# Brandt Reviews World Economic Situation in Fats and Oils

FORTY-SEVEN papers representing virtually all phases of fat and oil chemistry and industry were presented at the 24th fall meeting of the American Oil Chemists' Society. The technical sessions were held at the Sir Francis Drake hotel in San Francisco, September 26 to 28, and proved to be most interesting and stimulating. Most of the papers were related to the following general subjects: processing techniques, drying oils, biochemistry and nutrition, oxidation and rancidity.

The technical program was opened with a thorough review of the world economic situation in fats and oils by Karl Brandt of the Food Research Institute of Stanford University. Dr. Brandt first discussed the expansion in the production of fats and oils during the interval between world wars I and II in relation to the development of hydrogenation, solvent extraction, and other factors and then went on to consider the impact of world war II on the fat and oil industry and adjustments that have taken place since the war. Although normally the probable effects of various factors such as the competition of petroleum products with fat and oil products can be evaluated, Dr. Brandt felt that no accurate forecast of the immediate economic future of fats and oils is possible due to the existing international situation. He indicated however that even in the face of major uncertainties, the general outlook for fat and oil industries appeared to be good.

With a look toward the future H. W. Milner of the Carnegie Institute of Washington, Stanford, Calif., discussed the possibilities in photosynthetic methods for the production of oils and proteins. Specifically he described interesting laboratory experiments in which the proper control of nutrients and other environmental conditions made it possible to obtain a high yield of oil and protein from the algae *Chlorella* by photosynthetic processes. The experiments demonstrated that it was possible to attain a far more efficient utilization of sunlight and thus obtain higher yields of oils and proteins than in normal farm production. Dr. Milner however carefully pointed out the difficult engineering problems that must be solved before the new processes could be competitive with the current methods of production.

There were five papers dealing with processing methods in the production of fats and oils. In the first of these McCubbin outlined the goals of the oil mill superintendent in the operation of solvent extraction processes. The maintenance of continuous operation at full capacity and the production of uniform products of good quality were stressed. The importance of such factors as flake thickness and temperature in producing maximum yields, and the reduction of solvent losses, particularly by keeping air out of the extraction system, were emphasized. A careful consideration of utility requirements, maintenance requirements, and operating safety were also deemed necessary for the successful operation of a solvent extraction plant.

A new type of continuous solvent extractor was described by Smith in which a solvent is percolated through a moving bed of solids. Successive stages of the extractor are in a horizontal arrangement. Data were presented that illustrated the performance of the extractor under various conditions.

A solvent rendering process was described by Levin that removes moisture and fat simultaneously from animal and vegetable materials. By using water-immiscible solvents such as trichlorethylene, ethylene dichloride, and heptane, it was reported that moisture and fat could be separated at much lower temperatures than in the more commonly employed rendering processes, thus yielding better products and preventing the destruction of some of the more labile nutritional factors. The process was also reported to have other advantages for rendering and fish processing industries, such as shorter operating time, reduction of pollution, and lower operating costs.

Feuge and Janssen found that cottonseed oil could be bleached more readily and more efficiently by standard bleaching clays and carbons when the oil was in solution in hexane. The bleaching was accomplished by passing the oil solution through columns of clay or carbon supported on diatomaceous earth or sand. It was further shown that the columns could be easily regenerated with acetone and reused many times without appreciable loss in bleaching efficiency.

Another method for the removal of color from vegetable oils, a continuous process of washing with caustic soda, was described by Cavanagh. An important feature of the process is the use of high speed agitation. Depending on the oil to be processed and the degree of color removal desired, such factors as violence of agitation, temperature, strength of the caustic soda solution, and contact time in high speed agitators must be properly adjusted.

Two papers were concerned with surface active materials. In a paper dealing with applications of surfactants in chemical industry, Terry emphasized the possibility for many new applications to obtain better products, better product control, and reduced costs. The discussion was limited primarily to the use of surfactants in three general fields: a) for improvement in unit processes, b) as aids in metal processing, c) as antistatic agents in the plastic industry. In the first of these, possibilities for improvement in purity and yield of products, decrease in reaction time, improvement in filtrations, and the separation of emulsions were pointed out.

Vaughn, Suter, Lundsted, and Kramer discussed a series of nonionic detergents, particularly with reference to their physical properties and cotton detergency. In this connection the effect of water hardness on the detergency properties of nonionic and nonionic-anionic detergent mixtures was evaluated. Also taken into consideration were the effects of temperature, concentration, and other factors on carbon soil removal and whiteness retention properties.

