These four papers were given by representatives of the Pulp Chemicals Association before the Northeast Section of the American Oil Chemists' Society on December 6, 1960, at Whyte's restaurant in New York. Moderator was D.E. Campbell, secretary, Pulp Chemicals Association.

Tall Oil Industry Supply Situation

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TALL OIL is a co-product of the pulp and paper industry and originates in the form of tall oil skimmings containing the natural fats and resins in the pulp wood prior to cooking. The source is softwood, largely of the pine species, since currently most of the sulfate pulp production is in the southern regions of the United States. In this paper we shall largely deal with paper grades as against the nonpaper grades of sulfate pulp used in acetate, viscose, and cellophane. This section of the pulp and paper industry operates at a high production level compared to capacity.

Operating Rates to Capacity, Southern Pulp Mills

Cal. years	1950	98.8%
	1953	96.4%
	1956	98.7%
	1957	88.3%
	1958	82.4%
	1959	92.2%

Table I gives the productive capacity of sulfate pulp (paper grades) in the southern regions from 1959 through 1963 and a projection of what would be required in 1965 if the estimate of the U.S. Department of Commerce is fulfilled.

TABLE I

Sulfate Pulp (Paper Grades)[a] Capacity in Southern Regions of U.S.A.[b] Projections for Calendar Years

Projection for year	Sulfate[c] pulp capacity	Potential crude tall oil,[e] assuming yields based on softwood		
		70 lbs./ton	80 lbs./ton	90 lbs./ton
	1,000 tons	*1,000 tons*	*1,000 tons*	*1,000 tons*
1959	12,081	395	451	508
1959[d]	11,134	401	401	401
1960	12,687	414	473	532
1961	12,914	421	481	541
1962	13,122	427	488	549
1963	13,140	428	489	550
1965	14,596	476	544	612

[a] Does not include nonpaper grades for use in acetate-viscose or cellophane.
[b] Southern region includes Alabama, Arkansas, Florida, Georgia, Louisiana, Maryland, Mississippi, North Carolina, South Carolina, Tennessee, Texas, and Virginia.
[c] Stated annual capacities are the maximum tonnage considered normal that would be produced to meet full demand, assuming no unscheduled shut-down on facilities. A full stated annual capacity is rarely achieved for the entire year.
[d] Actual: crude tall oil fractionated, 272,340 tons; rosin produced, 95,246 tons.
[e] Potential rosin yield can be figured at 35% of crude tall oil.

Unfavorable Factors

Many members of the pulp and paper industry are of the belief that currently there is capacity in excess of demands. This is likely to prevail for a few years so the stated annual capacity for the next several years may not be realized. Besides, favorably or unfavorably, there will be the business conditions prevailing over the next several years. There is an increasingly larger production of sulfate pulp made from hardwoods which contain no fats or resins.

Hardwood pulp production continues to increase, primarily, to balance out the forests, and since it is a much denser wood, lower-cost pulp results. The use of chips continues to increase, but no conclusion has been reached whether the yield of sulfate turpentine or tall oil skimmings is affected favorably or unfavorably. In those pulp mills where no separate recovery systems exist for the separation of hardwood liquors and softwood liquors, it is apparent there is a reduced yield of tall oil skimmings.

	Total sulfate pulp production (paper grades), South	Hardwood	Softwood
	Tons	*Tons*	*Tons*
1947	4,391,926	117,622	4,274,304
1950	6,301,605	189,359	6,112,246
1953	7,751,428	346,965	7,404,463
1956	9,844,667	521,457	9,323,210
1957	9,692,103	532,959	9,159,144
1958	9,760,950	557,224	9,203,726
1959	11,133,745	716,331	10,417,414
1960 (9 mo.)	8,793,295	642,194	8,151,101

Much of the wood procurement is from independent producers, and, with the use of concentration yards, storage of wood for any long periods results in "dry wood," which adversely affects the amount of tall oil skimmings recovered.

An adverse effect on the conversion to crude tall oil, etc., is the diversion of tall oil skimmings for utilization other than acidification and fractionation. Many sections of the mining industry can afford to pay a substantially higher price for the tall oil skimmings than would be practical or economical for the members of the tall oil fractionation industry, especially where acidification plants are not tied into tall oil skimmings supply. This tonnage compared to the total supply of tall oil skimmings would not be a big factor. Other diversions would be the markets for crude tall oil that have been built up during the last 25 years for purposes other than fractionation but that likewise must be satisfied unless the tall oil industry can reconstitute a product that would provide a substitution.

Favorable Factors

Sufficient fractionation capacity is or will be completely installed by 1961 to process 500,000 tons of crude tall oil annually, the availability of which we may not approach until 1963.

The price structure that has prevailed over the last several months on gum rosin and wood rosin has likewise resulted in an elevated price structure for tall oil rosin. One seller's published price in tankcars, f.o.b. shipping point, is listed for various qualities in the range of 13.35¢ to 15.35¢ per pound. While currently there is some softness in the gum rosin price structure, this paper is not concerned with spot conditions but is largely to reflect what the author considers the long-range picture.

Considering the price of crude tall oil in the range of $60–$70 per ton in tankcars, there is a big incentive, based on the demand for tall oil rosin fully to fractionate all of the rosin acids. In the modern fractionation units this means an abundance of fatty acid fractions as well as the distilled fractions, which range in price from 5¢–8¢ a pound in tankcars, f.o.b. shipping point. As yet the tall oil industry has been unable to find markets for all of the fatty acids currently produced.

