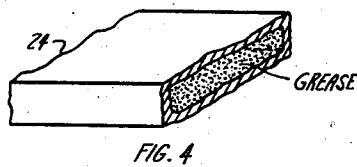
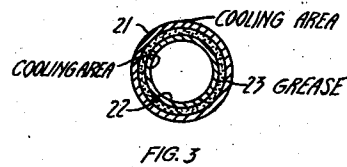
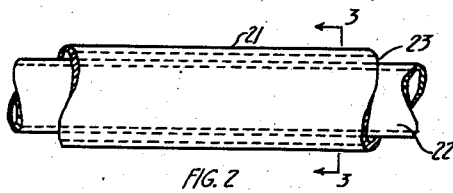
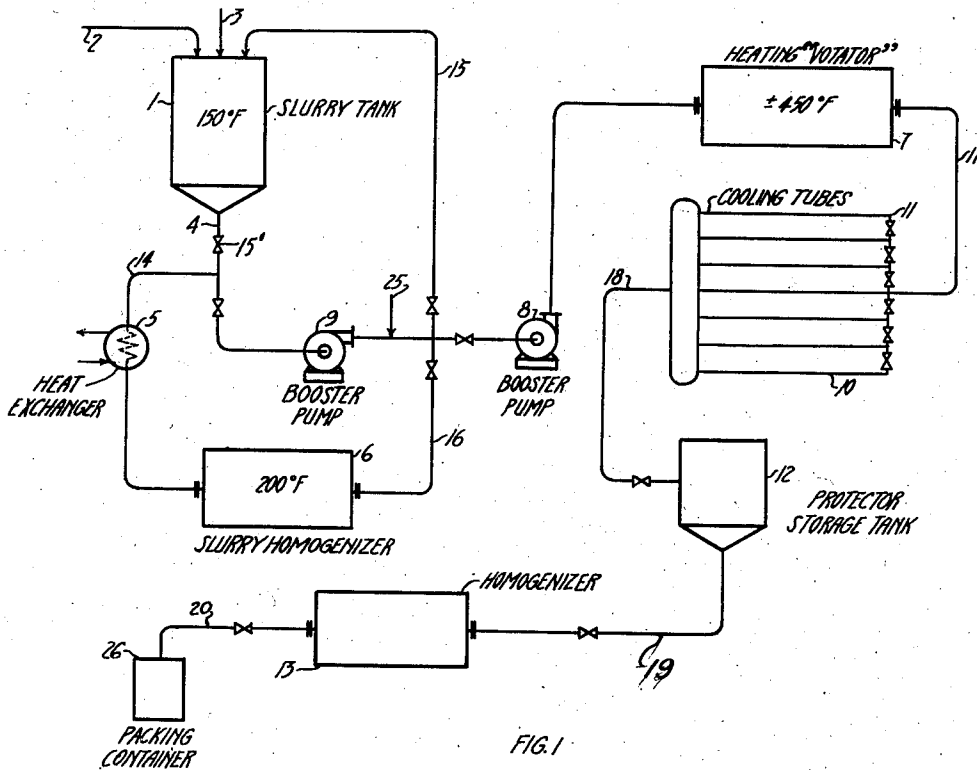


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MANUFACTURE OF GREASE

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MANUFACTURE OF GREASE

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This invention relates to a method of prepar-
ing greases. More particularly, this invention
pertains to a novel process of making alkali
and alkaline earth metal soap greases and to a new
and novel method of statically cooling them in
an enclosed system so as to obtain a product
having a stable, smooth, buttery, homogeneous
texture and consistency. In one of its specific
embodiments, this invention pertains to a novel
method of statically cooling alkali and alkaline
earth metal soap greases in which soap is dis-
solved in mineral and/or synthetic oil type bases
in a plurality of elongated tubular zones of de-
sired diameter and length so as to cool statically
said greases at a sufficiently rapid and uniform
rate, thereby obtaining products having improved
stability, consistency and texture. Instead of
cooling greases in a plurality of elongated tubu-
lar zones or tubes, greases can be cooled in en-
closed vessels of restricted cross-section of not
more than about 4 inches into which grease can
be injected. This restricted space of the vessel
can be of any convenient shape such as annular
or rectangular, but should be of sufficient size
so as to accommodate the volume of the hot
greases entering therein. The cross-section into
which the hot grease is injected is of restricted
diameter or width in order to maintain efficient
heat transfer so as to cool the grease rapidly and
uniformly.

