THE ANIMAL AND VEGETABLE WAXES IN 1939

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THE Bureau of Foreign and Domestic Commerce of the United States Department of Commerce supplied the following data on wax imports during 1939:

Wax	Imports, in Pounds	Value
Carnauba wax	16,358,508	$4,928,147
Montan wax	7,178,938	690,171
Sperm oil	19,976,900	1,797,921
Wool fat	4,177,707	292,439
		$7,708,678

The value of the last two commodities was estimated by the reviewers from information obtained from other sources, and the figures are approximations only. No statistics for imports of beeswax and spermaceti were furnished by the Bureau. According to this authority the European war increased the price of most imported oils, fats and waxes and these commodities were generally at low levels during the summer of 1939. The following prices per pound are given as of July 1, and September 15, respectively: beeswax 19½c, 23c; candelilla wax 15½c, 16½c; and carnauba wax 31c, 35c. On August 28 sperm oil in drums was quoted in New York at 7.8 to 8c and on October 16 at 9.1c per pound. For the same dates lanolin or refined wool fat increased from about 19c to 30c per pound.

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The reviewers consider that the research conducted at the College of Pharmacy of Columbia University on the identification of the natural waxes in admixture was the most significant American work during the year. A schematic outline for the identification of waxes and wax-like substances in admixture was developed. Another phase of these studies pertained to the microscopy of waxes and their constituents.

Sperm oil investigations were continued in Japan with particular attention being paid to the preparation of higher aliphatic alcohols from this liquid wax. Much new information on the extraction of montan wax from peat and lignite, and on the refining of the product, resulted from research conducted in Eire and Russia.

L. Ivanovszky (*Oil Colour Trades J. 96,* 33, 35, 37 39) discussed waxes and wax-like substances from the standpoint of their composition, classification and industrial utilization. He stated that the new synthetic waxes are generally superior to the natural products in the various technical applications of such products. R. J. Anderson and L. F. Salisbury (*Ann. Rev. Biochem. 8,* 133-54) included waxes in a review on the chemistry of the acyclic constituents of lipides, and R. Savelli and C. Caruso (*Protoplasma 31,* 298-301) studied the waxy inclusions in protoplasm. The chemistry and nomenclature of waxes and wax-like substances was discussed by L. W. Greene (*J. Chem. Education 16,* 170-1). The following book was published: "Handbuch der Lebensmittel-Chemie. Bd. IV. Fette und Öle, Lipoide, Wachse, Harze, ätherische Öle," edited by J. Grossfield; Berlin, J. Springer, 966 pp., M. 135, bound M 138.60.

ANIMAL WAXES

Beeswax

The production of beeswax in Tanganyika Territory (East Africa) was described by L. W. Greene (*Am. Bee J. 79,* 72-4). A government-sponsored attempt to establish a local industry for bleaching the wax did not meet with success.

Investigation of the so-called Chaco wax by S. A. Celsi and C. Rutt (*Rev. facultad cienc. quím.* (Univ. nacl. La Plata) *12,* 83-9) showed that the wax had a melting point, iodine number and refractive index higher than that of ordinary beeswax. The acid, ester and saponification values were lower.

E. Bourdet (*Rev. marques parfums France 16,* 91-2) briefly reviewed the characteristics and composition of beeswax, and U. S. Navy Specification 52B4c, for the wax, dated June 1, 1938, was recorded in the literature. W. M. Hoskins and Y. Ben-Amotz (*Hilgardia 12,* 83-111) employed a standard beeswax surface in a study of the wetting abilities of aqueous solutions and oil sprays.

Wool Wax (Wool Fat, Wool Grease, Lanolin)

The investigation of Mongolian sheep wool begun in 1936 (see wax review for 1937 in this journal) was continued by M. Saito and T. Tinzei (*Rep. Inst. Sci. Res., Manchoukuo 2,* 171-85, 186-200, 201-219). They found that removal of suint (sweat), or both suint and grease, causes a decrease in tensile strength, elastic limit and Young's modulus of the fibers, but removal of the grease alone cause an increase in these values. The properties of Mongolian and Merino wools were described in detail.

E. W. Pierce (*Can. Textile J. 55,* No. 20, 29-32) pointed to the advantages of the so-called frosted wool process for degreasing wool (see wax review for 1938 in this journal). He also discussed other methods for scouring wool and modern equipment for conducting the processes. Soaps containing methylcyclohexanol and cyclohexanol are useful for wool scouring, according to J. M. Vallance (*Soap, Perfumery and Cosmetics 11,* 998-9). The various methods used to remove grease from raw wool were discussed by R. Hünlich (*Appretur-Ztg. 31,* 113-4), who detailed the advantages and disadvantages of each process. The use of fat solvents for this purpose was described by the following: A. Foulon (*Seifensieder-Ztg. 66,* 607-8); *Klepzig's Textil-Z. 42,* 301-2; *Wollen & Leinen-Ind. 59,* 200-1), E. Langer (*Spinner u. Weber 57,* No. 21, 35-6), B. A. Ryberg (*Am. Dyestuff Reptr. 26,* p. 461-7). In the latter communication the nature of the material extracted by ethyl alcohol and by ether was given particular attention. The effect of wool fat on the disposal of trade wastes was discussed by H. E. Howe and F. J. van Antwerpen (*Ind. Eng. Chem. 31,* 1329), C. R. Hoover (*Ibid. 31,* 1352) and by S. Sibata (*J. Soc. Chem. Ind., Japan 41,* Suppl. binding 235-6).

The use of fatty alcohols and their sulfonated derivatives for degreasing wool was reviewed from the standpoint of the patent literature by J. P. Sisley (*Rev. gén. mat. color. 43,* 30-3). Recent patents on the extraction of wool fat are given below.

J. Nüsslein and J. von Klenck (*U. S.* 2,137,823; *Fr.* 813,867) treated raw wool with naphthalene and extracted the product at 100° in a centrifuge. The American Chemical Paint Co. (*Brit.* 470,000; 495,193; *Fr.* 830,665) described a system of settling tanks and scouring bowls for treating wool-scouring liquors. The Société pour l'industrie chimique à Bâle (*Brit.* 490,774) developed a new wetting agent which was claimed to be useful for washing raw wool. The product was prepared by sulfonating a derivative of *n*-heptadecylbenzimidazole. Another agent for washing raw wool was prepared by heating cacao fatty acid with cresol until hydrochloric acid ceased to evolve, then treating the resulting tolyl ester with chlorosulfonic acid at 25° together with a small quantity of phosphorus trichloride. This was patented by the Oranienburger chemische Fabrik A.-G. (*Ger.* 666,626). The high-molecular ethylene glycol derived from sperm oil alcohols was sulfonated with chlorosulfonic acid to produce a wetting agent for degreasing raw wool, according to the Deutsche Hydrierwerke A.-G., W. Schrauth and H. Hueter (*Ger.* 670,556). E. Franz (*Ger.* 674,275) prepared slivers from air-dried raw wool by opening-out the wool at a temperature above the melting point of the wool fat. The patent includes the addition of either a mineral or fatty oil to lower the melting point of the wool fat.

L. Haskó (*Vegyi Ipar 37,* No. 21-2, 3-4) determined the characteristics of Hungarian wool fat and found: Acid value 0 to 56, saponification value 88.1 to 95.6, iodine no. (Wijs) 42.7 to 6.9 and unsaponifiable matter 40.0 to 6.4% (Lifschütz method). Unwashed raw wool was extracted in the laboratory using benzene and the wool fat obtained had the following characteristics (average of 25 samples): acid value 9.3, saponification value 98.6, iodine no. 41.8 and Lifschütz no. 48.8. This investigator also reported that the iodine numbers of Australian wool fat vary from 16.5 to 29.5 and that the average for the New Zealand product is 26.5. P. S. Roller (*J. Phys. Chem. 43,* 457-89) included lanolin in a study of the plastic flow of dispersions.

The following rapid plant laboratory method for the rapid determination of grease in wools was determined by J. W. Creely (*Textile World 89,* No. 4, 70; *Textile Mfr. 65,* 221; *Am. Dyestuff Reptr. 23,* No. 8, *Proc. Am. Assoc. Textile Chem. Colorists* P161-2): In a shaking machine agitate 5 gm. of the wool in a 500-ml. Erlenmeyer flask containing 300 ml. of petroleum ether. Shake the flask for 15 minutes and pour 250 ml. of the solvent into a 300-ml. flask and evaporate it to small bulk. Filter this through asbestos into a tared flask. Evaporate the filtrate to dryness, heat the residue for 15 minutes at 100° to 105°, cool and weigh. Multiply the weight of residue by 24 to obtain the apparent grease content. The method is intended to replace the slower Soxhlet extraction procedure. The latter method was investigated by J. L. Jortay (*Teintex 4,* 201-4) who compared ether, petroleum ether, ethyl alcohol, chloroform, acetone and water as degreasing solvents.

According to W. Normann (*Fette u. Seifen 46,* 273-4) the iodine numbers determined by the Kaufmann method (*Chem. Abs. 32,* 1958, 1961) were not noticeably affected by using carbon tetrachloride as a solvent instead of chloroform. In the case of wool fat, however, such a change in solvent reduced the quantity of bromine absorbed in one hour by nearly a half, although the amounts were approximately equal after 19 hours. When iodine numbers were determined by the Wijs method the differences were similar but smaller. When diffuse daylight was excluded an appreciable effect on the results was noted only in the case of the Wijs method. The selection of the solvent may be an important factor in the reliability of iodine number determinations on "abnormal fats" such as wool fat and heat-polymerized linseed oil.

Sperm Oil and Spermaceti

Continued interest in sperm oil was manifested in Japan (see wax review for 1937 and 1938). S. Komori (*J. Soc. Chem. Ind., Japan 42,* Suppl. binding 46-7) prepared unsaturated higher alcohols by hydrogenating sperm blubber oil in the presence of a zinc-chromium-oxygen catalyst, and A. Mugisima (*Ibid. 42,* Suppl. binding 18) investigated the composition of the hydrocarbon oil obtained from the high-pressure hydrogenation of sperm oil. The latter found hydrogenation in the presence of a nickel catalyst gives saturated aliphatic hydrocarbons containing one less carbon atom than the original fatty acid or alcohol present in the oil.

M. Tsujimoto (*Ibid. 41,* Suppl. binding 410-11) conducted research to determine whether the alcohols of bottlenose whale oil (Arctic sperm oil) were the same as those of ordinary sperm oil. It was learned that such was the case. Upon oxidation some secondary decomposition products were formed but the chief products were *n*-nonoic and acetylhydroxynonoic acids. This was taken to mean that the double bond in the molecule of bottlenose oil is located in the middle of the carbon chain. It is thus true oleyl alcohol which corresponds to oleic acid. The unsaponifiable matter of bottlenose oil was studied by Y. Toyama and T. Isikawa (*J. Chem. Soc. Japan 59,* 1193-1201). The following constituents were found: saturated alcohols, saturated hydrocarbons, an unsaturated alcohol, and an unsaturated hydrocarbon. The former comprised *n*-tetradecanol and a small amount of a C_{14} alcohol. Crystalline *n*-hexadecane and a liquid pristane made up the saturated hydrocarbon. The unsaturated alcohol was hexadecenol and the unsaturated hydrocarbon was identified as hexadecene. The latter yielded *n*-hexadecane upon hydrogenation.

Kharitonova, Rubinshtein and Shevlyagina (*Russ.* 46,660) hydrogenated spermaceti until a product melting at 44-5° was obtained. This product was then partially saponified to remove the triglycerides from the ethers of cetyl alcohol.

Other Animal Waxes

In the comprehensive studies on the coccids produced in Japan, M. Kono and R. Maruyama (*J. Agr. Chem. Soc. 14,* 697-701) reported that *Tachardina theae* from Formosa contained 26.06% of waxy substances. This wax was analyzed (*Ibid.* 1364-70) and the following compounds were isolated from a 140-gm. sample: melissyl alcohol 5.68, ceryl alcohol 6.58, cocceric acid 0.70, melissic acid 15.4, myristic acid 33.6, *n*-hentriacontane 0.70, dodecenic acid 8.40 and tetradecylenic acid 24.36 gm. In a later investigation (*Ibid. 15,* 177-81) the wax of this insect was found to contain dodecenoic and tetradecenic acids.

A. F. Suter & Co., Ltd., and A. Janser (*Brit.* 496,-124) developed a process for separating the resin and wax constituents of shellac with the aid of wetting agents such as mono- or tri-ethanolamine. Related to shellac is the gum lac of Madagascar, sometimes called lokombitsika or ant wax. R. Decary (*Rev. botan. appl. agr. trop. 19,* 198-201) reported that the material examined by him contained 28.25% of wax soluble in hot alcohol.

W. Bergmann (*Textile Research 9,* 175-82) continued his studies on silk wax (see 1938 review) and compared the wetting properties of raw and dewaxed silk. He also developed an analytical procedure for the determination of silk wax.

The unsaturated alcohols of karasumi oil were investigated by M. Tsujimoto (*J. Soc. Chem. Ind., Japan 41,* Suppl. binding 322). Both $\Delta^{9,10}$—octadecenol and $\Delta^{9,10}$—hexadecenol were identified in the liquid part of the unsaponifiable matter from this oil. The latter alcohol occurred in larger quantity and was stated to be identical with zoömaryl alcohol previously isolated from sperm-head oil (see *Chem. Abs. 30,* 316).

According to W. Davies (*Australian J. Exptl. Biol. Med. Sci. 17,* 81-4) mutton bird oil, a liquid wax, contains only 0.005% vitamin A and 5 international units per gram of vitamin D.

VEGETABLE WAXES

Cane Wax

C. A. Fort (*Sugar Bull. 17,* No. 4, 4) determined the wax content of three varieties of sugar cane from Louisiana and found that the combined wax and fat present varied from 0.19 and 0.26%, equivalent to an average wax content of 4.5 lb. per ton of cane. It is stated that the use of fertilizers tends to reduce the percentage of wax present. Additional work by the same investigator (*Ibid. 17,* No. 20, 3-4), this time with six varieties of Louisiana cane, showed that the wax content ranged from 0.009 to 0.075% and the fat content from 0.1 to 0.125%. These waxes melted between 70° and 80°. About one pound of wax can be produced from a ton of cane from these varieties.

