Review of Literature On Fats, Oils and Soap for 1941[*] —Part 1

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General

Although the Continental European literature, since the May issues was not available for review, there was only a small decrease in the literature on fats and oils for the year. Publications on the biochemistry and physiology of fats and oils have increased, suggesting a growing interest in this field.

The 1942 production plans were revealed by Secretary of Agriculture Wickard (*U. S. D. A. Information for the Press, Dec. 18*):

> "A high level of domestic demand for fats and oils and substantial purchases of lard for export, are expected for 1942. With increased livestock slaughter in prospect the output of animal fats and oils will be expanded. Production goals for 1942, moreover call for increases of 1.1 million acres of soybeans and 1.7 million acres of peanuts. With average crop yields, these increases would provide an additional 500 million pounds of oil."

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Other federal activities in the fat and oil field were the establishing of definitions and standards for edible fat products and orders regulating commerce in tung, palm, coconut, and other necessary oils difficult to obtain.

The average level of prices for fats and oils moved up as recorded in the following table from *Chemical and Metallurgical Engineering* of January, 1942:

Weighted Index of Prices for Oils and Fats
Base = 100 for 1937

Jan. 1942	135.60
Dec. 1941	129.80
Jan. 1941	75.28
Jan. 1940	75.64

A prediction by Secretary of Agriculture Wickard (*U. S. D. A. Information for the Press, Dec. 18*) on the trend for 1942 was as follows:

> "Prices for fats and oils will probably average higher next year than this although government measures may tend to hold advances from present levels within narrow limits. Prices of domestic oilseeds are now comparatively high and are expected to average at least as high in 1942 as in 1941, even though the output of soybeans and peanuts is increased next year."

An unusual price trend occurred during the year on the raw materials from which vitamin containing oils were extracted. In October soupfin shark livers reached a high of $9.20 per pound in Astoria, in November they declined to $4.00 to $6.00 per pound. This price fluctuated because the foreign source of medicinal marine oils was cut off and because of the seasonal variation in the vitamin potency.

Statistical reviews giving data on production and consumption, and notes on interchangeability of fats were prepared by Potts (*Oil & Soap, 18,* 199) and Levitt (*Chem. Ind. 49,* 320). According to the editors of *Chemical and Metallurgical Engineering* official estimates on domestic consumption of fats and oils were about 11 billion pounds. This represents a 13% increase over 1940, the previous record year. Other comparative data were as follows (in million pounds):

	1939	1940	1941
Production of domestic fats and oils	7,776	8,310	8,900
Imports of foreign fats and oils	1,815	1,707	1,364

War conditions fostered the publication of many communications on fat economy, interchange and searches for new sources. These were on the following subjects:

Fat outlook. Jones—*Oil & Soap 17,* 27.

Fat from poultry viscera. Stewart and Mussehl—*Poultry Sci. 20,* 450.

Substitutes for milk fat in dairy calf ration. Schmalfuss—*Fette u. Seifen 48,* 278.

Biological fat synthesis. Cifèrri and Gargolio—*Chim. e ind. Italy 17,* 146; *Reichel—Angew. Chem. 53,* 577

Drying oils: present status, interchangeability, new substitutes, etc. Eisenschiml—*Paint, Oil, Chem. Rev. 103,* No. 6, 18; *Paint, Varnish Prod. Mgr. 21,* 66; Weatherston—*J. Oil Colour Chem. Assoc. 24,* 191; Mundy—*ibid.* 183; Foulon—*Farbe u. Lack, 1940,* 267. Wagner—*ibid.* 83; Behr—*Paint Ind. Mag. 55,* 412; Bush—*ibid. 56,* 82; Trig—*Am. Paint J. 25,* Apr. 7, 7; Lund—*Oil & Soap 18,* 151; Bush—*Off. Digest Federation Paint & Varnish Production Clubs No. 203,* 65; Trigg—*Paint, Oil Chem. Rev. 103,* No. 8, 18, No. 11, 7; Hintze—*Fette u. Seifen 48,* 62.

Synthetic fat acid industry. Kawai—*Chem. Rev. Japan, 7,* 177.

Edible oils of Canada. McLeod—*Oil & Soap 18,* 154.

Shall we build a stock pile of fats? McBride—*Food Ind. 13,* No. 4, 46.

Castor oil. Anon.—*Defense 2,* No. 24, 17; Mehta—*Paint Ind. Mag. 56,* 155; Morgan—*Paint Manuf. 11,* 136.

Growing American tung oil. Smith—*Am. Paint J. 25,* July 21, 28, July 28, 52; Gardner and Scofield—*Natl. Paint, Varnish Lacquer Assoc. Sci. Sect. Circ. No. 622,* 153.

Parinarium (drying) oil. Steger and van Loon—*Rec. trav. chim. 60,* 13.

Tobacco seed (drying) oil. Rao and Anjaneyulu—*Paint, Tenali, 1,* No. 3, 35.

Coyol oil—Substitute for coconut oil. Anon.—*Foreign Crops & Markets 42,* No. 9, 274.

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[*] Report of the American Oil Chemists' Society Committee for Review of Literature on Fats, Oils, and Soaps. G. R. Greenbank, Geo. S. Jamieson, H. A. Mattill, R. C. Newton, M. M. Piskur, Chairman.

Grapefruit seeds yield textile oil. Anon.—*News Bull. Natl. Farm Chemurgic Council 2,* 22.

Synthetic food fats from coal. Williams—*Food Manuf. 16,* 161; *Coke Smokeless Fuel Age 3,* 187.

Williams, in the last reference above, reported that food fats were actually being prepared in Germany by hydrogenating water gas to hydrocarbons, oxidizing these to fat acids and esterifying with synthetic glycerol.

The following books were printed during the year:

The Industrial Chemistry of Fats and Waxes. T. P. Hilditch. Second ed. London, Bailliere, Tindall & Cox. 532 pp. Reviewed in *Chem. Age. London 45,* 121.

Chemistry and Technology of Marine Animal Oils With Particular Reference to Those of Canada. H. N. Brocklesby. *Fisheries Research Board, Can. Bull. No. 59,* 431 pp.

Primary Technical Treatment

During the year meat packers had adjusted their rendering operations to conform with the government ruling whereby certain edible pork trimmings could not be utilized for pure lard production but should be converted to a product named edible pork fat. Small packers who did not have sufficient raw materials for this grade of edible fat converted the stock into inedible products which were of less value. An interesting communication on this subject by Harris (*Natl. Provisioner 104,* No. 12, 8) fostered production of the edible products and issued procedures and precautions for their manufacture. The All-Union Science Institute (Liberman and Petrovskii—*Myasnaya Ind. 1939,* No. 7, 13) issued directions for dry rendering pig bones. Hinko (*Seifensieder-Ztg. 68,* 137) published directions for manufacturing a good quality fat resembling *premier jus* from mutton fat stock. Mechanical features of a new whale rendering apparatus were described (*Aktieselskapret Kvaerner Brug.—Brit. 527,454*). A rendering process devised by Fauth and Reichert (*U. S. 2,229,378*) comprised heating the stock at 70-90° in water containing a protein precipitating agent and a demulsifier and bringing the temperature to 130° before skimming and centrifuging out the residue. A method of producing fish oils patented by Hempel (*U. S. 2,266,036*) comprised pressing, adding an alkaline buffer to the press liquor and separating the oil fraction.

