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(54) **RAILWAY LUBRICANT**

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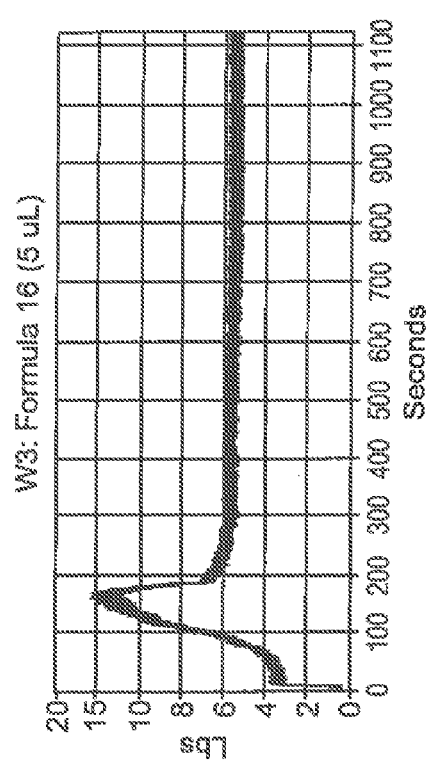
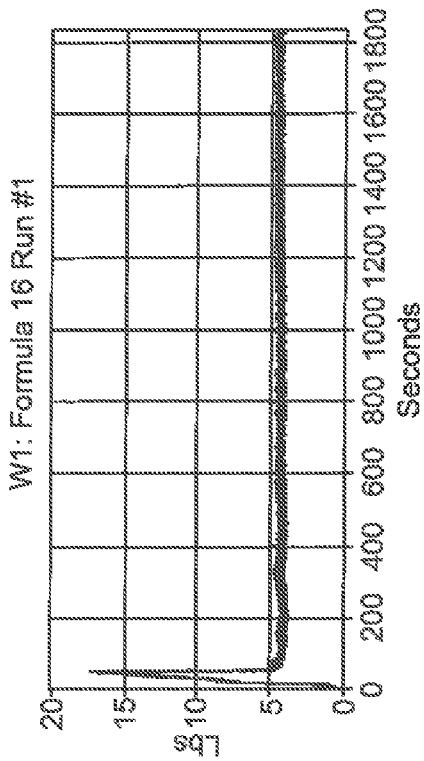
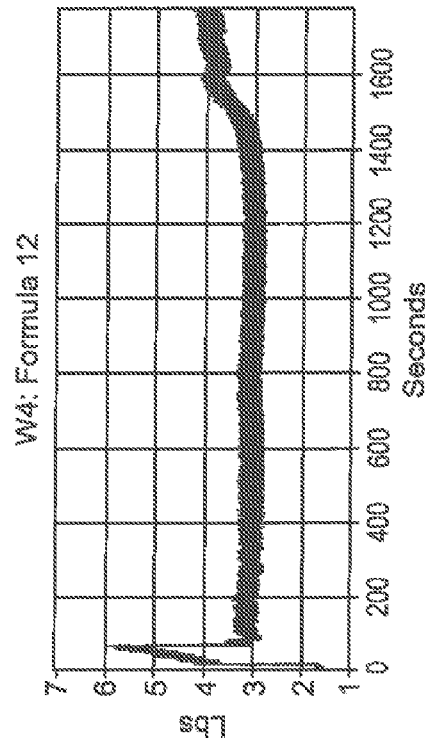
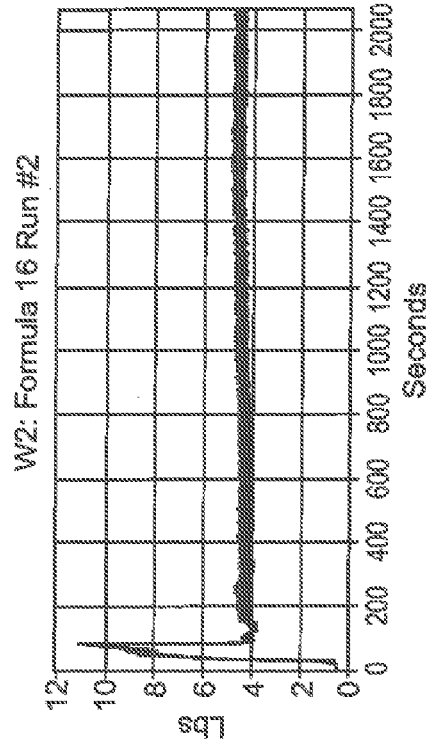
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(60) Provisional application No. 62/236,421, filed on Oct. 2, 2015.

