CHEMICAL & Metallurgical ENGINEERING

DECEMBER • 1944

Volume 51 Number 12

In this Issue

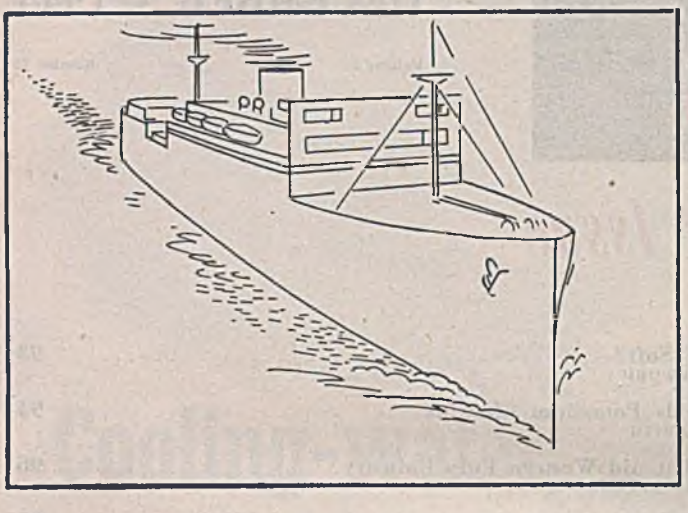
Published monthly. Price 35 cents per copy. Publication office, 99-129 North Broadway, Albany 1, N. Y. Address communications about subscriptions to Director of Circulation, Chem. & Met., 330 West 42nd St., New York 18, N. Y. Subscription rates: United States, Mexico, Central and South American Countries $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. Contents copyrighted, 1944 by McGraw-Hill Publishing Company, Inc. 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 26; St. Louis 8; Boston 16; Los Angeles 14; Atlanta 3; Pittsburgh 22.
Return Postage Guaranteed

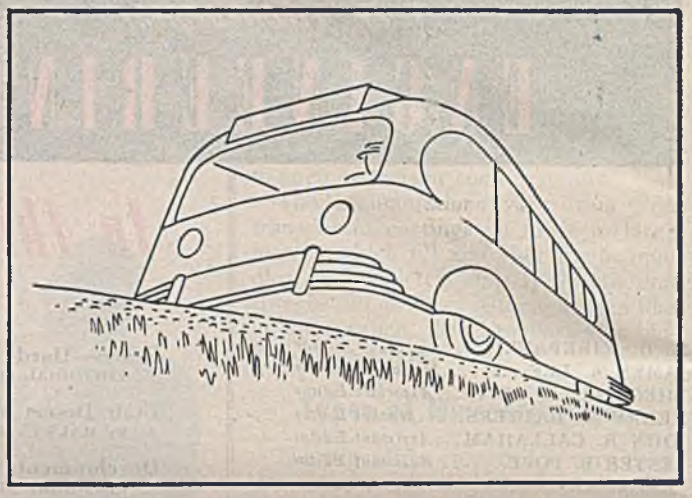
McGRAW-HILL PUBLISHING CO., INC.

JAMES H. McGRAW
Founder and Honorary Chairman

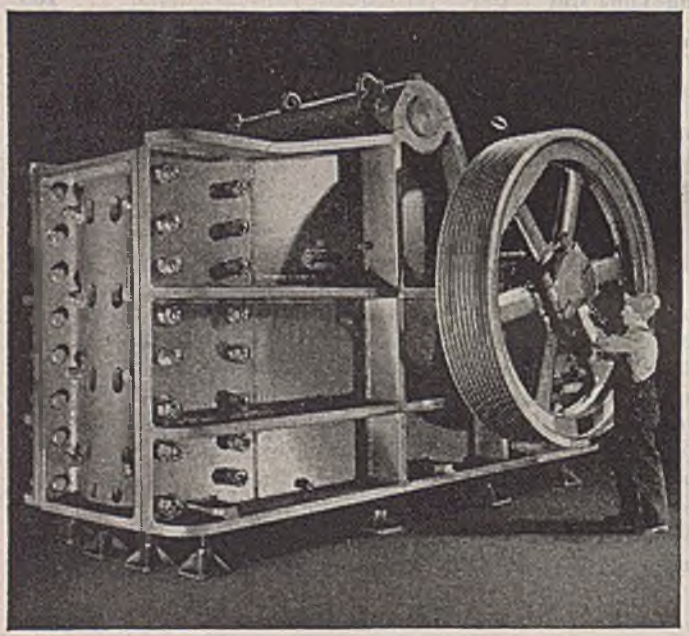
Publication Office
99-129 North Broadway, Albany 1, N. Y.
Editorial and Executive Offices
330 West 42nd Street, New York 18, N. Y.
JAMES H. McGRAW, Jr.....*President*
HOWARD EHRLICH
Executive Vice-Pres. for Business Operations
JOHN ABBINK
Executive Vice-Pres. for Editorial Operations
CURTIS W. McGRAW
Vice-President and Treasurer
J. A. GERARDI.....*Secretary*
J. E. BLACKBURN, Jr.
Director of Circulation
Member A.B.P. Member A.B.C.
Cable Address McGRAWHILL New York

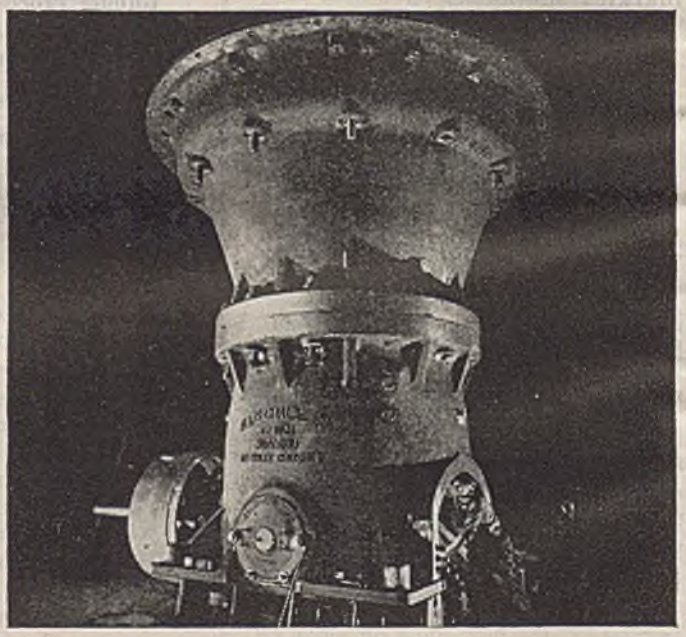
Carriers are Different





Crushers are Different





1 A-C JAW CRUSHERS are usually applied to primary crushing of tough, blocky materials. In the smaller sizes, they are sometimes used as single-stage machines. Have large receiving openings for blocky feed. Are available with non-choking or straight jaw plates. Five types: "All-Steel", Superior, Type "B" Blake, A-C Fine Reduction, and Dodge. Sizes from 4" x 6" to 84" x 66". Bulletin B6034.

2 A-C GYRATORY CRUSHERS are used for high-capacity primary crushing or to follow primary crushers of jaw or gyratory type. Have greater feed area and considerably greater capacity than jaw crushers. Are low in operating and maintenance cost. Three types: Superior-McCully (Bulletin B6004); Type "R" (Bulletin B6006); and Type "Fine-R". Sizes from 2" to 60" receiving openings.

Growing crystals of lead fluoborate—250 dia.

NEW CHEMICAL "TOOLS" FOR AMERICAN INDUSTRY!

METAL FLUOBORATES

Cadmium Fluoborate
Chromium Fluoborate
Copper Fluoborate
Ferrous (Iron) Fluoborate
Indium Fluoborate
Lead Fluoborate
Nickel Fluoborate
Silver Fluoborate
Stannous (Tin) Fluoborate
Zinc Fluoborate

Alkali Group

Ammonium Fluoborate
Potassium Fluoborate
Sodium Fluoborate

GENERAL CHEMICAL METAL FLUOBORATES

Many important products have been developed out of General Chemical's progressive research in fluorides. *Today*—its Metal Fluoborates command considerable attention as new chemical "tools" for electroplaters and metallurgists. *Tomorrow*—the unique properties of these versatile chemical compounds suggest many potential uses whose development is both a challenge and a promise of rich reward to research and industrial chemists interested in electrolytic and metallurgical processes.

ELECTROPLATING—Metal Fluoborates are supplied in a concentrated solution form. They require no time to dissolve and dilute quickly with water to the required plating strength! Laboratory tests and commercial applications indicate that the Metal Fluoborates have other outstanding advantages for electroplating, such as high anode and cathode efficiency, good conductivity, high concentration and ease of operation at room temperature.

At present there is a widespread acceptance of lead fluoborate plating baths and an ever-growing use of lead-tin, tin, zinc, cadmium, indium, copper and other Metal Fluoborate solutions.

METALLURGY—Magnesium and aluminum casting has opened a field where alkali fluoborate salts are extremely important. All these salts may find acceptance as fluxes for welding and soldering such metals as silver, gold, stainless steel, nickel, etc. Their further use by metallurgists for heat treating, hardening and other processes can be expected with new developments in the light metal field.

Indium and Lead Fluoborate Give Airplane Bearings Longer-Wearing Surfaces.

Metal Fluoborates Efficient in Barrel Plating, too.

Alkali Fluoborates Important in Magnesium and Aluminum Casting.

JUST RELEASED!

Important new research data on General Chemical Metal Fluoborates. Includes plating with Lead, Tin, Zinc and Cadmium Fluoborate, etc. Ask for Technical Service Bulletin No. 1015-A.

Copies on request from: Nearest Technical Service Office or General Chemical Company, Fluorine Division, 40 Rector Street, New York 6, N. Y. No obligation!

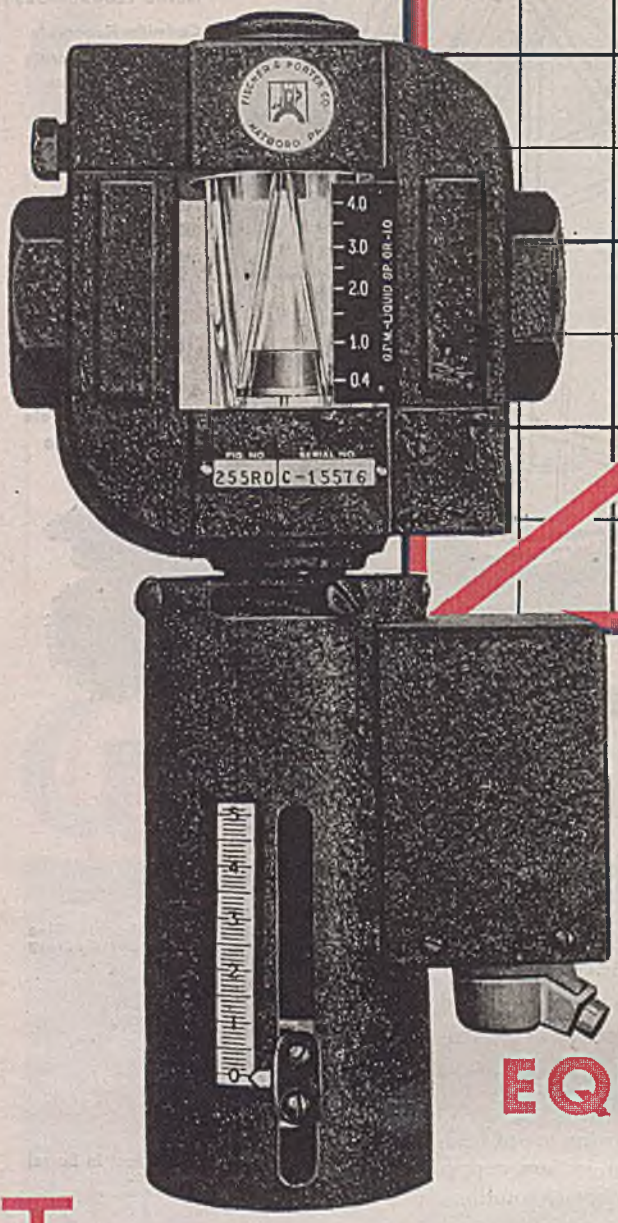
GENERAL CHEMICAL COMPANY ... FIRST IN FLUORIDES

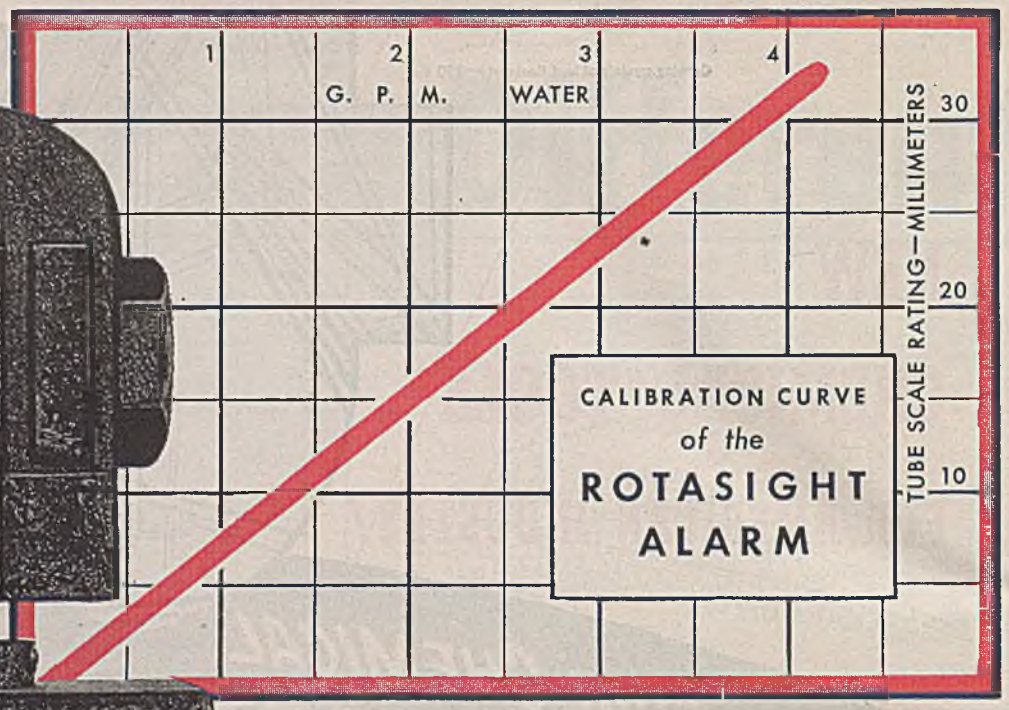
GENERAL CHEMICAL COMPANY

40 RECTOR STREET, NEW YORK 6, N. Y.

Technical Service Offices: Atlanta • Baltimore • Boston Bridgeport (Conn.) • Buffalo • Charlotte (N. C.) • Chicago Cleveland • Denver • Detroit • Houston • Kalamazoo (Mich.) Kansas City • Milwaukee • Minneapolis • New York Philadelphia • Pittsburgh • Providence (R. I.) • St. Louis Utica (N. Y.) • *Pacific Coast Technical Service Offices:* Los Angeles • San Francisco • Seattle, Wenatchee, Yakima (Wash.)

In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver





A Flow Rate ALARM that is EQUALLY SENSITIVE at all flow points

THE ROTASIGHT ALARM is an excellent flow rate alarm because the float, which actuates the alarm, responds to flow rate changes only. When we add, however, that the float reacts to flow changes with the same high sensitivity at all points in the flow range, it seems to justify the statement that the Rotasight Alarm is a *remarkable* flow rate protective device. The straight-line calibration curve, shown above, is typical of the Rotasight and proves that the float moves the same distance for a given flow increment at all points in the flow range, whether high or low. The result is a Flow Alarm that is positive and accurate at the exact flow rate where you desire protection.

The Rotasight is an area-type flow meter in which the float moves up and down in a precision-bore transparent metering tube fashioned with unique V-ported flutes. All of the flow goes through the meter and the float trips an external magnetic switch at the alarm point. The external switch is adjustable easily and quickly to any point over the entire flow range of the instrument.

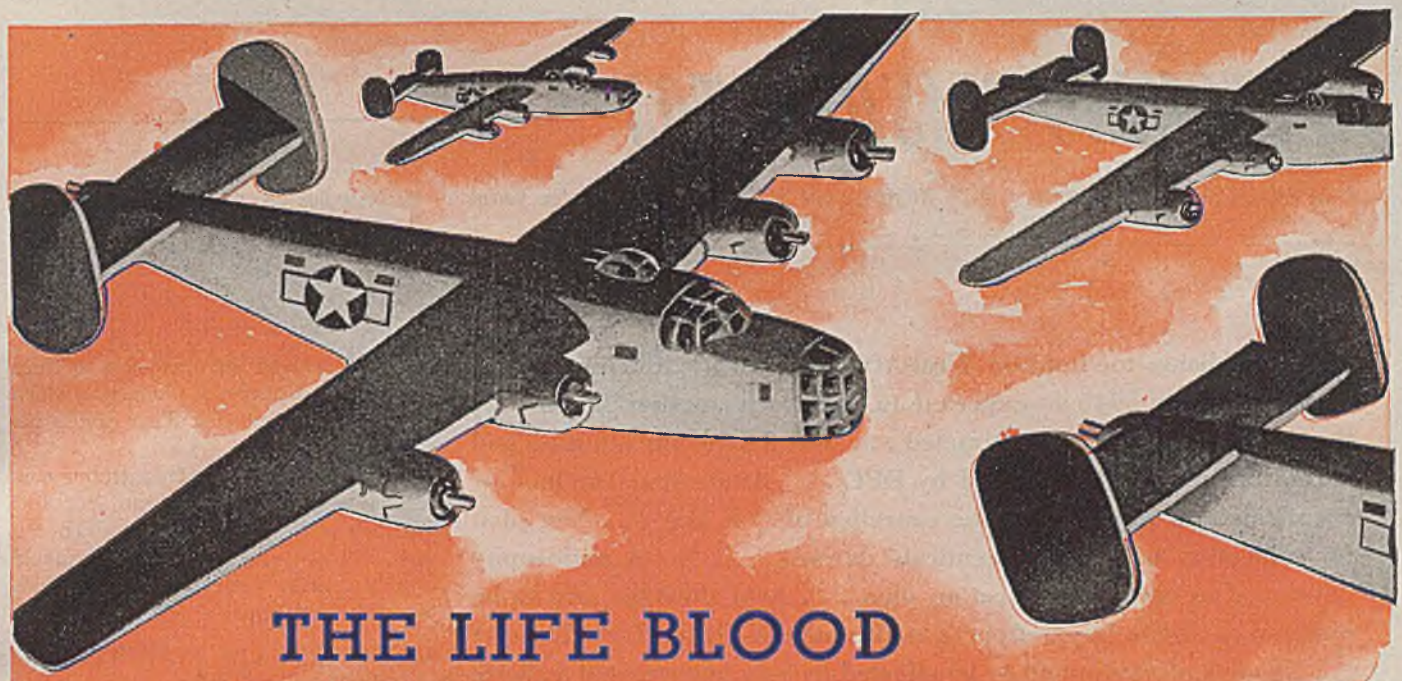
The Rotasight is cast in iron and bronze in sizes from ¼" to 2½" inclusive. It will handle minimum flows of 0.03 G.P.M. of liquid and 0.06 C.F.M. of gas, and maximum flows of 60 G.P.M. of liquid and 135 C.F.M. of gas. Larger flows up to 14,000 G.P.M. liquid or 16,000 C.F.M. gas may be metered in our Rotasleeve Alarm.

Leading manufacturers are using the Rotasight Alarm to protect expensive machinery and critical products. The full details are contained in an interesting new booklet 92-C, just off the press. You may obtain a free copy by writing us for it upon your Company letterhead.

The Rotasight Alarm may be equipped with explosion-proof switch housing for hazardous locations.

FISCHER & PORTER CO.

1812 County Line Road, Hatboro, Pennsylvania



THE LIFE BLOOD OF THUNDERING WAR BIRDS

Flows through Timken Seamless Steel Tubes

Producing high-octane gas, the life blood that makes our planes living things endowed with thunderous power, involves tremendous working pressures and fierce heat.

Because the quality of Timken Seamless Steel Tubes for pressure applications is guarded from melt shop to finished tube inspection, they are able to stand up under this gruelling punishment.

Made in carbon, intermediate alloy and stainless steel grades these fine tubes are used with confidence by petroleum refiners throughout the world to combat conditions of high temperature, high pressure and severe corrosion.

When you plan new construction or replacements specify Timken Seamless Steel Tubes. They will provide longer life, less down time and will minimize maintenance. If you like, a member of our technical organization will be glad to help you select the right tube for your refinery; or a request written on your firm's letterhead will bring data on a large number of steels for high temperature service. Steel and Tube Division, The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

SEAMLESS STEEL TUBES

WATCHING WASHINGTON

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

U. S. establishes toe hold on West African coast . . . Chemical plant construction in 1945 is expected to approach another boom . . . Postwar use of methanol estimated . . . Cost figures for alumina and aluminum plants summarized by DPC . . . Allocations for half of chemicals now controlled to be cancelled on V-E Day . . . New plan for allocation of certain chemicals devised . . . Novel philosophy developed as result of allocation plan . . . Acid shortage said to be regional . . . State Dept. effort is to eliminate U. S. tariffs on imports . . . Exports of equipment to be affected by new government policies . . . Petroleum interests to spend $350 millions on refineries

A FOOT IN THE DOOR

BEGINNING of the struggle to assure a portion of the West African postwar trade to United States business was seen in the dispatch of a mission to Liberia by Foreign Economic Administration. While the announcement frankly stated that the first object was the establishment of military installations, the importance to future trade with West African territories was seen in the plan of the mission to construct a seaport.

The mission was also charged with the task of increasing the production of rubber, palm oil and other resources of Liberia, primarily as a means of developing a traffic movement to be handled by the projected facilities. Besides serving notice to the European countries that we expect to be on the ground if an unfriendly power tries to move into that area, the port may develop into a trading depot for future commercial operations on the "dark continent."

MORE LIVES THAN A CAT

THE NEW facilities program for the chemical industry has more lives than a cat. A year and a half ago no less an authority than Donald Nelson, then Chairman of the WPB, announced that the construction program for chemical facilities was 90 percent complete, but construction has gone on at an accelerated rate.

Scheduled expansion during the year 1944 was for a volume of $10,000,000 per month. During the first six months that rate was maintained. In the third quarter the rate of construction was doubled with no relaxation in policy. In the fourth quarter construction proceeded at a still faster pace. The Construction Bureau still operates under the directive for wartime construction of May 20, 1942, which requires that any new facilities must be essential to the war effort. Dollar value of plants under construction at the close of 1944 is approximately the same as it was a year ago.

New construction during the year was in all lines with emphasis in two broad categories. The first was for feed recovery, recognizing the necessity for maintaining the supply of protein animal feed as the alcohol industry shifts from molasses to grain. The second broad category is in inorganic chemicals.

Some of the projects are just getting underway and will not show up heavily until next year. This year has seen approvals of new facilities valued at from $180,000,000 to $200,000,000. Of this total, more than half remain incomplete at the year end, but most of them will be finished within the next few months.

Construction in 1945 is expected to approach the 1944 boom, even despite an early V-E Day. Postwar construction and reconstruction of "surplus plants" will take up the slack caused by the German collapse.

BIG METHANOL MARKET

ESTIMATES of postwar use of methanol have been prepared by certain government specialists as an aid in planning disposal of some government property. The idea is that ammonia synthesis equipment will find much larger industrial use if it is employed for both methanol and ammonia manufacture. As a result it is forecast that a substantial part of both privately-owned and government-owned equipment will be converted to this use more or less permanently.

Major methanol markets estimated are for antifreeze, formaldehyde, other plastic components, synthetic chemicals, solvents, shellac and other finishes. Estimates of the total demand are from two to three times the peak of prewar production which was typically about 40 million gallons per year.

In making their estimates regarding conversion of these facilities, the specialists generally assume that a plant which can make 100 tons per day of ammonia should be able to make about nine million gallons per year of methanol.

ALUMINUM DATA REVIEWED

COST figures for nine government-owned aluminum plants have been summarized by Defense Plant Corp. from reports to it as owner. These give an interesting picture of Uncle Sam's out-of-pocket cost for this light metal during about a year past. The range in total out of pocket expense is wide because of the different conditions at the various establishments.

Of the various factors influencing cost perhaps the most significant are local power conditions and the percentage of rated capacity which could be operated. Plants of lowest over-all cost were generally operated well over rated capacity, in some cases at 115 to 120 percent of their rating regularly.

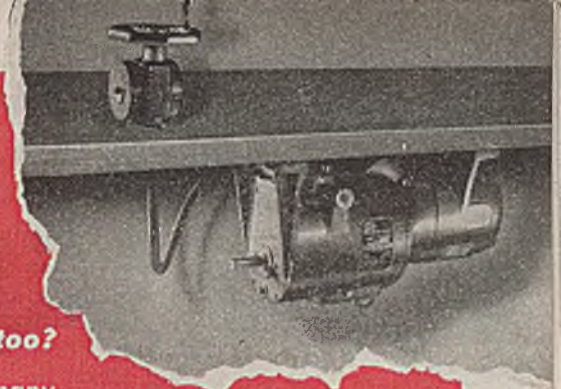
The out-of-pocket figures summarized go from 10.4 to 16c. per lb. of pig metal made. The breakdown of these figures indicates typical components of cost as follows, each in cents per pound of primary metal:

Alumina	5.3	to 5.8
Power	1.8	7.1
Labor	1.0	2.6
Carbon (electrodes)	0.9	1.5
Cryolite	0.05	1.0
Fluorite or aluminum fluoride	0.2	0.4
Depreciation (not in "out-of-pocket" total quoted)	0.3	1.0
Other items	0.5	3.0

Very high power cost was necessary at certain locations, especially those where the plants were built to meet war emergencies without regard to economics. Even high cost aluminum from such locations was much preferred to shortages.

MEANING OF ALUMINUM DATA

IT WILL be noted that figures for aluminum production given above do not include overhead expense, interest on either working capital or government investment, nor any of the customary private company costs such as taxes, sales expense, return on capital, or profit. In other words, these government plant data are not really comparable with commercial figures of privately-owned establishments; nor, officials warn, should they be assumed to



Why don't you get these EXTRA *advantages too?*

Variable speed operation offers tremendous advantages on many applications, and you'll find it's easy to secure even greater advantages . . . extra advantages from your variable speed drives when you use Master Speedrangers.

Extra advantages because the Speedranger is a compact integral unit . . . only one unit to mount . . . saves space, saves money.

Extra advantages because Speedrangers are available for every current specification, every type enclosure, with gearheads, unibrakes . . . and in the whole wide ranges of types in the Master line. This wide flexibility makes it easier to secure just the right drive for each installation.

Extra advantages because the all-metal construction of the Speedranger insures much longer trouble free service than can be expected of units where less durable materials are used.

Extra advantages because of the wide range of speeds . . . even up as high as 5000 R P M without the use of gearing.

Extra advantages because Speedrangers are designed, built and guaranteed as a unit in one plant by one manufacturer. They are not an assembly of products . . . they're designed from the ground up as well balanced, integral units.

Investigate how easily YOU can secure the many extra advantages of variable speed operation by using Master Speedrangers.

THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

MASTER SPEEDRANGERS

mean that the metal could profitably be sold to anybody at the figures indicated.

COST OF ALUMINA

ALUMINA has been manufactured for the government in two very large plants owned by Defense Plant Corp. at Baton Rouge, La., and Hurricane Creek, Ark. The rated capacity of these establishments is one billion, and one and one-half billion lb. per year, respectively. During the months of greater activity in the aluminum industry these establishments operated typically above 70 percent of their rated capacity. Under those conditions the cost of production was significant; and the resulting cost figures available from DPC are of substantial interest to chemical engineers.

The principal difference in costs at the two establishments when operating at comparable rates was in the cost of the bauxite delivered to them. This is evident from the following data now available from the two plants for a 9-mo. period when operations were at or near 70 percent of capacity:

	Plant 1 c. per lb.	Plant 2 c. per lb.
Bauxite	1.46	62
Direct labor	0.14	0.09
Lime and soda ash	0.84	0.61
Fuel and power	0.09	0.09
Repair and maintenance	0.16	0.09
Depreciation	0.11	0.08
Other items	0.18	0.10
Total cost of alumina	2.48	1.68

In addition to these direct costs there were, of course, also general overhead expenses and interest on both working capital and on government investment. There were no payments of taxes of local, state or federal nature nor any charges for capital account, sales expense, or profits. All of those facts must be taken into account in comparing these data with any commercial figures. Comparable figures for the privately-owned plants of Alcoa are not available.

PURE PYRETHRINS

IMPROVED odorless and non-irritating fly spray is forecast by the Department of Agriculture as a result of a method developed in the Bureau of Entomology for purification of pyrethrins. This will, it is hoped, make even more satisfactory the use of the pyrethrum type of insect sprays which are non-toxic to man but deadly to many household pests.

A nitromethane solvent dissolves the active component of crude pyrethrum. The solution is passed through charcoal which removes any remaining irritating material. Nitromethane is distilled off, leaving practically pure pyrethrins.

PATENT POLICY STATED

INVESTIGATORS of the Department of Agriculture are now specifically informed as to the policy of that department regarding patentable inventions which are developed with government funds. A report has been prepared on "Patent Manual for Employees of the United States Department of Agriculture." It appears to be the first case in which government policy of this sort has been so explicitly written down for the guidance of the staff and for the information of interested industry.

ALLOCATIONS TO BE REVOKED

CHEMICALS Bureau of WPB expects to cancel allocations for at least half of the chemicals now controlled immediately after V-E Day. Choice of commodities and exact date for release of each will have to be determined when that day arrives.

All that is certain now is that the Bureau is giving careful consideration in every program to the need of restriction next year. Some very scarce commodities will, of course, require allocation control much longer. Perhaps some of these may require brief control periods after Japan collapses. But in November the specialists were identifying some commodities for which the supply would be adequate as soon as the German campaign is ended. Fortunately the Chemicals Bureau is even more anxious to get rid of controls than industry. Many of the personnel wish to get back to their former jobs. This hoped for program of cut back on allocations applies to all of WPB as well.

NEW ALLOCATION PLAN

A NEW PLAN for allocation of sulphuric acid, ammonia, and other nitrogen compounds had to be devised by WPB. This was necessary to meet the congressional act with respect to reconversion which forbids WPB to discriminate against new companies coming into business at this time. It makes something of a mess in crucial chemical industry. Here's the way it works.

WPB will allocate these scarce chemicals, and perhaps others, by end uses instead of by individual customers. For example, nitrogen will be assigned to three major user groups. Explosives, other industry, and agriculture will get bloc assignments the total of which will represent the relative needs for these purposes. Each prime producer of nitrogen compounds will be told what proportion of his output goes to each such class or use. Perhaps some of the major groups will be broken down into sub-groups. But the government will not make the allocations by individual companies as it has in the past.

RESTRICTING NEWCOMERS

A NOVEL philosophy necessarily has developed as a result of the allocation plan just described. Here is a specific example of what may occur.

Suppose that all of the ammonia which the government wished to use for fertilizer had been allocated and then some new fertilizer maker should appear asking for 50,000 tons of ammonia. Under the law WPB could not deny him ammonia. But under the group allocation plan WPB does not need to face this issue.

Producers of ammonia are told, each individually, how much ammonia they must sell for fertilizer. When they have sold to their old customers all that they are so permitted to distribute, then "there simply isn't any more." They are not bound by this law. Each can choose his customers, and is expected to take care of his old customers as any sensible businessman would.

Incidentally this technique is going to do one thing which has long been sought. It is going to result in the early placing of orders for scarce goods. Anyone who forgets to place his order until he needs the goods will simply find a Mother Hubbard cupboard.

ACID USE RULES

SULPHURIC ACID allocations made under the broad program will not be as burdensome as usual in control programs. In the first place, WPB is exempting 500 tons per month of acid from any control for each "small order" user. Furthermore certain end uses such as aviation gasoline, tetraethyl lead and explosives get all the acid which they need because these are direct military requirements.

It is estimated that between 95 and 98 percent of the wanted acid is available. The scarcity is regional (Far West) and in certain local areas. New capacity coming in during the next 60 days will correct most of this difficulty. V-E Day in Europe will correct the remainder of it except West Coast difficulties.

MORE ACID TANK CARS

EACH monthly meeting of the Advisory Committee of the Inorganic Acid Industry finds new shortage problems in the sulphuric acid field. Each month it has recommended additional construction to enlarge the plant facilities of the country. But now it is hoped that the capacity coming into production during mid-winter will relieve all of the Eastern Seaboard shortages.

An additional 1,000 tank cars to move acid were expected to be available by mid-January. Of these 300 are converted Army cars, 600 are converted petroleum cars, and the balance are new cars being built in private shops. When this rolling stock is ready it is hoped that Midwest users will be adequately cared for, leaving the only serious shortage area in the Pacific States.

TRADE CONTROLS

DESPITE promises that Uncle Sam would withdraw import and export controls as soon as war conditions permit, no major portion of international business will be wholly managed by interested private industry. Practically all other industrial nations intend to control intimately the

TYGON *Gasketing*

THE use of Tygon "T", the rubber-like plastic, for gasketing is indicated where pressure-tight seals are required in connection with the handling of acids, alkalies, fresh or salt water, alcohols, oils, greases, or gasolines.

In such service, the inherent chemical inertness of Tygon "T", its non-aging and non-oxidizing properties, and the ease with which pressure-tight seals are formed, represent advantages not fully possessed by any other natural or synthetic material.

Tygon "T" may be readily formulated to meet a wide range of specific requirements. It may be made in formulations which will not support combustion; in non-toxic formulations for food and beverage handling; in formulations of varying flexibilities, some of which retain their flexibility at temperatures as low as 80 degrees below zero. Tygon "T" gasketing is suitable for use at temperatures up to as high as 150° F.

Tygon gasketing is available in these forms:

- We can furnish sheets, tape, ribbons, strip or extruded rings from which you can cut your own gaskets;
- We can furnish the complete gasket, died out from sheets, or cut from extruded tube or rod stock, to meet your specifications.
- Or we can furnish molded gaskets to solve highly complex sealing problems.

Why not send detail and assembly prints to us for analysis, suggestions, and samples of Tygon formulations best suited for your needs? Write today to: The U. S. Stoneware Company, Akron, O. In Canada, to: Chamberlain Engineering (Canada), Ltd., Montreal.

The development of effective means of corrosion control has been the work of The U. S. Stoneware Company for more than 78 years. Today, some fourteen production divisions in the United States and Canada, all operating under unified research and management policies, are manufacturing a wide range of specialized materials, each having individualized abilities for combating various corrosives. If you have a corrosive problem, we offer our help.

U. S. STONEWARE

Since 1865

New York Akron, O.

TYGON TANK LININGS AND GASKETING MATERIALS • TYGON SHEETINGS FOR SURGICAL AND HOSPITAL USE • TYGON FLEXIBLE TUBING
TYGON MOLDED ITEMS • TYGON LIQUID FORMULATIONS • TYGON DIPPING FORMULATIONS • TYGON TAPE • TYGON MASKING MATERIALS

trade of their nationals. Consequently Uncle Sam must do likewise.

The State Department effort, shown clearly at the recent International Trade Conference at Rye, N. Y., is further to eliminate U. S. tariffs on imports. There appears to be no substantial opposition that can stand up against the Hull program of cutting duties by 50 percent as permitted under the trade agreements law.

It is expected that many of the detailed permit systems for movement of specific shipments may be dropped but that these will be replaced by broad control programs which may take any one of several forms. Expected are exchange controls, credit controls, shipping space allocations at least until the Japs fall, and diplomatic arrangements which will insure that the leverage of trade is used to accomplish certain political purposes. Under these circumstances it is necessary to assume that governmental policies will largely fix company practice on larger goods movements.

INFLUENCE ON EQUIPMENT

Machinery and equipment manufacturers will be influenced by the government policies discussed in the previous paragraph, because foreign purchasers of capital goods are certainly going to be compelled to get approval from their own countries before spending money in the United States. Even enterprises with plenty of credit here will not be allowed to use it, except as the spending fits into the program of the nation to receive the new machinery. Salesmen for equipment as well as industrial goods are expected, therefore, to spend a great deal of their time in Washington dickering with both Foreign Economic Administration and trade representatives of foreign nations. Only when suitable arrangements have been made will it be worthwhile to talk business with any expectation of final or enforceable contracts.

100 BILLION TON MILES

Postwar traffic levels have been studied by Interstate Commerce Commission. Though primarily dealing with rail movement of goods, this agency has studied competitive transportation facilities. Estimates submitted to ICC indicate that from 1947 to 1949 there will be well over 100 billion ton miles of oil and gas moved by pipe line. If business activity is high, the total may reach 120 billion. This represents, incidentally, just about 10 percent of the total ton miles of all goods transported by all carriers.

EXPANSION PLANS

Increased demands for all petroleum products may make all or much of a program for the expansion of domestic and foreign petroleum refining facilities eligible for approval. A short time ago Deputy Petroleum Administrator Ralph K. Davies made known that petroleum interests plan to spend more than $350,000,000 on both domestic and foreign refining facilities as soon as materials become available. The program is divided almost equally between construction inside of this country and construction outside. The work is all to be done without financial assistance from the government.

RULES FOR APPROVAL

WPB Chairman Krug, in a letter to Deputy Petroleum Administrator Davies, has stated the conditions under which the construction of the new petroleum refining facilities can go ahead. Military demands for petroleum products are bringing the construction program into the area outlined by the WPB chairman. As evidence of the situation, pipeline movements in the last week in October were at an all-time high and for the months of November and December tank car movements to both coasts will be in the neighborhood of 15 percent, bringing the approximate movement to the West Coast up to 150,000 bbl. a day at the close of the year and to the East Coast up to $600,000.

MAGNESIUM OUTPUT

War Production Board has announced that magnesium production in government-owned plants will virtually cease by January 1. Dow Magnesium Co., Velasco, Tex., and Electro-Metallurgical Co., Spokane, Wash., will be closed. Partial curtailment was ordered at Diamond Magnesium Co., Painesville, Ohio. These cutbacks will reduce production in the U. S. to 8,000,000 lb. per month or one-sixth of rated capacity.

QUALITY OR PRICE

Quartermaster Corps purchases of raincoats have developed a controversy between synthetic rubber and synthetic plastics. The rubber for fabric coating is somewhat cheaper and more flexible at very low temperature and easier to fabricate, while the plastic coatings are lighter in weight, less subject to oxidation and more durable when considered only from the time factor. Either material gives excellent protection and satisfactory field service under most conditions.

Similar competition between new plastic products has been developed in many fields of postwar civilian interest. Nylon shoe laces, for example, have been essential for tropical areas because of their superior resistance to insects, mildew, and other causes of failure. Army officials believe that the field experience afforded by the war period will greatly stimulate comparable postwar uses for plastics as most of the development expense will be paid by these government experiences.

LABOR "MANDATE"

More aggressive labor spokesmen in Washington claim that the November election was a mandate for further labor legislation. Some of the best supporters of labor in high official positions are being alienated by the effort of union executives to put extreme pressure on them for immediate actions of a radical sort.

Confidently expected in the next Congress is a new minimum wage law. The report is that the President has approved a 60c. minimum hourly wage instead of the 40c. now required under the Fair Labor Standards Law. Initial requests of certain labor leaders are for 65c., apparently to give them some trading area when actual legislation is being formulated.

ROSTER COMMITTEE

The National Roster of Scientific and Specialized Personnel is being investigated by a committee of distinguished engineers, scientists, and other professional workers from social and economic fields. The committee has been asked by Paul V. McNutt, chief of FSA, to prepare a plan for "the most effective utilization possible of our scientific and professional groups in the reconversion period." Long term postwar plans are also expected.

SELF-EDUCATION URGED

The advantage of thorough preparation for contract termination to both contractors and subcontractors alike has been vigorously publicized by the War Department. Of the 28,000 war contracts which had been terminated by the first of November, all but 4,000 had been settled. Failure on the part of the individual contractor to submit his claim so that the settlement machinery could be put into motion is said to be the reason why these contracts are still unsettled.

PRE-TERMINATION SETTLEMENT

Carrying the pre-termination planning for contract settlement a step further, the War Department has advocated that either formal or informal agreements between contractors and government be reached at once. This is the second phase of pre-termination settlement which is to follow contractor's general study of his problems, establishment of a termination group within his own organization, and an agreement on a plan for the attack of the problem. Already the technical services of the Army are suggesting to various war contractors that they come to agreements on as many points as possible concerning what would be done when the contract is ended.

LABEL PRECAUTIONS

Makers of chemicals and other materials which are ultimately sold as foods, drugs or cosmetics must take great care in their labeling of bulk shipments. This fact is again emphasized by the refusal of the Supreme Court to accord a review of a Circuit Court decision on this subject of labeling.

When You Plan the Attack

"We go in at Fox Green," the officer explains. "Here's a house right on the beach. The church is up beyond—you'll see the steeple. We'll hit the beach at this point, where there's cover . . ." The amazing accuracy and detail of invasion maps are a striking example of the meticulous planning that has contributed so much to the success of American troops.

You, too, as you plan your postwar attack on new markets and the recapture of those lost since Pearl Harbor, will want to be doubly sure of every factor affecting your business. And that, of course, includes your sources of raw materials supplies.

If you have had no experience with Columbia products, it will pay you to investigate. High product standards, exclusive chemical specialties, centrally located plants, excellent distribution facilities . . . these are Columbia features which may present distinct advantages for your operation.

COLUMBIA CHEMICALS

PITTSBURGH PLATE GLASS COMPANY
COLUMBIA CHEMICAL DIVISION
GRANT BUILDING · PITTSBURGH 19, PA.

CHICAGO · BOSTON · ST. LOUIS · PITTSBURGH · NEW YORK · CINCINNATI
CLEVELAND · PHILADELPHIA · MINNEAPOLIS · CHARLOTTE

BUTADIENE MONOXIDE—Otherwise designated as 3,4-Epoxy-1-butene, or Vinylethylene Oxide, this new compound was last month introduced at the Chemical Industries Exhibit. It offers interesting possibilities in diverse organic processes, such as the production of polymerizable alkyd resins, unsaturated alcohol ethers and esters, and other organic chemicals and pharmaceuticals. Butadiene Monoxide samples and technical data are available to you on request, at no charge.

A NEW ALLYMER—"170" is a new Allymer liquid monomer developed for applications requiring more rapid cures. It may be modified in all proportions with other Allymers—CR 39 and CR 149—the modification of properties being in the direction of those of the Allymer used. Data and samples of this new development of the thermosetting, "contact-pressure" Allymers may be obtained on request.

FREEZE-PROOF COAL—Columbia Calcium Chloride is being used extensively to facilitate cold weather handling of coal. Easily applied, either in flake form or in solution, the Calcium Chloride prevents freezing of coal in transit or in stockpiles. The treatment serves another equally important purpose—effectively dust-proofing the coal for cleaner handling. Write for descriptive literature.

ALTITUDE FOR BISCUITS—Self-rising flours, which have so simplified the housewife's baking tasks, depend on the reaction of Sodium Bicarbonate on weak acids to produce carbon dioxide, which "raises" the dough. The action of yeast is similar . . . but the evolution of the gas is far less rapid. Many flour blenders prefer Columbia's "Flour Blend" Sodium Bicarbonate—especially prepared to prevent "caking" for combining with flours.

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 November, 1944. Copies of each item interpreted here may be obtained from the appropriate federal agency.

ANTI-FREEZE CONTROL

PRODUCTION of anti-freeze will be governed by the provisions contained in orders controlling ethyl alcohol, methyl alcohol, isopropyl alcohol and glycols. This has been effected by adding new schedules to Order M-300 to incorporate the anti-freeze restrictions in the respective schedules. The order affecting methyl alcohol became effective November 21 and the others will go into effect at midnight December 31. Distribution of ethyl alcohol will be changed from a quarterly quota basis to straight monthly allocation. The small order exemption for completely denatured and all proprietary types will be reduced from 972 gal. a quarter to a monthly maximum of 54 gal. For pure and specially denatured, the exemption remains at 54 gal. a month.

MORE ALCOHOL RELEASED

REQUIREMENTS for industrial alcohol for 1945 are estimated at 536,000,000 gal. with a potential supply of 607,000,000 gal. Government stocks on November 1 were about 64,000,000 gal. and as a result of the improved supply situation, WPB authorized the release, on November 13, of 2,000,000 gal. for civilian use as a supplement to fourth-quarter allocations. This additional amount is made available to producers of drugs and pharmaceuticals; food products including candy glazes, flavoring extracts and vinegar; toiletries and cosmetics including mouth washes, and oral antiseptics; adhesives; photographic materials; duplicating inks; brake fluids, and other normal users whose consumption has been restricted.

PLACED UNDER M-300

PRIMARY chromium chemicals, phthalate plasticizers and phosphate plasticizers have been placed under control of Order M-300. Applications for export of chromium chemicals will be submitted on a quarterly rather than a monthly basis.

Previous directives governing distribution of phthalic anhydride, maleic anhydride and maleic acid have been revoked and they now are under the general chemical order.

Methyl ethyl ketone has been added to list of chemicals controlled by M-300 and the same is true for butyl alcohol and butyl acetate and the small lot exemptions for the butyl products have been increased.

Polyethylene has been transferred to the allocation controls of the general chemicals order. With the exception of material permitted for experimental purposes, the entire output is reserved for military use.

Ethyl cellulose was transferred to M-300 on November 21 but this made no change in allocation provisions. A large part of supplies go to the military.

To assure equitable distribution, synthetic camphor will be distributed according to regulations of M-300. About 50 percent of civilian requests will be granted.

PHTHALIC ALKYD RESINS

BECAUSE of an improved supply situation, use of phthalic alkyd resins, beginning December 1, is permitted for several military applications and a limited number of essential civilian applications heretofore denied. Allocations will be considered on both a firm and anticipated order basis for light weight deck coating in U. S. Specifications 52-D-9 and 52-D-11; light weight deck coatings approved by the U. S. Maritime Commission; Navy Specification 72-R-5 for rain clothes; U. S. Army Quartermaster Corps Specifications CQD-201 and 202; and U. S. Army Ordnance Specification 3-179. Requests for phthalic alkyd resins will be considered for use on motors, transformers, switch gear and similar electrical equipment.

PIGMENTS RESTRICTED

ALLOCATIONS of white pigments has been changed by an amendment to Order M-353. The order defines white pigments as including titanium dioxide and zinc sulphide. The amendment cancels all ratings on non-military orders and only those accompanied by a military certification are valid rated orders. This action is intended to expedite military deliveries and to place non-military orders on a more equitable basis.

Military requirements for synthetic hydrated yellow iron oxide pigments have increased recently and WPB has placed these pigments under Limitation Order M-383. Except for orders accompanied by preferred order certificates, all preference ratings for these pigments are canceled. Orders for general civilian use may be filled at the discretion of producers after military requirements have been met.

SULPHURIC ACID ALLOCATED

EFFECTIVE the first of this month, sulphuric acid was placed under the general allocation order M-300. After December, the introductory period, distribution will be on straight allocation under which each user must give a certificate as prescribed in the order. By a special provision when acid is purchased for a particular purpose and used for that purpose the residual acid may be used for any other purpose except the production of superphosphate without application or authorization.

Another feature of the order provides that residual acid cannot be delivered other than on specific authorization except when it is returned to the original supplier as a part of the standing arrangement.

Although not specifically stated in the order, it is evident that the War Production Board considers the production of superphosphate one of the biggest uses that can be contracted and that the superphosphate industry, along with some others, will act as a cushion from which the acid shortage will be made up.

PRICE REGULATIONS

INCREMENTAL output of easy processing channel carbon black will be exempt from price control. The additional production will be bought by the Defense Supplies Corp. and distributed by that agency.

Specific ceiling prices for four grades of crude talc produced in Nevada became effective November 16. Maximum sales prices range from $8 a ton for talc filler to $15.25 a ton for selected cosmetic talc, f.o.b. Zurich, Nev. Sales prices for talc produced outside Nevada are governed by Maximum Price Regulation 188 which has a base pricing period of March 1942.

Industrial grain alcohol producers east of the Rocky Mountains are to include their actual general and administrative expenses up to a maximum of 3c. a gal. in costs of production when computing ceiling prices under their cost-plus pricing formula.

Following the establishment of maximum prices for gum rosin last October, the base price for FF wood rosin increased from $3.18 to $3.50 per 100 lb., effective November 20. The base price for all pale grades which sold below $3.50 per 100 lb. also was marked up to that level.

The rise in ceiling prices for rosin brought readjustments in prices for rosin products. Ester gum made wholly from gum rosin is given an increase of ¼c. a lb. in its maximum bringing the base to 11¼c. a lb. The base ceiling for ester gum made from gum and wood rosin is calculated on a weighted average of 11¼c. a lb. for gum and 9¼c a lb. for wood, according to percentages by weight of gum rosin and wood rosin in the total rosin content.

Producers of wood rosin size may use their current lowest selling price for wood rosin less selling and administrative expense in computing maximum prices for wood rosin size. The first quarter of this year has been the base pricing period.

Imported nitrate of soda loaded on trucks at warehouses in New York, Camden, and Baltimore may be sold at an advance of 50c. a ton over the previous maximums of $30 a ton in bulk, $33 a ton in 100-lb. bags, and $32.40 a ton in 167- or 200-lb. bags.

M·S·A

FEND

A *Balanced* GROUP OF PROTECTIVE HAND CREAMS AND LOTIONS FOR PROTECTION AGAINST INDUSTRIAL SKIN IRRITATIONS ... EACH TYPE PROVIDING

EASY APPLICATION ... BLAND, NON-SENSITIZING INGREDIENTS ... LONG-LASTING, MORE EFFECTIVE PROTECTION ... EASY REMOVAL AT END OF WORK PERIOD

Write for your copy of the latest Fend Brochure, detailing the nine distinct Fend types of protective creams and lotions, together with a comprehensive listing of irritants encountered in industry and the corresponding Fend applications.

MINE SAFETY APPLIANCES CO.
BRADDOCK, THOMAS AND MEADE STREETS
PITTSBURGH 8, PA.

Diamond Caustic Soda

$Na_2CO_3 + Ca(OH)_2 = 2NaOH + CaCO_3$

SODA ASH + LIME = CAUSTIC SODA + CALCIUM CARBONATE

VITAL IN WAR...

INDISPENSABLE IN *PEACE!*

PULP AND PAPER

In making pulp and paper, caustic soda is used for de-inking and reclamation of waste paper.

SOAP

Another huge consumer of caustic soda is the soap manufacturing industry

IN THE HOME

Caustic Soda helps make many products used in the home—cellophane, paper, rubber, textiles, lye, soap, dehydrated foods

PETROLEUM

In petroleum refining, caustic soda is used to remove undesirable acids and other impurities.

CHEMICALS

Many chemical products and processes depend to a large extent upon caustic soda.

TEXTILES

In addition to its use in making rayon, caustic soda is employed in numerous other textile processes.

RAYON

The rapidly-growing rayon industry is now one of the greatest users of caustic soda.

IRON AND STEEL

Caustic Soda removes undesirable impurities in the manufacture of iron and steel.

FOOD PROCESSING

A large tonnage use for caustic soda is in the lye peeling of root crops such as carrots, beets, potatoes.

CLEANING

Many commercial and industrial cleaners are made more effective by the use of caustic soda.

RUBBER

Reclaiming of rubber has been materially aided by the use of caustic soda.

ALKALI

DIAMOND ALKALI COMPANY

PITTSBURGH, PA. AND EVERYWHERE

B&L Contour Projector magnifies tiny gear with accuracy to .0001"

B&L Range finders enable U.S. Navy gunners to hit a ship 17 miles away

Precision aerial camera photographs enemy territory with B&L lenses

Bomber navigators use B&L Sextant to plot course by sun, moon, stars

B&L Multiplex Projector plots topographic maps from aerial photos

Perimeter, one of many B&L vision testing instruments in military use

B-29 fliers, too, wear B&L Ray-Ban anti-glare glasses on Tokyo air raids

Coast Guard officer on convoy duty scans horizon with B&L Binocular

Medical Corps uses B&L Microscopes

B&L Spectrograph for metal analysis

B&L Research Metallographic Outfit

The B&L Anti-aircraft Height Finder

Here Are the Eyes of Victory

Allied might is rolling up a smashing record of individual victories that point to ever-more-imminent *total* victory.

The way in which American industry supports its fighting men is astounding our allies and confounding our enemies. In the production of war materiel, industry and science have cooperated to make our hard-hitting forces the most completely equipped in the field.

Optical science has made and is making its contribution to this production record. In fire-control—in aerial reconnaissance—in improving the vision of fighting men and production workers—in inspection instruments that make possible the precision our weapons demand—optical science provides the "Eyes of Victory."

Because Bausch & Lomb was prepared with manufacturing facilities (including its own optical glass plant) and a personnel trained and experienced in optical science, an otherwise certain shortage in vital optical equipment was averted.

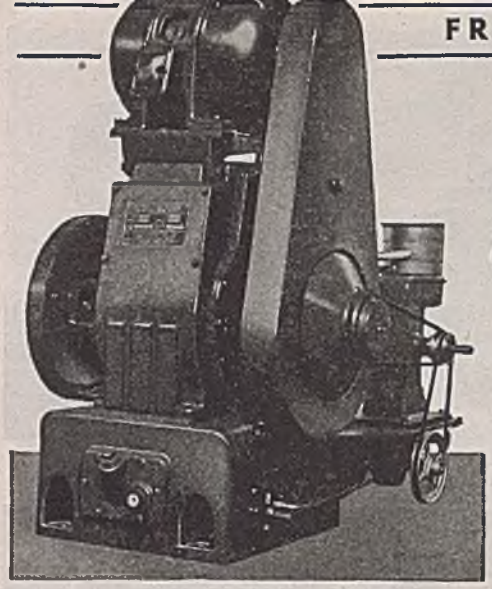
As long as American men are fighting, Bausch & Lomb will continue to center its efforts on military needs. After that, Bausch & Lomb knowledge and capacity will again be devoted to making life better through optical science, optical instruments and optical methods.

BAUSCH & LOMB

OPTICAL CO., ROCHESTER, N. Y.

EST. 1853

Makers of Optical Glass and a Complete Line of Optical Instruments for Military Use, Education, Research, Industry and Eyesight Correction and Conservation



Higher Vacuum

Opens Up Entirely New Fields of Manufacture

Higher Vacuum makes possible manufacture in the "substratosphere," at pressures within the micron range. It offers Industry an amazing new tool with which to better product quality and reduce processing costs. It opens up entirely new fields of endeavor . . . processing of blood plasma and penicillin for example.

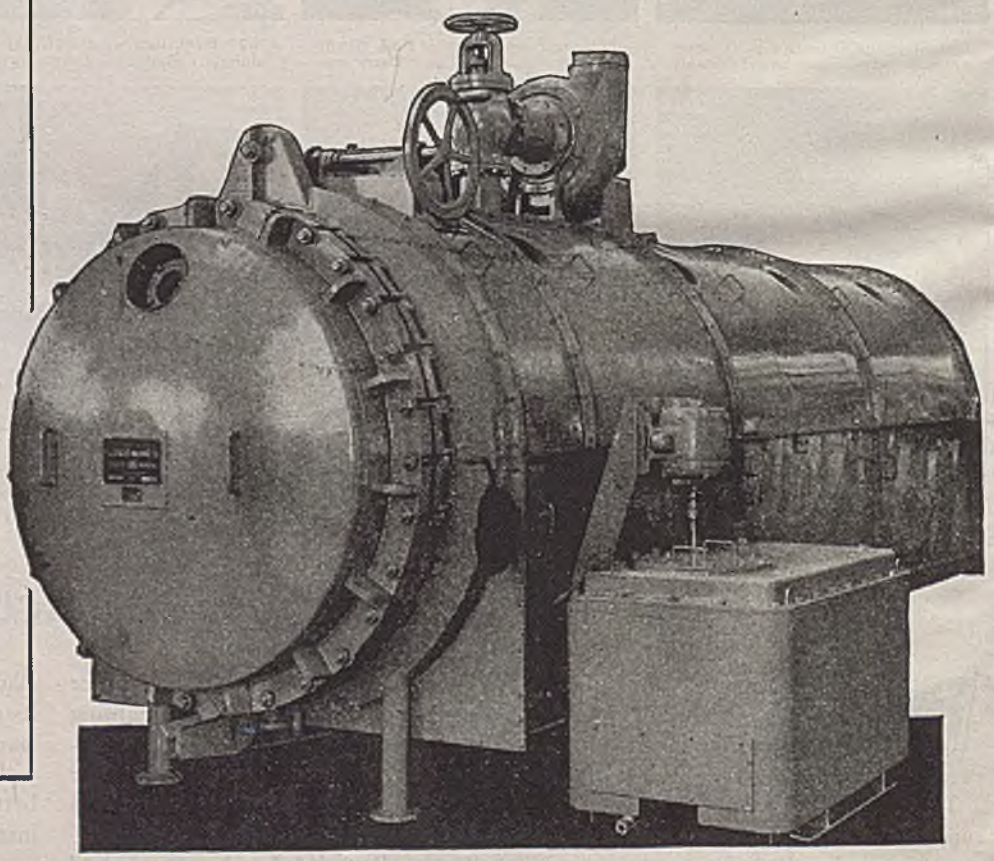
We pioneered in the field of Higher Vacuum . . . for 30 years have been developing processes . . . been engineering and building equipment, pumps, gauges and other auxiliaries with which to carry out these processes. A High Vacuum installation by Stokes is a complete system, engineered and built to make it easy and economically practicable to obtain and utilize Higher Vacuum to its full advantage.

We invite you to consult with us.

F. J. STOKES MACHINE COMPANY
5920 Tabor Road Philadelphia 20, Pa.

Outstanding Products of "Substratosphere" Manufacture

PLASMA
•
PENICILLIN
•
MAGNESIUM
•
OPTICS
•
FOODS
•
CHEMICAL SPECIALTIES
•
VITAMINS
•
LABILE BIOLOGICALS
•
ELECTRONICS
•
X-RAY



F.J.Stokes *High Vacuum* **PROCESSING EQUIPMENT**

FJS Est. 1895

CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902 S. D. KIRKPATRICK, Editor

DECEMBER, 1944

Peace—Hard or Soft?

NO ONE of our acquaintance wants a "soft" peace with Germany—soft in the sense that she will escape punishment or be in a position to foment future wars of aggression. On the other hand, many friends whose opinions we normally respect are arguing for a "hard" peace—hard in the sense that Germany must be completely broken and her industries destroyed. They honestly believe that anything short of that will leave behind a smoldering resentment which another generation will eventually fan into the flames of a third World War.

Some place, perhaps in the Bible, there is an old story about a warring prince who returned to his father's kingdom after a campaign of many conquests. "And what," asked the father, "did you do with your enemies?" Quickly and boastfully the conqueror replied, "Sire, I put them under the yoke and there they will stay forever and a day!" Slowly and thoughtfully the wise old ruler replied, "Son, you have erred. You should have exterminated them—or else given them a better peace than they had any reason to expect." That story has come to mind many times in recent months as we have tried to think through the processes and consequences of what will follow Germany's unconditional surrender.

Along with other American chemical engineers, we have discussed and had a hand in drawing up some of the various plans for controlling the chemical industry of Germany. We are convinced that it would be impossible for any country to start or carry on a modern war without certain industrial and technological resources. Nitrogen products, petroleum, iron and steel and perhaps the light metals required for aircraft—these are the obvious essentials that would seem most susceptible of control and therefore the keys to any disarmament program. Others have argued that electric power should be given first consideration. Certainly if all the large power plants and central stations in Germany were destroyed and her industries forced to draw their power from outside sources, it would be a simple matter to throw the switch and thereby cut off all manufacturing operations. Out in Chicago another friend argues for a means to put an end to German research, to stamp out her laboratories and do everything to make sure that new weapons and techniques of warfare could not be conceived and secretly developed.

All of these proposals, including our own, leave us with many grave doubts. We think we see almost impossible difficulties of administrative controls. We think we see such complete subjugation of existing institutions as to call for a virtual revolution and remaking of the social and economic structure of Europe and perhaps of the whole world. The problem is so complex that we are beginning to wonder if it is not a fatal mistake to consider these controls solely in terms of materials and industries.

Perhaps the people who can help most are not the representatives of the "hard" sciences such as chemistry and physics, but those from the so-called "soft" sciences, psychology and anthropology, for example. Certainly the peace we want for our children and their children will depend largely on the kind of people they will have to live with here and abroad. Is it too much to hope that through sound educational advances human nature can be made over sufficiently that people will want to live together in peace and understanding of their common objectives?

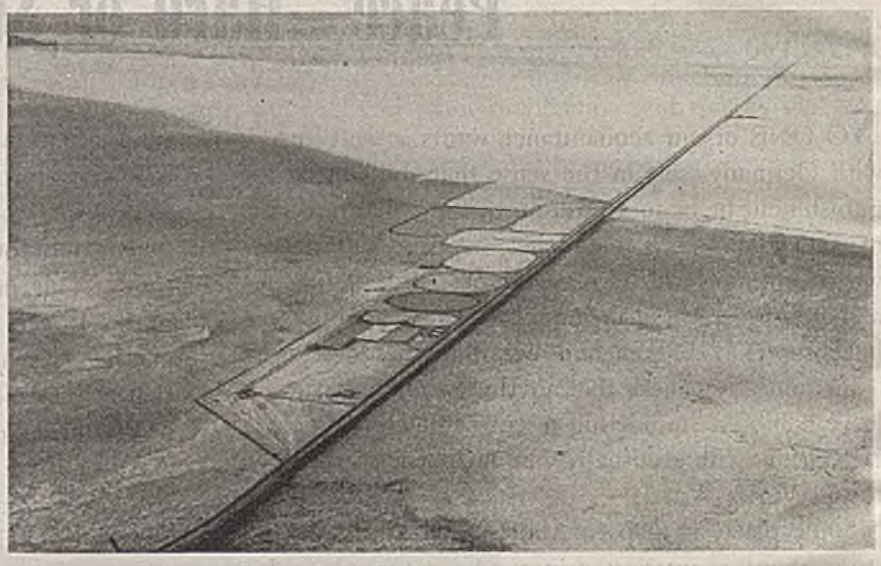
In the spirit of this fourth wartime Christmas, we devoutly hope that before another year is gone "Peace on earth, good will to men" will become a reality. It cannot come until lasting victory is ours but we will each speed it on its way if we can lend our sincere support to every effort that will bring about better understanding of the human as well as the material problems of peace.

HALWYN R. SMITH *Pacific Coast Editor, Chemical & Metallurgical Engineering*

UTAH DESERT

Yields Potassium Chloride for Western Agriculture

Desert heat with summer temperatures of 120 deg. F. or more presents an interesting work potential. Several process industries have utilized this heat source but none more interestingly than Bonneville, Ltd. in Utah for the production of potassium chloride from brine by solar evaporation. Today's direct application perhaps points to the future when harnessing of solar rays may lead to varied uses of this potential source of energy.—*Editors*



Buildings and solar evaporation ponds of Bonneville, Ltd.

Western Utah in ages past was covered almost entirely by ancient Lake Bonneville. With decreasing rainfall the waters began receding leaving the ancient shoreline still visible on surrounding mountains. Dissolved matter accumulated over vast periods of time precipitated by evaporation forming Great Salt Lake desert. This begins roughly at Grantsville 33 mi. west of Salt Lake City and extends on west 94 mi. to Wendover. In the north the desert begins 20 mi. south of the Utah-Idaho line and continues for 150 mi. south into Utah. The remaining vestige of this once great body of inland water is Great Salt Lake.

Adjoining Wendover on the east is an area which possibly represented the final evaporation place of a portion of the lake. It consists of salt flats 6 mi. in width which extend northeast 20 mi. and range from 4 ft. in depth at the center to feather edge at the boundaries. This region known as Bonneville Salt Flats achieved international renown prior to the war as the scene of speed and endurance automobile racing. A less spectacular operation launched nearby during this same period has proved fully as interesting. It embodied utilization of natural energy to duplicate in a short period of time results which had required centuries for nature alone to produce in the form of the potash beds at Carlsbad, N. M. Bonneville, Ltd., organized in 1937, began producing potassium chloride near Wendover in 1938.

PRIOR OPERATIONS

The history of potassium chloride production in this area actually begins during World War 1 when Solvay Corp. acquired 35,000 acres and began concentrating and precipitating potash crystals by solar evaporation. Due to the prevailing prices it was possible to separate and purify the product profitably by processes and equipment developed at that time. Cessation of the war upset this economy and operations were suspended. Estimates of German deposits totaled approximately 11 billion cubic meters which at the existing rate of consumption were sufficient to supply the world markets for 10 centuries. This factor alone rather disturbed continuance of operations.

Economical recovery continued to intrigue J. L. Silsbee, associated with Solvay as chemical engineer during their operations, and he continued working on possible means of separation. Culmination of his efforts resulted in formation in 1937 of Bonneville, Ltd., with Halstead Lindsley as president. Lands owned by Solvay were leased and an additional area of 35,000 acres was purchased which doubled the total working area. Upon the death of Silsbee experimental work continued under the direction of Lockwood W. Ferris, metallurgical engineer, who has served as general manager while directing the process adaptations and developments necessary for the attainment of successful operations.

Difficult problems confronted this group in their attempts to develop processes which would lend themselves to economical operations. The most puzzling remained the final separation and purification of crystals at the end of processing. This could be accomplished by several methods but none could be operated profitably. After numerous experiments the solution presented itself in the adaptation of a flotation process. Around this one phase largely hinges the success of the project.

Early difficulties encountered in corrosion of equipment resulted in development of inhibitors which have vastly lengthened the life of all installations with the single

exception of cast iron pump impellers. Cast iron in these was replaced with bronze.

At the beginning of the second season disaster occurred which seemed to spell the end of operations. All attempts to use the crystallization ponds of the previous year resulted in loss by draining off of brine solution. Repeated pumpings failed to alter the condition and it was surmised that the 4 in. of salt remaining from the season before had exerted a coagulating and drying effect upon the clay bordering the fissures beneath the bed. It had become incapable of moisture absorption and swelling action so that the fissures now served as excellent drainage channels back into the brine canal. The only solution appeared to be construction of new ponds. Not only did this mean shortening of the crop season but also required new financing.

POND DESIGN

For a time the fate of the project hung in the balance. Inspired by Lindsley who would concede no failure, the group after concentrated efforts developed a pond design which appeared capable of dispelling all future drainage trouble. Construction was pushed rapidly with little loss of time and production operations were once more resumed. This time the hydrostatic pressure of the canal brine exerted upon the strata below the pond bottoms served to retain the brine in the ponds without penetration or dilution. Excavations into which clay dikes had been tamped to a depth of 15 ft. now surrounded both canal and ponds. The naturally impervious, compacted clay at this depth and in the dikes served as reservoirs from which no brine could escape. No further difficulties were experienced with pond operations and this marked the first milestone in the path of progress.

Brine used for processing comes from the thin crystalline salt mass of the Salduro Marsh which exists in the fissures of the calcareous clay comprising the residual lake bottom. Miles and miles of deposits exist which contain 1 percent potassium chloride. After draining through a 50-mi. canal system, the brine is pumped into a series of evaporation ponds which cover approximately 4,000 acres or roughly a strip 10 mi. long and from ¼ to 1 mi. in width. The brine system is composed of four ions, Na^+, K^+, Mg^{++}, Cl^-, plus minor impurities. With solar evaporation the greater part of the sodium chloride drops out until the concentration reaches an equilibrium point consisting of 8 parts sodium chloride, 5 parts magnesium chloride, and 4 parts potassium chloride.

At this point the sodium and potassium salts crystallize out together leaving the magnesium salt in solution. At present an area of 200 acres is filled to a depth of 2 ft. with 25 percent magnesium chloride solution which is being held until it can be used commercially.

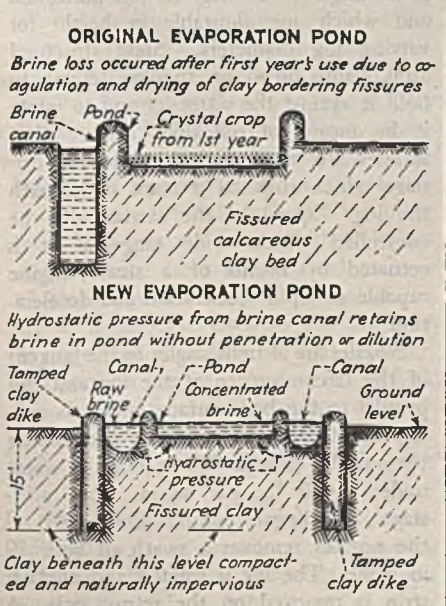
The four ion system of this brine lends itself to solar evaporation for separation. An interesting contrast is the Searles Lake brine of California which consists of six ions excluding magnesium but including carbonate, sulphate and borate. Although this area is hot and dry it undergoes decided temperature changes with the result that at some temperatures all the salts separate together. This brine cannot be handled by solar evaporation and requires close temperature control in production operations. Brine at Bonneville's operations is less critical from the temperature standpoint.

