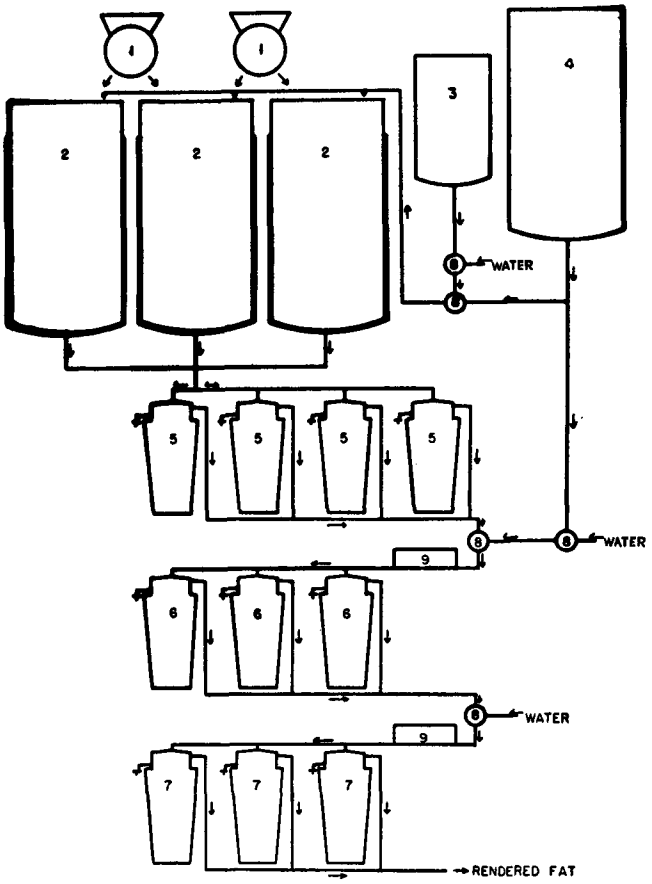

FIG. 3. Schematic diagram of suggested layout for alkali rendering operation for a packing plant killing 1100 hogs and 100 cattle per day: 1, two grinders; 2, three 1200-gal. steam jacketed digesting tanks; 3, 300-gal. supply tank for 20% sodium hydroxide solution; 4, 1200-gal. supply tank for 20% salt solution; 5, four primary centrifuges; 6, three centrifuges for first wash; 7, three centrifuges for second wash; 8, five proportioning and pumping devices; 9, two mixing and heating devices for the two washing operations.

in compounding high ratio cake shorteners from these fats although more work is needed in this direction.

In concluding this paper the author does not wish to leave the impression that the process and product just described are commercial realities. However, the results have been sufficiently promising to warrant preparation of patent application which are now pending. A somewhat similar process has been proposed for the recovery of fats and oils in the fishing industry, particularly by Anderson (2) who recovered oil from salmon offal. More work is required but these investigations indicate that alkali rendering may be practical and yield a high quality product in a competitive market. Events of the recent past have changed our company's policy with regard to meat operations; therefore, we are not planning to pursue these studies further but are taking this opportunity to describe our experiences to others.

Summary

An alkali rendering process for the production of edible animal fats has been described.

Laboratory and semi-plant scale experiments indicate that high quality edible lard and beef fat may be produced in a semi-continuous process.

Alkali rendered pork and beef fats are suitable for compounding into high quality domestic and commercial shorteners.

Acknowledgment

We wish to express our appreciation to the Sharples Corporation of Philadelphia, Pa.; the M & R Dietetics Laboratories, Inc., Columbus, Ohio; the A. E. Staley Manufacturing Company, Decatur, Illinois, whose cooperation made this study possible.

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1. Bailey, A. E., and Feuge, R. O., Ind. Eng. Chem. Anal. Ed. *15*, 280 (1943).
2. Anderson, Lyle, Fishery Market News 7, No. 4, 4 (1945).

Abstracts

Oils and Fats

Edited by
M. M. PISKUR and SARAH HICKS

THE POSSIBILITIES OF USING SPECIES OF PERENNIAL CUCURBITS AS SOURCE OF VEGETABLE FATS AND PROTEIN. L. C. Curtis (Univ. Connecticut, Storrs). *Chemurgic Digest 5*, 221, 223-4 (1946). A table gives a comparison between the composition and yield of soybeans, peanuts, and 3 species of cucurbits. No experimentation on these gourds has yet been made in the United States. The yield could be increased if the plants were cultivated or grown under more favorable conditions. At present, plants are growing wild in areas extending from Missouri to California and south into Mexico. They could be cultivated at very little expense, and their seed harvested mechanically, on land which is now agriculturally unproductive or fit for very inadequate cattle range.

