CHEMICAL & Metallurgical ENGINEERING

AUGUST • 1944

Volume 51 Number 8

In this Issue

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Published monthly. Price 35 cents per copy. Publication office, 99-129 North Broadway, Albany 1, N. Y. Address communications about subscriptions to Director of Circulation, Chem. & Met., 330 West 42nd St., New York 18, N. Y. Subscription rates: United States, Mexico, Central and South American Countries, $3 per year, $4 for two years, $5 for three years. Canada $3.50 per year, $5 for two years, $6 for three years (payable in Canadian funds). Great Britain and British Possessions, 30 shillings per year, 60 shillings for three years. All other countries, $5 per year, $10 for three years. Entered as second class matter September 3, 1936, at Post Office at Albany, N. Y., U. S. A., under act of March 3, 1879.

Branch offices: 520 North Michigan Avenue, Chicago 11; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Washington 4; Philadelphia 2; Cleveland 15; Detroit 2; St. Louis 8; Boston 16; Los Angeles 14; Atlanta 3; Pittsburgh 22.

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99-129 North Broadway, Albany 1, N. Y.
Editorial and Executive Offices
330 West 42nd Street, New York 18, N. Y.
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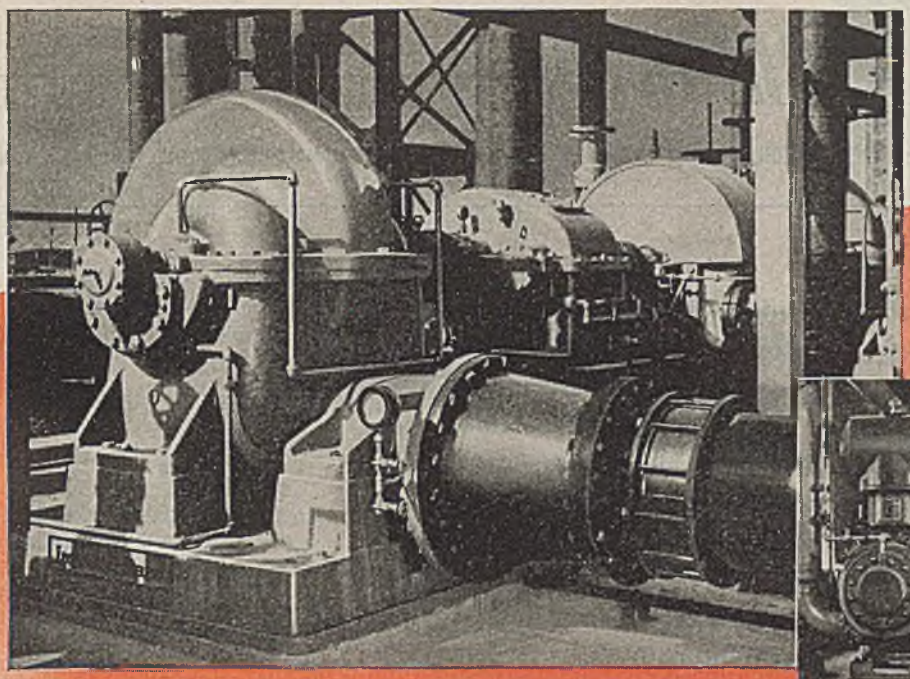
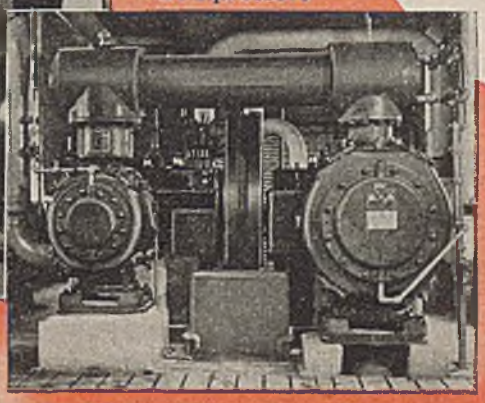


Water Supply Pumps

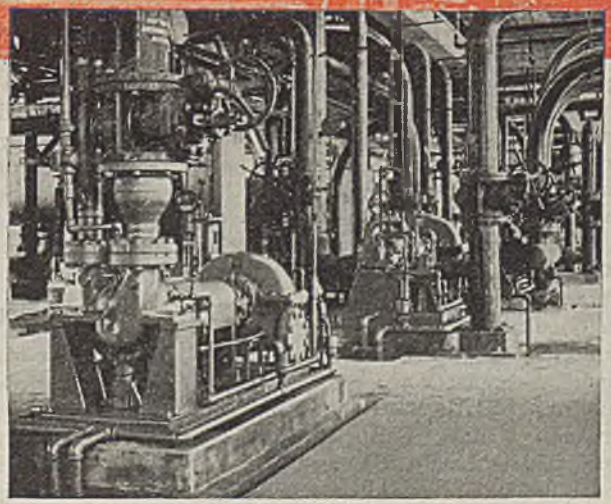
Compressors



I-R SERVES

Neches Butane Products Plant

Process Pumps



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CENTRIFUGAL PUMPS • CONDENSERS • COMPRESSORS • TURBO-BLOWERS • ROCK DRILLS • AIR TOOLS • OIL AND GAS ENGINES

WATCHING WASHINGTON

R. S. McBRIDE, Editorial Consultant • PAUL WOOTON, Chief of McGraw-Hill Washington Bureau • MALCOLM BURTON, Washington Correspondent

Increasing activity in the air demands more and more high-octane gasoline . . . Requirements for fertilizer materials indicate increases of as much as 25 percent . . . Specialists recommend use of urea as a part of cattle feed ration . . . Phosphate rock producers are investigated by FTC . . . Production trends in the chemical industries are continuing up . . . Wartime restrictions on glycerine have been removed . . . Donald Nelson issued a series of orders for reconversion . . . DPC has offered about 30 establishments for sale as surplus war property . . . One of the first sales of surplus plant facilities was made recently at Binghamton, N. Y.

NOT A POLITICAL ISSUE

ANTI-TRUST officials of the Department of Justice insist that "freedom of enterprise is not a political issue." This was both the subject and the theme of a formal address by Assistant Attorney General Wendell Berge who directs the Anti-Trust Division. His postwar program of 11 points was announced in this address, but cynics note that the address was delivered before a New York State gathering of Affiliated Young Democrats, Inc. They ask "if this is not a political sub-issue; why argue before the purely political gathering?"

OCTANE vs. RUBBER

BIG SHIFTS between chemical engineering operations of one type and another are likely to continue for the balance of the war period. The most extensive such modification of plans occurred in July when the demand for high-octane gasoline gave preference for that product over rubber. This cuts off some of the major manufacturing activities where butadiene was being made from petroleum. Thus a larger part of the synthetic rubber load had to be borne by alcohol butadiene.

That shift would not have been possible without serious cutback on tire manufacture under most circumstances. But the real limitation on tire output has been for several months the number of workers and the equipment which could be made available for large-size, heavy-duty tire making. During the latter half of July high officials from Washington took vigorous measures to speed up this heavy-duty tire production and succeeded in bettering conditions somewhat. Nevertheless, there remains prospectively a shortage of such tires until the peak of military demands is passed.

BUTADIENE FROM ALCOHOL

DURING the summer it is estimated that about 70 percent of the butadiene will be made from alcohol, while the seven petroleum butadiene plants are shut down. Next year, assuming that the high-octane program goes as expected, the supply of butadiene will be about 50-50 from the two sources. The urge to continue the trend from alcohol to petroleum is principally the lower cost of butadiene from that source.

AVAILABLE TRAINING

WHEN veterans return and seek jobs, as many thousands will do every month from now on, there are available several kinds of training at government expense. Any employer who finds such men not quite ready for the more urgent jobs can cooperate to get training classes organized through War Manpower, Office of Education, or special vocational training units. Where a refresher or specialist course is needed, this will be organized to suit the local requirements. Preference is given to employment for war projects; but almost equal service is available where essential civilian needs are served by the training program.

MORE FERTILIZER ESTIMATES

SINCE the first of June Washington has been talking about fertilizer material supply for the 1944–45 year. Late estimates of the Department of Agriculture regarding these materials, indicate increases over the preceding fertilizer year of 21 percent for potash, 25 percent for superphosphate, and a slight increase in nitrogen supply. The magnitude of increase in nitrogen use for fertilizer will depend principally, the industry states, on whether fertilizer makers will arrange to take ammonia, urea, and special solutions uniformly through the year rather than on a low-production basis during the first three or four months.

FERTILIZER SETBACK

CONGRESS has given the Department of Agriculture $300,000,000 to be spent during the fiscal year which begins July 1, for soil improvement and soil conservation program. AAA would like to spend about a quarter of this sum on fertilizers. Many in the fertilizer industry object, even though the nominal purpose is to educate farmers in the better and more extensive use of fertilizer.

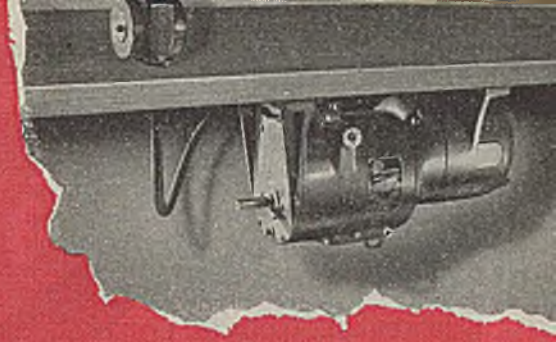
Triple-A undertook to encourage use of fertilizer on pastures and for cover crops. It gave away the wrong fertilizer to produce good results. As a consequence farmers in those areas have come to believe that fertilizer does not do them any good. It remains to be seen whether the industry will supply as much fertilizer for soil improvement work as AAA would like. Certainly the two philosophies of industry and government are diametrically opposed even on the question as to how to teach the farmer to use fertilizer for his own profit.

WHO IS SQUEEZED?

PRICING phosphate rock in Florida, OPA has authorized a 20-cent-per-ton increase in ceiling. This price will require also adjustment upward of the prices of superphosphate at the producer's level; but "that adjustment will apply only at the wholesale level and will not be reflected in higher prices for superphosphate or mixed fertilizer sold to farmers." OPA does not explain how the intermediate merchandising groups are going to escape the difficulties of this squeeze.

PHOSPHATE WORLD MARKET

DURING THE present fertilizer year Washington asks for production of 10,000,000 tons of phosphate rock in a program which calls for 12,767,000 tons in the fertilizer year 1945–46. The latter figure includes some phosphate for export. But the principal European supply is expected from North African mines as in prewar years. Re-establishment of large production and transport there is still restricted by scarcity of labor, equipment, and rail transportation. Present African shipments are about 2.5 million tons as



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compared with prewar averages near 4 million. The implication is that U. S. sources will be called on principally during the transition period, but export in any large amount cannot be expected to go from the United States when cheap labor and adequate facilities are again available in Africa.

BEVERAGE ALCOHOL LIMITS

BOTH industrial alcohol and distillery production for beverages during August are limited principally by restriction on raw materials. The use of corn, molasses, or grain sorghum was forbidden; but plenty of wheat or granular wheat flour was available. Industrial alcohol units have, of course, been limited in their holiday to half the capacity of their plants for beverages. The other half has been continued on the alcohol-for-rubber business.

UREA FOR FEED

TO OFFSET shortage of protein feed, Bureau of Dairy Industry specialists are recommending use of urea as a part of cattle feed ration. Experimental work done by competent animal husbandrymen seems to establish convincingly that such ruminants as sheep and cows can utilize urea for food to make protein. Other classes of animals cannot do so. Initial conclusions from BDI experiments are that 0.3 lb. per day per cow is a suitable urea ration. Feeding it mixed with silage is recommended. Chemical manufacturers may find this a small additional outlet for synthetic ammonia.

PHOSPHATE INQUIRY STARTS

PHOSPHATE rock producers are being investigated by Federal Trade Commission for alleged illegal agreements regarding sale of phosphate rock through the Phosphate Export Association and Florida Hard Rock Phosphate Export Association. These two organizations are set up under the Webb-Pomerene export trade act.

HIGH RATINGS HARD TO GET

TRIPLE A ratings are not passed out indiscriminately. The final decision on such requests goes before the WPB Special Rating Branch after the request has passed through the industry division and they are satisfied as to the essentiality and justice of the request. Only a relatively small percentage get final approval and that number will be still further reduced as the general supply situation deteriorates. Direct war products come first.

PRODUCTION TRENDS ARE UP AND UP

LATE in July four general trends in the chemical industry were apparent. Increasing tempo of air activity in both Europe and the Western Pacific have increased demands for high octane gasoline to astronomical figures. Changes in battlefield requirements for heavy artillery ammunition mean the downward trend of the production of TNT, smokeless powder and phosphorus has been reversed. More sulphuric acid, ammonia and toluol are being produced but not more than the capacity of available facilities. In late July the Gopher Arsenal and some others were being returned to production of explosives.

Production of fertilizer is expected to continue its upward trend. The necessity of growing more food for the liberated areas is behind the demand. It may be used in this country or sent abroad. In the field of plastics, an expansion of production of alkyd and vinyl resins already is underway. Demand for phenolics is high and is expected to continue into the postwar period.

FAT SALVAGE TO CONTINUE

SALVAGE of household fat is to be maintained in spite of the quantity of glycerine now on hand and the generally easy fat and oil situation. However, no emphasis will be put on the program. Washington officials are keeping it going because they know that once the momentum is lost it cannot be regained in case an increase in fat salvage should be necessary.

MACHINES TO REPLACE MEN

A WELCOME revision of the chemical industry's repair and maintenance order P-89 provides a general easing of restrictions all along the line and includes in the material for maintenance, repair and operating supplies "required to avoid losses of production below current rated capacity as a result of manpower losses by installation of labor-saving devices." Whether this provision will be of great importance to the chemical industry depends entirely upon the length of the war.

FOR SOCIAL REASONS

INTERRUPTION of manufacture of goods for the government will be ordered at the earliest possible date if the Donald Nelson and John Hancock philosophy prevails. These two influential Washington executives state categorically that "there will be no manufacture solely for social reasons."

Other Washington leaders are inclined to follow the argument of certain labor groups. These groups insist that the government should not abruptly cut off manufacturing because it throws workers out of jobs before they can get employment elsewhere. That philosophy was the one so conspicuously displayed in the sit-down stay-in at Brewster Aircraft some months ago. That event spotlighted the argument; but has persuaded few, if any, influential officials. Delay in cancelling government contracts beyond the time when it is known goods are not needed simply increases the danger of unemployment. At least that is the argument of those who, like Nelson and Hancock, plan prompt cutback when military requirements decline.

GLYCERINE UNLIMITED

WARTIME restrictions have been removed from glycerine. Stocks at the end of July were approaching a more than comfortable 100 million lb. Estimates that the stock would decline from the high level of January 1 when 81 million lb. were on hand have not been fulfilled. The rapid increase in stocks is directly traceable to both the increase in production and to a decline in requirements, particularly to a falling off of lend-lease requirements.

Recovery standards of the fat splitters and soapers were revoked the last of June. This was not expected to make a great change in the glycerine situation. Fat splitters who have been having a heyday at the expense of the small soap makers, who could not meet the glycerine recovery standards, will now feel the pinch. Small soap makers may now use fats and oils without regard to glycerine recovery. Glycerine is now a free moving commodity subject only to the whims of the buyers and sellers.

A JOB WELL DONE

ANNOUNCING accomplishment of its task to create a synthetic rubber industry of sufficient magnitude to make the United States independent of foreign rubber imports the Office of the Rubber Director became the first wartime agency voluntarily to surrender its emergency powers. Col. Bradley Dewey, Rubber Director, submitted his resignation to WPB and James F. Byrnes effective September 1.

RECONVERSION BEGINS

DESPITE absence for hospital care and subsequent convalescence from pneumonia, Chairman Donald M. Nelson of WPB was able to put over his program of planning for reconversion by a series of orders effective over the period July 15 to August 15. The basic controversy which delayed this development was one of psychology in employment.

AID FOR LIMITED RECONVERSION

DONALD NELSON'S plans for the relaxation of controls on civilian production go into effect this month. Four orders were written to put the general plans into effect. The orders are:

1. To relax some of the restrictions on the use of aluminum and magnesium. This has been done by increasing the list of eligible items which can be manufactured from the light metals. Substitution of aluminum and magnesium for other metals

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Compared to rubber, Tygon Tubing offers advantages of substantial importance. Unlike rubber, Tygon shows no tendency to oxidize, to develop cracks or fissures, or to become brittle with age. In its flexible forms it has s-t-r-e-t-c-h without snap, shows a flex life ten to twelve times that of rubber. It is highly resistant to abrasion.

Chemically, Tygon Tubing shows excellent resistance to water, alcohols and almost all acids and alkalies. It is not affected by oil, soap or perspiration. Tygon Tubing is, however, attacked by some solvents.

Physically, Tygon Tubing may be made in varying degrees of flexibility, semi-rigid, or rigid. Certain formulations, for example, retain their flexibility at temperatures as low as 80°F below zero; others are so rigid they may be readily turned, sawed or cut. Tygon Tubing, while thermoplastic, functions satisfactorily at temperatures up to 175°F. Certain surgical formulations withstand autoclaving at 20 lbs. of steam.

Applications for Tygon Tubing include such widely varying uses as laboratory and surgical tubing, transmission lines for beverages, electrical insulation sheathing (its dielectric strength is equal to that of rubber), air lines for automatic machines (Tygon Tubing may be braid reinforced for high pressures), channel strips, gasketing, bumpers, bushings, sight glasses, etc.

Tygon Tubing is now available in diameters up to 1¼", in any desired wall thickness, in clear, black, white, gray, and in a wide range of colors.

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beyond 500 lb. per quarter will be handled by a deferred allotment under CMP.

2. To permit the manufacture of experimental models of postwar items. Expenditures are limited to $5,000 per month without specific approval.

3. To permit unrated orders for machine tools for postwar use in the production of civilian items to be placed.

The fourth order, and the last one to be put into effect, puts responsibility for manufacturers return to civilian production in the hands of the WPB regional directors. Manufacturers who are able to establish to the satisfaction of the director that facilities, manpower and material are available and that no harm will be done to the war effort may produce civilian items or increase the limit on quantities of articles whose production previously had been permitted.

WPB RECONVERSION POLICY

During the time the "Nelson" orders were being held up in the War Production Board, rumor had it that the delay was caused by the representatives of big business trying to prevent small business from getting a head start in the race for postwar markets. Washington observers have looked on this as another part of the administration campaign to smear big business. As for the policy of WPB, it has been stated time and again. On Mar. 9, 1944, Donald Nelson expressed the policy in a letter to Senator Francis Maloney of Connecticut. He expressed his idea even more clearly in a speech given before the Chamber of Commerce, Atlanta, Ga., on Apr. 11, 1944.

UNTIL MILITARY OUTLET CLEARS

On the subject of reconversion to civilian production, Nelson said, "Until the military outlook is far clearer than it is today whatever readjustments are made in the interests of civilian production must be minor, and of such nature that they do not interfere in any way with war production.

"This WPB policy needs to be clearly understood. Concerns and individuals adversely affected by cutbacks and continued restrictions must recognize that political pressure and criticism of the government will not cause us to relax that policy."

In the same speech, Mr. Nelson dealt with the "question of new competition." "This question touches the roots of national policy. If the government were to attempt to prevent new competition there would clearly be grave danger of shackling the country with a regimented economy for a long while to come."

SURPLUS PROPERTY BILL

Immediately preceding Congressional adjournment for the conventions, Congressman William M. Colmer, chairman of the Special House Committee on Post-War Economic Policy and Planning, introduced a bill to cover disposal of surplus government property and plants. In theory the proposed legislation establishes an agency to handle disposal matters with the new administrator in charge. Practically, the organization which would be established by the proposed legislation continues the office of Surplus Property Administrator as set up by Executive Order and does not necessarily mean that there would be any change of present personnel.

The bill, H. R. 5125, has one provision which has to do with the declaration of surplus property not contemplated either by Clayton or Hancock in their work of writing it. To be specific, Section 7(a) provides that it is the duty of each agency of the government to determine what is surplus property and what is not. The duty of making such determinations is to remain in the hands of the owning agencies for the "duration of hostilities...but thereafter the Administrator shall have power to require such a determination upon a finding by him that any property is surplus to the needs and responsibilities of an owning agency."

It is expected that the armed services will vigorously resist the passage of Section 7(a) as it was introduced.

SURPLUS EQUIPMENT SALES

During the latter part of July DPC was offering about 30 establishments for sale as surplus war property. Approximately a third of these included machinery or equipment for industrial processing or handling of goods. The rest were either industrial sites, substantially bare land, or industrial buildings and real estate without machinery or equipment. The following items were included in the "for sale or lease" group of DPC in this manner:

1. A vegetable dehydration plant built for the Department of Agriculture and operated by Compak Foods, Inc., Santa Ana, Calif. Buildings included 41,000 sq-ft. of floor space; and machinery and equipment involved had cost $128,000.

2. A petroleum loading facility built for the Army and ODT was offered at Jacksonville, Fla. This complete terminal included 196 acres and tankage and equipment which cost nearly a million dollars.

3. Continental Ordnance Corp., East Chicago, Ind., has operated for WPB one of the largest and most expensive properties offered. It included 345,000 sq.ft. of floor space and machinery which cost $242,000.

4. Commodity Credit Corp., Winchester, Ky., was operator of a hemp fiber plant including 28,000 sq.ft. and a complete outfit of equipment costing $166,000.

5. Another large metal handling plant for finished castings included over $2,600,000 of building cost and over $4,000,000 of machinery and equipment which had been operated by Symington Gould Corp., Rochester, N. Y., for Army Ordnance and Army Air Corps.

6. A chrome ore concentrating plant was operated by Krome Corp. at Marshfield, Ore., including complete buildings and equipment costing $300,000.

7. A graphite processing plant built for WPB was operated by Benjamin Franklin Graphite Co., Chester Springs, Pa. It included about $100,000 of equipment.

8. A complete magnesite processing plant was operated by Warner Co., Philadelphia, Pa., for WPB. It included 26,000 sq.ft. of floor space, over a million dollars in buildings, and nearly a million dollars in equipment.

9. A small charcoal plant complete with about 77,000 sq.ft. of building space was built for WPB and operated by Coast Carbons, Inc., near Tacoma, Wash. It includes about $100,000 of equipment.

In a number of other plants there were small-cost installations of equipment and machinery for industrial processing, but most of the balance of the offerings were essentially real estate or empty buildings.

CHEMICAL PLANT SOLD

One of the first sales of surplus plant facilities by DPC has been announced. Ansco Division of General Aniline and Film Corp. bought for $175,000 a three-acre tract and six factory buildings in Binghamton, N. Y. This property was previously used for manufacture of equipment for the Navy. The machinery and facilities in the plant were removed for separate sale. It is expected that Ansco will develop one of its divisional activities on the property.

There were several industrial purchasers interested, but preference was given to this government-owned organization. The price paid "represents present-day replacement cost of the property less depreciation."

A SALE IS MADE

In this transaction to General Aniline the replacement cost—the land and buildings less one year's depreciation, less cost of the special appurtenances the purchaser did not need, which included a target range, special lights and air conditioning equipment—came to approximately $180,000. The final sales figure was $175,000 as explained above.

Although the property involved was sold to a firm whose stock is in the hands of the Alien Property Custodian, the transaction should not be considered as between two branches of government. If it had been, there would have been no sale. The fact that the property was offered for sale means that no government agency had use for it. This particular transaction had the active support of the local Chamber of Commerce and citizens.

When much *depends on one*

Even in those first tense moments of locating the enemy, the scout's keen eyes are observing every movement, his trained mind interpreting the action for his headquarters. Much depends on him . . . his report is a key piece in the complicated jigsaw of a large-scale military operation.

Much depends on Columbia chemicals, too, in their vital role in so many manufacturing operations. Uninterrupted, economical production and the characteristics desired in finished products are dependent on chemicals that conform to specifications.

This is why Columbia has established the highest standards for its products. This is why Columbia can assure the supplying of chemicals which meet the precise needs of its customers.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
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COLUMBIA SPOTLIGHT

THE GLASS AIRPLANE may well become a reality. Glass, spun into very fine fibers, has been combined with materials such as the Columbia Allymers to produce an airplane fuselage which has already passed service tests. This reinforced glass is so strong that, when forced against a section of a light metal alloy of identical size and form, it remains sound while bending the alloy out of shape. The Allymer-glass combination is not permanently affected, despite the fact that it is lighter in weight than the alloy.

COLUMBIA TANK CARS developed for the transportation of 73% Caustic Soda liquor have been of especial value to wartime railroad traffic. Approximately 60% greater tonnage of Caustic Soda can be delivered per tank car trip than could previously be handled in shipping the 50% strength liquor. Three of these new Columbia cars deliver the same tonnage at 73% concentration as did five cars of the 50% liquor. And in addition to tank car use, there has been a corresponding saving in railroad motive power, and in the handling, switching and spotting of a lesser number of tank cars.

BATTLES have been lost for the lack of pure drinking water . . . and Calcium Hypochlorite is playing an important part in safeguarding our armies' water supplies. One of the principal methods used at the front is the Lyster bag. Filled with locally obtained water, enough hypochlorite capsules are added to produce a safe chlorine residual. To the civilian the taste might be repulsive, but to the thirsty, battle-weary soldier it's nectar!

SILENE EF is the Columbia pigment which is apparently the nearest approach to a "white carbon black"—for years the dream of rubber compounders and pigment experts. Silene EF is at present used chiefly in critical items such as inner tubes . . . colored abrasion goods . . . products requiring high tear-resistance . . . and many molded items. It offers interesting possibilities, too, for products outside the rubber industry. Data on Silene EF and samples are available for experimental purposes, free of charge.

COLUMBIA CHEMICALS include Soda Ash, Caustic Soda, Sodium Bicarbonate, Liquid Chlorine, Silene EF (Hydrated Calcium Silicate) Calcium Chloride, Soda Briquettes, Modified Sodas, Caustic Ash, Phosflake, Calcene T (Precipitated Calcium Carbonate) and Calcium Hypochlorite.

INTERPRETATIONS

This installment covers orders, rules and regulations issued by the War Production Board and the Office of Price Administration during July, 1944. Copies of each item interpreted here may be obtained from the appropriate federal agency.

PHTHALIC ANHYDRIDE

BECAUSE of critically short supplies, phthalic anhydride used in the production of plasticizers for pyroxylin and vinyl resin coated fabrics, was not allocated in full in July for military end uses and none was made available for civilians. The industry committee has asked that a list be prepared of plasticizers made from other than phthalic anhydride and that those in sufficient supply be used to complete military requirements and partially satisfy civilian needs.

ALKYD RESINS

A MONTHLY emergency allotment of alkyd resins to be used in filling emergency orders for the military end uses that have been approved during the preceding two months on Form WPB-2945, now replaces interim applications for such materials. The usual interim application will be necessary in the case of end uses that have not been approved. Single shipments are limited to a maximum of 500 lb. of solid phthalic alkyd resin content.

GLYCOL ETHERS

MILITARY demand for glycol ethers has declined so the small order exemptions have been increased substantially. The increases are: monobutyl ether of ethylene glycol from 400 lb. to 4,000 lb.; monomethyl ether of ethylene glycol from 430 lb. to 2,150 lb.; monoethyl ether of ethylene glycol from 410 lb. to 4,100 lb.; and monoethyl ether of diethylene glycol from 460 lb. to 2,300 lb. At the same time, Order M-336, which formerly governed allocation of glycol ethers was revoked and control was transferred to M-300.

OILS AND FATS REGULATIONS

THE War Food Administration has determined the quantity of tung oil considered to be a safe monthly disappearance of current supplies and beginning Aug. 1, priority was given to the group of essential uses previously listed with finishes for transformers and foul-weather clothing added. After filling these requirements the remainder will be allocated for non-specified uses. Applications should reach WFA by the 15th of the month prior to the allocation period.

Suspension of inventory limitations on tallow and grease which has been in effect since May 15, has been extended through Oct. 31. Quota restrictions on the use of rendered pork fat and lard also were removed for the period from July 17 to the end of the month.

Because the present supply position of fats and oils is favorable, the order regulating the use and distribution of fish oil was revoked as of July 3. The order had required producers to set aside one-third of their production for specified uses.

COTTON LINTERS

REQUIREMENTS for smokeless powder and high tenacity rayon tire cord have increased and producers of cotton linters, beginning Aug. 1, were ordered to set aside 80 percent of their output that is acceptable for chemical use, for delivery to the Commodity Credit Corp. Until Feb. 1, producers had been required to set aside 65 percent of their output for CCC but because of a large stockpile, the order was rescinded on that date. Production of cotton linters for cotton year, Aug. 1, 1943 to July 31, 1944, is estimated at 1,200,000 bales.

CARBON BLACK

To assure an adequate supply of furnace type carbon black for the rubber industry, Order M-244 has been revoked and the product transferred to the controls of M-300. This places carbon black under allocation for the first time. Customers may now order up to 20,000 lb. furnace type or rubber grades of channel type by filing an end-use certificate with the supplier who must obtain WPB authorization for such quantities on Form WPB-2947.

CYANAMID FOR FERTILIZER

LIMITED amounts of cyanamid have been made available to farmers east of the Rockies for direct application to their crops. Small amounts also may be used in 11 States for use in tobacco plant beds, for pink rot control in Florida, and for weed control in New England. Last year such use of cyanamid was restricted to Mississippi for cotton and to Louisiana for sugar.

PETROLEUM SOLVENTS

ORDER M-150 has been amended to increase the list of permitted uses for aromatic petroleum solvents. For Class B, three new uses are permitted, for vinyl coatings on military orders where spray application is required, for specification coatings on military orders where the use of Class B solvents is required, and for brake lining, clutch facing, and coated abrasives. Permitted use of Class B solvents in aircraft coatings was broadened to include all coatings for aircraft including instruments and parts. Manufacturers are prohibited from using Class A solvents on products listed on Schedule A that are to be used with or incorporated in other products to be sold on civilian orders.

OLEYL ALCOHOL

HIGHER aliphatic alcohols are now subject to the provisions of M-300 and oleyl alcohol has been included. This action was taken in accordance with an agreement between WPB and WFA as the latter had been in charge of distribution of sperm oil from which oleyl alcohol is produced. In view of increased demands for sodium metal, also required for making oleyl alcohol, and the easier position of sperm oil, allocation of oleyl alcohol was transferred to WPB.

PRICE CEILINGS

MANUFACTURERS of waxed, oiled and petrolatum treated papers may apply for an adjustment in ceiling prices if unable to maintain production at the prevailing ceiling and if this production is required to meet military and essential needs.

A nation-wide retail price schedule became effective Aug. 1 for mixed fertilizers, superphosphate, potash and nitrogenous materials. There are 18 tables of maximum prices each applicable to certain geographical sections.

The average increase of 20c a ton went into effect July 6 for Florida pebble phosphate rock. At the same time general revision was made in the regulation covering hard phosphate rock and Tennessee brown rock but this did not involve any change in maximum prices.

At the end of June ceilings were established for technical grades of barium salts. The price for carbonate is $60 a ton fob plant with a high cost producer given a $70 a ton maximum. Price for chloride crystals is $73 a ton and anhydrous is unchanged at $105. These prices are for carlots, in bags. Effective July 31, the ceiling on barite produced in Missouri was raised to $8.50 a ton on basis of 94 percent barium sulphate content.

Benzol, toluol, and xylol have been placed under price control at March 1942 levels. Benzol sold by Defense Supplies Corp. is exempt and none of these products is affected by the order if they are made from petroleum.

Tung oil of domestic origin has been placed under a ceiling 38.375c a lb. in tankcars fob New York, Gulf ports, and Pacific Coast ports. Carlots in drums carry a maximum of 39c a lb. Crude peanut oil produced in newly developed crushing areas also is under price control with carlots fixed at 13c a lb. to 13.775c a lb. depending on the section.

Chestnut extract ceilings have been increased by about 13 percent in order to maintain maximum production. The new maximums range from $2.41 to $3.25 per 100 lb. in tankcars, the range depending upon producer.

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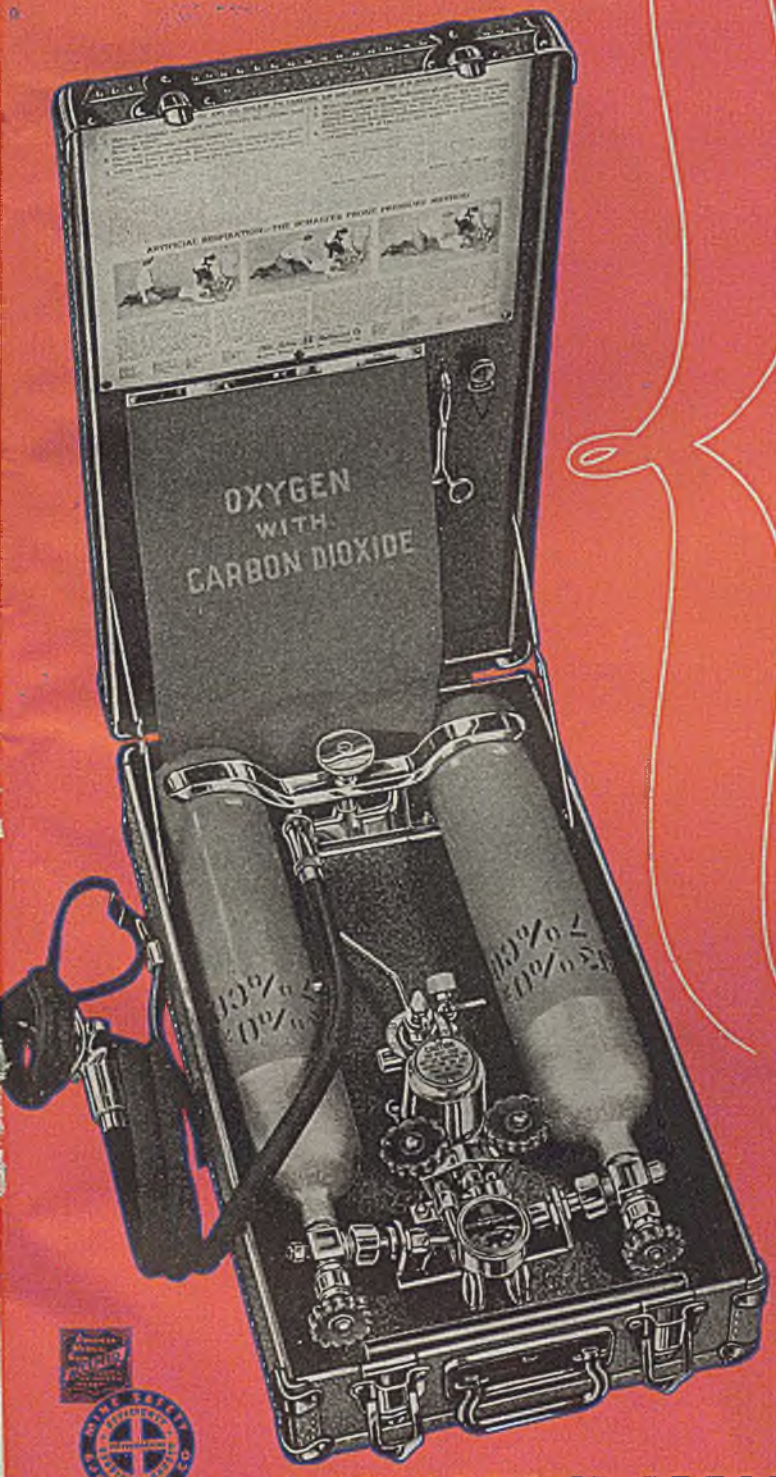

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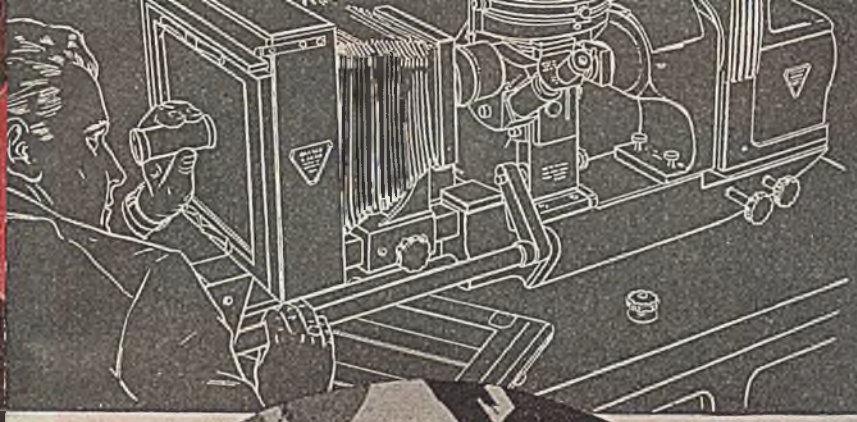

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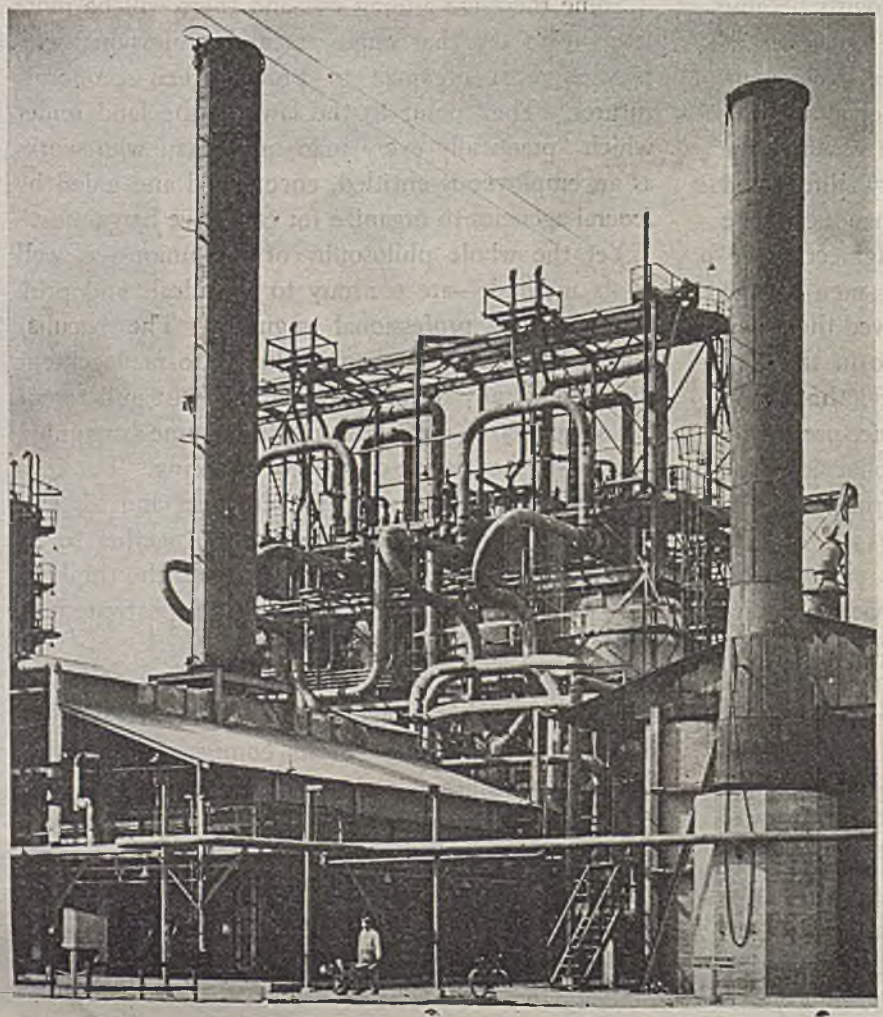
H. G. M. FISCHER and A. B. WELTY, JR. *Standard Oil Development Co., Bayway, N. J.*

SYNTHETIC TOLUOL

From Petroleum by Hydroforming Process

The story of synthetic toluol* from petroleum has a background of a combination of research, foresight, timing and luck which produced one of the great wartime industrial achievements, enabling our military to strike from the long list of critical materials an important item which had caused grave concern. Fortunately this development had matured to the stage of commercial operation several months before Pearl Harbor. Insofar as is permissible under current military and secrecy restrictions, the authors describe the research and development work which led to this achievement.—*Editors*

Hydroforming unit. Principal reaction in the process is the dehydrogenation of methylcyclohexane with heat and in presence of catalyst to give toluol

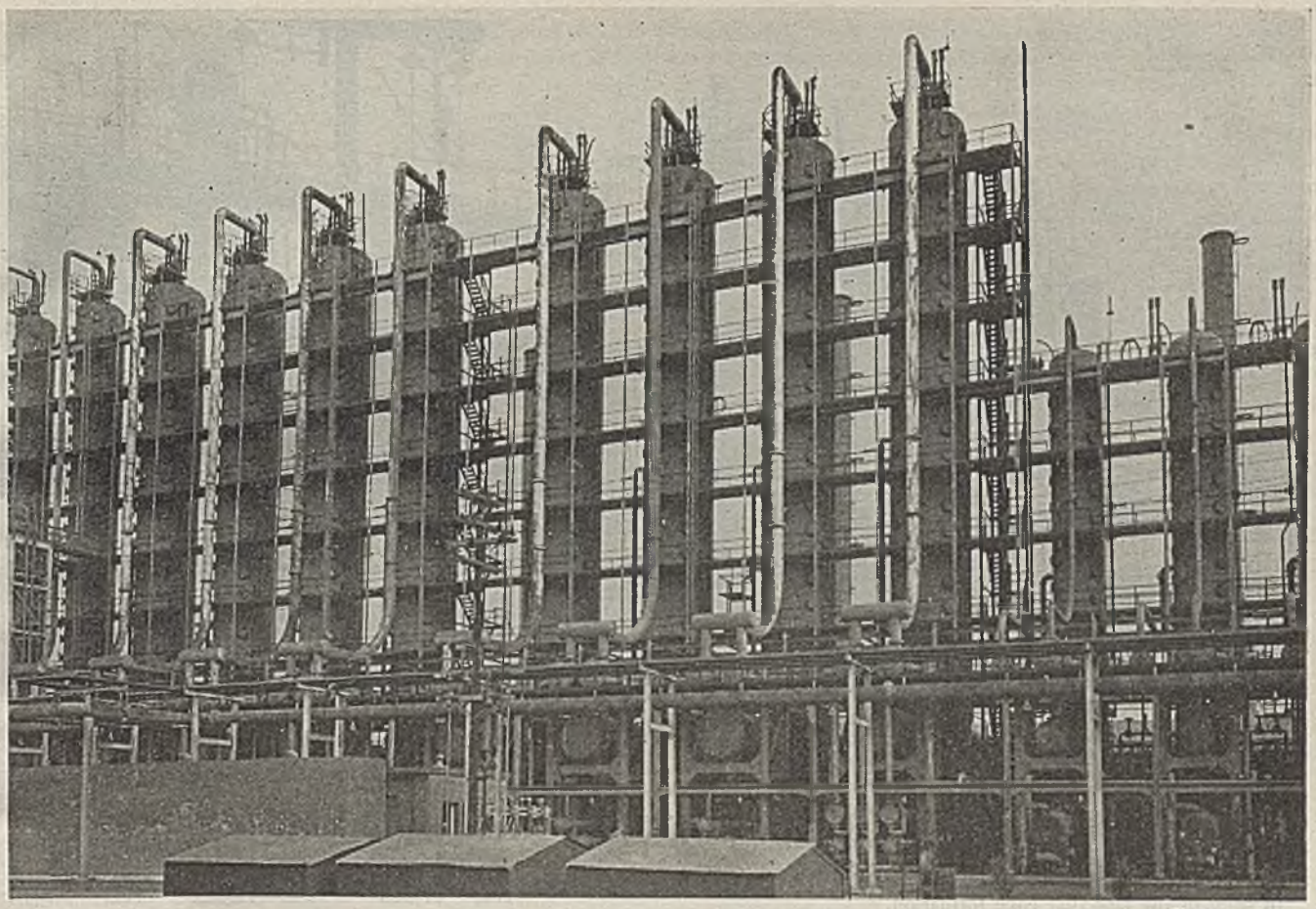


THE ENTIRE integrated process for making synthetic nitration grade toluol from petroleum had been worked out by 1940. Recognizing the imminence of war, Army Ordnance rushed to completion a plant at the Baytown Refinery of the Humble Oil and Refining Co. This was the first plant ever to produce, on a commercial scale, synthetic nitration grade toluol from petroleum. During the critical year following Pearl Harbor this plant alone supplied well over half of the toluol used in America to make TNT.

Toluol production prior to World War I was less than 1,000,000 gal. per yr. (U. S. Bureau of Mines data) since byproduct coking was practiced only to a limited extent at that time. However, under the stimulus of the war and an increase in price production increased rapidly until in 1918 it amounted to almost 9,000,000 gal. Following World War I the production of byproduct toluol dropped sharply to about 1,000,000—2,000,000 gal. per yr., then increased steadily until in 1940 it amounted to about 30,000,000 gal.

The amount of toluol present in crude petroleum varies widely, depending on its origin. In a few exceptional cases there is

* The word toluol is used in the chemical industry to designate a product high in toluene content. Nitration grade toluol specified by the government for TNT is virtually pure toluene.



Photos by Rosskam

Superfractionation towers of the toluol plant at the Texas Ordnance Works, Baytown

1 to 2 percent, but normally less than ½ percent is found. A rough estimate indicates that in order to provide all the nitration grade toluol needed (over and above that obtained from byproduct coke oven operations) by extracting the natural toluol present in crude petroleum would require special processing of about one-third of the crude naphtha produced in this country. Obviously such a procedure would be impractical and require a vast amount of collecting, transportation and refining equipment, and the synthetic approach seemed to be the only promising alternative.

Table I — Toluol and Methylcyclohexane (MCH) Contents of Representative American Crudes, Volume Percent

Crude	Toluol	MCH*
Texas Coastal	0.03	1.2
Conroe	2.0	2.5
East Texas	0.40	1.7
Kettleman Hills	0.70	2.1
Midway Light	0.02	0.52
North Sweden Mixture	0.80	3.7
Panhandle	0.22	2.3
Pecos	0.03	1.0
Refugio	0.26	2.9
Salt Flat-Regan	0.19	1.5
Santa Maria	0.14	0.79
Sugarland	Nil	1.0
Tomball Mixture	1.1	2.1
Tinsley	0.08	0.65
West Texas	0.50	1.3

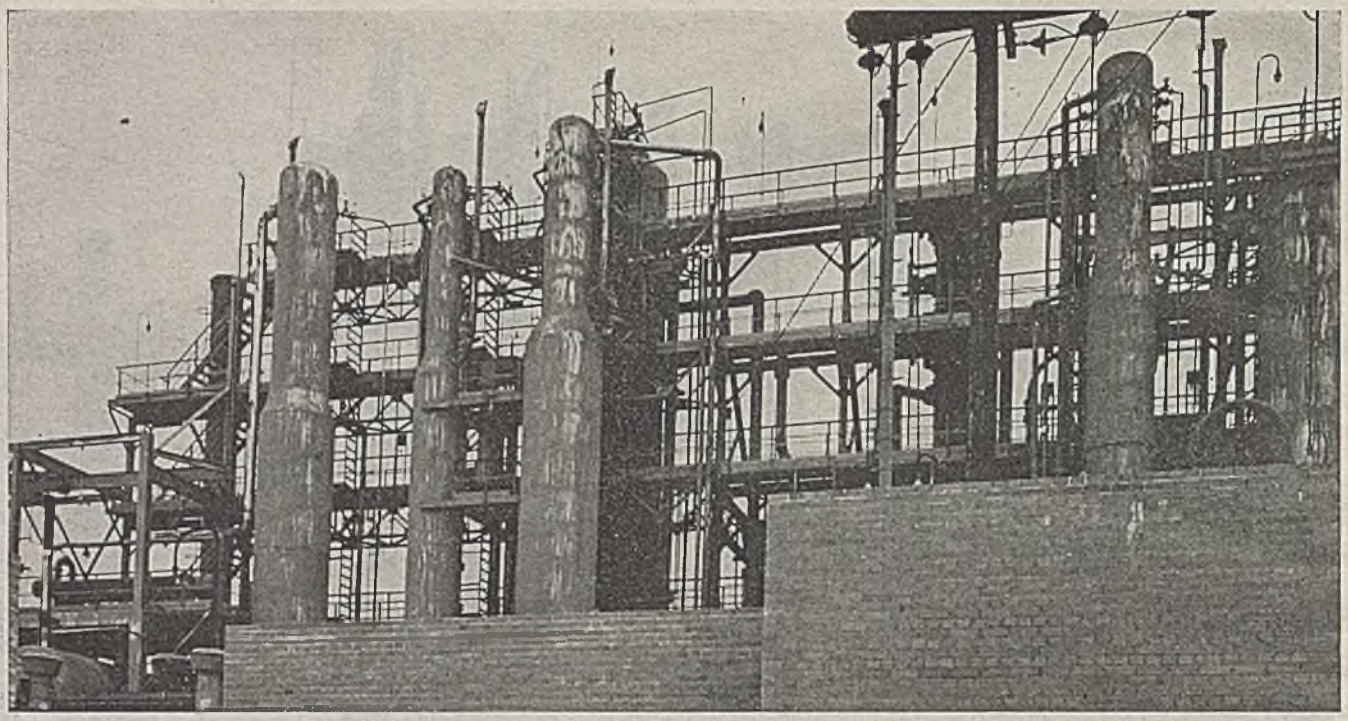
* Includes such ethylcyclopentane as is present.

The compounds present in crude naphtha can be classified according to type as paraffins, naphthenes (cyclic paraffins) and aromatics. The naphthenes present may be of either the five-carbon-ring type or of the six-carbon-ring type. For many years it has been known that with the aid of dehydrogenation catalysts, six-carbon-ring naphthenes and normal paraffins could be converted to aromatics. But processes using these catalysts had never become commercial because the catalysts became rapidly inactivated due to fouling with carbonaceous deposits.

Observations led to recognition of the fact that the carbonaceous deposits could be greatly minimized by carrying out the operation in an atmosphere of hydrogen. This is not surprising since with suitable catalysts and under suitable conditions the hydrogenation process can operate for many months without carbon deposition on the catalyst and even carbonaceous material can be converted to liquid products.

Such conditions, however, due to the high hydrogen partial pressure maintained, fail to give the degree of conversion to aromatic hydrocarbons considered necessary for commercial success. Therefore a modification of the hydrogenation process was devised to obtain the benefit of the hydrogen atmosphere without, however, consuming hydrogen, thus making it unnecessary to supply hydrogen to the process. By recirculating hydrogen-rich product gas to the catalyst chamber and operating at moderate pressure on selected feed stocks, the formation of coke on the catalyst was drastically reduced and the catalyst remained active for a relatively long period of time. This modification was called hydroforming. It is used today in most of the plants making synthetic toluol. The principal reaction in the process is the dehydrogenation of methylcyclohexane ($C_6H_{11}CH_3$) with heat and in the presence of a catalyst to give toluol ($C_6H_5CH_3$) and free hydrogen.

A flow diagram showing the essential elements of the hydroforming process is given. Fresh feed is heated to reaction temperature, first by heat exchange with the products from the reactor and then by a furnace. At the entrance to the reactor the hot oil vapor is joined by hot recycle gas, which may contain 40–80 percent by volume of hydrogen depending on the feed stock, catalyst and conditions used. The joined streams pass through one of the two reactors where the catalyst is disposed and where the conversion takes place. The product is cooled and condensed and the gas is separated from the liquid. Some of this gas is recirculated while the remainder is released as necessary to maintain the desired pressure on



Sulphur dioxide unit of the toluol plant. Brick splinterwalls serve as protection in case of air raids or explosions

the system. The liquid product is stabilized by removing the dissolved propane and lighter hydrocarbons.

In spite of the fact that coke formation is quite small it is still necessary to regenerate the catalyst at regular intervals. Therefore, in order to permit continuous operation, at least two reactors are provided, one of which is regenerating while another is converting. Regeneration of the catalyst is accomplished by burning off the accumulated carbon by means of air diluted with spent regeneration gas.

The hydroforming reaction is endothermic and the temperature drop from reactor inlet to outlet may be as much as several hundred degrees fahrenheit. To narrow the range of temperature of reaction, two reactors in series with reheating between may be used in place of each of those shown.

At the conditions used, the equilibrium relationships are such as to promote the dehydrogenation of naphthenes and the hydrogenation of any aliphatic olefins which may already be present in the feed or which may tend to form. The latter reaction accounts to a large extent for the lower coke formation in hydroforming as compared to operation without hydrogen because olefins, which tend to polymerize to form coke, cannot be present in high concentration on the catalyst surface.

Dehydrogenation of naphthenes, particularly 6-carbon-ring naphthenes accounts for most of the aromatics production. However, some toluol is undoubtedly produced from other components of the feed. Data on hydroforming relatively pure methylcyclohexane (MCH) are given in Table II.

Table II—Hydroforming "Pure" Compounds

Boiling point, deg. F.	Methylcyclohexane 214		n-Heptane 209		Toluo 231	
	Feed	Product	Feed	Product	Feed	Product
Yields based on feed, volume percent						
Dry gas		9.8†		26.5†		0.9†
Liquid paraffins	0.0	1.4		39.0	0.0	
n-Heptane	0.0	—	100	21.0	0.0	1.2
MCH	97.5	2.7	—	0.0	2.5	
Benzol	0.0	4.0	—	*	0.0	0.0
Toluol	2.5	71.2	—	11.7	97.5	97.9
Xylols, ethylbenzol and heavier aromatics	0.0	1.6	—	*	0.0	*
Boiling range of liquid product, deg. F.						
10% at		224		127		231
50% at		231		196		231
90% at		233		234		232
Calculated conversions to aromatics, percent						
MCH to total aromatics		93		—		—
MCH to toluol		85		—		—
n-Heptane to toluol		—		16		—

* Not determined, but believed to be less than 1 percent. † Weight percent.

The MCH disappearance amounted to over 97 percent by volume of that in the feed and 93 percent of it formed aromatics. In the process some side reactions take place resulting in the production of benzene and some higher molecular weight aromatics than toluol. About 85 percent of the MCH was converted to toluol. It will be noted that the volumetric yield was only 71 percent, however. This arises from the facts that in the conversion hydrogen is lost and the toluol has a higher liquid density than MCH. The theoretical volumetric yield from MCH is 83 percent. In these calculations it has been assumed that the 2.5 percent toluol in the feed passed through the operation unconverted.

Data on n-heptane are also given in Table II. Unlike MCH, n-heptane yielded, under the conditions employed, only a relatively small amount of toluol and, as indicated by the gas yield and the boiling range of the liquid product, was extensively cracked to lighter hydrocarbons and gas. Although 79 percent of the n-heptane disappeared in the operation, only 16 percent was converted to toluol. The superiority of MCH as a feed stock for producing toluol is obvious. While other catalysts and operating conditions can be used in laboratory equipment to obtain a more favorable yield from normal heptane, no process has come to light to make this operation commercially attractive.

Toluol was also hydroformed in order to demonstrate its stability. Little, if any, conversion occurred and it has generally been assumed in evaluating practical charging stocks that any toluol in the feed stock will appear in the hydroformed product.

The boiling points of MCH and toluol are such that both of these compounds can be conveniently included in a narrow-cut naphtha charge stock, and accordingly the synthetic and natural toluol appear in the hydroformed product together. Many other compounds are present in the feed. However, experience with a large number of different feed stocks has shown that the toluol yield can to a large extent be accounted for on the basis of the toluol and MCH content, and that, while the cumulative contribution of all other compounds present is an important consideration, the toluol yield from any one is probably quite small. An exception is the methylcyclohexenes which occur in cracked stocks and appear to give high yields of toluol.

It will be seen, then, that the methylcyclohexane (MCH) content of potential charge stocks can be used to calculate approximately their capacity to produce synthetic toluol by the hydroforming process. The MCH concentration in various crudes is shown in Table I. This MCH content is in each case greater than the toluol content and in many cases ten times as great. By converting the MCH much less crude need be processed and much less equipment is required to supply the nitration grade needed than if only the natural toluol were extracted.

In analyzing potential feed stocks it was not possible to distinguish between the isomers, methylcyclohexane, (b.p. 214 deg. F.) and ethylcyclopentane (b.p. 217 deg. F.) because their physical properties are so nearly the same. Therefore, in the analyses shown in Table I, the values given in the second column include such ECP as is present. Indications are that the MCH + ECP may be about 15–20 percent ECP. By analogy with dimethylcyclopentane, which has been shown to yield only a limited amount of toluol, it is to be expected that the ethylcyclopentane would produce much less toluol than methylcyclohexane, and it is necessary to take this into account when evaluating various feeds on the basis of their MCH + ECP content.

To determine the extent to which the toluol producing components of the feed could be concentrated in a narrow-boiling fraction, a typical 200–250 deg. F. virgin naphtha was fractionated into narrow cuts at 9 : 1 reflux ratio in a 24-plate column, and a number of the cuts were hydroformed. The highest yield was 44 vol. percent. In this case the feed analyzed 57 percent MCH + ECP and 5 percent toluol. The toluol concentration in the product was 59 percent and on a broader feed would be considerably lower.

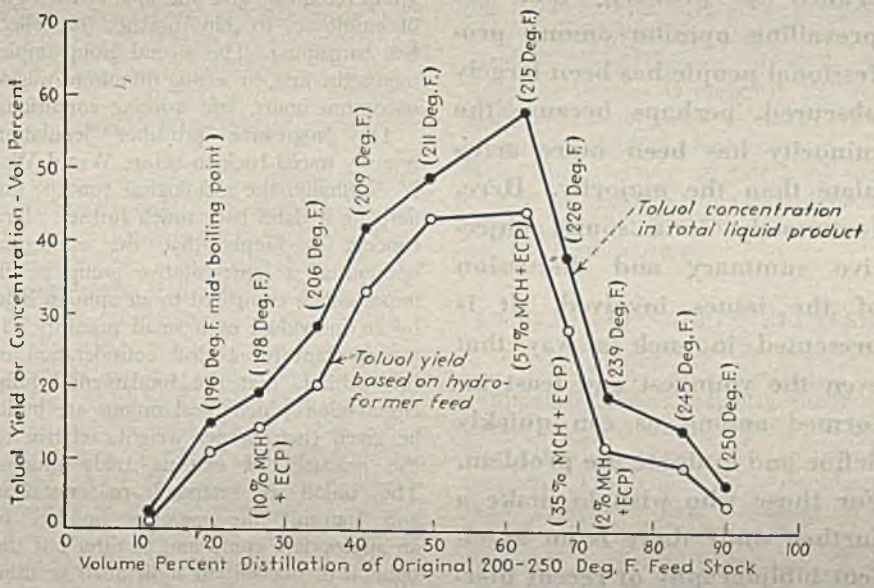
The success of a commercial operation for making synthetic nitration grade did not rest solely on a practical method for making the toluol from petroleum but also required solving the problem of separating it from other compounds boiling in the same range so as to produce the high degree of purity demanded by nitration grade specifications. Separation by superfractionation alone was not satisfactory because of the closeness of the boiling points of the compounds involved and the fact that in the presence of the other constituents toluol distills over a relatively wide temperature range (from perhaps 215 to 231 deg. F.).

Processes for liquid phase solvent extraction of aromatics from hydrocarbon mixtures were known, but the highest aromatics concentration obtainable was about 75–80 percent whereas the specifications for nitration grade toluol require 99+ percent purity. This problem had not arisen in making it from coal tar because that product contains little paraffinic, naphthenic or olefinic material and toluol is readily separated from the other aromatics present by chemical purification and distillation. The problem was solved by applying a new technique to an old process. Due to secrecy order restrictions details of the modified extraction process cannot be disclosed.

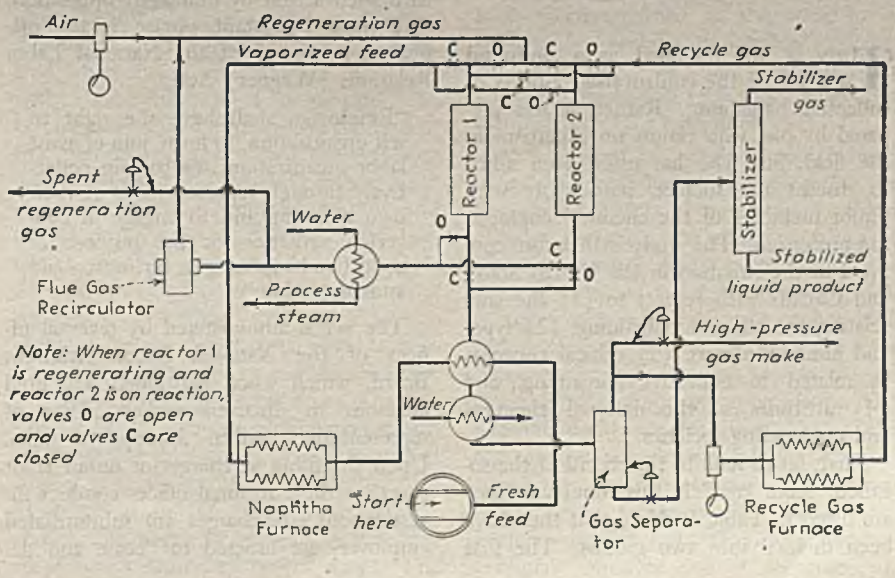
The hydroforming process has been shared with other companies and other hydroforming units have been built to produce synthetic toluol at various refineries throughout the country. The entire program has been coordinated by the Army Ordnance Toluene Technical Committee under the chairmanship of Maj. J. H. Matkin, and through this medium pertinent technical information has been made available to operators of the various toluol plants.

Recognition is due the many members of the technical staffs of Standard Oil Development Co., Esso Laboratories of Standard Oil Co. of Louisiana, Humble Oil and Refining Co. and the operators whose contributions have brought this undertaking to a successful conclusion.

Hydroforming various narrow boiling virgin naphtha fractions



Flow diagram showing essential elements of hydroforming process



ZOLA G. DEUTSCH *Consulting Chemical & Mechanical Engineer, New York, N. Y.*

COLLECTIVE BARGAINING

Does it Conflict with Engineering Ethics?

This paper deals with a controversial subject on which most engineers will probably admit that their thinking is still in a formative stage. The two extreme viewpoints have been argued so intensely that the prevailing opinion among professional people has been largely obscured, perhaps because the minority has been more articulate than the majority. Here, fortunately, is a sound objective summary and discussion of the issues involved. It is presented in such a way that even the youngest and least informed among us can quickly define and evaluate the problem. For those who wish to make a further study there is an excellent bibliography of recent literature. —*Editors*

THIS is not intended as a profound analysis of the controversial aspects of collective bargaining. Rather, it was prepared by one who claims no expertism in the field, but who has often been asked to discuss the subject, particularly with junior members of the chemical engineering profession. The study is therefore confined to the situation in the United States and Canada with respect to (1) the laws relating to collective bargaining, (2) types and aims of unions, (3) ethical concepts as related to collective bargaining, and (4) attitudes of the national chemical and engineering societies.

First, let us look to the record of the so-called "labor laws" in this country as they are listed in Table I. Note that they have been divided into two groups. The first group *recognize, give* and *uphold* the right of employees to join together for collective bargaining. The second group implements the first, in setting minimum wages, maximum hours, safe working conditions.

Table I. — United States Laws Relating to Collective Bargaining

Date	Name of Law	Majority Party	President
1926	Railway Labor Act	Republican	Coolidge
1928	Anti-Injunction Act	Republican	Coolidge
1933	National Industrial Recovery Act	Democratic	F. D. Roosevelt
1935	National Labor Relations Act	Democratic	F. D. Roosevelt
1931	Bacon-Davis Wage-rate Act	Republican	Hoover
1936	Walsh-Healey Public Contracts Act	Democratic	F. D. Roosevelt
1938	Fair Labor Standards Act	Democratic	F. D. Roosevelt

This progressive "pro-labor" legislation is easily traced back to before World War I. Naturally, the sociological concept underlying it dates back much further. This concept is simply that the concerted opinion of a representative group is all-important as compared to an opinion held by an individual or a small minority. It is important for a clear consideration of this subject, that the fundamental *principles* upon which ideal unions are built, be given their proper weight, relative to the *practices* of existing trade unions. The union is intended to crystallize and transmit the majority opinion of an appropriate group and to filter out the opinion of malcontent individuals or minorities. The laws are written to promote such action, also to prevent interference with such action by dominant opposition. The most important phrase is the oft-quoted Section 7 of the National Labor Relations (Wagner) Act:

> "Employees shall have the right to self organization, to form, join or assist labor organizations, to bargain collectively through representatives of their own choosing and to engage in concerted activities for the purpose of collective bargaining or for mutual aid and protection."

The act is administered by regional offices of the National Labor Relations Board, which when petitioned will hold elections to discover worker choice of representation within appropriate units. Upon the filing of charges of unfair labor practices these regional offices conduct investigations. If charges are substantiated employers are ordered to "cease and desist." Thus it is evident that group activity in these matters definitely overshadows any individual activity.