(57) **ABSTRACT**

A water-based solid lubricant includes water, glycerin, isoalkane, molybdenum disulfide, talc powder, calcium sulfonate, and polyisobutylene is described herein.



RAILWAY LUBRICANT

TECHNICAL FIELD

[0001] This application claims priority to U.S. Ser. No. 62/236,421, entitled Railway Lubricant, filed on Oct. 2, 2015, the contents of which are incorporated herein by reference. The present teachings relate to a lubricant. Such lubricants can have application, for example, as a railway lubricant.

BACKGROUND

Description of Related Art

[0002] WO 2014/107581 discloses a friction control composition having high and positive frictional properties for sliding steel surfaces that includes a water insoluble hydrocarbon that enables a reduced water content, a rheological additive, a freezing point depressant, a friction modifier, and a lubricant.

SUMMARY

[0003] The present teachings can provide a railway lubricant having water, a freezing point depressant, and a synthetic fluid.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Example arrangements are described hereinafter with reference to the accompanying drawings.

[0005] FIG. 1 shows test result graphs.

DEFINITIONS

[0006] Clay—a fine-grained natural rock or soil material that combines one or more clay minerals with traces of metal oxides and organic matter.

[0007] Clay Minerals—hydrated aluminum phyllosilicates, sometimes with variable amounts of iron, magnesium, alkali metals, alkaline earths, and other cations.

[0008] Friction Modifier—polar molecules added to lubricants for the purpose of minimizing light surface contacts (sliding and rolling) that may occur in a given machine design.

[0009] Lime—CaO or CaOH.

[0010] Not Water Soluble—the component has a solubility in water of less than 10% (ten percent) by weight, less than 5% (five percent) by weight, and even less than 1% (one percent) by weight.

[0011] Synthetic Fluid—a substance, pure or in a mixture, that has undergone at least one major chemical transformation (reaction) in its manufacturing process. It is the product of an intended chemical reaction and high temperatures and pressures. A simple physical separation, purification, or transformation (e.g. freezing, boiling, etc.) does not constitute a synthesis.

[0012] Viscosity Modifier—polymeric molecules that are sensitive to temperature.

DETAILED DESCRIPTION

[0013] A lubricant for top of rail is disclosed, wherein the lubricant includes water as a base, a freezing point depressant, and a liquid lubricant. Upon initial shear, the formulation is homogenous. The liquid lubricant, in one example, is a synthetic fluid, which is not water soluble. In one

example, the freezing point depressant is glycerin, although it is to be understood that the freezing point depressant could be any diol or triol, such as ethylene glycol, diethylene glycol, triethylene glycol, or propylene glycol. In one example, the liquid lubricant is isoalkane. The isoalkane can be a C14 to C30 isoalkane, and within that range, can be an isoalkane greater than C16. In one example, the isoalkane is greater than 75% by weight of C19 to C23 isoalkane. The longer chain length allows for a smoother and more uniform lubricant.

[0014] Synthetic-based fluids are classified into four categories: hydrocarbon, ethers, esters, and acetals. Synthetic hydrocarbons include normal linear paraffins (LPs), linear alpha olefins (LEOs), polyalphaolefins (PAOs), and internal olefins (IOs). Synthetic based fluids do not disperse in water and do not increase turbidity. A synthetic fluid has polyaromatic hydrocarbon (PAH) content of ≤ 0.001 percent, are biodegradable, and pass the Static Sheen Test. In this example, the synthetic fluid also acts as a friction modifier. In one example, the lubricant does not contain any non-synthetic fluids.