A review of seed crushing methods was prepared by Dean (*Oil Colour Trade J. 100,* 449). A German method which he described was based on the theory that a sponge can be cleansed quickly by repeated squeezing in water. This German equipment comprised alternate extraction drums and expellers. An ideal American plant, according to Dean, would consist of a large number of expellers, an extraction unit and a hydraulic crushing plant. Volkobrun (*Masloboino Zhir. Prom. 16,* No. 5/6, 64) issued instructions on humidifying cottonseed to 10-11% moisture content. Better oil yields of uniform quality from seeds varying in moisture content was claimed after installation of the humidifying process. Fauth (*U. S. 2,253,696*) prepared seeds for extraction by comminuting them to a strand-like mass in an extrusion machine and cutting the strands. Reduced power consumption over roller type apparatus was claimed. McKinney and Freeman (*Oil, Paint & Drug Reptr. 140,* No. 6, 5) recorded investigations on the various methods of drying tung fruit in preparation for extraction. Drying by storage was most economical. Difficulty was encountered by quick drying methods because the fruit seemed to release its moisture slowly. Another publication by the same investigators (*ibid.* No. 5, 5) recommended using solvent extraction in conjunction with pressing in order to obtain maximum oil recovery. To obtain good quality lallemantia or linseed oil, Lesyius (*Masloboino Zhir. Prom. 16,* No. 5/6, 15) suggested that pressing should be in 2 stages and heating should not be above 60°. Pressing in stages, that is, at a low pressure level followed by a high pressure level, was recommended also for cottonseed (Shapovalov and Krymova—*ibid.* 7). For apricot and plum pits Schcherbakov (*ibid.* No. 13, 11) recommended roasting at 110-20° to remove hydrogen cyanide, pressing twice cold and once at 100-20°. Chepiga (*ibid.* No. 5/6, 19) recommended the use of expellers and steaming temperature of about 104° for the extraction of castor oil. Flow sheets for a cottonseed pressing plant using expellers were drawn by Leahy (*Southern Power and Ind. 59,* No. 3, 63). Means of using combustion gases with fish oil pressing equipment for heating and drying were patented (Burger *et al.—Brit. 531,605*). Lava *et al.* (*Rev. filipina med. 32,* 139; *Philippine J. Sci. 74,* 247; *75,* 143) recorded that the best quality coconut oil was obtained by pressing the fresh undried meats and breaking the expressed emulsion by biochemical means. In a similar process Feikema (*Ing. Nederland.-Indie 8,* No. 1, 3) recommended the use of centrifuges to facilitate separation. During the year 4 patents were issued on improvements for expeller presses (Anderson—*U. S. 2,216,658, 2,249,724*; Suss—*U. S. 2,223,747*; Fleming—*U. S. 2,254,517*) and 2 patents were issued on the design of pot presses for pressing cocoa butter from liquid cocoa mass (Carver—*U. S. 2,226,920*; Leimer—*U. S. 2.253,437*).

Several patents dealt with continuous countercurrent extraction systems (Bottaro—*U. S. 2,218,080*; Swallen and Reintjes—*U. S. 2,227,605*; Bonotto—*U. S. 2,254,867*; Levine—*U. S. 2,264,390*; Lamy-Torrillion—*Brit. 512,660*). Economy in power consumption, new methods of recovering solvents and methods for drying the extracted residues were improved. Solvent recovery was also the subject of one paper (Sokolov—*Kozhevenno-Obu. Prom. U. R. S. S. 19,* No. 6, 38). It was advantageous to treat fish tissues with alkalies before solvent extracting (Taylor and Bedford—*U. S. 2,240,232*; Jones—*U. S. 2,238,059*). The alkali fixed the acids and coloring matter within the fish tissue, or in wet extraction, in the aqueous layer. Two communications dealt with the economy of solvent extraction. Bilbe's (*Mech. Eng. 63,* 357; *Chem. & Met. Eng. 48,* No. 4, 85) data showed that soybeans could be processed at a cost of $0.092 per bushel. Goss (*ibid. 80*), in addition to cost information, presented statistical information on the types of equipment in use and extent to which each was used. It was interesting to note that the processing of soybeans by the expeller, solvent and hydraulic methods was divided among them in the respective proportions, 74.4, 20.2 and 5.4% in 1939 and 68.5, 13.2 and 18.5 in 1936. Ruthruff and Wilcock (*Trans. Am. Inst. Chem. Engrs. 37,* 649) reported favorably on the production of the more highly unsaturated fraction of soybean oil by extracting the beans with selective solvents, as for example, furfural. Rosenthal (*U. S. 2,254,245*) selectively extracted a "winterized" grade of cottonseed oil by extraction at —20° with normally gaseous hydrocarbons. Olcott (*Ind. Eng. Chem. 33,* 611) in a review on problems involved in solvent extraction of cottonseed reported that ether, aromatic solvents and chlorinated solvents removed gossypol with the oil, while aliphatic hydrocarbons did not. The meal extracted with aliphatic hydrocarbons could be detoxified by re-extraction with a proper solvent or heating. Bull and Hopper (*Oil & Soap 18,* 219) tabulated the properties of the lipids obtained by successive solvent extractions of soybeans. The lipids from the first and sixth extractions varied 17.5 units in iodine number and 23.4% in phospholipids. Chernukhin *et al.* (*Masloboino Zhir. Prom. 16,* No. 4, 9) recommended the use of dichloroethane for extracting residual oil in castor oil cake.

Mechanical details of parts of oil-refining apparatus and welded connections were described by Hopkins (*U. S. 2,216,033*). The use of "Buna," a German synthetic rubber, in the oil industry was fostered by Stocklin (*Fette u. Seifen 48,* 205). Data on "Buna's" stability to heat, oils, fat acids, hydrocarbons, aromatic compounds, ketones, aldehydes, carbon disulfide and ether were tabulated.

This year's improvements in the Refining, Inc. methods of continuous refining (*U. S. 2,230,196, 2,239,131, 2,239,701, 2,242,175, 2,242,188, 2,247,359, 2,249,700, 2,254,094, 2,254,101 and 2,260,730*) were special procedures for some oils, equipment and methods for preliminary degumming; addition of boric acid to precipitate phosphatides; and procedures and equipment for dehydrating foots to allow easier separation. The Sharples Corp. continuous system of refining (*U. S. 2,245,846, 2,247,430, 2,259,540, 2,259,665*) was improved with a new centrifugal separator and the addition of a small amount of water for certain oils. For coconut type oils equipment was designed to remove part of the foots, water was added and the remainder of foots was removed. The De Laval Separator Co. (*U. S. 2,215,624, 2,230,796, 2,249,263*) improved the arrangement of apparatus and devised new proportionating devices for their continuous refining equipment. In a system designed by Colbeth (*U. S. 2,249,746*) the oils were treated countercurrently with alkaline aqueous solutions. Continuous refining equipment and procedures were also designed by Moore (*U. S. 2,236,493*) and Aktiebolaget Separator (*Brit. 526,852*). The utility of centrifuges in oil refining was discussed by Gillies (*Oil Colour Trades J. 99,* 242). A special centrifuge for oil was designed into which wash water could be sprayed during operation (van Riel—*U. S. 2,224,043*).