Viewed from the standpoint of the chemical industry, one would hardly consider the naval stores industry as a growth industry. For the crop year ending March 31, 1909, the sole source of rosin was gum, and the production amounted to 1,998,000 drums with a unit weight of 520 lbs.

Fifty-one years later, as reported in the crop year ending March 31, 1960, gum and wood rosin combined amounted to 1,532,800 drums, and for the same period the tall oil industry provided 382,970 drums. Thus over a span of 51 years there has been no total growth but a wide diversification in that the gum rosin production now represents a minor portion of the industry and has largely been replaced by wood rosin production. Production of wood rosin has been centered in fewer hands over the years with better chemical control, marketing, and access to low-cost stumps.

The declining production of gum rosin and what appears to be the potential decrease in production of wood rosin over the next several years have led many to believe that the pulp and paper industry could provide for the declining production of both gum and wood. This is hardly likely to happen for a great many years because in order to provide for the gum and wood rosin production which, in the crop year ending March 31, 1960, amounted to 1,532,800 drums, it would be necessary to have sulfate pulp production (ex-softwoods) of approximately 27,000,000 tons annually. This is based on an estimated yield of 80 lbs. of crude tall oil per ton of pulp and a yield of 35% from crude tall oil to rosin.

Currently the wood naval stores segment of the industry has been doing a remarkable job in production, and it is being made possible by the existing market price for rosin of all types. This has provided the incentive of going farther afield for the supply of stumps at very high cost. However, when these supplies of stumps have been exhausted in this area, the decline in wood rosin production should be substantial. Some experimental work is involved with the secondary growth of stumps, but this has not been fully realized, so it would be difficult to make any projection.

What then is the answer to the future supply siuation for rosin? George Varn of the Varn Trading Company, in a paper presented at the Naval Stores Breakfast of the Paint and Varnish Association recently, indicated that the gum industry depended upon 3,300 individual farmers who gather the pine gum as a means of added income. Unless the prices they receive for this pine gum provide substantial income, obviously little effort will be made by these formers to go into the field. Moreover many of these parcels of land are small and do not lend themselves too readily to low-cost labor because the parcels are not contiguous.

Many members of the industry believe that the only salvation in the future for rosin production is the revival of the gum naval stores industry. Because of the demand for rosin and the short-supply position the price of pine gum has fluctuated widely and over the past several months has climbed to $45 a barrel, which is admittedly too high except under conditions of supply and demand. From the long-range viewpoint pine gum at $35 a barrel can support gum rosin production profitably in the range of 13¢–14¢ a pound, provided it carries with it a price of approximately 50¢ per gallon for gum turpentine.

Considering the total potential recovery of sulfate turpentine from the pulp and paper industry and its utilization as a chemical raw material, it does not appear that gum turpentine prices can be sustained at a 50¢ level. Any decline from this figure down to 35¢ a gallon, which may be more realistic in the future, would mean that this difference would have to be made up from the price of the gum rosin. This may mean that over the next few years, in order to sustain this gum industry, the price range may have to be somewhere between 13¢ and 16¢ per pound.

Obviously, with the price of rosin going up drastically, the incentive for consumers is either to reduce their requirements where possible or obtain substitutes. This, of course, is of great concern to any industry, but the alternative to lost sales due to substitutions is the loss of production by not providing the incentive that appears to be required. It would therefore appear that, if it is a choice of two evils, the problem appears to be one of finding ways and means of increasing production not only to satisfy existing demands but those of the future. These demands can be satisfied in a big way only from the live tree.

There are mills in Pennsylvania and locations other than the southern regions that cook a small percentage of softwood. It is a matter of capital expenditure and price outlook on the tall oil skimmings that would justify recovery as against burning and recovery of the alkali. Two members of the naval stores industry have been very helpful to the pulp and paper industry in providing education and improving methods of recovering crude sulfate turpentine. Perhaps their experience in this general area may likewise be responsible for increasing recovery of tall oil skimmings.

Rosin has always been an export commodity, and to the extent that American producers are locating some of their operations throughout the world there may be an added favorable factor for the supply situation in the United States.

Markets have not yet been found for all of the tall oil fatty acids and the distilled tall oil production, but it is reasonable to believe that the answer will be found in the not too distant future. Over the next few years, where tall oil fatty acids have been accepted, one would expect favored-price position. Assuming price stability for these tall oil fatty acids, many efforts will be made to use them for building blocks for other derivatives.

I. Tall Oil Products in the Markets of the 60's

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DECEMBER is an anniversary date for the tall oil industry and for the Arizona Chemical Company. Ten years ago the first crude tall oil fractionation unit was put into operation by Arizona which would obtain a rosin product substantially free of fatty acid and a fatty acid product with low rosin acids content. This plant, still in operation, and the products it is producing were the forerunners of the tall oil products industry we know today. In the 10 years the industry has grown from this single-column plant to a dozen units, some having as many as four columns in continuous-series operation. The growth has not only been in the order of volume but also in the quality of the products, which in turn have expanded the markets and potential uses.

With this bit of history in the background I would like to discuss the current domestic market for tall oil fatty acids and other products obtained in the course of their production and suggest some of the market areas where these products have yet to reach their full recognition and utilization.

The first and still major market for tall oil fatty acids is in the production of oil-modified alkyd resins as vehicles for paints, varnishes, lacquers, and other protective coatings. This was a natural use for tall oil products because of the nearness of the fatty acid composition to soybean oil, which had been enjoying large-volume usage since World War II.