[0015] Friction modifiers and mild anti-wear agents are also called boundary lubrication additives. Esters, natural and synthetic fatty acids, as well as some solid materials such as graphite and molybdenum disulfide are used for these purposes. These molecules have a polar end (head) and an oil-soluble end (tail). Once placed into service, the polar end of the molecule finds a metal surface and attaches itself. As long as the frictional contact is light, these molecules provide a cushioning effect when one of the coated surfaces connects with another coated surface. If the contact is heavy, then the molecules are brushed off, eliminating any potential benefit of the additive.

[0016] In addition to the base, freezing point depressant, and liquid lubricant/friction modifier, additional friction modifiers/solid lubricants can be added to the composition. In one example, the additional friction modifiers/solid lubricants can be polar compounds, such as talc powder, graphite, polytetrafluoroethylene, tungsten disulfide, molybdenum disulfide, or hexagonal boron nitride. In one example, the additional friction modifiers/solid lubricants are not water soluble.

[0017] In addition to the base, freezing point depressant, liquid lubricant/friction modifier, friction modifier/solid lubricant, a suspension stabilizer and/or a viscosity index modifier can be added to the composition. In one example, the suspension stabilizer can be calcium sulfonate, lithium base greases, and aluminum base greases. The viscosity index modifier can be a medium or high molecular weight polymer, such as polyisobutylene, polyethylene, polytetrafluoroethylene, polypropylene, polycarbohydrate, or polyuria. In one example, the suspension stabilizer and viscosity index modifier are not water soluble. In one example, the lubricant contains no lime, in another example, the lubricant contains no clay, and in another example, the lubricant contains no lime or clay.

[0018] With viscosity modifiers, at low temperatures, the molecule chain contracts and does not impact the fluid viscosity. At high temperatures, the chain relaxes and an increase in viscosity occurs. When contracted, the molecules flow past one another easily, but when extended, they get caught on one another and impede the flow of the fluid they occupy. The addition of modifiers will only slow down the rate at which the viscosity decreases.

[0019] In one example, the water is between about 15% and about 35% by weight (including, but not limited to 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35), the freezing point depressant is between about 20% and about 50% by weight (including, but not limited to 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, and 50), the liquid lubricant is between about 15% and about 35% by weight (including, but not limited to 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35), the friction modifiers/dry lubricants are between about 0% and about 20% by weight (including, but not limited to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20), and the suspension stabilizer is between about 2% and 7% by weight (including, but not limited to 2, 3, 4, 5, 6, and 7), and the viscosity index modifier is between about 2.5% and about 10% by weight (including, but not limited to 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, and 10.0). As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing. When referencing no mixing prior to application, what is meant is that the lubricant's viscosity is such that no prior mixing is required to reduce the viscosity in order to facilitate uniform application onto the rail surface.

[0020] In one example, the water is between about 15% and about 35% by weight (including, but not limited to 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35), glycerin between about 20% and about 50% by weight (including, but not limited to 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, and 50), the isoalkane is between about 15% and about 35% by weight (including, but not limited to 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, and 35), molybdenum disulfide is between about 0% and about 10% by weight (including, but not limited to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10), talc powder is between about 0% and about 10% by weight (including, but not limited to 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10), and the calcium sulfonate is between about 2% and 7% by weight (including, but not limited to 2, 3, 4, 5, 6, and 7), and polyisobutylene is between about 2.5% and about 10% by weight (including, but not limited to 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, and 10.0). As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing.

EXAMPLE 1

[0021] In one example, the water is 22% by weight, the glycerin is 42% by weight, the isoalkane is 23% by weight, the molybdenum disulfide is 3% by weight, the talc powder is 8% by weight, and the calcium sulfonate is 2% by weight.

As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing. In this example, at -5.5°C ., the lubricant has a viscosity of 3,400 cP or less. At 0.1°C ., the lubricant has a viscosity of 2,300 cP or less.

EXAMPLE 2

[0022] In one example, the water is 24% by weight, the glycerin is 38% by weight, the isoalkane is 24% by weight, the molybdenum disulfide is 3% by weight, the talc powder is 8% by weight, and the calcium sulfonate is 3% by weight. As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing. In this example, at -5.3°C . (at 50 RPM or faster), the lubricant has a viscosity of 4,360 cP or less. At 0.7°C . (at 50 RPM or faster), the lubricant has a viscosity of 3,800 cP or less.