Cane wax extracted from the press-mud of a sulfitation factory in India was found to contain 43.7% of acids and 53.0% of unsaponifiable matter, according to a report by N. L. Vidyarthi and M. Narasingarao (*J. Indian Chem. Soc. 16,* 135-43). By ester fractionation under reduced pressure the acids were found to be: resin acid 4.5, caproic acid 0.6, palmitic acid 22.7, stearic acid 22.4, oleic acid 41.5 and arachidic acid 3.3%. The unsaponifiable portion contained about 80% of triacontanol (myricyl alcohol); about 10% of a mixture of sterols (brassicasterol, stigmasterol and sitosterol); and about 5% of pentatriacontane, C_{35}-H_{72}. No dibasic or oxy-acids could be found.

Sugar-cane gum, which has a bacterial origin, was analyzed by H. Colin and H. Belval (*Sucr. belge 57,* 373-4; *Bull. assoc. chim. 56,* 481-90). The gum contains from 2 to 3% of a wax which melts at 69-70°.

Cotton Wax

K. Hess, H. Kiessig, W. Wergin and W. Engel (*Ber. 72B,* 642-52) conducted a lengthy investigation on the formation of cellulose in the cell wall of cotton hairs, including the role of the fat-wax complex. The effect of natural or added fats and waxes on the measurement of strength of raw cotton was discussed by C. M. Conrad and E. E. Berkley (*Textile Research 8,* 341-52). The latter investigator (*Ibid 9,* 355-73) found that the wax pattern was more prominent than the cellulose pattern during the development stage when the cell contained only the primary wall. Prominent rings in the wax pattern indicated preferred orientation with the long axis of the wax molecules transverse to the fiber axis. V. N. Bylinkina (*Biokhimiya Kul'turnykh Rastenii 3,* 133-77; *Khim. Referat. Zhur. 1,* No. 11-12, 58) reviewed the existing data on the chemical composition of the cotton plant, including the wax content. The clinging power of single cotton fibers increases up to a certain limit with the amount of natural wax per unit surface, according to research conducted by K. R. Sen and N. Ahmad (*Indian Central Cotton Comm. Tech. Lab., Tech. Bull.* [*B*], No. *25,* 24 pp.; *Indian Textile J. 49,* 239-40). Removal of the wax probably exposes surface corrugations which increase the clinging power.

Removal of fats and wax-like substances by fermentation procedures was discussed by P. P. Viktorov and V. E. Ivanova (*J. Applied Chem.* (U. S. S. R.) *12* 251-61 (in French, 261)). According to L. Kollmann (*Textil Betrieb* Nov., *1938,* 16, 18-20), who studied the action of foams from soaps and other detergents on crude cotton, when the temperature of the foam is below 100° the cotton wax is not removed. H. Gerber (*Melliand-Textilber. 20,* 294-5) employed various sulfonated hydrocarbons to remove wax and pectin substances, and D. T. Milne and F. K. Cameron (*Ind. Eng. Chem. 31,* 1076-8) dewaxed cotton with organic solvents before pulping the cotton with chlorine.

Flax Wax

M. Lüdtke (*Melliand-Textilber. 20,* 253-6) discussed the waste products from retting flax and hemp as a source of wax, and the wax content of flax fibers was considered in investigations by M. A. Sobolev (*L'no-Pen'ko-Dzhutovaya Prom. 6,* 44-7; *Chem. Zentr. 1937, I,* 3571) and by A. F. Sitnin (*Ibid 7,* No. 5, 41-4; *Chem. Zentr. 1938, I,* 3282).

The dust that falls off during the combing of flax fibers was found to contain up to 69% wax in a study carried on by W. Kraszewski and S. Ginsberg (*Przemysl Chem. 23,* 136-8). They stated that the wax was similar to beeswax and had the following characteristics: m.p. 67.3-70°, acid value 17.5-23.8 and unsaponifiable matter greater than 20%. These workers suggest that the extraction of this wax would be economically feasible if larger quantities of the dust were available.

Montan Wax

C. R. Kent (*Australian Chem. Inst. J. & Proc. 6,* 127-38) established the presence of montan wax in Griffin and Cardiff coals of Western Australia. A review of the methods employed for extracting the wax from brown coal and for refining the crude product was prepared by G. C. Baerlocher (*Farben-Chem. 9,* 191-3, 198).

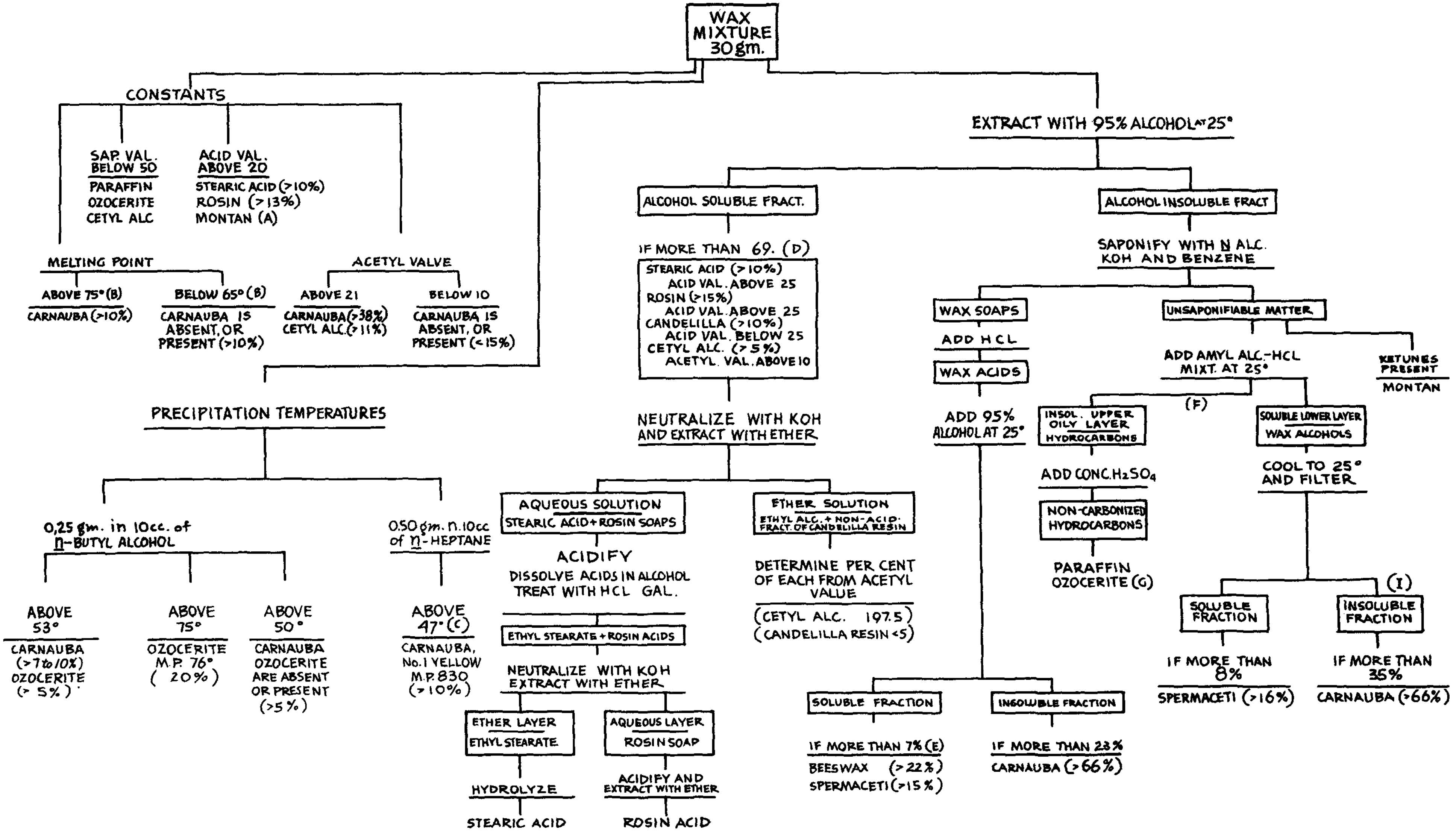
J. Reilly, D. F. Kelly and J. Duffy (*Sci. Proc. Roy. Dublin Soc. 22,* 149-55) conducted a series of experiments on the extraction of wax from peat using petroleum spirits and azeotropic mixtures of this solvent with methyl, ethyl, iso-propyl and *n*-propyl alcohols. The yield of wax was higher when the azeotropic solvent mixtures were employed. Further work on such solvents was reported by Reilly and co-workers (*Ibid. 22,* 181-5, 187-94). In order to separate a mixture of wax and paraffin from tar, M. F. Nikishina and K. K. Ebel (*Russ.* 46, 578) first treat the tar with aqueous alcohol and then with benzene.

Dichromates of potassium and sodium were used by I. R. Romins'kiĭ (*Mem. Inst. Chem. Tech., Acad. Sci. Ukrain. S. S. R.* No. *10,* 95-114 (in English, 116-18)) to refine lignite (montan) wax. The detarred wax was melted in 42% sulfuric acid heated at 105-110°. The dichromate was then added, either in powdered form or in solution, while the hot acid mixture was constantly agitated. The above temperature range was maintained and the process was continued from ten to twelve hours. The oxidation of the wax was conducted in three stages by adding three portions of dichromate, decreasing the quantity added in each succeeding stage. Both the dichromates were judged to be satisfactory as bleaching agents but are somewhat inferior to chromic anhydride. It is necessary to add from 145 to 160% by weight of either dichromate to obtain complete bleaching of the wax. Sodium dichromate is preferred to the potassium salt because it can be added in solution to better advantage. The refined wax was obtained in a yield of 80% by weight, based on the detarred wax. This same investigator (*Ibid.* No. *10,* 119-28 (in English, 130-1) reported that the direct addition of potassium permanganate or manganese dioxide to the sulfuric acid mixture was not satisfactory for refining the wax. Intermediate products which were insoluble in the acid produced a lumpy mass which prevented proper contact between the oxidizing agents and the wax. Better results were obtained by utilizing chromium compounds as intermediate oxygen transmitters. In the first stage of a two-step process Cr^{+++} was oxidized to CrO_4^{--} and the resulting oxidizing solution was then used to refine the wax. The bleaching action was inferior to that obtained with chromic anhydride or the dichromates used previously. In still another study in this series (*Ibid.* No. *10,* 133-60 (in English, 162-3), activated carbon was employed as the bleaching agent. Two methods for using this agent were tried. In the first the dissolved wax was treated with 400 to 600% by weight of activated carbon. The yield of refined wax was only 52% but the refined product was clearer than the detarred wax and had a lower acid value. The other method involved the use of wax before it was detarred but after it had been treated with chromic anhydride. In this case the wax was stirred vigorously with 10 to 20% of activated carbon at a temperature of 110° to 115° for 45 minutes. Treatment for a longer period has no value for increased bleaching.

V. I. Kuznetsov and I. R. Romins'kiĭ (*Ibid* No. *10,* 165-80 (in English, 181-2)) regenerated spent chromium solutions and used the product for bleaching lignite wax. The bleaching was not complete because only 104% of the oxidizer (CrO_3 basis) was employed instead of 120% of CrO_3 normally required. These workers (*Ibid.* No. *10,* 57-70 (in English, 72-4); 75-92 (in English, 93-4)) had previously investigated the use of chromic anhydride as a bleaching agent with gratifying results. The oxidation was conducted in the presence of 42% sulfuric acid and the process was carried out in three stages. The agent was added in the following increments: first step 90%, second step 20% and third step 10%. The corresponding acid additions were 900%, 500% and 500%, respectively (calculated on the basis of cc. per gm. of wax). The temperature was maintained at 106° to 111° for three hours and 40 minutes during the first stage, the chromic anhydride being added during the first three hours and 10 minutes. Small amounts of water were added from time to time to replace that lost by evaporation. Two hours and 20 minutes was the heating time for the second step and three hours and 25 minutes for the third. The mass was then cooled, the chromium solution was decanted and the wax was washed with 42% sulfuric acid, followed by boiling water until the product was acid-free. The yield was 80% of the detarred wax. Oxidation of the wax by chromic anhydride causes partial decomposition of the esters, as well as oxidation of some of the unsaponifiable matter and formation of higher fatty acids.

The purification of peat wax with clay was described by A. P. Katkovskiĭ (*Za Torfyanuyu Ind. 1938,* No. 10, 28-31), who used White Russian clay. The crude wax from peat contained wax 50%, asphaltenes 5%, paraffin 15% and oil 30% was obtained by distilling the peat. The crude product was treated with a mixture of gasoline and acetone at 0° to 5° and the separated wax was filtered off, recrystallized from gasoline, filtered again and washed with acetone. The amount of clay used was 15 to 20% based on the weight of wax, and the treatment was conducted by mixing for 20 minutes on a water bath and filtering at 80°. The refined wax melted at 69-70° and contained from 3 to 5% of oil. When recrystallized from alcohol, the wax contained no oil and the melting point was raised to 74-5°. Another method for purifying peat wax was that proposed by J. Reilly, D. F. Kelly, D. J. Ryan and E. Boyle (*Brit.* 494, 449). The wax was boiled with an aqueous solution of borax and sodium acetate to extract resin. Tar was extracted by treatment with a solvent such as a petroleum derivative, butyl acetate, tetrahydronaphthalene or decahydronaphthalene, or by treatment with a mineral acid followed by a mild alkali. The melting point and hardness of the purified wax can be raised by treatment with enough caustic alkali to combine with the free acids present, and then adding a solution of a calcium or magnesium salt to form an insoluble soap. In an alternate process, the melting point is raised and the acid value lowered by using triethanolamine, ammonia, phenylhydrazine or a salt of this compound, or *a*-naphthylamine. Alcoholic potassium hydroxide may also be employed to decrease the acid value. After the wax is freed from resin and tar it can be bleached by one of the following treatments: (1) nitric acid alone or dissolved in glacial acetic acid or (2) a solution of the wax in a solvent such as carbon tetrachloride or trichloroethylene is treated with gaseous nitrogen tetroxide.