RAPID METHOD FOR DETERMINING FAT CONTENT OF DRIED EGGS. C. Paley and S. Rubin (Certified Labs., Inc., N. Y.). *Food Industries 18*, 1194-5 (1946). By a modification of the Babcock test, using the "Paley" bottle with special strength acids, the fat content of egg powders can be determined with reasonable accuracy, and in less time than is required by the A.O.A.C. method.

THE RANCIMETER PREDICTOR OF KEEPING QUALITY. F. E. James. *Food in Canada 5*, 15 (1945). A new "Rancimeter" process involving titration tests shows a definite change in materials as they reach various stages. The results interpreted into months reveal how long a product will remain saleable on the grocers' shelves. By this method it has been possible to isolate and identify minute quantities of ingredients in a formula causing accelerated rancidity. Information is obtained in half a day which formerly required 4 months of storage tests. (*Biol. Abs. 20*, 772.)

CATALYTIC DEHYDROGENATION OF FATTY ACIDS. E. Raymond and J. Moretti. *Compt. rend. 222*, 893-5 (1946). The study of the dehydrogenation of the higher aliphatic acids was undertaken to determine

in the long-chain acyclic compounds the position of the C-H-linkage which has the least stability and is, therefore, most likely to undergo dehydrogenation. Raney Ni was used as a catalyst. The esters of lauric, myristic, palmitic, and stearic acids underwent successful dehydrogenation, but with greater difficulty the lower the molecular weight of the acid. The esters formed were unstable and liquids at ordinary temperature. (*Chem. Abs. 40,* 4024.)

COVITAMIN STUDIES. V. THE INTERRELATION OF ALPHA-TOCOPHEROL AND ESSENTIAL, UNSATURATED FAT ACIDS. E. L. Hove and P. L. Harris (Distillation Products, Inc., Rochester, N. Y.). *J. Nutr. 31,* 699-713 (1946). α-Tocopherol extends the effectiveness of suboptimal quantities of linolate in preventing or curing the essential fat acid deficiency syndrome in the rat. This sparing action has been shown using pure Me linolate or sesame oil. γ-Tocopherol also spares essential fat acid, *in vivo.* The interrelation of tocopherol and linolate appears not to be restricted to the gastrointestinal tract, since feeding of these substances separately at 24-hour intervals still shows enhanced growth, as compared with either supplement by itself. When tocopherol but no essential fat is fed to fat-deficient rats the deficiency symptoms are aggravated.

THE ROLE OF LINOLEIC ACID, α-TOCOPHEROL, AND OTHER FAT-SOLUBLE SUBSTANCES IN THE NUTRITION OF AN INSECT (*Ephestia kuehniella* Lep.). G. Fraenkel and M. Blewett. *Biochem J. 40,* xxii (1946). The caterpillars of the flour moth, *Ephestia kuehniella,* grow well on a diet consisting of casein, glucose, yeast, salts, water, and wheat-germ oil. Without wheat-germ oil growth is slow, the mortality high, and the moths never emerge from the pupae. With suboptimal doses moths emerge with the wings partly or entirely lacking in scales. Graded doses of the oil produce a graded response with regard to growth rate and state of scales. With the saponifiable fraction of wheat-germ oil alone growth is slow, but the moths emerge with perfect wings. With the unsaponifiable fraction alone growth is fast, but moths never emerge. The active substance in the saponifiable fraction is linoleic acid. Graded doses of linoleic acid give rise to moths exhibiting graded degrees of scale deficiency. Linolenic acid has approximately the same qualitative and quantitative effect as linoleic acid. Oleic acid has no effect. The chief active substance in the unsaponifiable fraction is vitamin E (α-tocopherol) and this can be replaced by other antioxidants.