The role of optical bleaches in household soaps and detergents was covered in a paper by Stearns, Cooke, and Millson. It was pointed out that the dyes used as optical bleaches represent various chemical classes having diverse properties. Important considerations for these materials are their absorption in the ultraviolet spectrum and fluorescence in the visual spectrum, their water solubility or dispersibility, their fiber substantivity, and their stability in the presence of other household chemical agents with which they may come in contact. In addition, the importance of various color and application characteristics was discussed.

Vold, Grandine, and Schott reported an attempt to clarify the current confusion relative to the phases that exist in solid sodium soaps. They presented data demonstrating the applicability of the x-ray spectrometer to the problem of solid soap forms and contrasted the results of their x-ray diffraction studies on a large number of soap samples with data obtained by other methods. Discordant data were explained on the basis of a variability of pattern due to a randomness in crystal structure, which was dependent upon the water content and the mechanical and thermal history of the soaps.

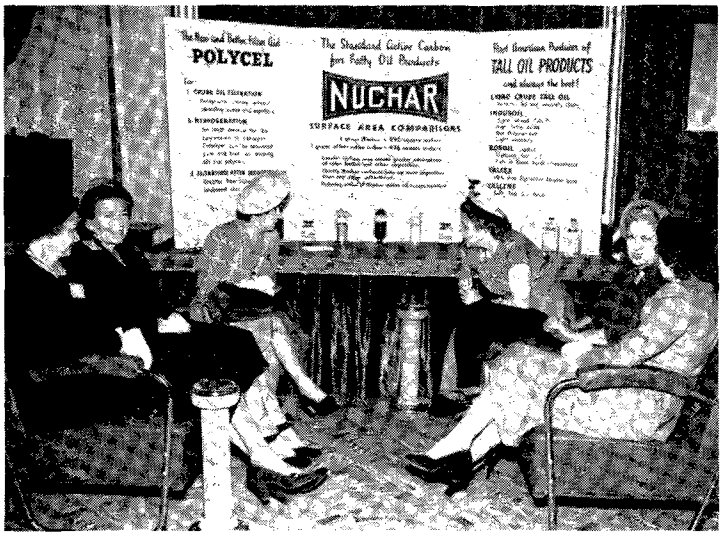
Advances in the application of an ion exchange process to the purification of glycerine, made possible by the introduction of newer forms of both cation and anion resins, were reported by Caskey. The economic feasibility of the process compared with standard procedures depends on various factors, particularly on the amount of impurities to be removed. The new process has the advantages of lower glycerine loss and the production of an extremely pure product but also has the disadvantage that crude glycerine must be diluted and reconstructed.

The oils from four varieties of safflower seed were examined by Soltoft and Dollear for the purpose of evaluating their usefulness in edible fat products. The yields and physical and chemical characteristics of the four oils were found to vary to some extent. One of the oils (Nebraska 852), which was refined, bleached, and deodorized, yielded a product having very light color. The processed oil however developed an off-flavor after a few hours of storage at room temperature and was particularly susceptible to the development of off-flavors on exposure to light. The stability of the oil was greatly improved by hydrogenation, but in order to obtain a fat with good keeping quality it was necessary to hydrogenate to a consistency above that of commercial all-hydrogenated shortenings.

EIGHT papers were in the drying oil field. Three of these were concerned with possible applications of safflower oil in surface coatings. Pointing out the increasing attrac-

GRACING the head table at the banquet at the Sir Francis Drake on September 27, 1950 are *(left to right)* E. B. Kester, general chairman, Mrs. Kester, President J. R. Mays Jr. and Mrs. Mays; *(standing)* Hugo de Bussieres, treasurer of the local committee, Mrs. de Bussieres, Mrs. and Mr. T. D. Sanford.

OPERA-BOUND? All dressed up are Mrs. Thomas M. Griffin *(front)* with E. M. James as escort, and Mrs. W. R. Prosch with Mr. Prosch. Opera was the optional diversion for Thursday evening, when Lily Pons sang in the role of "Lucia" in the famed War Memorial Opera house in San Francisco, where the United Nations organization was born.




CHATTING on the mezzanine of the Drake, prior to the ladies' luncheon on the Starlite roof are Mrs. W. K. Griesinger, Philadelphia; Mrs. C. B. Patterson, San Diego; Mrs. J. A. Lawson, San Mateo; Mrs. J. A. Gordon, Berkeley; Mrs. H. D. Fincher, Houston; and Mrs. A. H. Wood, Memphis.