Various factors can and do influence final struc-
ture, consistency and texture of greases during
manufacture; of these, the cooling is often most
influential. The physical properties of greases
made under identical conditions can be altered
to a marked degree, depending on whether the
cooling is effected under agitation or under static
conditions, or even when using different means
of statically cooling these greases. The method
and means employed in cooling greases, particu-
larly greases of the class referred to above, to
obtain an improved product, is not a simple
matter, but is a fine art requiring great skill.

Lubricating greases of the type under con-
sideration comprise mainly mixtures of oil and
soap employed in suitable proportions, said mix-
tures on being heated to elevated temperatures
so as to dissolve the soap in the oil form a
homogeneous solution which when properly
cooled forms greases. Factors which control
and govern the structure, consistency and texture
of grease products, include: the type and amount
of soap used, the kind of oil employed, presence
or absence of fillers and other additives, and, of
major importance, the method and conditions
under which the greases are cooled. Proper and
uniform cooling of greases from a molten state
is of major importance and is essential for pro-
ducing a desired product particularly in the case
of sodium, lithium, magnesium, barium and
calcium soap greases and/or their mixtures,

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otherwise a coarse, unstable, grainy or fibrous
grease is obtained.

Present methods for cooling greases, are: (1)
dynamic methods which include kettle and vota-
tor cooling and (2) static methods such as pan
cooling and the like. Both of these methods for
cooling greases under consideration are not par-
ticularly applicable since in practice it has been
found that the resultant products are inferior
in regard to both structure and stability.

One method of cooling a grease statically is
to allow it to cool in a kettle having a cooling
jacket around it through which air, water, or
any other cooling medium can circulate and cool
the kettle. In most cases this type of cooling is
effected in the same kettle used to compound
the grease. However, the hot fluid grease can
be transferred to a specially equipped kettle for
cooling and a new batch of oil and soap can be
added to the first kettle so as to have substantially
an uninterrupted process for making grease.
Still another method of cooling grease is to pour
the hot grease directly into shipping or storage
containers where they are allowed to cool. An
improved method of cooling grease is to pour it
into shallow pans or trays while in a hot fluid
state and allow it to remain and cool to desired
temperature.

All of these methods of cooling have disadvan-
tages when applied to lubricating greases which
are cooled from a molten state. Greases of this
type on cooling form what is known as false
bodies and tend to crumble and disintegrate
under pressure rather than retain a homo-
geneous structure. Since this gel-like formation
in such greases cannot be avoided generally, it
is at times necessary to homogenize such greases
in order to break down the stiff gel structure.
This results in a grease of softer but smoother
and more uniform consistency.

In the cases of greases having a pronounced
gel structure, it is essential and important that
the gel structure be uniform and stable with
regard to oil separation. To accomplish this,
greases of this type must be cooled rapidly, at a
controlled rate under static conditions. The
kettle, tray container or any other known method
of cooling these greases and particularly lithium
soap greases usually result in undesirable products
due to the fact that they are poor in quality
and appearance. This is due to the non-uniform
heat transfer during cooling of the grease, which
results in a stiff, highly gelled surface while the
center and other parts of the grease are soft,
semi-liquid or even liquid.

Of the three above mentioned methods, the
pan or tray cooling at present is the most de-
sirable method of cooling greases because the
trays are not of great depth. However, even
with shallow pans it is difficult to prevent a crust
from forming at the surface which acts as a

heat insulator, inhibiting further rapid and uniform cooling of the grease. In addition, cooling greases by this method is a fire hazard, particularly when the grease is poured into the pans at elevated temperatures and the oil employed in making the grease has a low flash point.

It is an object of this invention to provide a method of quickly, simply, safely and economically making and cooling alkali and alkaline earth metal soap greases under static conditions. Another object of this invention is to provide a method of rapidly cooling alkali and alkaline earth metal soap greases in enclosed systems which result in a product of uniform consistency. Furthermore it is an object of this invention to statically cool greases in elongated tubular enclosed systems thus alleviating fire hazard. It is also an object of this invention to provide a method of making and thereafter rapidly cooling under static conditions greases, particularly lithium soap greases, in narrow elongated tubes having uniformly controlled heat transfer so as to obtain greases of uniform consistency, desired texture, and good stability.