THE EFFECT OF DIETARY RESTRICTIONS AND α-TOCOPHEROL ON STOMACH LESIONS AND BODY WEIGHT OF RATS. E. L. Hove, K. Hickman, and P. L. Harris (Distillation Products, Inc., Rochester, N. Y.). *Federation Proc. 5,* 264-5 (1946). Stomach lesions in rats have been produced by feeding diets low in protein, essential fat acids, pyridoxine or calories. Intermediate degrees of restrictions induce rumen lesions which in all cases are prevented by daily administration of α-tocopherol. Rigid restriction of calories causes severe hemorrhagic lesions in the fundic area of the stomach which are less influenced by tocopherol treatment. α-Tocopherol fed either during or prior to a calorie restricted diet causes more efficient utilization of the available food at the higher caloric levels. The type of fat in the diet has a marked influence on weight loss during restriction. Weight losses are least severe with hydrogenated coconut oil in the diet, but increase as the unsaturation of the fat increases.

THE COMPONENT ACIDS OF COW COLOSTRUM FAT. C. P. Anantakrishnan, V. R. Bhale Rao, and T. M. Paul (Imp. Dairy Research Inst., Bangalore). *Biochem. J. 40,* 292-7 (1946). Samples of colostrum fat collected from 6 cows during the progress of lactation have been analyzed for chemical characteristics and the composite mixtures were subjected to fractionation in order to study the fatty acid composition. The results indicate that there is a gradual decrease in the oleic acid, and an increase in the fatty acids of low molecular weight in the colostrum fat as lactation advances. The colostrum fat differs in composition from normal butterfat.

STUDIES OF THE EFFECTS OF HIGH LIPID DIETS ON INTESTINAL ELIMINATION. III. UNSATURATED GLYCERIDES WITH SPECIAL REFERENCE TO TRIOLEIN. Helen L. Wikoff, W. R. Hoffman, and Jean Caul (Ohio State Univ., Columbus). *Am. J. Digestive Diseases 13,* 228-30 (1946). No general conclusions can be drawn concerning the effects on intestinal elimination produced by feeding diets rich in unsaturated glycerides. Triolein produced a laxative effect when added to the standard diet in either 10 or 20% concentrations. When the lower concentration was fed to the large dogs, more total lipids and more soap extract were present in the feces than when the higher concentration was fed. The low acid and I numbers of the soap extract after the diet with 10% triolein added indicate that the soap extract did not contain appreciable quantities of oleic acid. When the 20% diet was fed to these same dogs, oleic acid was apparently present in the soaps. If the effects produced by linseed oil were caused by the rather large per cent of the linoleic and linolenic acids present in its glycerides, then it might be assumed that the presence of glycerides of one of these acids or of both of them in the diet would cause constipation. Further investigations will be needed to clarify this point. However, it can be said that neither of these acids was present to any extent in the soap extract because the low I and acid numbers exclude such a possibility.

INACTIVATION OF INSULIN BY INTERMEDIARY FAT METABOLISM PRODUCTS. M. C. Nath and H. D. Brahmachari (Univ. Dacca). *Nature 157,* 336 (1946). The intermediary fat metabolism products, particularly the keto acids and esters, are responsible for causing partial or complete inactivation of insulin. Such inactivation takes place *in vitro* as well as *in vivo.* Results showing the influence of keto acids and esters on the inactivation of insulin are tabulated. (*Chem. Abs. 40,* 4150).

EFFECT OF CHOLINE ON THE INTESTINAL ABSORPTION OF FAT. A. C. Frazer (Univ. Birmingham). *Nature 157,* 414 (1946). The intestinal cells of rats fed 1 cc. of olive oil and 1 cc. of water are filled with large globules of fat and very little appears to have passed into the areolar tissue of the villus or into the lacteals. When 1 cc. of olive oil and 1 cc. of 0.5% choline chloride were fed, masses of fat were seen in the areolar tissue and the cells were more rapidly cleared. The fat remaining in the cells appeared more finely dispersed. The effect is immediate; evidence at present does not indicate any decrease in stomach emptying time or marked increase of intestinal movement with the doses of 2-5 mg. of choline used in the studies. (*Chem. Abs. 40,* 4150.)