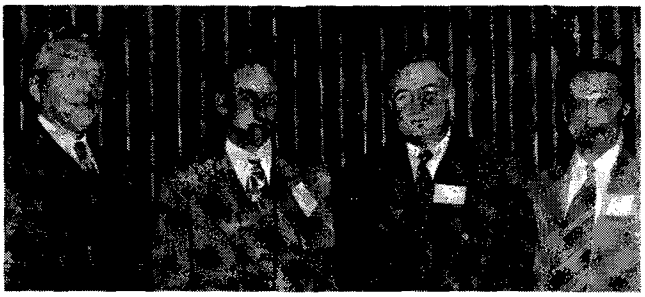
# Social Whirl for AOCS in San Francisco

JOLLY is the mood as the good ship, General Coxe, sets forth from Fisherman's Wharf for a moonlight cruise of the bay Tuesday, with W. A. Peterson, Jersey City, and the C. B. Pattersons of San Diego, on board.

IN THE ROLE of family friend is R. R. King *(right)* as he observes Marshall Odeen set up a Beckman instrument. The latter is the son of Henry Odeen, former Journal advertising chairman.

DINING at DiMaggio's, preliminary to the moonlight cruise, are Mr. and Mrs. A. L. Sawyer, Morristown, N. J.; Mrs. and Mr. J. A. Chenicek, Bensenville, Ill.; and A. A. Rodeghier, Chicago.

A BIG OH is being registered by Mrs. S. U. Greenberg of Berkeley as she looks at the fancy cake decorated with a confectionery grass hut, palm trees, and welcome sign during the ladies' Hawaiian luncheon.



**SPEAKERS — Ezra Levin, VioBin Corporation, Monticello, Ill.; C. D. Thurmond, Monsanto Chemical Company, San Francisco; H. J. Deuel Jr., University of Southern California, L. A.; and R. O. Feuge, Southern Regional Research Laboratory, New Orleans.**

tiveness of safflower oil for such applications, Thurmond reported the results of preliminary chemical studies with samples of this oil. Alcoholysis and polymerization reactions proceeded at rates equal to or greater than those of corresponding reactions with soybean oil. Short oil alkyds and other products derived from safflower oil were equal or superior in drying properties to similar products obtained from soybean oil. DaValle and Rhoades described results of studies employing thousand-gallon batches in which the heat polymerization characteristics of safflower oil were compared with those of linseed and soybean oil. They found that, by employing slightly higher temperatures, safflower oil could be polymerized at the same rate as linseed oil to produce a comparable product, which in addition had the advantage of paler color. Gordon, Hamlin, and Cartmell prepared long, medium, and short oil alkyds from safflower, soybean, and linseed oils and tested films from these products for their drying qualities, resistance to water and chemicals, abrasion resistance, and other properties. The products from safflower oil were superior to those from soybean oil in most respects and were also found to be superior to those from linseed oil for certain special usages.

Three papers dealt with protective coating vehicles obtained from various polyhydric alcohols. The film properties of esters of drying oil fatty acids and polyvinyl alcohol were investigated by Rheineck. The esterifications were conducted in homogeneous systems employing phenol as solvent. With a cobalt drier the esters of linseed acids were found to dry extremely rapidly and gave films of good depth, hardness, toughness, water and grease resistance, and durability. The alkali resistance however was poor.

In another study Cox, Jerabek, and Konen esterified polymers of allyl alcohol with the fatty acids of soybean oil, linseed oil, tall oil, and various resins. Polyallyl alcohols with various chain lengths were employed, and a number of products so obtained were evaluated extensively as protective coating vehicles. It was concluded that if polyallyl alcohols were available on an economically attractive basis, protective coating vehicles prepared from them could find many useful applications.

**LOCAL CHAIRMEN—E. F. Week, publicity; S. U. Greenberg, field trips and sight-seeing; C. J. Gaiser, shore dinner and boat ride; and J. A. Gordon Jr., registration and arrangements.**

Another polyhydric alcohol, xylitol, was employed by Teeter, Bell, and Cowan in the preparation of esters of linseed and soybean fatty acids. Films of the soybean ester containing a basic lead carbonate pigment possessed better drying properties than a soybean oil and white lead paint of similar composition. It was declared however that the paints prepared from the xylitol esters possessed crawling tendencies and objectionable thixotropic characteristics that must be overcome before vehicles of this type can be considered favorably for protective coatings.