Today, most agree that the attitude of the public, of Congress, and of the Supreme Court during recent decades has been pro-labor. Whether or not the present attitude will in the future continue to be regarded as pro-labor, or whether it may be offset by a surge in the opposite direction (such as took place with alcoholic liquor legislation), is obscure to most people. It seems just as likely that there will be further legislation favoring labor.

Suffice it to say for this part of the discussion, that labor's right to form collective bargaining groups is clearly established and so fortified by law that it is accepted widely even where the laws do not apply. The interpretations of laws by numerous board and court decisions in recent years give a very broad meaning to "interstate commerce," define employee as distinct from employer, and have clearly shown that many professional people, engaged in professional work, are in the employee class.

The laws and boards also recognize and define differences between professional and non-professional employees and have, in general, upheld well the desire of professional employees to form units appropriately apart from non-professional. However, a professional employee minority, if it remains acquiescent, can become dominated by a non-professional majority.

TYPES OF UNIONS

1. The single trade (craft) union throughout heterogeneous industry is sometimes called the horizontal union. For ex-

Based largely on a paper entitled "Professional Ethics and Unionization of Professional Workers," presented before the Chemical Engineering Division, Society for the Promotion of Engineering Education, Cincinnati, Ohio, June, 1944.

ample, there is a nationwide electrician's union whose local sections are geographical. Members of a single local may work in several factories, in mines and in the building trades. This type of union is generally associated with the American Federation of Labor. Of interest to professional men is its affiliate known as "Technical Engineers, Architects and Draftsmen's Union." It is estimated that this union had some 10,000 members during 1943 and that they were mostly sub-professionals.

2. The single industry union is often referred to as the vertical union. Unions of this type try to enlist as members all employees in a single industry whether they be electricians, laborers or draftsmen. For example, the United Automobile Workers of America tries to sign up every employee working for a manufacturer of automobiles or automobile parts, regardless of his craft or the company he works for. The locals are usually geographical. This type of union is generally, but not invariably, affiliated with the Congress of Industrial Organizations. Of interest to the engineering profession is the affiliate (although not a vertical union) known as "Federation of Architects, Engineers, Chemists and Technicians." This union claimed 10,000 members during 1943, and it is estimated that these were mostly in the sub-professional class.

3. The independent union is usually a union of all of the employees of a single corporation or a single plant or factory. Such unions try to represent all of the employees of a single factory or project, regardless of their craft or position, so long as they are in the employee class. Unions of this character do not become prominent because of their local status and generally small size. Such unions have difficulty showing that they are entirely a product of self-organization, free from all interference, restraint or coercion by the employer. Among them are two of interest to professional people; The Association of Railway Technical Employees in the Southern Pacific Railway Co., and the recently recognized "Research and Engineering Professional Employees Association" of the Standard Oil Co. of Indiana.

4. The union of governmental employees is a little more difficult to define. The Wagner act does not provide for employees of federal, state or municipal governments, and it has been quite clearly established in recent history that strikes against any government are unpopular and fail to force recognition of claims. Nevertheless, there are numerous bargaining groups among employees of federal, state and municipal governments, and they have a fairly good record of achievement. Of interest to professional people in this type of union are the Tennessee Valley Authority Engineers' Association and the several state employees' associations having both sub-professional and professional members.

The aims of all four types of unions briefly described above are classified into three types:

1. To increase pay, shorten hours, grant vacations, etc., is the most widespread aim of trade unions. This is properly considered the "greater-share-of-profits" aim.

2. To assure safety. Under this heading come such aims as eliminating insanitary working surroundings, hazardous working conditions, and also the less sharp complaints such as methods of avoiding monotony, harrowing noise, etc.

3. To assure security, involves those usual activities which try to make promotions independent of foreman's favoritism, try to make all hiring and firing independent of union activity, lodge, family or church connection. This aim, which is more important to trade unions than to "independent" unions contains more conflict with professional ethics than any other, as explained beyond under "leveling." Under this heading also come aims, not so much in conflict with the professional outlook, such as getting long notice before layoff, equitable and favorable pension arrangements, medical care, sick leave.

LONG-TIME OBJECTIVES

The four types of unions described above all hope to progress along the three aims by group activity as distinct from individual activity. The laws recognize and accept unions, but collective bargaining is done by the "appropriate unit" which is briefly defined as a somewhat homogeneous group of employees of a single project or factory. Such units usually get legal, technical and financial aid from the unions with which they are affiliated. The craft union hopes to benefit its members by bringing to the attention of the management and the public the problems and contributions of the particular trade or craft. The industrial union hopes to accomplish the same end, feeling that the more impelling action can be obtained by the grouping into the single industry. The independent union resists control of organized labor and is generally less concerned with the conditions of promotion. All try to protect and further the interest of the members by petitioning the employer and by creating and fostering public sentiment favorable to proposed reforms and ultimately (with the exception of the governmental unions) by the strike. In order to make these efforts more effective, some unions have auxiliary aims, such as the checkoff and the closed shop. These tend to give unions more power and effectiveness.

Professional people seem to be averse to the "leveling" effect of avoiding favoritism in hiring and promotion. The professional man is generally an individual in his tastes as much as in his assigned professional duties. He hopes to advance by excelling in peculiarly individual contributions. The medical and legal professions, at their own instance, have secured explicit exemption from these laws by the National Labor Relations Board. In the engineering profession, where an almost infinitely greater fraction of the practitioners are "employees," the individuality of the professional also is recognized.

One of the principles by which boards and laws have distinguished professional workers from non-professional workers is that the work of one cannot be performed by another without a long delay in breaking-in period. Consequently, the union aim which tends toward a strict seniority rule for promotion seems highly inapplicable to professional people and they struggle against its inclusion in any agreement under the jurisdiction of which they may be working.

Similarly, professional people generally engaged in directing their best efforts toward the elimination of waste and reduction in the amount of needed monotonous toil, are in direct conflict with union practices wherein one craft must relinquish work to another at arbitrarily chosen and obviously wasteful points; or where the output per worker is purposely and artificially held below some arbitrarily established maximum; or where craftsman and helper may never work separately. All such matters are distasteful to the professional people quite apart from any ethical concept which may be involved.

ETHICAL CONCEPTS RELATED TO UNIONISM

Although "ethics" is fundamentally the science of ideal human character, it is now more often understood as a set of rules-of-the-game. This is probably so because of the widespread adoption of codes of ethics by associations and societies, industrial and mercantile, as well as professional. Even when confined to professional societies, a comparative study of ethical concepts reveals a wide gradient of attitude. However, when confined to the societies of engineering workers, reasonable analogies are detectable. In the following, the statements in several such codes have been grouped into four categories:

1. Integrity, fair dealing and maintenance of confidential relationships are among the aspects of one type of ethical concept pervading the codes of ethics of all professional socities, whether in engineering or other learned professions. Although most individual professional men feel a clear understanding of these concepts, such understanding covers a considerable range from person to person. The relevant point in this discussion is the one of the confidential relationships between the professional man and his client or employer. In this respect, his position is quite distinct from that of a non-professional employee and is recognized as

such by the boards and courts holding jurisdiction in labor relations matters.

The concept of "confidential relations" is by many considered to put professional people in direct conflict with unionization. Extremists among professional people (of whom there are many) feel that joining a union is incompatible with holding membership in a professional society; that submitting to unionization constitutes surrender in the battle to secure recognition of engineering as a profession. Many union leaders, not necessarily in the extremist class, likewise feel that professional people are not good union material because of their confidential relationship with their employers. In certain cases, statements have been made indicating that union leaders would consider professional people as "borers from within." As pointed out beyond, in the discussion of the attitude of professional societies, the majority opinion (probably a narrow majority) regards affiliation with a union as not necessarily in conflict with professionalism.

2. Conservatism and professional dignity are the principal aspects of a second type of ethical concept. Most codes of ethics of professional societies admonish the membership to avoid association with questionable enterprises, avoid sensationalism in advertising, be conservative in the promotion of schemes, and in all other ways maintain professional dignity. Collective bargaining can, and on occasions is conducted without conflict with this concept, although probably a large majority of professional people consider that the bulk of the efforts and statements of union organizers violate or at least ignore it. For this reason, perhaps as much as for any other, unions and unionization are distasteful to professional people, among whom are many who consider the difference between a profession and a trade to be like that between white and black. Collective bargaining units of professionals, having achieved legal "recognition" might, according to this concept, vote for a process of individual bargaining.

3. The obligation to publish discoveries and to interchange technical information is a third ethical concept common to most published codes of ethics. Herein considered a part of this concept is the admonition that professional people give credit where credit is due. It usually refers to credit for discovery or invention, but it also refers to credit for painstaking or valuable work of any kind. The concept of credit-giving is germane to ethical behavior in connection with collective bargaining. When professional people in the employee class refrain from participation in collective activity and yet eventually accept tangible benefits from such efforts, they are in immediate danger of being regarded as unethical. Professional people, by the very fact of their professional stature, are expected to possess qualities of leadership, together with the combination of abilities which can produce virtue in an organization. Thus, many might consider true professional attitude in these situations to require participation on a high ethical plane.

Another aspect of this subject is the special aim of trade unions (specifically the CIO's FAECT) to get more remuneration (credit) for the inventions of its members, than is now common practice in most "patent agreements" entered into at the time of employment of professional people.

4. Refusal to accept low remuneration for professional service, together with the refusal to undertake work considered to be unprofitable to a client, is a fourth general ethical concept common to the published codes of most professional societies. It seems analogous to the first aim of most unions, i.e., to get a just and reasonable share of the profits of enterprises. Professional people consider it unethical to accept low remuneration and union organizers consider it degrading. For example, the letterhead of the A. F. of L.'s TEADU says, "*Your Pay Envelope Is a True Measure of Your Self Respect—Organize!*" A member of a collective bargaining unit who has genuine professional stature, is ethically bound to help his unit achieve a technical rather than an emotional approach to the problem of determining a proper share-of-the profits.

ATTITUDES OF PROFESSIONAL SOCIETIES

The climbing enrollment (up to wartime) in colleges throughout the country, together with the appetite for study engendered by widespread war training, is expected shortly to result in a greater fraction of our population completing professional training. At the same time, the growth of individual industry, through research, and amalgamation with related small industries, will make an ever-increasing ratio of this professional timber into non-professional "employees" or "captive chemists." Whereas today the union-eligible professional is typically the young, inexperienced and ambitious member of a professional society, that won't necessarily be so tomorrow. Even the non-engineering professional societies face an increase in the fraction of their membership in the employee class. It seems that relatively few of America's important professional societies are taking full cognizance of the imminence of this change.

The American Chemical Society is the largest single society of professional people related to engineering workers. Perhaps a larger proportion of its membership (than of the engineering societies) is in the employee class. Recent administrations of the ACS have taken an active and aggressive interest in the labor legislation and litigation affecting its individual members. Since the membership of the society embraces both individuals and corporations, the society has taken the attitude that it cannot become a union or a bargaining agent in any way. However, it assists its members in obtaining and preserving their rights by publishing advice in its journals and giving legal assistance to local groups. The society has taken rather definite stands in the matter. It is not opposed to collective bargaining for professional people, when such is not controlled by non-professional groups. Where deemed necessary, it favors bargaining units composed exclusively of professional people. It is "unalterably opposed" to forcible inclusion of any of its members in units dominated by non-professional employees, and their affiliation with any organization that conditions promotion primarily on the basis of seniority. It has established acceptably precise definitions of "technician," "professional employee," "chemical interne."

The American Society of Civil Engineers is the oldest and the second largest of America's major national engineering societies. Its Board of Direction, in the fall of 1943, adopted a report of its Committee on Employment Conditions, which was the result of continuous and intense study since 1937. The Committee's recommendations were three:

1. That each local section amend its constitution to make possible the formation, among the membership of employee bargaining groups, to be of assistance to legal collective bargaining units of professional engineering employees of a specific employer.
2. That funds be allocated to retain legal counsel and employ four nation-wide field representatives.
3. That a definition of "professional engineering employee" be adopted by the Board of Direction.

This action caused considerable controversy, an aggressive minority objecting strenuously. At an afternoon session of the annual meeting in January, 1944, at which the younger members were poorly represented, the subject was discussed and a motion for reconsideration of the action was defeated by a narrow vote of 120 to 97. Of some 60 local sections, as of June 1, 35 have concluded their considerations of the matter. Twenty-nine have voted to amend their constitutions in the manner recommended by the committee and approved by the Board of Direction. The affirmative vote has been large (about 93 percent.) Three sections have voted against such amendment and three have considered amendment unnecessary because of their rural character.

The American Institute of Chemical Engineers is the youngest and smallest of the major national engineering societies. Its Committee on Professional Guidance has given the subject much less consideration than has the Civil's Committee. Also

because the subject is in a category outside the strictly technical to which the Institute confines its publications, substantially nothing has been published under its sponsorship. It is understood that recently there have been suggestions at meetings of the Council of this Institute for symposia on the subject. Apparently the majority of the present Council feel that the problem is of less immediate interest because of less applicability to its members, than to the members of the American Socicty of Civil Engineers. At present the subject is being treated as too controversial and too fraught with danger of embroilment. That is, the members feel that any public statements they might make would be construed as coming from representatives of "management."

The ASME has sponsored the publication of numerous articles and has had discussions of the subject at its meetings. The AIEE has taken much milder interest. The AIME has given guarded editorial approval to the action of the Civils. Recently authorized is a survey of the "economic status" of engineers to be sponsored by ASME and AIEE. Perhaps it can be said that these societies reflect a gradient in attitude between that of the Civils and that of the Chemicals.

The Engineering Institute of Canada is interested in these problems. During April, 1944, the Wartime Labor Relations branch of the Canadian government issued an order-in-council (1003) which affects professional people in an employee capacity quite similarly to the laws in the United States. The *Engineering Journal* of this Institute has recommended to its membership careful study of the matter so that the opinion of the members may be transmitted to the government before the end of a six-month reconsideration period. Editorially, the *Journal* expresses the hope that Canadian conditions will permit "a more satisfactory solution than that being worked out in the States." The members are given a choice of three paths:

1. Throw in their lot with the trade unions.
2. Establish "employees' organizations" within the meaning of the order, which they would endeavor to operate and control themselves.
3. Have the Board exclude them permanently from the order, and then through their own existing organizations, set up some form of procedure which will demonstrate to recalcitrant employers the advantages of paying living wages, and at the same time will establish a means by which pressure can be applied as it is required.

A small committee has been appointed to study the matter and recommend a procedure for informing all members of the situation and getting their judgment to the Council.

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MOLECULAR DISTILLATION

A New Path to Separation of Chemicals

It is not very often that what may yet be described as a new unit operation becomes available to chemical engineering. Molecular distillation may soon be so described, for it offers a means of separating compounds of extremely high molecular weight, too high for classical distillation, yet differs in almost every way from distillation of the ordinary equilibrium type. Until quite recently it was solely a laboratory tool, developed by laboratory technicians. Now it has grown to plant scale and has moved into factory production. The next few years will see it go far as a potent new tool of chemical manufacture.—*Editors*

Although it was recently only a laboratory technique, used exclusively for research purposes, ultra-low-temperature distillation of high molecular-weight organics has now moved into industry for the tonnage production of vitamins A and E from marine and vegetable oils. More than 5,000,000 lb. of such oils as shark liver and pollack were distilled last year in the United States alone, to accomplish the separation of the odorous constituents, the vitamin fractions, and the bulk of the original oil which was then in suitably purified condition for food and industrial use. Surprising as the magnitude of this development is, it has expanded considerably during 1944 and is evidently only a foreshadowing of much wider use of new molecular distillation methods which will permit employment in other and even larger applications of an industrial scale.

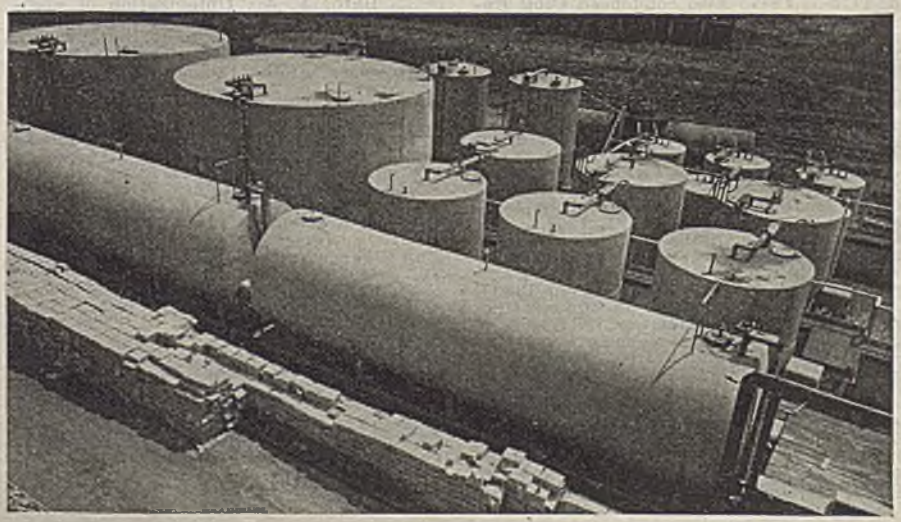
In the past many organic compounds of high molecular weight have been considered undistillable since the temperatures necessary for their treatment by classical distillation methods have resulted in their thermal destruction, rather than their separation. This includes the so-called "fixed" fats and oils and the natural waxes, as well as resins, vitamins and sterols. Molecular distillation offers opportunities for the separation and purification of such materials as these, as well as many others. For example, among the hitherto undistillable compounds are numerous synthetic polymers, plastics and plasticizers, drugs, highly oxygenated glycols, sugar derivatives, rubber intermediates, synthetic lubricants and heavy petroleum residues. Application of molecular distilling techniques to these and other classes of materials is not only possible but likely.

One important probable application is in the purification of the heavy plasticizers which must be used in compounding if the plastic is to be permanently free from shrinkage. So far as is known, no other method is capable of yielding a water-white product of the desired characteristics. The cost of treatment by molecular distillation is expected to be well within the value range of such materials, as is true of such other possible applications of considerable size as purification or separation of dimers and intermediate polymers in rubber and plastics manufacture, and purification of high molecular weight insecticides, lubricating oils and dye intermediates, as well as crude resins and waxes.

Even the natural mixed glyceride fats of marine and vegetable oil origin, which constitute one of the largest classes of available raw materials, may well yield to molecular distillation, despite the impossibility hitherto of handling such compounds by distillation (Hickman, *Chemical Reviews*, 34, 84, February 1944).

Past inability to apply distillation to substances such as those mentioned has not, of course, prevented their purification in all cases. Other separations have been available for some of the materials, including solvent extraction and fractional crystallization. It is obvious that molecular distillation will not replace all kinds of purification methods used formerly and it is not being advanced as a universal panacea. Only economic analysis of the individual situation will show where the best solution to a problem may lie. Nevertheless, molecular, or "vacuum short-path" distillation, as it is sometimes called, has definitely arrived as a

Fig. 1—Fish liver oils are stored in this tank farm prior to distillation



potent new tool for chemical engineers and chemical industry, which is usable on a large tank-a-day scale, as it has already been applied, in a small way by chemists in the high vacuum laboratories.

Simple molecular distillation is not without its disadvantages. It does not make extremely close separations and it is relatively inefficient from a thermal standpoint. For these reasons it is not suggested for use where ordinary distilling methods are satisfactory. Its significance lies in the fact that it extends the possibilities of distillation to entirely new fields.

The present status of molecular distillation has been reached through the efforts of many workers. The first true molecular still was built by Profs. J. N. Brönsted and G. von Hevesy, in Germany in 1922, for the purification of mercury. The first application of molecular distillation to organic chemicals, and the first comprehensive statement of the potentialties of the new method, were made by C. R. Burch, in England, who is generally considered to be the father of the industry. H. I. Waterman, at the University of Delft, Holland, and E. W. Washburn, of the U. S. Bureau of Standards, both were responsible for important early contributions, particularly in the improvement of drying oils.

The ideas of Burch and of Waterman were patented and developed by Metropolitan-Vickers Electrical Co., Ltd., the Shell-Mex Corp., Imperial Chemical Industries, Ltd., and The British Drug Houses, Ltd. Apparently, however, none of these met with commercial success, except perhaps for the rather limited use of molecular distillation by the last mentioned concern, in the semi-commercial production of vitamin A by what were essentially laboratory methods.

Following the early developments of the 1920's, work continued during the following decade. Much the greatest progress was made in the laboratory of K. C. D. Hickman, of Eastman Kodak Co., at Rochester, N. Y. Dr. Hickman and his associates had initially been interested in the high vacuum drying of photographic films. Their work on high vacuum condensation and fractionation pumps, and on motive fluids for such pumps, led naturally to experiments with molecular distillation which by 1934 had indicated a degree of success sufficient to interest General Mills, Inc. As a result, Eastman and General Mills pooled their interests, organizing the joint subsidiary, Distillation Products, Inc., for the manufacture of products by molecular distillation, such as vitamin concentrates, and for the development, construction and sale of high vacuum equipment.

Development of molecular distillation by this concern has involved many problems, both technical and commercial, which have been carried toward solution under the general managership first of K. E. Humphrey, treasurer of General Mills, Inc., and later, of R. W. Allbright, formerly president of American Anode, Inc., B. F. Goodrich subsidiary. Although successful stills were soon developed under Dr. Hickman and his research department, their use was comparatively expensive in the earlier models and hence was limited to valuable products. A logical choice for initial commercialization, therefore, was the separation of vitamins A and E from marine and vegetable oils. The problem of developing new and cheaper sources for the oils was handed over to G. C. Mees and now, as a result of his work, D. P. I. has become the world's largest purchaser of vitamin A oils. The complex problems of vitamin chemistry and testing were allotted to N. D. Embree and J. G. Baxter, while more recently a comprehensive biological department has been set up under P. L. Harris.

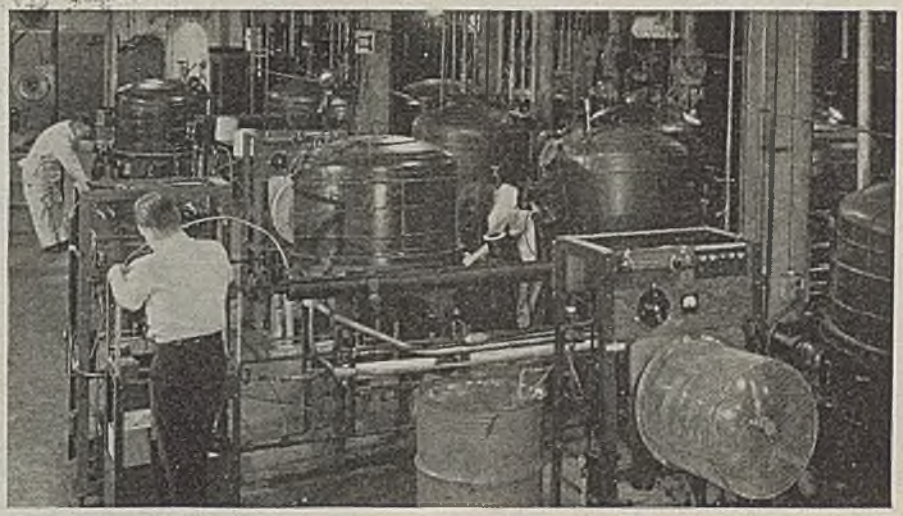


Fig. 2—32-in. centrifugal disk stills are used for separation of vitamin A

Later, as more efficient stills were produced, it became evident that molecular distillation would find application far beyond the confines of the vitamin and natural oil industries, thus prompting the decision of D. P. I.'s management to make the methods and equipment available to other concerns, except in a restricted field.* On this account it is expected that much wider use of molecular distillation will be possible than could have been realized by D. P. I. alone.

MOLECULAR DISTILLATION

As has frequently been pointed out (see for example, the author's articles, *Chem. & Met.*, p. 102, October, and p. 136, November, 1943), the presence of non-condensible gases in process equipment for evaporation and distillation procedures exerts a profound influence, usually completely altering the course of the evaporation as compared with a high vacuum operation, or even making it impossible. On this account it is clear that high vacuum in the region of 1 micron (0.001 mm. Hg) residual gas pressure has become of great and increasing importance as a tool in operations requiring the vaporization of molecules, particularly those of large molecular weight. Molecular distillation, which is distillation in this pressure region, conducted in equipment in which the vaporized molecules have but a short and unobstructed path to a condensing surface, is such a tool.

In the first of the two references mentioned immediately above, it was made clear how vaporization takes place from a liquid surface and how a definite vapor pressure exists for every volatile material, depending only on the material and its temperature. It was shown how this pressure exists independent of the presence of inert gas molecules above the liquid surface, but also how the inert molecules obstruct the movement of the vaporizing molecules away from the liquid surface, and so give rise to a definite boiling point for each material and inert gas pressure. The boiling point is that temperature which produces a sufficient pressure of the vaporizing material to push back the inert atmosphere and permit continuous evolution of the vaporizing molecules.

However, it was also pointed out that as the concentration of inert gas molecules is reduced, progressive decrease in boiling point takes place, sometimes as much as 150 deg. C., or even more, until a pressure is reached below which there is no further drop in boiling point. The explanation lies in the mechanism of interference set up by the inert molecules. When they became so few that their mean free paths are of the order of inches (at about 1 micron pressure), their collisions with the vaporizing molecules become infrequent and for all practical purposes it is as if no inert molecules were present. At such a low inert gas pressure, therefore, continuous evolution of the vaporizing molecules can take place, provided only that an equivalent number are withdrawn from the vapor space by

* Distillation Products, Inc., has reserved for its field the domestic exploitation of the natural oils and their products. Licensing arrangements for the use of stills and methods developed by D.P.I. are available for the processing of other products.

some such mechanism as condensation, reaction, absorption, or by means of a pump.

As a matter of fact, all materials, both liquids and solids, are capable of vaporization under extreme low pressure conditions, provided that a high enough temperature can be employed. The rate of vaporization may be impractically low, or the temperature to produce a practical rate may be so high as to destroy the material, but the principle remains nevertheless.

It follows that any material which can be made to vaporize at a practical rate, at a temperature which will not harm the material during its exposure to this temperature, can be distilled in equipment of suitable design if the inert gas pressure is sufficiently low. Since thermal decomposition is a time-consuming reaction, it also follows that materials can often be safely subject to otherwise harmful temperatures, provided the exposure is sufficiently short. As a third criterion of molecular distillation, it is evident that the net rate of vaporization, depending as it does on the rate at which the vaporized molecules can be withdrawn from the vapor space, can be improved by any means which facilitates their withdrawal. Most effective of these means is a short, direct and unobstructed path to the condenser, bearing in mind that the vaporizing molecules may leave the surface in any direction whatsoever, and that therefore the condenser must, so far as possible, encompass every path a vaporizing molecule may take.

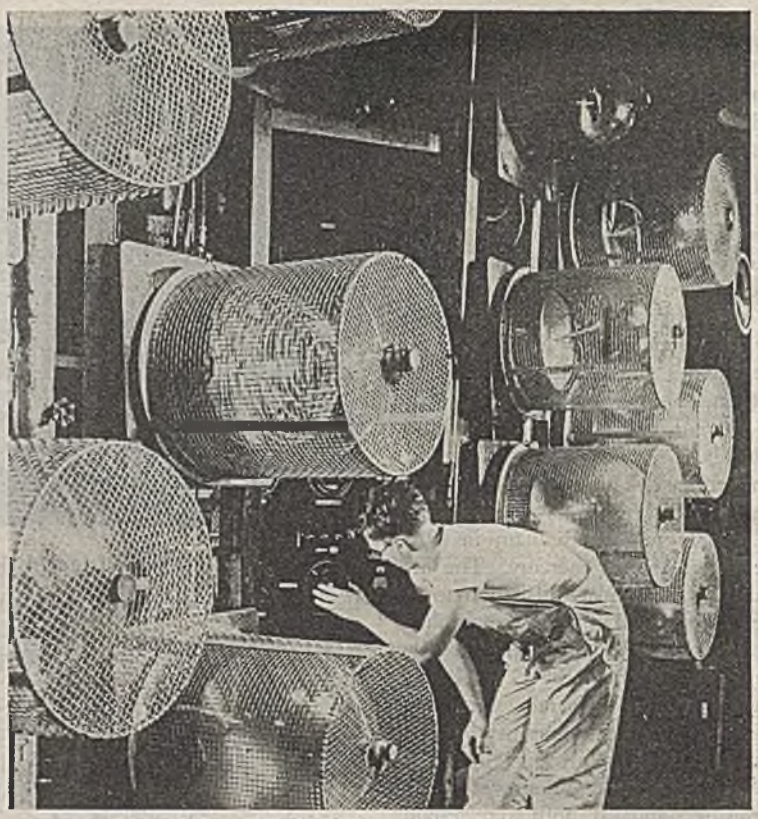


Fig. 3—Centrifugal stills of 14 in. diameter separate vitamin E

MOLECULAR STILL EVOLUTION

In retrospect, these criteria of molecular distillation seem simple and obvious. Nevertheless, many of the early investigators failed to appreciate their implications. While some grasped the need for a short, unobstructed path to the condenser, still they generally failed to apply the same reasoning to the path which the inert molecules, initially present or evolved during distillation, must take to escape by way of the vacuum pump from the system.

Thus we find in early laboratory equipment such anomalies as a distilling vessel with closely disposed condenser, as in Fig. 4(a), nevertheless equipped with a long, small-diameter connection to an undersized vacuum producer. Had these investigators understood that the inert molecules are not "sucked" to the vacuum pump, but rather must diffuse to it solely by their own random motion (*Chem. & Met.*, p. 102, 103, October, 1943), they would have realized that the shortest and largest possible diameter connection to a seemingly oversized vacuum producer was essential if speed in evacuation to pressures such as 1 micron was to be achieved. Not only were they forced to allow enormously long periods for the essential initial degassing, but in some cases they found it impossible ever to reach the desired low pressure in the distilling vessel itself, although such pressure could readily be attained at the pump inlet.

Other still builders attempted to adapt the construction of the ordinary laboratory still, employing a remote condenser, as in Fig. 4 (*b*), and thus greatly decreasing the possibility of vaporized molecules reaching the condenser.

Another anomaly evident in all the early designs (Figs. 4a and *b*) was the provision for storage of all, or at least a considerable part, of the material to be treated within the still proper, where it was necessarily subject to the evaporation temperature until vaporized. Since only the surface is active in vaporization, many billions of molecules were thus held at this temperature for long periods of time until, by sheer chance, each reached the surface where possibly it evaporated and escaped, but more probably, moved again into the body of the liquid. Particularly in the case of long-chain molecules, which may readily be broken by thermal reactions, this tended to degrade the material before it could distill and the advantage of the lowest possible evaporation temperature which is inherent in the molecular still was at least partially offset by too long exposure. The obvious solution, of course, is to eliminate so far as possible all of the material from the still proper, except for the active surface and a minimum under-layer, maintaining the bulk of the material at a safe low temperature until ready for treatment.

The first important improvement over the stills used elsewhere came in the falling film type developed in the earlier work at Rochester, which remains a satisfactory device for analytical distillations. In this type as thin a film of liquid as possible flows downward over a central heated evaporating cylinder, concentrically placed within a cylindrical jacketed or air-cooled condensing surface as in Fig. 4(c). This type might seem to fulfill all of the necessary conditions—continuous operation, ready evacuation, a short, unobstructed path from evaporator to condenser, and a small amount of material exposed to evaporator temperature for a short period of time. In fact, built to large size and of engineering materials, it has been employed with considerable success in semi-industrial-scale production. However, it has definite limitations in control over the exposure of the material. Depending on gravity flow of liquid which is usually highly viscous, even at evaporator temperature, it inherently employs thicker films than necessary,

Estimated Relative Thermal Exposures With Various Kinds of Stills

Based on boiling points of dibenzylphthalate and assumption that hazard doubles for each 10 deg. C. rise.)

Pressure Mm. Hg	Temperature Deg. C.	Relative Thermal Coeff.	Time	Relative Decomposition Hazard	Kind of Still
760 (1 atm.)	360	2^{12}	1 hr.	1.5 trillion	Simple flask
10 mm.	270	2^{14}	1 hr.	3 billion	Claisen flask
1 mm.	220	2^{9}	1 hr.	92 million	Wide-necked pot still
1 mm.	220	2^{9}	1 min.	1.5 million	Petroleum flash still
0.001 mm.	130	1	1 hr.	180,000	Molecular pot still
0.001 mm.	130	1	1 min.	3,000	Molecular falling-film still
0.001 mm.	130	1	1 sec.	50	Molecular centrifugal still
0.001 mm.	130	1	0.02 sec.	1	Molecular centrifugal still

thus increasing the thermal exposure. Despite every effort to secure uniform liquid distribution on the evaporator surface, it inevitably produces rivulets and ripples so that part of the material, in the thinner portions of the film, is always overheated.

Efforts at development of a rotary distributor for the falling film type led Dr. Hickman several years ago to a new idea, namely, that a centrifugal disk of shallow conical shape, as in Figs. 4(d) and 4(e), fed at the center of the concave side and discharging the residue around the periphery, would be ideal for the evaporating surface of a molecular still. Heating units could easily be located behind the disk, while control of the film thickness and time of passage from center to periphery could readily be achieved by choice of disk size, feed rate and rotational speed. Tremendous decrease in exposure could thus be attained, even at the higher temperatures which might be used to increase distillation rate. The accompanying table (after Hickman), based on the assumption that the thermal decomposition doubles with each 10 deg. C. rise in temperature, gives an idea of the decrease in decomposition hazard that is possible by lowering the boiling point and decreasing the exposure time with progressively better stills. The possible decrease in exposure compared with prevailing vacuum stills is thus seen to be in the range from 100,000 to 1,000,000 times.

The first unit built to employ the centrifugal principle had a 7-in. diameter rotor while later models were built with 32-in. (Fig. 2) and 14-in. (Fig. 3) diameter rotors, designed to operate at speeds up to 5,000 r.p.m. In the later types, the smaller machines are mounted vertically, as in Fig. 4(d), and the larger horizontally, or substantially so, as in Fig. 4(e), with just enough departure from rectilinear mounting to secure good condenser drainage. In each type the still consists of a dome inclosing the rotor, condenser, feed and discharge connections. An air-cooled glass bell serves for the smaller type, and a metal dome with sight glasses and welded-on water cooling pipes for the larger. The glass condenser of the smaller is generally supplemented by a water-cooled pipe coil of beehive shape placed opposite the rotor face and within the glass bell. In both types the residue discharged from the rotor is collected in a gutter spun on the edge of the disk, from which it discharges through a velocity-head pick-up tube. Both types employ an over-sized diffusion pump of the multi-stage condensation type, directly connected to the still backing plate behind the rotor.

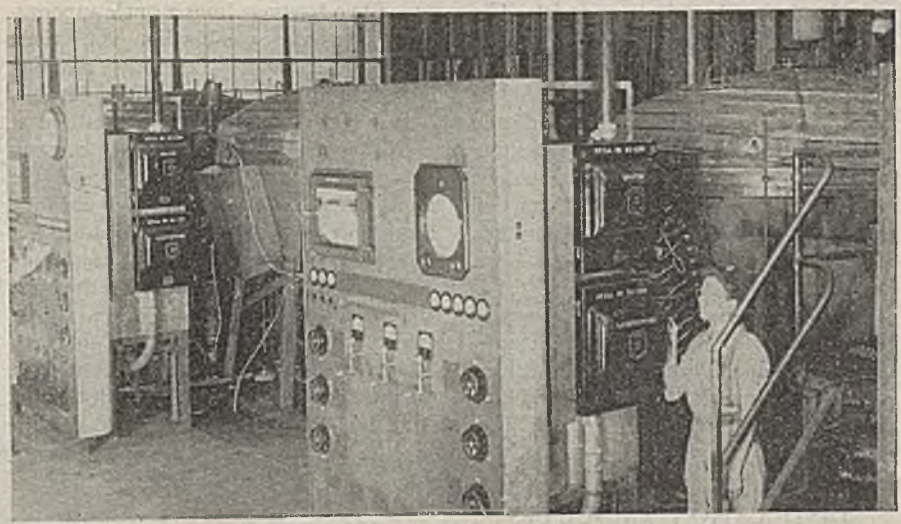


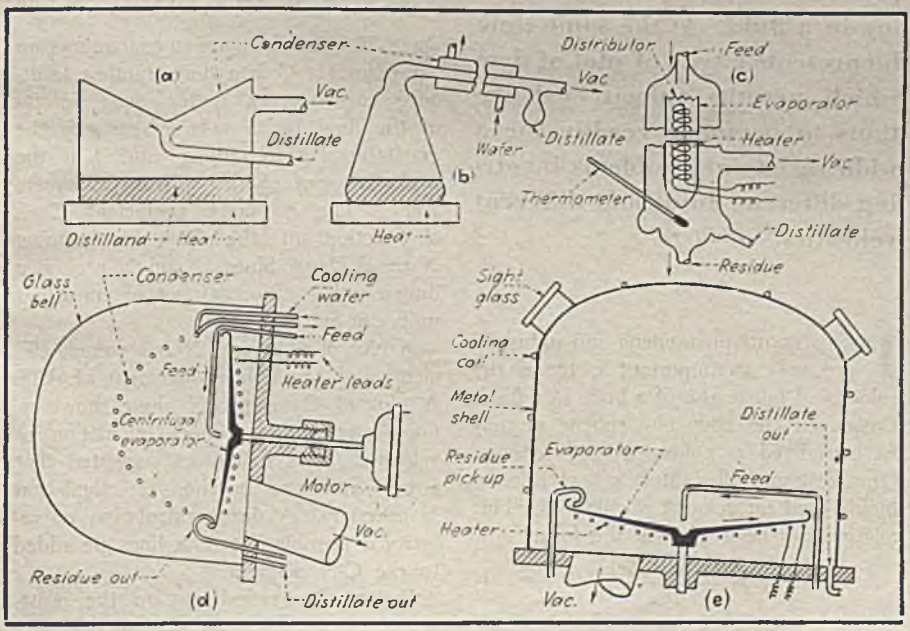
Fig. 5—Two of the new 5-ft. molecular stills during a two-month test run, before application of external insulation and painting

NEW 5-FT. STILL

Similar but more advanced principles, which cannot as yet be disclosed in detail, are incorporated in a newly completed design of 5-ft. still shown in Fig. 5. This still uses a truncated conical evaporating surface and a special type of condenser, together with a new design of multi-stage condensation pump of enormous capacity. Throughput of the new stills ranges from 500 to 1,000 lb. per hour per unit, depending on the type of service. Such stills are able to take off six or more separate fractions, using two or three units in series. For stripping they can remove up to 20 percent as distillate in a single pass through one still. Costs of power, water, steam and other services are said to be well within the limits of commercial economy. An even larger still, reportedly designed for a capacity of a tank car per day per plate, is now on the drafting board and is expected to be available within the present year.

The 14-in. stills at present are being used in the production of vitamin E and the 32-in. stills, vitamin A. Fish liver oils from the tank farm shown in Fig. 1 are processed without prior saponification, first being passed through a succession of the 32-in. stills (of which 21 are at present in operation) arranged to process the residue from each preceding still at a progressively higher temperature. In these stills the following cuts are made: (1) a de-gassing pass; (2) the protein and rancidity odors; (3) the free fatty acids, sterols, vitamin D (which cannot be recovered economically in competition with the synthetic product), glyceride ethers and esters, the preservatives, tocopherols (vitamin E) and their esters; (4) vitamin A and its esters;

Fig. 4—Steps in evolution of the molecular still: (a) early glass pot still; (b) glass still with outside condenser; (c) falling film still, used successfully in analytical distillation; (d) vertical centrifugal disk still used in smaller sizes; (e) horizontal centrifugal disk still in larger sizes



and (5) the residue of glyceride fat. The odor fraction (2) is rejected; the vitamin E fraction (3) is refractionated in the small stills; the vitamin A fraction (4) is run to large storage and blending tanks prior to sale; and the residual fraction (5), either separately, or combined with the residue from the re-run of the vitamin E fraction (3), is sold for food or industrial purposes.

After its discharge from the large stills, the vitamin E fraction (3) is redistilled in a succession of the smaller stills for separation of the more volatile fatty acids, sterols, glyceride compounds, etc., from the tocopherols (vitamin E). Market conditions determine the disposition of the non-tocopherols.

DISTILLATION PRINCIPLES

Since every material in a mixture subjected to molecular distillation will have some distilling tendency at any temperature which may be used, so long as there is a temperature difference between the evaporator and the condenser, no equilibrium between liquid and vapor can exist. Hence, differing from normal-pressure equilibrium distillation, anything approaching a complete separation of the components is obviously impossible with a single pass through a molecular still.

Thus the distillate represents simply a mixture of the original components in which the more volatile materials appear in higher proportions than in the original feed stock, while the residue favors the less volatile components. By several redistillations the separation can be carried farther toward completion and as near so as desired, although absolute separation is theoretically impossible.

Nothing at present on the horizon suggests that the molecular still will be able to duplicate fully in its own sphere the precise separations of the equilibrium still. Certain important improvements over the simple, single-rotor still are possible, however; for example, employment of a series of rotors and condensers for successive distillations within a single inclosure, or perhaps a series of temperature zones in the same rotor, capable of producing several fractions, each of which emphasizes a material distilling at peak rate at successively higher temperature. Decidedly encouraging results are said to have been attained in multiple molecular distillation by J. R. Bowman, working at Mellon Institute under a grant from Gulf Oil Corp. Another possibility suggested by Dr. Hickman (*Chemical Reviews, loc. cit.*, p. 78) is the use of selective partial condensation, employing a warm condenser which will condense the less volatile molecules and reject the more volatile. A condenser of perforated construction might, for example, be used, which would allow the more volatile materials to pass through, later to be condensed on a still colder surface, thus giving two fractions from a single vaporization. Perhaps combination of these methods will also prove attractive, resulting in better separations than are now possible.

It is evident from this discussion that at present competition does not exist between the classical equilibrium still and the molecular still. Each has its own territory, the former, materials of high volatility and low molecular weight; the latter, substances undistillable by earlier methods, in the range between, say, 250 and 1,200 molecular weight. Whether or not the two methods ever become competitive, it is clear that the possibilities for distillation have been enormously enhanced. By the same token, new materials will become available and new properties discovered in old materials as a result of separations that can now be made for the first time. A potent new tool promises development of important and hitherto unsuspected fields for chemical industry.

In the preparation of this article the author has drawn heavily on the advice and the writings of K. C. D. Hickman, vice president and director of research of Distillation Products, Inc. To Dr. Hickman and to his company, grateful acknowledgment is due also for the privilege of inspecting this first factory scale installation of molecular distillation equipment.

Determining Fall or Rise Velocity of SPHERES IN FLUIDS

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Stoke's law is commonly used in determining the settling rates of fine particles in a liquid or gas, but is inadequate in many important industrial processes where the flow of fluid relative to the particle is turbulent. For example, calculations for the rise or fall of "fluidized" solids in a gas stream require a technique for handling extreme turbulence. In this article, Prof. Binder reviews the theory applying to a sphere rising or falling in a fluid. At the same time he presents a type of plot of data which permits velocity calculations to be made readily for a wide variety of problems involving different fluids and different velocities.—*Editors*

In numerous phenomena and industrial processes an important factor is the velocity of fall or rise of a body in a fluid. Frequently the body is a sphere, or may be considered as equivalent to a sphere. One relation, called Stoke's law, is commonly used for velocity calculations. This relation can be written in the form

$$V = \frac{D^2 (w_1 - w)}{18\mu} \qquad (1)$$

where V is the relative velocity between the sphere and the fluid, D is the diameter of the sphere, w_1 is the specific weight of the sphere, w is the specific weight of the fluid, and μ is the dynamic viscosity of the fluid. This relation is convenient and simple. It is limited, however, to laminar flow. There is the general problem, then, as to possible direct velocity calculations for both laminar and turbulent flow.

Many experimental data have been collected on the resistance of spheres for steady flow. The results have been organized by expressing a resistance coefficient as a function of the Reynolds number. The following form is customary:

$$R = C \frac{\rho V^2}{2} A \qquad (2)$$

where R is the resistance to relative motion (as pounds), C is a dimensionless resistance coefficient, ρ is the mass density of the fluid ($\rho = w/g$, where g is the gravitational acceleration), and A is the projected area of the sphere (as square feet). The resistance coefficient C is a function of the Reynolds number $N = \rho VD/\mu$. Since C and N each is a dimensionless ratio, any set of consistent units can be employed.

A plot of C against N is a sound, efficient, and common arrangement of data. A plot of C against N alone, however, does not permit a direct calculation of velocity. It is sometimes suggested that a trial and error method of calculation is necessary. A direct calculation of velocity is possible if certain lines are added to the C-N diagram.

For steady vertical motion the resist-

Fig. 1—Skeleton diagram of Fig. 2, illustrating the procedure for making the calculation

ance to relative motion R equals the difference between the buoyant force and the weight of the sphere. Consider downward motion of the sphere through stationary fluid as an example of this type. Then

$$R = \frac{\pi D^3 (w_1 - w)}{6} \qquad (3)$$

Equation (2) can be written as

$$\frac{2R}{\rho A} = C V^2 = \frac{C N^2 \mu^2}{\rho^2 D^2}$$

whence

$$\frac{2R \rho D^2}{\mu^2 A} = N^2 C \qquad (4)$$

In practical problems it is convenient to take the square root of each side of Equation (4), to give

$$B = \left[\frac{2R \rho D^2}{\mu^2 A}\right]^{1/2} = NC^{1/2} \qquad (5)$$

where the left side will be designated as a B number. Note that B is a dimensionless ratio and can be written as

$$B = \left[\frac{4D^3 w (w_1 - w)}{3g\mu^2}\right]^{1/2}$$

In a particular problem B is known, but N and C are not known. N and C, however, are coordinates of the established plot of N versus C. If the plot employs logarithmic scales, then a constant B line is a straight line, and requires only two points for plotting because

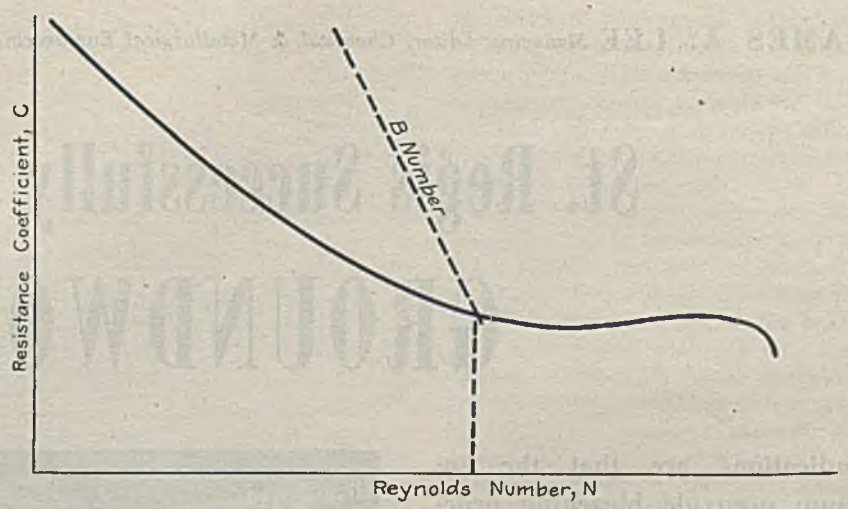
$$\log B = \log N + \tfrac{1}{2} \log C$$

Figure 2 shows an established plot of data for resistance coefficient C against the Reynolds number* to which constant B lines have been added. The adapted data for Fig. 2 correlate the work of several different investigators.

In making a velocity calculation, the procedure is to calculate B, follow along a B line to the curve, determine the Reynolds number, and then compute the velocity. The procedure is illustrated in Fig. 1. Note that Fig. 2 covers a large range of Reynolds numbers, for both laminar and turbulent flow. Figure 2 can be used for a wide variety of problems involving different fluids and different velocities.

The foregoing discussion outlines a procedure which has general application. B lines can be easily constructed on other plots of resistance coefficients versus the Reynolds number, for example, on plots giving data for bodies of shapes other than spherical, or bubbles, in a fluid. The data from a plot such as that shown in Fig. 2 can be arranged to give a plot of the B number against the Reynolds number. Such a plot for spheres is shown in Fig. 3.

* Data adapted from "Das Widerstandsproblem," by F. Eisner, *Proc.* Third Int. Cong. App. Mech., Stockholm, 1931.



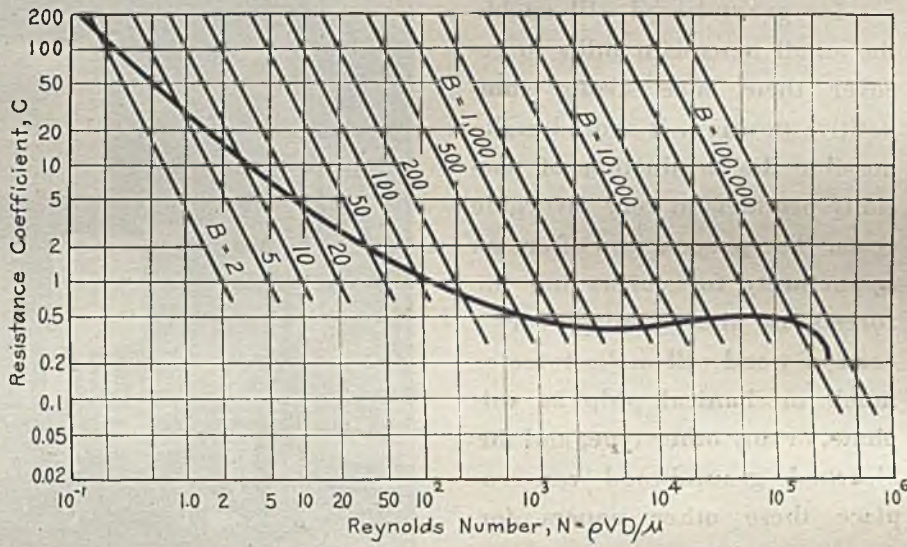
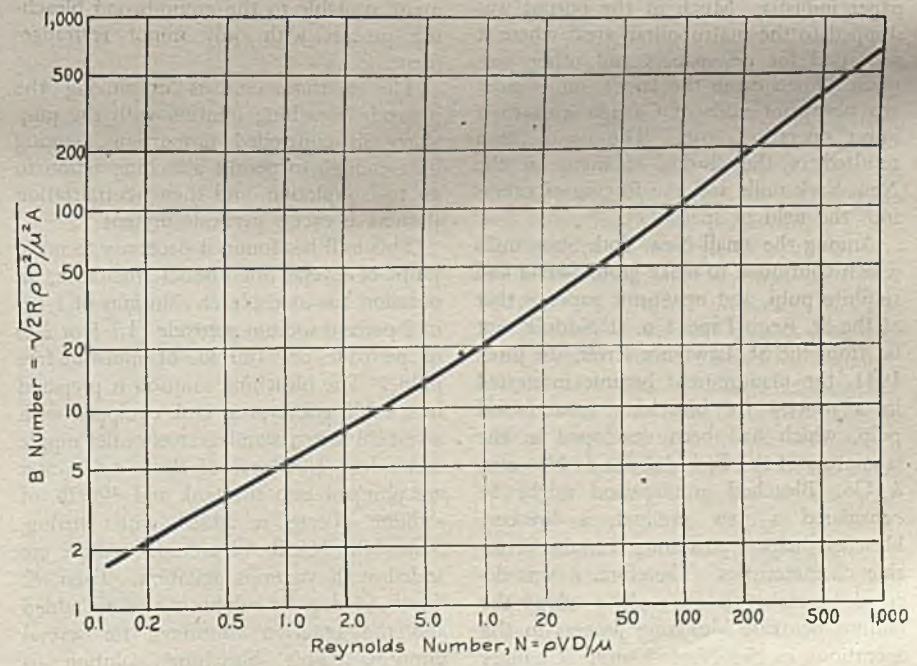


Fig. 2—Plot of B numbers against Reynolds numbers for spheres, with additional B coordinates

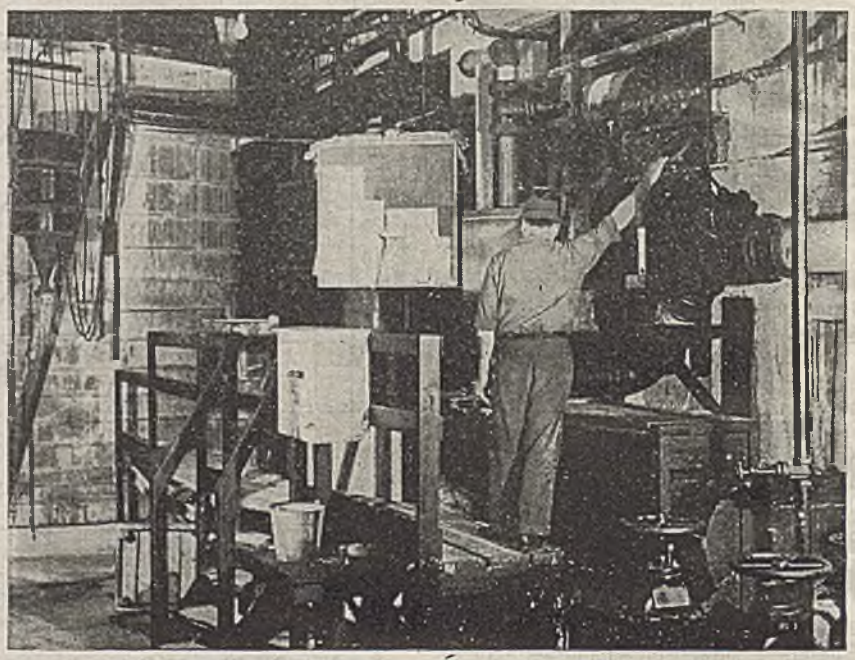
Fig. 3—Plot of B numbers against Reynolds numbers for spheres, based on data from Fig. 2



JAMES A. LEE *Managing Editor, Chemical & Metallurgical Engineering*

St. Regis Successfully Bleaches GROUNDWOOD

Indications are that the sodium peroxide bleaching process for groundwood will enable the small newsprint mills to recover their once strong competitive position. It should make possible the production of specialty products at very favorable costs. The process also offers an opportunity for conserving the forests of the country, for a cord of wood will make twice as much mechanical pulp as sulphate, or any other type, and the bleached groundwood can replace these other papers for many uses.—*Editors*



Chemical make-up tank at left, next is supply tank, and near operator is box in which groundwood and bleaching solution are mixed

Some years ago Northern New York was the location of a thriving pulp and paper industry. Much of the output was shipped to the metropolitan areas where it was used for newspapers and other purposes. Then came the larger, more modern newsprint mills of Canada with their lower operating costs. The competition resulted in the closing of many of the New York mills and the forcing of others into the field of specialties.

Among the small New York State mills which continued to make groundwood and sulphite pulp, and newsprint paper is that of the St. Regis Paper Co. at Norfolk, not far from the St. Lawrence River. In June, 1941, the management became interested in a process for bleaching groundwood pulp, which had been developed in the laboratory of the E. I. duPont de Nemours & Co. Bleached groundwood might be considered a new product, a low-cost bleached paper possessing certain favorable characteristics. Therefore, it was decided to make an attempt to adopt the sodium peroxide bleaching process to the operations in the Norfolk mill. Changes were made in the mill system which made deckers, tanks, pumps, and other equipment available to the groundwood bleaching process with only minor rearrangement.

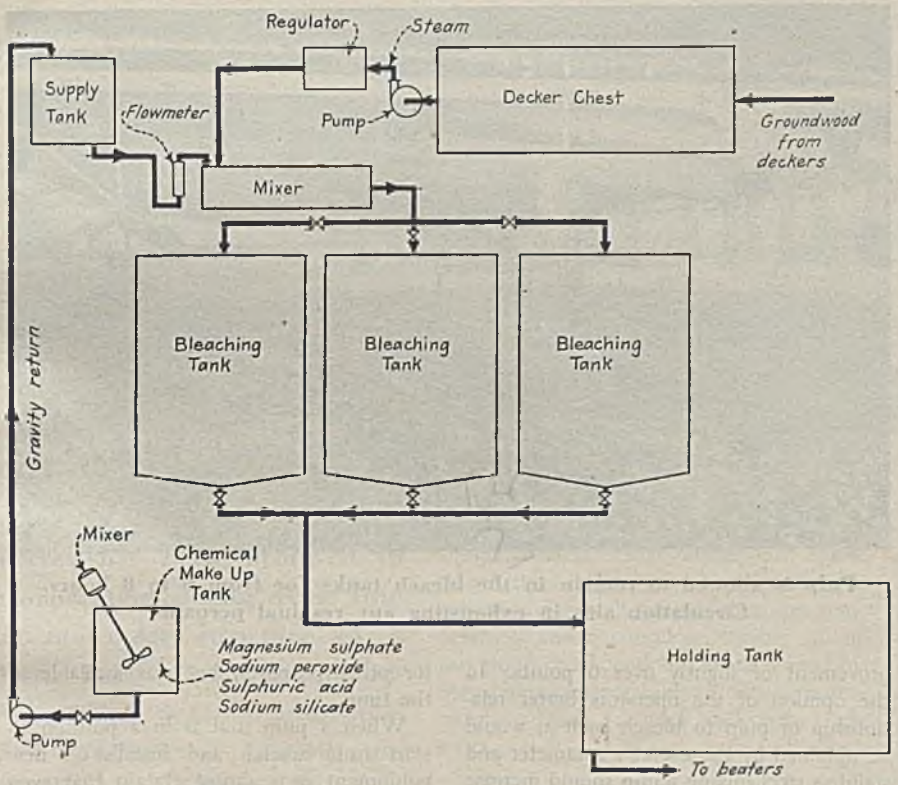
The method consists of mixing the peroxide bleaching solution with the pulp slurry in controlled proportions, storing long enough to permit bleaching action to go to completion, and then neutralization if there is excess peroxide present.

This mill has found it necessary to make pulps of several brightnesses, therefore, on occasion has used bleach solutions of 1,1.5 or 2 percent sodium peroxide (1,1.5 or 2lb. of peroxide per 100 lb. of moisture-free pulp.) The bleaching solution is prepared in a 1,200 gal. cypress tank equipped with a vertical mixer, stainless steel outlet nipple and valve. 1,000 gal. of clean, cold water are pumped into the tank and 400 lb. of sodium silicate is added with stirring. Slowly the 160 lb. of sodium peroxide are added with vigorous agitation. Then 92 lb. of 66 deg. Bé sulphuric acid are added and the agitation continued for several minutes. This bleaching solution is pumped to a supply tank, a 650-gal. cypress tank with a float valve on the inlet pipe.

Sodium peroxide is the active bleaching agent in the process. Since sodium peroxide and sodium silicate together supply more than the amount of alkali required for the process, the value of the latter lies in its SiO_2 content rather than in its Na_2O content. Sodium silicate has the properties of a detergent and a penetrant. It buffers the bleaching solution and aids in maintaining the pH in the desired range. It forms a protective coating on the surface of metals and inhibits corrosion of equipment. It also has a stabilizing action on peroxide solutions under the conditions which prevail in the bleaching process.

For good bleaching results the total alkali content of the bleach liquor must be controlled within rather close limits. Sodium peroxide is basically a combination of anhydrous caustic soda and active oxygen. Part of the alkali introduced into the bleach liquor as sodium peroxide must be neutralized with sulphuric acid.

Magnesium sulphate has a remarkable stabilizing effect on alkaline peroxide so-



Changes in mill system made deckers, tanks, pumps, and other equipment available to the bleaching process with only minor rearrangement

lutions under the conditions which prevail in the bleaching process. It performs this function by inhibiting the catalytic effects of the traces of metals, particularly iron, copper and manganese, which are commonly present in pulp wood and in mill waters. The stabilizing effect is obtained with a very small amount of sulphate.

At the present time the mill is using wood brought in last season. It is composed of about 5 percent poplar, 65 percent spruce, and 30 percent balsam. The unbleached pulp has a brightness of 56-59 G.E. units.

The unbleached groundwood from the deckers passes to conventional type concrete chests with the bottom designed for complete drainage of stock at 3 percent consistency. This stock is pumped to the mixer by an Allis-Chalmers pump.

At the present time a Trembly regulator operating in the line between the beaters and the decker chest controls the consistency to the bleaching plant and beaters at 3.3 percent, but nearly completed construction plans call for a Dezurik regulator to be located between the deckers and the unbleached groundwood storage chest controlling the consistency to the above chest at 5 percent with subsequent use in the bleachers and beaters at this higher consistency.

The peroxide bleaching solution (250 gal. per ton of dry weight pulp) meets the groundwood in the mixer, an oblong cypress box with a heavy-duty iron mixing screw, which rapidly and thoroughly mixes the peroxide bleach liquor and the pulp. Much of the bleaching action occurs immediately on contact. The pH of the stock on leaving the screw mixer is from 10.6 to 11.

From the mixer the stock and bleach solution mixture pass by gravity to any one of four bleach tanks. Two are tile-lined rectangular and two are cylindrical concrete tanks. Three of these tanks are used in rotation with the fourth used as a pump-over tank to speed up the rotation rather than use to the machines from each individual tank.

About an hour and a half are required to fill a tank with 12,500 lb. (on air dried basis) of stock. Present plans call for the installation of a mixing pump to replace the screw type mixer, and with the proposed increase in consistency to 5 percent, the filling time will probably be reduced to about 20 minutes.

After standing for 7 to 8 hours in the bleaching tanks the pH of the stock is reduced to approximately 9.5. About 70 percent of the bleaching action occurs in the first three hours. This plant is operating the bleaching system at 85 to 90 deg. F. although it is believed that the optimum temperature is 100 to 110 deg. F. Above that temperature the efficiency decreases as the peroxide is decomposed. An increase in temperature shortens the time required for bleaching. The pulp is allowed to remain in the bleach tank for from 6 to 8 hours or until the peroxide has been exhausted.

About an hour before the bleaching action in a tank is completed, the contents are circulated and returnd to the same tank by use of the bleach groundwood system pump. This circulation aids in exhausting any residual peroxide and brings the bleached pulp slurry to a uniform consistency prior to pumping it over to the fourth or holding tank.

Stratification of the pulp and liquor takes place only in the bleaching tanks and the circulation just described breaks this up. Circulation through the beater feed line, with constant return to the holding tank is interrupted while the pulp is circulating. The continuous circulation through the beater feed line with return to the holding tank is done to make the pulp available to the beaters at any time.

In the storage of the pulp between bleaching and beater rooms no special problems have been encountered.

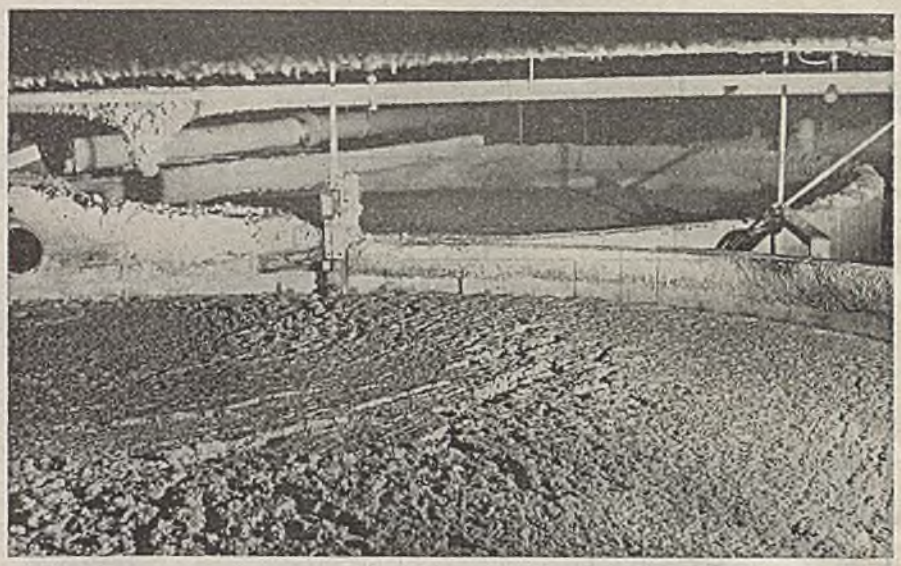
In the beater from 1 to 2 lb. of sodium thiosulphate (hypo) in crystalline form is added to 1,800 lb. of stock (on dry basis). The hypo reduces any oxygen that might remain. The possibility of oxygen at this stage is due to operating inefficiencies, which it is hoped will be eliminated soon. The pH of the slurry is reduced by the addition of alum to 4.4 to 4.6. When practical sulphite cooking liquor will be substituted for the hypo. The cooking liquor will be more efficient for it will serve not only to reduce the peroxide but also to neutralize the alkali thus making possible the addition of a smaller quantity of alum.

The stock must be acidified to remove the yellow tint which forms when coming in contact with the bleaching solution in the screw mixer. After 72 hr. the color becomes increasingly more permanent. It has been found advisable to acidify within that time so as to insure complete disappearance of color.

Sodium peroxide bleached groundwood is an interesting pulp. It shows many qualities and characteristics that make it a useful material for the production of a wide range of papers. The desirable characteristics of groundwood for producing papers of good bulk, high opacity, good printing properties, and low costs are unimpaired by the bleaching and to them are added good brightness, improved color, and somewhat better permanence.

