

Jan. 9, 1945.

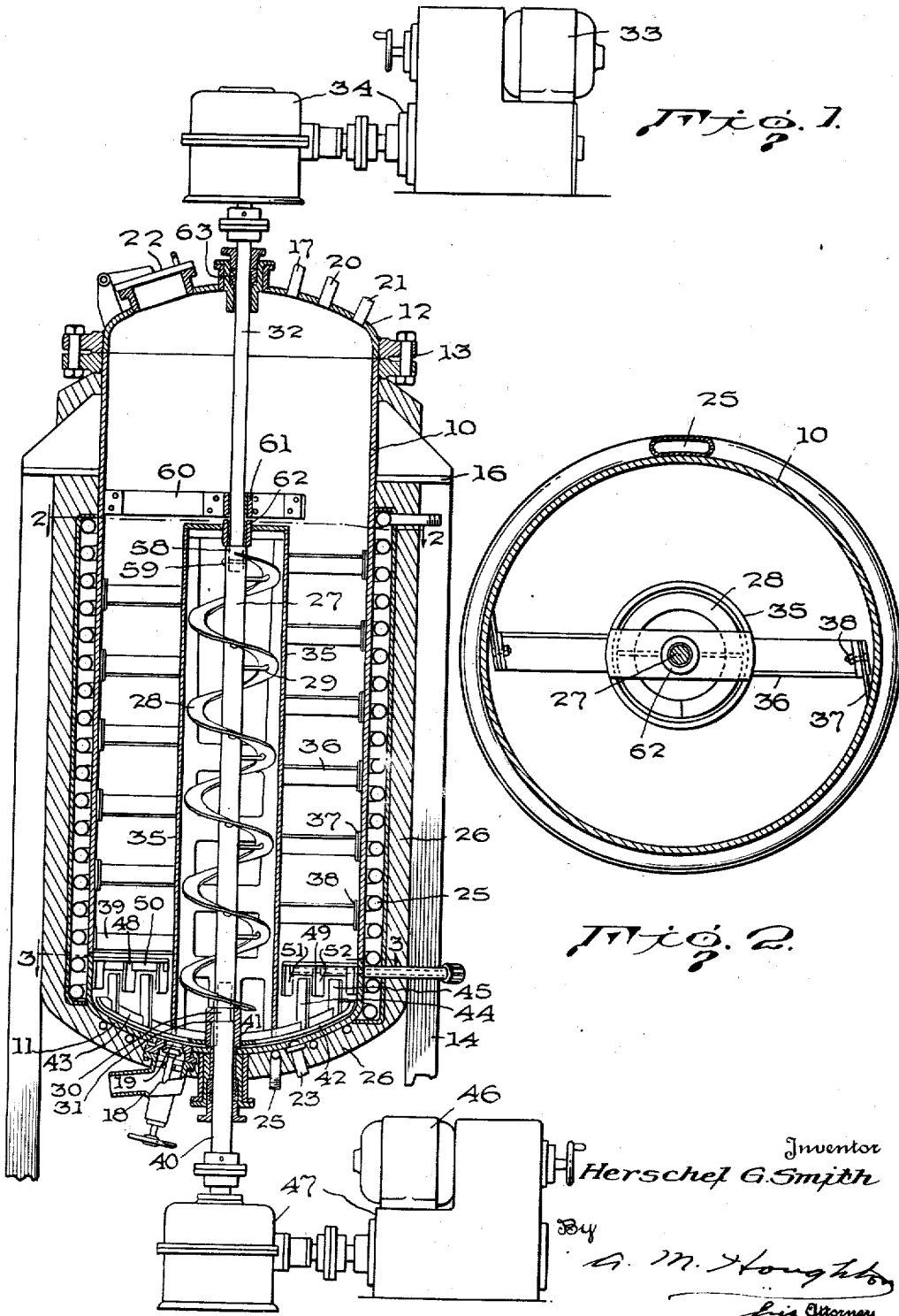
H. G. SMITH

2,367,149

GREASE MANUFACTURING APPARATUS

Filed Sept. 20, 1943

2 Sheets-Sheet 1



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Fig. 3

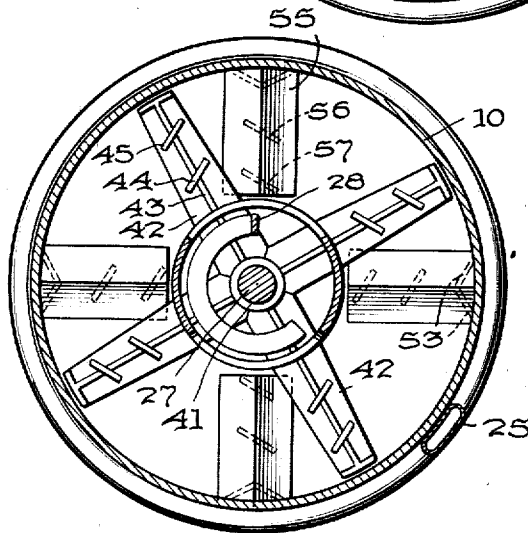
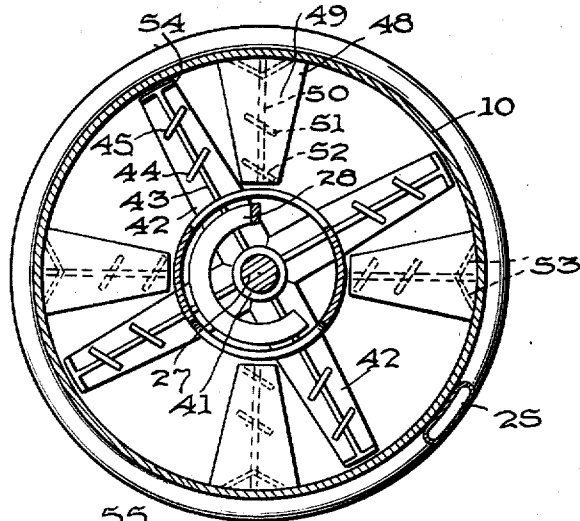


Fig. 4

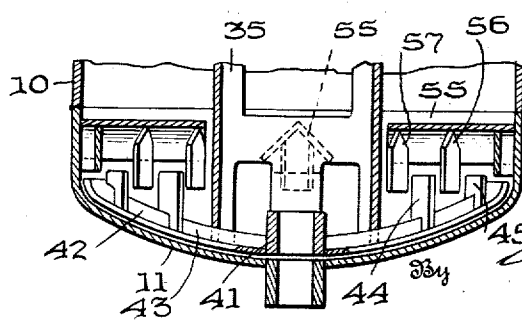


Fig. 5

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UNITED STATES PATENT OFFICE

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GREASE MANUFACTURING APPARATUS

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6 Claims. (Cl. 252—32)

This invention relates to the manufacture of lubricating greases and more particularly it comprises an improved kettle apparatus for manufacturing lubricating greases and the like, which affords positive circulation over all heated surfaces and at the same time provides for scraping adherent material from those surfaces where local overheating is likely to occur, thereby avoiding decomposition of the materials in process and resulting in a lubricating grease of superior quality.

In my United States Patent No. 2,298,317, issued October 13, 1942, I have described and claimed an apparatus for manufacturing stable homogeneous lubricating greases which are free from occluded gases. The present invention is an improvement upon the aforesaid patent wherein in manufacturing special greases by certain processes a product of superior characteristics results.

In my above noted patent, variations of the general procedure for making different types of greases are shown as adaptable to kettles with spiral ribbon mixer lift in the center of the kettle and paddle mixer for flow downward in the outer portion of the inside of the kettle. The procedure as outlined involves the mixing of some oil with a soap stock, fatty acid, or fatty glyceride, with the required amount of saponifying alkali, or mixtures of metal hydroxides, then heating the mixture while using the spiral mixer, usually drying the soap pulp as soon as possible with open kettle at atmospheric pressure, and finishing the grease with addition of oil while cooling with the use of vacuum. This and other procedures can be readily carried out in my improved kettle which is particularly adaptable for manufacturing special greases and the like.