SCHEME FOR ANALYSIS OF WAX MIXTURES



V. I. Kuznetsov and N. S. Trofimovs'kiĭ (*Mem. Inst. Chem. Tech., Acad. Sci. Ukrain. S. S. R.* No. *10,* 3-35 (in English, 36-7)) studied the removal of tar from raw lignite wax. They prepared the wax samples by extracting Alexandrian lignite with benzene. Tar was removed by treatment with ethyl acetate or with benzene-acetone solutions in varying proportions. The extracts were chilled to —7° to —10° and filtered. Both solvent treatments were equally effective and the yields of detarred wax were approximately 70%. The crude wax contained 24.49% tar, 1.93% ash and 5.41% of material insoluble in benzene.

According to V. I. Kuznetsov, N. S. Trofimovs'kiĭ and L. B. Rapp (*Ibid.* No. *10,* 39-54 (in English, 55)), the solubility of detarred lignite wax in benzene, alcohol-benzene, ethyl acetate, and dichloroethane increases with increase in temperature. On the other hand, the solubility of the tar decreases with rise in temperature. It is recommended that wax extraction be carried out at elevated temperature while detarring of the crude wax be conducted without heating.

A procedure for separating fatty acids from Alexandrian lignite wax was developed by V. I. Kutnetsov, I. B. Mizets'ka, L. B. Rapp and E. A. Simzen-Sichevs'ka (*Ibid.* No. *10,* 183-95 (in English 196-7)). The procedure involved the following steps: (1) saponification, (2) conversion of the potassium salts to calcium salts, (3) separation of the unsaponifiable portion (alcohols), (4) separation of the mixed free acids, (5) preparation of the methyl esters of these acids, (6) fractionation of the esters, (7) saponification of the ester fractions, and (8) separation of the free acids for identification.

Successive treatment of fused montan wax with a solution of hydrogen peroxide and then with a chromic acid solution was described in a patent issued to the I. G. Farbenindustrie A.-G. (*Brit.* 488, 381; same as *Fr.* 829,021). It is claimed that the wax can be successfully bleached by this procedure.

Other Vegetable Waxes

W. Kraszewski and St. Hermanowicz (*Przemysl. Chem. 23,* 93-5) isolated hemp wax from waste resulting from the production of hemp. The wax had the following characteristics: m.p. 73-74°, Ivno. 22.2-22.8, acid value 46-47, and unsaponifiable matter 11%.

The temperatures of crystal deposition of stearone and carnauba wax from solutions in 25 organic solvents were determined by K. Kino (*J. Soc. Chem. Ind., Japan 42,* Suppl. binding 186-7). The lowest saturation temperatures for stearone were found in aromatic hydrocarbons, chloroform and carbon tetrachloride; the next lowest in turpentine, hydroaromatic hydrocarbons, cyclic ketones and acetic esters; and the highest in dibutyl phthalate, castor oil and ethylene glycol monomethyl acetate. A somewhat similar behavior was found to be characteristic of carnauba wax but its solubility in the organic liquids was greater.

H. Wagner (*Z. Untersuch. Lebensm. 76,* 449-75; *77,* 225-47) continued his studies on the composition of the wax-like portion of the coffee bean extracted by the Kaffee-Hag process (see 1938 review). Capric and stearic acids could not be found but the presence of palmitic acid and a higher fatty acid having a molecular weight of 310 to 314 was reported. The oily portion of the wax was made up principally of glycerides. Oleic and linoleic acids were identified in the liquid fatty acids. In the unsaponifiable matter, phytosterol (m.p. 138.4°) and kahweol (m.p. 143.5°) were found together with phosphatides. Trigonelline could not be identified. G. B. Martinenghi (*Olii minerali, grassi e saponi, colori e vernici 18,* 112-14) reported that the fats extracted from coffee grounds collected from hotels contained 9.76% of a waxy unsaponifiable substance which had a high melting point and an iodine number of 157.2.

A. Wenusch (Österr. Chem.-Ztg. *42,* 226-31), in a study on the composition of tobacco smoke, found that plant wax was one of the constituents favoring the formation of a neutral smoke.

Guacan wax from *Myrica pavanis* was investigated by O. A. Bisbal (*Rev. farm. Peruana 4,* 9-12; *Rev. flora med. 1,* 554). This fruit wax contained the following: stearic acid 30%, palmitic acid 20.5%, oleic acid 20.5% and unsaponifiable matter 24%.

H. Friese, E. Clotofski and R. Döderlein (*Ber. 72B,* 1226-32) studied the composition of the wax-like extractive from pine bark, and O. F. Ungnade (*Oil and Soap 16,* 60) established the presence of long-chain aliphatic alcohols in the unsaponifiable portion of oil from the African palm (*Elaeis guineensis*) F. Hawke (*J. S. African Chem. Inst. 21,* 57-58) reported that the cloudiness in a batch of refined sesame oil was caused by a white, waxy substance which melted at 80.5°. The substance was insoluble in ether but was soluble in hot absolute ethyl alcohol and in benzene. Tests showed the absence of nitrogen, sulfur, halogens, sterols, glucosides and carbohydrates. T. Hata (*J. Chem. Soc. Japan 59,* 1099-103) found that pineapple seeds contained 1.8% of an oil which comprised a mixture of fat and wax, and a dark waxy solid was obtained from the unsaponifiable matter of wheat bran oil by E. C. Barton-Wright (*Cereal Chem. 15,* 723-38). A higher aliphatic alcohol mixed with paraffin hydrocarbons was reported by L. Schmid and W. Hosse (*Mikrochemie 26,* 59-66) to be present in the unsaponifiable portion of the cornpoppy flower. The removal of waxes from fibrous cellulose materials was included in a patented process described by C. Ruzicka, C. V. Sale and G. S. Sale (*Brit.* 501,485).

A. C. Hulme (*Dept. Sci. Ind. Research* (Brit.), *Rept. Food. Invest. Board 1937,* 123-4) found that the wax content of apples increases during the early stages of storage. There was an increase in the fraction soluble in cold alcohol from 139.4 to 175.5 milligrams per gram of fresh tissue. The fraction insoluble in alcohol but soluble in ether likewise showed an increase (14.5 to 36.1 milligrams).

Cerotic acid was identified among the constituents of the bark of *Tabernaemontana coronaria* by A. N. Ratnagiriswaran and K. Venkatachalam (*Quart. J. Pharm. Pharmacol. 12,* 174-81), and a wax alcohol melting at 114° was found by A. E. Rheineck (*Pharm. Arch. 10,* 69-80) in the seed hairs of *Asclepias syriaca.* M. P. Gupta and S. Dutt (*Proc. Natl. Acad. Sci. India 8,* 49-52) isolated a wax from *Indigofera linifolia.* This wax had the formula $C_{42} H_{84} O_2$, melted at 78-9°, and was stated to be a ceryl ester of palmitic acid.

According to M. L. Jacobs and W. R. Lloyd (*J. Am. Pharm. Assoc. 28,* 408-12) *Kalmia augustifolia* contains a wax alcohol, probably "carnaubyl alcohol." A combined fat and wax content of 1.06% was reported to be present in *Solidago serotina* by A. Castiglioni (*Ann. accad. agr. Torino 80,* 51-7), and P. J. Jannke (*Pharm. Arch. 9,* 65-75) isolated a black wax-like solid from *Gnaphalium obtusifolium.* The material had a saponification value of 123-127. Waxes were also reported to be present among the constituents of *Adonis cupianus* by A. Gatto (*Arch. farmacol. sper. 67,* 226-

31), and of *Vitis quadrangularis* by P. B. R. Murty and T. R. Seshadri *(Proc. Indian. Acad. Sci. 9A,* 121-7).

H. des Abayes *(Bull. soc. sci. Bretagne 14,* 154-64) separated a wax from the lichen, *Cladonia subfrangiformis,* and a light yellow, waxy solid was obtained from yeast by E. S. Cook and C. W. Kreke *(Studies Inst. Divi Thomae 2,* 47-9). The composition of the waxes extracted from human, bovine and avian tubercle bacilli was investigated by R. J. Anderson and coworkers *(J. Biol. Chem. 126,* 505-13, 515-26, 527-41; *129,* 57-63). The wax fraction of leprotic nodules was studied by E. M. Paras *(Philippine J. Sci. 66,* 155-60).

EXTRACTION, REFINING, PROCESSING AND COLORING

Solvents from hexane to nonane, inclusive, were proposed for extracting waxes by C. Gower *(Can.* 378, 341), and a continuous rotary-drum apparatus for extracting, filtering and drying materials containing waxes was described by E. Bartusch *(Ger.* 671, 230).

A powdered hard wax, such as montan wax, is refined by treatment with cold 55% nitric acid and the mixture is then warmed to 80° for a short time, according to a patent issued to Werner & Mertz A.-G. *(Ger.* 674, 282). In an alternate process treatment with the acid at 65-80° may be used, but in either case the impurities are precipitated by adding paraffin wax followed by a small amount of hydrogen peroxide. Amines and imines are employed for extracting impurities from waxes according to patents granted to the N. V. de Bataafsche Petroleum Maatschappij, S. L. Langeclijk and W. Coltof *(Dutch* 44,533 and 44,737). Waxes and other substances immiscible with water are refined by heating them to a temperature of 200° to 400° and injecting either cold or hot water, according to the Industrie chimique de Paris *(Fr.* 832,170). It is claimed that the impurities are removed by the steam formed in the process.

P. Irmen *(Brit.* 503,607) described the following process for hydrogenating beeswax: a solution of 70 grams of the wax in 1000 grams of olive oil, heated to 95-100°, is stirred into a boiling solution of 30 grams of a 1:1 mixture of sodium and potassium phosphates in 2000 grams of water. On cooling, the wax-oil mixture rises to the surface and is washed with warm water after the lower emulsion layer is drawn off. It is stated that the method is applicable to other waxes. The I. G. Farbenindustrie, W. Pungs and M. Jahrstorfer *(Ger.* 665, 535) improved the properties of natural waxes by treating them with hydrogen at a pressure of 100 to 150 atmospheres and a temperature of 200° to 220°, in the presence of a cobalt or nickel catalyst. I. P. Petryaev *(Masloboĭno Zhirovoe Delo 14,* No. 5, 17-18) hydrogenated porpoise oil at 240° to 270° in the presence of 0.45% of a nickel catalyst.

When distilled at 20 mm. pressure, montan wax gives 94% of distillate, according to B. G. Simek and J. Ludmila *(Congr. chim. ind., Compt. rend. 18me. congr., Nancy* Sept.-Oct., *1938,* 888-902). The Rütgerswerke A.-G. and L. Kahl *(Brit.* 499, 924) developed a process for recovering the products formed by the distillation of waxes and similar substances, and K. C. D. Hickman and A. O. Tischer *(Brit.* 489-623) patented an apparatus for the short-path, high-vacuum distillation of animal oils and waxes (see also *Brit.* 479,802; 480,885; and *Fr.* 812,734 in the 1938 wax review).

Gas-fired pans for melting waxes were described by N. H. Greenway (*Gas. J. 225,* 53-4.)

Benzoic and substituted phenoxalkyl carboxylic esters may be used as solvents for waxes, according to the I. G. Farbenindustrie A.-G. *(Brit.* 502,375), and the use of isobutyl acetate for the same purpose was described by W. M. Bruner and V. W. Ware *(Paint, Oil Chem. Rev. 101,* No. 19, 9-11, 16).

Dyes for coloring waxes were patented by H. Neresheimer, A. Vilsmeier and K. Heymann *(U. S.* 2,135,-259); Neresheimer and Vilsmeier *(U. S.* 2,158,296); K. Köberle *(U. S.* 2,163,950); I. G. Farbenindustrie A.-G. *(Brit.* 487,705; 489,562; 490,018; 501,742; *Fr.* 830,224); Société pour l'ind. chim. à Bâle *(Brit.* 498,-575; *Ger.* 673,025).

PHYSICAL, CHEMICAL AND BIOCHEMICAL PROPERTIES

The properties of wax acids with 24, 26, 28, 32 and 36 carbon atoms, and their methyl and ethyl esters, were reported by F. Francis and S. H. Piper *(J. Am. Chem. Soc. 61,* 577-81). Lead and copper soaps of cerotic acid were investigated by J. D. Piper, A. G. Fleiger, C. C. Smith and N. A. Kerstein *(Ind. Eng. Chem. 31,* 307-17). Various properties of cetyl alcohol were studied by M. M. Davies and G. B. B. M. Sutherland *(J. Chem. Phys. 6,* 767-70); J. Michel *(Bull. soc. chim. Belg. 48,* 105-57); N. I. Glazov *(J. Phys. Chem.* (U. S. S. R.) *11,* 484-91); S. I. Sklyarenko and M. K. Baranev *(Ibid. 12,* 271-6); A. Ksenofontov, M. Proskurnin and A. Gorodetzkaya *(Ibid. 12,* 408-10; *Acta Physicochim U. R. S. S. 9,* 39-44); P. A. Rebinder and A. A. Trapeznikov *(Acta Physicochim. U. R. S. S. 9,* 257-72 (in English); and A. A. Trapeznikov *(Ibid. 9,* 273-312; *10,* 65-82 (in English).

The hydrocarbons found in waxes were described by J. Hadáček (Příroda *29,* 20-4; *Chem. Obzor 13, Abstracts* 132.

L. Ivanovszky has maintained for quite some time that solvent retention capacity is a useful property for the evaluation of waxes and wax mixtures. His latest contribution to this subject *(Oil Colour Trades J. 96,* 365-70) deals mainly with the investigation of mixtures of ozocerite and paraffin wax and discusses the relationship between retention capacity and setting point. He states in this connection that beeswax has a markedly lower, and bleached montan a markedly higher, retention than would be expected from the setting points of the two waxes.