On the paper machine this pulp handles easily combining rapid drainage with good forming and "laying" capacity to make possible high machine speeds, according to Lyman A. Beeman, operating manager, and his associates. Bulkiness as measured either in the pulp itself or in paper can be said to be identical with the unbleached pulp. Although it might be argued there would be some slight changes, these are entirely minor. The strength characteristics, as measured in the pulp, seem to be identical but due to more uniform sheet formation on the paper machine, it seems to be true that there is a tendency toward a slightly stronger finished paper. The

Peroxide bleaching solution and pulp slurry meet in screw mixer



Pulp is allowed to remain in the bleach tanks for from 6 to 8 hours. Circulation aids in exhausting any residual peroxide

opacity might be expected to be lower because of the brightness of the bleached paper but this follows only to a very slight extent.

Improvement in color is of course the most important change and brings the pulp into competitive range in brightness with the bleached chemical pulps of a G.E. brightness reading of 70 and over depending on amount of peroxide used, color of the raw pulp, and other factors. On experimental batches brightness values as high as 80 have been obtained but they are probably not economical. The U. S. Bureau of Standards has stated that the results of their tests indicate that while this bleached groundwood pulp can not be regarded as being very stable to light, it is more stable than the unbleached pulp.

Cleanliness of the bleached pulp is excellent. Many of the fiber bundles and some of the wood dirt spots are softened so that they break up and disappear. Slime, once formed, is still present even after bleaching. The bleach liquor, however, seems to be toxic to slime formation and so it is eliminated as a source of trouble in the system. This bleaching method is simpler to operate and requires less equipment than chlorine bleaching and therefore is adaptable to small plants.

A short time ago a batch of 50 percent groundwood and 50 percent sulphite was bleached using this same peroxide process, except that more sodium silicate was used to increase the pH and buffer action. The results were said to have been entirely satisfactory, however, in the case of higher percentage of sulphite pulp the bleaching results have not been good.

In April, 775 tons of groundwood pulp were produced of which 485 tons were bleached. A 1.8 percent sodium peroxide bleach (1.8 lb. of peroxide per 100 lb. of moisture-free pulp) results in an improvement of 7.8 G.E. units of brightness while a 1 percent peroxide solution gives an improvement of slightly over 6 points. In the opinion of the operators better relationship of pulp to bleach such as would be obtained by the use of a rotameter and stainless steel mixing pump should increase brightness another 2 points. Also better results are expected when a higher stock consistency is used.

The cost of treating a stock of 3.3 percent consistency and 56 to 59 points brightness with 1.5 percent peroxide resulting in a brightness of 64 to 65 points averaged during the past year $7.04 per ton. That a steady improvement was made is indicated by the cost of a recent month which was $6.20 per ton.

The breakdown of costs for bleaching 634 tons in a recent month is as follows:

Based on a 1.5 percent peroxide bleach	
Steam	$290
Hypo	245
Power	120
Labor for bleaching	415
Sodium peroxide	2,155
Sulphuric acid	215
Sodium silicate	470
Supplies and maintenance (includes Mg_2SO_4)	15
Total	$3,925
Cost per ton	$ 6.20

It is expected that certain improvements in operation and equipment will result in a cost of about $5.00 per ton broken down as follows:

Tonnage	634
Steam	$ 50
Hypo	50
Power	150
Labor for bleaching	300
Sodium peroxide	1,785
Acid	215
Silicate	470
Supplies and maintenance	15
Total	$3,035

Results in this will have been largely accomplished with equipment that had been designed and in use for many years for other purposes, but was available at the time.

When a pulp mill is in a position to start from scratch and installs all new equipment it is almost certain that even more favorable results will be obtainable. In such case it would be possible to use a single bleaching tower system, a continuous method, and other operating conditions believed to be more favorable by the engineers of the du Pont company. Operation of this system is similar to the batch process previously described. The bleaching tower is a tiled-lined concrete or wooden structure designed to provide for passage of pulp through the tower from the bottom to top or top to bottom in a wad without channeling. Other features have been described in paper read before T.A.P.P.I.

The most convenient and economic material for use in neutralizing and reducing treatment in the final stage of the process is sulphite cooking acid. This is particularly true in mills which produce both groundwood and sulphite pulp. The present stage of development would seem to indicate that a consistency of 5 percent will prove most economical, both from the handling and bleach results standpoints.

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EDITORIAL STAFF

HEAT STABILITY

Features New Group of Synthetic Resins

Success has been achieved in incorporating silicon oxide into the molecular structure of a plastic thus combining the advantages of organic and inorganic compounds. The silicone resins exhibit splendid heat stability and in addition inertness, water proofness and excellent dielectric strength. They are produced in the form of fluids, varnishes, greases, and solids. Many chemical plants will find the plug cock lubricating greases of particular interest. —*Editors*

HEAT-STABLE, organo-silicon oxide polymeric materials, known as silicones, have been produced on a semi-commercial scale for some time by the Dow Corning Corp., Midland, Mich., (*Chem. & Met.* Vol. 50, pp. 149–150, Mar. 1943) but due to the necessity for military secrecy little information has been available heretofore about this interesting group of products. Recently, performance data on the silicones were announced by executives of the parent companies Corning Glass Works and Dow Chemical Co. The entire output has been used for war purposes, but a plant of much larger capacity is now under construction in Midland, and will be completed early in the fall.

SEVERAL FORMS

Silicone products include water-like fluids that remain as fluid as water at the temperature of dry ice. Other fluids are available that retain the consistency of honey over a wide temperature range. Also, there are varnishes and resins for use in electrical equipment where high-temperature operation is desired, and lubricating greases for uses involving high temperatures, low temperatures and chemical resistance. All of the group of silicones are characterized by their temperature stability, inertness, waterproofness and excellent dielectric properties.

COOPERATIVE DEVELOPMENT

Research on the silicones was instigated many years ago by Dr. E. C. Sullivan, director of research at Corning Glass Works when he decided to investigate the field of polymer chemistry lying between that of glass on the one hand and of organic plastics on the other. Here the fundamental work on the structure of these materials and the development of electrical insulation was done. Later it was decided to use the services of a fellowship at Mellon Institute to investigate another phase of the development.

When it became obvious that substantial amounts of the materials would be required in order to prove their value, the assistance of the Dow Chemical Co. was enlisted to produce semi-commercial quantities. This choice was influenced by the availability of practically all of the required raw materials at Midland. The work there was conducted by a group under the direction of Dr. E. C. Britton, director of Dow's organic research laboratory. After considerable cooperative work had been done it was decided by Dr. Willard H. Dow and Glen W. Cole that a company should be formed for the manufacture of the products. Accordingly, in February, 1943, Dow Corning Corp. was organized.

Although details of the method for manufacture of silicone resins have not yet been disclosed, it is probable that the general procedure follows the synthesis investigated a number of years ago by Russian scientists. Principal raw materials are silicon tetrachloride, magnesium halide and any one of a number of aromatic halides, such as chlorobenzene. These are reacted by the Grignard mechanism to yield monosilanechlorides of the types $RSiCl_3$, R_2SiCl_2 and R_3SiCl. These are decomposed by hydrolysis to give either silanols, silanediols or silanetriols, depending upon proportions of silicon tetrachloride used and condition in the Grignard reaction. Typical silanetriols, for instance, include $C_6H_5Si(OH)_3$, $C_6H_5CH_2Si(OH)_3$ and $C_{10}H_7Si(OH)_3$. The silanatriols when heated lose water to give their anhydrides, known as siloxanes. These siloxanes polymerize under a variety of conditions to give a wide range of silicone resins.

Many different types of silicones are being made commercially at the present time. They include 12 viscosity grades of Dow Corning Fluids, Type 500, for use as low as —70 deg. F., eight viscosity grades of Type 200 for use from —40 deg. F. to 400 deg. F., and five grades of Type 700 for high temperature lubrication.

The resins for high temperature electrical insulation include four impregnating varnishes, 992, 993, 994 and 2,052. These are for various services. A thermosetting resin, 2101, is for laminating glass or asbestos cloth to produce non-carbonizing board.

HIGH-TEMPERATURE LUBRICANT

Greases for special purposes include No. 31 for use in bearings that must function at very low temperature, No. 41 is for use at temperatures up to 500 deg. F., No. 7 for oxygen equipment, stop cock and plug cock grease for use in the chemical process industries. It is useful in plug cocks which must operate at elevated temperatures or in corrosives.

While little information has been made public about silicone plastics they have been produced. The plastics are colorless and transparent. Like the other members of the group they possess the same outstanding characteristics, and like the fluids, varnishes and greases should have many peacetime applications.

For characteristics and other information about each of these silicone materials, see pp. 135 and 136 of this issue.

SOAP INDUSTRY

Overcomes Raw Material Shortages

Manufacturers of soap have long been noted for the flexibility of their production formulas which, under ordinary conditions, permits them to select their raw materials from a varied list of oils and fats. With imports of oils and oil-bearing materials greatly curtailed, with raw-material quotas established for the industry, and with government directives prescribing the use of fillers, soapers have shown a versatility which, so far this year, has resulted in an outturn of soap at a rate but little below that reached in the peak year of 1941—*Editors*

IN THE FINAL quarter of last year, soap makers were directed to speed up production and to make this possible, they were given higher quotas of oils and fats and at the same time were requested to use larger amounts of rosin and water softening builders. Under this stimulus the outturn of soap moved up appreciably and continued to expand throughout the first quarter of this year when the rate of production was not far below the record level reached in 1941. This was the first full quarter of operations under the order prescribing the use of rosin and fillers and the importance of this directive may be seen from the fact that consumption of rosin in the quarter was approximately 66 million pounds or about four times as much as was used in the corresponding period of 1943.

Domestic production of inedible tallow and greases was unusually high in the first half of this year and stocks of most oils and fats were liberal at the end of June. This might be interpreted as favorable for a continuance of near-record activities at soap plants but production of fats is expected to drop rather sharply in the second half of the year and even though it could be maintained at recent levels, this would not benefit individual consuming industries unless current allotments were revised. The rosin situation also has been reversed. Formerly, supplies were ample and prices were relatively low. More recently offerings have been light and prices climbed so rapidly that it was found necessary to establish ceilings for the respective grades. In view of this reversal, the distribution order which prescribed the use of rosin in soap has been rescinded and this undoubtedly will curtail consumption.

SCARCITY OF OILS

When it is considered that in 1941 the soap trade consumed approximately 695 million pounds of vegetable oils as compared with less than 230 million pounds in 1943, it becomes clear how great a share proportionately must be borne by tallow and greases if the output of soap is to be maintained at anything like a normal level. Formerly this country imported about two billion pounds of inedible fats with coconut and palm oils accounting for a good part of the total. For some time such imports have been reduced to almost negligible quantities and while production of domestic oils has been increased in the last two years, the greater part of this production has been channeled into edible lines. Government agencies have estimated that for the present year, total requirements of inedible tallow and greases will be about two billion pounds. The bulk of this is scheduled for the soap kettle with the allotment for civilian soap 1,289 million pounds and that for military and export soap, 264 million pounds. If edible fats in the form of lard and rendered pork fat are made available for soap making to the same extent as in the first half of the year, the industry might come close to duplicating its efforts of 1941.

An interesting account of the difficulties which beset the soap industry last year has been issued by the Bureau of Agricultural Economics. This report stated that utilization of primary fats and oils in the manufacture of soap in 1943 together with estimated use of foots or refining residues totaled 1,853 million pounds, 7 percent less than in the preceding year and 18 percent less than in the record year of 1941. With consumer income and industrial activity at new high levels, demand for soap was active both for household use and for use by workers in industrial plants. Requirements of the armed forces increased and lend-lease exports of soap rose to 17 million pounds compared with 4 million pounds a year earlier.

The reduction in 1943 in consumption of fats in soap was largely due to the shortage of hard fats and the restrictions of War Food Order 42. These restrictions place a limit on manufacturers' total use of fats and oils in the manufacture of products for civilians. Although there had been close control throughout 1942 over utilization of imported coconut, palm, and babassu oils, no restriction was placed on total use until late in 1942.

Quotas established for soap manufacturers for the first and second quarters of 1943 were based on 84 percent of average utilization in the corresponding quarters of 1940 and 1941. In the third quarter a revision was made reducing this average to 80 percent. With supplies more ample in the final quarter a second revision was made which increased the quotas for the manufacture of package and bar soap to 90 percent of base period use, for bulk package soap to 110 percent, and for mechanics soap to 150 percent. Under

Soap Consumption of Oils, Fats, Foots, and Rosin, by Quarters—1943–1944

Item	1943 Jan.-Mar.	1943 Apr.-June	1943 July-Sept.	1943 Oct.-Dec.	Jan.-Mar. 1944
	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.	1,000 lb.
Inedible tallow and greases	378,147	335,376	304,330	330,820	385,068
Coconut, palm-kernel, and babassu oils	18,688	29,125	71,982	50,205	51,363
Lard, including rendered pork fat	.....	.....	18,085	55,954	44,136
Whale and fish oils	10,676	17,071	7,137	10,088	11,388
Palm oil	4,777	3,565	12,459	11,820	3,119
Other fats and oils, hard	24	24	901	3,978	4,194
Other fats and oils, soft	3,331	3,384	16,450	5,387	8,303
Foots (estimated)	41,900	42,200	28,600	36,300	32,200
Total fats, oils, and foots	457,543	430,745	459,944	504,552	539,771
Rosin	16,693	23,889	33,012	44,723	65,994
Total fats, oils, foots, and rosin	474,236	454,634	492,956	549,275	605,765

these quotas total consumption of fats in civilian soap was estimated to be equivalent to 92 percent of base period use. Use of foots from domestic vegetable oils, or fatty acids derived from these foots, was limited in the first quarter to 150 percent of the base period. In the second quarter such use was cut to 100 percent and further reduced in the third quarter to 80 percent. In the final quarter the allowable percentages were the same as those for fats and oils, depending on the type of soap produced.

Even at the restricted rate of soap output for civilian use, supplies of soap fats threatened in mid-1943 to become inadequate to fill manufacturers' quotas. Imports and available supplies of the quick-lathering fats, chiefly coconut, babassu, and palm oils, were much smaller than in prewar years. The immediate cause for the tightness in soap fat supplies was a decline in output of inedible tallow and greases in late 1942 and early 1943 when an increase had been expected. This scarcity of tallow and greases was accentuated by the need for certain derivatives such as lard oil and red oil or oleic acid in the manufacture of special products for use in war industries. Miscellaneous uses for inedible tallow and greases increased 76 million pounds in 1943 despite a decrease of 104 million pounds in total use.

To make the best of available supplies of inedible tallow and greases stocks in the hands of producers, distributors, and users were limited by War Food Order 86, effective Aug. 1, 1943. The order also required producers of these products to reserve 30 percent of their production each month to fill orders from consumers other than soap makers.

In June and July, supplies were supplemented by the release of coconut, and palm oils from government stocks and in July and August, allocations of soybean oil were made to soapers. Edible fats, banned from use in soap making after Jan. 1, 1943 were again made available after July 10 and in the last half of the year 74 million pounds of lard went into soap.

The tightness in supplies of soap was relieved in early 1944 by a substantial increase in supply of inedible tallow and greases, together with the availability of unusually large quantities of lard for soap making. Apparent production of inedible tallow and greases in the first three months of 1944, at 353 million pounds, was the highest for any quarter on record. It was 124 million pounds greater than in the preceding quarter and 151 million pounds above that for the comparable quarter of 1943. Although consumption expanded as a result of the larger supplies, inventories also rose, recovering to approximately the prewar level.

Because rosin came into more prominence in the soap industry last year, the report includes a reference to the use of rosin in soap. It describes rosin as a material that can be used interchangeably with foots and soft oils to soften a soap which would otherwise be too hard. Rosin and tallow mixed in correct proportion make a good soap. Rosin prices in most years are only a fraction of those which prevail for fats and oils. As recently as 1935 and 1936, rosin constituted over 7 percent of the total saponifiable materials used in soap but by the early 1940's its use had declined to between 4 and 5 percent of the total.

Primary Fats and Oils, Foots and Rosin Used in Manufacture of Soap

	1939 1,000 lb.	1940 1,000 lb.	1941 1,000 lb.	1942 1,000 lb.	1943 1,000 lb.
Hard oils (tallow class):					
Slow lathering —					
Tallow, inedible	785,041	786,456	1,057,303	1,188,923	884,862
Whale and fish oils	166,483	107,911	76,312	72,401	44,972
Greases	120,856	256,886	310,487	338,974	463,811
Palm oil	102,146	84,934	129,871	55,865	32,621
Tallow, edible	418	657	4,826	634	4,652
Oleostearine	278	549	70	483	275
Lard	50	645	89	96	74,039
Total	1,175,272	1,238,038	1,578,958	1,657,376	1,505,232
Quick lathering —					
Coconut oil	388,912	396,857	484,124	140,487	142,346
Palm-kernel oil	3,057	197	1,113	1,353	1,840
Babassu oil	37,633	41,221	29,753	19,105	25,814
Total	430,202	438,275	514,990	160,945	170,000
Soft oils:					
Cottonseed-oil foots and other foots	119,000	99,000	126,000	116,000	149,000
Olive oil, sulphured and inedible	20,507	16,585	10,584	5,188	5,486
Soybean oil	11,177	17,612	24,737	31,510	15,428
Cottonseed oil	1,061	2,971	3,010	2,863	991
Corn oil	4,441	3,638	4,948	4,102	831
Castor oil	946	1,225	1,976	1,599	878
Linseed oil	1,780	1,489	2,278	4,019	1,697
Peanut oil	805	387	597	485	258
Sesame oil	14	38	304	189	70
Oleo oil	67	127	189	205	2,160
Rape oil	2	49	5	.....	1
Olive oil	54	130	84	27	11
Neat's-foot oil	11	19	35	19	68
Perilla oil	1	.....	.....	.....	.....
Other vegetable oils	7,364	2,051	1,162	2,162	675
Total	167,230	145,321	175,909	168,368	177,552
Total fats, oils, and foots	1,772,704	1,821,634	2,269,857	1,986,689	1,852,784
Rosin	96,356	78,419	103,061	97,850	118,317
Total fats, oils, foots and rosin	1,869,060	1,900,053	2,372,918	2,084,539	1,971,101

USE OF ROSIN

Last year rosin was in plentiful supply and prices for K grade at New York varied between 4c and 5c a pound compared with more than 13c for once-refined cottonseed oil, slightly less than 13c for the comparable grades of soybean oil, and 7.4c for acidulated cottonseed oil foots, basis 95 percent, these prices for oils and foots being for tank cars at New York. The relatively low price of rosin, the scarcity of soap fats, and the fact that the use of rosin was not subject to quotas, led to a steady increase in its use during 1943. After October, soap makers were required by War Food Order 86 to increase the rosin content of their soap for civilians.

It was the tight situation in oils and fats that gave emphasis to the intensive drives which have been made in fat salvage campaigns to supplement supplies from household collections. In 1943, less than 100 million pounds of household fats were collected whereas the 1944 total is set at 230 million pounds. The amount made available last year, while relatively small, relieved a critical shortage of glycerine which was needed in the manufacture of munitions and other war-vital materials. The production of soap and other materials adequate for the military, industrial, and civilian needs also was made possible by this cooperation of the public in salvaging fats.

The higher grades of household fats are used for soap making. Others are split to produce glycerine and fatty acids, from which come stearic and oleic acids, vital components of war materials. For every 100 pounds of soap produced, there is a yield of about eight pounds of glycerine needed in hundreds of war and civilian items. Chilling and pressing the fats produces lard oil, a metal processing medium. Every lathe, drill press and grinding wheel running in the country's war plants requires lard oil to cut steel shaft surfaces, grind the gears and drill the holes into the toughest of materials.

At the time the fat salvage program was inaugurated in July, 1942, the production of glycerine, required for many war products and medicines, was comparatively low. Glycerine stocks stood at 70,000,000 pounds on Jan. 1, 1944 and production this year is expected to range between 192,000,000 and 204,000,000 pounds, close to the estimated maximum demand. Any substantial change in the fat supply picture will adversely affect the glycerine supply, and might necessitate restoring the restrictions of 1943.

Glycerine has scores of war uses. Approximately 20 percent of the 1944 supply will go into explosives and another 5 percent into medicines and pharmaceuticals—including smallpox vaccines, sulfa drugs, ointments, antiseptics, opiates, heart stimulants. Glycerine is also used in the manufacture of cellophane, grease-proof paper, synthetic rubber, and lacquers.

FROM THE VIEWPOINT OF THE EDITORS—

SELLING SURPLUS GOODS

As THE more active war production period approaches an end, Administrator Will Clayton is organizing what seems to be a very sound program for the sale of plants, equipment and industrial goods which Uncle Sam finds to be surplus property. We are impressed and pleased by some of the principles which Mr. Clayton has set forth as his governing plan. Let us note a few here:

No speculators! No dumping to break the market. Use of regular channels of trade. Testing of the market before large sales begin. No preference to anybody. No boosting of monopolies. The realization for the Treasury of the maximum return only when some other consideration of long-term benefit is not more important.

Much more difficult will be the application of these rules. However, they are feasible of application if there is sincere and active cooperation of industry.

Particularly important at the outset will be assistance from normal producers and distributors of chemicals to see that surpluses are moved promptly when so identified by the Government. Any firm regularly engaged in the marketing of chemicals should keep in touch with those who will offer surplus stocks so that they may promptly supply them to industries hungry for these materials. If regular sales agencies do not do so, we may expect speculators and inexperienced newcomers to enter the markets. This merely invites diversion of goods from a destination of greatest need into channels of less service to industry and the public. Even when such stocks of goods seem large, they must be moved promptly or the rebuilding of postwar programs will be delayed to the detriment of all.

SELLING SURPLUS PLANTS

MUCH MORE serious than the disposal of surplus goods will be the government's eventual disposal of some $33 billions now invested in plants and facilities. The Committee for Economic Development has estimated that the merchantable war goods which must be sold in this country will not amount to more than the equivalent of two months of normal retail sales. Plant and equipment, on the other hand, even after writing off half the total for military installations and another $10 billion for shipyards and other large and non-marketable properties, will still leave the equivalent of at least two years of normal investment in plant expansion. Properly to handle this problem, says the C.E.D., will call for "daring business statesmanship," as well as "great ingenuity" in reconversion and the "bold dismantling" of many plants which cannot be converted.

Committees from both the National Association of Manufacturers and the U. S. Chamber of Commerce have made careful studies of this problem and, for once, their recommendations are in close agreement. Both would set up an independent autonomous agency or commission composed of a number of full time, fully experienced industrial executives to whom they would give full authority over all property acquired for war use and no longer needed for the national defense. Both would establish advisory committees representing the industries most directly affected—having in mind the protection of private enterprise from unfair competition at the same time serving the primary objectives of providing the maximum of employment compatible with military security.

These are considerations for the Congress when it finally gets back to the job of drafting the necessary legislation. Meanwhile it is encouraging to find that the sort of engineering advice recommended in the comprehensive report on this subject in *Chem. & Met.* in April 1944 (pp. 117–24) is already beginning to bring in concrete recommendations and to point toward workable solutions for many of these problems. Well qualified chemical engineering consultants and representatives of construction and equipment companies have been called in to fill the gaps in the knowledge and experience of the governmental employees. Their studies will be of real value when the time comes for opening up actual negotiations for these properties.

REVERSE DRAFT

SO MANY critical things have been said about General Hershey and the Selective Service organization that it is time someone should back away and take a look at the record. When he started his job in September 1939 there were only 635,000 on the army and navy rolls and of these only 325,000 were on active duty. Now there are about 11,300,000, and all are active. Most of that huge number were inducted into the service during 30 months, at a time when the monthly quotas were averaging about 300,000. From here on in the need will probably be only for replacements and the bulk of these will come from the 100,000 boys who reach their eighteenth birthday each month.

These mobilization figures take on new interest, however, when we recall that Section 8 of the original Selective Service Act attempts to provide for the orderly demobilization of these same soldiers and sailors. Congress was very generous in ordering General Hershey and his organization to help these men recover their original jobs with no loss in rate of pay, status or seniority. Other laws have since added even more complications so it is no wonder that the general is a bit concerned about holding his great volunteer organization together long enough to do the back haul job. It won't be short nor easy of accomplishment. At the rate of a half million a

month, which is perhaps more than we have physical facilities to demobilize (let alone jobs and "economic status"), it would take a couple of years for complete demobilization. We should not be very much surprised if it took twice that long. Presumably length of service and number of dependents will determine the order in which the men are released—but again there are these economic and social considerations that will have to be clarified by new regulations, if not legislation.

As the draft machinery is shifted into reverse, there are going to be many problems that will try the patience and resourcefulness of us all. The country is fortunate in having such a level-headed citizen as Major General Lewis B. Hershey "in the driver's seat."

"WELL DONE . . . THANKS"

ALL in the chemical engineering profession will echo these words of Bernard Baruch, spoken as he was told that Col. Bradley Dewey had resigned as Rubber Director and had recommended that his Office should voluntarily surrender its emergency powers. Dewey and his predecessor, Jeffers, have reason to be proud of the accomplishments of those American industries that so ably met the challenge of the Japanese aggressor. Today our synthetic rubber plants are producing at the rate of 836,000 long tons per year, which is half again as much as our prewar imports of national rubber. More important, the continued progress in reducing costs has definitely assured our future independence, if necessary, from any foreign source.

JOINT ACTION ON STREAM IMPROVEMENT

ALMOST from the beginning the pulp and paper industry has been concerned with the effluents and wastes discharged into the surface waters of the country. In an effort to improve this situation, millions of dollars have been spent. Unfortunately, this effort has been largely on an individual mill or local group basis; the programs have been developed primarily to meet local conditions and in most cases the results have not been made available to the industry as a whole. Meanwhile, the enormous growth of the industry and the more stringent stream pollution regulations that are constantly being enacted into laws have only aggravated the situation. Faced with the problem that was continually growing worse and showed evidence of shortly becoming critical, several of the industry's leaders met and made plans for the formal organization of the National Council for Stream Improvement (of the Pulp, Paper and Paperboard Industries), Inc. Already its membership includes many of the companies in the industry and it is hoped that all organizations engaged in the production of pulp of any kind or character soon will give it their support.

The Council was set up as a non-profit making corporation. Its research program provides for a number of projects at selected universities and other institutions. As the plan encompasses both basic and applied research and development, institutions of proximity to the industries involved will be selected in most cases. Already arrangements have been completed with Mellon Institute for extensive research concerning waste treatment, recovery and utilization.

This organization of the whole industry will be able to plan a coordinated program, eliminate duplication of effort, and solve many of the waste disposal problems that have plagued the mills. It will be able to develop means for the recovery and utilization of materials now wasted. These and many other reasons indicate the soundness of the cooperative approach to research in connection with the industry's waste disposal and utilization problems.

CARTEL BEFORE THE HORSE?

ANNOUNCEMENT from the State Department on July 18 that the United States would shortly participate with Great Britain and The Netherlands in a conference on postwar problems of crude and synthetic rubber has brought forth some surprising and conflicting reactions. At a time when the Anti-Trust Division of the Department of Justice is gunning for export combinations of American chemical manufacturers, it seems strange to find that another governmental department has organized an advisory committee of the leading executives of the rubber companies and discussed with them the "desirability of establishing a committee to keep the crude and synthetic rubber situation under control with a view to eventual consideration of postwar problems affecting rubber." This quotation is from a statement attributed to B. F. Haley, chief of the State Department's Commodities Division, who is to head the American delegation.

Subsequently seven representatives of petroleum companies interested in the production of butadiene were invited to meet with the State Department officials and to help them in preparing for the forthcoming "tri-power rubber discussions."

Meanwhile the word is passed to the press that all this is preliminary and exploratory. We are assured that nothing will be done as long as the war is on—or at least not until the Far Eastern plantations have been recaptured from Japan. We would feel better if we were assured that nothing would be done until the owners of the American synthetic rubber industry were given adequate information about any and all proposals that will affect the long-time future of their large investments as taxpayers.

FRANK JEROME TONE, 1868–1944

DR. FRANK J. TONE's long and brilliant career as electrochemist, engineer and executive spanned practically the whole history of the electrochemical industry in America. His first association with Edward Goodrich Acheson almost co-incided with the opening of the great hydroelectric plants at Niagara Falls. His company was the first to apply a thousand horsepower to an electrothermic process and at one time it was thus utilizing about half of the entire output of Niagara Falls power. His personal contributions included the invention and development of many valuable products and processes in the field of synthetic abrasives and refractories. His great services to his profession and his fellow workers in the Carborundum Company have been recognized by numerous honors —local, national and international citations. Withal he was a friendly, personable man whose inspiration and guidance will be sorely missed by all of us.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

Until further notice the editors of *Chem. & Met.* will award a $50 Series E War Bond each month to the author of the best short article received during the *preceding* month and accepted for publication in the "*Chem. & Met.* Plant Notebook." Articles will be judged during the month following receipt, and the award announced in the issue of that month. The judges will be the editors of *Chem. & Met.* Non-winning articles submitted for this contest may be published if acceptable, and if published will be paid for at space rates applying to this department.

Any reader of *Chem. & Met.*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Neither finished drawings nor polished writings are necessary, since only appropriateness, novelty and usefulness of the ideas presented are criteria of the judging.

Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition, novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address entries to Plant Notebook Editor, *Chem & Met.*, 330 West 42nd St., New York 18, N. Y.

JULY WINNER!

A $50 Series E War Bond will be issued in the name of

J. A. MAY
Styrene Division
The Dow Chemical Co.
Lake Jackson, Texas

For an article dealing with a "slide rule" nomograph easily used by non-trained personnel, which has been adjudged the winner of our July contest.

This article will appear in our September issue. Watch for it!

June Contest Prize Winner

NEW CHART PERMITS READY PROPORTIONING OF TWO LIQUID OR GAS STREAMS

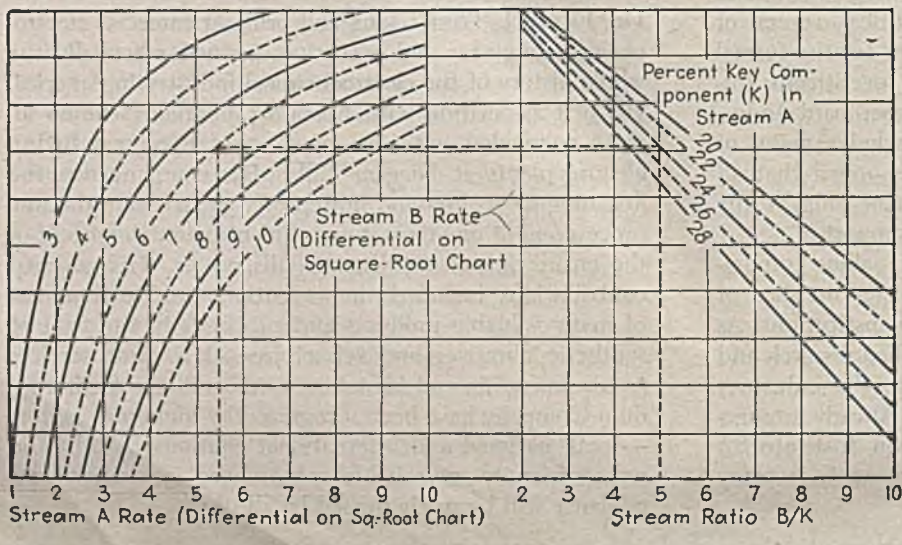
J. W. RUSSELL
Chemical Engineer
The Ohio Oil Co., Robinson, Ill.

For application to petroleum refinery operation particularly, where orifice type meters recording on a square-root chart are widely employed, this inexpensive and simple method for proportioning two liquid or gas streams is presented. For example, a chart similar to the one presented could be developed for injecting a solution of inhibitor into a line carrying cracked stabilized gasoline.

For a ratio of inhibitor (key component of Stream A) to cracked gasoline of 1 : 5, a line is extended vertically from 5 on the right hand scale to cut the diagonal representing the concentration of inhibitor in Stream A (for example, 24 percent). From the intersection of the vertical and diagonal lines, a horizontal line is extended to the left to cut the curve representing the rate of flow (for example, 6, the differential on the square-root chart) of cracked gasoline (Stream B). A second vertical line dropped from the intersection of the horizontal line and the curve for the differential of the cracked gasoline meter enables the plant operator to determine quickly and accurately the required flow rate of Stream A, the solution of inhibitor, which in this case is seen to be 5.5.

Flow rates are represented by the differential of the square-root chart to simplify the application of the proportioning chart and reduce the possibility of an arithmetic error when calculating the flow using a square-root chart multiplier.

Chart for proportioning two liquid or gas streams



MINIATURE CHEMICAL PLANT OF TRANSPARENT PLASTIC

H. F. REICHARD
Chemical Engineer
New Brunswick, N. J.

To present ideas for equipment modifications or new manufacturing units to management, or to the public at exhibitions, attractive models are very helpful. Herein is presented a simple method by which practically any piece of chemical plant equipment may be constructed in small scale of plastic sheeting and the pieces connected together with plastic tubing for pipe, and supported on a plastic rod framework, to form a complete miniature plant.

The equipment pieces are made up by cutting pieces from plastic sheeting and welding them together with a hot pointed tool. The most suitable resins for the sheeting are polyvinyl compounds or cellulose esters. The implements required are scissors, a knife, and a welding tool consisting of a needle in the end of a pen holder.

Details of the method may be illustrated by following the making up of a basic equipment type, a reaction kettle. The steps are shown in the sketch on p. 123.

To make up the cylindrical body of the kettle the proper sized piece is cut from

(Continued on page 123)

REPORT ON.....

CHLORINE INDUSTRY

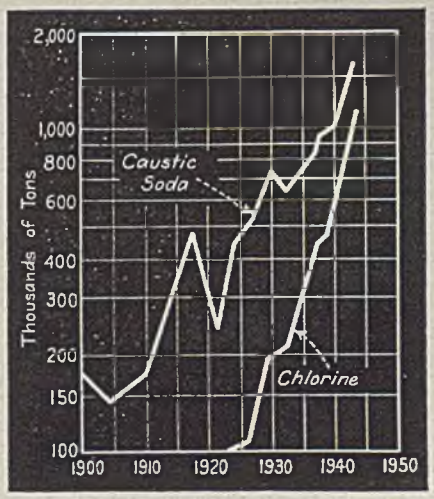
Plans for Markets in Postwar Pentad

Plenty has happened during the war pentad to keep the chlorine-caustic industry on its toes: government restrictions on normal peacetime outlets and distribution, the mushrooming of innumerable direct and indirect military uses with insatiable demands, a doubling of production facilities for electrolytic caustic and chlorine, government participation to such an extent that government-owned plants can produce a quarter of the nation's chlorine, technical advances in methods of processing and handling. The industry knows that many problems will come with peace to haunt the postwar pentad, yet it looks forward with confident optimism. The reasons are sound, for all signs indicate chlorine will continue toward the goal of becoming queen of the chemicals and that caustic soda will remain the heavy-duty worker for industry. Wherever there is a vigorous synthetic organic chemical industry there will be healthy demands for chlorine; heavy industry always needs cheap caustic.

MODERN CIVILIZATION as we would like to know it, with all its vices and virtues and debatable fine points, would soon collapse if the alkali-chlorine and associated industry were suddenly annihilated. Caustic, for instance, enters directly or indirectly in some way into all of the staples of life: clothing, food, shelter, transportation. Such commodities as soap, petroleum products, rayon and other textiles, rubber, oils and fats, pulp and paper, all are highly dependent upon caustic soda, commoner among chemicals, for their present state of development.

Just as many of the products of heavy industry are dependent upon caustic soda, so many of the refinements of our age depend upon chlorine and chlorine derivatives. White paper instead of dingy pulp, sanitary water, tailor-made plastics, selective solvents, non-toxic refrigerants, special synthetic rubbers, vitamins and sulfa drugs, poisonous warfare gases, high-test gasoline, water-proofing and fire-proofing materials, delicate dyes, medicines, fine chemicals—such products are typical of those fathered by chlorine. If it can be said that the production of caustic is an indication of the stability of the heavy-industry civilization of any nation, then the production and consumption of chlorine is a gauge of the refinements of that civilization.

Production of caustic soda and chlorine climbs, the gap narrows



In what ways and in what degrees does the chemical and mechanical civilization of this country differ from those of Poland, Italy, Germany, France and even England and Russia? To a large extent, the differences arise from the fact that this nation has a more highly developed and specialized synthetic organic chemical industry. A high standard of living calls for diversified synthetic organic chemicals; these in turn demand chlorine and still more chlorine, versatile tool of synthesis. These three factors, in fact, create a cycle of cause and effect and each is a reflection of the state of the others. Thus the future of chlorine is hitched to the star of the organics. Since 1921 this country has increased its volume production of

Location of Caustic Soda and Chlorine Plants in the United States

Alkali Producers		
Belle Alkali Co.	Belle, W. Va.	Moore-Vorce cell
Columbia Chemical Div. of Pittsburgh Plate Glass Co.	Barberton, Ohio	Lime-soda process
	Barberton, Ohio	Vorce & Hooker cells
	Natrium, W. Va. (D.P.C.)	Hooker-Columbia cells
Diamond Alkali Co.	Painesville, Ohio	Lime-soda process
	Painesville, Ohio	Tucker-Windecker cell
Hooker Electrochemical Co.	Niagara Falls, N. Y.	Hooker S cell
	Tacoma, Wash.	Hooker S & Hooker E cells
Isco Chemical Co.	Niagara Falls, N. Y.	Nelson cell
Mathieson Alkali Works, Inc.	Saltville, Va.	Lime-soda process
	Lake Charles, La.	Lime-soda process
	Niagara Falls, N. Y.	Castner cell
Michigan Alkali Div. of Wyandotte Chemicals Corp.	Wyandotte, Mich.	Lime-soda process
	Wyandotte, Mich.	Imperial Chemical Ind. & Hooker cells
Niagara Alkali Co.	Niagara Falls, N. Y.	Vorce cell
Niagara Smelting Div. of Stauffer Chemical Co.	Niagara Falls, N. Y.	Wheeler cell
Pennsylvania Salt Mfg. Co.	Wyandotte, Mich.	Gibbs (improved) cell
	Tacoma, Wash.	Gibbs (improved) cell
Solvay Process Co.	Syracuse, N. Y.	Lime-soda process
	Detroit, Mich.	Lime-soda process
	Baton Rouge, La.	Lime-soda process
	Syracuse, N. Y.	Allen-Moore (KML) cell
	Baton Rouge, La.	Hooker cell
	Hopewell, Va.	Nitrosyl chloride process
Southern Alkali Corp.	Corpus Christi, Texas	Lime-soda process
	Corpus Christi, Texas	Hooker cell
Stauffer Chemical Co.	Los Angeles, Calif.	Lime-soda process
Westvaco Chlorine Products Corp.	So. Charleston, West Va.	Vorce & Nelson cells
Pulp & Paper Mills		
D. M. Bare Paper Co.	Roaring Springs, Pa.	MacDonald cell
The Brown Co.	Berlin, N. H.	LeSueur & Allen-Moore cells
Castanea Paper Co.	Johnsonburg, Pa.	Hargreaves-Bird cell
Champion Paper & Fibre Co.	Canton, N. C.	Hooker cell
	Houston, Texas	Hooker cell
	Hamilton, Ohio	Hooker cell
Eastern Manufacturing Co.	South Brewer, Me.	Allen-Moore (KML) cell
Kimberly Clark Co.	Kimberly, Wisc.	Wheeler cell
Oxford Paper Co.	Rumford, Me.	Sorenson cell
Penobscot Chemical Fiber Co.	Great Works, Me.	Larchar cell
Southern Advance Bag & Paper Co.	Hodge, La.	Henderson cell
S. D. Warren Co.	Cumberland, Me.	Allen-Moore (KML) cell
West Virginia Pulp & Paper Co.	Mechanicsville, N. Y.	Hooker cell
	Luke, Md.	Hargreaves-Bird & Hooker
	Tyrone, Pa.	Hargreaves-Bird cell
	Covington, Va.	Hargreaves-Bird cell
Magnesium Producers		
Basic Magnesium, Inc. (D.P.C.)	Las Vegas, Nev.	Hooker cell; MEL magnesium cell
Dow Chemical Co.	Midland, Mich.	Dow magnesium cell
Dow Chemical Co. (50% D.P.C.)	Freeport, Texas	Dow magnesium cell
Dow Magnesium Corp. (D.P.C.)	Velasco, Texas	Hooker cell; Dow magnesium
	Marysville, Mich.	Dow magnesium cell
Diamond Magnesium Co. (D.P.C.)	Painesville, Ohio	Dow magnesium cell
Mathieson Alkali Works (D.P.C.)	Lake Charles, La.	Mathieson-Consolidated magnesium cell
International Minerals & Chemicals Corp. (D.P.C.)	Austin, Texas	Dow magnesium cell
Other Producers		
The B. F. Goodrich Co.	Louisville, Ky.	Hooker S cell
Chemical Warfare Service	Huntsville Arsenal, Ala.	Hooker S cell
	Rocky Mt. Arsenal, Colo.	Hooker S cell
	Edgewood Arsenal, Md.	Hooker S cell
	Pine Bluff Arsenal, Ark.	Hooker S cell
Chlorox Chemical Co.	Oakland, Calif.	Whiting cell
Dow Chemical Co.	Freeport, Texas	Dow cell
	Midland, Mich.	Dow cell
	Pittsburgh, Calif.	Dow cell
E. I. du Pont de Nemours & Co.	Deepwater Pt., N. J.	Wheeler (modified) cell
	Niagara Falls, N. Y.	Downs cell
Ethyl Gasoline Corp.	Baton Rouge, La.	Downs cell
Fields Point Mfg. Corp.	Providence, R. I.	Townsend cell
General Electric Co.	Pittsfield, Mass.	Hooker S cell
Gulf Refining Co.	Port Arthur, Texas	Nelson cell
Hercules Powder Co.	Hopewell, Va.	———
Rayo Chemical Co.	Los Angeles, Calif.	———
Monsanto Chemical Co.	Monsanto, Ill.	Tucker-Windecker & Hooker
Morton Salt Co.	Manistee, Mich.	Vorce cell
Potash Co. of America	Carlsbad, N. M.	———
Wm. Zinsser & Co.	New York, N. Y.	Sorenson cell
Zonite Products Corp.	New Brunswick, N. J.	———

synthetic organic chemicals almost 50-fold, chlorine by 20-fold and caustic soda by 7-fold.

Historically, the chlorine industry is almost an upstart as compared to the venerable caustic soda industry. Even as late as 1931, the lime-soda process was producing over twice as much caustic soda as the electrolytic method. It was as recently as 1940 that electrolytic production of this chemical nosed ahead of lime-soda output. This significant event has largely been due to the rapidly increasing demands for chlorine, formerly a secondary byproduct of the electrolysis of salt.

The important question now is: Will this accelerated demand for chlorine extend into the postwar pentad and beyond or will excess chlorine capacity become a problem child of our postwar chemical economy? Will electrolytic chlorine eventually become the tail that wags the entire caustic soda industry?

Present indications lead one to believe that the demand for chlorine will continue to be healthy (with the possible exception of the initial postwar readjustment phase) for years to come and that the supply-demand ratio between electrolytic caustic soda and chlorine will become more delicate with time, at the expense of lime-soda caustic. It is for these good reasons that this report has largely been restricted to the electrolytic phases of the industry and that particular emphasis has been given to chlorine, its present performance and future potentialities.

APPROACH OF WAR

In the late prewar years, the caustic-chlorine industry was experiencing a lusty and well-balanced growth. By 1938–39 the electrolytic and lime-soda outputs of caustic soda were running neck to neck to reach a total of a million tons. The demand for caustic by both the rayon and the chemical industries, the largest consumers, was steadily increasing.

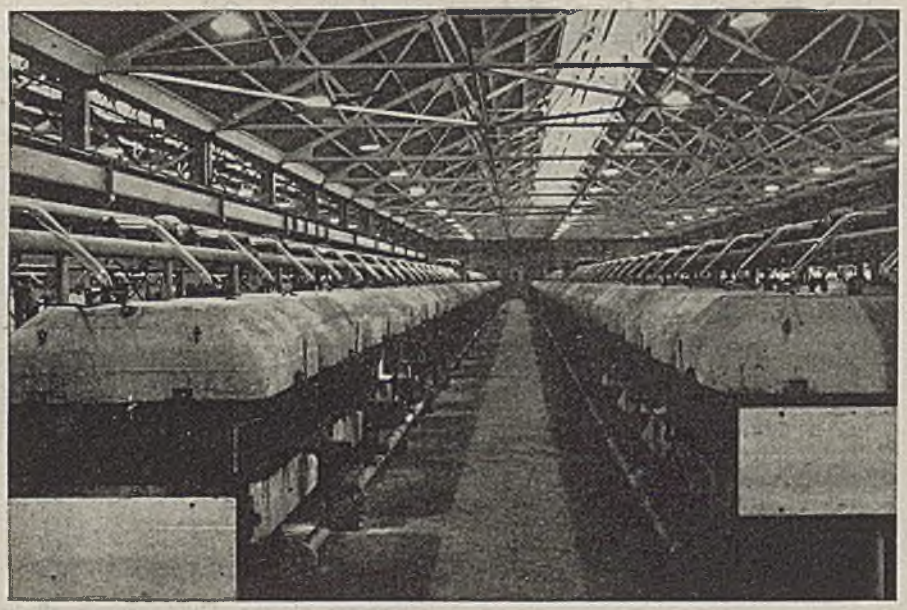
Production of chlorine was being forced rapidly upward: from 67,000 tons in 1921 (at which time it was more or less a surplus on the market) to 446,000 tons in 1937 and almost 800,000 tons in 1941. By the late thirties the chemical industry was taking well over half of the entire chlorine output; pulp bleaching had fallen from almost 50 percent of the output as late as 1932 to less than 25 percent. These shifts offer clues to postwar trends.

Then came the war. Chlorine was among the first important chemicals of commerce to feel the full impact of war-whetted demands. Even in the regime of Lend-Lease, production facilities were unable to supply both military and civilian demands even though the industry was running at over 98 percent of capacity in 1940 and at 99 percent in early 1941. The Chemical Warfare Service began using some chlorine as early as 1940, but the amounts were not large at that time. By the middle of 1941 some 30 percent of the country's chlorine output was being channelled into defense uses; this included that required for public health purposes.

Still the military demands increased and in November, 1941, a decrease in the use of chlorine in the manufacture of pulp, paper and paperboard was ordered. In general, this cut reduced all grades of chlorine-bleached paper to the standards of 1931–32. This order, affecting practically all grades of paper with the exception of newsprint, saved about 60,000 tons of chlorine a year.

Chlorine has remained tight throughout the war and shows promise of staying so, although new plants and expansions have helped to relieve the situation. Demand for chlorine is expected to increase gradually for at least another year of war.

Meanwhile, demands for caustic soda increased at a more temperate pace. The chemical industry took increasing quantities of caustic soda until in 1943 it became the largest single consumer, with the rayon industry a close second. Even though caustic soda is not "tight" in the unpleasant sense of the word, there is nothing like a surplus of this alkali even now. In this respect the lime-soda producers have helped the situation by curtailing production to a certain extent, thereby also releasing additional soda ash to industry.



This assembly of Hooker-Columbia cells at the DPC plant operated by Pittsburgh Plate Glass Co. has one of the largest chlorine capacities in the country

PLANT EXPANSIONS

As soon as it became evident that there would be a shortage of chlorine, alkali producers set about the job of eliminating production bottlenecks. enlarging plant facilities and, in a number of cases, erecting entirely new plants. The government took an active part in this expansion program by financing new plants through DPC. The Chemical Warfare Service began producing chlorine at four of its arsenals, and some of the magnesium producers installed electrolytic caustic-chlorine facilities. No new lime-soda plants have been erected, nor any major expansions made in present facilities. Instead, these caustic producers have been able to increase their output almost 30 percent over that for 1939 by eliminating production bottlenecks and through fuller utilization of existing facilities.

Plant capacities of commercial producers of electrolytic caustic soda have been increased from over 700,000 tons annually in 1941 to some 1,200,000 tons annually at the present. During the same period, capacities of privately-owned chlorine plants have been increased from 800,000 tons to almost 1,300,000 tons annually. New private plants erected since 1942 include those of the B. F. Goodrich Co. in Louisville, and of General Electric Co. in Pittsfield, Mass.

It is significant to note that of the 1,036,000 tons of electrolytic caustic soda produced in 1943 by private plants, some 245,000 tons or 24 percent, was consumed in the producing plants. On the other hand, of the 1,212,000 tons of chlorine produced by private firms in the same year, some 700,000 tons or 58 percent was consumed by producing plants. The comparable figure in 1939 was only 34 percent. These figures, which do not include producer consumption involving inter-plant transfer, indicate the rapidly growing rate at which chlorine is being used in the production of other chemicals (the percentage made and consumed by pulp and paper mills is relatively small and stabilized) and the trend for producers to become their own best customers.

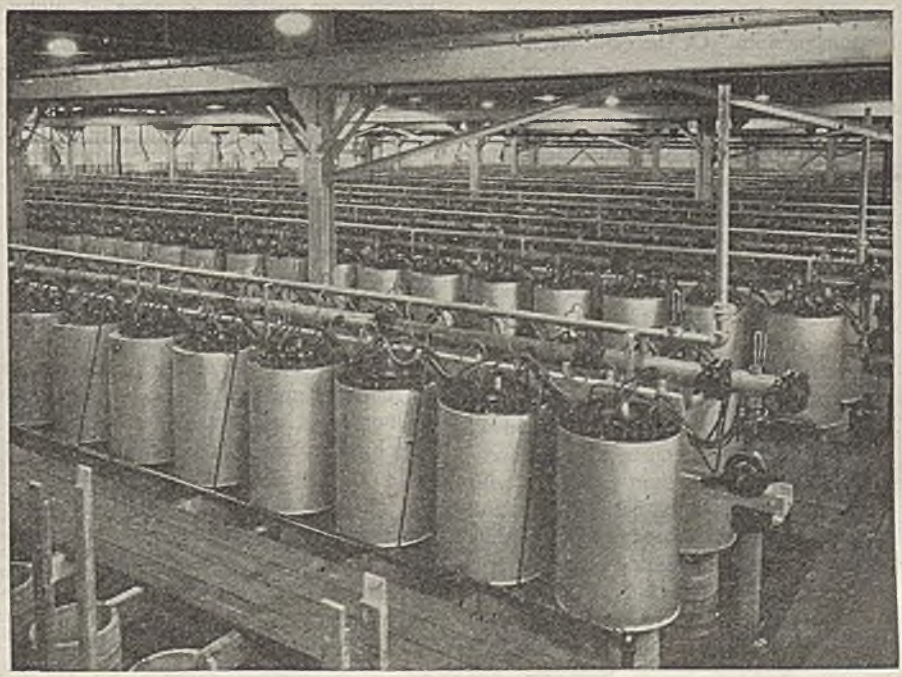
THE PEOPLE'S PLANTS

Since 1941, the government has found it necessary to enter into the production of electrolytic caustic soda and chlorine in a big way. This it has done through Chemical Warfare arsenals, through DPC-financed plants operated by private industry, and through government-financed electrolytic magnesium plants.

Details on capacities of certain of these government plants as well as distribution breakdown figures are not generally available. In general, however, it is known that government-financed plants account for approximately a quarter of the nation's chlorine capacity. Consequently, of the approximate 1,600,000–1,800,000 tons of chlorine produced in 1943, government plants accounted for approximately 400,000–600,000 tons. These figures may cause nightmares to some persons making plans for the postwar pentad. On further analysis, however, they are not so formidable.

Of this total government capacity, about 100,000 tons are supplied by the four Chemical Warfare Service arsenals at Huntsville, Rocky Mt., Edgewood and Pine Bluff. Two of these arsenals have capacities of 100 tons of chlorine a day

Next to Hooker cells, the Vorce cells of Westvaco Chlorine Products Co., shown here in a large installation, are most important capacity-wise



U. S. Production of Caustic Soda (Short Tons of 100 Percent NaOH)*

	Lime-Soda	Electrolytic	Total
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	387,235	186,182	573,417
1929	524,985	236,807	761,792
1931	455,832	203,057	658,887
1933	439,363	247,620	686,983
1935	436,980	322,401	759,381
1937	488,807	479,919	968,726
1939	532,914	512,492	1,045,406
1940 (est)	505,000	595,000	1,100,000
1941	685,999	743,316	1,429,310
1942	634,291	939,878	1,514,169
1943	673,495	1,036,564	1,710,059
1944 (4 mo.)	266,367	395,106	661,473

* Figures for 1921-1943, except 1940, are from the U. S. Bureau of the Census. Electrolytic caustic soda figures up to 1941 do not include that made and consumed at wood-pulp mills, estimated at about 30,000 tons in 1927 and 1929, 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934, 17,000 tons in 1935, 19,000 tons in 1936 and 1937, 18,000 tons in 1938, 25,000 tons in 1939 and 30,000 tons in 1940. Figures for 1941-1944 include production at pulp mills. Does not include production at government-owned plants, all of which are electrolytic.

(although one is operating at only 50 tons a day) and two have capacities of 50 tons of chlorine a day. For the good of the German people, it is high time that someone inform Hitler that these arsenal chlorine plants operate only to sell caustic soda and chlorine. For some time our Chemical Warfare Service has had enough stocks of chemical gases of all types to pickle every Nazi and every Jap several times over. Comfort to the enemy?

It is extremely doubtful if these chlorine plants will be operated by CWS after the war. Some tentative efforts are probably now being made to dispose of the units. However, it is very likely that at least some of them will be kept in stand-by condition or that the government will allow them to be operated by private industry if the demand for chlorine or caustic soda should warrant such operation.

A goodly portion of the remaining government-financed chlorine capacity is accounted for by the producers of electrolytic magnesium. Of the eight electrolytic and carbothermic magnesium plants that require or produce chlorine in their magnesium operations, two have separate installations for producing caustic-chlorine, both of which use the Hooker S type of cell. With the exception of the Dow operations and possibly one or two other producers, it is safe to say that the magnesium producers shown in the accompanying table will cease operations in the immediate postwar. One electrolytic DPC-financed plant has never been able to produce commercially; some of the others are still relatively high-cost producers and all are now operating at curtailed capacity.

Of the two magnesium producers with separate chlorine plants, Basic Magnesium, Inc., has the larger capacity. This Nevada giant has a chlorine unit housed in two buildings, each of which has 450 Hooker S cells of 7,500 amp. capacity. These 900 cells thus have a daily capacity of 200–225 tons of chlorine. Only a relatively small portion of this production is needed for make-up purposes in the magnesium operations; the remainder is for sale. The fate of these magnesium and chlorine units after the war is debatable. If magnesium operations cease, it is entirely possible that the chlorine units will continue operations, although it is more likely that they may be dismantled for use elsewhere, possibly abroad.

Chlorine capacity of the Dow Magnesium Corp. (DPC) plant at Velasco, Texas, is unknown. There is a good possibility that this plant will continue magnesium operations after the war, in which case the chlorine production will continue to be used for make-up in the magnesium plants at Velasco or at Freeport. Excess capacity can be fed into the nearby Dow chlorinated hydrocarbons plant or Ethyl Dow units.

Largest of the DPC-financed alkali-chlorine plants not associated with CWS or magnesium producers is the unit at Natrium, W. Va., operated by the Columbia Chemical Division of Pittsburgh Plate Glass Co. This plant uses Hooker-Columbia cells and is one of the largest installations ever built as a unit. Its capacity is presumably in the neighborhood of 250–300 tons of chlorine a day.

TECHNICAL DEVELOPMENTS

At the same time these plant expansions were taking place, a number of technical improvements in the processing, purification and handling of caustic soda and chlorine were being made by the more progressive members of the industry.

The more important technical developments during the past five years in both chlorine and caustic soda manufacture and handling include the following:

(1) A general trend toward the use of mercury arc rectifiers in place of motor generator sets for large installations with high circuit voltages, resulting in high efficiency of power conversion.

(2) Rapid increase in use of cells of larger capacity and higher power efficiency, especially those of the Hooker S type, and of a larger number of cells per circuit, thus reducing investment and operating costs per ton of product (see accompanying sketch; described in a later paragraph).

(3) Development of the Pittsburgh Plate Glass liquid ammonia process for purification of diaphragm cell caustic soda to render it suitable for rayon and other high-quality uses (see accompanying sketch; described in a later paragraph).

(4) Development of treated graphite for anodes that have considerably longer life than those formerly used.

(5) Installation of facilities for continuous settling of treated brine in most of the new plants.

(6) Improved design of tank cars of

Production and Consumption of Chlorine by Private Plants[1]

	Production	Consumption at Producing Plants
1937	446,261	160,301
1939	514,401	175,126
1941	797,976	396,079
1942	987,784	557,796
1943	1,211,720	698,767
1944 (5 mo.)[2]	532,323	314,888

[1] As short tons. Data from Bureau of the Census.
[2] Preliminary.

welded construction and methods of insulating these, such as with the Columbia tank lining, to permit shipment of 73 percent caustic without metallic contamination (described in a later paragraph).

(7) Extensive use in new plants of rubber-lined steel for handling wet chlorine, although chemical stoneware is still in predominant use throughout the industry.

(8) Use of 55-ton single-unit chlorine tank cars and fusion welded construction instead of hammer welded for single-unit tank cars of 30 tons or smaller.

(9) Development by Pennsylvania Salt Mfg. Co. of a process for producing liquid chlorine relatively free of non-volatile material.

(10) Improvement in the Vorce cell (Westvaco Chlorine Products, Inc.) by the addition of an extra cathode inside the row of anodes, thus increasing the power efficiency and capacity of the cell (see accompanying sketch).

(11) Improved method of handling 73 percent high-quality caustic soda at customers' plants to accomplish dilution and quick cooling in order to minimize metallic contamination during unloading.

IMPROVED HOOKER CELL

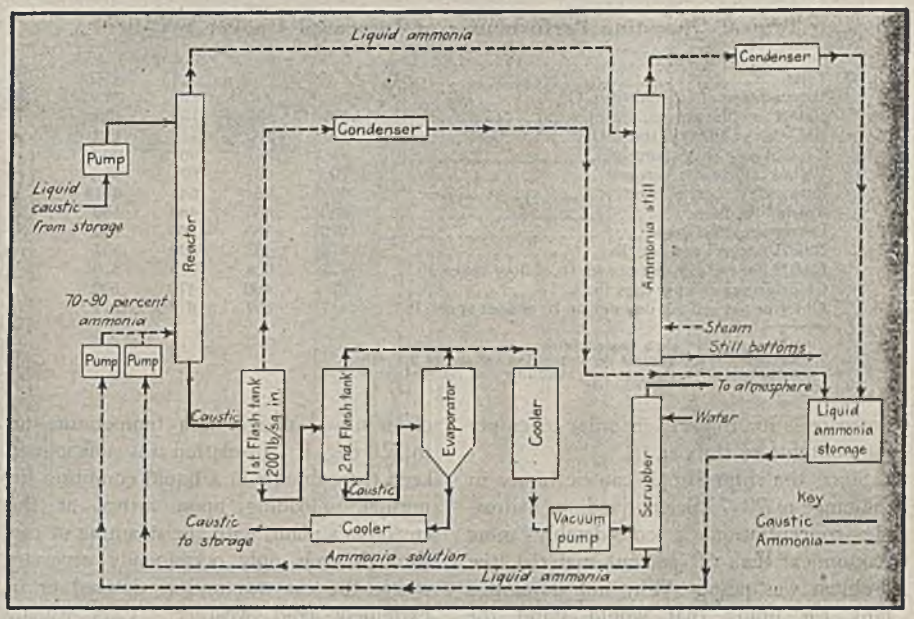
The improved Hooker type S cell is a 7,500-ampere unit which produces about one quarter of a ton of chlorine per cell per day. Its large capacity per unit volume and high power efficiency have given it preference in the expansion of the chlorine industry during recent years, particularly in the war period. Hooker type S cells have been installed in 18 plants during the past four years, including several of the largest installations in the country. The large capacity of the cell makes it well suited for large installations, because of the reduction in investment and operating costs not only for the cells and cell building but also for the electrical conversion equipment.

This cell was designed originally for operation at 6,000 amperes with a permissible range of 5,000–7,000 amperes. Several years of operating experience have shown that the cell can be economically operated over a range of 4,000–8,000 amperes and that the optimum operating load is about 7,500 amperes. Improvement in the electrical connections and increase in the weight of copper used at certain points

were the only changes necessary for operation at higher loads.

Certain other minor details in this cell have also been changed in recent years. The heat exchanger between caustic liquor and feed brine and the insulation of the cell cathode have both been eliminated for simplification of operation. Copper conductors are welded to the cathode frame, improving the durability of this connection as compared with the riveted construction previously used. Improved insulators have been developed for the hydrogen connection to the cell and for the cell liquor outlet to reduce current leakage in circuits with high operating voltages, such as 500–750 volts. The accompanying diagram shows the principal features of the construction of the cell, including these improvements.

Operating characteristics have been improved with increased experience and improved operating conditions so that at the rated load of 7,500 amperes, an average of 96 percent current efficiency is obtained with 138 grams per liter caustic soda in the effluent liquor. Average graphite life has been increased from 350 days, which corresponded to operation at only 7,000 amperes in 1938, to over 450 days corresponding to 7,500 amperes in 1944.



This purification process of Pittsburgh Plate Glass Co. makes a rayon-grade caustic by removing chlorides and chlorates from impure diaphragm liquors

NEW PURIFICATION PROCESS

For economic reasons, the rapid expansion in chlorine capacity has been essentially all in the form of diaphragm electrolytic cells which produce a relatively impure caustic soda as a co-product. Approximately 1.1 tons of caustic are produced for each ton of chlorine, and the effect of this output has been no small item in the caustic field. At the same time, due to the expansion of the rayon industry and other uses, there has been a growing demand for very high-grade caustic. The alkali industry has thus been faced with the dilemma of producing more and more low-grade caustic with a demand for more and more high-grade material.

Most objectionable impurities identified with electrolytic caustic are sodium chloride (about 2 percent, dry basis) and sodium chlorate (about 0.1–0.5 percent, dry basis). Sodium chloride is objectionable because of the large amount, and the chlorate because its oxidizing properties greatly increase the tendency of the caustic to pick up metal impurities from storage tanks and pipe lines. In some cases it also causes objectionable side reactions.

Various methods of purfication of caustic soda have been practiced on a commercial scale, such as the Hooker process for crystallizing out hydrates, dialysis, etc. However, the process evidently receiving the widest acceptance at the present time was developed and patented by the Columbia Chemical Division of Pittsburgh Plate Glass Co. Four separate commercial installations are now in operation in different parts of the country.

In commercial practice, a liquid-liquid diffusion tower is used to separate out the sodium chloride and sodium chlorate constituents from the dilute caustic. Ammonia of 70–90 percent strength is pumped into the bottom of this tower and 50–70 percent caustic liquor into the top. Being immiscible and of different specific gravities, these travel in opposite directions. By regulating the relative volumes of the two, any desired sodium chloride and sodium chlorate anaylsis can be secured in the finished product. It is common practice to reduce the chlorate to zero and the chloride to 0.1–0.2 percent, dry basis.

Ammonia liquor from the top of the diffusion tower is redistilled to recover the ammonia. A very small fraction (3 percent or less) of the original caustic is recovered from the still bottoms and can usually be disposed of at no loss. The purified caustic contains some ammonia, which is rather easy to remove because of its low solubility. It can be removed either by blowing air through the liquor or by evaporating a small amount of water from the solution. The accompanying flow sheet will serve to illustrate the general plan of operation.

CAUSTIC TRANSPORTATION

Originally the only concentration of liquor shipped in tank cars was approximately 50 percent sodium hydroxide. Later more concentrated material containing up to 73 percent sodium hydroxide was shipped. The temperatures at which these two concentrations freeze are approximately 55 deg. F. for the 50 percent and 150 deg. F. for the 73 percent concentration. This means that during cold weather the 50 percent material will crystallize in the ordinary type of tank car, and that the higher strength material will do so the year around. This resulted in the use of

Estimated Distribution of Caustic Soda Consumed in the United States (Short Tons)

Consuming Industries	1935	1936	1937	1938	1939	1940	1941	1942	1943
Soap	96,000	104,000	94,000	95,000	100,000	103,000	125,000	120,000	105,000
Chemicals	118,000	130,000	173,000	138,000	187,000	212,000	260,000	300,000	360,000
Petroleum refining	81,000	88,000	82,000	80,000	99,000	105,000	116,000	100,000	130,000
Rayon, staple fiber & cellulose film	163,000	170,000	186,000	158,000	196,000	230,000	270,000	300,000	320,000
Lye and cleansers	38,000	46,000	48,000	40,000	44,000	48,000	52,000	70,000	100,000
Textiles	34,000	43,000	45,000	36,000	44,000	48,000	63,000	110,000	120,000
Rubber reclaiming	11,000	14,000	17,000	11,000	18,000	15,000	18,000	20,000	24,000
Vegetable oils	14,000	14,500	20,000	21,000	17,000	16,000	20,000	19,000	19,000
Pulp and paper	38,000	43,000	48,000	37,000	47,000	78,000	100,000	85,000	95,000
Exports	69,500	77,000	102,000	101,000	130,000	105,000	120,000	*	*
Miscellaneous	56,500	63,500	173,000	150,000	143,000	158,000	230,000	340,000	510,000
Total	719,000	793,000	988,000	865,000	1,025,000	1,118,000	1,374,000	1,464,000	1,783,000

* Included in miscellaneous.