Broadly this invention comprises a method of making alkali and alkaline earth metal soap greases and thereafter rapidly cooling them by disposing them preferably in enclosed relatively narrow elongated tubes having controlled heat transfer. The length of the tubes can be varied and is not a limitation; but the diameter should not exceed 4 inches and can vary from around about $\frac{1}{4}$ to not more than about 4 inches. In most cases it is preferable to use tubes having a diameter of around about $2\frac{1}{2}$ to $3\frac{1}{2}$ inches because of the ease of filling and removing greases from such size tubes and because tubes of this size provide a sufficient heat transfer rate. The tubes or elongated grease coolers can be made of iron, steel, aluminum or alloys thereof or any material which provides sufficient heat transfer and which has no adverse catalytic effect upon the grease. The tubes can be cooled by circulating around the tubes air, water, brine or other cooling medium.

The time required for cooling greases of the type and method under consideration generally depends upon the material from which the tubes are made, as well as the cooling medium employed. Usually it takes from a fraction of an hour to about 10 hours for a grease to cool by the method of this invention. The preferred cooling time in $\frac{1}{4}$ to $3\frac{1}{2}$ inch steel tube is between about $\frac{1}{4}$ to 3 hours for lithium soap grease. In addition to being more convenient and safer, cooling greases by this method eliminates the danger of contamination and oxidation.

The alkali and alkaline earth soaps used in making greases may be made by conventional methods, e. g. by saponification of fats, fatty acids and the like with alkali and alkaline earth oxides or hydroxides of sodium, lithium, potassium, rubidium and cesium, beryllium, magnesium, calcium, strontium and barium, using one or several of the metals. Specifically the fatty materials used can be tallow, lard, horse fat, fatty acids derived from vegetable oils such as castor oil, cotton-seed oil, rape oil, soya bean oil, corn oil and may be in hydrogenated or non-hydrogenated form. Fish oil and hydrogenated fish oil fatty acids, tall oil fatty acids, naphthenic acids, rosin oils, synthetic fatty acids, and synthetic acids produced by oxidizing paraffin waxes also can be used as well as free fatty acids such as lauric, myristic, palmitic, stearic, arachic, behenic, oleic, ricinoleic, hydroxy stearic and the like.

It has been observed that the type of base oil used has a marked influence upon the physical properties of greases. When compounding lithium soap grease it is preferable to use naphthenic type oils although other type oils can be used, since grease thus compounded is less susceptible to bleeding and has improved temperature consistency characteristics. With other alkali and/or alkaline earth soaps, mineral oils of light, medium and heavy lubricating oil stocks derived from paraffinic, naphthenic or mixed crudes can be used as well as synthetic lubricating stocks such as produced by polymerizing olefinic materials in presence of Friedel-Craft catalyst, polymerizing alkylene oxides in presence of iodine, hydriodic acid and the like, volatilizing mixtures of fixed and mineral oils, and those produced from alkyl esters or organic acids, e. g. 2-ethylhexyl sebacate, ethyl ricinoleate, dioctyl phthalate and the like.

The temperature to which oil and soap is heated to form a homogenous grease usually ranges from around about 350 to 500° F. A preferred temperature range when making lithium soap grease is around about 400 to 425° F.

The heating and mixing can be done in a heating "Votator" or any other suitable piece of equipment. From there the hot liquid grease according to this invention goes directly to elongated cooling tubes without any intermediate treatment. The grease is cooled there under static conditions to a desired gelation state and thereafter forced out of the cooling tubes into a homogenizer where it is worked into a homogeneous mass and thereafter filled or packaged in suitable containers.

In order to more clearly set forth the invention reference is now made to the accompanying drawing, which is a flow diagram illustrating a method of producing and subsequently cooling alkali soap greases by means of this invention. It is understood that modification as to equipment, its arrangement, type and kind of materials and their proportions can be resorted to without departing from the spirit of the invention as presented in the subjoined claims.