STUDIES ON THE COMPARATIVE NUTRITIVE VALUE OF FATS. VII. GROWTH RATE WITH RESTRICTED CALORIES AND ON INJECTION OF THE GROWTH HORMONE. H. J. Deuel, Jr., C. Hendrick, and M. E. Crockett (Univ. Southern California School Med., Los Angeles). *J. Nutr. 31,* 737-46 (1946). When rats were fed diets of mineralized skimmed milk powder and vitamin-fortified fats at a level of 60% of the *ad lib.* intake over a period of 9 weeks following weaning, the rate of growth was identical irrespective of whether the fat employed was a butter, a margarine, a commercial hydrogenated fat, or corn, cottonseed, peanut, or soybean oil. Moreover, there is no indication that differences exist in the ability of the rats to respond with increased growth during a 3-week period of *ad lib.* feeding following the period of restricted food intake in any dietary groups. When growth hormone was injected, the augmented growth was as great or greater with the rats receiving the vegetable fat diets as with those receiving the butter diet. Since not only does increased growth not occur when growth hormone is injected in rats receiving deficient diets (i.e., vitamin A-free) but also the period of survival is decreased, the present results are interpreted as indicating that the various vegetable fats and margarine have an ability equal to butter in supporting such added growth requirements. When growth hormone was injected, a greater efficiency in the utilization of the foodstuffs for growth was found. VIII. THE FAILURE OF ETHER EXTRACTION TO LOWER THE NUTRITIVE VALUE OF SKIMMED MILK POWDER IN DIETS CONTAINING VARIOUS VEGETABLE FATS. H. J. Deuel, Jr., C. Hendrick, E. Movitt, M. E. Crockett, I. M. Smyth, and R. J. Winzler. *Ibid.* 747-53. Residual fat is removed from skimmed milk powder only to the extent of 12-31% by 4 successive 8-hour extractions with diethyl ether and to 21-48% when extraction is continued for 4 additional 8-hour periods when the mixture is constantly agitated. Continuous extraction for 72 hours with diethyl ether on a Soxhlet apparatus removes about 20% of the residual lipids while extraction with Et alcohol resulted in a lowering of 35% of the original content. The most effective extraction was made by simultaneous extraction with alcohol and ether. No differences in rate of growth or in the total ultimate gain in weight over a 12-week period was observed when weanling male and female rats were fed extracted skimmed milk powder mixed with fat, irrespective of whether a butter or a margarine, or corn, cottonseed, peanut, or soybean oil was the fat used. IX. THE DIGESTIBILITY OF MARGARINE FAT IN HUMAN SUBJECTS. H. J. Deuel, Jr. *Ibid. 32,* 69-72. Margarine fat composed of hydrogenated domestic vegetable oils was found to be digested to an average of 97% by normal men and women which was an identical value obtained in 3 tests on butter fat. There was no evidence of any unpleasant physiological effects when a maximum of 111 g. of margarine fat was ingested daily.

INFLUENCE OF DIFFERENT FATS AND OILS ON THE COMPOSITION OF BODY FAT AND THE LIPID CONTENT OF THE LIVER OF RATS. N. C. Datta (Haffkine Inst., Bombay). *Ann. Biochem. Exptl. Med. 5,* 109-16 (1945). Groups of 6 young rats each were fed for 80 days on a fat-free diet *(I)* and on diets containing 25% butter *(II)*, hydrogenated vegetable fat *(III)*, mustard seed oil *(IV)*, and *IV* mixed with 5-10% argemone oil *(V)*, respectively. The I no. of *II* was 35.0, of *III* 67.0, and of *IV* 101.4. The I no. of the adipose fat after feeding diet *I* was 58.13, *II* 50.73, *III* 72.32, *IV* 91.8, and *V* 94.43. Hence, *II* and *III* became more unsaturated before they were stored by the rat, *IV* became less unsaturated. The I no. of the depot fat resembles that of the ingested fat but the body fat of the rat is destined to have a certain degree of saturation. The liver of rats fed on *V* is characterized by the presence of an excessive amount of cholesterol. (*Chem. Abs. 40,* 4415).