Details concerning coagulation temperature and concentration of caustic for refining sunflower and rapeseed oils were presented respectively by Skipin *et al.* (*Masloboino Zhir. Prom. 16,* No. 5/6, 1) and Prusak (*ibid.* 7). Treatment before alkali refining was recommended by a few patentees. Bleaching with hypophosphorous acid and with activated carbon prior to refining, was recommended, respectively, by Lever Bros. (*Brit. 531,047*) and by Buxton and Simons (*U. S. 2,255,875*). Acidity was decreased and less refining loss obtained when vegetable oils were pretreated with sodium ferrocyanide (Daly and Walsh —*U. S. 2,253,480*). Miscellaneous procedures for refining included use of ethylene imine as a refining agent (Schurink and Coltof—*U. S. 2,228,038*), removing colloidal metallic impurities by treatment with hydrochloric acid (Taylor and Jakobsen—*Can. 399,020*; *U. S. 2,210,548*), and subjecting the oil to radiant energy of wave lengths less than 0.535 microns to reduce the dispersion of colloids and to precipitate the colloidal material (Fash—*U. S. 2,229,062*).

Drew (*U. S. 2,238,441-2*) patented the reconstruction to edible fat of the soap and oil removed during the refining of coconut oil. The stock was split and the fat acids were then distilled and reesterified with glycerol.

Manderstam (*Oil Colour Trades J. 98,* 795) reviewed the prevailing methods of deacidifying fats and oils. Advantages and disadvantages of batch alkali refining, continuous refining and distillation methods were reviewed. Kaufmann (*Fette u. Seifen 48,* 53) investigated the effect of refining methods on phosphatides, sterols, vitamins A, D, E, F and K, and hydrocarbons. This, his only available publication on the subject, gave the formulas, properties and content in oil of these substances. In a brief review, Boekenoogen (*ibid.* 59) pointed out that deacidifying by adsorption, as well as other methods, affected accessory nutritive material. For instance, alkali refining and aluminum oxide removed phosphatides, alkali allowed sterols to remain, but aluminum oxide removed them and adsorbents removed more carotinoids than alkalies.

Buxton and Simons (*U. S. 2,266,719*) recommended that oils containing vitamins be bleached by adsorbents while in hydrocarbon or chlorinated hydrocarbon solutions. Kellens (*U. S. 2,260,910*) bleached fats or oils by heating to 90° with an acid solution of nickel, cobalt, zinc or manganese oxides prior to a supplementary decolorizing with active earth. Tutiya (*Materials for Chem. Ind., Tokyo, 13,* 91) pointed out that rice oil must be decolorized with acid clays together with acid to remove the red and blue color. The chemical bleaching agents patented were sodium perpyrophosphate (Noder — *U. S. 2,250,203*), hypophosphorous acid and its salts (*U. S. 2,259,968*) alkali hyposulfite or formaldehyde sulfoxylate and hydrogen peroxide (Plauson—*Ger. 694,124 Cl. 23e*) and hypochlorite and ceric sulfate (*Brit. 528,129*). Cocoa butter was simultaneously deodorized and decolorized by heating at 115°, steaming with vapor heated to 165°, cooling to 100° and adding earth (Morris—*Gordian 46,* No. 1086, 17). Nalchikin is a newly discovered Russian decolorizing earth (Kuadzhe—*Masloboino Zhir. Prom. 16,* No. 5/6, 21). Erdheim (*Seifensieder—Ztg. 68,* 125) reviewed the information on the manufacture and uses for natural bleaching earths. Oil was recovered economically from decoloring earths with dichloroethylene solvent by Brauer (*Masloboino Zhir. Prom. 16,* No. 5/6, 11). Methods of bleaching palm oil were discussed by Vallance (*Soap 17,* No. 3, 27).

Equipment for continuously deodorizing oils was based on passing the oil through a heated zone and then through a vacuum zone against a countercurrent of steam (Dean—*Can. 395,855,* Jenny—*Swiss 207,514 Cl. 38a*). Buxton (*U. S. 2,258,671-3*) deodorized medicinal vitamin oils by heating in the presence of sugar or an aldehyde of 2 carbon atoms or an edible gum. Tunogae and Enomoto (*Japan 129,647*) deodorized oils by emulsifying, adding an electrolyte and passing electricity through the charge. According to Renner (*Brit. 513,514*) treatment with the enzymes from plasmolyzed yeast was efficient in deodorizing oils. Effective deodorization of sunflower oil required steaming for 2 hours at 160° (Petryaev—*Masloboino Zhir. Prom. 16,* No. 5/6, 69). Removal of absorbed gas from oils was accomplished by the Eastman Kodak Co. (*Brit. 523,346*) by subjection to the vacuum of a short-path still. Theory and practice of deodorization by steam was discussed and illustrated with graphs by Bailey (*Ind. Eng. Chem. 33,* 404). He pointed out that the rate of steaming was twice as great at a pressure of one inch than at 0.25 of an inch.

New methods of processing tall oil were described. Hixson and Miller (*U. S. 2,247,496*) separated fat acids from rosin acids by extraction with normally gaseous hydrocarbons. Murdock (*U. S. 2,235,462*) improved the product in relation to color and odor by heating until 5% was lost. Dreger (*U. S. 2,240,365*) saponified, then passed inert gas through the heated mixture to volatilize the nonsaponifiable material. Methods of processing and treating the oil for use as a binding agent for printing inks were described by Tobias (*Farben-Ztg.* 45, 68, 86, 117, 133, 150, 167, 183).

An increased amount of work was done on valuable minor constituents of fats and oils. Phosphatides were produced by Thurman (*U. S. 2,245,537*) by degumming the oil at a pH of 7 and precipitating the phosphatides by washing with an aqueous medium of pH 2 to 6. Beck and Klein (*U. S. 2,214,520*) adsorbed the phosphatides on calcium phosphate and recovered them with organic solvents. Phosphatides were recovered from foots by emulsifying with water, separating the emulsion, extracting the oil and free fat acids with a fatty oil and separating the product from the residual emulsion (Julian and Engstrom—*U. S. 2,249,002*). The phosphatides were the subject of 3 short discussions or reviews (Eichberg—*News Ed. A. C. S. 19,* 575; Halder *et al.*—*Fette u. Seifen 48,* 302; Schmalfuss—*ibid.* 306). Vitamin concentrates were prepared from oils by saponifying and extracting with dichloroethylene (Freedman and Dubin—*U. S. 2,248,619-20*) or methyl chloride (Taylor *et al.*—*U. S. 2,266,830*). Hickman (*U. S. 2,218,240, 2,229,173, 2,249,524-5, 2,256,392*) prepared various concentrates of vitamins and sterols from oils by short-path vacuum distillation. According to Quackenbush *et al.* (*Ind. Eng. Chem. 33,* 1276), tocopherols were quantitatively distilled from the above type still at a maximum temperature of 147°. Several patents were issued on the preparation of derivatives of sterols and vitamins (Marker—*U. S. 2,255,072-4, 2,262,244*; Karrer—*U. S. 2,245,480, 2,231,125*; Linsert—*U. S. 2,257,176, 2,264,320*; Boer—*U. S. 2,266,674*).