In addition to low cost, tall oil fatty acids gave the protective coatings manufacturers a unique raw material which provided sufficient unsaturation or linoleic acid content to give air-drying characteristics and lacked the multiunsaturated fatty acids, such as linoleic, which caused paint films to discolor or yellow rapidly. The unique characteristic was in particular demand by the producers of household appliances coated with white baking enamels. Since tall oil fatty acids were available in the natural state as free fatty acids, the alkyd resin formulator was also provided with greater versatility in the selection of hydroxyls (other than glycerine) and other modifiers permitting the development of specialty products more tailored to fit the paint industry's needs.

Tailoring was not however left only in the hands of the alkyd formulator for the tall oil fractionators found, through the proper design and operation of their units, that tall oil fatty acids could themselves be tailored to fit the more specific needs of the consuming industry. Today most tall oil fatty acids producers provide a line of products with varying degrees of fatty acid purity and composition and physical characteristics. Products with 99-plus per cent fatty acid content and colors as light as 2 Gardner are now available, also products with high oleic acid content tailored to meet the needs of soap and emulsifier applications as well as products with high linoleic acid content for alkyd products.

A SECOND major use for tall oil fatty acids is in soap products, chemical specialties, emulsifiers, wetting agents, and synthetic detergents. Low-rosin, less than 2%, tall oil fatty acids provide physical characteristics equal to oleic acid or red oil in many liquid soap products. First, let's go back a bit to industrial scrub soaps and paste or soft soaps. These were made with rosin-fatty acid mixtures because, in addition to low cost, these soap products had exceptional detergency characteristics. Distilled tall oil or fractionated tall oil products with high rosin content, 20–30%, were substituted for these mixtures. For a number of years the use of tall oil products in soaps was limited to the industrial products until the advent of the household general-purpose pine-scented cleaners where the tall oil fatty acids have found large-volume usage. Today tall oil fatty acids are finding broader markets in competition with oleic acid and should, in the future, compete with the premium-grade oleic acids in certain markets.

Space does not allow discussion of all of the markets in which these acids are utilized, but a few of the other more important include flotation reagents, rubber processing chemicals, and chemical intermediates.

Growth of the use of tall oil fatty acids in present markets involves both economic and technological factors. Currently 30 to 40 million pounds of tall oil fatty acids are consumed by the alkyd resin industry. Its chief competitor, soybean oil, enjoys a volume of close to 100 million pounds in this industry. Since the production of alkyd resins is expected to increase in the future at a slower rate, because of inroads being made by the water-based thermoplastic vehicles, tall oil fatty acids must compete directly with soya oil for a market having a limited growth potential. Soybean oil, being a triglyceride, already contains one-third mole of glycerine per mole of fatty acid; thus the prices of these two materials cannot be compared directly as glycerine is a component in the alkyd formula. At current prices for glycerine, fatty acids must be priced 2 to 3¢ per pound below soybean oil to be competitive. Exceptions to this may be where producers have been able to save this differential by reducing processing costs through shorter reaction cycles with tall oil fatty acids. Until 1959 tall oil fatty acids enjoyed price stability quite unlike the commodity oils because the price differential was well above 2 to 3¢. In that year the high production of soybeans and the extensive volume of oil produced from crushing to meet the meal demands, forced prices of soybean oil to historical lows. To maintain the competitive price differential, tall oil fatty acid prices were lowered. Today crude soybean prices have been holding at about 9¾ to 10¼¢. Using a figure of an average of 1¼¢ to degum the crude oil to make it suitable for alkyd manufacture, tall oil fatty acids would then be competitive at 8 to 9¢ per pound. Current tall oil fatty acids, depending on grade, sell at 5 to 8¢ per pound.

Because of the large volume of tall oil fatty acids now, and soon to be, available from increased fractionation capacity and the usually high and stable price of its co-product, rosin, my guess is that tall oil fatty acid prices will be stable for some months to come. Moreover, at current low prices, there has been and will continue to be improvements in the quality of tall oil fatty acids. Technologically these improvements have brought the tall oil fatty acids closer to soybean oil in performance characteristics to the extent that many alkyd manufacturers in the past two years have developed formulations that are interchangeable between soybean oil and tall oil fatty acid.

By maintaining a favorable economic differential and by continual improvement of tall oil fatty acids, the growth of the use of tall oil fatty acids by the alkyd industry should continue as it was prior to the recent period of price adjustment.

THE DEVELOPMENT of growth of tall oil fatty acid usage in the soap and other saponified acid products has not been affected by the economic factors for they have historically been at a price well below competitive fats and oils, such as oleic and coconut oil. With the improvements being made in color and odor characteristics and rosin acids content we can look to even faster growth of the use of tall oil fatty acids in this area. Of course, this market is actually diminishing in favor of synthetic detergents. However detergents are expensive, and there are many areas where more economical tall oil fatty acid soap products will revitalize this industry.