The present invention, therefore, comprises an improved apparatus for manufacturing lubricating greases of the soap-and-oil type in which the grease constituents are subjected to agitation during one or more of the stages of compounding, blending, extending, finishing and drawing of the grease, such agitation advantageously being so accomplished that upward axial flow is maintained in a relatively tall, narrow body of grease constituents with a downward flow at the periphery of said body, returning to the core at the bottom of the kettle; and it also comprises apparatus in which agitation in the enclosed vessel may be effected readily and in which other steps in the manufacture of lubricating greases may also be effected conveniently and economically.

My improved apparatus provides heating means wherein the area of the kettle which is subject to overheating is minimized; and the grease is thoroughly mixed while being forced toward the center of the kettle at its bottom where it is re-circulated by convenient mechanism such as a vertical spiral conveyor. The mechanical means provided for downward movement in the peripheral portion of the kettle includes scrapers which will remove completely any material adhering to the walls thereby avoiding the formation of hard incrustations of decomposed grease or soap which otherwise form on the heated walls, impeding downward flow and, when broken off, producing hard lumps which are undesirable in the finished grease. By providing for positive circulation of the grease from the peripheral walls of the kettle inwardly along its bottom to join the upward, axial flow at the core, the accumulation of hard masses in the bottom of the kettle and local overheating are obviated.

Efficient agitation in the bottom of the kettle is extremely important in the initial stages of preparing a saponified material, for at this stage the charge consists usually of a mixture of two liquids in which may be suspended or mixed considerable quantities of partially soluble solids. Intimate contact of the various phases and thorough circulation of the total kettle charge tend to reduce the time required for the saponification reaction, and aid in producing a smooth, uniform product.

The grease manufacturing apparatus described in the arts, which provides "sweep paddles" to agitate the grease, will circulate the grease locally, but does not usually operate satisfactorily in the bottom part of the kettle. Local eddies are produced with the result that there is little directed circulation of the total contents from bottom to top and back to the bottom of the vessel.

Likewise, a single-motion agitating mechanism, which is in effect one unit of a plurality of "sweep paddles," tends to rotate the whole contents of the kettle as a single body. This tendency is especially pronounced in the manufacture of semi-solid grease in some of the apparatus used today and prevents the double-thrust type of central paddle from being effective in inducing up-flow in the central portions and down-flow in the peripheral portion of the vessel.

The efficient agitation provided by the cooperating vanes in the lower part of the kettle is well suited to the milling of greases for the purpose of altering the gel structure, for a worked or

"butter type" grease may thus be processed readily by working at a suitably lower temperature in the same apparatus in which it was compounded.

In some cases it is recognized that the grease manufacturing operation per se does not obviate the formation of lumps or hard masses of grease, and that some sort of milling of the grease is needed. With my improved apparatus grease milling or working after the grease or soap has been manufactured is generally unnecessary, as hard soap lumps do not form, due to the uniform and complete agitation obtained, particularly in the bottom of the kettle. As a matter of fact milling actually takes place in my improved apparatus in the process of manufacturing the grease or soap.

Furthermore, with some types of greases the milling step is applied in order to alter the gel structure and produce a grease which will not soften appreciably on further working in service; such worked greases can be processed readily in my improved apparatus. Such milling may be accomplished in the improved apparatus described in the present invention by working the grease at a suitable low temperature in the same apparatus in which it was made. The efficient agitation provided by the vanes on stationary brackets in combination with the vanes on rotating arms, both located in the lower part of the kettle, is well suited for this purpose, resulting in a homogeneous product of very pleasing appearance. This working of the grease in the same kettle in which it was made, after rapid cooling by circulating water through the external coil, results in a great saving of time and labor, and yields a product of improved quality, as compared with that produced by conventional processing.