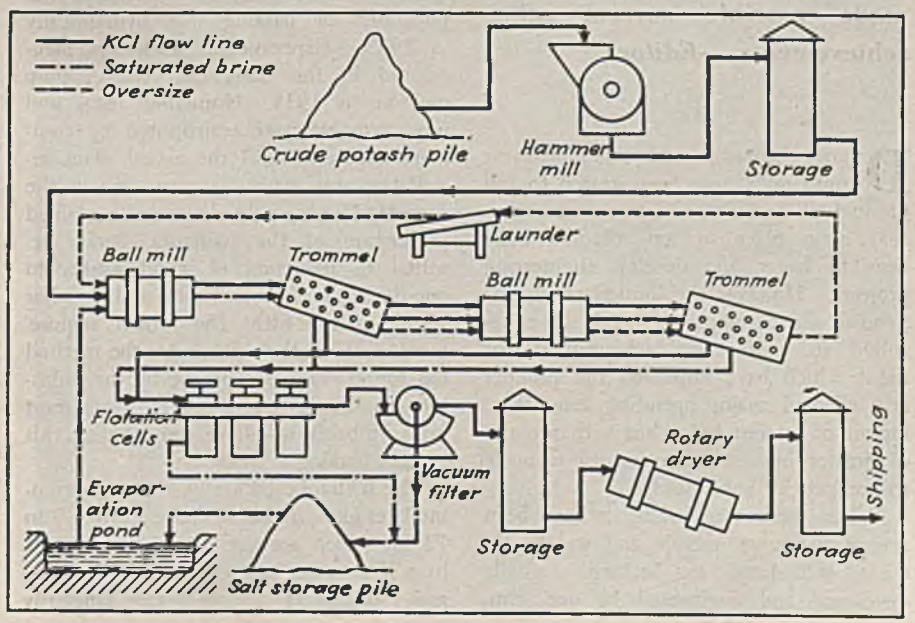
June, July and August are the three months which represent the crop season at Wendover. The heat energy which is developed by the sun during this 90-day period of evaporation is rather amazing when it is disclosed that generation of a like quantity of energy artificially would require the consumption of 3,000 tons of coal daily for 365 days. Harvesting of the crude salts from the ponds is accomplished by bulldozers and trucks. The material is transported to the processing plant which covers an area of five acres. The dried cake consisting of one-third potassium chloride and two-thirds sodium chloride is disintegrated by a hammer mill. It is then mixed with a portion of brine saturated with respect to potassium and sodium chlorides and introduced to ball mills for wet grinding. Trommel screens are used after both primary and secondary mills for return of oversize. Ground slurry is pumped to a series of flotation cells with the potassium chloride being floated and then filtered by a rotary vacuum filter. It is dried in a rotary dryer and loaded into railroad cars. Tails from flotation pass to a salt storage pile from which the liquor drains into an evaporation pond. The solution is adjusted with respect to potassium chloride saturation after which it is returned to the brine storage tank for reuse in processing.

STEADY GROWTH

Initial operations began with a 75-ton daily plant which during the past six years has undergone gradual expansion until reaching its present 500 ton daily capacity and a plant value of $750,000 financed entirely by its own production. Operating economies are now such that it is profitably processing crude material which has a gross value of 20c. per ton. This becomes further remarkable when it is disclosed that the plant is entirely diesel-powered, being too far distant from any source of industrial electricity.

Yearly production has now attained a volume of 27,000 tons, the bulk of which is being used as fertilizer in the states east of the Mississippi.



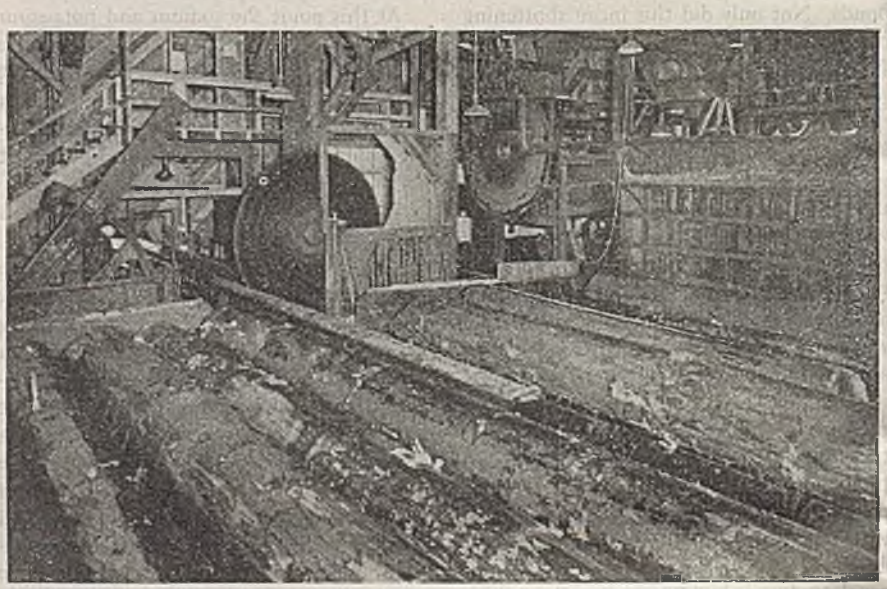


EDITORIAL STAFF REPORT

DEVELOPMENTS

That Aid Western Pulp Industry

Spurred on by the need to make the wood supply go just as far as possible and to improve the product, pulp and paper mill engineers of the Northwest have made noteworthy developments that will influence the industry from coast to coast. The hydraulic log barker has resulted in reduction of wastes and savings of labor. News of its accomplishments is spreading far and wide. Chipping of whole logs became an actuality last year with the installation of the world's largest chipper. An innovation in the form of a common blow chest has resulted in improved cleanliness of final product. And stainless steel has made possible several other achievements.—*Editors*



Swing cutoff saw used for cutting logs into 20-ft. lengths at Everett, Wash., mill. Log storage deck ahead of hydraulic barker is in foreground

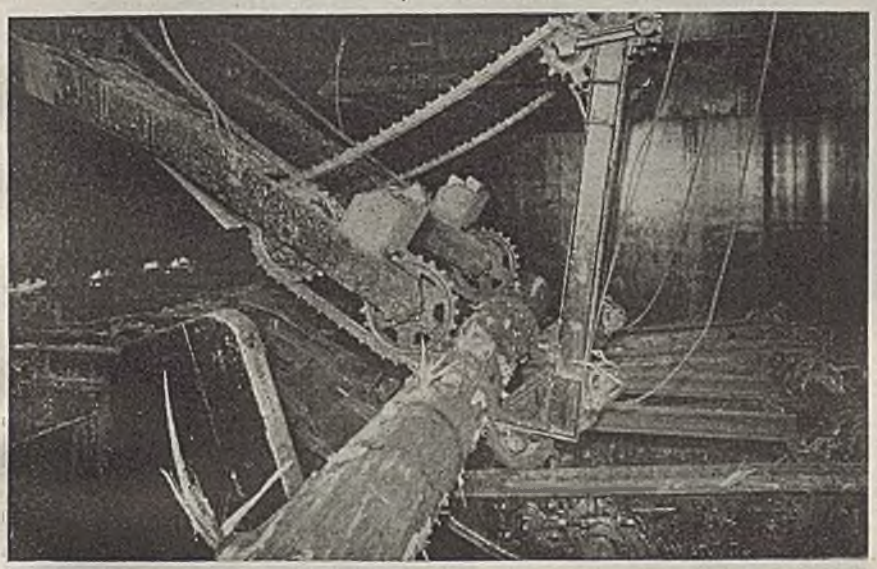
During the past several years Northwest pulp mills have been geared to full productive capacity. Concentration on that main objective has afforded little time to foster and develop engineering projects. However the limited efforts expended on development work have resulted in engineering achievements of merit which have improved the product and effected major operating economies; factors of interest today but with promise of greater interest when return is made to competitive conditions.

While the accomplishments have been several the most notable and widely discussed is hydraulic log barking. Initially developed and engineered by one firm, their success has inspired the total of the industry with the result that others have made installations. Engineers of Weyerhaeuser Timber Co. first discussed the possibility of barking logs hydraulically in 1933. Experimental work was inaugurated in the Longview, Wash., pulp division in 1935. Numerous ideas and improvements were contributed by company engineers until the actual plant installation was made two years ago in the Everett, Wash., pulp division. Sustained production of the hydraulic barker resulted in reduction of wood wastes to one-third the former losses and a labor saving of four-fifths the former requirements. With these attributes the method has found ready acceptance by the industry. In the matter of several years most mills probably will have converted to this type of barking.

The hydraulic barker at Everett accommodates logs ranging in diameter from 9 to 72 in. which are cut into 20-ft. lengths by a 108 in. diameter cutoff saw. Loading and unloading occur simultaneously through watertight vertical sliding doors by means of chain conveyors. In the barker the log rests upon steel knees set at an angle of 20 deg. to the horizontal and which are adjustable in height for varying log diameters. Steel structural arms clamp down on the log serving to hold it against the water jet and to rotate it by means of indexing chains. Two nozzles are mounted on a traveling carriage which runs on a track underneath the log. Speed of the carriage can be controlled within wide range as it is actuated by means of a steam engine capable of rapid acceleration and deceleration.

Nozzles are at right angles to the tangent of the circumference of the log and run parallel to the bark surface under all conditions of log taper. Sprays overlapping the nozzles deliver 750 g.p.m. of water under 1,400 lb. per sq.-in. from a 7-stage centrifugal pump. One pass of the nozzles removes a swath of bark 10 in. wide. The log is rotated and another strip is removed on the return pass. A

log of 40 in. diameter and 20 ft. length can be barked in less than 30 sec. Barked logs are removed from the knees by means of a cylinder-operated unloader actuated by the high-pressure water of the system. The control room placed at one end of the machine has a 5-ply plate glass window through which the operator can observe processing while handling the levers and buttons which actuate the motors of the equipment. The unit barks sufficient logs in 8 hr. for the daily manufacture of 275 tons of sulphite pulp. Before installation the Everett mill used 1,032 ft. of logs per air-dry ton of sulphite pulp which with hydraulic barking has been reduced to 790 ft. This represents a savings of .23 per-



Position of log in Weyerhaeuser barker resting on adjustable steel knees held in position by steel arms; rotated by indexing chains

cent or 20,160,000 ft. of logs annually.

The next installation was made at the mill of National Paper Products Co. at Port Townsend, Wash. Its operating principle is similar but it uses a lesser water pressure of 650 lb. per sq.in. More recently a new lathe type hydraulic barker has been installed in mills of Rayonier, Inc., at Port Angeles and Grays Harbor, Wash. Logs up to 50 in. in diameter and 22 ft. in length are chucked between two rotary spindles, one the tail stock and the other the driving head similar to a lathe. Nozzles are suspended from an overhead carriage which is lowered into position against the log at a constant distance and angle of impingement regardless of the diameter. In operation the jet cuts a swath of bark 7 in. wide with each revolution. The installations operate with 1,100 lb. per sq.in. water pressure and each barks 100 logs per hr.

Other projects center around construction, plans, and developments. Hawley Pulp and Paper Co. has engaged upon construction of a lathe type in their Oregon City mill while authorization has recently been granted by WPB to Soundview Pulp Co. for construction of a new type at Everett. This will be of ring type consisting of three segments each containing a number of nozzles with movable parts used in a variety of combinations. This unit will bark logs up to 60 in. in diameter and 32 ft. in length with a water pressure of 1,250 lb. per sq.in. Experimental work has been inaugurated by another firm on a type through which the logs feed lengthwise in continuous flow. It is believed that this version will lend itself to lighter construction and can be made in portable form for direct use in the forest on mill wastes. This type of barker is also intended to solve to a great extent the problem of handling small logs and logs of miscellaneous lengths.

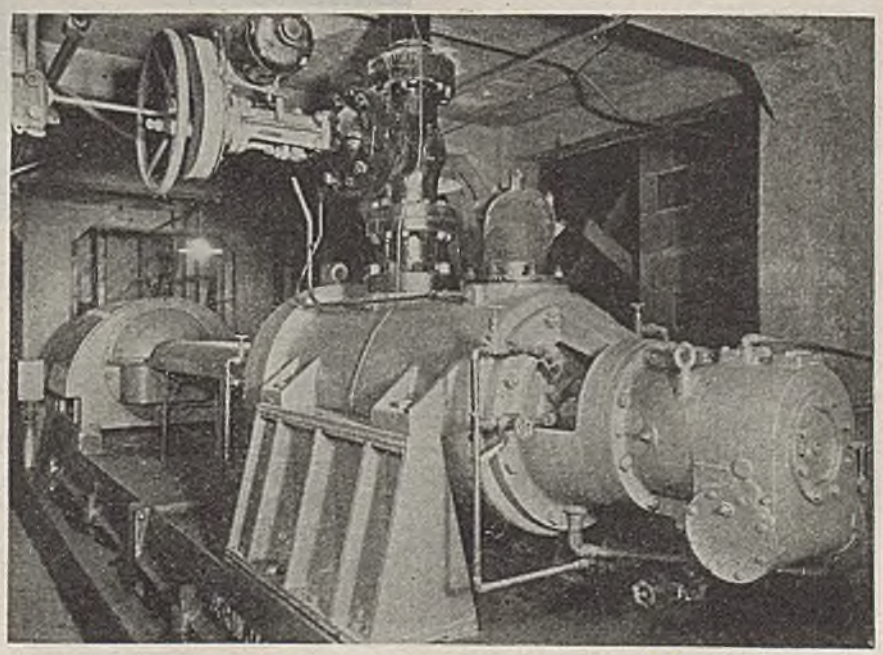
Design and construction of a hydraulic slab barker by the engineering and operating departments of Puget Sound Pulp and Timber Co. recently has been accomplished at Bellingham, Wash. Slabs 12 in. wide and 2 ft. long or more are transmitted on bed feed rolls to the barker where they are held down by two top rolls in a swing frame. Three nozzles $\frac{3}{16}$ x $\frac{5}{8}$ in. are located in a straight line crosswise to the slabs and approximately 17 in. away from the table feed rolls. Bark is stripped from the slabs with a speed of 1 to 3 ft. per sec. or an average of 5 cords per hr. with a water pressure of 1,100 lb. per sq.in.

Hydraulic barking in its various phases is firmly launched in the Northwest industry and the savings in waste and labor have amply rewarded the thought and efforts expended on this important development.

Chipping of whole logs became an actuality last year with the installation of the world's largest chipper of 171 in. diameter and 10 in. thickness in the Everett mill of Weyerhaeuser Timber Co. Chipper with arbor weighs 45 tons. It is used in conjunction with the hydraulic barker. Barked logs 20 ft. in length drop down an inclined chute against the face of the chipper which carries four knives of 50 in. lengths. Within several minutes the whole log is completely reduced to chips. Previous conventional chippers have been only 120 in. in diameter.

Appearing on the horizon is the Norman chipper which bears promise of smoother operation and more uniform chips. Making use of helicoidal blades the action in

Seven-stage centrifugal pump used to deliver water to the Weyerhaeuser barker under a pressure of 1,400 lb. per sq. in.

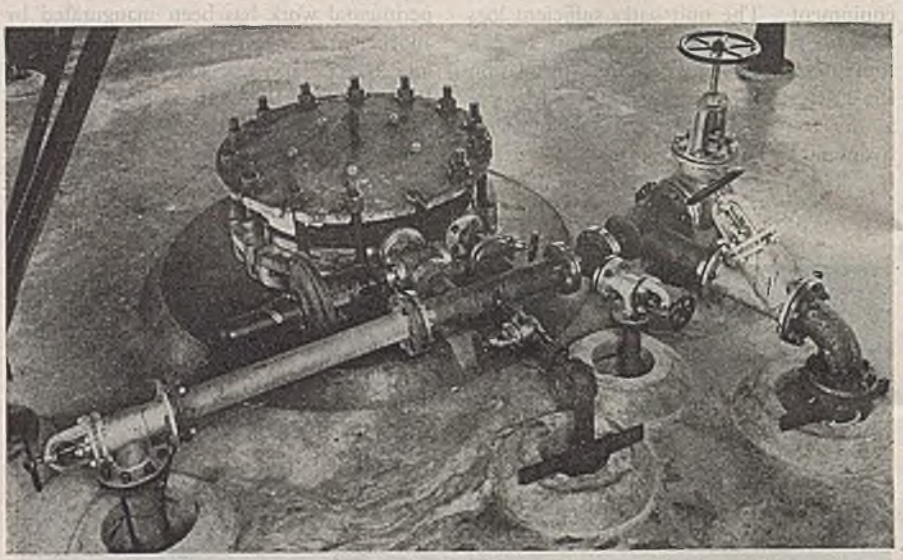


wood is similar to a propeller in water resulting in consumption of stock at uniform speed.

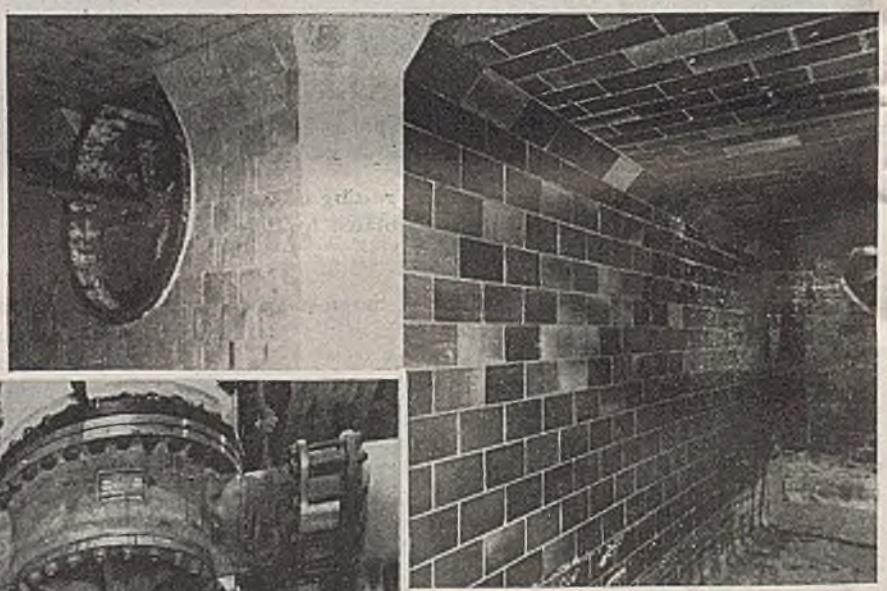
Pulp from each digester is usually washed out in individual blow-pits from which it is hosed for conveyance to the screen room. An innovation in the form of a common blowchest has recently appeared in the new sulphite mill of Powell River Co. in British Columbia. A large tile-lined agitator chest receives horizontal blows from three pulp digesters. It is designed to hold over two blows or about 40 tons (air dry) at 3 percent consistency. Water is added in measured volumes during the blowing period to facilitate maintenance of uniformity and consistency. Stock is pumped from the blowchest to the screen room. This method offers the advantage of a low-pressure blow with a minimum of wood knot breakage before knotting and blending. An appreciable improvement in cleanliness of the final product has been achieved.

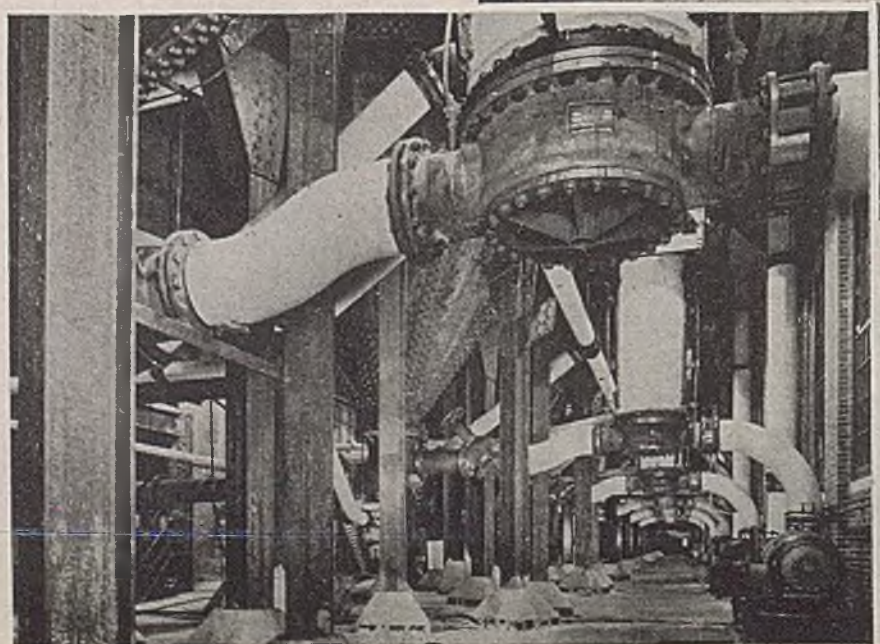
STAINLESS STEEL

It is felt by some that the use of stainless steel has resulted in the most notable engineering achievement on the part of the industry during recent years. Partial inroads were made by this material prior to the war but restrictions and shortages have somewhat limited installations the past two years. It is believed that when available wider use of this steel will be made in other types of equipment because the few installations made have thoroughly demonstrated its value and long life against corrosion encountered in the industry. Most noteworthy contribution of this material has been its use in sulphite pulp circulating equipment. Customary practice has been to admit live steam directly to the pulp digesters during cooking operations. This however results in zones of varying temperatures and production of non-uniform stock. Circulation however was impossible until use was made of stainless steel. In the new system the liquor is withdrawn from the top of the digester through an annular ring of strainers on the interior by means of a suction pump. It is passed through a 2-pass heat exchanger where it is heated indirectly without addition of steam and then returned to the bottom of the digester for re-circulation. This process yields a superior product of uniform characteristics. Postwar operations will undoubtedly find various new applications and wider usage of this material throughout the western pulp mills.



Stainless steel valves and piping used at top of digesters to withdraw sulphite liquor by means of suction pumps on the floor below





Central blowchest in sulphite mill of Powell River Co. in British Columbia. Tile-lined agitator chest receives low-pressure blows from three digesters

●

Stainless steel sulphite pulp circulating equipment showing two-pass heat exchangers which receive liquor from pumps at right and delivers it to bottom of digesters at left and in center

TARVER S. MURPHY, JR. *Black, Sivalls & Bryson, Inc., New York, N. Y.*

Determining Needed Relieving Capacity for RUPTURE DIAPHRAGMS

In an earlier article (*Chem. & Met.*, Nov. 1944, p. 108 ff.) the author attempted to remedy the principal misunderstandings concerning rupture diaphragms for protecting equipment against overpressures, discussing their physical characteristics, how and why they are used, and how it is possible to calculate the required size of diaphragm for the protection of a given piece of equipment, *provided* the necessary relieving capacity is known. This last, however, is not only the nub of the whole matter, but also the most difficult part, and so has been left for a separate article. In some systems the problem is simple, in others it is incapable of advance solution. Even in the worst cases, however, it is possible to make some educated guesses which go far toward a correct application.—*Editors*

Without the ability to make a fair approximation of the rate at which a fluid may have to be vented from a pressure system to prevent overpressure, the subjects of rupture diaphragm characteristics, use and sizing, discussed in the author's first article (*Chem. & Met.*, Nov. 1944, p. 108ff) are not of much value. This question of required relieving capacity for various types of system that may be subject to destructive overpressures is the most difficult part of the problem and also the crux of the matter.

The proper answer in one instance may be immediately recognizable. To illustrate: consider that a tank or possibly a delicate pressure instrument is subject to overpressures which may reach it only through a 2-in. pipe from the pressure source. A 2-in. Safety Head* or other suitable rupture disk, properly installed in the line *between* the pressure source and the unit to be protected, allows for relief of any pressure which can be supplied through the line, and hence is adequate.

On the other hand, there are instances where the necessary relieving capacity is most difficult to ascertain, or may defy exact determination. Most such cases are probably encountered in chemicals manufacture where slight variations in some processes may set off violent reactions of practically indeterminate intensities and magnitudes. Even air-tank fires or "explosions" (mentioned later) are fair samples, in that any one occurrence may vary considerably from others.

The approach to proper protection in any application calls for the fullest degree of investigation as well as experience, and for any action that is necessary or justifiable by the importance of safe operation.

Regardless of the kind of system to be protected, the approach to the solution is basically the same. It lies in answering the questions constituting the following three essential steps:

I. What will be the source or sources of overpressure?

II. What will be the likely maximum rate of volume increase from and at a given pressure (say, the rupture disk setting); or what rate of pressure increase may occur, to what maximum pressure if the increase is unrelieved, within the constant volume of the vessel or system?

III. Finally, what size of rupture disk is required to discharge this volume or weight of fluid as fast as generated, or at a rate which will not permit a pressure rise above the maximum safe figure? (Covered in the author's earlier article, *Chem. & Met.*, Nov. 1944.)

Analysis of any pressure hazard will most likely show that for Step I above, the source of overpressure in a closed system will be limited to one or more of:

A. A volume of gas or liquid flowing directly into the vessel or system—as through piping.

B. Heat imparted to the contents by an outside medium—such as by exposure fires, steam jackets or coils, atmospheric temperature, etc.

C. Exothermic reaction of the contents.

D. Burning of the contents.

E. Release of electrical or other heat-producing energy within the vessel or system.

F. Reduction of volume by mechanical means, as by a piston.

An analysis of Steps II and III for each of the sources of overpressure named above is discussed in what follows:

For overpressure source A, Step II requires determination of the maximum rate of flow into the vessel or system, in terms of pounds or cubic feet per second. Regarding Step III, frequently a rupture disk of the same size as the incoming line can be located before the vessel in such a way as to discharge the input completely, without raising the pressure in the vessel. Where it is necessary or preferable to locate the disk so that excessive pressure will reach the vessel to be protected, before discharging, then the disk should be of a size capable of venting the incoming flow fully, and from a maximum pressure not above the diaphragm rupture pressure or the vessel design pressure, depending upon the installation.

For overpressure source B it is necessary first to consider the manner by which the system contents is heated from an outside source. Heat may be imparted by any external means such as a heating jacket or coil; exposure fire; atmospheric temperature; etc. The containing walls or shell of the system or tank are the "heating surfaces" through which heat is transferred to the contents. "Rate of transfer" is a commonly used term, expressed usually as B.t.u.'s per square foot, hour and degree mean temperature difference. Rates will differ widely according to such factors as the thermal conductivity of the shell (different for steel, aluminum, copper, etc.); the shell thickness; its insulation; velocities of the heating or heat-absorbing mediums over the surfaces; whether the system contents is liquid or gas; proximity of the system to heat source; etc.

It is certainly worthy of mention here

* Rupture diaphragm assembly manufactured by the author's company.

Fig. 1—Pressure rupture of a creosoting vessel after combustion of its contents caused this destruction

that considerable renewed attention is lately being given to rates of heat input from external conflagrations. It can be seen from tests by Fetterly[1] in 1928; later tests by Duggan, Gilmour, and Fisher[2]; and reportedly still others made under the sponsorship of the Rubber Reserve Co., that intense fire burning around a tank may impart heat to *wet contents* at rates of some 20,000 to 26,000 B.t.u. per sq. ft. per hour, with fire temperatures of approximately 1,200 to 2,500 deg. F. However, it will be found that various regulatory groups thus far have based relief provisions for such cases on transfer rates somewhat less than those just mentioned. It remains to be seen whether experiences gained as a result of a number of vessel failures due to fire, may not make it desirable to set transfer rates at higher values in line with the present trend.

Three common classes of system subject to Source *B* overpressures include: (1) Pressure systems filled entirely with liquid, where heating of the contents causes liquid expansion—such as liquid lines or full tanks which may be closed off by valves; (2) pressure systems partially filled with volatile liquids, where vapor pressure may be dangerously increased with excessive addition of heat; and (3) pressure systems containing gases or vapors, the pressure of which will increase in proportion to temperature increase.

For the first of the three classes mentioned above, Step II calls for determination of the liquid volume expansion due to temperature. For instance, steam tables show the differences in specific volume of water between various temperatures. Tables or other data can likewise be found for practically any liquid in question. Step III merely requires a discharge area capable of relieving the liquid volume at least as rapidly as the volume could increase at the probable rate of temperature rise. It should be recognized that a rather small discharge area is adequate to relieve the volume increase of large liquid bodies. On the other hand, if a liquid be of volatile nature, then it may be necessary to determine requirements as in the next paragraph.

For the second of the three classes of system subject to Source *B* overpressure, Step II requires determining the rate at which the volatile liquid will be vaporized *from* and *at* a temperature corresponding to the vapor pressure at which discharge is desired. For example: A vessel contains 1,000 sq. ft. of surface area wetted by liquid propane. The maximum pressure to be imposed on the vessel, or the rupture disk pressure, is 200 lb. per sq. in. ga. The latent heat of vaporization of propane is about 132 B.t.u. per lb. from and at 200 lb. per sq. in. ga. If the heat transfer rate through the wetted surface is taken as 20,000 B.t.u. per sq. ft. per hr., then the heat transferred per hour = surface × rate = 1,000 × 20,000 = 20,000,000 B.t.u. Vaporization from and at 200 lb. per sq. in. ga. = heat transferred per hour ÷ latent heat = 20,000,000/132 = 151,500 lb. per hr.

Thereafter, Step III requires selection of a rupture disk size capable of relieving 151,500 lb. per hr. If we use the API-ASME formula, Eq. (1) (Eq. 5 in the author's first article), and assume that the vapor is superheated to 150 deg. F., or 610 deg. F. abs.; that the discharge coefficient is 0.81; and that the molecular weight is 44, then we have:

$$W = 306\,Cap\sqrt{M/T} \qquad (1)$$

where W = discharge capacity, pounds per hour; C = a discharge coefficient = 0.81 for gases and vapors; a = effective area, square inches; p = the initial absolute pressure, pounds per square inch; M = the molecular weight of the vapor; and T = the initial temperature, degrees F. abs. Solving for a we have $a = 151{,}500 \div (306 \times 0.81 \times 215\sqrt{44/610}) = 11$ sq. in., requiring a 4-in. Safety Head.

For the third class of system Step II requires determination of the rate at which the gaseous contents of the system must be discharged to keep the pressure within the required limit. This means determining the rate of volume increase of the contents at constant pressure (not exceeding the rupture disk bursting pressure), due to temperature rise.

For example, consider a vessel of 1,000 cu. ft. volume, with 600 sq. ft. of heating surface, containing air at 100 deg. F. at a required bursting pressure of the rupture diaphragm of 150 lb. per sq. in. abs. Assume an initial temperature difference of 550 deg. F. (at which the vessel would not be weakened), and a transfer rate of only 5,000 B.t.u. per sq. ft. per hr. Then weight of air in the tank at 150 lb. per sq. in. abs. and 100 deg. F., is $W = PV/RT = 150 \times 144 \times 1{,}000 \div (53.3 \times 560) = 720$ lb. Here $PV = WRT$ is the fundamental thermodynamic equation for any "perfect" gas; P = pressure, pounds per square foot abs.; V = total volume, cubic feet; R = the universal gas constant, which for air = 53.3; and T = temperature, degrees F. abs. = 460 + 100 = 560.

The initial (maximum) rate of temperature rise of air in the tank, in degrees F. per hour equals:

$$\Delta T = \frac{\text{Sq. ft.} \times \text{transfer rate}}{\text{Lb. air} \times \text{sp. ht. at const. pressure}}$$

or $600 \times 5{,}000 \div (720 \times 0.24) = 17{,}350$ deg. F. per hour, which is $17{,}350 \div 3{,}600 = 4.8$ deg. F. per second.

Since the initial volume (at constant pressure) thereby increases per second to $100 + 4.8/560 = 100.86$ percent, the initial rate of discharge should be $720 \times 0.86/100.86 = 6.15$ lb. per second (approx.). Applying Fleigner's formula (Eq. 3 in the first article) against the initial condition, and using a coefficient of 0.81, we have $W = 0.53 \times 0.81 \times AP_1/\sqrt{T_1} = 6.15 = 0.53 \times 0.81 \times A \times 150/\sqrt{560}$, whence $A = 6.15 \times 23.3/64.4 = 2.22$ sq. in. A 2-in. Safety Head would easily provide this area, while the 1½-in. size would be too small.

Note that, in the example just given, a rather low temperature difference was taken, less than the temperature at which tank shell would have been weakened. Duggan, Gilmour, and Fisher[2] point out the possibility that an "empty" tank (gas or vapor-filled) may fast become sufficiently heated in or near a fire to be in

danger of failure from weakening of the steel shell. The formula they show assumes reasonably that at about 1,100 deg. F. temperature the shell would be weakened enough to fail at its original allowable working pressure; that temperature range through which shell would be heated is about 1,050 deg. F.; and that about 80 percent of the heat input is retained; so that:

$$\theta = 5{,}114\, t/0.8\, I \qquad (2)$$

$\theta = 0.320\, t$ when $I = 20{,}000$ B.t.u. per hr. where θ = time in hours to reach "critical" weakness; t = thickness of the tank shell (uninsulated), inches; and I = unit rate of heat input, B.t.u. per hr. per sq.ft.

It may be well, therefore, in any application of this type, for the user to select a size of rupture disk which, when it has burst, will allow the pressure to fall to about 25 percent of the allowable working pressure during the time calculated from Equation (2). This reasoning takes recognition of the API-ASME code which allows approximately 25 percent of their cold strength for vessels at 1,100 deg. F.

Beyond the allowances already mentioned for protection of vessels against rupture during conflagration there appear to be other well-founded reasons for attempting to maintain some balance of venting control at such times, though these last may be problematical of attainment. One reason is that for a vessel that is largely filled with a volatile liquid, the rate of relieving vapor pressure should be only just fast enough to prevent the pressure from going above the safe limit. The theory here is that as liquid is vaporized it cools the exposed shell above the liquid surface, preventing dangerous over-heating. In this case it is contemplated, however, that the conflagration will be extinguished by the time the liquid is about all vaporized. Otherwise, the situation becomes

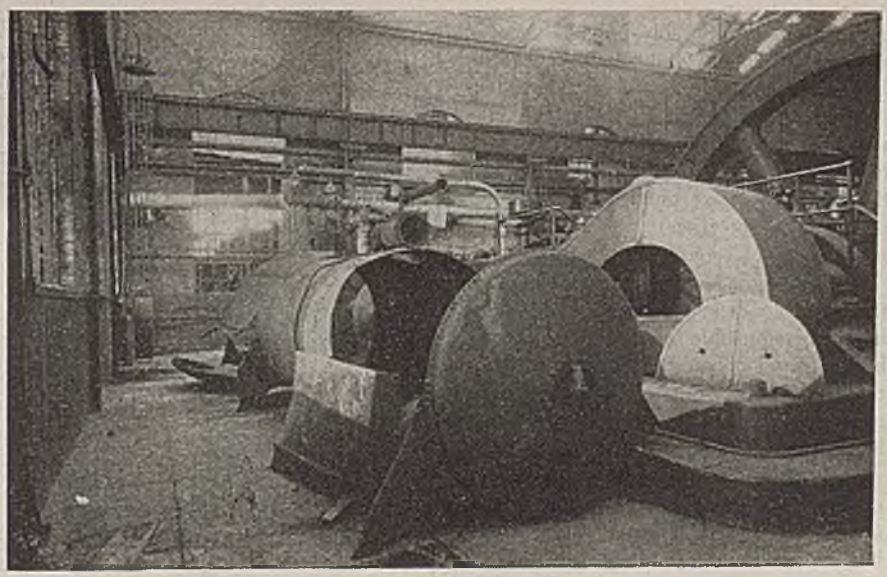


Fig. 3 — Failure of this air receiver following ignition of oil vapor in the air blew out windows and destroyed the roof of this plant

that of the "empty" (gas or vapor-filled) tank. Another reason is that care should be taken to prevent too sudden cooling of a vessel just following a conflagration, as by a hose stream, in case the contents are flammable. Here the danger lies in the possibility of drawing sufficient air into the vessel, upon cooling, to provide a combustible mixture which might be set off if an ignition source still remained. This precaution may well apply either to a rupture disk which has burst, or to a relief valve which may have failed to close tightly due to warping by the fire.

For overpressure sources *C* and *D* it will be appreciated generally that pressures generated by chemical reactions, whether or not combustion is involved, must be dealt with according to the specific case at hand. Slightly altering the initial conditions for any anticipated reaction may well result in wide differences of intensity and magnitude. It must suffice here to mention that in general the most effective application of rupture disks lies in the use of one or more, so sized and located as to best relieve the volume in question, at or below the maximum pressure allowed, as fast as it is generated by the reaction.*

Scattered reports have been received of various lines, manifolds, ducts, etc., provided with rupture disks of one sort or another, some of which have functioned as desired, while others (particularly in large, light, low-pressure ducts) did not. Reports have told also of the violent nature of explosions which have sometimes been experienced in relatively small and long lengths of line.

An article by Elting Henderson[4] contributes test criteria to such considerations. A preliminary report obtained on a more recent set of tests (understood to be as yet incomplete or unpublished) appears to parallel Henderson's findings. Henderson shows essentially that, in 4-in. welded pipe of 300 to 3,000-ft. lengths, following ignition of reasonably "ideal" gas-air mixtures: (1) From an initial pressure of 1 atm., and with the mixture in a *static* condition, combustion pressures developed in the order of 100 to 200 lb. per sq. in., as calculated, which agrees very well with the expected behavior within small vessels; (2) from about the same pressure, but with the mixture in *turbulent flow*, a pressure peak was developed in the order of 2,000 lb. per sq. in. at a point 50 ft. from the ignition source, while the pressure wave continued along the line at an intensity of about 500 lb. per sq. in.; (3) from 90 lb. per sq. in. initial pressure, with *turbulent flow*, one length was split

Fig. 2—Overpressure in a brine cooler released ammonia which became ignited, causing destruction of this plant by fire

* As exceptions, two applications of common interest will be covered in some degree later herein. These are for protection against the combustion of propane-air mixtures within pressure vessels; and lubricating oil vapor-air mixtures within compressed air piping and receiver tanks.

open, another noticeably bulged. A peak pressure of about 9,000 lb. per sq. in. was measured, while a wave of about 3,000 lb. per sq. in. continued down the line; and further, (4) that the initial temperature has a marked effect, and that obstructions in the pipe (presumably including changes of direction) produce pressure peaks.

While most of Henderson's article thereafter concerned prevention and purging of combustible mixture in pipelines, his tests and conclusions lend support to the thought that the following conditions may apply generally to more or less similar installations:

1. Peak pressures occur at some multiple of the pipe diameter from the ignition source, or the distances between peaks may be a function of pipe diameter. These distances may or may not be affected by the initial compression.

2. Peaks may result from secondary flame waves or points of ignition, occurring ahead of pressure waves, and acting cumulatively with them.

3. Where pressure wave travel is in advance of the flame, in static mixtures, to the completion of burning, petroleum vapor-air mixtures probably do not exceed maximum pressures of some 8 to 12 times the initial compression, both initial and final pressures on the absolute basis.

4. However, for *turbulent* petroleum vapor-air mixtures in relatively long lines, peak pressures reached may approximate 100 times the initial compression, both pressures again on the absolute basis.

When rupture disks are used to protect against such pressures, they should be located frequently enough, and particularly at changes of piping direction, either to prevent peaks or more quickly to vent the pressures generated.

For overpressure source (*E*), pressures created within a vessel or system by release of electrical energy may result from the expansion of gases or the vaporization of liquids (such as oil) when these are heated from arcing or from the resistance of the medium through which the current flows. Knowing the maximum rate at which heat may be generated by the current flow permits calculation of the rate at which gases or vapors will be expanded or created, thus showing the relief needs. If, however, the arcing or other action results in a chemical change of the pressure medium (such as the formation of hydrogen), and thereby brings about complex reactive conditions—or if sudden violent arcing brings about hydraulic impact—the problem becomes complex.

For overpressure source (*F*), which may be illustrated by the starting-up or operating of a positive displacement compressor or pump, where there may be the possibility of a closed valve or obstruction in the discharge line, Steps II and III will ordinarily require determination of the rate of displacement of the compressor, and thereafter the size of rupture disk capable of discharging that amount from, or at less than, the pressure at which the disk will rupture.

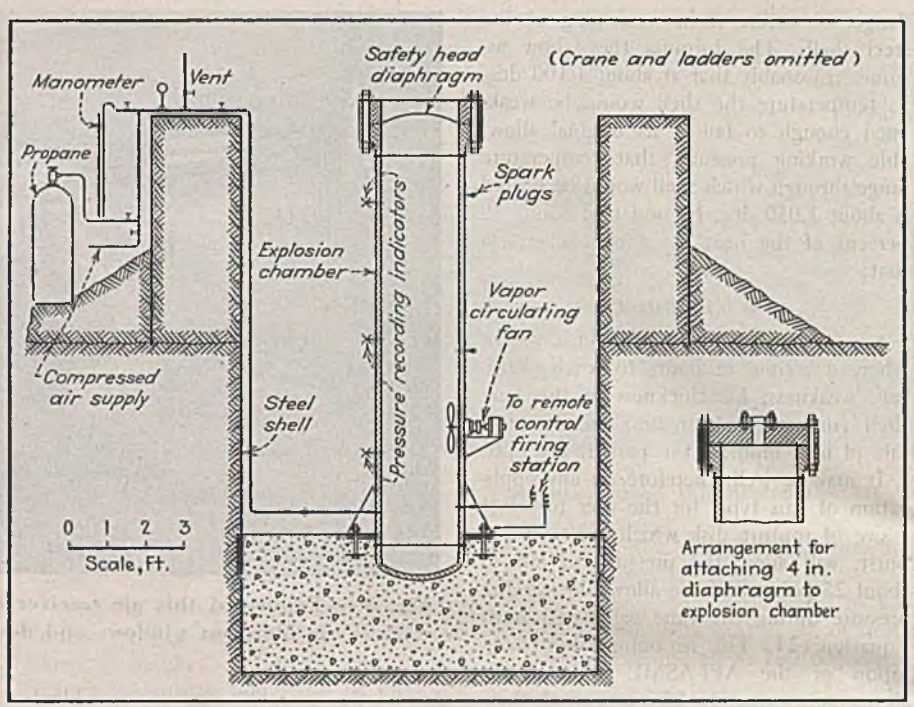


Fig. 4—Pit and equipment used for explosion tests on propane-air mixtures by Black, Sivalls & Bryson, Inc.

COMBUSTION WITHIN SYSTEM

As was mentioned earlier, owing to the wide variety of conditions under which pressure hazards may and do occur when combustion of the system contents takes place, little appears to be known of methods for providing sure protection for random vessels. The wisest policy appears to be that of exhaustive investigation, followed by use of well designed equipment, controls, relief devices, and operating care, so as to minimize the danger.

Adequacy of the protection afforded by rupture disks is probably the surer if the following conditions can be expected: That pressure waves will emanate from a localized area or point at which ignition occurs, and at a greater speed of travel than that of the flame wave, particularly in vessels where diameter is larger with respect to volume; that the slower or weaker the "fire," the less will be the intensity or shock of the pressure waves; that the larger the vessel, the longer will be the time interval for localized ignition to result in a general pressure increase within the vessel, to cause it to be increasingly stressed. This time element, or rate of pressure rise, is of particular importance in attempting to protect a vessel, whether a diaphragm or any other means is used.

As with other systems the requirement again is for a diaphragm or orifice area through which discharge can take place rapidly enough to prevent the peak pressure finally reached within the vessel from being sufficient to cause vessel rupture.

Information given below results either from limited tests conducted by Black, Sivalls & Bryson, Inc.[4] or from a combination of such tests with information based on experiences and opinions contributed by representative individuals in the field.

Vessels Containing Petroleum Vapors—Fig. 4 shows equipment used[4] for studying explosions of propane-air mixtures. It included flanges for installing Safety Heads of sizes from 2 to 24 in. in the 24-in. diameter vessel.

It was found that: (1) The ideal mixture averaged about 1 part propane to 12.8 parts, by weight, of air. Tests were conducted from an initial temperature of about 100 deg. F.; (2) maximum explosion pressures reached (when unrelieved) were about eight times the initial absolute pressure of the mixture, regardless of the initial pressure used; (3) the fastest period recorded for reaching maximum pressure following ignition was 0.2 to 0.3 seconds for the 24-in. diameter by 10-ft. deep vessel; (4) the maximum (relieved) pressures reached, when using 16-in. and larger diaphragms, were difficult to read, due to pressure vibrations. Use of diaphragms smaller than 12 in. permitted easy reading.

Fig. 5 is a nomograph prepared from results of the tests just described, which permits calculating Safety Head sizes for protection of various sizes of vessel. No responsibility can be assumed by Black, Sivalls & Bryson, Inc., or by the author for its adequacy. The ratio *R* is that of the pressure at which vessel would have been tested hydrostatically, to the pressure at which it is operating, both pressures on

the absolute basis. It is considered that operating pressure is at or below the maximum allowable working pressure, and that the vessel construction complies with the ASME unfired pressure vessel code, or equivalent.

Compressed Air Receivers and Piping—Many operators and some manufacturers of compressed air equipment have elected to provide rupture diaphragm protection to relieve emergency pressures which result from occasional ignition of lubricating oil vapor within the system. Experience indicates that ignition is most likely to occur at the discharge valve of the compressor. The flame may travel or be pumped on to the receiver tank, but sometimes the shock is of sufficient violence to rupture piping before reaching the receiver. Some receivers have blown up, others have had the fire burn in them for a while, then go out. Some, where not ruptured, have bellied out in barrel shape owing to the heat of the fire and to the excessive pressure. Others have been undamaged, yet had all the paint burned off. It is generally conceded that relief valves cannot cope with the situation. Relief valves, of course, should be installed in every case to handle normal relief needs, at least of capacity equal to that of compressor, which is a small fraction of the ignition-emergency need. The rupture diaphragm and relief valve must, therefore, be installed independently of each other.

It is considered best practice to install one rupture diaphragm at the end of the first run or piece of pipe leaving the compressor, for the purpose of relieving the condition, if possible, before it can travel toward the receiver. In all sizes of piping it is desirable to make this installation within a few feet of the compressor. When this diaphragm ruptures it not only relieves the compressor discharge, but also permits air to discharge back through the piping from the receiver. A Safety Head installed in the piping should be of the same size as the piping.

It is worthy of mention here that this diaphragm can be made of one of the materials which are lowered in bursting pressure as temperature increases, so that should ignition occur, or the equipment be operating hot and in danger of ignition, the diaphragm will burst at a considerably lower pressure than rated.

The number of additional rupture diaphragms, if any, to be located between the compressor and receiver will depend upon conditions, such as operating characteristics, length of line, other equipment, etc.

Protection to the receiver proper is, however, the final and probably the most important objective. The proper size of rupture diaphragm for a receiver tank has been and may still be considered a controversial subject, but with many installations being made, it became necessary some time ago that a consistent basis be established for sizes considered adequate. As a result a rough formula was derived and tentatively adopted for this purpose among engineers of the author's company. It results from the following direct assumptions, some of which are thought to be conservative enough to balance any discrepancies occurring when actual conditions are more severe than allowed for: (1) That a combustible air-oil vapor mixture may occur throughout the entire volume of the tank; (2) that the maximum "unrelieved" pressure resulting from complete combustion may reach eight times the initial absolute pressure; (3) that the pressure increase will be at a uniform rate and will require at least 1 second for reaching its maximum; and (4) that the most severe conditions of relief may find the contents being discharged at eight times the initial absolute temperature.

The formula gives relief capacity in terms of the equivalent cubic feet per minute of "free" air (14.7 lb. gage at 60 deg. F.) to protect the tank. It is:

$$\text{Required Capacity} = 11.3 \times \text{Tank Volume (cu. ft.)} \times \text{Initial Working Pressure (lb. per sq. in. abs.)} \quad (3)$$

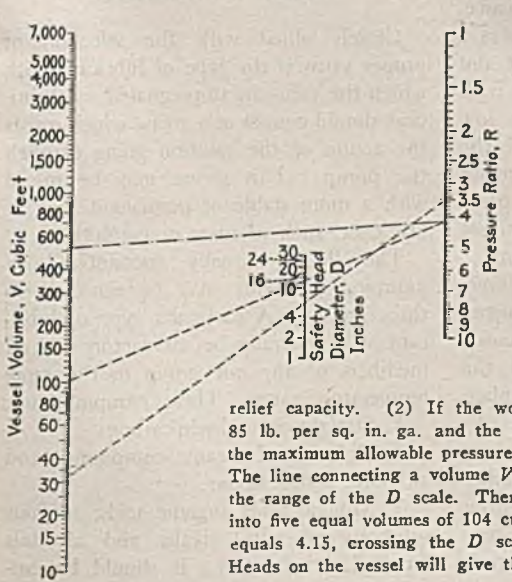


Fig. 5—Nomograph for estimating Safety Head sizes to protect against propane and similar explosions in pressure vessels

As examples, it is desired to protect a vessel against rupture due to a combustion explosion of propane or similar combustible inside the vessel. (1) If the working pressure is 95 lb. per sq. in. ga. and the test pressure, 370 lb. per sq. in. ga., the maximum allowable pressure ratio R (using absolute pressures) is 3.5. Connect R equals 3.5 with 32 cu. ft., the vessel volume, showing a Safety Head diameter D of 6 in. for the required relief capacity. (2) If the working pressure of a 520-cu. ft. vessel is 85 lb. per sq. in. ga. and the test pressure is 400 lb. per sq. in. ga., the maximum allowable pressure ratio (using absolute pressures) is 4.15. The line connecting a volume V of 520 with R equals 4.15 passes above the range of the D scale. Therefore consider the vessel to be divided into five equal volumes of 104 cu. ft. each. Connect V equals 104 with R equals 4.15, crossing the D scale at 12. Therefore, five 12-in. Safety Heads on the vessel will give the desired relief capacity

When reference is made to Table II of the first article (Nov. 1944, p. 111), covering relieving capacity for natural gas, with its air conversion factor, it can be seen readily what size Safety Head will pass this capacity, depending on the diaphragm bursting pressure used.

For example, consider a tank of 50 cu.ft. volume with the initial working pressure 235 lb. (250 lb. abs.) and with a Safety Head designed to burst at 375 lb. gage. The required capacity is $11.3 \times 50 \times 250 = 141{,}400$ cu.ft. per min. At 375 lb. bursting pressure a 6-in. Safety Head provides a capacity of $215{,}000 \times 0.788 = 169{,}500$ cu.ft. per min., while a 4-in. Head provides $96{,}000 \times 0.788 = 75{,}700$ cu.ft. per min. capacity; use a 6-in. Head.

It should be noted that provision must be made on any air tank using a rupture diaphragm for a nozzle or suitable connection of the same size. If not, the connection size used will determine the maximum effective size of the diaphragm.

It is certainly hoped that no one in following the method suggested herein, or any other, will ever consider that a rupture diaphragm eliminates or minimizes in any way the strict importance of precautions and practices strongly recommended by compressor and lubricant manufacturers, by various State, Code, insurance and other groups.

In conclusion, the author asks the reader to bear in mind the primary purpose of this article and the one before it. It is to provide basic information essential in making the proper application of pressure-rupture relief devices in most of the many different types of pressure vessels and pressure systems. These articles, of course, have made no attempt to cover fully all cases.

The articles have been written because it has been found repeatedly that individuals who have only occasional contact with the subject rarely have at hand an immediate concept or working knowledge of the fairly numerous factors essential to this rather specialized branch of engineering. If the information presented can then "give bearings," or serve as a guide toward more certain solutions it will have accomplished its purpose.

REFERENCES

1. John F. Fetterly, The Determination of the Relief Dimensions for Safety Valves on Containers in Which Liquified Gas is Charged, and When the Exterior Surface of the Container is Exposed to a Temperature of 1,200 deg. F., in Annual Report No. 22, Bureau of Explosives, 1928.
2. J. J. Duggan, C. H. Gilmour and P. F. Fisher, Requirements for Relief of Overpressure in Vessels Exposed to Fire, paper presented at Los Angeles June 14-17, 1943, meeting of American Society of Mechanical Engineers.
3. Elting Henderson, Combustible Gas Mixture in Pipe Lines, *Gas Magazine*, September 1941.
4. Merl D. Creech, An Investigation of the Ability of Rupture Disks to Prevent Explosions of Compressed Air Receivers, Engineering Dept. Report, Black, Sivalls & Bryson, Inc., January 25, 1940.

STANLEY L. LOPATA *Technical Service Engineer, The Duriron Co., Dayton, Ohio*

Practical Approach to Packing of CHEMICAL PUMPS

Successful packing of chemical pumps is often one of the most exacting phases of chemical plant work. The author classifies the commonly pumped liquids and lists satisfactory types of packing for each. He discusses the characteristics of the various yarns and lubricants employed in packings, shows how the packing should be installed and explains how to determine when it should be replaced. His comments on the use of grease and water seals will assist in the proper understanding of these adjuncts.—*Editors*

IN RECENT years the chemical industry has advanced further into the large scale manufacture of vitamins, pharmaceuticals and many organic products which involve the handling of large quantities of liquids. In many cases these liquids have properties of such a nature that very specific pumping practices have had to be developed for successful solution of the problems encountered. The most important types of liquids falling into this category are solvents, acids, alkalis, and mixtures consisting of solvents with either acids or alkalis. With suitable preventive maintenance, stuffing box failures which often occur when handling these liquors can be practically eliminated by the proper selection of packing and lubricants*, and the use of a technique of packing installation suitable to the pump and the packing chosen for the service. In selecting a packing, the main body or yarn should be resistant to the solution at the operating concentration and temperature. The principal yarns used in the chemical industry at the present time may be divided into the following categories:

Asbestos	Canadian white yarn
	Rubber or synthetic elastomers and asbestos yarn
	African blue yarn
	Plastic—shredded asbestos and graphite
Metallic	Metal shredded with asbestos (plastic type)
	Metal coil—foil or yarn
	Interwoven metal and yarn
Synthetic	Shredded with metal
	Yarn
Glass	Yarn

It must be evident that there is no one universal packing and it is with this thought in mind that the recommendations of the accompanying table are offered.

The packings listed in this table are not the only ones which have been or may be used for the various solutions, but the types listed have been used fairly successfully. Among the types mentioned above as a packing, but omitted from the table, is glass wool. One reason is that this type of packing works well only on those pumps which have no shaft whip, and such pumps are turned out only by the purest chance. The continual slight shaft whip creates a small annular opening between shaft and packing that is very difficult to seal with lubricant. This is caused by the low resilient factor of glass packing and the inability of the glass to absorb and retain lubricants. Pumps packed with glass packing are prone to leak a steady stream of liquid after a short period of operation.

In centrifugal pump packing the following physical properties and characteristics of the yarn are of value: (1) Tensile strength, flexibility and softness of the fiber; (2) resilience of the woven fiber; (3) absorption of the liquid handled; (4) retention of the lubricant.

High tensile strength and good flexibility of fiber prevent the individual strands from snapping and shredding and possibly contaminating the solution being pumped. Soft fibers tend to reduce the possibility of scoring the pump shaft, particularly when the stuffing box gland is tightened too much. The woven fibers must be resilient to take the slight whip of the impeller shaft without injuring it. The resilience also helps the packing to shape itself around the pump shaft. An anomaly of fiber softness is that while the blue African asbestos is much harsher and more abrasive than the white Canadian asbestos, its greater resistance to chemical attack results in its predominance in the field of chemical packings. If the packing has a tendency to absorb the liquid being pumped it may swell, or the liquid may cause the packing to harden and score the pump shaft.

At this point it should be noted that the condition of the surface of the pump shaft or sleeve against which the packing rubs is most important. The ideal shaft surface to minimize friction and leakage is one which has been ground to a polished or mirror finish. Ridges or marks on the shaft always provide a channel for liquid to leak from the pump out through the stuffing box. For this reason, whenever rough surfaces are found on the pump shaft, the impeller should be removed and the shaft turned or ground smooth.

WHAT LUBRICANT?

Closely allied with the selection of proper yarns is the type of lubricant with which the yarns are impregnated. A lubricant should consist of a grease which resists the action of the solution going through the pump. This grease may be mixed with a more stable or permanent type of lubricant, such as mica or graphite.

The liquids usually encountered in pumping problems may be classified in three groups. A particular type of lubricant will generally be satisfactory for all members of any one group in the same temperature range. These groupings are:

1. Straight-chain hydrocarbons.
2. Chlorinated organic compounds and aromatic hydrocarbons.
3. Mineral acids, organic acids, aqueous solutions of salts, alkalis and alcohols (methyl, ethyl, etc.). It should be em-

* *Editor's Note:* It is possible that the recently announced silicone-base greases for plug cocks may be found suitable for a considerable range of packing lubricant applications.

General Recommendations for Packings for Pumps Handling Chemicals

Acetic acid	Plastic-shredded African blue asbestos mixed with graphite and lubricant; or African blue asbestos lubricated with graphite and glyceride-free lubricant.
Aqua regia	African blue asbestos lubricated with graphited non-oxidizing lubricant.
Carbolic acid (phenol)	African blue asbestos or Canadian white asbestos lubricated with graphite and glyceride-free lubricant.
Chlorsulphonic acid	African blue asbestos lubricated with graphite and non-oxidizing lubricant.
Hydrochloric acid	African blue asbestos lubricated with graphite and glyceride-free lubricant; or Canadian white asbestos bound with chlorinated rubber and lubricated with graphited glyceride-free lubricant.
Lactic acid	African blue asbestos lubricated with graphited or mica-impregnated glyceride-free lubricant.
Mixed acids	African blue asbestos lubricated with graphited non-oxidizing glyceride-free lubricant.
Nitric acid	African blue asbestos lubricated with graphited glyceride-free lubricant.
Oxalic acid	African blue asbestos lubricated with graphited glyceride-free lubricant; or Canadian white asbestos interwoven with lead or tin, lubricated with graphited glyceride-free lubricant. (Required when pumps are steamed out to melt crystals.)
Phosphoric acid	African blue asbestos lubricated with graphited glyceride-free lubricant.
Sulphuric acid	For concentrations up to oleum, African blue asbestos lubricated with graphited glyceride-free lubricant.
Oleum	Semi-metallic, lead surrounded by Canadian white asbestos lubricated with graphited glyceride-free lubricant; or plastic; or shredded African blue asbestos or shredded lead lubricated with graphited glyceride-free lubricant.
Tartaric or citric acids	Canadian white asbestos lubricated with mica and a white lubricant (usually used in food products).

Aqueous Solutions of Metal Salts With and Without Low Concentrations of Their Respective Acids

Copper sulphate **Nickel sulphate**	Lead foil lubricated with graphited glyceride-free lubricant*, or African blue asbestos* lubricated with graphited glyceride-free lubricant.
Ferric chloride **Copper chloride** **Nickel chloride**	African blue asbestos lubricated with graphited free lubricant*; or Canadian white asbestos bound with chlorinated rubber, lubricated with graphited and glyceride-free lubricant.*
Sodium nitrate **Copper nitrate**	African blue asbestos lubricated with graphited glyceride-free lubricant.*
Aluminum sulphate	African blue asbestos lubricated with graphited glyceride-free lubricant.
Sodium chloride	Canadian white asbestos lubricated with graphited glyceride-free lubricant.
Potassium cyanide **Sodium sulphite**	Canadian white asbestos interwoven with lead, lubricated with graphite and glyceride-free lubricant*; or lead foil lubricated with graphited glyceride-free lubricant.*
Sodium hydroxide	Canadian white asbestos lubricated with graphited glyceride-free lubricant; or plastic shredded Canadian white asbestos, shredded white metal, lubricated with graphited glyceride-free lubricant.

Solvents Containing No More Than 5 Percent Free Acid

Acetic ether **Acetone** **Methyl alcohol** **Ethyl alcohol** **Methyl acetate** **Butyl acetate** **Amyl acetate** **Naphtha** **Kerosene** **Formaldehyde** **Benzene** **Toluene** **Zylene**	Canadian white asbestos lubricated with graphite and lubricant; or plastic-shredded Canadian white asbestos, shredded lead or babbit, graphite and lubricant.
Carbon tetrachloride **Ethylene dichloride** **Benzyl chloride**	Plastic-shredded African blue asbestos, graphite and lubricant.

*Plus a water seal.

phasized, however, that a lubricant satisfactory in the low temperature range may not be satisfactory at higher temperatures.

Mineral-base lubricants are usually resistant to the acid- and water-miscible solutions while soap-base lubricants are satisfactory for straight-chain, non-chlorinated solvent solutions. Aromatic and chlorinated solvents may be used with some of the latter lubricants, but this is something that only individual testing can determine. In addition to these, lubricants consisting of blown castor oil, heavy metallic soaps, etc., are offered as possibilities. Many excellent lubricants are made by embodying the permanent lubricant (powdered graphite) in the grease, taking advantage of the bulking feature of the powder to adjust the final viscosity of the lubricant. Many of the larger packing manufacturers have their own lubricants for the above services and these are procurable in various grades. To complement one's own experience, laboratory results of packing manufacturers should be utilized. The ideal lubricant should be very plastic and soft, yet not melt at the temperature involved; otherwise it will soon run into the pump or else into the solution drip pan.

WHAT MELTING POINT?

A grease should also have good lubricating properties for rotating shafts. In estimating the operational temperature required of the grease, it should be remembered that the friction of the pump shaft rotating in the packing may generate 25 to 50 deg. F. temperature rise in the stuffing box. If the gland is tightened unduly, the packing may be heated 400 to 500 deg. F. A few minutes running under these conditions will not only score the shaft but may make it expand lengthwise sufficiently to cause the impeller to rub on the cover. For that reason, the lubricant selected need only have a melting point 50 to 100 deg. F. higher than the liquid temperature.

Many lubricants, in addition to being loaded with graphite or mica, are sized with ground asbestos to give additional body. The first of these types is preferable. Another common practice which works well in the field in the case of hard resistant greases is to incorporate a non-volatile resistant plasticizer so as to give the grease proper viscosity.

In addition to being impregnated with grease, the packing should also be coated with graphite or mica, particularly if there is no lantern gland or other method of supplementary lubrication or sealing of the stuffing box. Usually on white products which cannot be discolored, mica is used. However, graphite packing should not ordinarily be used with stainless steel shafts. In certain solutions and under various conditions, graphite particles on stainless steel become cathodic to the adjoining stainless steel and the electroyltic cell set up may cause the shaft to pit. (It is not possible

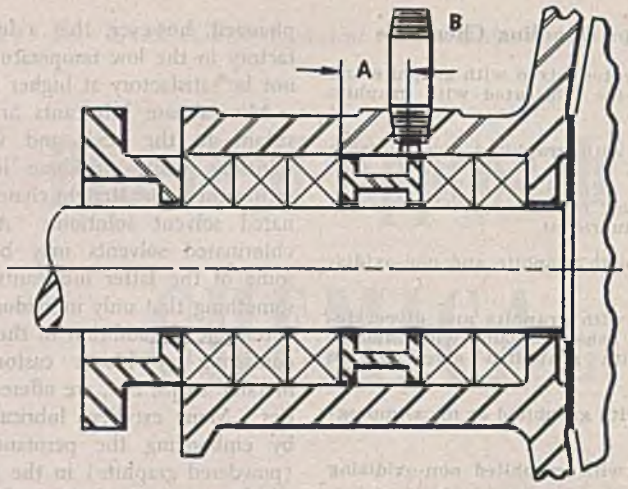


Fig. 1—When a lantern ring is used in a pump stuffing box, the distance *A* is the amount that the ring can be moved from connection *B* and still permit satisfactory sealing and supplementary lubrication

to state all of these conditions as not much experimental work has been done.)

After a desirable packing impregnated with proper lubricant has been selected, the question of how to install the packing arises. The first operation is to remove all of the old packing, making sure that the packing between the bottom of the box and the lantern gland is also removed. If there is a lantern gland attachment, as in Fig. 1, the distance between the bottom of the box and the point of entrance of the supplementary grease lubricant should be measured—to determine the number of rings to be inserted before the cage ring.

INSTALLING PACKING

The first ring of packing to be inserted should be flexed carefully between the fingers, taking care not to break or flatten it but just to loosen up the fibers and soften the ring. If the packing is supplied in coil form rather than rings, the proper length should be laid out and cut off on a bevel or diagonal. The advantage of the bevel cut over a square joint is that when the packing swells due to temperature rise or some slight solution action, the sliding ability of the joint absorbs a portion of the ring expansion. The ring is then placed around the shaft and pushed to the bottom of the box. A small, special caulking tool should be used for this purpose so the packing can be seated very uniformly. Any plant shop can turn out a few of these ramming or caulking tools for the various types of pump in the plant. A very light mallet should be used, or sufficient hand pressure, 20 to 30 lb. per sq.in., should be exerted against this bottom ring to make sure it is well seated, but that the fibers are not damaged.

In case of the second ring of packing, this should be flexed between the fingers only about half as much as the first ring and rammed home the same way. The remaining rings may be inserted just as the packing is received, but each one should be seated individually and the joints staggered. The reason for not using the gland to push the packing into the box is that glands are usually too short properly to seat the individual bottom rings of packing, which then would be seated only after three or four rings of packing were in the box. If the gland is used the resultant pressure on the bottom ring is always uneven. After the box is filled and the gland inserted, the gland should be checked to make sure that it is not canted so as to ride on the shaft and apply uneven pressure on the packing. The packing gland nuts should be turned with the fingers, then tightened with a wrench to a torque of about 25 to 40 in.-lb. After this the gland bolts should be loosened and drawn up finger tight to insure a pressure on the gland that is not excessive.

Loosening and properly seating the packing has the functions, first, of filling all the openings between the shaft and the inside wall of the stuffing box so that, when hydraulic pressure is applied from the inside of the volute (as occurs when many types of pump are running), no large openings are available for the liquid to get through; and second, of insuring enough resilience in the packing to flatten out even more and completely fill the annular opening in the box, just in case the shaft is scored or the bottom ring of packing is not seated properly.

Under some conditions, alternate rings of hard and soft packing, all well lubricated, give excellent results. Certain pumps, depending on depth of stuffing box and gland design, if packed with all soft packing never transmit gland pressure beyond the two or three rings of packing nearest the gland, because of packing deformation and force vectors which are transmitted to the inside wall of the stuffing box. When all hard packing is used, the gland pressure necessary to give effective sealing may score the shaft. The use of alternate soft and hard rings of packing, however, permits the soft packing to be compressed between two relatively hard, flat surfaces. Each ring of soft packing on compression therefore tends to perform similarly to a light gasket seal on both the shaft and the inside diameter of the stuffing box. Usually a deep stuffing box, one that holds six or eight rings of packing, is essential to secure good results with this procedure.

It should also be pointed out that a centrifugal pump should never be operated dry to run-in the packing; this melts out the lubricant and heats the shaft, with the possibility of causing the damage mentioned above.

The question is always asked whether or not a pump should be completely repacked when the gland has been tightened all the way. This is a point of contention and truly should be clarified. Cage rings are from ¼ to 1 in. thick and should not be pushed below the entering point of the lubricant since the lubricant would then be sealed against the outside of the packing and could not penetrate or flow to the shaft easily. This is evident from distance A in Fig. 1. Therefore, each pump or make of pump should be regarded as an entity in itself. After the width of the cage ring is measured, instructions can be given as to the number of rings of packing, equivalent to distance A, that can be added before completely repacking the pump. In most cases, one or two rings of packing can be added. These additions do not restore the box to its highest efficiency and no more than the correct calculated number of rings should be added before a complete repacking job.

This method of packing is recommended for centrifugal pumps which have a stop at the bottom of the stuffing box. However, some pumps with vertical seals are designed so that the bottom ring of packing seals itself against a ring on the shaft or against the back of the impeller. In this case, the bottom ring of packing should be fairly hard and well lubricated. Carbon is sometimes used. In cases like this, the second ring should be the one flexed and loosened. Another variation of the basic packing procedure described occurs when plastic or shredded packing is used. In such case it will always be necessary to have one or two rings of harder or braided packing possessing a high tensile strength, both at the bottom of the box and next to the gland. These rings prevent the packing from being extruded into the pump or out into the drip pan.

As indicated in Figs. 1 and 2, lubrication should be applied at the point marked B, either through the lantern gland or through a gland follower. These devices tend to reduce the friction between the shaft and the packing and hence the wear and tear on both packing and shaft. The lubrication supplied in packing by the manufacturer is never sufficient to last the normal operating life of the packing

and lack of lubrication not only causes increased friction but also reduces the resilience of the packing and permits it to harden.

In Fig. 3 a typical constant-pressure lubricator is shown. In too many cases ordinary cup grease is forced into the lubricator. The tension of the spring on the piston slowly forces grease through the lantern attachment into the cage ring where it comes in contact with the impeller shaft. It is evident, therefore, that the grease supplied to the lubricator should have similar properties to the grease with which the packing is impregnated. Regular cup grease emulsions too often break down, permitting solid matter to clog the channel of the lubricator, thereby impairing its efficiency either partially or completely. In addition, if the grease being used for lubrication of the packing is attacked by the solution being pumped, its efficiency as a lubricant is doubtful.

LUBRICANT VISCOSITY

In selecting the proper grease for the lubricant, after its chemical resistance is proven there arises the problem of consistency, plasticity or hardness. Certain good acid-resisting greases are too hard to be forced through a lubricator, even though it may be supplied with an extra-heavy spring. The best test to determine the proper viscosity of the lubricant is under actual operating conditions, but as a preliminary indication the lubricator can be filled when unscrewed from the pump. If the solution temperature is 150 to 250 deg. F., then a flow of grease of ½ to 2 in. per minute through the lubricator when it is kept at a temperature of 50 to 75 deg. F. less than the solution being pumped, usually will give good sealing. The same grease flow rate when testing at room temperature gives satisfactory results with a solution temperature of 40 to 150 deg. F.

If it has been determined that water can be used in the lantern gland (which is favored whenever a small amount of dilution of the liquid being pumped is permissible), a pressure at from 2 to 10 lb. per sq.in. should be used. If, however, the pump is one which develops a high pressure in the stuffing box, enough pressure should be used on the water in the gland to overcome the solution pressure. This balancing of pressure can easily be regulated with a valve on the water connection feeding the lantern gland. Litmus paper or a universal indicator paper can be used to test the pH of the leakage. On acid solutions the water pressure should be adjusted so the pH of the gland leakage is approximately within the limits of from 5 to 7. If the pH of the solution being pumped is buffered or has a pH of 6 it may be advisable to keep the drip between 6.5 and 7.

Following, some special pumping conditions are described, together with the means used to solve the problem.

1. Solutions of sulphuric acid containing considerable amounts of copper sulphate or nickel sulphate at 110 deg. F. were being pumped. As with all fibrous material, both the pressure from inside the volute, and capillary action through the packing, permitted some of the liquid being pumped to seep in through the packing. On account of the frictional heat in the box and ordinary evaporation, sulphate salts crystallized in the box around the packing. These salts are extremely abrasive and not only scored the shaft but ruined the packing.

On this service metallic lead packing was used and worked very well when combined with a water seal on the lantern gland. The solutions described have less tendency to creep between the layers of lead foil than between layers of asbestos. The water keeps the creeping liquid dilute, and also washes out the stuffing box, thereby keeping it free from crystals. However, a word of caution is advisable in using metallic packings—they are quite sensitive to gland pressure and should be tightened only slightly.