Although most of the interest is in the tall oil fatty acids, fractionation processes obtain other products and by-products which should receive mention. Generally the fractionation of crude oil yields a rosin product and a fatty acid product, but in order to provide the highest quality in these primary products it is necessary to remove the components of crude tall oil that are undesirable in the primary products. These by-products fractions contain a substantial percentage of either rosin or fatty acid. For example, there is what is commonly referred to as heads fractions. About 8% of the crude tall oil feed or potential of 80 million pounds per year of this fraction is produced. A head fraction may contain from 60 to 90% fatty acid and as little as ½% rosin acid; the balance is unsaponifiable materials. The fatty acid portion is rich in saturated fatty acids, such as palmitic, and stearic of a lesser amount. A head fraction may contain as high as 30–50% of these saturated acids. Although these heads fractions find some use, such as flotation reagents or in core oil manufacture, there are times when the fractionator must burn to dispose of them. Here is a product, rich in more valuable components, which is now selling at about 2¢ per pound. Both volume and price should be attractive for use of these materials in the development of fatty acid derivatives.

Another of these by-products is the high boiling residue removed from the crude tall oil before final separation of the rosin and fatty acid products. Again based on the potential fractionation of a billion pounds of crude tall oil, an estimated 170 million pounds of tall oil pitch will be produced. This material is normally composed of 20 to 30% rosin acids, some of which are chemically combined as esters, and 25 to 40% fatty acids, again in the form of esters. It is estimated that only about half or less of the pitch produced today is finding use; the balance is being burned. At today's low market price of 1¼¢ per pound, this product should find greater usage, possibly in low-cost resinous products.

NOW FOR A LOOK at some of the possible new markets for tall oil fatty acids: first, what might be expected in the way of new fatty acids from tall oil.

The producing industry has reached the ultimate that can be accomplished by large-scale fractionation to improve these products and is already turning to other physical and economical means of making improvements. Bleaching and chemical treatment are among these. Other low-cost methods are needed however if the highest purity, color and odor characteristics are to be achieved. The current products are unique in that their composition is practically pure oleic and linoleic acid in about equal quantity. Individually, both are of substantially greater value than the mixture. This should make these products attractive starting-materials for processing high-purity oleic and linoleic acid derivatives.

Another direction of development is through the modification of the fatty acid structure, such as hydrogenation, to produce high-purity stearic acid. Dimerization of tall oil fatty acids is already commercial and can be expected to be an important growth potential. Hydroxy substitution to produce intermediates for syndets is another possibility. Patents have already been issued on a process for splitting tall oil fatty acid by oxidation to produce short-chain mono- and dibasic acids. To my knowledge, this has not been applied commercially. Tall oil fatty acids have yet to enter the food field or animal-feed additives although, in the past year, interest in this direction has been indicated.

II. Tall Oil Products in the Markets of the 60's

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MY SUBJECT has to do with the activities outside of the Continental U.S.A. The first paper emphasizes the close relationship between the availability of crude oil and the rate of production of pulp and paper in this country, in particular the close correlation with the growth of the kraft or sulfate process for pulp manufacture.

Practically all of the rosin available from tall oil is now being produced from the supplies in hand. Despite this, rosin from this source comprises only about 21% of all rosin produced in this country. This great demand for rosin has suddenly and surprisingly emerged in the past 18 months, "surprisingly," because there never has been a time, in recent history, when this did not seem to be one commodity which was in plentiful supply.

I would like to mention one of the several factors bearing on this shortage and one of the side effects resulting from it. The transfer of gold from U.S. reserves in the past few years did not seem a serious problem until very recently. Foreign investment has been explosive in speed in order to develop the supply of goods to meet a pent-up demand in England, Europe, and elsewhere throughout the world.

Along with this there has been a vastly improved standard of living and—in parallel—an amazing increase in the use of paper. Grades of paper which were not available in some areas are now commonly seen. Population growth and, in particular, *per capita* consumption, cause other sections of the world to plow investment into paper production at a fantastic rate. Yet the world use of paper is still very small. While the *per capita* use in the United States is 440 lbs., the average in 94 countries is only 54. The consumption in 79 of the 94 countries is less than 100 pounds per person, and these 79 countries contain about 86% of the world population.

TO GET BACK on the tall oil track, I should point out a few of the facts on how this growth affects availability of crude tall oil and the primary products from it. In doing so, I have selected the major pulp-producing countries outside of the United States. Only a few of these contribute any significant amount of oil.

Canada, next only to our own country in pulp manufacture, applies most of her productivity to newsprint, upwards of 5,000,000 in a total of 8,500,000 tons. Only a handful of pulp producers are using the kraft process on coniferous furnish. Hercules has recently started a fractionation plant in Burlington, Ontario, with a supply of tall oil from these companies in the head-of-the-lake area. Their total supply of approximately 10,000 tons per year will yield 6–7,000,000 pounds of rosin for the Canadian market as well as about 5,000,000 pounds of valuable fatty acids.

Sweden, the first commercial producer and user of tall oil, has a prevailing capacity of approximately 40,000 tons per year. Four fractionators consume all but 5–10,000 tons of this output, a supply of rosin for the country's internal needs. Most of the exported crude tall oil is used by Spangenberg in Hamburg, Germany, for fractionation. His rosin and fatty acids are used in Germany for resins, soaps, etc. The fatty acid output in Sweden moves to the inner six and outer seven countries for soaps, resins, and related uses. Most of this tall oil fatty acid is of the 4–6% rosin variety. One fractionator, Mo och Domsjo, has shut down because of insufficient tall oil and low-quality oil resulting from increased use of hardwood.

Four fractionators in Finland are now consuming 26,000 tons per year of crude tall oil. The country is in the midst of a large expansion of all segments of its pulp, paper, and paperboard industry in anticipation of increased world demand for its product. Most of the crude tall oil produced is used internally to supply needed rosin. Fatty acids are exported into the European market in competition with ours.