The tendency of a grease to solidify in certain areas is reduced by the use of superheated steam flowing through an external continuous coil attached to the wall of the kettle. This coil, which is advantageously line-welded to the outer wall of the kettle, has numerous advantages over other means usually employed for heating grease kettles. This external coil makes possible a smooth inner wall free from obstructions which would hinder the circulation of the contents of the kettle. The coil is superior to a heating jacket in that there is no possibility of a heating "short circuit" as is often noted with a jacketed kettle using superheated vapors as a heating medium. Such "short circuits" produce overheated areas and result in inefficiency in heating through use of only part of the heating surface. The same coil can be used for heating either with superheated steam for temperatures above those obtainable with normally available steam pressures or with saturated steam for lower temperatures; and it may also be used for rapid cooling by means of water. Decomposition of the heating medium often encountered with circulating oil is not a problem with superheated steam. The usable heat capacity of superheated steam is roughly equivalent, pound for pound, to that of a circulating-oil heating medium. The heat transfer rate is often higher. In plant installations, the exhaust superheated steam may be returned to low-pressure steam mains for process or power uses. The use of superheated steam in the external coil of my improved apparatus for processing saponifiable material, particularly in manufacturing greases, has many advantages over other means usually employed in heating grease kettles.

Among the objects which are achieved by my invention is the provision of an improved grease manufacturing apparatus which insures thorough agitation and circulation; which avoids excessive soap consumption sometimes encountered in bulk production; which obviates too rapid local drying or cooking of the pulp at high temperatures in the lower part of the kettle; which maintains the grease mixture at a higher temperature when it attains the water-free state; and which facilitates mixture of the oil in a satisfactory gel state of desired consistency.

The foregoing and other objects of the invention will be apparent from the following drawings and description. In the accompanying drawings, showing two forms of a specific embodiment,

Figure 1 is a vertical sectional view of a vertical columnar type kettle;

Figure 2 is an enlarged cross sectional view of the kettle taken on line 2—2 of Figure 1;

Figure 3 is an enlarged sectional view of the kettle taken on line 3—3 of Figure 1;

Figure 4 is an alternate arrangement for the bottom of the kettle as shown in Figure 3, and is shown as an enlarged sectional view of the kettle taken on the line 3—3 of Figure 1; and

Figure 5 is a fragmentary vertical sectional view of the kettle and the mechanical arrangement shown in Figure 4; an alternate arrangement for the bottom of the kettle shown in Figure 1.

Referring to the drawings in which like reference numerals designate the same parts throughout the several views, and more especially to Figures 1 to 3, the apparatus includes a thin-walled kettle 10, advantageously fabricated from sheet-steel and having a rounded bottom 11 and a rounded dome-like cover 12 detachably secured thereto at a fluid-tight joint 13. The kettle is fabricated in any suitable way, as by welding, and the interior height is advantageously great compared to the diameter. The kettle is conveniently supported on pillars 14, by means of lugs 15, as shown. An inlet connection 17 at the top serves for introduction of liquid grease ingredients, and means for removal or drainage of the kettle contents is provided by a valved outlet 18 at the bottom. The movable part of the valve 18 advantageously includes a plug 19 which, in closed position, becomes flush with the interior of the kettle bottom, as shown, to prevent pocketing.

A connection 20 with suitable exhausting means permits the interior of the kettle to be put under vacuum when desired; and another connection 21 permits the interior of the kettle to be placed under pressure when desired. A man-hole 22 permits inspection as well as introduction of solids. A thermocouple 23 of compact type is provided in the kettle bottom, as shown, for temperature measurement. Heating means are provided for the kettle, advantageously taking the form of steam coils 25 surrounding the bottom and the sides of the kettle for the major portion of its length, and preferably line-welded thereto. An insulating jacket 26 covers the coils as shown. If cooling rather than heating is desired, cold water, or some other liquid, can be run through the coils in lieu of steam. An ordinary jacket may be substituted for the coil 25, if desired, to control the temperature of the kettle and contents thereof.