The viscosities of fatty acids and cetyl alcohol in organic solvents were measured under the influence of electric fields by O. Kimura *(Bull. Chem. Soc. Japan 14,* 243-9). Correlations between molecular weight and viscosity of high-molecular weight compounds such as hydrocarbons and alcohols were discussed by F. Hoyt and H. Gilman *(Proc. Iowa Acad. Sci. 45,* 133). A method for determining the surface tension of solids, based on Antonoff's rule *(Chem. Abst. 26,* 3417) was proposed by this investigator *(Ann. Physik 35,* 84-96). The surface tension of wax was measured by this procedure. The conventional methods employed to determine the coefficient of expansion of liquids can be applied to liquid or solid waxes, according to Löwe *(Seifensieder-Ztg. 66,* 105).

B. A. Talmud and D. L. Talmud *(Acta Physicochim. U. R. S. S. 10,* 481-90 (in English)) determined the catalytic activity of enzymes on organic adsorbents, including cetyl alcohol. The average oxidizing power of *Acetobacter peroxidans, A. rancens* and *Bacterium aceti* was 0.8 for cetyl alcohol (ethyl alcohol = 1000), according to studies conducted by K. Tanaka *(J. Sci.*

Hiroshima Univ. B, II, *3,* 121-34 (in German)). The influence of the male sex hormone on the fat content of rabbits fed on a diet containing lanolin was determined by H. S. Lee *(Japan J. Dermatol. Urol. 43,* 53-4), and Kon's silver reaction of endocrine organs of the rabbit fed with lanolin and lecithin was studied by S. Omura and F. Osaku *(Trans. Soc. Path. Japon. 28,* 40-2). N. Imai *(Nagoya Igakki Zasshi 47,* 245) rubbed the skin of rabbits with lanolin and reported that the treatment increased the cholesterol content of the skin. According to M. Honsyō *(Ibid. 47,* 1259) a diet high in lanolin increases the cholesterol present in the spleen of rabbits.

R. Maccolini *(Boll. soc. ital. biol. sper. 13,* 900-3) reported that lanolin apparently has no modifying effect on the immunizing ability of glucide-lipoid antigens, and R. W. Benham *(J. Investigative Dermatol. 2,* 187-203) discovered that the lipolytic fungus, *Pityrosporum ovale,* grows on Currie's agar if enriched with lanolin.

E. Somekawa *(Sci. Papers Inst. Phys. Chem. Research* (Tokyo) *35,* 121-9) disclosed that when rats were fed on a diet containing 10 to 15% of Arctic sperm oil they contracted seborrhea and died in a few weeks. Cetin prepared from either the head oil or the blubber oil of the sperm whale by recrystallation from acetone did not produce seborrhea. The oil which diffused from the skin of rats suffering from this malady had I no. 76 and sapon. value 96.67. It contained a 3 to 1 mixture of oleyl and cetyl esters of an unsaturated acid having an acid value of 171.485, I no. 77.34. The acid contained 22 carbon atoms with one double bond. A free acid, a free alcohol, and a resin were also found in the oil.

COMPOUNDS DERIVED FROM WAXES

In a process for recovering high-molecular fatty acids which was patented by the I. G. Farbenindustrie A.-G. *(Brit.* 494,853), the acids or their soaps are extracted from the crude mixtures with the aid of solvents. These mixtures may comprise the oxidation products of paraffin or montan wax or the saponification products of beeswax, carnauba wax, montan wax, sperm oil or wool fat. The unsaponifiable matter is extracted from the saponified mixtures by employing a fat solvent such as benzine, benzene, toluene, xylene, carbon tetrachloride, trichloroethylene, monochlorobenzene, carbon disulfide or diisobutyl ether mixed with a monohydric alcohol, ether, ester or ketone such as propyl alcohol, isopropyl alcohol, butyl alcohol, amyl alcohol, acetone, methyl ethyl ketone, ethyl acetate or ether, all of which contain from 3 to 6 carbon atoms. The fatty acids are liberated from the purified soap by treatment with a mineral acid. When the crude products contain a large proportion of unsaponifiable matter, a preliminary extraction with a solvent from the latter group is recommended.

R. Greenhalgh and Imperial Chemical Industries Ltd. *(Brit.* 488,036) prepared nitrites of cerotic and melissic acids by causing phosgene to react with a primary amide of the acid.

EMULSIFICATION

T. W. Dickeson *(Brit.* 487,855) claimed that activated gelatinous aluminum hydroxide is suitable as an emulsifying agent in the preparation of polishes, coating compositions and similar products. E. E. Mayer and M. Rothwell *(Brit.* 491,229) prepared concentrated aqueous dispersons of wax and rosin by heating paraffin, esparto, candelilla, wool or montan wax (10 to 95%) with rosin and 12 to 25% of water and 2 to 20% of alkali. The heating was continued until the mixture did not separate into layers on cooling. Various other ingredients such as starch, animal glue, casein, rubber latex, coloring agents, fungicides and insecticides were incorporated to produce a variety of technically useful compositions. According to a patent granted to E. I. du Pont de Nemours & Co. *(Brit.* 492,742) the diethylcyclohexylamine derivative of dodecyl sulfate is an emulsifying agent for carnauba wax or beeswax. Howards & Sons Ltd. and L. C. West *(Brit.* 501,521) proposed a cyclohexylamine soap of stearic, oleic, ricinoleic or linoleic acid, or of cycloaliphatic fatty acids or naphthenic acids as emulsifying agents for animal and vegetable waxes. Molten waxes were emulsified in a high-speed rotary apparatus by G. R. Holdsworth *(Brit.* 495,107). The I. G. Farbenindustrie A.-G. *(Brit.* 493,221) employed a sulfonation product of a high-molecular olefin for breaking emulsions of oils, fats and waxes. The same firm *(Brit.* 505,983) prepared clear, stable emulsions of waxes with the aid of phosphatides such as lysolecithin and lysocephalin.

Alkyl ethers of hydroxyalkyl amines and their derivatives were patented as emulsifying agents for waxes by Zschimmer & Schwarz chemische Fabrik Dölau *(Fr.* 832,288).

Emulsifiable wax compositions, prepared by treating unsaturated waxes with a sulfite and an oxidizing agent, were described by the I. G. Farbenindustrie A.-G. *(Ger.* 672,491; 672,492). This firm *(Ger.* 674,874) made a colloidally soluble product by heating wool fat with metallic sodium for one hour at 150° (see also *Brit.* 483,315 in the 1938 review). Another I. G. patent *(Ger.* 671,091), relating to colored wax emulsions, corresponds to *U. S.* 2,128,025 covered in last year's review. A stable aqueous emulsion of soft wax was prepared by using electrochemical equivalent quantities of the alkali salt of the dodecyl ester of sulfuric acid and laurylpyridinium bisulfate, according to Böhme-Fettchemie-G.m.b. H. and E. Grötte *(Ger.* 668,889).

ANALYSIS

S. Zweig *(Dissertation,* Columbia University, College of Pharmacy, *1939,* 89 pp.) developed a procedure for the identification of the commonly used waxes in admixture. The research was conducted in three stages: (1) determination of the solubility of waxes in different types of organic solvents, (2) determination of the precipitation temperatures of wax solutions at different concentrations, and (3) separation by physical and chemical methods of the homologous compounds and a comparison of their properties. In the first stage the object was to investigate the possibility of separating mixtures of waxes by the use of selective solvents. Solubility data expressed in grams of wax per 100 cc. of solvent was determined for stearic acid, spermaceti, beeswax, candelilla wax, crude montan wax, bleached montan wax, three grades of paraffin, two grades of ozocerite, and two grades of carnauba wax in the following solvents: hexone, dibutyl ether, isopropyl ether, ethyl ether, pent-acetate (a mixture of acetates of the isomeric amyl alcohols), isopropyl acetate, butyl acetate, methyl cellosolve acetate, butyl lactate, petroleum ether, heptane, benzene, ethylene chlorhydrin, ethylene dichloride, amyl chloride, pentachloroethane, carbon tetrachloride, trichloroethylene, chloroform, methyl chloroform, mesityl oxide, diacetone, cellosolve, methyl cellosolve, acetic anhydride, tertiary amyl acetate, *n*-hexanol, methyl *n*-amyl ketone and acetone. It was found that spermaceti and stearic acid were in all cases more soluble than the other waxes. In general the waxes at room temperature did not dissolve completely in most solvents, even when as little as 1% of the wax was employed. At higher temperatures, especially above the melting point of the wax, they were freely soluble even in some of the poorer solvents. Except for ethylene chlorhydrin, the chlorinated solvents were superior to all others and pentachloroethane was reported to be the best solvent of all those investigated. Benzene had the greatest solvent power of all the non-chlorinated compounds. Solubility of the hydrocarbon waxes decreases with increase in melting point. Based on precipitation temperatures, the waxes were arranged in order of their increasing solubility as follows: ozocerite 76/78, carnauba No. 1 yellow, ozocerite 65/67, refined carnauba, candelilla, bleached montan, beeswax, paraffin 138/40, paraffin 133/35, paraffin 125/27, spermaceti, stearic acid. Exceptions to this regular order were noted with a few solvents. Attempted separation of waxes by selective solubility did not yield promising results, but adaptation of solubility data as indicated by precipitation temperatures is useful in analysis when employed in conjunction with other experimental evidence.

The second stage of the above investigation was concerned with a detailed study of precipitation temperatures of waxes in several solvents with the following results: The precipitation temperatures (*PT*) of solutions of wax mixtures in *n*-butyl alcohol and in *n*-heptane can be employed for detecting carnauba wax and ozocerite when mixed with other waxes, within the limitations given below. A *PT* in *n*-butyl alcohol above 65° for a solution of 0.125 gm. of wax in 10cc. of solvent indicates the presence of a high-melting ozocerite. If the *PT* for the solution is between 50° and 60° the mixture probably contains either ozocerite, carnauba No. 1 yellow or refined carnauba, or all three. An exact identification can then be made by correlating the *PT* data from *n*-butyl alcohol and *n*-hexane, and from separating the components as described in the third part of the study below. If the *PT* is above 46° for 0.5 gm. of wax in 10cc. of *n*-heptane, the presence of carnauba No. 1 yellow is indicated. The presence of candelilla wax or rosin in the mixture interferes with the determination in *n*-hexane but not in *n*-butyl alcohol. When the *PT* is below 50° the absence of carnauba and/or ozocerite can be inferred very definitely.

In the third part of the research beeswax, candelilla, carnauba, bleached montan and spermaceti were seprated into the following fractions: fraction soluble in ethyl alcohol at 25°, fraction insoluble in alcohol at 25° (this was divided into the fraction soluble in aqueous alkali after saponification, fatty acid fraction soluble in alcohol at 25°, and the fraction insoluble in alcohol at that temperature). The unsaponifiable matter was divided into three portions as follows: matter insoluble in boiling amyl alcohol-hydrochloric acid mixture, alcohols and other unsaponifiable matter soluble in the above boiling mixture but insoluble at 25°, and matter soluble in amyl alcohol at 25°. The properties of each fraction were determined and the resulting data were tabulated and discussed, but the information obtained is too extensive to permit its inclusion within the limited scope of this review.

Based on the information obtained in the foregoing research, Zweig prepared the accompanying schematic outline for the analysis of wax mixtures. The letters shown on the outline correspond to explanatory notes as follows: (A) variations in composition prevent any definite statement as to quantity present; (B) based on data taken from the literature; (C) candelilla interferes with determination of precipitation temperatures in *n*-heptane since cloudy solutions are formed; (D) candelilla resin and rosin form cloudy solutions in *n*-heptane; (E) all per cent figures are based on the weight of wax mixture sample; (F) absence of a solid hydrocarbon fraction indicates absence of paraffin and ozocerite, and presence of candelilla (>5%), beeswax (>10%) and montan; (G) 20 to 30% of crude ozocerite is attacked by concentrated sulfuric acid; (H) the hydrocarbons from candelilla, beeswax and montain are carbonized; and (I) since the alcohols of other waxes are also found in this fraction and since they are closely related to the carnauba alcohols, the fraction is of value only in the presence of over 60% of carnauba wax.

H. Taub and S. Zweig (*J. Am. Pharm. Assoc. 28,* 135-9) studied the microscopy of waxes and of known mixtures of these products. Crystals were obtained by dissolving the wax in a solvent with the aid of heat and allowing the solution to cool spontaneously to room temperature. Each wax tended to produce one, or at most, two distinct types of crystal formation. Because of its dual action as a solvent and a reagent, monoamylamine proved to be very useful in this work. Crystals were also obtained using *n*-butyl alcohol as the solvent. Apparently characteristic crystal formations were obtained with beeswax, carnauba wax, candelilla wax and ozocerite, using monoamylamine. Unusual structures were produced by potassium stearate in *n*-butyl alcohol and cerotic acid in monoamylamine. It is suggested that this technic may prove useful in identifying the constituents of wax mixtures.

INDUSTRIAL USES

Polishing and Floor Wax Compositions

According to C. Becher, Jr. (*Seifensieder-Ztg. 66,* 9-10, 27-8, 47-8), in the preparation of non-aqueous wax dispersions for use as high-quality polishes the wax should be dispersed in the solvent in the form of very fine crystallites or even colloidally. Substitutes for turpentine, such as benzine, produce coarser dispersions than desired but the condition can be corrected by proper wax selection (such as formulating with ozocerite and possibly with soft waxes) and by employing decalin as one of the components of the dispersing medium. C. Lüdecke (*Ibid. 65,* 667-8, 691-3, 711-12, 731-2, 751-2) described floor-wax compositions containing antiseptics, and H. Barron (*Rubber Age* (London) *19,* 301-3) suggested the following polish for rubber flooring: an emulsion of carnauba wax 87, oleic acid 9, triethanolamine 4.9 and water 500 parts. If this gives a finish that is too slippery the following composition should be used: carnauba wax 13.2, oleic acid 1.5, triethanolamine 2.2, shellac 2, borax 1, 28% ammonium hydroxide 0.32 and water 99 parts.

A waxy polishing composition for use on leather and lacquered surfaces, patented by W. Hentrich and C. A. Lainau (*U. S.* 2,139,231), was prepared from the monobasic carboxylic acid ester of a perhydrogenated novolak. A Shapiro (*U. S.* 2,153,161) proposed an aqueous emulsion containing carnauba wax, a hydrocarbon solvent boiling at 180-260°, and triethanolamine for polishing automobiles and furniture. G. Kaufman (*U. S.* 2,167,438) described an apparatus for the manufacture of wax polishes.