With the exception of the Iron Curtain countries, where we've seen figures or estimates on paper and paperboard, but none on crude tall oil, other potentials are small.

Japan has a large paper industry, but the kraft process on pine is small. Much of their fiber is from rice. Two fractionators, Arakawa Forest Products and Harima, need outside tall oil sources.

Australia relies on nonoil-producing eucalyptus for its pulp.

New Zealand pulps a radiata pine but has a potential only of 1,500 tons per year of crude tall oil from two mills, probably too small to invest in recovery and acidulation of skimmings.

When all this is added up, crude tall oil economically available, outside the United States, may be somewhere in the neighborhood of 100,000 tons per year, yielding approximately 60,000,000 lbs. of rosin and 50,000,000 lbs. of fatty acid. When this rosin supply is added to the U.S. production from tall oil, the total is about 280,000,000, which is equivalent to less than 20% of free world supply.

Therefore the point brought out in the first paper, that tall oil cannot be considered a solution to the general rosin shortage, applies to the remainder of the world as well as to the United States. By the same token however there is the comforting thought that a home need not be found for any large increase in the supply of tall oil fatty acid. There is a real problem with the amount being produced now.

Fatty Acids: Past, Present, and Future

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AT FIRST GLANCE it might appear that the century-old fatty acid industry is a static one in contrast to a dynamic pulp chemicals industry. The 1945 records quite plainly show that there were 13 producers of full or partial fatty acid product lines. Likewise the 1960 records show exactly the same number, 13.

In 1945 there was only one producer of fractionated tall fatty acids; in 1960 there are nine. This 1945 producer plus one other nonpulp chemical producer have both since discontinued the offering of tall oil-derived acids. The score card on fatty acid producers, though, suggests that the number 13 has been lucky or unlucky, depending upon your vantage point. Of the 13 producers in 1945, six are still in business; one dropped out and has just re-entered on a limited basis; three are completely out of business; and three have changed hands (one a consolidation with another producer). This leaves a total of nine original producers, which means that four completely new companies are on the scene in 1960. One company started and then discontinued production in the meantime.

During these 15 years total fatty acid production, exclusive of tall fatty acids, has progressed from approximately 275 million pounds in 1945 to 400 million pounds in 1960. In the meantime low-rosin tall fatty acid production (0–6% rosin) has zoomed from practically nothing to a current annual rate of 150 million pounds.

We in the fatty acid industry have watched the rapid growth of tall fatty acids with mixed emotions because we see a tough competitor, especially to oleic and vegetable fatty acids, also an interesting and economical raw material for further processing or derivative manufacture. Before we can make an intelligent prediction about the future, we should take a quick look at the recent past. As already mentioned, the two largest areas of domestic fatty acid replacement by low-rosin tall acids are oleic and highly-unsaturated vegetable fatty acids.

LET'S LOOK at a few drums of fatty acid to see what has happened, based on information from the Fatty Acid Producers Council. Here's 1952: a 201-million-pound drum split up as follows: 74 million pounds of oleic; 102 million pounds of vegetable fatty acid; and 25 million pounds of tall fatty acid (20% max. rosin) estimated. Now we have 1955: a 208-million-pound drum divided among 93 million pounds of oleic, still increasing; 68 million pounds of vegetable fatty acid, a sharp drop; and 47 million pounds of tall fatty acid (20% max. rosin), almost a 100% increase from 1952.

This would indicate that vegetable fatty acid volumes in soaps, emulsifiers, and surface coatings were feeling sharp inroads while oleic acid sales continued to grow. This is not surprising as tall fatty acid quality was just beginning to approach oleic in odor, color, lower rosin, etc.

Here is our 1958 drum, a little larger: 220 million pounds of oleic is now 77 million pounds, down from 93 million pounds in 1955 and a smaller part of the total drum; vegetable fatty acid is at 41 million pounds, down very sharply again from 68 million pounds in 1955; and tall fatty acid is 112 million pounds (this time 15% rosin max.) up over 100% again, from 1955 at 47 million pounds. With an improvement in quality tall fatty acid in this period replaced large volumes of oleic acid in soaps, emulsifiers, and chemical intermediates. Again vegetable fatty acids were even larger losers in these areas and in alkyd resins.

Coming up to date, here is the 1959 drum, weighing in at 277 million pounds: oleic at 85 million pounds recovers sharply from its low point in 1958 of 77 million but is still losing in percentage of the total drums; vegetable fatty acid also recovers slightly to 42 million pounds from 41 million in 1958; and tall fatty acids at 150 million pounds (now 6% max. rosin) up almost 50% again from 112 million in 1958. During 1959 it would appear that direct replacement of existing oleic and vegetable fatty acids by low-rosin tall fatty acid came to a virtual halt. Sharply increased oleic volume in new and old markets more than offset any direct loss, and there was a small increase in vegetable fatty acid consumption.

So 1960 should be up again in total volume to 295 million pounds: oleic at 87 million pounds; vegetable fatty acids at 43 million pounds; and tall fatty acid (0–6% rosin) up again to 165 million pounds from 150 million in 1959. Tall fatty acids continue increased movement into areas where finished-product pricing precludes usage of oleic and vegetable fatty acids.

It is always risky business to foretell the future, but we shall take a flyer and present 1965's drum like this: 380 million pounds: oleic, up to 100 million pounds from 87 million in 1960; vegetable fatty acid up to 50 million pounds from 43 million in 1960; and tall fatty acids (0–6% rosin) up again sharply to 230 million pounds. Consistent growth of oleic and vegetable fatty acid may be noted, at an annual average rate of about 2.5% *versus* a growth rate of approximately 7% for low-rosin tall acids.