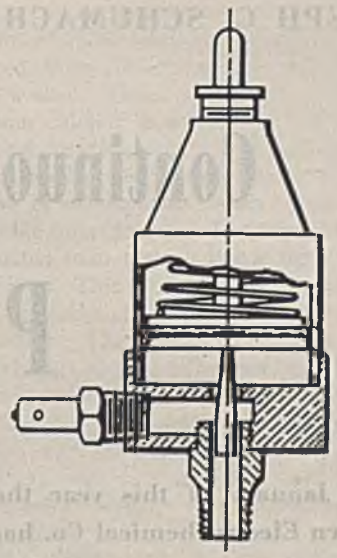


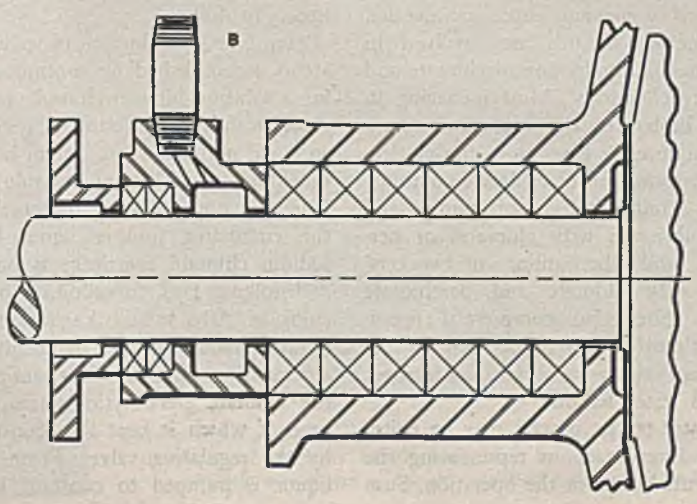
Fig. 3—In this type of lubricator the annular opening between the piston guide and the discharge fitting is too small to feed grease of proper viscosity to a lantern gland; the condition can be corrected by cutting off the guide piston

2. Mixtures of concentrated phosphoric and sulphuric acids at 200 deg. F. were being handled, containing small amounts of solids. Leakage attacked the pump base and destroyed the floor. The pumps had to be repacked weekly.

In this case the pump being used was lubricated through a gland follower and the stuffing box was quite deep—containing eight rings of ½-in. packing. A soft, plaited blue African asbestos impregnated with graphite and an acid-resisting lubricant melting at 350 deg. F. was used. To help supply lubrication to the packing at the bottom of the box, layers of the base lubricant with which the packing was impregnated were placed behind each ring of packing. Then a slightly lower melting point lubricant, 300 deg. F., was used in the gland follower. While the lubricator had to be refilled more often than when the 350 deg. F. grease was used, it kept the packing pliable and soft over a six-months period.

It is easily recognized that individual judgment regarding the frequency of grease-cup refilling may vary, and the question is not only one of economics but also is peculiar to each plant setup. If the plant has a pump maintenance man or greaser, it may be practical to use quite a low-melting-point grease and refill the cups daily. However, a plastic grease which needs replenishment less often is to be preferred. Individual plants will undoubtedly find it expedient to deviate from the suggestions contained herein, but the practices and generalities described have worked out satisfactorily in actual practice.

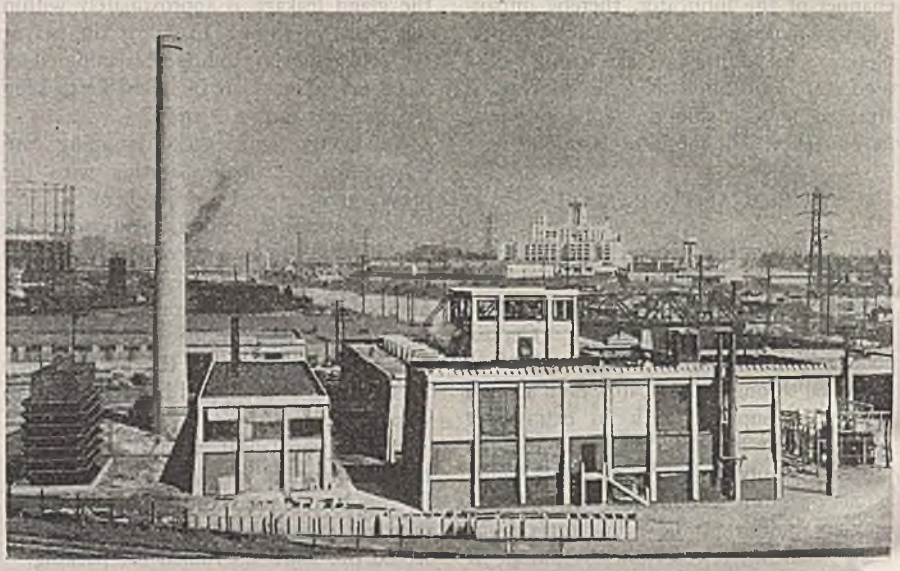
Fig. 2—This means can be used for supplementary lubrication when a lantern gland is deemed undesirable; grease or sealing water is supplied through connection *B*



JOSEPH C. SCHUMACHER *Technical Director, Western Electrochemical Co., Los Angeles*

Continuous Electrolytic Process for PERCHLORATE

Since January of this year the Western Electrochemical Co. has been producing potassium chlorate and perchlorate by a process which merits recognition on three separate scores. First, it represents a victory over the inherent manufacturing hazards which had spelled doom for earlier processes. Second, it is a continuous process, in contrast to batch methods previously tried. Third, it frees this country of dependency upon foreign sources of potassium chlorate and perchlorate.—*Editors*



Western Electrochemical's potassium perchlorate plant in Los Angeles

PRODUCTION of chlorate and perchlorate chemicals in the United States has risen sharply since 1940 as a result of the establishment of new plants throughout the country. This production was created to corner for ourselves at least a portion of the world market which prior to the war was supplied almost entirely by foreign producers. But by 1941 domestic production became more than a good business proposition. It became a matter of necessity. Mounting military and civilian demands so far exceeded the trickle obtainable from abroad that potassium perchlorate was placed on the list of strategic chemicals, and all chlorate and perchlorate chemicals were put under allocation by WPB subject to Limitation Order M-171. Further impetus to the establishment of domestic plants had been furnished by the hope-inspiring investigations of electrolytic sodium chlorate by P. H. Groggins and his Department of Agriculture associates.

These then were the circumstances surrounding the formation of the Western Electrochemical Co. in 1941. It was established for the express purpose of producing chlorate and perchlorate chemicals for West Coast and foreign demands from the power facilities and natural resources available in the Los Angeles area. Primary objective from the outset was the evolution of a continuous process, one which would bestow the double blessing, increased efficiency of operation plus decreased dependence on hard-to-get manpower. Laboratory studies indicated the feasibility of such a process and final operational problems were fully worked out in a small pilot plant.

A survey of previous processes revealed that numerous hazards are involved in the commercial production of chlorate and perchlorate chemicals. Most menacing to life and limb are: the evolution of explosive mixtures of gases from the electrolytic cells, formation of explosive combinations by contamination of pump and bearing lubricants with chlorates or perchlorates, and the soiling of workers' clothing with chlorate and perchlorate solutions. Successful commercial operation for almost a year speaks well for the plant design which was developed to meet these and lesser hazards.

Chemistry of the process may be epitomized in three reactions representing the three essential steps in the operation. Sum total of these reactions amounts to this: Potassium chloride, water, and electric power go into the process. Potassium perchlorate and hydrogen gas come out.

$$NaCl + 3H_2O + 6\ Faradays \rightarrow NaClO_3 + 3H_2 \quad (1)$$
$$NaClO_3 + H_2O + 2\ Faradays \rightarrow NaClO_4 + H_2 \quad (2)$$
$$KCl + NaClO_4 \rightarrow KClO_4 + NaCl \quad (3)$$

The following description of the process is graphically depicted in the *Chem. & Met.* Flowsheet on page 130. Reference to the flowsheet will make this discussion easier to follow.

Step One—Production of sodium chlorate is accomplished by continuously feeding a solution high in chloride and low in chlorate into the electrolytic system while an equal portion of the system liquor high in chlorate and low in chloride is simultaneously pumped out. In actual practice the circulating mother liquor from the sodium chlorate centrifuge is pumped to a dissolving tank for addition of sodium chloride. After sufficient agitation this feed liquor is allowed to flow by gravity through a regulating valve into the sump tank of the chlorate electrolytic system, the volume of which is kept at a constant level by the regulating valve. From here the liquor is pumped to constant level feed

tanks and from there to the cells. Electrolysis is carried on continuously in the cell compartments with the conversion of sodium chloride to sodium chlorate. During electrolysis the entire cell system is cooled by a circulating medium and pH is maintained by the addition of dilute hydrochloric acid. Liquor from the cells is conducted back to the sump tank for subsequent recirculation. The same centrifugal pump which moves the electrolyte through the cell system is also equipped with a constant measuring device which allows a portion of the liquor, equal to the volume being added, to be withdrawn from the system into a surge tank. Here the liquor stands for a time so that graphite, which has separated from the anodes as the natural result of electrolysis, has a chance to settle to the bottom of the tank and be drawn off from time to time. The supernatant chlorate liquor is filtered and retained in a storage tank until it is pumped to a crystallizer where by temperature reduction the sodium chlorate crystals are precipitated and withdrawn from the bottom. The crystal-and-liquor mass is run through a centrifugal extractor where the mother liquor is removed and sent back to the head of the process. Sodium chlorate crystals (99.5 percent pure on a dry basis) are washed to remove occluded mother liquor, dried centrifugally, and stored for use in the second step of the process which will be described.

Step Two—Production of sodium perchlorate is begun by dissolving sodium chlorate in water and allowing it to flow by gravity through a regulating valve to the perchlorate electrolytic system. The pumping, cooling and pump-out designs of this are identical with those of the chlorate system, except that a smaller volume of liquor is handled and the cell characteristics are different, as shown in the accompanying table. Concentrated

Operating Characteristics of Cells

	Chlorate Cells	Perchlorate Cells
Anode material	Graphite	Platinum
Anode current density, amp. per sq. ft.	30	250
Cathode material	Steel	Steel
Catl ode current density, amp. per sq. ft.	50	140
Volts per cell	3.0–3.5	5.5–6.0
Amp. per cell	2,500	2,500
Avg. current efficiency, %	75	90–92
Temperature, deg. C.	45	65
Electrolyte	NaCl	$NaClO_3$

sodium perchlorate from the cells must first be treated in a tank for removal of reagents used in processing. It is then ready for the third, and final, step.

Step Three—Production of potassium perchlorate is performed in a crystallizing tank. Filtered potassium chloride solution is added to the sodium perchlorate liquor, and potassium perchlorate crystals are precipitated from solution. These are removed from the crystallizer, centrifuged and washed. The mother liquor contains sodium chloride as a result of the metathetical reaction which produced potassium perchlorate. Concentration of the liquor in an evaporator causes the sodium chloride to settle out and permits it to be separated from the salt liquor slurry by a salt filter. This solid NaCl is returned to the beginning of the process as previously described. The washed potassium perchlorate is conveyed to a steam-heated continuous-conveyor dryer which produces a white granular product containing approximately 0.03 percent moisture. The dried product, either as is or in pulverized form, is packed for shipment in 100-lb. bags or steel drums.

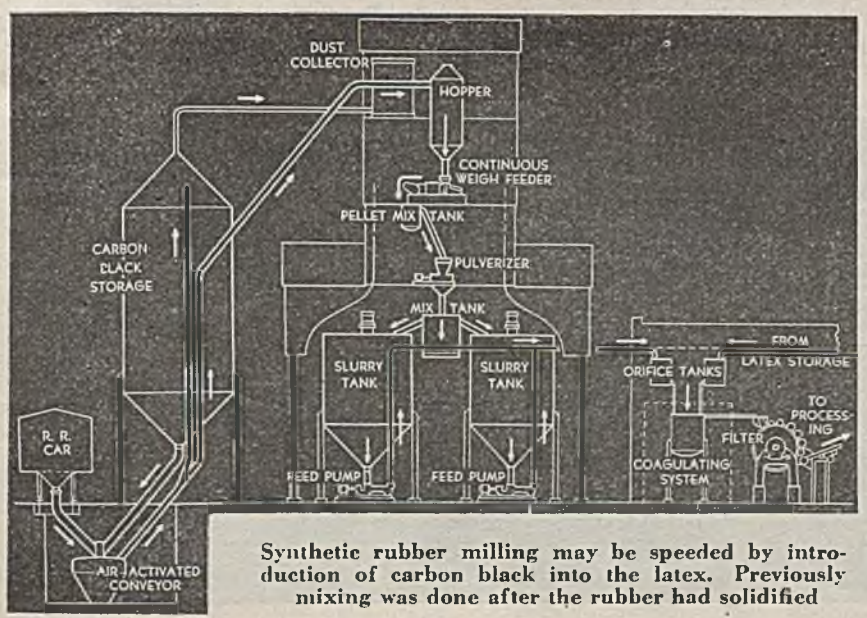
The development of these operations occurred over rather a short period of time when compared with most plant developments. Assistance by David H. Eason, chief chemist, and Ernest M. Kane, chemical engineer, aided in solving many of the difficult problems encountered. Credit is due them for their part in accomplishing successful production records. Success of operations in large part is due to Kenneth Walsh, president, for the vision and foresight required to initiate developments and the subsequent able management of the project's rapid growth.

Rubber Processing Time Cut

THE General Tire & Rubber Co. has developed a process which permits the addition of carbon black to the rubber latex in the manufacture of synthetic rubber. This is said to cut milling time by 35 percent, reduce power consumption by 20 percent, and result in a material reduction in production costs.

Just eight weeks' time were required for engineers of the Blaw-Knox Co. to design and have built this equipment and 70 ft. high building, making it possible to mix carbon black with liquid rubber thereby cutting the milling time for making synthetic rubber by one-third.

Carbon black is delivered by railroad car as shown at the left in the accompanying diagram. It is taken by the air-activated conveyor into the storage room and sent, as needed, on to the hopper, upper center. The arrows show the course of the carbon black until it is pumped into the main synthetic rubber plant for mixture with the latex before the rubber coagulates into a solid or plastic form. Previously the mixing was done after the rubber had solidified.



Synthetic rubber milling may be speeded by introduction of carbon black into the latex. Previously mixing was done after the rubber had solidified

The engineers received the data and information as to how the scientists had been able in a laboratory successfully to mix the carbon black with the liquid latex and began work on their blueprint job June 16. Less than ten days later in Baytown, Tex., a gang of men began excavating and preparing railroad sidings for the building. The blueprinting was completed by July 1, and on August 15 everything was ready. The first rubber was turned out the next day.

The discovery was made by Gilbert Swart, research director for General Tire, working in cooperation with Harold Pushee, chief chemist, and Robert Iredell, chief engineer. It is in commercial operation on a large-scale basis in Baytown, Tex., where the company operates a government-owned synthetic rubber plant. Other government-owned plants will probably have the necessary equipment installed to use the process.

Postwar Plans Intensify Interest at NATIONAL POWER SHOW

Compared with the Power Show of two years ago, the Show held in New York during the last week in November appeared to be less affected by the War, and more influenced by the postwar plans of engineers in the mechanical industries. As in the past *Chem. & Met.* has "covered the Show" from the chemical engineer's standpoint, bringing to light developments that are new since the 1942 Exposition. — *Editors*

DURING the week of November 27, coincident with the annual meeting of the American Society of Mechanical Engineers, the 16th National Exposition of Power and Mechanical Engineering was held at Madison Square Garden in New York. It was bigger than the 1942 Power Show, with approximately 15 percent more exhibitors and a high level of attendance. Interest obviously was spurred by problems of postwar reconversion which are expected by many to become pressing soon for most manufacturers.

Unfortunately, as in 1942, the exposition was considerably curtailed as compared with prewar expositions, owing to lack of space. Curtailment of equipment, however, was somewhat less in evidence, indicating probably that factory schedules were less severe than in 1942. As in earlier Power Shows, *Chem. & Met.'s* editors combed the booths for new developments likely to be of interest to chemical engineers. In the following, developments of this character which have been announced since the last Power Show in 1942 are briefly described.

FLUIDS HANDLING

Along with its variable capacity plunger type pump, the Aldrich Pump Co., Allentown, Pa., exhibited a new inverted, vertical, three-plunger type pump. The advantages of locating the crankshaft below instead of above the plungers are said to be: connection to the prime mover is simpler; the liquid end is more accessible; and easier inclosure of the power end for lubrication purposes can be accomplished. Inverted pumps are available for pressures up to 15,000 lb. per sq. in., in capacities up to 288 g.p.m.

The line of spring hangers for power and other piping manufactured by Blaw-Knox Co., Pittsburgh, Pa., has been extended considerably with the introduction of a rolling type hanger incorporating rollers in the support, to provide for either longitudinal or both longitudinal and lateral movement of the entire hanger with expansion and contraction changes in the piping. Two models employ a single set of rollers for longitudinal movement only, while two more are provided with a second set at right angles to the first, enabling movement to occur in any direction in a horizontal plane.

Chicago Metal Hose Co., Maywood, Ill., has added both larger and smaller sizes to its line of flexible, corrugated steel tubing, making it available in inside diameters of 5/16 to 6 in. The annular corrugations allow the tubing to be bent manually and give it its ability to tolerate vibration and thermal expansion.

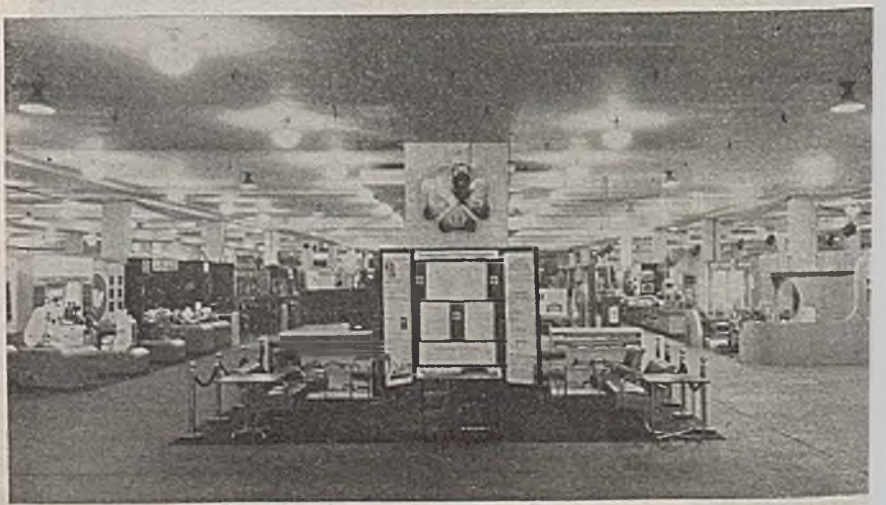
In the display of the J. S. Coffin Co., Englewood, N. J., was a new steam-turbine-driven centrifugal pump for 300 g.p.m. against 750 lb. per sq. in. The pump is obtainable with either external or built-in controls. A new pump control steam valve, with constant pressure regulator, was also shown. The control valve is used to throttle incoming steam in the event of some mishap to the fluid side of the pump, such as a ruptured discharge line, complete or partial loss of suction at the pump inlet, or a temporary lack of liquid which would cause excessive speed and possible scoring of wearing rings or packing.

An improvement in pump packing exhibited by the Darling Valve & Mfg. Co., Williamsport, Pa., is the Darcova Pumcup, a cup-type packing for piston pumps handling a wide variety of chemicals and other products. Two of the cups are used with a special piston, the two facing in opposite directions so as to be effective with both directions of piston movement.

Niagara Blower Co., New York City, had on display evaporative heat exchangers with the company's new "balanced wet-bulb" temperature control, claimed to control the temperature of process liquids or gases within an accuracy of 2 deg. F. An automatic modulating control action mixes fresh and recirculated air to achieve a constant balance of heat input and heat removal.

Among products shown by the Parker Appliance Co., Cleveland, Ohio, was a machine which will produce either a double or single flare or a hose bead at the end of aluminum or copper tubing quickly and automatically. The double flare is valuable when tubing made of soft metal is to be joined since the single flare frequently shears off under the pressure of the coupling nut. When a tube is inserted in the machine, hydraulic pressure is automatically applied to a die around the tube and the flare or bead is formed. Each machine has two sets of dies and all dies are interchangeable in the die-holding fixtures.

A new design of pump, being offered for license, was exhibited by Albert F. Pezzillo, Philadelphia, Pa. The pump is of the axial flow type and is built in



the center of the rotor of the driving motor, the motor itself being of the submerged type. The combined pump and motor unit closely resembles a standard electric motor except for the presence of inlet and outlet pipes along the axis of rotation.

Filters designed primarily for use in aircraft hydraulic systems were exhibited by Purolator Products, Inc., Newark, N. J. They were shown in capacities from ½ to 12 g.p.m., to remove particles as small as 3-5 microns. The filtering medium is paper impregnated with phenol-formaldehyde resin.

A new small air compressor, having a capacity of 50 cu. ft. of free air per minute and known as Model WD50, was exhibited by Schramm, Inc., West Chester, Pa. This unit is of the V type, employing forced air circulation for cooling the four cylinders. It has a direct-connected built-in motor although it may also be belt-driven if desired. Accessories include an air cleaner, unloader, pilot valve, oil and pressure gage.

New in the manufacture of screw pumps is the Sier-Bath Gear Co., North Bergen, N. J., which exhibited such a pump. The pump employs two rotating shafts, one driven from the other through intermeshing herringbone gears. Each shaft carries a right and left hand screw thread of square section and the two shafts are meshed and installed within a casing with inlet connections at the ends and a discharge in the middle. This construction permits the pumping of extremely viscous liquids and is balanced so as to eliminate end thrust. Capacities range from 5 to 500 gal. per minute and discharge pressures from 25 to 400 lb. per sq. in.

FURNACES AND REFRACTORIES

Improved operation of boilers and furnaces is claimed where a visual check can be kept at all times on firebox conditions through the use of the new Cat's-Eye manufactured by Ess Instrument Co., Fort Lee, N. J. This device is a peep-hole lens of bulls-eye type, permitting flame characteristics to be viewed from any point in the boiler room.

A modification noted in the stoker equipment exhibited by the Iron Fireman Mfg. Co., Cleveland, Ohio, was a new type of grate used with pneumatic spreader firing in which the grate sections are formed into alternate ribs and depressions so as to maintain a protective bed of ash on the grate after ash dumping. Air openings in the grates now discharge at an oblique angle through the grate surface for better distribution of air and to avoid blasting effect.

Johns-Manville Corp., New York City, has rounded out its line of insulating firebrick. This concern exhibited insulating units covering a wide temperature range. Four recent units are useful either for backing-up furnace refractories, or as an exposed furnace lining, except when subject to slag action or mechanical abuse. For exposed use, these units are suitable for temperatures to 1,600 deg. F., 2,000 deg. F., 2,300 deg. F. and 2,600 deg. F.

These newer insulating refractories come both in brick and block form.

At the Exposition was the first public showing of a unit steam generator made by the Preferred Utilities Manufacturing Corp., New York City. This is a self-contained, oil-fired, portable steam plant embodying in one compact unit all the equipment necessary to produce steam. The unit is claimed to operate on any grade of oil without smoke, and with an overall efficiency of well over 80 percent. No chimney is required, other than a vent to the outside air, draft being supplied by an induced draft fan. Fuel consumption averages about 30 gal. per hr. per 100 hp. Units are made in sizes ranging from 20 to 500 hp. for pressures up to 200 lb.

To take care of instances where boilers are installed with the expectation that they may later be equipped with water walls, to meet future increases in demand, Geo. P. Reintjes Co., Kansas City, Mo., developed and exhibited a new furnace wall refractory shape and method of support which permits the special shapes to be removed at the time the water walls are to be added, without tearing down the rest of the wall. Special refractories accommodating the pipes entering the furnace can then be substituted for the blocks removed.

INSTRUMENTS AND CONTROL

Its new Helicoid movement for pressure and vacuum gages was demonstrated by the Certified Gauge & Instrument Corp., Long Island City, N. Y. This device, which is employed instead of a rack and pinion for transmitting movement of the pressure spring to the indicating pointer, consists of a driving cam in contact with a helical-slotted roller on the pointer shaft. This movement is claimed to eliminate lost motion and wear, thereby retaining its accuracy better than conventional movements.

A new electronic recorder for temperature, temperature difference, strain, solution conductivity and moisture content of moving webs and sheets, was exhibited by the Foxboro Co., Foxboro, Mass. The measuring system consists of an alternating current bridge balanced by a variable balancing capacitor. Any unbalance of the bridge is communicated through an electronic voltage amplifier and balance control tube to a power amplifier operating a split-coil solenoid motor which, by the position of the armature in the split coil, resets the balancing capacitor. The position of the latter is communicated to the recording pen and recorded on the chart in terms of the measured variable. Moving parts are decidedly simple and the instrument is rapid in action, moving full scale in 3 seconds.

An oxygen analyzer used extensively by the Army and Navy air forces was shown by the Hays Corp., Michigan City, Ind. The analyzer is especially valuable in determining the purity of oxygen within the range of 98-100 percent. Variations within that range can be determined closely since the scale on the burette is approximately 6 in. long and measures only between those two percentages.

Industrial Instruments, Inc., Jersey City, N. J., featured application of its "Solu-Bridge" controller to the measurement and control of the purity of water processed in a cation-anion double exchanger unit. The instrument operates by measuring the conductivity of the effluent water. If the solids content of the water rises above desired purity the conductance goes up and the instrument automatically diverts the flow to waste, at the same time flashing a visual signal or ringing a warning bell.

Installations requiring extreme accuracy of liquid level and interface level control can be handled with the new Series 12,000 displacement type controller, it is claimed by the manufacturer, Mason-Neilan Regulator Co., Boston, Mass. This controller employs a displacer rather than a float and has a new type of pneumatic control mechanism eliminating pivot bearings so as to provide extreme sensitivity. It is provided with a throttling range adjustment from 0 to 100 percent and a calibrated specific gravity scale for adjustment from 0.5 to 1.2 or from 0.8 to 2.0 specific gravity. Various standard ranges from 14 in. to 15 ft. are available, meeting most requirements.

An integrated remote-control system for the treatment of boiler water, some of the principles of which can be extended to other industrial applications of propor-

tioning pumps, was exhibited by Proportioneers, Inc., Providence, R. I. In this system a separate line runs from one drum of each boiler to a centrally located testing bench which may be in the power supervisor's office or at some other location. At this point standard tests can be performed and remote control adjustments applied to the proportioning pumps which feed the chemicals for water treatment to the boilers. This remote control system is a newly developed electronic method for adjusting the quantity delivered by each pump within a fixed interval of time.

The Fred H. Schaub Engineering Co., Chicago, Ill., had on exhibit its standard Magnetrol liquid level controller, but with a Micro switch used in place of the usual mercury switch. With the Micro switch installed the gage will register accurately when it is tipped as much as 30 deg. off center.

Its newly designed Universal rotameter was demostrated by Schutte & Koerting Co., Philadelphia, Pa. The improved instrument is said to have greater versatility in chemical industry applications. End fittings can now be supplied in a number of corrosion-resistant materials, including Haveg, Karbate, hard rubber, hard lead, and porcelain. Rotameters are available with these fittings in sizes from ½ to 4 in.

Stow Manufacturing Co., Binghamton, N. Y., emphasized the strides that have been made during the War in the application of flexible shafts for the remote control of valves. Valve control gear of this type has been largely adopted by the Navy. Widespread industrial use in the postwar period seems likely for the operation of inaccessible valves since a flexible shaft can readily be carried around obstructions and can be employed in controlling valves up to 70 ft. away from the handwheel. Shafts up to 1¼ in. in diameter are being used for valves as large as those with 18-in. handwheels.

Uehling Instrument Co., Paterson, N. J., exhibited a number of new instruments for pressure and liquid level measurement. Among these were an improved inclined draft gage, an absolute pressure gage of the U-manometer type, and a liquid level gage of the hand-pump-operated pneumatic type. This last gage may, if desired, be equipped with an electrically operated high-low level alarm.

Extreme precision and versatility are incorporated in a new mercury manometer shown by Wallace & Tiernan Products, Inc., Belleville, N. J. The level of the mercury surface is read by a small, light float carrying an antiparallax reading surface which is viewed through a magnifying eye piece. Readings accurate to 0.1mm. of mercury are claimed possible. A dial calibrated in terms of ambient temperature is provided to correct for temperature changes of the mercury column. Temperature corrections are applied by changing the length of the entire scale which is made of a flexible plastic.

LUBRICATION

An improvement in automatic greasing methods known as the hydraulic system was introduced by the Lubricating Division of Blaw-Knox Co., Pittsburgh, Pa. The improvement lies in the measuring valve units, each one of which is capable of serving two outlets. Each unit is fed by two lubricant lines from the pump. Each has two slide valves reciprocated by alternate pressures in the two lubricant lines. A measuring piston controlled by an adjustable stop reciprocates under control of the slide valves, delivering a measured charge to each bearing outlet alternately.

Another improvement in lubricating systems was the introduction of a 25-lb. central pumping unit for either oil or grease, shown by the Farval Corp., Cleveland, Ohio. The new unit is similar in principle to the company's larger motor driven pumps although it incorporates several changes in design. The pump, operation of which is controlled by a timer, features a double-plunger construction completely eliminating springs and check valves which are said to be a constant source of trouble in pumping greases. One plunger serves as a slide valve, the other as the pumping element proper.

Further development in its centralized lubrication sytem for the distribution of oil or grease to bearings of machinery was evident in equipment exhibited by Trabon Engineering Corp., Cleveland, Ohio. A new system, designated as Type M, requires that only one lubricant line be run from the pump to each assembly of distributing valves. Each assembly consists of an inlet block and an end block between which are three or more intermediate sections. The latter each provide lubricant to two bearings. Pistons in the intermediate sections are actuated back and forth in a cylinder by the pressure of the incoming lubricant, the design being such that when the system is under lubricant pressure, each outlet discharges in turn until a cycle is completed, after which the cycle is repeated.

A new oil purifier known as Type M was exhibited by Honan-Crane Corp., Lebanon, Ind. The new unit is built in various sizes having from 1 to 38 purifying cartridges per unit, designed for the purification of fuel and lubricating oils. Filter cartridges are cloth-wrapped and consist of a layer of specially processed fullers earth, surrounding a felt-covered screen tube at the center for discharge. The purifying agent is said to remove all types of contamination.

The Dixon Crucible Co., Jersey City, N. J., was on hand with several new uses for graphite. One made use of a small hand bulb which, when squeezed, sprays a dust of finely divided graphite into the part to be lubricated. Another is a bright aluminum-graphite paint for use where a lustrous finish as well as heat resistance are desired.

MATERIALS HANDLING

A new ½-ton electric hoist manufactured by American Engineering Co., Philadelphia, Pa., was exhibited by George C. Lever Co., New York City. Except for size, the new hoist is said to be comparable to the larger members of this manufacturer's line. Gearing is of the heavy-duty spur type. An electric brake is built integral with the motor. An American Standard I-beam 5 to 12 in. deep, with a flange not over 5 in. wide, can be accommodated by the trolley.

As an intermediate materials handling unit, between hand trucks and power-operated trucks, Automatic Transportation Co., Chicago, Ill., exhibited two new Transporters, one for the handling of pallets, the other for skids and similar load carrying units. Both units are elevated by a foot-operated hydraulic lift but are transported by a motor-driven front wheel. The units are generally similar in appearance to a conventional hand truck and are similarly guided. Capacities range upward to 4,000 lb. for the pallet type and 6,000 lb. for the platform type.

Another combination hand and electric lift truck was featured at the booth of Barrett-Cravens Co., Chicago, Ill. Again, the truck outwardly resembles a hand truck but motive power is furnished by two compound-wound electric motors, one for each rear wheel. The unit was designed to transport skid loads in confined areas. Brakes are applied automatically when the tow handle is moved either up or down, thus facilitating the operation of the truck up and down ramps.

Recent improvements in the design of

its barrel lift were exhibited by the Falstrom Co., Passaic, N. J. This device handles standard 55 gal. steel drums, both in transporting and in tilting. It is first wheeled to the drum, which is then attached to a cradle by means of a chain. A lever handle, which later serves to push the unit, raises the drum to carrying position. At its destination the drum is readily tilted before emptying and is securely held at all points of the operation.

Differing from power-operated high-lift trucks only in the fact that it is small, lightweight and manually operated, is a new hydraulic high-lift truck exhibited by Lyon-Raymond Corp., Greene, N. Y. The device is similar to hydraulic hand trucks except that its elevating platform can be raised as high as 48 in. by a hand-operated pump. Construction is of electrically welded tubular steel, with a lift capacity of 1,000 lb.

Another first-time showing was held by the Service Caster & Truck Division of Domestic Industries, Inc., Albion, Mich. That company is now producing a series of fork lift trucks which will carry up to 6,000 lb. and lift loads as high as 108 in. The truck is powered by a four-cylinder Ford tractor engine. The lift mechanism is so constructed that the operator has complete visibility of the load. Service has also added a simply-constructed skid spotter to its line of materials handling equipment.

For the transportation, elevation and emptying of acid carboys the Revolvator Co., North Bergen, N. J., introduced a new hand-operated carboy elevator mounted on wheels for transportation. The machine first straddles the carboy which is then clamped to its projecting arms. The elevator is then operated by a crank and the carboy is tilted after moving to the desired location over a tank, by means of a worm and gear which holds the carboy definitely in any position.

POWER TRANSMISSION

An improvement in power transmission equipment, the American Speed-Jack drive, was shown by American Pulley Co., Philadelphia, Pa. This device is of the double V-belt type. A double cone pulley with a movable central portion common to the two pulleys is mounted on a jack-shaft. The motor belt engages one cone pulley while the belt to the driven load engages the other. Moving the jack shaft causes a change in center distances, automatically moving the common element of the double pulley so as to increase the driving diameter of one pulley while reducing the driving diameter of the other by the same amount.

Baldwin Belting, Inc., New York City, for the first time exhibited the double-U leather packing for hydraulic plungers manufactured by Wayne Davies & Co., Worcester, Mass. This packing employs a double thickness of leather, usually one ply of chrome and one of oak-tanned leather, forming a U-shaped channel within which is a phosphor bronze spring spacer carried on a white oak hoop. The fingers of the spring maintain a light pressure in both directions within the packing channel near its lip, to maintain a primary seal until the lips are set by the operating pressure.

Indicative of a recent trend in speed reducers is the new Speedaire fan-cooled, worm-gear reduction unit exhibited by the Cleveland Worm & Gear Co., Cleveland, Ohio. Through the incorporation of a built-in fan cooling system, the capacity of a unit of given size is materially increased, thus enabling a smaller and less expensive unit to be applied for the transmission of a given quantity of power.

Model 800 DC is the designation of a new instant-reversing model of selective speed transmission exhibited by Drive-All Mfg. Co., Detroit, Mich. This change-gear device contains a double clutch of heavy multiple disk type for reversing, and speed-changing gears up to a 2 to 1 ratio. Various arrangements may be secured. For example, the speed in one direction may be low and in the opposite direction high; or the speed in both directions may be the same; or two different speeds may be secured in the same direction.

VARIABLE DRIVES

A variable speed drive which can be attached to any standard variable speed transmission unit has been developed by the Ohio Gear Co., Cleveland, Ohio. The heart of the unit is a double set of differential gears which carry the load from the reducing transmission unit to the output shaft. Using an 1800-r.p.m. squirrel-cage motor as a source of power, output speed can be obtained from 0 to 800 r.p.m. in one direction, or from 400 through zero to 400 r.p.m. reverse. Torque remains constant throughout the entire speed range.

The Reeves Pulley Co. of New York, New York City, exhibited several new developments in variable-speed power transmission equipment and accessories. One was a variable speed transmission provided with a built-in speed reducer driven from the output shaft of the variable unit for further ratios up to and including 6.9 to 1. Another new development, the Reeves Vari-speed, Jr., consists of a special variable diameter cone-disk motor pulley driving a standard V-belt which in turn drives a standard V-sheave. The motor pulley cones automatically move apart or together, varying the driving diameter, as the center distance of motor shaft and driven shaft is varied.

Prominent at the booth of Vickers, Inc., Detroit, Mich., was a hydraulic transmission system in which the prime mover drives a variable-delivery piston-type oil pump and the hydraulic fluid in turn drives an oil motor. A small electric motor built into the oil pump permits remote control of the pump output and thus controls the output speed of the oil motor. Large models of the transmission system will handle up to 550 hp. at 95 percent efficiency. The oil pump and motor are of standard Vickers plunger type; but by assembling the whole in one transmission unit the company has made an innovation.

MISCELLANEOUS

An interesting new type of bushing intended to take the place of conventional solid threaded bushings for use in bolted connections to light metals and alloys was exhibited by Aircraft Screw Products Co., Long Island City, N. Y. Developed for use in aluminum alloy cylinder heads, to provide a wear-resisting thread, the device would appear to have other applications where such metals and plastics are used. The bushing consists of a coil of diamond-shaped wire which is screwed into threads tapped in the light metal. Once in place this Heli-Coil insert provides hard, smooth threads for a bolted connection or spark plug, but if the threads should wear, the coil can be removed and a new one installed.

Electric Arc, Inc., Newark, N. J., exhibited the Smith-Dolan induction heating process for preheating of parts to be welded. The equipment used consists of a special transformer with automatic control, and a coil of large diameter wire which surrounds or is placed contiguous to the work. A powerful electric field is created in the vicinity of the coil and when metal to be heated is placed within the influence of the field, the temperature of the entire mass is quickly raised to the desired value.

Fairbanks, Morse & Co., Chicago, Ill., had on display a new protected polyphase squirrel-cage motor which is completely symmetrical from one end of the shaft to the other. Two fans, one on each end, circulate air across the motor in both directions. The motor is completely inclosed, except for small air vents at each end and may be mounted on a horizontal or vertical surface, or upside down. Motors of this type may be obtained in any size from ½ to 600 hp.

A complete new line of thermostatic steam traps was exhibited by the Sarco Co., New York City. By employing much larger bellows of the heavy wall, helically corrugated type, size-for-size capacities have been doubled. This greatly enlarges the field for this simple trap, which operates on all pressures from 0 to 220 lb. per sq. in., without seat change. The new traps also are said to have exceptionally large air-venting capacity.

Its new Sterling Viking diesel engine was exhibited by Sterling Engine Co., Buffalo, N. Y. This company has built gasoline engines for an extended period, but this is the first diesel it has manufactured. The installing dimensions are the same as that of the company's gasoline engines while the weight of the new diesel is slightly less than that of a comparable gasoline engine of the same power output.

The Wright-Austin Co., of Detroit, Mich., has developed two new items for its line of steam power plant accessories. A Plexiglas gage-glass protector was shown, used instead of the conventional wire glass protector. A new high-pressure water gage, capable of withstanding 700-750 lb. per sq. in. pressure, consists of two 2.5-in. glass plates lined with mica to avoid erosion, and separated by two stainless steel spacers.

FROM THE VIEWPOINT OF THE EDITORS—

UNCLE SAM, MANUFACTURER

Some socialistically minded members of Congress now have the support of the National Farmers Union in their desire to extend the fertilizer manufacturing business of the government. James G. Patton, president of the Union, has come out vigorously in support of additional establishments of the TVA type. He is backing the bill of Senator Lister Hill which would put the government in business for the production and distribution of potash, sulphuric acid, phosphate and fertilizer—all for the benefit of farmers and without private profit to industry.

The probable financial difficulties that will arise as the result of further entry of the government into the fertilizer business are quite evident to anyone who has studied this industry. Unfortunately, however, the agitators for governmental operation have developed some rather persuasive (although specious) arguments in which they compare the cost of fertilizer chemicals at the point of production with the price paid for fertilizer by the farmers. They find that the fertilizer delivered to the farm costs several times as much as the cost of the major ingredients. Thus they claim that the government should go into the business to save this mark-up.

Perhaps the only way to answer this criticism is to publicize those actual costs which enter between rock mine, ammonia plant, and the potash works on the one hand and the farmers' truck into which the bagged fertilizer is placed, on the other. Too little attention is given to the presentation of the many services necessary to bridge that gap. Perhaps the fertilizer industry will have to carry out an educational program, comparable to that which has been done in the newspapers by the baking and dairy industries. Coincidentally, continued study must be made to reduce wherever possible the costs of distribution, even if it means completely upsetting the normal channels of trade. Both the fertilizer industry and the farmers would be benefited by such studies.

FOR CONTROLLING CARTELS

Senator Kilgore's Committee and its friends in the Department of Justice would have us believe that cartels were sinister devices supported and fostered chiefly by German industrialists to assist Nazis to militarize their country and the world at large. But as Sir Clive L. Baillieu, British delegate to the recent International Business Conference at Rye, N. Y., pointed out, cartels are neither all black nor all white in their business and governmental relations.

Surprisingly enough, the International Conference went on record as approving the use of cartels in world trade. It recommended immediate inter-government study, in association with business interests, of all agreements which regulate production, marketing, prices, and patent exchanges, with the expected result of an international reconciliation of views and the establishment of rules and standards to govern such agreements in international trade. A somewhat similar solution to the problems of cartels is offered by Milo Perkins, former director of the Board of Economic Welfare, in the current issue of *Harper's*. He suggests passage of legislation requiring registration of all cartel arrangements, and calls for the establishment of a Board of International Trade to determine the validity of such registrations and to pass on all international commodity agreements.

Cartels have been so firmly entrenched in international trade that their elimination in many instances would mean completely upsetting the economic balance of the world. Therefore, it would be simpler to eradicate secret price agreements and other abuses that have given them a bad name. Surely this could be accomplished by an international organization whose responsibility it would be to supervise and regulate all such trade agreements.

RECOVER OR ELSE

Alcohol producers have learned during the war period the great economic advantage of better protein byproduct recovery. During the past year many millions of dollars have been authorized by WPB in new construction for this byproduct phase of both beverage and industrial-alcohol establishments.

The maintenance and operation of these facilities contributes economic advantages to the public as well as byproduct profits to the distiller. The time will come again when these considerations may determine whether a distiller can stay in business or not. Development of improved byproduct recovery in a form that the feed industry wants has become a permanent and important part of this business. And most distillers will find, if they try, that they can achieve still better recovery, or still lower costs of recovery. The industry must continue to strive for these important objectives if it is to survive postwar competition.

WE WELCOME COMPETITION

Some time ago we expressed our indebtedness to a certain advertising department that added the word "imagineering" to our editorial vocabulary. The same company is also deserving of commendation for a thoughtful series of statements on inter-industry and inter-material competition as it affects the future of aluminum. Coming closer to home, the most recent of these advertisements begins with the interesting sentence, "We welcome competition in the aluminum industry."

Some have said that this is but a gesture. We do not

think so. We not only believe the statement but maintain that there is good sense back of the principle which it sets forth.

During years of struggle to develop the aluminum industry, Alcoa has been aggressive and progressive for new technology. As it has achieved success there has always been the danger that its strong position in its industry might lead to complacency and lack of vigor. Fortunately this has not been the case.

Many other big companies have found that one of the most successful means for stimulating their own departments of research, development, and sales is to have vigorous competition. Then these division heads know that they must always be doing a bit better than the month before or the year before or they will slip back in relation to their competition. This is a wholesome stimulant. It is the basis of much of America's industrial progress.

MR. SECRETARY FORGETS

SECRETARY of Agriculture, Claude R. Wickard, undertook to tell a farm and industry conference in Texas how the related interests of agriculture and industry should be aided for the postwar period. The objective of bettering both and providing many jobs is commendable. But the Secretary forgot the one real way to make progress.

For about twenty-five years many of us have been campaigning for more extensive industrial use of the products of American agriculture. Long before the name "chemurgy" was coined, we urged these principles. We still do.

We wish that the Secretary and his advisors in economics would understand this matter better. Their efforts will be productive in the long run only when they find ways to grow farm products cheaply enough that they can be processed more extensively, especially for nonfood uses. Only so can we pay the farmers of America the higher income which they deserve without artificial subsidies and added paternalism for the incompetents. We are sorry that the Secretary does not oftener recognize this fact and campaign for it.

LET'S USE THE RIGHT NAMES

LATELY there has been much confusion in the use of the terms technologist and technician. Professional men themselves should both use the right terms and also try to get others to do so. There is a simple way to explain this relationship.

A technologist is an engineer, scientist, or other person who is professionally trained and knows how to apply science or to practice some technical art with full professional skill. Such a person ordinarily is a college graduate with actual experience in his profession.

A technician, as the dictionary says, is "one skilled in a technique." Such a person may have gained his skill at a technical institute or in the earlier years of a college or university course, or he may obtain it by actual practice and experience. Such a person is seldom fully trained professionally. He is an assistant or aid to the professional worker.

The doctor has technicians in his office, laboratory and hospital to help with details. The engineer uses the technician as a detailer, analyst, a sampler, or an operative of special skill. The scientist has the aid of technicians in many ways to do his testing and carry out his "techniques" for him. But the results obtained by the technician come to the professional man for interpretation, which may mean diagnosis or prescription from the doctor or application in industry or science. The technician knows how but not always why.

These distinctions are important just now because Uncle Sam is embarking on the training of hundreds of thousands of veterans as they return to civil life. Some of these young men and women will get full college professional training and thus some of them will become technologists. Far more will go to the technical institutes and become skilled technicians of value to society, and worthy of good compensation as specialists.

Finally, we should note that these technicians are not artisans. They are not mere doers of work in the skilled crafts. One cannot say whether a technician or an artisan is of higher rank. There is no need to make a distinction of that sort. The important thing is to know the difference and to use the terms correctly.

If you bind the annual volumes of *Chem. & Met.* or have other need for the Editorial Index for the current year, please address a postcard immediately to Index Editor, *Chem. & Met.*, 330 W. 42nd St., New York 18, N. Y.

HOBBLES ON ALASKA

INTERIOR DEPARTMENT executives are again seeking Government control of mining, forestry and certain process industries. This time Alaska is the victim.

The effort is to put a great part of that territory under the control of the Department by claiming that it belongs to the Indians. We do not know how much the natives really deserve in territory ownership, but we do know that they are not likely to benefit by the absurdly restrictive plans of the Interior executives whose prime objective is obviously the getting of more power.

SAFETY EDUCATION NEEDED

NO JOB of a chemical engineering executive is more important than taking care of the safety of his employees. All will recognize, therefore, the importance of specific collegiate training in safety for the young engineer. Hence all will welcome the effort of the Division of Labor Standards in Washington to give some aid to colleges in preparing a suitable part of their engineering curricula to include this kind of training.

Fortunately, those guiding this project are practical engineers. They do not assume that any man should be trained solely in safety. They realize that he must first be a good engineer before the safety training can do him a great deal of good. And they recognize that only a very small percentage of engineering graduates will ever specialize in safety work.

Industrial executives can help in this program to the benefit of their own companies and the profession. They can assist the faculties in chemical engineering departments with material needed for useful safety training. They can encourage the young men whom they hire to give conscientious thought to safety considerations as well as efficiency matters. As a matter of fact, no unsafe procedure or method is an efficient one.

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 isue 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 writing 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.

NOVEMBER WINNER!

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

F. R. WARD
Chemical Engineer
Knoxville, Tenn.

For an article dealing with a new means for interface level control in extraction columns, which has been adjudged the winner of our November contest. This article will appear in our January issue. Watch for it!

October Contest Prize Winner

SIGHT GLASS DESIGN ELIMINATES BREAKAGE BY IMPROVED METHOD OF SEALING

W. F. CALDWELL
American Cyanamid Co.
New York, N. Y.

SIGHT GLASS breakage is due primarily to the high gasket pressure required to make a perfect seal, and the design illustrated eliminates this difficulty completely. While it is more costly than the usual closure, it is fully justified by the savings in breakage and production interruptions.

Modifications in design may well be necessitated by variations in pressure and size to meet special requirements, but if the general principles remain unaltered, satisfactory results are certain. As a matter of fact, the sight glass shown has had long use on anhydrous liquid ammonia at pressures to 300 lb. without failure or breakage.

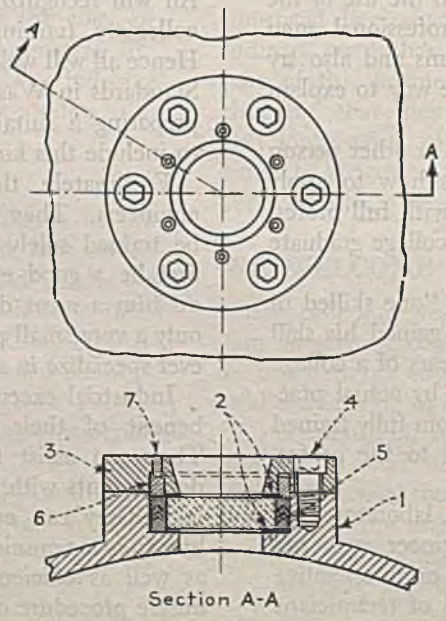
Boss (1) on the vessel is recessed to a depth equivalent to the glass thickness plus the two cushion gaskets (2) which should be about $\frac{1}{32}$ in. thick. These gaskets serve merely to provide a cushion and slight additional clearance is not objectionable, since no pressure should be exerted on them when the retainer (3) is drawn down firmly on the boss (1) by retainer screws (4).

The annular packing space (5) around the glass should be $\frac{1}{4}$ in. wide or larger, depending on the sight glass diameter, and packed with V-type packing, Garlock Chevron or other similar ones on the market. The V is in inverted position when retaining pressure in the vessel, but is reversed for vacuum.

The annular space is packed first with the bottom adapter ring, then V-rings and finally, the top adapter ring should extend slightly above the boss (1). The sight glass retainer ring (3) containing the packing adjuster ring (6) is then drawn firmly down by retainer screws (4) and finally, the packing adjuster ring (6) is forced down by the adjuster ring screws (7) until the edges of the V-packing make contact with the glass and annular packing space wall so that when pressure is applied internally, the edges are forced tighter against the glass and wall, thus making a perfect seal.

This type of sight glass has the advantages that no pressure is exerted on the glass except that due to internal pressure in the vessel, and since the packing is not compressed, there is ample freedom of movement for expansion and contraction due to heat changes.

This design for a sight glass eliminates gasket pressure



CALCULATION OF LOGARITHMIC MEAN OF TWO NUMBERS

M. T. SANDERS
Atlas Powder Co.
Wilmington, Del.

OCCASIONALLY one is faced with the problem of wholesale calculation of "logarithmic means." In one such instance the writer constructed a table of factors which enable the calculations to be done by means of the "C" and "D" scales of a slide rule.

The logarithmic mean C_m of two numbers C_1 and C_2 is defined as

$$C_m = \frac{C_1 - C_2}{\ln (C_1/C_2)}$$

This equation is transformed to $C_m = C_2(a-1)/\ln a$, where $a = C_1/C_2$.

The table shows values of the expression $(a-1)/\ln a$ (called "factor") for values of a between 1.00 and 3.98 in steps of 0.02 and for values of a between 4.00 and 6.80 in steps of 0.05.

The method of calculating the logarithmic mean of two numbers C_1 and C_2 on the slide rule is as follows:

C / D	Set index over C_2	read a over C_1	under factor read C_m

For example, if $C_1 = 45.2$ and $C_2 = 20$, set the index of the slide rule "C" scale

Values of Factor $(a-1)/\ln a$

a	0	2	4	6	8
1.0	1.000	1.010	1.020	1.029	1.039
1.1	1.049	1.059	1.068	1.078	1.087
1.2	1.097	1.106	1.115	1.125	1.134
1.3	1.143	1.152	1.161	1.171	1.180
1.4	1.189	1.198	1.206	1.215	1.224
1.5	1.233	1.242	1.250	1.259	1.268
1.6	1.276	1.285	1.293	1.302	1.310
1.7	1.319	1.327	1.336	1.344	1.352
1.8	1.361	1.369	1.377	1.386	1.394
1.9	1.402	1.410	1.418	1.426	1.434
2.0	1.442	1.450	1.458	1.466	1.474
2.1	1.482	1.490	1.498	1.506	1.514
2.2	1.522	1.530	1.537	1.545	1.553
2.3	1.561	1.568	1.576	1.584	1.591
2.4	1.599	1.607	1.614	1.622	1.629
2.5	1.637	1.644	1.652	1.659	1.667
2.6	1.674	1.682	1.689	1.696	1.704
2.7	1.711	1.719	1.726	1.733	1.741
2.8	1.748	1.755	1.762	1.770	1.777
2.9	1.784	1.791	1.799	1.806	1.813
3.0	1.820	1.827	1.835	1.842	1.849
3.1	1.856	1.863	1.870	1.877	1.884
3.2	1.891	1.898	1.905	1.912	1.919
3.3	1.926	1.933	1.940	1.947	1.954
3.4	1.961	1.968	1.975	1.981	1.988
3.5	1.995	2.002	2.009	2.016	2.023
3.6	2.029	2.036	2.043	2.050	2.057
3.7	2.063	2.070	2.077	2.084	2.090
3.8	2.097	2.104	2.110	2.117	2.124
3.9	2.131	2.137	2.144	2.150	2.157

a		a		a	
4.00	2.164	5.00	2.485	6.00	2.790
4.05	2.180	5.05	2.500	6.05	2.805
4.10	2.197	5.10	2.516	6.10	2.820
4.15	2.213	5.15	2.532	6.15	2.835
4.20	2.229	5.20	2.547	6.20	2.850
4.25	2.246	5.25	2.563	6.25	2.864
4.30	2.262	5.30	2.578	6.30	2.879
4.35	2.278	5.35	2.593	6.35	2.884
4.40	2.294	5.40	2.609	6.40	2.909
4.45	2.310	5.45	2.624	6.45	2.923
4.50	2.327	5.50	2.639	6.50	2.938
4.55	2.343	5.55	2.654	6.55	2.952
4.60	2.359	5.60	2.670	6.60	2.967
4.65	2.375	5.65	2.685	6.65	2.982
4.70	2.390	5.70	2.700	6.70	2.996
4.75	2.406	5.75	2.715	6.75	3.011
4.80	2.422	5.80	2.730	6.80	3.025
4.85	2.438	5.85	2.745		
4.90	2.454	5.90	2.760		
4.95	2.469	5.95	2.775		

$$C_m = \frac{C_1 - C_2}{\ln(C_1/C_2)} = C_2 \frac{(a-1)}{\ln a} \quad \text{where } a = \frac{C_1}{C_2}$$

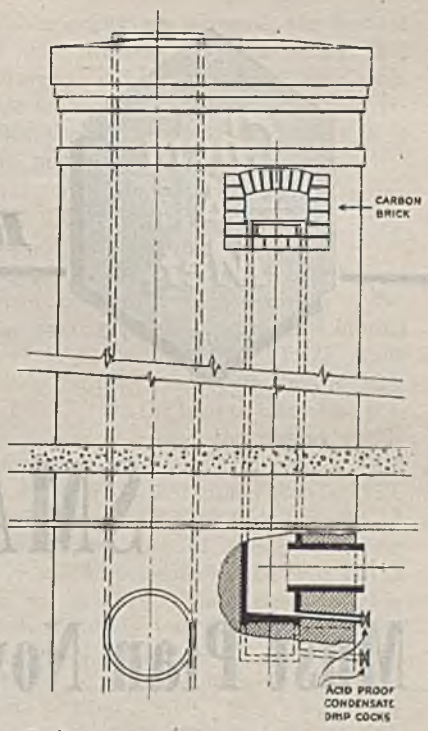
opposite 20 on the "D" scale; opposite 45.2 on the "D" scale read $a = 2.26$ on the "C" scale. The table shows that 1.545 is the factor corresponding to $a = 2.26$.

With the "C" scale index still opposite 20 on the "D" scale, set the runner to 1.545 on the "C" scale. The corresponding number of the "D" scale is 30.9 which is the logarithmic mean of 20 and 45.2.

CARBON FLUE DISPERSAL AND CONTROL OF CORROSIVE GASES

A UNIQUE application of carbon for controlling corrosive and explosive gases has been developed and installed in the new laboratory building of St. Lawrence Alloys and Metals, Ltd., at Beauharnois, Que. Construction of the new laboratory required that gases from furnaces and testing tables in the basement be dissipated through a brick chimney running up through the center of the building. Due to the corrosive action of the gases on the chimney brick, it was felt that periodic and expensive repair jobs would be required if the gases were exhausted directly through a chimney of the customary brick design.

Two 8-in. i.d. flues of corrosion resistant carbon pipe were built into the chimney to carry gases and protect the brickwork. Two flues were constructed to keep separate those gases that might produce an explosion if permitted to mix. Metal hoods over the testing tables and furnaces and connected to the horizontal carbon tubes carried ammonia, hydrochloric acid, ether, and ethyl acetate gases into the No. 1 flue. Hydrofluoric, sulphuric, nitric, perchloric acid gases and chlorine fumes were directed into the No. 2 flue.



Carbon vent pipes avoid corrosion in chimney for corrosive gases

The gases are exhausted through the flues by mechanical means. To minimize condensation, or a liquid backdrip of acid solutions, roofed chambers with side outlets were built of carbon brick. The bottom of each flue consists of a slanted carbon disk covered with a built-up layer of carbon cement. Should there be condensation and the formation of acid solutions in the bottom of the flues, the solutions will flow out through a small carbon pipe spillway located directly under the inlet section, when the carbon dripcock is opened.

Loading stringers on to two post type anodizing racks in the plant of Glenn L. Martin Co., Baltimore, Md.

ADJUSTABLE racks designed by employees in the finishing and plating department have almost halved the time required to load work for anodizing at the Glenn L. Martin Co. There are two basic types of rack: one has an aluminum alloy center post with a frame at the bottom on which parts can be stacked around the center post in the manner of a log cabin, with a pressure plate at the top to hold the racked work in place; the other type of rack has two posts with a fixed channel section separating them at the bottom, and a movable section above.

Simple and durable, providing a sure and positive electrical contact, the new racks have an almost indefinite life, with only the bottom frame having to be cleaned after use.

SOURCE OF COLD WATER IN SMALL QUANTITIES

R. N. JOHNSON
Smith, Kline & French Laboratories
Philadelphia, Pa.

OFTEN in semi-plant and laboratory operations a small supply of cold water is needed, and melting ice does not conveniently satisfy such a need. Convenience and efficiency are often set aside due to an unjustifiable expenditure of both time and money.

Where the tap water is sufficiently good to be used directly or where cooling effect alone is desired, it has been found that by merely tapping in on the reservoir of the conventional electrically operated water cooler, cold water for many purposes is at hand. Where justified, such water may be piped to the desired location. Insulation of such a line is recommended.

Since compressor and reservoir tank sizes in water coolers vary, the potential supply of cold water depends on the capacity of the particular unit available.

REPORT ON.....

SMALL INDUSTRY

Must Plan Now to Survive Postwar Changes

MAJOR A. GREGG NOBLE *Chemical Warfare Service, Washington, D. C.*

The small plant, contend many economists, is the backbone of any industrial democracy. Indeed, a goodly portion of the chemical process industry is composed of these "little fellows" who are contributing so much toward our victories in this war and who hope to contribute much toward a state of healthy employment after the war. But what will actually happen to our small industries in the first years of peace? There is no union to protect, plea or plan for them, to guarantee a minimum "livable" business. Can small industry actually survive the first tidal wave of change and readjustment that will come with peace, the keen technological competition that will follow? Yes, answers Major A. Gregg Noble of the Chemical Warfare Service who, at the request of the editors, here states the basic logic behind his firm belief in the future of small industry.

Economists differ in their estimates of the nature of our postwar panorama: depressions, the abundant life, or a mixture of both. Ample arguments are offered for both sides of the picture, but the optimistic viewpoint prevails even though quantitative statistical evidence exists against it. This viewpoint prevails at least to the extent that the present trend in government is beginning to turn—the trend that has produced confiscatory tax rates, a confused financial policy, overregulation of business and the inefficiencies resulting from poor administration and bureaucratic controls.

Every chemical industry, no matter how small, is a business and every businessman is an entrepreneur. Since the entrepreneur is one who risks his capital for profit on the prediction of the future of business, by the very definition of his profession, the small industrialist can have but one long-range outlook as to future governmental policies. Anything less favorable than a practical "down to earth" approach is not desired by business at large nor by the individual in particular.

The small industry has inherent advantages over the larger industry, while it also has inherent disadvantages. One of the latter is the absence of experts or specialists in each phase of a coördinated well-rounded enterprise, experts who can be called in for consultation and problem study. It therefore becomes the executive head of the small manufacturing establishment to give consideration to the future problems of growth which inevitably arise when the small industry attempts to become a big industry. These problems can be later delegated for detailed execution, but certainly the unsettled turbulence which is to be expected in the postwar world necessitates primary decisions as to policy now.

It is of utmost importance that studies be made of each plant, process or corporation to determine in what aspects the particular industry and its environments will differ in the postwar and transition period from those that were in effect during the war. Proper prospective of these factors may modify the postwar prospects of the individual industry with respect to the future. For example, how many industries will be trapped by a lulled sense of manufacturing security? A false security, which of necessity is a product of wartime economy, may insidiously engulf a manufacturer before he is alerted to the necessity of making satisfactory adjustments. No prior earnings or financial statements can forecast such difficulties. In a total war, competition in the sense of free enterprise is modified to an extreme degree.

Competition, the vitamin necessary for strong and vigorous growth, has been disregarded and laid aside in order to expedite the production of wartime material. That job has been accomplished and accomplished well. Industry took unto itself

a herculean task. It has tackled all types of processes—processes which heretofore were altogether out of its particular field of endeavor. The soap manufacturer has built and operated ordnance plants, the rubber manufacturer, airplanes; the list can continue from ships to tanks and from guns to drugs. Even the road builder has constructed intricate chemical units.

But the small producer can ill afford to become complacent on hearing the list of accomplishments of which he is already proudly aware. Those accomplishments were produced by and large when costs were a secondary consideration, when production was effectively on a cost-plus basis; where in many instances raw materials and component assemblies were expedited and furnished by the government or prime contractor; where marketing consisted of product responsibility which ended at the siding; where labor movement (and wages to a lesser extent) was restricted; where financing required only phenomenal patience to endure the necessary governmental forms and where expert assistance in the way of engineers, fire protection, free patent license and personnel instruction was available for the asking.

POSTWAR PRUNING

In the postwar era it will be necessary to prune back the growth promoted under these artificial stimuli. The plant must be sufficiently vigorous to withstand the climactic rigor of competition and business for a profit. This, then, is an attempt to present for the consideration of the small industry some of the problems which sooner or later will arise. Let it be said now that there are no new principles or profound formulas contained here for the successful operation of any enterprise. Instead it is but one man's view, primarily from an engineering standpoint, of some of the more pertinent problems which should be given consideration prior to extensive commitments on postwar production. It is, in essence, a bird's-eye check of the factors by which a management and engineering executive can evaluate the performance of his organization in the past four or five years. Such evaluation will point the way to future corrections and trends.

It is pertinent that the small industry give consideration to first things first. There is no intangible asset as priceless to any corporation, be it small or large, as an efficient and strong organization sparked by competent executives at the top. Executives must keep strong personalities working together, united in loyalty to company policies. The breach of diversion of this accomplishment is a measure of the inefficiency of the management's personnel relationships. There are few companies where retrospect of such a nature might not indicate improvement.

One of the best means of visualizing how an organization functions is through an organization chart which provides a means of indicating the flow of authority, the limits of responsibility, and the function of each group and sub-group therein. If the functions, authority, responsibility and inter-relationships of each principal executive down to the foreman are so vague that they do not lend themselves to quick notation and analysis by the responsible individual, then the amount of further confusion will be directly proportional to the distance from the top.

The complexity of organization in the large industry can be very great, in the small industry relatively simple. Functionally, however, they perform the same duties since products will be manufactured, sold and financed regardless of size. As the one-man organization increases in size, that size is limited to the capacity for work by the "one man" unless some of those responsibilities are delegated to subordinates. Fundamental as it is, nonetheless, one of the rules of management most often broken is that no responsibility should be delegated without clear, definitive lines of co-equal authority.

Nothing inhibits initiative so quickly or destroys morale so insidiously in an organization as does a breach of the above commandment. Frequent inspection for the observance of this principle should extend from top executive to foreman.

Another principle, more often observed in the breach than in fulfillment, is the tendency for extension of supervisory powers from an executive to an excessive number of subordinates. Such an extension can only result in inefficiency. As the number of subordinates reporting to one supervisor are increased, the amount of time available for planning by that supervisor and the amount of time available for each subordinate is essentially indirectly proportional to $(2)^X$ where X is the number of subordinates.

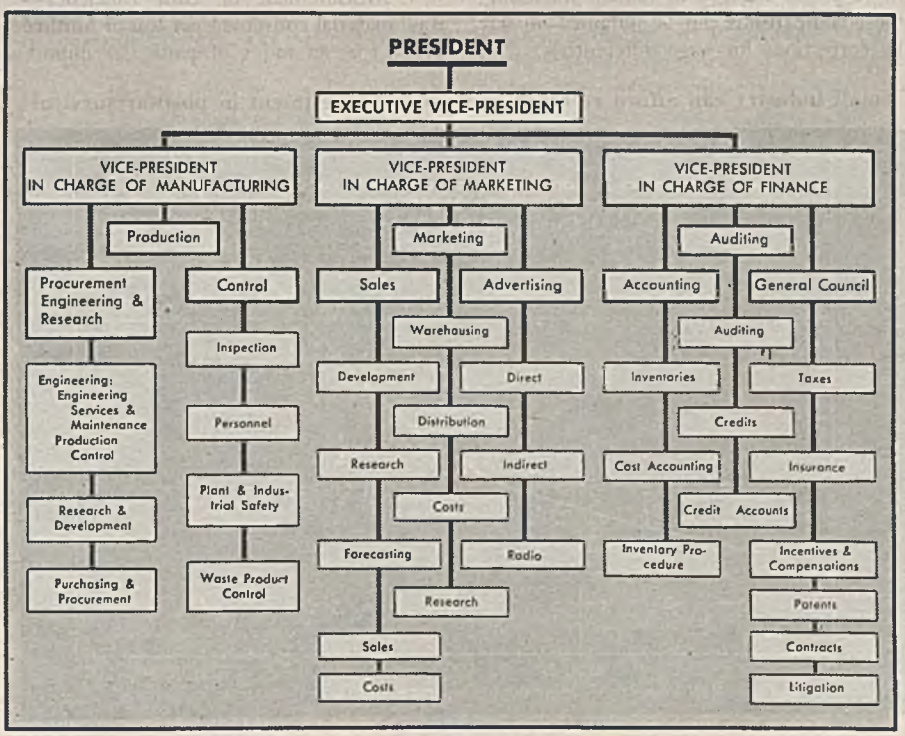
PRODUCTION COSTS

The National Industrial Conference Board reports that hourly earnings of factory workers in 25 industries rose in July 1944 to a new record of $1.072, while weekly earnings reached the record high of $49.23. On the basis of take-home pay, using 1939 as a base, the present weekly wage has doubled while the hourly rates are almost 60 percent greater than in 1939; where the rate in 1939 had increased 12 percent over that of the banner year 1929 and 42 percent over the close of the last war in 1919. The increase in labor wages is not the only factor in increasing the cost of production.

Of much more importance is the decrease in labor output. It is a significant trend that of the 30 manufacturing industries recently selected by the Bureau of Labor Statistics for a comparison of productivity and labor costs, 15 of those industries showed a greater percentage gain in unit labor costs than in manpower output by over 20 percent. Of those remaining industries, 9 showed an average decrease in manpower output of 7.5 percent while the corresponding unit labor costs increased. Industry as a whole cannot be indicted upon the statistics of only a portion. It is, nevertheless, believed to be indicative of the situation which the majority of management must face.

One thing is certain: there can be no

Organization charts should show flow of authority and limits of responsibility



decrease in prices to the mass consumer so long as labor costs are increasing and the output per worker is decreasing or remaining stationary. Since wages are politically the last to be reduced, it therefore behooves the engineer to devote his attention to ways and means of increasing manpower output. The current drive of organized labor to break the "Little Steel" wage formula forecasts future wage increases. That shadow of the future lends impetus to the analysis of production methods.

What then are some of the symptoms by which management can gage the health of its plant prior to the acute infectious states wherein red spots the balance sheet? In this therapy the cost engineer, the statistician and the accountant all can lend valuable assistance.

There are five useful measures of efficiency which are highly recommended and which are available from customary plant data. No time-consuming computations are necessary. They can be used for direct comparisons between competitive plants or processes and are independent of dollar costs, management or location.

1. Measurement of Labor Efficiency—Units produced in thousands or tons per K.M.H. (per thousand manhours). This index is one which in the long trend should be gradually increasing. It will reflect labor-saving devices and the elimination of unnecessary processing steps. Conversely, it will reflect poor planning, uneconomic utilization of labor or equipment, or plant shut downs of unusual duration; whether it be a motor assembly line or a vitamin synthesis by the batch process. Other things being equal, it can be a measure of morale. It is the simplest means of gaging labor efficiencies of two or more plants engaged in similar processing. Cost comparisons can be obtained quickly by corrections for wage differentials.

2. Measurement of Equipment Efficiency—Percentage of time on stream is the total operating time per elapsed time since start of operation (usually less for batch operations than for continuous operations). Plant capacities are often intangible figures dependent upon many factors. Chief among those factors is the efficient utilization of equipment. Equipment which is shut down for any reason, for repair, for lack of raw stock or for utilities failure represents lost production. It represents capital investments which are not earning a return. The wise plant management will keep a close check on the operating efficiency of all plant equipment. For example, it is particularly important for pioneer processes which are built to serve as a guide to management for future expansion policies. Here laxity on checking inefficient equipment operation may mean the abandonment of promising fields of endeavor or unnecessary investment in capital equipment. If low equipment efficiencies are obtained, it is the technician's responsibility to secure an understanding of the reasons for their causes and how they may be corrected and to make certain that management is aware of that understanding.

3. Measurement of Quality Efficiency—Percentage of rejects per thousand units produced represents the percentage of material rerun or reprocessed. Many operations are unduly costly because of a large percentage of rejects or production which does not meet specifications and must be reprocessed. Faults are quickly indicated by unusual departure from the trends. The follow-up check may point to contamination, poor raw material, equipment or personnel failure, or even excessive quality inspection beyond the extent warranted by use and price of the product.

4. Measurement of Unit Efficiency—Raw material consumed per ton of finished product is an index of particular importance in chemical processes. An important item in the cost of production is expenditure for material. It is desirable that such costs be less than or equal to those of a competitor—real or fancied. One yardstick independent of prices is provided by this index.