THE EFFECT OF FEEDING SHARK-LIVER OIL TO COWS ON THE YIELD AND COMPOSITION, AND ON THE VITAMIN A AND CAROTENE CONTENT OF THE MILK. K. L. Blaxter, S. K. Kon, and S. Y. Thompson (Univ. Reading). *J. Dairy Res. 14,* 225-30 (1946). An experiment with 10 dairy cows has shown that the daily feeding of 30 or 60 g. of shark-liver oil containing 80,000 I. U. of vitamin A per g. is without effect on milk yield, fat yield, the fat and solids-not-fat percentage of the milk, and on the health and well-being of the cow. The concentration of aneurin, riboflavin, and vitamin C in the milk was not affected by the feeding of shark-liver oil. The total carotenoids of the milk fat decreased when shark-liver oil was fed. The vitamin A content of the fat increased 1100% when 30 g. were given and 1850% when 60 g. were fed. The highest individual value reached was 390 I. U. per g. fat.

THE ROLE OF DIMETHYL- AND MONOMETHYLAMINO ETHANOL IN TRANSMETHYLATION REACTIONS IN VIVO. V. du Vigneaud, J. P. Chandler, S. Simmonds, A. W. Moyer, and M. Cohn (Cornell Univ. Med. Coll., N. Y.). *J. Biol. Chem. 164,* 603-13 (1946). Dimethylaminoethanol was found to be active in preventing the formation of fatty livers and hemorrhagic kidneys but was decidedly inferior to choline in growth-promoting properties on a homocystine diet. Feeding experiments in which the monomethyl- and dimethylaminoethanols were labeled with deuterium in the Me group proved that these compounds are excellent precursors for the synthesis of choline in the animal body. An explanation has been suggested for the apparently contradictory behavior of dimethylaminoethanol, that is, its efficiency as a precursor of choline and its relative inefficiency in substituting for choline to give growth on Me-free diets.

PATENTS

FAT-SOLUBLE VITAMIN FRACTIONATION. L. O. Buxton (National Oil Products Co.). *U. S. 2,404,618.* A process of producing a vitamin A concentrate and a vitamin D concentrate from a marine oil comprises saponifying the marine oil to the extent of 95-99% based on the weight of the saponifiable matter present therein whereby substantially all of the vitamin A esters are split and substantially no vitamin D esters are split, separating the unsaponified fraction containing the vitamins from the saponified fatty matter and extracting the unsaponified fraction with isopropanol containing at least 9% water to recover a vitamin A concentrate, the residue constituting a vitamin D concentrate.

PRODUCTION OF FAT-SOLUBLE VITAMIN ESTER CONCENTRATES. C. E. Dryden and L. O. Buxton (National Oil Products Co.) *U. S. 2,404,365.* A process for the production of fat soluble vitamin ester concentrates from vitamin containing material of marine origin comprises partially saponifying the material while maintaining the temperature thereof during saponi-

fication between approximately 0-25°, separating the soap from the unsaponified residue and treating the unsaponified residue with methanol to remove that portion of the residue soluble therein and produce a concentrate high in vitamin ester content.

BUTTER PRODUCT AND PROCESS FOR PRODUCING THE SAME. L. O. Buxton (National Oil Products Co.). *U. S. 2,404,034-7.* These processes for producing a butter concentrate contain the steps of dissolving butter oil in a greater volume of isopropanol, heptane, acetone, Et acetate, or other compatible organic solvent, cooling the mass to below 10° to cause layer formation, and separating the solvent layer, having dissolved therein a major portion of the vitamins, flavor-imparting and antioxidant constituents originally present in the butter oil.

VACUUM DISTILLATION APPARATUS. K. C. D. Hickman and E. S. Perry (Distillation Products, Inc.). *U. S. 2,403,978.* This invention relates to improved vacuum distillation apparatus particularly of the type wherein the vaporizing and condensing surfaces are stationary and separated by substantially unobstructed space.

COMPOSITION. M. P. Kleinholz (Sinclair Refining Co.). *U. S. 2,403,928.* The improved mineral oil composition comprises a petroleum lubricating oil fraction with which there has been compounded a proportion, effective to retard rusting of a semilactide of the α-hydroxy fat acid.

ANTICORROSIVE. H. G. Smith and T. L. Cantrell (Gulf Oil Corp.). *U. S. 2,403,762.* The new compositions of matter are oil-soluble addition salts of primary fatty amines containing 8-18 C atoms and acid phosphate diesters of 2,4,6-trialkylated phenols containing at least 1 branched chain alkyl group, said primary fatty amine salts being substantially neutral compounds soluble in mineral oils and miscible with hydrocarbons.

Abstracts

Drying Oils

Edited by
HOWARD M. TEETER

OITICICA OIL. *Chemurgic Dig. 5,* 248-9 (1946). An historical and technical review.