An emulsifiable wax composition suitable for preparing a variety of polishes was developed by M. G. G. Noncle (*Fr.* 837,418). It was prepared from candelilla wax 20-95, shellac wax 5-50, montan wax 0.5-10, stearic acid 1-50, zinc stearate 0.05-20%, with or without other ingredients. If metal polishes are prepared from the mixture, it is emulsified in white spirit in the presence of ammonia or an amine and abrasives are added. The Boston Blacking Co. (France) (*Fr.* 837,935) prepared shoe polishes by suspending fine particles of wax in water with the aid of atomization.

A 6 to 30% solution of sodium silicate was intimately mixed with beeswax or wax substitutes to form a floor polish by E. Ottopál (*Hung.* 119,125). I Baranyai, Jr. (*Hung.* 120,405) proposed a shoe polish made by melting wax, saponifying it with alkali and then adding water and lanolin.

A mixture of distilled water, turpentine, wax, carbon tetrachloride, paraffin, montan wax, Japan wax, potash and amyl acetate was suggested by E. Grotz (*Swiss* 203,097) as a cleaning composition for glass, wool, leather, etc. The same patentee (*Swiss* 203,145) developed a somewhat similar composition for use as a furniture polish.

C. S. Glickman (*Soap* (*Sanitary Products Sect.*) *14,* No. 10, 86-8, 101-103; No. 11, 95, 97, 99, 117) contributed a comprehensive discussion on the evaluation of modern polishes. The various types of wax polishes now being marketed were considered from the following standpoints: ease of application, wearing qualities, drying, resistance to water, nonslipperiness, scuffing, degree of dispersion and gloss (or luster). Twelve brands of water-emulsion polishes showed the following composition on analysis: solids 11.58 to 17.59 and carnauba wax 7.18 to 11.49 (average 9.84)%. The dry matter had the following average composition: borax 4, wax 65, soap 17, shellac 14, wax-soap ratio 4.01:1 and wax-lac ratio 5.38:1. According to that writer, an ideal water emulsion polish should contain at least 17% of carnauba wax of the highest quality and a soap which will not darken the wax. Also the gloss should increase after the polish is applied and during the first stages of wear. The same author discussed federal, state and other specifications for floor waxes (*Ibid. 15,* No. 3, 90-2, 107-109).

M. Fuld (*Ibid. 15,* No. 1, 95, 97-8, 113) likewise discussed the various specifications for floor waxes. He developed a machine for determining the coefficient of friction by the principle of oblique-thrust and employed it to determine the slipperiness of wax finishes. Various waxes gave coefficients of friction varying from 0.1623 to 0.3000. It was ascertained that maximum slipperiness of a wax finish developed three days after application. Water resistance of such finishes was also determined. In a latter communication (*Ibid 15,* No. 8, 99, 101, 103, 105, 107, 109, 113, 127) the same investigator described testing surfaces and tests for slip, wear, gloss, washability and tracking of floor waxes. W. König (*Farben-Ztg. 44,* 791-3, 817) studied the gloss of polishing agents from the standpoint of the unit of work expended in polishing. He rated the effectiveness of a polishing agent in terms of work expended to obtain the desired gloss, and devised a machine for measuring the gloss photoelectrically.

Reviews and discussions pertaining to wax polishes were prepared by the following: F. v. Artus (*Farben-Chem. 9,* 366-70, 405-9, 414); G. S. Collingridge (*Chem. Age* (London) *40,* 448-50); F. Ohl (*Allgem. Ole-u. Fett-Ztg. 35,* 528-32); G. Schröder (*Farbe u. Lack 1939,* 147-8); W. Meyer (*Ibid. 1939,* 159-60); A. Kraus *Holz. Roh-u Werkstoff 1,* 465-9; *Rev. Current Lit. Paint, Colour, Varnish & Allied Ind. 12,* 88); F. Ohl (*Kunstoff-Tech. Kunstoff-Anwend. 9,* 56, 58-60, 62-3); W. Meyer (*Seifensieder-Ztg. 64,* 1011-12, *65,* 168-9, 188-90, 347-8); and F. v. Artus (*Ibid. 66,* 174-5, 235-6, 279, 280, 299, 300, 319, 320, 340, 359, 360, 379, 380, 399, 400, 438, 439, 458, 459, 478-80, 498-9, 518-19). One book on these products made its appearance: J. Davidsohn and A. Davidsohn, "Shoe Creams and Polishing Waxes," London, Leonard Hill, Ltd., 142 pp., 10s. 6d. (Reviewed in *J. Intern. Soc. Leather Trades Chem. 22,* 527; *Chem. Trade J. 103,* 420).

Molding, Plastic and Resinous Compositions

Phonograph records prepared from vinyl polymers and containing vegetable wax were described by N. Tregubov (Novosti Tekhniki *1939,* No. 31-2, 50-1), and records made from the same type of resin with montan wax added were investigated by I. P. Losev, *et al.* (*Org. Chem. Ind.* (U. S. S. R.) *6,* 164-7). Waxes may be added to a coating composition for dental impression material according to a patent granted to Surgident Ltd. (*Brit.* 500,000). F. Schoenbeck and E. Czapp (*Ger.* 676,302) proposed a mixture of lightly tanned gelatin, glycerol and a solid wax alcohol for filling teeth. A process for making porcelain dentures involving the use of a wax pattern was developed by Erdle & Prange, Inc. (*Brit.* 493,042).

Methacrylate resin hot-melt blends with waxes and the emulsification of such compositions were described by D. E. Strain, R. G. Kennelly and H. R. Dittmar (*Ind. Eng. Chem. 31,* 382-7), and blends of natural resins with waxes were among the products discussed by C. L. Mantell, A. Skett, R. W. Allan, J. H. Holzberger and C. W. Kopf (*Official Digest Federation Paint & Varnish Production Clubs 1939,* No. 183, 74-83).

D. E. Strain (*U. S.* 2,141,546) esterified acryloxy carboxylic acids with alcohols such as cetyl alcohol to form molding, coating and film-forming compositions. Waxes may be added to the products specified. G. D. Graves (*U. S.* 2,146,209) also proposed the addition of waxes to synthetic resins, in this case to resinous imides of substituted acrylic acids. Resinous olefin-sulfur dioxide reaction products, which may be either used alone or blended with waxes, were patented by C. S. Marvel and D. S. Frederick (*U. S.* 2,169,363).

The addition of waxes to resinous imides was covered in a patent granted to E. I. du Pont de Nemours & Co. and G. D. Graves (*Brit.* 505,354), and to urea-aldehyde condensation products in a patent to the same company (*Brit.* 494,700). Derivatives of sperm oil were employed as surface-tension-reducing agents for aldehyde resins by the I. G. Farbenindustrie A.-G. (*Brit.* 496,815). The products were suggested for use as shellac substitutes in polishes, paper sizes, insulating compositions or sound records. The same company (*Brit.* 503,595) described resinous condensation products of olefins with montan wax or other waxy substances. According to the N. V. Philips' Gloeilampenfabrieken (*Brit.* 490,447) the following procedures may be followed in producing a heat-hardenable phenolic resin: (1) a cresol-formaldehyde resin and montan wax blend is heated before or after hot-pressing, and (2) a mixture of cresol-formaldehyde resin, powdered mica and montan wax, with or without the addition of tritolyl phosphate, is heated before hot-pressing. In a patent issued to the Standard Oil Development Co. (*Brit.* 491,199) provision is made for the addition of waxes to polymeric cellulose compositions.

Wax was employed as a plasticizer in thermoplastic, pressure-sensitive compositions suitable for removable coatings on paper by A. Abrams and G. W. Forcey (*U. S.* 2,142,039). M. Bandli (*Fr.* 829,550) proposed the use of mixtures of cellulose ethers and waxes as plasticizers for synthetic resins, fixatives for perfumes, or as varnishes.

The use of waxes or their derivatives in compositions for making films, composite wrapping sheets and the like was described in the following patents: A. Hershberger (*U. S.* 2,138,578; 2,159,151-2); A. O. Daller (*U. S.* 2,143,844); E. Gebauer-Fuelnegg and E. W. Moffett (*U. S.* 2,156,755); W. H. Charch and D. E. Bateman (*U. S.* 2,159,007); N. F. Beach (*U. S.* 2,166,-711); F. M. Meigs (*U. S.* 2,169,366); J. G. Moore, E. Moores and Imperial Chemical Industries, Ltd. (*Brit.* 488,937); M. F. Monbiot and J. R. E. Stoddart (*Brit.* 498,053); British Waxed Wrappings Ltd. and R. J. Browne (*Brit.* 501,749). Studies conducted by J. Seiberlich (*Pulp Paper Mag. Can. 40,* 19-20) on the behavior of solutions of fats, waxes and cellulose derivatives, when spread on the surface of water, pointed to a close relation between the permeability of thin cellulose lacquer films and the formation of either clots or unimolecular films on the water surface.

Waterproofing, Coating and Impregnating Compositions

F. v. Artus (*Farben-Chem. 10,* 326-8, 349) described a belt dressing comprising rosin mixed with wool fat, montan wax or similar products, and W. Meyer (*Seifensieder-Ztg. 65,* 832-4, 851-3, 872-3, 892) discussed edge waxes among the products used in the etching of glass. P. F. Bruins and W. H. Gardner (*Ind. Eng. Chem. 31,* 1178-81), in a study of packaging shellac varnishes recommended coating the inside of the can with a modified wax. This procedure prevents contamination of the shellac with iron from the can. It is stated that one part of iron in 500 parts of the varnish makes the product unsuitable for application to bare wood. R. Grader (*Asphalt Teer Strassenbautech. 39,* 467-70) reported that the addition of 5% of paraffin, whole asphalt, montan wax or chlorinated rubber lowered the moisture permeability of bitumens.

D. B. Williams (*U. S.* 2,167,140) specified cetyl alcohol as a dust-laying and sealing agent for the inner surfaces of gas-distribution conduits. An acid resist powder for use in etching, patented by D. B. Alnutt (*U. S.* 2,168,756), was prepared from a filler such as soapstone, a synthetic resin-carnauba wax mixture, talc, aluminum stearate and a coloring material. Dewey & Almy Pty. Ltd. (*Australian* 107,408) proposed a coating composition made from a wax and depolymerized rubber.

An emulsion of tallow 6, beeswax or other ester of cerotic acid 1, water 30 and soap 3 parts was specified as a composition for preserving belts and ropes by E. Pfahl (*Brit.* 488,643). According to E. W. J. Mardles (*Brit.* 505,482) a composition for protecting metal or wood is prepared from wool fat (with or without solvent) and a natural or synthetic hard wax. Up to 50% of wax may be added. Beeswax, carnauba wax and high-melting paraffin are cited in examples.

Deutsche Erdöl A.-G. (*Fr.* 834,024) prepared emulsions of unsaturated asphalts containing water-repellent substances such as wax and suggested their use as coating or impregnating compositions. A fluid coating material, made from rubber, wax and/or resin, dissolved in a naphtha solvent, was claimed by International Cottaphane Ltd. and C. R. Hill (*Fr.* 838,811).

Halogenated polymerization products of hydrocarbons may be added to wax for preserving wood, according to the Standard Oil Development Co. (*Ger.* 665,197). L. A. Svensson nee Hugó (*Ger.* 669,152; *Swed.* 93,636) employed a mixture of asphalt, coumarone resin and montan wax, emulsified in alkaline solution with the aid of methyl cellulose, for coating iron, wood and concrete. The I. G. Farbenindustrie A.-G. and J. Söll (*Ger.* 671,460) employed wax to coat a sealing device for an apparatus designed for the generation of fluorine.

Wood is first impregnated with a synthetic-resin solution and then with wax, according to a patent issued to A. Nowak (*Austrian* 156,108). A mixture of terpineol with waxes was proposed by C. Luckhaupt (*Fr.* 830,151) for impregnating fibers, fabrics, paper, paper-pulp or wood and articles prepared from such porous materials.

Emulsifying, Dispersing and Wetting Agents

V. Kartaschoff (*U. S.* 2,149,527) prepared lake-forming, emulsifying and detergent substances by heating hydroxylated polyamines with fatty acids derived from spermaceti, and the Oranienburger chemische Fabrik A.-G. (*Ger.* 664,514) sulfonated wax alcohols with sufficient sulfonating agent to esterify one OH group and then treated the product with a phosphatizing agent to esterify the other group. Washing or emulsifying compositions resulted from this process.

Olefins obtained by cracking spermaceti were treated with chlorourea and the resulting chlorohydrin was sulfated with sulfuric acid at a temperature below 25°, in a procedure described by H. E. Buc (*U. S.* 2,139,669). Detergents and wetting agents were produced. Compositions intended for similar use, prepared by acetylating and then sulfonating wool fat, beeswax, etc., were developed by W. Schrauth (*U. S.* 2,163,133). Detergent, wetting, flotation, frothing, and antispattering agents were made from sulfo carboxylic esters of sperm oil alcohols by B. R. Harris (*U. S.* 2,166,141), and the alcohols prepared from hydrogenated waxes were employed by M. Iselin and J. Bindler (*U. S.* 2,139,190) to make amino derivatives for use as wetting agents.