The "drum" approach has made no allowances for business cycles, but we believe that it does tell an accurate story. We have not included the effect of 20–50% rosin distilled tall oils on fatty acid markets. These products have grown from a few million pounds in 1952 to a current 50–60 million pounds annually. Also some replacement of fatty acids other than oleic and vegetable may have been made by tall fatty acids and distilled tall oils, but certainly not as significantly.

Total fatty acid volume, excluding tall acids, has increased from 360 million pounds in 1952 to 400 million in 1960 and is expected to be in the 430–440-million-pound range by 1965. Over this same period crude tall oil fed to fractionating systems has increased from 100–600 million pounds and should be 900–1,000 million pounds by 1965.

A LOOK AT the export picture is very interesting too. Total export volume of fatty acids in 1952 was 36 million pounds, of which 24 million was vegetable fatty acid. In 1960 this volume has dropped to 10 million pounds, including only 1¼ million of vegetable fatty acids. In contrast, total tall oil exports (including acid-refined, distilled tall oil and tall oil fatty acids) in 1952 were 10 million pounds and in 1960 will approach 33 million pounds, of which 25 million pounds will be 0–6% tall fatty acid.

Here's the outlook for future fatty acid export. There will be no sizeable increase in demand on standard fatty acids as resurgent foreign economies, especially in Europe, provide adequate oleic, vegetable, and miscellaneous fatty acids. Volume will continue to increase on premium and specialty fatty acids not produced outside the United States, plus some continued movement of low-grade animal and vegetable fatty acids at price levels of tallow or less. Tallow pricing will remain in the 5–8¢ range through 1965 (*Chicago*).

Exports of crude tall oil will continue to decrease as greater quantities are fractionated in the United States. There will be a continued increase in export demand for top-quality low-rosin tall fatty acids not manufactured outside the United States or Canada, especially for alkyd use. Anticipated soya oil world-price levels of 8–11¢ per lb. should help (Decatur). The support program has to be watched.

There will be start-up of processes abroad for which tall fatty acids are the logical raw material. The first polymerization plant on the continent, in Holland, is due to be onstream soon. Plasticizer volume is due to grow.

We believe that large export volumes of low-rosin tall acids and distilled tall oils will continue to move into soap use as competition to tallow and grease, which will provide only minimum dollar returns. Cost *versus* other available world fats and oils will remain a chief attraction in this tall acid and tall oil export market for the next four or five years.

ON THE domestic scene all fatty acids will continue to enjoy further growth as indicated by our 1965 drum. Sizeable expansion of premium oleic acids in areas where low polyunsaturate content is a must, in low-temperature rubber polymerization, also in chemical intermediate areas where bland odor and stable color are critical. A price level more than twice that of low-rosin tall acids can well be justified for a water-white, bland, and stable raw material. Vinyl plasticizers will continue to provide volume premium oleic and tall acid consumption.

One large oleic potential, not really estimated on our 1965 drum, will be the volumes used captively for ozonation processes to produce dibasic and short-chain monobasic acids. Only oleic can be used in the process, and all current indications point to rapid expansion in this area.

Vegetable fatty acid consumption will continue to expand in soaps, syndets, and alkyds where saturated acid content is important, along with light color, bland odor, and iodine value. Also there will be growth in consumption on high I.V., low-titre acids for fast drying, color-stable alkyds. All this means increased usage where two or three times the cost of low-rosin tall acids can be recovered in the price of a quality-finished product.

Low-rosin tall fatty acid availability will continue to increase sharply. Premium-quality grades will find an expanding market at their economical price levels. More and more top-quality tall fatty acids should be used in surface coatings, not necessarily as direct replacements for whole oils but in completely new formulations with improved properties over previous products. A long period of stable pricing will be a must to achieve much higher volume in alkyds as over-night substitution is just not made in alkyd formulations even though the economics are highly favorable. Continued modification and improvement of low-rosin tall acids will be necessary in properties, such as unsaponifiables and conjugation, to insure peak alkyd performance in areas of dry, gloss, gloss retention, and color retention.

Tall fatty acids may be thought of as a high-quality raw material *versus* other equal or higher-priced fats or oils. Therein lie tremendous potentialities. How about separating pure oleic acid from tall fatty acids instead of tallow? The co-product would be almost pure linoleic acid with an I.V. in the linseed range, a natural for alkyds. This approach would not produce saturated fatty acids as a co-product marketing problem.

Hydrogenation of improved tall acids may provide 99+ purity stearic acid. Polymerization has provided large markets already and now is on the threshold of far greater expansion. Dimers and, more recently, trimers in such diverse uses as polyamides, alkyds, and epon resins are just hitting their stride. The 5% rosin tall oil acids and distilled tall oils along with other fractionation co-products will certainly remain the "workhorse" wherever inexpensive carboxyl reactivity and relatively high I.V. are required.

Not to be overlooked is a market for tall acids that will be gradually created by the withdrawal of crude tall oil availability. In diverse uses, such as flotation and linoleum, pure fatty acids may actually prove to be just as economical from an over-all dollar-value and performance view-point. Also fractionation co-products or blends can offer economical crude replacement.