ISOMERIZED OILS. H. R. Touchin. *Paint Manuf. 25,* 237-9 (1946). A review of progress in isomerized oils. 17 references.

THE USE OF LOW-TEMPERATURE CRYSTALLIZATION IN THE DETERMINATION OF THE COMPONENT ACIDS OF LIQUID FATS. III. FATS WHICH CONTAIN ELEOSTEARIC AS WELL AS LINOLEIC AND OLEIC ACIDS. T. P. Hilditch and J. P. Riley (Univ. of Liverpool, Eng.). *J. Soc. Chem. Ind. 65,* 74-81 (1946). The general principles of analysis were previously described by Hilditch, *et al.* (see abstracts of previous papers in this series). Each fraction of acids was analysed spectrophotometrically before and after isomerization with alkali to determine the proportion of α-eleostearic acid and linoleic (and if present, linolenic) acids. The characteristics of American tung, Chinese tung, essang (*Ricinodendron africanum*), neou (*Parinarium macrophyllum*), and krobanko (*Telfairia occidentalis*) oils, respectively, were: sapon. equiv., 286.7, 288.7, 291.2, 299.3, 277.7; iodine number (Wijs), 163.0, 162.6, 150.8, 108.2, 109.0, n_{40}, 1.5133, 1.5120, 1.5010, 1.4848, 1.4772; and the compositions of their respective fat acids were: palmitic, 5.5, 4, 9.5, 12, and 15%; stearic, —, —,1, 2, and 9%; oleic 4, 9, 9.5, 40, and 27%; linoleic, 8.5, 10, 26, 15, and 29%; α-eleostearic, 82, 77, 54, 31, and 20%. Two points of interest emerged: (1) None of the four eleostearic-containing fats contained the non-conjugated triene linolenic acid. This suggests the possibility that the two triene acids do not occur together in the same vegetable fat. (2) The diminution in eleostearic acid content is most clearly paralleled by increase in the saturated acids. In regard to the possible economic value of the last three oils, they are freely produced in Nigeria. Neou and essang nuts have the disadvantage of high shell content, although the kernels are rich in fat and readily extractable once they are decorticated. Krobanko oil appears to have little technical outlet. (*Chem. Abs. 40,* 4535.)

HEAT POLYMERIZATION OF CASTOR OIL. S. Mukherjee and B. K. Mukherjee (Univ. Coll. Sci. Technol. Calcutta). *J. Ind. Chem. Soc. 22,* 305-8 (1945). Castor oil polymerizes at temperatures as low as 50°. The molecular weight increases 2 or 3 times its original value when the oil is heated 4 hours at 100°. The oil is partly dehydrated and the diene value increases. The viscosity, specific gravity and refractive index increase proportionally with the increase in molecular weight. The changes in acetyl, iodine and diene values are not regular and indicate that polymerization does not take place by simple doubling of the molecule but that the glycerides are first decomposed into fatty acids and lower glycerides and the fatty acids then undergo polymerization. (*Chem. Abs. 40,* 4537.)

THERMAL POLYMERIZATION OF DRYING OILS. H. E. Adams and P. O. Powers (Armstrong Cork Co.). *J. Applied Phys. 17,* 325-37 (1946). A statistical analysis of the thermal polymerization of drying oils was made. Comparison of the predictions from this analysis with experimental data disclosed discrepancies which would be explained by the existence of an intrapolymer. A sample of linseed oil was polymerized in 50% xylene solution at 300°, and its properties were compared with those of a sample of pure linseed oil bodied for the same time at 300°. The iodine values of both samples were identical, but the viscosity and molecular weight of the sample bodied in solution were lower than for the oil not bodied in solution. Since in dilute solution intramolecular reactions are favored at the expense of intermolecular reactions, the results are consistent with formation of the postulated intrapolymer.

VISCOSITY OF LINSEED STAND OIL AT HIGH SHEARING STRESS. D. Tollenaar and H. Bolthof. *Ind. Eng. Chem. 38,* 851-3 (1946). Bodied, or stand oils, prepared by heating linseed oil, possess anomalous viscosity as demonstrated by the fact that the viscosity of the oil varies with the shearing stress or rate of shear. Shearing stresses necessary to produce this effect are encountered in printing presses. The pick-