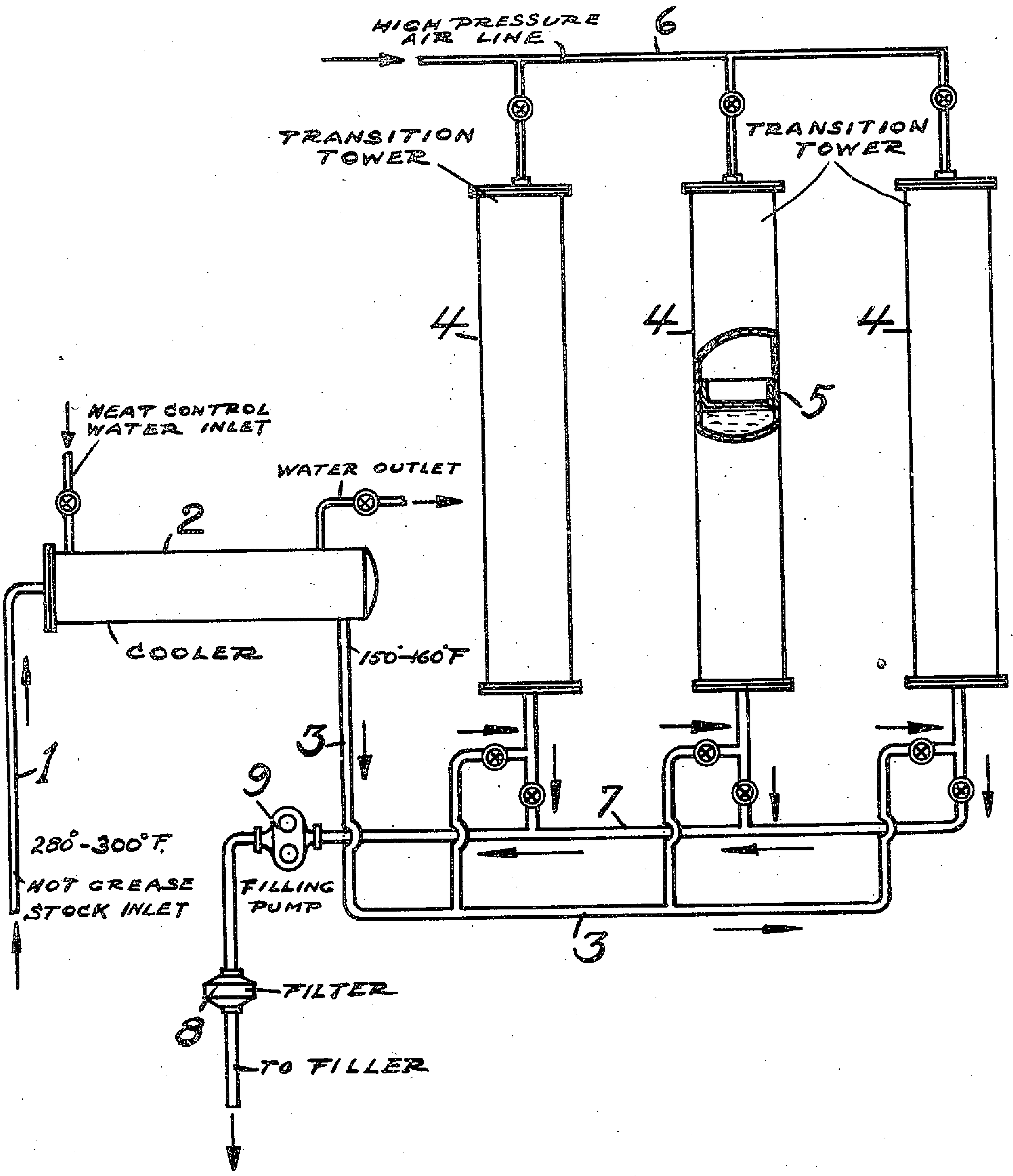
March 7, 1944. A. BEERBOWER ET AL 2,343,736

LUBRICANT, ETC

Filed Aug. 28, 1942



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Patented Mar. 7, 1944 2,343,736

UNITED STATES PATENT OFFICE

2,343 736

LUBRICANT, ETC.