Adequate markets for tall oil rosin at profitable price levels must continue to provide the volume of 230 million pounds indicated for 1965. In two of the largest rosin-consuming areas, paper and synthetic rubber, tall fatty acids and distilled tall oil may prove to be their co-product brother's toughest competition. This eventuality could provide all the new profitable markets needed for tall acids but could have the boomerang effect of curtailing total fractionation if rosin demand dropped sharply.

We may have fond memories of a good 5¢ cigar, but in fatty acids there is no problem. Take whatever the product requires, an oleic fifteen-center or an even-nickel tall fatty acid!

• *35 Years Ago*

"Congress Would Outlaw the Margarine Maker," by H.W. Wiley, author of the Pure Food Law, was published in the March 1926 issue of the Journal of Oil and Fat Industries. The paper covered Mr. Wiley's letters to Senator Ellison D. Smith, showing that the recent bill introduced in Congress would impose such prohibitive taxes on the manufacture and distribution of margarine as to make traffic of any sort in that product impossible. He also indicated that oleomargarine is a legitimate article of commerce and is entitled to a place in our markets without discrimination.

The editor, H.S. Bailey, in "The Laboratory as a Stepping Stone in the Fat and Oil Industry" stated that the best men for executive positions are those who have the best all-around training. He further commented "the best chemist is the one who has had the best scientific instruction, combined with the industry and ability to apply his scientific knowledge to bringing forth useful results."

Offers Two Books

The Dechema Deutsche Gesellschaft für Chemisches Apparatewesen, Frankfurt, Germany, offers two books entitled "The Achema Year Book 1959-61, European Catalogue of Chemical Plant, Apparatus, and Instruments," edited by H. Bretschneider, and "Measurement of the Quality of Liquids in Containers," edited by K. Fischbeck.

The "Achema Year Book 1959-61" in two volumes, translated in English, French, German, and Spanish, is a handbook of information for those interested in the world Chemical Engineering Exhibition-Congress for 1961 at Frankfurt, June 9-17. The "Measurement of the Quality of Liquids in Containers" represents a collection of data for the calculation of the capacities of containers.

• *A Portrait*
Rugged Individualism

A YOUNG MAN lived with his parents in a public housing development. He attended a public school, rode the free school bus, and participated in the free lunch program. He entered the army and, upon discharge, kept his national service life insurance. He then enrolled in the state university, working part-time for the state to supplement his GI check.

Upon graduation he was married to a public health nurse and bought a farm with an FHA loan, then obtained an RFC loan to go into business. A baby was born in the county hospital. He bought a ranch with the aid of a GI loan and obtained emergency feed from the government. Later he put part of his land in the soil bank, and the payments helped pay off his debts. His parents lived very comfortably on the ranch with their social security and old-age assistance checks.

The county agent showed him how to terrace the land, then the government paid part of the cost of a pond and stocked it with fish. The government guaranteed him a sale for his farm products.

Books from the public library were delivered to his door. He banked money with an insured government agency. His children grew up, entered public schools, ate free lunches, swam in public pools. The man owned an automobile so he favored the federal highway program.

He signed a petition seeking federal assistance in developing an industrial project to help the economy of the area. He was a leader in obtaining the new federal building and went to Washington with a group to ask Congress to build a great dam costing millions so that the area could get cheap electricity.

Then one day he wrote to his Congressman: "I wish to protest excessive government spending and high taxes. I believe in rugged individualism. I think people should stand on their own two feet without expecting hand-outs. I am opposed to all socialistic trends and demand a return to the principles of our constitution."

CONTRIBUTED.

• *On the Educational Front*

The Coatings Technology Department of The North Dakota State University, Fargo, N.D., announces the 3rd Annual Symposium on New Coatings and New Coatings Raw Materials, June 5–8, 1961. Topics by 18 specialists will include the newer developments in pigments, additives, water-thinned vehicles, and new studies relative to coatings.

The first GE-225 information-retrieval system, a high-speed transistorized computer, will be installed soon at the Documentation Center, School of Library Science of Western Reserve University, Cleveland, O., for use in metallurgy and allied subjects; literature of diabetes and allied fields; disease vector control literature; and strategies for mechanized searching under a grant from the Air Force Office of Scientific Research.

Research in corn and its components will occupy 25 scientists working on grants from The Corn Industries Research Foundation during the year, besides grants-in-aid to 18 universities and other institutions, according to Frank K. Greenwall, president of Corn Industries Research Foundation Inc., Washington, D.C., and chairman of the Board of National Starch and Chemical Corporation, New York.

Develops New Practice

Practice (ISA-RP16.4), intended to provide a basis to define the nomenclature and terminology for the extension type of variable area meters (rotameters), is announced by the Instrument Society of America through its standards and practices department.

"The Outlook for the Rotameter in Process Instrumentation" by Seymour Blechman, vice president of the Brooks Instrument Company Inc., was discussed recently before the Tulsa Chapter of the Instrument Society of America.

• *Names in the News*

H.L. Larson (1956) has left the Witco Chemical Company in Chicago to take a position as senior development engineer with the Goodyear Tire and Rubber Company, Akron, O.

Tara Yamashita (1958), formerly with the Japan Oil and Vitamin Inspection Institute, is now with Nihon Suisan Yushi Kyokai, Tokyo, Japan.

N.A. Eastwood (1952), production manager, Scudder Foods Products Inc., reports that the firm has moved to 1525 North East street, Anaheim, Calif., from Monterey Park.

H.J. Harwood (1949), formerly with Armour in Chicago, has been transferred to the research laboratory, Armour Industrial Chemical Company, at McCook, Ill.