Typical Operating Performance of Improved Hooker S Cells

Current, amperes	5,000	6,000	7,000	7,500
Volts	3.28	3.35	3.45	3.48
Temperature of effluent, deg. C.[1]	85	90	92	93
NaOH in effluent, gm. per liter	135	135	138	138
$NaClO_3$ per 1,000 parts NaOH	2.5	2.0	1.8	1.0
Current efficiency, percent	94	95	95.5	96
Voltage efficiency, percent[2]	70	69	67	66
Power efficiency, percent	66	65	64	63.5
Anode life, days	660	555	480	450
Diaphragm life, days	220	185	160	150
NaOH per cell per day, lb	373	452	530	567
NaOH per cell per day per sq. ft. of floor space, lb.[3]	5.3	6.4	7.5	8.0
Chlorine per cell per day, lb	330	400	470	500
Chlorine per cell per day per sq. ft. of floor space, lb.[3]	4.7	5.7	6.7	7.1

[1] When supplied with heated brine.
[2] Assuming a theotretical decomposition voltage of 2.3 volts.
[3] Including all aisles but not including cell renewal space.

steam coils for thawing in order to empty the contents of the car.

Since the shipment of caustic liquor in the range of 70–73 percent sodium hydroxide concentration is considerably more economical than 50 percent material, the problem was posed: Why not develop a tank car lining that would stand the temperatures involved in the higher test liquor and use a tank car of welded construction for better adherence of the lining to the interior of the tank car? After a considerable amount of research and development work, a tank car lining known as Columbia No. 5 was evolved and patented by Columbia Chemical Division of Pittsburgh Plate Glass Co. A welded steel tank car of improved design and insulation lined with this material made available for the first time shipment of high-purity 73 percent caustic soda solution to such exacting quality consumers as the rayon industry. The lining in use is a modified ethyl cellulose material.

Caustic liquor of 73 percent concentration was loaded into these lined tank cars of improved design at a temperature up to 220 deg. F. Insulation was sufficient to keep the contents in a liquid condition for normal unloading upon arrival at the customer's plant, with the steaming of cars through coils only occasionally necessary where the car was unduly delayed or in extremely cold weather. Cars usually arrived at consumers' plants with the contents at a temperature of approximately 180–190 deg. F., sufficiently above the crystallizing point to enable the unloading to proceed in a normal manner.

NEW HORIZONS

Most important war-time development in the chlorine-caustic field has been the remarkable expansion in the uses of chlorine. These represent both new and expanded present uses, but almost without exception the most important advancements have occurred in the use of chlorine for the synthesis of other chemicals, especially organic materials.

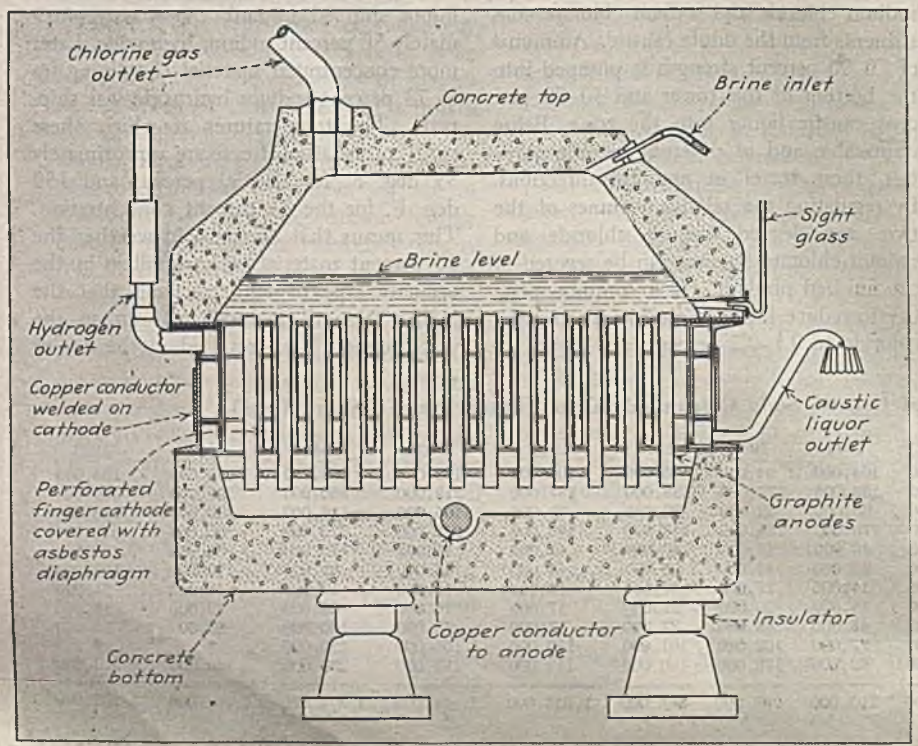
Postwar-wise, it is fairly safe to assume that there will be no radical changes over prewar demands for chlorine in such uses as pulp and paper production, water and sewage treatment and textile bleaching. All these uses will tend to increase, of course, but in accordance with the growth and progressiveness of the respective industries. Pulp treatment, for instance, will probably consume some 190,000-200,000 tons of chlorine yearly; consumption in this industry for 1937 was estimated at 117,000 tons and for 1940 at 170,000 tons. Sewage and water treatment will be at about 50,000 tons annually, since by 1941 some 85 percent of the public water supplies in the United States were already using chlorine for sterilization. During the war Army camps, both at home and abroad, have used considerable chlorine for water sterilization. The textile industries will probably not require over 30,000 tons of chlorine annually as compared to the estimated 22,000 tons so used in 1937.

This leaves the chemical uses of chlorine as the most promising and worthy of postwar cultivation. Production of bleaching powder of 35-37 percent available chlorine has almost doubled since the 1939 figure of about 17,000 tons; this will drop sharply after peace. Instead, true calcium hypochlorite, containing 70 percent available chlorine, will largely replace the older bleaching powder. The two principal processes in this country producing calcium hypochlorite are those developed by Mathieson Alkali Works, Inc. (H.T.H.) and more recently by the Columbia Chemical Division of Pittsburgh Plate Glass Co. Sodium hypochlorite will probably continue in favor as a bleach, particularly for domestic and laundry purposes.

Two of the most recent developments in bleaching compounds are the processes advanced by Mathieson Alkali Works, Inc., for producing sodium chlorite (1940) and chlorine dioxide (1943). The first of these, containing about 125 percent available chlorine, has been adopted commercially for certain purposes in the pulp and textile industry; chlorine dioxide shows promise as an oxidizing and bleaching agent to be generated at the point of use under carefully controlled conditions.

Quantitatively, the most important war-stimulated uses of chlorine that hold promise of postwar applications on a large scale include the chlorinated hydrocarbons, chlorinated paraffins, glycols and derivatives, silicone resins, synthetic rubbers, Freons, polychlorostyrene resins, benzene derivatives, acrylate resins, vinyl and polyvinyl and miscellaneous compounds.

This sketch shows details of latest improvements in the Hooker S cell



CHLORINATED HYDROCARBONS

Chemically, the term chlorinated solvents usually includes carbon tetrachloride, trichlorethylene, perchlorethylene and sometimes tetrachlorethane and pentachlorethane. In 1940 the principal compound

of this group was carbon tetrachloride. In that year the 50,400 tons of carbon tetrachloride produced required some 47,000 tons of chlorine.

Since that time trichlorethylene has moved up to first place in the chlorohydrocarbon family. This important degreasing agent probably required in the neighborhood of 90,000-100,000 tons of chlorine for 1943. Before the war, trichlorethylene was being used on a large scale for degreasing automobile motor parts and it had to some extent displaced carbon tetrachloride as a dry cleaning agent. It is now the principal degreasing agent for machine parts going into tanks, airplanes and other military weapons. Perchlorethylene, to a lesser extent, is used in metal degreasing.

Postwar prospects for chlorinated hydrocarbons as dry cleaning and metal degreasing agents are very promising. Output has increased several times since 1939; unit production costs have been lowered. Solvent degreasing is usually about four times as fast as other cleaning processes and requires only about a quarter of the factory space. In spite of the fact that alkaline cleaners may stage a minor comeback, especially in the small metal cleaning establishments, the chlorinated organics will continue to be the most important degreasing agents. They may well remain the largest single consumers of chlorine in the organic field. Because of their nonflammability, recoverability and freedom from residual odors these compounds will soon become the principal agents used in the dry cleaning field, especially in the larger establishments.

Consumption of chlorine by the chlorinated hydrocarbon family is now probably in the vicinity of 250,000-275,000 tons annually. In all likelihood postwar consumption, after an initial period of readjustment, will be approximately of the same general order.

PLASTICS AND RUBBERS

The last few years have seen a large increase in the use of chlorine in certain synthetic rubbers and synthetic rubber-plastics materials. One of the most important of these is Koroseal, a vinyl chloride derivative. Production of Koroseal has been increased to more than six times its 1940 capacity, and very recently the B. F. Goodrich Co. announced still another expansion program. More than 90 percent of this material is being allocated to direct military uses, chiefly for sheathing marine wire and cable and for waterproofing military clothing. It is certain that the present Koroseal capacity will not be in excess of that required to furnish postwar consumer demands. Even before military demands took up most of the outlet, new uses for the plastic were developing faster than production could be boosted.

Goodrich produces vinyl chloride by addition of hydrogen chloride to acetylene, but the hydrogen chloride is made from electrolytic chlorine. Approximately 0.62 lb. of hydrogen chloride goes into each pound of vinyl chloride. Goodrich's new chlorine plant at Louisville was built to supply this concern's expanded Koroseal operations.

Also important derivatives of vinyl chloride are the Carbide & Carbon plastic Vinylite and synthetic fiber Vinyon. In fact, vinyl and vinylidine resins are some of the most rapidly advancing in the entire plastics industry. Even though relatively unknown only a few years ago, production of polyvinyl chloride (92 percent vinyl chloride) resins alone now probably reach 35,000 tons annually; production of all vinyl resins (including vinylidine chloride, introduced in 1940) has been estimated at over 50,000 tons. It is difficult to estimate the chlorine annually going into this class of resins, but it is almost certain to exceed 30,000 tons. In fact, the entire production of one of the country's largest single chlorine plants goes almost entirely into production of vinyl compound and ethylene glycol. Yet these resin materials have actually just begun to make their way into the industrial world.

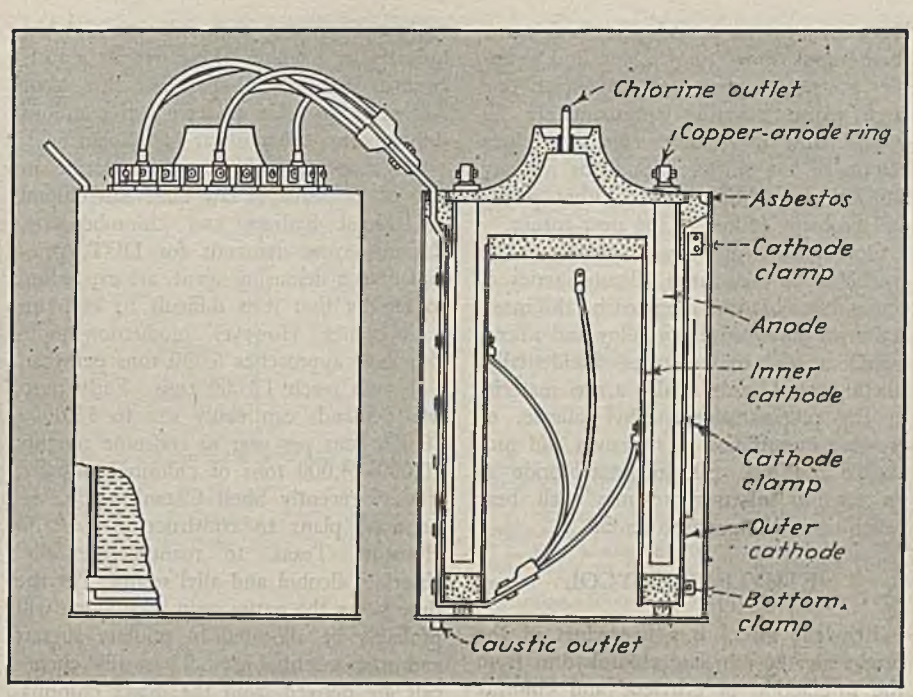
Ethylene dichloride, made by reacting chlorine with ethylene or with ethane, is an important fumigant, solvent and intermediate for ethylenediamine. Its most important reaction, however, is with sodium polysulphide to form the synthetic rubber Thiokol, of which probably some 60,000 tons are produced annually.

Neoprene is indirectly a chlorine derivative, since it is made from chloroprene which, in turn, is a product of the reaction of hydrogen chloride on vinyl acetylene. Chloroprene contains almost 40 percent chlorine; annual production of Neoprene rubber is in the vicinity of 52,000 tons.

Of considerable interest and promise at this time is a recently developed rubber-like material, as yet unproved commercially, that may become one of the major single consumers of chlorine, since it is said to contain 35–40 percent chlorine.

Before the war, chlorinated rubber was widely used in many paints, varnishes and plastics. Of more importance at this time are the chlorinated paraffins, which have been widely adopted by the military forces as the base for impregnated compositions for treating canvas duck and other textile materials to make them flame resistant, waterproof and mildew-proof. Production capacity of these chlorinated paraffins has expanded greatly since the beginning of the war; there are reasons to believe that this expanded use will extend into the postwar pentad, chiefly for fabric impregnation, plasticizers, lubricating oil additives (such as Standard's Paraflow), and to a certain extent even as a lining for food containers (substitute for tin) and as a corrosion-resistant paint for chemical processing equipment. Chlorinated paraffins usually contain 43–70 percent combined chlorine.

Most single propitious wartime development in the entire resins and plastics field is the recent commercialization of the silicone series of resins by Dow Corning Corp.



Latest improvement in the Vorce cell is the addition of an extra cathode

Performance of the Double-Cathode Vorce Cell

Percentage of caustic soda	8.607
Percentage of salt	15.79
Percentage of sodium carbonate	0.115
Percentage of sodium chlorate	0.026
Percentage of chlorine in gas	98.95
Percentage of carbon dioxide	0.7
Amperes per cell	1.600
Average volts per cell	3.3
Current efficiency, percent	94–97
Power efficiency, percent	65.5–68
Kwh. per lb. caustic soda	1.059

Developed over a period of several years, these resins show tremendous and versatile postwar applications. At least one large plant, covering approximately 20 acres, is now being constructed to produce certain of the silicone resins for military and other essential needs. Other plants will probably follow in the near future.

One of the primary raw materials in the synthesis of the entire silicone series is silicon tetrachloride, prepared by the interaction of chlorine, silicon alloy and silicon carbide at high temperatures. Incidentally, silicon tetrachloride is also a raw material in the preparation of ethyl silicate, of growing importance in adhesives and protective coatings. Silicon tetrachloride as an organic intermediate may well bear watching in the postwar pentad.

ETHYLENE GLYCOL

Ethylene glycol is a byproduct of the production of ethylene chlorohydrin from the interaction of ethylene and chlorine water, probably the most prolific reaction in all industrial organic chemistry since it serves as the basis of a line of well over fifty commercial organic products. The firm of Carbide & Carbon Chemicals Corp., second largest chemical firm in this country in respect to capitalization, is to a large extent based upon this fundamental reaction of chlorine water with ethylene gas. Some of the more important end products include ethylene glycol (Carbide's Prestone), ethylene oxide, dichlorodiethyl ether (by 1938 used in the Chlorex process as the solvent in 13 percent of the solvent-refined lubricating oils in this country), Carbitols, malonic acid, ethylene diamine and other amines, indigo, cellulose solvents.

Most important of these, tonnage-wise, is the antifreeze and coolant ethylene glycol, production of which has more than doubled since 1940 by the entrance of new producers into the field. During the war, demand for ethylene glycol has been particularly heavy as a coolant in certain liquid-cooled airplane engines and in recoils of anti-aircraft guns. After the war it will probably retain a considerable use in civilian aviation as well as resume its importance as an antifreeze for automobiles, the use of which has been largely curtailed during recent years although as much as 20 million gallons may be so used this year. The manufacture of ethylene glycol requires a considerable tonnage of chlorine. One large plant alone furnishes about 100,000 tons of chlorine annually to be used almost exclusively for ethylene glycol and vinyl compounds. Recently, propylene glycol has shown promise of breaking into postwar markets in a substantial way.

MORE NEWCOMERS

Of all the insecticidal developments during the past half century, dichlordiphenytrichlorethane (DDT) has caused most excitement among entomologists and the industry as a whole. Most recent reports confirm the earlier hopes that this agent will probably prove to have a tremendous influence on the postwar insecticide field.

DDT requires the use of chlorine in two of its principal raw materials, chloral or chloral hydrate and chlorobenzene. Present Army demands for DDT, principally as a delousing agent, are expanding so rapidly that it is difficult to keep up with events. However, production probably now approaches 6,000 tons per year, will soon reach 12,000 tons. Early postwar demands can easily rise to 15,000–20,000 tons per year to consume roughly 10,000–14,000 tons of chlorine annually.

Very recently Shell Chemical Co. announced plans to construct a plant in Houston, Texas, to manufacture allyl chloride, alcohol and allyl resins. For the time being the entire resin production will probably be allocated to military aircraft and other essential uses. These allyl chemicals are derived from the direct chlorination of propylene. Incidentally, the allyls are intermediates in the preparation of the monochlorohydrin, from which synthetic glycerine can be produced by hydrolysis. Propylene glycol is another potentiality. Propylene chloride derivatives may well bear a long-range postwar watching.

DD, Shell's new soil fumigant that has certain advantages over other fumigants and shows promising postwar possibilities, is a mixture of 1,3-dichlorpropylene and 1,2-dichlorpropane. It is obtained as a byproduct in the manufacture of allyl chloride.

Recently, dichlorostyrene and polychlorostyrene, new materials developed for high frequency electrical insulation and other uses, have been placed under allocation. None of these materials are now allowed for civilian use. Their commercialization is too recent to allow postwar evaluation, yet the concensus of opinion seems to agree that these resinous materials have promising possibilities.

In the same category of postwar unknowns is the status of magnesium chloride, recently being discussed in favorable terms. Certainly there is plenty of opportunity, insofar as productive capacity is concerned, for this chemical to prove its mettle and merits.

DuPont Freons, particularly Freon-12 or dichlorodifluoromethane, have been causing some speculation in serious chlorine circles. Freons are made from carbon tetrachloride, chloroform or hexachlorethane.

Freon 114 is used to produce the low temperature of —112 deg. F. required in the manufacture of Neoprene. Freons 13, 14 and 22 are used in the quick freezing processes for food (hence have potential postwar possibilities) and in the dehydration of blood plasma.

Most of the excitement, however, has been caused by recent developments in the use of F-12. Latest estimates place civilian requirements of this chemical for refrigeration and for air conditioning purposes at approximately 8,000–10,000 tons annually. Present production has been placed at about 28,000–30,000 tons annually, equivalent to roughly 15,000 tons of chlorine.

One of the largest demands for Freon at the present is in the aerosol insecticide bomb, containing 90 percent Freon, being used in the fight against malaria by the armed forces. This principle of aerosol dispersion of insecticides is promising postwar-wise in spite of most arguments to the contrary; if Freon continues to be used as the dispersing agent this will mean an appreciable indirect use of chlorine.

MISCELLANEA

Some of the other relatively new uses of chlorine in industrial organic syntheses include those that are themselves minor yet help to make this chemical so important in an overall picture. Synthetic vitamins, for instance, are very small in tonnage; yet it has been estimated that these chemicals require over 2,500 tons of chlorine and 4,000 tons of caustic soda annually. Because of the generally low yields, these raw materials are considerably in excess of the finished products. Certain sulfa drugs require considerable chlorine in the form of chlorosulphonic acid.

With the increasing emphasis on organic compounds, such chlorine-introducing chemicals as sulphuryl chloride, thionyl chloride, sulphur dichloride and sulphur monochloride have been receiving attention.

Not to be overlooked, of course, are the possibilities of foreign markets, particularly for chlorine. Latin American demands, it is believed by many, will be of a magnitude to encourage cultivation. China is another possibility, and the rehabilitation of Europe may even require American chlorine for a time. There are also interesting possibilities in the dismantling of surplus productive capacity and shipping this abroad for reassembly. Russia, it is reported, has already contracted for a 200-ton chlorine plant to be delivered under Lend-Lease after the war. Other similar moves may follow.

Postwar-wise, the caustic-chlorine industry can remain in a healthy state of production and competition provided that government-owned facilities cease operations immediately and with finality just as soon as private plants are in a position to supply all demands. Competition for markets will certainly be keen, maintaining prices at low levels, stimulating new uses and keeping the industry on its toes.

Reprints of this report are available at 25 cents per copy. Address the Editorial Department, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

PLANT NOTEBOOK

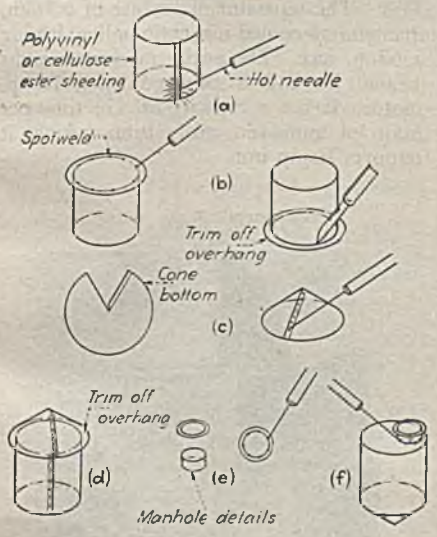
(*Continued from page 114*)

the resin sheeting, holding it as a cylinder between thumb and forefinger with slight overlap of the ends, and welding in spots along the overlap with the heated point of the welding tool, as in sketch (a). Experience has shown that the tool temperature is quite critical. Heating the needle point to red heat in a bunsen burner or kitchen gas flame and allowing it to cool just below redness before using gives the best results with thin sheeting.

The flat top is put on the kettle by spot-welding a slightly oversize piece on top of the cylinder and trimming off the overhang as in (b).

The conical bottom is made up by cutting out a piece of sheeting as sketched and spotwelding the seam, as in (c). The slightly oversize cone is then fastened to the cylindrical portion in a manner similar to the flat top and the overage trimmed off (sketch d). A manhole with flange is made up and welded on the kettle top as shown in (e) and (f).

With practice other, more complex pieces of equipment may readily be built up from simple geometric shapes. If it is desired to connect pieces to form a complete plant, thin plastic rod may be welded



Steps in fabricating a miniature reaction kettle from plastic sheeting

together to form a supporting framework. Plastic tubing may be used to simulate piping connecting the pieces of equipment.

In addition to its value for display purposes such an unit may be used for work-simplification studies.

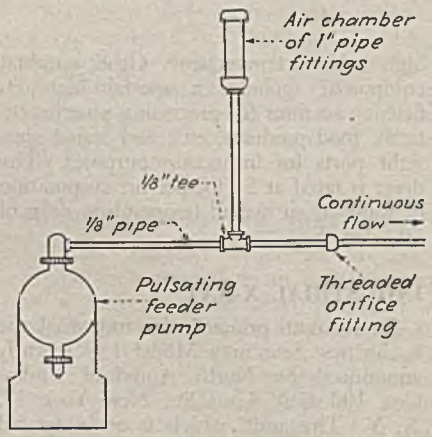
DEVICE FOR SMOOTHING FLOW FROM A FEEDER PUMP

GEORGE TAUTH

Chemical Engineer
Johnson & Johnson
New Brunswick, N. J.

IN THE metering of small quantities of liquid from a chemical feeder pump, the discharge was found to occur in pulsations corresponding to the piston strokes. The type of feed desired was a uniform, continuous flow. Adjustment of the piston stroke length did not give a satisfactorily smooth flow, and in order to secure this the device shown in the accompanying sketch was resorted to.

This consists of an air chamber made up of pipe fittings, and an orifice fitting



Air chamber and orifice installed on pulsating feeder pump

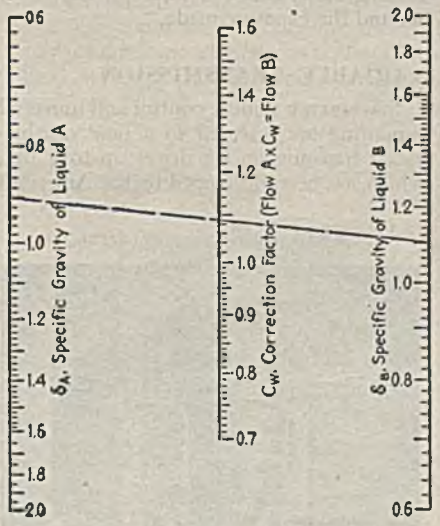
in the line from the pump discharge head. The air in the chamber is compressed on the compression stroke of the pump, and its expansion during the return stroke keeps the liquid flowing. The function of the orifice is to restrict the liquid flow and hence make the air chamber effective.

ROTAMETER CONVERSION CHART FOR LIQUID WEIGHTS

D. S. DAVIS

Wyandotte Chemicals Corp.,
Wyandotte, Mich.

WHEN a rotameter is used to measure the weight rate of flow[3] of a liquid other than that for which it was calibrated, a conversion factor must be employed. In



Rotameter conversion nomograph for liquid weights

the case of Stabl-Vis and Ultra Stabl-Vis rotameters the factor, C_w, for multiplying indicated weight rates of flow of liquid A to obtain weight rates of flow of liquid B is given by the expression[2],

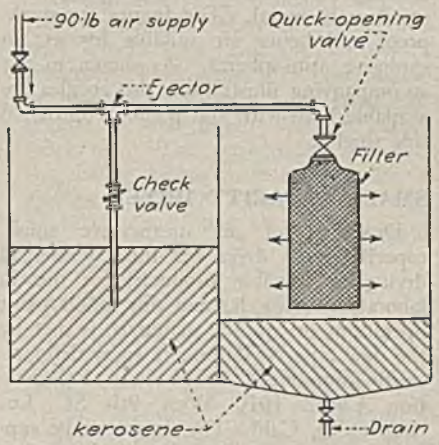
$$C_w = \left[\frac{\delta_B\,(\delta_f - \delta_B)}{\delta_A\,(\delta_f - \delta_A)}\right]^{0.5}$$

where δ_A = specific gravity of liquid A
δ_B = specific gravity of liquid B
δ_f = specific gravity of the float.

The nomograph, which permits rapid and accurate solution of the equation for the case of stainless steel floats for which $\delta_f = 7.92$, was constructed by methods previously described[1]. The index line shows that indicated weight rates of liquid A having a specific gravity of 0.90 should be multiplied by 1.09 when the rotameter is used for liquid B having a specific gravity of 1.10.

REFERENCES

1. Davis, D. S., "Empirical Equations and Nomography," p. 104, 1st ed. McGraw-Hill Book Co., Inc., New York, N. Y., 1943.
2. "Theory of the Rotameter," Sec. 80-A, Fischer & Porter Co., Hatboro, Pa.
3. For a nomograph for correcting *volume* rates of flow, see D. S. Davis, Rotameter Conversion Nomograph for Liquid Volumes, *Chem. & Met.*, 139, Nov. 1943.



Air-pressure cleaning tank for oil filters

SIMPLE CLEANER FOR OIL FILTERS

P. H. LAWRENCE

B. F. Goodrich Co.,
Louisville, Ky.

OUR PROBLEM was to simplify and improve the cleaning of oil pressure unit Purolator filters. Kerosene blown through the filters backwards seemed to be the best way to do the job, but it was messy and inefficient when done with only a bucket of kerosene and an air line.

Consequently, a small tank was built and fitted out as illustrated in the accompanying drawing. An ejector in the air line picks up kerosene and feeds a spray of air and liquid continuously through the filter unit when the latter is pushed up against the quick-opening valve shown over the right-hand tank. This effects a thorough cleaning job in a matter of moments.

The ejector is simply constructed of pipe fittings. It consists merely of a ½-in. tee through which an ⅛-in. nipple extends, being brazed to the inside of the nipple at the up-stream side. The air line is of ½-in. pipe, and the kerosene suction line, of ¼-in. pipe.

PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

ACETATE SAFETY GOGGLES

Two NEW acetate safety goggles, said to be extremely light in weight without sacrifice of strength, have been announced by the American Optical Co., Southbridge, Mass. These goggles were developed for general industrial use after extensive experimentation. They are designed for accurate fit and are said to be suitable both for workers wearing non-prescription safety glasses and for those with defective eyesight who must wear protective lenses ground to their own prescription. Being made without metal, the frames are particularly suitable for workers having skins sensitive to metal. The frames are spark-proof and hence are suitable for use in explosive atmospheres. As shown in the accompanying illustration, the goggles are available both with and without ventilated side shields.

SMALL CAPACITY DRYER

DEMAND for an inexpensive small-capacity spray dryer for the commercial drying of valuable products, for use in laboratory research, and for pilot plant operations on specific materials, is met by the new type N Turbulaire spray dryer recently announced by Western Precipitation Corp., 1016 West 9th St., Los Angeles 15, Calif. The dryer can be supplied in black iron, stainless steel or other alloys and includes as standard equipment an electric heater, a 4-ft. desiccator with cone bottom and hand-operated mechanism for sweeping surface accumulations from the conical section, a Multiclone collector, fan, bag house and control instruments, all mounted on a single frame for maximum capacity and ease of installation. Only electrical, compressed air and feed line connections need be made. The entire assembly occupies a floor space of 5 x 9⅔ ft., with a height of 10½ ft.

In order to gain maximum operating flexibility, optional direct or indirect type heaters are available while the remaining equipment can be designed to meet special needs. In addition, the desiccating chamber is provided with a secondary inlet for introducing tempering air at any desired high or lower temperature. Other optional equipment includes a special high efficiency air filter for processing pharmaceuticals, food products, etc., and sealed glass sight ports for inspection purposes. The dryer is rated at 25 lb. per hr. evaporation of water at an overall temperature drop of 300 deg. F.

New types of acetate goggles

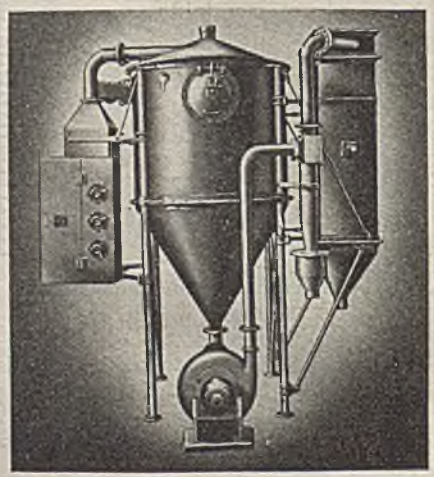
INDUSTRIAL X-RAY

DEVELOPED primarily for industrial use is the new Searchray Model 150 recently announced by North American Philips Co., 100 East 42nd St., New York 17, N. Y. This unit, which is of integrated construction, may be employed either in the laboratory or as part of a production line for the examination of formed metal or molded plastic parts and for the detection of foreign materials in packaged products. The unit gives the benefit of X-ray analysis without the expense of lead lined rooms. All that is necessary to put it into operation is to connect it to a 220-volt, 60-cycle, single-phase power line. It is claimed that inexperienced operators can employ it successfully within a short time. The unit is ray-proof, shock-proof, and self-contained, with all adjustments and operations made from one position. For non-destructive internal examination the object is placed in a specimen compartment. The specimen can then be positioned by means of a built-in fluoroscopic screen before making the radiograph. With the object in desired position, the proper voltage is selected from a direct reading scale, the film inserted, the timer set and the exposure made.

VARIABLE TRANSMISSION

SIMPLIFIED remote control and universal mounting are featured in a new variable-speed transmission for drives up to 1 hp., which has been developed by the American Pulley Co., 4200 Wissahickon Ave., Philadelphia 29, Pa. As is shown in the accompanying illustration, the remote control is accomplished through a flexible shaft, making it possible to mount the unit anywhere in or on the machine and place the control in a safe, handy location. The transmission, which is known as the Speed-Jack, is of the double-cone-pulley type. The movement of the flanges forming the pulleys is controlled mechanically and not by belt pull so that the Speed-Jack may be mounted vertically, horizontally or in any other position best suited to the equipment. The unit utilizes V-belts to provide stepless controlled speed through a 3 to 1 ratio. The flanges themselves are of plastic, steel faced for wear and lightness.

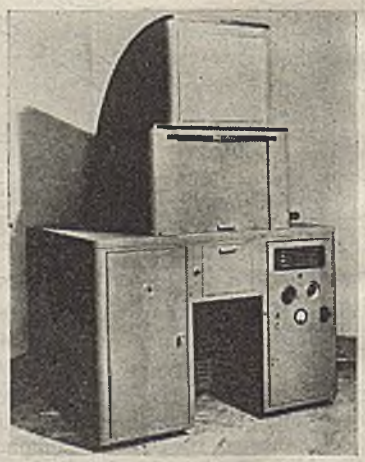
Small capacity spray dryer



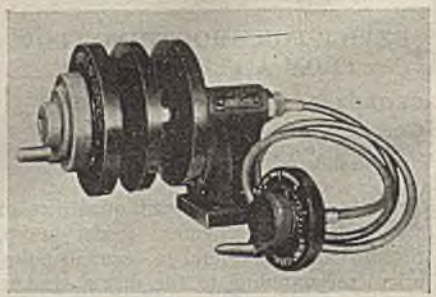
PULLEY SEPARATOR

WHAT is said to be the largest magnetic pulley ever incorporated into a magnetic separator has recently been shipped by the Dings Magnetic Separator Co., Milwaukee, Wis. The separator makes use of a 36-in. diameter air-cooled magnetic pulley, having a 63-in. face. The entire machine weighs 17,000 lb. and is powered by a 10-hp. motor. It has a capacity of 450 tons per hour of mine-run coal, from which it removes tramp iron.

Industrial X-ray unit



Remote controlled variable-speed transmission



RESPIRATOR FACELET

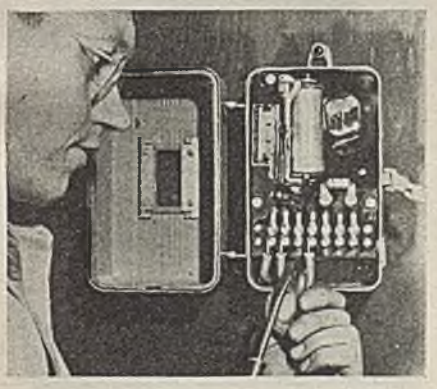
PROTECTION against certain dust, fume and gas hazards is facilitated, according to American Optical Co., Southbridge, Mass., by use of the knitted cotton facelets which are now available for its R-1000 respirator and most other standard respirators. These facelets are said to make any respirator more comfortable to wear because they are soft against the skin, absorb perspiration and give the face a certain measure of protection against dust and dirt. Since they thus help to prevent skin irritation they are said to eliminate need for protective creams to avoid face chapping. Since they are designed to make industrial operations more comfortable, they are claimed to be especially valuable for workmen handling products such as cement, lime, gypsum and other chemicals, as well as for those spraying paint. The new facelets can be ordered separate from the respirators, being packed 50 in a box. They can be washed and used over and over again.

ELECTRONIC RELAY

AMPLIFICATION of the very limited currents transmitted by delicate control contacts is possible with a new electronic relay recently announced by the Industrial Control Division of General Electric Co., Schenectady, N. Y. The relay is also suitable for detecting currents in high resistant circuits and can be operated by any material having a resistance of from zero to 500,000 ohms or even higher. Hence, it is suitable for controlling liquid levels in tanks and boilers, sorting metallic parts by size, detecting broken threads in textile machinery and as a limit switch requiring extreme light pressure to operate.

R-1000 respirator equipped with facelet

New electronic relay



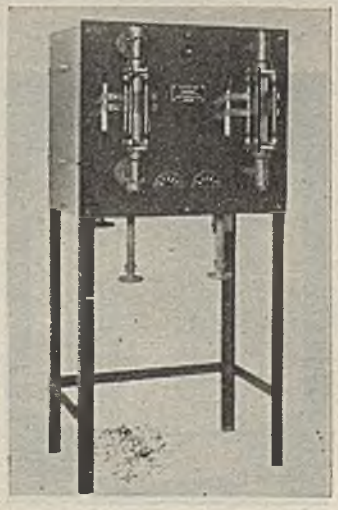
The unit is small and light in weight, consisting of a standard type electronic tube, a supply transformer and an electromagnetic relay, all mounted in a weather-resistant inclosure suitable for wall or machine mounting. In operation, the electromagnetic relay is kept energized as long as the controls connected to the input grid circuit of the electronic tube remain open. The instant these contacts close, the relay is de-energized. A built-in time delay device is provided to prevent chattering on momentary contact closure. The relay circuit can be used either to make or break a load circuit when the actuating contacts are closed.

ELECTRONIC FLOW CONTROL

LIGHT-CARRYING properties of Lucite plastic are employed in an interesting way in a new electronic flow controller recently announced by the Brooke Engineering Co., 4517 Wayne Ave., Philadelphia, Pa. The instrument, two of which are shown on a single panel in the accompanying illustration, consists of a rotameter, two photocells, the necessary electronic amplifying equipment and a reversing motor-operated valve controlling flow through the rotameter. Light is transmitted from an incandescent lamp through two curved strips of Lucite and projected through the rotameter tube into two corresponding Lucite strips which conduct the respective light beams to the two photocells. As long as the rotameter float is between the two light beams, the system is in balance and the valve position remains unchanged. If the flow changes and the float moves upward or downward by as little as 0.01 in., sufficient light is cut off from one phototube to cause the control to correct the flow in the proper direction. The control is compensated to prevent hunting or overtravel and the motor speed is proportional to the distance the float moves away from the control point.

This system of using two light beams, one above and the other below the float, compensates for changes in color of the fluid metered. Line voltage changes as great as plus or minus 10 percent are said not to affect the control. Failure of the lamp or one of the electronic tubes closes the control valve and sounds an alarm. The design is such that the float will be brought back to the normal position even if some wide fluctuation throws it outside the light beam. Adjustment is secured by moving the Lucite bars up or down in slots in the panel.

Electronic control applied to rotameter



DRY EXTINGUISHER

EXTINGUISHMENT of fires in flammable liquids as well as fires of electrical origin is the function of the new "All-Out" fire extinguisher which is being manufactured by the National Powder Extinguisher Corp., 50 Rockefeller Plaza, New York, N. Y. The extinguisher, which weighs 37 lb. fully charged and is said to be easily handled by both men and women workers, ejects a stream of dry chemical extinguishing agent which, when activated by heat forms a fire-smothering cloud over the flaming area at distances up to 18 ft. The cloud is said to have insulating qualities which help guard against reflash and also serve to deflect heat from the operator, permitting close range attack with greater safety and without heat discomfort. The chemical, a non-conductor of electricity, is said to be harmless to people as well as to delicate parts of machinery. The extinguisher and its extinguishing agent have been tested and approved by the Associated Factory Mutual Laboratories for use on burning oil, alcohol and gasoline fires.

PROTECTIVE CREAM

CLAD is the name given to the new line of protective skin creams developed in the laboratories of the B. F. Goodrich Co., Akron, Ohio, and now available from this concern. The creams are made in two types, for dry and for wet working conditions. The dry cream is as nearly neutral to the skin as possible, eliminating skin drying or any tendency to cause burning or irritation under prolonged use. It can be used to protect exposed portions of the body against dirt, grease, grime and other similar substances. The cream for wet use is made for protection where water and other dilute aqueous and mild chemical solutions are present. Although the use of protective creams is said not to be as effective as rubber gloves, it is claimed

New dry-powder fire extinguisher

nevertheless to assist workers greatly in reducing the hazards from dermatitis and in reducing "wash-up" time. It is suggested that such creams are particularly useful for workers drafted from the home and from white collar groups into industrial plants who find it more necessary to secure protection than experienced workers.

ELECTRONIC HEATER

DESIGNED primarily for the preheating of plastic preforms prior to molding, a new electronic power generator designated as RCA Model 2-B has been announced by the RCA Victor Division of Radio Corp. of America, Camden, N. J. This new unit, which is compact and self-contained as appears in the accompanying illustration, is said to be as automatic as a "pop-up" breakfast table toaster, and almost as simple to operate. Modifications are available for heating of other materials than plastic preforms, such as assemblies of wood veneer. Slightly smaller than a small electric refrigerator, the unit is streamlined and provided with a built-in heating electrode assembly in a chamber at the top. A wire-mesh screen which is closed over the heating chamber when in use insures safety for the operator without shielding the work from view. The cover automatically pops open and shuts off the power at the expiration of a predetermined heating interval, which is adjustable for each type of heating job. This heater is of the high-frequency dielectric type in which heat is generated within the material, rapidly and without heat transfer from an external source.

SPACE HEATER

HEATING of small structures and providing additional heat for limited areas is the function of a new small model of the Dravo direct-fired heater which has been announced by the Dravo Corp., Machinery Division, Heater Department, 300 Penn Ave., Pittsburgh. Pa. Capacities range from 300,000 to 850,000 B.t.u. per hour. Developed primarily for use by the armed forces at advance bases, the heater is now available for industrial use. It operates similarly to the company's other direct-fired heaters but is scaled down in size in keeping with its smaller output. Size has been reduced to floor space requirements of 5½ x 3 ft. The unit can be suspended from the wall if desired and can burn either gas or oil, these fuels being readily interchangeable with substitution of suitable burners.

High-frequency heater for plastic preforms

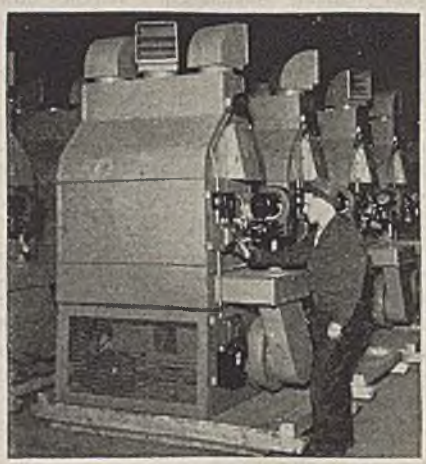
WIND-ACTUATED EXHAUSTER

POSITIVE VENTILATION, regardless of of wind direction or velocity, is claimed for the new Agitair wind-actuated exhauster, made without moving parts, and recently offered by Air Devices, Inc., 17 East 42nd St., New York 17, N. Y. The unit, made in many standard sizes and in special types required by particular applications, is weather-proof and light-proof. It is said to provide positive elimination of down-draft. If desired, special finishes are available for corrosive use.

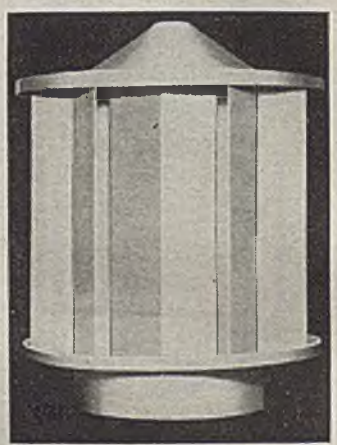
BIN DISCHARGER

TO FACILITATE the discharge from bins and storage hoppers of non-free-flowing materials, Stephens-Adamson Mfg. Co., Aurora, Ill., has introduced the circular Redler bin discharger which is made with a circular top bolted directly to the round opening of a circular bin or to a short adapter attached to a rectangular bin. Fine bulk materials handled in bins generally give trouble due to bridging and many methods have been resorted to, including pounding and poking to insure discharge. A different principle is employed in the new discharger in that the bin opening can be made large enough in diameter to prevent bridging. A cone extends up into the material and induces it to flow freely into all parts of the round trough below. The cone is fastened to a circular disk which is slowly rotated by a drive mechanism. Redler U-type flights are fastened at spaced intervals to the edge of this disk and travel in the inclosed trough, conveying material around the trough to a desired discharge point. The discharge opening is sheltered by a small roof above the flights which prevents uncontrolled outrush of material. According to the manufacturer, this construction insures a constant even-controlled discharge from any type of bin.

Small capacity industrial space heater



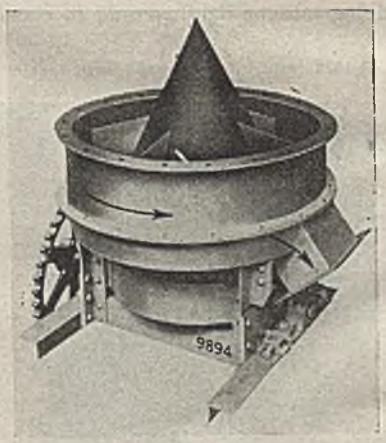
New wind-actuated exhauster



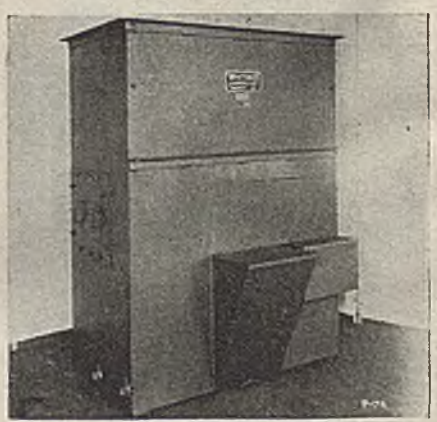
DUST SUPPRESSOR

TYPE GA-Hydro-Clone is the designation of a new and simple dust suppressor which is now being offered to industrial plants by Whiting Corp., Harvey, Ill. The unit uses no filters, exhaust fans or other moving parts but employs compressed air, generally available in the plant, to create a powerful suction on hoods surrounding the dusty operations. The dust so collected is then mixed with water. The dust is knocked out of the air stream and settles in the bottom of the unit as a sludge which is easily removed through a clean-out opening. When compressed air is not available, a centrifugal pump is furnished to circulate the water which is maintained at a constant level by means of a float valve.

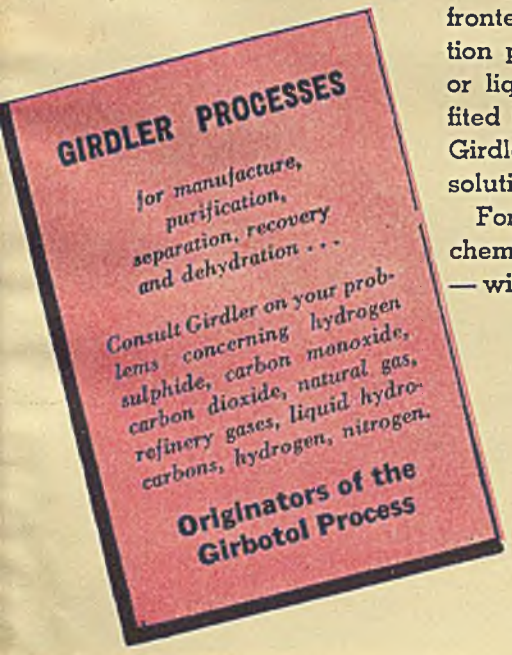
Circular Redler bin discharger



Wet-type dust suppressor



Profit by GIRDLER'S Gas Processing Experience!



Many industrial concerns, confronted with production or purification problems of gaseous mixtures or liquid hydrocarbons, have profited by "taking a straight line" to Girdler — the shortest distance to solution of *your* problem!

For years, the Girdler staff of chemical and structural engineers — with the most modern research and development facilities at their command — have proved their ability to furnish practical, speedy and economical answers to even the toughest gas processing problems. We will be glad to receive an inquiry from you on *your* problem — no matter how urgent or seemingly difficult it may be, it will receive prompt attention.

The GIRDLER CORPORATION
Gas Processes Division · Louisville 1, Ky.

CHEMICAL ENGINEERS AND CONSTRUCTORS

STAPLE FIBER PRODUCTION

THE viscose rayon process was discovered by the English chemists, Cross and Bevan in 1892, and spinning of yarn was developed a few years later. Courtaulds, Ltd., was the first to spin commercial quantities, and its offspring in this country, the American Viscose Corp., started in 1910. In the early years the entire output was filament yarn but more recently an important portion of the production has been in the form of staple fiber, which has been made in its plants at Front Royal, Va., Nitro and Parkersburg, W. Va.

Production of rayon staple fiber is comparatively simple. Wood pulp serves as the source of cellulose. Large sheets are placed on edge in long vats and are steeped for 2 hr. in caustic soda. The reaction removes impurities and forms alkali cellulose. Excess liquor is drained from the pulp and traces are forced out by a hydraulic ram. The soft, damp sheets are placed in a machine which tears and beats them into crumbs. They are then aged for 48 hr. The crumbs are placed in a churn and liquid carbon bisulphide is added. The mixture is slowly revolved for a few hours and cellulose xanthate is formed. It is dumped into a mixer containing a weak solution of caustic and rapidly revolving blades beat the substance until it becomes one uniform mass. This mixing is the final step in converting the cellulose to the liquid form called "viscose." It must be aged and thoroughly filtered before being spun into threads. The viscose solution is strongly alkaline and hardens upon coming into contact with acid, thus reverting the cellulose to a solid form by neutralizing the alkali.

Differing from rayon which is twisted into yarn as the filaments leave the spinneret, rayon staple fiber is made by drawing the filaments from many spinnerets together without twisting and cutting them into definite short lengths. The length and diameter of these fibers can be varied, according to the purpose for which the rayon will be used. The short lengths are washed, desulphurized, bleached, given a finishing bath, and finally dried. The rayon staple fiber is then ready to be shipped.

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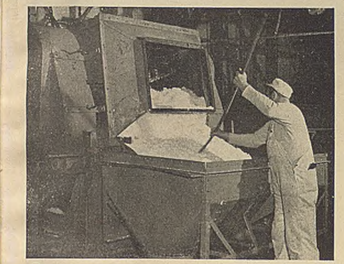
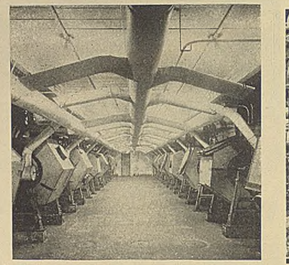
A *Chem & Met* FLOW SHEET

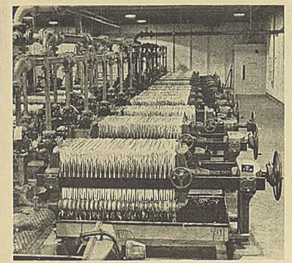
1 Storage building for wood pulp which serves as the source of cellulose for viscose rayon staple fiber production



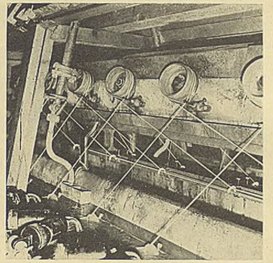
3 Soft, damp sheets of alkali cellulose are placed in this machine and torn and beaten into fine crumbs



5 In a revolving churn crumbs are mixed with liquid carbon bisulphide to form xanthate

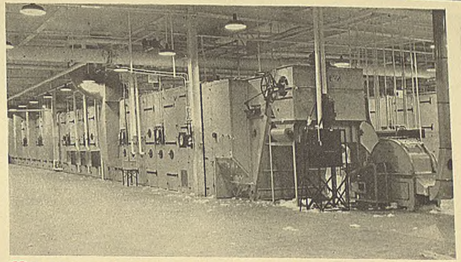


7 Before leaving the aging cellar for the spinning rooms, viscose is filtered several times

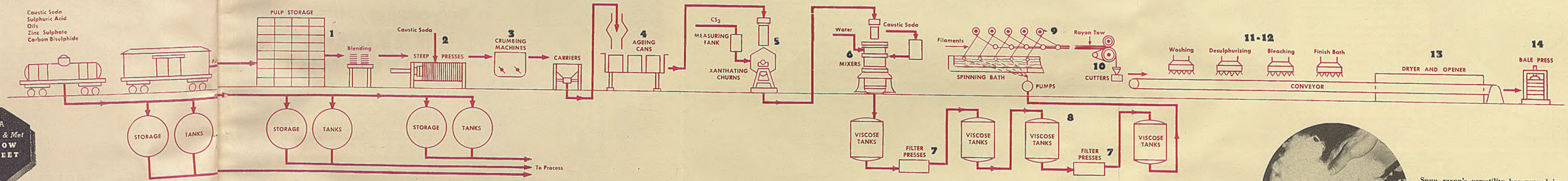


9 The tow is made by drawing the filaments from many spinnerets together without twisting

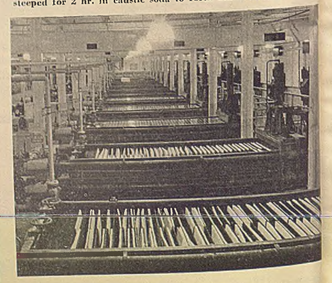
11 The short lengths are washed, desulphurized and bleached before drying



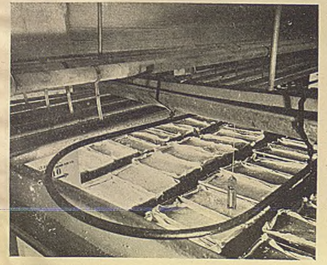
13 The drying and conditioning of the staple fibers of rayon are carried out in long tunnel dryers. At the far end of the dryer is an "opener" which fluffs-up the fibers



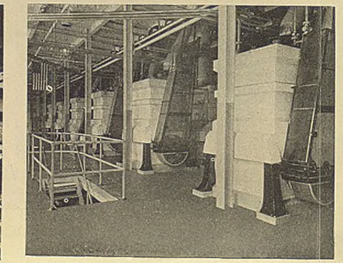
2 Large sheets of pulp are placed on edge in long vats and steeped for 2 hr. in caustic soda to form alkali cellulose



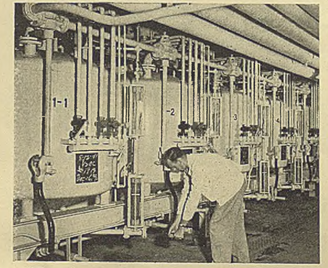
4 Crumbs are aged for about 48 hr. in large cans placed in the aging cellar. Time and temperature are controlled



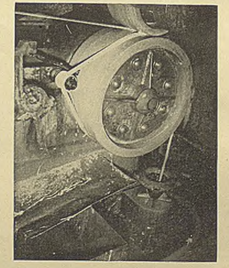
6 Xanthate is dumped into a mixer containing a weak solution of caustic soda to form liquid viscose



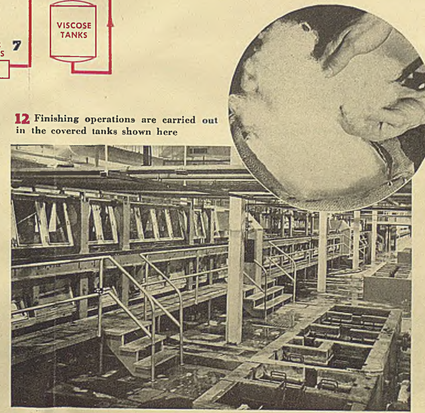
8 Aging tanks in a cellar of one of the American Viscose Corp.'s plants making staple fiber



10 Tow of untwisted filaments is cut into short lengths of rayon staple fiber

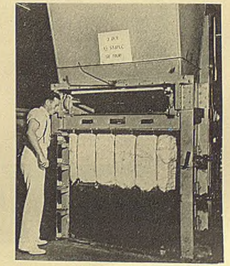


12 Finishing operations are carried out in the covered tanks shown here



Spun rayon's versatility has proved important factor in broadening textile field

14 Staple fiber is shipped in bales to be converted into spun rayon yarn



NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

CONTENTS

Light weight and with extremely low heat conductivity, a foam plastic has been developed by General Electric Co., Pittsfield, Mass. A cubic foot of this phenolic plastic weighs only 1½ to 2 lb.

NON-SKID COATING

From the Minnesota Mining & Mfg. Co. comes announcement of a non-skid airplane walkway coating that is less than one-fifth the weight of rubber matting adheres to metal, plywood and painted surfaces, remains flexible at temperatures ranging from —20 deg. F. to plus 160 deg. F. and is resistant to fire, gasoline, aromatic fuel, salt water, oils and hydraulic fluid and oxidation. Made of Thiokol and ground cork, this surfacing material is applied at room temperature with an open nozzle paint spray gun. It can also be applied with a knife or brush and patches so constructed blend well with the original coating.

ABSORBENT PAPER FELT

Introduced recently, Fleecemat is a highly absorbent felt made of a blend of fibers which is said to give the sheet excellent resiliency. It is a product of William A. Hermanson & Co., Boston 16, Mass. Fleecemat is used to pack between sheets of plastic, the dimensional stability of which is affected by atmospheric changes in temperature and humidity. It acts not only as an insulator, to prevent rapid changes in temperature affecting the sheets, but also provides an absorptive means of leveling out the humidity changes. It also acts as a resilient cushion to prevent damage to the face of the plastic, and acts as a shock absorber as well. The unusual high absorbent capacity of the fabric makes it an excellent impregnating medium; both thermoplastic and thermosetting types of plastic in fluid form can be impregnated into the sheet, providing good impact strength. The material is available in sheets or rolls of any size desired, from 0.012 to 0.040.

ALCOHOL-SOLUBLE RESINS

A group of alcohol-soluble resins, known as polyamide resins Series ED and DET, are in commercial production of General Mills, Minneapolis. The ED series, made by reaction of the dimerized and trimerized linoleic and linolenic acids of soybean oil with ethylene diamine, are hard, dark amber colored products capable of hot melt or solvent application. They are finding application in protective coatings for wood and metal, binders, gaskets and can sealing compounds where their alcohol solubility, fusibility, thermal stability and grease and alkali resistance can be used to advantage. The ED series resins are available in three forms, hot melt compounded, hot melt uncompounded, and solvent type uncompounded. The Series DET are thick, viscous adhesives available in a range of viscosities. The polyamide resins were first produced by the Northern Regional Research Laboratories, Peoria, Ill., under the name of NORELAC.

HIGH TEMPERATURE VARNISHES

Two types of silicone impregnating varnishes made by Dow Corning Corp., Midland, Mich., are useful in the manufacture of high temperature stable electrical equipment. One should provide a highly

flexible coating which retains flexibility under adverse operating conditions. The other should be convertible by heat to form a hard solid throughout relatively deep sections. On conversion, it can be reasonably brittle but it should not soften with heat or tend to flow under the centrifugal forces operating in rotating parts. Since this combination of properties is often difficult and impractical to handle in a single material, Dow Corning offers two resins to cover the use requirements. These resins, designated as Dow Corning 993 and Dow Corning 2052, are now in commercial production. No. 993 is a heat curing, high temperature stable silicone varnish recommended for (1) impregnating motor stators, transformer coils and other non-rotating coils; (2) varnishing Fiberglas or asbestos served magnet wire; (3) varnishing Fiberglas, mica and asbestos electrical insulating cloths, tapes, sheets and sleeving. No. 2052 is a silicone electrical insulating varnish which requires much lower curing temperatures than previously available silicone varnishes. It can be set with heat to form a solid structure which will not liquefy or soften even at a temperature of 200 deg. C. It was specifically developed for impregnating rotating equipment which operates at high temperatures.

PLUG COCK GREASE

One of the new silicone products is known as Dow Corning plug cock grease, whose unusual physical properties make it an ideal grease for lubricated valves and plug cocks. It is particularly useful in plug cocks which must operate at elevated temperatures or be subjected to corrosive chemicals. This grease reduces the maintenance and replacement costs of plug cocks in chemical service. It also provides a nearly universal plug cock lubricant, thus removing the need for keeping in stock a grease for every type of chemical service condition. It is made by Dow Corning Corp., Midland, Mich. It has a consistency of vaseline at normal temperatures, remains a soft grease and will not harden or melt over a temperature range from —40 deg. F. to more than 500 deg. F. It is highly resistant to attack by acids, alkalis and oxidizing agents, minimizes the corrosion of metal plug cocks by keeping the corrosive liquid from contacting the metal surface, thereby promoting the continued free operation of the valve. The vapor pressure is so low as to be negligible even up to 400 deg. F. This contributes to the retention of its vaseline-like consistency at elevated temperatures. It also insures that volatile material from the lubricant will not contaminate the product being transported in the line. It has no corrosive action on metals and does not swell or deteriorate rubber, synthetic rubber or plastics.

Dow Corning 31 grease is for use in bearings that must function at very low temperatures and Dow Corning 41 is for use at temperatures up to 500 deg. F.

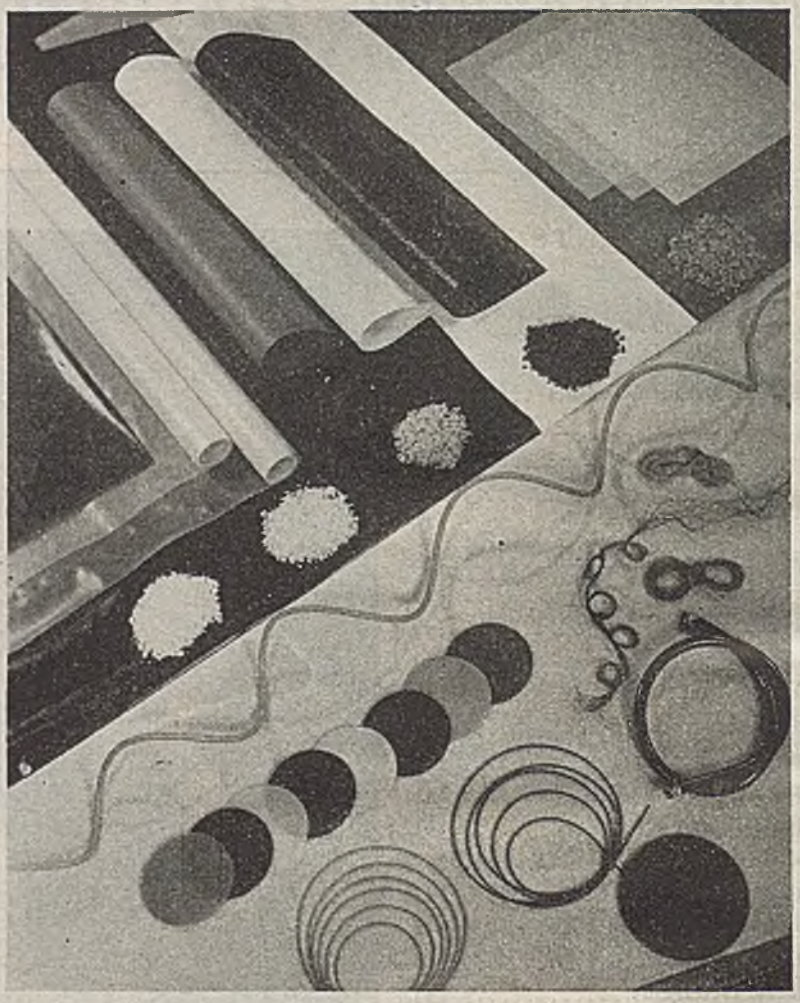
SILICONE FLUIDS

Dow Corning fluids are water white and are characterized by an extremely low rate of viscosity change with temperature, compared to petroleum oils of equivalent viscosity. They also have higher flash and fire points and a complete freedom from solvent or swelling effect on synthetic or natural rubber and on many kinds of plastics. They are not affected by oxygen under pressure at ordinary ranges of temperature. Since they are resistant to oxidizing solution, mineral acids, salts and alkalis, they have proved to be highly useful as an impregnant for asbestos packing and gaskets in chemical pumps.

Three series of fluids made by Dow Corning Corp., Midland, Mich., are available depending upon the temperature and viscosity range to be covered. Type 200 fluids are useful down to —40 deg. C. or up to 300 deg. C. and include medium through very high viscosity liquid silicones. They are non-volatile and possess flash points in excess of 600 deg. F. They are not miscible with alcohol, glycol, glycerin or lubricating oil, but will blend readily with most of the common organic solvents including light naphthas.

For extremely low temperature uses, Dow Corning type 500 fluids include liquids ranging in viscosity from that of water to medium viscosity fluids. They are all useful at temperatures down to —70 deg. C. and below. The very low viscosity fluids are distillable and have appreciable vapor pressures at room temperatures but higher viscosity fluids in this series are non-volatile and useful up to 200 deg. C.

There are five grades of Type 700 for high temperature lubrication.