Mika, Jacob, and Tess found that the film properties of several types of alkyd resins could be improved by incorporating *p*-tertiary butyl benzoic acid into the resins. This acid was used in the preparation of short-soya baking alkyd resins, long-linseed air-drying resins, and nonoxidizing alkyd resins such as are used for the modification of lacquers and baked finishes. Improvements in properties that were noted in one or more of these resins included increased viscosity, increased hardness, better water resistance, better gloss and gloss retention, improved color and enhanced resistance to light discoloration, better heat resistance, and improved drying properties. The aromatic acid could also be used to advantage to replace part or all of the amino resins in alkyd-amino-resin combinations for some purposes. The use of very large amounts of the acid however produced marked brittleness.

Eldred and Lathrap discussed the results of analyses of the relative proportions of alpha and beta eleostearic acids in a number of samples of oriental tung oil. They also studied the behavior of the oils when kept at reduced temperatures and ascertained a relationship between the lowest temperature at which the oils would remain clear and their contents of beta eleostearic acid. The rate of increase of beta eleostearic acid in commercial tung oils in storage at elevated temperatures was also determined.

EIGHT papers were concerned with various biochemical aspects of fats and oils. As an introduction to this section of the program H. J. Deuel Jr. of the University of Southern California discussed the functions of fat in the diet, giving attention to both the qualitative and quantitative aspects of fat nutrition. He described how fats contribute to physiological well-being in various ways, demonstrated in animal experiments by better growth, better feed efficiency, earlier sexual maturity, improved reproductive performance, greater physical endurance, longer survival time in starvation, and less waste of body heat. It has also been shown that fats have a sparing action on protein and cause a lowered excretion of nitrogen. Dr. Deuel also reviewed the role of dietary fats in providing essential fatty acids, in providing and serving as carriers for fat soluble vitamins, and in enhancing the flavor and improving the palatability of other foodstuffs. Thus it has become increasingly evident in recent years that fats have many functions in addition to supplying calories in highly concentrated form.

A paper by Greenberg, Deuel, and Brown discussed their findings by means of biological assays concerning the interrelationships of essential fatty acids. Linolenic acid was ineffective in producing a growth response in fat-depleted male rats unless linoleic acid was given simultaneously. Arachidonic acid was found to be more than twice as effective as linoleic acid, and its potency was further enhanced when fed simultaneously with linoleic acid. In the assay method employed in these studies it was found that the growth response was proportional to the logarithm of the dosage of linoleic acid. This relationship persisted up to the highest doses studied, 100 mgm. of linoleic acid per day. Biological assays of the essential fatty acid contents of samples of margarine and butter fat gave lower values for the essential fatty acid content than spectrophotometric analyses.

Reiser reported the effects of feeding fat-free diets to laying hens on the polyethenoid fatty acid content of the neutral fat and phospholipids of the eggs. The di- and tetraenoic acids in the yolks decreased markedly, and the hexaenoic acid disappeared entirely. The addition of linoleic acid to the diet resulted in the deposition of hexaenoic, dienoic, and tetraenoic acids in the chronological sequence indicated. The total lipids and the proportions of neutral fat and phospholipids in the egg yolk were unaffected by the quality or quantity of fat in the ration.

In comparative studies of the nutritive values of various mono-, di-, and tri-glycerides Mattson and Beck found that the monoglycerides gave the same growth as triglycerides in some cases and less in others depending upon the fatty acids that were present. The caloric efficiencies for monoglycerides

**LOOKING FOR THE MOON—This quartet stopped exploring the General Coxe long enough to pose obligingly: *(below)* R. A. Burt and J. M. Oughton, Canada Packers; *(above)* Wales Newby, Cotton Products Company, Opelousas, La.; and M. A. Partridge, Canada Packers, Toronto.**

and triglycerides were about the same in all cases, but stearins and laurins gave poorer efficiencies than the glycerides of oleic acid or of the fatty acids of a hydrogenated mixture of soybean oil and cottonseed oil. No abnormalities other than poor growth were noted in any case, and it was concluded that the mono-, di- and tri-glycerides are nutritionally equivalent on an equicaloric basis.

In a somewhat similar study Ames, O'Grady, Embree, and Harris compared the nutritive values of distilled monoglycerides derived from cottonseed oil and the cottonseed oil itself at levels of 15% and 25% in the diet. No significant differences in fat digestibilities were found, and the monoglycerides were equivalent to cottonseed oil in promoting the growth, reproduction, and lactation of albino rats.