5. Measurement of Utility Consumption Efficiency—Steam, power, fuel, or water consumed per unit of product produced provide an excellent index for those industries where utilities are an important cost item. For example: kwh. per ton in the case of chlorine production; bbl. of fuel oil per bbl. gasoline in the gasoline industry; or gal. of water per lb. in the case of the paper industry.

There are, of course, many indices which can be used. Others which are in common usage and familiar to all are absenteeism, accident rates and labor turnover. Nevertheless, it is believed that those discussed above will serve the most useful purpose to the management as a quick check on a new process, plant, or personnel, or for comparative purposes with well-developed standard efficiencies. Management would do well to have those indexes available as often as periodically needed for assurance of good operation. They will serve as a guide to indicate whether production rates and costs, viz., production per man-hour, has been equal to, better than, or sub-standard to the prewar national annual increase of 2 to 3 percent. If not, then, they should send their engineers and accountants to follow those words "Seek and ye shall find" the cause. Otherwise, it can be assured that their competitors will do so.

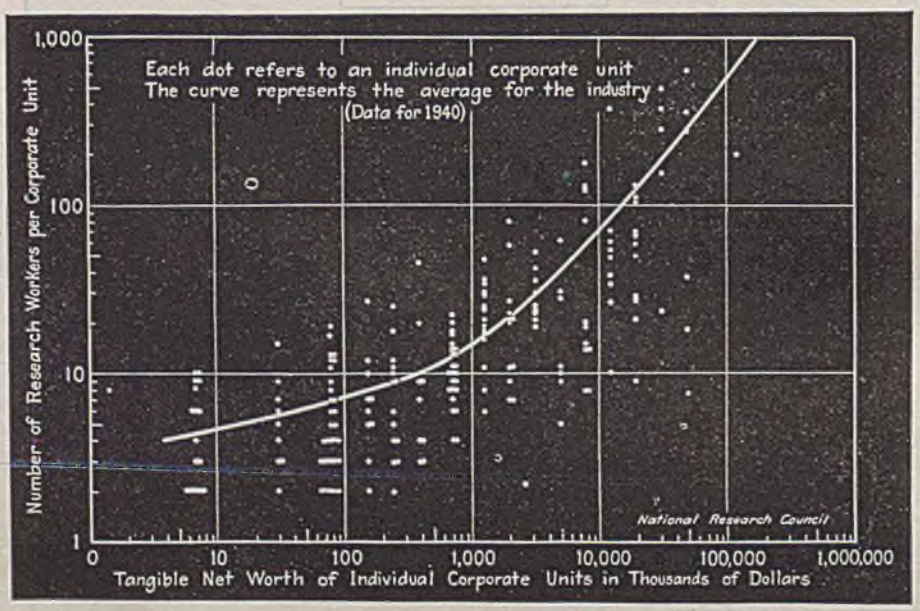
RESEARCH

One other path which offers management or the small plant executive some opportunity to rise above his competitors is research. This path is long and tortuous and seldom offers quick returns. In many corporations the cost of research is budgeted in the bracket of 0.2 to 2 percent of sales. Any material increase for research expenditures outside this bracket is a sail into uncharted waters and is likely to result in engulfment. Companies embarking on a research program should watch expenditures beyond the critical bracket.

Research in general can be said to be directed toward the attainment of any or all of the following objectives: (1) To reduce production costs; (2) to reduce processing time; (3) to increase yield; (4) to increase life of equipment (decrease maintenance); (5) to provide cheaper raw materials; (6) to develop new products; (7) to develop new outlets for present products; (8) to dispose of waste products; (9) to prevent stream and atmosphere pollution; (10) pure research.

Assistance can often be obtained for problem four from metal manufacturers

Small industry can afford research staffs as an investment in postwar survival



or equipment manufacturers. For answers to specific problems outside of the scope of the technical staff on items 1, 2, 3, 5, 8, and 9, it is probably more economical to call in a consulting firm. It is important that the problem be correctly and completely defined to the consultant. The pollution problem is one which should be given mature consideration. Processes where pollution is a factor will require positive definitive treatment in the not-too-distant postwar future.

Development of new products, while one of the natural functions of research, often can be facilitated by other means. One of the most profitable sources is the encouragement of ideas contributed by employees, particularly by technical men such as engineers and chemists or from contacts developed by sales engineers, dealers or manufacturer's representatives. Those ideas are seldom spontaneous and their birth must be fostered by some mechanism provided by the management which facilitates their transference to a responsible agency for evaluation. This system alone is insufficient, but supplemented by means of posters, foremanship talks, house organs and a sound company policy well worked out as to detail, it will go far to prevent sterilization of creative ideas. Good ideas are invaluable assets. It is mandatory that those individuals responsible for the assessment of the value of the contributions advise the contributors promptly as to their disposition and the reasons for their action, if further fertile growth is desired.

It is possible to secure additional ideas for new products through such sources as the Alien Property Custodian, the Patent Office, various trade associations and technical societies, but in general these presume a staff of engineers and are not as applicable to the smaller manufacturer as the methods outlined above. Of recent interest, which may indicate a trend, is the formation of a patent pool by the New Haven (Conn.) Chamber of Commerce which makes available through membership certain patent rights to the small manufacturer in that area. Of a comparable nature is the assignment of the income from a patent holding company (U. O. P.) for research in the petroleum industry which is available to all.

ENGINEERING LAYOUT

Plant layout has been said to be a production problem. This is true in the larger sense but it is also true that the tendency is to turn the task over to the engineer, if in a small plant, or to the production engineer, if in a large plant. Recognition of the importance of plant layout is illustrated in recent magazine advertising by one of the large motor companies.

Importance of the assignment of competent engineering talent to plant problems cannot be over-stressed. Here in layout is where idleness, industrial hazards, and their corresponding labor problems, bottlenecks, excessive maintenance and a host of other troubles can be avoided. It is where efficient and flexible materials handling equipment and transportation to and from the plant should be studied. These data cannot be determined subsequent to the initial operation. If determined *in situ* the result is delays, mounting costs, and production loss while awaiting reconstruction changes.

One particularly bad case was brought to the writer's attention. At this plant is was considered satisfactory for the operation of a production assembly line to shut down every two or three hours for twenty minutes in order to allow a switch engine to pull in a freight car loaded with raw materials. Both raw material components and finished products were loaded direct from and to freight cars from the same short dead-end spur track. Perfectly obvious, but nevertheless it was not foreseen that the production capacity was limited and the costs were higher proportionately. The time when plant buildings are determined by the summation of the area required by the individual machines is past. Each plant and its layout should be the result of a study of all of the combined functions which make it up; each major change will institute a revision in that study. Time spent on plant studies of this nature now will pay big dividends when the squeeze comes for reconversion.

Procurement of disposed surplus property for reconversion in the postwar period should be preceded by a consideration of this factor. Cheap procurement of a building requiring an inefficient plant layout may end up in an expensive process attractive only from a competitor's point of view.

ENGINEERING MAINTENANCE

Due to the inherent lag between the end of the war and the time reasonable reconversion is accomplished, it is possible that the problem of maintenance will grow still more instead of less acute by virtue of longer service without repair. The smart maintenance operator will welcome that in-between-conversion-time as an opportunity for checking and repairing big overhaul jobs which full scale operation prevented.

There are many tricks in the mechanic's bag which can be used to squeeze that extra service from equipment until replacements are more easily obtained. The building up of worn, corroded, or abraded surfaces by brazing, welding and metallizing is one; lining vessels with metal-clad corrosion-resistant sheets or even ceramic and rubber linings is another. Corrosion is often aggravated in equipment where plant practice consists of transfer of liquids by vacuum or blowing. Dropping the dew point of the introduced gases another 10 to 20 deg. and concurrently tightening all places where leaks might be introduced such as stuffing box glands and flanges should do much to help that situation. In the replacement of corrosion-worn equipment, frequent reference to the latest published data for choice of materials of construction is an invaluable guide.

Table I—Productivity and Unit Labor Costs—1943[1] (1939 - 100)

	Output per Manhour	Unit Labor Cost
Agricultural implements	104.1[2]	111.6[2]
Boots and shoes	111.3	130.6
Bread & bakery products	94.0	137.1
Cane sugar refining	91.3	139.6
Canning and preserving	123.5	132.4
Canned fruits & vegetables	130.3	127.8
Canned and cured fish	86.4	142.8
Cement	92.1	130.1
Coke group	105.3	110.0
Beehive coke	103.0[3]	
Byproduct coke	106.2[3]	
Confectionery	103.4	131.2
Cotton goods	101.9	148.9
Fertilizers	102.1	150.9
Flour & grain-mill products	83.1	161.3
Ice cream	147.1[3]	79.5[4]
Leather	110.7	123.9
Lumber & timber products	118.5	130.7
Newspapers & periodicals	101.4	112.3
Nonferrous smelting & refining	98.7	144.3
Paints & varnishes	109.8	117.5
Paper & pulp	94.2	144.2
Petroleum refining	108.6[2]	98.9[2]
Rayon	135.9	100.5
Slaughtering & meat packing	96.9	131.9
Tobacco products	103.4	131.0
Cigars	107.7	133.3
Cigarettes	109.7	114.4
Other tobaccos	85.7	143.5
Woolen & worsted goods	107.4	147.2

[1] U. S. Department of Labor, Bur. Lab. Statistics, April 1944. [2] 1941. [3] 1942.

The supply of dry air in the plant process is often a bottleneck. It may be due to higher demands on the drying equipment resulting from excessive summer humidity or from increased production. It may be supplemented with pre-refrigeration if an absorbent unit is used, or by a clean-up absorber if a refrigeration unit is the installed equipment. The economics of the combined units are exceptionally good.

Recorded data on the inspection of motors (see check charts, *Chem. & Met.*, March 1943), pumps and packing glands, with assigned responsibility for their maintenance, do much to lessen down time. Respect for lubrication is also increasing. It is poor practice, but still one sees an occasional laborer being made an oiler whose only recommendation for the job is the cheapness of the dierct labor costs. Of particular importance is the correct alignment and clearance of rotating equipment, fans, centrifugal pumps, grinders, mixers and couplings. Protection of oiled surfaces from dirt, water and chemicals by adequate housing is fundamental.

As with the motors, the lubricating of equipment can be coded and systematized for supervision. Any of the major oil companies will be glad to make a survey and to furnish written recommendations

Table II—Job Rating Factors

Factor	Maximum Points	Notation	Tentative Limits
Education	10	Formal education required to perform jobs	4th Gr.-College Grad.
Experience	10	Rate for time on comparable jobs (½) on the job (½) as training time	None to 12 months
Skill or accuracy	10	None for day labor — exceptional for a die maker	None to exceptional.
Ingenuity	10	Need for versatility & resourcefulness outside of supervisory control	None to continuous.
Responsibility	10	Can often be delineated in terms of dollar value	None to complete.
Supervision	10	Can be rated as either required by the employee or given by the employee	None to continuous.
Environment	10	Physical exertion, monotony, occupational hazards, temperature extremes and extent of exposure a consideration.	
Cooperation	10	Necessity for joint effort and tact in working with others	None to 200 or less.

for types of oil and a schedule of lubrication.

The use of tell-tale holes and drilling of equipment periodically to determine the extent of corrosion are methods used in the oil industry on pressure vessels and piping for predicting the life of equipment, and is recommended highly for adoption by the chemical industry. The statistical accumulation of such data provides the design engineer with valuable information on which to base specifications and procurement.

Porcelain and glass piping will require little maintenance other than replacement of gaskets and packing if kept free from strain and vibration. The use of glass-lined mixing equipment for continuous corrosive service requires frequent inspection and specially trained mechanics with fixed responsibility. Intermittent and alternate use of alkalis and acids aggravate maintenance troubles. All types of porcelain and gold plugs and patches should be tried under existing operating conditions to determine which will give the best service.

One system of maintenance that has brought returns in a large chemical installation consisted of setting up a recovery section wherein all equipment and valves taken out of service were dismantled and overhauled before placing back in service.

Standardization tends to simplify almost any problem. Standardization of equipment in the small plant is of more importance than in the large one. The large plant with more facilities and better trained personnel can afford diversification. The small plant cannot. It should be remembered that comparisons of equipment without an adequate statistical population may give serious erroneous results. Ordinarily a small plant will not have facilities to run life tests. Standardization should also include valves, lubrication and packing.

An item of maintenance often overlooked is lighting equipment. Light efficiency depends on keeping reflectors clean. Routine periodic replacement of light units will give more light where it is needed.

By instrumentation, in the sense which it is used here, is meant the application of devices or mechanisms to a process which indicate, measure or record physical or chemical changes of a process and may, at finite intervals, make the necessary corrections to maintain optimum values between predetermined limits.

The rewards of correctly applied and well analyzed instrumentation are high. The limitations are such that the layout and determination of significant independent variables requires a combination of both instrument engineering and process experience. No plant should undertake a major instrumentation of its processes without having experienced or factory trained instrument mechanics for servicing. The more complex the process the greater the need for competent maintenance.

Application has progressed to the point where there are few variables in a process which cannot be recorded, measured or controlled. Processing measurements of control such as temperature, pressure, flow control, liquid level and liquid level interfaces, electrical properties, density, pH, humidities, and gas analysis are being used in hundreds of installations on a diversity of jobs. Temperature measurements are most reliably determined industrially by means of thermocouples, which give accurate and sensitive results. The measurements of flow and liquid level control of hazard and corrosive liquids and molten solids are no longer an impossibility. The continuous process of the present day is partially possible only because of the application of automatic instrumentation. Conversely, all batch processes can well stand examination to determine why they cannot be made continuous by better control of process variables.

By means of remote transmission systems it is practical to centralize the majority of the instruments in a control room within the operating area. Such centralization results in a simplification of work and a lessening of personnel requirements. Another advantage of complete instrumentation is a reduction in capital investment by closer working margins on process variables.

The leadership which the petroleum industry has taken in the continuous processing field has in part been due to the recognition of the contribution of modern instrumentation to successful plant operation. In many cases the industry has been responsible for some of the new developments and applications of instrumentation. Over-instrumentation is just as bad as over-engineering and the occasional examples of it are easily identified by the number of instruments not in use by the operator. A rough criterion as to dollar value can be had by using the petroleum industry's guide. Some companies estimate that 9 to 15 percent of the cost of a complex installation will usually be expended for instrumentation.

JOB EVALUATION

Job evaluation is a scientific correlation of wage rates to work measurements resulting from a rational consideration of definite arbitrary factors. If correctly and honestly applied it permits the most equitable distribution of income to both the worker and the employer. Sufficient importance is attributed to correct job evaluation plus the lack of understanding by the smaller concern to warrant its consideration here in some detail.

One excellent method of evaluation is by means of the point system. In this system, certain arbitrary factors may be all given equal worth or, depending on the type of work and prevailing conditions, may be given a weighted value. For example, in Table II, a suggested list of factors for evaluation are given equal weight; in times when labor shortages prevail it would be wise to assign extra value (from 2 to 25 times) to the factor (previous experience) requiring a long and expensive training period. Such weighting recognizes the desirability of reducing labor turnover. There are many good texts on the subject.

As for the mechanics of application of the study to a specific plant the following steps are suggested:

(1) Evaluate the jobs in accordance with factors set forth in the table. With respect to the items of education and experience, rating should be on what is desirable and not on what is in effect.

(2) Give each job a name and then arrange the jobs by name in ascending order of point requirements.

(3) Lay off two scales on cross-section paper. The ordinate scale should be laid off in cents per hour or dollars per day as desired; the units of the abscissa will be skill points. The limits of the ordinate scale are established by the prevailing rates in the area or section; the lowest is that of the lowest laborer and the highest is that of the senior foreman or equivalent. The limits of the abscissa will be determined by the minimum and maximum determined from point evaluation of the job factors.

(4) Draw a line between the maxima and minima established by the limits shown above.

(5) Next plot on the chart every job by an X depending on the skill points and present rates.

It may be observed that all the points fall close to the line (drawn in under step 4 above), in which case the correlation between the evaluation of the jobs and prevailing pay scale is good. In addition, some of the points fall either above or below the line. Assuming that the rating is rational, it would indicate that the wage rates are out of line with the majority of jobs by being either too high or too low. Changing the slope of the line by raising the lower end indicates that the minimum rate with respect to the majority was too low or in the case of the upper end that the senior rate was too low.

In the end, however, the adjusted rate line should have no major deviation of points from it. Any which deviate widely call for re-examination of the job factors. In many instances, the jobs group themselves naturally in clusters; jobs requiring the same degree of skills should result in the same return to the employee and the same expenditure to the management. For example, how else can a chemical plant operator be compared in net worth to a mechanic such as a carpenter?

Advantages which will accrue from the study of the chart established by job evaluation are threefold. First, it provides a means of simplification of wage rates by utilization of the cluster principle, that is, a stepwise system of wages can be evolved for jobs of many heterogeneous types of work within the same plant. (A stepwise system consists of grouping of wages corresponding to a group value within the point system. For example, assume that there is a natural cluster of jobs in the skill point range 36–44. The corresponding average rate of $7.00 per day is indicated from the chart.) If the rates for the adjacent groups are $6.00 per day and $7.75 per day, respectively, it then provides a mean of rewarding diligence and seniority for those few workers who may not be qualified for the next group by having a sub-apprenticeship below and a premium step above the average of the $7.00 rate. This could be $6.40 and $7.25. The use of the $6.40 rate in the $7.00 class may also serve as a means of discipline.

Second advantage of the job evaluation chart is that it provides a logical basis for the development of a job ladder. Such a ladder is a list of jobs (wage rates) falling under the normal groupings. If posted on the bulletin board by the name of the job at the plant, it is readily accepted as equitable and fair by the employees. The job ladder tends to create prestige of the employee for his job. It also serves as a natural basis for promotions from a lower to a higher grade. In some cases it has served to prevent inequities being worked by union seniority rules in that promotion is primarily on the basis of the job ladder. If the evaluation is developed in cooperation with an intelligent union representative, many sources of employee friction are removed. In all cases it is essential that the evaluation be conducted in cooperation with personnel who adequately know the job. The third accrued advantage is that it makes the overpaid job, which has been established from pressure, favoritism or conditions now non-existent, stand out like a sore thumb. It is sometimes curious also to see jobs less well thought of established in importance.

Fourth, it provides a convenient means of raising or lowering the wage rates equitably for the many and several causes, by raising or lowering the scale parallel to original slope.

PERSONNEL POLICIES

No article would be complete without some brief mention of postwar personnel trends. It is certain that the trend of management in general will be to take a broader outlook than prior to the war. Personnel relationships are intangible values difficult of assessment. The growth of unions, if the artificial stimuli supplied by the present administration were discounted, is due in a large measure to the feeling of insecurity and lack of permamency and the sense of relative unimportance of an employee to the company. Such a feeling of unfairness, injustice and insecurity is now apparent in the white collar class. It is up to management to make corrections and to do so as promptly as possible. Unionization of these groups is incipient.

Many and varied are the means taken to build up an *esprit de corps* within an organization. Some which have been proposed are: incentive compensation devices, the financing of housing and small loans to employees, routine medical and legal care, paid and arranged vacations, insurance, pensions, formal education of employees' children of unusual promise, provision of local community facilities for community meetings and athletics. Some of these can be provided with small administrative expense, others require quite a staff and investment.

Any new policies should be well worked out with respect to detail and considered from all angles prior to installation. Fluctuation and indecision are counter personnel policies. It should always be remembered that any of the above devices are but supplementary to fair play and honest dealings in employee relationships. Nothing can be substituted for a sincere and friendly interest of the boss for his subordinates whether he be the chairman of the board or the labor foreman.

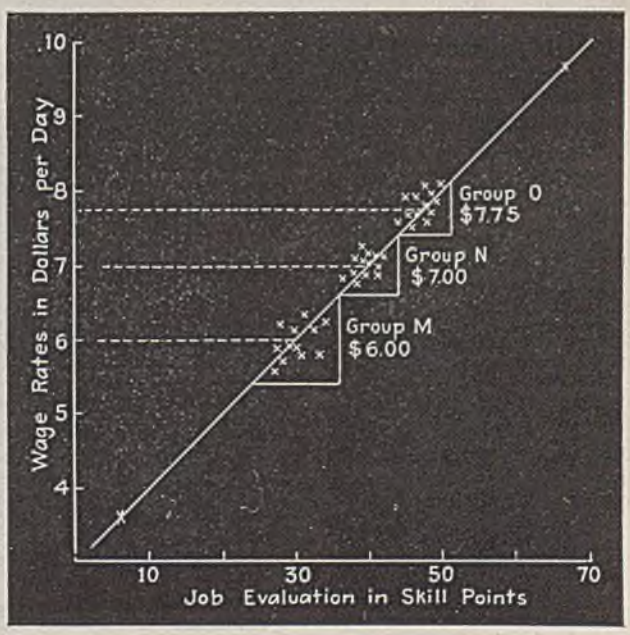
MARKETING

Little has been said so far as to the place of the engineer in the field of marketing. The exception is, of course, the function of the sales engineer. The relationship of the sales engineer to marketing, as a whole, is relatively small.

Reasons for the dearth of assigned engineering talent or the scientific approach to marketing are various. Probably contributory was the natural and successful growth of sales prior to the war which resulted from enthusiasm and art as a precursor to large-scale production. This encouraged a laissez-faire attitude. Certainly contributory was the lack of appreciation on the part of management as to methods of performance evaluation, and to the natural reluctance of the engineer to enter a virgin field where so many factors are based on judgment and presumptions and where the collection of facts and their correlation is so difficult of ascertainment. The need for the engineer to analyze the problem, marshal the facts, correlate performance, forecast sales and provide indexes of efficiency is well defined. An alert management will avail itself of all the tools necessary for the proper maintenance and progressive operation of the establishment.

There are no firm answers as to what the marketing engineer must face in the way of facts in the postwar period. The most that can be offered is an incomplete

Job evaluation by chart analysis simplifies the wage rate problem by utilizing the cluster principle



and tentative list of factors which should be evaluated with respect to each industry and type of product.

Some of the unknown factors which make intelligent marketing difficult to evaluate result from the shift in population to various sections of the country and particularly to medium size cities (100,000 to 200,000 population) and the extent to which that transient population will shift back after the war. It is the author's opinion that this return migration will amount to some 60 to 85 percent of the abnormal growth. The reason for this supposition is that in those areas, war production such as ship building, planes, and special munitions is of a type which will probably shrink to less than 10 percent for peacetime business. Nor do they readily lend themselves to reconversion for peacetime production. What will be the relative strength of the urban and rural populations? Will the suburban trend continue after the war as before, or will the impetus for rural settlement of returning veterans draw from the other side?

Equally as important as the shift in population is the tremendous relative increase in the purchasing power of the lower and lower middle income groups. If this relative increase is maintained, and there is reason to think that an appreciable portion will be, it is then of extreme significance. It can be reasoned that the necessities of existence for the lower income group by comparison with the higher income groups may be obtained by a relatively small expenditure of funds. Thus a large percentage increase in income will not correspondingly increase basic expenditures for necessities. The difference, less taxes and savings, is the margin for an extremely wide base of population which will provide the demand for the low income class type of luxury items. Such spending favors low cost, mass distribution articles. Another factor is the danger of new and competitive products born of wartime developments which must be foreseen and guarded against.

It is probable that a seller's market will prevail after the war. But to sell systematically presumes a competent distributing and service organization rehabilitated for postwar needs. Prior to rehabilitation, however, the need for those organizations in the prewar districts must be pretty well established or reallocated through adequate market research. The release of statistics by the WPB, BLS, WFA, the Bureau of Census and the Department of Commerce will help in many cases if intelligently correlated.

A competent distributing organization presumes two things; first, that the job is being done equally as well, or better than one's competitor, not only in the specific field but also in the allied fields. Second, that there is an economic justification for distribution in the areas being served. An indicator of comparison is the 5 percent cost-to-sales figure for mass distribution by the top ranking organizations. Distribution costs in excess of this rule-of-thumb percentage might warrant investigation.

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.

Shots in the arm to speed reduction in costs may be provided by an analysis of materials handling, application of modern methods of materials handling equipment to reduce manpower requirements and by a speed-up of deliveries by relocation and consolidation of distributing centers in strategic areas of larger units. Just as important is the installation of an accurate system of inventory accounting with suitable checks, maintained by responsible individuals.

The adequacy of a service organization has been mentioned above. This will be extremely important in the initial peacetime phase of reconversion with the introduction of new products coupled with the new applications for old products. Consumer ill-will can easily result from overconfident statements on performance or delivery and lack of knowledge of product characteristics. Reputations are easily vulnerable, difficult to repair and slow to heal.

In many highly competitive fields, there is no essential difference in products and price despite advertising claims; therefore, the most efficient and progressive sales service organization will secure more than its proportionate share of the market. The executive should predetermine if his organization requires a realignment in percentages of sales development, service engineers, sales engineers, salesmen and simply routine contact men, with reference to the new territories and new products. Such a determination requires an accurate analysis of the functions of a particular marketing organization and the relative importance of each function.

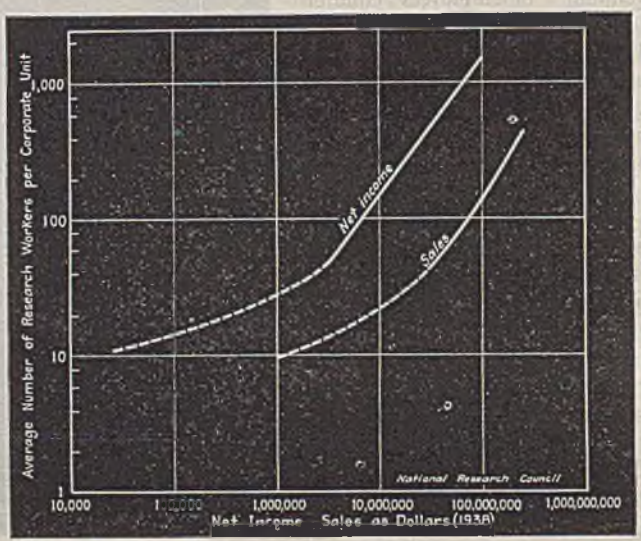
One approach which may bring results in the postwar period, in the event extended credit service to consumers is contemplated, is that of marketing arrangements with the local banking houses or one of the consumer credit corporations to facilitate credit extensions.

Need for some measure of efficiency is of as great importance in marketing as in production. Correlated to this is the need for the knowledge of what constitutes the minimum economic order which will be profitable to the company, and an accurate indication of profitable and unprofitable territories with respect to distribution costs. For example, one large company found that a small fraction of their sales occurring in outlying districts amounted to an appreciable fraction of their total distribution costs. The cost of distribution of the product in these sections was found upon analysis to be prohibitive. The analysis also indicated that appreciable savings could be obtained in practically all bulk delivery points through the application of a scientific and systematized approach to measurement and materials handling common to all.

On summation, it is believed that the best means by which the small chemical industry can gain postwar security is to avail itself of all the tools necessary for the proper maintaenance and progressive operation of its establishment. It will seek first to examine where and how the organization functions and how it may be bolstered, expanded or retrenched most efficiently in the light of presumed environmental conditions. It will examine production costs, not necessarily in terms of dollars and cents but rather from a consideration of the factors involved in those costs and how they can be made more efficient. That same procedure of securing facts, analyzing the data, checking performance evaluation and making plans for the future will be applied systematically to all departments—marketing, financing, personnel and research. Preliminary conditioning of the corporate body by such training will make the plunge into the ice-cold waters of competition less of a shock. Only the trained can stand the forced march under full pack.

The author acknowledges the assistance of Mr. Harold S. Haber, industrial engineer, in the preparation of the section on job evaluation and Mr. Montague Zink for his valuable suggestions and editing.

Size alone is no criterion of research virility



PROCESS EQUIPMENT NEWS

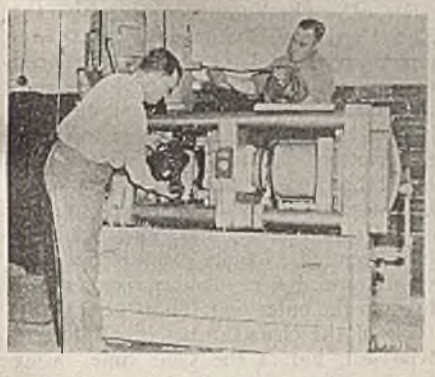
THEODORE R. OLIVE, Associate Editor

CONTINUOUS MOLDER

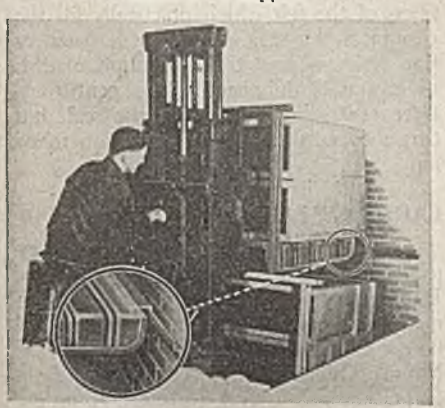
FOR INJECTION molding and extrusion of all kinds of plastics and rubber, engineers and technicians of the Chrysler Corp., Detroit, Mich., have developed a new continuous machine said to be the only one of its kind in the world. As a striking example of the capabilities of this machine, it is claimed that if it were necessary to do so, it could lay an unbroken seamless tube of material from New York to San Francisco. In use by the Chrysler Corp., the machine has also been licensed for the production of seamless plastic rocket-launching tubes and for the mass production of rubber insulators. The machine was developed from original designs of Walter P. Cousino, now a Chrysler project engineer. It employs a worm-screw feed for thermoplastics, thermo-setting plastics, natural and synthetic rubber, and has produced in less than 5 minutes a battery case requiring 8 lb. of thermo-setting plastic. It is claimed that the largest previous known injection molding was 36 oz. The manufacturers feel that the new machine may eventually replace the old type compression method of molding plastics and rubber as well as conventional equipment of the injection type.

The machine consists of a simple hopper holding the material to be molded or extruded. The material is fed to a heating cylinder where a special stirring apparatus keeps it evenly mixed. The plasticized material is then forced under screw pressures up to 22,000 lb. per sq. in. through a nozzle clamped to the die plate. When the mold is filled the back pressure automatically stops and reverses the feeder, thus keeping the material remaining in the heating chamber pliable and ready for the next injection. The machine is said to be much smaller and lighter than conventional equipment of much smaller capacity.

Inventor removing products from continuous molding machine



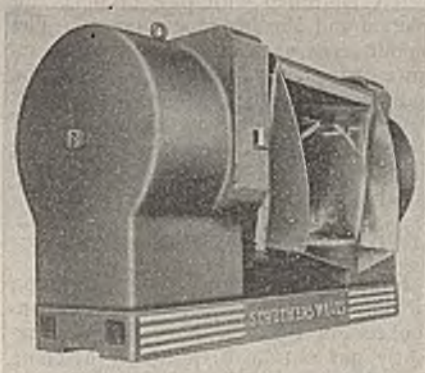
Placing new skid, showing method of support



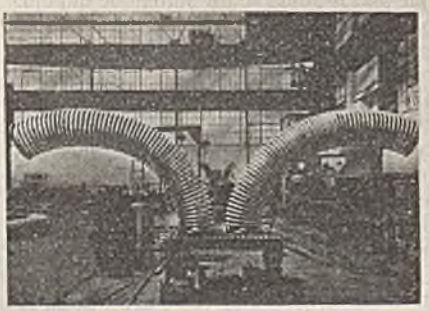
NOVEL SKID PLATFORM

TO PERMIT the use of skids in the handling of fragile materials which otherwise could not be stacked without danger of damage, the Union Metal Manufacturing Co., Canton, Ohio, has developed a new type of skid platform equipped with a vertical end frame at one end and an interlocking channel arrangement at the other. In operation the bottom row of skids is placed on the floor with the frame end of the skid away from the wall. The second row is then placed so that the turned-down channel on the forward end of the skid engages a Z-bar attached to the wall as shown in the insert in the accompanying illustration. The leg of the skid at the rear end then rests on the end frame of the skid beneath. The skid platforms can thus be tiered as high as the lifting mechanism of the fork or platform lift truck will take them. Additional rows may be tiered to the same height as the row against the wall by hooking the front channel of each succeeding skid on to the end frame of the skid ahead of it.

Northmaster shredder and mixer



16-in. corrugated flexible stainless steel connector



SHREDDING MACHINE

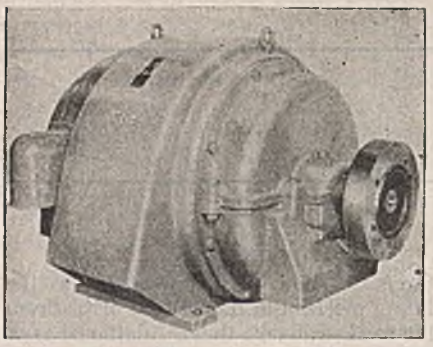
SIZES up to 4,000 gal. working capacity are available in a new model of the Northmaster shredding and mixing machine manufactured by the Northmaster Division of Struthers-Wells Corp., Titusville, Pa. The new machine, which can be built in any commercial metal or alloy, employs a new form of mixing element in combination with a serrated saddle and specially constructed mixing chamber. The result is said to be a notable improvement in the performance of the machine when shredding such products as alkali cellulose, paper, plastics, asbestos and other fibrous materials. The design is said to minimize the tendency for the moistened pulp to collect in corners of the trough above the blade, thus escaping treatment. The use of corner irons or large fillets to prevent pocketing is generally unnecessary, thus giving increased production and a better quality of product, according to the manufacturer. Another advantage is that an increase in jacket area is thus possible. The shredder is equipped with anti-friction bearings, straddle-mounted driving gears and an automatic lubrication system, among other features. Various types of drive are optional, including multiple V-belt, silent chain or direct-connected motor.

ELECTRONIC RECORDER

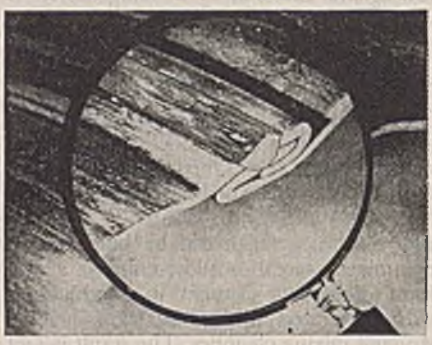
ONE OF the first of several new electronic instruments to be released in quantities and without resort to any kind of rationing system, has been announced by the Brown Instrument Co., Wayne & Roberts Aves., Philadelphia, Pa. The instrument, of the circular-chart type, is a combination recorder-controller, developed particularly for use in chemical and other process industries. The company has stated that other electronic controllers will be announced as soon as they are available for general distribution.

FLEXIBLE CONNECTORS

LARGE diameter flexible corrugated stainless steel tubing is being manufactured for the first time in bent lengths by Zallea Bros. & Johnson, Wilmington 99, Del. Shown in the accompanying illustration are two 16-in. diameter diesel exhaust connectors, each 9 ft. long and bent to 110 deg. Such connectors are being used on engine exhaust and high-temperature vapor lines. They absorb linear expansion, con-

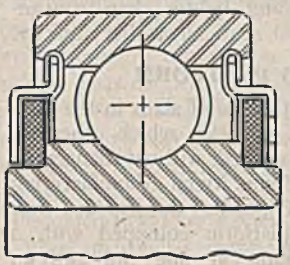


Drip-proof 300-hp. motor

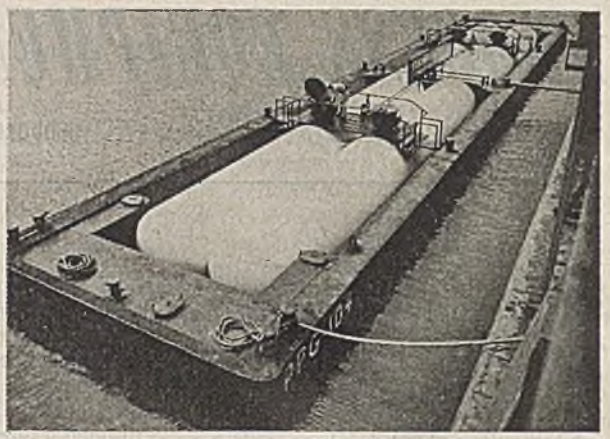


Welded lock seam for pipe conduit

Full automatic heavy-duty molding press



New "slinger" felt seal applied to bearings



Chlorine Transported by Barge

Columbia Chemical Division of Pittsburgh Plate Glass Co., Natrium, W. Va., is now employing a barge in the delivery of liquid chlorine at Charleston, W. Va. The barge carries 380 tons which it transports over a distance of 203 miles for discharge into the pipelines of the Carbide & Carbon Chemicals Corp. The chlorine is carried in four fusion-welded steel tanks with a minimum wall thickness of 1¼ in., built to withstand a pressure of 300 lb. per sq. in. The barge is 135 ft. long and has a beam of 26 ft. In the design of the new equipment particular attention was paid to safety requirements, with unloading facilities arranged to permit unloading and loading from either side.

traction and extreme deflection and are available in sizes of 6 in. diameter and larger in carbon steel, any type of stainless steel and other corrosion-resistant alloys, for use on corrosive liquids and gases. These connectors are claimed to handle temperatures from sub-zero to 1,800 deg. F. Curved connectors are suitable for pressures to 30 lb. per sq. in. and straight connectors, for absorbing linear expansion only, for pressures up to 300 lb. per sq. in.

HEAVY-DUTY MOTORS

Drive requirements in heavy-duty industrial applications, taking from 200 to 1,000 hp., can be handled effectively, according to the manufacturer, with a new line of large, heavy-duty induction motors recently announced by Electric Machinery Mfg. Co., Minneapolis 13, Minn. These motors, built in squirrel-cage and wound-rotor types, employ a heavy reinforced motor frame of fabricated steel plate or close-grained cast iron, depending on the type and size of motor. Form-wound stator coils have multi-layer insulation with high dielectric strength and moisture resistance, somewhat pliable to withstand the strains of heavy service. The cage winding is of brazed construction with high thermal capacity. A rotor fan with conical baffling provides adequate ventilation for cool motor operation. Either one-to-one ratio sleeve bearings or ball or roller bearings can be provided, as desired. A special inclosure for drip or splash protection or for other special conditions can be provided, if desired, as well as totally inclosed construction for direct ventilation.

PIPING CONDUIT

According to a recent announcement from the Ric-wiL Co., 1572 Union Commerce Building, Cleveland, Ohio, an improved seam is being used in this company's helical corrugated conduit housing for pre-fabricated insulated pipe units. This conduit is now fabricated with a reinforcing full-welded lock seam which extends spirally the entire length of each section. This weld is produced automatically by machine at the factory, before galvanizing, assuring a permanently tight joint which is waterproof and tight against pressure. Sections are 21 ft. long, completely fabricated with pipe or pipes, insulation and aligning pipe supports. The conduit ends are expanded smooth to remove corrugations for several inches at the ends, thus permitting a tight field connection of the section to be made by means of a new drive coupler recently described in these pages. The new lock seam is illustrated in an accompanying view.

AUTOMATIC MOLDING PRESS

Full-automatic operation of a 50-ton molding press for plastics has been announced in the new No. 235 press recently put out by F. J. Stokes Machine Co., Olney Post Office, Philadelphia, Pa. The new machine operates on the hydraulic rather than the mechanical principle and is available for automatic molding of larger plastic pieces. The press incorporates several new features, including a patented sensitive "trap" or checking device which is sensitive to a fraction of a gram, yet is said to be rugged enough for continuous heavy duty work. Another feature is a multiple feed with micrometer adjustment for capacities up to 48 cu. in., designed to distribute the molding powder how and when required in the mold. Operating in conjunction with the feed device is a new simplified ejection and knockout system, all governed by a timing control. The press is self-contained and electrically powered and heated. A 2-hp. motor develops its full 50-ton pressure capacity. The press opens and closes at the rate of 100 in. per minute with a controlled final compression speed adjustable to the flow characteristics of the molding material. Push button control permits semi-automatic operation when necessary to adapt the press to insert work.

BEARING SEAL

In order that the advantages of the self-sealed type of ball bearing may be available in the post-war period to a wider range of applications than formerly, the New Departure Division of General Motors Corp., Bristol, Conn., has developed an improved bearing seal said to be suitable for many uses under conditions of heavier loads, higher speeds and increased temperatures, as compared with earlier sealed bearings. The new seal employs a hard-woven ring of high-grade felt, pressed on to the bearing's inner ring against a high locating shoulder, and inclosed by strong formed steel members permanently fixed to the outer ring. Thus the seal partakes of the characteristics of a "slinger" type seal, but at the same time, owing to the extremely small clearance around the felt and the effect of the fine surface fibers of the felt which practically fill the clearance, the seal also exerts a maze or trap action against the infiltration of dirt, or escape of lubricant. Thus centrifugal force assists in maintaining the seal, but this is by no means the only action relied on.

LARGE INJECTION MOLDER

A capacity of 16 oz. of material injected per cycle is available in the new 16-oz. injection molding machine for thermal plastic materials recently announced by the Hydraulic Press Manufacturing Co., Mount Gilead, Ohio. The machine incorporates many new features, according

to the manufacturer. Both mold and injection unit are operated by direct hydraulic means. The machine employs a two-zone heating system capable of plasticizing 100 lb. of material per hour. It is entirely self-contained with the oil reservoir, pump, motor and all accessories built in.

ELECTRONIC CONTROLLER

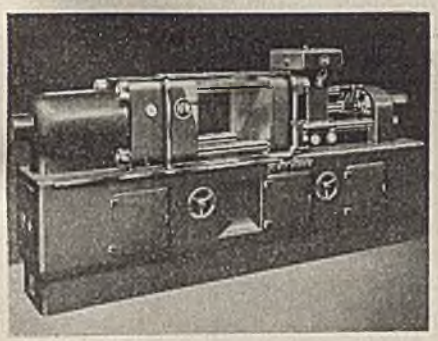
EMPLOYING the shielding effect of a vane passing between two coils in an electronic circuit, The Bristol Co., Waterbury 91, Conn., has developed a new line of electronic type controllers. These Free-Vane electronic instruments are available in recording and indicating models for temperature, pressure, liquid level and humidity in low-open, high-open, low-high, low-open-high, and low-normal high control types. A time-cycle control feature can be added to any of these types.

This company has also announced a new series of air-operated control instruments known as Model 93, for temperature, pressure, vacuum, liquid level and humidity. Also Free-Vane controllers, with air as the actuating element, these instruments have a throttling range of ½ to 15 percent. They are of direct-set type and can be set to the control of any value within the instrument range by turning a control pointer to the desired value.

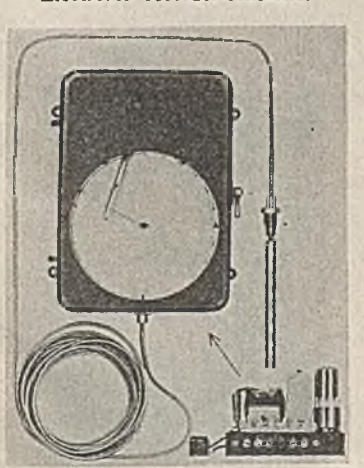
LOW-PRESSURE GAGE

A NEW GAGE, sensitive to a head of 0.02 in. of water, has been developed by Wallace & Tiernan Products, Inc., Belleville, N. J., for applications requiring accurate measurement of liquids and gases at low pressures. The gage is said to be sensitive to one part in 500 and accurate to one part in 300. Backlash has been eliminated, according to the manufacturer, so that the action of the extremely sensitive series-connected beryllium copper capsules, which serve as the pressure sensitive element, is transferred to the pointer with maximum accuracy. The gage can be furnished to cover a pressure range as low as 10 in. of water. Various scale arrangements are available such as the use of an expanded scale at lower pressures and a contracted one at higher pressures. A compound instrument for both pressure and vacuum is available. Either static or differential pressure may be measured.

16-oz. injection molding machine



Electronic recorder-controller



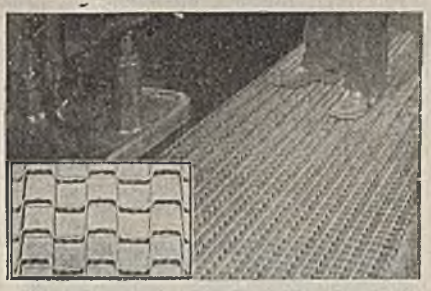
OIL HEATER

MODEL S-12 is the designation of a new automatic oil circulating and heating unit, intended for providing heat transfer oil at elevated temperatures, which has been announced by the Youngstown Miller Co., Sandusky, Ohio. The machine is available in various sizes. For example, a typical model has 12.8 kw. of electric heaters applied externally to the heating portion of the tank, and a capacity of 12 gal. of oil. The heated oil is circulated by a ½-hp. rotary pump, so located that the drip from the stuffing box of the pump returns to the circulating oil pool. The tank is equipped with three thermostats and a simple selector switch so that the operating temperature can be switched to any of three pre-selected temperatures without changing the setting of the thermostats. Any three temperatures between 200 and 500 deg. F. can be chosen. Equipment includes a jewelled signal light, a float indicating oil level and a thermometer.

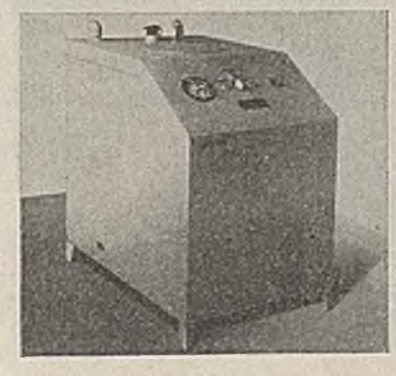
STEEL SAFETY MAT

TO IMPROVE the non-skid protection afforded by roll-up type steel mats, Wm. F. Klemp Co., 6641 So. Melvina Ave., Chicago 38, Ill., has developed a new design having a slight crimp or center bend in one side of the strong steel mesh. This crimp, shown clearly in the insert in the accompanying illustration, is said to add materially to the safety of the mat. Mats, being made of steel, are non-absorbent and easily cleaned in hot water or cleaning solution. They can be made in any length up to 25 ft. and any width to 6 ft. Any area can be covered by joining multiples on the job without special tools.

Steel safety mat showing construction



Oil heating and circulating unit



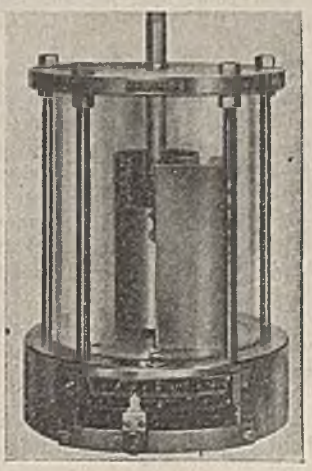
FLOW SPLITTER

SIMPLICITY is featured in a new flow splitter, the Micro Rotaweir, which is being produced in sizes from 30 to 900 g.p.h. by Fischer & Porter Co., Hatboro, Pa. Larger sizes up to 15,000 g.p.h. are contemplated. In this equipment the inlet pipe enters the top of a cylindrical receiving chamber which has a rectangular weir as an overflow. A vertical knife edge is set against the external edge of the weir, thus dividing the stream in two parts as it flows over the lip of the weir. One of the streams flows into a closed compartment with a bottom outlet; the other stream spills into the area surrounding the receiving chamber and discharges from the bottom of the vessel within which the receiving chamber is inclosed. The receiving chamber is connected through a stuffing box at the bottom to an external lever by means of which the weir may be rotated to any position with respect to the flow-dividing knife edge. The equipment is obtainable in any desired metal with the shell either of metal or of Pyrex glass. If desired, lagging and heating coils can be provided for liquids tending to solidify in process.

AIR CIRCUIT BREAKER

FOLLOWING what is said to be a recent trend toward the elimination of oil in indoor switchgear equipment, Allis-Chalmers Mfg. Co., Milwaukee, Wis., has introduced a new Ruptair magnetic type air circuit breaker which is now available in high voltage switchgear rated 5,000 volts and below, and 150,000 kva. interrupting capacity and below. The breaker's overall dimensions are as compact as those of a standard oil breaker, and all parts are readily accessible. In this breaker the arc chute has been carefully coordinated with the contact and arc runner design to give consistent and reliable interruption through the entire range of current to be interrupted. The magnetic circuit is arranged to force the arc up into the arc chute immediately upon sep-

Simple type liquid flow splitter



aration of the arcing contacts. Inspection and maintenance of the contact assembly can be accomplished without disturbing the arc chute or magnetic circuit in any way.

This company has also announced a new magnetic reduced voltage cage motor starter, which protects the motor from sustained overloads, locked rotor conditions and overloading from too frequent starting. This is accomplished with an accurately calibrated thermal overload relay. The new starter is available for the control of motors from 5 to 2,500 hp., up to 5,000 volts. Reduced voltage, two-point starting is obtained with a built-in auto-transformer, utilizing a synchronous motor-driven adjustable timing relay for transition from starting to running position.

EQUIPMENT BRIEFS

Discharge pressures up to 500 lb. per sq. in. are possible with a new pumping unit announced by Blackmer Pump Co., Grand Rapids 9, Mich. Built in all-iron and bronze-fitted constructions, the new pumps are available in capacities of 50 and 90 g.p.m., for gear reduction, gearhead motor and engine drive. This is the first pump of this concern's manufacture for pressures greater than 300 lb. per sq. in. It employs the same swinging vane principle as the company's other pumps.

Avoidance of glare and discomfort is said to follow the use of the Cat's-Eye developed by Ess Instrument Co., Fort Lee, N. J., for inspection of the interior of fire boxes, boilers and other direct-firing equipment. This device, which is easily attached to burners or peep holes, is so constructed that shadows of the smoke-haze and the flame characteristics of the fire box can be seen at a glance at any point in the boiler room.

With production of its Exide-Ironclad battery now at a peak, the Electric Storage Battery Co., Philadelphia, Pa., has introduced a new Exide-Powerclad battery to supplement production of earlier types and thus relieve shortages. The new battery employs a new type of positive assembly using a plate completely inclosed in a slotted polystyrene retainer which, in combination with the separators, is said to assure effective retention of the active material, to provide rapid diffusion of the electrolyte, and assure long life and capacity discharge.

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y., has announced a new gas proportioner for use by those requiring mixtures of gases for protective atmospheres. The device consists of a mixing block incorporating accurately sized orifices, on which are mounted flow meters, pressure gages and needle valves for the gases, as well as inlet and outlet nipples. Any two of six available flow meter sizes can be used, permitting a wide variation in the proportions of the two gases to be mixed.

An atomizing nozzle made entirely from hard rubber is now available from Spraying Systems Co., 4023 West Lake St., Chicago 24, Ill., for use in chemical processes handling corrosive liquids. The nozzle produces a hollow-cone type spray and is said to give the finest possible atomization of the liquid at the available pressure.

Klein Filter Manufacturing Co., 1227 School St., Chicago, Ill., has introduced an improved diatomaceous earth filter featuring maximum flow, product uniformity, and ease of cleaning, together with minimum space requirements and good appearance. Sizes of 24 and 36 in. diameter are available.

A new method of increasing the speed of welding of mild steel, known as "Fleet-Welding," has been introduced by Lincoln Electric Co., Cleveland, Ohio. The method involves a new welding procedure which is said to require no difficult changes from conventional arc welding technique. Information on the new method will be supplied to interested users.

A recent development of Charles W. Downs and Son, Co., 2280-2300 14th St., Detroit 16, Mich., is a line of true-perspective drawing instruments said to answer the current need for instruments which will enable the average good draftsman to make accurate perspective drawings. They reduce perspective art to its simplest terms, and make possible a degree of "photographic accuracy" claimed heretofore not to be achieved by any but the most skillful perspective artist.

Included in the line are a wide variety of perspective graphs, which permit the artist to show his subject at any chosen angle. There is also a set of true-perspective circles which avoid the distortion usually found where ellipses or free-hand circles are used. Perspective scales, showing diminishing units of measurement as they recede toward the vanishing point at the designated angles, are another item.

Flexible, but non-collapsible, is a new type of portable air duct developed by E. I. DuPont DeNemours & Co., Wilmington, Del., for either blower or exhaust systems. It is an improved "Ventube" flexible ventilating duct suitable for industrial uses such as building and maintenance of vats, tank cars, and boilers, or for rapidly changing air in work rooms or drying rooms. The duct is a sleeve or tube of standard "Ventube" impregnated cloth, either regular or fire-resistant, with a tempered steel helical spring inside it.

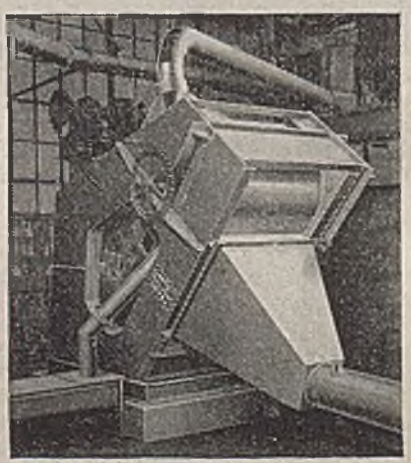
COMPACT DRYER

For the drying (or cooling) of bulk materials which do not require long retention periods, the Link Belt Co., 300 West Pershing Rd., Chicago, Ill., has developed the new Multi-Louver dryer which contains moving louvers supported on power-operated endless chains. The function of the moving louvers is to present material as it flows so as to secure the most efficient drying action. Passages between the louvers permit circulation of heated (or cooled) air at low velocity through the material which is in a constant state of movement and mixing. After passing through the bed of material the air is exhausted at the top of the dryer. The principle of passing air through a constantly mixing bed of material is the same as that employed in the company's Roto-Louver dryer in which, however, the louvers are secured in a fixed position inside of a revolving drum. This principle is said to permit the use of relatively high temperatures without overheating, thus resulting in rapid drying without detrimental effect. The new dryer can be built in more compact form than the Roto-Louver type but, of course, cannot give as long retention.

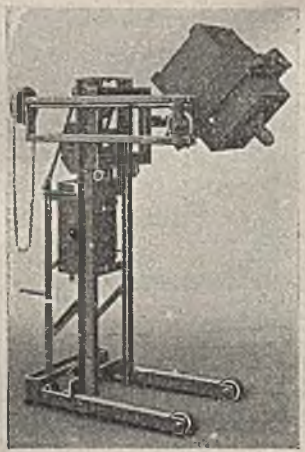
CARBOY DISPENSER

Carrying, elevation and tilting for pouring from carboys is accomplished by the Revolvator carboy dispenser manufactured by the Revolvator Co., North Bergen, N. J. An example of numerous special adaptations that have been made of this company's portable elevator, the equipment is wheeled into position, straddling the carboy on the ground. The carboy is clamped to the machine, after which it can be elevated quickly to the desired height by turning a crank. A worm-gear tilting mechanism operated by a hand cham tilts the carboy to the desired position and holds it there as long as desired. By this means a carboy can be transported along side of a reaction vessel and the contents poured into the vessel under complete control of the operator.

Multi-Louver dryer for bulk materials



Carboy elevator and tilter



Have you a problem concerning any of these gases ?

HYDROGEN SULFIDE

REFINERY GASES

HYDROGEN

NATURAL GAS

CARBON DIOXIDE

NITROGEN

CARBON MONOXIDE

The Girdler Corporation—developer of Girbotol and other gas processes—offers unrivaled engineering experience, facilities, and service on any questions involving gases, gaseous mixtures or liquid hydrocarbons.

Girdler is internationally known for special *economical* and *efficient* processes for gas manufacture, purification, separation and dehydration.

Consult The Girdler Corporation, if you are interested in any of the gases listed above, or mixtures of these gases.

THE GIRDLER CORPORATION

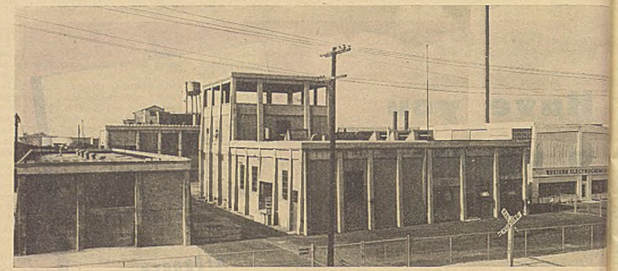
Gas Processes Division - *Louisville, Kentucky*

NOTE: The Girbotol Process, an exclusive Girdler development, is adaptable to the removal of hydrogen sulfide from liquid hydrocarbons.

GIRDLER

SPECIALISTS IN BETTER GAS PROCESSES

★ *Buy another war bond this week.*



Devoted exclusively to the production of potassium perchlorate, this plant of the Western Electrochemical Co., Los Angeles, Calif., began production in January, 1944

POTASSIUM PERCHLORATE

ONE OF the few sources of potassium perchlorate in the world has originated during the past two years in Los Angeles, Calif., in the well-engineered plant of Western Electrochemical Co. The process in use embodies several radical departures from prior methods. Most noteworthy is the application of continuous processing with the result that crystals are obtained in a state of purity far above specifications for a product of this nature. The process as outlined briefly below is discussed in greater detail on page 108.

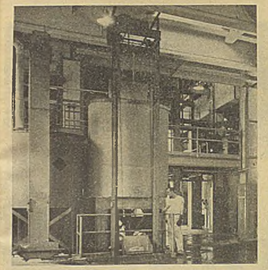
To get the process rolling it was necessary to form a saturated solution of sodium chloride and adjust it in a dissolver to desired conditions by addition of hydrochloric acid and sodium dichromate. Regeneration of sodium chloride in the process makes further additions unnecessary except for minor losses. The dissolver is used essentially for concentration adjustments of regenerated solutions before passage to the feed tanks. A continuous flow of cell liquor high in chlorides and low in chlorates is maintained from the feed tanks to a specially designed electrolytic cell system in which a series of reactions proceeds toward the ultimate formation of hydrogen gas and sodium chlorate. Liquor high in chlorates and low in chlorides is continuously withdrawn from the cells into surge tanks. Chlorate crystals are formed in a crystallizer of special design and separated from the mother liquor by means of centrifugals. Mother liquor is returned to the dissolver for adjustment, then recirculated through the chlorate system. Solid sodium chlorate is 99.5 percent $NaClO_3$ after drying and in this form is held ready for the perchlorate-forming electrolysis which follows.

Sodium chlorate crystals are dissolved in water to form cell liquor which passes to cells for oxidation to sodium perchlorate. This is piped to a perchlorate crystallizer where the addition of potassium chloride solution permits crystals of potassium, rather than sodium, perchlorate to be precipitated from the solution. Centrifugals separate crystals from the mother liquor. The liquor containing sodium chloride is concentrated in an evaporator and the salt removed by filtration. Remaining liquor is recirculated through the evaporator and solid NaCl is returned to the dissolver at the very beginning of the process.

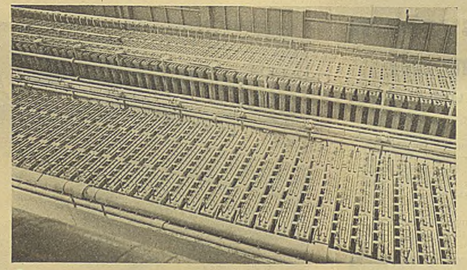
Potassium perchlorate crystals are loaded into a unique conveyor dryer by the unusual application of a skip hoist. Grinding is accomplished by means of a hammer mill with a cyclone attachment for collection of fines which are later added to the product to give the specified mesh sizes. Final packaging is in steel drums or in moisture-proof, multiwall paper bags.

The addition of potassium perchlorate production to the growing list of chemical industries in the West has truly presented an interesting chapter in this volume of chemical plant accomplishment.

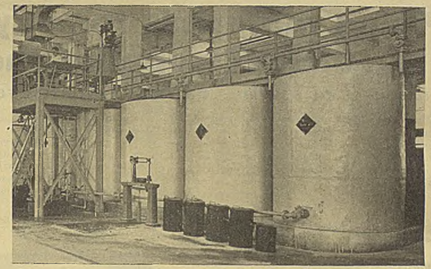
CHEMICAL & METALLURGICAL ENGINEERING
December 1944
PAGES 130 to 133



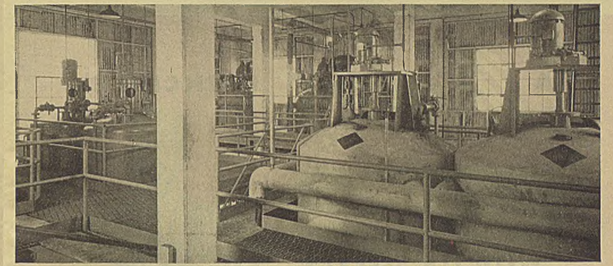
1 Solution make-up tanks for dissolving NaCl and KCl and adjustment of pH with HCl



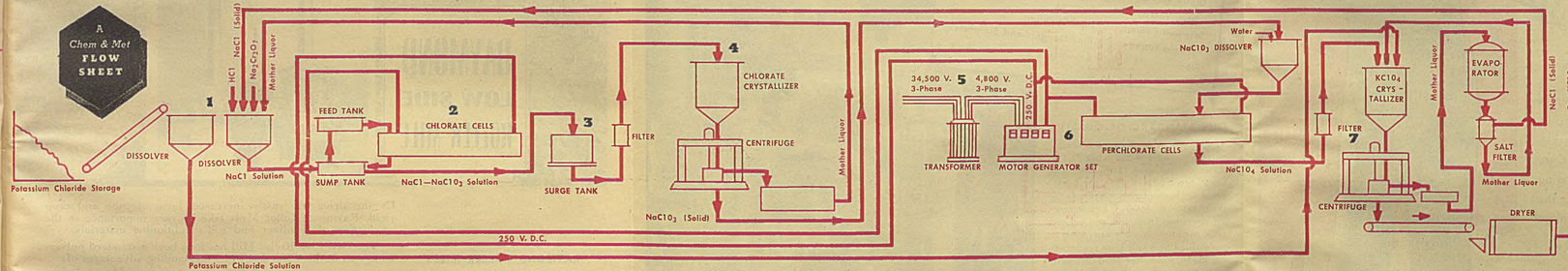
2 Electrolytic cells in which sodium chloride is reacted to form sodium chlorate. Each cell takes 2,500 amp. at 3-3.5 v. Current efficiency averages about 75 percent



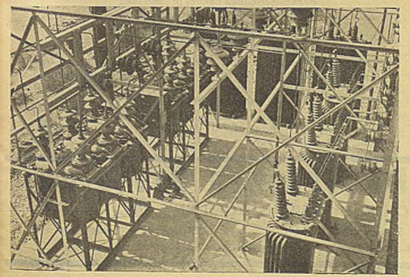
3 Surge tanks where liquor from chlorate cells accumulates prior to crystallizing. Graphite sloughed from anodes during electrolysis settles to bottom and is removed



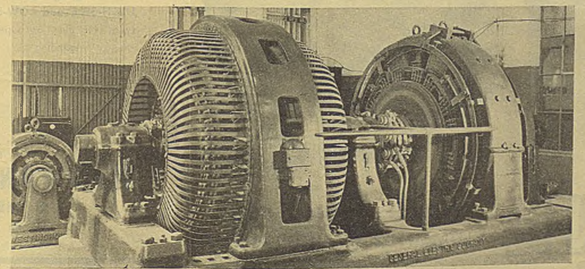
4 Specially designed crystallizers where, by means of temperature reduction, sodium chlorate is selectively precipitated from mother liquor. After washing and drying sodium chlorate is 99.5 percent pure



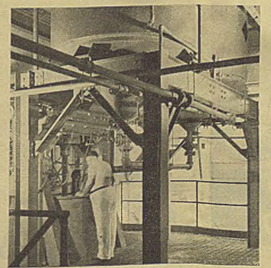
5 Transformer substation where 34,500-v., 3-phase a.c. is reduced to the 4,800-v. a.c. taken by the motor-generator rectifier shown in illustration 6



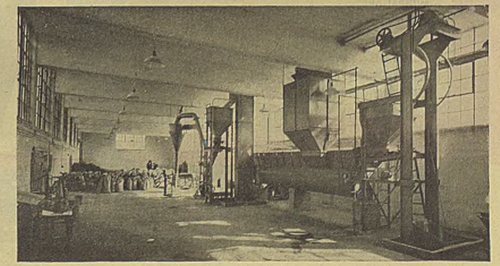
6 Motor-generator set which changes 3-phase a.c. from transformer to d.c. for use in chlorate and perchlorate electrolytic cells. Power to long banks of series-connected cells is maintained at 250 v. d.c.



7 Crystallizer overhead and centrifuge in foreground effect separation of $KClO_4$ from cell liquor



8 Wet potassium perchlorate comes up from lower right and is dried, ground, and packaged for market in 100-lb. paper bags or steel drums. Final product essays 99.60 percent $KClO_4$



NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

CONTENTS

SILICONE RUBBER

CHEMICALLY speaking, silicone rubber, a product of General Electric Co., Schenectady, N. Y., is radically different from any natural or synthetic rubber ever produced. Whereas the long drawn-out molecule of natural or synthetic rubber has for its "backbone" a chain of carbon atoms, the backbone of a silicone rubber molecule is a long chain of silicon-oxygen units. Attached to each silicon atom are two methyl groups, one on each side like the paired legs of a centipede.

Physically, silicone rubber has its good and its bad points. Greatest shortcoming is its very low tensile strength, but G-E promises that laboratory work will bring tensile and tear properties up to par. Greatest asset is its ability to retain elasticity at high temperatures, operating for "days at 300, a very long time at 200, and continuously at 150 deg. C." Compare these to the top temperature for natural or synthetic rubber, 85 deg. C. At the other extreme, silicone rubber stays elastic down to —50 deg. C. Another, and related, property is its lack of "compression set" at high temperatures. If a block of silicone rubber is compressed between two steel plates to 70 percent of its original height, held for a prolonged period near 150 deg. C., then cooled to room temperature and released from the plates, it will return almost to its original height. The best natural or synthetic rubber will not return at all. Finally, silicone rubber is unaffected by ozone, corona, or ultraviolet light—agents which deteriorate natural or synthetic rubber very rapidly.

Commercially speaking, silicone rubber is still in its infancy. Production is measured in pounds and goes exclusively to high-priority war uses. The price is high now but should come down when production expands beyond pilot plant proportions. Processing offers no special problems except that the conventional vulcanizing methods cannot be used; however silicone rubber may be compounded with standard fillers and may be extruded, molded and vulcanized on standard rubber handling equipment. Applications to date have all made use of its heat resistance and low compression set. Gaskets in B-29 turbosuperchargers and shock absorbing gaskets around the front glass in Navy searchlights are the two most dramatic applications; in both cases silicone rubber fully withstands high temperatures which cause every other elastic material to lose its resilience after short service. Forecasted future uses include: more gaskets for high temperature equipment, tubing for handling hot liquids, wire and cable covering, automobile and truck tires (if and when tensile strength is improved) that will not suffer from overheating, rubber rolls for printing with hot melt ink, and garden hose which can be left outdoors in all kinds of weather.

SILICONE RESINS

CLOSELY related to silicone rubber, General Electric has developed a great variety of silicone resins which will be useful for electrical insulation, for molding and laminating, and will have all the high temperature resistance of other types of silicones. In the field of protective coatings, for example, no paint or enamel except vitreous or porcelain has been able to withstand high temperatures without suffering such film failures as bad discoloration, cracking, or brittleness of the film. Enamels can now be made from silicone resins which will show no discoloration of whites after exposure for hundreds of hours to temperatures as high as 250 deg. F. These films are also resistant to water, acids and alkalis. Such finishes will undoubtedly find many uses as baking enamels for refrigerators, ranges, radiators, and heat exhaust pipes.

Another silicone derivative, called Dri-Film, is used to produce a water-repellent coating on ceramic insulators in aircraft radio sets. Water condenses on a Dri-Filmed surface, not as a continuous film, but as myriad tiny droplets. Therefore, when a plane dives from great heights into a humid atmosphere, condensing water vapor does not provide a continuous path for short-circuit currents.

ACETATE DYES

A NEW series in its line of acetate dyestuffs has been announced by Tennessee Eastman Corp., New York, N. Y. The series, designated LF, shows exceptional fastness to sunlight and will include yellows, violets, reds, greens, blues, oranges, browns, and pinks.

First in the series, Eastman Fast Yellow GLF, produces bright shades of neutral yellow on acetate rayon or nylon. Light fastness in pastel shades is from 25–40 hr., and in heavy shades approaches 240 hr. Yellow GLF exhausts rapidly, levels exceptionally well, may be used on either jig or box, and dyes over temperatures ranging from 130–190 deg. F. It leaves cotton and viscose rayon white.

Second in the series, Eastman Fast Violet 5RLF, is an anthraquinone dyestuff, dyeing cellulose acetate a reddish shade of violet with outstanding fastness to sunlight. Nylon develops a somewhat bluer shade with good light fastness. It dyes at 160–190 deg. F. and is recommended for both box and jig dyeing.

Apart from the LF series, a new azo blue dye has been developed for the Eastone series which is said to be exceptionally fast to gas fading. Eastone Blue BGF is dischargeable as well as usable for plain dyeing, and it dyes at somewhat lower temperatures than azo dyes previously offered to the trade. It is not recommended for use on highly twisted fabrics below 180 deg. F. but is recommended for fabric construction that will withstand processing at 180–190 deg. F.

RESINOUS BONDING AGENT

METAL-TO-METAL joints more aerodynamically perfect and efficient than those ordinarily produced by rivets are now provided by a thermosetting synthetic resin known as Redux. The manufacturer, Resinous Products & Chemical Co., Philadelphia, Pa., acquired American patent rights from Aero Research Ltd., of England, where Redux was put to successful use in Britain's aircraft production.

The joint is produced in four steps: carefully clean the surfaces to be joined; apply Redux Liquid by brush or spray gun; dust dry Redux Powder over the wet surface; and finally, cure the joint under heat and light pressure. A ½-in. lap joint and thin 24ST Alclad aluminum sheet will consistently show a tensile shear strength of 3,000–4,400 psi. after bonding for five minutes at 300 deg. F. and 50 psi. Strength of the bond is said to be maintained even after 30 days exposure to salt spray and over the range of temperatures encountered in ordinary usage.

Metal-to-wood bonds are also possible and in nearly all tests the joint has been far stronger than the wood. Other applica-

tions may lie in the fabrication of articles where compregwood, rigid moldings, hard surfaced laminates, and other impervious materials must be glued together or to dissimilar materials.