EXAMPLE 3

[0023] In one example, the water is 21% by weight, the glycerin is 38% by weight, the isoalkane is 20.3% by weight, the molybdenum disulfide is 3% by weight, the talc powder is 6% by weight, the calcium sulfonate is 1.9% by weight, and 10% by weight polyisobutylene. As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing.

EXAMPLE 4

[0024] In one example, the water is 22% by weight, the glycerin is 38% by weight, the isoalkane is 25% by weight, the molybdenum disulfide is 3% by weight, the talc powder is 5% by weight, the calcium sulfonate is 2% by weight, and 5% by weight polyisobutylene. As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing.

EXAMPLE 5

[0025] In one example, the water is 24.5% by weight, the glycerin is 38% by weight, the isoalkane is 25% by weight, the molybdenum disulfide is 3% by weight, the talc powder is 5% by weight, the calcium sulfonate is 2% by weight, and

2.5% by weight polyisobutylene. As with other examples, the railway lubricant can be devoid of surfactants and/or emulsifiers. As with other examples, the liquid lubricant, the friction modifiers, the suspension stabilizer, and/or the viscosity modifier can be non-water soluble. As with other examples, the railway lubricant can be devoid of any water soluble components, except for the freezing point depressant. As with other examples, the lubricant can be applied with no mixing.

[0026] FIG. 1 show graphs of test results measuring force over time, which for a top of rail lubricant translates into potential energy savings by reducing friction loss on a track. These graphs show the relative consistency and repeatability of the testing on similar formulations.

[0027] Clause 1—A water-based solid lubricant including water; glycerin; isoalkane; molybdenum disulfide; talc powder; calcium sulfonate; and polyisobutylene, wherein the lubricant contains no non-synthetic fluids, wherein the lubricant has a viscosity of less than 5,000 cP.

[0028] Clause 2—A lubricant including water; a freezing point depressant; and, a synthetic fluid, wherein the lubricant contains no non-synthetic fluids and no lime, wherein the lubricant has a viscosity of less than 5,000 cP.

[0029] Clause 3—The lubricant of clause 2, wherein the lubricant further comprises a friction modifier, wherein the lubricant contains no clay, wherein the lubricant has a viscosity less than 3,400 cP.

[0030] Clause 4—The lubricant of clause 2 or 3, wherein the lubricant further comprises a solid lubricant, wherein the isoalkane is at least 75% by weight C19 to C23 isoalkane.

[0031] Clause 5—The lubricant of clauses 2-4, wherein the lubricant further comprises a viscosity index modifier.

[0032] Clause 6—The lubricant of clauses 2-5, wherein the lubricant further comprises a suspension stabilizer.

[0033] Clause 7—The lubricant of clauses 2-6, wherein the freezing point depressant is a diol or triol.

[0034] Clause 8—The lubricant of clauses 2-7, wherein the synthetic fluid is isoalkane.

[0035] Clause 9—The lubricant of clauses 3-8, wherein the friction modifier is a polar compound.

[0036] Clause 10—The lubricant of clauses 4-9, wherein the solid lubricant is a polar compound.

[0037] Clause 11—The lubricant of clauses 5-9, wherein the viscosity index modifier is a medium or high molecular weight polymer.

[0038] Clause 12—The lubricant of clauses 6-11, wherein the suspension stabilizer is lithium complex base grease, aluminum complex base grease, or calcium sulfonate.

[0039] Clause 13—The lubricant of clauses 7-12, wherein the diol is a 1,2-diol or a 1,3-diol.

[0040] Clause 14—The lubricant of clauses 7-13, wherein the diol is ethylene glycol, diethylene glycol, triethylene glycol, or propylene glycol.

[0041] Clause 15—The lubricant of clauses 8-14, wherein the isoalkane is a C17 isoalkane to a C30 isoalkane.

[0042] Clause 16—The lubricant of clauses 9-15, wherein polar compound is graphite, polytetrafluoroethylene, tungsten disulfide, molybdenum disulfide, or hexagonal boron nitride.

[0043] Clause 17—The lubricant of clauses 10-16, wherein the polar compound is talc powder.