In a study of the effect of dietary fats on the quality and stability of turkey meat Klose, Mecchi, Hanson, and Lineweaver fed combinations of meat meal or fish meal with coconut oil or linseed oil. Wide differences were found between the linseed oil and coconut oil groups in the fatty acid composition of carcass fats. The fat of turkeys fed linseed oil was much less stable in storage than that of birds fed coconut oil and in addition developed a fishy flavor and odor on roasting. The substitution of fish meal for meat meal produced slight but adverse effects on stability and flavor.

DeEds and Allen employed albino rats in a study of the toxicity of lauryl gallate, a substance that has been proposed for use as an antioxidant in edible fats and oils. Concentrations up to 1% of lauryl gallate in the diet for periods of 254 days produced no evidence of toxicity as judged by food intake, growth, and general behavior of the animals and by observations at autopsy and microscopic examinations of stained tissue sections.

Studies of the hydrolysis of cottonseed oil in mixtures with castor bean lipase cream were reported by Balls and Rose. After a number of hours at room temperature the mixture could be separated into solid and liquid phases. The contents of mono- and diglycerides were determined, revealing that the solid phase contained about 2½ times as much monoglyceride as the liquid phase. The formation of mono- and diglycerides at $-18°C$ was also studied.

Farr described a modification of the active oxygen method for determining the stability of fats, which could be used to evaluate the stability of fats in a much shorter time than required by more commonly used procedures. By using higher temperatures, highly stable fats could be evaluated in hours in cases where days would be required in tests at 97.7°C.

An automatic apparatus for determining the stability of fats and oils by an oxygen absorption method was described by Hunter. Oxygen was automatically introduced by a syringe in response to the fall of pressure in the reaction vessel, and an electrically operated device recorded any predetermined amount of oxygen absorption.

The comparative antioxidant potencies of various alkyl hydroxyanisoles and hydroxyphenetoles were reported by Rosenwald and Chenicek. 3-t-butyl-4-hydroxyanisole was found to be more effective than any of the 4-hydroxy anisoles in which various alkyl groups were placed in the 2 position. The effectiveness of butylated 2- and 3-hydroxyanisoles was found to be low. The antioxidant potencies of three isomeric t-butyl hydroxyphenetoles was found to be comparable to those of the corresponding t-butyl hydroxyanisoles.

IN a series of three papers from the Northern Regional Research Laboratory Dutton and coworkers presented the results of analyses of oxidation products of fats by countercurrent distribution methods. In mixtures of model compounds the weight distribution curves of individual compounds were found to be predictable from the partition coefficients and were little influenced by the presence of the other dissolved compounds. Applying the method to the oxidation products formed in the reaction of oxygen with methyl oleate, it was found that mono-hydroperoxides were first formed but that in subsequent stages a considerable amount of oxidation took place at the double bonds. In similar studies with methyl linolenate virtually no monomeric monohydroperoxides were found, and more than half of the double bonds originally present were destroyed by oxidation. It was concluded that the destruction of double bonds was probably due to polymerization initiated by oxidative attack at the double bonds since dimers were formed during the process.

Privett and Lundberg discussed the errors that are encountered in applying the alkali-conjugation spectrophotometric method of analysis to autoxidized fats. They described a procedure whereby a quantitative separation of the oxidized and unoxidized fatty acids could be achieved by liquid-liquid fractionation, thus permitting an accurate analysis of the unoxidized portions.

In order to provide information needed in the application of infra-red spectroscopy to research on vegetable oils O'Connor, Field, and Singleton presented data and reference curves for the saturated fatty acids and their methyl and ethyl esters in homologous series from 6 to 18 carbon atoms. They also discussed the significance of the intensity relationships of several absorption bands found throughout the homologous series.

Pool and Klose described a new procedure for the determination of monocarbonyl compounds in rancid fats. The material to be analyzed is passed through a column of alumina containing adsorbed 2,4,-dinitrophenylhydrazine. The monocarbonyl reaction products are readily desorbed while the 2,4,-dinitrophenylhydrazine and the dicarbonyl reaction products remain on the column. The hydrazone in the effluent is then determined colorimetrically.

Week and Sevigne studied factors affecting the correlation of vitamin A colorimetric assays with spectrophotometric assays. One of the chief factors affecting this correlation is the presence of the cis form, neovitamin A. They analyzed 30

**ODEEN FAMILIES—All set for the moonlight cruise on the General Coxe are Mr. and Mrs. Henry Odeen *(left)*, Memphis, and Mr. and Mrs. Marshall Odeen, South Pasadena, Calif.**

samples containing vitamin A from natural and synthetic sources and found neovitamin A to be present in quantities of 10 to 45%. The effect of these variations on practical vitamin A assays was evaluated.

