and zinc dialkyl dithiophosphates.

Suitable corrosion inhibitors include thiazole derivatives, sarcosines, amine phosphates and carboxylic acid salts.

Other desired additives may be included depending on the intended end use of the oil and the environment of use. Additives which may be included dependent on the environment of use include thickeners and pour point depressants. Specific end uses are as lubricant for the chain and bar of a chain saw, as a gear oil and as a hydraulic fluid. The latter use has many applications, e.g. in car dampers, motor cycle forks, injection moulding machinery and the hydraulics of earth-moving machinery, dumper trucks and the like.

Where the oil is intended as a chain saw chain and bar lubricant, it preferably includes a tackifier in the formulation. This is preferably present in an amount of from 3 to 20% by weight. Examples of suitable tackifier(s) are polyisobutylenes, polymethyl alcohols with or without carrier oils.

Where the oil is intended as a gear oil, the formulation preferably includes the following additives:

This is the replacement sheet

Date: 21 NOV 1996

thickener	2.00	to	30%	by weight
extreme pressure additive	0.25	to	2%	by weight
metal passivator	0.01	to	1.0%	" "
anti-foam agent	0	to	0.05%	" "

Examples of thickeners include polyisobutylenes, polymethacrylates, hydrogenated or blown vegetable oils, esters and diesters.

Examples of extreme pressure additives include sulphides based on fatty acid glycerides/esters, sulphur carriers and dialkylpentasulphides.

Examples of metal passivators include sulphur-nitrogen heterocyclics, sulphonates and tolytriazole derivatives.

Examples of anti-foam agents include silicone fluids and organic polymers.

Other possible gear oil additives are demulsifiers, e.g. ethoxylated fatty alcohols and tackifiers, e.g. natural polymers in vegetable oil carriers which may be used in amounts of from 0.01 to 1.0 and from 0.10 to 3.00% respectively.

Where the oil is intended as a hydraulic fluid, it preferably contains an anti-foam agent, e.g. silicone fluids, in an amount of from 1 to 500 parts per million by weight.

Other possible hydraulic fluid additives are metal passivators and demulsifiers, which may be as specified above.

As indicated above, a crystallisation retarder may be included in the formulations. This is preferably an ester additive and may be used in an amount up to 0.24% by weight, preferably from 0.04 to 0.18% by weight.

This is the replacement sheet

Date: 21 NOV 1996

Preferably, the ester additive is an ester of sorbitan and stearic acid. For example, it may be sorbitan monostearate, sorbitan tristearate or poly-oxyethylene sorbitan tristearate, sorbitan tristearate being particularly preferred. Alternatively, it may be, for example, a polyglycerol ester.

Palm olein is a liquid fraction derivative obtained when the palm oil is fractionated into solid and liquid fractions. It typically has Iodine Values (IV) in the range from about 55 to 67. Iodine Value is an indication of the degree of unsaturation. See Institute of Petroleum method IP84 for a detailed explanation of its measurement. Palm olein has been widely used, particularly in the Far East and South America, as a food/edible oil, particularly for frying.

It is well known that clear palm olein of IV approximately 55 becomes cloudy as its temperature drops below about 20°C. This is believed to be due to crystallisation of some of the molecules, primarily tri-glycerides, within the palm olein. It is also known that such crystallisation may be retarded by suitable additives such as, inter alia, sorbitan esters as described above.

The actual temperature and form of crystallisation depends on a number of factors including the IV of the olein used, the rate of cooling and whether the test method is isothermal or temperature programmed. For example, if test methods are equal, a specific palm olein of relatively high IV might start to become cloudy due to crystallisation at, say 15°C, whereas one of lower IV, e.g. 55, might start at 20°C. Similarly, two identical oleins may crystallise at different temperatures if subjected to different temperature regimes.

Preferably, for use in an oil of the invention, the stabilised palm olein should have an IV of at least 60 and preferably from 62 to 67. Palm oleins of lower IV have been found to be less preferable, albeit still useful, in that, even when stabilised they may undergo crystallisation causing cloudiness during normal temperature changes

This is the replacement sheet

Date: 21 NOV 1996

in a tropical climate. Thus, oils of the present invention can be formulated to have useful application in relatively hot climates where minimum temperatures are unlikely normally to fall below about 12°C. Thus, for example, they may be of particular value in tropical regions of countries such as Brazil, Malaysia, Singapore, Indonesia and Thailand.

This is the replacement sheet

Date: 21 NOV 1996



CLAIMS

1. An industrial oil having a composition comprising palm olein as base fluid with an anti-oxidant and an anti-wear additive.
2. An industrial oil according to Claim 1, which contains from 30 to 99.5% by weight of palm olein.
3. An industrial oil according to Claim 1 or 2, which contains from 0.25 to 5% by weight of anti-oxidant.
4. An industrial oil according to Claim 1, 2 or 3, which contains from 0.25 to 3% by weight of anti-wear agent.
5. An industrial oil according to any one of the preceding claims, in which the anti-oxidant is selected from amine-, phenol- and phosphite-based additives.
6. An industrial oil according to any one of the preceding claims, in which the anti-wear additive is selected from amine phosphates, triphenylphosphorothionates and zinc dialkyl dithiophosphates.
7. An industrial oil according to any one of the preceding claims, which contains up to 1% by weight of a corrosion inhibitor.
8. An industrial oil according to Claim 7, in which the corrosion inhibitor is selected from thiazole derivatives, sarcosines, amine phosphates and carboxylic acid salts.
9. An industrial oil according to any one of the preceding claims, which contains up to 60% by weight of other base fluid.