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Application August 28, 1942, Serial No. 456,494

4 Claims. (Cl. 252—35)

This invention relates to a novel method and apparatus for manufacturing lubricating greases, more particularly aluminum greases.

Aluminum soap greases have been shown to be outstanding automotive, chassis and tractor roll lubricants but the processing difficulties encountered in their manufacture have restricted their use. While aluminum soap greases can be readily compounded from aluminum stearate and oil at 280° to 300° F., it is subsequently necessary to cool the greases to a transition temperature of usually about 120° to 150° F. The grease must then not be disturbed while it changes from a stringy liquid to a solid gel, which requires from two to eight hours, or so. Attempts to cool the grease in shipping containers result in a wide variation in consistency, ranging from a hard grease on the outer edge of the barrel to a soft fluid oil in the center; also the consistency varies greatly with different sized containers. Consequently aluminum soap greases have usually been manufactured by pouring the hot liquid grease into shallow pans holding from 100–500 lbs. of grease, and allowing it to cool overnight, after which it is subsequently shoveled back into the kettle, stirred and filtered into containers. Large floor space is necessary for this pan method of cooling, and an excessive amount of labor is required to handle the product. In another method, which for convenience might be referred to as the "kettle-cooling" method, the hot grease is cooled to about 160° F. in a special scraped kettle, and allowed to stand unstirred overnight, after which it is stirred and filtered as it leaves the kettle. The present invention comprises a method for delivering the grease cooled in a semi-continuous manner and eliminates the need for a special kettle, replacing it by simple equipment. It has the advantage of being useable with continuous grease blending equipment, whereas the kettle-cooling method is not. The present invention also has many advantages over the pan-cooling method.

Broadly the invention comprises quickly cooling the hot aluminum soap grease in a suitable cooling zone down to a temperature not more than a few degrees above the transition temperature of the grease, then transferring it into a suitable transition zone, preferably consisting of one or more vertical towers, where the grease is permitted to remain substantially undisturbed until it has undergone transition from a stringy or rubbery form to an unctuous gel-form, after which it is then forced out through a filter into suitable cans or other containers for storage or shipment. The vertical towers constituting the transition zone should have a capacity of not much more than half of the capacity of the grease cooking kettle, if two towers are used alternatively, or not much more than one-third the capacity, if three towers are used. These transition towers can be made of relatively simple and inexpensive materials, such as plain iron pipe having suitable diameter and length according to the desired capacity, such as a pipe of 12" or so inside diameter, and 8' or 10' high, either well insulated on the outside or jacketed to provide circulation of water or other fluid heat transfer medium in order to maintain the desired temperature approximately constant during the transition period. These transition towers should preferably be equipped with a floating piston to assist in forcing the grease out of the bottom of the tower by compressed air after the transition is completed. Obviously towers of other dimensions may be used, such as smaller pipes 2" to 4" or so in diameter and 1' to 3' or so in length for small laboratory or pilot plant work, and larger pipes having an inside diameter up to 3' or 4' or so and up to 15' or 20' in length for large plant operation. Generally, the length of the pipe should be at least two, but not more than five, times the diameter. When compressed air is used to force the grease back down out of the towers after transition, preferably dry air should be used so as to avoid condensation of moisture in the towers, especially if no floating piston is used. The piston may also be moved by means of a hydraulic or screw jack, or other suitable means.

The time required for the transition of the grease from the stringy or rubbery form to the desired smooth gel form, usually is between one-quarter hour to six hours or so, depending primarily upon the composition of the grease.