Employing an infra-red spectrophotometer in an investigation of the autoxidation of methyl oleate, Knight, Eddy, and Swern demonstrated that cis-trans isomerization occurred, particularly during the initial stages of autoxidation. They proposed a mechanism by which the cis-trans isomerization might occur, based on a rotation about the carbon to carbon bonds in the allylic free radicals that are formed during the reaction.

Similarly Feuge, Pepper, O'Connor, and Field followed the formation of trans double bonds by means of infra-red spectrophotometry during the hydrogenation of methyl oleate and triolein. In all cases an equilibrium mixture of 67% trans and 33% cis isomers was reached. The rate of formation of the trans isomers was found to increase with increasing temperature, increasing catalyst concentration, and decreasing dispersion of the hydrogen in the oil phase.

Teeter, Gast, Raleigh, and Woods reported further studies of the reactions of tertiary butyl hypochlorite with vegetable oils and their derivatives. The reactions of tertiary butyl hypochlorite with alkyl oleates and alcohols produced derivatives which on hydrolysis and subsequent saponification yielded mixtures of 9, and 10 ketostearic acids. In an analogous reaction methyl linoleate was converted to methyl dimethyoxydichlorostearate, and after pyrolysis a methyl diketostearate was isolated by low temperature crystallization.

In the first of two papers Craig, Geddes, and Lundberg described methods for obtaining improved yields in the preparation of symmetrical mixed triglycerides. A second paper described the results of dilatometric studies on individual triglycerides and on various mixtures of simple and symmetrical mixed triglycerides. In the mixtures in general it was found that the melting point of triolein was unaffected by the presence of other components but the melting points of saturated triglycerides were lowered by the presence of triolein. The calculation of solid to liquid ratios in any but the most simple mixtures was found to be impossible because of an extension and overlapping of the melting ranges of the individual components in the mixtures.

Using a Craig countercurrent distribution apparatus, McGuire and Earle studied the composition of the alcohol-soluble and alcohol-insoluble fractions of linseed phosphatides. The alcohol-soluble portion was found to consist almost entirely of choline phosphatides, but fractionation of the alcohol insoluble portion yielded two types of phosphoinositides having phosphorous-nitrogen-inositol ratios of approximately 2:1:1 and 4:4:1.

By means of silicic acid columns and subsequent distillation Herb and Riemenschneider successfully isolated a purified methyl eicosapentaenoate. The results of spectrophotometric examinations of this material after isomerization with alkali were discussed, and evidence for the presence of a 22 carbon fatty acid having four or five double bonds was found.

A new wet method for the sieve analysis of finely ground soybeans and soyflour was devised by Bolam and Earle. In their technique a spray of carbon tetrachloride was directed against the under side of the sieve to keep the openings clear, thus permitting all the fines to be carried through the sieve by the return flow of the solvent. Replicate analyses of various samples gave results which usually did not differ from the average values by more than 1%.

W. O. LUNDBERG.

**KNOTTY PROBLEM—A special group from the Governing Board is set to revise some complicated phrases *(left to right)*: V. C. Mehlenbacher, C. P. Long, President J. R. Mays Jr., and R. T. Milner.**

**WRONG PICTURE—This group should have been taken later on the field trip, say climbing up the walkway to the Vingnes, copra ship just in from the Philippines at the Cargill dock in San Francisco or at the Beringer winery in the Napa Valley; but here they are, ready for a big day: L. R. Brown, A. E. Staley, Decatur, Ill.; O. J. Fiala, Durkee Famous Foods, Chicago; and E. D. Gile, Opelousas (La.) Oil Refinery; *(above)* F. B. White, Foster Wheeler, New York City.**

## It's a Man's World

**ONLY ONE LADY at this table, and she can hardly be seen: Mrs. W. K. Griesinger. Her table-mates *(left to right)* are T. C. Smith, Charles Humes, R. R. King, Newell Beatty, John Blum, Larry Pyle, A. A. Rodeghier, S. P. Taylor, her husband, E. J. Rhein, and George N. Walker. (The one unidentified face belongs to another table apparently.)**

**ALMOST A STAG TABLE TOO: from the left, Mr. and Mrs. Raymond Reiser, Leon Adler, Margery Lee Kershaw, O. H. Bratt, B. J. Cagan; and O. S. Privett, W. O. Lundberg, A. E. Rheineck, D. F. Houston, Twylla R. Knight, and A. R. Baldwin.**