[0044] Clause 18—The lubricant of clauses 5-17, wherein the viscosity index modifier is a polyisobutylene, polyethylene, polytetrafluoroethylene, polypropylene, polycarbonate, or polyurea.

[0045] Clause 19—The lubricant of clauses 2-18, wherein the freezing point depressant is glycerin.

[0046] Clause 20—The lubricant of clauses 1-19, wherein the water is about 15% to about 35% by weight. The lubricant of clauses 1-19, wherein the water is about 20% to about 30% by weight. The lubricant of clauses 1-19, wherein the water is about 25% to about 35% by weight. The lubricant of clauses 1-19, wherein the water is about 25% to about 30% by weight. The lubricant of clauses 1-19, wherein the water is about 20% to about 35% by weight. The lubricant of clauses 1-19, wherein the water is about 15% to about 30% by weight. The lubricant of clauses 1-19, wherein the water is about 15% to about 25% by weight. The lubricant of clauses 1-19, wherein the water is about 15% to about 20% by weight. The lubricant of clauses 1-19, wherein the water is about 20% to about 30% by weight. The lubricant of clauses 1-19, wherein the water is about 20% to about 25% by weight. The lubricant of clauses 1-19, wherein the water is about 30% to about 35% by weight.

[0047] Clause 21—The lubricant of clauses 2-20, wherein the freezing point depressant is about 20% to about 50% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 25% to about 50% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 30% to about 50% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 35% to about 50% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 40% to about 50% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 45% to about 50% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 20% to about 45% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 20% to about 40% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 20% to about 35% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 20% to about 25% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 25% to about 45% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 30% to about 45% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 40% to about 45% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 25% to about 40% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 25% to about 45% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 30% to about 40% by weight. The lubricant of clauses 2-20, wherein the freezing point depressant is about 35% to about 40% by weight.

[0048] Clause 22—The lubricant of clauses 2-21, wherein synthetic fluid is about 15% to about 35% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 20% to about 35% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 25% to about 35% by weight. The lubricant of clauses 2-21, wherein synthetic

fluid is about 30% to about 35% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 15% to about 30% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 15% to about 25% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 15% to about 20% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 20% to about 30% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 20% to about 25% by weight. The lubricant of clauses 2-21, wherein synthetic fluid is about 25% to about 30% by weight.

[0049] Clause 23—The lubricant of clauses 3-22, wherein the friction modifier is about 0% to about 10% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 0% to about 7.5% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 0% to about 5% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 0% to about 2.5% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 2.5% to about 10% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 2.5% to about 7.5% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 2.5% to about 5% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 5% to about 10% by weight. The lubricant of clauses 3-22, wherein the friction modifier is about 5% to about 7.5% by weight.

[0050] Clause 24—The lubricant of clauses 4-23, wherein the solid lubricant is about 0% to about 10% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 0% to about 7.5% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 0% to about 5% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 0% to about 2.5% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 2.5% to about 10% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 2.5% to about 7.5% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 2.5% to about 5% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 5% to about 10% by weight. The lubricant of clauses 4-23, wherein the solid lubricant is about 5% to about 7.5% by weight.

[0051] Clause 25—The lubricant of clauses 5-24, wherein the viscosity index modifier is about 0% to about 15% by weight. The lubricant of clauses 5-24, wherein the viscosity index modifier is about 0% to about 10% by weight. The lubricant of clauses 5-24, wherein the viscosity index modifier is about 0% to about 5% by weight. The lubricant of clauses 5-24, wherein the viscosity index modifier is about 5% to about 15% by weight. The lubricant of clauses 5-24, wherein the viscosity index modifier is about 5% to about 10% by weight. The lubricant of clauses 5-24, wherein the viscosity index modifier is about 10% to about 15% by weight.

[0052] Clause 26—The lubricant of clauses 6-25, wherein the suspension stabilizer is about 0% to about 7% by weight. The lubricant of clauses 6-25, wherein the suspension stabilizer is about 1% to about 7% by weight. The lubricant of clauses 6-25, wherein the suspension stabilizer is about 2% to about 7% by weight. The lubricant of clauses 6-25, wherein the suspension stabilizer is about 3% to about 7% by weight. The lubricant of clauses 6-25, wherein the suspension stabilizer is about 4% to about 7% by weight. The lubricant of clauses 6-25, wherein the suspension sta-

bilizer is about 5% to about 7% by weight. The lubricant of clauses 6-25, wherein the suspension stabilizer is about 6% to about 7% by weight.