Referring to the flow diagram, it shows a slurry tank 1 into which is introduced calculated proportions of alkali or alkaline earth metal soap and mineral oil through conduit 2. If other additives such as oxidation and corrosion inhibitors, anti-bleeding agents, oiliness agents, fillers and the like are added to the grease they can be introduced into the slurry tank 1 through conduit 3 at a convenient time. The oil and soap is heated to between about 135 to 175° F. and preferably $\pm 150^\circ$ F. and then led through conduit 4 to conduit 14 and into a heat exchanger 5. From the heat exchanger the mixture goes to a slurry homogenizer 6 where it is worked at a temperature of around about $\pm 200^\circ$ F. The mixture can then be returned to the slurry tank 1 through lines 16 and 15, for further working or by-passed through line 16 through pump 8 and into a heating "Votator" 7, an enclosed heat transfer mechanism manufactured by the Girdler Corporation, Votator Division, Louisville, Kentucky, and described in their bulletin entitled "The Votator." If the mixture is returned to slurry tank 1 for further working it is subsequently discharged from the tank into line 4, through a booster pump 9 on through line 25 and pump 8 and into the heating "Votator" 7. The grease temperature in the heat "Votator" 7 is kept at around about 400 to 500° F. and preferably around about 400 to 430° F. The utiliza-

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tion of a heat "Votator" for making grease is of considerable advantage over the open kettle method, since the "Votator" is entirely closed eliminating the danger of oil flashing and causing fire. The hot liquid grease from the "Votator" is led along conduit 17 directly into a plurality of elongated cooling tubes 10 each tube having attached thereto control valve 11. If desired other convenient enclosed shaped cooling vessels or containers 21 and 24 as shown in Figs. 2 and 4 can be substituted for the cooling tubes 10 shown in flow diagram 1. In Fig. 2, a transverse cross section taken on the line 3—3 thereof being shown in Fig. 3, the hot grease from "Votator" 7 is inserted into the area marked 23 and is cooled by suitable means by space marked 22 and 21. Fig. 4 may be a rectangular shaped body of restricted thickness but of relatively great length and height so that a large volume of grease can be injected into it and thereby eliminate the necessity of a large number of tubes as noted by 10 in Fig. 1. If cooling tubes are used the grease is kept in them under static conditions until the grease has cooled down sufficiently, to form a pronounced gel structure. The grease is then discharged through conduit 18 into a production or storage tank 12. There the grease is accumulated and then conducted through 19 into a homogenizer 13 where it is worked into a homogeneous mass at a temperature ranging from room temperature to around about $\pm 150^{\circ}$ F. The grease is then discharged through conduit 20 to suitable packing containers 26 ready for distribution. The grease in its production stages is conducted to or by-passed around certain equipment by means of conduits as noted in Fig. 1 each having attached thereto control valves 15'.

To illustrate the applicability of this cooling method for making grease, a specific example, namely, the method of making and cooling a lithium soap grease will be herein fully described following the flow diagram.

Around about 7-10% by weight of lithium stearate and a suitable amount of mineral lubricating oil, preferably naphthenic base oil are introduced into slurry tank 1 and agitated at a temperature of around about $\pm 150^{\circ}$ F. The oil-soap mixture is then led through conduit 4 and 14 through heat exchanger 5 and into slurry homogenizer 6 where the mixture is homogenized at a temperature of around about 200° F. The composition is then conducted through lines 16 and 15 back to slurry tank 1 for further agitation and finally discharged at a temperature of about 150° F. through line 4 to pumps 9 and 8 and into heating "Votator" 7. There the oil-soap mixture is heated to about $\pm 425^{\circ}$ F. and then discharged directly into a plurality of steel tubes 10 each having a diameter of about 3 inches and a length of about 40 feet. The grease is cooled statically in these tubes down to about 150° F. and forced out of them into a production or storage tank 12. When sufficient grease is accumulated in tank 12 it is conducted into a homogenizer 13 for working into a homogeneous consistency and texture, after which it is packed in containers 26. Grease produced by this method frequently requires less soap and has a consistency, texture and stability which is superior to any known grease produced and cooled by present known methods.

The composition of grease produced and cooled by this method can be modified and varied over wide limits. Thus instead of making a straight

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lithium stearate grease as disclosed above, mixture of lithium stearate and alkaline earth naphthenates or other soaps can be used. Also mixture of different metals as well as their acid radicals can be used in compounding grease. Thus a grease comprising sodium stearate, calcium naphthenate and lithium stearate can be made and then statically cooled by the method described.