Several means of processing wax type oils were described. Matumoto (*Rpts. Chem. Res. Prefectual Inst. Adv. Ind., Tokyo, No. 3,* 25) saponified whale head oil with a saponification equivalent of calcium hydroxide plus 1% sodium hydroxide and recovered alcohols by extraction or distillation. This procedure decreased foaming. Tada and Kubo (*Japan 132,566*) hydrolyzed lanolin and separated the constituents by distillation. A patent by Thurman (*U. S. 2,245,538*) covered a continuous method of saponification and distillation of the wax alcohols. The fat acids may be recovered from the saponified residues of alcohol extraction by liberation with carbon dioxide (Leithe and Luther—*U. S. 2,232,331*) or with inorganic acids (Luther—*U. S. 2,228,925*).

Ono (*J. Agr. Chem. Soc., Japan 16,* 439) demonstrated that there was some selectivity in the hydrolysis of fats. In general, his data showed that the higher unsaturated acids were liberated first; there was also a close relation between emulsifying power and hydrolysis. Suen and Chien (*Ind. Eng. Chem. 33,* 1043) found that plotting the logarithm of the concentration of unhydrolyzed oil in the oil phase against time during hydrolysis yielded a straight line. This was interpreted to indicate a first order reaction. Patents on procedures and equipment for continuous hydrolysis of fats were issued and assigned to Procter & Gamble Co. (*U. S. 2,233,845; 2,267,750*) and Montecatini soc. gen. p. l'ind. miner, e chim. (*Fr. 849,594; Brit. 525,381*); a batch system was patented by Nill (*U. S. 2,254,109*). Improvements in fat acid stills were devised by Potts and McKee (*U. S. 2,224,925-6, 2,224,984, 2,224,986*) and Sondermann (*U. S. 2,224,025*). Improvements were made in the high-vacuum short-path stills by Hickman (*Brit. 524,390, 524,439, 530,367, 530,371; Ger. 700,764 Cl. 30h; Fr. 845,957; U. S. 2,234,166, 2,249,526*) and Burrows (*Brit. 523,754*).

Selective hydrogenation of linoleic to oleic acid without greatly increasing stearic acid was accomplished by Ueno and Tokunaga (*J. Soc. Chem. Ind. Japan 43B,* 292) at 25 atmospheres pressure and 180° temperature with 2% highly active nickel catalyst. High speed mixing, increased rate of passage of hydrogen and low-activity catalyst gave favorable selectivity according to Elovich and Zhabrova (*Masloboino Zhir. Prom. 16,* No. 5/6, 24). According to Tutiya (*Materials for Chem. Ind., Tokyo 13,* 251) free acids were more rapidly hydrogenated than glycerides. Yamaguti *et al.* (*Waseda Applied Chem. Soc. Bull. 17, No. 3,* 110) prepared data on the course of the hydrogenation of soybean oil with nickel formate catalyst. Conversion of linolein to olein was completed at iodine number about 78. According to Ueno *et al.* (*J. Soc. Chem. Ind., Japan 43B,* 434) potassium and sodium soaps were negative hydrogenation catalysts; calcium, magnesium and barium were weakly negative; while aluminum and iron soaps were indifferent. Yakukov (*Masloboino Zhir. Delo 16,* No. 3, 12) recorded that Russian filtered hardened fat contained 2-4% colloidal nickel. Hertelendi (*Magyar Chem. Folyoirat 47,* 49) recorded data on hydrogenation of castor oil with nickel, molybdenum and molybdenum plus sulfur catalysts at temperatures up to 400°. Most efficient conditions for producing a fuel suitable for mixing with gasoline were at temperatures of 210-230° with a molybdenum catalyst. The yield was about 60%.

For recovery of nickel catalyst, Sterlin (*Masloboino Zhir. Delo 16,* No. 4, 13) recommended a preliminary de-oiling with dichloroethane and Wellman (*U. S. 2,253,835*) patented a preliminary electrolytic anodic oxidation in aqueous alkaline solution to decompose the organic material.

Many publications on the chemistry of drying oils included reviews or discussions on the present knowledge in the field (Bradley—*Paint Ind. Mag. 56,* 11;

Paint Tech. 6, 85, 108, 133; Henk—*Fette u. Seifen 48,* 24; von Mikusch and Priest—*Oil & Soap 18,* 50; Igoshina—*Byull. Obmen Opyt. Lakokrasochnoi Prom. 1940,* No. 2, 16; Kitagawa and Sinozaki—*J. Soc. Chem. Ind., Japan 43B,* 370; Behr—*Off. Digest Fed. Paint & Varnish Prod. Club No. 195,* 203).

Morrell and Phillips (*J. Oil & Colour Chem. Assoc. 23,* 103) applied the hydrogen iodide gas method of determining reactive oxygen on various oils and on β-eleostearin in obtaining evidence to support the hypothesis that during oxidation the main products were a polymerizable peroxide, a polymerized peroxide and a ketol grouping. Stand oils from linseed oil gave both reactive oxygen and hydroxyl values, thus indicating that from linolenin a double conjugated system was first formed, followed by diene dimerization to yield 2 dimers, one of which was more active than the other. With β-eleostearin complete oxidation with formation of a monoperoxide "oxyn" was obtained on heating to 230-240°. Oxidation of olive oil produced peroxides from 50% of the olein present. Castor oil oxidized to about 40% of the maximum oxidation obtained with olive oil; while dienol and trienol prepared from the castor oil oxidized in a manner similar to linseed and tung oil. Bradley and Johnston's (*Ind. Eng. Chem. 33,* 86) latest work was on dehydrated castor oil, with which polymerization yielded a dimer, a trimer, and no evidence of higher polymers. The data were said to support the theory that polymerization of drying oils depended upon the reaction of conjugated diene structures along lines already established for butadiene. Drinberg (*J. Gen. Chem. U.R.S.S. 10,* 2052) recommended that thermochemical methods, instead of the methods of Carothers and Bradley be applied to oxidation of fats. Data on heat of polymerization of several oils indicated the course of the reaction. He submitted an equation for a typical autoxidation process. Powers, Overholt and Elm (*Ind. Eng. Chem. 33,* 1257) plotted changes in iodine value, specific refraction and density of oils and fat acids against oxygen absorbed. They suggested that drying and aging went through five steps: an induction period, a rapid oxidation stage, a period where the oxygen rearranged to a conjugated system, a polymerization stage and finally a depolymerization stage during which oxidative decomposition of the polymers took place slowly.

Some investigators worked on the acceleration of drying. Glimm and Seeger (*Fette u. Seifen 48,* 322) found that radiation with red-yellow light had the same effect as daylight. High temperature drying improved corrosion resistance but affected color and luster according to Yakubovich and Ostrin (*Byull. Obmen Opyt. Lakokrasochnoi Prom. 1939,* No. 12, 26). A first coat could be dried at 150° but a maximum of 50° was safe for the final coat. Nicholson (*Ind. Eng. Chem. 33,* 1148) plotted the effect of various gases on drying time. Carbon dioxide or nitrogen atmospheres did not affect the rate of drying. Traces of ozone shortened the induction period. Sulfur dioxide reduced the drying time of zinc oxide paint, but lengthened that of titanium dioxide or zinc sulfide paints. And hydrogen sulfide reduced the rate of oxygen absorption of all paints. Burr (*U. S. 2,242,230*) converted unconjugated polyunsaturated fat acids to the conjugated form by heating with basic alcoholates in the absence of water. These products were subsequently converted to the glycerides before use.