Other patents covering the manufacture of wetting agents are as follows: by N. V. Chemische Fabriek "Servo" and M. D. Rozenbroek (*Brit.* 489,026): the sodium compound of glycerol is heated with acetylated wool fat and with acetylated hydroquinone; by the I. G. Farbenindustrie (*Brit.* 495,414): alkylated or cycloalkylated phenols are esterified with montanic acid; by V. Mills (*Brit.* 499,373); alcohols obtained from waxes are sulfonated; by Henkel & Cie G.m.b.H. (*Brit.* 501,408); chloroacetone is condensed with the sodium compound of sperm oil alcohols, the resulting ether is reduced with hydrogen in the presence of a nickel catalyst and the product either treated with ethylene oxide or sulfonated; by R. Kimbara (*Brit.* 502,964): naphthalene is sulfonated and then condensed with sperm oil alcohols; by H. Zimmerman (*Can.* 377,543): a-terpineol, camphor or limonene is added to the product obtained by treating cetyl or other higher alcohol with sulfuric, boric or phosphoric acids; by Soc. pour l'ind. chem. à Bâle (*Fr.* 48,632; addn. to 713,082 (*Chem. Abs. 26,* 1733)): 4-sulfophthalic anhydride is heated with a commercial mixture of lauryl, myristyl and cetyl alcohols, and the product is neutralized with sodium hydroxide, ethanolamines or cyclohexylamine; by Oranienburger chemische Fabrik A.-G., K. Lindner and A. Russe (*Ger.* 670,962): wool fat or other high molecular materials are treated with strong sulfonating and condensing agents such as sulfuric acid-halohydrins or their soluble salts or esters, mixed with lower alcohols; by A. T. Böhme Chem. Fabrik and E. Engel (*Ger.* 663,953): the alcohol obtained from saponified sperm oil is sulfonated with chlorosulfonic acid; and by I. G. Farbenindustrie A.-G. and H. Schütte (*Ger.* 664,176): spermaceti is dissolved in an inert solvent and is treated with a sulfonating agent in such a manner that the esters are saponified and the liberated alcohols are sulfonated.

H. A. Piggott and Imperial Chemical Industries Ltd. (*Brit.* 488,869) produced foaming agents by converting cetyloxymethylpyridinium sulfite into an oxalate. The former compound was made by passing sulfur dioxide into a heated mixture of cetyl alcohol, paraformaldehyde and pyridine. Another foaming agent, described by the Flesch-Werke A.-G. für Gerbstoff-Fabrikation und chemische Produckte (*Ger.* 664,730), was prepared by mixing potato starch with 66° Bé. sulfuric acid and adding fused cetyl alcohol, the temperature being maintained below 50°. The properties of neutral wool fat were included in a discussion of foam-preventing materials by F. Ohl (*Gelatine, Leim, Klebstoffe 6,* 166-73).

Electrical Industry

Cable waxes were investigated by F. Ohl (*Draht-Welt 30,* 367-70) and wool fat was one of the greases studied by D. T. Wright (*Underwriters' Labs. Inc., Bull. Research,* No. *4,* 11 pp.) in research on the effect of grease in metal-to-metal joints on the safe operation of explosion-proof electrical equipment.

Electrical resistances suitable for dry rectifiers, formed of silicon carbide, clay and graphite, impregnated with wax, were described by R. O. Grisdale (*U. S.* 2,143,414). A service-entrance cable, patented by C. L. Chatham (*U. S.* 2,163,235), was insulated with a resilient fibrous material saturated with a wax composition, and J. Wertzheiser and H. Charmoy (*U. S.* 2,164,168) specified wax for insulating an armored electrical cable.

The following uses of waxes in electrical equipment were also patented: by Crosse & Blackwell Ltd., C. G. Sumner, R. I. Johnson and W. Clayton (*Brit.* 492,900): wax is employed to coat a film produced by electrodeposition; G. C. Gaut, B. F. Huggins, D. Swaddle, H. V. G. Stubbs and The Plessy Co. Ltd. (*Brit.* 493,607—Addn. to 460,895 (*Chem. Abs. 31,* 4604)): the electrical resistance element described in the previous patent is coated with a waterproof lacquer made by suspending finely divided carbon in a solution of cellulose acetobutyrate and spermaceti in diamyl tartrate and ethylene dichloride; by Jenaer Glaswerk Schott & Gen (*Brit.* 495,303): the membrane of a glass electrode for measuring H-ion concentration is strengthened by applying a mixture of gum 65, wax 26 and Venetian turpentine 9%; by The British Thomson-Houston Co. Ltd. (*Brit.* 498,724): wax may be mixed with magnesium oxide to form an insulating coating; Telegraph Construction & Maintenance Co. Ltd., Cable & Wireless Ltd., J. N. Dean, W. Gardner, K. L. Wood and P. B. Alfieri (*Brit.* 502,868): fabric tape is coated with a layer of a flexible rubber- bitumen-wax composition in the manufacture of submarine cables (see *Brit.* 322,208; *Chem. Abs. 24,* 2816); E. I. du Pont de Nemours & Co. (*Brit.* 503,376); condensation polyamides employed for insulating electrical conductors are coated with wax; Le matériel téléphonique (Soc. anon.) (*Fr.* 828,277): wax is incorporated into a composition employed for making magnetic cores for induction apparatus; and by the Marbon Corp. (*Fr.* 837,354): wax is included among the ingredients of a rubber hydrochloride composition suitable for insulating wires.

Photographic Industry

E. Hewitson (*Brit.* 499,313—Addn. to 468,678 (*Chem. Abs. 32,* 440)) found that the addition of an alkali metal salt of hexametaphosphoric acid prevented coagulation of the wax emulsion covered by the previous patent. In the preparation of mat photographic paper, J. Knöfel (*Can.* 378,510) incorporated a wax into the silver halide emulsion layer or the protective layer, and a similar patent was granted to the I. G. Farbenindustrie A.-G. (*Fr.* 835,246). The patent issued to Kodak-Pathé (*Fr.* 48,840—Addn. to 797,142 (*Chem. Abs. 30,* 6298) is identical with *Brit.* 499,313, cited above.

Metallurgic Industry

P. Stoughton and R. F. Davis (*U. S.* 2,144,642) coated silverware with a film deposited from an emulsion prepared from carnauba wax 4.5 lb., stearic acid 18 oz., triethanolamine 5 fl. oz. and water 4 gal. In the waxing of tin plate, W. E. Burns (*U. S.* 2,159,351) directed a stream of hot air carrying wax vapor against one side of the sheet while cooling air was employed against the opposite side. Metals were coated by the electrophoretic deposition of wax from an aqueous dispersion, according to a process described by Crosse & Blackwell Ltd., W. Clayton, R. I. Johnson and C. G. Sumner (*Brit.* 490,851). General Motors Corporation (*Fr.* 832,052) treated surfaces of aluminum or aluminum alloys, such as grids used in ice-making vats, to produce a coating of highly activated aluminum oxide and then applied a coating of wax.

Food Industry

The effect of waxing fruits on their preservation in storage was investigated by F. W. Allen (*Ice and Refrig.* 96, 451-3). He found that the water loss was reduced by this treatment but in the case of cherries it was necessary to wax the stems also. Fruit spoilage was increased by waxing in some instances unless the mold spore contamination was reduced before the wax was applied. L. L. Claypool (*Proc. Am. Soc. Hort. Sci. 36,* 374-8) stated that waxing fruit generally increased the content of carbon dioxide, and J. M. Rattray (*Union S. Africa Dept. Agr., Rept. Low Temp. Research Lab. 1935-36,* 167-87; *1936-37,* 75-91) studied the use of waxed paper for preventing spoilage of grapes. Rattray and E. Beyers (*Ibid. 1936-37,* 102-12) reported that waxed crystalline paper was superior to sulfite paper wrappers for this purpose. According to C. W. Hitz and I. C. Haut (*Proc. Am. Soc. Hort. Sci. 36,* 440-8) waxing of apples reduced the percentage of wilt and loss in weight when given a pre-ripening treatment. Pre-ripening of Grimes Golden apples for one week before waxing prevented the development of undesirable flavors resulting from the wax treatment. The latter treatment also retarded the development of yellow color.

In contrast with the above results with grapes, W. J. Williams (*Ice and Cold Storage 41,* No. 489,203) stated that oranges kept better in storage when wrapped in sulfite tissue paper than when waxed wrappers were used, but S. Yang and I. Lin (*Fukien Christian Univ. Sci. J. 1,* 91-8) found that waxed wrappers prevented mold and stem-rot of citrus fruits. Also J. E. van der Plank and J. M. Rattray (*Union S. Africa Dept. Agr., Rept. Low Temp. Research Lab. 1936-37,* 151-3) reported that moisture-retentive waxed crystalline paper reduced loss in weight and pitting of Marsh grapefruit. Wastage by mold, however, increased when such wrappers were used. Waxing prevents the darkening of the segment membranes of lemons during storage, according to the research conducted by C. Brooks and S. P. McColloch (*Ice and Cold Storage 41,* No. 486,152).

E. V. Hardenburg and H. Platenius (*Am. Potato J. 16,* 37-40) prepared a preliminary report on the waxing of seed potatoes, and E. G. Hood and A. H. White (*Can. Dairy and Ice Cream J. 18,* No. 3, 55-7, 74) showed that aluminum-foil butter wraps were superior to paper liners with a wax adhesive for preventing surface flavor on butter. V. L. S. Charley (*Ann. Rept. Agr. Hort. Research Sta., Long Ashton, Bristol 1937,* 195-230) recommended the use of wax-lined, lacquered cans for storing pasteurized apple juice since plain cans were found to be unsatisfactory.

Patents on the use of waxes in connection with food products were taken out by the following: by J. H. Sharma (*U. S.* 2,133,404): a waxy mixture containing dye is employed for coloring citrus fruits; by J. R. MacRill (*U. S.* 2,150,283): citrus fruits are preserved by treating them with an emulsion containing paraffin, carnauba wax, cottonseed oil, oleic acid, triethanolamine, kerosene, sodium carbonate and water; by J. R. MacRill and R. D. Nedvidek (*U. S.* 2,150,284): a process similar to that covered by the preceding patent is described; by J. N. Sharma (*U. S.* 2,153,487): citrus fruits, cantaloupes, apricots or tomatoes are coated with a composition prepared from sodium hydroxide, triethanolamine, stearic acid, paraffin, carnauba wax, shellac and water; by Huntley & Palmers Ltd. and Horace M. Rabone (*Brit.* 496,462): a wax matrix is employed in the manufacture of molds or embossers for biscuits; by Marathon Paper Mills Co. and A. F. Burgess (*Brit.* 496,870; 496,871—Addn. to 481,426 (*Chem. Abs. 32,* 6780): a wax-rubber composition is used for packaging cheese; and by J. S. Reichert, J. M. Youel and R. T. Mills (*Can.* 377,682): lanolin is one of the ingredients specified for stabilizing cake batter during baking.

Insecticides, Fungicides and Disinfectants

The application of wax polish to wood prevents attack by wood-boring beetles, according to an investigation conducted by A. N. Gulati (*Indian Textile J. 48,* 435-6). Standard beeswax surfaces were employed in studies of wetting by insecticidal sprays made by G. T. Brown and W. M. Hoskins (*J. Econ. Entomol. 32,* 57-61); E. L. Wampler and W. M. Hoskins (*Ibid. 32,* 61-9); and by G. S. Hensill and V. J. Tikenko (*Ibid. 32,* 36-40).

Wool fat may be added to insecticidal compositions prepared from an active ingredient such as 2-benzothiazolyl ethyl sulfide, solvents and solid diluents, according to a patent issued to B. Collie, S. Ellingworth, A. Robertson and Imperial Chemical Industries Ltd. (*Brit.* 500,197). S. Marcovitch and W. W. Stanley (*J. Econ. Entomol. 32,* 154) reported that emulsions of wool fat, containing 1% of the fat, did not injure apple, peach, bean, tomato or tobacco foliage. Such emulsions were made with the addition of 2 oz. of blood albumin per gallon of fat. When emulsions containing from 3 to 6% of wool fat were employed, it was found that they had no toxicity to coddling moth eggs but the addition of 3% of naphthalene increased the ovicidal efficiency. Effective control against red spider was obtained with 2% wool fat emulsions and the use of 1% emulsions with copper fungicides seemed to prevent copper injury to the foliage. Wool fat was especially recommended for its adherent properties.

An insecticide and fungicide such as powdered aluminum arsenate mixed with lanolin was proposed by Bozel-Maletra (Soc. industrielle de produits chimiques) (*Fr.* 831,338), and an insect-trapping composition, made by melting together polymerized isobutylene, paraffin oil and montan wax or its glycol ester, was patented by the I. G. Farbenindustrie A.-G. (*Brit.* 489,494).

The Chemische Werke Albert and H. Mengele (*Ger.* 671-209—Addn. to 665,732 (*Chem. Abs. 33,* 1070) developed a disinfectant prepared by adding a saturated solution of mercuric iodide in potassium iodide to wool fat and emulsifying the mixture.

Pharmaceutical Industry

Lanolin and wax were included among the ointment bases discussed by M. A. Lesser (*Drug Cosmetic Ind. 44,* 33-6), and G. Hopf (*Fette u. Seifen 46,* 144-6) stated that in numerous instances the choice of an emulsifier is more important than the oil or wax employed in the preparation of salves for application to the skin or for use in therapy, when the value of the salve is considered from the standpoints of spreading, penetrating and coating properties.

The Chemische Werke Albert, H. Mengel and K. Koulen (*Ger.* 670,434—Addn. to 665,732 (*Chem. Abs. 33,* 1070)) patented a composition prepared by emulsifying a saturated solution of silver iodide in potassium iodide with wool fat and suggested its use as a salve. Pomades or ointments with a cod-liver oil base, and containing beeswax, lanolin and spermaceti, were described by A. Ferraris (*Boll. chim. farm. 78,* 379-81), and H. W. Siemens (*Nederland. Tijdschr. Geneeskunde 81,* 5815-17) conducted new investigations on the treatment of psoriasis and reported that petrolatum was preferred to lanolin as a vehicle for the chrysarobin or cignolin employed as the therapeutic agent. W. McP. Fitzhugh, Jr. (*Laryngoscope 48,* 884-903) included the use of a lanolin base in research on the effect of sulfhydryl compounds in otolaryngology. A composition for accelerating perspiration, patented by Cutasy Laboratories, Inc. (*Fr.* 836,799), contained mineral oil 45-70, petrolatum 13-25 and waxes 20-35%.

An ointment prepared from calcium linoleate 5.0, lecithin 5.0, anhydrous lanolin 5.0 and petrolatum (white or yellow) 85.0% was found by K. Glennon (*J. Am. Pharm. Assoc. 28,* 305-9) to be of value in the treatment of burns and sunburn. H. Leclerc (*Presse Méd. 46,* 1865) recommended suppositories made from ointment of poplar buds, cacao butter and white wax for the treatment of hemorrhoids. The use of cetyl alcohol in the preparation of suppositories was described by A. Ferraris (*Boll. chim. farm. 77,* 725-7) and by the Chemische-pharmazeutische A.-G. Bad Homburg (*Ger.* 667,500).