To stabilize greases of the type described against oxidation it is advisable to add minor amounts of oxidation inhibitors to the grease. Among the antioxidants which are effective with grease composition of the type disclosed are: N-alkyl para phenylene diamine and condensed polynuclear aromatic mono-amines. Such inhibitors are N-butyl paraphenylene diamine, N-N-dibutyl para-phenylene diamine, etc. Also effective as oxidation inhibitors are alpha or beta naphthylamine, phenyl-alpha or beta naphthylamine, alpha-alpha, beta-beta, or alpha-beta dinaphthylamine, diphenylamine, tetra-methyl diamino diphenyl methane, petroleum alkyl phenols, and 2,4-di-tertiary butyl 6-methyl phenol. Corrosion inhibitors which are particularly applicable with compositions of this invention are N-primary amines containing at least 6 and more than 18 carbon atoms in the molecule such as hexylamine, octylamine, decylamine, dodecylamine, octadecylamine, heterocyclic nitrogen containing organic compounds such as alkyl substituted oxazolines and their salts illustrative examples being "Alketerge-C" and "Alketerge-O," manufactured by Commercial Solvents Corp., which compounds are fully described in U. S. Patents 2,372,409 and 2,372,410.

Extreme pressure agents can be added to such grease and the preferred comprise esters of phosphorus acids such as triaryl, alkylhydroxy aryl, or aralkyl phosphates, thiophosphates or phosphites, etc., neutral aromatic sulfur compounds such as diaryl sulfides and polysulfides, e. g. diphenyl sulfide, dicresol sulfide, dibenzyl sulfide, methyl butyl diphenol sulfide, etc., diphenyl selenide and diselenide: dicresol selenide and polyselenide, etc.: sulfurized fatty oils or esters of fatty acids and monohydric alcohols, e. g. sperm oil, jojoba oil, etc., in which the sulfur is tightly bound: sulfurized long-chain olefins obtained by dehydrogenation or cracking of wax: sulfurized-phosphorized fatty oils, acids, esters and ketones, phosphorous acid esters having sulfurized organic radicals, such as esters of phosphoric or phosphorus acids with hydroxy fatty acids: chlorinated hydrocarbons such as chlorinated paraffins, aromatic hydrocarbons, terpenes, mineral lubricating oil, etc.: or chlorinated ester of fatty acids containing the chlorine in position other than alpha position.

Additional ingredients which can be added are anti-bleeding agents such as lithium, calcium and strontium naphthenates, cresol, petroleum cresol and glycerine: anti-wear agents such as oil-soluble urea or thio-urea derivatives, e. g., urethanes, allophanates, carbazides, carbazones, etc.; or rubber, polyisobutylene, polyvinylesters, etc.; VI improvers such as polyisobutylenes having a molecular weight above about 800, volatilized paraffin wax, unsaturated polymerized esters of fatty acids and monohydric alcohols, etc.: oiliness agents such as stearic and oleic acids and pour point depressors such as chlorinated naphthalene to further lower the pour point of the lubricant.

The amount of the above additives can be

added to grease composition of this invention in around about 0.01% to less than 10% by weight, and preferably 0.1 to 5.0% by weight.

Greases prepared and cooled by the method described have unusually smooth textures, uniform consistency and are extremely stable over wide temperature ranges and for long periods. They are particularly applicable for lubricating ball bearings used in aircrafts and various mechanisms which required lubrication at temperatures ranging from below -80 to about 350° F. for long periods.

We claim as our invention:

1. The method of cooling a grease comprising a major portion of mineral lubricating oil and between about 7 to 10% by weight lithium stearate, between about 0.1 to 5.0% by weight calcium methane, from a temperature of $\pm 425^{\circ}$ F. by weight of an oxidation inhibitor selected from the class consisting of N,N' dibutyl para phenylene diamine, and tetramethyl diamino diphenyl methane, from a temperature of $\pm 425^{\circ}$ F. by forcing it from an enclosed heating and mixing heat transfer mechanism directly into a plurality of air cooled narrow elongated steel tubes having a diameter of between about 3 to $3\frac{1}{2}$ inches and said grease being kept in said tubes and cooled statically therein to a temperature of around about 150° F., and passing it to a homogenizer for working to a desired texture and uniform consistency.