A combination of polymerization kettles designed by Harris and Sutherland (*U. S. 2,240,618*) were equipped with means for carrying out the reaction in an inert gas atmosphere. Treating procedures for semidrying oils by Corkery (*U. S. 2,248,964-6*) comprised oxidizing the oil with oxygen containing gas and at the gelation point adding 20 to 70% resin or a drying oil. Behr's (*U. S. 2,239,692*) continuous process called for polymerization equipment and means for separating with solvents the polymerized from the unpolymerized portions. Products with improved film-forming characteristics were obtained from polymerized drying oils by Morse (*Ind. Eng. Chem. 33,* 1039) by distillation of approximately 10% in a molecular still.

The accelerators and improvers patented for use in oil bodying processes were polyhydric alcohol-polycarboxylic acid resins (Durant—*U. S. 2,252,396-8*), polyaromatic compounds carrying at least 2 phenol groups and a carboxyl group (Schwarcman—*U. S. 2,230,470*), aromatic sulfonic acids or sulfonyl chloride (Auer—*U. S. 2,244,666*), alkali metal sulfites (Auer—*U. S. 2,234,545*), raw isano oil (Koninklijke Ind. Maatschappij vorheen Noury & van der Lande N. V.—*Brit. 516,024*) and certain fractions obtained by high-vacuum distillation of natural oils (Fawcett—*Brit. 516,476*). The Northwestern Paint & Varnish Production Club (*Natl. Paint, Varnish, Lacquer Assoc., Sci. Sect. Circ. No. 604,* 295) recorded the effect of 24 rubber and other accelerators on the heat-bodying of linseed and soybean oils. Benzothiazole, thiobenzoate and mercaptobenzothiazole with cyclohexylamine were most satisfactory. Some were ineffective while others darkened the oils considerably. According to Gardner and Waddell (*Ind. Eng. Chem. 33,* 629) cobalt, lead and manganese soaps of 9,10-dichlorostearic acid were as efficient as the naphthenate driers. Manganese and lead driers dried raw oil to films much faster than bodied oil, with cobalt the reverse was true. Cobalt promoted most complete oxidation while lead caused gelation at much lower oxygen content. The use of metallic salts of alkaline oxidation products of primary alcohols as driers was patented by Meidert and Pongratz (*U. S. 2,251,798*). The patented antiskinning ingredients for drying oils were an organic compound containing the bivalent oximido group (Reynolds and Kellog—*U. S. 2,228,487*), halogenated aralkylated and alkylated polyhydric phenols (Martin—*U. S. 2,225,918-20*) and polyhydroxyl substituted naphthalene or phosphoric esters of polyhydric phenols (Martin—*U. S. 2,228,667-8*). Oils containing pentaerythritol-rosin esters yielded varnishes which when used on steel showed greater adhesion and protection against rusting than ester gum and phenolic varnishes (Oswald—*Paint, Varnish, Production Mgr. 21,* 102).

Tatimori (*Bull. Chem. Soc. Japan 15,* 315, 474; *16,* 16, 45, 51, 75, 82, 114, 118; *J. Soc. Chem. Ind. Japan 43B,* 257, 260, 289, 339, *44B,* 8, 62; *Farben-Ztg. 46,* 154; *Paint, Varnish, Production Mgr. 21,* 98, 100) studied the effect of various catalytic material on gelation of tung oil. Tabular and graphical data were presented with equations to calculate the effect of the amount of catalyst on the gelation time. Benzoyl peroxide and solutions of iodine in chloroform, phenyl chloride, dibromoethylene, acetic acid, acetic anhydride or nitrobenzene promoted gelation. Brominated soybean oil, brominated oleic acid, sulfur, selenium, stearic acid, cetyl alcohol and basic inorganic compounds, retarded gelation of the tung oil. Solutions of iodine in ethyl ether, butyl alcohol, hexane, cyclohexane, acetone and aniline had little or no effect. Solutions of iodine in benzene, carbon disulfide and tribromomethane gave a weak accelerating action. The effect of adding bodied drying oils depended on the amount of peroxides in the added oils. The molecular weights of the bodied tung oils were determined cryscopically in 5 different organic solvents. Hannewijk, Over, van Vlodrop and Waterman (*Verfkronieck, 13,* 162; *Paint Ind. Mag. 56,* 48) prepared viscous products from tung oil by reacting with phenol in presence of inorganic acids or sulfur dioxide and determined characteristics of the products. They had diene values of zero and they were not split by refluxing in neutral solution or in concentrated hydrochloric acid or in 0.5 *N* alcoholic potassium hydroxide.

Carrick and co-workers (*Am. Paint J. 25,* Oct. 21, 58; Nov. 4, 58; Nov. 18, 65; Dec. 2, 48; Dec. 16, 18; Dec. 30, 54; Jan. 13, 20; Jan. 27, 56) recorded graphically the relation of drying time to the change in weight, iodine value, thiocyanate value, diene value, saponification value, acetone insoluble, combustion analysis, peroxide number and development of certain qualitative tests on films of air blown, heat-treated linseed oil, raw linseed oil, raw perilla oil, raw safflower oil and trilinolenin. Graphical data by Bowles (*J. Oil Colour Chem. Assoc. 24,* 29) gave the effect of varying amount of cobalt on gelation of linseed oil films. In the same communication organic nitrogen bases were considered strong inhibitors; sulfur dioxide and hydrochloric acid in the air were strong inhibitors, but as a polymerization catalyst sulfur gave a positive effect. Nasini (*Ann. chim. applicata 30,* 337) tabulated the viscosities of pure and oxidized linseed oils in several solvents. Ginn (*U. S. 2,260,140*) claimed cooking linseed with 1/8 to 2½% castor oil would yield varnish similar to tung oil varnish.

The drying properties of oiticica oil were improved by treatment with an aliphatic aldehyde having more than 3 carbon atoms (Groger and Horst —*Ger. 697,082 Cl. 22h*). The drying properties of either oiticica or po-yoak oils were improved by acetylation (Rheineck—*U. S. 2,210,305*). Reports on properties of soybean oil paint and varnish and their comparison with products of other oils were prepared respectively, by the Chicago Paint & Varnish Production Club (*Natl. Paint, Varnish, Lacquer Assoc. Sci. Sect. Circ. No. 604,* 275) and Lewis (*Paint, Oil & Chem. Rev. Apr. 25, 1940*). Instruction for preparing drying oils from sunflower seed oil were issued by Ivanova (*Byull. Obmen. Opyt. Lakokrasochnoi Prom. 1939,* No. 10, 17). The drying qualities of various grape seed oils were recorded by Paleni (*Fette u. Seifen 48,* 283). According to Shuraev and Vasil'eva (*Masloboino Zhir. Prom. 16,* No. 5/6, 32) saponification of cottonseed oil with insufficient alkali yielded soaps of the unsaturated acids which could be reconstructed to glycerides with drying oil properties. A new drying oil was extracted from the inner kernel of the nut of the Chinese tallow tree by Quinby (*U. S. 2,248,823*).