Polyethylene plastics are available in a great variety of forms and shapes

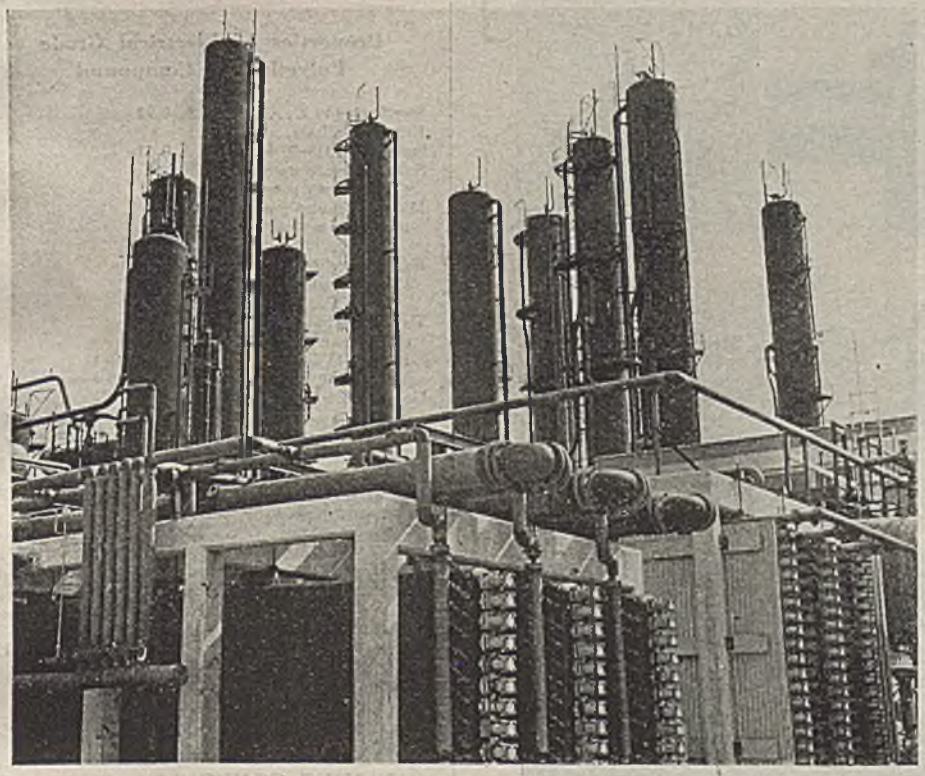
POLYETHYLENE PLASTICS

Polyethylene plastics are inherently flexible, translucent materials that possess unusual properties. They are entirely new materials, unique in the plastics field as well as in the industrial field. These plastics have excellent insulating properties. They are tough and resistant to shock. The amount of water they will absorb is inappreciable, while films of the material will not permit the passage of appreciable amounts of water vapor. In addition, polyethylenes soften at the unusually high temperature for thermoplastic materials of 230 deg. F., and remain virtually unaffected by temperatures 90 deg. below zero fahrenheit. A little over two years ago, the U. S. Navy learned that Carbide & Carbon Chemicals Corp., New York, N. Y., in collaboration with an associate company, Linde Air Products Co., had developed a high-pressure synthesis for a new material, polyethylene, and it was found that this material was suited to meet the Navy's requirements of an insulation for coaxial cable used in radar equipment. At the Navy's request, these two companies,

Questions we are often asked

ABOUT GLASS-LINED STEEL

How Do You Solve Heat Exchanger Problems That Involve Acid Corrosion?



WHERE CORROSIVE CONDITIONS EXIST due to strong acids, which may be at elevated temperatures and pressures, glass-lined heat exchangers, as developed by Pfaudler, provide the practical and efficient answer to a troublesome problem in heat transfer.

For example, at the Neches Butane Products Co. and at the Sinclair Refining Co. plant in Houston, Polymer heaters and coolers built of Pfaudler Glass-Lined Steel are in continuous service for the production of butadiene. Over 8500 feet of jacketed and unjacketed glass-lined steel pipe together with return bends carry a continuous stream of sulphuric acid and hydrocarbons without contamination, corrosion or undesired catalytic effect, at temperatures as high as 250°F, with demonstrated overload capacity.

Temperature and acid conditions are only two of the factors present, since pressures of 150 PSI are encountered in this service. New glass-lined flanges were developed to withstand this pressure. (Pfaudler also makes glass-lined pipe on special order for pressures up to and including 300 PSI.)

The heater sections, shown at the left of the photograph, are made up of steam jacketed 10 ft. lengths of glass-lined pipe, two lengths being joined end to end in 20 ft. passes. The cooler sections, at the right, are made up of similar unjacketed lengths of glass-lined pipe with cooling obtained by means of water cascading down the outside of the pipe banks. For smaller installations, it is often desirable to circulate water through the jackets in true counter-current flow. The sections of the three parallel banks are connected in series by means of glass-lined 180° return bends bolted to the pipe, utilizing lead shrouded asbestos gaskets.

Standard heat exchanger calculation methods are utilized in arriving at the proper sizes of units, taking into consideration the resistance offered by the glass lining. The flexibility of the double pipe or "hairpin" design enables us to offer units in a wide range of heat transfer surfaces and with various series or parallel series arrangements for heaters, coolers, condensers, etc. Sections may be added, removed, or rearranged as process conditions change.

Where you have a problem involving corrosive products, in heat transfer or in any other production process, let Pfaudler engineers bring their many years experience in these matters to work for you.

THE PFAUDLER COMPANY, ROCHESTER 4, NEW YORK
ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT
Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

working together, designed a plant to produce the material. By changing the conditions of manufacture the properties of the base resin can be varied to satisfy the needs of particular applications. At the present time only one grade of resin is being produced. Among the properties which can be varied are tensile strength, elongation at break, tear resistance, and brittleness temperature. The resin can be produced as clear translucent articles or can be formulated in a wide color range offering exceptionally higher luster. The plastics are so light that they will float on water. They may be extruded, molded, fabricated into sheets and film, or coated on to cloth.

Properties of Electrical Grade Polyethylene Compound

Specific gravity	0.92
Refractive index	
Specific heat (18–20 deg. C.)	0 53
Softening temperature, deg. C. (Transparency point)	105
Moisture diffusion constant (mg. $hr.^{-1}$ $cm.^{-2}$ mil^{-1} at 30 deg. C.)	0.023
Water absorption Percent weight gain, 100 hr. at 25 deg. C	0 03
Thermal conductivity cal $cm.^{-1}$ $sec.^{-1}$ $(deg. C.)^{-1}$ Range 0–15 deg. C.	0 81 x 10^{-4}
25–40 deg. C.	0 92 x 10^{-4}
Linear coefficient of expansion cm./cm./deg. C.	25 x 10^{-4} (above 115 deg. C.) Varies below 115 deg. C.
Tensile strength, lb. per sq. in.	1800
Elongation, percent	600
Impact strength, ft.-lb. $in.^{-1}$ notch	>3
Brittleness temp., deg. C.	Below minus 70 deg. C.
Dielectric constant, 50 mc.	2 29
Power factor x 10^{4}	30
Volume resistivity, Megohms-Cm.	$>10^{6}$
Avg. molecular weight	18 000 20,000
Heat of combustion, cal. $gm.^{-1}$	11 100 ± 15
Thermal diffusivity, $cm.^{2}$ $sec.^{-1}$	1.60 x 10^{-3} (0.15 deg. C.) Value is changing (15-25 deg. C.) 1 37 x 10^{-3} (25-40 deg. C.).

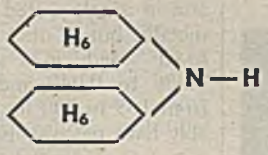
CAULKING COMPOUND

To meet naval ship construction and repair demands for a mixture resistant to salt air and water, acid and alkaline corrosion, Cordo Chemical Corp. of Norwalk, Conn., has produced Co Res-Co acid proof caulking compound. It is primarily a semi-solid form of the plastic coating Co-Res-Co. One of its applications is for pre-painting caulking jobs where chemical conditions of any kind are encountered.

CHAIN MODIFIER OR REGULATOR

Since it is no longer of value to the enemy, one of the secrets of success of the synthetic rubber program can be told. It is OEL, and called the "one essential ingredient." This chemical, extracted from a natural oil, acts as a regulator to control the growth and structure of the giant molecules which, in turn, determine the properties of the finished synthetic rubber. OEL, the chain modifier, or regulator, which governs the properties of the finished products, was produced by United States Rubber Co., New York, N. Y., long before Pearl Harbor. Proper control of the modifier governs the mixture to a point where polymerization is accomplished with chains of molecules of desired lengths. This consistency of production assures a

Your order for MONSANTO DICYCLOHEXYLAMINE will be filled immediately, whether you're in a war industry or not. Currently, supplies are ample and indications point to continued availability of this intermediate to *all* industries. Why not check into the possible applications of Monsanto Dicyclohexylamine to your present products, or think of it in connection with your long-range planning? Samples and prices sent promptly upon request on your company letterhead. The coupon below is for the convenience of those wishing a copy of our new booklet on the properties and uses of Monsanto Dicyclohexylamine. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri. District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal, Toronto.



MONSANTO DICYCLOHEXYLAMINE HAS THESE CHARACTERISTICS

Color: Clear colorless liquid.
Purity: 99% approx.
Crystallizing Point: 0.1°C.
Boiling Point: 255.8°C.
Specific Gravity: 0.916—0.920 at 15 5°/15.5°C.
Flash Point: 100°C.
Fire Point: (Sustained Combustion): 160°C.
Solubility: Slightly soluble in water. Soluble in all common organic solvents.

Dicyclohexylamine is a strong base, being stronger than ammonia. It forms salts with all acids and forms soaps with fatty acids.

MONSANTO DICYCLOHEXYLAMINE SERVES IN THESE APPLICATIONS

Starting Point or Component in:

1. Manufacture of Insecticides
2. Corrosion Inhibitors
3. Oil Additives
4. Emulsifying or Demulsifying Agents
5. Manufacturing Dyestuffs
6. Organic Syntheses

These suggested uses are for illustration and are not to be construed as recommending violation of any patent.

MONSANTO DICYCLOHEXYLAMINE OFFERS FUTURE POSSIBILITIES

While Monsanto Dicyclohexylamine is a thoroughly proved intermediate in various industries, its possibilities are by no means exhausted.

New applications, new processes, new products may be revealed by research conducted around Dicyclohexylamine and its uses. Our technical service men will be glad to work with you on such projects.

MONSANTO
CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Monsanto Chemical Company, Organic Chemicals Division
1700 S. Second St., St. Louis 4, Mo.
Without cost or obligation to me, please send a copy of the new booklet on Monsanto Dicyclohexylamine.

Name _____
Company _____
Street _____
City _____ Zone _____
State _____

standardized mixture at all times and permits the manufacture of completed tires, tubes and other finished articles of war to meet stringent usage tests. Since this rubber program for GR-S has been initiated, other modifiers have been found but to date OEL is still being used in practically all manufacture of Buna S synthetics, according to the company.

FLAMEPROOF RUBBER CLOTH

DESIGNED to solve several major problems which have faced the aircraft industry, a glass, flameproof, synthetic rubber coated cloth has been developed by the United States Rubber Co., New York, N. Y. Tensile strength at abnormally high temperatures, extreme lightness in weight and high tear resistance are its main features. In addition, it is fire, gasoline, oil, grease, water, mildew, and insect proof, and not affected by acids or alkalis.

Double-coated, this same glass cloth is being used for gun bore aligning targets, because it retains its shape without stretching or distortion of the gun sighting pattern. The finished weight of the double-coated glass cloth is only 7.6 oz. per sq.yd. and a single-coated cloth used for the metallic hot-air duct weights only 5 oz. per sq.yd. Made in a variety of gages from 0.006 to 0.040 and in tensile strengths from 165 to 800 lb. per inch, it will probably have postwar uses.

CLEANER

AFTER requests from jobbers for an effective remover for rubber heel marks and dirt, Gymn cleaner was developed by Twi-Laq Chemical Co., Brooklyn 1, N. Y. For wood floors, it can be used full strength. For linoleum and painted concrete floors, the cleaner is diluted for use.

ALKALI CLEANER FOR PORCELAIN

DIRT, soot, carbon, etc., that gather on electrical insulators on the power lines throughout the country may be removed by Nielco 1931-T, developed by Nielco Laboratories, Detroit 19, Mich. It is said to be an alkali cleaner of low sodium oxide content, free flowing and readily soluble in tepid water. When used at boiling temperatures, it gives off no harmful caustic vapors and is not as harmful to the hands as the strong alkali cleaners. To use this cleaner, most any kind of a tank can be employed, if steel is not available, wood, such as cypress, can be used. The tank should be provided with a heating coil and if fast action is required, ample heat should be provided so as to keep the solution at boiling temperature.

SODA BRIQUETTES

BRIQUETTES of soda ash compressed into pellets approximately 1½ in. in length, 1 in. wide and ⅝ in. thick, are offered by Columbia Chemical Division, Pittsburgh Plate Glass Co., Pittsburgh 19, Pa. They are extensively used by the steel industry and foundries in the reduction of sulphur in iron. Columbia soda briquettes are said to provide an efficient, inexpensive material for the reduction of sulphur and the physical cleaning of iron. They make possible the reduction of sulphur contents of from 30 to 70 percent. Dusting loss encountered principally with the use of or-

dinary forms of light or dense soda ash is reduced to a minimum. This adds to the efficiency of the briquettes and improves general working conditions.

STEEL PURIFIER

HENNIG purifier, offered by Columbia Chemical Division, Pittsburgh Plate Glass Co., Pittsburgh 19, Pa., has a soda ash base to which is added other materials for the treatment of steel. It is compressed into pellets of the same size and form as soda briquettes. Hennig purifier assists in the production of denser, cleaner, stronger steels, having a minimum of non-metallic inclusions and oxides.

GLASS FIBER INSULATION

FIBROUS glass sheets, known as Fiberglas Type XM-PF, have been developed by the Owens-Corning Fiberglas Corp., Toledo, Ohio. Glass fibers with a diameter measured in ten-thousandths of an inch and weighing only 0.004 lb. per sq.ft. when bound with a thermosetting resin and formed into ½ in. thick sheets, are being used in cabins and flight decks of certain types of U. S. war planes. The fibrous sheets provide insulation against the extreme cold of the stratosphere and aid in deadening fatigue-causing sound. This insulation reduces the burden on heating equipment and as a consequence permits lighter apparatus to be employed.

The sheets are incombustible and are the lightest inorganic material commercially available for sound-proofing and insulation of planes. They gain less than one percent of their own weight from moisture in the air when subjected to temperatures of 125 deg. F. and 90 percent relative humidity.

PHOSPHORESCENT PIGMENTS

A PHOSPHORESCENT pigment, which emits a brighter phosphorescent afterglow for a longer period of time than similar long-afterglow pigments, was recently announced by the New Jersey Zinc Sales Co., New York, N. Y. This pigment, designated CaS-SrS-2470, is specifically intended for use in such wartime applications as phosphorescent paints, marking tapes and decalcomanias.

COTTONLEATHER

AN ABRASION resistant plasticized cotton fabric, has been developed by Southern Friction Materials Co., Charlotte, N. C. Called Cottonleather Fabric, the new product is not only abrasion resistant, but fluidproof, and heat resistant, and has numerous industrial applications including covering for rollers, pulleys and conveyor system treads; safety stair treads; safety flooring; safety shoes; chute lining; and bearing wicking.

The normal abrasion resistance rates for Cottonleather Fabric are 12,000 rev. per mm. Its resistance increases with the hardening that accompanies aging. It is adequately flexible and offers about the same tensile strength as cotton fabric. It can resist 250 deg. F. for four hours and also withstand boiling in machine oil for 15 min. without softening. While Cottonleather Fabric is waterproof, there is a porosity approaching eight percent,

which can be employed to hold oil or water. Shrinkage is less than 1/10 of one percent. It has a medium coefficient of friction of three to three and a half when dry and retains most of this percentage when wet with water or with oil. While the fabric is adequate as a low voltage and low frequency insulator, its dielectric properties are low and vary with humidity. It takes and holds paint, varnish, shellac and wax well, and can be impregnated with water, alcohol, petroleum solvents, coal tar solvent, castor oil or machine oil without materially weakening the structure.

CONCRETE COATING

CONCRETE, stucco and brick can be protected against weathering by Waterfoil, a new coating developed by A. C. Horn Co., Long Island City, N. Y. The inorganic gels in Waterfoil perform the valuable weatherproofing functions of retarding penetration of moisture from the outside and permitting escape of excess moisture when expanded by higher temperature. It is applied with a rough brush and is said to "weld" itself into the spaces of the masonry surface as it hardens into a heavy, microscopically sponge-like coating. One coat is claimed to be in effect equivalent to several coats of paint.

NON-CRITICAL RESIN

MADE entirely from non-critical raw materials, U. S. Industrial Chemicals, Inc., New York, N. Y., has a synthetic resin which combines a high melting point (obtained without the use of metals, phenol formaldehyde or dibasic acids) with the ability to aid in the bodying of "soft" oils. With this combination the product, S&W Arochem 348, facilitates the production of varnishes superior to ester gum varnishes, and approaching the quality of modified phenolic or maleic varnishes.

Varnishes compounded with S&W Arochem 348 are faster drying and have greater film hardness than comparable ester gum varnishes. When processed with dehydrated castor or similar oils, varnishes of much higher viscosity can be obtained. Equivalent viscosities can be attained with less processing, meaning savings in time and varnishes produced of a paler color. Arochem 348 is completely soluble even in very high-viscosity drying oils.

Specifications

Acid value	15-25
Color (G.H. 1933—50% solution in toluol)	10-12
Melting point (mercury method)	115-130 deg. C.
Specific gravity	1.1
Viscosity (G.H.—60% solution in toluol)	Approx. C.

FLUOROPHOSPHORIC ACIDS

FOR THE first time, the strong mineral acids, the mono- and the difluorophosphoric acids in anhydrous form, are available and are being offered by the Ozark Chemical Co., Tulsa, Okla. The new fluorophosphoric acids offer promise of combining in a very convenient form for a number of reactions, the reactivities of both concentrated orthophosphoric acid and of anhydrous hydrogen fluoride, and in addition they possess properties peculiar to themselves.

The monofluorophosphoric acid has a molecular weight of 100.04. It is an oily liquid, practically odorless. In appearance and viscosity it is very similar to concentrated sulphuric acid. It cannot be distilled; it is relatively stable thermally with only moderate decomposition on heating at 185 deg. C. under reduced pressure. It decomposes at higher temperatures. This acid becomes viscous on cooling, can scarcely be poured at —30 deg. C. and is a solid glass at the temperature of dry ice. On long storage of the acid in glass bottles with glass stoppers, the stoppers "freeze" and cannot be removed. It displays to a large extent the analytical reactions of sulphuric acid.

The difluorophosphoric acid has a molecular weight of 102.4. It is a thin, colorless, fuming liquid, with very irritating vapors. Its appearance is similar to that of concentrated perchloric acid. It has a boiling point of 115.9 deg. C.; distillation at atmospheric pressure results in slight decomposition. Its heat of vaporization is 7.925 calories per mole. It has a melting point of —96.5 deg. plus or minus 1 deg. C. There is much more pronounced reactivity and more corrosive action than possessed by monofluorophosphoric acid. It displays to a large extent the analytical reactions perchloric acid.

RUST PREVENTATIVES

Rust preventative oils and fingerprint removers have been developed by Shell Oil Co., New York 20, N. Y., and will be marketed as the Ensis line. In four different types of products, the Shell Ensis line will be made available in fourteen grades covering a wide range of applications. These products were designed chiefly for packaging as they combat humidity and salt atmosphere. The protective coatings formed by Ensis rust preventatives graduate from thin, transparent, oily films that need not be removed before use, to heavy coatings able to withstand the damaging effects of moisture for extended periods of time. One of the most important of the new products will dissolve finger prints, displace water, and afford long range protection against high humidity conditions during storage. Another, a heavier, extremely powerful preservative, is designed for use on packaged precision parts or for unpacked equipment. All of the new preservatives are said to be much easier of application and removal than the old style semi-solid compounds used for years in the packaging of rifles and arms parts.

SYNTHETIC DETERGENT

New casein fibers blended with rayon make possible many interesting new fabrics, but their sensitivity to alkalinity and high processing temperatures create special problems of scouring and finishing to yield clear, even shades and attractive "hand." Harshness and boardiness often have proved difficult to eliminate, using conventional types of processing compounds. To help overcome these problems, Quaker Chemical Products Corp., Conshohocken, Pa., now offers Quaker Dianol AG, a new synthetic detergent, especially suited to the processing and finishing of casein fiber fabrics.

CROCKER-WHEELER MOTORS for CHEMICAL PLANTS

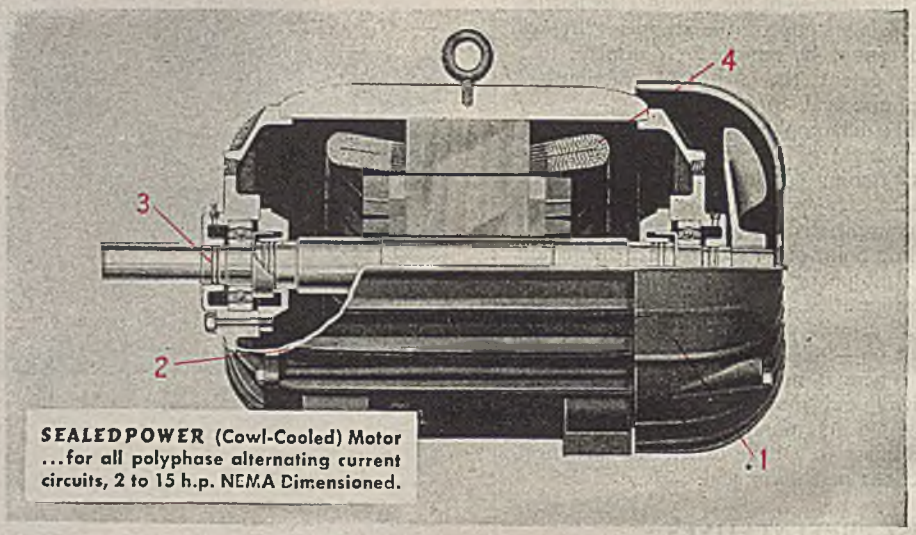
FEATURES

1. Totally Enclosed Cowl-Cooled type minimizes fire hazard, resists corrosion. Protects against acid or alkali fumes, splashing or dripping corrosive liquids, air-borne moisture, steam, corrosive gases, conducting dusts, metallic chips, lint, etc.

2. Fin Type single shell construction, with all surfaces exposed and a readily removable fan shroud, gives non-clog ventilation. Easy to clean...foreign matter passes over the surfaces of and not through the motor.

3. Patented GROOVSEAL antifriction bearings — no greasing needed for at least a year—minimizes maintenance. Seal permits use of softer grease, for better lubrication and longer bearing life. Water-tight — Dust-tight — Air-tight.

4. Vacuum Impregnation with high grade insulating varnish seals out foreign matter and moisture from each individual coil...makes windings a homogenous mass... reduces hot-spot temperature and lengthens insulation life. Adherence of varnish prevents vibration of wires inside or outside of slot.



SEALEDPOWER (Cowl-Cooled) Motor ...for all polyphase alternating current circuits, 2 to 15 h.p. NEMA Dimensioned.

SEALEDPOWER ...Industry's Most Trouble-Free Motor... *because*

THE CHEMICAL INDUSTRY has many processes where the conventional open type motor drives are unsuitable. Crocker-Wheeler's new totally-enclosed **SEALEDPOWER** motor largely eliminates difficulties encountered in chemical plants. The design of the motor protects it against steam, moisture, acid, alkali, splash, drip, fumes, and corrosion found in all phases of chemical processing.

Therefore, this **SEALEDPOWER** Motor is a must for all plants where corrosive conditions exist.

Crocker-Wheeler, one of the leading manufacturers in the field, specializes solely in the design, manufacture and application of electric power equipment.

As power specialists, Crocker-Wheeler field engineers know the power needs for your industry—of your particular production processes.

Call in one of our experienced engineers for specific advice on motors, generators, couplings and control... no obligation.

CROCKER WHEELER Motors Generators

JOSHUA HENDY IRON WORKS

CROCKER-WHEELER DIVISION

ESTABLISHED 1856

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CHEMICAL ENGINEERING NEWS

PROGRAM COMPLETED FOR ELECTROCHEMISTS

ARRANGEMENTS have been completed for the fall meeting of The Electrochemical Society, Inc., which will be held in the Hotel Statler, Buffalo, Oct. 12-14. On the opening day there will be a luncheon with Dr. Paul S. Brailer in charge. The luncheon address will be delivered by Rob Roy MacLeod, vice president, Buffalo-Niagara & Eastern Power Co. In the afternoon a scientific-technical session will be held with production of caustic soda and chlorine as the topic. The dinner in the evening will be informal.

On Oct. 13, the morning session will be a continuation of the caustic-chlorine discussion. The different divisions of the Society will meet at luncheon. The afternoon gathering will be divided into two parts, one dealing with induction heating and the other with new developments in dry cells. The Acheson Medal dinner will be held in the evening with the speakers including President S. D. Kirkpatrick, Dr. Hiram S. Lukens, and Thomas F. Slattery. Prior to the dinner there will be a reception in honor of Dr. Wm. Blum, Acheson medallist and Dr. Blum also will address the dinner gathering.

The final day will open with a session in charge of the Electrodeposition Division. This will be followed by a luncheon with Ralph M. Hunter as the speaker. He will discuss the electrochemistry of magnesium. Three round table discussions are scheduled for afternoon. One on teaching electrochemical engineering, one on bright plating, and the third on the color in electrolytic caustic soda.

POWER SHOW SCHEDULED FOR NEW YORK

THE 16th National Exposition of Power and Mechanical Engineering will be held in Madison Square Garden, New York, Nov. 27 to Dec. 2. The event will be keyed to the effective solution of continuing war production problems, particularly those caused by sudden shifts in military needs. It will also provide informational sources for the advancement of postwar planning.

Held biennially, the National Power Show, as it is commonly known, is widely recognized as an effective institution for the development of more effective utilization of the nation's power resources. It is anticipated that this year's Exposition will attract large number of engineers, executives and operating personnel concerned with current production problems as well as preparations for civilian pursuits.

More space has been provided than at the last Exposition, the number of booths has been increased and advance bookings ensure a greater number of individual displays than in 1942.

The show is under the sponsorship of an advisory committee, of which I. E. Moultrop, consulting engineer, continues as chairman with John H. Lawrence, vice chairman.

DONALD B. KEYES HEADS REORGANIZED OPRD

DONALD B. KEYES has succeeded Harvey N. Davis as director of the Office of Production Research and Development in WPB as was announced last month under "Names in the News." (See *Chem. & Met.*, July 1944, page 162.)

Dr. Keyes came into WPB first as the chairman of the Referee Board of the Chemicals Division. That board and its research review functions were transferred

Dr. Donald B. Keyes, director OPRD

into OPRD when the latter agency was founded a year ago. Many of OPRD policies were in effect a continuance and expansion of the Referee Board precedents.

Assisting Dr. Keyes in general administration will be Dr. Maurice Nelles, who is chief of the industrial processes work, serving as deputy director; and, Dr. W. L. Faith of the Chemical Industries Branch, serving as assistant director. Dr. Faith will be responsible for all of the project reviews, which include handling relations with sponsor agencies of the government and with contracting groups from the outside.

Operations of the office will be conducted through five branches. Four of these are a continuation of earlier work on metals and minerals, chemical industries, production economy, and industrial processes such as metal working, welding, casting, forging, etc. A new branch is to be created to handle industrial consumer products with emphasis on such commodities as do not logically fall either in the metal, mineral or chemical groups.

OPRD will undertake relatively few projects that are new. When such projects on research and development are presented, it will carefully consider those wherein the value of the results is believed to warrant investigation even at this late stage in the war period. OPRD continues to be, in effect, the research department of the War Production Board. It still has the authority to reject research and development projects requested by any of the commodity or operating divisions of WPB.

FURTHER CUTBACKS ORDERED AT MAGNESIUM PLANTS

ANOTHER reduction in production schedules for plants producing magnesium was announced by The War Production Board on July 29. The new schedule calls for termination of production at the plant operated by the Dow Magnesium Corp., at Marysville, Mich. and reductions in the output schedules of four other producing plants. The plants affected and the reductions prescribed are at the Dow plant in Velasco, Texas, cut from 6,600,000 lb. a month to 6,000,000 lb.; Magnesium Reduction Co., Lucky, Ohio, cut from 1,050,000 lb. a month to 833,000 lb.; Electro Metallurgical Co., Spokane, Wash., cut from 2,300,000 lb. a month to 1,200,000 lb.; and Basic Magnesium, Inc., Las Vegas, Nev., cut from 6,500,000 lb. a month to 4,500,000 lb.

All these plants are government-owned and the drop in production rates was explained on the grounds that it would bring surplus supplies of magnesium more into line with the nation's stockpile objectives. Considerations of manpower were given as the reasons for the selection of the plants made subject to cutbacks.

HERCULES TO EXPAND ETHYL CELLULOSE PLANT

PLANS for expansion of its ethyl cellulose plant at Hopewell, Va., were announced last month by the Hercules Powder Co. The ethyl cellulose requirements of the Army and Navy have lately been revised upwards by the sharp increases in ammunition production ordered by the War Department and this explains the need for more capacity. Construction was to start at once according to the statement of Mahlon G. Milliken, general manager of the cellulose products department and the expansion will add more than 60 percent to the present capacity.

CHEMICAL INDUSTRY MEDAL TO COL. BRADLEY DEWEY

THE Chemical Industry Medal for 1944 is to be given to Col. Bradley Dewey. This award is made annually by the American Section of the Society of Chemical Industry. Colonel Dewey has been selected as this year's medalist for his work in colloid chemistry, especially as it pertains to rubber latex, and his accomplishment in administering the synthetic rubber program during the critical war period.

ELECTRONICS CONFERENCE PLANNED FOR CHICAGO

A COMPREHENSIVE program covering television, ultra-high frequency and radio developments in the communications field and industrial measurements, electronic controls, induction heating, and power and medical applications of electronics is announced by the executive committee of the National Electronics Conference to be held at the Medinah Club, Chicago, Oct. 5–7.

Dr. J. E. Hobson, director of the School of Engineering of the Illinois Institute of Technology is chairman of the executive committee and in referring to the forthcoming gathering, he said that in addition to providing a permanent record of technical and application papers for reference and study, it should serve to help integrate and correlate work being done in fields rather divergent in their applications of electronic devices and principles. Emphasis will be placed on applications in industry, processing operations, power conversion, and measurements.

INDUSTRIAL FERMENTATION COURSE AT BROOKLYN POLY

A NEW graduate course on industrial fermentation will be held at the Polytechnic Institute of Brooklyn on Thursday evenings starting Oct. 4. Important processes, methods and equipment used in industry for the production of organic chemicals by the action of yeasts, bacteria and molds will be presented under the direction of James F. Loughlin. Among the processes which will be covered are bakers' yeast, glycerol, industrial ethyl alcohol and alcoholic beverages by yeast, butanol, acetone, isopropyl alcohol, butylene glycol, acetic, butyric and lactic acids by bacteria, and citric and gluconic acids, as well as penicillin, by molds.

PITTSBURGH PLATE GLASS IN CANADIAN FIELD

ANNOUNCEMENT has been made by H. B. Higgins, president of the Pittsburgh Plate Glass Co., that his company has broadened the scope of its activities in the paint field through the acquisition of a substantial interest in The Murphy Paint Co., Ltd. of Canada. Established more than 20 years ago by Harry W. Thorp and Louis Hambrock, The Murphy Paint Co. operates factories at Montreal and Windsor and has numerous branch warehouses and offices throughout Canada. Harry W. Thorp will continue as president of the Canadian company.

STANDARD OIL COMPANIES WILL CONSOLIDATE

ACCORDING to an announcement by M. J. Rathbone, president of the Standard Oil Co. of New Jersey, an agreement has been reached between his company and the Standard Oil Co. of Louisiana whereby the companies will consolidate at the end of this year. Standard of Louisiana is a wholly owned subsidiary of Standard of New Jersey. Mr. Rathbone who was recently elected to head the New Jersey company, formerly was president of Standard of Louisiana and will head the consolidation of the two companies.

No material change will be made in the organization of Standard of Louisiana which has its main offices in Baton Rouge. M. W. Boyer executive vice president of the Louisiana company will become a vice president of the consolidated company and will maintain his headquarters in Baton Rouge.

HYCAR LOWERS PRICES FOR SYNTHETIC RUBBER

A FURTHER reduction in the price for synthetic crude rubber made by Hycar Chemical Co. and announced last month, lowers the cost by approximately 10 percent and represents the fourth drop in price since August 1941. The substantial reductions in the price of synthetic rubber have been made despite the fact that demand has greatly exceeded supply and cost has been a matter of little consideration, Frank M. Andrews, general sales manager of Hycar Chemical Co., pointed out.

The new prices for Hycar, a special-purpose synthetic crude rubber are: Hycar OR-15, 50c a lb.; OR-24, 45c and OS-10, 45c. The price reduction coincides with rubber order R-1 released July 1, making rubbers of the butadiene-acrylonitrile type available on a more liberal basis.

ALLOWABLE CONCENTRATIONS FOR FORMALDEHYDE

THE American Standards Association has approved a new standard, setting a safe limit for allowable concentrations of formaldehyde. This is the sixteenth in a series of standards developed through the Association to set safe limits for the presence of toxic dusts and gases in the air of work places. The standard describes the general, physical-chemical, and toxic properties of formaldehyde, sets a maximum allowable concentration of 10 parts per million parts of air by volume, and describes the sampling procedure and analytical methods. A bibliographical list of references to the text is included.

RUBBER DIVISION OF ACS CANCELS ANNUAL MEETING

BECAUSE of wartime conditions, the Rubber Division of the American Chemical Society has cancelled its 1944 annual meeting, scheduled for New York City in mid-September, Harold Gray, chairman of the division, announced last month. Gray is technical superintendent of the B. F. Goodrich tire division at Akron, Ohio.

The division has held annual meetings for more than a quarter of a century, attracting some 2,000 leading technical men, but cancelled this year's meeting because of overtaxed condition of travel facilities, especially those along the Eastern Seaboard, needed for wounded service men returning from war zones, and the still critical rubber situation which, Gray said, makes it unwise for so many top flight rubber technicians to be away from their jobs at the same time.

SHELL TO BUILD NEW ALLYL ALCOHOL PLANT

AN announcement by J. Oostermeyer, executive vice president of Shell Chemical Division of Shell Union Oil Corp., states that the War Production Board has authorized construction of an allyl chloride and allyl alcohol plant at Houston, Texas, construction to begin at once. The new type plant is the result of many years of research and development work on the part of Shell Development Co. While allyl chloride and allyl alcohol will have many uses in the synthetic chemical industry, it is expected that immediate application of the output of the new plant will be in the field of plastics for aircraft and war material construction.

GLUTAMIC ACID PLANT ON PACIFIC COAST

To produce glutamic acid, needed by the government for the war, Spreckles Sugar Co. is constructing a $200,000 unit at its Woodland, Calif., factory, according to C. J. Moroney, general manager of the company. International Minerals and Chemical Co., Chicago, will join in producing the acid from beet molasses residue at Woodland.

CONVENTION CALENDAR

American Chemical Society, 108th meeting, Pennsylvania Hotel. New York, N. Y., Sept. 11–15.

American Association for Advancement of Science, Cleveland. Ohio, Sept. 11–16.

American Association of Textile Chemists and Colorists, annual meeting, Claridge Hotel, Atlantic City, N. J., Oct. 12–14.

Electrochemical Society, Inc., fall meeting, Hotel Statler, Buffalo. N. Y., Oct. 13–14.

Third National Chemical Exposition, Chicago Coliseum, Chicago. Ill., Nov. 15–19.

American Institute of Chemical Engineers, fall meeting, St. Louis. Mo., Nov. 19–21.

Technical Association of the Pulp and Paper Industry, annual meeting, New York, N. Y., Feb. 1945. Regular fall meeting will not be held this year.

GUAYULE EXTRACTION PLANT FOR CALIFORNIA

A CONTRACT for the design of a guayule extraction plant for the Emergency Rubber Project, a division of the Forestry Service of the U. S. Department of Agriculture, has been awarded to Southwestern Engineering Co. of Los Angeles, Calif.

The plant, to be erected in the Bakersfield area of California, will process guayule shrub planted in that section two years ago. It has been announced that considerable additional acreage will be planted there this fall.

In a statement at Washington on July 13, George R. Salmond, head of the government's emergency guayule rubber program, indicated that an existing plant at Salinas, Calif., with the newly launched Bakersfield undertaking, is expected to yield five to six tons of rubber daily.

The guayule is raised on government-owned plantations which are the scene of intensive cultivation due to success attained in extracting rubber from wild and cultivated plants shipped from Texas for California planting.

ANODES BY AIR FOR CHINA'S CHLORINE PLANTS

GRAPHITE anodes are now being flown over the Himalayas to Chungking from railheads in India to keep China's chlorine and caustic soda industry operating at full capacity. Supplied by National Carbon Co., Inc., the anodes are shipped to railheads in India and are then flown to Chungking.

China's first chlorine and caustic soda plant, and until recently its only one, was set up in Shanghai in 1929. As it was the only unit in China, prodigious efforts were required to keep it from falling into the hands of the Japanese when they took Shanghai. It was dismantled and the most irreplaceable units transported by river sampan and coolie-back to Chungking, where it was re-assembled. Shipments of anodes from this country have enabled the plant to remain in continuous operation since it was rebuilt at Chungking.

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DIVISION OF HIGH POLYMER PHYSICS ORGANIZED

THE division of high polymer physics of the American Physical Society has been in the process of organization for several months. The inaugural meeting was held in connection with the recent meeting of the American Physical Society at the University of Rochester. An executive committee for the division was appointed by the Society and this committee elected as officers, J. H. Dillon, Firestone Tire & Rubber Co., chairman; P. Debye, Cornell University, vice chairman; W. James Lyons, Southern Regional Research Laboratory of the Department of Agriculture, secretary; and L. A. Woods, National Bureau of Standards, treasurer. Other members of the executive committee include W. F. Busse, General Aniline & Film Corp., R. Bowling Barnes, American Cyanamid Co., and J. P. Elting, Kendall Mills.

GENERAL ANILINE ACQUIRES DEFENSE PLANT PROPERTY

IT WAS announced last month that the Defense Plant Corp. had sold surplus real estate consisting of 3.34 acres at Binghamton, N. Y. together with improvements consisting of six buildings to the Ansco Division of General Aniline & Film Corp., New York, for $175,000. The property had been owned by the Defense Plant Corp. since July 1942 and had been operated by Kollsman Instrument Division, Square D Co., Flushing, L. I., for the manufacture of products for the Navy Department. Only the land and buildings were sold. The machinery and equipment will be disposed of separately.

The property was recently declared surplus to the war effort and the purchaser was one of several interested prospects. The sales price was described as representing present day replacement cost less depreciation.

READERS' VIEWS & COMMENTS

"BIG" AND "SMALL"

To the Editor of Chem. & Met.:

Sir:—I have just read your editorial "Big Questions About Little Business." I like your thoughts on the matter.

I am one of those who have been identified as "small business," and I do not know of a single thing that I would want the government to do for our business excepting to leave all business alone to work out their own problems. If "small business" needs to borrow money, they can borrow it from the banks if the history of their business is sound.

"Small business" has a rightful and useful place and frequently furnishes a product or a service that cannot be supplied by "big business."

Some "small business" concerns grow into "large business" and such healthful growth is evolutionary and maybe slower but sounder than by some revolutionary external process. There is some "small business" that cannot ever evolve into "large business," and it is a part of the

responsibility of management to recognize this fact. When management does not know that they are in the category of "small business," they are likely to run into difficulties.

"Small business" is sometimes mismanaged and is blown up like a rubber toy balloon. There is no more rubber in the balloon when it is inflated ten times its diameter than when it is uninflated. Eventually the business, like the balloon, bursts.

"Small business" is frequently very much more profitable than "large business," and the returns per dollar invested are greater. A peanut vendor, who makes a profit day after day from the selling of his wares is, in accordance with the profits, larger than "big business" that never pays the stockholders a dividend.

I cannot imagine why "small business" is entitled to a service from the government to which "large business" is not entitled. If a "small business" cannot afford to engage technical skill and research, they have no right to expect it for nothing from others.

My company is in the pump business. We come in the category of "small business." If we would try to imitate the large pump manufacturers with whom we have absolutely no quarrel, we would not be in business. The reason that we have been in business so many years, have a profitable record, have no indebtedness and, therefore, are financially sound, is because we evidently have been able to render a service that is in demand, and "big business" are our best customers.

Almost everyone knows that there are infinite numbers and types of pumps required, ranging from little ¼-in. size to the mammoth water work pumps, and no one concern even in "big business" covers the entire field.

"Small business," which has no useful or legitimate service to render, cannot maintain itself no matter how much they may be bolstered from the outside. They ultimately are doomed to extinction. "Small business," which has a service or a product for which there is a market, has nothing to fear from "big business."

I am in full agreement that "coddling of the little fellow may seem like good politics," but such "good politics" ultimately results in bad government.

I do not want to be taxed to support somebody else's business, and I do not want anyone else taxed to support my business.

WM. F. TRAUDT

Taber Pump Co.
Buffalo, N. Y.

CORRECTION

To the Editor of Chem. & Met.:

Sir:—May I call your attention to a typographical error in the article "The Coming Search for Synthetic Motor Fuels"? The heat of reaction in the Fischer-Tropsch synthesis is about 7,000 B.t.u. per lb. of product, instead of 17,000 as indicated in the last paragraph on p. 110 of the June 1944 issue of *Chem. & Met.*

R. D. GLENN

Carbide and Carbon Chemicals Corp.
South Charleston, W. Va.

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CHEMICALS INDISPENSABLE TO INDUSTRY AND VICTORY

THE NATIONAL DEBT—

and Your Postwar Job

Coming upon the heels of a ruinous ten-year depression, this war has once more made it clear to us that the strength of our country depends upon our ability and willingness to produce. Until the world conflict eclipsed the depression, we saw what failure to use our productive capacity can do — even to a country potentially as rich as ours.

The stark reality of war finally shocked us out of our economic lethargy. The necessity of supplying our Armed Forces with almost unlimited quantities of goods unleashed our inventive genius and revealed to us our real capacity to produce. It indicated what our standard of living might be if, in time of peace, we used our full productive capacity.

Today we are producing more than all the other nations combined, half again as much as in 1940. Today our production is insuring victory to our fighting men.

But what of the future?

Already our national debt has reached astronomical proportions, and it is going higher. The depression years' fear of insecurity that all but paralyzed our spirit of enterprise, our inventive genius, and our natural instinct for expansion, appears likely to return promptly if industrial activity again is curtailed for long because of unwise public policies.

This war is being fought to make men free. But our economy cannot be kept free through military conquest alone. There is another responsibility which we on the home front cannot avoid any more than we can build walls around our future. That is the problem created by our frightening public debt.

This is a two hundred billion dollar war. It affects the lives of every one of us. At the end of this war, the public debt of the United States will be at least ten times the twenty-five billion dollars that it was at the end of the first World War. It will be almost twice the present annual national income of the country. The interest charge alone will be about 4 per cent of the national income. If the burden were spread evenly, interest alone would take at least $80.00 of every worker's income per year, or approximately $1.60 out of each and every weekly pay check.

Some people fear that the heavy taxes required by the debt will keep the country poor by obstructing employment and limiting the output of goods.

Others believe that the size of the debt does not matter because we owe it to ourselves. They reason that if A is taxed $100 to pay $100 interest to B, A has $100 less to spend and B has $100 more, but both together have the same amount. They, therefore, hold that the demand for goods and the volume of employment remain unchanged.

Which view is correct?

Is our huge debt bound to be a crushing burden which limits employment and lowers the nation's standard of living, or will it simply redistribute income? May the public debt under certain conditions even be used to help increase employment and raise our living standards?

Most people, rich and poor alike, find it difficult to believe that the national debt "just doesn't matter". They know that the interest alone on this huge debt will be almost equal to the total amount of taxes ever raised before by the government for all purposes in any peacetime year. They find it difficult to follow the kind of reasoning that suggests increasing the already mammoth debt year by year in order to maintain full production and employment. They fail to see how this "debt raising" can go on indefinitely.

On the other hand, the records show that other nations have more than once successfully managed even greater debt burdens than will confront the United States after the present war. The interest on the British debt after the Napoleonic Wars was nearly 8 per cent of the national income, and after the first World War was over 7 per cent. But despite heavy taxes and some unfortunate mistakes in economic policy (such as restoring the prewar pound), per capita real income in Great Britain rose about 31 per cent between 1920 and 1929. In fact, it rose as rapidly as it did in the United States. The world depression was far less severe in Britain than it was in the United States; and, by 1936, when industrial production still was 6 per cent below 1929 in the United States, it was nearly 16 per cent above 1929 in Britain. Britain's heavy debt burden proved less of a handicap to her during the depression than our weak banking system did to us.

Whether the debt becomes a crushing burden or whether we use it to further our progress depends upon who holds the debt and how the money is raised to pay the interest.

Here are the important possibilities:

1. If the expenses of the government, including the interest on the debt, are met largely by heavy taxes upon business profits—i.e., by taxes upon job-giving—then they will reduce employment, output, and our standard of living, regardless of who holds the debt. Heavy taxes on profits prevent enterprise from expanding current operations or enlarging the capacity of its plants, unless the prospects for profit seem certain and the prospects for loss are slim. Hence the jobs that might be created to take advantage of long chances will not come into existence, and the country as a whole will be poorer.
2. If the expenses of the government are met largely by stiff surtaxes upon the incomes of persons who do a considerable amount of saving, and the debt is, in the main, owned by millions of small investors, then the net effect of the debt upon the volume of employment and output will be fairly neutral. The stiff surtaxes, while reducing the savings of the well-to-do, will cause them to avoid risky investments and to hold part of the savings of each year in the form of cash. This will limit the demand for goods and the volume of employment. But this effect will be partially offset if millions of small holders of the debt are led by their savings in government bonds to spend a larger part of their current income.
3. If the expenses of the government are met largely by sales taxes or other taxes on small incomes, and if the debt is held largely by the well-to-do or by business corporations, then the effect of the debt will be unfavorable to employment and production. The limitation to the spending power of the small-income group will reduce the volume of investment opportunities, and the transfer of income to the well-to-do will increase the volume of investment-seeking funds.
4. If the debt is widely distributed among millions of small holders, and the expenses of the government are met largely by taxes on individuals, if substantial exemptions from surtaxes are given for all income invested in new plant or equipment, and if there are liberal offsets for losses, then the debt will help increase employment and raise the standard of living. The millions of small holders will gain a sense of security from their accumulated savings and hence be encouraged to spend a larger portion of their current incomes. The stiff surtaxes will reduce the savings of the well-to-do; liberal exemptions for income put into new plant and equipment, and generous treatment of losses, will cause the well-to-do to invest their savings in job-giving enterprise rather than to hold them in idle cash.

But what is the situation today?

Today, non-banking corporations own nearly half of the Federal debt, commercial banks about one-fourth, and individuals less than one-fourth. Not more, and probably less, than one-tenth of the debt is held by persons earning less than $5,000—although these persons receive three-fourths of all income.

Today, about half of the revenues of the Federal government come largely from taxes which must be regarded as *taxes upon the creation of new jobs.* If these conditions continue, we may be sure that the debt will be a disastrous obstacle to a rising standard of living after the war.

What can be done to change this situation?

To begin with, vigorous steps should be taken to get much more of the debt into the hands of individuals, particularly of those in the small-income group. During the last three years, the incomes of individuals, after taxes, have exceeded the supply of consumer goods by $74.2 billion. In other words, individuals have been compelled, by the sheer scarcity of goods, to save over $74 billion. Of this amount, only $27.4 billion, or 37 cents out of every dollar, has gone into government bonds. Indeed, individuals have saved more in the form of cash and bank deposits than in the form of government bonds. The sale of war bonds to individuals was most disappointing in the recent drive. It was so disappointing, in fact, that I would favor a special drive *for individuals only,* to be scheduled before the next general drive. During 1944, when the supplies of civilian goods are severely restricted and when the fighting is at its climax, the Treasury will have its best opportunity to persuade individuals to buy more bonds. This opportunity should not be lost. An increase of at least twenty-five billion should be the goal for the next year. Every citizen should be made to understand that by buying war bonds now, he is not only helping to win the war; he is helping to make possible a more prosperous and stable America after the war.

The efforts to sell bonds to individuals should be vigorously continued throughout the shift from war production to civilian production. During this period, corporations which, up to now, have been the largest buyers of government bonds, will need all their depreciation allowances and undistributed profits to pay for new equipment, and to restore their own dealers' inventories. The government, however, will still have large bills to settle and will need to sell as many bonds as it can for some months after the end of hostilities. During this period, the demand for most types of goods is likely to exceed the immediate productive capacity of industry. Hence, the sale of bonds by the government will make for economic stability.

The huge expenses, including interest on the debt, which the government must meet after the war, require that the tax system be drastically reformed. Today, taxes fall most heavily upon those incomes which are the reward for increasing production and employment, because profits are taxed first as corporate profits, and taxed again as dividends to owners of the corporation. Surtaxes are so stiff and offsets for losses so meager that the well-to-do capitalists cannot afford to encourage and help promising young businessmen to start new enterprises.

A nation whose expenses are as large as those of the United States will be after the war must be sure that its tax system provides incentives, not penalties, for increasing production and employment.

Should the debt be repaid? Some people fear that any reduction of the debt would have a deflationary effect and cause unemployment. An opposite view was expressed by Mr. Morgenthau recently: "We have a big public debt that must be paid off, and the quicker we do that the better." Both of these views are extreme. Repayment of part of the debt during a period of depression would increase unemployment. Every period of high prosperity, however, would give the government an opportunity to pay off part of the debt without limiting employment. During these periods of prosperity, business corporations will sell government bonds in order to buy equipment; and many individuals will redeem war savings bonds in order to purchase houses, automobiles, and other goods. If the government budget runs a surplus during periods of high prosperity, and if this surplus is used to retire some of the bonds sold by corporations or redeemed by individuals, the country will be protected against a disorderly and speculative rise in prices. Thus, reduction of the debt can be made a device for stabilizing our economy.

There are two other reasons why reduction of the debt will be desirable.

In the first place, it will help prepare the country financially for a possible third World War. Determined as we are that this war shall be the last one, common sense tells us not to count on this. At any rate, we must be prepared for any eventuality.

In the second place, gradual reduction of the debt would stimulate employment by creating the expectation of lower taxes. It is not generally appreciated how much the willingness of individuals and business concerns to spend money is affected by the prospects of higher or lower taxes. One of the best ways to make individuals and enterprises spend more freely is to convince them that taxes will become a little lower, year by year.

Many people have difficulty in visualizing the day when there will be a substantial reduction in the burden of the national debt. And yet, if the country pursues wise economic policies, there is no reason why the debt burden should not be cut in half during the next generation.

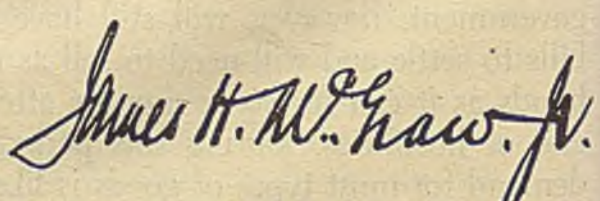
The days of technological progress and economic expansion are not over. They are, in fact, only well begun. During the Twenties, the national income in dollars of constant purchasing power increased by well over 50 per cent. Between 1929 and 1939, it increased by less than 6 per cent. Perhaps the rate of the Twenties cannot be maintained indefinitely; but scientific research and development work in industry are laying the foundation for very large advances in national income. Suppose that the national income increases 33 per cent in the first decade after fighting stops (say, hopefully, 1945), 25 per cent in the next decade, and thereafter at the rate of 20 per cent a decade. In 1955, the national income (at present prices) would be about $173 billion; in 1965, about $216 billion; and in 1975, about $257 billion. By 1970, the burden of the debt would be reduced by nearly half, even if not a cent of it were repaid!

A huge public debt is a test of the character, the common sense, the foresight, and the equally important technical and engineering skill of a nation. *It requires that tens of millions of small income earners be willing to become substantial holders of the debt. It requires that the nation be willing to tax itself heavily, but in ways which increase the attractiveness of job-giving or self-employment relative to job-holding; it requires that the nation be willing to pursue policies of expansion and to put a rising income for the nation ahead of the pleas of self-seeking groups in labor, agriculture, and industry.*

A huge debt may so draw out the hidden powers of a people that it makes the nation wealthier rather than poorer, stronger rather than weaker.

Up to now, Americans have not met the test of a big public debt too well. Individuals have saved more in cash than in government bonds, and the country has shown little interest in avoiding the kind of taxes that reduce the demand for labor. These shortcomings, I am sure, stem largely from the fact that the American people never have had the problems of debt and taxation honestly and adequately explained to them.

I have confidence in the American people. I believe that Americans have the intelligence to understand this problem of the public debt, the character to face their responsibility regarding it, and the common sense to accept the challenge and make the most of it.



President, McGraw-Hill Publishing Company, Inc.

NEWS FROM ABROAD

BRITISH GOVERNMENT PLANS GRADUAL REDUCTION OF INDUSTRY CONTROLS IN POSTWAR PERIOD

Special Correspondence

THE British Government has been subjected to a great deal of criticism for its failure to formulate its economic policy for postwar days, but the last few months have brought a number of important pronouncements on such essential questions as employment policy, monetary plans, liquidation of controls, encouragement of research, health services, relations with the Dominions, technical education, and colonial development, so the next step lies with industry and labor. Not all these proposed policies are yet sufficiently clearly defined in their practical application to allow of definite comment. For the most part they represent able expositions of the current trend of economic thought, adapted to the obvious effects of wartime developments, but still requiring adjustment to external conditions and policies of other countries.

Fortunately, the government economic policy has met with general approval. It proposes a gradual reduction of control with its restrictions on individual liberties and initiative for such time after the war as is required to effect the transition from wartime to peace time conditions, but it proposed a gradual reduction of control in agreement with the leading organizations of industry and labor and accepts the principle of government responsibility for maintaining a high level of employment when the immediate postwar boom resulting from the release of pent-up demand has come to an end. On the other hand, it is not proposed that the government should try to replace private enterprise.

The chemical industries do not belong to those which, like the building trades, will profit directly and immediately from government reconstruction plans. On the other hand, chemical manufacturers are keenly interested in government proposals because they are typical of those British manufacturing industries on which the prosperity of the country depends but which will certainly require a helpful government attitude if they are to master the transition problems. The fundamental fact is that the British chemical industry is less favorably placed with regard to certain conditions of production than chemical producers abroad. It lacks certain important raw materials and cheap sources of power and energy; coal there is in abundance, but it is not particularly cheap and its cost has lately been rising. Secondly, productivity is not as high as in the United States; in the words of Lord McGowan, chairman of Imperial Chemical Industries Ltd., English workers must be armed with more capital instruments per head, of a technical standard equal to that to be found elsewhere. Thirdly, an antidote must be found to the apparently irresistible increase in costs which threatens to leave British chemical manufacturers in a position where they would find it difficult to compete with foreign producers; such an antidote is needed even if cooperation by international agreement takes the place of untrammelled competition.

A few figures may be quoted to illustrate the position of the British chemical industry. Although they relate to one firm, I.C.I., the leading combine, they are in some respects characteristic. The company which now employs 100,000 people in the British Isles reported gross manufacturing and trading proceeds of £105,000,000 for 1942. Of this amount, £56,000,000 was spent on raw materials and purchases for resale; maintenance of plants; freight charges; factory, sales and administration expenses (excluding personnel); and £3,500,000 was set aside for obsolescence and depreciation of plants. (For comparison it may be stated that the company in the sixteen years from 1927 to 1942 spent £62,000,000 on capital expenditure at works in the British Isles, on land, plants, buildings, machinery, and equipment.) Another £30,500,000 were needed for wages, salaries, pensions and contributions to pensions funds; and £12,500,000 became due to the British and Overseas Governments as Excess Profit Tax, National Defense Contribution and income tax. Including £1,500,000, representing the company's investment, property and miscellaneous income, the net profit stood at £4,000,000 of which £3,000,000 was distributed as net dividends and £1,000,000 retained for addition to reserves.

HIGH TAXATION

The most striking features in this enumeration are the low amount for depreciation and obsolescence and the large sum taken up by taxation. The 1943 figures are not yet available in this comprehensive form, but it is known that the total gross income shown in the consolidated income statement was £18,705,000 against £22,253,000 in 1942, a decrease by one-sixth, which was mainly due to rising costs not matched by increases in prices. The decline, it is true, was offset by a corresponding fall in taxation, since the excess profit tax absorbs all wartime income gains and declines if and as net profits decline. But the upward trend of costs is one of the most ominous wartime features in the British chemical industries. Leading firms in the industry do not believe that it can be fully counteracted, but try to meet the rising trend of costs by economies and increased efficiency and to keep selling prices low.

In his last budget the Chancellor of the Exchequer announced tax concessions for expenditure on research which previously had often been regarded as a kind of luxury. This, in conjunction with government support of cooperative research in-

stitutes and private realization of the need for constant research, is likely to bring about greatly improved methods of production and, if investigations are extended in that direction, of marketing and utilization. In any case, chemical firms are looking forward to a period after the war when exceptionally large capital investments will be carried out. All the big firms have shown great interest in young industries and laid the foundations for expansion in their direction by forming new subsidiaries, etc. Capital expenditure, however, has been held up by government control of new plant construction and financial issues. Nevertheless extensive plans have been prepared. The leading combine intends to "spend many more millions on new works and extensions," and smaller firms have made similar arrangements, but necessarily they will work on a more modest scale.

COOPERATIVE METHODS

Cooperation within certain industries may lead some such producers as the coal mines and gasworks to enter the chemical field. These industries realize that efficient production methods include utilization of byproducts, and while the existing chemical firms are quite willing to undertake such work, it seems that those large firms in industries bordering on the chemical field which are directly interested in the profitable utilization of byproducts will themselves engage in chemical production. At this early stage it cannot be said how the established chemical firms will be affected, but repercussions arising from this side are likely to be considerable. Problems created by such developments have a close bearing on another important question, that of cooperation. The British chemical industry is generally very much in favor of cooperative methods, within the industry as well as with government agencies, labor and foreign competitors. The relations with the latter in particular are likely to receive a great deal of critical attention.

The case for other than competitive methods in export markets is largely based on the evils necessarily attached to perfectly free competition in a market which does not provide sufficient outlets for the entire supply. In addition, it is pointed out that "technological developments founded on expanding research, progress in organization, speed in communications, spread of knowledge and every other world factor, make for ever more intricate economic interdependence," while "mass production in response to mass demand promotes the growth of large-scale organization." At the same time, it is being realized that "the concern of the State in industrial organization will tend to increase," and a far-reaching measure of government control will probably have to be accepted by industry. Leading British chemical firms seem to accept this prospect as inevitable and indeed helpful, but the details of such cooperation and control will require consideration and discussion. At present it can only be said that there is a great deal of agreement on the requirements of British industry and the need for cooperation, if possible, not only in the home market but also in the export field.

HIGH YIELD OF BLACKSTRAP FROM CUBAN SUGAR

CUBA'S current sugar crop, estimated at 5,500,000 short tons, will be the largest since 1929 and the third largest on record. The yields of blackstrap molasseses have been running high. The first 53 mills to complete operations averaged 48 gal. of blackstrap per ton of sugar. Allowing a maximum of 1,000,000 tons from the 1944 crop to be produced in the form of invert would leave 4,500,000 tons for raw sugar with blackstrap as a byproduct. At an average yield of 48 gal. per ton this would give approximately 215,000,000 gal. of blackstrap but present calculations are based on a production of 200,000,000 gal. Of which at least 65,000,000 gal. are to be delivered to the United States under an existing contract at 13.6c. a gal.

BRAZIL INCREASES OUTPUT OF CITRIC ACID

ACCORDING to reports to the Department of Commerce, Brazil has stepped up production of citric acid to a point where domestic requirements are taken care of with a surplus for export. Production is now under way at the Fazenda Amalia plant of I. R. F. Matarazzo. Daily output of 400 kg. is expected soon with an eventual capacity of 1,000 kg. Consumption in Brazil is about 15,000 kg. a month.

Industria Brasileira de Produtos Quimicos Ltda, Sao Paulo, has a monthly production of 7½ tons of liquid citric acid, equivalent to about 2 metric tons of crystals.

CUBA SPEEDS MINING OF REFRACTORY CHROMITE

METALLURGICAL chromite mining in Cuba was more active in recent months than at any time in several years with three mines working in April. Refractory chromite output increased at Punta Gorda at both the Cayoguan and Narciso mines. At Camaguey, the only other active refractive chomite area in Cuba, production and shipments continued at the same rate as in previous months.

SHORTAGE OF VEGETABLE OILS IN VENEZUELA

BECAUSE the sesame crop failed and copra and babassu oil from Brazil have not been available, a severe shortage of vegetable oils has been felt in Venezuela. Manufacturers of soap, candles, vegetable shortenings, and edible oils have been forced at times to close their plants.

MATCH FACTORY PLANNED FOR VENEZUELA

INVESTIGATIONS have been made in Venezuela by the Swedish Match Co. with a view to establishing a match factory there. An appropriation of $25,000 was made for the purpose and the Swedish company sent a technician to Venezuela to carry on investigations. It is stated that a supply of suitable wood has been found and that a company may be formed with a capital of 3,000,000 bolivars, one-half of which would be furnished by Venezuelans. Valencia is regarded as the possible site for the plant.

TURKEY NOW PRODUCING WINDOW GLASS

THE only window glass plant in Turkey was completed in the early part of this year and is now reported to be turning out glass in sufficient amounts to furnish the major part of that country's requirements. The new plant is an annex to the glass and bottle factory at Pasabahce on the Bosphorus near Istanbul. Training in the manufacture of window glass was obtained from German engineers.

TURKEY BUILDS CAUSTIC AND CHLORINE PLANT

PRODUCTION of chemicals in Turkey is broadening out to include a wider variety of finished products. The first chemical plant, scheduled to go into operation last April, was for the manufacture of sulphuric acid and superphosphate. It is now reported that a new plant at Izmit is nearing completion. It will make caustic soda and chlorine. Equipment for this plant was imported from Germany in 1939 but its installation was delayed because of conditions due to the war. It is further reported that plans are being made to establish production of chrome chemicals for the domestic tanning industry.

INDIA OFFERS BONUS FOR RUBBER PRODUCTION

IN AN attempt to stimulate production of crude rubber, the Government of India has introduced a production bonus scheme which is to operate from April 10, 1944 to June 30, 1945. Its further continuance will be dependent on the results attained. Under the plan, a basic annual production figure is fixed and divided into appropriate quarterly quotas. Bonus payments are to be based on the extent by which production exceeds the base figure.

REFRIGERATION USED AS AID IN SERICULTURE

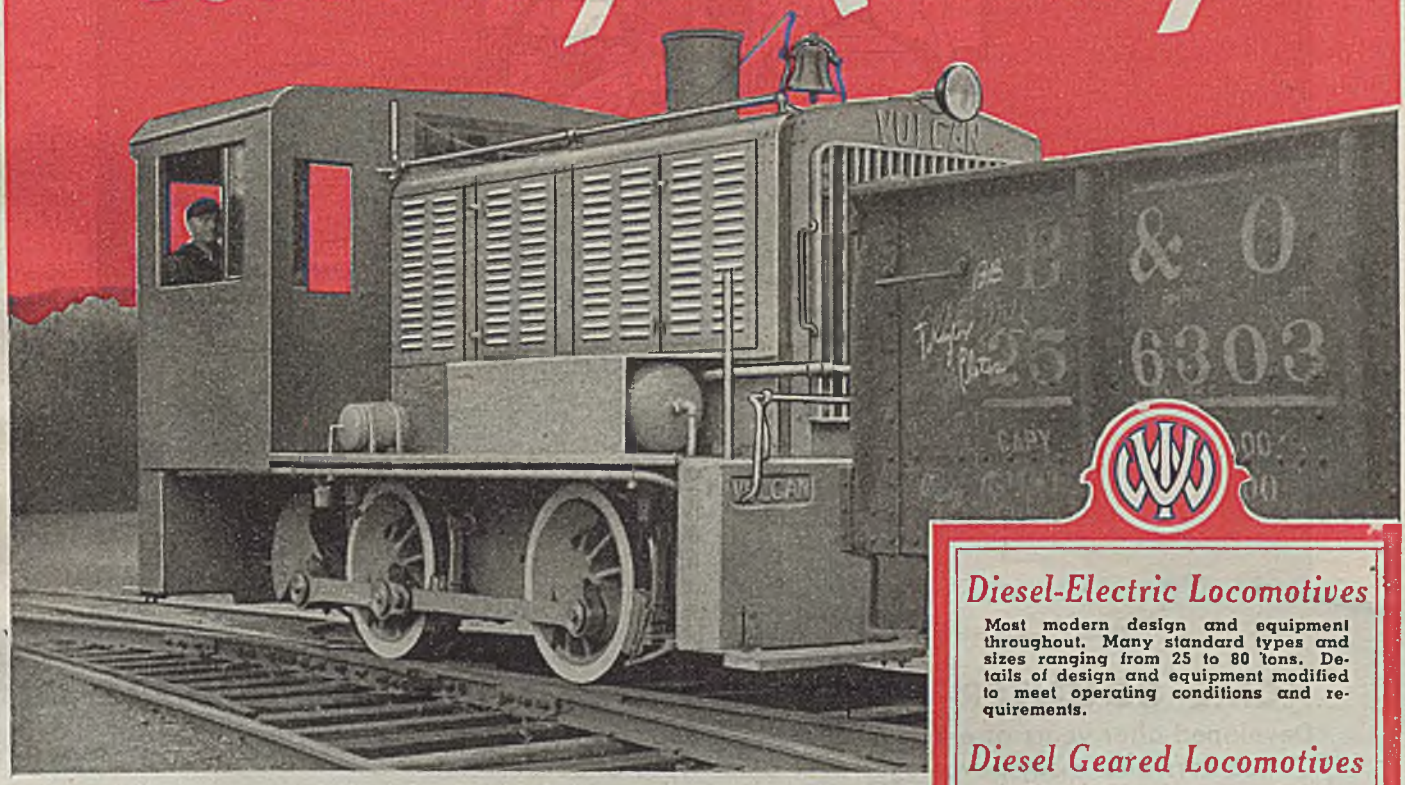
THE Department of Commerce has an interesting report from Brazil to the effect that experiments conducted in one of Brazil's new experimental stations indicate that through the process of refrigeration, 10 crops of cocoons can be produced in a year. Refrigeration to furnish the low temperatures necessary in the life cycle of the silk worm is said to be feasible in Brazil which has a climate suitable for growing mulberry trees during the entire year.