A therapeutic lanolin solution suitable for absorbing toxins from the human blood stream was patented by G. W. Boericke and W. W. Young (*U. S.* 2,154,432). Lanolin employed as a vehicle for inoculation serums was suggested by the Chemische Fabrik vorm. Sandoz (*Swiss* 199,316), and A. Rogers (*U. S.* 2,167,251) made use of a wax-coated plate in the manufacture of surgical tape from submucous animal intestinal tissue. Hormone preparations were made from the wax-like extractives of tree bark by C. F. Boehringer & Soehne G.m.b.H. and W. Discherl (*Ger.* 664,580). Another hormone preparation, containing wool fat, was claimed by the I. G. Farbenindustrie A.-G. and H. Friedrich (*Ger.* 672,804).

Building Materials

K. Peschek (*Osterr. Chem.-Ztg. 41,* 418-20) discussed recent developments in improving the properties of wood, including its impregnation with montan wax. The addition of this wax to road tar was investigated by H. Mallison and H. Schmidt (*Asphalt Teer Strassenbautech. 39,* 51-4, 59-62, 75-9, and 91-4).

A sheet material formed of wood fiber and other materials and treated with an oil-wax emulsion was developed by G. H. Ellis and W. H. Schlafge (*U. S.* 2,143,831). A. L. Eaton and C. W. Cazel (*U. S.* 2,148,-113) proposed the following waterproofing material for covering concrete floors or walls: coal tar 76, resin 10, carnauba wax 1, pine tar oil 1, solvent naphtha 4 and asbestos fiber 8%.

Waxes may be employed as binders for colored roadmaking compositions according to a process disclosed by the Gesellschaft für Teerstrassenbau m.b.H., H. Luer and W. Lorenz (*Brit.* 490,003). Cement compositions containing waxes were described by K. Halbach (*Brit.* 496,561), and the use of waxes as addition products to bituminous materials employed in building construction was proposed by W. Kirchner (*Brit.* 502,-294).

Petroleum Industry (Including Lubricants)

Wool wax, prepared by saponifying lanolin and distilling the unsaponifiable residue at reduced pressure, is added to motor fuels, according to a patent issued to D. B. Macdonald (*Brit.* 503,599). The wax may be added to the fuel through the induction pipe, or it may be applied as a coating to this pipe or to the manifold. Improvement of the fuel is claimed.

The I. G. Farbenindustrie A.-G. (*Fr.* 838,995) employed the reaction product of ethylene oxide and montanyl alcohol for separating petroleum emulsions.

Lubricating oils were dewaxed with the aid of a volatile solvent containing crude montan wax by L. P. Evans (*U. S.* 2,158,358), and the same product was used to modify the crystal structure of paraffin in a dewaxing process described by the Texaco Development Corp. (*Fr.* 48,671—Addn. to 812,430 (*Chem. Abs. 32,* 1086).

R. C. Williams (*Ind. Eng. Chem. 31,* 725-7) studied various lubricants for use in drawing copper wire and reported that beeswax was the most satisfactory wax-like lubricant tried. In contrast to soap solutions which deposited copper soaps on the wire, beeswax was unreactive and also was advantageous because of its adhesive nature and typical waxy properties. G. M. Panchenkov and K. V. Konstantinova (*J. Tech. Phys.* (U. S. S. R.) *9,* 537-44) studied the lowering of the coefficient of static friction between polished metals lubricated with cetyl alcohol.

Less than 2% of wax inhibits the paraffinic clouding of hydrocarbon oils, according to C. E. Francis (*U. S.* 2,148,292). The following waxes and wax-like substances were specified: beeswax, spermaceti, bayberry, candelilla, carnauba, Chinese insect, cocoa, cottonseed, Japan and montan waxes. Wax-like, hydrogenated castor oil mixed with sulfur was suggested as a lubricant suitable for use under extreme pressures or at high temperatures by V. R. Abrams (*U. S.* 2,157,379). Sperm oil was one ingredient of a lubricating composition for use in effecting heavy press fits of metal parts, in a process described by O. L. Maag (*U. S.* 2,160,577). About 1% of sulfurized sperm oil mixed with a solvent-extracted dewaxed petroleum oil forms a nonsludging lubricant for internal-combustion engines, according to F. C. Haas (*U. S.* 2,162,398).

R. P. Russell (*Can.* 378,296) prepared a thickened oil having a viscosity of approximately 1000 sec. Saybolt at 210°F. by voltolizing an unsaturated liquid wax ester of a monocarboxylic acid. The product was mixed with a petroleum lubricant before voltolization.

Paper Industry

The use of montan wax for sizing paper was discussed by F. Hoyer (*Gelatine, Leim, Klebstoffe 6,* 160-6), and the preparation and use of rosin-wax sizings was described by R. W. Kumler (*Pulp Paper Mag. Can. 39,* 745-8). Titanium oxide was recommended as a brightening and opacifying agent for waxed papers by O. Hansen (*Zellstoff u. Papier 19,* 525-8). H. R. Thies (*Paper Trade J. 108,* No. 8, 96-102) and J. F. Maguire (*By Gum* (Detroit) *9,* No. 4, 8-9; *Rev. Current Lit. Paint Colour Varnish & Allied Ind. 12,* 324) reviewed the incorporation of waxes into resins for coating paper, while W. A. Kirkpatrick, 2nd. (*Tech. Assoc. Papers 22,* 322-4; *Paper Trade J. 109,* No. 12, 36-8) gave a description of the use of waxes in testing printing papers.

The following patents were issued: to L. B. Arnold, Jr. (*U. S.* 2,142,986): an emulsion of wax and deacetylated chitin is employed to render paper water-resistant and of "reduced noiseness"; to H. S. Mitchell (*U. S.* 2,155,731): a wax coating containing citric acid is applied to paper or cardboard to form a wrapping for fats and oils, or products containing them, to prevent rancidity; to G. A. Moore (*U. S.* 2,157,212): a wax film is cast over a nitrocellulose film on paper in the manufacture of an impervious sheet material for tobacco containers; to T. A. Hodgdon (*U. S.* 2,158,-754): a process for preparing laminated glassine paper with the aid of hot liquid wax is described; to T. A. Hodgdon and P. E. Hodgdon (*U. S.* 2,158,755): similar to the preceding patent; to J. Knaggs and Portals Ltd. (*Brit.* 488,787): synthetic resins and waxes such as montan wax are used to make oil- or water-proof paper; to E. I. du Pont de Nemours & Co. (*Brit.* 489,-668): wax emulsions prepared with the aid of aminoalkylcelluloses are employed for sizing paper and for fixing acid dyes to paper; to British Waxed Wrappings Ltd. and R. J. Brown (*Brit.* 491,147): natural or synthetic waxes are interposed between two sheets of paper to make a wrapping material for fatty substances; to W. Pelzer (*Brit.* 496,465): a small amount of wool fat is employed to increase the flexibility of a waterproofed paper; to Bakelite Ltd. (*Brit.* 500,357): lithopone and carnauba wax are added to synthetic resin compositions for coating oxy-cellulose paper; to I. G. Farbenindustrie A.-G. (*Brit.* 500,444): montanic acid or its sodium salt may be added to a composition for treating paper or cardboard; to Pattilloch Processes Inc. (*Brit.* 502,944; *Can.* 376,347): a process for sizing with wax is specified; to I. G. Farbenindustrie A.-G. (*Brit.* 505,200); paper pulp is sized with a wax; to International Patents Development Co. (*Fr.* 838,346): a water-resistant coating for paper is prepared by dissolving zein in aqueous alcohol and mixing it with wax dissolved in a hydrocarbon solvent; to Radebeuler Maschinenfabrik August & Co. and F. Stolze (*Ger.* 664,556): a dry binding agent such as wax is one ingredient of a coating for paper used for printing; to O. Morch (*Norw.* 60,067): in the manufacture of water-repellant paper a spray of liquefied wax is projected into a fiber suspension and the latter is converted into paper, board or fibrous sheets; and to Soc. pour l'ind. chim. à Bâle (*Swiss* 203,436): wax is added to a hardenable carbamide-aldehyde size.

Munitions Industry

The Remington Arms Co., Inc., J. F. Hutchinson and A. A. Schilling (*Brit.* 498,923) employed as lubricants for ammunition higher alcohols with or without such waxes as paraffin, ozocerite, ceresin, beeswax, carnauba, candelilla, bayberry, Chinese insect or the synthetic waxes obtained from the chlorination of aromatic hydrocarbons. Projectiles can be lubricated by dipping them in a bath of molten wax, according to G. H. Jacobs (*Can.* 380,054), and E. Messina (*Fr.* 830,288) proposed a method for making a bullet-proof armor of fibrous material by uniting several sheets of such a fabric as silk with the aid of wax. The laminated product is then subjected to a pressure of 100 to 150 atmospheres.

Textile Industry

The use of waxes for softening textile fabrics was discussed by C. Borghetty (*Am. Dyestuff Reptr. 28,* No. 8, *Proc. Am. Assoc. Textile Chem. Colorists* P206-8). According to T. Hennig (*Deut. Textilwirt. 6,* No. 10, 8-10, 12) the addition of waxes and paraffins to a solution of aluminum formate and Marseilles soap makes fabrics repellent to dye solutions for 30 to 60 min., when such a mixture is used to impregnate textiles. The use of waxes dissolved in solvents or emulsified with soaps for waterproofing textiles was described by M. Burnand (*Teintex 4,* 27-33, 97-104, 155-63), and the relation between water repellency and temperature was investigated by H. W. Stiegler and J. M. Hood (*Am. Dyestuff Reptr. 28,* No. 11, *Proc. Am. Assoc. Textile Chem. Colorists* P285-7), using four wax-type products.

Waxes such as carnauba and beeswax, may be used for polishing and glazing yarns and twines, according to results obtained by W. I. Finnetney (*Cotton* (Atlanta) *103,* 61-2, 66 (Aug.)). H. Gerber (*Melliand-Textilber. 19,* 804-7) stated that the use of montan wax and bentonite with mineral oil emulsions did not overcome their unsatisfactory nature when used as thickeners in textile printing. The use of wool fat and compositions prepared from it for finishing wool was described by K. Jochum (*Ibid. 19,* 807-9), and sulfonated cetyl alcohol was found by F. Defalque (*Ind. textile 54,* 606-8) to be useful in boiling-off colors from cellulose acetate fabrics. E. Dutoit (*Teintex 3,* 612-16) delustered viscose-rayon fabrics with the aid of an emulsion containing montan wax and aluminum stearate.

The patents reported during the year were issued as follows: to G. D. Graves (*U. S.* 2,138,031): amino alcohol acrylates are employed to fix waxes to textiles in waterproofing treatments; to C. Dreyfus and H. Platt (*U. S.* 2,145,923): yarns and fabrics containing artificial fibers are coated with a wax-like material to retard the evaporation of solvent; to H. Rein (*U. S.* 2,166,325): resistance to creasing of cellulose filaments is improved by treatment with a liquid containing a wax and the sodium salt of oleic acid *N*-methyltauride; to H. Karplus (*U. S.* 2,166,739): a process for delustering rayon involves the use of waxes; to D. Finlayson and R. G. Perry (*Brit.* 488,945): waxes may be added to compositions designed to reduce the electrostatic charges on textile materials; to A. Scholler (*Brit.* 489,895): a composition for simultaneously delustering, waterproofing and finishing textiles comprises a dilute dispersion of wax, an inorganic delustrant (such as the oxides of titanium, zirconium, barium or lead or the sulfate of the latter two metals) and a stabilizer such as tapioca starch; to E. B. Higgins (*Brit.* 490,215): an emulsion of wax and albumin is employed for waterproofing textiles (see also *Brit.* 380,052; 380,065; 380,076 (*Chem. Abs. 27,* 3998); 394,816 (*Ibid. 28,* 342), and 421,519 (*Ibid. 29,* 3752); to J. G. Evans, A. Shepherdson and Imperial Chemical Industries Ltd. (*Brit.* 493,111): compositions such as pyridinium derivatives from the chloromethyl ethers of sperm oil alcohols are incorporated in the spinning solution in a process for rendering rayon water-repellent; to G. H. Ellis (*Brit.* 493,915): packages of textile yarn are treated with a natural or synthetic wax dissolved in an organic solvent; to Färberie-und Appretur-Gesellschaft vormals A. Clavel und F. Lindenmeyer (*Brit.* 494,673): Natural or synthetic waxes may be used in a method for making crepe-like fabrics; to J. H. Gaskell (*Brit.* 495,264): wax is an optional ingredient in a composition for finishing hair cloth or its imitations; to Institute of Paper Chemistry (*Brit.* 498,771): silk, wool, cotton and rayon is waterproofed by treatment with minute particles of a waxy material surrounded by a film of water-insoluble protein; to Soc. pour l'ind. chim. à Bâle (*Brit.* 504,666): beeswax is proposed as a water-repellent material in a method for producing pattern effects on textiles; to E. Franz (*Brit.* 505,020): fulling and shrinking of textiles is conducted in the presence of a water-insoluble neutral lubricant such as wax dispersed in water; to C. E. Reynolds (*Can.* 377,142): shoe fabric of open construction is treated with wax; to Lister & Co. Ltd. and W. Garner (*Fr.* 830,294): the tendency of textile oils to cause exothermic oxidation is reduced by adding sulfurized sperm oil; to W. Böhme (*Ger.* 660,071): laddering of silk and rayon fabrics is prevented by treatment with a mixture of tree resin 110, camphor 2, Venetian turpentine 2, white wax 2, borax 192, gum benzoin 5, water 575 and ethyl alcohol 112 parts; and to Deutsche Hydrierwerke A.-G., W. Schrauth and R. Hunter (*Ger.* 669,494): textiles are treated with alkali xanthates of wool fat alcohols.