A plastic drying oil coating composition patented by McGrew (*U.S. 2,246,452*) contained fish oil, asbestos, mica, a drier, zinc oxide and a thinner. Other literature on fish oils fostered their use in the protective coating field (Drinberg and Snedze—*J. Applied Chem. U.R.S.S. 13,* 1449; Ivanova *et al.*—*Byull. Obmen Opyt. Lakokrasochnoi Prom. 1940,* No. 10, 19).

In preparing a drying oil from castor oil by dehydration the catalysts patented were aromatic or aliphatic sulfonic acids (Bogatyrev *et al.*—*Russ. 53,779*) and magnesium sulfate with phosphorus pentoxide (Sorensen—*U. S. 2,230,549*). Brod (*U. S. 2,212,385*) dehydroxylated castor oil by acetylating and heating to split off acetic acid. Recovery of 9-11 octadecadiene acid from dehydroxylated castor oil by De Groote and Wirtel (*U. S. 2,266,960*) was by vacuum distillation. Good protective coating products were also prepared from castor oil by esterifying the hydroxyl groups with drying oil acids (Rheineck and Long—*U. S. 2,256,353*) or by heating with phthalic anhydride (Ubben and Price—*U. S. 2,246,768*). The growing importance of castor oil in the drying oil field was attested by the many communications describing the dehydroxylated product and the protective coatings made therefrom (Cincinnati-Dayton-Indianapolis-Columbus Paint & Varnish Club—*Natl. Paint, Varnish, Lacquer Assoc. Sci. Sect. Circ. No. 604,* 331; Weaver—*Am. Paint J. 25,* Dec. 30, 16; *Paint Ind. Mag. 55,* 352; Gilbert—*J. Chem. Ed. 18,* 338; Morgan—*Paint Manuf. 11,* 166; Bogoslovskii—*Byull. Obmen Opyt. Lakokrasochnoi Prom. 1940,* No. 1, 21; Ivanova *et al.*—*ibid.* No. 4, 9; No. 5, 19; Rubinskii—*Masloboino Zhir. Prom. 16,* No. 5/6, 41; Osnos *et al.*—*ibid.* 33; Esafov and Shapadi—*J. Applied Chem. U. R. S. S. 13,* 1040). Other publications on manufacturing paint oils from nondrying oils were on the manufacture of alkyds of the oils (Dmietrieve and Dogadkina—*J. Applied Chem. U. R. S. S. 14,* 110; Kulikov—*Byull. Obmen Opyt. Lakrasochnoi Prom. 1940,* No. 5, 25; Blagonravova *et al.*—*ibid.* No. 10, 18; Varlamov—*Pishchevaya Prom. 1,* No. 1, 30).

A drying oil was prepared by interpolymerization of cottonseed oil with unsaturated hydrocarbons (Karasev *et al.*—*Masloboino Zhir. Prom. 16,* No. 5/6, 38). Four methods of manufacturing drying oils from hydrocarbons were described (Rothrock—*U. S. 2,252,333*; Thomas—*U. S. 2,240,081*; Christmann—*U. S. 2,253,323*; Kulikov *et al.*—*Byull. Obmen Opyt. Lakakrasochnoi Prom. 1940,* No. 1, 27).

Products (Except Detergents)

To evaluate the creaming quality of shortening requires a determination of the air entrapped in a cake mix. According to Bailey and McKinney (*Oil & Soap 18,* 120) suitable calculations can be made by using the following densities for the cake ingredients: sugar 1.59, shortening 0.91, flour 1.42, eggs 1.03 and milk 1.03. The density of the mix was determined by weighing it in a cup of known capacity. A good shortening incorporated about 270% air when creamed with granulated sugar. Newton and Phelps (*U. S. 2,234,931*) prevented shortening from setting up in a brittle, liquid or slushy condition by pumping it under pressure through a long tube after chilling. Schou (*Fr. 848,515*) patented the use of polyglycerol esters of polymerized fat acids as dispersion agents for shortening. A patented cake mix and an egg ingredient for cake by Katzman (*U. S. 2,243,867-8*) contained as a shortening ingredient the reaction product of metaphosphoric acid with mono- and/or di-glycerides prepared from fats.

Several methods of separating liquid and solid constituents of oils were suggested. Voogt and Seeles (*U. S. 2,228,040*) prepared a low cold test neat's-foot oil by removing the oil constituents which separated at —10° when the oil was dissolved in 4 volumes of a 1:4 mixture of benzol:acetone. According to Ozaki (*J. Electrochem. Assoc. Japan 8,* 154) solid constituents of oils were deposited on the electrode and wall of the container by application of a direct electric current. Liquid and solid products were prepared by Konstantinov and Laryukov (*Russ. 54,049*) by cooling on rollers, shaving off and pressing the chips. A review on the subject was prepared by Singer (*Seifensieder-Ztg. 68,* 194). A salad oil prepared by Eckey and Lutton (*U. S. 2,266,591*) contained mixed fat acid esters of polyglycerol to prevent deposition of stearin.

Erlandsen (*Fette u. Seifen 48,* 313) pointed out that the salt taste intensity of margarin depended on the melting time of the product while on the tongue. For fats with melting points between 22 and 33° the melting times in seconds at 40° were tabulated; they varied between 260 and 1160 seconds. Margarin tasted saltier in summer than in winter. A review by Unger (*Fette u. Seifen 48,* 184) favored adding vitamins to margarin and discussed sources for vitamin concentrates. Reddie (*Brit. 528,123*), Newton and Brown (*U. S. 2,232,401*) emulsified aqueous margarin ingredients with supercooled fat. Epstein and Harris (*U. S. Reissue 21,683*) revised one of their patents on the use of polyhydroxy esters having unesterified hydroxyl groups as emulsifiers for margarin. A lactic acid free margarin patented by Otting and Chrysler (*U. S. 2,233,179*) contained lipolyzed butterfat as a flavoring ingredient. Hildisch (*Brit. 524,594*) patented a mixture of milk, glycerol, salt, coloring matter, flavor, egg yolk, lecithin and vitamins for use in the manufacture of margarin. Two patents (Heft *et al.*—*U. S. 2,258,288, 2,260,747*) covered mechanical features of a machine for forming prints of margarin, butter, lard and like products. A cheese product prepared by Pässler (*Ger. 697,440 Cl. 53e.*) contained lecithin.

Several patents on emulsifiers dealt with the manufacture and uses of glycerol and polyglycerol esters for that purpose (Harris—*U. S. 2,258,892*; Cahn and Harris—*U. S. 2,236,517*; Herlow—*Brit. 530,240*; Richardson—*U. S. 2,252,692*). Esterifying fat acids and glycerol in dioxane with sulfuric acid as the catalyst was an innovation in the manufacture of mono- and di-glycerides by Richardson. Kawai (*J. Soc. Chem. Ind. Japan 43B,* 219, 220, 427) recorded data on the preparation of mono- and di-glycerides by the reaction of various fats and fat acids with glycerol. Potassium carbonate, tin and zinc catalyzed the reaction; the presence of mixed free fat acids was also an improvement when reacting fats or oils with glycerol. A discussion on uses of emulsifiers was prepared by Harris, Epstein and Cahn (*Oil & Soap 18,* 179), covering their use in margarin, shortening, chocolate, etc. Glycerol, polyglycerol, sulfosuccinic acid, certain amino and sorbitol compounds containing fat acid radicals were patented for use in photographic emulsions (Swan and Lindquist—*U. S. 2,240,469-76*). Cetyl and stearyl alcohols were fostered as emulsifiers for cosmetics (Redgrove—*Manufg. Chemist 12,* 243). An apparatus for forming emulsions was designed by Schutte (*U. S. 2,254,049*).