LAMINATION RESIN

THE SIZE of plastic or laminated objects has always been limited by the size and cost of the heavy machines required for operation at the great pressures involved in existing compression or injection molding methods. Because the size of machine rises in geometric ratio to the size of the article being manufactured, it has heretofore been very unusual to produce molded items, other than flat panels, in sizes greater than 36 in. across.

Recently, however, the Monsanto Chemical Co., St. Louis, Mo., announced the perfection of a synthetic resin which needs be subjected to only low pressure during the laminating process. Since low-pressure lamination does not require heavy machines, the manufacturer prophesies that the new product will open entirely new fields to the plastics fabricator. He will be able to step from small objects to such large-sized items as trailer bodies, curved wall panels, machine housings, full sized radio cabinets, chests, crates and drums. Present output is limited to military uses, most of them secret, so that it is impossible to evaluate fully its serviceability in postwar applications.

PROTECTIVE CREAMS AND LOTIONS

ADDITION of Fend-U, Fend-F, and Fend-PC brings to nine the number of creams and lotions now offered under the Fend group by Mine Safety Appliances Co., Pittsburgh, Pa. Like other Fend types they are simply rubbed onto the skin before work and are easily removed by soap and water at work's end.

Fend-U is a lotion which forms a semi-water-repelling film on the worker's skin and protects against all types of cutting oils and cooling compounds; kerosene, carbon tetrachloride, tetrachlorethylene, benzol, and other solvents and degreasers; mild acid or alkaline solutions; and against alcohols and acetates.

Fend-F is a water-soluble, heavy duty lotion which helps guard against dermatosis from aluminum, magnesium, or zinc dust; it forms an effective barrier against Fiberglas, sharp particles, fruit and vegetable fuzz, and chlorinated solvents.

Fend-PC is a water-soluble cream which helps reduce nervous perspiration, thus acting to prevent rusting of polished metal surfaces by contact with skin moisture. It also protects against grime, grease, dirt, and dust-borne irritants.

ACETYL BENZOYL PEROXIDE

PILOT-PLANT quantities are available from the Lucidal Corp., Buffalo, N. Y., for use as an active catalyst in the polymerization of various monomers, a drying agent or catalyst for unsaturated oils, a bleaching agent and germicide. This peroxide has a higher active oxygen content than any other diacyl peroxide now used, and moreover it is available in a pure, undiluted form which makes it interesting as a polymerization catalyst in the production of plastic materials where no catalyst diluent can be tolerated.

Properties of Acetyl Benzoyl Peroxide

Physical form	Flammable yellow-white crystals with "excellent solubility characteristics."
Active oxygen content, percent	8.4
Molecular weight	180
Melting point, deg. C	36–37
Formula	$CH_3 \cdot CO \cdot O \cdot O \cdot CO \cdot C_6H_5$

ACIDPROOF CEMENT

PRINCIPAL feature of a new synthetic resin cement is its nonporosity. Duracite, developed by the U. S. Stoneware Co., Akron 9, Ohio, is said to have high compressive strength, 14,000 to 16,000 psi. It is resistant to non-oxidizing acids, all alkalis, and solvents. Duracite will withstand temperatures as high as 350 deg. F. It can be stored indefinitely, is non-toxic, and is suggested for use on floors where it sets in about 20 min.

PHENOLIC MOLDING COMPOUND

FOR electrical applications involving high and low temperature variations as in automotive ignition parts Durez Plastics and Chemicals, Inc., North Tonawanda, N. Y., has formulated a new phenolic called Durez 12708 Natural. It is a mineral-filled material and so has better arc resistance than the standard wood-flour-filled phenolics. Due to its very low mold shrinkage factor the stress around molded inserts is low and therefore its susceptibility to cracking is not so great as in many other materials. All other physical properties, including preforming qualities, are said to be good.

Properties of Durez 12708

Specific gravity	1.86
Mold shrinkage, in. per in.	0.003
Water absorption, percent	0.04
Dielectric strength, v. per mil at room temp.	450
Dielectric fatigue, v. per mil, step by step method	350
Power factor, room temp	0.05
Dielectric constant, room temp., 60 cycles	5

PYRIDYLMERCURIC FUNGICIDES

THREE pyridylmercuric salts—chloride, stearate, and acetate—are being commercially produced for fungicidal use by Mallinckrodt Chemical Works, St. Louis, Mo. Among the materials which can be protected with the new fungicides are: textiles, felt, cork, paint, lacquer, varnish, wax, paper, synthetic resins, rubber, leather, oils, and greases. Tests indicate that the salts meet all the requirements of a good fungicide. They are toxic to all organisms tested, including those found singly or in combination in the tropics. They resist leaching by rain or by wash water, especially if used in conjunction with a water-repellent treatment or one of the permanent finishes. Being non-volatile at ordinary temperatures, there is little loss by volatilization and sunlight does not impair their fungicidal qualities. Pyridylmercuric chloride and pyridylmercuric stearate appear to have no irritating effect on the skin in concentrations which effectively prevent fungal growths. No ill effects are observed when used on materials where color, odor, or electrical properties are important. Pyridylmercurics are economical, says the producer, when one considers not so much the original price as the adequacy and durability of protection and the ease and safety in handling.

SYNTHETIC RESIN

FOR USE as a coating, impregnating, or casting resin, Duralon, synthetic resin of the furan type has been developed by U. S. Stoneware Co., Akron 9, Ohio. It can be molded or extruded as well as cast while necessary fillers such as asbestos, carbon and silicious materials can be incorporated. It is resistant to many chemicals including hydrochloric and sulphuric acids up to 40 percent. However, it is not recommended for concentrated nitric and other oxidizing agents. It is said to be excellent for all chlorinated solvents.

RESIN FOR STEAM-SET INK

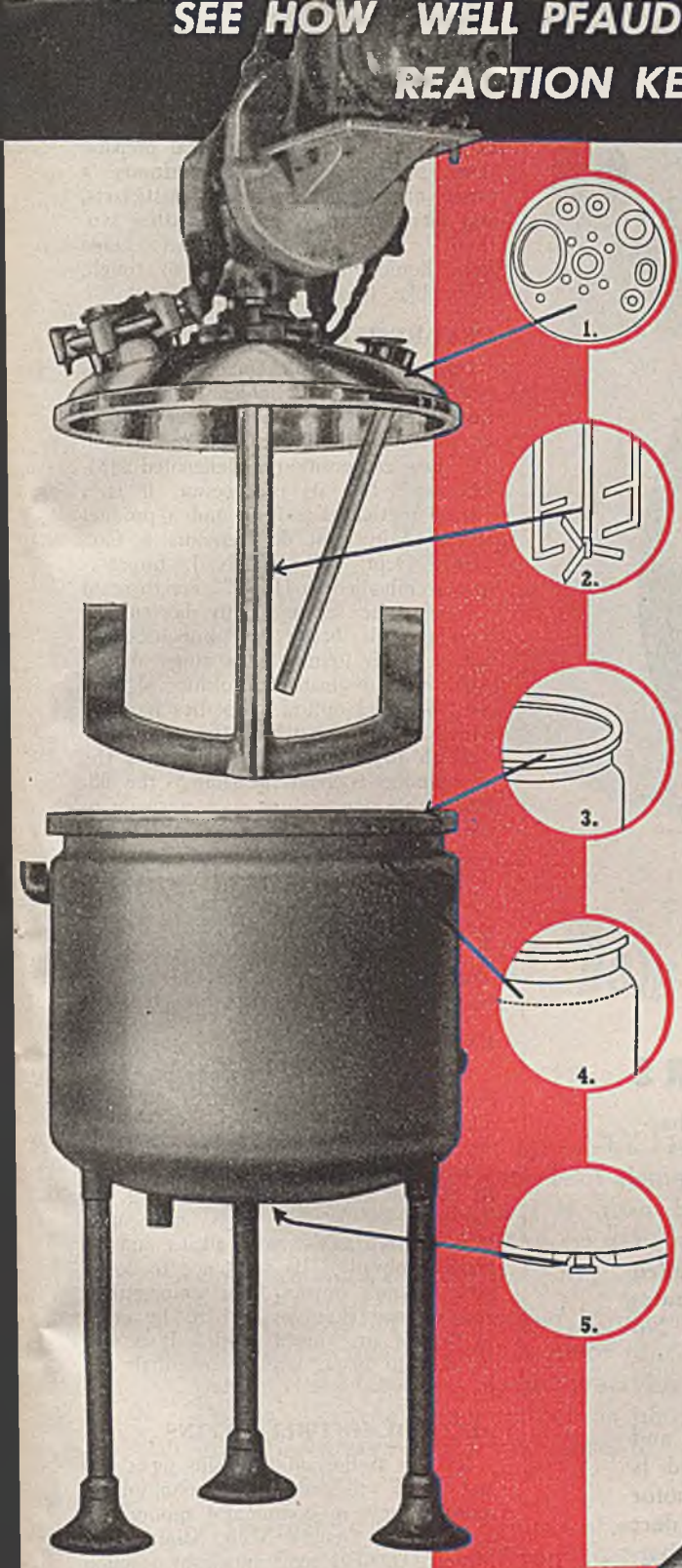
STEAM-SET inks consist of pigment, resin binder, and an odorless, high boiling organic solvent. To function properly the resin binder must be soluble in the solvent and in a mixture of solvent plus a limited quantity of water, but it must be insoluble in a mixture of solvent plus an unlimited quantity of water. The resin thus stays in solution under humid conditions of the pressroom; but when a film of ink is transferred to paper, a jet of steam causes the solution to break and form a thin, hard surface over the underlying portion which is still plastic and adheres to the paper. Formation of this hard surface prevents any offset or transfer of ink from the printed sheet.

Amberol 820 is a new synthetic resin binder developed especially for use in these inks by Resinous Products and Chemical Co., Philadelphia, Pa. Steam-set inks containing Amberol 820 are notable for their carefully balanced water tolerance, remaining stable on the press rolls yet breaking sharply under a steam jet. The resin itself is soluble in ethylene glycol, butanol, ether, alcohols, and aqueous ammonia but insoluble in water and aliphatic and aromatic hydrocarbons. It is highly resistant to petroleum and hydrocarbons but is compatible with the various Carbowaxes, zein and certain types of urea-formaldehyde resins.

ORGANIC CHEMICALS AND REAGENTS

A LARGE number of organic compounds which have heretofore been regarded as laboratory curiosities can now be produced commercially by techniques developed by Mallinckrodt Chemical Works, St. Louis, Mo. Studies of the condensation reactions of alkyl carbonates show that it is commercially practical, for the first time, to produce malonic esters, the higher beta-keto and alpha-cyanoesters, oxazolidones, isoxazolones, oxazolidinediones, and polymeric substances derived from the reaction of organic carbonates with polyfunctional compounds such as aminoalcohols. Since most of the almost numberless condensation products within these classes are newcomers to the industrial scene, their uses and applications can only be guessed. Sev-

SEE HOW WELL PFAUDLER'S STANDARD STAINLESS STEEL REACTION KETTLES MEET YOUR REQUIREMENTS



Chemical engineers find that they can use standard Pfaudler Stainless Steel Reaction Kettles where they believed it was necessary to have special equipment. Perhaps you can, too.

Incorporated into these standard designs are the requirements that meet a majority of conditions. For example, top-head openings are sufficient in size and number to provide for incoming product lines, light, vapor take off, agitator, etc. Standard motor drives and agitators complete the picture. With capacities ranging from 5 to 500 gallons you are in a position to select a kettle that meets your special requirement at lower cost.

CONSTRUCTION FEATURES

Here are some of the construction features of standard Pfaudler Stainless Steel Reactors that our research and experience show adds to the durability and efficiency of this equipment.

1. Top-head openings for each series of kettle sizes provide the maximum that can be arranged for each diameter, thus offering maximum flexibility in use.
2. Standard stainless steel anchor agitators (shown in photo) or impellers (sketch) with or without patented adjustable baffles provide a wide degree of mixing action.
3. All flanged surfaces (vapor outlets included) are surface ground to obtain accurate gasket seats so essential to safe operation.
4. Stainless steel sealer ring avoids contact of carbon steel with stainless steel liner . . . hence eliminates possibility of metal dilution.
5. Stainless diaphragms are used again to prevent metal dilution and possible contamination of stainless steel outlet—another of Pfaudler's many safety factors for your protection.

You can save yourself time and money on new equipment by investigating fully the adaptability of Pfaudler's Standardized Line of Stainless Steel Reaction Kettles to your needs and by consulting with Pfaudler engineers on your requirements.

GENERAL SPECIFICATIONS OF STANDARD KETTLES

Pfaudler Stainless Steel Reaction Kettles are built with all welded Stainless Steel liners and mild steel jackets for heating and cooling, stainless steel clamped top-heads in sizes up to 150 gallons and welded top-heads 150 gallons and over (clamped tops as alternate), motor or pulley driven stainless steel agitators of various types. They withstand internal pressures up to 75 p.s.i. depending on size. Capacities range from 5 gallons to 500 gallons providing you standard units for laboratory, pilot plant, and production work. Send today for your copy of Pfaudler Bulletin 823.

THE PFAUDLER CO., Rochester 4, N. Y. Branch Offices: 330 West 42nd St., New York 18, N. Y.; 1442 Conway Bldg., Chicago 2, Ill.; 1325 Howard St., San Francisco 3, Calif.; 455 Paul Brown Bldg., St. Louis 1, Mo.; 7310 Woodward Ave., Detroit 2, Mich.; 1318-1st Nat'l Bank Bldg., Cincinnati 2, O.; 1228 Commercial Trs. Bldg., Philadelphia 2, Pa.; 751 Little Bldg., Boston 16, Mass.; 1034 Washington Bldg., Washington 5, D. C.; Box 982, Chattanooga 1, Tenn.; Enamelled Metal Products Corp., Ltd., Artillery House Artillery Row, London, S.W. 1, England.

CUSTOM-BUILT STAINLESS STEEL EQUIPMENT

Should your requirements demand custom-built equipment, or variations from the standard line, you can entrust the building of this equipment to Pfaudler with confidence. Your problems will be solved by a company with an *engineering staff* and *fabrication facilities* that enable it to meet the most exacting needs in corrosion resistant equipment.

Pfaudler

THE PFAUDLER COMPANY, ROCHESTER 4, NEW YORK

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

eral of the malonates, for example, are suggested as plasticizers, others as emulsifying or wetting agents. In the other classes are found pharmaceutical preparations, addition agents for lubricants, a variety of unusual solvents and plasticizers, and many intermediates for further synthesis. The polymeric products range from liquid, linear polymers to tough, rubber-like, insoluble solids.

HEAT-RESISTANT LUCITE

SUFFICIENT improvement has been made in Du Pont's older heat-resistant Lucite, HM-119, to render it so obsolete as to be withdrawn from production. The new composition is designated HM-122, and, like its predecessor, it is a methyl methacrylate resin and a product of E. I. du Pont de Nemours & Co., Plastics Dept., Arlington, N. J. Improvements embodied in HM-122 are three in number: faster setting quality shortens the molding cycle; better flow properties permit a wider temperature range during molding; and greater uniformity of heat resistance and optical properties is maintained from one batch to the next.

With respect to other properties the new product is about the same as the old. Permissible temperatures in use remain in the range, 170 to —70 deg. F. Transparency, optical properties, colorability, dimensional stability, and toughness are still as good as ever, and the cost is no greater than the cost of ordinary acrylic powders. At present HM-122 is available only for war work, but its uses are expected to multiply rapidly when peace comes.

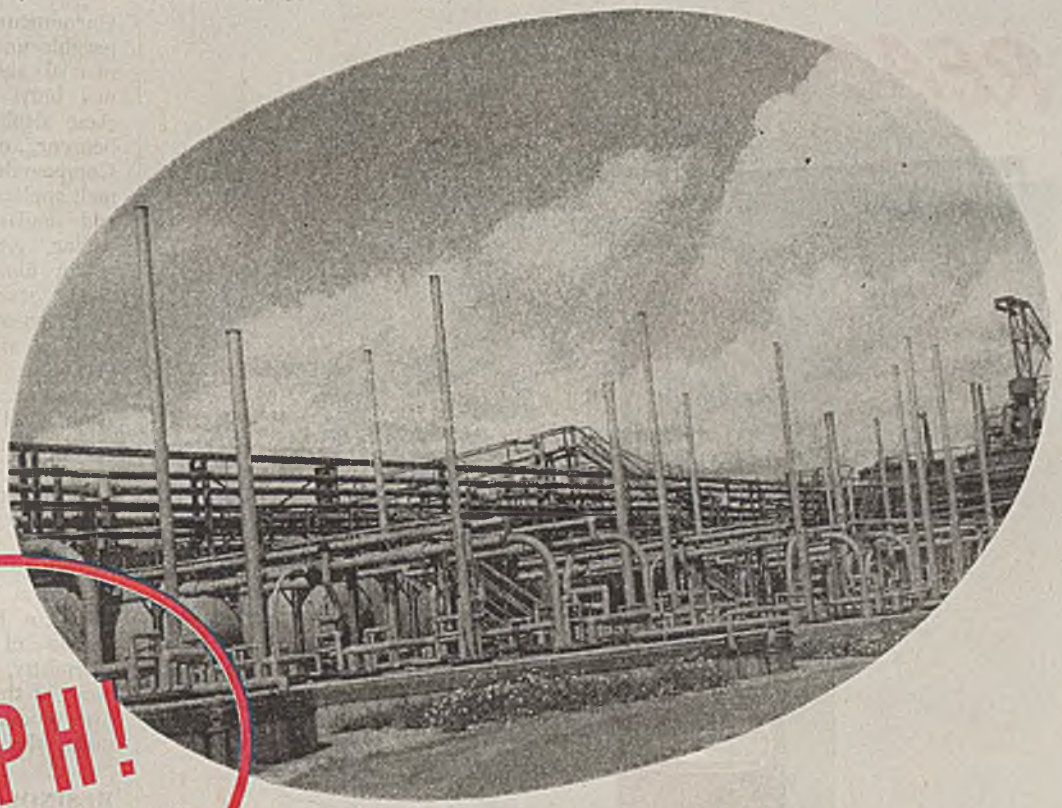
ENAMEL FINISH

CAPABLE of displacing many protective finishes which require scarce materials, Silco, is a non-critical, priority-free, vitreous enamel developed by Mitchell-Bradford Laboratories, Bridgeport, Conn. At the low temperature of 350 deg. F., the finish is sprayed, dried, and cured. It withstands acids, mild alkalis and all organic solvents. Its resistance to corrosion, abrasion, impact, high temperatures, and thermal shock is said to be equal to that of any known finish. It is now supplied in black, white, olive drab and navy grey.

ALCOHOL-SOLUBLE RESINS

KNOWN as Polyamide Resins series ED and DET, a group of alcohol-soluble resins is now in commercial production, according to General Mills, Minneapolis, Minn. 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. Their widest use to date is in the manufacture of heat sealing, grease-resistant coatings for food containers and label adhesives. They are also 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



OOMPH!

for bombs or biscuits

In underground concrete tanks at a Monsanto plant in Tennessee, millions of pounds of elemental phosphorus are stored under a capsheaf of water. From here it will go into munitions production or to be made into peacetime products such as leavening for biscuits.

The phosphorus, produced by Monsanto's modern, electric furnace method, is more than 99.9% pure. A part of this Monsanto product is serving with the Armed Forces. The remainder, either as phosphoric acids or phosphates serves war industries or those supplying civilian needs.

Phosphoric acids and phosphates, derived from Monsanto phosphorus are uniformly high in quality. Because of quality, many industries have come to look upon Monsanto as headquarters for phosphorus, phosphoric acids and phosphates. We invite your inquiries. MONSANTO CHEMICAL CO., Phosphate 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 CHEMICALS
SERVING INDUSTRY...WHICH SERVES MANKIND

Phosphorus and Related Products

By the World's Largest Producer of Elemental Phosphorus

PHOSPHORUS (YELLOW)
PHOSPHORIC ANHYDRIDE
PHOSPHORIC ACID — TETRA
PHOSPHORIC ACID — 85%
PHOSPHORIC ACID — 75%
MONOSODIUM PHOSPHATE
DISODIUM PHOSPHATE (ANHYDROUS AND DUOHYDRATE)
TRISODIUM PHOSPHATE
SODIUM ACID PYROPHOSPHATE
TETRASODIUM PYROPHOSPHATE
AMMONIUM PHOSPHATES
CALCIUM PHOSPHATES (MONO-DI-TRI)
CALCIUM PYROPHOSPHATE
POTASSIUM PHOSPHATES
MAGNESIUM PHOSPHATES
SODIUM IRON PYROPHOSPHATE
FERRO PHOSPHORUS
SPECIAL PHOSPHATES FOR SPECIAL APPLICATIONS

Uncompounded. The solvent type is dispersible up to 45 percent solids in commercial absolute isopropyl alcohol, normal butyl alcohol, and in mixtures of these alcohols with petroleum naphthas, benzene, or toluene. The Hot Melt Compounded form is designed for hot melt application to glassine, waxed glassine, and similar papers where a rapid heat-sealing, grease and moisture vapor resistant film is desired.

The series DET polyamide resins are thick, viscous adhesives available in a range of viscosities. Like the ED products, they may be applied as hot melts or may be dispersed in isopropyl or butyl alcohol. This series is made by the interaction of diethylene triamine with the dimerized and trimerized linoleic and linolenic acids of soybean oil. Both series of resins are compatible with rosin and other materials and are insoluble in lubricating and vegetable oils.

General Mills gives full credit to the Northern Regional Reserach Laboratory, Bureau of Agricultural and Industrial Chemistry, Peoria, Ill., for the development of the polyamide resins which were first produced by the Peoria Laboratory under the name of Norelac.

RESINOUS PLASTICIZER

Most recent member of the Paraplex resins is Paraplex G-25. It has been developed by the Resinous Products and Chemical Co., Philadelphia, Pa., and is a derivative of the sebacic acid family, being the first truly resinous plasticizer to show compatibility with polyvinyl chloride and vinyl copolymers. The material was the first, according to the manufacturers, to combine the desirable properties of ester types with the permanence characteristics of a stable, synthetic resin in such polyvinyl chloride compositions.

INSULATOR

A many-purpose tape has been announced by Irvington Varnish and Insulator Co., Irvington 11, N. J. Flexible and elastic, Fibron tape is manufactured from Vinylite resin. It is heat-sealing, flame resistant and high in dielectric and mechanical strength. Fibron tape is used for insulating wires, cables and electrical equipment; for splicing cables; and for protecting wiring, piping and equipment exposed to caustic or corrosive fumes, oil, grease, acids or alkalis. The tape has a low-temperature flexibility and a tensile strength of 1,700 lb. per sq.in. Its dielectric constant at 30 deg. C. (60 kilocycle) is 7.6, while its bonding temperature is stated as approximately 150 deg. C.

dl-TRYPTOPHANE

Tryptophane, one of the essential amino acids in protein, has for years been studied for its nutritional and therapeutic value, but it remained for the Dow Chemical Co., Midland, Mich., to produce it in quantities larger than 25 or 50-lb. lots. Dow's product, 99.5 percent pure, is probably not superior to others on the market, but it has the distinction of being available in any quantities desired. The two main fields which tryptophane will probably

Ten pounds of Activated Alumina fill that laboratory model Lectrodryer to the brim, whereas the "three tons of air per minute" machine holds 250,000 pounds. But both have this in common. They do a super-drying job, removing every trace of moisture to dew points below -110° F.

Activated Aluminas are economical to employ, a single charge lasting for years. Their high drying efficiencies are restored by heating, an operation often handled automatically by the machines. Where low-temperature drying is required by a process, Alorco Activated Aluminas likewise serve.

Whether your problem is one of drying air, gases or organic liquids, it will pay you to investigate the use of Alorco Activated Aluminas there. Machines for drying such materials are available. Your engineers don't have to waste valuable time developing special equipment.

For information on these machines and materials, write ALUMINUM COMPANY OF AMERICA (*Sales Agent for* ALUMINUM ORE COMPANY) 1910 Gulf Building, Pittsburgh 19, Pennsylvania.

ALUMINUM ORE COMPANY

ALORCO

Aluminas and Fluorides

Uncompounded. The solvent type is dispersible up to 45 percent solids in commercial absolute isopropyl alcohol, normal butyl alcohol, and in mixtures of these alcohols with petroleum naphthas, benzene, or toluene. The Hot Melt Compounded form is designed for hot melt application to glassine, waxed glassine, and similar papers where a rapid heat-sealing, grease and moisture vapor resistant film is desired.

The series DET polyamide resins are thick, viscous adhesives available in a range of viscosities. Like the ED products, they may be applied as hot melts or may be dispersed in isopropyl or butyl alcohol. This series is made by the interaction of diethylene triamine with the dimerized and trimerized linoleic and linolenic acids of soybean oil. Both series of resins are compatible with rosin and other materials and are insoluble in lubricating and vegetable oils.

General Mills gives full credit to the Northern Regional Reserach Laboratory, Bureau of Agricultural and Industrial Chemistry, Peoria, Ill., for the development of the polyamide resins which were first produced by the Peoria Laboratory under the name of Norelac.

RESINOUS PLASTICIZER

Most recent member of the Paraplex resins is Paraplex G-25. It has been developed by the Resinous Products and Chemical Co., Philadelphia, Pa., and is a derivative of the sebacic acid family, being the first truly resinous plasticizer to show compatibility with polyvinyl chloride and vinyl copolymers. The material was the first, according to the manufacturers, to combine the desirable properties of ester types with the permanence characteristics of a stable, synthetic resin in such polyvinyl chloride compositions.

INSULATOR

A many-purpose tape has been announced by Irvington Varnish and Insulator Co., Irvington 11, N. J. Flexible and elastic, Fibron tape is manufactured from Vinylite resin. It is heat-sealing, flame resistant and high in dielectric and mechanical strength. Fibron tape is used for insulating wires, cables and electrical equipment; for splicing cables; and for protecting wiring, piping and equipment exposed to caustic or corrosive fumes, oil, grease, acids or alkalis. The tape has a low-temperature flexibility and a tensile strength of 1,700 lb. per sq.in. Its dielectric constant at 30 deg. C. (60 kilocycle) is 7.6, while its bonding temperature is stated as approximately 150 deg. C.

dl-TRYPTOPHANE

Tryptophane, one of the essential amino acids in protein, has for years been studied for its nutritional and therapeutic value, but it remained for the Dow Chemical Co., Midland, Mich., to produce it in quantities larger than 25 or 50-lb. lots. Dow's product, 99.5 percent pure, is probably not superior to others on the market, but it has the distinction of being available in any quantities desired. The two main fields which tryptophane will probably

Ten pounds of Activated Alumina fill that laboratory model Lectrodryer to the brim, whereas the "three tons of air per minute" machine holds 250,000 pounds. But both have this in common. They do a super-drying job, removing every trace of moisture to dew points below -110° F.

Activated Aluminas are economical to employ, a single charge lasting for years. Their high drying efficiencies are restored by heating, an operation often handled automatically by the machines. Where low-temperature drying is required by a process, Alorco Activated Aluminas likewise serve.

Whether your problem is one of drying air, gases or organic liquids, it will pay you to investigate the use of Alorco Activated Aluminas there. Machines for drying such materials are available. Your engineers don't have to waste valuable time developing special equipment.

For information on these machines and materials, write ALUMINUM COMPANY OF AMERICA (*Sales Agent for* ALUMINUM ORE COMPANY) 1910 Gulf Building, Pittsburgh 19, Pennsylvania.

ALUMINUM ORE COMPANY

ALORCO

Aluminas and Fluorides

enter are those of nutrition and chemotherapy. It will, like vitamins, be added to diets deficient in tryptophane and will be fed to those who cannot readily digest normal food protein. At present this material is administered in solution along with other essential amino acids to keep up the blood protein of persons suffering from shock or injury. Amino acids, including tryptophane, provide a readily assimilated source of protein, much as intravenous sugar solutions provide a quick source of carbohydrate.

CHLORINATED RUBBER

A NEW synthetic product of Union Bay State Chemical Co., Cambridge, Mass., is not actually a chlorinated rubber but is "practically identical" to it in point of solubility, stability, compatibility with plasticizers, and resistance to flame, moisture and chemicals. It is called Chlorinated Isopol and is available at present in limited quantities only. Suggested uses include: fireproofing and moisture proofing fabrics and other materials, a primer for metal-to-rubber adhesion, an acid and alkali resistant coating for metal and concrete, and an ingredient in adhesives, paints, lacquer and ink.

RUST DISSOLVER

A SOLVENT, called CarboRustex, which has great affinity for rust but which will not attack unoxidized metal has been put on the market by the Carbozite Corp., Pittsburgh, Pa. In addition to rust-attacking agents CarboRustex contains ingredients which disperse the solvent evenly and others which attack any grease or oil whose presence might prevent the active agents from coming into direct contact with the rust. Most of the ingredients evaporate slowly so that the surface remains moist and the dissolving action continues for a maximum length of time. The solvent is neither toxic, flammable, nor injurious to the skin and may be applied by dip, spray, or brush. To prevent reoxidation of the metal after rust is removed, it is necessary to rinse with an inhibitor since the surface is chemically clean and quite vulnerable to oxidation.

RESIN FOR ENAMELS

BAKED enamels, such as refrigerator finishes, have outstanding hardness and color retention when made with vehicles based on urea and melamine-formaldehyde. But such coatings must be correctly plasticized and modified or the coating will be entirely too brittle, too low in gloss and poor in adhesion. Properly formulated alkyds are good plasticizers and modifiers for the purpose, but due to the shortage of phthalic anhydride such alkyds are next to impossible to obtain for civilian end uses. To fill the gap, U. S. Industrial Chemicals, New York, N. Y. has put on the market a non-critical resin known as S & W Aroplaz 1311 for use with baked coatings. Combinations with the new resin "do not bake quite as hard as with phthalic alkyds; but they are sufficiently glossy, tough, color-retentive, flexible, and adhesive to be entirely suitable for most purposes."

transmit power the wasteless way

Medart SS Type Pillow Block equipped with Timken Tapered Roller Bearings mounted on adjustable base.

A tremendous volume of power has been —and is being — wasted through obsolete mechanical transmission equipment; burned up by friction before it reaches the point of application.

Every unit of power lost means an increase in power cost. In addition an excessive amount of lubricant is required together with many extra man-hours to apply it. There is, furthermore, an ever-present danger of product damage or contamination through lubricant leakage. Maintenance is high because, among other things, rapid shaft wear is prevalent.

Add to all this the constant threat of unscheduled work stoppages through power interruptions resulting from transmission failures and you have a strong case in favor of replacing your obsolete, worn-out, plain bearing transmission equipment with modern Timken Bearing Equipped units *now*. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

CROCKER-WHEELER MOTORS for CHEMICAL PLANTS

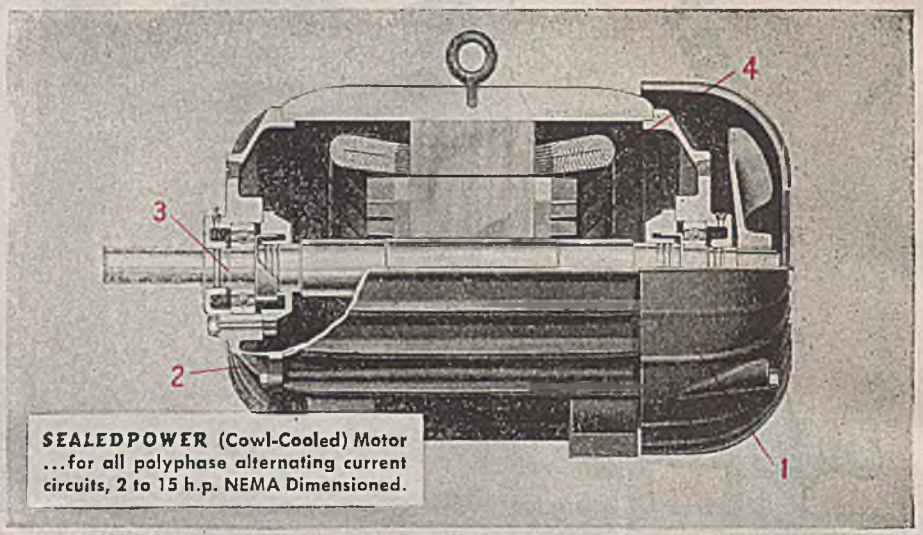
FEATURES

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.

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

AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON • LOS ANGELES

CHEMICAL ENGINEERING NEWS

ELECTROCHEMISTS TO HOLD CONFERENCE IN CHICAGO

BECAUSE of the growing importance of the electrochemical industry in the Chicago area, the Chicago Section of The Electrochemical Society is sponsoring an industrial development and electrochemical conference to be held January 19 in the Museum of Science and Industry, Chicago. The Chicago Association of Commerce, the Commonwealth Edison Co.; and the Armour Research Foundation are cooperating with the Chicago Section.

Primary object of the conference is to acquaint technologists and executives with industrial and electrochemical progress and particularly the possibilities for electrochemical development in the Chicago area. The program includes an industrial processing symposium with a question and answer period. Among the speakers who will deliver papers are W. O. Batchelder, commercial vice president, General Electric Co.; E. P. Querl, manager industrial department, Chicago Association of Commerce; T. G. LeClair, staff engineer, Commonwealth Edison Co.; Harold Vagtborg, director, Armour Research Foundation; S. D. Kirkpatrick, president, The Electrochemical Society and editor, *Chemical & Metallurgical Engineering*; C. F. Burgess, C. F. Burgess Laboratories, Inc.; R. B. Wittenberg, International Minerals & Chemical Corp.; H. E. Dralle, Westinghouse Electric & Mfg. Co.; and C. A. Crowley, Graham, Crowley & Associates.

RESEARCH LABORATORIES MAY BE SET UP IN CANADA

ANNOUNCEMENT has been made that the British Columbia Industrial and Scientific Research Council set up by the provincial government will immediately carry out a survey of existing research facilities in the province and at the same time extend contact with individual industries in British Columbia. It is expected this survey will indicate how existing facilities could be used to undertake research for industry, and how the Council can best serve the province at the present time. Eventually, it is the aim of the Council to establish central laboratories in a coordinated plan to supplement existing facilities with a nucleus staff which will be able to carry on research for industry on a cost basis.

Encouraging progress is reported on all research projects being undertaken by the Council. Research on the charcoal properties of softwoods obtained in the Zeballos Valley has been completed and a report prepared.

All dairymen in the province are now receiving a pamphlet containing practical suggestions which may help to prevent the spread of mastitis—a dairy cattle disease causing heavy financial losses each year.

Gracilaria plants, sea weed, growing twice as large as have been reported elsewhere, have been found in the Gulf of Georgia within the last two months. Gracilaria has a high commercial value as it is a source of agar which is used in the manufacture of food and medicines as well as in many industrial products.

MINING ENGINEERS ELECT OFFICERS BY MAIL

THE American Institute of Mining and Metallurgical Engineers, which will hold its annual meeting in New York next February, has selected officers for 1945 through a letter ballot. Harvey Seeley Mudd, president and managing director, The Cyprus Mines Corp., Los Angeles, was elected president and director. Donald H. McLaughlin, vice president and general manager, Cerro de Pasco Copper Corp., New York, and Leo F. Reinartz, manager Middletown Division, American Rolling Mill Co., Middletown, Ohio, were chosen as vice presidents and directors.

NEW PRODUCTS EXPOSITION ANNOUNCED FOR CHICAGO

AN OPPORTUNITY to inspect those developments of wartime inventive effort that will go on the market after the end of hostilities, will be presented through "The Products of Tomorrow Exposition" which is scheduled to be held in the Coliseum, Chicago, in the early spring. The exposition will be under the management of Marcus W. Hinson who has acted in a similar capacity for the chemical expositions which have been held in Chicago. He is being assisted by a planning committee made up of technical and industrial leaders.

Exhibits will include new products developed in all lines of American industry with Canadian and South American countries expected to participate. Present plans call for the exposition to continue for 17 days and while March 1 is suggested as the opening day, definite scheduling is more or less contingent upon the termination of the war in Europe and on government permission to begin large-scale production of new products for civilian use.

VAGTBORG TO HEAD MIDWEST RESEARCH INSTITUTE

HAROLD VAGTBORG, at present director of the Armour Research Foundation at Illinois Institute of Technology, has been appointed president of the Midwest Research Institute, Kansas City, Mo. Mr. Vagtborb became director of the Armour Research Foundation in 1936 and also organized and served as the first director of the Institute of Gas Technology, another Illinois Tech affiliate, from 1941 to 1943. Under his direction, the Foundation grew from a staff of three scientists, quarters of three rooms, and budget of $300,000 a year to its present status where it employs 300 persons, occupies five buildings, and had a budget for the fiscal year recently completed of more than one and one-half million dollars.

Mr. Vagtborg will assume his new duties at the beginning of the year. The Institute was organized as a nonprofit, scientific, research organization founded to develop agriculture, business, commerce, industry, and the natural resources of the midwest. A number of projects are under way at the Institute. The first was that of adapting crystalline ammonium nitrate for use as a commercial fertilizer. This was undertaken at the request of the military Chemical Works, Inc., which operates an ordnance plant near Pittsburg, Kans.

MONSANTO DEVELOPS BOMB LAUNCHING PROPELLANT

PLANS for the manufacture of a launching propellant for American models of the robot bomb were announced last month by officials of the Monsanto Chemical Co. and the Army Air Forces Technical Service Command at Wright Field, Dayton, Ohio. Development and testing of the propellant were accomplished through cooperation of Monsanto, the National Research Council, and the Air Technical Service Command. Dr. Charles Allen Thomas, head of Monsanto's Central Research Laboratories at Dayton, had a leading role in directing the research.

This announcement came shortly after it became known that Monsanto had been authorized by the Ordnance Department

IF YOU WANT YOUR *CHEM. & MET.* ANNUAL INDEX YOU MUST ASK FOR IT NOW

WPB's allocation of paper for our use again forces us to forego our usual practice of binding the annual editorial index into the December issue of *Chem. & Met.* We can continue, however, to print the index as a separate 8-page pamphlet which we will mail without charge to *all* readers who will send in their requests prior to January 15. Thereafter we cannot promise to take care of your requirements. Hence it is important that we hear from you immediately. If you want an annual index for your 1944 volume address a post card to Index Editor, *Chem. & Met.*, 330 W. 42nd St., New York 18, N. Y.

of the U. S. Army to design, build and operate a facility for production of what was referred to as a new ordnance development. The new plant, estimated to cost about $8,000,000 will adjoin the Longhorn Ordnance Works which Monsanto operates at Karnack, Texas.

CHEMICAL FOUNDATION DENIES CONSPIRACY CHARGE

RECENTLY the Federal Grand Jury at Trenton, N. J. indicted 18 steel companies and six of their officers on a charge of conspiracy. The Chemical Foundation, Inc., was named as a co-conspirator. The Foundation has issued a statement which states that The Chemical Foundation licensed over 96 steel companies to use its patents on stainless steel. These patents were available to all American firms on a non-exclusive and equal basis. All these licenses expired with the patents in May 1937. Since that time the Foundation has had no knowledge of any steel companies in the United States or elsewhere and it is not possible that it had any part in any alleged conspiracy which might be the subject of a present indictment in the Federal Court.

TO ATTEST TECHNICAL INSTITUTE PROGRAMS

PLANS are under way for the accrediting of the curricula of technical institutes by the Engineers' Council for Professional Development according to an announcement made by H. P. Hammond, dean, School of Engineering, Pennsylvania State College who is chairman of a subcommittee on technical programs. Dean Hammond announced the personnel of the committee as follows: C. W. Beese, Purdue University; George W. Case, U. S. Office of Education; John T. Faig, Ohio Mechanics Institute; L. J. Fletcher, Caterpillar Tractor Co.; E. H. Rietzke, National Council of Technical Schools; and B. M. Woods, University of California.

PULP AND PAPER INTERESTS CANCEL ANNUAL MEETING

THE ANNUAL meeting of the American Paper and Pulp Association, which has been held in New York in February for a number of years, will not take place in 1945. In place of the annual meeting such business meetings will be held as are necessary for the conduct of the business of the industry. These meetings will be largely concerned with the necessity for increased pulpwood production, the continuation of waste paper salvage campaigns, and the maintenance of mill operations in the face of acute labor shortages.

VITAMIN D PATENTS UNDER FURTHER CHARGES

WISCONSIN Alumni Research Foundation has for some time been attempting to defend its patents for production of Vitamin D in foods, drugs, and other industrial products by irradiation with ultraviolet light. It lost one suit in the West which later was reopened for reconsideration. It also brought suit in the Chicago Federal District Court against Douglas Laboratories charging infringement. Early this year the Antitrust Division of the Department of Justice intervened, asserting public interest and alleged abuse of

CONVENTION CALENDAR

Compressed Gas Manufacturers Association, thirty-second annual meeting and wartime conference, Waldorf-Astoria, New York, N. Y., January 22-23.

American Institute of Mining and Metallurgical Engineers, annual meeting, Pennsylvania Hotel, New York, N. Y., February 18-22.

Technical Association Pulp and Paper Institute, annual meeting, Hotel Commodore, New York, N. Y., February 19-22.

American Society for Testing Materials, spring meeting, Hotel William Penn, Pittsburgh, Pa., February 28.

Society of the Plastics Industry, Pacific Coast Section, annual conference, Biltmore Hotel, Los Angeles, Calif., March 6-7.

The National Farm Chemurgic Council, eleventh annual chemurgic conference, Hotel Statler, St. Louis, Mo., March 28-31.

American Institute of Chemical Engineers, regional meeting, Houston, Texas, April 1-4.

The Electrochemical Society, Inc., annual meeting, Hotel Claridge, Atlantic City, N. J., April 12-14.

American Ceramic Society, forty-seventh annual meeting, Hotel Statler, Buffalo, N. Y., April 15-19.

one mark of quality

• No matter how diverse the corrosion-resistant castings for the processing industry—there's one common mark of quality: The Sivyer diamond.

This trademark stands for Sivyer's 35 years of steel casting experience and the skill resulting from this experience. It is your assurance of longer-lasting corrosion-resistant steel castings—because Sivyer has the "know-how" to produce them this way.

That is why experienced buyers specify castings carrying the Sivyer diamond ◈ —the mark worth looking for.

SIVYER STEEL CASTING COMPANY

MILWAUKEE ◈ CHICAGO ◈

ARMY E NAVY

the patents by the owner and his licensees.

Recently the Antitrust Division has further entered this case with the following specific charges against the Foundation and chemical, food and drug companies who are licensees. These companies, it is charged: "Divide fields of manufacture, use the sale of Vitamin D and Vitamin D products; agree upon whether additional concerns should be permitted to become licensees and engage in the business of manufacturing, using or selling Vitamin D products; prevent and suppress competition in the manufacture, use and sale of Vitamin D products among licensees under the Steenbock patents; and prevent and suppress such competition between licensees and other concerns."

COMPANY ORGANIZED TO MAKE CHEMICALS FROM PETROLEUM

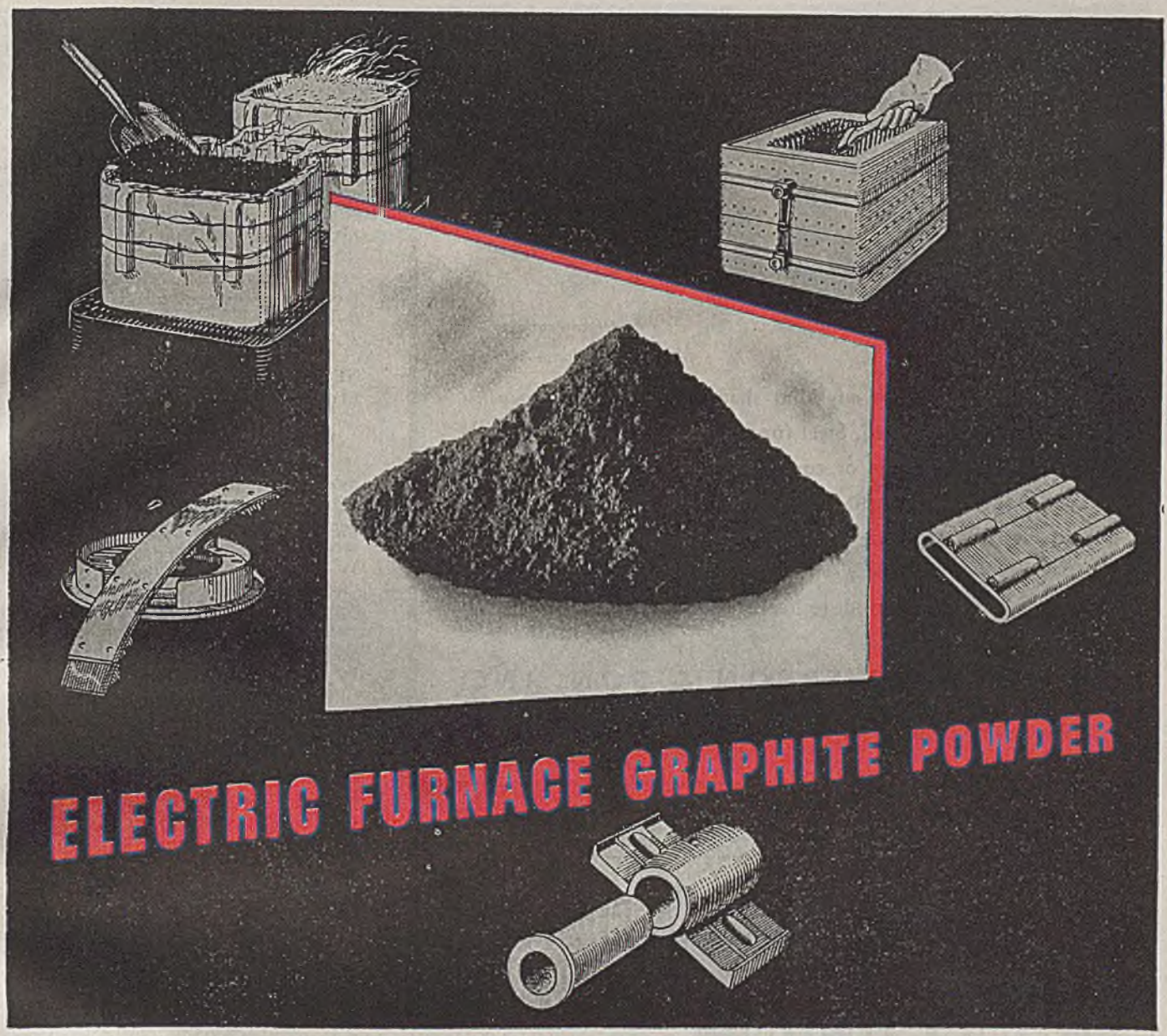
FORMATION of the Jefferson Chemical Co., Inc., jointly owned by the American Cyanamid Co. and The Texas Co. was announced in the latter part of November. The new company will use petroleum and petroleum gases to produce such chemicals and chemical products as are likely to be in demand by various consuming industries. W. B. Bell is chairman of the board, W. S. S. Rodgers, vice chairman, and H. L. Derby, president. Directors are W. S. S. Rodgers, W. B. Bell, Harry T. Klein, H. L. Derby, M. Halpern, K. F. Cooper, R. J. Dearborn, M. C. Whitaker, W. M. Stratford, R. C. Gaugler, W. E. Kuhn, and L. C. Perkinson. Headquarters will be at 30 Rockefeller Plaza, New York.

PAPER INTERESTS ESTABLISH WATER POLLUTION RESEARCH

THE National Council for Stream Improvement of the Pulp, Paper and Paperboard Industries has announced the establishment of a research project at Manhattan College, New York, under the direction of Prof. C. J. Velz, head of the department of civil engineering. The project will consist of a sanitary analysis of the watersheds in which the industry is concerned. It will include calculations of projected stream profiles for the purpose of determining the degree of responsibility of the pulp, paper and paperboard industries in relation to other industries for pollution and point out what degree of abatement is necessary to return streams to a condition satisfactory for uses to which they are put. This information will also help in guiding the research program conducted by the Council which is concerned with treatment and recovery of wastes and insure the industry against investment in inadequate treatment facilities.

UNIVERSITY OF DELAWARE PLASTICS PROGRAM

PLANS for the coming year of the plastics division at the University of Delaware include research projects of two basic types as well as a graduate program of advanced courses in plastics technology. These plans are an outgrowth of the



MAKES THEM BETTER!

As a hot-topping compound, it produces sounder ingots by reducing the size of the pipe. As a mold wash, it prevents stickers. It provides brake linings with essential qualities for longer life. It is the lubricant of many oilless bearings. It is formed into electronic tube elements of high efficiency.

These are a few of the many jobs that "National" electric furnace graphite powder performs . . . to make things better!

To this end, an increasing amount of graphite powder goes each year to the iron and steel, foundry, chemical and process, petroleum, rubber, mechanical, and many other industries. Besides the applications illustrated, graphite powder is used in powder metallurgy, clutch facings, fabric belting, greases, wire drawing, rubber compounds, powder glazing, crucibles, batteries, boilers, ink and paint pigments, pencils, crayons. The list grows steadily.

"National" electric furnace graphite powder comes in a number of grades, each classified on the basis of purity, electrical resistance, and fineness . . . all held within accurately controlled limits.

Ask us how electric furnace graphite powder may help serve you . . . or serve you further.

KEEP YOUR EYE ON THE INFANTRY
. . . THE DOUGHBOY DOES IT!

organization of a plastics division about two years ago when an initial grant of $20,000 was made to the university by Philadelphia Textile Finishers, Inc. Additional grants since then have permitted an expansion of activities culminating in the present organization and program.

Because the many technical aspects involved in the field of plastics are both engineering and chemical in nature, the plastics division has on its staff members from pure sciences as well as from engineering. Present emphasis is on research problems in high-polymer chemistry and in engineering design.

NEW ZEALAND WOOD TESTED FOR PULP PURPOSES

THE New York State College of Forestry at Syracuse University has received 20 cords of pulpwood from New Zealand for experimental purposes. The wood is popularly known as Monterey pine. It was sent to the forestry college by the Whakatane Paper Mills, Auckland, because no institution in New Zealand or in Australia is equipped to carry on the investigations desired by the company.

It was sent to determine the possibilities of making satisfactory chemical pulp for book and writing paper, rayon and other purposes. Prof. Clarence E. Libby, head of the department of pulp and paper at the forestry college, reports that excellent results are being obtained in pulping this wood and that paper machine runs of several types of paper will be made from this pulp in the near future.

FOAMGLAS PLANT WILL BE DOUBLED IN CAPACITY

PLANT additions which will ultimately cost $750,000, have been announced by the Pittsburgh Corning Co. for its Foamglas plant at Port Allegany, Pa. The additions will double the capacity for producing Foamglas which was first put into commercial production less than two years ago. Foamglas, so far produced in rigid slabs and in various thicknesses, is a true glass which has been blown up or "cellulated" so that its volume is about 15 times that of ordinary glass. Wartime use has taken a large part of recent output. It is used as the buoyant element in life rafts, net buoys and similar heavy flotation equipment, also in many types of ship construction.

PITTSBURGH PLATE GLASS CO. TO EXPAND FACILITIES

PLANS for a $700,000 addition to its window glass plant at Mt. Vernon, Ohio, have been announced by the Pittsburgh Plate Glass Co. Within the past year, the company has acquired a substantial interest in the Murphy Paint Co., Ltd., of Canada, has constructed a large addition to its plant at Creighton, Pa., and is now constructing a paint plant at Springdale, Pa. The company also has adopted a new official insignia consisting of the letters PPG interlocked, in order to facilitate the ready recognition of its varied products.

MATERIALS OF CONSTRUCTION REPORT ADDITIONS

Our attention has been called to certain omissions in the Report on Materials of Construction for Chemical Engineering Equipment in the September, 1944, issue of *Chem. & Met.*

On page 101 should be added Pittsburgh Steel Co., Pittsburgh, Pa., makers of wrought stainless steels in wire, bars, and wire products.

On page 102 should be added American Steel Casting Co., Newark, N. J., makers of American CN-7 corrosion-resistant castings with the composition Fe; Ni, 23-26; Cr, 18-20; C, 0.07 max., and American CT-7 corrosion-resistant castings with the composition Fe; Ni, 34-37; Cr, 13-17; Mo, 3-4; C, 0.07 max.

On page 131, in "Makers of Structural Carbon and Graphite Products," to the list of products of the National Carbon Co., Cleveland, Ohio, should be added "impervious carbon shapes."

On page 132, in "Makers of Cements and Putties for Acidproof Brick and Stoneware," should be added National Carbon Co., Cleveland, Ohio, makers of acidproof carbonaceous cements known as National cements.

On page 132, in "Makers of Glass, Glass-lined and Fused Silica Equipment," should be added Pittsburgh Plate Glass Co., Pittsburgh, Pa., makers of glass and glass-lined tanks.

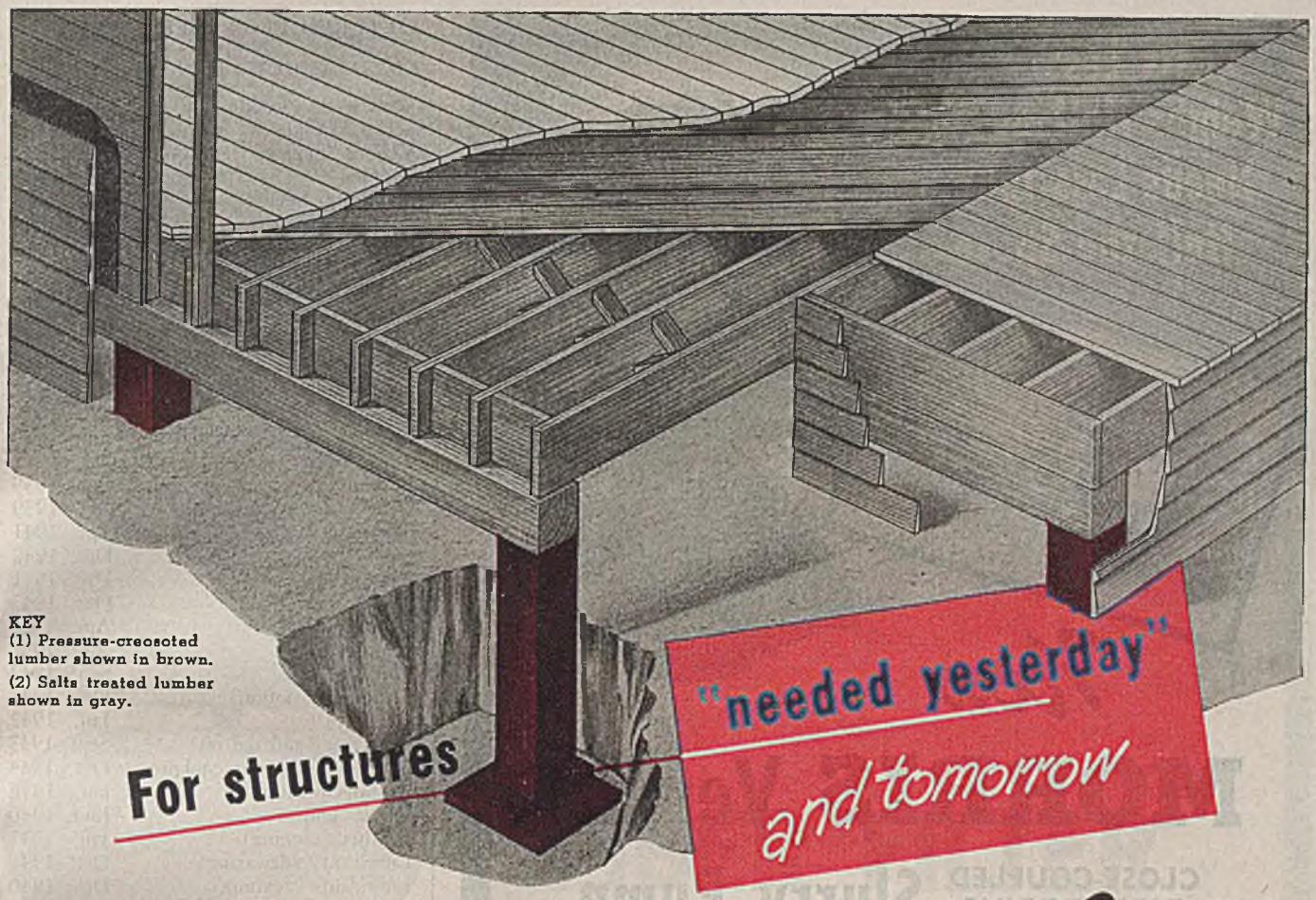
On page 135, in "Representative Makers of Industrial Rubber Products and Rubber-Like Materials," should be added Republic Rubber Division, Lee Rubber and Tire Corp., Youngstown, Ohio, makers of a complete line of industrial goods including conveyor and transmission belt, both regular and acid resisting; water, steam, and air hose; hose for conveying chemicals; and specially molded products. Also in this division should be added Johns-Manville Corp., New York, N. Y., makers of packings and gaskets; Clipper bearing protectors; and molded products.

LUMBER BYPRODUCTS PLANTS PLANNED FOR OREGON

Plans have been made by the Hughes Research and Engineering Co., North Sacramento, Calif., for the erection of two lumber byproducts plants in Oregon, one at Klamath Falls and the other at Bly. These plants will manufacture alcohol, glucose, wallboard, and flooring. The process to be used in the manufacture of the chemicals has been developed by the company as a result of a two-year research conducted by Fred Hughes and J. Ray Schwenk.

ST. REGIS PAPER STARTS EXPANSION PROGRAM

A construction and expansion program to cost about $3,000,000 has been started by the St. Regis Paper Co. at its pulp and paper mill in Deferiet, N. Y. The program includes the installation of a new high speed paper machine, expansion of capacity to produce bleached sulphite and bleached groundwood pulps, a new steam plant, and a new bleaching unit.



USE PRESSURE-TREATED WOOD

The time for "expendable" building is past, and even on rush construction thoughtful engineers are applying the peace-time yardsticks of low first-cost, low maintenance and long service life. Pressure-treated wood completely meets this difficult combination of requirements.

The illustration indicates recommended practice in applying pressure-treated wood in the average building. (1) Pressure-creosoting of foundation parts, and of any other wood members in contact with the ground gives long and proven protection. (2) Pressure-treatment with chemical salts of joists, framing, other structural members, flooring, sheathing, siding, trim and roofing affords like protection—and in addition can provide resistance to flame spread without adversely affecting color, odor or paintability.

ADVANTAGES

1. **Speed of Erection**
2. **Long Life**
3. **Fire Resistance**
4. **Decay Resistance**
5. **Termite Resistance**
6. **Non-Spalling**
7. **Non-Corrosive**

Structural parts can be completely pre-framed to blueprint in our plants, and easily assembled with local labor. At the same time if any structural modifications are required, they can be handled right on the job.

For a quick picture of the many places where pressure-treated wood is serving and saving for other engineers—and for some tips as to where it might do the same for you—ask for our bulletin, "Economical and Permanent Construction with Pressure-Treated Wood."

KOPPERS COMPANY • WOOD PRESERVING DIVISION

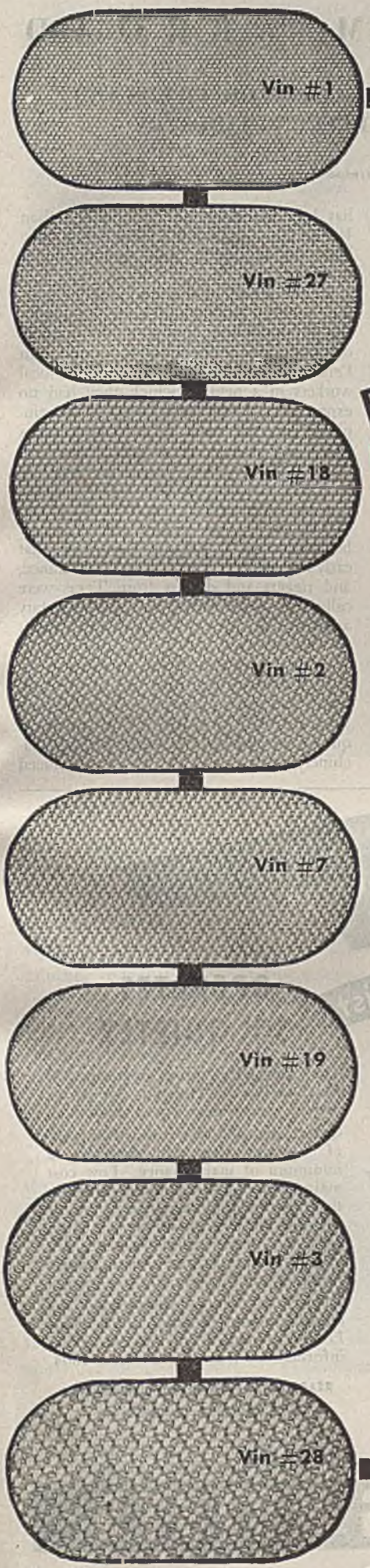
PITTSBURGH 19, PA.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

PICTURED FLOWSHEET INDEX

CHEM. & MET., 1939-1944



FOR FILTERING MINERAL ACIDS and ALKALIES

VINYON*

FIBER FILTER FABRICS

Perfected and developed through three years of field studies, Vinyon Fiber filter fabrics are the result of constant research. They are solving many problems in the filtration of mineral acid or alkali solutions.

Subject always to certain heat limitations, Vinyon fiber fabrics are unusually efficient because VINYON is especially made for a high resistance to mineral acids and alkalies present in many filtration operations.

The longer life of these fabrics for the filtration of corrosive fluids results in ultimate economy in purchase of the filter septum and in higher efficiency due to fewer shutdowns for replacement.

The engineers on our staff will be glad to discuss the possible application of Vinyon fabrics to your own particular industry. If you have a filter fabric problem with any of the processes or products listed below, you are invited to consult us. Include any information regarding your filtration process and we shall be glad to make suggestions and help you in any way possible.

Please address inquiries to 65 Worth Street, New York 13, N. Y.

- Pigments and Dry Colors
- Dyes and Intermediates
- Pharmaceuticals
- Mineral Acid Solutions
- Metallurgical Processes
- Strong Alkali Solutions
- Salt Solutions
- Bleach Liquors
- Electroplating Processes
- Ceramics

BUY MORE WAR BONDS

* Reg. Trade Mark C. & C. C. C.

WELLINGTON SEARS COMPANY, NEW YORK, N. Y.

NEWS FROM ABROAD

GREAT BRITAIN DEVELOPS CRUDE OIL FIELDS AND PLANS PETROLEUM REFINING INDUSTRY

Special Correspondence

One of the most welcome industrial developments in wartime Britain has been the expansion of crude oil production from 238 long tons a month in 1939 to 100,000 tons per annum at the present time. This news which came as a complete surprise to the public was released quite recently. Until then nothing was known officially beyond the meager prewar findings which did not seem to justify any substantial expectations with regard to Britain's future as an oil producer.

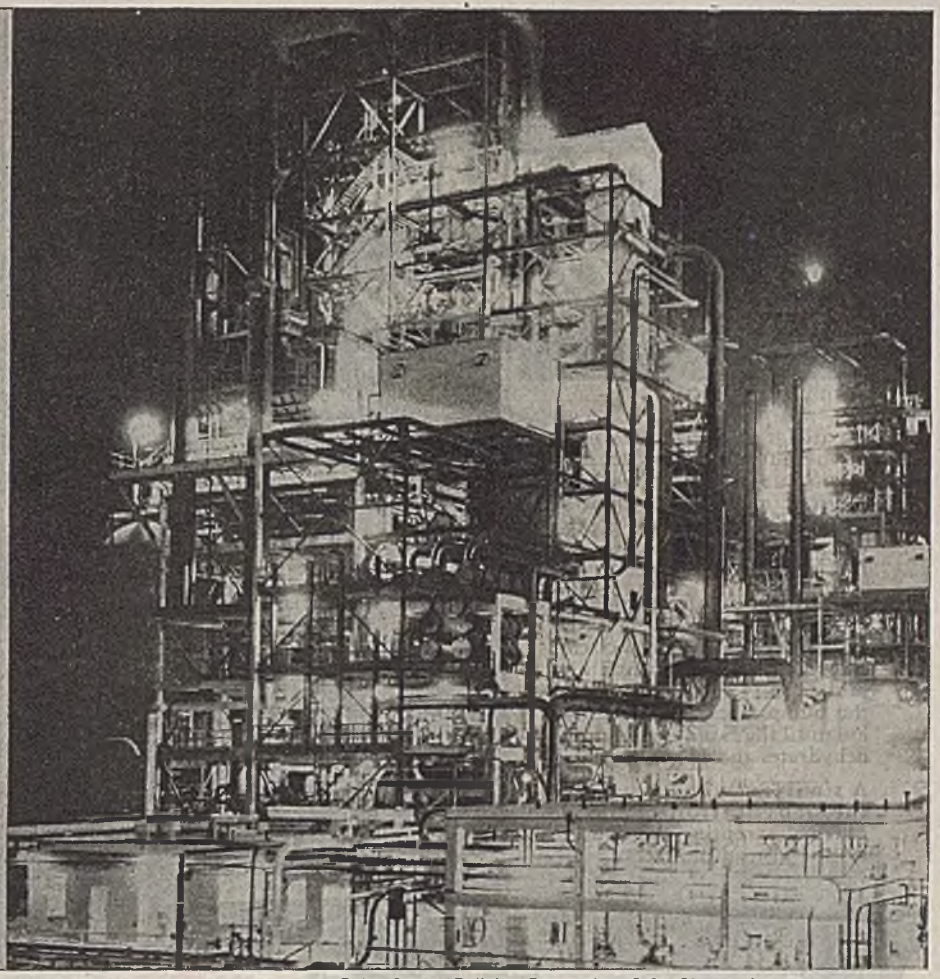
There is one main oilfield in which production started in July, 1939, and a few other fields, including a small field in another part of the country, but no information has been given about the actual sites. Before the war certain parts of Scotland seemed to hold out most promise. There are now 238 productive wells, scattered over many square miles, though the main field which is owned and operated by the Anglo-Iranian Oil Co. is about two miles by one-half mile. The oil-bearing strata lie between 2,000 and 2,500 feet, and deep test drilling is being carried out with a view to testing for a lower horizon; one test borehole has been sunk to over 7,000 feet. At another field somewhere else oil has been struck at a depth of less than 100 feet. Some 1,600 shot-holes have been drilled on an area covering 1,300 square miles.

In the actual production work cooperation between British and American experts has given excellent results. Skilled English oil specialists were brought back from Persia to supervise and instruct local workers in a field in which they had no experience. About 1,000 workers are employed on the main field in continuous operations seven days a week. They include 150 ex-miners from the Yorkshire coalfields. When, in the middle of the war, the output target was fixed at the rate of 100,000 tons per annum which has now been attained, it became soon clear that early success depended on expert assistance, and riggers and drillers from Texas were called in. Since early 1943 supplementary assistance has been given by United States oil contractors.

Among examples of the excellent progress of the drilling work are wells completed and put into operation in seven days from the start of drilling. The period required for moving the heavy drilling machinery from site to site has been reduced

"Hot spot"

HAZARDS ELIMINATED BY FIBERGLAS* TOWER PACKING



National Petroleum News Photo • Cities Service Refining Corporation—Lake Charles, La., Refinery. The M. W. Kellogg Co., Jersey City, N. J.—Engineers-Contractors.

The Fiberglas Tower Packing being used in three horizontal acid coalescers, 3′ 6″ I.D. x 15′ 0″ long at Cities Service Refining Corporation's Lake Charles, Louisiana refinery affords another example of the many advantages derived from the use of this unique material. Each of the three coalescers contains 78 cu. ft. of Fiberglas Tower Packing. Furnace oil, acid, sludge and water are being satisfactorily handled. The units are operating at the required pressure drops and are adequately meeting all specifications.

Being made of glass fibers, Fiberglas Tower Packing is incombustible, thus preventing "hot spots". Fiberglas Tower Packing affords exceptional surface area—as much as 232 sq. ft. per cu. ft., when packed at a 6-lb. density. And at this density the free volume is 96.1%.

The glass fibers, of which Fiberglas Tower Packing is made, are arranged in jack-straw manner and held together with a water-soluble binder to give them form for easy handling during application. The individual fibers will not absorb moisture, will not rot or decay and are not affected by most acids. And because of its low cost it is not necessary to clean Fiberglas Tower Packing; simply replace it, easily and quickly, with clean packs.

Perhaps you, too, can benefit by using Fiberglas Tower Packing in your fractionation, distillation, evaporation, diffusion, filtration, contact or eliminator process. Samples for experimental work, together with all use and application data available, will be furnished upon request. Write: *Owens-Corning Fiberglas Corporation, 1950 Nicholas Building, Toledo 1, Ohio. In Canada, Fiberglas Canada Ltd., Oshawa, Ontario.*

Free Samples

Write for folder containing samples of seven *Fiberglas Basic Fibers* ranging in diameter from .00022" to .0080".

ARMY E NAVY

FIBERGLAS TOWER PACKING

*T.M. Reg. U. S. Pat. Off.

to as little as 12 hours. In one instance a complete outfit of portable units was moved and had bored 960 feet at a new site 24 hours after leaving the previous one. This was achieved by close cooperation between oil experts, drilling contractors, and authorities.

The oil produced has been described as equivalent in quality to Pennsylvania crude. It is carried by a pipeline to a railway siding nearby and thence by tank cars to the refinery. It is used for the manufacture of high-grade petrol lubricants, even of aviation grade, and paraffin waxes. Considerable trouble has been taken to interfere as little as possible with normal farming activities and the amenities of the countryside. There are no derricks. The seven-foot high oil pumps are electrically driven and silent. There are offices, stores, workshops, and laboratories, but otherwise there is nothing to draw attention to the sites, and as soon as a well has been completed, the machinery is removed and the site levelled. Only a small area of a few square yards is fenced off. The first well which has been in production for five years is still yielding several tons of oil a day, and according to the chief geologist's statement, this particular field will continue to produce oil at a decreasing rate for 10–15 years at least. Further exploration work is being carried out with a view to extending the productive area.

From a quantitative point of view, the present production may seem insignificant: the total produced at present is only one percent of the average prewar consumption in Great Britain. But in view of the disappointing progress before the war when one prospecting area after another had to be abandoned as unproductive and the total amount of petroleum produced over several years did not amount to more than 967 tons, the wartime development is certainly gratifying. Moreover, it is of interest in connection with plans for the establishment of a petroleum refining industry and chemical plants based on it in the British Isles. For these reasons it may be assumed that the possibilities of Great Britain as an oil producer will be carefully investigated after the war. This is in line with the general policy of making the best use of locally available raw materials which has been given a fillip during the war.