The temperature maintained in the grease during the transition period will also vary largely according to the composition, for instance, between the approximate limits of 90° F. and 180° F. and usually between the somewhat narrower limits of 115° to 160° F. The upper range of the transition temperature, i. e., about 140° to 160° F. is that required when the grease is made from an aluminum soap which is substantially all aluminum stearate, whereas a lower temperature range of about 100° to 140° F., usually 110° to 130° F., is better for a grease made with an aluminum soap consisting of about 90% aluminum stearate and 10% aluminum naphthenate, and an even lower temperature range of 90° to 110°

F. is better if in the latter composition the aluminum naphthenate is replaced by naphthenic acid.

In carrying out the invention the hot soap-oil solution to be subjected to cooling and transition may be prepared in several ways, for instance by dissolving an already prepared aluminum soap in a mineral oil, or by reacting aluminum hydroxide or other suitable aluminum compound with a solution of fatty acid in oil. Instead of, and in addition to, aluminum stearate and aluminum naphthenate, other soaps may be used, such as aluminum soaps of synthetic fatty acids made by the oxidation of paraffin wax. In general the carboxylic acids having 10 or preferably 15 carbon atoms or more are suitable. Also soaps may be made from saturated fatty acids derived from fats or oils of animal, vegetable and fish origin. In any case the proportion of aluminum soap in the finished grease should be about 5–10%, or in some cases between the broader limits of 3–20% by weight.

The oil to be used as base stock in preparing greases according to this invention may be any mineral oil stock, such as used heretofore for such purposes, for instance light, medium, or heavy lubricating oil base stocks derived from any of the various crude oils, i. e., of paraffinic, naphthenic or mixed base crudes. These oil base stocks may be subjected to any of the conventional refining treatments, such as distillation, clay treating, acid treating, aluminum chloride treating, solvent extraction, de-asphalting, etc. For general use a pale or red oil of medium or heavy viscosity, from naphthenic or mixed base crudes is preferred.

The grease cooking temperature, i. e., that to which the mixture of oil and aluminum soap must be heated to effect proper solution or dispersion of the aluminum soap in the oil to make a completely homogeneous composition, will range from about 200° to 350° F., depending upon the nature and proportion of the aluminum soap used as well as on the type of oil, but ordinarily the cooking temperature should be about 250° to 300° F.

The cooler into which the hot soap-oil solution or dispersion is passed in order to cool it down to a temperature not more than a few degrees, such as 10° or less above the grease transition temperature, may consist of ordinary pipe coils surrounded by a suitable cooling medium, such as water (preferably having a temperature not substantially below 100° F.), so as to avoid undue hardening of the grease on the inside of the cooling coils, or which may consist of a jacketed kettle through which cooling water of proper temperature may be circulated, but it is preferably a helical conveyor such as the Carbondale scraped wax chiller. Such a chiller may have, for instance, a diameter of 6″ and a length of 40′ or so for commercial operation, or about 1″ to 1½″ or so in diameter with a length of about 1′ to 3′ for laboratory or pilot plant operation. In either case the pipe containing the helical or screw conveyor should be jacketed or surrounded by another pipe having warm water circulating through it to keep the temperature fairly constant and to prevent graininess.

After the soap-oil solution or dispersion has been cooled to near the transition temperature and then passed into the transition tower for the required transition period and has attained the desired smooth unctuous gel or grease structure, it is then forced back out of the transition towers, filtered and filled into cans, barrels or other suitable containers for shipping or storage.

The finished aluminum grease made according to this invention should normally have a worked penetration within the approximate limits of 300–400, preferably 320–350, according to the A. S. T. M. penetration test, when the grease contains 5–10% of soap, but lower if more soap is used.

The objects and advantages of the invention will be still better understood from a description of the accompanying drawing and the examples which follow.

Referring to the accompanying drawing, a hot aluminum stearate soap-oil solution or dispersion made by conventional methods, such as those described above, and issuing from a suitable source not shown (preferably continuous), and having a temperature of about 280° to 300° F., is fed through line 1 to cooler 2 from whence it issues at a temperature of about 150° to 160° F. through line 3 into one of the transition towers 4 in which the incoming grease composition raises the floating piston 5 and in which after filling this grease composition is permitted to remain substantially undisturbed for the required transition period until the composition has acquired the desired grease structure, after which it is forced, by compressed air from line 6, back out of the tower 4, through line 7, through filter 8 into suitable can or barrel filling equipment, not shown. The filling pump 9 may be provided between line 7 and filter 8 to assist in forcing the grease through the filter into the cans and barrels for shipment or storage.