Pink (*Trans. Faraday Soc. 37,* 180) reported that magnesium oleate and magnesium and nickel stearates gave a stable water-in-oil emulsions, but oleates of calcium, barium, strontium, zinc and nickel did not. Advice on stabilization of the water-in-oil emulsions was also presented. Similar information on oil-in-water emulsions was prepared by King (*ibid.* 168).

Two patents dealt with the manufacture of alcohols from fats or fat acids by high temperature hydrogenation (Am. Hyalsol Corp.—*U. S. 2,242,017, 2,248,465*). Komori (*J. Soc. Chem. Ind. Japan 43B,* 428) hydrogenated unsaturated fat acid esters to the corresponding unsaturated alcohols by use of iron-chromium oxide catalyst at a temperature of about 320° and a pressure of 240 atmospheres.

Chlorinating a mixture of stearic and palmitic acids and then separating the chlorinated compound was a means of preparing relatively pure stearic and monochloropalmitic acids (Ross and George—*U. S. 2,255,-230*). Another patented method of fractionating fat acids was by crystallization from liquid ethane, butane or propane (Hixson and Miller—*U. S. 2,219,-652*). Pentalecanal was produced by oxidation of α-hydroxypalmitic acid (Lauer *et al.*—*J. Am. Chem. Soc. 63,* 1153). Oxidation of ricinoleic acid with potassium permanganate yielded 33% azelaic acid (Murai and Hamano—*Waseda Applied Chem. Soc. Bull. 17,* No. 3, 114). Mercaptans of fat acids were prepared by refluxing the bromides of the fat acids with thiourea and sodium hydroxide in 95% alcohol solution (Urquhart *et al.*—*Org. Synthesis 21,* 36). Hydroxamic acids were prepared from the ethyl esters of fat acids by treatment with hydroxylamine hydrochloride and sodium ethylate and their properties were recorded (Inoue and Yukawa—*J. Agr. Chem. Soc. Japan 16,* 504). The melting points of many quinonyl derivatives of fat acids were also recorded (Fieser *et al.*—*J. Am. Chem. Soc. 62,* 2966). The manufacture of stearates and palmitates of zirconium, cerium and titanium was patented (Bigelow —*U. S. 2,252,658*). A fat acid derivative of estradiol was suitable for use by injection to form "hormonic depots" (Weisz—*U. S. 2,253,669*). Special strong activity was claimed for fat acid derivatives of estrone, equilin and equilenin (Miescher and Scholz —*U. S. 2,228,397*). Azo dyes from oleic acid furnished solutions less intense in color than an equal weight of less expensive dyes (Swern *et al.*—*Oil & Soap 18,* 222). A review by Bertram (*Rec. trav. chim. 59, 650*) on elaidinization of fat acids contributed evidence that elaidic acid was the *cis-* form. Kass, Nichols and Burr (*J. Am. Chem. Soc. 63,* 1060) prepared elaidolinolenic acid which they maintained was a geometric isomer of α-linolenic acid; the existence of β-linolenic acid was questioned.

Developments in the uses for fat acids and fat acid derivatives by Armour & Co. investigators led to the expansion of their production facilities (*News Ed. A. C. S. 19,* 970). Their new fat acid derivatives were reviewed by Ralston (*Chem. & Met. Eng. 48,* 126). New developments by Ralston and co-workers were the manufacture of mercurated fat acid ketones for use as antiseptics and germicides (*U. S. 2,262,-430*). the use of fat acid amines as sterilizers (*U. S. 2,247,711*), the use of fat alcohols and fat acid amines as insecticides and insect repellants (*U. S. 2,254,665, Oil & Soap 18,* 11, 89), unsaturated fat acid amines for the flotation of ores (*U. S. 2,267,307*), fat acid chlorides for use as intermediates for other preparations (*U. S. 2,262,431*) and a protective coating ingredient was a reaction product of cyclopentadienes and fat acid chlorides (*U. S. 2,237,825*).

A discussion on the status of textile oils was prepared by Preston (*Manufg. Chemist 12,* 233). New patented textile treating agents and lubricants were dehydrated castor oil having one of the double bonds of each acid group saturated (Colbeth—*U. S. 2,225,552*), a mixture of grapefruit seed oil, sulfonated emulsifier and mineral oil (Kaplan — *U. S. 2,229,975-6*), a mixture of mineral oil, neat's-foot fat acid-lactic acid diglyceride and diglyceride of neat's-foot oil fat acids (Goodings *et al.*—*U. S. 2,238,882*), mixtures of sulfonated olive oil, mineral oil, blown neat's-foot oil, oleic acid and triethanolamine (Pilgrim and Robinson—*U. S. 2,245,412*), chlorine derivatives of higher fat acid alkylolamide acetates (Weisberg and Corman—*U. S. 2,226,136*) and a mixture of urea, sulfonated stearic acid and petrolatum (Arnold—*U. S. 2,246,085*).

Hoare (*Tin and Its Uses, No. 11,* 6) discussed substitutes for tinning oils. Tallow and many other fats were not particularly efficient because they had a low lead oxide absorption capacity and were inactive at the lower working temperatures. They could be used in a second bath as a draining medium and thus save palm oil.

Past publications on the insecticidal properties of fat acids and some of their derivatives were reviewed by Thomssen and Doner (*Soap 17,* No. 4, 94). The use of a fraction distilling from castor oil between 260 and 300° as an insecticide was patented (Colbeth —*U. S. 2,257,711*).

Lee and Chandler (*J. Bact. 41,* 375) found that cutting oils contained 15 to 50 million bacteria per c.c. According to Lensden and Derlich (*Zentr. Bakt. Parasitenk. 1 Akt. Orig. 146,* 284) fish-liver oils had definite bactericidal and sporicidal action. Certain quaternary ammonium fat acid derivatives (Raymond and Dillon—*U. S. 2,252,863*) and fat acid salts of alkylated alklene polyamines (Kyrides—*U. S. 2,246,524*) were used as bactericides. A theory dealing with adsorption at cellular interface was suggested as a reason for the subtractive effect exerted by a weak fungistatic fat acid on a strongly fungistatic fat acid (Hoffman—*J. Am. Chem. Soc. 63,* 1472). Para-caproylamino-benzenesulfonhydroxamide was a new "sulfa" drug which was claimed to have a greater antistreptococcal activity than an equal weight of sulfanilamide (Scudi and Graessle—*Proc. Soc. Exptl. Biol. & Med. 46,* 364).

Patented textile waterproofing agents were metallic soaps (Nothum and Licata—*U. S. 2,262,815*; Kawano —*Japan 133,593*) and albumins that were coagulated and coated with free fat acids (Higgins—*U. S. 2,250,377*). An improved rock wool product was obtained by coating mineral wool with a waterproofing mixture of mineral oil and metallic soaps (Cullison—*U. S. 2,252,169*).