PATENT REFORM

The British chemical industry has now expressed an expert view on the proposals for a reform of the patent law which is of particular interest in view of its bearing on questions of international cartels and monopolies. These views are expressed in a Memorandum of Evidence submitted to the government committee on patent law reform by the joint chemical committee on patents on which various big firms and other interests are represented. The committee has come to the conclusion that abuses of patent monopoly insofar as proved are usually found to be due to the abuse of the power of wealth and proposes a reduction in the number of invalid patents, lowering of the cost of litigation for a successful defendant in the patent courts, and easier conditions for the grant of compulsory licenses.

The committee thinks that it should be

made compulsory on patentees to register all patent licenses with the Patent Office to avoid useful patents being bought up and left unused by powerful interests. Where a patent is being worked abroad and the product imported into Great Britain under an agreement with a British licensee who agrees not to work the invention in the British Isles but to cover all requirements by buying from the foreign producer, the Comptroller of Patents should be given power to grant a compulsory license without royalty or even, in extreme cases, to exclude both the original patentee and the licensee from manufacturing or selling under the patent. The applicant for a compulsory license should be required only to make out a prima facie case, and thereafter the onus of proof should pass to the patentee.

As additional reasons for refusal of patent grant are recommended (a) that the invention is not of industrial significance and (b) that it does not contribute any item of new knowledge to the art. A new use of an old manufacture, on the other hand, which is based upon the discovery of a hitherto unknown property of the old material may be deemed worthy of patent protection.

PATENT POOLING

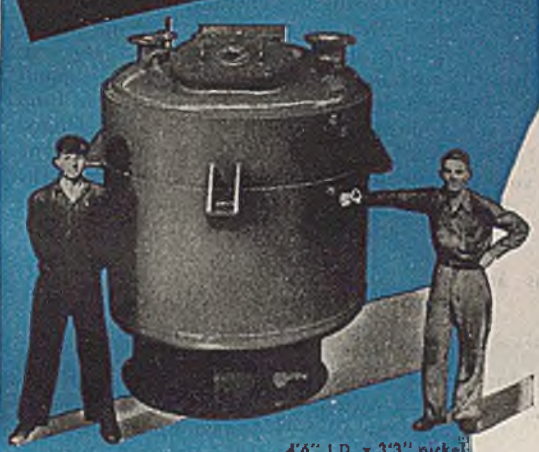
In a minority report one member of the committee, delegated by Therapeutic Research Corp. of Great Britain Ltd., the joint enterprise of five important chemical manufacturers, deals with such pooling of patents as may keep a newcomer from entering an industry. Such abuse of patent monopoly, which may result in all those engaged in the industry being coerced to adopt restrictive trade practices, is in his view at present prevalent and could be substantially overcome by the endorsement of all patents "Licenses of Right". It is, he added, a matter of extreme difficulty to give concrete examples of actual abuse of patent rights, but it would be unreasonable to assume that when discovery upon oath regarding cartel agreements in the United States disclosed so many abuses, similar discovery upon oath, if practicable, in Great Britain would not disclose like abuses in agreements made with the same German firms, even though possibly to a somewhat lesser extent. He recommends that all licenses under patents should not merely be registered, but the full documents should be open to public inspection.

It will be seen from these extracts that the opposition against patent protection abuses is directed against the secretiveness of the agreements concerned just as much as against the actual abuse of power given by patents. British chemical manufacturers in particular object to licenses which preclude the possibility of manufacturing operations in the country while the same article is being made abroad and imported into the British market. On this point there seems to be far-reaching agreement, even though the extent of demanded disclosures and the procedure of protection may be in dispute. There are no objections, however, to cooperation on a national or international scale or to pooling of patents.

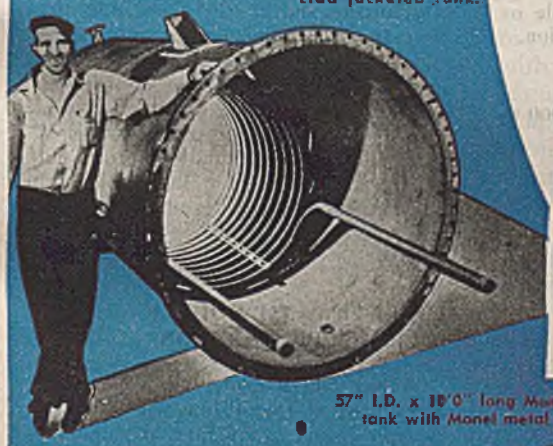
There have been few changes in the British chemical markets during recent

The Problem: RELIABLE FABRICATION OF NICKEL AND NICKEL ALLOYS

The Solution: NOOTER!



4'6" I.D. x 3'3" nickel clad jacketed tank.



57" I.D. x 18'0" long Monel metal tank with Monel metal coils.

Solid and clad nickel and nickel alloys are among the most difficult materials to fabricate. It takes long experience and special methods.

Nooter has learned, by experience, how to surmount economically the many problems presented by this difficult type of construction.

Punching, rolling, shearing, forming, and welding require special treatment, involving problems of heat treatment, sound welds, and iron-free surfaces.

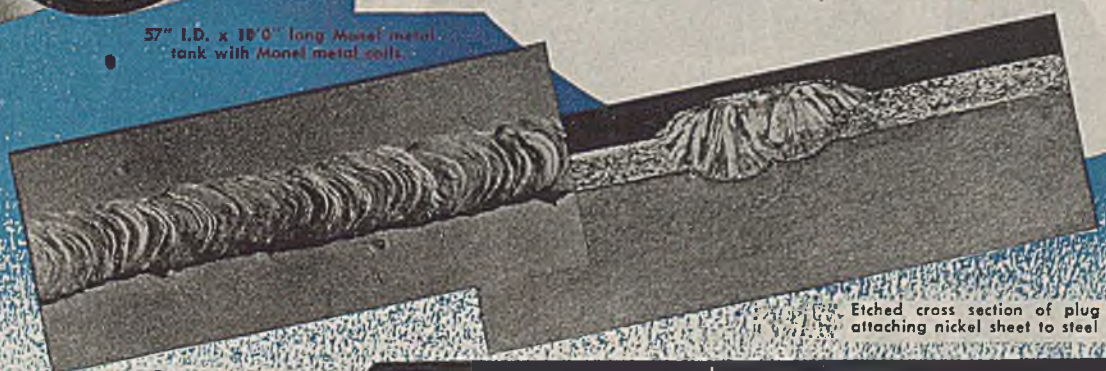
Nooter fabricates: Nickel, Monel, Inconel and Cupro Nickel; also Stainless Steel, Bronze, Aluminum, Copper and Steel.

May our Engineers help you?

JOHN NOOTER BOILER WORKS CO.

Alloy and Bi-Metal Fabricators

1409 SOUTH SECOND ST. • ST. LOUIS 4, MISSOURI



Etched cross section of plug weld attaching nickel sheet to steel plate.

Typical nickel weld.

ARMY NAVY

NOOTER ST. LOUIS

months, though there has been a general easing of the situation in directions where shortages were observed. Prices are firm, and markets steady. Nor is there much likelihood of early changes in this situation. The bulk of the business is done under long-term contracts. The export trade is still strictly limited, mostly to the Dominions and Colonies.

BRAZIL TO HAVE COLLEGE OF CHEMICAL ENGINEERING

ANNOUNCEMENT has been made that construction will begin on a two million dollar building at Sao Paulo, Brazil, to house the first college of chemical engineering in that Republic. The institution, when completed, will combine with the existing School of Business Administration and School of Technical Drawing to form the Technical University of Sao Paulo. Rev. Roberto Saboia de Madeiros, S. J., is the organizer of the project and was instrumental in obtaining financial support and equipment for the institution from industrialists in Brazil and the United States. The university will be non-sectarian and at least three instructors from the United States will be numbered among its faculty.

PERU DOUBLES CONSUMPTION OF BARIUM CHLORIDE

IMPORTS of barium chloride into Peru have been rising in recent years. During the year 1938-41 demand for this chemical was slight. In 1942 imports increased substantially, and in 1943 were more than twice the 1942 figure. Germany was the principal source in the immediate prewar year, but the United States has been the sole supplier since 1940. Barium chloride is used in Peru for the production of hydrochloric acid and liquid refrigerant, and in leather tanning. It is also employed in manufacturing pigments, and for laboratory purposes.

ARGENTINA TO DOUBLE SULPHUR PRODUCTION

WHILE official figures are not available, an estimate of 18,000 tons has been given as representing production of sulphur in Argentina last year. Efforts are being made to double the output in the current year which if successful would mean a supply of 36,000 tons. This not only would take care of home requirements but also leave a surplus for export.

MORE PYRITES PRODUCED IN SWEDEN IN WAR YEARS

PRODUCTION of pyrites in Sweden has greatly increased since the beginning of the war period largely because of enlarged mining activities in the Boliden area. That area is estimated to have produced 200,000 metric tons in 1943, which with pyrites produced at the Falun mines probably covers current Swedish needs. Sulphur recovered from flue gases at the Ronnskar

INSULATION helps speed penicillin production

Armstrong's Corkboard and Cork Covering help maintain exact temperatures in mass production of this wonder drug

AT several stages in the production of penicillin, unvarying temperatures must be maintained to prevent contamination. In processing this life-saving drug, precise low temperatures must be held to keep the protein content "fixed," and thus retain its potency. Certain vats and rooms are refrigerated, and the air in them is sterilized. In these air-conditioned and refrigerated areas, insulation plays a vital part in holding the correct temperatures regardless of outside conditions.

In selecting insulation for these areas and refrigerating equipment, absolute dependability was a prime requirement. That is why Armstrong, with its 40 years' experience in the manufacture and application of low-temperature insulation, was called upon to insulate several penicillin plants. Armstrong's Corkboard and Cork Covering have already helped to produce billions of units of this wonder drug.

New problems of low-temperature control come to Armstrong engineers year after year. Each problem is solved in a practical way because they have handled a variety of low-temperature insulation jobs, both simple and complex, in many fields.

In three important ways, Armstrong's "know-how" follows through to assure dependable insulation. Armstrong offers first, a complete line of efficient materials including Corkboard, Mineral Wool Board, Foamglas*, Cork Covering, and sundries for their efficient erection; second, practical engineering aid in planning and designing the insulated structure; and third, proper installation—for all Armstrong offices and distributors maintain crews of skilled mechanics.

For complete information, write today to Armstrong Cork Company, Building Materials Division, 3312 Concord Street, Lancaster, Penna.

* Reg. U. S. Pat. Off. Product Mfg. by Pittsburgh Corning Corp.

ARMSTRONG CORK COMPANY

Insulation Headquarters

smelter amounts to about 4,000 tons a year and amounts produced at shale-oil plants may equal three times that amount. Sulphuric acid production in Sweden likewise has increased greatly as has nitrogen fixation and calcium chloride. Superphosphate production, based on apatite, is expected to reach 330,000 tons in 1944.

INDIA WORKS TO EXPAND MARKETS FOR JUTE

IMPORTANT work is being done by the Indian Central Jute Committee in conjunction with universities and mills to improve jute fibers to a point where they will prove satisfactory for use in many new fields. Particular emphasis is placed on expanded markets. Synthetic resins are being investigated in an attempt to increase strength through forming an artificial cementing material to hold the short fibers together. Bleaching methods are being tried in an effort to reduce the loss of strength occasioned by many bleaching agents now in use. A blue-dyed and polished jute twine is being tried and samples have been sent to South Africa for testing. Another outlet for jute may be found in knitted goods if the harsh feel of the fabric can be eliminated by treatment. It has been suggested that luster could be obtained through use of rayon.

SPAIN INCREASES OUTPUT OF MURIATE OF POTASH

MORE favorable reports are heard regarding the potash industry in Spain. Last year production continued on the down grade although the decline was less sharp than in 1942. In recent months substantial orders have been received from outside countries and it is estimated that 1944 production of muriate of potash will reach a total of 120,000 tons of K_2O. Total production of Union Espanola de Explosives, Minas de Potasa de Suria, and Potases Ibericas amounted to 87,000 metric tons of K_2O in 1943 compared with 117,000 tons in 1941 and 89,000 tons in 1942.

RUSSIAN CHEMICAL PLANTS AGAIN IN OPERATION

THE SOVIET press is authority for the statement that Lenin Soda Factory, Voroshilovgrad, Oblast, Soviet Russia, has been partially restored and is now producing 230 tons daily. Annual production of the plant formerly was 400,000 tons or more than one-half the prewar output of the country. It further is stated that chemical plants in Stalino Oblast have produced more than 5,300 tons of chemical materials since their restoration.

SWEDISH WAREHOUSES FILLED WITH CELLULOSE

PRESENT stocks of cellulose in Sweden are reported to amount to about 700,000 tons which means that warehouses are filled to capacity. In 1939, Sweden exported 833,000 tons of pulp to the United States and a recent statement credits

PILOT YOUR PRODUCTS TO PROFITABLE MARKETS WITH MOSINEE *Paperology*

Many a product is being piloted "on the beam" to bigger and better market opportunities with Mosinee Paperology "at the controls". In much of the same manner that metallurgists create alloys resistant to acid, rust, stain or corrosion . . . alloys of specified hardness, toughness, pliability, density, spring, weight, color, etc...Mosinee Paperologists develop "special analysis" papers to meet a wide variety of industrial product and packaging requirements.

Scientifically engineered Mosinee is taking the place of other materials previously considered "essential" in electrical products.

The success of many plastics depends upon paper made to a specific formula with positive control of chemical and physical properties. Products and parts made of Mosinee frequently represent improved quality and utility. Costs are reduced . . . markets expanded.

Mosinee can be engineered to work better in your processing machines or packaging equipment . . . minimizing delays, work-stoppages and manpower losses, reducing maintenance costs, lowering production costs and boosting output.

Mosinee Paperologists are ready to work on your present or postwar problems.

Please address your letter "Attention Dept. C"

MOSINEE PAPER MILLS COMPANY
MOSINEE • WISCONSIN
Essential Paper Makers

Sweden with a willingness to ship pulp to the United States in the same tonnage as before the war. Recently Great Britain placed a contract for Swedish pulp involving shipments of 20,000 tons a month for a year but ample supplies are said to be available to meet American needs.

ALCOHOL PRODUCTION MAKES PROGRESS IN AUSTRALIA

A PLANT at Cowra, New South Wales, has been producing alcohol for about a year. Another at Warracknabeal, Victoria, was recently completed and two more, located at Wallaroo, South Australia, and at Collie, Western Australia, are expected to go into production early next year. In February 1942 the Commonwealth entered into an agreement with the Colonial Sugar Refining Co., Ltd., for the erection of four distilleries. This company already was a producer of alcohol from molasses in four plants. The Cowra plant was finished in December 1943 and the Victoria plant by last September but was not in operation at that time. Construction of the other two plants was delayed by lack of materials and equipment. The alcohol is used for power purposes and the process employed is called "Amylo" a fairly recent development which necessitated much experimenting.

Yield of power alcohol from this method is 2.5 gal. per bu. of wheat compared with 2.3 gal. yielded by the more familiar malt process.

CHINA DRAFTS TRADE LAW FOR POSTWAR GUIDANCE

IN ACCORDANCE with a resolution adopted by the twelfth plenary session of the Kuomingtang's Central Executive Committee, plans for the postwar development of China's industries are being formulated. A Trade Law has been drawn up which will guide the negotiation of such commercial treaties with foreign powers as will place future trade relations on an equitable basis. Measures also have been prepared by the Ministry of Economic Affairs concerning the employment of foreign investments and technical assistance.

NEW OIL REFINERY WILL BE BUILT IN VENEZUELA

AN UNOFFICIAL report states that a 35,000-bbl. 80-octane gasoline refinery will be built at Puerta de la Cruz, Venezuela, by an United States company. According to the report, the installations will include crude and cracking stills, an acid plant, and electric-generating facilities with a cost of about $5,000,000.

ALUMINUM PRODUCTION GAINS IN SWEDEN

ALUMINUM production in Sweden has reached a capacity of more than 5,000 tons annually, making the country independent of imports. Domestic andalusite and cryolite are the raw materials for the principal plants located at Mansbo and Kubikenborg.

THE FAR EAST

Frontier for American Enterprise

IN THE great tradition of America, our frontier lies to the West. But for a United States that stretches from the Atlantic to the Pacific, to Go West is to arrive in the Far East. The feet of literally millions of our young men are now set upon that route.

Accomplishment of their objective—the defeat of Japan—will not end our responsibilities to the Orient any more than the defeat of Germany will end our responsibilities to Europe. This time we mean to see the venture through.

The first sketch of a political program for enlisting the strength of nations of good will to enforce the peace was drawn at Dumbarton Oaks. That is a good start. But those who participated know how much work remains before the blueprint becomes a fully matured plan, the plan becomes a structure, and the structure takes life and effective being in the living imagination and will of the peoples of the world.

No political accord, however high its purpose, can endure for long if it depends upon the loyalty and support of populations embittered by hopeless poverty that is offered no promise of relief. The poisonous dust of mass despair makes inevitable an ultimate explosion, whether it be sparked by a torch supplied from without or by its own internally generated heat. Much of the Far East is sufficiently close to that position to pose a grave problem to the Western world. It is of particular importance that American business men and workers alike recognize the nature of their responsibility in the matter, for to them the great area of the East presents also an opportunity and a challenge.

☆ ☆ ☆

The Orient—stretching in a vast semicircle from Manchuria and Japan to India and Ceylon—is the home of more than a billion people, the world's greatest potential market. In its mountains are the earth's richest stores of tin and mica; its deposits of iron ore, coal, and manganese rival those of France, Russia, and the United States. Its rice paddies are the most productive in the world, its coconut and rubber plantations the largest, and its cotton production is of major volume.

And yet, this fabulous region—with its riches of manpower and raw materials—suffers from living standards at the lowest rung of the world scale. With as much as 85 per cent of the populations of this great area devoted to the production of farm products, starvation has been an endemic plague to countless millions of its inhabitants, and will remain so until they graduate from the crudely primitive methods of the crooked stick and the bamboo plow to the use of the implements of a modern world in both agriculture and industry.

The improvement of agricultural methods and the burgeoning of industrial development depends upon tools—a preponderance of simple tools, no doubt, at the beginning, for modernization of economic processes is a development that cannot be forced at a rate faster than the ideas upon which they depend can be developed. If we, in the United States, are to hope to supply a major portion of the implements upon which the salvation of the East depends, we must be prepared to export also the skills and technologies which will make their effective use possible.

The possibility of a world market for machinery and manufactured products is a challenge that American industry cannot afford to ignore. The United States will emerge from the war with almost half of the world's industrial capacity within its borders, with much more than half of the heavy industries. Drastic and painful readjustments are inevitable; but they can be mitigated to the extent that we can find outside markets for the products for which we have excess capacity.

We shall find ourselves, at war's end, in a singularly favored position to compete in any equipment markets which are open. It is not merely that we shall have the productive capacities crying for outlets. Aside from Germany and Japan, which for some time will not be in a position to compete, our two major industrial Allies, Great Britain and Russia, will face enormous tasks in providing for their own rehabilitation. Neither of them is likely to be in a position to export more capital than they absorb; and although Canada, Sweden, and Switzerland will be, the United States will stand alone as the one major creditor nation in the world. If the potential advantages of this position are managed with wisdom and imagination, they will enormously enhance our opportunities for supplying a great share of the capital goods demand of undeveloped areas.

☆ ☆ ☆

What is the dimension of the Far East's potential demand? What are some of the difficulties standing in the way of its being realized?

If needs were the only measuring stick, the Far Eastern market would provide a bottomless pit into which even the great stores of our exportable capacity could be poured with room to spare.

China, alone, with its teeming population of 450 millions, has spelled out needs in dimensions large enough to stir the imaginations of the equipment producers of the world.

Business Week (February 5, 1944) supplements Dr. Sun Yat-Sen's spacious first estimates of the requirements for a thorough-going industrialization program with figures provided by current Chinese planners—25,000 locomotives; 300,000 freight cars; 20,000 passenger coaches; 20,000,000 tons of steel; and 90,000 power driven machine tools for the first five years of reconstruction. An American manufacturer of farm equipment, who recently surveyed the agricultural requirements of China, estimates an ultimate Chinese market for 20,000,000 tractors.

India's drawing-board plans are equally expansive. According to the bold pattern drawn up by a group of Bombay industrialists—some of whom are due to visit the United States early in 1945—India, after the war, will require a capital investment of $2,000,000,000 a year over the next 15 years, of which $250,000,000 per year for the first seven years will be in the form of imported capital goods.

Included on the huge import order list of the Bombay executives are mining, roadbuilding and power station equipment, heavy locomotives, metallurgical plants, agricultural machinery, and a long list of machine tools.

There can be no question of the need of these countries for the industrial equipment—and for many items of manufactured goods—which we are so eminently in a position to supply. But realism requires that we measure this demand against the Far East's probable capacity in the relatively near future to absorb industrial goods.

A Chinese economist has estimated that China, in 1937, had a total industrial capital ir estment of about $1,000,000,000 in American values, or something like $2.50 per capita of population. In contrast, the American investment, in manufacturing facilities alone, is now more than $600 per capita.

What it could mean in terms of capital goods requirements if China alone carries out this dream of modernizing, not to the utopian level of the United States but to the present modest level of the less developed Soviet Union, is typified by measuring just three lines: 500,000 tons of steel a

year, for five years, to add 12,500 miles to the railroad system; 2,187,500 motor vehicles; 3,300,000 telephones.

But it is one thing to cite mountainous figures demonstrating needs. It is another, and far less optimistic exercise, to find assurance that practical opportunities for satisfying such needs can be made to materialize. Let us face some of the major difficulties and see if they are insurmountable.

☆ ☆ ☆

The first hurdle to be cleared is the question of whether or not we want to promote the industrialization of the Far East. The wisdom of doing so has been vigorously challenged. The negative argument, on the economic side, generally runs thus: If we provide industrial equipment to backward economic areas, we deprive ourselves of the greater long-run opportunity of selling them manufactured articles which our aid has enabled them to produce for themselves.

It is only fair to say that such a thing might happen—that it has happened in isolated instances in the past. But the overwhelming weight of economic history demonstrates that the broader attitude is also the profitable one.

The United States itself is the living refutation of the fear which now cramps the outlook of many of its own citizens.

From 1790 until 1850 the foreign trade of our new fledged Nation had many of the characteristics which pertain to the trades of China and India today. We imported manufactures and we exported raw materials, agricultural products, and newly mined gold. Our imports exceeded exports, the difference being made up partly by payments to us for shipping services and partly by industrial development loans. It is relevant to inquire how the trade of the lenders was affected by this policy of supplying us with industrial capital and machinery.

From 1850 through 1939 the pattern of America's foreign trade changed. Slowly at first, and then at accelerated pace, our import ledger showed a percentage decline in manufactured goods and a percentage rise in raw materials to feed our expanding industrial facilities. But while finished manufactures declined percentagewise in our import budget, so great was the increase in our total foreign trade operations in the century from 1830 to 1930 that our imports of manufactured goods increased more than twentyfold, and they more than doubled between 1900 and 1939.

Clearly industrial Europe gained rather than suffered from the industrialization of the United States, and it is equally clear that we, in turn, shall benefit from the industrialization of the world's undeveloped territories. Further evidence is provided by Canada which, with its high industrial development but only 12 million people, buys from us each year almost as much as the relatively unindustrialized 130 million people south of the Rio Grande.

If it be granted, as I believe it must, that the development of Far Eastern countries will be to our advantage as well as theirs, the second question that we should face is the speed with which it can be accomplished. Is there genuine promise in the proximate future of opportunities for American enterprise of the magnitude set forth in the estimates quoted above?

In all fairness, I am forced to state my conviction that the road is longer than is indicated by Chinese and Indian leaders. It is natural, and far from censurable, that their eyes should be focussed upon the urgency of national needs, rather than upon obstacles in the way of their fulfillment.

On the other hand, it is possible that our own long process of industrialization may lead us to conclusions of undue conservatism. Ideas, once they break the crust of resistance are the most contagious of bacteria, and the tempo of their infiltration seems to increase by geometrical progression in a world of swift communication.

☆ ☆ ☆

In an interesting recent study of The International Labor Office, it is suggested that the general economic level of the rest of Asia outside Japan in the late 1930's was not dissimilar to that of Japan in 1900. Between 1900 and 1936, Japan increased its total capital investment more than threefold devoting between 10 and 17 per cent of its annual income to capital outlays. A comparable tempo of development for China, India, and other Asiatic areas would result in a capital expansion that would dwarf to insignificance the most optimistic blueprints that have been put forth to date. I am not suggesting this as a likely possibility, but rather as a caution lest we, in the name of hard-headed realism, underestimate Asiatic potentials as much as their own nationals exaggerate them.

Finally, in appraising the outlook for American enterprise in Far Eastern markets, we collide, head-on, with the problem of how we are to be paid. Here, hard-headedness can be only a virtue, for the lack of it will breed inevitable disaster for the Asiatics as well as for us.

In the last analysis, the dimension of the American market in the Far Eastern countries will be determined by the dollar exchange at their command, obtained through the products, goods, and services which they are able to provide to us, with due allowance for multilateral trade arrangements. It is true that the balance temporarily can be distorted through the extension of developmental loans. There is little question but that such loans will be in order after the war, and if they are wisely made, for productive projects that eventually will increase the exporting capacities of the countries to which they are extended, they can be thoroughly justified. But the best loans provide only a temporary expedient. In the long run, the balance of current payments must be restored with sufficient margin to provide interest payments and finally amortization of principal.

☆ ☆ ☆

How, then, are we to attack the problem of increasing our imports from the Orient?

In 1937, the total exports of the Far East amounted to something over $5,000,000,000—a little less than $1,500,000,000 in foodstuffs, a little more than $2,500,000,000 in raw and partly manufactured materials, and better than $1,000,000,000 of manufactured articles. Of this total, the United States purchased only about 20 per cent—approximately 10 per cent each of the foodstuffs and manufactures, and 30 per cent of the materials.

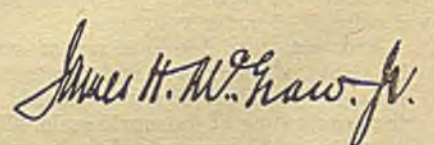
Despite changes in our technologies which will probably reduce our future takings of such important items as rubber and silk, the achievement of a high level of economic activity in this country after the war will provide a basis for increasing our Eastern imports, but only if it is an accepted part of our national policy to do so.

This means an alert and aggressive exploration of two-way trade possibilities on the part of both American business and our governmental agencies. It cannot be done by either alone.

The war has dislocated many of the trade patterns that prevailed in the past. The East is hungry for the type of products which we, uniquely, are situated to supply, but it will make its bargains with those who will not only fill its needs but will also provide outlets for its produce. Even the prewar magnitude of the exports from this area provides ample margin for the most meticulous and imaginative shopping of Eastern markets with the aim of increasing the modest share of our prewar purchases. And a farsighted program of development loans can greatly increase the capacity of these countries to produce what we want.

In general, we can trust American enterprise to explore rigorously all likely export opportunities. But the equally vigorous investigation of import possibilities will require a break from past traditions on the part of American business and American government.

Both East and West must learn to think in new patterns for the successful opening of a new frontier.



President McGraw-Hill Publishing Co., Inc.

Kidde total-flooding system smothers fire in flammable liquid storage room in less than twenty seconds.

BEFORE TOUGH FIRES GET TOO TOUGH

. . . blast them out with Kidde!

In fighting the tough fires—the fast-moving ones that break out in flammable liquids—you've got to smother them fast, or they'll spread beyond control in a few minutes.

Ordinary water type extinguishers cannot control these tough fires. But built-in Kidde systems, releasing carbon dioxide at high pressure, snuff them out in a matter of seconds. Clean, dry and inert, the gas leaves no after-fire mess to be cleaned up. There is no damage to any materials, or chemicals in process.

These Kidde extinguishing systems can be engineered to control an entire fire hazard automatically, by flooding it with safe, fast-acting carbon dioxide.

Kidde systems can close windows and fire doors, shut off fans and motors, when the gas is released. Other types of Kidde equipment provide equally effective protection against fires that break out in electrical apparatus. Kidde equipment carries the full approval of all laboratories for Class C (electrical) as well as for Class B (flammable liquid) fires.

Plan to install this clean, safe, speedy method of extinguishing in every tough-fire hazard. Check the accompanying list now. If even one of these danger points needs protection in your plant, call in a Kidde representative . . . he'll be glad to share his fire-prevention know-how with you. Write us today.

KIDDE KILLS TOUGH FIRES

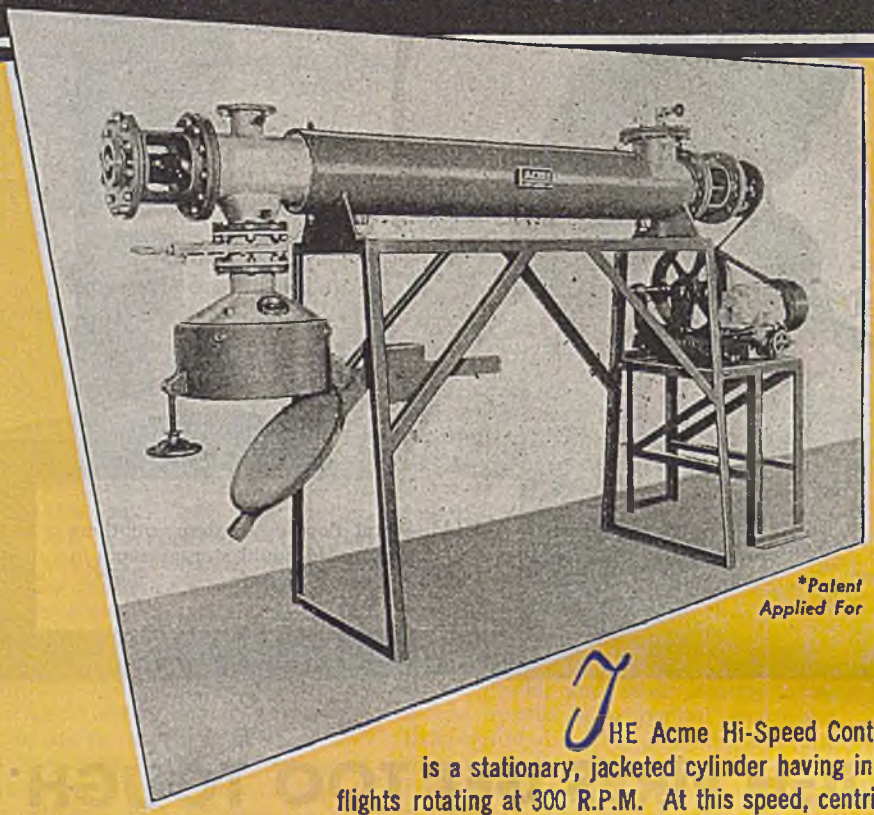
- Process Rooms
- Mixing Tanks
- Agitators
- Pump Rooms
- Storage Areas
- Drum-filling Rooms
- Motors
- Transformers
- Electrical Control Panels

Walter Kidde & Company, Inc. • 140 Cedar Street • New York 6, N. Y.

EVAPORATION • CRYSTALLIZATION • DRYING

3 Processes in one continuous operation...

with NEW ACME HI-SPEED ROTARY FILM-TYPE DRYER*



*Patent Applied For

PILOT INSTALLATION

continuously producing 50 lbs. of dry chemical salt per hour from a solution, while evaporating and recovering 170 lbs. per hour of organic solvent.

THE Acme Hi-Speed Continuous Rotary Film-Type Dryer is a stationary, jacketed cylinder having internal removable-type conveyor flights rotating at 300 R.P.M. At this speed, centrifugal force throws the material being handled against the heating surface in the form of a thin film or layer, utilizing the jacketed surface of the cylinder for heat transfer.

The Acme Hi-Speed Continuous Rotary Film-Type Dryer is operated under pressure or vacuum and may be used for the recovery of solvents. It can be used for cooling as well as heating. Inert gases may be introduced if desired, thereby producing a deodorized, dry product.

This unit is designed in single and multi-stage arrangements, fabricated of ferrous or non-ferrous metal, and in sizes to suit individual requirements. This apparatus can be adapted to many processes, resulting in elimination of separate unit operations by combining them in one machine—one operation. Thus we reduce both initial cost and cost of production.

ACME Processing Equipment

ACME COPPERSMITHING and MACHINE CO., ORELAND, PA.

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

Our request for guest columnists has smoked out another teller of tales. Robert S. Aries has come along with his recollections of the hardware business and we are delighted to recount them in the first two stories of this month's log. Bob is at present field director of Northeastern Wood Utilization Council, and a consultant for a number of firms including Publicker Commercial Alcohol Co. — *Dan Gutleben*

BOB ARIES of Publicker's staff of wizards, stepped from the campus to the bottom rung as chemical engineer of a hardware manufacturing outfit in Connecticut. His predecessor in this job, as of the depressing period of 1932, was a Ph.D. who resigned because his weekly stipend was depressed from $22 to $16. For a short spell the foremen recovered their feeling of security. And then Bob appeared! Every business, even so prosaic as hardware, had to have a "Doc" and besides they were available at a special introductory price. A problem was waiting for Bob. For many years the plating shop foreman had been using a saponifying agent for degreasing the sheets that came from the stamping department. Suddenly the degreasing agent lost its effectiveness and a crew of men with rags was supplementing the cleaning agent. Bob's investigation discovered that the purchasing agent had without notice substituted a mineral oil for the vegetable oil previously used to lubricate the stamping dies. It had a competitive advantage and Bob's expertness made it possible to collect the profit of the purchasing agent's brainstorm by switching to an emulsion type degreaser.

A CHOCOLATE BAR accidentally fell out of the foreman's pocket into the silver-plating vat. He took the loss philosophically. Then, being a man of ready wit, he observed amazingly that there was an improvement in the luster of the plated ware! Thereafter he added a chocolate bar to the plating vat every week, his reasoning being analogous to that of the doctor who prescribed sauerkraut for pneumonia because a former patient, subsisting plentifully upon this diet, recovered. The foreman did not know that there was some technological connection between the influence of dextrose in the plating solution and the luster, but the facts were plain and he held the secret. However, with a chemist like Bob wearing a white coat and gumshoeing around the secret leaked out. Adding sugar to the plating vat was made legal and purposeful. Incidentally the white coat and the title of Doc, not to mention the inborn fitness, attracted to his chemical duties the job of health adviser to the men and women of the plant.

EPISODES ARE FASHIONED out of the imagination of long-haired poets and sold for cash to entertain the multitude. On the other hand the plant engineer can acquire factual episodes right in his own plant that run the entire gamut of qualities from comedy to tragedy. Let him but go to the locker room at midday or at night when the craftsmen are called from labor to refreshment. There, by the application of discretion and friendliness, he can fraternize with the hewers of wood in a manner to enhance mutual respect and admiration. The "biographs" extractable from the run-of-mill sugar tramps cannot be exceeded in fascination by the tales spun by Nick Carter himself.

ELMER (PIPES) JONES was in the midst of vigorous lathering when the chronicler entered that master pipefitter's office. He explained that appearances notwithstanding he was not trying to simulate a snowman but was merely following the established custom which marks a coal miner.

Two weeks after the settlement of the great anthracite strike in 1902 father Jones was killed in a mine accident in Scranton, leaving Elmer at 18 to care for the mother and six sisters. Family finances were at low ebb. Strike benefits for the past six months had amounted to $5.15 per week to support a family of nine. Three years later the mother died. By that time four sisters had jobs or were married. Elmer then moved to a boarding house and took the two little sisters with him. Anthracite mining was slipping into a slump with four-day work weeks. One day in 1912 a notice was nailed on the bulletin board at the head house, "Closed till further notice." Elmer collected his $22.00 of pay, sent the little girls to his married sister's and unceremoniously decamped for Philadelphia, leaving his board bill stranded. In Philadelphia he walked the streets for six weeks in search of a job, a married sister meanwhile providing food and shelter. Then he annexed a job in a pickle factory at $10.00 per week. When he had amassed a small surplus he took a week off to visit his home town. He presented himself to his former landlady and offered to pay his bill, but that good lady not only refused to accept any money, she fell about his neck and took him in like a long lost son. He then took his little sisters south and set up housekeeping in Philadelphia. In '17 he joined the pipe fitters' crew at the sugar house and 17 years later he became master fitter and was dubbed "Pipes."

Pipe's father was known as a "contractor" in the anthracite mine. His job was to drill 2-in. holes from 5 to 8 ft. deep by hand and blast away the coal. He had to furnish his own tools as well as the powder. He was allowed one helper and while he himself was drilling, the helper would shovel the coal into the 3½-ton mule-drawn cars. Six cars constituted the maximum output permitted to a contractor under the rules of the Union. The pay was $1.08 per car, one-third of which was paid to the helper. Twelve hours were usually required to attain this maximum but sometimes by good fortune the majority of the contractors might finish at 2 o'clock when the mule trains would pull out for the day leaving others with only two cars for the day's output. Elmer had an hourly job at 19c. per hr. He never worked less than 12 hr. On Sunday he performed maintenance work, a certain fixed routine being followed. When this was completed the boys were permitted to call it a day even though the clock may have registered only six hours!

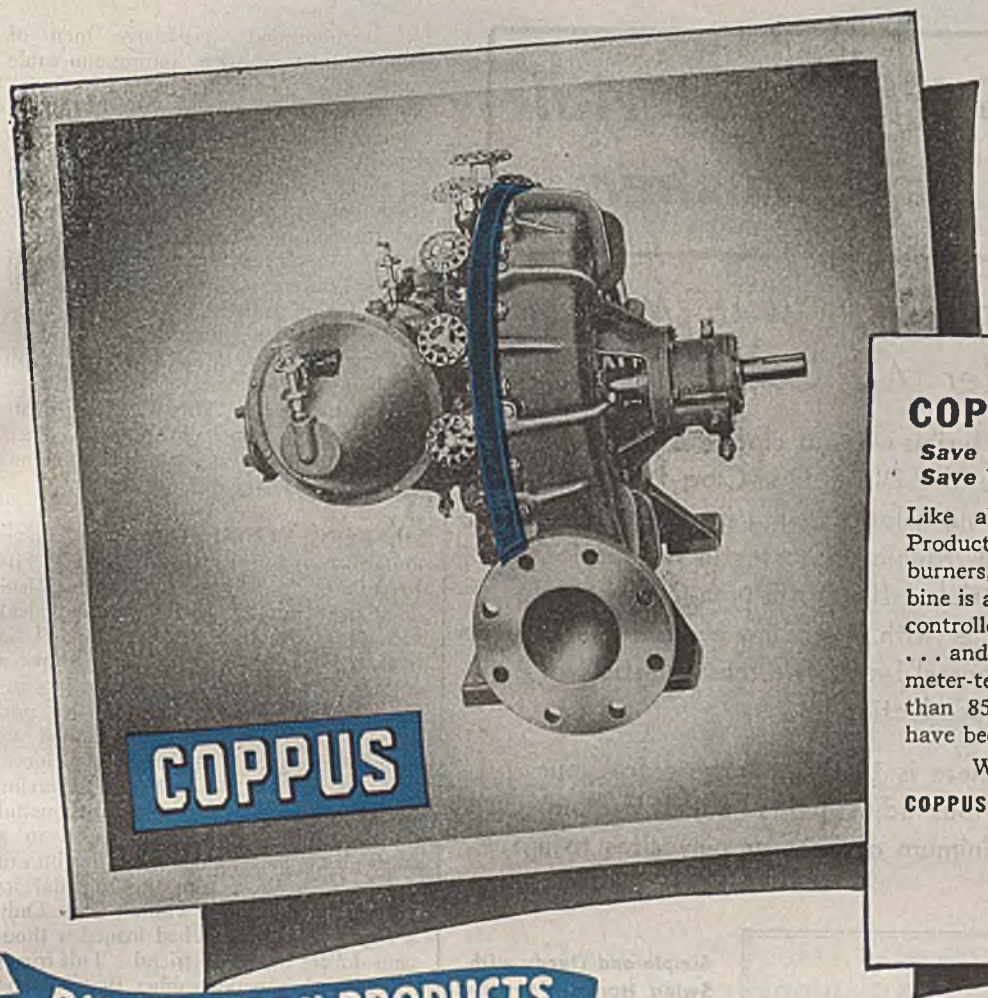
In the cool of the evening of pay days the miners practiced relaxation in the streets in front of the saloons. Some mischievous kid would heave a brick bat into the crowd and thus provide the spark which set off the fireworks. Some Irish patriot might mount the flag of Saint Patrick above the Stars & Stripes. This started the riot among the Patriotic Sons of America. Nine o'clock was curfew in the Jones household and when father wasn't in by that time, mother and Elmer would go down the street and bring him home. The Irish didn't fight when they were sober. A fight climaxed the pleasure of liquor. There was no rancor, and the "cold grey dawn of the morning after" was endured as the price of the fun. Sometimes after the combat a pair would be sprawled on the floor of the basement saloon swearing and brandishing their fists but too full of liquor to get within striking range. The next day each would brag about the clouting that he had administered to the other.

HARRY KLINE, master machinist, was considered to have reached the estate of wage earner at 15. Accordingly, he trundled along behind his father into the anthracite mine. One of his first observations was that men of 50 looked old. Working conditions were given little consideration in 1891. Harry's young mind was not fettered with the idea that the little Pennsylvania coal mining town was the only source of sustenance in a land of milk and honey. Accordingly he announced at supper that he would not be a miner. As usual the good mother took

Harry's part. At last it occurred to the "old man" that an acquaintaince from the home town had gone to Wisconsin and had become the superintendent of the Brown Corliss Engine Co. Thither Harry was sent, the station agent generously estimating his age at the half-fare rate of 12 yr. The superintendent offered him a laborer's job at $1.50 per day, but Harry elected an alternative apprenticeship at five c. per hr. Board was priced at $3.00 per week and space for flopping was allotted to Harry in the drafting room. For the benefit of his savings account he did chores for the superintendent's wife. Six months later Harry was assigned to the operation of a large steam hammer. His skill grew to a point where he could crack an egg on the anvil. One day the superintendent brought an important bondholder into the forge shop to impress him with the skill of his craftsmen. He laid a bar of "Grandfather's Wonder Soap" on the anvil and stuck a pin into it and then ordered Harry to drive it home. The financier bent down to get a good look. Something slipped in the coordination of Harry's mind and hand, and the huge plunger came down with a wallop that splashed black tar soap all over the consequential visitor's white shirt. That would have finished Harry except for his fleetness of foot. He presented himself to the superintendent's wife and asked if she wanted him to fill the coal box and wood box. "Why you filled those last night." "Well, haven't you got some windows to wash or something?" At this point she suspected that something had gone wrong at the shop. She made Harry stay for supper and then reminded her husband that Harry was only a boy and that he himself had not been an angel at that age. The motherly instinct overcame all difficulties and Harry was back at the hammer next day.

Harry came to the sugar house in '17. He now spends all his free time entertaining his grandchildren—to the distraction of their mothers. Now and then he returns to the little mining town to visit his sister. His nephew is occasionally permitted to go into the mine to feast his eyes on the electrical machinery. Uncle Harry learned that the boy was saving his pennies to buy a book for the elucidation of the mysteries of electricity. The boy had accumulated $0.06 against the price of $1.06. Harry thereupon admitted that he himself had a desire to learn electrical fundamentals and suggested that they go into partnership in the purchase of the book. Harry proposed to invest a dollar. Agreement was promptly reached and an order was placed for the book. Uncle Harry imposed the condition that the boy must take good care of the community property and study assiduously, bearing in mind that Uncle Harry might without notice requisition his share. The boy lost some sleep that night and Harry says that at sunrise he heard him bustling about his chores accompanied by unusually enthusiastic whistling.

THE DAY'S NEED for men could be easily satisfied twenty years ago by merely going out to the front gate and picking them over! The workmen available in



COPPUS TURBINES

Save Metal in Wartime — Will Save You Money in Peacetime

Like all Coppus "Blue Ribbon" Products (blowers, ventilators, gas burners, etc.), the Coppus steam turbine is a precision-made product . . . controlled by Johansson size blocks . . . and every turbine is dynamometer-tested before shipment. More than 85% of all orders since 1937 have been repeat orders.

Write for Bulletin 135-9

COPPUS ENGINEERING CORPORATION

582 PARK AVE.

WORCESTER 2, MASS.

BLUE RIBBON PRODUCTS

DESIGNED FOR YOUR INDUSTRY...ENGINEERED FOR YOU

If a COPPUS "Horse Power" Steam Turbine can power your pump, blower, fan, stoker, dryer, mixer, etc. . . . then you'd waste money and metal buying an "Elephant Power" Turbine. COPPUS Blue Ribbon Turbines come in 6 frame sizes; matching size to job saves critical metal for war and money for yourself.

And the blue ribbon means workmanship that promises peak performance.

our neighborhood were large men of Slavic extraction with unpronounceable names. The time keeper had a remedy for the difficult situation. When Epham Chomotobski applied the time keeper assigned to him the name, "Jim Cole." Jim got along perfectly under this name till it came time for naturalization and then he had the adopted name legalized by court order. Another "Polander" was dubbed "Frank Meyers." Jobs were scarce but Frank found something else that suited him better. His neighbor, Frank Konczak, took over his time check and pseudonym and before anyone knew it, he substituted for Frank Meyers. This was a fortunate circumstance as the substitute developed into an important and valuable foreman, still under the name, Frank Meyers.

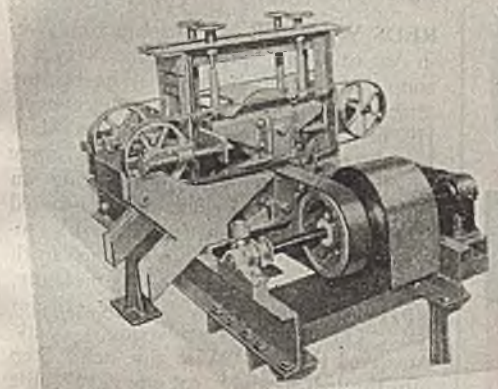
MELKON VOSBILKIAN has known more than one man's share of tragedy. For 19 years the genial widower, now 60, had disciplined himself with thrift and had accrued a handsome reserve. In '39 he made a down payment of $300 against a cottage and then withdrew his savings account of $2,340 to complete the purchase. He fondled the hard-earned accumulation and to celebrate his achievement he went out to visit friends, leaving the money together with about a thousand dollars worth of jewelry wrapped in a sugar bag and hidden in his bureau drawer. On his return the bag and its contents had vanished without trace. Only a year earlier Melkon had loaned a thousand dollars to a good friend. This friend was of such superior caliber that Melkon considered it superfluous to request a note of indebtedness. The friend is no longer friendly and the debt is repudiated. Melkon started at once to build a new savings account.

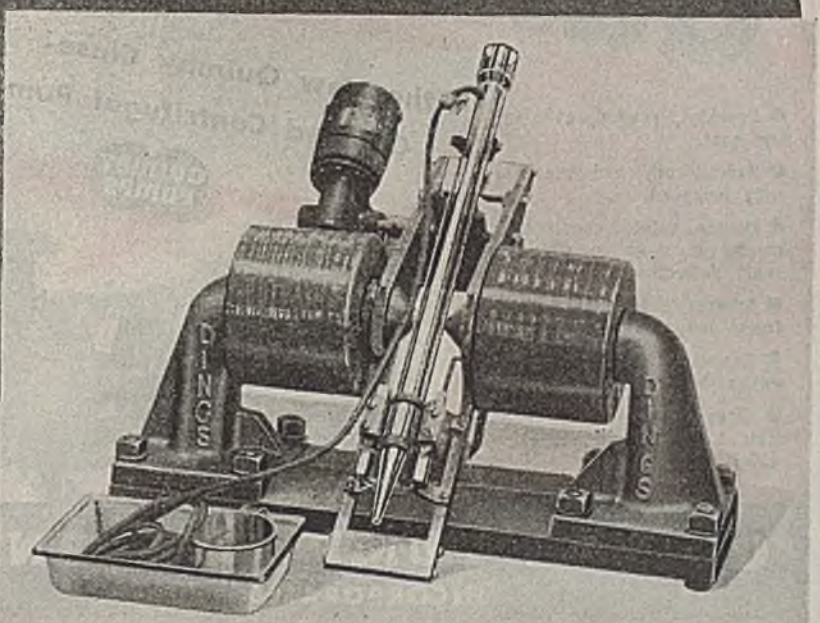
THE CLERK of the distillery made the front page in the morning paper. One night a few months ago said clerk was dressed for departure from the plant and was waiting for the whistle to proclaim the end of day. Just then some bonehead twisted the bung off a drum of fusel oil and beat it in panic. The clerk waded through the spray and did the heroic act, thereby absorbing the pungent aroma "than which there is no whicher." Then he boarded his car and drove homeward. When he crossed Thompson Street he met with an unfortunate collision, with the red light against him. The police surgeon, using his nose, pronounced the clerk soused. This is the story as woven by the clerk. However, the jury exhibited amusement and sympathy in the story but was prejudiced by the recurrence of similar circumstances that had brought the clerk to the police station before. The judge ordered him jugged for a week and awarded him a 2-yr. suspended sentence. His lawyer had accepted a fee of $50 for which he promised to "fix it." Unfortunately, when the case came to a head the lawyer was himself in the dog house and threatened with disbarment.

SANDY left the shipyards in Glasgow after the great War and sailed for New Orleans. Upon his debarkation he found

For your laboratories

Dings Magnetic Equipment





Right—The Dings-Davis Tube Tester for determining magnetic content of ores. Gives quick, accurate answer in 10 to 15 minutes. Shows results obtainable on latest improved wet type separators.

Above—Dings Rowand-Wetherill Type Cross Belt Separator for laboratory use. A two pole unit. 2'-7½" x 7'-3".

Below—Dings Induced Roll Type IR Laboratory Separator. A two roll unit. 29" wide x 22" deep x 40" high.

The units illustrated here are typical of the complete line of Dings Magnetic equipment specially designed for mineralogical laboratories operated by mining companies, Bureau of Mines Stations and technical universities. Dings Separators for laboratory use are usually scale models of commercial machines and will produce results obtainable in commercial practice. They are built to the same high standards of design and quality that characterize all Dings equipment.

In addition to building machines for laboratory use, Dings maintains a completely equipped Magnetic Laboratory for magnetic analysis of mineral samples. This service is rendered free of charge and is available to all qualified individuals or companies. You are invited to submit samples for magnetic test to determine magnetic content, type of separator to use, results obtainable, etc. For full details, write to Dings..

Left — Alnico Horseshoe Magnet. Very powerful. 2½" wide x 3" high. Pole bases ¾" x ¾"

Dings MAGNETIC SEPARATION HIGH INTENSITY

NEW CATALOG—a new catalog, No. 11, is now being printed, giving complete data on Dings Laboratory Equipment and the Dings Magnetic Laboratory. Write for your copy.

DINGS MAGNETIC SEPARATOR CO., 505 E. Smith St., Milwaukee 7, Wis.

World's Largest Exclusive Builder of Magnetic Equipment. Est. 1899

a job in a large sheet metal shop. Then he sought out the Union headquarters and acquired membership even as all good Scotsmen have done at home. At the first business meeting Sandy listened attentively to the harangue for a proposal that was receiving enthusiastic applause. Sandy did not register satisfaction. When the chair nodded to him he arose and made vigorous expression of his views, which were at variance with the common sentiment. The boys disagreed violently and before Sandy could collect his thoughts he was out in the street on his ear! Sandy learned at once that American labor deliberations of the time admitted pugilistic as well as forensic argument. In '24 he came to the refinery as a journeyman and two years later succeeded Charlie Kelly as master of the sheet metal shop.

REDS WAGNER left Shackamaxon Ave. in August, 1940, and joined the Navy. A couple of months before that he became attache of the staff of messenger boys. His first assignment was a trip to Mark Lowe's office downtown to fetch some papers. Mark observed him sitting on the waiting room bench and concluded that the kid was loafing. Mark's superiority asserted itself and he lashed forth with severity commixed with profanity. Up jumped the kid and returned tit for tat. "Oh ho, wise guy" quoth Mark. Answered the kid, "Wise guy, hell. Step into the hall if you've got any guts!" Big Mark deflated and the incident closed. On another occasion the kid was told to make search at the "five-and-dime" for small tin sample-pans. He judged that what the store had to offer might not be suitable. He therefore visited a second-hand kitchen supply store that he passed on the way and came back with an assortment of samples with complete information as to prices and delivery. Small wonder that the Japs have so much respect for Admiral Nimitz when he has dependable lads like Reds to "carry the message to Garcia."

THE MANAGER of a nationally known manufacturer of gelatin called at our plant to secure first-hand information about mechanical filters. We showed him all over the works, explained the operation of our filters backwards and forwards, and sent him away with a glad heart and a pocketful of descriptive matter on the subject of his quest. Our hospitality had been spontaneous. There was no thought of reward. However, a few years later, the well-known American housewife began demanding sugar in some of the products of the gelatin manufacturer, and soon he began placing orders for our sugar by the carload.

THE FOREMAN in the carton filling department missed a small sprocket from one of the machines. He surmised that it might have fallen into a carton and searched some hundreds of packages without result. Two weeks later a letter came from a housekeeper in Warren, Pa., with which she returned the sprocket. Sugar rationing was not in effect at that time, and so the sales manager delivered to the customer in Warren a 100-lb. assortment of the finest sugars that we could produce.

When G.I. Joe comes Home

your Red Cross stays at his side

No matter what emergency may arise, G. I. Joe can look to the Red Cross for help. Thousands of appeals from ex-servicemen and their families are being answered every day. The job is big, and *growing*... what can *you* do to help?

J. E. is home, medically discharged. A physical disability prevents returning to his old job. Through vocational training, he learns leather-working and becomes self-supporting.

Mrs. L. T., en route to join her soldier-husband, is suddenly taken sick in a strange city. Immediate hospital care, provided through the Red Cross, probably saved her life.

Although six months have passed since his discharge, R. D. is still unable to hold a job. A Red Cross worker discovers psychiatric care is needed, and sees that he gets it.

Mrs. E. K., whose husband is an invalid, is stricken with a serious illness. The Red Cross arranges to bring home her soldier-son, who keeps the family together and avoids a broken home.

T. H. is home, medically discharged. His pension is delayed. The Red Cross helps him secure necessary proof of his claim, and tides the family over until the first check comes.

Two soldiers' wives arrive at an army camp and find their husbands have been sent abroad. The Red Cross, when informed of their plight, loans them funds to return home.

In these and other ways the Red Cross is helping G. I. Joe. It furnishes financial aid... sends letters, telegrams, cables... arranges for medical care... gives training in arts and skills... lends a helping hand where it is most needed. These services must be continued. Keep them going—by helping through your local Red Cross Chapter.

NAMES IN THE NEWS

O. R. Kuster

Clifford A. Hampel

Paul Ryan

O. R. Kuster has been named chief project engineer of General American Process Equipment and is located at their New York office. Mr. Kuster has had wide experience in chemical plant design in The Netherlands, Russia, Chile and this country, specializing in fertilizers, potash, aluminum and magnesium salts. He was formerly with the Dorr Co.

Roger Adams has been named chairman of the Board of Directors of the American Chemical Society to fill the vacancy left by the death of Thomas Midgley. Dr. Adams, who is on leave of absence from his position of head of the department of chemistry at the University of Illinois, is vice chairman of the National Defense Research Committee in the OSRD.

W. M. Barr, chemical and metallurgical engineer of the Union Pacific railroad, has been promoted to the post of research and standards consultant for the road.

Robert P. Kenney, chief of the vinyl resins unit of the chemicals bureau, WPB, has been named manager of international service of the chemical division, The B. F. Goodrich Co. His headquarters are at the division's main office in Cleveland.

Russell T. Griffith, formerly instructor in chemical engineering at Illinois Institute of Technology, has joined the staff of the Institute of Gas Technology.

George Krieger who has been with WPB and recently special assistant to Donald M. Nelson, has resigned to return to the Ethyl Corp.

A. J. Schmitz has been appointed Pacific regional manager by Allis-Chalmers Mfg. Co.

Whitney Weinrich has resigned his position with the Refining Division of the Petroleum Administration for War to join the Research Department of the Phillips Petroleum Co. at Bartlesville, Okla., in its Engineering and Development Division.

Clifford A. Hampel has joined the research staff of the Minnesota Mining & Manufacturing Co. at St. Paul where he will specialize in the development of new chemicals from non-metallic minerals in the roofing granule division of the company. After spending several years in the chlorine industry with Mathieson Alkali Works and Diamond Alkali Co., Mr. Hampel was for the past year a member of the staff of the Columbia University, Division of War Research, in New York.

Livingston W. Houston, chairman of the board of the Ludlow Valve Manufacturing Co., has been elected president of Rensselaer Institute to succeed **William O. Hotchkiss** who retired last year.

Julian L. Culbertson, professor of chemical engineering at Washington State College, has been appointed visiting professor of chemical engineering at Columbia University for the academic year 1944-45.

Frederick W. Heyl has resigned his post as vice president and director of research of The Upjohn Co., Kalamazoo, Mich. He has been succeeded by **Merrill C. Hart**. Dr. Hart was previously assistant to Dr. Heyl.

Fritz Rostler has been appointed research professor of chemistry in the Engineering Experiment Station of the University of Delaware. He was formerly chief chemist of Wilmington Chemical Corp. and will continue to be connected with that company in a consulting capacity.

George C. Kiefer, who has been associated with the Allegheny Ludlum Steel Corp. since 1916, has been named chemical engineer and associate director of research, corrosion and coatings division.

Earl P. Stevenson, a graduate of Wesleyan University in the class of 1916, and president of Arthur D. Little, Inc., of Cambridge, Mass., has been elected a member of the university board of trustees.

Paul Ryan, former president of the National Refining Co. of Cleveland, who recently has been serving with the Petroleum Industry War Council, has been elected a vice president of the M. W. Kellogg Co. where he will manage a newly instituted consulting service.

F. H. Ernst has been appointed assistant production director of the Rayon Division of E. I. du Pont de Nemours & Co. He was formerly manager of the Du Pont rayon plant at Old Hickory, Tenn., and will be succeeded there by **E. E. Swensson**.

Leslie J. Kane has been named associate chemical engineer on the staff of the Institute of Gas Technology. **William Volk**, formerly research chemical engineer for the M. W. Kellogg Co. and the Kellex Corp., will serve as assistant chemical engineer in the Institute's coal and coke section.

E. A. Walsh, formerly with E. I. du Pont de Nemours & Co. at Niagara Falls, and **John F. Schnacky**, previously with Phillips Petroleum and Eastman Kodak companies, have joined the staff of the Institute of Gas Technology as chemical engineers.

Kenneth D. Morrison has been elected a vice president of the Davison Chemical Corp.

Jesse E. Hobson has been appointed director of the Armour Research Foundation of Illinois Institute of Technology to replace **Harold A. Vagtborg** who has recently been named president of the Midwest Research Institute in Kansas City. Dr. Hobson has been head of the electrical engineering department at Illinois Tech since 1941 and has had wide industrial experience in addition to his academic work.

Robert Clark Hill, a recent graduate of Columbia University, has become affiliated with the research and development laboratories of the Bakelite Corp.

Lyle M. Geiger

Lyle M. Geiger has been appointed to the position of director of research. The Neville Co., Pittsburgh, Pa. Mr. Geiger has been serving as acting director of research for the past year and a half.

Paul M. Mueller, formerly with the Revere Copper & Brass Co., has joined the Blaw-Knox Co. as chief engineer in charge of development.

S. Henry Ayers has joined the Marco Co., Inc., Wilmington, Del., as head of their research laboratory. Dr. Ayers is a graduate of the Massachusetts Institute of Technology and for a number of years was connected with the research laboratories of the U. S. Department of Agriculture.

Martin J. Conway has been appointed manager, Petroleum Division of Lukens Steel Co. and subsidiaries. Mr. Conway was graduated from Oxford University with degrees in mechanical and chemical engineering. He has been with Lukens since 1926 and since 1940 was special engineer in the sales department.

Leonard Byman, chemical engineer, has joined the staff of the Battelle Memorial Institute, Columbus, where he will be engaged in chemical research.

Raymond E. Olson, manager of the sales engineering department of the Taylor Instrument Companies, has been elected to the Board of Directors.

M. N. Burleson has been appointed industrial hygienist of the B. F. Goodrich Co., succeeding H. H. Radke, transferred to the chemical division.

George B. Hogaboom, well known electroplating expert, has retired as chief of research of Hanson-Van Winkle-Munning Co. after 20 years. For the present he is devoting the major part of his time as special consultant of WPB.

Ernest G. Jarvis, metallurgist and alloy specialist, has been named chief metallurgist for Continental Industries, Inc., New York.

Svarre Hazelquist, former chief chemist of the Weyerhaeuser Timber Co.'s pulp division, was recently promoted to technical

director, succeeding E. P. Wood. Mr. Wood resigned to become assistant manager of a paper mill in Mobile. A. E. Erickson has been named chief chemist.

P. S. Dickey has been appointed chief engineer of the Bailey Meter Co. He will supervise all engineering research and design activities for the company.

David M. Ritter, formerly associated with E. I. du Pont de Nemours in the experimental station at Wilmington, has recently joined the pulp mills research project at the University of Washington to engage in research dealing with the chemistry of lignin.

James M. Robbins has been named technical representative of the B. F. Goodrich Co. on the staff of the new Colombian Tire Co. in Bogota, S. A. The Colombian plant now nearing completion will produce tires and tubes early next year.

E. A. Verrinder has been promoted to the position of chief engineer of the Riverside, Calif., division of Food Machinery Corp. to succeed G. C. Paxton who has retired.

George McCoy, formerly instructor of organic chemistry at the University of Pennsylvania, has joined the research and development staff of Pennsylvania Salt Mfg. Co. Other recent additions to the Penn Salt research and development staff include: Isabella A. Romans, Ward W. Whitebread, Savin Zavarella, Harold B. Staley and Frank W. Panepinto.

D. C. Storms who has been general superintendent of the St. Louis Ordnance Plant has been appointed works manager of the East Alton plant of Western Cartridge Co. He succeeds F. A. Schotters who has been appointed to the staff of Olin Corp., handling special assignments involving general administration and engineering development.

S. M. Rust, retiring president of the Rust Engineering Co., has been elected chairman of the company's board of directors, and S. M. Rust, Jr., who has been serving as executive vice president, has been elected president.

OBITUARIES

Walter W. Mohr, 48, a member of the engineering staff of the Edward Valve & Mfg. Co., East Chicago, died November 13.

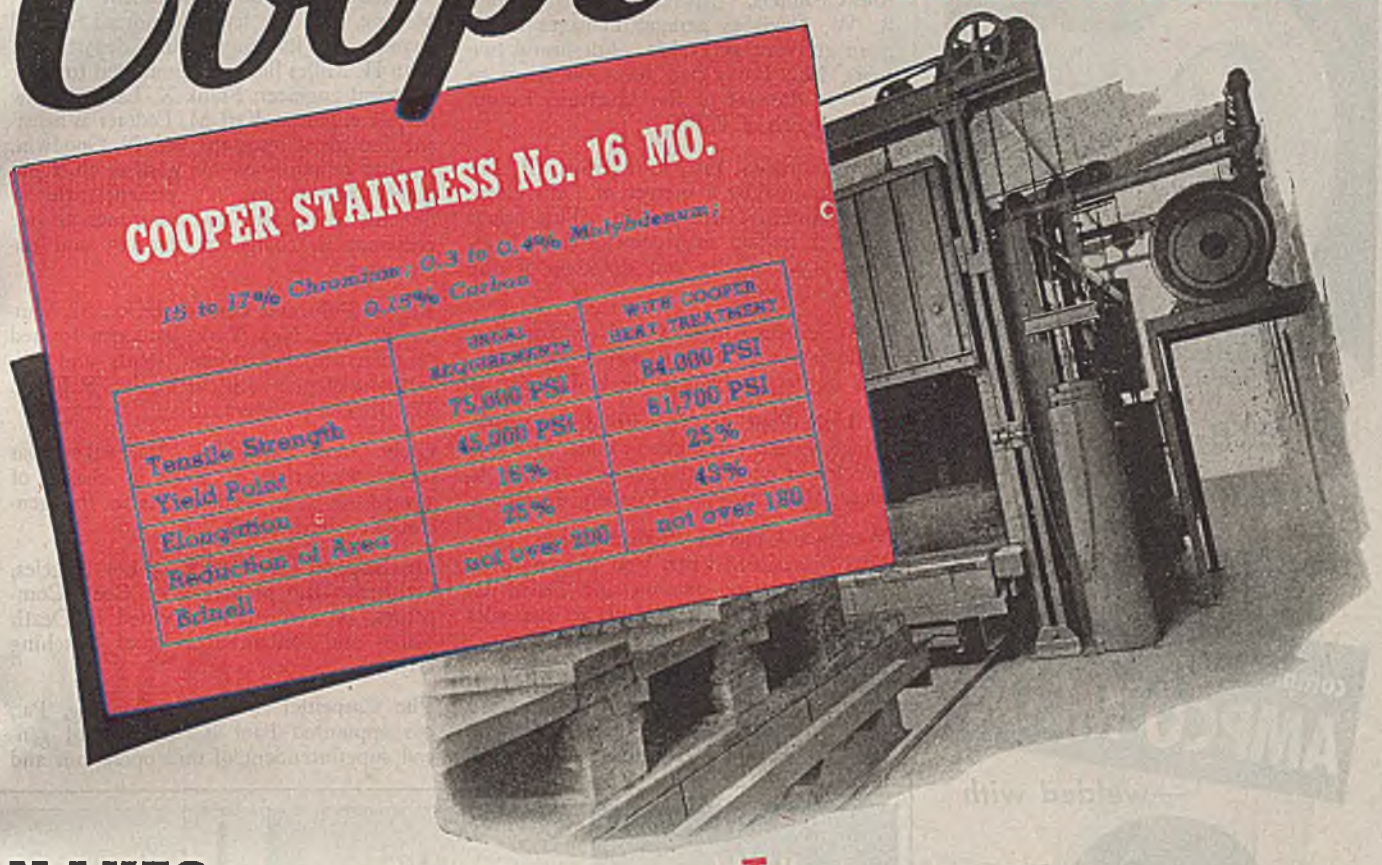
Dudley H. Miller, 74, president of the Speer Carbon Co., died November 8.

Max Bergmann, 58, specialist in protein chemistry, died November 7 in New York.

George W. Coggeshall, 76, director of research for the S. D. Warren Co., died November 18 in Beverly, Mass.

Florus R. Baxter, 83, chemical engineer and retired chief of the testing laboratories of Socony Oil Co., died December 3 at Rochester, N. Y.

Cooper HEAT-TREATMENT



COOPER STAINLESS No. 16 MO.

15 to 17% Chromium; 0.3 to 0.4% Molybdenum; 0.15% Carbon

	USUAL REQUIREMENTS	WITH COOPER HEAT TREATMENT
Tensile Strength	75,000 PSI	84,000 PSI
Yield Point	45,000 PSI	61,700 PSI
Elongation	16%	25%
Reduction of Area	25%	48%
Brinell	not over 200	not over 180

MAKES STAINLESS CASTINGS STRONGER AND MORE MACHINABLE

The modern heat-treating methods used by Cooper improve the physical properties and corrosion resistance and at the same time the machinability of many corrosion-resistant castings. The accompanying table shows typical results accomplished by this method in treating one alloy. Note particularly that while the tensile strength and yield points are increased, this improvement is not secured at the sacrifice of machinability. The greater ductility and lowered hardness indicate improved machinability.

THE COOPER ALLOY FOUNDRY CO.
170 Bloy St., Hillside, N. J.

THE *Only* ALLOY FOUNDRY WITH *All* THESE FACILITIES

- Laboratory control over raw materials and finished products.
- Dual foundry . . . both hand and machine molding.
- Electric arc and high-frequency-induction melting furnaces.
- Centrifugally-cast castings.
- Heat treating of Castings up to six feet.
- X-ray and Gamma-ray inspection.
- Precision Castings.
- Machine shop . . . specially equipped for finishing stainless steel.
- Improved cleaning . . . including Lustracast electrolytic finishing which leaves all surfaces bright.
- Castings furnished rough, polished or fully machined . . . one ounce to two tons.
- Development of special alloys to meet unusual requirements.
- Technical consulting service.

THE Cooper ALLOY FOUNDRY CO.
STAINLESS—MONEL—NICKEL

INDUSTRIAL NOTES

Onyx Oil & Chemical Co., Jersey City, has appointed Charles G. Marshall director of its industrial division.

Allis-Chalmers, Milwaukee, has named R. W. Davis as general manager of its plant at Norwood, Ohio. For nearly two years, Mr. Davis had been on leave to serve as director of the Electrical Equipment branch of WPB.

Olin Industries, Inc., East Alton, Ill., has been formed by a merger of Olin Corp. and Western Cartridge Co. This brings under a unified management the 12 affiliates, subsidiaries and divisions of the two companies.

United States Rubber Co., New York, has made James E. Power eastern sales manager of the mechanical goods division.

E. I. du Pont de Nemours & Co., Wilmington, has appointed Matt Denning director of sales of the finishes division to succeed the late W. Franklin Donohoe.

Westvaco Chlorine Products Corp., New York, has added Fritz Von Bergen to its technical service division and David C. Kirk and Frank D. Nichols to the sales division.

Mixing Equipment Co., Inc., Rochester, N. Y., announces that the Emerson Scheuring Tank & Mfg. Co. of Indianapolis will act as its representative in central Indiana and the White Industrial Sales & Equipment Co. of Cincinnati will handle sales in that region.