J.P. Hart (1956) has become water treatment chemist for the Oklahoma City Water Department. He was formerly with Armour and Company of that city.

E.N. Frankel (1956) has left the Northern Regional Research Laboratory, Peoria, Ill., for the Winton Hill Technical Center of Procter and Gamble Company, Cincinnati, O.

John Morrisroe (1955), president, sends a change of name for the Pilot California Company to the Pilot Chemical Company of California, Los Angeles.

E.I. Smith (1948), manager of the shortening and oils department, Canada Packers Ltd., Toronto, announces promotions: R.A. Burt (1945) becomes manager of the bakery research laboratory; A.G. Williamson (1956) succeeds him as superintendent; and A.E. Cheadle (1958) moves to the shortening and oils trading department.

William B. Bishop, formerly general superintendent, has been promoted to director of facilities planning at the A.E. Staley Manufacturing Company, Decatur, Ill.

Richard L. McCullough has been promoted from assistant to supervisor of analytical chemistry, Research Center, Hooker Chemical Corporation, Grand Island, N.Y.

General Research and Development, a Division of Buchart Engineering, York, Pa., has added three staff members: Leland Beik, marketing; Kenneth Treer, automation; and Edward Holbrook, pneumatics.

A.C. Zettlemoyer (1948) has been appointed Distinguished Professor of Chemistry by Lehigh University, where he has been teaching since 1941.

William A. Bittenbender has been named corporate director of research by The Glidden Company, Cleveland, O. He was formerly director of production and engineering for Merck Sharp and Dohme Division of Merck and Company.

George Y. Brokaw (1948), head of the distillation development laboratory since 1954, has been named senior research associate at Distillation Products Industries, a Division of Eastman Kodak Company, Rochester, N.Y. He is known for his studies of synthetic Vitamin A.

Robert H. Reed has been appointed vice president of development, Solvay Process Division, Allied Chemical Corporation, Syracuse, N.Y. Raymond C. Baxter has been made a vice president of engineering for Allied Chemical's National Aniline Division and will leave Syracuse for New York.

Bob West, formerly research associate at Jefferson Medical College, will assume the duties of assistant director of biological laboratories of Rosner-Hixon Laboratories Inc., Chicago.

Raymond L. Mayhew has been named manager of technical service and development at Antara Chemicals, General Aniline and Film Corporation, New York.

Henry N. Staats has joined Coleman Instruments Inc., Maywood, Ill., as development director.

Wales H. Newby (1941) has been made supervisor of product quality by the Bogalusa Division of the Crown Zellerbach Corporation, Bogalusa, La. He came to the company in 1956 and has been chemist, laboratory supervisor, and chief chemist before taking this newly created position.

Alfred R. Gilbert, of the General Electric Research Laboratory, Schenectady, N.Y., has been named section manager for the new Polymer Reactions Section.

Three members of the Plastics Division have been promoted to the post of scientist by the Monsanto Chemical Company of St. Louis, Mo.: Robert F. Wall, senior research group leader, and T.D. McMinn, research specialist, of Texas City, Tex., and Paul Ehrlich, research group leader, of Springfield, Mass.

Warren W. Brandt leaves Purdue to become head of the department of chemistry at Kansas State University, Manhattan, Kans.

Lawrence J. Giacoletto, formerly manager of the electronics department, Ford Motor Company Scientific Laboratory, has been appointed professor in the Department of Electrical Engineering and the Division of Engineering Research at Michigan State University, East Lansing, Mich.

Max T. Rogers, professor in chemistry at Michigan State University, has been named acting head of the department, succeeding Laurence L. Quill, head of the university's mathematical and physical science division.

Herbert C. McKee has been appointed assistant director, Department of Chemistry and Chemical Engineering of Southwest Research Institute, San Antonio, Tex. He has been with the Institute since 1953.

• *Industry Items*

LaPine Scientific Company is the new name of Arthur S. LaPine and Company, Chicago. The Eastern subsidiary, formerly Tenso-Lab Inc., at Irvington-on-Hudson, is now LaPine Scientific Company, New York.

E.F. Drew and Company Inc., Boonton, N.J., announces the Food Emulsifier Division. Available is a quality-controlled variety of F.D.A.-acceptable food-grade emulsifiers.

Foster D. Snell Inc., New York, a 41-year-old firm of chemical consultants, has acquired Calkin and Bayley Inc., industrial consultants of New York, to be operated as a subsidiary, with George T. Bayley as vice president in charge.

General Electric's Silicone Products Department, Waterford, N.Y., is building a $1-million process plant to produce new types of intermediate silicone chemicals.

Merck and Company Inc., N.J., announces that the French pharmaceutical firm, Laboratoires Delagrange, will merge with the French chemical firm, Synorga A.A. of Chenove, to form a new firm named Compagnie Chimique Merck Sharp and Dohme S.A. in Paris.

The Atlantic Refining Company and the Pure Oil Company have authorized the M.W. Kellogg Company to construct an aromatics manufacturing unit this year at Pure Oil's refinery in Nederland, Tex. It will produce benzene primarily, also toluene and zylene.

Regional distributors for General Aniline and Film Corporation, New York, to handle certain IGEPAL surfactants and the CHEELOX chelating and sequestering agents, will be Hoosier Solvents and Chemicals Company, Indianapolis, Ind., Central Solvents and Chemicals Company, Chicago, and Wisconsin Solvents and Chemicals Company, Milwaukee, Wis.