Flame resistant plasticizers were prepared by reacting castor oil fat acids and a polycarboxylic acid with free halogens (Hill—*U. S. 2,230,351*). Other fat derived constituents of protective coatings were fat acid esters of cellulose (Hiatt and Crane—*U. S. 2,254,652*), certain biquaternary dimorpholine compounds (Geigy A.-G.—*Swiss 206,717 Cl. 36p.*), butyl 12-ketostearate (Cox—*U. S. 2,227,823*) and a 4-ketostearic or 4-hydroxystearic glyceride derived from oiticica oil (E. I. du Pont de Nemours & Co.—*Brit. 517,949*). An electrical insulating varnish comprised essentially the reaction product of gilsonite, tung oil and heat thickened alkyd ester of cashew nut shell oil (Schaufelberger—*U. S. 2,264,409*).

Several patents assigned to Petrolite Corp. Ltd. (*U. S. 2,226,121, 2,226,124-6, 2,241,011, 2,246,842, 2,246,856, 2,250,176, 2,250,404-8, 2,259,704, 2,262,357-8, 2,262,737-9, 2,262,736*) were on demulsification or preventing formation of water-in-oil emulsions from the acidification of calcareous petroleum oil-bearing strata. The demulsifiers patented were principally derivatives of various amines which contained a fat acid or other soap-forming organic radical linked to the nitrogen of the amine. The fat acids of castor oil were especially suitable.

Several suggestions were on the use of vegetable oils or their derivatives as lubricants. Castor oil was made soluble in mineral oil by heating in vacuum in the presence of iron oxides or salts (Jaki — *Hung. 125,486*) or treatment with acid halides of phosphorus at temperatures below 100° (Levi—*Brit. 528,847*). Isii (*J. Soc. Chem. Ind. Japan 43B* 255, 256, 315, 374, 377) investigated the hydroxylation of soybean oil to impart lubricating and drying properties similar to those of castor oil. He tabulated the physical and chemical properties of such products prepared by oxidizing with hydrogen peroxide and with air while in glacial acetic acid solution. A patented process for hydroxylating unsaturated oils included the use of vanadium, osmium, chromium, tungsten or molybdenum oxide as a catalyst to accelerate the oxidation with hydrogen peroxide (Milas—*U. S. 2,267-248*). Vegetable oils with iodine values above 100 were converted to products suitable for lubrication by hydrogenating to iodine values below 110 and polymerizing to increase viscosity (Standard Oil Development Co.—*Dutch 49,214*). Hydrocarbon lubricating oils were improved by the addition of small amounts of tri(*p*-lauryl phenyl) phosphate (Ries—*U. S. 2,237,632*), a combination of lecithin and triphenyl phosphite (Musher—*U. S. 2,223,941*), a condensation product of aromatic compounds and fat acids (Prutton—*U. S. 2,223,127-30*) or a symmetrical diphenylethylenediamine compound of a halogenated fat acid (Musselman — *U. S. 2,254,490*). Patented grease formulas contained insoluble metallic soaps (Schott and Churchill—*U. S. 2,253,399*). rosin soap and soda soap of hydrogenated fish oil fat acid pitch (Brunstrum and Swenson—*U. S. 2,229,368*) and sulfurized or chlorinated fat acids (Davis—*U. S. 2,236,896-7*). Aluminum soaps for use in greases were prepared by saponifying fat acids with aluminum hydroxide in the presence of hydroxides or carbonates of potassium, sodium or ammonium (Boner — *U. S. 2,267,148*).

Several miscellaneous uses for fat derivatives were proposed. The use in the printing ink industry of stand oils prepared from tall oil esters was recommended (Kühn — *Farben-Ztg. 45,* 404). Small amounts of esters of malic or tartaric acid and stearic acid were added to dry cleaning solvents to improve cleansing (Tucker—*U. S. 2,251,694-5*). A hydraulic pressure transmitting fluid contained castor oil glycerol, glycol, alcohol, soap and water (Fulton—*U. S. 2,238,045*). A mixture of fat acids and oil of fish or linseed oil was patented for use as a wave-stilling oil (Compagnie francaise de raffinage —*Brit. 529,429*). A synthetic wax contained hydrogenated castor oil, abietyl alcohol and ethyl ethers of cellulose (E. I. du Pont de Nemours & Co. — *Brit. 529,797*). Tallow or resin treated cement increased the resistance of concrete made therefrom to freezing and thawing (Swayze—*Eng. News-Record 126,* 946). A substantially anhydrous solution of ammonium salts of tall oil acids in saturated alcohols of one to five carbon atoms was used as a flotation agent (Jayne —*U. S. 2,238,021*).

Interest in manufacturing hydrocarbons from fats appeared in countries lacking mineral oils. Hydrocarbons were prepared by heating fat acid nitriles with acid clays (Mori — *Japan 131,410*), by heating oils with sulfur dioxide and hydrogenating the product (Kioka—*Japan 130,295*) and by cracking cottonseed oil with heat under pressure (Lo and Ts'ai—*J. Chinese Chem. Soc. 16,* 1). Splitting off carbon dioxide from tallow with heat and a catalyst, followed by hydrogenation yielded high molecular weight hydrocarbons or alcohols or both (Jahrstorfer and Schwarte —*Ger. 695,862 Cl. 12o*).

Note On the Use of Southern Sweet Gum As An Anti-Oxidant In Lard*

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In the search for anti-oxidants or stabilizers for use in lard, vegetable oil shortenings, and other edible fats, many investigators have studied natural vegetable gums or resins.

The idea of using natural gums as anti-oxidants in fats would seem to be a logical one because of the experience of manufacturers of lard with the greatly increased keeping time of benzoinated lard (lard containing gum benzoin). Natural gums have been used as preservatives, drugs, and perfumes from the ancient days of frankincense and myrrh up to the present time.

Storax or Styrax gum has been found to have some value as an anti-oxidant in edible fats, and since Southern Sweet Gum (Liquid-ambar Styraciflua) produces a gum similar to the oriental Styrax, two small samples of this American gum of known origin were tested in laboratory samples of lard.

The sweet gum samples were gathered in August, 1940, and August, 1941, from trees growing near Darlington, South Carolina. The gum was separated from pieces of bark and other foreign material by hand, so that the samples used in the lard were somewhat crude in character.

The 1940 sample of sweet gum was added to prime steam lard and the mixtures along with a control sample were tested for keeping time by the Swift method with the following results:

Prime steam lard-control	7 hrs. keeping time.
Lard plus .05 per cent sweet gum	17 hrs. keeping time.
Lard plus .05 per cent sweet gum, plus .01 per cent phosphoric acid	17 hrs. keeping time.

(NOTE: The lard used in above test was produced and tested in Toronto, Canada.)

The 1941 sample of sweet gum gave the following results:

Prime-steam lard-control	10 hrs. keeping time.
Lard plus .10 per cent sweet gum	13 hrs. keeping time.
Lard bleached with .05 per cent Fullers earth	3 hrs. keeping time.
Lard plus .10 per cent sweet gum, bleached with .05 per cent Fullers earth	7 hrs. keeping time.

(NOTE: Above test was made on lard produced in Madison, Wis.)

The samples of lard containing sweet gum had an aromatic odor and flavor which could undoubtedly be removed by steam deodorization.

The Swift accelerated stability test results on the two samples of Southern Sweet Gum indicate that this native American gum has some value as a stabilizer when used in lard in relatively small percentages.

It is proposed to do further work on additional samples of sweet gum to check its value as an anti-oxidant and to determine whether or not it can be used in edible fats under the food laws.

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