[0053] Clause 27—The lubricant of clauses 20-26, wherein the water is 23% by weight.

[0054] Clause 28—The lubricant of clauses 20-27, wherein the freezing point depressant is 42% by weight.

[0055] Clause 29—The lubricant of clauses 20-28, wherein the synthetic fluid is 23% by weight.

[0056] Clause 30—The lubricant of clauses 20-29, wherein the friction modifier is 3% by weight.

[0057] Clause 31—The lubricant of clauses 20-30, wherein the solid lubricant is 8% by weight.

[0058] Clause 32—The lubricant of clauses 20-31, wherein the viscosity index modifier is 2.5%, 5%, 7.5%, or 10% by weight.

[0059] Clause 33—The lubricant of clauses 20-32, wherein the suspension stabilizer is 2% by weight.

[0060] Clause 34—The lubricant of clauses 20-26, wherein the water is 24% by weight.

[0061] Clause 35—The lubricant of clauses 20-26 or 34, wherein the freezing point depressant is 38% by weight.

[0062] Clause 36—The lubricant of clauses 20-26, 34, or 35, wherein the synthetic fluid is 24% by weight.

[0063] Clause 37—The lubricant of clauses 20-26, 34-36, wherein the friction modifier is 3% by weight.

[0064] Clause 38—The lubricant of clauses 20-26, 34-37, wherein the solid lubricant is 8% by weight.

[0065] Clause 39—The lubricant of clauses 20-26, 34-38, wherein the viscosity index modifier is 10% by weight.

[0066] Clause 40—The lubricant of clauses 20-26, 34-39, wherein the suspension stabilizer is 2% by weight.

[0067] Clause 41—A water-based solid lubricant including 22% by weight water; 42% by weight glycerin; 23% by weight isoalkane; 3% by weight molybdenum disulfide; 8% by weight talc powder; and 2% by weight calcium sulfonate, wherein the lubricant has no non-synthetic fluids, wherein the lubricant has a viscosity of less than 5,000 cP.

[0068] Clause 42—A water-based solid lubricant including 24% by weight water; 38% by weight glycerin; 24% by weight isoalkane; 3% by weight molybdenum disulfide; 8% by weight talc powder; and 3% by weight calcium sulfonate; and polyisobutylene, wherein the lubricant has no non-synthetic fluids, wherein the lubricant has a viscosity of less than 5,000 cP.

[0069] Clause 43—A water-based solid lubricant including 21% by weight water; 38% by weight glycerin; 20.3% by weight isoalkane; 3% by weight molybdenum disulfide; 6% by weight talc powder; 1.9% by weight calcium sulfonate; and 10% by weight polyisobutylene, wherein the lubricant has no non-synthetic fluids, wherein the lubricant has a viscosity of less than 5,000 cP.

[0070] Clause 44—A water-based solid lubricant including 22% by weight water; 38% by weight glycerin; 25% by weight isoalkane; 3% by weight molybdenum disulfide; 5% by weight talc powder; 2% by weight calcium sulfonate; and 5% by weight polyisobutylene, wherein the lubricant has no non-synthetic fluids, wherein the lubricant has a viscosity of less than 5,000 cP.

[0071] Clause 45—A water-based solid lubricant including 24.5% by weight water; 38% by weight glycerin; 25% by weight isoalkane; 3% by weight molybdenum disulfide; 5% by weight talc powder; 2% by weight calcium sulfonate; and 2.5% by weight polyisobutylene, wherein the lubricant

has no non-synthetic fluids, wherein the lubricant has a viscosity of less than 5,000 cP.

[0072] Clause 46—The lubricant of clauses 1-45, wherein the lubricant contains no surfactant or substantially no surfactant, wherein the lubricant contains no lime.

[0073] Clause 47—The lubricant of clauses 1-46, wherein the lubricant contains no surfactant or substantially no emulsifier, wherein the lubricant contains no clay.