2. The method of cooling a grease comprising a major portion of mineral lubricating oil and between about 7 to 10% by weight lithium stearate, between about 0.1 to 5.0% by weight calcium naphthenate and between about 0.1 to 5.0% by weight of a corrosion inhibitor selected from the class consisting of hexylamine, octylamine, decylamine, dodecylamine, octadecylamine and alkyl substituted oxazolines, from a temperature of $\pm 425^{\circ}$ F. by forcing it from an enclosed heating and mixing heat transfer mechanism directly into a plurality of air cooled narrow elongated steel tubes having a diameter of between about 3 to $3\frac{1}{2}$ inches and said grease being kept in said tubes and cooled statically therein to a temperature of around about 150° F., and passing it to a homogenizer for working to a desired texture and uniform consistency.

3. The method of cooling a grease comprising a major portion of mineral lubricating oil and between about 7 to 10% by weight lithium hydroxy stearate, between about 0.1 to 5.0% by weight calcium naphthenate and between about 0.1 to 5.0% by weight of a corrosion inhibitor selected from the class consisting of hexylamine, octylamine, decylamine, dodecylamine, octadecylamine and alkyl substituted oxazolines, from a temperature of $\pm 425^{\circ}$ F. by forcing it from an enclosed heating and mixing heat transfer mechanism directly into a plurality of air cooled narrow elongated steel tubes having a diameter of between about 3 to $3\frac{1}{2}$ inches and said grease being kept in said tubes and cooled statically therein to a temperature of around 150° F., and passing it to a homogenizer for working to a desired texture and uniform consistency.

4. The method of cooling a grease comprising a major portion of mineral lubricating oil and between about 7 to 10% by weight lithium palmitate, between about 0.1 to 5.0% by weight calcium naphthenate and between about 0.1 to 5.0% by weight of a corrosion inhibitor selected from the class consisting of hexylamine, octylamine, decylamine, dodecylamine, octadecylamine

and alkyl substituted oxazolines, from a temperature of $\pm 425^{\circ}$ F. by forcing it from an enclosed heating and mixing heat transfer mechanism directly into a plurality of air cooled narrow elongated steel tubes having a diameter of between about 3 to $3\frac{1}{2}$ inches and said grease being kept in said tubes and cooled statically therein to a temperature of around about 150° F., and passing it to a homogenizer for working to a desired texture and uniform consistency.

5. In a process of preparing lithium soap grease comprising a major proportion of mineral lubricating oil and a minor amount of lithium stearate, sufficient to impart a pronounced gel structure to said grease when uniformly cooled, the method of rapidly and uniformly cooling said grease which comprises, forcing the grease from an enclosed heating and mixing heat transfer mechanism while in a liquid state at a temperature of from about 100 up to about 425° F. and higher directly into a plurality of air cooled narrow elongated steel tubes having a diameter of about 3 up to about $3\frac{1}{2}$ inches, said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

6. In a process of preparing lithium soap grease comprising a major proportion of a mixture of mineral lubricating oil and 2-ethyl hexyl sebacate and a minor amount of lithium stearate, sufficient to impart a pronounced gel structure to said grease when uniformly cooled, the method of rapidly and uniformly cooling said grease which comprises, forcing the grease from an enclosed heating and mixing heat transfer mechanism while in a liquid state at a temperature of from about 100 up to about 425° F. and higher directly into a plurality of air cooled narrow elongated steel tubes having a diameter of about 3 up to about $3\frac{1}{2}$ inches, said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired and uniform consistency.

7. In a process of preparing lithium soap grease comprising a major proportion of mineral lubricating oil and minor amounts of lithium soap of high molecular weight monocarboxylic acids and their mixtures, sufficient to impart a pronounced gel structure to said grease when cooled, the method of rapidly and uniformly cooling said grease, which comprises forcing the grease from an enclosed heating and mixing heat transfer mechanism while in a hot liquid state directly into a plurality of air cooled narrow elongated steel tubes ranging in diameter from between about $2\frac{1}{2}$ to not more than $3\frac{1}{2}$ inches, said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

8. In a process of preparing barium soap grease, the method of rapidly and uniformly cooling said grease by forcing it from an enclosed heating and mixing heat transfer mechanism while in a hot liquid state, directly into a plurality of air cooled narrow elongated steel tubes having a diameter of from between about $2\frac{1}{2}$ to not more than $3\frac{1}{2}$ inches said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period

sufficient for the grease to form a desired texture and uniform consistency.