According to the report, these experiments have led to an installation of extensive refrigerating rooms in one of the buildings of the station. Other buildings are being equipped with processing, testing, and weaving equipment. Nearby are some 300,000 mulberry trees which are being tested for the most satisfactory strains.

SCOTLAND WILL MAKE IODINE FROM KELP

KELP is now being collected on the coast of western Scotland to furnish raw material for the production of iodine and transparent wrappings. Two factories have been built for this purpose and a force of 60 men has been recruited for gathering the kelp.

"Always Ready"



THE 35-ton Vulcan Diesel Geared Locomotive shown above switching cars in the yard of a busy defense plant "Has Everything" to assure dependable trouble-free operation, including a distinctive type of Heavy-Duty, CONSTANT-MESH, SPUR-GEARED, TRANSMISSION, with four speeds forward and reverse.

Gear-Stripping is absolutely eliminated and its stepped-type clutch jaws engage so easily that gear changes can be made smoothly at much higher speeds than with the usual system of sliding and clashing gears. Another important and exclusive advantage is DIRECT DRIVE IN HIGH GEAR, which still further reduces gear wear and noise.

Write us regarding any industrial haulage or switching requirement. And remember that a Vulcan locomotive is always a quality product—with an extra margin of durability and trouble-free operating capacity that assures important savings over any prolonged period of operation.

Diesel-Electric Locomotives

Most modern design and equipment throughout. Many standard types and sizes ranging from 25 to 80 tons. Details of design and equipment modified to meet operating conditions and requirements.

Diesel Geared Locomotives

Distinctive Vulcan features include constant-mesh, 4-speed, spur-geared transmission with direct drive in high gear, and separate final-drive gear assembly with side-rod connection to driving wheels. Standard sizes range from 6 to 35 tons. Gasoline locomotives in same range of types and sizes.

Steam Locomotives

All industrial types in a wide range of sizes up to 100 tons. Fuel can be either oil, coal or wood.

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Trolley, cable-reel, battery and combination types for underground service from 6 to 30 tons. Load-carrying larries and electric haulage units for industrial service designed and built to meet any specific requirement.

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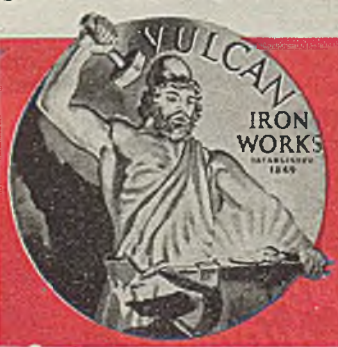
include continuous Rotary Kilns, Coolers and Dryers, Crushing Rolls, Pulverizers, Grinding Mills, Briquetting Machines, Electric Hoists, Allcasteel Sheaves, Shaking-Chute Conveyors and other modern equipment for the mining, rock products and chemical-processing industries.



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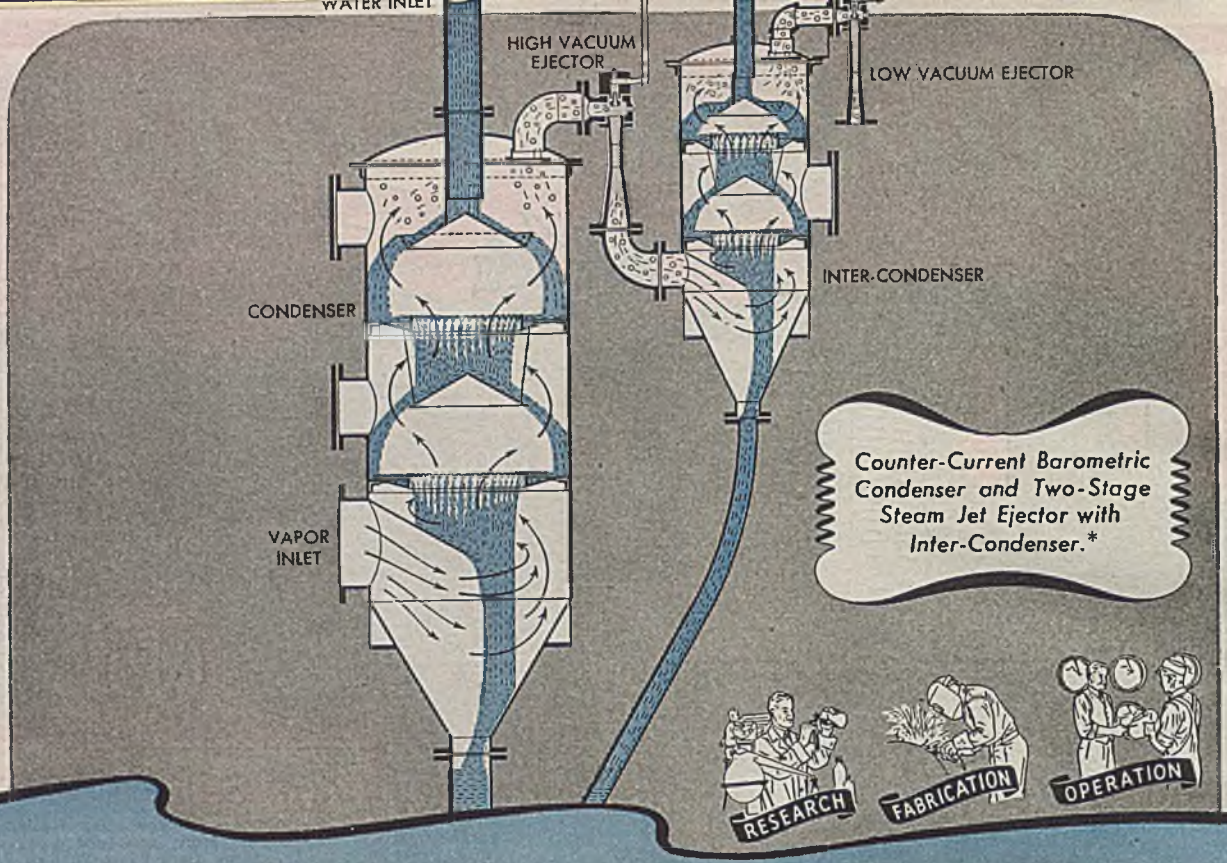

ACME COUNTER-CURRENT BAROMETRIC CONDENSERS

Developed after years of experience and field application, Acme Counter-Current Barometric Condensers offer many advantages over other types of condensers:

1. Vacua exceeding 28" Hg. achieved through dry operation.
2. Mimimum pressure drop is guaranteed through scientific proportioning.
3. Counter-Current flow insures ideal performance even under varying loads.
4. Low initial and maintenance costs.
5. No pump required; condensate removed by gravity
6. Minimum water consumption results in greatest operating economy.
7. Less installation space required because of Acme compact design.
8. Simple construction; all parts accessible.

ACME STEAM JET EJECTORS

In their many applications for removing water vapors, air, or other incondensible gases from a vacuum chamber, Acme Ejectors consistently offer superior performance at lowest cost:

1. Simple in construction; no moving parts; built for long life.
2. Stable operation even under varying loads.
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4. Lower initial cost; negligible maintenance cost.

Where vacua not exceeding 27" to 28" Hg. are desired, we offer the Acme Patented Multi-Jet Barometric Condenser, fully described in our Bulletin MJ-44, sent upon request . . . The complete Acme line embraces every important type of condenser and ejector. Our engineers are prepared to study the requirements of any process, and to make suitable recommendations for the most efficient operation.

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FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

OLD MAN NEWHALL, the famous builder of sugar refineries (McCahan, Camden, Pennsylvania, Edgewater, Arbuckle, Yonkers, Hershey Chocolate Works and several Cuban plants) fitted the melter house with a substantial steel skeleton in 1902 but for reasons of finance, the floors were made of yellow pine. On the sixth floor he built a wall around four bays and called it the raw sugar bin. The sugar was discharged through holes in the floor and when the angle of repose was reached, unless shovelers got into vigorous action, the flow to the minglers stopped. Frantic signals were then sent to the dock to speed up. When the flow from the dock came too fast, the signal was reversed. Discharging bags ("cutting in") was a 24-hr. operation. Frequent production delays occurred. When the sugar came slower than Henry could melt, he blamed Dock Superintendent Ed Haggerty and when Henry was melting slower than Ed was delivering, then Ed blamed Henry. "After many days" the awkwardness of the situation became sufficiently impressive to demand a change.

The economical procedure in discharging the bags of raw sugar from the ship's hold is to deliver them in one continuous, streamlined movement by way of the cutting-in station to the process or to bulk storage. The expense of making up drafts (i.e. seven 325-lb. bags in a sling) in the ship cannot be avoided. Piling the bags in the warehouse requires duplication of this expense although if the bags are left in the original slings to be picked up later by the crane, the re-piling cost is reduced. In the short haul transport, the heaviest expense occurs at the terminals.

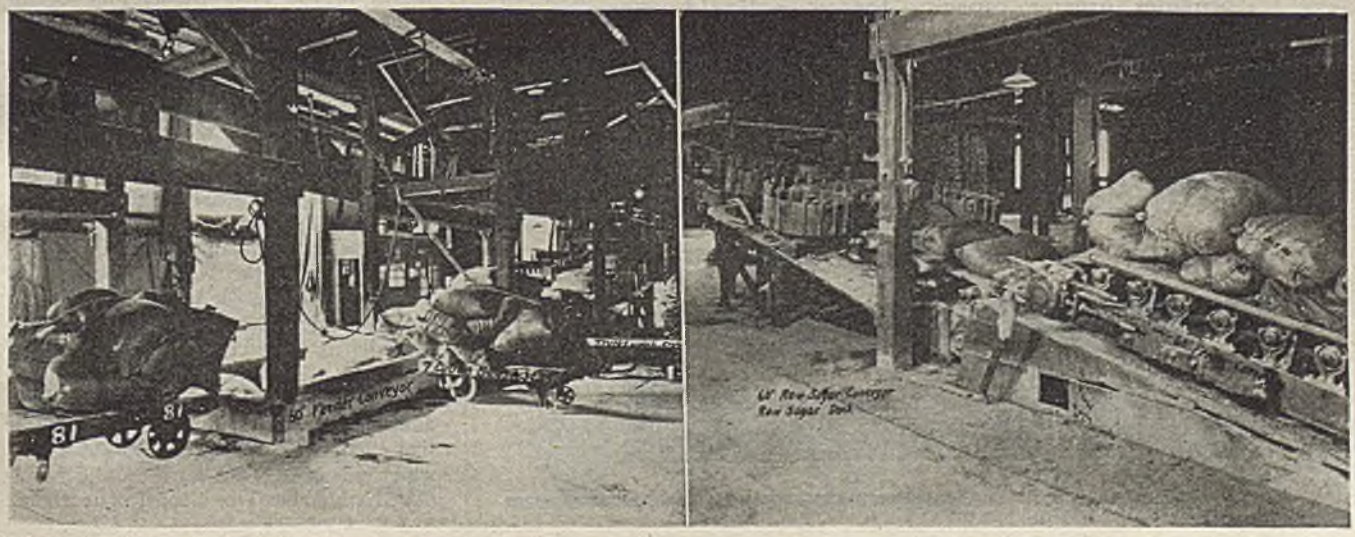
Every time a bag stops in its journey to destination, special effort, both manual and mental, is required to get it started again. The human machine is equipped with mental supervisory apparatus but it does not preponderate as a power plant. The current minimum operating price is 75c. for a maximum of 1/15 hp.-hr. plus social security tax and a complicated system of accounting, not to mention an occasional hospitalization for hernia. A mechanical horse-power-hour as generated in the sugar house power plant costs a third of a cent including overhead. The bags should therefore be immediately converted into bulk storage from which recovery is a mechanical job. This argument is still applicable but before many years raw sugar will be shipped in bulk, as is done with grain or crude oil, and thereby effect a great saving in labor and bags. This method of shipment is even now practiced by the Revere and California and Hawaiian Refinery.

Editor's Note.—*Dan said the other day he felt a bit selfish about making the "Log" a One-Man Show. "There must be a lot of Chem. & Met. readers, old and young, who at one time or another have jotted down notes on interesting experiences that they might be willing to share with the rest of us. How about asking these fellows to dust 'em off and send 'em in to you or me?" Maybe Dan's got a pretty good idea here. Suppose we give it a try? Send in your notes and if we can use 'em, we'll help you buy that next war bond.*—S.D.K.

THE RAW SUGAR UNLOADING FACILITIES are illustrated. A 60-in. feeder belt receives the one-ton drafts of bags from the trucks and, under manual speed control, the bags are fed to the main belt. En route to the cutting-in station, the sewn ends of the bags are opened. The belt conveyor inclines downward at the discharge end and above this there is arranged a horizontal trolley conveyor which the boys dubbed "carrousel." The carrousel is provided with multiple hooks like garden rakes suspended on chains which roll into spring-loaded reels when not in use. (For drawing and photographs see *Chem. and Met.*, Feb., 1931, p. 109). As the bags arrive under the carrousel, workmen insert hooks into the bottom end and then, as travel continues, the bag lowers, is up-ended and discharged. The bulk sugar then rises in the elevators to fill the 1,000 ton live-storage bin above the melter house which continuously supplies the process. When the bin is filled, the surplus sugar returns to the bulk storage space on the dock from which it is recovered as required by means of conveyors as shown. The dock operation is now an eight-hour shift. In case the bin should run low during the night, a single operator can start the conveyors under the dock floor and deliver additional sugar.

FOR THE CONSTRUCTORS, the task of making the installation was a "12-Sunday" job with now and then a Saturday pinched off for good measure. It included the unpleasantness of driving

Raw sugar unloading facilities. A 60-in. feeder belt receives the one-ton drafts of bags from the trucks and under manual speed control, the bags are fed to the main belt



170 piles under the cellar and reinforcing the columns to carry the new loads. The conception of the plan demanded some few sleepless nights of cogitation followed by the suggestions and criticisms of the gang.

The basis of turning the gang loose is William Wrigley's famous pronouncement to wit, "When two men in an organization always agree, one of them is unnecessary." The construction proceeds like a game of chess, with the operating superintendent sitting in, jealously guarding his prerogative to avoid production delays. Sugar refining is a 24-hr. process. A hiatus in the orderly schedule affects the efficiency of extraction through both mechanical and chemical losses. Moreover, there is joy in the game even under the accompaniment of the kibitzers and sidewalk superintendents who keep their eyes at the knotholes or razz from the bleachers.

THE FIRST ATTACK AGAINST THE JOB was erection of part of the bin that projected above the roof where no obstacles interfered. When this was completed and decked over, steel hanger rods were dropped down to the sixth floor and there arranged to carry the old wooden bin so as to permit sawing off of the floor joists at the perimeter and thereby allowing the steel walls of the new bin to be completed, leaving the old wooden box suspended within.

BEFORE THE WOODEN FLOORS, bins and chutes had been replaced with steel and concrete throughout the plant, acetylene burning had to be preceded by careful preparations. The log records experiences in the procedure. Helper Tommy was stationed in the old bin on the sixth floor surrounded by fire buckets and a fire hose. Twenty feet above, Burner Bruno was all set to burn off an old steel beam. The chronicler made a final inspection of the fire-fighting arrangements and, finding them in order and in charge of a competent mechanic, went aloft and stood by while Bruno began to spit fire. Presently a black cloud of smoke issued from below. The chronicler beat it down and applied the hose. In a few minutes volunteers came from all directions. When the excitement was over, Tommy was found lying beside the buckets, soused to the ears! Beside him lay an empty unlabeled flask. Whatever may have been the contents of the flask, it had terrific potency.

ON ANOTHER OCCASION a 1¼-in. steel pipe had to be cut out for the new bin. Neither the master fitter nor any of the others recognized the pipe. It was, therefore, adjudged dead and accordingly Bruno directed his flame against it. A sudden blast from the "dead" pipe snuffed out Bruno's torch. It was found that the pipe contained illuminating gas and providentially its force cheated the fire department out of a nasty job.

The signal of completion of the bag dumping device was the erection of a sign "Patent applied for Feb. 26, 1927" which was carried out for the "Old Man" (W. H. Hoodless) in a spirit of facetious-

ness. Later the sign was changed by legal authority to "Patent, June 17, 1930." Many a friendly competitor has taken pattern from our simple device with the Old Man's blessings. After some floundering, operation got underway and a large saving obtained. In the beginning there was the usual resistance to change. Ed, who had unloaded some thousands of ships condemned the design. His assistant, noting the hump-backed alignment of the 60-in. belt conveyor and the carrousel at the discharge end, announced that he was going to apply for the hot dog concession. Nevertheless, when the Old Man threatened to become tough, cooperation was forthcoming and the installation turned out to be a huge success. Ed then broadcast that he himself had proposed the very same device not less than ten years ago! Everybody adopted it and extracted satisfaction from the thought that he was the first to think of it.

THE OPERATION OF THE APPARATUS disclosed no unusual behavior. The bin on the roof, though 65 ft. deep, discharged freely and has never required cleaning since it was built in 1926. The bulk storage bin on the dock, having a flat bottom, is 40 ft. deep. When the dock crew goes home at 5 o'clock, the bin above the melter house is filled but its capacity is not equal to 16 hours of refinery operation. To make up the deficiency, Joe Disvk starts the conveyors under the dock bulk storage, opens the trap doors in the floor and lets the sugar feed through to the belt. Sugar flow continues till the angle drops to 40 deg. with the horizontal. Sometimes, however, especially in cold weather, the sugar stands vertically like a cliff. Joe then undercuts the bank with the aid of the clamshell bucket suspended from the traveling crane left over from the former handling apparatus. Then he watches the cliff topple over and deliver an avalanche to the conveyor, the while he enjoys the comfort of a soft seat in the cab.

One night he stood at the toe of the bank and took a poke at the wall with a bar. Suddenly there was a slide that engulfed Joe just clear of his Adam's apple. The helper could not get near him for fear of another slide that would cover Joe without trace. So he speeded up the conveyor. When the level of the sugar dropped to Joe's armpits, the helper swung the hoisting rope from the overhead crane, lassoed Joe around the waist and heaved. Joe responded perfectly but just as his legs were about to dangle free, the rope unhooked and he sank back. The second lift proved successful. Joe made no effort to assist his helper to extricate him. Inasmuch as the embarrassment befell him in the line of duty, getting him out was the responsibility of the House. The hospital attendant examined him and found no injury—not even imaginary.

●

A FAITHFUL MECHANIC of foreign extraction failed to appear on the job one day last week. This was so unusual that a messenger was sent to his house to ascertain the cause. His wife stated that Frank

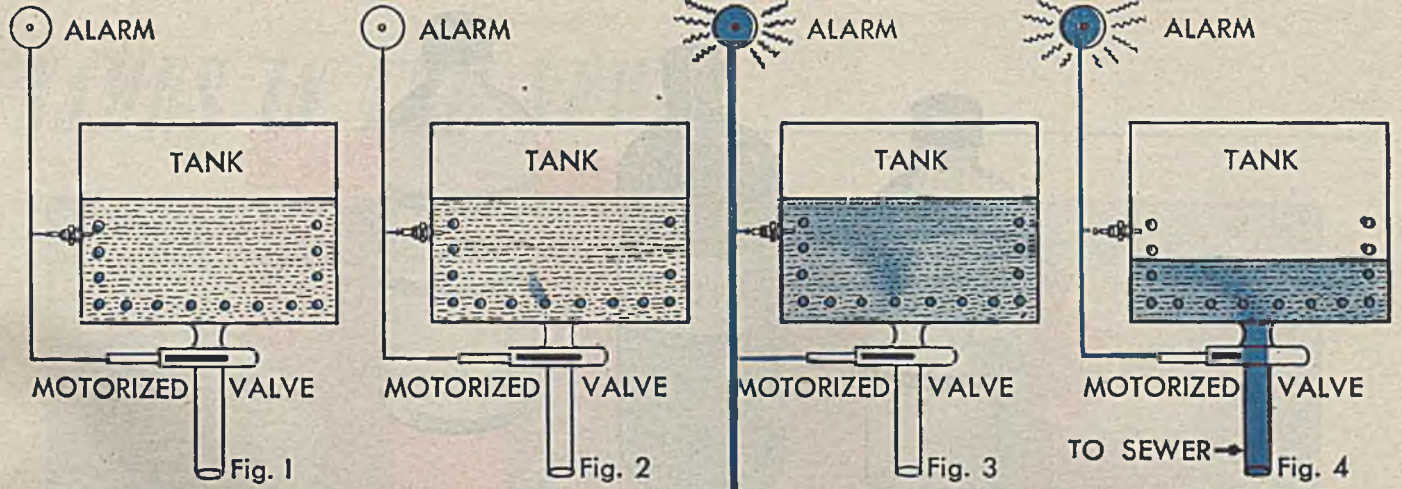
had disagreed with a traffic cop's decision and started an argument. He was therefore detained for the night in the hoosegow. The next day Frank was back on the job and he swore that no policeman could do that to him! Frank had missed the advantages of the great American sandlot where the kids razz each other but they learn to accept the decision of the umps, nauseating though it may be.

BARNACLE BILL, skipper of the steam dredge "Pacific," periodically brings his craft to Pier 47 to remove the black ooze that settles out of the big city sewers along the water front. Last week he issued a special invitation to the chronicler and the steam-plant foreman to share corned beef and cabbage at high 12 aboard his ship. Externally a barge that wallows in the muddy water has no appeal except to a craftsman who perceives in its function a useful service. However, within the galley there is the usual regard for human sensibilities. The steam plant foreman, accustomed to the need for protection against coal dust, omitted to remove his hat. The Skipper announced, "I want every man to feel at home. If he wears his hat at dinner at home, it's all right to wear it here!"

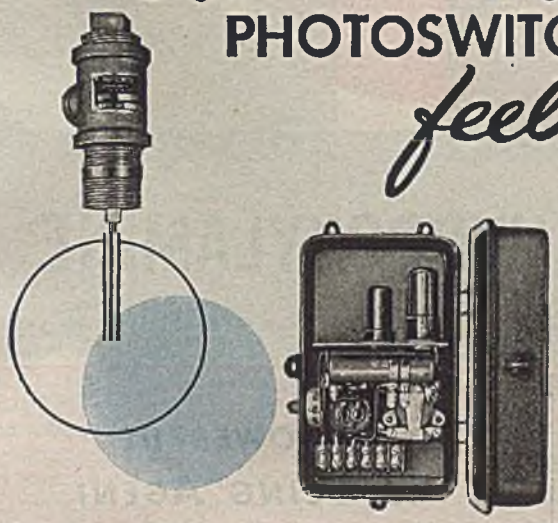
HADES, ACCORDING TO VIRGIL, was inhabited by ethereal entities—the souls of departed men. They could think, wish, will and suffer but could not accomplish. Their bodies had been taken away and the souls were awaiting assignment to another body, classified as to quality and esteem according to the deserts of their late earthly performance. The refining and improvement of the soul was achieved during sojourn on earth. Promotion came about according to merit by way of reincarnation. The basis of the stimulation to exemplary mundane behavior was the prospect of improvement during the next cycle. Virgilius must have been a chemist!

A RESTAURATEUR IN LINCOLN, Neb., during the chronicler's sojourn there, conceived the idea of saving the time of his waiters and at the same time apply flattery as a drawing card for customers. He discarded the conventional meal checks and by a sign on the wall requested the guests to add up their own bills and pay the cashier accordingly. This resulted in a certain increase in customers but the chef found that the customers grew careless about their arithmetic.

THE LOWLY "HEWER OF WOOD" has learned that simulating stupidity keeps him out of trouble but he frequently applies ingenuity of high order. Before the wooden floors with which the refinery was infested were replaced with concrete, drops from leaky pipes were caught in a bucket until a week-end opportunity came for repair. The "Polander" despaired of the frequent necessity of dumping the bucket and besides he had done it long enough. Accordingly he punched a hole in the bottom of the bucket at a point that coincided with a knot-hole in the floor.



PHOTOSWITCH CONCENTRATE CONTROLS *feel* LIQUID MIXTURE CHANGES *Electronically*



Photoswitch Concentrate Controls — electronic teammates of Photoswitch Level Controls — check liquid mixtures, detect changes and contamination, and act *instantly* to sound alarms, operate signal lights, start pumps, open or close valves . . . as required.

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How Photoswitch Detects Contaminated Condensate

Fig. 1. This tank contains hot condensate water, used to heat coils through which flows an electrolyte containing acids. Photoswitch Concentrate Control P25N, with horizontal probe fitting permanently installed in the tank wall, guards against contamination of the condensate by the acid, should a leak develop in the coils.

Fig. 2. A leak develops in the electrolyte coils.

Fig. 3. Concentration of acid leaking into the condensate has reached the critical low solution point at which the highly sensitive Photoswitch Electronic Control is designed to operate. A microcurrent passes through the liquid at the probe, and is amplified by the Photoswitch Control to operate a signal and a three-way, motorized valve which cuts off flow of condensate from the tank to the boilers, and dumps the contaminated water into the sewer.

Fig. 4. Exhaust valve empties tank so that coil leak can be repaired.

The installation pictured here is used in a large smelting plant for automatic detection and control of contamination in hot condensate, used to heat coils through which an acid electrolyte flows. Coil leaks permit the acids to mix with the condensate, rendering it unfit for use in the boilers. Electronic detection and automatic control provide the surest, simplest and most economical solution of the problem.

This is another example of the electronic versatility and economy of Photoswitch Level Controls for liquids and powders. Their magic fingers are also handling single level indication and control, on and off pump control at two levels, or boiler feedwater control in thousands of plants and industries throughout the country. They are *floatless, efficient, maintenance-free,* and have no moving parts to wear out.

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NAME	Hydroxylammonium acid sulfate	Hydroxylammonium sulfate	Hydroxylammonium chloride
FORMULA	$NH_2OH \cdot H_2SO_4$	$(NH_2OH)_2 \cdot H_2SO_4$	$NH_2OH \cdot HCL$
Molecular Weight	131.11	164.14	69.50
Approximate Specific Gravity	1.83	0.91	0.62
Melting Point, °C	Indefinite	162 d.	152 d.
pH of 0.1 M Aqueous Solution at 25°C	1.6	3.5	3.4
*Solubility—g/100g at 25°C			
In Water	390 Approx.	63.9	94.7
In Methanol	20.2	0.1	17.5
In Ethanol, 95%	4.3	0.2	10.5
In Ethanol, Absolute	6.3	0.1	6.6
In Butanol	2.2	0.03	0.6

*These Hydroxylammonium salts are only very slightly soluble in ethers, esters, and aliphatic or aromatic hydrocarbons.

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HYDROXYLAMINE in stable form . . . manufactured from the Nitroparaffins . . . is now available at reasonable prices. It is useful in removal and purification of aldehydes and ketones . . . as an analytical reagent . . . as a resin catalyst, rubber accelerator, flotation agent . . . in the preparation of nitriles, acid amides, isoxazoles, metal complexes, barbituric acid derivatives, and other compounds used in pharmaceuticals, dyestuffs, photographic chemicals, insecticides, and antiseptics. Larger postwar production and lower prices warrant re-examination of the possibilities of Hydroxylamine. Write our Technical Service Division for samples.

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NAMES IN THE NEWS

H. C. Parmelee

William Blum

R. C. Wickersham

H. C. Parmelee has retired as editor of *Engineering and Mining Journal* and has just been succeeded in that position by **Evan Just**, assistant editor and former secretary of Tri-State Zinc and Lead Ore Producers Assn. Dr. Parmelee joined the McGraw-Hill Publishing Co. in 1910 as western editor of *Chem. & Met.* and was its editor from 1918 to 1928. He continues his 34 years association with the McGraw-Hill companies as editor emeritus of *E.&M.J.* and chairman of the advisory committee on chemical engineering texts and reference books.

Gerald J. Cox, who recently joined Corn Products Refining Co.'s research staff, left Mellon Institute in 1941 to join the War Production Board and then served as a consultant for the National Research Council.

W. F. Leicester has been appointed president of the Casein Co. of America, a division of Borden Co. Formerly vice president, Mr. Leicester succeeds William Callan, who continues as a vice president of the Borden Co. and a member of the directing board of the Casein Co. of America. He has been in charge of the glue division of the Casein company since 1923.

John W. Boyer, chief of the alcohol and solvents branch of the Chemicals Bureau, WPB, has resigned to establish himself in Washington as a consultant to the chemical industry. He will be succeeded by **Frank E. Bennett**, chief of the industrial alcohol unit of the Chemicals Bureau. Mr. Boyer joined WPB in May, 1942, as a business specialist, having been called from his farm near Charlottesville, Va., where he had retired after 20 yr. in the chemical business. He was formerly connected with the American Cyanamid Co., Mathieson Alkali Co., Monsanto Chemical Works, Calco Chemicals Co., and the Solvay Process Co. Mr. Bennett, who comes from Orange, N. J., joined WPB in February, 1942, after 23 yr. of experience in the chemicals industry.

William Blum, chief of the Section of Electrochemistry, U. S. Bureau of Standards, has been elected to receive the eighth Edward Goodrich Acheson medal and thousand dollar prize of the Electrochemical Society. The formal presentation of the award will take place at the fall convention of the society at Buffalo on October 13.

A. N. McFarlane of the research department of Corn Products Refining Co., Argo, Ill., has been appointed associate director of research. Dr. S. M. Cantor is the newly appointed assistant director.

Lawrence A. Appley has been appointed a member of the War Manpower Commission's National Management-Labor Committee. Mr. Appley will serve as a member at large. For the last year and a half he has been associated with WMC as director of the Bureau of Placement and then became its deputy chairman. He resigned July 1 because of ill health. After a period of rest and recuperation, he will return to his post with the Vick Chemical Co. which he joined in 1941 as vice president in charge of personnel planning and research.

Orlan McGrew Arnold has been selected by Chrysler Corp. as head of its division of physical chemical research at Detroit, Mich. Born in York, Neb., Dr. Arnold was graduated at Grinnell College, Iowa, in 1928, and earned his doctor's degree at the University of Wisconsin.

Edward U. Condon, associate director of the Research Laboratories for the Westinghouse Electric & Mfg. Co., has been elected to membership in the National Academy of Sciences, membership in which is based upon outstanding contribution to the field of science.

L. W. Eastwood, formerly vice president of the Maryland Sanitary Mfg. Co., has been named to the staff of Battelle Institute, Columbus, Ohio, where he is engaged in metallurgical research.

R. C. Wickersham has been appointed assistant general manager of the Tar and Chemical Division of Koppers Co. He joined Koppers in 1916 after graduation the previous year from Lehigh University with a degree in engineering. After successive promotions, he was manager of Koppers Co.'s White Tar Division, Kearny, N. J., at the time of his recent appointment.

Jesse J. Baum, until recently process engineer and metallurgist with the Allison Engineering Division, General Motors Corp., has joined the Duraloy Co., Scottdale, Pa., as plant superintendent.

S. A. Berryann, assistant export manager for the Brown Instrument Co., Philadelphia precision industrial instrument division of Minneapolis-Honeywell Regulator Co., has been awarded honor medal for the highest average attained in chemical engineering, junior year, at the Drexel Evening School of Drexel Institute, Philadelphia.

Clarence L. Wanamaker has been named general manager of the Munitions Division of United States Rubber Co. to succeed Ernest G. Brown, recently chosen general manager of mechanical goods, general products, Lastex yarn and rubber thread divisions. Mr. Wanamaker, a native of Melrose, Mass., graduated from Dartmouth College where he attended the Tuck School of Business Administration and Finance.

Ward W. Pigman, specialist in carbohydrate chemistry and enzyme systems at the Bureau of Standards, Washington, D. C., has joined the research staff of Corn Products Refining Co., Argo, Ill.

Harold W. Heine has been awarded the William F. Meredith Fellowship for graduate study in chemistry at Rutgers University. He graduated from the university in July with a bachelor of science degree in chemistry. The fellowship was created by the Titanium Alloy Mfg. Co.

as a memorial to the firm's founder and late president.

O. T. Manning of the control laboratory at Wood River Refinery of Shell Oil Co., has been awarded both the Silver Star and the Legion of Merit medal for gallantry in action. Lt. Col. Manning is serving with the armed forces in Europe.

Albert Hershberger, for a number of years attached to the Pioneering Research section of the Du Pont Rayon Department, has been appointed supervisor of new films research in the Cellophane Research section at Buffalo, N. Y.

Frederick W. Adams

Frederick W. Adams has been appointed director of research of the Clark Thread Co., Newark, N. J., and associated companies and will make his headquarters at the New York offices of the company. He will be responsible for the development of plans for the coordination and expansion of research within this organization. Mr. Adams was formerly associated with the Pittsburgh Plate Glass Co. in their product development department.

A. P. Frame, vice president and chief engineer of the Cities Service Refining Corp., has been appointed director of the Refining Division of the Petroleum Administration for War. He succeeds **E. D. Cumming** who has returned to New York City to resume his duties as vice president of the Shell Oil Co.

Peter F. Warfield has been appointed to the research and development laboratories of the Bakelite Corp. in Bloomfield, N. J. Dr. Warfield was recently graduated from the University of Illinois.

Joseph H. Hart, formerly chief chemist, has been promoted to laboratory director for Kelite Products, Inc., Los Angeles.

L. M. Pidgeon, head of the Department of Metallurgical Engineering of the University of Toronto, has been awarded the McCharles prize in recognition of his development of a process for the production of magnesium from Canadian dolomite.

H. O. Teeple, chemical engineer, has joined the technical service group of the

Development and Research Division of the International Nickel Co. at New York.

P. E. Fluor, executive vice president and general manager of Fluor Corp., Ltd., Los Angeles, was elected president to succeed **J. S. Fluor, Sr.**, while **J. S. Fluor, Jr.**, succeeds P. E. Fluor.

Raymond B. Prouty has been elected vice president in charge of production of the Whitlock Mfg. Co., Hartford, Conn. Mr. Prouty joined the Whitlock organization in 1925.

William J. Priestley

William J. Priestley has been elected president of Electro Metallurgical Co., Electro Metallurgical Co. of Canada, Ltd., Michigan Northern Power Co. and Union Carbide Co. of Canada, Ltd., subsidiaries of Union Carbide & Carbon Corp. Mr. Priestley succeeds the late **Francis P. Gormely.**

Charles A. Powel, manager of headquarters engineering of the Westinghouse Electric & Manufacturing Co., has been elected president of the American Institute of Electrical Engineers for the year beginning August 1944.

William W. Watkins has been appointed research manager to head the organic chemistry activities in the pioneering research laboratory of the Du Pont Rayon Department at Buffalo, N. Y.

I. A. Oehler has been named chief process engineer of the American Welding & Manufacturing Co., Warren, Ohio.

Edward M. Chace, director of the laboratory of fruit and vegetable chemistry for the Department of Agriculture in Los Angeles, has retired from that position.

Arthur S. Shoffstall has retired from his position as general manager of the Huntington Works of International Nickel Co. Mr. Shoffstall will continue in the capacity of a consultant to the head office of the company.

Harold C. Haskell, an executive of E. I. du Pont de Nemours & Co., received an honorary Master of Arts degree from Tufts College June 18.

Eugene L. Ray, Linotype

W. E. Brinker, Jr.

William E. Brinker, Jr., chairman of the chemical engineering department, Northwstern Technological Institute, has joined the staff of Corn Products Refining Co., Argo, Ill., as director of engineering, Chemical Division. In the past Dr. Brinker has served as thermal engineer with the American Dressler Tunnel Kilns, Inc., industrial fellow at the Mellon Institute of Industrial Research, and professor of chemical engineering at the University of Pittsburgh. More recently he has been responsible for planning and developing the chemical engineering department and laboratories at the newly established Northwestern Technological Institute.

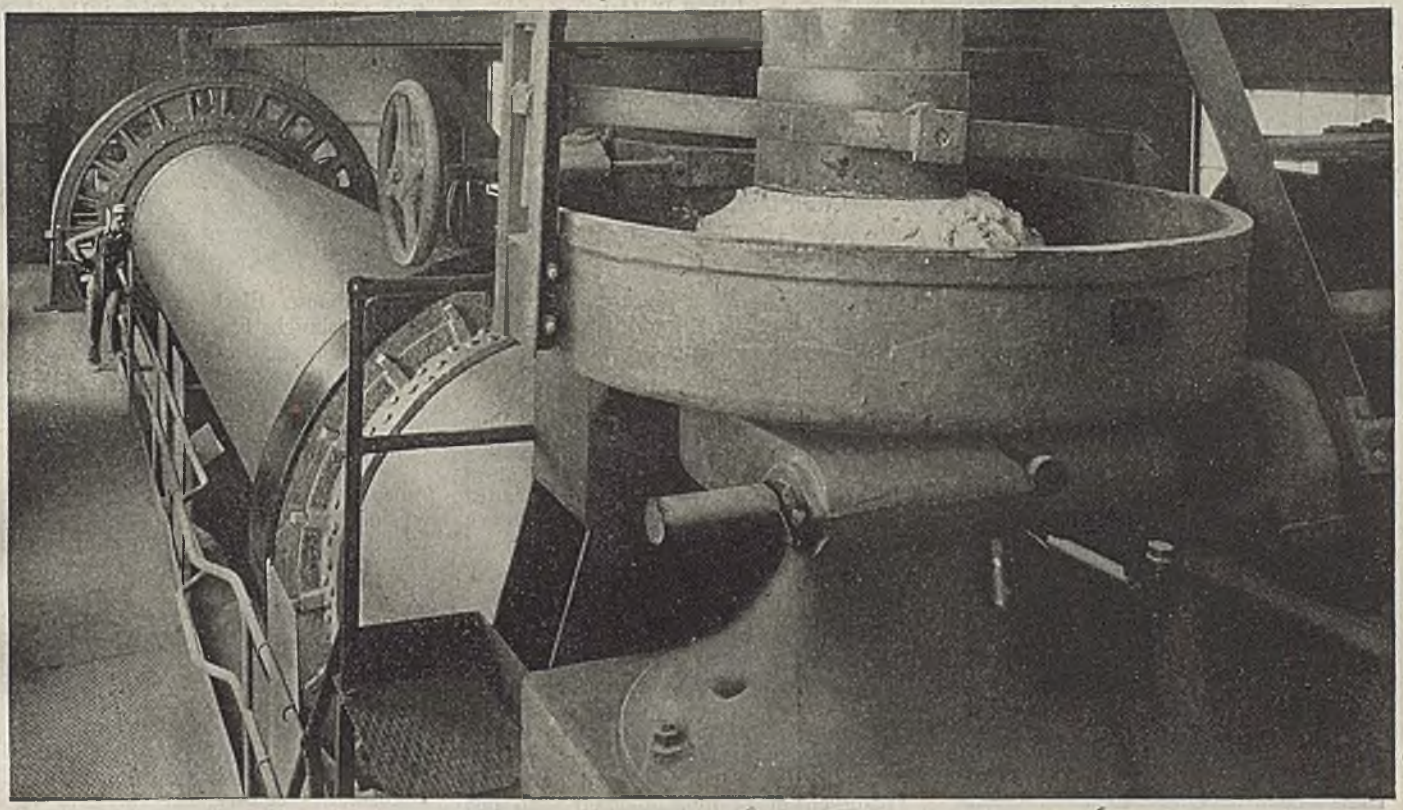
OBITUARIES

Frank J. Tone, chairman of the board of the Carborundum Co., Niagara Falls, N. Y., died July 26 at his home after a long illness. Dr. Tone retired as president of the company in April 1942 when he became chairman of the board, and acted in an advisory capacity. Associated with the concern nearly 50 years, Dr. Tone was the originator of the first commercial process for the production of silicon metal. He received the Perkins medal in 1938 and was a former president of the Electrochemical Society, recipient of the Edward Goodrich Acheson Medal conferred by that society in 1935. He was also the recipient of the Jacob Schoellkopf Medal, granted by the western New York branch of the American Chemical Society in 1931.

George E. Cox, general manager of the North American Cyanamid Co., Niagara Falls, Ont., since 1930, died July 19 at the age of 73. Born in Baltimore, Mr. Cox was graduated from Johns Hopkins University. Before joining Cyanamid in 1912, he was employed by the General Electric Co. and Union Carbide & Carbon Co. During the first World War, he assisted in constructing the plant at Muscle Shoals.

Francis P. Gormley, recently elected president of Electro Metallurgical Co., of Canada, Ltd., Haynes Stellite Co., Michigan Northern Power Co., and Union Carbide Co. of Canada, Ltd., subsidiaries of Union Carbide & Carbon Corp., passed away July 14.

Compartment Mills



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INDUSTRIAL NOTES

The National Radiator Co., Johnstown, Pa., has placed Paul B. Holmes in charge of sales of the heating division to succeed the late Charles L. Crouse.

Allis-Chalmers, Milwaukee, has appointed John Avery manager of the blower and compressor department to succeed G. L. Kollberg. Mr. Kollberg has retired after 47 years with the company but will continue as consultant and adviser on engineering matters.

McAlear Mfg. Co., Chicago, and Climax Engineering Co., Clinton, Iowa, have acquired Hanlon-Waters, manufacturer of control instruments.

Dow Chemical Co., Midland, Mich., has extended the technical and distribution facilities of its fumigant division to cover the eastern territory and has appointed George F. Kerbey to head up this branch with headquarters in the Philadelphia office.

Mt. Vernon Car Mfg. Co., Mt Vernon, Ill., has appointed Richard T. Coyne manager of sales to succeed T. M. Evans, vice president, who has resigned.

American Cyanamid Co., Calco Chemical Division, Bound Brook, N. J., has formed a pigment department under the management of John Allegaert with Leo Sklarz as manager of sales. Dr. R. A. Shive has been appointed director of technical services of the department.

The Midvale Co., Nicetown, Philadelphia, has selected Thomas Rutherford as manager of railroad and casting sales and has appointed Truxton R. Broadhead Philadelphia district sales manager.

John C. Dolph Co., Newark, N. J., has added David M. Kelly to its engineering staff. Mr. Kelly is in charge of the industrial service division.

Aluminum Co. of America, Pittsburgh, has appointed three assistant sales general sales managers. R. V. Davies will have charge of sales engineering and sales development activities. R. B. McKee will have charge of district sales offices and all direct selling. Donovan Wilmot will direct product manager activities and warehouse distribution.

Mixing Equipment Co., Inc., Rochester, N. Y., is now represented in Georgia, Alabama, and the greater part of Tennessee by Edgar A. Rogers who is making his headquarters in the Chattanooga Bank Bldg., Chattanooga, Tenn.

Elgin Softener Corp., Elgin, Ill., has appointed B. M. Thompson, 8 East 66th St., New York, as district engineer in lower New York and upper New Jersey and Orra F. Hawn, 7 Academy Road, Albany, as district engineer in upper New York.

Federal Electric Products Co., Newark, N. J., has acquired the property and business of the electrical division of Colt's Patent Fire Arms Mfg. Co. at Hartford, Conn. and will operate it under the supervision of Thomas M. Cole, executive vice president of Federal.

Electric Machinery Mfg. Co., Minneapolis, has appointed R. H. Olson vice president in charge of sales with headquarters at the main office. He had been serving as manager of New York district office.

Westinghouse Electric and Mfg. Co., East Pittsburgh, has promoted L. E. Osborne, manager of the steam division at Philadelphia, to assistant to the vice president where he will serve as engineering consultant. C. B. Campbell succeeds Mr. Osborne as manager of the steam division.

American Machine and Metals, Inc., East Moline, Ill., has placed Winfred L. Foss in charge of its district sales office in the Park Square Bldg., Boston.

The B. F. Goodrich Co., Akron, has named Jay E. Miller advertising manager of the industrial products and sundries division of which he is also sales promotion manager.

Allis-Chalmers, Milwaukee, has elected to its board of directors, Ernest Mahler, a chemical engineer and executive vice president of the Kimberly-Clark Corp., of Neenah, Wis.

The J. B. Beaird Co., Shreveport, has opened a branch office in the Citizens State Bank Bldg., Houston, Texas, under the management of Hubert B. Wilder.

Thermoid Co., Trenton, N. J., announces the appointment of A. C. Teetsel as manager of friction materials manufacturing.

The Pennsylvania Salt Mfg. Co., Philadelphia, has opened an office in the Carew Bldg., Cincinnati. In charge is Louis M. Kuilema formerly with the Paper Makers chemical department of Hercules Powder Co.

Shell Oil Co., Inc., New York, has transferred E. E. Williams, former division supervisor of the company's marketing division at Detroit, to the New York office where he will be field assistant to F. B. Boice in LP gas activities.

The Osborn Mfg. Co., Cleveland, has promoted F. T. Turner to assistant sales manager of the brush division. He had been working on special assignments in the home office.

Warren Steam Pump Co., Inc., Warren, Mass., has placed Parkman A. Collins in charge of its office in Boston. He succeeds Howard C. Fiske who has retired after 45 years service with the company.

Fisher Governor Co., Marshalltown, Iowa, is now represented in the Tennessee district by Johnson and Scott with headquarters in the Dermon Bldg., Memphis.

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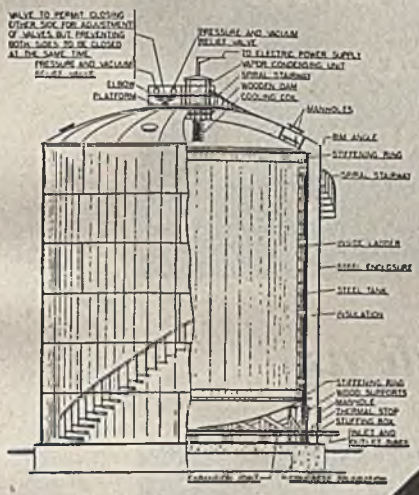

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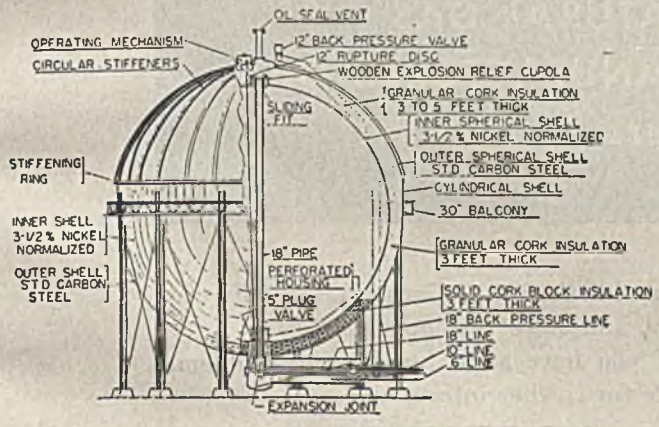

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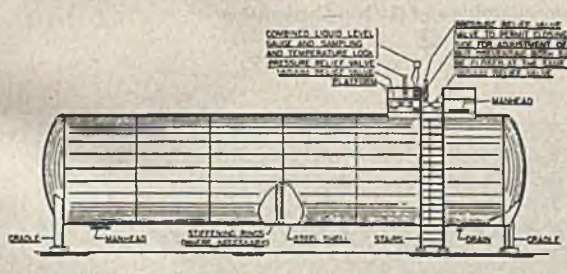

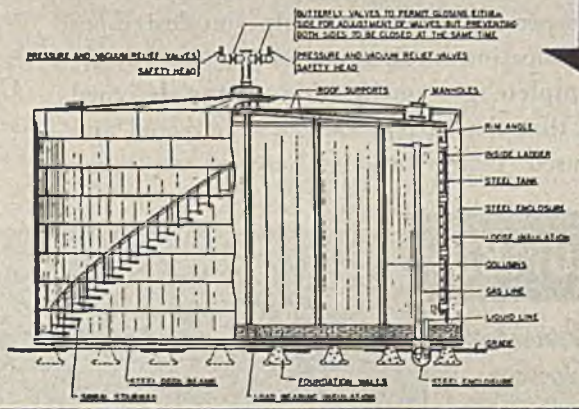

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CONVENTION PAPER ABSTRACTS

BUTANE DEHYDROGENATION

BUTANE dehydrogenation has been in operation since 1940. Numerous interesting engineering problems were encountered in developing the process through the pilot plant stage. The catalyst used has the essential characteristics of high activity, good selectivity, thermal and mechanical stability, and low cost. The process temperature and pressure are determined by consideration of thermodynamic equilibrium and the ratio of thermal to catalytic reaction rates. The plant design is controlled by the high endothermic heat of reaction, the exothermic heat of regeneration, and the necessity of low-pressure drop. These considerations lead to a heat exchanger type of reactor, with the catalyst in tubes heated and cooled by circulating flue gas.

A simplified flow chart for the process is shown in the accompanying illustration. The charge butane is pumped through a heat exchanger and heater, where it is vaporized and heated to approximately the required reaction temperature, and then is directed by means of switch valves to the processing reactor where it flows downward through catalyst tubes. Reaction occurs rapidly near the entrance as the charge enters the tubes; then, owing to the retarding effect of reaction products, decreases as it proceeds through the tubes.

Because the reaction is endothermic, heat is supplied by hot flue gas circulated outside tubes. Flue gas flow is parallel to, and in the same direction as, the process gas flow inside the tubes; thus the greatest temperature difference and greatest heat flow occur at the top of the tubes, and as the flue gas is cooled, the temperature difference and heat flow become less.

The butane temperatures in the inlet portion of the tube can be raised or lowered by adjusting the inlet temperatures of the flue gas and/or the butane itself. The butane temperatures in the outlet portion can be varied almost independently by adjusting the flue gas flow rate, thus changing its temperature in this zone.

The heating flue gas is recirculated through ducts by a fan; its temperature is raised by the addition of hot combustion products from fuel gas burned in a heater, and it is then directed by dampers to the processing reactor where its temperature is lowered by heat transferred to the reaction.

The product leaving the catalyst tubes is composed of butylene, hydrogen, unreacted butane, and small percentages of other light hydrocarbon gases resulting from side reactions. It passes through the outlet switch valves and the charge heat exchanger into a gas scrubber where it is further cooled by a circulating oil stream. The product is then sent to other processes. Usually, it is compressed and sent to an absorber for separation of the butane-butylene fraction from lighter gases. The butane-butylene fraction may be used as feed for polymerization or alkylation. In this case the unconverted butane would be separated by fractional distillation and returned to the dehydrogenation process. In other circumstances, the butane-butylene fraction might be directly resolved into butylene and recycle butane by solvent or azotropic operations. This would be done, for example, in order to obtain concentrated butylene for charge to a butadiene plant.

Regeneration involves passing of air diluted with inert gas through the catalyst bed. Since the oxygen is removed from this mixture in the reactor, the exit regeneration gas is recycled as the diluent. Thus, the regeneration system consists of a closed loop through which gas is circulated by a compressor. Air is admitted to this gas before it enters the reactor and a corresponding amount of gas is vented after it leaves the reactor. The regeneration system operates under pressure and uses a cold compressor.

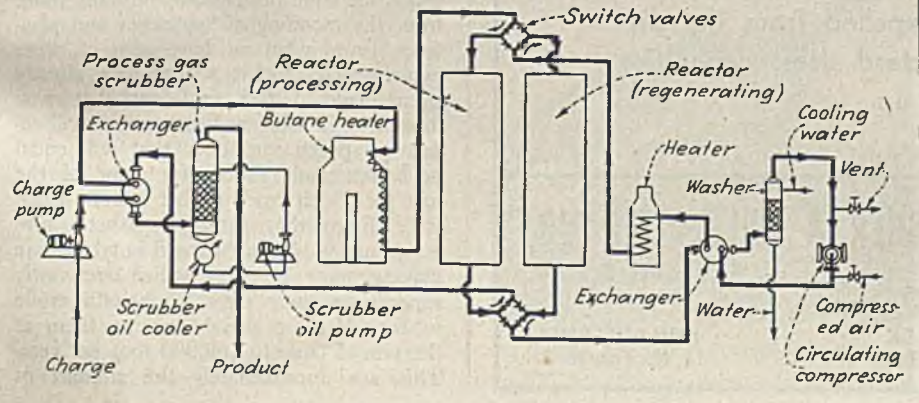
C. C. Watson et al., Universal Oil Products Co., Riverside, Ill., before American Institute of Chemical Engineers, Cleveland, May 16, 1944.

SYNTHETIC RUBBER IN THE FUTURE

LAST month (May) we reached an all-time peak in rubber production. Before 1941 consumption was at the rate of 54,000 tons a month. And, in the feverish rearmament year of 1941, consumption averaged 63,000 tons. But last month we made, in the United States and Canada, almost 70,000 tons of synthetic rubbers. In these days, production and consumption are almost synonymous.

With the increasing tempo of the war, we must do more and in the next six months we will step up production another 15,000 tons per month; about 20 percent. Some of this increase will be in

Flowsheet for butane dehydrogenation process



the form of butyl rubber which will then take its place for many of the innertubes. Despite the fact that buna-S is now being made at rated capacity (735,000 tons per year for the United States and Canada), it will be made at even greater rate.

But we still face problems. The first of these is the tremendous shortage of heavy-duty tires, most of which are needed by the military. The second problem is intimately tied to the first. Though it has been possible to replace all crude rubber with synthetic in smaller tires and many thousands of other articles, it is impossible to make some heavy-duty tires of synthetic until we have more rayon tire cord. Even then the technical problems incident to these heavy-duty tires are such that some crude rubber must be used. All of this means that even with our tremendous present production of synthetics, we are still forced to use crude rubber at a greater rate than we are obtaining it. Our stockpile of crude is dwindling and it is only because we know we will have the continued teamwork of planners, executives, technicians, test fleets, and workers that we dare prophesy that we will "squeak by." "Squeak by," we will, but it will be a close call.

The limitations which will control how fast the foregoing problems can be solved stem from manpower shortages and the difficulties of running factories at full speed, while installing and starting up new equipment and making changes in formulae. These problems are accentuated by the almost innumerable changes of plans that are inevitable in modern war. Above all, we must remember that in this synthetic program we are putting into effect in one year technological changes that would normally require 10 to 15 years. Such difficulties call for tolerance, understanding, cooperation and all out effort by everyone—by everyone in government, management, laboratories, and factories.

The manufacture of synthetics has now reached the point where—short of unexpected catastrophes—there will be enough rubber available to meet any now foreseen demand. So you can see the problems of converting synthetic rubber into the sinews of war are still with us. It is futile to make a truck without tires. It is equally futile to make synthetic rubber and fail to make good tires.

No one should conclude that the quality of products made from synthetics cannot be improved. The last year has seen great improvement and the horizon of quality is still far away. Some of these improvements will come from better compounding, some from the blending of synthetics and plastics. From what we have seen of these experimental synthetics that have already been made, I feel confident that new formulations using new monomers will result in special synthetics that will equal or better crude rubber for some of the jobs for which crude rubber is now necessary. From the specialty synthetic rubbers, buna-N, Neoprene, and butyl, we are making some products which are vastly superior to those once made with crude rubber. We are already making them at the rate of close to 100,000 tons per year. This was approximately the amount of

rubber that the country was consuming just before World War I. The future of special synthetic rubbers is still before them.

Though during the war the average cost must (because of the call of other programs for certain of the cheaper raw materials) remain much higher, nevertheless we have already made some buna-S at a cost, before depreciation and profit, of less than 13c. It requires only the simplest reasoning to show us that the rubber industry is free to develop new products without fear of having to discard them, as it was forced to do in the past, because of run away rubber prices. To me it is equally obvious that the inevitable industrialization of South America, Russia, China, India and parts of North Africa, and the East Indies that will follow this war, will mean a world demand for rubber far beyond the capacity of the plantations that existed before the war. With the chemists forging ahead as they now are, I cannot envision capitalists risking much new money to clear jungles, plant rubber trees, graft and cross-fertilize them, and then wait seven years for a crop which must be harvested by men who surely after the war will not be willing to work for a few pennies a day. The synthetic rubber industry will live.

We all look forward to the day when industry will be released from Government control and when competition will once again drive the imagination of men and make far greater and greater progress. Before the war, every year marked some progress but much effort went into sales appeals based upon price rather than the selling of differences of quality. Synthetic rubber is going to mean not a year or two, but decades of opportunity for men to make better synthetics.

Bradley Dewey, Rubber Director, before Convocation of the University of Akron, Akron, Ohio, June 4, 1944.

ELECTROCHEMISTRY IN THE POSTWAR WORLD

INDUSTRIAL electrochemistry has been indispensable in the mechanization of war and it will be essential in the expanding economy necessary to postwar prosperity. Alloy steels, aluminum, magnesium, abrasives, alkali, chlorine, synthetic organic chemicals derived from calcium carbide, chromium plating, and hundreds of other products of electrothermic and electrolytic processes are the raw materials of war machines as they are the source of much of the equipment of every-day life. In the postwar world electrochemistry should create new products and new industries, and by process improvement and increased efficiency should reduce the cost of existing products and insure their wider distribution. These developments should mean high production, wide employment, a large national income, and thus a higher standard of living.

Electrochemistry is uniquely qualified to lead in the industrial expansion which should follow the war. Its processes are direct, closely controllable and adapted to the mass production of things which are basic to industry at large. Its products can be had pure in quality, low in price,

and in enormous quantities. Electrochemical technology is labor-saving and is of such nature as to provide agreeable working conditions for labor. Electrolytic and electrothermal processes aid in the conservation of national resources by their economy in the use of raw materials and their ability to utilize lower-grade minerals in ore-reduction and similar operations.

Looking into the future it seems probable that there will be some recession immediately after the war in the power requirements of the electro-process industries, but it is reasonable to expect that the present level of activity will be reached again on an ascending curve within three to five years afterward. It has been predicted that the automobile industry alone will require three-fourths of the present production of aluminum within three years after victory. Magnesium will find extensive use in heliocopters, planes, engraving plates, household appliances, primary batteries, etc. Streamlining of railroad equipment may well utilize alloy steels at the present rate of production. Plastics and synthetic organic chemicals will require an ever-increasing production of calcium carbide. A wider variety of organic compounds will be produced by electrolytic reactions. Rapid electroplating of steel strip with tin, zinc and other metals which has proved so successful will be more widely extended. Electrowinning processes will find increasing application in the reduction of ores. Electronic devices long used in communications and radio fields will be developed for wide industrial applications. The conspicuous use of the electron in the technology of the present war will lead to an enormous expansion in the use of electronic equipment for peace purposes just as the war expansion of chemical industry in the United States twenty-five years ago led to a revolutionary increase in the quantity and variety of peacetime chemical production.

R. M. Burns, Bell Telephone Laboratories, New York, before The Electrochemical Society, Milwaukee, Wis., April 14, 1944.

WPB PHILOSOPHY

THE GOVERNMENT that does not take vigorous economic action to check an inflationary boom that is going too far, or to prevent an economic depression, fails in its duty to the people. We need occasional adjustments of the economy by the Government if our system is to work. We need wise and discreet government action taken in good time to prevent economic breakdowns and abuses of power, and to bring about necessary developments that would not otherwise be forthcoming. The important thing is to be sure that such action is taken only when necessary, that it is not carried too far, and that it is in the interest, not of any one group in the society, but of the people as a whole.

The War Production Board has no intention of trying to effect permanent changes in the basic American economy. Our mandate from the Congress is limited to action in the interests of war production. The restrictions which we have had to place on the economy are purely and simply for the purpose of furthering war production. When those restrictions are

no longer necessary for war production, then they will be removed. Some major restrictions are in fact already being removed.

By the progressive removal of restrictions at appropriate times, we feel that we are acting to further the healthy reconversion of American wartime industry, when and as war production eventually begins to taper off. This policy will aid the country to return gradually to civilian production. If large reductions in overall war output were made before industry was prepared to expand civilian output, unemployment and depression might result. By permitting advance preparations for civilian production, we greatly reduce these dangers.

We are still engaged in an all-out war production effort. In the months ahead, that effort must be sustained and even intensified. The time will come, however, when the now tight supply of manpower will be eased, and when the emphasis of production effort. In the months ahead, goods. Many problems and many difficulties will confront us when that time comes. But I am convinced that we can overcome all obstacles if we keep the goal of democratic freedom always in view, while realizing that the road to freedom, like any road, needs to be kept in good condition and occasionally repaired by the government.

Charles E. Wilson, WPB, before Stevens Institute of Technology, Hoboken, N. J., June 27, 1944.

CHEMICAL INDUSTRIES

Our industry is a basic industry, in fact, the basic industry of all industries. Our products are used in every line of manufacture and production. The country could not successfully carry on modern warfare without a completely integrated chemical industry.

The demands of modern warfare require ability to expand existing facilities quickly, to build new plants, to supply new products resulting from research and technological improvement. Supremacy in this field may be the determining factor in the outcome of the war. At the outset of this war we occupied no inferior position with respect to our enemies in either capacity or technical knowledge and experience. Private enterprise without the aid of Government subsidy had achieved the position of being able to furnish our Nation and its Allies with vast quantities of chemicals and other materials necessary to the war effort.

In the period between 1939 and 1944 over $1,200 million were spent in the chemical war plant program. Approximately $400 million of this total was provided by private investment. The chemical output increased 233 percent over that of 1939, and a further increase is possible if required. While there may have been some over-expansion, especially in the planning of government-owned plants, it should be recognized that time is of the essence in production for war, and the total requirements cannot be accurately gaged at the time of planning. We should not lose sight of the fact that we are waging technological warfare against an enemy who is also technologically expert.

When the war ends, as it inevitably

must, and we turn to peacetime production, the chemical industry faces new problems and new opportunities. While our industry is one that has no serious problem of reconversion as such, nevertheless there will be a tremendous amount of repairs and replacement necessary in our factories. The reduced labor supply and scarcity of materials has made it impossible for plants to be kept in normal repair, and large sums of money must be spent in the postwar period to rehabilitate these facilities. A huge sum has been invested by the industry in its war plants. Much of this investment will be valueless after the war, and must be written off.

As to the future, we will see opportunities for expansions in our industry not dreamed of in the past. The substitution of synthetic chemical compounds for many natural products is inevitable. The march of scientific progress in the chemical profession will go on. If unhampered by unreasonable restrictions and hindrances from government sources our industry will continue to produce new and improved products, thereby offering enlarged opportunities for other industries which will use them. Our future contribution to the standard of living of our people, the improvement in their health, and the lengthening of the life span can become the great accomplishments of the next decade. The fundamental character and universal use of our products makes our responsibility the greater. Our aim has been and must continue to be to furnish better and more useful products at the lowest possible cost.

Harry L. Derby, president, Manufacturing Chemists' Association, before 72nd annual meeting, New York, June 1, 1944.

SPECTROMETRIC GAS ANALYSIS

Demands upon the petroleum and chemical industries for large amounts of aviation gasoline, synthetic rubber and other vital materials have led these fields to adopt newer, faster methods of analysis. In particular, infra-red and ultra-violet spectroscopic procedures have proved to be exceptionally useful, owing in large part to the speed of analysis, the fact that "on stream" determinations can be made, and the ready adaptation of spectroscopic appliances to automatic control of reaction and processing equipment.

Both ultra-violet and infra-red spectroscopy are based on the well-known phenomena that the absorption spectrum of a molecule is unique, and that with few exceptions admixture with other compounds does not affect this property. As a result, the concentration of any component in a mixture can be determined spectroscopically, provided it has at least one absorption band at a wave-length where the other components are relatively transparent.

Absorption spectrometry in the ultra-violet is being used as a rapid, versatile method for the identification and quantitative determination of substances having one or more conjugated double bonds. Paraffins and mono-olefins do not exhibit characteristic absorption much above 200 mu; consequently, they cannot be studied with routine ultra-violet spectrometers. This property makes it possible to determine the concentration of di-olefins and

aromatics in gases containing, in addition to those materials, paraffinic and monoolefinic constituents. The concentration of each aromatic and di-olefin present in gases containing relatively few of such constituents can also be ascertained in many cases.