Paint, Varnish and Lacquer Industry (Including Ink and Crayons)

The use of waxes in the production of mat finishes was discussed by H. W. Chatfield (*Paint Manuf. 9,* 117-18, 196, 198). Addition of natural or synthetic waxes to varnishes will reduce gloss, but in the case of baking varnishes a very large percentage of wax must be added or else the matting effect will be destroyed by baking. If too much wax is used the film becomes badly deteriorated because of lack of toughness and loss of adhesion.

Resin-wax dispersions in paints and varnishes were reviewed by R. J. Moore (*Am. Paint J. 23,* 7-9, 56-8 (Feb. 6, 1939)), and the use of wax dispersions containing dyes for staining wood was discussed by W. Schneider (*Farben-Chem. 10,* 95-101, 271-5).

V. R. Abrams (*U. S.* 2,157,378; 2,157,380) proposed the use of wax-like hydrogenated castor oil in free-flowing pigment suspensions. An antirust liquid or plastic composition, patented by E. W. J. Mardles (*Brit.* 503,772), comprises wool fat, resin and up to 0.5% of beeswax, carnauba wax or high-melting paraffin. The N. V. Industrieel Maatschappij vorheen Nourv & van der Lande (*Dutch* 46,234) made optional the addition of waxes to drying oil compositions prepared from "Isano oil" (from *Ongokea klaineana*), and A. Y. Drinberg (*Russ.* 47,383) protected varnished surfaces with a coating made from rosin, wax, tripoli and organic solvents. Emulsions for painting and waterproofing, containing methylcyclohexanol stearate, coumarone resin, montan wax and methylcellulose, were developed by L. A. Svennsson and C. D. Svennsson (*Swed.* 95,304).

Waxes may be added to polymerizable oils prepared by reacting methacrylic anhydride with a partly esterified polyhydric alcohol, according to a patent issued to E. I. du Pont de Nemours & Co (*Brit.* 506,666). The following process for making driers was described by J. D. Riedel-E. de Haën A.-G. and R. Uhde (*Ger.* 668,255-Addn. to 642,931 (*Chem. Abs. 31* 5,903): the fatty acid from crude wool fat is mixed with one-third of its weight of the waste from the distillation of fatty acids and the product is heated to 270-300°. Coconut or palm oil fatty acid distillation waste may be employed.

According to the Deutsche Hydrierwerke A.-G. (*Brit.* 493,765), a composition for removing paints, lacquers and varnishes comprises the following: an organic solvent such as benzene, tetrahydronaphthalene, ethyl alcohol or methylene chloride has dissolved therein an alcoholate of an alkali or alkaline earth metal, magnesium, aluminum or zinc. The alcoholate is derived from an OH compound containing at least six carbon atoms such as the higher aliphatic alcohols (lauryl, myristyl, cetyl, stearyl, oleyl, wax alcohols, etc.) obtained by reducing fats, oils, sperm oil, spermaceti, carnauba wax, beeswax, wool fat and the like.

S. Miquelard (nee Vonin) (*Fr.* 830,138) used beeswax or lanolin in the preparation of color lakes in paste form, and E. Germann (*Ger.* 678,367) made a glaziers' putty by heating wool fat with a drier such as lead resinate or manganese borate, the temperature being held at 60°. The product was then mixed with five times its weight of precipitated chalk.

A mixture of dyes, oil and wax was suggested as a duplicating ink by W. J. Hughes (*U. S.* 2,155.861-2), and the same inventor (*Can.* 382,180) prepared a similar ink from the following ingredients: crystal violet 11.0, magenta 5, brilliant green 13.5, chrysoidine 15.5, beeswax 4, eleostearin 6, mutton tallow 26 and lard oil 4 lb. E. F. Nurse (*Paper & Print 12,* No. 1, 38; *Rev. Current Lit. Paint Colour Varnish & Allied Ind. 12,* 180) discussed inks suitable for printing waxed cartons.

Hot metallic surfaces can be marked with a crayon made from pigment, rosin, wax and sodium phosphate or sodium bisulfate, according to L. Aronberg (*U. S.* 2,141,965), and indelible colors suitable for pressing into pencil-like forms, comprising chlororubber, beeswax, tallow, mineral or vegetable oil and dyes or mineral pigments, were described by M. Steinlechner (*Hung.* 121,116).

E. Schwalbe (*U. S.* 2,135,735) prepared waxy ink compositions for carbon papers and typewriter ribbons by using cetyl alcohol, crystal violet, carnauba wax and sesame oil. A somewhat similar composition employing carnauba or montan wax and stearyl or cetyl alcohol, but including a volatile solvent, was patented for use on carbon paper by P. V. Brower (*U. S.* 2,138,836). A light-absorbing substance with wax as a binder is applied to carbon paper in a method devised by Kalle & Co. A.-G. (*Brit.* 487,751).

Patents on the use of waxes in the manufacture of transfers and copying materials were issued to the following: F. Piller (*U. S.* 2,152,621); J. Groak (*U. S.* 2,168,098; *Brit.* 503,695) and W. S. Lawrence (*Brit.* 495,770).

Cosmetic and Soap Industry

The growing importance of cetyl alcohol in the formulation of ointment bases, superfatted cosmetics, lipsticks, rouge, beard softeners, shaving soaps and powders, and the various massage-, tissue- or vanishing-creams led H. Goodman and A. Suess (*Urol. Cutaneous Rev. 42,* 909-10) to study its dermatological properties. The purest form of cetyl alcohol, produced by saponifying spermaceti with potassium hydroxide, is non-irritating to the skin, is odorless and tasteless, and is not affected by acid, alkali, light and air; nor does it become rancid. The skin surface is rendered velvety rather than smooth and slippery. On the other hand, cetyl alcohol prepared by the catalytic reduction of fats, cetyl palmitate and palmitic acid is decidedly inferior and is irritating to the skin. Lipstick dermatitis from dyes in a variety of excipients, including cetyl alcohol and mineral waxes, was investigated by H. L. Baer (*Ibid. 42,* 903-9).

In evaluating the various compositions employed to protect the skin against ultraviolet rays, A. Bachem and B. Fantus (*Arch. Phys. Therapy 20,* 69-76) found that an emulsion containing 50% of water and 50% of a mixture of one part of wool fat and three parts of petrolatum gave the best results.

The following patents were granted: to S. White (*U. S.* 2,148,285-6: a shaving cream contains lanolin; to W. Schrauth and K. Stickdorn (*U. S.* 2,164,723): cetyl alcohol is employed as a base for therepeutic and cosmetic emulsions; to J. W. Blower (*Brit.* 495,245): calamine is added to toilet preparations containing wax; to R. E. Goldsbrough (*Brit.* 496,893): ti-tree oil from *Melaleuca alternifolia* is emulsified with cetyl alcohol or its derivatives to make creams for cosmetic or pharmaceutical purposes; to Max Factor & Co. (*Brit.* 501,732): cosmetics in dry solid cake form are prepared with the aid of emulsified waxes; to A. Juncker (*Ger.* 669,435): a cosmetic for coloring the lips comprises olive oil 3, oleic acid 2, lanolin 1, beeswax 1, triethanolamine 1, eosin 1 and distilled water 91%; to I. G. Farbenindustrie A.-G. and H. Friedrich (*Ger.* 672,720): anhydrous lanolin is dissolved in petroleum ether and treated with metallic sodium wire while being heated in a water bath to produce a cosmetic; to Deutsche Hydrierwerke A.-G. (*Ger.* 673,440): cosmetics are prepared from liquid animal waxes which have been freed from glycerides and solid waxes by distillation; and to Orosa A.-G. (*Swiss* 197,425): a carrier for hair dyes is made from wool fat, the glyceride of stearic acid, wax, cetyl alcohol, stearin, Turkey-red oil, toluenediamine, water, alcohol and ammonium hydroxide.

Reviews and discussions on the use of waxes and higher aliphatic alcohols in cosmetics were reported by the following: S. P. Jannaway (*Perfumery Essent. Oil Record 30,* 45-9), H. S. Redgrove (*Am. Perfumer 38,* No. 2, 32-3; No. 3, 35-6; *Mfg. Perfumer 4,* 43-4), H. Helfer (*Drug Cosmetic Ind. 45,* 42-3, 47), F. H. Sedgwick (*Soap, Perfumery Cosmetics 12,* 161-3),

N. J. Anderson (*J. Chem. Education 16,* 160-2), E. Bourdet (*Rev. marques parfum. France 16,* 144-5), Ekmann (*Riechstoff-Ind. Kosmetic 13,* 221-7; *14,* 1-15) and J. Augustin (*Seifensieder-Ztg. 66,* 45-6).

A patent review on the production of soaps from wool fat was compiled by W. Schütze (*Fette u. Seifen 45,* 423-4), and the use of lanolin, spermaceti and wax alcohols for superfatting soaps was discussed by J. Glenn (*Soap 15,* No. 9, 21-4, 70). W. Schrauth (*U. S.* 2,157,022) proposed the use of waxes for superfatting toilet soaps.

A. Bohanes (*Chem. Obzor 13,* 70-3; *14,* 100-1), discussed the principles governing the preparation of detergents from sulfonates of cetyl, melissyl and other higher alcohols. According to K. Jochum, H. Geier and K. Pauser (*U. S.* 2,159,381) a mixture of an alkaline pyrophosphate and the ether of melissyl alcohol and phenolsulfonic acid is suitable as a detergent for washing white linen goods. A cleansing agent proposed by Henkel & Cie G.m.b.H., W. Hentrich and E. Elbel (*Ger.* 676,659) was prepared from hardened whale oil, sodium soap, wool fat and a substituted cresoxyacetic acid, and the Soc. Vaudoise d'agriculture, de viticulture et agricola (*Fr.* 828,605) described a cleaning agent composed of paraffin, ozocerite, beeswax, waste cotton and kaolin.

Leather Industry

S. P. Anchelevich (*Kozhevenno-Obuvnaya Prom. 17,* No. 9, 18-19) obtained a glossy finish on Russian leather by using the following composition: carpenter's glue 46.5 gm., 10% casein solution 155 cc., water-soluble nigrosine 8 gm., wax emulsion 100 cc., blood 340-385 cc. and water to make 1 liter. The wax emulsion was made by dissolving 1 gm. of soap and 2 gm. of potassium carbonate in hot water and adding 10 gm. of molten wax. The mixture was heated until homogenous and enough water was added to bring the volume to 100 cc.

The effect of various materials, including waxes, on the mechanical properties of leather was discussed by R. M. Lollar (*J. Am. Leather Chem. Assoc. 33,* 630-46; *34,* 194-207, and F.v. Artus (*Farben-Chem. 9,* 333-40, 347) reviewed the various products employed for polishing leather. He recommended that imported materials such as carnauba wax be replaced by the synthetic IG waxes of German origin. H. Rehmann (*Monatschr. Textil-Ind. 54,* 137) impregnated harness with a cold solution of beeswax and paraffin in linseed oil varnish, and with a mixture of beeswax and linseed oil.

The following patents appeared: O. F. Muller (*U. S.* 2,140,759): furs are finished by immersion in an emulsion of wax, phthalic acid and formaldehyde followed by heat; Imperial Chemical Industries Ltd. (*Brit.* 490,146): montan wax is used in a composition for making artificial leather; A. O. Jaeger (*Brit.* 490,714): an emulsifying agent such as wool fat acids is employed in a process for fat-liquoring leather; and W., O., H. and R. Freudenberg and C. L. Nottebohm (*Brit.* 505,794): wax emulsions are used for coating compound sheet materials proposed as a leather substitute.

Rubber Industry

A horticultural binding tape, prepared with the aid of a rubber-wax composition, was patented by the Marathon Paper Mills Co. and A. F. Burgess (*Brit.* 493,144-Addn. to 481,426 (*Chem. Abs. 32,* 6780)).

N. H. Korobov (*Russ.* 50,974) described a rubber cement made from rubber, rosin, wax, chalk, zinc oxide, birch tar and aldol.

Miscellaneous Uses

Adhesives employing waxes were patented by the following: E. I. du Pont de Nemours & Co. (*Brit.* 500,949), R. Tempé (*Fr.* 829,504) and by the I. G. Farbenindustrie A.-G., M. Müller-Cunradi, K. Daimler and H. Thron (*Ger.* 677,440).

A mixture of wax and paraffin or asphalt was described in an article on glass etching by H. Schulz (*Glasshütte 68,* 828-30). Natural or synthetic waxes may be added to compositions for binding abrasives in the manufacture of sand cloth or paper, according to E. I. du Pont de Nemours & Co. (*Brit.* 503,542).

Intermediates for condensation reactions were made by E. Ott (*U. S.* 2,137,584) by causing hydrogen sulfide to react with an unsaturated wax. Saponification products of waxes were added to fertilizers by A. Zangger and Bernese Alps Milk Co. (*Brit.* 488,350). Wax-impregnated gaskets for use at high temperatures and pressures were proposed by W. Claypoole (*U. S.* 2,164,764), and the wax treatment of hemp rope was described by R. C. Williams and H. M. Bone (*U. S.* 2,139,343). A mixture containing wool-fat pitch was used to inhibit the oxidation of bitumens in a method patented by O. Smiley (*U. S.* 2,154,873).

C. E. Linebarger and C. E. Linebarger, Jr. (*U. S.* 2,133,300) employed montan wax in the manufacture of Chaslyn hydrometer units. A tissue-embedding wax, made from paraffin 200 gm., rubber 2 gm. and beeswax 0.5 gm., was developed by E. M. Beyer (*Am. J. Clin. Path.,* Tech. Suppl. *2,* 173-5).

The use of lanolin as a vehicle for plant stimulants was described by L. D. Romberg and C. L. Smith (*Proc. Am. Soc. Hort. Sci. 36,* 161-70), T. R. Alexander (*Plant Physiol. 13,* 845-58), J. H. G. Ferman (*Rec. trav. botan. néerland. 35,* 177-287), and by M. Herlitzka (*Fr.* 832,728).

Correction Notice

In the August issue page 174, right hand column, the last sentence of the first paragraph should read as follows:

> The air in shortening is determined by preparing mediums of the same gravity and calculation from the specific gravity data. (Coffey & Spannuth—*Oil & Soap, 16,* 158.)