Within the kettle is a double agitator-mixer assemblage to insure a uniform temperature and thoroughly mix the ingredients placed in the kettle. This includes a helical agitator of the

conveyor type having an axle 27, advantageously of tubular construction, on which is mounted a helical ribbon 28 by means of struts 29. At its lower end this inner helical agitator terminates with a stub shaft 30, seated for rotation in a thrust bearing 31. At its upper end it is provided with a shaft 32, extending through the top of the kettle in the form shown in Figure 1, by which the helix is rotated by means of an individual motor 33 and gearing arrangement 34.

There is also provided an outer, coaxial, independently rotated agitator or conveyor, including a perforated frame 35 closely spaced from the ribbon 28 and having attached thereto a plurality of staggered and inclined paddle blades 36 and vertical blades 44 and 45 attached to rotating arms 42. At their ends these inclined paddle blades 36 carry adjustable flexible metal scraper elements 37 arranged to scrape the kettle walls (Figure 2) and clamped to the blade ends as shown at 38. A bottom-scraping blade 39 attached to frame 35 is shaped to clear the tapered arm 49 attached to the inner wall 10 of the kettle.

Attached to the lower vertical shaft 40 and hub 41 are four arms 42 shaped to conform to the curvature of the kettle bottom 11. A stiffening member 43 is welded at right angles to and against the upper side of each curved arm 42 and to the driving hub 41. Extending upward from each curved arm 42 and welded to the arm parallel to the axis of the kettle are two flat blades 44 and 45 slotted to straddle the stiffening member 43 and slanted to an angle of 120 degrees with the plane of this stiffening member 43. The tubular member or frame 35 which carries the upper scraper arms 36 and scrapers 37 is also slotted to straddle the stiffening member 43 and is welded to this member and to the four arms 42.

The entire assembly of shaft 40, hub 41, arms 42, tubular sleeve 35, scraper arms 36, scrapers 37, stiffening member 43, and blades 44 and 45 rotates in a clockwise direction looking from above. This entire assembly is driven by an individual motor 46 through a gearing arrangement 47 to the shaft 40.

The four stationary members 48 are identical and each consists of a flat tapered arm 49 attached to the inner wall 10 of the kettle and pointing toward the center of the kettle. Against the under side of this arm 49 is attached at right angles a stiffening web 50 and two stationary deflecting blades 51 and 52 extending downward to assist the rotating blades 44 and 45 in working the grease between them as they pass. Two regular brackets 53 are attached to the sides of the stiffening web 50 and the wall of the kettle to provide further bracing of the stationary blades 51 and 52 and also serve as additional blades to permit full working effect at the outer edge of the movable blades 45. The stationary blades 51 and 52 are set at an opposing angle to the rotating blades 44 and 45 to effect an increased working of the grease.

The four rotating arms 42, shaped to parallel the bottom of the kettle, move the grease from the bottom of the kettle and the stiffening members 43 move it around in rotating to further increase the mixing effect. Further mixing action is obtained between the upturned tip 54 of the movable blades and the bottoms of the braces 50 and the deflecting members 53. This substantial construction of the moving scraper and mixing

blade assembly affords ample strength for the high torque drive necessary for satisfactory working of heavy greases.

An alternate modification of construction for the mixing arrangement in the bottom of the kettle is shown in Figures 4 and 5. The construction is essentially the same as that shown in Figures 1 and 3, except that the stationary blade support arms 55 are constructed of equal leg steel angles instead of the flat arms 49 and their stiffening members 50, as shown in Figures 1 and 3. These angles are mounted in the same positions as the flat arms 49 with the apex turned upward and the legs sloping downward. Two blades 56 and 57 are attached to the underside of each angle in the same manner as blades 51 and 52 shown in the first arrangement illustrated by Figures 1 and 3.

Advantageously the interior of the kettle is smooth and accurately cylindrical, so that grease is continually removed from the walls and bottom by the scrapers without leaving any dead pockets or dead films. The annular zones of the kettle walls traversed by scrapers 37 slightly overlap, so that all parts of the wall are subjected to scraping action; there are no dead annular spacers untouched by the scrapers.