With infra-red spectrometers, dry gases having as many as seven components can be analyzed with an accuracy of from 1 to 2 percent of the total. Minor impurities cannot usually be determined in concentrations below 0.1 percent with any accuracy. The instruments are not foolproof, but operators who have had one or two years of technical training can be taught in a relatively short time to operate them and to evaluate the data. Servicing should never be attempted by routine operators.

The ultra-violet spectrometer does not lend itself readily to the analysis of multicomponent mixtures containing more than three components, but under favorable conditions very low concentrations of impurities can be determined, either in the anhydrous state or associated with water. The precision of ultra-violet analysis is somewhat better than that associated with infra-red analysis, amounting to about 0.5 percent. Routine work requires persons who have had one or two years' technical training, and the instrument can be serviced by routine operators.

L. J. Brady, Industrial Fellow, Mellon Institute before American Gas Association, New York, June 7, 1944.

PRODUCTION OF CALCIUM AND MAGNESIUM

Since the beginning of World War II, the Electro Metallurgical Co. has developed and brought into commercial production, processes for two of the light metals, calcium and magnesium. Calcium had been imported from France where it was produced by the electrolysis of fused calcium chloride and this method was chosen for development in this country. In pilot plant operation of cells for this purpose, it was found necessary to dehydrate the commercial calcium chloride to prevent hydrolysis which had deleterious effects on cell performance. The metallic calcium was collected by moving a contact cathode up as the metal deposited on it thus forming a calcium "carrot." Satisfactory automatic control was developed so that the cells needed only periodic attention. The calcium "carrots" are 85 percent pure and for some uses must be purified by melting and casting in an argon atmosphere or even by high vacuum distillation. The metallic calcium is used in ferrous and nonferrous metallurgy and for pharmaceutical purposes.

In 1940, the Electro Metallurgical Company, which had been interested in the production of magnesium for many years, began an active program of the development of a process based on the reduction of magnesium oxide by silicon. On studying this reduction, it was found that burned dolomite (a mixture of calcium and magnesium oxides) could be used as a source of magnesium oxide and ferrosilicon as a source of silicon. On the basis of experimental work a cold shell furnace was developed the inside of which was heated

electrically to 1150 deg. C. and could be evacuated to low pressures. A plant was designed to contain 432 of these furnaces along with a ferrosilicon plant and a dolomite kiln. In order to product the high vacuum necessary, steam jet pumps were designed which were larger than had ever been used previously and have performed very satisfactorily. The successful development of these two processes is a result of cooperation of the departments of the Electro Metallurgical Company and many engineering, construction and manufacturing companies.

Glen D. Bagley, Union Carbide & Carbon Research Division, Jacob F. Schoellkopf Medal Recipient before Western New York Section of American Chemical Society.

FREEDOM OF ENTERPRISE

WHAT will happen when we face the staggering postwar increase in the national debt and in national taxation? What is going to happen to the vast industrial empire when our Government will no longer be in the market for billions of dollars worth of war goods annually? What is going to happen to thousands of plants now working on war contracts which do not have sufficiently large cash reserves to carry them over an extended reconversion period? What is going to happen when 10 million ex-servicemen come home looking for jobs, and 20 million ex-war workers seek continued employment in our businesses, factories, farms and service trades?

Let us remember: There are no jobs without employers—no employers without risk capital—no risk capital without incentive—no incentive without Freedom—and no Freedom without fighting for it.

Businessmen are the shock troops on the economic home front. They have a great responsibility—and a great opportunity. If they succeed in reviving industry and employment after the war, they will do four things: Lighten the burden of taxation; reduce the threat of inflation; raise the general standard of living for us all; and maintain freedom of enterprise—Democracy itself.

What is this freedom of enterprise which we stand in danger of losing? In the past, we have taken it so much for granted that most of us would find it hard to define. Recently, a Gallup Poll indicated that only three out of ten people could give any kind of a clear definition.

Let's look at this incentive idea from the angle of a South Sea Islander. This fellow is ambitious. While others lie in the shade, he works and builds himself a boat. His first fishing expedition is very successful. He catches more fish than his family can eat.

This give him another idea. Why not take back a boatload of fish and trade some to his neighbors for coconuts and berries instead of picking them himself?

Mr. Fisherman comes in and begins to unload his boat. The Governor of the island happens by and sees all the fish. "Mr. Fisherman," he says, "you are unusually fortunate to have so many fish. We have some people here who are old and ill, and it would be awfully nice if you would give them part of your catch." The Fisherman, being a generous man, gave the aged and the ill all the fish they could eat.

There weren't many of these people and the contribution made only a small dent in his boatload of fish.

Each time Mr. Fisherman came back with a boatload of fish, he sent a part of his catch around to the aged and infirm. Then others, who had been too lazy to work as hard as Mr. Fisherman, began to complain that they did not have fish every day. "Why should Mr. Fisherman be permitted to have a whole boatload of fish when we have none? Let's make him divide up his catch with all of us. We outnumber him. We can make him do it."

One day, Mr. Fisherman came back and a great crowd of islanders met him at the beach. They shouted insults at him and they divided or destroyed all that Mr. Fisherman had produced. What did Mr. Fisherman do? He did just what you or I would do, he quit. Why should he exert himself if the islanders would not permit him to enjoy the benefits of his own productive efforts? Mr. Fisherman had lost his incentive. His family, thereafter, lived on the same low plane that all of the other islanders did. The sick and the aged were deprived of the surplus of Mr. Fisherman's catch. The islanders no longer had the daily load of fish for which to trade berries and coconuts. Everyone was worse off because too high a tax had been levied on the productive efforts of Mr. Fisherman—a tax so high that it destroyed Mr. Fisherman's incentive.

We, in America, have lived under what we call the incentive system. We have had an incentive to work and create, just as Mr. Fisherman had an incentive to fish. We now are threatened with the loss of that incentive by progressively increasing taxation. As a result, expansion of an industry can come neither from plowed back earnings nor from sale of stock equities. Small industries are prevented from growing into big industries. Big industries stagnate. It is estimated that small industries were liquidated at the rate of 100,000 per year over the last several years. It has become very obvious during the past generation that progressively increasing taxation brings chronic unemployment.

C. D. Dallas, Revere Copper and Brass, before Northeastern Roofing, Siding, and Insulating Contractors Association, New York, March 6, 1944.

ZINC SMELTING AND REFINING

Zinc smelting in the United States has undergone important wartime changes. At the outbreak of war in Europe, due to depressed zinc prices caused by threat of foreign importations, the zinc smelting industry was still in a period of depression. Output was on a limited basis and profits were very meager or non-existent. With the outbreak of hostilities in Europe, the domestic zinc smelting industry was among the first of all American industries to enter into an extensive expansion program and at no time during the entire war period has production of war goods been hampered by any scarcity of zinc. The present outlook for the war period is that our production is more than ample to take care of any and all war-time requirements and the zinc smelting industry can well be proud of its very enviable record during this great national emergency.

The most outstanding changes in zinc

smelting during the war period have been, (1) the increased proportion of total metal produced by electrolytic process; (2) the very significant change in total output from ores of foreign origin; (3) the radical changes in grades of metal produced as brought about by war-time requirements.

On the technological side of the picture, unlike a great many other war industries, the zinc smelting industry has been changed very little by technological developments during the war period. All basic methods now used for zinc production were known and in commercial operation many years prior to the outbreak of war, and even minor technological changes have been insignificant. The one possible exception to this has been the development of a method to distill zinc directly from lead blast furnace slag by an electrothermic process; however, to date this process has not been placed on a commercial basis.

The immediate postwar outlook for the zinc smelting industry is not too disturbing unless present large stocks of zinc metal are not intelligently handled. The consensus of opinion seems to be that large quantities of zinc which probably will be required by a large civilian goods and construction program in the United States will result in a good rate of production. In addition to this, Europe, which has always been a large consumer of zinc in the building trades, will have to be rehabilitated. American smelters will be called upon to furnish a sizeable portion of the metal required in this world rehabilitation program.

R. A. Young, before American Zinc Institute, St. Louis, April 17-18, 1944.

Annual Production of Slab Zinc in the United States
(Short Tons)

	1940	1942	1943	Estimated Present Rate	Estimated Increase 1940 to Present
By Method					
Primary distillation	488,235	638,885	612,000	650,000	33%
Electrolytic	187,040	252,987	329,900	350,000	87%
Secondary distillation	48,917	53,195	47,800	50,000	2%
Total	724,192	945,067	989,700	1,050,000	45%
By Source of Ore					
Domestic ore	589,988	629,957	588,000	670,000	13%
Foreign ore	85,287	261,915	353,900	330,000	288%
Secondary materials	48,917	53,195	47,800	50,000	2%
Total	724,192	945,067	989,700	1,050,000	45%
By Grades of Metal					
Special high-grade and high-grade	294,059	481,923	603,700	555,000	89%
Intermediate	62,900	77,529	54,100	40,000	−36%
All other grades	367,233	385,615	331,900	455,000	24%
Total	724,192	945,067	989,700	1,050,000	45%

RUBBER PROBLEMS

We are still rolling on rubber, and essential transportation will continue to roll because of the stupendous job done by Americans in the engineering and construction of 48 plants to produce the butadiene, styrene and other materials and to manufacture synthetic rubber, and in the development, production processing and utilization of synthetic rubber by the rubber industry.

Invaluable contributions have been made by military and civilian users in the conservation of rubber. Synthetic rubber of all types is now being produced at the rate of nearly 700,000 tons a year, and during the last quarter of this year may reach the rate of 900,000 tons annually. This total far exceeds the all time record consumption of rubber in the United States in 1941 of 865,000 tons.

Currently it takes more time, both man-hours and machine hours, to make products out of synthetic rubber than it does for natural: first, because synthetic rubber must be worked or processed or milled longer before it reaches a proper state of plasticity; second, because in many cases the extra operation of applying rubber cement between plies or layers of tires and other products is necessary, an operation not required at all with natural rubber because it is tacky or sticky while synthetic, now being used, is not; third, because of longer training and instruction periods in coping with the behavior of synthetic rubber.

One of the most pressing current problems with which we are now confronted is the depletion of high-skilled and experienced manpower not only in rubber products manufacture but in the chemical, petroleum, rubber-making and textile branches as well.

It is now time that we, the people, should be thinking seriously about the long-range political and economic problems that the existence of America's rubber-making capacity raises.

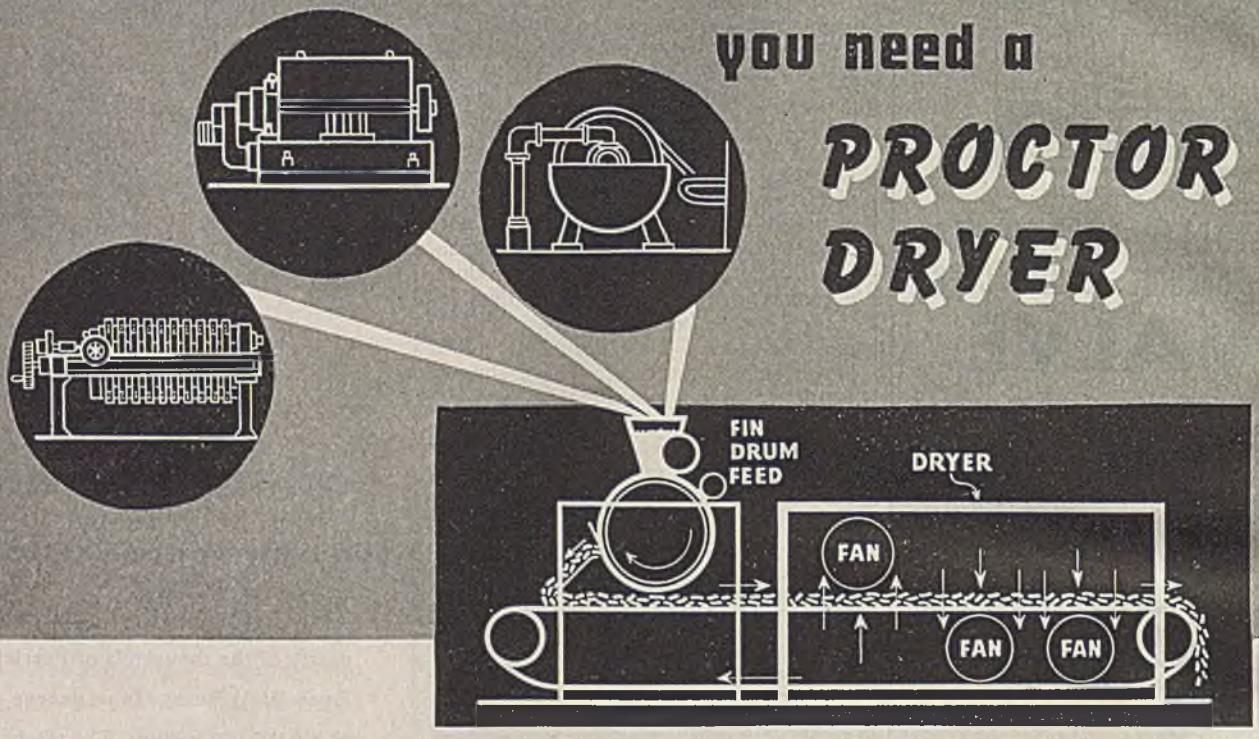
Is there one basic factor upon which America's long-range rubber policy can be founded? In my opinion, there is. This factor is national security! We have learned through bitter experience that we cannot afford to face the future without an adequate "insurance policy" in rubber.

When peace comes, our synthetic rubber plants will be just as vital to the security of the American people as they are today in the midst of war.

The next consideration would be how much synthetic rubber production should be continued after the war. That question has a two-part answer. First, regardless of economic factors, as much rubber as the long-range planning of our armed forces might specify. That may be as much as 200,000 or more tons a year of general-purpose synthetic rubber. Second, as much additional production as can be justified through the free play of economic forces in meeting our postwar rubber needs which we estimate may total 900,000 tons a year, or nearly 50 percent greater than consumption in 1940.

John L. Collyer, president, The B. F. Goodrich Co., before 10th Annual Chermurgic Conference, St. Louis, March 29, 1944.

If you need TONNAGE PRODUCTION you need a PROCTOR DRYER



For tonnage production of wet-solid or plastic materials we recommend the Proctor Aero-Form Continuous Drying System. The continuous operation of this system overcomes all of the costly disadvantages of batch drying. It brings many benefits from the standpoint of the ultimate quality of the product being dried. Last, but far from least, this system makes tonnage production a reality . . . at new low costs. Coming in the form of a filter cake, from a plate and frame filter, coming from a continuous centrifugal filter or from a continuous rotary filter—the product is first preformed into the most ideal shape for continuous drying. It is then carried through the drying cycle, loaded to a uniform depth on a constantly moving conveyor. On completion of the cycle the material is discharged at the delivery end—ready for subsequent processing. This system makes the ideal link between preliminary and subsequent processing. It takes uniform quantities, dries the material thoroughly and quickly, to the desired moisture content, and automatically passes on uniform quantities to subsequent processing equipment. If you have a product which requires tonnage production—it will pay you to carefully investigate the advantages of this Proctor Aero-Form Drying System.

PROCTOR DRYERS
for the
CHEMICAL INDUSTRIES

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FOREIGN LITERATURE ABSTRACTS

SUGAR DECOLORATION

In studying the adsorption of electrolytes by animal charcoal (from bones) in sugar solutions, it was observed that changes in pH had considerable effect on the decoloration of syrups which contained well-adsorbed anions and cations. Adsorption of anions with a special affinity for calcium, such as sulphate, phosphate and oxalate, predominates. These react with the components of the mineral skeleton of the carbon and cause an increase in the pH of the syrups depending on the adsorption and the "buffer" qualities of the respective electrolyte. The alkaline earths predominate in the adsorption of the cations, the former being partly absorbed after the hydrolytic dissociation of the lime, causing a decrease in the pH of the syrups. Considerable effect of the co-adsorption of the electrolytes is noted in the case of adsorption of coloring agents. The coloring agents of the syrups are electronegative in character and behave like anions with little affinity for the carbon. The presence of anions such as sulphate, phosphate, etc., is unfavorable to or inhibits the adsorption of the coloring agents by imparting a negative charge to the carbon or by suppression of the weaker adsorption of the anion. The presence of bivalent cations favors the adsorption of the coloring agents apparently by emphasizing the positive character of the carbon. The electric nature of the adsorption is also apparent in other absorbent materials of a different composition from that of animal charcoal, such as bauxite and vegetable charcoals.

Digest from "Resume of the Works Presented at the 3rd Congress of the Chemical Association of Brazil: The adsorption of Electrolytes by Animal Charcoal and its Influence on the Decoloration of Sugar Solutions" by Kurt Lowy, *Revista Brasileira de Quimica*, XVII, No. 98, 120-120, 1944. (Published in Brazil.)

CHLORINATED OLEFINS

A catalyst was sought by means of which chlorine addition products could be prepared from olefins in the gaseous state at readily attainable temperatures with a minimum formation of higher chlorination products. Catalysts investigated included pumice; titanium oxide precipitated upon pumice; bauxite containing iron in powdered form on pumice; and bauxite in grains of about the size of a pea.

With pumice at 12 deg. C., the yield of dichloroethane obtained was 66 percent, the remainder being higher chlorination products. With a rise in temperature, chlorine substitution increased and 1,1,2-trichloroethane was formed up to about 46 percent. Thus higher chlorination products were more abundant than at the lower temperature. Results with titanium dioxide-pumice were about the same. The other catalysts gave considerable amounts of higher chlorination products at low temperatures. However, between 55 and 65 deg., dichloroethane was obtained with a yield of 90-95 percent.

Experiments were conducted on the addition of chlorine to propylene, since possibilities of substitution were greater. In addition, higher temperatures would lead to formation of unsaturated products such as allyl and propenyl chloride. By using bauxite granules at 100-115 deg., dichloropropane was formed in yields of 85-90 percent. Addition of chlorine to a mixture of ethylene and propylene gases was investigated, giving good yields of dichloroethane and propane at 95-105 deg. Only small amounts of unsaturated and more highly chlorinated compounds were formed. Yields were good when 1,2- and 2,3-dichloro- were made at 110-115 deg. from alpha- and beta-butylene.

Reaction tubes in these experiments were 880 mm. long and had an I.D. of 12 mm. In order to equalize the temperature in the tube, avoid igniting the reaction products and prevent local overheating, water was used in the cooling jacket when the temperature was below 100 deg. Oil, however, was used if the temperature was over 100 deg. Gases were introduced through separate tube to prevent reaction before contact with the catalyst.

The catalyst was first heated for 1.5 hours at 400-450 deg. in order to free it of water. Activity of the bauxite was lowered in the first run, after which it was maintained for up to 120 hours. Five percent excess of ethylene and propylene over chlorine was used. A mixture of alpha- and beta-butylene, prepared by passing n-butyl alcohol over phosphoric acid deposited on alumina, was chlorinated by passing over bauxite granules at 105-115 deg. Distillation of the raw product gave nine percent, 2,2-dichlorobutane and 70 percent 1,2- and 2,3-dichlorobutane.

Digest from Addition and Substitution of Chlorine in Olefins," by Ion Gavat, *Berichte der deutschen chemischen Gesellschaft* **76**, 1115-18, 1943.

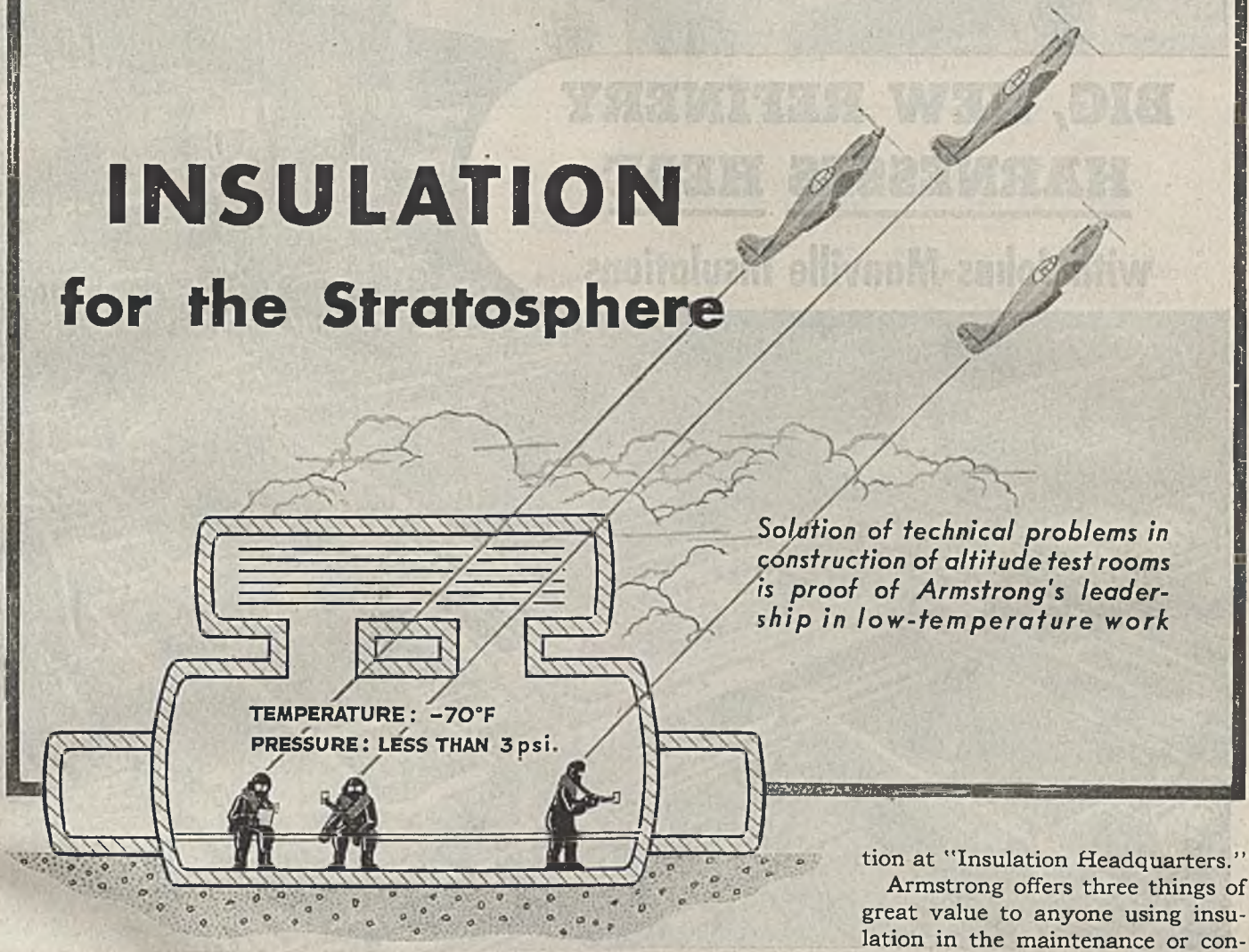
UNSATURATED SILICO-ORGANIC COMPOUNDS

IT HAS RECENTLY been demonstrated that silicon-containing organic compounds with a triple bond in the side chain can exist, and hexa-acetylene siloxane, triethoxysilyl phenyl acetylene and diethoxydiphenyl acetylenyl monosilane have been prepared experimentally.

It has been found that rupture of the bond between silicon and carbon atoms can occur during hydrolysis when there is a triple bond in close proximity. A study on the silicon-containing derivatives of acetylene showed that the position of the triple carbon bond next to the silicon atom weakens the Si-C bond to a great extent. When triethoxylylphenyl acetylene is hydrolyzed with cold water, the Si-C bond is ruptured with formation of phenyl acetylene, which is contrary to general opinion as to the stability of the Si-C bond. On the other hand, the triple bond in the other acetylene substance studied was found to be fairly unreactive to a certain degree and the addition of bromine, for example, took place incompletely and rather slowly.

Digest from "Unsaturated Silico-Organic Compounds, Preparation of Hexa-acetylene Siloxane and Triethoxysilyl phenyl Acetylene," by U. Volinov and A. Reutt, *Zhurnal Obschei Khimii* X, No. 17, 1600-1604, 1940. (Published in Russia.)

INSULATION
for the Stratosphere



Solation of technical problems in construction of altitude test rooms is proof of Armstrong's leadership in low-temperature work

BY building test facilities that reproduce on the ground the extreme conditions of high altitude, the aircraft industry today is probing the secrets of the stratosphere —where the temperature is −70° F. and pressure is less than 3 psi.

Building of these test rooms is a complex task calling for the development of construction techniques beyond those of standard practice. In solving the insulation problems for a large share of such test programs, Armstrong conducted research to determine the physical properties of all materials involved, and to establish methods of application to meet severe conditions.

Because of its more than 40 years' experience in the manufacture and application of low-temperature insulation, Armstrong is able to develop the techniques required for such specialized work. No matter what your problem may be, you can expect to get the solution at "Insulation Headquarters."

Armstrong offers three things of great value to anyone using insulation in the maintenance or control of low temperatures: first, a complete line of efficient materials —including Corkboard, Mineral Wool Board, Foamglas*, Cork Covering, and complete sundry items; second, practical engineering aid in designing the insulated structure; and third, proper installation—for all Armstrong offices and distributors maintain erection crews.

For complete information write today to Armstrong Cork Company, Building Materials Division, 3308 Concord Street, Lancaster, Penna.

*Reg. U. S. Pat. Off. Product Mfg. by Pittsburgh Corning Corp.

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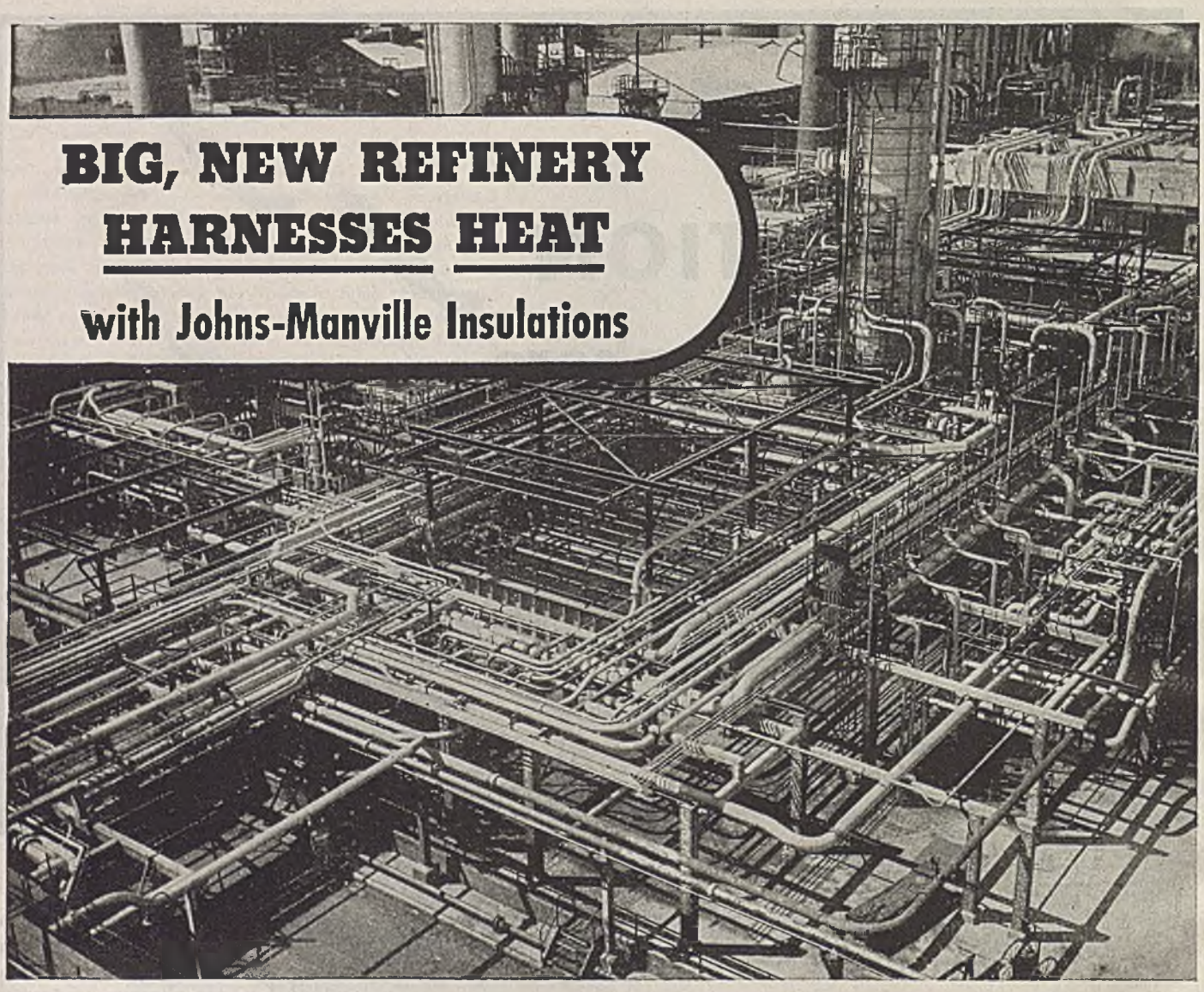

BIG, NEW REFINERY HARNESSES HEAT

with Johns-Manville Insulations

OF IMMENSE importance to the war effort is the Union Oil Company's huge new refinery in southern California. This refinery, covering 371 acres, is the last word in the making of aviation super-fuel.

Designed for manufacture of the last possible product from a barrel of crude, it combines catalytic cracking, isomerization, and alkylation. This combination will allow the maximum production of all types of gasoline from the crude oil. In operation, the new units will consume enough heat to warm a city of a million.

The refinery required a vast amount of insulating and refractory materials to harness and conserve the heat. The engineers selected Johns-Manville to supply these materials almost 100%. Follows a summary of the J-M materials supplied.

FURNACES—J-M Sil-O-Cel C-22 Insulating Brick and J-M-26 Insulating Firebrick

STACKS AND FURNACE DOORS—J-M Sil-O-Cel C-3

PIPE LINES AND VESSELS FOR HEATED LIQUIDS—J-M Superex and J-M 85% Magnesia

PIPES AND VESSELS FOR COLD LIQUIDS—J-M Rock Cork

INSULATION WEATHER PROOFING—J-M Insulkote

Besides supplying practically all insulating materials, J-M also supplied other products such as asbestos rope and listing tape for packing the trays in the columns; J-M #60 Cut Service Gaskets for flanges; J-M Spirotallic for high-temperature flanges; Transite Pressure Pipe for fresh and salt water lines.

For facts on these and other J-M materials useful in refineries, write Johns-Manville, 22 East 40th St., New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville
INDUSTRIAL INSULATIONS
FOR EVERY TEMPERATURE . . . FOR EVERY SERVICE

CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor

REFERENCE 1

HACKH'S CHEMICAL DICTIONARY. *Third edition. Edited by Julius Grant. Published by The Blakiston Co., Philadelphia 5, Pa. 925 pages. $12.*

PUBLICATION of a new edition of a chemical dictionary is an event well worth notice—particularly a new edition of a volume as well-known and as good as Hackh's. It is disappointing, therefore, to have to report that the 1944 offering is practically the same as that of 1937. The main difference is size. The new third edition has nearly 10 percent fewer pages because Dr. Grant and the publishers have eliminated pronunciation from all words and the pronunciation key which appeared on every page of the second edition. Another space-saver was the omission of many illustrations such as blowpipe, clamp, condenser, desiccator and the like. This excision could and should have been carried further to include most of the portraits which still take up space but add little value.

Some newcomers, with definitions, in the third edition are: D.A.; dehydrated food; elastomer; polystyrene; rayolander; sulfa drugs; and nylon (with an erroneous definition and with the coal-air-water derivation tale). A few abbreviations and terms which might have been included are: DDT, the new insecticide; GR-S and the other GR elastomers; carbothermic and ferrosilicon processes for Mg production; cellulose acetate butyrate; chlorinated rubber; nitroparaffins; Alnico; PETN and RDX. We are already looking forward to a fourth edition which will include definitions of these and other new products and which will correct errors which exist and which seem to be the result of haste in preparation of the volume.

REFERENCE 2

HANDBOOK OF CHEMISTRY. *Fifth edition. Edited by N. A. Lange and G. M. Forker with R. S. Burington. Published by Handbook Publishers, Inc., Sandusky, Ohio. 2,074 pages. Price $6.*

IN THE brief span of 10 years that Lange's Handbook has been available, it has earned for itself a well-deserved place on many a bookshelf of technical references. The fourth revision makes it even more valuable for chemists and chemical engineers. Most conspicuous of the changes made for the new edition are those in the long table of constants of organic compounds. This whole table has been reset and there are now 6,507 entries —2,055 more than in the fourth edition. Other new material includes a periodic chart, a short article on industrial waters, and tables giving data on flammable liquids, flame temperatures, fluorescence of chemicals, and plastics. These and less obvious additions and changes add value to a reliable time-saver.

FIGHTING BOOKS

THE CHEMICAL FRONT. *By Williams Haynes. Published by Alfred A. Knopf, New York, N. Y. 264 pages. Price $3.*

FIGHTING OIL. *By Harold L. Ickes. Published by Alfred A. Knopf, New York, N. Y. 174 pages. Price $1.75.*

Reviewed by S. D. Kirkpatrick

LONGER ago than we like to admit, Mr. Knopf sent for review these two of his famous Borzoi books whose announced purpose is to help people understand the world at war. They are worthy of that important task, and in the interim since they were published, thousands of laymen have undoubtedly been given a clearer insight into the methods and materials of this highly technological struggle.

Both books are interesting, fast-reading and individualistic in the way the authors have handled subjects of such vast magnitude and complexity. Our old friend Billie Haynes always spins a good yarn and has the rare faculty of making many of his old ones seem new and strange to even his veteran readers such as the present reviewer. Technical accuracy, perhaps for reasons of military security, is sometimes stretched almost to the breaking point. For example, the dramatic story of RDX is dulled a little for chemical engineering readers when we find it confused with our old friend penthrite—penta-erythritol tetranitrate. But these little slips are offset many times over by such superlative stories as the one on the job Cyanamid did at Welland for the Canadian Government. More power to the pen of our premier storyteller and chemical historian!

The "Old Curmudgeon" was just beginning to hit his pace as an author when he wrote "Fighting Oil" a year ago. The highly personalized style, which he suddenly developed with the help of George Briggs and Chandler Ide, stands him in good stead in tackling the almost impossible job of telling the war story of petroleum in a dozen chapters and 165 pages. But he does it and manages to work in as well a lot of amusing sidelines to remind you that as a political leader he also has views on other subjects.

That so much has happened on both the chemical and petroleum fronts since these books first appeared is merely a reminder of how tremendous has been technical progress in the past six months. The next will see even more interesting developments and more need for Borzoi books like these.

NOMOGRAPHS

CHEMICAL ENGINEERING NOMOGRAPHS. *By Dale S. Davis. Published by McGraw-Hill Book Co., New York, N. Y. 308 pages. Price $3.50.*

Reviewed by T. H. Chilton

THOSE who have wished for a collection of the "Davis Nomographs" will be glad to know that the suggestion of Dr. Harrison E. Howe and others that these charts be collected and published has become a reality, and that 200 charts can be found in one handy volume. They will be anxious to know whether the charts are readily usable in a standard book-size page, and whether the book lies flat enough to accommodate a straight-edge. The answer to both questions is in general affirmative, as surprising as it may seem. The narrow margins of wartime books work against these requirements and a few of the scales do come too close to the "valley" of the book, but the thin paper used keeps the thickness down and helps the book lie flat.

The book will be most appreciated by those who come to rely upon it for reference to a particular chart or series of charts that they know it contains. Over half of the charts present physical property values, and while the collection of charts is comprehensive, it is not encyclopedic, and will not supplant a handbook of data. Likewise, while the collection of charts for performing mathematical operations (such as calculation of minimum number of plates at total reflux) or the calculation of heat transfer coefficients in natural convection (with one of the three or four charts combining the advantages of line-coordinate with alignment charts), it makes no pretense to take the place of a handbook of engineering.

The vapor pressure charts of Killeffer are reproduced, as also those of Germann and Knight, and of others, and also (in another chapter) charts for correction of

RECENT BOOKS RECEIVED

Automatic Control Engineering. By E. S. Smith. McGraw-Hill. $4.

Chemical Machinery. By E. R. Riegel. Reinhold. $5.

Colloid Chemistry. Vol. V. Ed. by Jerome Alexander. Reinhold. $20.

Electronics Today and Tomorrow. By J. Mills. Van Nostrand. $2.25.

The Extrusion of Metals. By C. E. Pearson. Wiley. $3.75.

Organic Chemistry. By L. F. Fieser & M. Fieser. Heath. $6 (college edition). $8 (trade).

Photomicrography. Theory and Practice. By C. P. Shillaber. Wiley. $10.

Soil and Plant Analysis. By C. S. Piper. Interscience. $4.50.

Theoretical Chemistry. By Samuel Glasstone. Van Nostrand. $5.

Varnish Constituents. By H. W. Chatfield. Leonard Hill, Ltd., (London). 35s.

boiling points to 760 mm. Partial pressures out of solutions of industrial chemicals are given; and data on gas solubility (seven charts on solubility of SO_2 in water). Viscosity data are given for 110 liquids in one chart (due to Genereaux), and for many solutions; and data on specific heat, thermal conductivity, and Prandtl number. Data are presented on density of solutions; and the Berl charts on density corrections at various temperatures are reproduced (on about one-half the size of the original).

The coverage of the charts for solving equations is wide. They relate to distillation, flow of fluids, heat transfer, fuel analysis, milk and cream, the paper industry, pH, and tank volumes. As stated before, these will have to be known individually and used habitually to be appreciated.

Most of the charts are of the simple three-scale type read by means of a straight-edge. Some require a reference line, and the usefulness of the book would be increased if all of these were provided with an arbitrary scale (the reader may add one) so that the user will not have to make pencil marks on the paper.

The index is fairly complete, though more cross-indexing would help; and a simple list of figures would be useful for reference.

No attempt has been made by the reviewer to check the accuracy of construction of the charts, which will have to be taken for granted; it was noted, as is inevitable, that the range of the charts is limited. Whether the author's choice of range is that useful for the problems one encounters will have to be determined by trial.

The book is on the whole remarkably free from typographical errors. This reviewer wishes to commend the author on the consistency with which he employs in the text a set of abbreviations conforming closely to that adopted for the "Transactions of the American Institute of Chemical Engineers" (and spelling: e.g., of the word "mole"); unfortunately, the draftsmen who lettered the charts used their fancy in this particular (or perhaps followed the original authors of the separate charts). One instance which departs from the recommended practice, where (B.t.u.)(ft.)/(hr.)(sq.ft.)(°F.) is used instead of the preferred B.t.u./(hr.)(sq.ft.)(°F./ft.), may have caused the careful proofreaders to overlook the erroneous position of the slant bar in the units of *h*, on p. 81, which should read B.t.u./(hr.)(sq.ft.)(°F.). The use of symbols is unavoidably inconsistent in a work covering such a diversity of fields, and taken from so many different publications; the symbols are, however, clearly defined. The directions for use are not always on the same page as the charts themselves, but this is inevitable if the charts are to occupy the largest possible portion of a page.

"Creosole" is misspelled on Fig. 161; "Phthalicanhydride" looks funny as one word on p. 224. It is difficult to determine that the figures on the curves in Fig. 10 are all preceded by a minus sign. There appears to be a superfluous scale in Fig. 148; perhaps it was intended to supplant the pressure scale in Fig. 158, which does

not show a value for 760 mm. There is a discrepancy between the text and the chart with respect to Fig. 123; the strength of the alkali used for titration is N/5, as stated on the chart, and not 0.5 N.

These, however, are minor criticisms in a work which will undoubtedly find a useful place on many a chemist's and engineer's bookshelf.

SOLUTION CHEMISTRY

THE PHYSICAL CHEMISTRY OF ELECTROLYTIC SOLUTIONS. *By Herbert S. Harned and Benton B. Owen. American Chemical Society Monograph No. 95. Published by Reinhold Publishing Corp., New York, N. Y. 611 pages. Price $10.*

Reviewed by F. C. Nachod

AS THE authors state in their preface: "The science of solutions is very complex." A great amount of data has been amassed in the past four decades and it has been certainly no easy task to organize such a vast field in such an exemplary and concise manner as Professors Harned and Owen have done.

The text is divided into three main parts, each of which comprises five chapters. The first part is the theoretical section, the second part contains a discussion of experimental methods without detailed descriptions of techniques, and the last part emphasizes properties of electrolytes rather than the methods by which they were measured.

A great deal of factual data is collected and condensed in tables in the appendix, and in chapter 5, entitled "Numerical Compilations of Physical Constants, Characteristic Slopes, and Mathematical Functions." Any worker in the field of solution chemistry will rejoice to have the material available in such handy and elegant form.

The audience addressed comprises chemists rather than chemical engineers, which is self-evident from the title and the subject matter. Parts of the book are no easy reading, as for example, chapter 2 on interionic attraction and ion distribution.

The thermodynamic notation used is that of Lewis and Randall which will be pleasant to most readers. All in all, your reviewer feels that this is truly a streamlined text, written in clear language (and good English) by critical scientists. Everybody who works in this field should have this text on his bookshelf for ready reference.

NATURAL PIGMENTS

THE CHEMISTRY OF NATURAL COLORING MATTERS. *The Constitution, Properties and Biological Relations of the Important Natural Pigments. By Fritz Mayer, translated and revised by A. H. Cook. Published by Reinhold Publishing Corp. 354 pages. Price $10.*

Reviewed by J. E. Copenhaver

THE American Chemical Society is to be complimented in selecting this valuable treatise as one of its Monograph Series, No. 89. In so doing, the Society has snatched from the jaws of War a contribution of inestimable value and has made it more readily available to future investigators. It was fortunate that Dr. Cook was able to carry to completion, with extensions, this, the third German edition of

"Chemie der organischen Farbstoff" by Dr. Mayer, whose tragic death in 1940 was, in the words of Dr. Cook, "as sad as any imaginable."

Natural coloring pigments covers substances of widely varying chemical constitution as can be seen from the headings of the five chapters: Carotenoids (Polyene Pigments), Diaroylmethane Compounds, Carbocyclic Compounds, Heterocyclic Compounds, and Compounds Containing Heterocyclic Nitrogen Atoms. Drs. Mayer and Cook have presented these varied classes of compounds systematically and molded it into a unified whole. The text is well illustrated with graphical formulas and pertinent references are given as footnotes.

The book is recommended as a text or a reference to both chemist and biologist specialists in this particular field. It is felt that this work will be an inspiration and guide to future investigators in unraveling the complex nature of many of the natural pigments.

MATHEMATICS

BASIC MATHEMATICS FOR WAR AND INDUSTRY. *By P. H. Daus, J. M. Gleason and W. M. Whyburn. Published by The Macmillan Co., New York, N. Y. 277 pages. Price $2.*

BASIC MATHEMATICS FOR ENGINEERS. *By P. G. Andres, H. J. Miser and H. Reingold. Published by John Wiley & Sons, New York, N. Y. 726 pages. Price $4.*

CALCULUS REFRESHER FOR TECHNICAL MEN. *By A. A. Klaf. Published by Whittlesey House, McGraw-Hill Book Co., New York, N. Y. 431 pages. Price $3.*

AS IS apparent from the titles, these three math books are for as many different audiences. The first meets the requirements of those courses wherein civilian and military technicians are quickly trained. Its five chapters cover arithmetic, algebra, geometry, trigonometry, and solid geometry and spherical trigonometry. Examples and problems have been made as "practical" as possible to stimulate and sustain student interest.

The second book is a more complete text which presupposes two years of high-school work. Its range is from a review of arithmetic through integral calculus. Treatment throughout stresses engineering applications. There are numerous problems for student solution, many of which have been given an engineering flavor by the use of formulas of electrical, mechanical and other branches of engineering.

Mr. Klaf uses the question and answer method to help us review our calculus. There are 756 questions and problems with completely worked-out solutions, each of which emphasizes some point. In addition, the author gives some problems without solutions (but with answers) so that the reader may practice.

RECENT BOOKS & PAMPHLETS

Temperature Drop in Ducts for Forced-Air Heating Systems. By A. B. Kratz, F. Konzo and R. B. Engdahl. Bulletin Series No. 351,

published by the University of Illinois, Urbana, Ill. 60 pages. Price 65 cents. A report of an investigation conducted by the Illinois Engineering Experiment Station in cooperation with the National Warm-Air Heating and Air Conditioning Association.

Symposium on the Identification of Water-Formed Deposits, Scales, and Corrosion Products by Physico-Chemical Methods. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 44 pages. Price 65 cents. Three technical papers, general discussion, and an extensive introduction.

Application of Overfire Jets. By R. B. Engdahl, Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio. 14 pages. Technical Report No. 7, reprinted from *Trans. ASME*. Construction, selection, installation, and application of overfire jets for the elimination of smoke and reduction of fuel waste.

Guide to Weldability of Steel. Published by Welding Research Council, 29 West 39th St., New York 18, N. Y. 81 pages. Price $1. A guide intended to present and to facilitate prompt and thorough testing of a proposed system of ductility pre-determination.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

Vegetable and Fruit Dehydration. U. S. Department of Agriculture. Miscellaneous Publication No. 540. Price 30 cents.

Protecting Plant Manpower Through the Control of Air Contaminants. By Philip Drinker. Division of Labor Standards, Special Bulletin No. 14. Price 10 cents.

Extent of Collective Bargaining and Union Status, January 1944. Bureau of Labor Statistics, Bulletin 776. Price 5 cents.

Changes in Import Duties Since 1930. A supplement to the earlier summary of the same title. The revised edition contains changes which took effect between February 1, 1943, and July 1, 1944. U. S. Tariff Commission.

Renegotiation Regulations. A loose-leaf manual issued by War Contracts Price Adjustment Board. The manual initially contains approximately 275 pages, and will be supplemented from time to time as the Regulations themselves are supplemented. It is available at a prepaid subscription price of $2.00, including 12 monthly supplements.

Index of United States Army and Federal Specifications Used by the War Department. This manual with monthly supplements is available at a yearly subscription rate of $1.50.

Treatment of Casualties from Chemical Agents. War Department, Technical Manual TM 8-285. Price 15 cents.

Survey of the Nation's Critical and Strategic Minerals and Metals Program. S. Res. 66, Senate Subcommittee Print No. 6. 78th Congress, 2nd Session. Subcommittee on Mining and Minerals Industry.

Animal and Vegetable Fats and Oils. Production, Consumption, and Stocks, Quarterly for Calendar Year 1939 to 1943, Inclusive; and Imports and Exports for Calendar Years 1939 through 1940, and the First Three Quarters of 1941. Prepared under supervision of Zellmer R. Pettet. Bureau of the Census. Price 10 cents.

Textiles—Testing and Reporting (4th Edition). National Bureau of Standards. Commercial Standard CS59-44. Price 10 cents.

Lactic Acid. By M. J. Sheehan. Unnumbered "Synopsis of Information" document, issued by Bureau of Foreign and Domestic Commerce. Mimeographed.

Calcium Arsenate. By L. N. Markwood and Laura G. Arrington. Unnumbered "Synopsis of Information" document, issued by Bureau of Foreign and Domestic Commerce. Mimeographed.

Lead Arsenate. By L. N. Markwood and Laura G. Arrington. Unnumbered "Synopsis of Information" document, issued by Bureau of Foreign and Domestic Commerce. Mimeographed.

Cresols and Cresylic Acid. By S. M. Phillips. Unnumbered "Synopsis of Information" document, issued by Bureau of Foreign and Domestic Commerce. Mimeographed.

United States Stock-Pile Wools. Their Relation to the Present Wool Situation and to Post-War Supplies. U. S. Tariff Commission. War Changes in Industry Series Report No. 3. Mimeographed.

Construction, Care, and Use of Permissible Flame Safety Lamps. By A. B. Hooker. Bureau of Mines, Miners' Circular 44. Price 10 cents.

Dilution of Stack Effluents. By G. E. McElroy and others. Bureau of Mines, Technical Paper 657. Price 10 cents.

Electrical Devices Applied to Metallurgical Research. By E. V. Potter. Bureau of Mines, Technical Paper 661. Price 10 cents.

Procedure for Applying for Tests Made on All Explosives and Blasting Devices by the Explosives Division of the Bureau of Mines. Bureau of Mines, Schedule 1C. Price 5 cents.

Apparatus for Determining Minimum Energies for Electric-Spark Ignition of Flammable Gases and Vapors. By P. G. Guest. Bureau of Mines, Report of Investigations R. I. 3753. Mimeographed.

Explosions in Medium-Pressure Acetylene Generators. By G. W. Jones and others. Bureau of Mines, Report of Investigations R. I. 3755. Mimeographed.

National Motor-Gasoline Survey, Winter 1943-44. By O. C. Blade. Bureau of Mines, Report of Investigations R. I. 3758. Mimeographed.

The Burning Rate of Fuse. By D. Harrington and R. G. Warncke. Bureau of Mines, Information Circular I. C. 7281. Mimeographed.

Hazards from Common Gases and Vapors Encountered at Surface Disasters. By G. W. Jones. Bureau of Mines. Information Circular I. C. 7287. Mimeographed.

Minerals Yearbook Preprints. Printing of the separate chapters of Minerals Yearbook of the Bureau of Mines for industry operations in 1943 has begun. These printed pamphlets supersede the mimeographed preliminary reports which were issued a few months earlier under the Bureau's MMS series. The new pamphlets are available generally at 5 cents each for each of the commodities reported on in the Minerals Yearbook. Pamphlets now issued are: Slate. By Oliver Bowles and M. S. Jensen; Gold, Silver, Copper, Lead, and Zinc in Texas. By Chas. W. Henderson and R. H. Mote.

Mineral Statistics. Preliminary figures for 1943 production of metals, minerals, and mineral products have recently been released in the Mineral Market Reports of the U. S. Bureau of Mines as one- or two-page mimeographed press releases of the "MMS" series. The following subjects have been reported on: Secondary Magnesium; Sand and Gravel; Magnesite and Other Magnesium Compounds; Blast Furnace Slag; Abrasive Materials; Liquefied Petroleum Gases; Peat; Ferrous Scrap and Pig Iron.

Federal Specification for Aprons; Surgeons' (Synthetic Rubber and Resin Coated). ZZ-A-611a. Price 5 cents.

Pigment Specifications. The revised editions of numerous paint pigment specifications have been prepared for Federal Standard Stock Catalog recently. These should be ordered at 5 cents each from the Superintendent of Documents by title and number as follows: Aluminum-pigment; powder and paste (for) paint—TT-A-468. Bone-black; dry — TT-B-600. Chrome-yellow and chrome-orange; dry—TT-C-290. Chrome-green; pure, dry—TT-C-235. Chromium-oxide-green; dry—TT-C-306. Iron-blue; dry—TT-I-677. Lampblack; dry—TT-L-70. Ocher; yellow, dry—TT-O-121. Ultramarine blue; dry—TT-U-450. Titanium-Dioxide; dry—TT-T-425.

FOREIGN TRADE STATISTICS

Bureau of the Census has announced the release of new statistical reports and new statistical services giving data regarding imports and exports of commodities. In general these are available as described below, and releases will be made at intervals of six months or one year following the end of the month to which the data relate. More prompt release is forbidden for security reasons. The following documents may be ordered from Bureau of the Census, Washington 25, D. C.:

Report No. FT 100. Total imports of individual commodities showing no country detail, available 12 months after the period covered. Calendar Year 1942—total for year, individual calendar months not shown separately. Price 50 cents. First six months of 1943—total for six months, individual calendar months shown separately. Price $1.25. Monthly, starting with figures for July 1943. Price per issue 30 cents. Yearly subscription, including calendar year annual, $3.00.

Report No. FT 400. Total exports of individual commodities showing no country detail, available 12 months after the period covered, exports of foreign and domestic merchandise shown separately. Calendar Year 1942—total for year, individual calendar months now shown separately. Price 50 cents. First six months of 1943—total for six months, individual calendar months shown separately. Price $1.25. Monthly, starting with figures for July 1943—Price per issue 30 cents. Yearly subscription, including calendar year annual, $3.00.

Report No. FT 110. Imports from the Latin American countries in commodity-by-country arrangement showing for each commodity the total imported from all the Latin American countries and the amount imported from each, available 12 months after the period covered. First six months of 1943—total for six months, individual calendar months not shown separately. Price 50 cents. Monthly, starting with figures for July 1943.—Price per issue 30 cents. Yearly subscription, including calendar year annual, $3.00.

Report No. FT 410. Exports to the Latin American countries in commodity-by-country arrangement showing for each commodity the total exported to all the Latin American countries and the amount exported from each, available 12 months after the period covered. First six months of 1943—total for six months, individual calendar months not shown separately. Price $1.85. Monthly, starting with figures for July 1943. Price per issue $1.50. Yearly subscription, including calendar year annual $18.00 . (Prices for parts of FT 410 will be quoted upon request.)

Report No. FT 120. Imports from the Latin American countries in country-by-commodity arrangement showing for each country the total value of all imports including strategic, critical and military commodities and the amount of each commodity imported except strategic, critical and military, available 12 months after the period covered. First six months of 1943—total for six months, individual calendar months not shown separately. Price 50 cents. Monthly, starting with figures for July 1943. Price per issue 30 cents. Yearly subscription, including calendar year annual $3.00.

Report No. FT 420. Exports to the Latin American countries in country-by-commodity arrangement showing for each country the total value of all exports including strategic, critical and military commodities and the amount of each commodity exported except strategic, critical and military, available 12 months after the period covered. First six months of 1943-total for six months, individual calendar months not shown separately. Price $1.85. Monthly, starting with figures for July 1943. Price per issue $1.50. Yearly subscription, including calendar year annual $18.00. (Prices for parts of FT 420 will be quoted upon request.)

Report No. FT 800. Shipments of merchandise from continental United States to Alaska, Virgin Islands, and Puerto Rico, and shipments of merchandise from each to continental United States showing commodity detail, available 12 months after the period covered. Calendar year 1942—total for year, individual calendar months not shown separately. Price $1.00. First six months of 1943—total for six months, individual calendar months not shown separately. Price $1.00. Monthly, starting with figures for July 1943. Price per issue 50 cents. Yearly subscription, including calendar year annual, $5.00.

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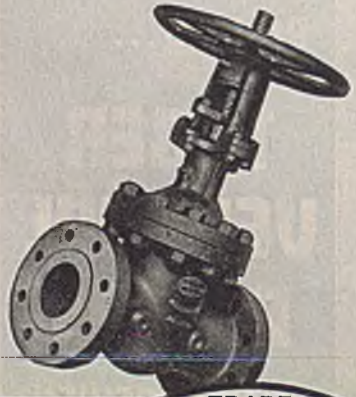

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Chain Belts. Chain Belt Co., Milwaukee, Wis.—8-page illustrated bulletin covering Rex Z-Metal chain belts. Lists properties of Z-Metal and types of Z Metal chain belts. Bulletin 437.

Compressors. Clark Bros., Olean, N. Y.—12-page brochure describing compressors for repressuring, pressure maintenance and oil conservation, containing flowsheets of operation and illustrated descriptions of various types of compressors.

Compressors and Pneumatic Tools. Sales Technical Service Dept., Standard Oil Co. (Indiana), Chicago, Ill.—40-page bulletin, designed for notebook insertion, giving detailed data on axial, centrifugal, rotary and reciprocating compressors, illustrated with cross sections, cutaway sketches. Also includes information on pneumatic tools, both reciprocating and rotary. Bulletin No. C-202.

Drying. Blaw-Knox Division of Blaw-Knox Co., P. O. Box No. 1198, Pittsburgh, Pa.—60-page, illustrated, well-designed booklet dealing with equipment and plants designed for drying purposes, including data on revolving shell dryers, calciners, kilns, coolers, rotary vacuum dryers, carbonators, vacuum drum dryers, flakers, chamber dryers, blenders, and allied equipment. Includes scale drawings, a flow diagram and cross sections. Bulletin No. 1598.

Electron Microscope. Radio Corporation of America, Dept. 255-A, Electron Microscope Section, Camden, N. J.—16-page folder describing this concern's electron microscope for research analysis production, giving details on its nature, uses, operation, and its structural features. Contains photographs used as examples of the work of this instrument and tells its various applications in the fields of medicine, bateriology and industry. Bulletin No. 1J-8771.

Electronic Tubes. Electronics Dept., The General Electric Co., Schenectady, N. Y.—4-page folder with a quick-selection chart of electronic tubes for industry, giving prices, types, shipping weight and technical data. Bulletin No. ETI-12B.

Gaskets. United States Gasket Co., 1544 Pierce Avenue, Camden, N. J.—20-page, spiral-bound catalog describing the specifications and prices for gaskets for pressures from 10 psi to 3500 psi, including gaskets for power, municipal, chemical and industrial installations. Lists the metal covered types, the "SR" for raised face, smooth face crane cap or Van Stone joints, Style H gaskets with a guide for positive positioning, and a wide variety of gaskets for boiler handholes and tubecaps, boiler manholes, large and small tongue and groove fittings, large and small male and female joints. Catalog No. 202.

Heating. Selas Corp. of America, Erie Ave. and D St., Philadelphia 34, Pa.—6-page booklet giving six case histories, each describing heating processes which have been improved, and which dealt with high-speed printing, oil refining assembly-by-brazing, the heat treatment of massive castings, aircraft heating and mechanized flame hardening.

Heavy Duty Heaters. B. F. Sturtevant Co., Hyde Park, Boston, Mass.—36-page, well-planned booklet presenting this concern's line of heavy duty heaters, describing their structural features, and giving cross section and construction details, and temperature rise constants. Includes dimensions, face areas and pressures, and numerous data tables for heater selection when operating conditions fall within the range of velocities, entering air temperatures and steam pressures shown in the tables. In addition offers temperature difference charts, piping diagrams and weights and applications of the heaters. Catalog No. 462.

Idea Exchange. Morton Mfg. Co., Nation-Wide Bureau of Ideas, 341 North Leamington Ave., Chicago 44, Ill.—Bulletin No. 1 of a new subscription service listing ideas in many fields available for development. Ideas are gathered from general public in response to national advertising and may be taken up direct with suggestors by the subscribers to bulletin.

Plant Efficiency. Lamson Corp., Syracuse 1, N. Y.—24-page pamphlet entitled "Case Histories to Aid You in Blueprinting Conversion to Peace." Gives problems and solutions involved in materials-handling operations, which have arisen and been met in war plants and are applicable in conversion to peacetime production.

Pulverizers and Separators. Raymond Pulverizer Div., Combustion Engineering Co., Inc., 1324 North Branch St., Chicago 22, Ill.—12-page booklet featuring; the laboratory mill, giving its construction, and showing an assembly view and detail parts; the 8 in. screen mill for either commercial or laboratory usage; and the laboratory separator, complete with operating instructions. Also includes data on the 30 in. mechanical air separator. Bulletin No. 53.

Pumps. Hydro-Power Systems, Inc., Mount Gilead, Ohio—16-page bulletin detailing the modern line of hydro-power gear pumps for medium pressure hydraulic application. Includes data on construction, dimensions, and operating characteristics of models G and LG hydro-power gear pumps, with sectional views, dimensional drawings and tables. Bulletin No 440.

Resin. Research and Development Laboratories, U. S. Stoneware Co., Akron, Ohio—6-page preliminary bulletin describing the type, history, use, physical, chemical and electrical properties, and application of Duralon, a furan derivative resin. Bulletin No. R-3.

Robot Oil Reclaimer. Youngstown Miller Co., Sandusky, Ohio.—4-page folder covering a robot oil reclaimer, based on batch oil reclaimers with the new feature of automatic and continuous operation. Gives applications and capacities. Bulletin No. YM-700.

Rotary Pumps. Blackmer Pump Co., Grand Rapids 9, Mich.—6-page illustrated folder describing this concern's line of rotary pumps and how they work. Design data included. Bulletin 304.

Spring Suspension. Genspring Inc., 500 Fifth Ave., New York 18, N. Y.—28-page booklet presenting data on a spring suspension for pipe lines, discussing the problem of pipe line suspension, the principle of the new NR hanger, details of construction and installation, and adjustment information. Includes tables on types of support hangers, ball couplers assemblies, pipe clamps, hanger rods and rod couplings, and strongbacks. Gives applications, information on low headroom non-resonant variable support hanger, with tables, and data for determining over-all height of assembly and rod sizes. Bulletin No. 101.

Transformers. General Electric Co., Schenectady, N. Y.—16-page illustrated booklet summarizing the safety and savings claimed through the use of the all-purpose Pyranol transformer. Installation is described and general information given. Bulletin GEA-4193.

Trucks. Revolvator Co., Tonnele Ave. at 86th St., North Bergen, N. J.—4-page illustrated pamphlet describing the double-stroke Red Giant liftruck. Tables of dimensions and general information are included. Bulletin No. 140.

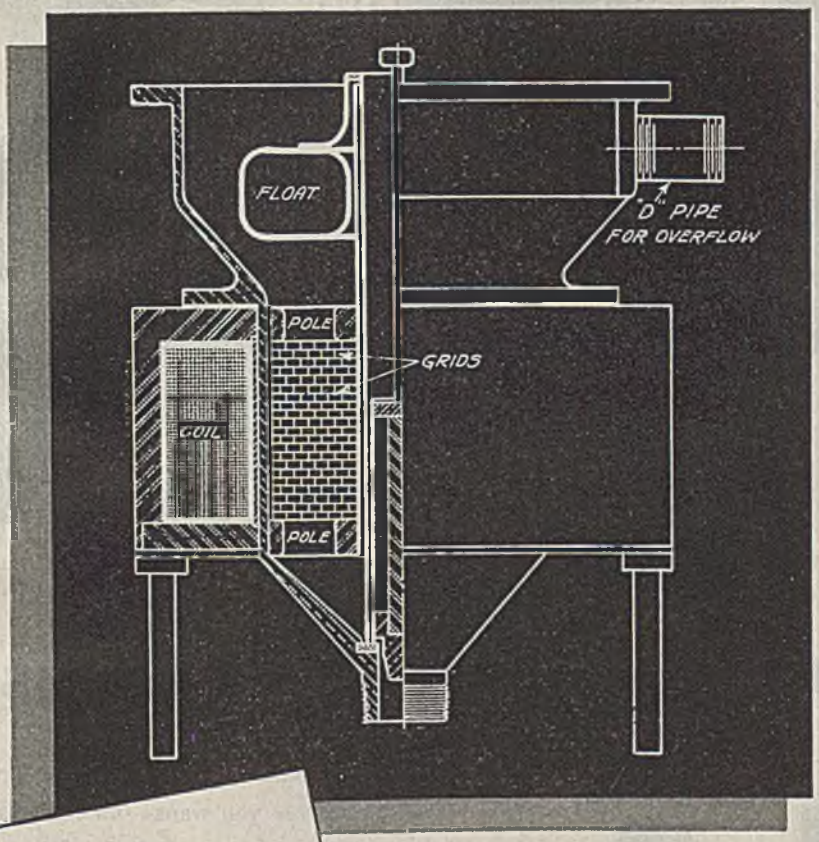
Valves. Reading-Pratt & Cady Division, American Chain & Cable Co., Inc., Bridgeport, Conn., 11x17 in. illustrated chart giving eleven tips on the handling and care of valves, and showing common mishandlings that reduce valve life. Designed for new workers, or as refreshers for old hands. Bulletin No. 61444.

Valves. Stock Engineering Co., West 98th St. and Theodore Ave., Cleveland 2, Ohio—4-page folder describing a new bulk material valve, giving a labelled cutaway drawing, a page of specifications and six accessory sketches. Bulletin No. 25.

Welding. General Electric Co., Schenectady, N.Y.—28-page reprint collection, designed for notebook insertion, detailing information on resistance welding, methods and equipment, selection of equipment, welding electrodes and their maintenance, and preparation of material for welding. Includes explanatory charts, illustrations and photographs. Bulletin GET-1189.

Welding. Victor Equipment Co., 844-54 Folsom St., San Francisco, Calif.—16-page brochure with color illustrations describing this concern's line of welding and cutting apparatus. Includes price information. Form 20.