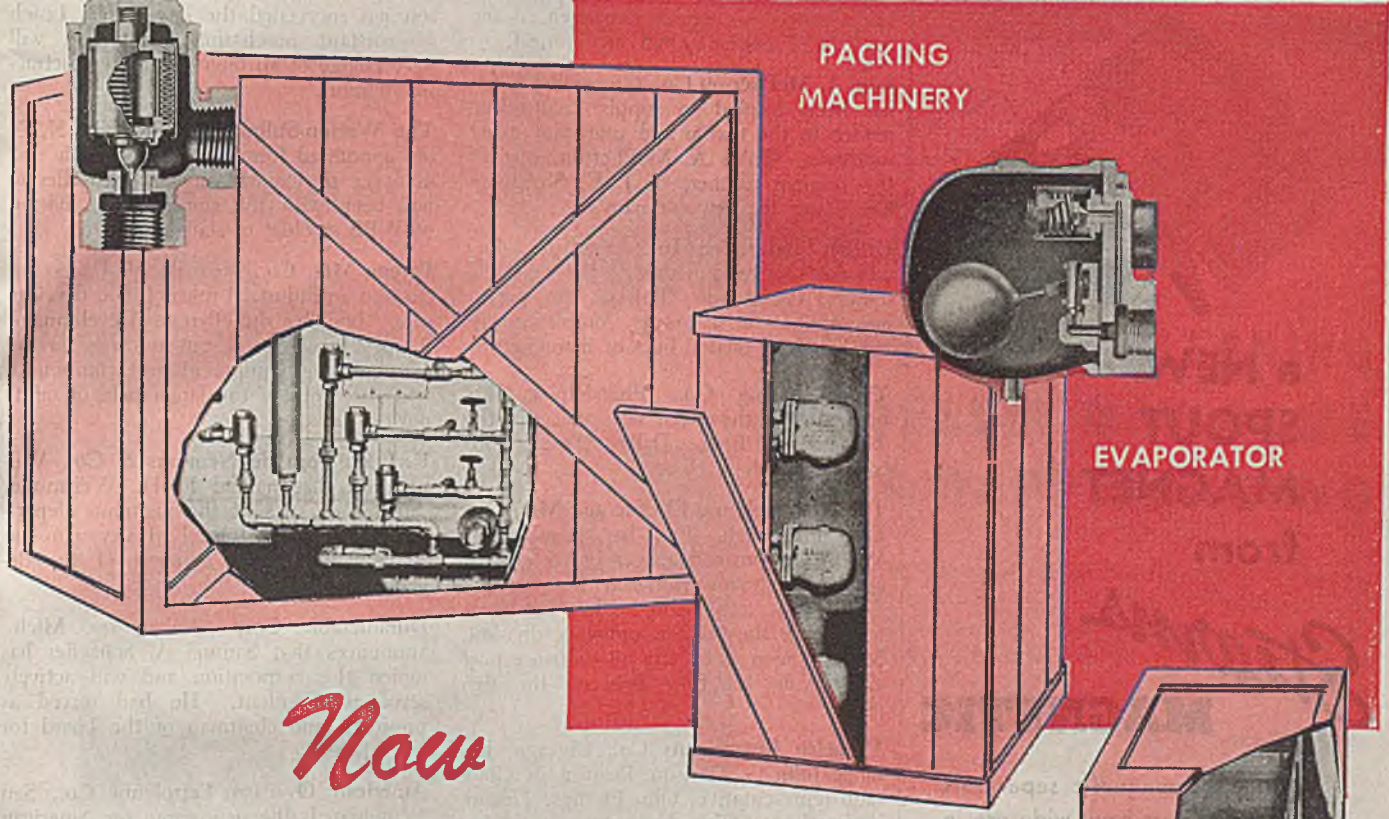
Weston Electrical Instrument Corp., Newark, N. J., has announced several changes in its engineering department. John H. Miller has been promoted to chief electrical engineer; Frank X. Lamb is now project engineer; Karl M. Lederer is assistant director of research. W. N. Goodwin, Jr., has relinquished his post as chief engineer but retains his present title of director of research and continues as vice president in charge of research and engineering.

Regent Pulp and Chemical Co., 52 Vanderbilt Ave., New York, has been formed to act as manufacturers agents and distributors of pulp and chemicals. S. F. M. Maclaren is president.

Globe Steel Tubes Co., Milwaukee, has placed Frederick K. Krell in charge of advertising with headquarters in the general sales department.

Los Angeles Chemical Co., Los Angeles, has leased the properties of Coen Companies, Inc., which are located in Death Valley and contain deposits of bleaching clays.

The Carpenter Steel Co., Reading, Pa., has appointed Paul B. Greenawald general superintendent of mill operations and



Now SARCO comes with the job

Much machinery now comes "SARCO equipped." Makers of machinery find it insures efficiency. Reliable work satisfies the customers and reduces service complaints.

Sarco makes four different types of steam traps and fits the trap to the job.

Sarco also has heating and cooling controls, simple, inexpensive and trouble-proof.

High speed production with high accuracy and rigid inspection on war work has set the use of temperature control ahead ten years. In scores of cases, the capacity of machines has been increased — always with a reduction in the heat cost per unit processed.

Why not find out now what Sarco can do for your product?

ON YOUR NEW STEAM EQUIPMENT ASK FOR:

Sarco Steam Traps
Sarco Heating Controls
Sarco Cooling Controls
Sarco Mixing Valves
Sarco Pipe Line Strainers

44

SARCO COMPANY, INC.
475 FIFTH AVENUE
NEW YORK 17, N. Y.

Represented in Principal Cities

SARCO Saves Steam

SARCO CANADA, LTD., 85 Richmond Street, West, TORONTO, ONTARIO

has advanced George V. Luerssen to the position of assistant chief metallurgist.

John A. McPherson Co., Greenville, S. C., has been formed to supply engineering service to the textile and pulp and paper industries. John A. McPherson, one of the original partners of J. E. Sirrine & Co., heads the new company.

Dresser Industries, Inc., Bradford, Pa., will move its headquarters to the Terminal Tower, Cleveland. This is the parent corporation of a group comprising 10 companies in related lines of manufacture.

Yarnall-Waring Co., Philadelphia, has opened a southwestern sales office in the Texas Bank Bldg., Dallas, Texas, with S. R. Edwards in charge.

The Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa., has re-appointed W. O. Lippman manager of its electric appliance division works at East Springfield, Mass., a position he left last April to manage the Canton ordnance division. Mr. Lippman will retain his ordnance post and divide his time between the two plants.

Wheelco Instruments Co., Chicago, has made John G. Davison, Denver, its Colorado representative, Olin Phillips, Toledo, its northern Ohio representative, and has added Minnesota to the territory served by L. E. Cyrtmus, Milwaukee.

Clark Equipment Co., Battle Creek, Mich., has announced that James Swanson has succeeded the late D. E. Leach as assistant purchasing agent and will have charge of all buying for the tructractor division.

The Watson-Stillman Co., Roselle, N. J., has appointed John Thomas Gillespie, Jr., manager of export sales. Mr. Gillespie had been with the shipbuilding division of WPB as chief of staff branch.

Pyrene Mfg. Co., Newark, N. J., has organized an industrial research and development branch, the Pyrene Development Corp. It will carry out research on fire extinguishing equipment and compounds and also work in the larger field of safety devices.

E. I. du Pont de Nemours & Co., Wilmington, has named F. H. Weismuller director of sales of the pigments department to succeed John F. Daley who has been made general manager of the department.

Durametallic Corp., Kalamazoo, Mich., announces that Samuel A. Schaeffer has joined the corporation and will actively serve as president. He had served as president and chairman of the board for several years.

American Overseas Petroleum Co., San Francisco, is the new name for American Eastern Petroleum Co. which was formed last July to manage foreign exploration and development activities of companies jointly owned by Standard Oil Co. of Calif. and The Texas Co.

Somewhere--here--

YOUR FLUID-CLEANING PROBLEM MAY COME TO A HAPPY ENDING

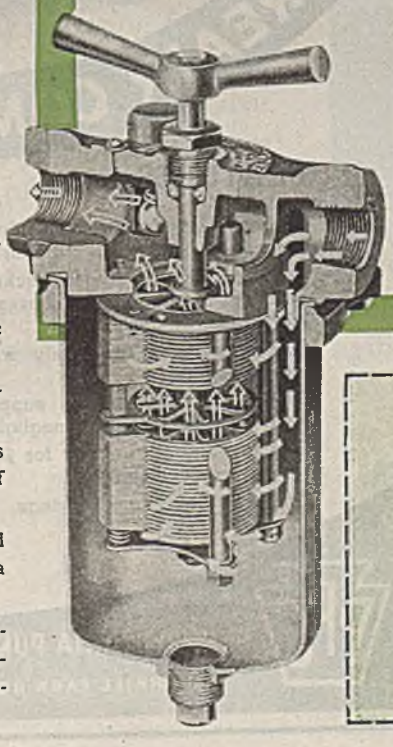
Do your plant records tell the wasteful story of uneven production? Do your fluid-handling operations require frequent shut-downs to clean or renew your straining equipment? If so, it will be worth your while to get an accurate picture of what Cuno *Filter-Fine* strainers can do for YOU.

Our free 32-page "QUICK FACTS" booklet tells how Cuno engineers have helped other engineers solve filtration problems in the fluid-handling systems of a dozen different industries. It cites specific cases, gives specific answers to specific questions. It is adequately illustrated with application diagrams and photographs. It may give you an idea or offer a solution to your own particular filtering problem.

"QUICK FACTS" shows the application of Cuno filters on: Aircraft Engines and Fluid-handling systems — Machine Tools — Gas and Diesel Engines — Turbines, Blowers and Compressors — Burners and Combustion Controls — Special Machinery and Equipment — Steel Mill Lubricating, Descaling and Cooling systems — in Metal Working Plants, Process and Food Industries. Also, it shows Cuno filters as applied to Paints, Coatings and Finishes.

Besides this, "QUICK FACTS" describes detailed construction of both types of Cuno filters — the *Auto-Klean* (illustrated right) and the *Flo-Klean*. It explains:

1. How the filter is cleaned without interrupting fluid flow.
2. How full flow is maintained with a single Cuno filter — no larger than other *partial-flow* types.
3. Why the cartridge need never be removed for renewal or cleaning.
4. How minimum pressure drop is obtained.
5. How an exclusive feature prevents clogging and avoids the build-up of sticky residue.
6. How the Cuno filter can be designed into a single machine, or applied to a centralized system.
7. How rigid, special-metal construction stands up under all kinds of conditions of abrasion, corrosion, erosion, pressure and temperature.



KEEP FLOW ON "GO" WITH

CUNO

THE "FILTER-FINE" STRAINER

CUNO ENGINEERING CORPORATION
112 South Vine Street
Meriden, Conn.

Please send me a free copy of QUICK FACTS

NAME.....

COMPANY.....

ADDRESS.....

CONVENTION PAPER ABSTRACTS

CONTENTS

PETROLEUM FUEL OILS

THE QUESTION of adequate supplies of fuel oils, including fuel oil for domestic heating, is bound up with the larger question of adequate crude oil supplies. It appears certain that adequate supplies of such oils in the United States for the next decade or two will depend upon substantial imports from abroad. Such imported oil will make up for our own domestic shortage and should long postpone the necessity for manufacturing oils by the hydrogenation of coal or the distillation of shale.

Immediately after the war, with elimination of most of the war demand, there would be overproduction of oil in the United States if production could be continued at the present rate; but production of most fields is now being forced beyond proper rates of flow with resulting serious damage to the fields. With nine to ten million automobiles now off the road our immediate postwar demand for motor fuel will probably be less than in 1941. This situation will permit slowing down production in many fields in an effort to restore them to healthy condition. Some producers who are able to restrict their production and repair the war damage, at least partially, will certainly do so.

We now have an import tariff of 21c. per bbl. on crude oil produced abroad, designed to offset the difference between the cost of oil production in Venezuela and the United States. Such a tariff is of course passed on to the consumer and is not enough to affect seriously such luxury use of fuel oil as domestic heating. The key to reasonable fuel oil prices, including domestic heating grades, is substantial imports of oil from abroad. Barring general inflation there is little probability of high petroleum prices in the United States for several years after the war.

Coincident with the prospect of increased petrolcum imports we may expect continued advances in petroleum technology to increase the efficiency with which we use crude petroleum. The manufacture of gasoline by cracking has practically doubled the amount of gasoline produced from crudes and improvement of cracking processes is still going on.

Line vibration caused by pulsating gas flow from compressors has always been a perplexing problem. Now... for the first time... *results can be pre-determined.* The Fluor Pulsation Dampener *positively* and *completely* stops vibration by converting the pulsating gas flow into a steady stream. The expensive practice of oversizing pipe lines merely to combat pulsation is no longer necessary. This means a tremendous saving... plus the elimination of trial-and-error procedure and resulting high maintenance cost due to failure of springs and other mechanical means commonly used to reduce line vibration. This positive protection can be used on both intake and discharge lines. Pressure drop is negligible. Designed for all operating pressures.

Patents Applied For

FLUOR PULSATION DAMPENER

SINCE 1890

FLUOR

ENGINEERS • MANUFACTURERS • CONSTRUCTORS

PROCESS PLANTS AND EQUIPMENT FOR THE OIL, GAS AND ALLIED INDUSTRIES

THE FLUOR CORPORATION, LTD., 2500 S. ATLANTIC BLVD., LOS ANGELES 22 • New York, Pittsburgh, Kansas City, Houston, Tulsa

Continued mechanical development of diesel engines and better diesel oils, as well as economics, forecasts much greater use of such engines. Fuel oils have always been the reservoir of low value oils which have been cut into to increase the yields of the more valuable products. If for any reason imports should fail to satisfy our needs for both fuel oils and other products, fuel oil supplies would be greatly curtailed in order to manufacture adequate quantities of gasoline and other essential products.

Benjamin T. Brooks before annual meeting of Association of Consulting Chemists & Chemical Engineers, New York, Oct. 24, 1944.

PRODUCTION AND PURIFICATION OF BUTADIENE FROM ALCOHOL

THE PROCESS now used for large scale production of butadiene from alcohol was developed in Carbide and Carbon Chemicals Corp.'s research laboratories in 1940-41. Total rated capacity of the plants using this process is 220,000 tons per year. Improvement of the catalyst by continued research between the initial design of the plants and their completion, plus perfection of manufacturing technique through experience with the large scale operations, have resulted in productions considerably greater than the design capacity. In the second quarter of 1944, the production of butadiene from alcohol was at the rate of about 396,000 tons per year. Of all the butadiene produced in government owned plants, through June 1944, 75 percent was from alcohol.

The process consists primarily of the reaction of one mol of alcohol with one mol of acetaldehyde to form one mol of butadiene plus two mols of water. Acetaldehyde is manufactured by the dehydrogenation of alcohol. The reactions take place at elevated temperatures and substantially atmospheric pressure. Conversion is not complete. Reaction products are separated by distillation and unreacted materials are returned to the process. Butadiene is purified by treatment with "Chlorex" and subsequent distillation. In the wartime plants, built without complete byproduct recovery equipment to save investment in money and critical materials, the actual efficiency from alcohol, to the butadiene contained in the product, is 61.6 percent. By installing additional equipment for recovering useful byproducts for use as such, or for reconversion into alcohol, the practical efficiency from alcohol to butadiene and byproducts can be brought up to about 75 percent.

W. S. Brackett and J. L. Marsh, Carbide & Carbon Chemicals Corp., before American Institute of Chemical Engineers, St. Louis, Nov. 20, 1944.

REMOVAL OF AMMONIA BY CHLORINE

EXCESSIVE amounts of free ammonia in both domestic and industrial waters lead to a large variety of difficulties. In domestic waters these may lead to poor bacteriological removals, to an intensification of odors, and to the gradual closure of water distribution mains. In industrial waters this may lead to excessive ammonia corrosion, to the fouling of condensers or to the accumulation of organic material in

Destructive heat...brittle cold

TITEFLEX FLEXIBLE TUBING remains flexible and pressure-tight under the widest range of temperature variations. We think, for instance, that you'll be interested in the problem of a phonograph record manufacturer . . .

• He makes records on presses like the one in our illustration, and he found the solution to supplying both *steam* and *cold* water to the stationary and movable platens by choosing Titeflex all-metal tubing.

• What a change from the temperatures and pressures of steam applications to -50°F. of high-altitude aircraft installations. Yet Titeflex remains perfectly flexible at -50°F., while other types of tubing become brittle from the low temperature. In addition — because it's *all-metal* — Titeflex is not affected by the destroying influence of oils, gasoline, and most chemicals.

• Undoubtedly the versatility of Titeflex will find many applications in your own plant for your wartime or postwar planning. We'd like you to write for our catalog No. 113 which gives specifications on Titeflex and which suggests many applications of which you might not otherwise think.

TITEFLEX, INC.
523 Frelinghuysen Avenue
Newark 5, N. J.

piping. In either case the removal or destruction of all the free ammonia present and the maintenance of free available chlorine residuals has gone far toward the alleviation of such difficulties.

This can be accomplished in one operation by the addition of chlorine in the ratio of 10 ppm. or more of chlorine to each part of ammonia present. The optimum pH for completion of the reaction lies between 6.5 and 8.5 and the time of contact should not be less than 20 min. Temperature is of relatively small importance although when it drops below 45 deg. F. there will be some retardation of the reaction.

The production and maintenance of free available chlorine residuals indicates that the ammonia has been removed. This point can be determined by means of the Laux Flash Test. Through the use of this test laboratory findings can be duplicated in plant practice.

A. E. Griffin, Wallace & Tiernan Co., before Fifth Annual Water Conference of the Engineers' Society of Western Pennsylvania, Pittsburgh, Oct. 30, 1944.

INDUSTRIAL MINERALS IN POSTWAR CHINA

SEARCH for new deposits of both metallic and non-metallic minerals has developed new tools and technique. There is in addition to these, a much advanced knowledge of ore genesis and geological structures, more efficient mining methods, and the development of better extractive technique than was available when much of the earlier work in China was done.

There is also to be taken into account the element of accidental discovery. Many mineral deposits, both metallic and non-metallic, are covered by surface debris and often the upper limits of orebodies do not reach the surface even where the surrounding rock mass is exposed. Some such orebodies have been discovered by technical practices, others are encountered as an incident to exploration in the vicinity of known mineral bodies.

In view of the fact that even in an area intensively prospected, deposits of non-metallic minerals usually remain obscure or unknown until industry demands their output, it is not surprising that so little is known of their occurrence in China.

If a demand is developed it may be taken as axiomatic that sources, if they exist, will come to light. The converse is in a measure also true. If usable deposits of important tonnage and quality are sought and found, it may be possible to develop a market for their output.

Suitable transportation must, of course, be provided. The construction of roads, bridges and railroads in themselves provide important markets for non-metallic minerals in the form of Portland cement, sand, gravel, asphalt surface fillers, lime, gypsum, and other products.

The development of a large non-metallic industry in an area such as China is a huge undertaking. Search, discovery and development to a point of establishing important tonnages of suitable material are necessarily the first steps to that end. Utilization involves the provision of fuel, power, transportation and, for domestic consumption, the intercorrelation with

Clark "Angles" IN HELIUM PLANT

4,200 B. H. P. in Otis, Kansas, Installation

The superiority of CLARK "Angle" design has been proven in every field of compressor service. CLARK "Angles" handle all types of gas and are quickly adapted by our engineers to meet any special requirements.

Here CLARK "Angles" are shown in the Bureau of Mines helium plant at Otis, Kansas. Four of the seven 600 H.P. units perform dual service, one of the three cylinders on each engine being used for single-stage compression in one service, the other two cylinders for two-stage compression in a second service. The remainder of the seven units provide three-stage compression of nitrogen from atmospheric pressure to 600 pounds per square inch.

CLARK engineers are experts in solving special problems. Call on them.

CLARK BROS. CO., INC. . . . OLEAN, NEW YORK

Export Office: 30 Rockefeller Plaza, New York. Domestic Sales Offices and Warehouses: Tulsa, Okla.; Houston, Tex.; Chicago, Ill. (122 S. Michigan Ave.); Boston, Mass. (Park Square Bldg.); Huntington Park, Calif. (5715 Bicket St.) Foreign Offices: London, England; Avda Roque Saenz Pena, 832 Buenos Aires.

CLARK

One of the Dresser Industries

other industrial development in the country.

China now is in a better position to carry such work forward than at any previous period. It can take full advantage of the methods that have been developed and the knowledge gained elsewhere during the last 40 years or so, a period which has witnessed the growth of the non-metallic industries in other countries from comparative obscurity to a point where, in the United States, output has at times equalled or exceeded in value, that of all the metals.

Samuel H. Dolbear, consulting mining engineer, before Industrial Minerals Division, A.I.M.M.E., Los Angeles, Oct. 19, 1944.

RESORCINOL-FORMALDEHYYDE RESINS

Resorcinol resins have promising postwar prospects as adhesives for marine use, aircraft, furniture, and building construction and as resins for laminating, molding, casting, coatings, and grinding wheels, because of their great strength, durability and superior resistance to corrosion and immersion in water.

Originally developed to overcome the corrosion attending the addition of an acid catalyst necessary for curing other resins at room temperature and to avoid decomposition of the materials themselves when bonded with acid-resisting phenol-formaldehyde resins, resorcinol resins were also found to be effective in curing at high temperatures. This accelerated curing cycles from 6 to 1 min., in a typical example where the glue line temperature was 180 deg. F. Laminated timbers for small boats were produced with these resins at temperatures of 140 deg. F. and have withstood severe wartime tests. In the manufacture of plywood tubing these resins have also found wide use.

Paper and fabric laminates prepared with resorcinol resins have greater strength than similar materials made with phenol-formaldehyde resins. In manufacture of grinding wheels, as well, they have been found to give twice the efficiency and wear given by phenol-formaldehyde resins.

They have also been employed as bonding agents in assembly gluing of laminated and molded phenolic parts as methyl methacrylate, resin, nylon, allyl, polymers, and even natural and synthetic rubbers.

Philip H. Rhodes, Pennsylvania Coal Products Co., before Society of Plastic Industry, New York, Nov. 13, 1944.

MAGNESIUM CHLORIDE FROM DOLOMITE

The International Minerals and Chemical Corp. operating the Austin Magnesium Plant for the Defense Plant Corp. developed a process for making $MgCl_2$ from Texas dolomite.

The dolomite $MgCO_3.CaCO_3$ is calcined to MgO+CaO and wet-slaked to the hydrates providing a chemical and physical separation of the dolomite components.

All the $Ca(OH)_2$ in the hydrate slurry is preferentially carbonated at atmospheric pressure, using 30 percent CO_2 kiln gas from the calcining step, to $CaCO_3$ providing a basis for selectivity reacting $Mg(OH)_2$ with 20 percent HCl (pH 7.8) in the presence of $CaCO_3$ (pH 5.8 as compared to $Ca(OH)_2$ pH 12.6).

Chemicals ... for G.I. JOE

Stauffer CHEMICALS SINCE 1885

Yes, G. I. Joe would have a tough time fighting this war without the kind of chemicals manufactured by Stauffer. All of his personal equipment from head to toe — his guns, ammunition and other equipment — require larger quantities of industrial chemicals for their manufacture. Stauffer makes a long list of industrial chemicals in more than a dozen plants, strategically located throughout the United States — chemicals for consumption by every conceivable industry — for war and the home front. Wherever your plant is located, Stauffer can supply you promptly and efficiently with industrial chemicals that have proven consistently dependable for almost sixty years.

STAUFFER PRODUCTS

*Aluminum Sulphate
Borax
Boric Acid
Carbon Bisulphide
Carbon Tetrachloride
Caustic Soda
Citric Acid
*Diluents
Cream of Tartar
Liquid Chlorine
Muriatic Acid
Nitric Acid
Silicon Tetrachloride
Sodium Hydrosulphide
Stripper, Textile
Sulphur
Sulphuric Acid
Sulphur Chloride
*Superphosphate
Tartar Emetic
Tartaric Acid
Titanium Tetrachloride

(*Items marked with star are sold on West Coast only.)

STAUFFER CHEMICAL COMPANY

420 Lexington Avenue, New York 17, N. Y.
444 Lake Shore Drive, Chicago 11, Illinois
555 South Flower St., Los Angeles 13, Cal.
636 California Street, San Francisco 8, Cal.

The carbonated slurry, with an average particle size of 2 microns, is dewatered with continuous centrifuges to 55 percent total solids and the cake is repulped with 16 percent $MgCl_2$, from the process, and adjusted in continuous secondary atmospheric carbonators to 10 percent total solids. Soluble calcium contained in the 16 percent $MgCl_2$ solution is precipitated as $CaCO_3$. ($Ca^{++} + Mg(OH)_2 + CO_2 \rightarrow CaCO_3 + Mg^{++} + H_2O$).

The neutralization of $Mg(OH)_2$ with 20 percent HCl in the presence of $CaCO_3$ is controlled stoichiometrically with a slight conversion of $CaCO_3$ to the chloride, two-thirds of which is recarbonated in the secondary carbonation step.

The $CaCO_3$ is separated from the $MgCl_2$ in thickeners and filtered on rotary vacuum filters with the filtrate returned to the thickeners. Two-thirds of the overflow is used to repulp the aforementioned cake and one-third is concentrated in submerged combustion evaporators to 34 percent $MgCl_2$ and treated with $MgSO_4$ to control the soluble calcium.

The treated $MgCl_2$ is aged and the precipitated $CaSO_4$ is removed by filters. The filtrate is further processed to 75 percent flaked $MgCl_2$ and electrolytically reduced to Mg and Cl_2. The Cl_2 is reacted to provide 20 percent HCl and recycled to the process.

E. E. Wrege and C. J. Anstrand, International Minerals and Chemicals Corp., before American Institute of Chemical Engineers, St. Louis, Nov. 21, 1944.

INDUSTRIAL MASS SPECTROMETRY

ANALYSIS of gas and liquid mixtures by the mass spectrometer has proved itself to be of considerable value in the petroleum industry. Essentially this new method consists of the determination of the composition of a mixture from its mass spectrum and a knowledge of the mass spectra of the components in that mixture.

The mass spectrum of a pure substance may be defined as a plot of the relative abundances of positive ions formed at different masses when the substance in vapor form is bombarded by electrons. The mass spectrum of a substance is found to depend upon its molecular structure as well as upon the number and kind of atoms forming its molecules. Generally speaking, there is a one to one correspondence between a substance and the mass spectrum of that substance. This characteristic permits the analysis of a mixture from its mass spectrum even though some of the components of the mixture are isomers.

The contribution to each peak in the mass spectrum of a mixture resulting from a particular component of a mixture is proportional to the partial pressure of that component in the mixture. In other words, the mixture mass spectrum is a linear superposition of the mass spectra of the components of that mixture. It follows that the analysis of a mixture can be made from its mass spectrum by solving a set of linear simultaneous equations.

The characteristics of the mass spectra of the components of many common mixtures such as depropanizer overheads, depropanizer bottoms and debutanizer over-

heads permit the rapid determination of the key components. In these cases the computation time is less than ten minutes and the instrument time approximately twenty minutes.

Empirical constants were obtained by averaging the errors observed upon running a large number of synthetic samples containing C_1 through C_4 paraffins and olefins. These empirical constants are used in predicting the accuracy of analyzing a mixture for which synthetic mixtures have not been run, but for which the mass spectra of each of the components have been obtained.

Experience obtained from both commercial and laboratory operation of the instrument has shown that the mass spectrometer method is well adapted to: (1) Determination of small amounts of a substance (contaminent) in a mixture or a pure substance; (2) analysis of mixtures containing hydrogen, helium, nitrogen, etc.; (3) analysis of wide range mixtures such as hydrogen and C_1-C_5 paraffin olefin mixtures obtained from a cracking still overhead; (4) determination of key components from simple mixtures such as butadiene and styrene in a mixture containing C_4 and C_5 olefins and diolefins, styrene, ethylbenzene, and butadiene dimers; (5) analyses of mixtures containing a large number of isomers such as a mixture of C_6 paraffins and cyclics.

Although there has been no commercial application to C_7 and C_8 mixtures to date, laboratory data indicates that the mass spectrometer may make possible the routine analysis of complex C_7 or C_8 mixtures such as the C_8 fraction of an aviation alkylate.

H. W. Washburn, H. F. Wiley, S. M. Rock and C. E. Berry, Consolidated Engineering Corp., before American Institute of Chemical Engineers, St. Louis, Nov. 21, 1944.

WARTIME DEMANDS STIMULATE LITHIUM PRODUCTION

THE United States is the leading producer and consumer of lithium, lithium alloys, and lithium compounds. The largest known ore reserves in the world are within our boundaries. While Germany originally developed many of the present uses of lithium, wartime research in this country has multiplied the commercial uses of lithium many times. For the past two and one-half years, lithium production has been almost entirely devoted to the war effort. Its true importance in military operations will probably not be revealed until final victory is won.

The principal minerals mined today in the United States in order of their abundance are lepidolite, spodumene, and amblygonite. The last named is the most desirable one from the standpoint of chemical production, with the single exception of a new source of lithium; namely, a lithium-sodium-phosphate compound derived from Searles Lake brine at Trona, California. This unique compound first entered the market in 1938.

While the di-lithium sodium phosphate produced at Searles Lake cannot be properly classed as an "ore" in the strict sense of the word, it is processed by methods familiar to the mining industry. The brine from Searles Lake has long been known

BLAW-KNOX *High Pressure Autoclaves*

High pressure technique is a development of recent years. Blaw-Knox has been actively engaged in the design and construction of autoclaves during this period and is proud of the contributions to the art which have come from the Company's engineering offices and shops.

A veteran staff is prepared to study each autoclave problem; to collect and interpret the pertinent physical and chemical data; to develop an efficient functional and mechanical design; and to build a safe, economical, and workable piece of process equipment.

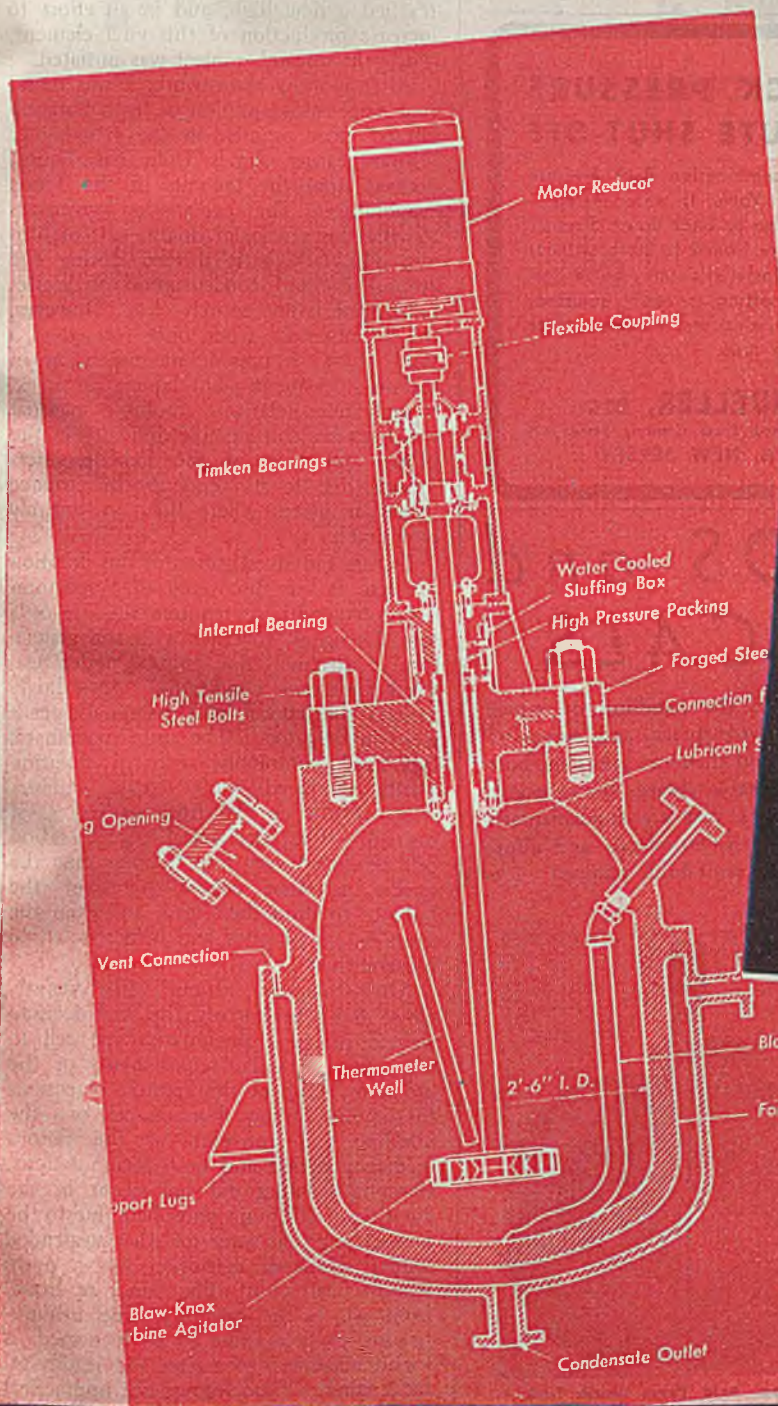
★ *Bulletin No. 1925 will bring you 50 pages of technical data on autoclaves and allied equipment, let us know your requirement.*

BLAW-KNOX DIVISION of Blaw-Knox Company

2090 Farmers Bank Building, Pittsburgh, Pennsylvania

NEW YORK CHICAGO PHILADELPHIA BIRMINGHAM WASHINGTON

Representatives in Principal Cities



Blaw-Knox furnishes a complete service to the process industries, including welded process vessels and other equipment of steel, alloys and other metals. Blaw-Knox facilities include complete engineering personnel, chemical engineering laboratories—field erection and plate fabrication of every description.

BLAW-KNOX PROCESS EQUIPMENT

to carry lithium in solution but only in very small amounts.

Following the installation of the soda products plant at Trona in 1934 for the byproduct recovery of soda ash and sodium sulphate from waste salts of the brine evaporators, it was found that considerable lithium was present in certain residual slimes which remained after dissolving most of the sodium salts. These slimes tended to accumulate as scums and sediments in some of the large storage tanks used for intermediate process liquors in this section of the Trona plant. Later, in 1937, after some experimental work, a limited recovery of these concentrates was commenced on a commercial basis.

However, in 1942, the wartime demands of lithium and lithium compounds reached a new high, and in an effort to increase production of this vital element, a diligent research project was initiated.

After months of testwork, it was found that a special adaptation of froth flotation offered great promise in the recovery of lithium-bearing slimes from the liquors derived from the tail-salts of the Trona evaporators. The explanation given as to why this particular double salt of lithium (Li_2NaPO_4) is formed during the evaporation and concentration of Searles Lake brine is not entirely clear. However, this lithium salt, when once formed as a solid phase, is present in suspension in certain subsequent plant liquors as an extremely fine, relatively insoluble material which causes considerable difficulty in the proper operation of the soda products process due to its tendency to produce slimes at places where they are entirely undesirable.

During the investigation of this flotation problem it was discovered that optimum flotation conditions required the use of a special reagent, together with the generation of extremely fine bubbles under relatively quiescent conditions. Accordingly various mechanical and pneumatic cells were investigated. The usual pneumatic type cell commonly used in flotation plants produced quite coarse bubbles which broke up the froth as fast as it formed. The mechanical type flotation cell produced very fine bubbles, but the terrific agitation caused some of the bubbles to drop their load, and even the introduction of grids and baffles failed to prevent this.

After balancing various costs, maintenance and other factors, the final decision was to design a pneumatic type cell to meet the particular requirements of the problem. One of the greatest objections to the old Callow flotation cell was the blinding and corrosion of the porous media by pyritic and limy accumulations. Blinding troubles did not occur in the flotation of dilithium phosphate due to the non-settling character of the suspended solids. However, corrosion was a problem to deal with. The liquor or brine, from which the extremely fine lithium-bearing particles were to be recovered, is highly alkaline in character and readily attacks fabrics. Since canvas was impractical from two standpoints—corrosion and coarseness of bubbles generated, various other porous media were investigated. Final selection resulted in the use of a

porous medium which was non-corrosive and which generated very fine size bubbles.

Early in 1944, construction was commenced on a flotation plant of unique design to increase the recovery of lithium. In this plant, lithium-bearing froth is recovered by flotation from the alkaline brine. The flotation concentrate is further thickened by settling, and is then leached with hot water to dissolve soluble impurities. After leaching, the sludge is sent to filters for final washing and recovery. The use of a pressure-type filter is necessitated by the slow-filtering characteristics of the slurry, and the need for a thorough washing of the product. Losses due to washing are minimized by the fact that di-lithium sodium phosphate is relatively insoluble when compared to the impurities removed by the washing and leaching processes.

After filtering and washing, the lithium concentrates are dried in a steam jacketed dryer. The finished product is shipped in burlap sacks lined with paper liners. These lithium concentrates analyze as high as 22 percent lithium oxide, and constitute the highest known grade of raw material for the production of lithium and lithium compounds.

Ever increasing use of lithium, lithium alloys, lithium compounds, and lithium minerals points only to increasing demands in the postwar world. The field of lithium alloys is only beginning, and the field of lithium organics is almost untouched. With improved processes for the beneficiation of low-grade lithium ores and the recently expanded output of lithium concentrates from Searles Lake, the increased demand for lithium can be satisfied. The United States with the largest reserves of lithium raw materials in the world will undoubtedly be called upon to supply the major portions of both the domestic and foreign markets for this important element.

Lawrence A. Roe, American Potash and Chemical Corp., before American Institute of Mining and Metallurgical Engineers, Los Angeles, Oct. 20, 1944.

INDUSTRIAL WASTE DISPOSAL

THE POSTWAR period will see a greatly increased interest on the part of manufacturers concerning the disposal of liquid wastes from manufacturing processes. During the war many instances of pollution have been condoned by public authorities in order to place no barriers whatever in the path of production of war essentials.

The best way for industry to prepare to meet increasing demands for waste disposal is to become better informed as to the volume and nature of liquid wastes, to institute a program of measurement and evaluation of various types of wastes within the plant, to prevent as far as possible all losses of valuable products by careless operation or control, to salvage usable products, even if not profitable to do so, to estimate the residual non-recoverable wastes, and to investigate methods and costs of treatment of these irrecoverable wastes.

After these steps have been taken, the wise manufacturer should look to the river or lake or other recipient of the wastes, and try to learn all that he can concerning the capacity of such body of water for

receiving the industry's waste, treated only to the degree to satisfy the requirements of the uses or utility of the stream. If the manufacturer knows the year-round regimen of the stream, with reference to flow, dissolved oxygen content, biochemical oxygen demand, sludge beds, reaeration capacity and possibly bacterial content, he can talk the same language as the public official with whom he has to deal.

Sulphur compounds are among the worst components of industrial wastes, because of the rapid chemical depletion of dissolved oxygen. Sulphites and sulphides are the worst offenders. Sometimes sulphur can be recovered from these wastes, if not with profit, at least at low expense.

Organic wastes act more slowly than sulphur compounds to deplete dissolved oxygen and the time and extent of depletion are subject to the well-known laws and reaction rates. This type of industrial waste pollution is probably the most widespread and most expensive to abate, for example, packinghouse wastes, pulp and paper wastes, food products, brewery, distillery, canning, starch and tannery wastes.

Some chemical wastes are toxic to the normal biological life in streams or sewage-treatment plants, for example copper pickling wastes, chromium wastes, chlorinous liquors, tar liquor, and a few organic compounds. Others (ammonia-still wastes) will produce chlor-phenol tastes in water supplies in most minute amounts, of the order of 5 parts per billion.

Removal of suspended solids is usually not an especially difficult problem, although disposal of the sludge may be expensive. Screens, various types of cleaning mechanisms in settling tanks, flotation processes, chemical precipitation—all have their place.

For mineral oils, skimming tanks of the API type appear to be successful, especially for large and fluctuating flows. Small, patented grease traps or oil interceptors are not very effective. Wastes containing vegetable or animal fats are usually in smaller volume than those from petroleum refineries or rolling mills, and catch basins near the source of the fats may be satisfactory.

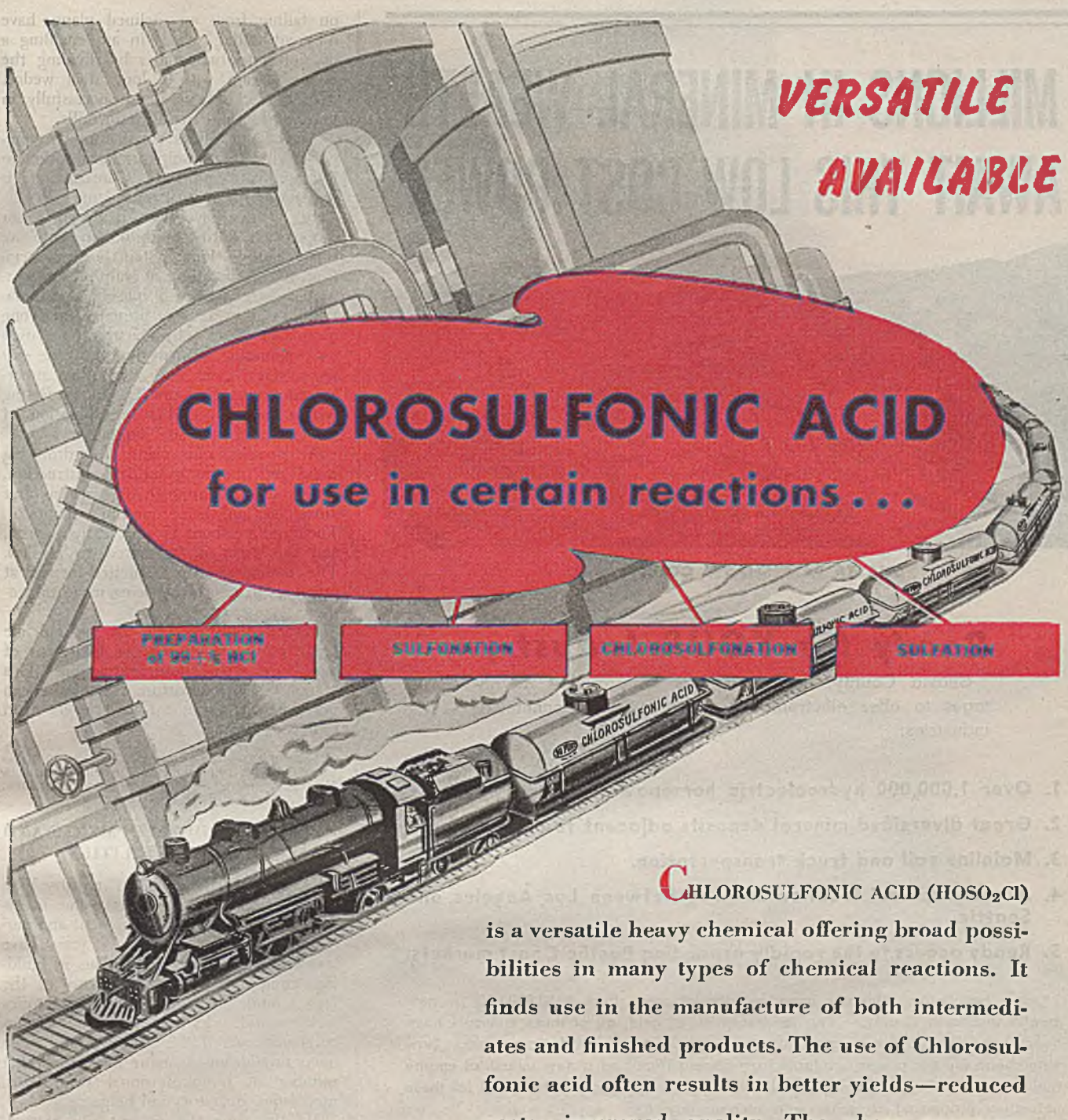
Wastes from the chemical industry, especially organic chemicals, are probably the most varied of all industrial wastes, and their effects on streams or sewage treatment plants can rarely be predicted on the basis of past experience.

F. W. Mohlman, director of laboratories, Chicago Sanitary District, before 33rd National Safety Congress, Chicago, Oct. 5, 1944.

WOOD PRODUCTS IN SWEDEN

FORCED by the war to abandon an economy based on world trade, Sweden embarked on a program of unprecedented research and experimentation in an effort to evolve an economy based on self sufficiency. Chief object of research was wood, Sweden's principal raw material. Many new processes and techniques have been developed, some of which are especially applicable to our own wood industry.

A device has been developed for sorting chips into prime and second qualities on the basis of the fact that knots are heavier and chunkier than pure chips. The chips,



CHLOROSULFONIC ACID ($HOSO_2Cl$) is a versatile heavy chemical offering broad possibilities in many types of chemical reactions. It finds use in the manufacture of both intermediates and finished products. The use of Chlorosulfonic acid often results in better yields—reduced costs—improved quality. The above processes illustrate some of the applications for this interesting reaction tool.

For further information, write: E. I. du Pont de Nemours & Co., (Inc.), Grasselli Chemicals Department, Wilmington 98, Delaware.

TYPICAL ANALYSIS OF DU PONT CHLOROSULFONIC ACID

Specific gravity @ 60°F	1.752
Total Chlorosulfonic acid ($HOSO_2Cl$)	98.8%
Free Sulfuric acid (H_2SO_4)	0.7%
Iron (Fe)	0.001%
Boiling point	316°F. (Approx.)
Freezing point	—112°F. (Approx.)

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

DU PONT CHLOROSULFONIC ACID

Now used in tank car quantities by many manufacturers

on falling from an inclined plane, have different falling speeds in air, enabling a division into two grades by dividing the falling stream with a long steel wedge. This device is being used successfully in one Swedish and two Finnish mills.

Several companies are planning to precook with dilute sulphuric acid prior to the sulphate process. Construction is under way on at least one plant.

Big strides have been made in liquor evaporation, both for sulphite and sulphate waste liquors. Four systems are in operation for evaporation of sulphite liquors. Two are based on multiple-effect evaporation; one uses a spray principle; and one uses stack gases. Two systems are used for evaporating sulphate liquors. One employs stack gases and the other superheated steam. One mill has an interesting system for the combined evaporation of sulphite and sulphate liquors.

At present, one plant is hydrolyzing wood and another is under construction. Moist chips are impregnated with sulphur dioxide gas and then ground in a defibrator. The chips are about 15 percent hydrolyzed, and the sugar is fermented to alcohol. The residual wood is briquetted for fuel at present, but efforts are being made to promote its use as a plastic.

Several hundred tons of furfural are being produced by aqueous hydrolysis of oak chips after tannin extraction. This marks a sharp departure from American practice which uses oat hulls as its main source of furfural.

Edwin C. Jahn, New York State College of Forestry, before New Developments in Wood Products Conference, Syracuse, N. Y., Oct. 6, 1944.

PETROLEUM DEVELOPMENTS AND POSTWAR POTENTIALITIES

MANAGEMENTS in the oil industry have long recognized the practical value of organized research and development and particularly during the past 25 years have invested many millions of dollars in building, equipping and staffing many of the largest and finest industrial laboratories in the world. In 1941, these laboratories employed over 7,000 scientists and engineers in addition to many more than that number of non-professional technicians, mechanics, operators and helpers.

By the time the present war started, these great research and development organizations, working in close integration with their producing, manufacturing, and marketing organizations, had accumulated quite an imposing list of new technical developments. A good proportion of these developments had already passed the commercial and economic tests and were established in successful processes and products. Our refineries had been essentially rebuilt on modern lines, with new distillation units, new cracking plants, new lubricating oil plants and new specialty plants filling out a new refinery skyline, and providing a variety of quality products undreamed of 25 years ago.

Our aviation gasoline production now compares to our regular housebrand motor gasoline production not so many years ago. Furthermore, the performance rating has long since far surpassed the old yardstick, iso-octane. A whole series of new catalytic

processes for rearranging hydrocarbons, some developed before the war and some during the war, have contributed to this flood of super aviation gasoline, now amounting to over 500,000 bbl. per day. This production required an investment of $760,000,000 in new plants, 82 percent of which was private capital put up by the oil industry.

Catalytic cracking, isomerization, alkylation and polymerization add greatly to a refinery's flexibility to produce products of a wide range of qualities and to vary the distribution of products to meet changing market demands or changes in character of crude oil receipts.

Expressed in terms of possible yields of gasoline from crude oil,—without thermal cracking we could average 20 percent; with thermal cracking we reached 45 percent. By using all the new processes now available, engineers estimate we could now reach 85 percent if it were required. In practical terms this means that after the war we can make all the gasoline that is required of at least prewar quality for the prewar cars; we can also make available in large quantities super fuels far surpassing any prewar gasoline, for any new power unit which may require them.

The Petroleum Industry was called on to produce toluene for the production of TNT. Fortunately we were ready and several processes were quickly placed in commercial operation.

The production of butadiene for 600,000 tons a year of synthetic rubber is another outstanding contribution of the petroleum industry to essential war production. The successful production of synthetic rubber at reasonable prices gives assurance that we need never again face the prospect of being without tires. Furthermore, it is entirely possible, even probable, that the best tires of the future will be made from synthetic rubber produced from petroleum chemicals.

Also important in the aggregate, although smaller individually, are the hundreds of specialties and chemicals which the oil industry is producing and is prepared to produce for the postwar years. Included are insecticides, fungicides, and disinfectants; paint driers, solvents, and drying oils; plastics and chemicals for plastic production; ship launching greases, cutting oils, soluble oils, quenching oils, core binders and anti-rusting agents for use in producing and protecting mechanical equipment; flotation agents for the mining industry; glues and impregnants for the plywood industry; laminating materials and waterproofing compounds for paper sacks and cartons; wetting agents and detergents for the soap industry.

These are but a few examples. The list could go on and on, because our chemists have found that petroleum is a prolific source of raw materials which they are just beginning to feel familiar with. When they get really well acquainted, we expect to find ourselves with the basis for a petroleum chemical industry rivaling that of the coal tar industry.

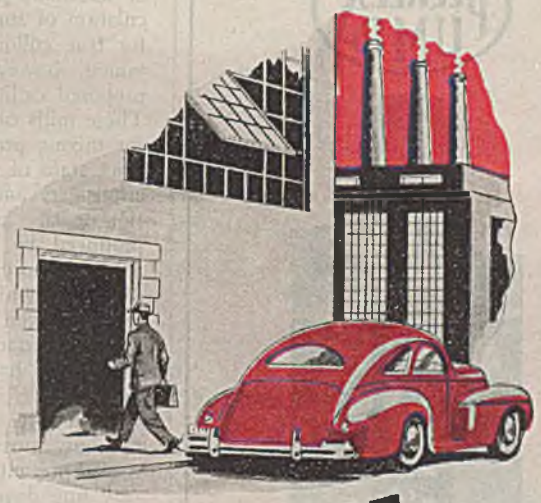
A. L. Lyman, California Research Corp., before Industrial Development Committee of the Los Angeles Chamber of Commerce, Sept. 5, 1944.

2 WAYS TO IMPROVE COMBUSTION *whatever your fuel*

PREHEAT ENGINEERING DESIGN

All fuels burn better with preheated combustion air, and it is a "must" for many of them, such as high-moisture powdered coal. In planning new steam generation plants or other furnaces for oil refineries, chemical plants, etc., remember that the *continuous regenerative counterflow* principle of the Ljungstrom Air Preheater assures maximum heat transfer with minimum weight and size. Flexible and compact, it may be used in a wide range of applications. With the Ljungstrom it is possible to obtain preheated air up to 1500 deg. F.

All boiler manufacturers can furnish you designs incorporating the Ljungstrom Air Preheater. Or, the engineering staff of The Air Preheater Corporation is prepared to assist you, your consulting engineers or your boiler company, in applying standard or special types of Ljungstrom Preheaters to your fuel conservation needs. Our engineers are ready to work with yours to help you make better use of low-grade, more abundant fuels and to help you plan for future modernization of, and additions to, your steam generating plants.



PREHEAT ENGINEERING SERVICE

Today, when boiler efficiency must be stepped up, and kept up, to generate steam with the current inferior fuels, the need for expert service has increased. To assist you in securing efficient operation under abnormal conditions, The Air Preheater Corporation has expanded its service facilities, so that an Air Preheater Service Engineer, whose sole responsibility is Ljungstrom Preheaters, is quickly available to keep your Ljungstrom operating smoothly, and at peak efficiency.

NEW! When, for reasons of fuel conservation Ljungstrom Preheaters are operated with lower gas exit temperatures than those for which they were designed, deposits sometimes form. To do an even better job of removing these deposits, a new, single-nozzle cleaning device is available for immediate installation on *all* Ljungstroms. Full details will be sent upon request.

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, New York

FOREIGN LITERATURE ABSTRACTS

DISPERSION MILLS

GRINDING action of so-called colloidal mills is generally limited to disintegration of secondary particles formed by the flocculation of smaller ones. The proper size for true colloidal dispersions is rarely attained, however. Chwala has therefore proposed calling them disintegrator mills. These mills can also be used to advantage for mixing products which exist in a distinct state of non-miscible liquids, and as emulsifiers and homogenizers. Their action is the result of the shearing effect produced by two surfaces in very close proximity to each other. These are usually two disks which rotate in opposite directions or even a rotor with a smooth or grooved surface which rotates in a stator which also has a smooth or grooved surface.

As a rule, percussion or friction mills can only provide coarse dispersions unless special precautions are taken. For example, very fine dispersions can be obtained by using a simple ball mill if the drum is made to rotate very slowly so that the balls act by abrasion and not by impact. Friction improves with decrease in rate of sliding of the touching bodies. A mill with a diameter of 220 cm., half full of 1-mm. porcelain balls and rotating at a speed of 30 rpm., will produce a suspension of 2 percent sulphur in glycerin with a grain size of 0.1 micron after 150 hr., a suspension of 5 percent chromium oxide in light hydrocarbons with a grain size of 0.5–1 micron after 200 hr., or a suspension of 10 percent kaolin in water with a grain size of 0.5–1 micron after 150 hr. The long time required is a disadvantage in industrial application but this problem can apparently be partly solved by using cylinders instead of balls.

The principles of the vibratory mill are also explained. Padszus' cyclone grinding is useful in reducing metallic powders to a very fine state of subdivision. The procedure consists of the formation of whirlpools of air in a metallic powder which results in mutual abrasion of the particles. The inventor claims that he obtained copper dust which, after addition of a colloidal protector, gave sols which maintained their characteristic coffee color in reflected light and the red or brown color by transparency of colloidal copper solutions for a period of two months.

Digest from "Some Observations on the Dispersion of Materials" by F. Delarozière, *Rev.-Prod. Chim.* 46, 2, 1943. (Published in France.)

MODIFIED ALKYD RESINS

MODIFICATION of alkyd resins by introduction of monovalent alcohol or monobasic acid radicals is usually not difficult. Among acids not belonging to the higher fatty group, the use of benzoic acid is of some interest. It can be used to yield very valuable products which are compatible with nitrocellulose. Modification of alkyd resins with the higher fatty acids has certain limitations. The following are

THE RIGHT KEY....

RED FUMING Nitric Acid

TECH. & REAGENT
SP. GR. 1.59—1.60

(HNO_3 plus dissolved NO_2)

In Laboratory Lots and Grades

Technical—In Commercial Quantities

The right key to your research, process development, or production problem may be Baker & Adamson's Red Fuming Nitric Acid.

Here is a strong nitric acid in which large quantities of nitrogen dioxide are dissolved. The product is a powerful oxidizing agent; its properties suggest many uses . . . as a nitrating agent for special nitrations where other acids are not suitable . . . as a stripping agent for electroplating . . . and other applications.

Investigate the potentialities of this special B&A mineral acid for your needs *now*. Perhaps it will prove the "key" chemical for you as it has for many other users!

HAVE YOU THIS NEW BOOK?

Among the 1,000 B&A Laboratory Reagents and Fine Chemicals at your command are many idea-provoking chemicals such as Red Fuming Nitric Acid. They are all listed in Baker & Adamson's new catalog. Laboratories, manufacturers, colleges and others will find this 188-page book an invaluable guide. *Write for your copy today on organization letterhead.* No obligation.

Setting the Pace in Chemical Purity Since 1882

B&A BAKER & ADAMSON QUALITY STANDARD OF PURITY

BAKER & ADAMSON *Reagent and Fine Chemicals*

Division of GENERAL CHEMICAL COMPANY, 40 Rector St., New York 6, N. Y.

Technical Service Offices: Albany • Baltimore • Boston • Bridgeport (Conn.) • Buffalo • Charlotte (N. C.) Chicago • Cleveland • Denver • Detroit • Houston • Kansas City • Milwaukee • Minneapolis New York • Philadelphia • Pittsburgh • Providence (R. I.) • St. Louis • Utica (N. Y.)

Pacific Coast Technical Service Offices: Los Angeles • San Francisco • Seattle, Wenatchee and Yakima (Wash.)

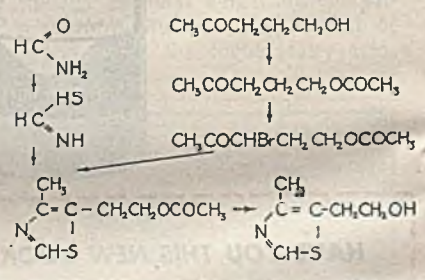
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

methods normally used for introduction of these higher fatty acids into alkyd resins: (1) Heating of the glycerophthalic resins with the corresponding fatty acids; (2) esterification of the glycerophthalic resins with fatty oils; (3) reaction of poly acids, poly alcohols and fatty oils; (4) reactions between poly acids and poly alcohols which have been partially esterified with fatty acids; (5) reactions between the poly alcohols, poly acids and fatty acids.

Digest from "Possibilities of Obtaining Modified Alkyd Resins by Means of Fatty Acids" by J. Scheiber, *Fette und Seifen* 50, 12-18, 1943. (Published in Germany.)

MANUFACTURE OF VITAMIN B_1

THE BACHMAN method for preparation of 4-methyl-5-(β-hydroxyethyl)-thiazole has the disadvantage that 4-methyl-5-(α-hydroxyethyl)-thiazole is formed simultaneously and it is impossible to separate these two compounds. Modifications were therefore introduced into this method which made it suitable for the industrial preparation of 4-methyl-5-(β-hydroxyethyl)-thiazole exclusively. The raw material, acetopropyl acetate, was brominated in the presence of chalk. This prevented the accumulation of HBr which had served as the isomerizing agent in the Bachman method, and also made it possible to conduct the reaction under intensified conditions and shorten the time of synthesis. The synthesis can be represented as follows:



Condensation of the 4-methyl-5-(β-hydroxyethyl)-thiazole with 2-methyl-4-amino-5-bromomethyl-pyrimidone results in production of 95-100 percent pure vitamin B_1. This method has been adopted by the Vitamin Institute (USSR) for the manufacture of this vitamin.

Digest from "Vitamin B_1. Report IV. Technical Synthesis of 4-methyl-5-(β-hydroxyethyl)-thiazole" by Y. M. Slobodin, M. S. Ziguel and M. V. Yanisheyskaya, *Zhurnal Prikladnoi Khimii* XVI, No. 7-8, 280-282, 1943. (Published in Russia.)

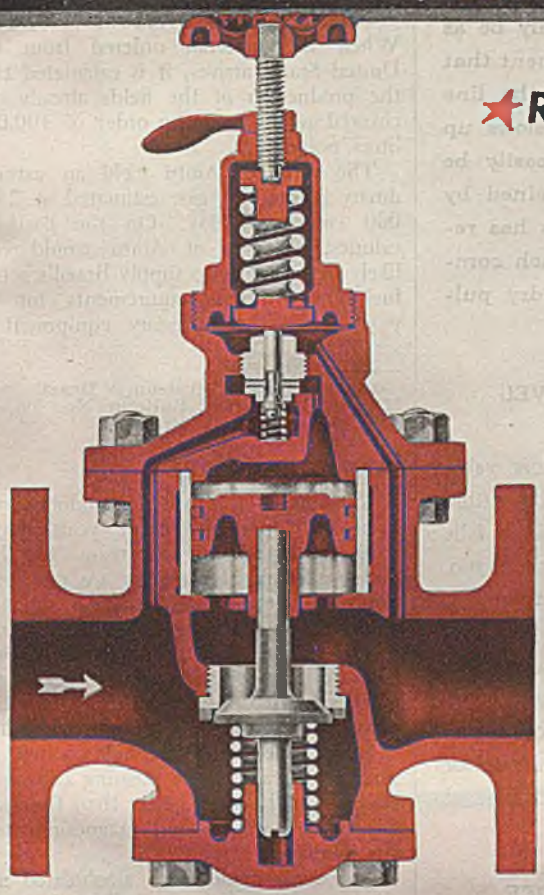
BRAZILIAN PETROLEUM

PROSPECTING for petroleum in Brazil has been done almost exclusively by the government. Areas most likely to yield petroleum have been determined by geological studies and soundings. The National Petroleum Council was established in 1938 and the following year the new organization began a program of extensive work on geological and geophysical studies and soundings. Wells were drilled in the territory of Acre in spite of the many difficulties which existed in regard to transportation of material to this region.

In the state of Alagoas drilling was carried down to approximately 3,000 meters but so far no appreciable petroleum layer has been encountered.

Best results were obtained with work carried out in the state of Baia. The oil

Leslie Regulating Valves

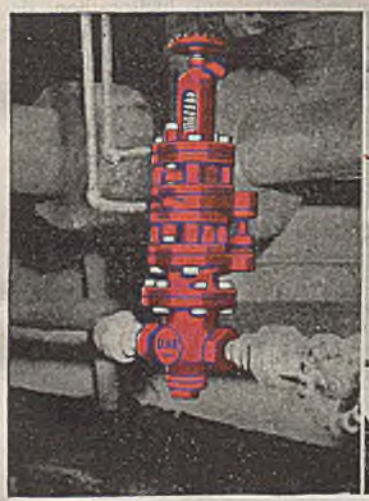


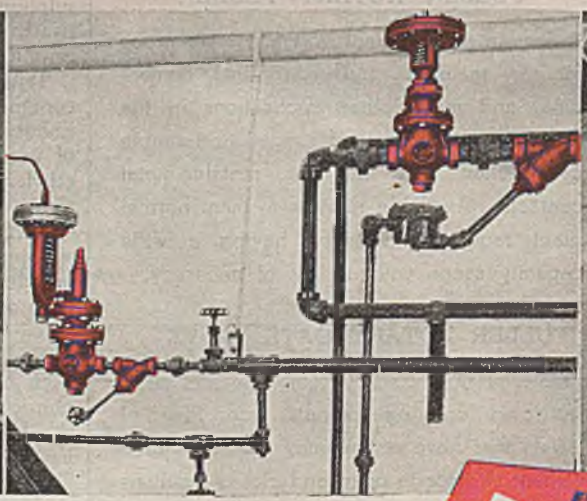
★REDUCE MAINTENANCE
★PROVIDE CLOSER CONTROL AT WHITE LABORATORIES!

WHITE LABORATORIES can tolerate no deviation from set process steam pressures, in spite of widely fluctuating loads, in the manufacture of its vitamin products and other pharmaceuticals. At the same time, maintenance must be kept within reasonable limits.

TO REDUCE FREQUENT AND COSTLY REGULATOR MAINTENANCE, Norman E. Smith, Chief Engineer, began installing Leslie products back in 1932. Now there are 60 Leslie Pressure Reducing Valves in the Boiler House, Manufacturing Plant, Compressed Air and Air Conditioning Systems—as well as Leslie Pump Governors and Leslie Temperature Regulators. Yet only one Leslie product has needed a major repair in these twelve years.

THE PRINCIPLE OF THE SPRING-LOADED INTERNAL PILOT, PISTON-OPERATED VALVE, developed by Leslie, is responsible for this combination of ruggedness with unusual sensitivity and accuracy. The bronze body valves are of 88-10-2 composition, enabling them to withstand pressures to 300 p.s.i. and temperatures to 550 degrees F. Cast steel valves are designed for 600 p.s.i. and temperatures to 750 degrees F. The main valve seats are Stellited to 600 Brinell and the main valves are surface hardened to 800 Brinell.





(Left, above) **WIDE LOAD CHANGES** demand fast acting, accurate pump governors such as this Leslie, standard equipment for White Laboratories fuel oil and feed water pumps.

(Center, above) **LESLIE TEMPERATURE REGULATORS** employed in White Laboratories include the self-contained unit at the left and the auxiliary operated unit at the right.

(Right, above) **LESLIE PRESSURE REDUCING VALVES** get many unusual jobs at White Laboratories. Here, in the oil feed line, a J-1 model safeguards the air conditioning air compressor from shut-downs.

ESTABLISHED 1900
LESLIE
REGULATING VALVES
LESLIE-TYFON WHISTLES

LESLIE CO. • LYNDHURST • NEW JERSEY

fields of Lobato, Joanes, Candeias, Aratu and Itaparica were discovered in the neighborhood of its capital. Although some of the wells had to be shut down and others were kept under a program of restricted production, due to lack of adequate equipment, the petroleum extracted was as follows:

	Liters
1940	329,925
1941	500,818
1942, first 9 mo.	3,670,957

When the material ordered from the United States arrives, it is calculated that the production of the fields already discovered will be on the order of 100,000 liters per day.

The wells of Aratu yield an extraordinary amount of gas, estimated at 280,000 cu.m. per day. On the basis of calories, the gas of Aratu would very likely be sufficient to supply Brazil's actual fuel consumption requirements for 10 years, once the necessary equipment is set up.

Digest from "Petroleum," Brazil 1942, Mineral Resources, Bulletin No. 56, 64, 1943. (Published in Brazil.)

SYNTHETIC SOAPS

A NUMBER of synthetic products have been developed in recent years which have good detergent properties. The Igepons, especially Igepon T, are condensation products of taurine with an acid chloride. They are good washing agents, impart a pleasing appearance to fabrics and are not very sensitive to acids and metallic salts. Igepal is a condensation product of terpineol with ethylene oxide.

Sulphonated fatty alcohols, which are similar to soap, give a pleasing texture to fabrics and they wet better than the soaps do. Their calcium and magnesium salts are soluble.

Nacconol, made from alcoholated and sulphonated petroleum hydrocarbon derivatives and consisting of 12–14 atoms of carbon, is used as the sodium salt.

Triton is probably the result of the combination of phenol with tri- and tetra-isobutylenes (residues from manufacture of iso-octane), followed by reaction with ethylene oxide and subsequent sulphonation.

Tergitols, whose detergent properties are approximately the same as those of the petroleum derivatives mentioned above, have an active group which is a sulphonated secondary carbon atom.

Very interesting soap substitutes have been made for some time by adding sulphuric acid to the cracking products of the higher saturated hydrocarbons. They have a double bond in the alpha positions. The sodium salt can be represented by the formula:

$CH_3–CH_2–. . . . .CH_2–CH(SO_3Na)–CH_3$.

The crude product is extracted with gasolene in order to separate the paraffins, olefins, higher alcohols, polymerized olefins, etc. and detergents are thus obtained which consist chiefly of alcohol sulphates. The resulting solution can be used either as a liquid soap or in the solid state if it is dried by pulverization.

Digest from "Synthetic Products Used as Soaps" by Andel, *Chem. Weekblad.* 49, 314, 1942. (Published in Germany.)

WATCH THIS SCOREBOARD OF LITHIUM USES

	Benzoate	Bromide	Carbonate	Chloride	Citrate	Fluoride	Hydroxide	Nitrate	Salicylate	Stearate	Sulphate
Air Conditioning		X		X			X				
Batteries				X			X				
Beverages			X	X	X			X			
Ceramics			X								X
Chemicals & Dyes											
Heat Treating			X	X				X		X	
Lubricants							X				
Paint											
Pharmaceuticals	X	X	X							X	
Wax											
Welding				X			X				

Not many years ago, lithium was little more than a name in your chemistry book. Even today uses for lithium salts are few but they *are growing* both numerically and in stature, as the scoreboard shows.

For example, Litholite A (Foote Lithium Stearate) is the basis of greases which operate satisfactorily under all weather conditions—dry or humid, and at temperatures from 400°F. to —90°F. Lithium fluoride is one ingredient of phosphorescent pigments for instrument dials.

Lithium compounds made war-urgent aluminum welding practical. Low cost lithiated paraffins have proved to be more resilient, stronger, and higher in melting point than the vegetable waxes for which they substituted.

Due to its ease of determination by spectro-chemical analysis, lithium sulphate is used as a trace element for the production control of chemicals and dyes.

Lithium citrate adds zest to soft drinks, lithium carbonate improves ceramic glazes and glasses, lithium bromide finds its way into nerve tonics. And so it goes.

IMMEDIATE AVAILABILITY

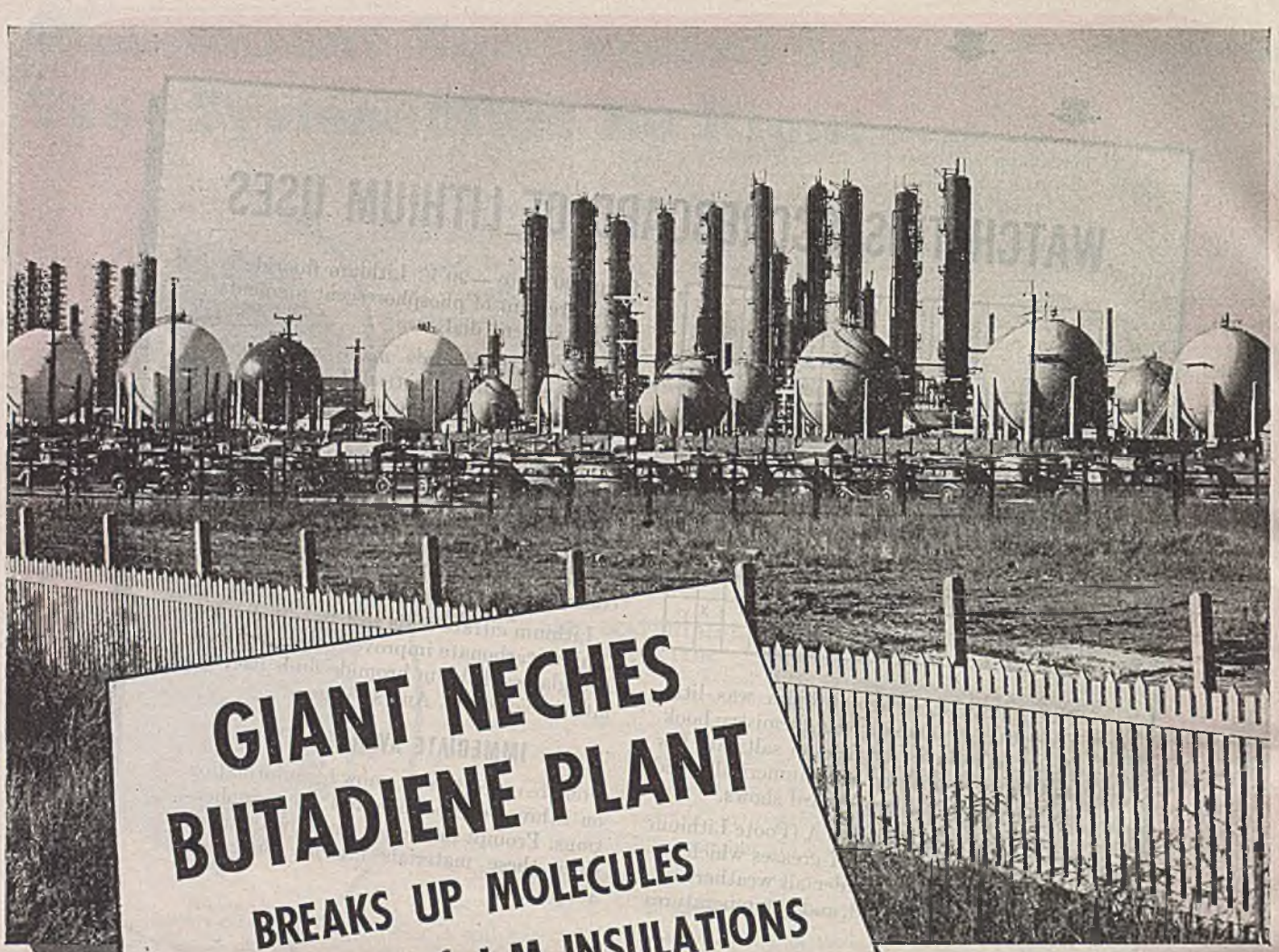
You are urged to write now for information on lithium compounds and their applications. Prompt deliveries can now be made since these materials are no longer on allocation.