The bottom of the shaft 27 is provided with a bearing collar or hub 41 surrounding the stub shaft 30. The shaft 27 is constructed so that the pin 59 may be removed and the center conveyor removed by disconnecting shaft 27 from shaft 32 at an overlapping union 58. The shafts 27 and 32 are kept in position by a support arm 60 and a bearing 61. The upper end of the frame 35 is attached with a bearing collar 62 to the tubular shaft 27 and 32 which extends through the top of the kettle through a fluid-tight packing provided at gland 63. Thus the motor 33 drives the shafts 32 and 27 through a gearing arrangement 34 and rotates the helicoid ribbon in one direction at the same time a second motor 46 drives the hub 41, the connecting arms 42, the frame 35, the scraper arms 36, and the scrapers 37 in the opposite direction. Thus there is in effect a double agitator mixer each having separate drives capable of rotating at different speeds.

The ratios of the speeds of rotation of shafts 32 and 40 are so selected that the inner helical agitator 28 is driven at a somewhat higher angular speed than the outer agitator blades 36. These ratios are so selected that the quantity of material in the kettle moved downward a given distance by the outer agitator during a given period is about equal to the quantity moved upward by the inner agitator during the same period.

In my improved apparatus there has been added the variation of a variable speed drive from the top, with a much more powerful drive from the bottom, for controlling agitation, and for the added mixing effect and adequate control thereof at the bottom of the kettle, with direct drive on the special paddle mixers applied from the bottom by an extra heavy shaft, so that, in general, for the design of the paddle shaft arrangement I have a system by which any heavy torque is applied directly to the mixture at the point such is encountered at the bottom of the kettle. With the bottom mixer arrangement, for some greases the pulp at the bottom is handled by the special mixers, and by the opposing paddles as the grease becomes softer and softer.

and the upper paddles come into use; and the torque is reduced greatly or is distributed in the proper order from the bottom drive upward. The vanes of the special paddle or shredder type mixer at the bottom are so pitched as to tend to throw any heavy soap concentrate or pulp in the bottom towards the spiral mixer, while at the same time preventing any massing and slipping of pulp, such as occurs in a dough mixer, which I have noted to a limited extent in the large scale kettles of other designs.

As is shown in the accompanying drawings the bottom drive shaft and mixing device are of heavy construction, especially in the bottom where the really heavy drag or torque occurs. This arrangement is a very simple yet effective one for accomplishing a countercurrent drive without complicated gear arrangements, and with a simpler type of single stuffing box at each point, for counter rotating effect on the two types of agitators or mixers. Both the bottom paddle type mixer and the top spiral worm lifter mixer are provided with suitable variable speed drives so that the optimum speed for compounding can be applied and the mixing of different types of materials can be effected with maximum efficiency and economy by use of the variable range of speeds to meet the special conditions for different types of materials and for different stages of compounding.

This double-motion agitator described above gives intimate contact between the fat or soap base and the alkali; enables oils to be added to soap concentrates or grease in less time; thoroughly mixes the contents of the kettle, whether the kettle is charged to its capacity or to a fraction of its capacity; prevents portions of the material being processed from becoming overheated, overcooked, or decomposed; gives a milling action which some materials require; and does all of this with a minimum of power because of the flexibility of the independent drives which are useful for processing different types of material at various speeds in the various stages of compounding.

It is to be understood that the mechanical arrangements described herein are not to be limited to grease making. As is obvious to those skilled in the art, the present invention finds use in many applications and processes. For instance the improved kettle can be used to manufacture heavy soap specialties, heavy chemicals, clay and silicate binders, light and fine powders, polishes, pastes, as well as other grease-like products. Also the kettle can be used advantageously in numerous processes such as compounding, mixing, saponification, sulfonation, and the like.

Although this invention has been disclosed in connection with the specific details of preferred embodiments of my improved grease making apparatus, it must be understood that such details are not intended to be limitative of the invention except insofar as set forth in the accompanying claims.