[0074] Clause 48—The lubricant of clauses 1-47, wherein the friction modifier, the solid lubricant, the liquid lubricant, and/or the viscosity modifier are not water soluble.

[0075] A method for lubricating a top of rail, the method comprising the steps of providing a lubricant according to any of clauses 1-48 and applying the lubricant to the top of rail without mixing.

[0076] Various example embodiments have been described above for lubricants. Skilled readers will understand, however, that changes and modifications may be made without departing from the spirit and scope of the following claims and their equivalents.

Having thus described the disclosed system and method, it is now claimed:

1. A water-based lubricant comprising:
 - water;
 - glycerin;
 - synthetic isoalkane, wherein the synthetic isoalkane is at least 75% by weight C19 to C23 isoalkane, wherein the synthetic isoalkane has a polyaromatic hydrocarbon (PAH) content of ≤ 0.001 percent;
 - molybdenum disulfide;
 - talc powder;
 - calcium sulfonate; and
 - polyisobutylene, wherein the lubricant contains no lime and no clay, wherein the lubricant has a viscosity of less than 5,000 cP at 22° C.
2. A lubricant comprising:
 - water;
 - a freezing point depressant;
 - a viscosity index modifier; and
 - a synthetic fluid, wherein the lubricant has a viscosity of less than 5,000 cP at 22° C., wherein the lubricant contains no non-synthetic fluids, wherein the synthetic fluid has a polyaromatic hydrocarbon (PAH) content of ≤ 0.001 percent.
3. The lubricant of claim 2, wherein the lubricant further comprises a friction modifier, wherein the lubricant contains no lime.
4. The lubricant of claim 3, wherein the lubricant contains no clay, wherein the lubricant further comprises a water-based lubricant.

5. The lubricant of claim 4, wherein the lubricant further comprises a suspension stabilizer.

6. The lubricant of claim 5, wherein the freezing point depressant is a diol or triol.

7. The lubricant of claim 6, wherein the synthetic fluid is isoalkane.

8. (canceled)

9. The lubricant of claim 7, wherein the viscosity index modifier is polyisobutylene, polyethylene, polytetrafluoroethylene, polypropylene, polycarbohydrate, or polyuria, wherein the suspension stabilizer is lithium complex base grease, aluminum complex base grease, or calcium sulfonate.

10. The lubricant of claim 9, wherein the diol is a 1,2-diol or a 1,3-diol.

11. The lubricant of claim 9, wherein the diol is ethylene glycol, diethylene glycol, triethylene glycol, or propylene glycol.

12. The lubricant of claim 7, wherein the isoalkane is a C17 isoalkane to a C30 isoalkane.

13. The lubricant of claim 7, wherein the water-based lubricant is talc powder, graphite, polytetrafluoroethylene, tungsten disulfide, molybdenum disulfide, or hexagonal boron nitride, wherein the viscosity index modifier is a polyisobutylene, polyethylene, polytetrafluoroethylene, polypropylene, polycarbohydrate, or polyuria, wherein the freezing point depressant is glycerin.

14. The lubricant of claim 5, wherein the water is about 15% to about 35% by weight, wherein the freezing point depressant is about 20% to about 50% by weight, wherein synthetic fluid is about 15% to about 35% by weight, wherein the friction modifier is about 0% to about 10% by weight, wherein the solid lubricant is about 0% to about 10% by weight, wherein the viscosity index modifier is about 0% to about 15% by weight, wherein the suspension stabilizer is about 0% to about 7% by weight.

15. The lubricant of claim 5, wherein the lubricant contains no surfactant or substantially no surfactant.

16. The lubricant of claim 4, wherein the lubricant contains no surfactant or substantially no emulsifier.

17. The lubricant of claim 16, wherein the friction modifier, the water-based lubricant, the liquid lubricant, and/or the viscosity modifier are not water soluble.

18. A method for lubricating a top of rail with a water-based lubricant, the method comprising the steps of:

- providing a lubricant according to claim 2; and
- applying the lubricant to the top of rail without premixing.

19. The method of claim 18, wherein the lubricant further comprises a friction modifier.

20. (canceled)

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