An Improved WET SEPARATOR



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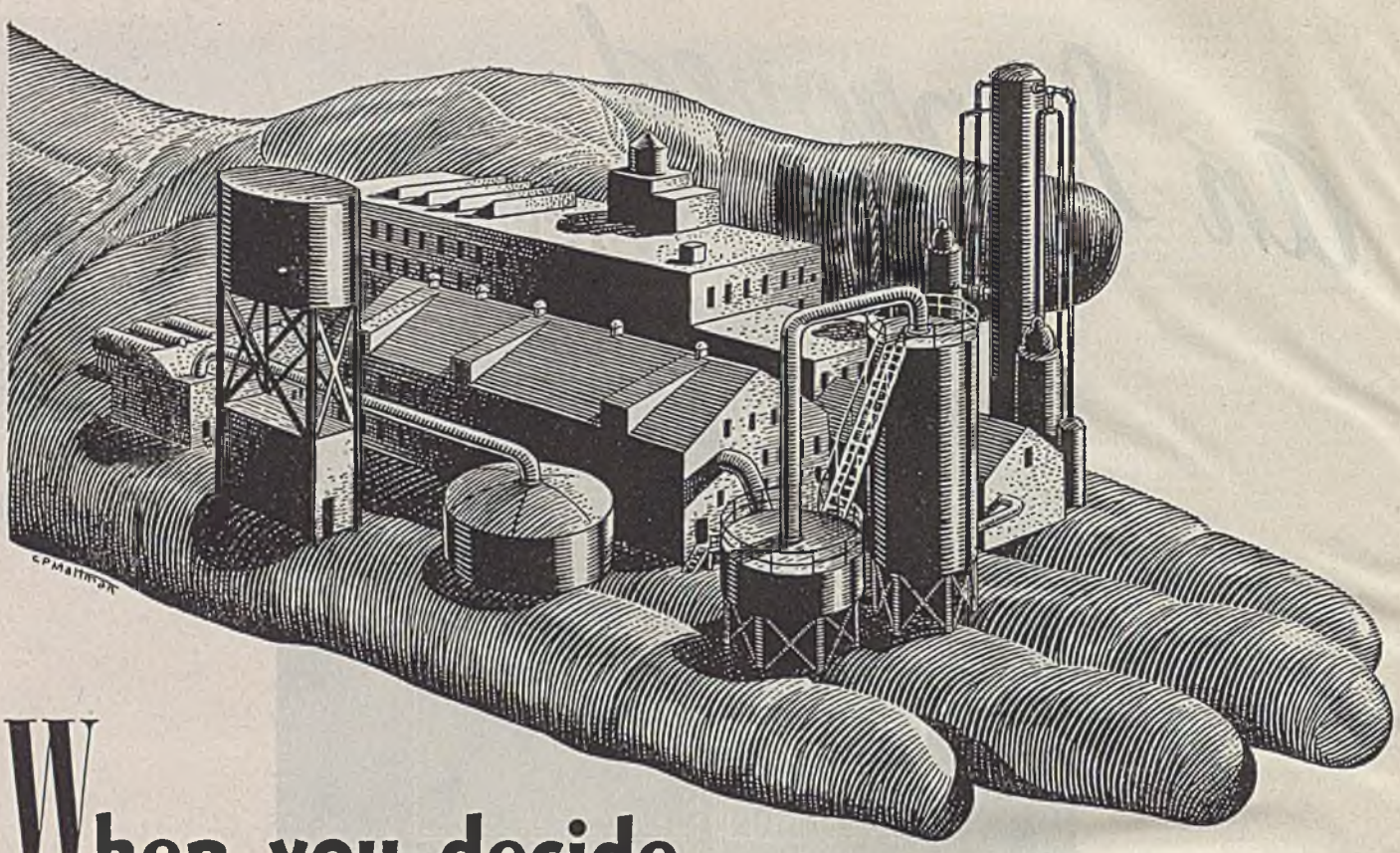

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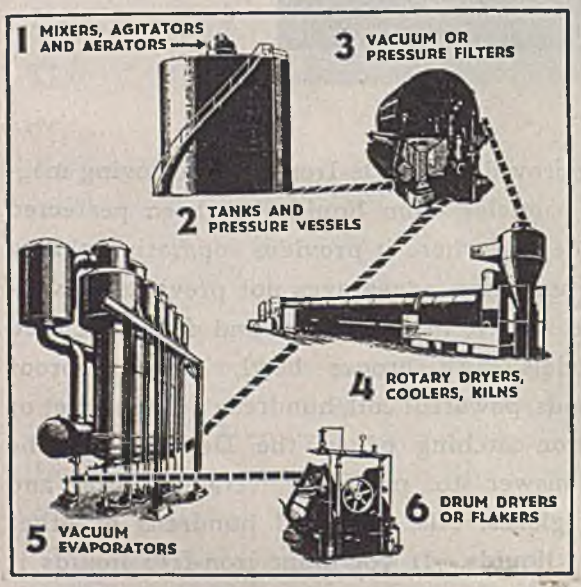

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CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

CHEMICAL CONSUMPTION AT FAIRLY STEADY RATE WITH PRODUCTION STILL ADVANCING

DESPITE the cutbacks in some branches of the military program, increased demand has been met for smokeless powder and heavy explosives and this has increased consumption of various kinds of chemicals in recent months. The Federal Reserve Board index for production of industrial chemicals has been mounting in the face of a decline in the general industry index. Recent reports about new high octane refineries coming into operation and more recently the announcement that the synthetic rubber program had been completed offer some explanation for rising trend in chemical production and consumption. It is evident that some of the production lines which have been curtailed have not been large consumers of chemicals and those industries which have been expanding draw heavily upon chemicals as raw materials. Hence the chemical index runs counter to the general trend.

The last month has brought but little change in the manufacturing lines catering to civilian needs. Government orders for certain types of cotton goods have cut down the amounts going into regular consuming outlets. Mills are still handicapped and are consuming cotton far below the level of two years ago. Petroleum refineries hit new high daily rates in June but July operations have been on a smaller scale. The urgent call for glass containers has spurred glass plants to work at capacity and a new record for output was reached in June with July rates also reported to be keeping up well. Steel mills have dropped from the peak rates of recent months but are expected to reverse this trend later in the year. A very high percentage of paint production is going for military purposes but demand for civilian use has been fairly active and total sales in May were the highest for any month on record.

The *Chem. & Met.* index for industrial consumption for June stands at 186.44 with that for May revised to 189.42. For the same months last year, the indexes were 177.35 and 179.58 respectively. For the first half of the year the index is 185.04 against 174.28 for the first half of 1943. For this year to date the index each month has been about 10 points higher than in the corresponding months of last year. The most prominent factor in pushing the index up in the current year has been the high rate of output of superphosphate plants and the consequent broadening in the market for sulphuric acid. Production of fertilizers is in accordance with a definite schedule which calls for still higher outputs between now and the close of the fertilizer year, hence a long term period of large consumption of chemicals is in prospect in that direction.

The index for war production has been revised by the War Production Board. In addition to the total munitions index, there is available for the first time a separate index for each of the seven major categories of munitions production. One of the main divisions is ammunition and established at 25 for January 1942, it climbed steadily through the year with December reported at 84. In 1943, January brought an index of 90 and by November this had increased to 120 which was the highest thus far recorded. In the present year the index dropped to 101 in January but rose to 113 in April. From current reports, the number will continue to rise and may go back to the 120 level.

The pushing up of explosives outputs has had a corresponding effect on production of chemicals which are important raw materials for that industry. For instance, nitric acid and ammonia began to slow up somewhat after last November but more recently they have been turned out in full volume and for May nitric acid output was reported at 38,958 tons of 100 percent while synthetic ammonia was produced to the amount of 42,308 tons, these figures in both cases representing outputs of private plants. A study of the other chemicals for which monthly production data are available shows that in almost all cases they are surpassing by a substantial margin the records made in the corresponding months of last year but the monthly gains will decrease in coming months because production totals in the latter part of 1943 were at a rate fairly comparable with those of the present.

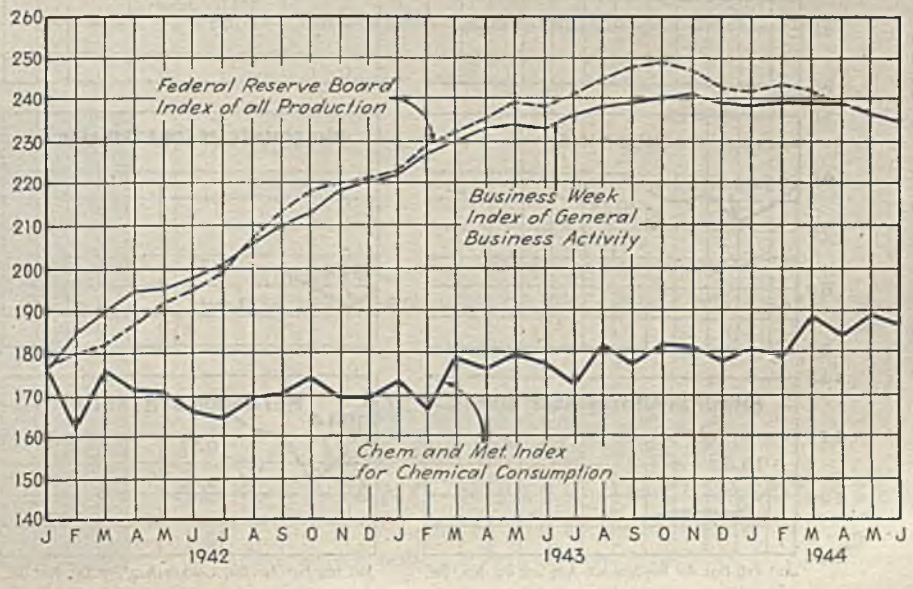
Latest reports regarding the supply of alcohol are favorable although the stockpile will be lowered as a result of the conversion of some plants in August to turning out distilled liquor. Current estimates for production of industrial alcohol this year place the total at 586,200,000 gal. with requirements estimated at 614,300,000 gal.

The packaging situation still gives concern but has been relieved somewhat by the unusually high rate at which glass container plants are working and also by the fact that stocks of aluminum have increased to a point where it has been shifted to the list of materials which are currently in balance between demand and supply. About 7,000,000 lb. of aluminum will be made available in the third quarter of this year for experimental use in the manufacture of cans. The improved position of glass containers is explained by the fact that whereas production in 1943 was about 93,000,000 gross the 1944 production is expected to reach 106,000,000 gross.

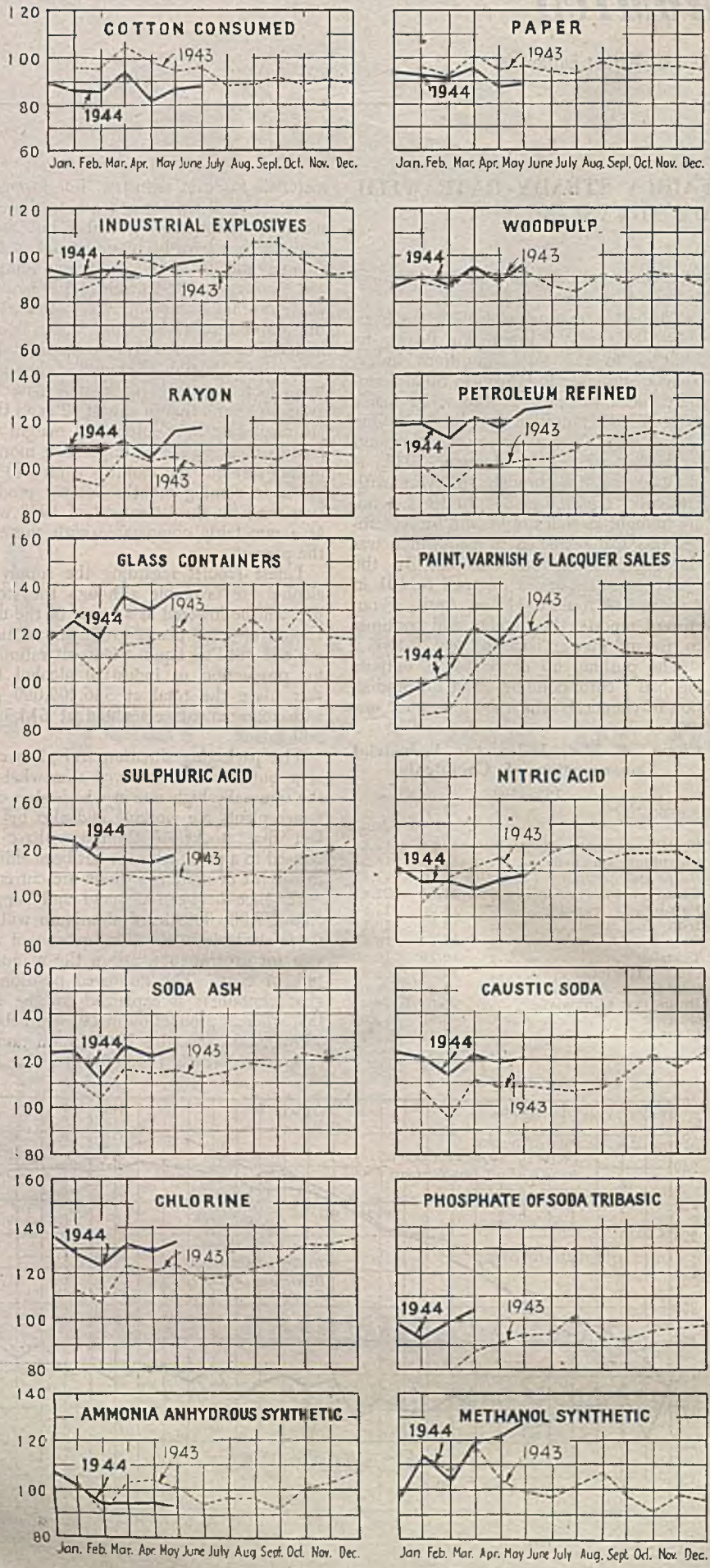
***Chem. & Met.* Index for Industrial Consumption of Chemicals**

1935–100

	May Revised	June
Fertilizers	43.10	42.60
Petroleum refined	18.04	18.28
Pulp and paper	19.10	18.85
Glass	21.11	21.40
Paint and varnish	18.56	17.80
Iron and steel	13.45	13.16
Rayon	17.61	16.82
Textiles	10.19	10.00
Coal products	10.18	9.98
Leather	4.10	4.05
Industrial explosives	5.58	5.62
Rubber	3.00	3.00
Plastics	5.40	5.20
	189.42	186.76



PRODUCTION AND CONSUMPTION TRENDS



While the position of important consuming industries may change considerably in the latter part of the year, especially if war developments bring about a shifting in demand for certain types of heavy chemicals, the output of large tonnage chemicals seems to have gone ahead at a fairly steady rate which, barring this shift, makes it possible to estimate for the second half of the year. Sulphuric acid plants are working at a rate which would bring the total for 1944 to approximately 8,500,000 tons of 100 percent acid. In 1943 the output was 8,036,000 tons, in each case the figures refer to commercial plants, excluding government owned and operated plants. Chlorine production at commercial plants may be projected to a total of 1,280,000 tons for the year as compared with 1,212,00 tons in 1943. The urgent demand for chromate and bichromate of soda has brought out plans for increasing plant capacities but so far this year this has not made much change in the monthly outputs but it is probable that the present indication of a 1944 production of 85,000 tons will be increased through higher operating rates later in the year.

Production of crude vegetable oils generally has been lower than in the corresponding period of last year. Linseed oil offers an exception as considerable gains have been shown in the monthly outputs so far this year but the outlook is not too promising as the seed supply promises to be sharply under that of last year and difficulties may be found in negotiating shipments from the Argentine.

In the leather trade, the most important feature of the month was the order from WPB which directed tanners to produce during August, approximately 5,500,000 ft. of leather suitable for top and toe of combat shoes. This figure represents an increase of 22 percent in production of this type of leather over the July production. This directive did not result in a general increase of 22 percent throughout the tanning industry but rather that more leather went into special production.

Industrial production in general did not change much in the last three months. The Federal Reserve Board unadjusted index is 236 for June as against 237 for April and May. The index for chemicals dropped to 321 in June as against 324 in May but industrial chemicals were reported at 410 for both those months. Stone, clay and glass products were reported at 165 for June, unchanged from May. Leather and products moved up one point to 113.

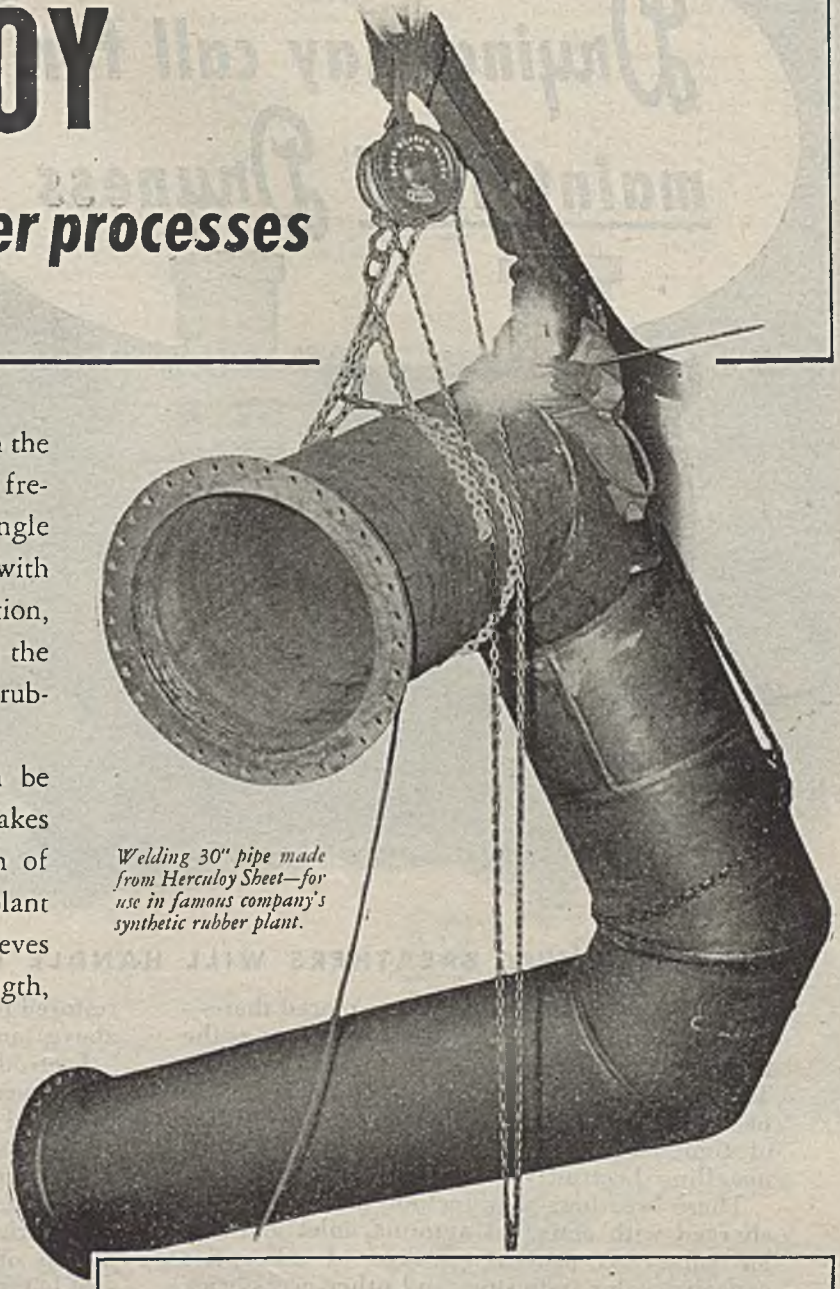
The paint trade has been encouraged to look for a large demand for paint products in the postwar period as a result of extensive building operations and now the planning committee of that industry points to the possibility for production of 18,000,000 cars and trucks in the first three years after the war which would open up a greatly expanded market for industrial finishes. This increase of 70 percent over the three years prior to 1941 was estimated as a result of a careful study made by the paint committee into the prospects of the automotive industry.

HERCULOY

in synthetic rubber processes

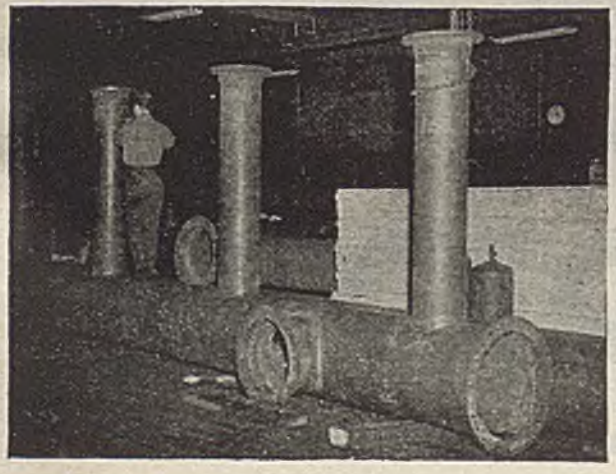
POSSESSING the strength of mild steel with the corrosion resistance of copper, Herculoy frequently makes it possible to combine in a single part both structural and process functions, with resulting economies in time and cost of erection, and in maintenance. It is a pleasure to note the use of Herculoy in speeding up the synthetic rubber program.

Herculoy — a copper-silicon alloy — can be welded readily by gas or electricity, which makes it especially attractive for the construction of pressure vessels, stills and similar chemical plant apparatus. Heat treatment after working relieves internal stresses without sacrificing strength, hardness, or resistance to abrasion. Write for new Manual, "Revere Copper and Copper Alloys—Technical Information for Product Designers." Contains data on Herculoy chemical and physical characteristics, as well as on other Revere products.



Welding 30" pipe made from Herculoy Sheet—for use in famous company's synthetic rubber plant.

Manifold, 20" with 12" branches, fabricated from Herculoy Sheet by Gerstein & Cooper, South Boston, Mass.



TYPICAL APPLICATIONS of Revere Copper and Copper-Base Alloys:

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Evaporators	Storage Tanks
Pressure Vessels	Reactor Vessels
Receivers	Fractionating Columns
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We supply copper and copper-base alloys in: SHEET, STRIP, PLATE, ROD, BAR and SHAPES, TUBE and PIPE, WELDING ROD

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York 17, N. Y.

United States Production, Consumption and Stocks of Chemicals, May 1944

(Data from U. S. Department of Commerce Bureau of the Census and WPB Chemicals Bureau)

Chemical and Basis	Units*	May 1944 (Preliminary) Production	May 1944 (Preliminary) Made and Consumed	May 1944 (Preliminary) Stocks	April 1944 Production	April 1944 Made and Consumed	April 1944 Stocks
Acetylene: for use in chemical synthesis	M cu. ft.	[1]	[1]	[1]	[1]	[1]	[1]
For commercial purposes	M cu. ft.	[1]			[1]		
Synthetic anhydrous ammonia (100% NH_3)	Tons	42,308	32,107	3,766	43,191	36,982	2,834
Bleaching powder (35%–37% avail. Cl_2)	M lb.	5,747	1,301	1,138	5,343	1,498	1,487
Calcium acetate (80% Ca $(C_2H_3O_2)_2$)	M lb.	1,083	[3]	294	775	[3]	358
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	4,890	[3]	7,709	4,099	[3]	8,530
Calcium carbide (100% CaC_2)	Tons	[1]	[4]	[1]	[1]	[4]	[1]
Calcium hypochlorite (true) (70% available Cl_2)	M lb.	1,261	[3]	424	1,241	[3]	605
Calcium phosphate — monobasic (100% $CaH_4(PO_4)_2$)	M lb.	4,270	[3]	5,669	3,882	[3]	5,558
Carbon dioxide: liquid and gas (100% CO_2)	M lb.	[1]	[1]	[1]	[1]	[1]	[1]
Solid (dry ice) (100% CO_2)	M lb.	[1]	[1]	[1]	[1]	[1]	[1]
Chlorine	Tons	109,327	61,484	9,053	106,764	72,385	7,942
Chrome green (C.P.)	M lb.	570	57	1,000	524	[2]72	1,020
Hydrochloric acid (100% HCl)	Tons	31,418	18,240	2,575	29,671	15,723	4,158
Hydrogen	Millions of cu. ft.	[1]	[1]	4	[1]	[1]	4
Lead arsenate (acid and basic)	M lb.	[1]	[1]	[1]	[1]	[1]	[1]
Lead oxide — red (100% Pb_3O_4)	M lb.	9,390	266	5,733	8,855	645	4,946
Methanol: natural (80% CH_3OH)	Gal.	364,434	[4]	312,433	[2]340,660	4	[2]310,105
Synthetic (100% CH_3OH)	M gal.	6,694	[3]	6,768	6,320	3	7,128
Molybdate orange (C.P.)	Lb.	104,933	5,400	165,013	114,147	11,561	[2]157,506
Nitric acid (100% HNO_3)	Tons	38,958	33,996	7,047	38,161	[2]33,984	[2]6,887
Oxygen	M cu. ft.	[1]	[1]	[1]	[1]	[1]	[1]
Phosphoric acid (50% H_3PO_4)	Tons	59,147	52,587	13,910	[2]57,807	[2]54,563	12,458
Potassium bichromate and chromate (100%)	M lb.	733	[3]	399	638	[3]	410
Potassium chloride (100% KCl)	Tons	[10]	[10]	[10]	103,709	[3]	30,895
Potassium hydroxide (caustic potash) (100% KOH)	Tons	3,736	704	1,949	3,494	700	1,720
Soda ash — ammonia soda process:							
Total wet and dry[5] (98%–100% Na_2CO_3)	Tons	303,823	.....	.....	385,085	.....	.....
Finished light (98%–100% Na_2CO_3)[6]	Tons	212,240	45,933	22,124	206,990	48,661	21,380
Finished dense (98%–100% Na_2CO_3)	Tons	126,642	3,214	10,085	124,727	2,896	12,660
Natural [7]	Tons	15,221	.....	3,341	13,778	.....	1,724
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	13,077	[3]	5,501	12,791	[3]	5,535
Sodium bichromate and chromate (100%)	Tons	7,060	[3]	1,195	6,920	[3]	1,403
Sodium hydroxide, liquid: electrolytic process (100% NaOH)	Tons	100,553	24,971	32,875	99,052	22,480	35,736
Lime-soda process (100% NaOH)	Tons	57,733	[3]	13,967	58,037	[3]	14,741
Sodium phosphate: monobasic (100% NaH_2PO_4)	M lb.	[1]	[3]	[1]	[1]	[3]	[1]
Dibasic (100% Na_2HPO_4)	Tons	[1]	[3]	[1]	[1]	[3]	[1]
Tribasic (100% Na_3PO_4)	Tons	[1]	[3]	[1]	[1]	[3]	[1]
Sodium silicate (water glass): liquid (40° Baumé)	Tons	97,976	4	100,584	88,315	4	94,146
Solid (all forms combined)	Tons	10,548	2,639	8,191	10,809	2,796	8,455
Sodium sulphate: glauber salt and crude salt cake [7]	Tons	[1]	[1]	[1]	[1]	[1]	[1]
Anhydrous (refined) (100% Na_2SO_4)	Tons	[1]	[3]	[1]	[1]	[3]	[1]
Sulphur dioxide (100% SO_2)	M lb.	[1]	[1]	[1]	[1]	[1]	[1]
Sulphuric acid:[9] chamber process (100% H_2SO_4)	Tons	272,128	.....	266,448	[2]263,132	.....	[2]287,962
Contact process [8] (100% H_2SO_4)	Tons	491,179			480,675		
Net contact process [9] (100% H_2SO_4)	Tons	442,141	.....	.....	428,712	.....	.....
White lead	Tons	7,113	2,198	8,850	6,206	2,480	8,694
Zinc yellow (C.P.)	M lb.	2,914	274	1,039	[2]2,672	318	928

* All tons are 2,000 lb. [1] Not yet available. [2] Revised. [3] Data cannot be published. [4] Not available. [5] Total wet and dry production. [6] Not including quantities converted to finished dense. [7] Data collected in cooperation with the Bureau of Mines. [8] Includes oleum grades. [9] Excludes spent acid. [10] Data collected and compiled by Bureau of Mines beginning May 1944.

CHEM. & MET.

Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	109.48
Last month	109.50
August, 1943	109.03
August, 1942	109.11

CURRENT PRICES

The accompanying prices refer to round lots. Where it is trade custom to sell fob works, quotations are so designated. Prices are corrected to August 8

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.07 –
Acid, acetic, 28%, bbl., 100 lb	3.38 – $3.63
Boric, bbl., ton	109.00 – 113.00
Citric, kegs, lb	.20 – .23
Formic, cbys, lb	.10½ – .11
Hydrofluoric, 30%, drums, lb	.08 – .085
Lactic, 44%, tech., light, bbl., lb	.073 – .075
Muriatic, 18°, tanks, 100 lb	1.05 –
Nitric, 36°, carboys, lb	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½ – .12½
Phosphoric tech., tanks, lb	.04 –
Sulphuric, 60°, tanks, ton	13.00 –
Tartaric, powd., bbl., lb	.70½ –
Alcohol, amyl	–
From pentane, tanks, lb	.131 –
Alcohol, butyl, tanks, lb	.10½ – .18½
Alcohol, ethyl, denatured, 190 proof	–
No. 1 special, tanks, gal. wks.	.50 –
Alum, ammonia, lump, bbl., lb	.04½ –
Aluminum, sulphate, com. bags, 100 lb	1.15 – 1.40
Ammonia, anhydrous, cyl., lb	.16 –
tanks, lb	.04½ –
Ammonium carbonate, powd. tech., casks, lb	.09½ – .12
Sulphate, wks, ton	28.20 –
Amylacetate, tech., from pentane, tanks, lb	.145 –
Aqua ammonia, 26°, drums, lb	.02½ – .03
tanks, ton	65.00 –
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl. ton	75.00 – 78.00
Nitrate, casks, lb	.09½ – .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran., bags, ton	45.00 –
Calcium acetate, bags	3.00 –
Arsenate, dr. lb	.07 – .08
Carbide, drums, ton	50.00 –
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride drums, gal	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb	1.75 – 2.00
Copperas, bgs, f. o. b., wks, ton	17.00 – 18.00
Copper carbonate, bbl., lb	.19½ – .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.57 –
Diethlylene glycol, dr., lb	.14½ – .15½
Epsom salt, dom., tech., bbl., 100 lb	1.90 – 2.00
Ethyl acetate, tanks, lb	.11½ –
Formaldehyde, 40%, tanks, lb	.036 –
Furfural, tanks, lb	.09 –
Glaubers salt, bags, 100 lb	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18¾ –
Lead:	
White, basic carbonate, dry casks, lb	.08½ –
Red, dry, sck. lb	.09½ –
Lead acetate, white crys., bbl., lb	.12½ – .13
Lead arsenate, powd., bag, lb	.11½ – .12
Lithopone, bags, lb	.04½ – .04¾
Magnesium carb., tech., bags, lb	.06½ – .06½
Methanol, 95%, tanks, gal	.58 –
Synthetic, tanks, gal	.24 –
Phosphorus, yellow, cases, lb	.23 – .25
Potassium bichromate, casks, lb	.09½ – .10
Chlorate, powd., lb	.09½ – .12
Hydroxide (c'stic potash) dr., lb	.07 – .0¼
Muriate, 60 % bags, unit	.53½ –
Nitrate, bbl., lb	.05½ – .06
Permanganate, drums, lb	.19½ – .20
Prussiate, yellow, casks, lb	.17 – .18
Sal ammoniac, white, casks, lb	.0515 – .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, 100 lb	1.05 –
Dense, bags, 100 lb	1.15 –
Soda, caustic, 76%, solid, drums, 100 lb	2.30 – 3.00
Acetatedel., bbl., lb	.05 – .06
Bicarbonate, bbl., 100 lb	1.70 – 2.00
Bichromate, casks, lb	.07½ – .08
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb	.03 – .04
Chlorate, kegs, lb	.06½ – .06¾
Cyanide cases, dom., lb	.14½ – .15
Fluoride, bb., lb	.07 – .08
Hyposulphite, bbl., 100 lb	2.40 – 2.50
Metasilicate, bbl., 100 lb	2.50 – 2.65
Nitrate, bulk, 100 lb	1.35 –
Nitrite, casks, lb	.06½ – .07
Phosphate, tribasic, bags, lb	2.70 –
Prussiate, yel. bags, lb	.09½ – .10
Silicate (40° dr.), wks., 100 lb	.80 – .85
Sulphide, bbl., lb	.02½ –
Sulphite, crys, bbl., lb	.02½ – .02½
Sulphur, crude at mine, long ton	16.00 –
Dioxide, cyl., lb	.07 – .08
Tin crystals, bbl., lb	.39½ –
Zinc chloride, gran, bbl., lb	.05½ – .06
Oxide, lead free, bag, lb	.07½ –
5% leaded, bags, lb	.07½ –
Sulphate, bbl., cwt	3.85 – 4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13¾ – $0.14½
Chinawood oil, tanks, lb	.38½ –
Coconut oil, ceylon, tank, N. Y., lb	nom
Corn oil crude, tanks (f.o.b. mill), lb	.12¾ –
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12¾ –
Linseed oil, raw, car lots, bbl., lb	.151 –
Palm casks, lb	.09 –
Peanut oil, crude, tanks (mill), lb	.13 –
Rapeseed oil, refined, bbl., lb	nom
Soy bean, tank, lb	.11¾ –
Menhaden, light pressed, dr., lb	.1305 –
Crude, tanks (f.o.b. factory) lb	.08½ –
Grease, yellow, loose, lb	.08½ –
Oleo stearine, lb	.09½ –
Oleo oil, No. 1, lb	.11½ –
Red oil, distilled, dp.p. bbl., lb	.12¾ –
Tallow extra, loose, lb	.08½ –

COAL-TAR PRODUCTS

Alpha-napthol, crude, bbl., lb	$0.52 – $0.55
Alpha-naphthylamine, bbl., lb	.32 – .34
Aniline oil, drums, extra, lb	.1 – .16
Aniline salts, bbl., lb	.22 – .24
Benzaldehyde, U.S.P., dr., lb	.85 – .95
Benzidine base, bbl., lb	.70 – .75
Benzoic acid, U. S. P., kgs., lb	.54 – .56
Benzol, 90%, tanks, works, gal	.15 –
Benzyl chloride, tech., dr., lb	.23 – .25
Beta-naphthol, tech., drums, lb	.23 – .24
Cresol, U. S. P., dr., lb	.11 –
Cresylic acid, dr., wks., gal	.81 – .83
Diphenyl, bbl., lb	.15 –
Diethylaniline, dr., lb	.40 – .45
Dinitrophenol	.23 – .25
Dinitrotoluol bbl., lb	.18 – .19
Dip oil, 15%, dr., gal	.23 – .25
Diphenylamine, dr. f.o.b. wks., lb	.60 –
H-acid, bbl., lb	.45 – .50
Hydroquinone, bbl., lb	.90 –
Naphthalene, flake, bbl., lb	.07 – .07½
Nitrobenzene, dr., lb	.08 – .09
Paracresol, bbl., lb	.41 –
Para-nitraniline, bbl., lb	.47 – .49
Phenol, U. S. P., drums, lb	.10½ – .11
Picric acid, bbl., lb	.35 – .40
Pyridine, dr., gal	1.70 – 1.80
Resorcinol, tech, kegs, lb	.75 – .80
Salicylic acid, tech., bbl., lb	.33 – .40
Solvent naphtha, w.w., tanks, gal	.27 –
Tolidine, bbl., lb	.86 – .88
Toluol, drums, works, gal	.33 –
Xylol, com., tanks, gal	.26 –

MISCELLANEOUS

Casein, tech., bbl., lb	$0.19 – $0.24
Dry colors	
Carbon gas, black (wks.), lb	.0335 – .30
Prussian blue, bbl., lb	.36 – .37
Ultramarine blue, bbl., lb	.11 – .26
Chrome green, bbl., lb	.21½ – .30
Carmine, red, tins, lb	4.60 – 4.75
Para toner, lb	.75 – .80
Vermilion, English, bbl., lb	2.75 – 2.80
Chrome, yellow, C. P., bbl., lb	.14½ – .15½
Gum Copal Congo, bags, lb	.09 – .30
Manila, bags, lb	.09 – .15
Demar, Batavia, cases, lb	.10 – .22
Kauri, cases, lb	.18 – .60
Magnesite, calc., ton	64.00 –
Pumice stone, lump, bbl., lb	.05 – .07
Rosin, H., 100 lb	6.45 –
Turpentine, gal	.89 –
Shellac, orange, fine, bags, lb	.39 –
Bleached, bonedry, bags, lb	.39 –
T. N. bags, lb	.31 –

CHEM. & MET.

Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.24
Last month	145.24
August, 1943	145.55
August, 1942	141.53

NEW CONSTRUCTION

PROPOSED WORK

Conn., Stamford—American Cyanamid Co., 1937 West Main St., is receiving bids for the construction of Warehouse No. 3.

Ga., Griffin—Knox Glass Bottle Co., Fannin Rd., Jackson, Miss., is having plans prepared by H. L. Robinson, Archt., c/o owner, for the construction of a 100 x 800 ft. factory.

Kan., Topeka—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., plans to construct a synthetic rubber manufacturing plant here to be operated by Goodyear Tire & Rubber Co. of Kansas, Inc., Topeka. Estimated cost $6,500,000.

Ky., Louisville-National Distillers Products Corp., 120 Bway., New York, N. Y., plans to construct an evaporator building and dryer house. Estimated cost $42,250.

La., Monroe—Interstate Natural Gas Co., Inc., Monroe, plans to construct two 1000 hp. gas compressors, housing and auxiliary equipment in Ouchita Parish. Estimated cost will exceed $40,000.

Neb., Ralston—The Refinite Corp., 11th and Harney Sts., Omaha, is having plans prepared by Henningson Engineering Co., Standard Oil Bldg., Omaha, for the construction of a processing plant here. Estimated cost $250,000.

N. J., Arlington—E. I. du Pont de Nemours & Co., Inc., 1007 Market St., Wilmington, Del., will soon award the contract for the construction of a 1 and 2 story nylon storage building.

N. J., Princeton—Heyden Chemical Co., 50 Union Sq., New York, N. Y., plans to construct additional facilities at its plant here. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $215,000.

O., Cleveland—Standard Oil Co., Harold West, Engr. in charge, Midland Bldg., plans to construct additional facilities for its refinery here. Estimated cost $100,000.

O., Toledo — Owens-Corning Fiberglas Corp., Nicholas Sq., plans alterations and addition to its factory here. Estimated cost $193,817.

Pa., Jeanette—Pennsylvania Rubber Co., P. C. Mathewson, Mgr., plans to alter and construct additional facilities at its plant.

Tex., Bowie—Continental Oil Co., Ponca City, Okla., plans to construct a gas repressing plant to include 600 hp. compressor capable of handling 4,000,000 cu. ft. gas daily. Estimated cost $750,000.

Tex., Houston—Shell Union Oil Corp., Chemical Div., Shell Bldg., plans to construct a chemical plant in this area. Estimated cost $1,000,000.

	Current Projects		Cumulative 1944	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$40,000	.....	$810,000	$1,677,000
Middle Atlantic	295,000	$8,585,000	7,102,000	9,988,000
South	122,000	4,230,000	12,207,000	19,831,000
Middle West	294,000	65,000	779,000	27,347,000
West of Mississippi	8,540,000	1,750,000	26,515,000	17,102,000
Far West	.....	5,000,000	7,299,000	12,506,000
Canada	140,000	550,000	7,947,000	6,227,000
Total	$9,431,000	$20,180,000	$62,659,000	$94,678,000

Tex., Pasadena—Southern Acid & Sulphur Co., Wallisville Rd., Houston, plans to construct nine reinforced-concrete and steel silos here. Dorr & Co., Inc., 570 Lexington Ave., New York, N. Y., Engrs.

Ont., Sault Ste Marie—Windsor Metallurgical Processes, Ltd., Sault Ste Marie, plans to construct a metallurgical processing plant. Estimated cost $50,000.

Ont., Toronto—Fyron Ceramics, Ltd., c/o G. Ruel, 51 West King St., Toronto, plans to construct a plant for the manufacture and processing of ceramics, etc. Estimated cost $50,000.

Que., Kenogami—Price Bros. Co., Ltd., 65 St. Anne St., Quebec City, plans to remodel its paper mill. Estimated cost $40,000.

CONTRACTS AWARDED

Calif., Torrance — General Petroleum Corp., 108 West Second St., Los Angeles, has awarded the contract for the design and construction of a stoker unit for twin cracking plant to M. W. Kellogg Co., 190th and Figueroa Sts., Gardena. Estimated cost $5,000,000.

Ky., Louisville—B. F. Goodrich Co., Main St., Akron, O., has awarded the contract for the construction of a chemical plant here to Austin Co., 16110 Euclid Ave., Cleveland, O. Estimated cost $1,200,000.

La., Baton Rouge—Consolidated Chemical, Inc., North Baton Rouge, will construct an addition to its chemical plant. Work will be done by force account and subcontracts. Estimated cost $500,000.

La., Haynesville—Ohio Co., Midstates Oil Corp., Gulf Refining Co. & Associates, City Bank Bldg., Shreveport, have awarded the contract for the design and construction of a gasoline and cycling plant to Jones & Laughlin Supply Co., Petroleum Bldg., Tulsa, Okla. Estimated cost $1,700,000.

N. J., Passaic—Raybestos-Manhattan, Inc., Willett St., has awarded the contract for the construction of a factory building to Lamworth-Hughes Co., 177 Van Houten St., Paterson. Estimated cost $45,000.

N. J., Piscataway (Bound Brook P. O.)—Bakelite Corp., 30 East 42nd St., New York, N. Y., has awarded the contract for alterations to its plant to W. L. Blanchard, 45 Poinier St., Newark. Estimated cost $90,000.

O., Mansfield—Mansfield Tire & Rubber Co., has awarded the contract for the construction of a 4 story, 35 x 60 ft. factory addition to Simon Small & Sons Co., 13 Park Ave., Mansfield. Estimated cost $65,000.

Pa., Aliquippa—Jones & Laughlin Steel Corp., 3rd and Ross Sts., Pittsburgh, has awarded the contract for the construction of 106 by-product coke ovens to Koppers Co., Koppers Bldg., Pittsburgh. Estimated cost $7,500,000.

Pa., Philadelphia—International Chemical Co., 2642-48 North Mascher St., has awarded the contract for a storage building to S. H. Lecin, 1717 Sansom St., Philadelphia. Estimated cost $50,000.

Pa., Punxsutawney—Defense Plant Corp., 811 Vermont Ave., N. W., Wash., D. C., has awarded the contract for the construction of a manufacturing plant to consist of two 2 story, 120 x 230 ft. buildings to Wigton-Abbott Corp., 1225 South Ave., Plainfield, N. J. Estimated cost $900,000.

Tenn., Memphis—Southern Acid & Sulphur Co., Warford Ave., has awarded the contract for the construction of additions to its chemical plant to H. K. Ferguson, Hanna Bldg., Cleveland, O. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $330,000.

Tex., Columbus—Shell Oil Co., Inc., P. O. Box 2099, Houston, Zone 1, has awarded the contract for the design and construction of a cycling plant to have a daily capacity of 100,000,000 cu. ft. gas, to Petroleum Engineering Co., Inc., Commerce Bldg., Houston. Estimated cost $1,750,000.

Va., Bentonville—Stauffer Chemical Co., 420 Lexington Ave., New York, N. Y., has awarded the contract for plant here, main building to be 40 x 200 ft., to Brown & Matthews, 122 East 42nd St., New York, N. Y. Estimated cost $500,000.

Que., Hull—Canada Cement Co., Ltd., Montreal, has awarded the contract for No. 3 plant addition to E. Brunet & Son, 35 Aylmer St., Hull. Estimated cost $50,000.

Que., Montreal—Canadian Copper Refineries, Ltd., Durocher Ave., has awarded the contract for the construction of a copper sulphate plant to Foundation Co., Ltd., 1538 Sherbrooke St., W., Montreal, estimated cost $500,000.

Structurally different the *FLOW-MASTER* has introduced *Homogenization* to Industry heretofore thought impossible resulting in *new products* — and improvements of standard items.

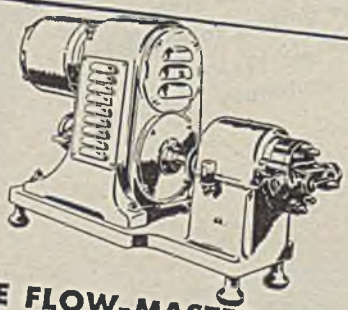
Your products can be continuously handled in large volumes for hydraulic grinding to micron size and homogenizing by an entirely new method that doesn't depend on pressure alone.

Products that no homogenizer was ever able to process are now handled on the FLOW-MASTER and the volume is constant regardless of reduction size.

No scorching or off-flavoring occurs because the product must keep steadily moving from entrance to exit, and there are no threads, pockets or corners in which it might become lodged.

Sanitary: easily and quickly cleaned when changing from one product to another.

Quality, Appearance, Taste, Texture and Sales Appeal are all improved and the manufacturing cost is lowered.

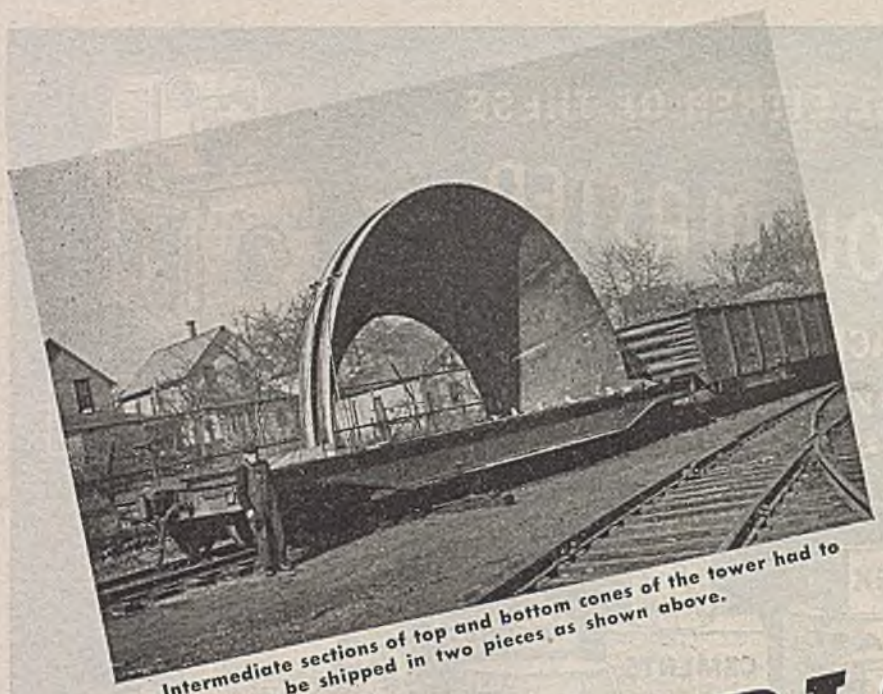


THE FLOW-MASTER PUMP

If your product needs to be transferred — metered or proportioned, you need the FLOW-MASTER because it will not only do all these but it will maintain volumetric efficiency against normal wear.

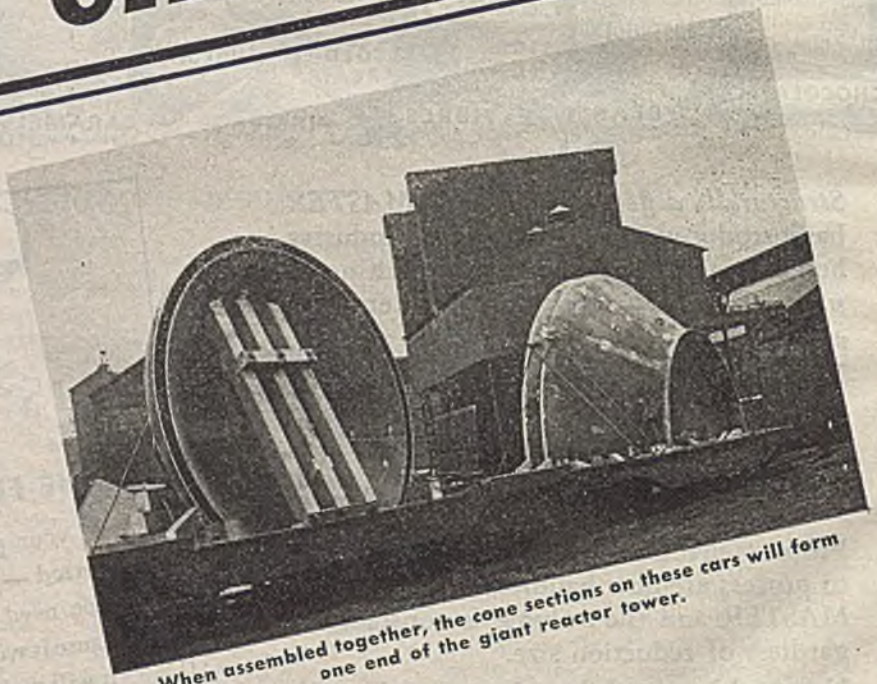
Attention Equipment Manufacturers: Just as the heart is the pump of the human body, so the pump is the heart of equipment for product movement — It will pay you to investigate the FLOW-MASTER.

MARCO CO. Inc., *511 Monroe Street, Wilmington 7, Del.*



Intermediate sections of top and bottom cones of the tower had to be shipped in two pieces as shown above.

FIVE CARLOADS of



When assembled together, the cone sections on these cars will form one end of the giant reactor tower.

THE BABCOCK & WILCOX

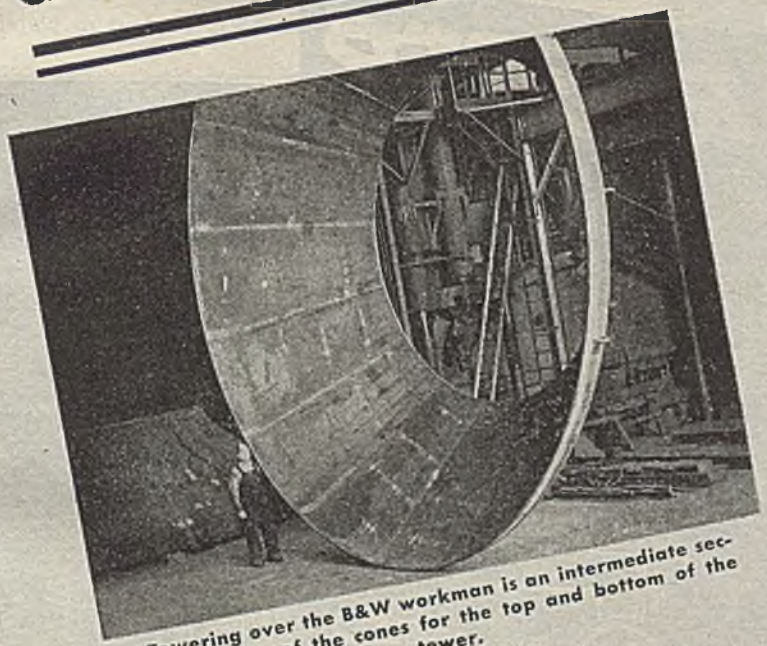
85 LIBERTY STREET, NEW YORK

achievement

NEW problems . . . in design . . . in fabrication . . . in transportation . . . in fitting . . . in solved in supplying a giant alloy-clad reactor tower for a new West Coast refinery. It was the kind of a job that called for ingenuity and originality from start to finish.

Because of its immense size—85 feet high, 27 feet in diameter and weighing 360,000 lb.—the tower had to be designed and fabricated so that it could be shipped in sections from the B&W plant for final assembly at the refinery. When installed, the vessel will operate at 30 lb. per sq. in. at a temperature of 1000° F. in producing aviation gasoline. For long life and freedom from shutdowns at this high temperature, the tower was provided with a lining of B&W Croloy, fully bonded over the entire area.

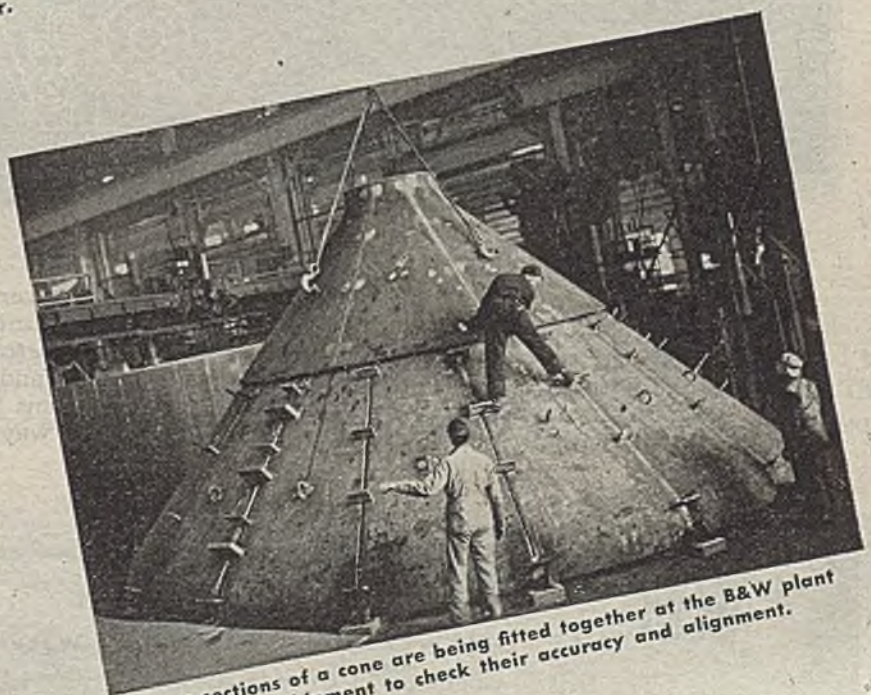
No technical problem is ever too difficult, no fabricating job too complicated for B&W when it comes to supplying pressure vessels of any kind for today's processing methods. Any requirement for pressure vessels can be brought to us with confidence of getting sound engineering and finished products of proved reliability and economy.



Towering over the B&W workman is an intermediate section of one of the cones for the top and bottom of the tower.

COMPANY

6, N. Y.



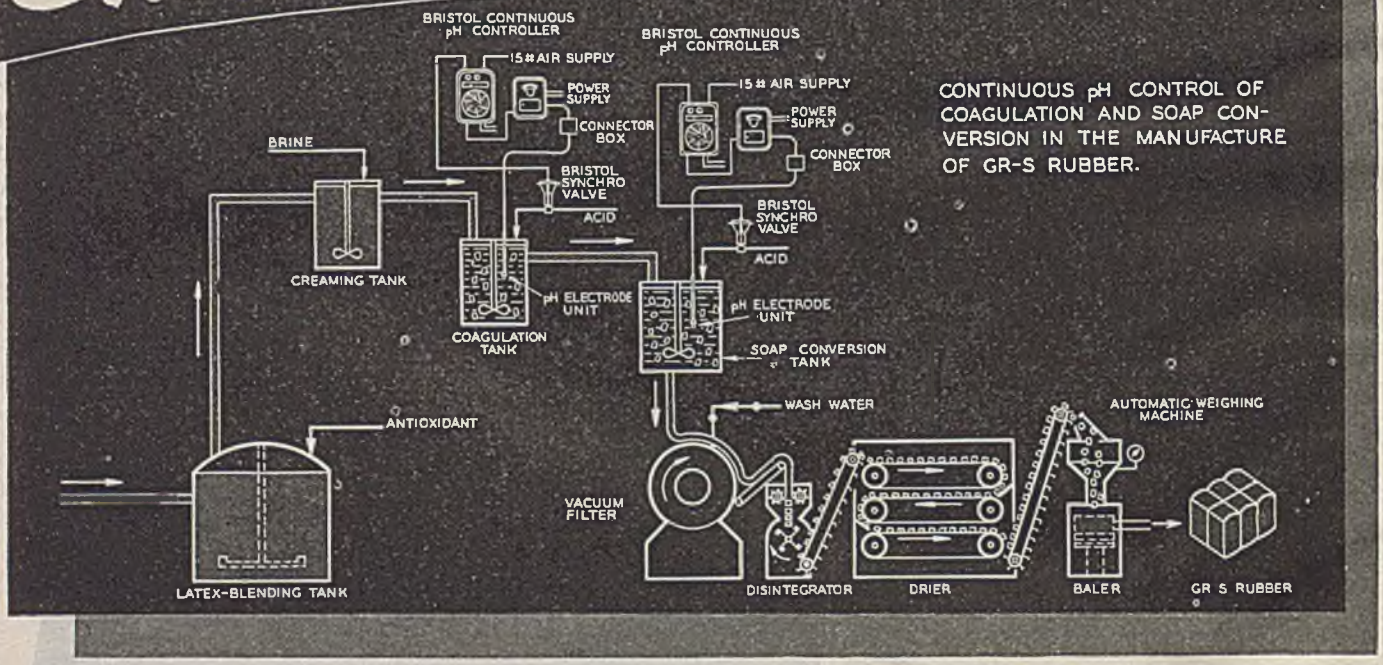
Two sections of a cone are being fitted together at the B&W plant before shipment to check their accuracy and alignment.

S-51T

pH Control

Bristol Continuous pH Controllers Help Speed Production
. . . Guarantee Uniform Quality in the Manufacture of—

SYNTHETIC RUBBER



CONTINUOUS pH CONTROL OF COAGULATION AND SOAP CONVERSION IN THE MANUFACTURE OF GR-S RUBBER.

A glance at the schematic drawing above reveals how Bristol Continuous pH Controllers are applied to the coagulation and soap conversion tanks in the manufacture of synthetic rubber.

In every synthetic rubber plant built under government auspices, those vital steps are guided by Bristol pH Controllers. Operation is fully automatic and the instruments hold the pH value of the solutions to a degree of constancy obtainable in no other way.

THE BRISTOL COMPANY, Waterbury 91, Connecticut

The Bristol Company of Canada, Ltd., Toronto, Ont.

Bristol's Instrument Co., Ltd., London N.W. 10, England

AIDS THE "GROWTH" OF A TROPICAL PRODUCT IN AMERICAN PLANTS

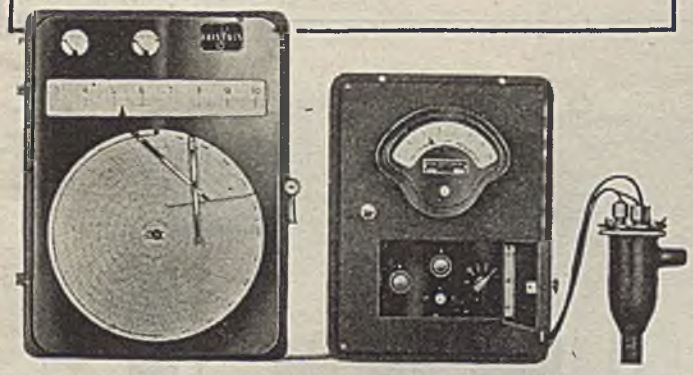
A typical method of automatically controlling the pH value of a solution is shown at the right. The pH Controller can maintain any predetermined pH value in the tank as the solution passes through it. The Bristol Automatic Liquid Level Controller shown in the sketch automatically controls the liquid in tank at exact level required by the process.

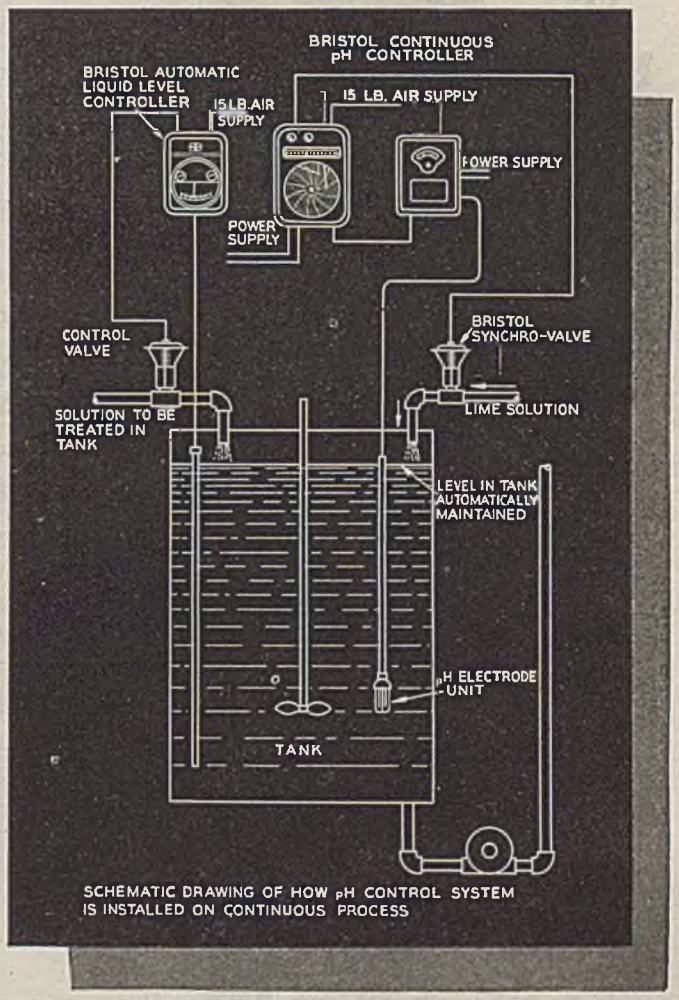
Bristol pH Recorders and Continuous Controllers combine ruggedness and sensitive accuracy.

Two types of assemblies are available. *Enclosed Flow Type* — In this assembly, the electrodes and temperature bulb are mounted within an acid-resisting enameled iron flow chamber through which a sample of the solution under measurement flows or is pumped. *Immersion Type* — This assembly, designed for immersion in tanks or vats, is mounted on a stainless steel plate and protected by a stainless steel cage.

Electrodes for both types are made for use at temperatures up to 100° C.

Write for Bulletin 103 on Automatic Control of Synthetic Rubber Processes.





SCHEMATIC DRAWING OF HOW pH CONTROL SYSTEM IS INSTALLED ON CONTINUOUS PROCESS

BRISTOL PROCESS CONTROL IS WORTH INVESTIGATING

Bristol's leadership in automatic process control must have been the deciding factor in the exclusive choice of Bristol pH Controllers in government-sponsored synthetic rubber plants. This same engineering leadership can be translated into benefit for you... for your processes. A Bristol engineer will be glad to talk things over with you. No obligation, of course. The Bristol Company, 109 Bristol Road, Waterbury 91, Conn.

BRISTOL

Engineers Process Control for Better Products and Profits

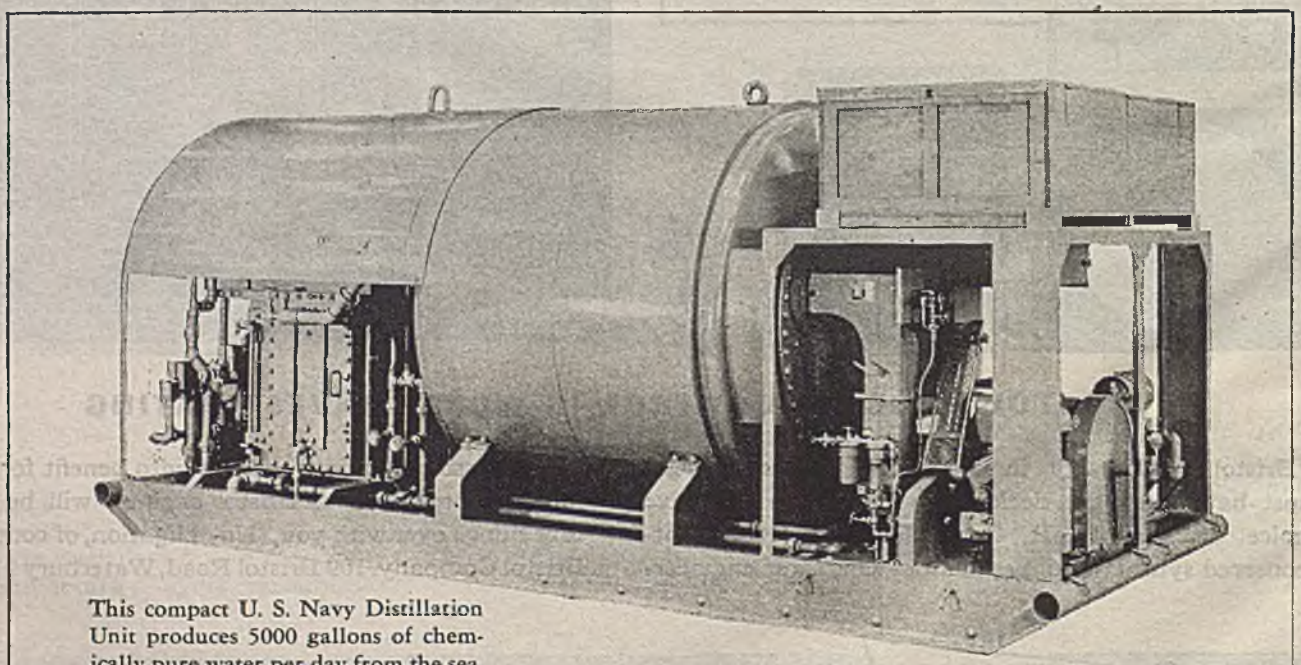
AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

From the briny deep

IT'S ALL DRINKING

AMONG THE FIRST ITEMS of equipment to be put ashore in amphibian operations, is the "seagoing waterworks." Through such distillation units, raw sea water or bacteria laden swamp water is quickly converted to chemically pure water for drinking, cooking and hospital use.

And Anaconda Copper and Copper alloys have contributed materially to the Cleaver-Brooks Company, Milwaukee, units shown here. Condenser tubes are of Anaconda Admiralty Metal, tube sheets are of Anaconda Muntz Metal. Admiralty tubes are also used in the preheater and cooler, Anaconda Copper Sheet for evaporator baffles (to prevent drops of sea water from



This compact U. S. Navy Distillation Unit produces 5000 gallons of chemically pure water per day from the sea.

ANACONDA from mine to consumer

Anaconda Copper & Copper Alloys