What I claim is:

1. Apparatus for making lubricating greases comprising an externally heated, elongated kettle body, means for circulating the charge therein in axial flow in one direction, separate means for circulating the same in opposite direction peripherally along the heated walls of said kettle body and operating in contact with such walls to prevent incrustation of the charge thereon, and co-

operating fixed and movable agitating means in the bottom of the kettle for positive circulation of the charge between the axial and peripheral flows.

2. Apparatus for making lubricating greases, which comprises a vertically disposed cylindrical kettle body having a rounded bottom and a smooth inner surface, a cover adapted to cooperate with said kettle body to form a gas-tight vessel having a substantial vapor space above the level of a charge therein, means for charging constituents into said vessel, means for heating and cooling said vessel and contents thereof, and means for thoroughly agitating a charge in the vessel, said agitating means including a driven inner helical ribbon agitator, a driven outer concentric paddle agitator having scrapers positioned to contact the inner surface of the vessel, and an assembly of rotatable arms closely paralleling the bottom of the kettle upon which are mounted a plurality of vertical paddles so positioned as to clear a plurality of stationary depending vertical paddles mounted within the kettle and cooperating therewith to impel the charge radially of the kettle, means for maintaining the desired absolute pressure in the vessel, and means for withdrawing finished grease from said vessel.

3. As an improved agitator for grease kettles and the like, a double-motion agitator comprising an inner helicoid ribbon adapted to impart a positive upward flow to the central portion of the contents of the kettle, an external agitator having a plurality of horizontal vanes adapted to impart a positive downflow to the peripheral portion of said contents, a driven vertical vane assembly in the bottom of the kettle adapted to impart a positive inward flow to the bottom portion of said contents, and a stationary vertical vane assembly in the bottom of the kettle adapted to impart a positive inward flow and prevent said contents from rotating with the agitator, said stationary vertical vane assembly being securely attached to the inner side of the lower portion of said kettle.

4. The apparatus of claim 6 wherein the said plurality of horizontal vanes are attached at one end to a perforated cylinder, the said vanes being provided at the outer ends with adjustable terminal scrapers adapted to free the walls of the kettle from adhering deposits.

5. In a saponification kettle having a centrally mounted rotary tubular frame enclosing an oppositely rotating helical ribbon agitator, and outwardly extending vanes on said tubular frame for imparting downflow to the peripheral portion of the contents, the improvement comprising a plurality of angularly disposed arms conforming with the kettle bottom, means for rotating said arms, spaced upright vanes carried by said arms, and a plurality of depending, fixed vanes supported within the kettle above its bottom, adapted to extend between the rotating vanes, whereby in rotation of the latter the kettle contents are worked and milled.

6. Apparatus for manufacturing lubricating greases comprising an elongated, externally heated kettle formed with a smooth interior wall, a helical ribbon agitator mounted axially within said kettle on a shaft extending through the top thereof, driving means for said shaft, a tubular frame surrounding said helical ribbon agitator and rotated in an opposite direction by a second shaft extending through the bottom of said kettle, separate driving means for said second shaft, spaced horizontal paddles carried by said tubular frame and extending into scraping contact with

the inner side wall of the kettle, and a plurality of arms radiating from said second shaft and rotated thereby to sweep over the inner surface of the kettle bottom, said arms having a plurality of vertically mounted inclined vanes adapted to pass between spaced, fixed vanes supported within the kettle, whereby the kettle contents, when circulated peripherally downwardly, are milled as

they are advanced to the center portion of the kettle where the rotating tubular frame cuts a core which is raised by the oppositely rotating helical ribbon agitator and the contents are thereby maintained in continuous circulatory movement.

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CERTIFICATE OF CORRECTION.

Patent No. 2,367,149.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, second column, line 27, for the word "spacers" read --spaces--; page 4, first column, line 52, for "specialities" read --specialties--; and second column, line 44, claim 4, for the claim reference numeral "6" read --3--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 27th day of March, A. D. 1945.

Leslie Frazer

(Seal)

Acting Commissioner of Patents.

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