Example 1

A grease was prepared with the following formula:

	Per cent
Aluminum stearate	7.0
Aluminum naphthenate	0.7
Oleic acid	1.0
Heavy lube oil (200 seconds viscosity at 210° F.)	14.0
Medium lube oil (70 seconds viscosity at 210° F.)	78.25
Polyisobutylene (mol. wt. about 30,000)	0.05

This composition produced a very satisfactory grease for use as chassis lubricant, when prepared by the method of this invention, using as a transition tower a double (jacketed) pipe 8′ high, 13¼″ inside diameter, with a float inside to maintain a flat grease surface while the grease is being forced out by air pressure. The temperature of the water in the tower jacket was maintained at about 130° F.

Example 2

An aluminum grease was made with a composition identical with that used in Example 1, except that the 8% of soap used consisted entirely of aluminum stearate (no naphthenate being used). This composition produced a grease of very satisfactory texture with a worked penetration of 352, the temperature in the tower jacket being maintained at about 140° to 150° F.

Example 3

Another batch of grease was made with the same formula as used in Example 2, except that the aluminum stearate used was obtained from a different manufacturer than the one from which the aluminum stearate used in Example 2 was obtained. With a transition temperature of 150° F., a grease of very good quality and excellent appearance was obtained having a worked penetration of 341.

Example 4

A grease of the following composition was prepared:

	Per cent
Aluminum stearate	5.0
Aluminum naphthenate	1.0
Oleic acid	1.0
Heavy lube oil (200 seconds viscosity at 210° F.)	92.25
Polyisobutylene	0.75

This material was cooled to 95° F. and maintained at this temperature for four hours in the tower described in Example 1. A semi-fluid lubricant suitable for tractor or tank lubrication was produced.

It is not intended that this invention be limited to any of the specific examples which have been given merely for the sake of illustration nor to the specific embodiment of the invention as illustrated in the drawing, but only by the appended claims in which it is intended to claim all novelty inherent in the invention as well as other modifications coming within the scope and spirit of the invention.

We claim:

1. The process of manufacturing an aluminum soap grease which comprises making a hot grease stock comprising about 90–95% of mineral lubricating oil and about 5–10% of an aluminum soap of high molecular weight carboxylic acid, having a temperature of 280° to 300° F., cooling it to near its transition temperature, between the approximate limits of 90° and 180° F., depending upon its composition, passing it to a vertical tower-shaped transition zone and letting it remain there substantially undisturbed and at a substantially constant temperature for a transition period of about one-quarter hour to six hours until it has acquired the desired grease structure, and then filtering the grease.

2. Process according to claim 1 in which the aluminum soap used in making the grease stock comprises about 80–95% of aluminum stearate and about 20–5% of aluminum naphthenate and the transition temperature is held at 100° to 120° F.

3. Process according to claim 1, in which the aluminum soap used comprises about 80–95% of aluminum stearate and about 20–5% of naphthenic acid, and the transition temperature is held at about 100° to 140° F.

4. A semi-continuous process for manufacturing aluminum soap grease which comprises continuously making a hot grease stock comprising about 90–95% of oil and about 10–5% of aluminum soap, having a temperature of 280° to 300° F., continuously cooling said grease stock to near its transition temperature, continuously passing the cooled grease stock into one of a plurality of vertical transition towers containing a floating piston to cover the upper surface of the grease in said tower, permitting said grease stock to remain undisturbed in said transition tower for a sufficient period of about one-quarter hour to six hours to acquire the desired grease structure, continuously forcing the finished grease out of one of a plurality of such transition towers through a filter and into suitable containers for storage and/or shipment.

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