This Sheet Has Been Replaced



This is the replacement sheet

Date: 21 NOV 1996



- 7 -

10. An industrial oil according to Claim 9, in which the other base fluid is selected from polyalpha olefins, synthetic esters, polyglycols and refined petroleum fractions.
11. An industrial oil, according to any one of the preceding claims, which contains up to 2% by weight of an ester as a crystallisation retarder for the palm olein.
12. An industrial oil according to Claim 11, in which the ester is present in an amount of from 0.04 to 0.24% by weight.
13. An industrial oil according to Claim 11 or 12, in which the ester is selected from sorbitan monostearate, sorbitan tristearate and polyoxyethylene sorbitan tristearate.
14. An industrial oil according to Claim 11, 12 or 13, in which the palm olein has an Iodine Value of at least 60.
15. An industrial oil according to Claim 14, in which the Iodine Value is from 62 to 67.
16. An industrial oil according to any one of the preceding claims, which additionally includes from 2 to 20% by weight of a tackifier.
17. An industrial oil according to Claim 16, in which the tackifier is selected from polyisobutylenes and polymethylalcohols.
18. An industrial oil according to any one of the preceding claims, which additionally includes from 0.25 to 2% by weight of an extreme pressure additive.
19. An industrial oil according to Claim 18, in which the extreme pressure additive is selected from sulphur carriers, sulphides based on fatty acid glyceride/esters and dialkylpentasulphides.

This Sheet Has Been Replaced



This is the replacement sheet

Date: 21 NOV 1996



20. An industrial oil according to any one of the preceding claims, which additionally includes from 0.01 to 1.0% of a metal passivator.
21. An industrial oil according to Claim 20, in which the metal passivator is selected from sulphur-nitrogen heterocyclics, sulphonates and tolytriazole derivatives.
22. An industrial oil according to any one of the preceding claims, which additionally includes up to 0.05% by weight of an anti-foam agent.
23. An industrial oil according to Claim 22, in which the anti-foam agent is selected from silicone fluids and organic polymers.
24. The use as an industrial oil of a composition of any one of the preceding claims.

This Sheet Has Been Replaced



This is the replacement sheet

Date: 21 NOV 1996

ABSTRACT

INDUSTRIAL OILS

The invention provides an industrial oil, e.g. for a chain saw chain and bar lubricant, a gear oil or a hydraulic fluid, based on vegetable oil rather than mineral oil and in which the base fluid is a palm olein.

The industrial oil comprises palm olein as base fluid with an anti-oxidant and an anti-wear additive.

This is the replacement sheet

Date: 21 NOV 1996

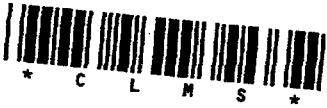


- 6 -

REPLACEMENT PAGE	
☐ Description	: page 1 to page 1
☒ Claim(s)	: page 6 to page 8
☐ Drawing(s)	: page 1 to page 1
☐ Abstract	: page 1 to page 1
DATE OF RECEIPT 8-6-78	

CLAIMS

1. An industrial oil having a composition comprising 30 to 99.5% by weight of palm olein having an iodine value in the range from about 55 to 67 as base fluid, together with from 0.25 to 5% by weight of an anti-oxidant and from 0.25 to 3% by weight of an anti-wear additive.
2. An industrial oil according to claim 1, in which the anti-oxidant is selected from amine-, phenol- and phosphite-based additives.
3. An industrial oil according to claim 1 or claim 2, in which the anti-wear additive is selected from amine phosphates, triphenylphosphorothionates and zinc dialkyl dithiophosphates.
4. An industrial oil according to any of claim 1, 2 or 3, which contains up to 1% by weight of a corrosion inhibitor.
5. An industrial oil according to claim 4, in which the corrosion inhibitor is selected from thiazole derivatives, sarcosines, amine phosphates and carboxylic acid salts.
6. An industrial oil according to any one of the preceding claims, which contains up to 60% by weight of other base fluid.
7. An industrial oil according to claim 6, in which the other base fluid is selected from polyalpha olefins, synthetic esters, polyglycols and refined petroleum fractions.



8. An industrial oil, according to any one of the preceding claims, which contains up to 5% by weight of an ester as a crystallisation retarder for the palm olein.

9. An industrial oil according to claim 8, in which the ester is present in an amount of from 0.04 to 0.24% by weight.

10. An industrial oil according to claim 8 or 9, in which the ester is selected from sorbitan monostearate, sorbitan tristearate and polyoxyethylene tristearate.

11. An industrial oil according to claim 8, 9 or 10, in which the palm olein has an Iodine Value of at least 60.

12. An industrial oil according to claim 11, in which the Iodine Value is from 62 to 67.

13. An industrial oil according to any one of the preceding claims, which additionally includes from 2 to 20% by weight of a tackifier.

14. An industrial oil according to claim 13, in which the tackifier is selected from polyisobutylenes and polymethylalcohols.

15. An industrial oil according to any one of the preceding claims, which additionally includes from 0.25 to 2% by weight of an extreme pressure additive.



16. An industrial oil according to claim 15, in which the extreme pressure additive is selected from sulphur carriers, sulphides based on fatty acid glyceride/esters and dialkylpentasulphides.

17. An industrial oil according to any one of the preceding claims, which additionally includes from 0.01 to 1.0% of a metal passivator.

18. An industrial oil according to claim 17, in which the metal passivator is selected from sulphur-nitrogen heterocyclics, sulphonates and tolytriazole derivatives.

19. An industrial oil according to any one of the preceding claims, which additionally includes up to 0.05% by weight of an anti-foam agent.

20. An industrial oil according to claim 19, in which the anti-foam agent is selected from silicone fluids and organic polymers.

21. The use as an industrial oil of a composition of any one of the preceding claims.