9. In a process of preparing sodium soap grease comprising a major proportion of mineral lubricating oil and a minor amount of sodium soap of high molecular weight monocarboxylic acid, the method of rapidly and uniformly cooling said grease by forcing it from an enclosed heating and mixing heat transfer mechanism while in a hot liquid state, directly into a plurality of air cooled narrow elongated steel tubes having a diameter of from between about $2\frac{1}{2}$ to not more than $3\frac{1}{2}$ inches and said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a desired texture and uniform consistency.

10. In a process of preparing alkali and alkaline earth soap grease of high molecular weight monocarboxylic acid and their mixtures comprising a major proportion of mineral lubricating oil and substantially minor amounts of said soap, sufficient to impart a pronounced gel structure to said grease on cooling, the method of rapidly and uniformly cooling said grease, which comprises forcing the grease from an enclosed heating and mixing heat transfer mechanism while in a hot liquid state directly into a plurality of air cooled narrow elongated steel tubes ranging in diameter from between about $2\frac{1}{2}$ to not more than $3\frac{1}{2}$ inches, said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

11. In a process of preparing alkali and alkaline earth soap grease of high molecular weight monocarboxylic acid and their mixtures comprising a major proportion of a suitable organic lubricating base and substantially minor amounts of said soap, sufficient to impart a pronounced gel structure to said grease on cooling, the method of rapidly and uniformly cooling said grease, which comprises forcing the grease from an enclosed heating and mixing heat transfer mechanism while in a hot liquid state directly into a plurality of air cooled narrow elongated steel tubes ranging in diameter from between about $2\frac{1}{2}$ to not more than $3\frac{1}{2}$ inches, said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

12. In a process of preparing alkali and alkaline earth soap grease comprising a major proportion of a mixture of mineral oil and 2-ethyl hexyl sebacate as the base and substantially minor amounts of said soap, sufficient to impart a pronounced gel structure to said grease on cooling, the method of rapidly and uniformly cooling said grease, which comprises forcing said hot liquid state grease from an enclosed heating and mixing zone directly into a plurality of narrow elongated tubular zones ranging in diameter from between about $\frac{1}{4}$ to not more than about 4 inches, each tubular zone allowing for good heat transfer and cooled by suitable means, said grease being kept in said tubular zones and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired and uniform consistency.

13. In a process of preparing alkali and alkaline

earth soap grease, the method of rapidly and uniformly cooling such grease, which comprises forcing the grease at a temperature from between about 400 up to about 500° F. from an enclosed heating and mixing heat transfer mechanism directly into a plurality of cooled narrow elongated steel tubes ranging in diameter from between about $2\frac{1}{2}$ to not more than about $3\frac{1}{2}$ inches, said grease being kept in said tubes and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

14. In a process of preparing alkali and alkaline earth metal soap grease, the method of rapidly and uniformly cooling such grease which comprises forcing the hot liquid state grease from an enclosed heating and mixing zone directly into a plurality of narrow elongated tubular zones ranging in diameter from between about $2\frac{1}{2}$ inches to not more than about $3\frac{1}{2}$ inches, each tube allowing for good heat transfer and cooled by materials from the class consisting of air, water, and brine, said grease being kept in said tubular zones and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

15. In a process of preparing alkali and alkaline earth metal soap grease, the method of rapidly and uniformly cooling the hot grease which comprises forcing the hot liquid state grease from an enclosed heating and mixing zone directly into a plurality of narrow elongated tubular zones ranging in diameter from between about $\frac{1}{4}$ to not more than about 4 inches, each tubular zone allowing for good heat transfer and cooled by suitable means, said grease being kept in said tubular zones and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

16. In a process of preparing alkali and alkaline earth metal soap greases, wherein the hot grease is rapidly and uniformly cooled, the improvement which comprises forcing the hot liquid state grease from an enclosed heating and mixing zone directly into a zone of restricted cross-section having a thickness of not more than about 4 inches and cooled by suitable means, said grease being kept in said cooling zone and cooled statically therein substantially at a uniform and uninterrupted rate for a period sufficient for the grease to form a pronounced gel structure throughout and have a desired texture and uniform consistency.

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