THE ESSENCE OF THINGS TO COME

Our business is to locate and process ores and minerals and keep an eye open for ways to use them. This means research in cooperation with others and original research in the Foote laboratories. From recent investigations have come pure Ductile Zirconium, a Lithium base for greases that will withstand brutal temperatures; and better ceramics with Strontium salts. Other possibilities are brewing—perhaps for your industry. Get in touch with us and we'll keep in touch with you.

Foote
MINERAL COMPANY
A Step Ahead in Industrial Ores and Chemicals

PHILADELPHIA • ASBESTOS • EXTON, PENNSYLVANIA
Home Office: 1618 SUMMER STREET, PHILADELPHIA 3, PA.
West Coast Repr.: Griffin Chemical Co., San Francisco, Calif. • English Repr.: Ernst B. Westman, Ltd., London, Eng.



GIANT NECHES BUTADIENE PLANT

BREAKS UP MOLECULES with the aid of J-M INSULATIONS

The giant Neches Butadiene Plant, built by The Lummus Company and operated by five oil companies on a non-profit basis.

TO PROVIDE the exacting heat control so essential to the efficient operation of the world's largest butadiene plant, Neches engineers chose Johns-Manville Insulations. Here, heat must be handled with precision accuracy in each of the 54 skyscraper-like towers where molecules are broken up. It must be carefully preserved in the miles of piping from the four boiler plants, which rank in size among the world's largest.

To take care of these vital jobs, Neches engineers specified J-M 85% Magnesia and J-M Superex. Elsewhere in the huge plant, as well as in the neighboring co-polymerization plant, where the butadiene becomes synthetic rubber, additional J-M Insulating Materials are widely used.

Other J-M products are also at work in this plant. Many miles of Transite Pipe, tested to 200 lbs. pressure for 2 hours, are used for an efficient grid system of fire protection lines. And, numerous electrical panel boards, necessary for the control of processes, are of J-M Asbestos Ebony.

* * *

For details on the J-M materials useful in refineries, write Johns-Manville, 22 East 40th Street, 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

NUMBER ONE CITIZEN

BERNARD BARUCH. *By Carter Field. Published by McGraw-Hill Book Co., (Wittlesey House), New York, N. Y. 314 pages. Price $3.*

Reviewed by Bradley Dewey

THIS book is a fascinating story of parts of the life and some of the character of one of the great men in the country's history. One who picks it up will find it hard to turn off the light until he has read it from cover to cover. It cannot be read without a realization that the writer has known his subject for years, and has—for at any rate the first part of the book—done his best to portray, and in places analyze, a great man—his life—his motives—and some of his character.

However, it is by no means the ultimate biography of Bernard M. Baruch, the great elder statesman and wise man of his generation,—a man who would be better characterized as America's number one citizen than as the "Park Bench Statesman." It will serve as a valuable starting point for someone else, but it is to be hoped that the ultimate record will more fully portray the part he has played in connection with World War II, and the trying days leading up to it. One who has known Bernard Baruch only during this period feels the total inadequacy of the last part of the book. This is especially true in connection with one of his greatest accomplishments—the Rubber Survey Committee and the so-called Baruch Report on the Rubber Situation. Here he took a situation which was so bogged down that the public was almost in revolt and the country in grave danger, and by organizing around himself a committee of outstanding men, who in turn called in twenty-six technical consultants, did, in less than a month, a job that would have been a good job had it taken three months. He gave back to the country a feeling of confidence that enabled the Office of Rubber Director to bull through the program which he set. His suggesting that the Office of Rubber Director should be part of the War Production Board, but frankly stating that once a Rubber Director was appointed, the Chairman of the Board should "cease to concern himself with his actions" was the stroke of genius which let the job get done.

When the final history is written, chapters more fascinating than those in the first of the book will tell how Bernard Baruch has been the confident adviser of factions within the Government, and how even those who have received no soft words from him have gone to him for advice, harsh as it might be. It will show how he has been able to maintain the confidence of strong, earnest men while still telling them that the men against them were equally fine. It will describe how in at least one case—that of Jeffers and Dewey vs Patterson and Forrestal—he was able to see his convictions accepted and both sides become firm friends who saw the other's positions and accepted them.

The book should be read, but I hope that those who read it will realize that Bernard M. Baruch is a greater man than it portrays, and that his part in this war, though anonymous, has been as great—perhaps greater—than that of any other than those who actually suffered on the field of battle.

MOST VALUABLE

DANA'S SYSTEM OF MINERALOGY. *Seventh edition. Vol. I (Elements, Sulfides, Sulfosalts, Oxides). By Charles Palache, Harry Berman, and Clifford Frondel. Published by John Wiley & Sons, New York, N. Y. 834 pages. Price $10.*

ALL persons concerned in any manner with minerals will welcome the first volume of the seventh edition of Dana's "System." This great work has already served as the mineralogists' Bible for over a century, undoubtedly a unique achievement for any scientific book, and is still by far the most valuable work in the field. Extensive changes have been made in this present edition, including a new mineral classification based on crystal chemistry and a new elastic series of classification numbers for species. Crystallographic, optical and other physical data have been rechecked and brought completely up to date.

This first of the proposed three volumes of the new edition is outstandingly comprehensive, authoritative, scholarly. The binding and typography are excellent; the editing approaches perfection. Authors, editors and publishers can justifiably be proud of the work, the preparation of which was proposed in 1915 and seriously begun in 1927. Completion of the work was made possible by advancement of funds by the publishers and by a grant from the Geological Society of America. Incidentally, both authors and publishers have declined to accept any profit from sales of the book until this grant has been repaid!

VITAMINE UND HORMONE

ERGEBNISSE DER VITAMIN UND HORMONFORSCHUNG. *By Hellmut Bredereck and Robert Mittag. Published by Advance Scientific Publishers, New York, N. Y. 138 pages. Price $2.50.*

Reviewed by R. G. Heiligmann

FIRST of three volumes (in German) relating to the manufacture of vitamins and hormones, this small book is a comprehensive and intensive summary of vitamin and hormone research. It is definitely not a book for the layman but rather a refresher and ready-reference for the biochemist, physiologist and drug manufacturer. Structural aspects and physiological properties are extensively reviewed and the various synthetic methods of preparation are outlined with profuse employment of equations to clarify the reactions involved. As a final offering, the authors discuss the problems of isolation from natural sources. References are listed and pertinent data are summarized in the several tables. The volume is pocket-size, ring bound and possesses a soft leather cover. While not a stately volume for the library shelf, it is well constructed and will absorb plenty of use or abuse.

APPLIED PHYSICAL CHEMISTRY

TERNARY SYSTEMS. *By G. Masing, translated by B. A. Rogers. Published by Reinhold Publishing Corp., New York, N. Y. 173 pages. Price $4.50.*

Reviewed by M. F. A. Wulfinghoff

GEORG MASING has acquired an enviable reputation in the field of applied physical chemistry through his earlier publications on metallurgy and on the theory of corrosion. This handy volume contains a very readable treatise on the theory of ternary systems of solids, particularly met-

RECENT BOOKS RECEIVED

Fats and Oils. By H. G. Kirschenbauer. Reinhold. $2.75.

Outline of the Amino Acids and Proteins. Ed. by M. Sahyun. Reinhold. $4.

The Theory of Resonance and Its Application to Organic Chemistry. By George W. Wheland. Wiley. $4.50.

allic alloys, for readers who are already familiar with the theory of binary mixtures and the methods used in their investigation. B. A. Rogers has supplied an excellent translation of this work, and added some critical footnotes which indicate that he is thoroughly familiar with both the technological and the linguistic aspects of his assignment. He has succeeded in imparting to his English edition all of the qualities which make Masing's sober, objective way of presentation so attractive. The illustrations as well as the index and the typography leave virtually nothing to be desired.

APPLIED RHEOLOGY

THE EXTRUSION OF METALS. *By Claude E. Pearson. Published by John Wiley & Sons, New York, N. Y. 205 pages. Price $3.75.*

A CONCISE account of prewar practice in England, U. S., and Germany; describing in detail the construction of numerous presses and outlining the mechanics of operation as applied to various metals and various products. Includes an analysis of metal flow and evaluates the influence of pressure, temperature and rate of extrusion.

REPRINT

THE ANALYTICAL CHEMISTRY OF INDUSTRIAL POISONS, HAZARDS AND SOLVENTS. *Second revised reprint. By Morris B. Jacobs. Published by Interscience Publishers, New York, N. Y. 661 pages. Price $7.*

FOR a review of this volume the reader is referred to our comments on the first edition (*Chem. & Met.*, Nov. 1941, p. 182). The two are practically identical. Plates for the 1941 edition were used for that of 1944. The revisions noted are not very important. They comprise: addition of two references, one on p. 134 and one on p. 198; dithiooxalate was reset as one word on p. 237; pp. 274 and 277 show phosphomolybdate changed to molybdiphosphate; volumetrically was changed to titrimetrically on p. 274; on p. 360 two superfluous references have been dropped to make room for one new sentence in the text; and a new footnote was added to the table on pp. 626–7. Price of the book remains unchanged.

ABRASIVES—ZIRCONIUM

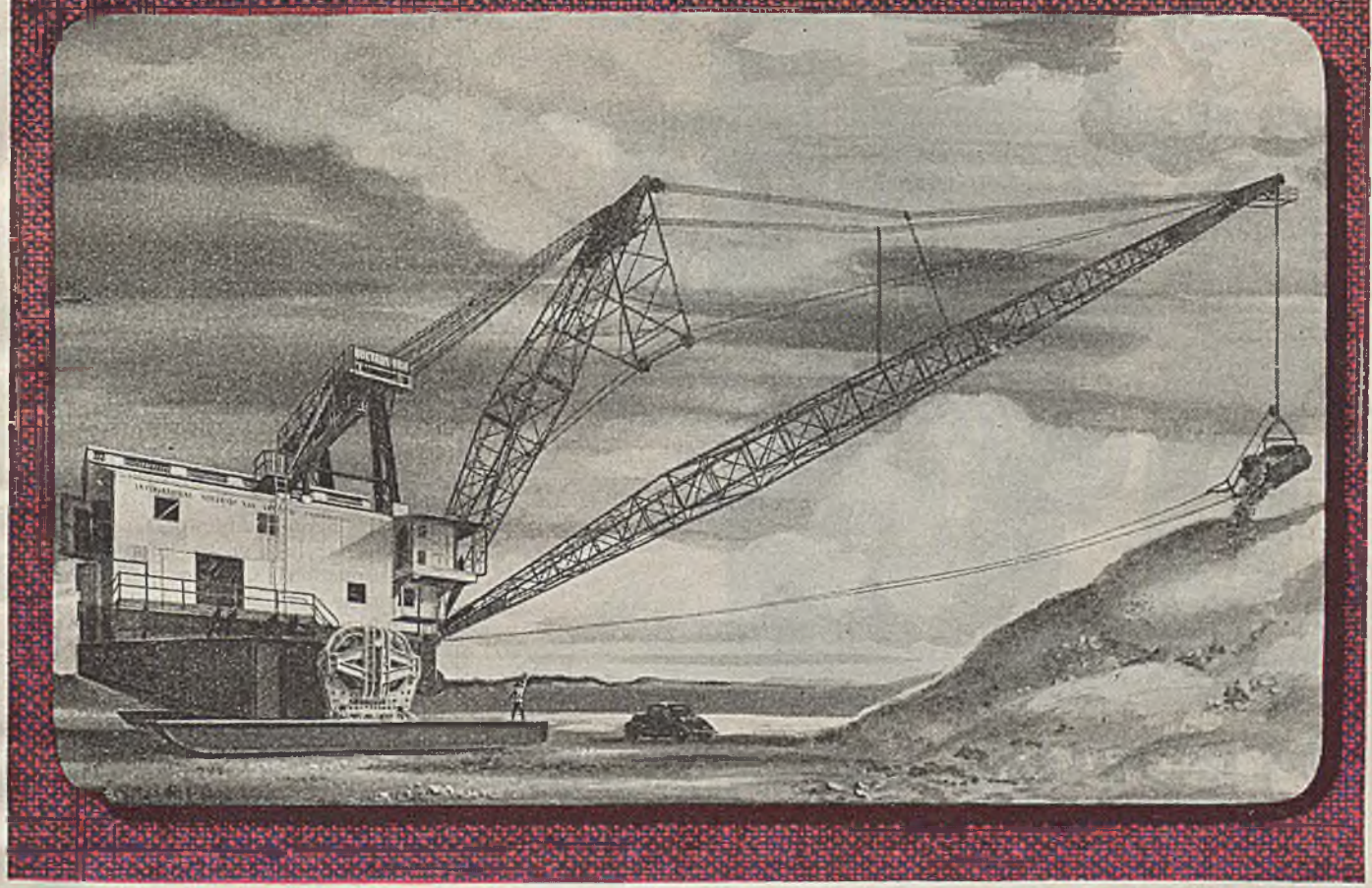
MATERIALS HANDBOOK. *Fifth edition. By George S. Brady. Published by McGraw-Hill Book Co., New York, N. Y. 765 pages. Price $5.*

A FIFTH edition of Col. Brady's perennial favorite is now available. In appearance and style of presentation of data it is similar to the fourth (see *Chem. & Met.*, Dec. 1940, p. 882). Comparison of the two editions reveals many instances where material has been added or modernized. The book is to be recommended for its general information. Its intended audience —purchasing agents, engineers, executives and foremen—will find it a ready reference to a multitude of materials.

The author's foreword for the user should, perhaps, suggest that the quickest way to locate information on any specific

MORE PHOSPHATE ROCK

for Postwar Crops and for Industry



→ To increase the production of phosphate at its Peace Valley Mine in Florida, International has ordered a new dragline, the largest in the world, which will be installed during 1945.

→ To produce phosphates for a wide variety of industrial uses and for the rapidly developing agriculture of the west, International has begun operations at its newly opened mine in the phosphate fields of Montana.

For more than thirty-five years the nation's largest miner of phosphate rock, International is now expanding its production to meet the larger postwar requirements of agriculture and industry for the essential chemicals derived from this important natural resource. International Minerals & Chemical Corporation, General Offices: 20 N. Wacker Drive, Chicago 6

MINERALS
CHEMICALS

for industry and agriculture.

Potash and Phosphate
for Fertilizers and Industrial Chemicals

Fertilizers
and Fertilizer Materials

Chemicals
Epsom Salt—Defluorinated Phosphate — Glutamic Acid — Monosodium Glutamate — Potassium Chlorate — Silica Gel — Sodium Silico-Fluoride — Sulphuric Acid —and others.

International

MINERALS *and* CHEMICALS

CHEMICALS • PHOSPHATE • POTASH • FERTILIZER

material is to consult the index. Reason for this is that materials are not always where they might be expected to be found in an alphabetical listing. For example, there are paragraphs on copper acetate and copper carbonate but none on copper sulphate—it's blue vitriol. There are no separate entries for potassium chloride r hydroxide—discussions of these two chemicals are found under headings of potassium chlorate and sodium hydroxide respectively. There is no paragraph on ice, so Flakice was put in with dry ice. The few errors, typographical and factual, noted in cursory examination will undoubtedly be corrected in a subsequent edition.

USEFUL BUT DULL

THEORETICAL CHEMISTRY. *By Samuel Glasstone. Published by D. Van Nostrand Co., New York, N. Y. 515 pages. Price $5.*

Reviewed by Linus Pauling

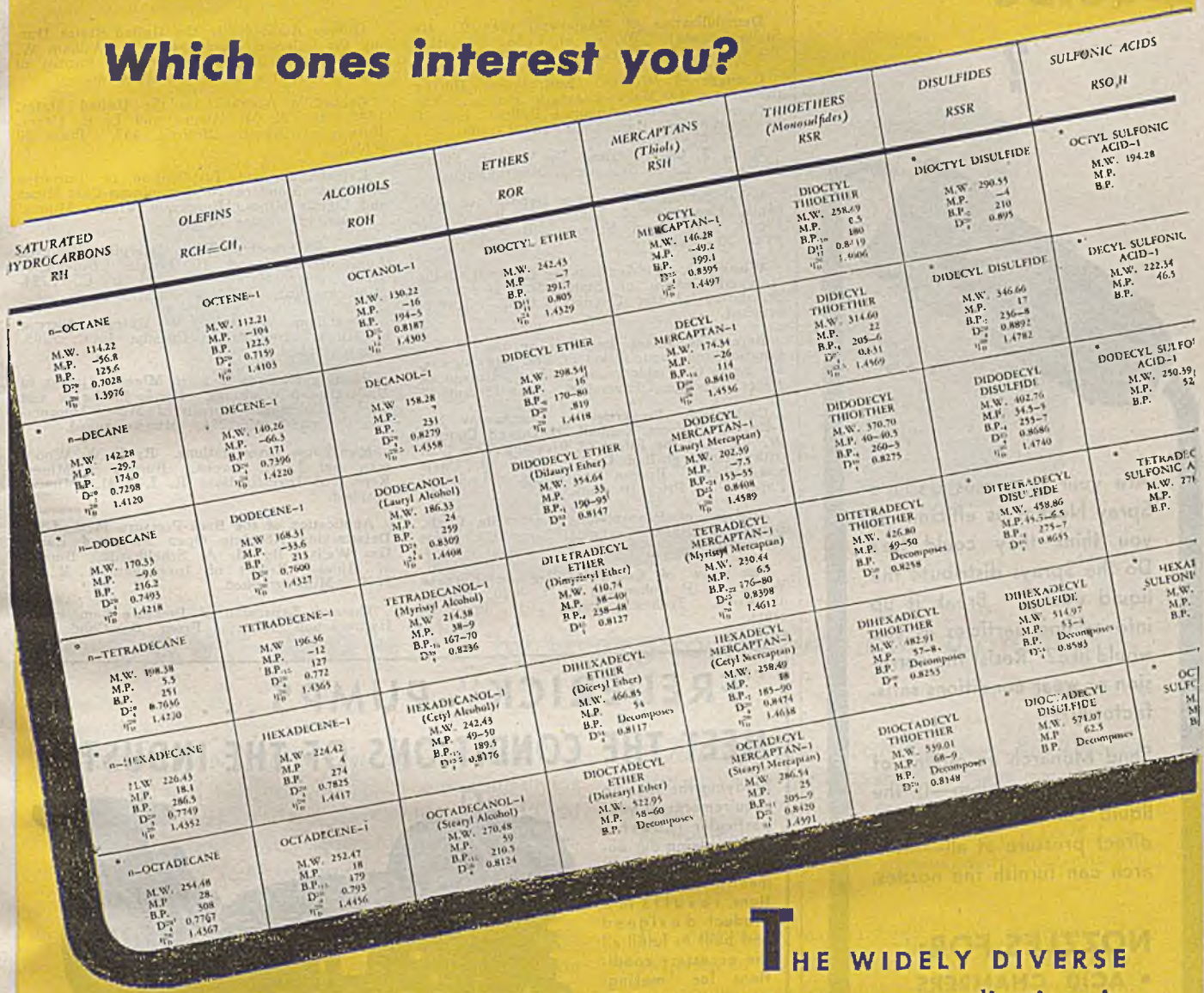
IN THE development of a field of science, after the period of excitement, of exhilaration as each of the puzzling experimental observations is explained or clarified by an advance in theory, the time comes when succinct summarizing works are written, useful but dull, giving information but no inspiration. Glasstone's "Theoretical Chemistry" is a book of this sort.

In this book in 505 pages of text the author gives a detailed discussion of quantum numbers, quantum mechanics, the quantum theory of valence, molecular spectra of diatomic and polyatomic molecules, the electronic configurations of diatomic molecules, statistical mechanics, statistical thermodynamics, and intermolecular forces. The treatment of each topic is detailed and thorough. There is emphasis on the mathematical aspects of the topics rather than their descriptive aspects, but the mathematical methods used are in the main kept within the scope of a reader with an elementary knowledge of calculus and simple differential equations, as planned by the author. The book seems to be free from important errors, although some minor ones appear. The typography is good, except that numbers under the radical sign are displaced from the line formed by other characters.

It is my opinion that the book should be more valuable as a reference book for use by a reader already familiar with the topics discussed than as a text book for the instruction of the newcomer to the field. The presentation of most of the topics is too brief and condensed to carry much meaning to the reader who is approaching the subject for the first time; such a reader would be well advised to make use of other books, in which only one of the several topics treated by Glasstone is taken up, with a greater discussion of the experimental background for the theoretical treatment. It is possible that this book could be used successfully as a text by an experienced teacher with a broad understanding of the field, who could lend interest to the subject by discussing in greater detail the correlations with experiment, the historical development, the contributions of individual physicists and chemists of the present generation, and the nature of the problems still awaiting solution.

NEW ALIPHATICS

Which ones interest you?



SATURATED HYDROCARBONS RH	OLEFINS RCH=CH₂	ALCOHOLS ROH	ETHERS ROR	MERCAPTANS (Thiols) RSH	THIOETHERS (Monosulfides) RSR	DISULFIDES RSSR	SULFONIC ACIDS RSO₃H
n-OCTANE M.W. 114.22 M.P. −56.8 B.P. 125.6 D^{20}_{20} 0.7028 n^{20}_{D} 1.3976	OCTENE-1 M.W. 112.21 M.P. −104 B.P. 122.5 D^{20}_{20} 0.7159 n^{20}_{D} 1.4105	OCTANOL-1 M.W. 130.22 M.P. −16 B.P. 194–5 D^{25}_{4} 0.8187 n^{25}_{D} 1.4303	DIOCTYL ETHER M.W. 242.43 M.P. −7 B.P. 291.7 D^{15}_{4} 0.805 n^{25}_{D} 1.4329	OCTYL MERCAPTAN-1 M.W. 146.28 M.P. −49.2 B.P. 199.1 D^{25}_{4} 0.8395 n^{25}_{D} 1.4497	DIOCTYL THIOETHER M.W. 258.49 M.P. 6.5 B.P. 180 D^{15}_{15} 0.8719 n^{25}_{D} 1.4606	DIOCTYL DISULFIDE M.W. 290.55 M.P. −4 B.P. 210 D^{25}_{4} 0.895	OCTYL SULFONIC ACID-1 M.W. 194.28 M.P. B.P.
n-DECANE M.W. 142.28 M.P. −29.7 B.P. 174.0 D^{20}_{4} 0.7298 n^{20}_{D} 1.4120	DECENE-1 M.W. 140.26 M.P. −66.3 B.P. 171 D^{20}_{20} 0.7396 n^{20}_{D} 1.4220	DECANOL-1 M.W. 158.28 M.P. 7 B.P. 231 D^{20}_{20} 0.8279 n^{20}_{D} 1.4358	DIDECYL ETHER M.W. 298.54 M.P. 16 B.P. 170–80 D^{20}_{4} .819 n^{20}_{D} 1.4418	DECYL MERCAPTAN-1 M.W. 174.34 M.P. −26 B.P. 114 D^{20}_{20} 0.8410 n^{20}_{D} 1.4536	DIDECYL THIOETHER M.W. 314.60 M.P. 22 B.P. 205–6 D^{25}_{4} 0.831 n^{25}_{D} 1.4569	DIDECYL DISULFIDE M.W. 346.66 M.P. 17 B.P. 236–8 D^{20}_{4} 0.8892 n^{20}_{D} 1.4782	DECYL SULFONIC ACID-1 M.W. 222.34 M.P. 46.5 B.P.
n-DODECANE M.W. 170.33 M.P. −9.6 B.P. 216.2 D^{20}_{20} 0.7493 n^{20}_{D} 1.4218	DODECENE-1 M.W. 168.31 M.P. −35.6 B.P. 213 D^{20}_{20} 0.7600 n^{20}_{D} 1.4327	DODECANOL-1 (Lauryl Alcohol) M.W. 186.33 M.P. 24 B.P. 259 D^{25}_{4} 0.8309 n^{25}_{D} 1.4408	DIDODECYL ETHER (Dilauryl Ether) M.W. 354.64 M.P. 33 B.P. 190–95 D^{20}_{4} 0.8147	DODECYL MERCAPTAN-1 (Lauryl Mercaptan) M.W. 202.39 M.P. −7.5 B.P. 153–55 D^{25}_{4} 0.8408 n^{20}_{D} 1.4589	DIDODECYL THIOETHER M.W. 370.70 M.P. 40–40.5 B.P. 260–3 D^{25}_{4} 0.8275	DIDODECYL DISULFIDE M.W. 402.76 M.P. 34.5–5 B.P. 255–7 D^{20}_{4} 0.8686 n^{20}_{D} 1.4740	DODECYL SULFO ACID-1 M.W. 250.39 M.P. 52 B.P.
n-TETRADECANE M.W. 198.38 M.P. 5.5 B.P. 251 D^{20}_{4} 0.7640 n^{20}_{D} 1.4270	TETRADECENE-1 M.W. 196.36 M.P. −12 B.P. 127 D^{20}_{4} 0.772 n^{20}_{D} 1.4365	TETRADECANOL-1 (Myristyl Alcohol) M.W. 214.38 M.P. 38–9 B.P. 167–70 D^{20}_{4} 0.8236	DITETRADECYL ETHER (Dimyristyl Ether) M.W. 410.74 M.P. 38–40 B.P. 238–48 D^{25}_{4} 0.8127	TETRADECYL MERCAPTAN-1 (Myristyl Mercaptan) M.W. 230.44 M.P. 6.5 B.P. 176–80 D^{25}_{4} 0.8398 n^{20}_{D} 1.4612	DITETRADECYL THIOETHER M.W. 426.80 M.P. 49–50 B.P. Decomposes D^{25}_{4} 0.8258	DITETRADECYL DISULFIDE M.W. 458.86 M.P. 44.5–6.5 B.P. 275–7 D^{20}_{4} 0.8655	TETRADEC SULFONIC A M.W. 27 M.P. B.P.
n-HEXADECANE M.W. 226.43 M.P. 18.1 B.P. 286.5 D^{20}_{4} 0.7749 n^{20}_{D} 1.4352	HEXADECENE-1 M.W. 224.42 M.P. 4 B.P. 274 D^{20}_{4} 0.7825 n^{20}_{D} 1.4417	HEXADECANOL-1 (Cetyl Alcohol) M.W. 242.43 M.P. 49–50 B.P. 189.5 D^{50}_{4} 0.8176	DIHEXADECYL ETHER (Dicetyl Ether) M.W. 466.85 M.P. 54 B.P. Decomposes D^{25}_{4} 0.8117	HEXADECYL MERCAPTAN-1 (Cetyl Mercaptan) M.W. 258.49 M.P. 18 B.P. 185–90 D^{25}_{4} 0.8474 n^{20}_{D} 1.4638	DIHEXADECYL THIOETHER M.W. 482.91 M.P. 57–8. B.P. Decomposes D^{25}_{4} 0.8253	DIHEXADECYL DISULFIDE M.W. 514.97 M.P. 53–4 B.P. Decomposes D^{25}_{4} 0.8583	HEXAI SULFONI M.W. M.P. B.P.
n-OCTADECANE M.W. 254.48 M.P. 28. B.P. 308 D^{20}_{4} 0.7767 n^{20}_{D} 1.4367	OCTADECENE-1 M.W. 252.47 M.P. 18 B.P. 179 D^{20}_{4} 0.793 n^{20}_{D} 1.4456	OCTADECANOL-1 (Stearyl Alcohol) M.W. 270.48 M.P. 59 B.P. 210.5 D^{20}_{4} 0.8124	DIOCTADECYL ETHER (Distearyl Ether) M.W. 522.95 M.P. 58–60 B.P. Decomposes	OCTADECYL MERCAPTAN-1 (Stearyl Mercaptan) M.W. 286.54 M.P. 25 B.P. 205–9 D^{25}_{4} 0.8420 n^{25}_{D} 1.4591	DIOCTADECYL THIOETHER M.W. 559.01 M.P. 68–9 B.P. Decomposes D^{25}_{4} 0.8149	DIOCTADECYL DISULFIDE M.W. 571.07 M.P. 62.5 B.P. Decomposes	OC SULFO M. M. B.

THE WIDELY DIVERSE properties of these aliphatic derivatives suggest numerous applications in present processes and in the development of new products. These new compounds are available in laboratory and pilot plant quantities in both fine chemical and technical grades.

Bulletin available on request giving physical properties, general characteristics and suggested uses in many fields. Write for your copy today.

THE CONNECTICUT HARD RUBBER COMPANY

427 EAST STREET — NEW HAVEN, CONNECTICUT

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.

Demobilization of Manpower, 1918-19. By Stella Stewart. Bureau of Labor Statistics. Bulletin No. 784. Price 15 cents.

Changes in Women's Employment During the War. By Mary Elizabeth Pidgeon. Department of Labor. Special Bulletin No. 20 of the Women's Bureau. Price 10 cents.

B. L. S. Chart Series. By Mary E. Spear. Bureau of Labor Statistics. Mimeographed.

Cobalt-bearing Manganese Deposits of Alabama, Georgia, and Tennessee. By W. G. Pierce. Geological Survey. Bulletin 940-J. Price 20 cents.

Whiteware. Publications by the staff of the National Bureau of Standards. Bureau of Standards. Letter Circular LC762. Mimeographed.

Bureau of Mines Research on the Hydrogenation and Liquefaction of Coal and Lignite. By Arno C. Fieldner and others. Bureau of Mines. Technical Paper 666. Price 15 cents.

Carbonizing Properties of Pocahontas No. 3-Bed Coal From Kimball, McDowell County, W. Va., and the Effect of Blending This Coal with Pittsburgh-Bed Coal. By J. D. Davis and others. Bureau of Mines. Technical Paper 670. Price 10 cents.

Analyses of Pennsylvania Anthracite Coals. Bureau of Mines. Technical Paper 659. Price 40 cents.

The Flow of Coal-Ash Slag on Furnace Walls. By P. Cohen and W. T. Reid. Bureau of Mines. Technical Paper 663. Price 10 cents.

Quarry Accidents in the United States During the Calendar Year 1942. By William W. Adams and Virginia E. Wrenn. Bureau of Mines. Bulletin 458. Price 15 cents.

Coal-Mine Accidents in the United States, 1942. By W. W. Adams and L. E. Geyer. Bureau of Mines. Bulletin 462. Price 20 cents.

Explanation and Justification of Tentative Inspection Standards for Bituminous-Coal Mines and Lignite Mines. Bureau of Mines. Miners' Circular 45. Price 20 cents.

Prospect Trenching With Caterpillar-Mounted Angledozers. By S. H. Lorain. Bureau of Mines. Information Circular I. C. 7294. Mimeographed.

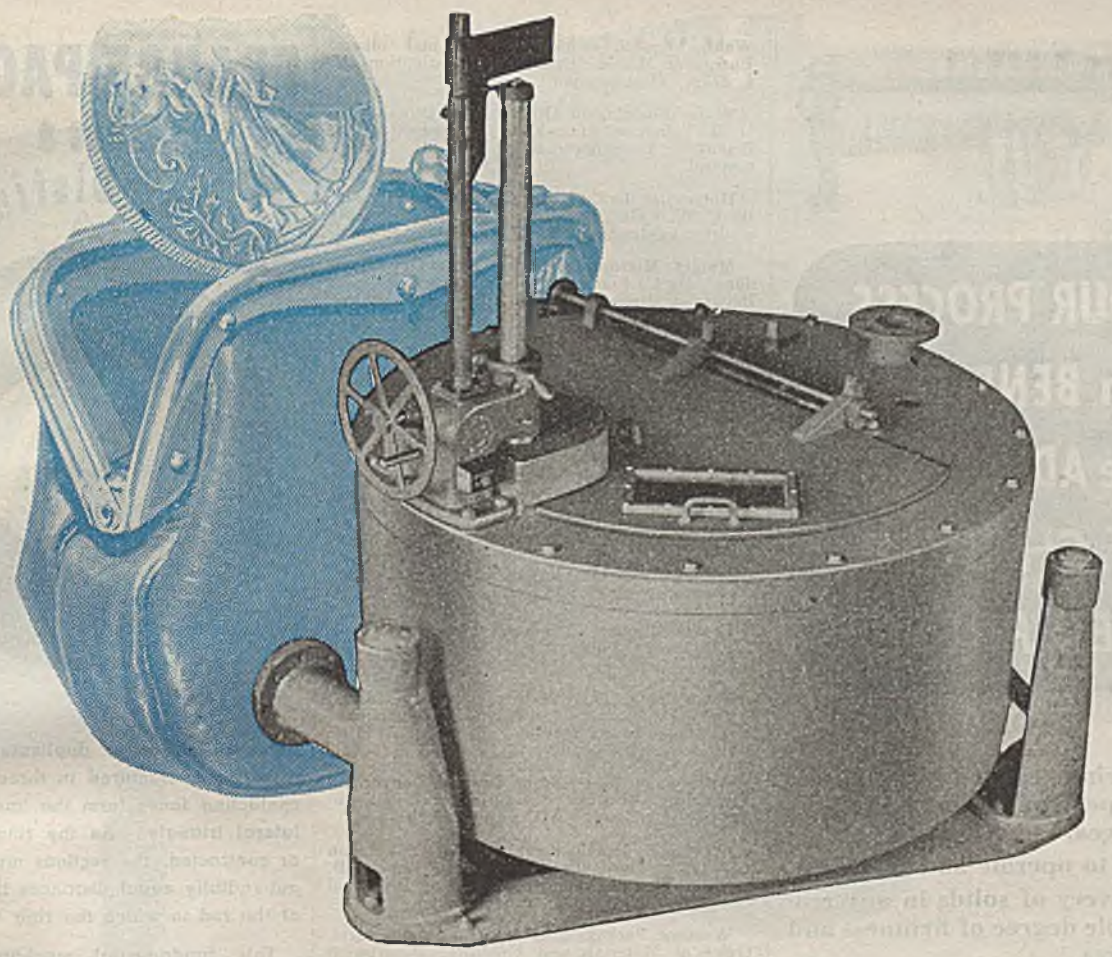
Corundum. By Robert W. Metcalf. Bureau of Mines. Information Circular I. C. 7295. Mimeographed.

Blasting Hazards in Strip Mines Adjacent to Underground Workings. By J. J. Forbes and H. F. Weaver. Bureau of Mines Information Circular I. C. 7296. Mimeographed.

Manganese Investigations. By F. W. Woodman and J. H. Jacobs. Bureau of Mines. Report of Investigations R. I. 3681. Mimeographed.

Application of the Back-Pressure Method for Determining Absolute Open Flows of Large Gas Wells. By M. A. Schellhardt. Bureau of Mines. Report of Investigations R. I. 3767. Mimeographed.

Thermal Expansion of Pressure Samples of Hydrocarbon Liquids From Gas-Condensate



SAVE MONEY *by saving room, time and materials*

EXTRACTION: AT&M Centrifugals Save Floor Space . . . Compared with unwieldy, space-consuming drying equipment, tanks, vacuum boxes and ovens, AT&M Centrifugals make every square foot more productive. And special AT&M construction features often permit use of centrifugals where headroom might otherwise be insufficient.

One concern, faced with the problem of extracting oils from wax, replaced bulky equipment formerly used with AT&M Centrifugals, saving not only space, but time and money. For this application, AT&M engineers developed special baskets and a spray flotation device.

CLARIFICATION: AT&M Centrifugals Save Time and Materials... Saving time and conserving materials for costs' sake—not just to speed deliveries—will soon be the major aim of production men. AT&M Centrifugals offer important advantages to cost-minded executives.

For example, a manufacturer of war materials who switched to centrifugals to recover a scarce grinding compound, now feels that the cost of recovering this expensive material is low enough to be practical in peacetime. He is using AT&M-developed centrifugals that have special clarifying baskets to remove solids from oils and recycle fluid in one swift operation.

Consider Centrifuging for

extraction . . . filtration . . . dehydration . . . precipitation . . . impregnation . . . coating. See AT&M's 8-page catalog in CHEMICAL ENGINEERING CATALOG.

Consider AT&M for

capable engineering service (as war needs permit) — no charge for study and recommendation. Centrifugals and baskets in all machinable metals and coatings. Strict confidence preserved. AMERICAN TOOL & MACHINE COMPANY, 1415 Hyde Park Ave., Boston 36, Mass., 30A Church Street, New York, N. Y.

SAVE TIME, SPACE AND COSTS WITH

A. T. *and* M.

CENTRIFUGING

Wells. By R. Vincent Smith and others. Bureau of Mines. Report of Investigations R. I. 3772. Mimeographed.

Water Flooding of Oil Sands in Illinois. By D. B. Taliaferro and others. Bureau of Mines. Report of Investigations R. I. 3778. Mimeographed.

Horizontal Drilling for Oil in Pennsylvania. By C. W. Elder, Jr. Bureau of Mines. Report of Investigations R. I. 3779. Mimeographed.

Midget Microprojector for Dust Determinations. By Carlton E. Brown. Bureau of Mines. Report of Investigations R. I. 3780. Mimeographed.

Minerals Data for 1943. Chapter preprints of Minerals Yearbook 1943 are now being released. Those now available are largely the state reports for Gold, Silver, Copper, Lead and Zinc; but a few other commodity chapters are being sent out from time to time. Not all the chapters will be released at once since some contain information that is still regarded as of military significance. Those interested should request the Bureau of Mines for copies of the pamphlets or notice of their issue as they are available by indicating the specific subjects of importance. Bound copies of the complete volume will not be released until after the war, according to present expectations.

Patent Manual. Department of Agriculture. Miscellaneous Publication No. 551. Price 10 cents.

Saline Soils, Their Nature and Management. By O. C. Magistad and J. E. Christiansen. Department of Agriculture. Circular No. 707. Price 10 cents.

Analysis of Gases From Cans of Dehydrated Vegetables. Bureau of Agricultural and Industrial Chemistry. AIC-47. Mimeographed.

Survey of Development and Use of Rayon and Other Synthetic Fibers. By Robert B. Evans. Bureau of Agricultural and Industrial Chemistry. AIC-64. Mimeographed.

Wartime Packaging of Agricultural Products. Office of Materials and Facilities, Department of Agriculture. Mimeographed.

Regional Laboratory Bibliographies. Those interested in the varied publications of the four Regional Research Laboratories of the Bureau of Agricultural and Industrial Chemistry can secure from each laboratory a mimeographed list of various articles and documents which have been published, insofar as these are available. These items are in general magazine articles, but a limited number of them are mimeographed preliminary reports or printed Government documents.

Advertising as a Factor in Distribution. Distribution Methods and Costs, Part V. Summary of a printed report. Federal Trade Commission.

The Care of Floors. Bureau of Standards. Letter Circular LC764. Mimeographed.

Floor Oils.. Bureau of Standards. Letter Circular LC765. Mimeographed.

Pyrethrum (Synopsis of Information). By L. N. Markwood and Laura G. Arrington. Bureau of Foreign and Domestic Commerce. Mimeographed.

Industry Report—Pulp and Paper Series—Part I. September 1944. Bureau of Foreign and Domestic Commerce. Mimeographed.

Solid Carbon Dioxide (Dry Ice). Bureau of Standards. Letter Circular LC763. Mimeographed.

Mineral Industries 1939. Vol. 1. General Summary and Industry Statistics. Sixteenth Census of the United States 1940. Bureau of the Census. Price $2.75. Cloth bound.

Foreign Commerce and Navigation of the United States, Calendar Year 1941. Bureau of the Census. Price $2.50. Cloth bound.

Advance Listing of Industrial Plants and Plant Sites to be Disposed Of By Defense Plant Corporation. Defense Plant Corporation. Available only from the regional offices of Reconstruction Finance Corporation, not available in Washington.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog have been issued on the following items: Glue; Resin-Type Liquid and Powder—C-G-496. Mortar: Heat-Setting, Refractory—HH-M-622. Iron Oxide: Black, Synthetic, Dry (Paint Pigment)—TT-I-698. Iron Oxide: Brown, Synthetic, Dry (Paint Pigment)—TT-I-702.

BYRON JACKSON

Pneumatic Sponge

BYRON JACKSON PNEUMATIC SPONGE CONSTRUCTION DETAIL

Impeller is a two-port, non-clogging type, of heat treated Meehanite affixed to a stainless steel shaft, supported by heavy, sealed, grease lubricated, duplex thrust and radial ball bearings. A renewable bronze wear ring, matching the impeller, is inserted within the suction cover.

Volute case, including suction and shaft covers, are of semi-steel. Connector between air motor and pump is of Meehanite and the steel studs, connecting the flanges, are provided with bronze nuts. A perforated steel plate attached to pump below the case serves as a screen to exclude gravel or debris that cannot be passed through pump.

Designed for pumping heads to 150 feet, in single stage, and 300 feet in two stages, the Byron Jackson Pneumatic Sponge finds wide application for use in refineries, on tank farms and in chemical plants for pumping out ditches, pits, tanks, sumps, basements, manholes or other similar applications where the pumped fluid contains a heavy percentage of solids.

Built either as a single stage unit, or in two stages, for series operation, the Pneumatic Sponge is a centrifugal pump, driven by a rotary air motor, operating on compressed air at pressures from 70 to 100 psi, suitable for operation in any position.

Compact, ruggedly constructed, yet light in weight, the sponge pump is quickly and easily moved from place to place; can be dismantled or converted from individual to parallel or series operation in minimum time and with minimum effort, without the possibility of misalignment.

Motor is equipped with a governor and variable speed control, thereby permitting regulation to suit particular conditions of the job.

Two standard sizes are available: 2½" in single or as a two stage unit and a 3" single stage low head unit. Write today for new Sponge Pump Bulletin No. 44-7035. Just off the press.

ARMY E NAVY

BYRON JACKSON CO.

Houston • Los Angeles • New York

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 letterheads.

After-Cooling. Niagara Blower Co., 6 East 45th St., New York 17, N. Y.—2-page illustrated bulletin briefly listing advantages of Niagara Aero after-coolers. Large seven-color operating drawing on back illustrates how this mold keeps water and oil out of compressed air. Bulletin No. 98.

Air Recovery. W. B. Connor Engineering Corp., 114 East 32nd St., New York 16, N. Y.—120-page volume entitled, "Air Conservation Engineering," on principles and application of air recovery. Contains reference data section, comprising tables of ventilation equipment, territorial climatic conditions, etc.; and a complete catalog section containing descriptions, illustrations, dimension information and installation data for Dorex air recovery equipment.

Aliphatic Derivatives. The Connecticut Hard Rubber Co., 407 East St., New Haven, Conn.—4-page folder announcing this company's newly available aliphatic derivatives, which are supplied in various grades from technical to "fine chemical." General characteristics and suggested uses listed.

Board Forming Machine. Oliver United Filters, Inc., 33 West 42nd St., New York 18, N. Y.—12-page brochure explaining advantages and performance of the Oliver board forming machine, and also its construction. Illustrated. Bulletin No. 212-R.

Business Engineering. George S. May Co., 122 East 42nd St., New York 17, N. Y.—16-page bulletin telling about the history, purpose and progress of this company in the field of business engineering. Includes discussion of administration, operation and sales; also a two-page chart entitled: "How Business Engineering is Applied to Business."

Bursting Pressures. Globe Steel Tubes Co., Milwaukee 4, Wis.—19-page reference chart with tables of bursting pressures of seamless steel tubing from ⅛ in. to 9⅜ in. O. D. Gives three example problems. Illustrated Bulletin No. 112.

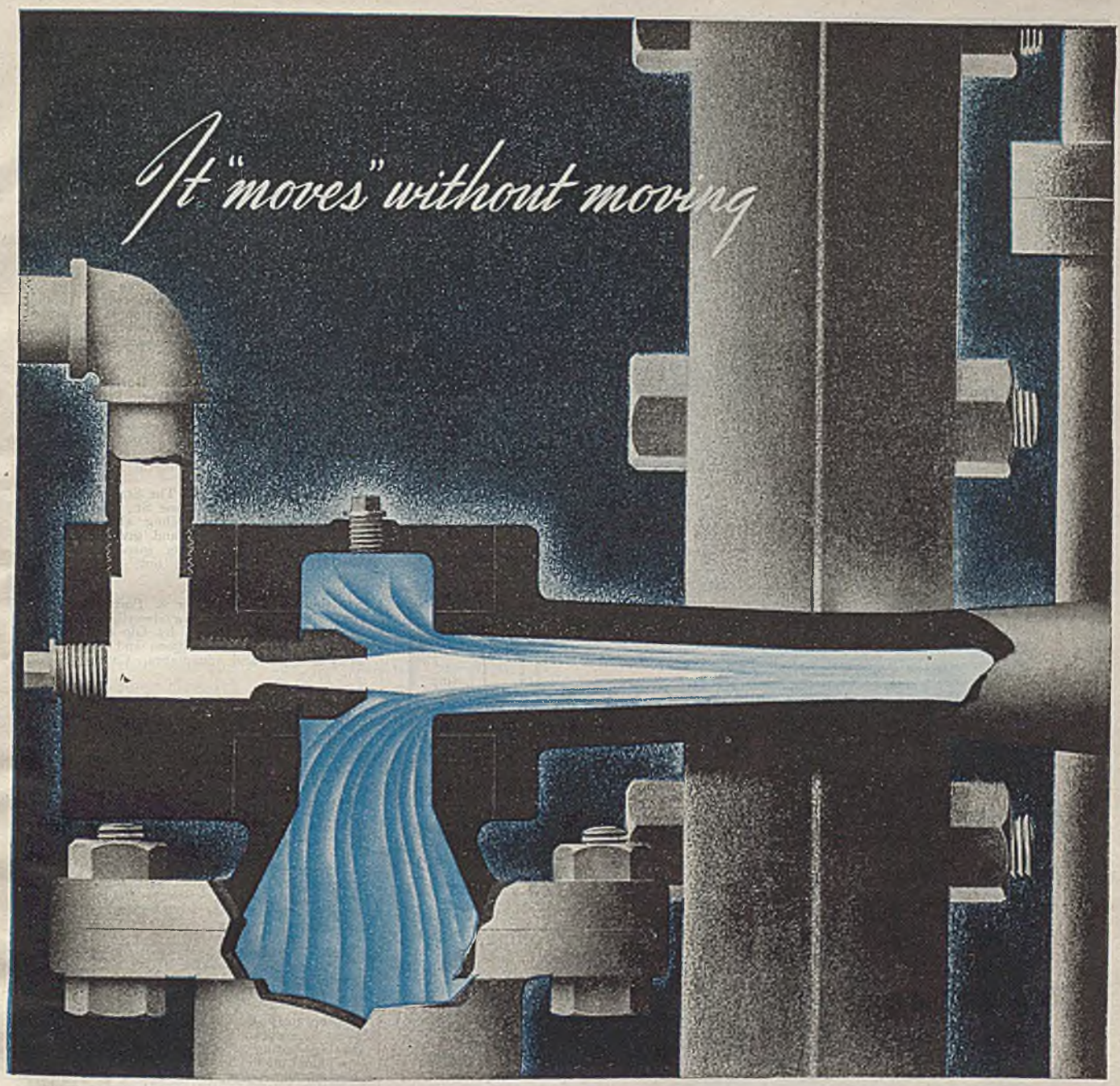
Continuous Blending. Sprout, Waldron & Co., Muncy, Pa.—8-page, two-colored bulletin on the intimate blending of fine chemicals, food, and insecticide powders. Contains description of blending systems designed for continuous automatic operation. Illustrations show comparison between this method of mixing and conventional mixing methods.

Conveyor Systems. Robinson Air-Activated Conveyor Systems, 205 East 42nd St., New York 17, N. Y.—4-page pamphlet describing this company's air-activated conveyor systems. Contains advantages, list of installations and schematic drawing of a typical installation. Bulletin No. 310.

Cooling Tower. The Fluor Corp., Ltd., 2500 South Atlantic Blvd., Los Angeles, 22, Calif.—19-page bulletin in Spanish telling about the Aerator cooling tower of this company. Contains views of the standard, Coil Shell, and Combination types. Many graphs, several tables, and diagrams serve to clarify production and performance data. Title: "Fluor Torres Entriadoras Aerator."

Couplings. Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia 34, Pa.—16-page bulletin describing various types of coupling with price and weight lists. Advantages of each type are described briefly. Bulletin No. 150.

Dryers. Centrifugal & Mechanical Industries, Inc., 2nd and President Sts., St. Louis 18, Mo.—8-page bulletin covering CMI continuous centrifugal dryers. Tells operating principles and applications. Has two half-page colored drawings of gravity discharge and



This pump, having *no* moving parts, is so fundamentally simple and trouble-free that it takes but little imagination to appreciate its advantages. Such pumps, which operate on the jet principle, have long been used to lift and transfer liquids and solids; to produce vacuum or pressure; to condense vapors; to mix gases; to heat and agitate liquids . . . and for many other purposes. They not only perform economically, but their simplicity assures continuous, trouble-free operation.

Where can you apply this time-tested, dependable jet principle to improve your process or to reduce the cost of your product? The research and engineering facilities of Schutte & Koerting, who have pioneered the application and development of jet pumps of all types since 1876, are available for consultation on your specific problems.

STEAM JET	LIQUID JET	AIR JET
Agitators	Agitators	Agitators
Compressors	Condensers	Compressors
Ejectors	Compressors	Ejectors
Exhausters	Exhausters	Exhausters
Heaters	Mixers	
Vacuum Boosters		

. . . both SINGLE- and MULTI-STAGE

Write today for Condensed Catalog J-2 which outlines many of the countless industrial applications of the jet principle.

SCHUTTE & KOERTING CO.

MANUFACTURING ENGINEERS

1190 THOMPSON STREET

PHILADELPHIA 22, PENNSYLVANIA

mechanical discharge types of dryers. Bulletin No. 4-D.

Explosive Rivets. E. I. duPont de Nemours & Co., Inc., Explosives Dept., Wilmington 98, Del.—Manual on postwar uses of explosive rivets, discussing the brief history of the explosive rivet, and telling about the improved du Pont rivet. Includes possibilities for postwar uses of these rivets.

Filter Paper. Carl Schleicher & Schuell Co., 116-118 West 14th St., New York 11, N. Y.—2-page folder covering filter papers, and improved methods of testing and control.

Flooring. Walter Maguire Co., Inc., 330 West 42nd St., New York 18, N. Y.—6-page bulletin on Emeri-Flor, made with Cortland Emery Aggregate. Features the way to cut flooring maintenance costs and reduce slipping accidents. Flooring cross-section is illustrated. Also gives flooring test curves for load and strength; presents check chart for flooring selection.

Gas Analysis Apparatus. Burrell Technical Supply Co., 1936-42 Fifth Ave., Pittsburgh 19, Pa.—4-page catalog describing new models of Burrell gas analysis apparatus. Models are illustrated. Lists for each type, the standard equipment supplied, and the reagents recommended are included. Bulletin No. 446A.

Gas Holder Corrosion. The Stacey Bros. Gas Construction Co., 5535 Vine St., Cincinnati 16, Ohio—15-page bulletin telling about corrosion in wet-seal gas holders, and giving details of this company's gas holder inspection service. Well illustrated and laid out. Bulletin No. 1-44.

Glass Tubing. Fischer & Porter Co., Hatboro, Pa.—8-page catalog describing precision bore glass tubing made by Glo-Tech process, with comparative illustrations and full descriptions of types and advantages. Catalog Section No. 95-A.

Heat Transfer Equipment. Downingtown Iron Works, Downingtown, Pa.—24-page brochure including many illustrations of this company's heat transfer equipment, and notes on design and performance. Tables give rates of heat transfer, material specifications, etc. Many diagrammatic drawings of construction details and dimensions.

Induction Heating. Induction Heating Corp., 389 Lafayette St., New York 3, N. Y.—36-page booklet listing advantages, history, and performance data of Thermonic induction generators. Attractive layout with several illustrations and drawings. Covers fundamentals of induction heating, surface hardening, brazing, and internal heating.

Infra-Red Heating. Wabash Appliance Corp., 345 Carrol St., Brooklyn 31, N. Y.—Profusely illustrated brochure telling uses and limitations of Birdseye infra-red radiant heat lamps.

Laboratory Equipment. Schaar & Co., 754 West Lexington St., Chicago 7, Ill.—319-page catalog listing complete lines of laboratory equipment made by Corning Glass Works and Kimble Glass Co., and the complete line of chemical and scientific porcelainware made by Coors Porcelain Works. Also includes list of variety of special instruments and utensils in their latest modifications. Catalog No. 44, Pt. 1.

Mixer. Farrel-Birmingham Co., Inc., Ansonia, Conn.—32-page bulletin giving details of latest developments in Banbury mixers. Discusses applications of this machine in fields of rubber, plastics, linoleum, asphalt, and paint. Contains performance records and features of design and construction. Several blueprints illustrate typical installation arrangement of mixers with auxiliary equipment. Extensively illustrated. Bulletin No. 180.

Packaging. Robert Gair Co., Inc., 155 East 44th St., New York 17, N. Y.—28-page booklet entitled: "The Palletized Load," by J. D. Malcolmson. Discusses a new philosophy of simplified packaging effecting economies in shipping space and handling costs. Tells theory of palletized load, that of designing shipping containers to fit freight cars, instead of designing the latter to hold a certain amount of merchandise.

Photoelectric pH Determination. Photovolt Corp., 95 Madison Ave., New York 16, N. Y.—4-page pamphlet discussing photoelectric pH determination as carried out with this company's Lumitron Colorimeter Model 400, which requires neither WPB approval nor high priority ratings. Contains price lists and applications.

Power Transmission. Multiple V-belt Drive Assn., 140 South Dearborn St., Chicago 3, Ill.—48-page pocket-size brochure entitled: "From

Want ½ CYCLE SHORT-CIRCUIT PROTECTION FOR YOUR MOTORS?

USE G-E LIMITAMP CONTROL

Equipped with EJ-2 Fuses
Contactors Good for Years of Constant, Repetitive Service

THIS control gives your motor the fast, positive short-circuit protection so necessary for safe operation on high voltages. Its interrupting capacity is more than adequate for installation on most industrial power circuits, and it can be used with squirrel cage, synchronous, and wound-rotor motors.

The current-limiting fuses, Type EJ-2, are an especially important feature. They operate in a split-cycle. When a short occurs, they cut off the rise in current in less than a quarter cycle, and clear it in less than a half cycle—long before the short has had time to harm the contactor or motor.

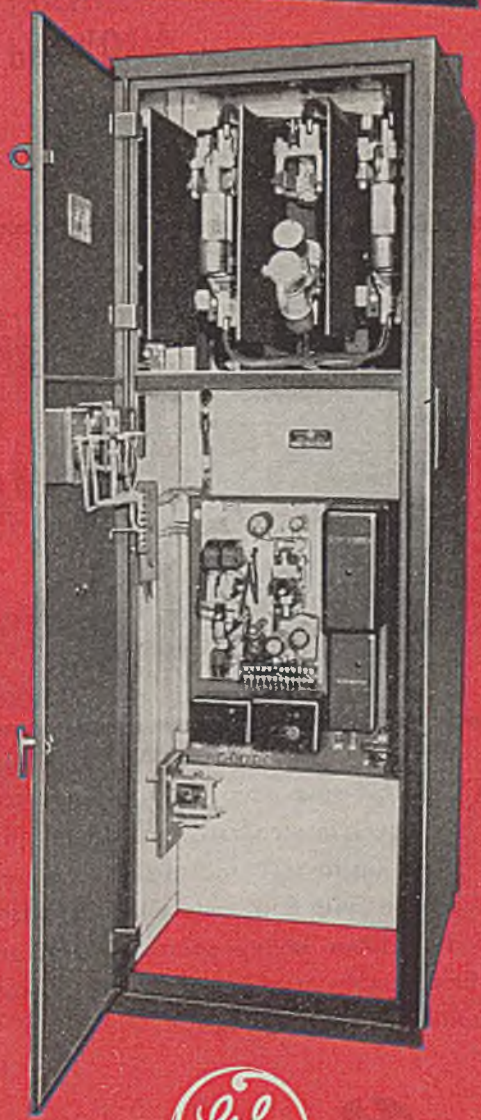
The full short never passes through the contactors in Limitamp controllers. Also, these contactors, which are air-break, are designed to meet the most severe requirements of high-voltage motor-control service. Mechanical life of several million operations, and contact-tip life twenty or more times the life of comparable oil-immersed tips, make these air-break contactors the logical answer for any severe duty—in steel mills, rubber mills, etc.

Here are 3 other important advantages

1. *Overload protection*—Isothermic overload relays protect the motor from overheating due to sustained overloads, locked rotor, or single-phasing.
2. *Personnel protection*—Totally metal-enclosed controllers give protection to operating personnel.
3. *Undervoltage protection*—All Limitamp controllers can be furnished with either instantaneous or time-delay undervoltage protection.

Need More Information?

You'll want to know all about this motor control. How the bus bars are enclosed for the operators' protection. How a group of these starters can be fitted together to give you a neat, compact control panel. Our local sales engineers will be glad to help you select a control to fit your application. *General Electric Company, Schenectady 5, N. Y.*



GENERAL ELECTRIC

676-160-8900

INDUSTRIAL CONTROL

Buy all the BONDS you can—and keep all you buy

the Shadoof to the Dominant Drive," giving a thumb-nail history of man's effort to transmit power for his own benefit. Written in simple prose style, this booklet is profusely illustrated with two-color drawings. It is composed to answer such questions as: "What are the 4 basic tools?" "What is the story of the first multiple rope drive?" "In what industry was the multiple V-Belt drive first used?"

Pressure Filter. Oliver United Filters Inc., 33 West 42nd St., New York 18, N. Y.—4-page leaflet describing the Sweetland pressure filter. Several illustrations show batteries of installed filters. Table of general data covers sizes, capacities and shipping weights. Bulletin No. 111-R.

Pressure Piping. Tube Turns, Inc., Louisville, Ky.—20-page booklet giving allowable working pressures for welding fittings in five classes of piping; power, oil, district heating, gas and air, and refrigeration. A group of 14 tables lists allowable pressures at the indicated temperatures for any size and weight Tube Turn fitting.

Process Equipment. Denver Equipment Co., 1400 17th St., Denver 17, Colo.—30-page bound booklet describing this company's ball rod mills, comprehensively covering cost, capacity, convertibility, types of discharge, bearings, gears, and drives. Profusely illustrated with half tones and diagrammatic drawings. Special slide rule inside back cover helps determine size of ball mill necessary to grind desired quantity ore to desired mesh; and to determine capacity. Bulletin No. B2-B4.

Process Equipment. Dri-Steam Products, Inc., 29 Broadway, New York 6, N. Y.—23-page bound bulletin containing information on separators, strainers, and desuperheaters. Tables of dimensions and construction drawings included.

Process Equipment. H. K. Porter Co., Inc., of Pittsburgh, Oliver Bldg., Pittsburgh 22, Pa.—Catalog listing 40 different categories of process items, with profuse illustrations, engineering drawings, and descriptions of operating principles. Porter Process Div. equipment includes agitators, autoclaves, jacketed fittings, centrifugal pumps, etc. Tells about coordination of Quimby plants at Newark and New Brunswick, N. J., and the Devine plant at Mt. Vernon, Ill., with the Porter plant.

Protective Coatings. B. F. Goodrich Co., Akron, Ohio—4-page catalog addition discussing Koroseal tape RX and Korolac RX, a solution of Koroseal. Tells applications and methods of using. Illustrated. Catalog Section 8505.

Ratio Control. Askania Regulator Co., 16th and Michigan Ave., Chicago 16, Ill.—16-page bulletin pointing out manner in which Askania ratio control may be applied to many types of proportioning applications in the process industries. Orifice calculation chart for easy method of orifice size determination for air and gas flows. Illustrated. Bulletin No. 101.

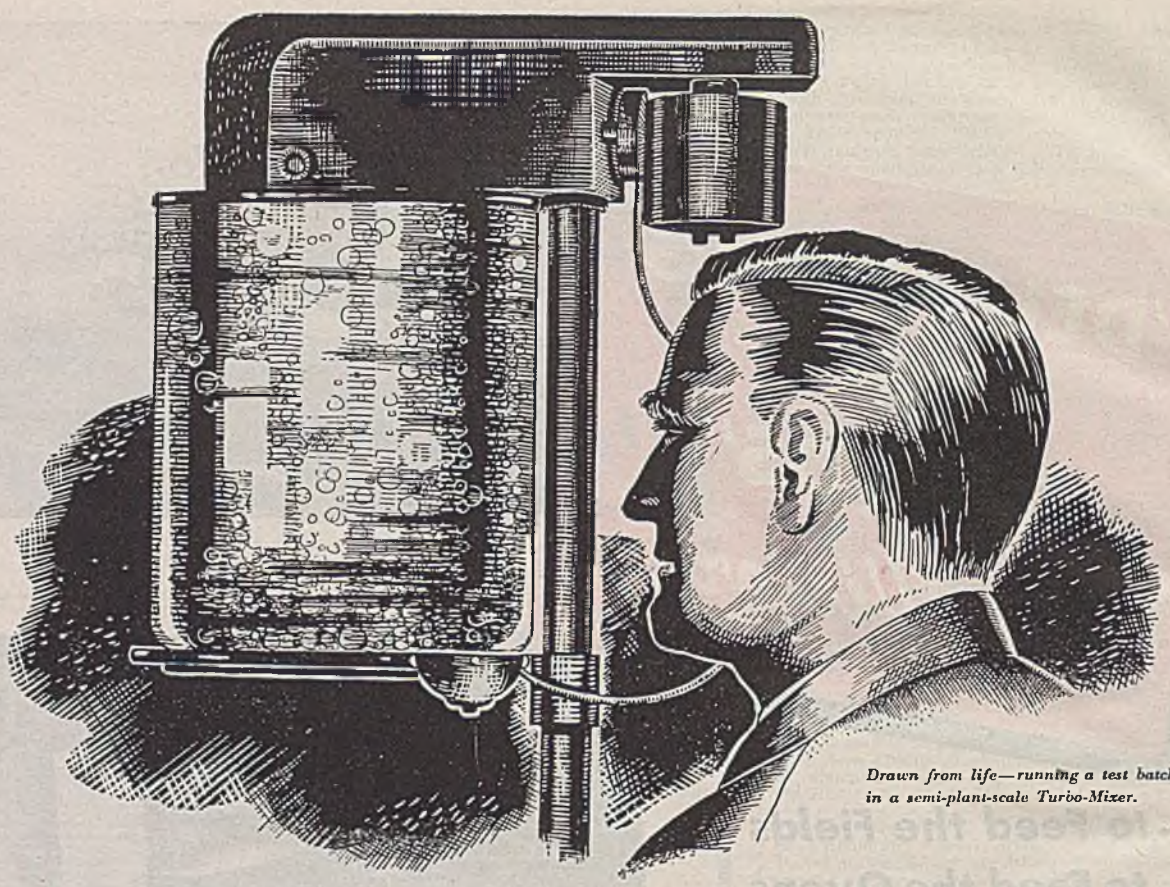
Refrigeration. Pennsylvania Salt Manufacturing Co., 1000 Widener Bldg., Philadelphia 7, Pa.—15-page pocket-sized brochure on refrigeration with ammonia. Contains data covering ammonia and its shipping containers, a brief outline of the fundamentals of compression and absorption refrigeration, and a description of appurtenances such as oil traps, accumulators and foul gas purgers and their proper operation; illustrated.

Rotating Equipment. Blaw-Knox Div., Blaw-Knox Co., P. O. Box 1198, Pittsburgh 30, Pa.—60-page bulletin explaining this company's line of revolving shell dryers, kilns, coolers, rotary vacuum dryers, flakers, chamber dryers, and blenders. Gives brief descriptions of techniques, such as drying, and brings in applications of Blaw-Knox equipment. Well illustrated. Bulletin No. 1958.

Safety Valves. J. E. Lonergan Co., 2nd and Race Sts., Philadelphia 6, Pa.—8-page bulletin describing Lonergan's pop safety valves, including tables of standards. Models are illustrated. Information Bulletin No. 501-A.

Skin Cream. B. F. Goodrich Co., Akron, Ohio.—4-page section dealing with problems of skin protection in industry. Lists advantages, methods of application of Clad creams for wet or dry work. Illustrated. Catalog Section No. 12010.

Worm Gear Reducers. Cleveland Worm & Gear Co., 330 East 80th St., Cleveland 4, Ohio.—16-page bound booklet containing comprehensive exposition of Speedaire fan cooled worm gear reduction units. Lists advantages, description, design, and installation data. Profusely illustrated section on home organization. Catalog No. 300.



Drawn from life—running a test batch in a semi-plant-scale Turbo-Mixer.

HERE IS ENGINEERING—PLUS!

Part of every engineering job can be done, of course, at a desk or drafting table. But here at General American Process Equipment, "paper work" is only the beginning. From there, our pilot-plant Testing Laboratory takes over, and PROVES our recommendations in actual semi-plant-scale equipment which accurately predicts what our production machines will do.

Naturally this kind of Plus Engineering reduces our net profit possibilities. But it's more than worthwhile, because it increases *yours*. We'd like an opportunity to prove it to you.

* * * * * * * * *

GENERAL AMERICAN PROCESS EQUIPMENT DIVISION GATX GENERAL AMERICAN

General American Process Equipment is a consolidation of four outstanding process equipment manufacturers, each a well-known specialist in its field, now welded together to serve you with one organization, one responsibility and one high standard of performance.

This organization also represents the Plate and Welding Division of General American Transportation Corp., at Sharon, Pa.

GENERAL AMERICAN PROCESS EQUIPMENT

A Division of General American Transportation Corporation

Executive Offices: 425 BAXTER AVENUE, LOUISVILLE 4, KENTUCKY
New York Office: 420 LEXINGTON AVENUE, NEW YORK 17

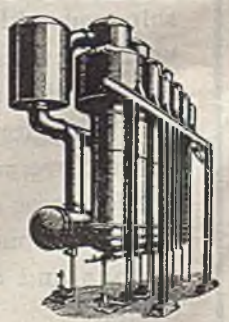
FRACTIONATING COLUMNS, PRESSURE VESSELS

TURBO-MIXERS, AGITATORS

CONKEY VACUUM AND PRESSURE FILTERS

AMERICAN DRUM DRYERS AND FLAKERS

LOUISVILLE DRYERS, COOLERS, KILNS



CONKEY VACUUM EVAPORATORS

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

INDUSTRIAL CONSUMPTION OF CHEMICALS ADVERSELY AFFECTED BY SCARCITY OF CHEMICALS

ALLOCATIONS of chemicals in the last few months generally have been more liberal in the amounts made available to producers of civilian goods. This has increased the volume of many finished products which come into the open market. However, as the revised munitions program has gained headway, distribution controls of several heavy tonnage chemicals have been tightened and the increased demand for them for strictly war materials has appreciably cut down the movement of these chemicals into regular consuming channels. An outstanding example is found in the recent placing of sulphuric acid under allocation and the curtailment of supplies particularly for the manufacture of superphosphate. The weighted influence of the reduction in the use of basic chemicals for civilian production more than offsets the advantage gained by the larger allocations of chemicals which do not rate so high from a tonnage standpoint. The result is that while total production of chemicals may remain constant or move upwards, consumption in civilian industries is almost certain to be adversely affected over the remainder of the year.

The *Chem. & Met.* index for industrial consumption of chemicals was 179.15 for October compared with a revised figure of 174.01 for September. Last year the indexes for those months were 181.94 and 177.02 respectively. As a steady rate of consumption was maintained throughout the final quarter of last year, the current channeling of materials will bring the average index for the final quarter of this year below that for the comparable period of last year which is the first time such a comparison has been unfavorable in more than five years.

This does not mean a general drop in manufacturing activities. Some lines such as petroleum refining, steel and glass, are holding close to their peak rate of operations. Pulp and paper mills likewise have been able to stay above their last year's levels but future supplies of pulpwood still give concern and the industry continues on a more or less hand-to-mouth basis. Rayon production is on its way to a new yearly record but there have been reports that mills have not been receiving caustic soda up to full requirements because of the sudden increase in demand for caustic for military purposes. The drop in the index for industrial consumption of chemicals, therefore, is almost entirely due to the position of fertilizer chemicals. Curtailment for fertilizer use of spent sulphuric acid, ammonia, and nitrate of ammonia represents a large drop in the tonnage moving to that industry. Some hope for relief in the acid situation is seen in the fact that new productive units will come into operation late in December or early next year.

The index for industrial production of the Federal Reserve Board continues on a declining line and while the monthly changes have not been abrupt, the cumulative effect has been to place industry in general and most of the component branches on a level considerably lower than the peak figure of 249 reported for October 1943 as the index for October 1944 is 232, both these figures being on an unadjusted basis. The Board's index for chemicals reached its high of 400 in October 1943 and stands at 309 for October this year. For industrial chemicals, which classification is more representative of the industry, the high mark for production came last June when the index stood at 412 and the fall to 400 for October has been less than the rate of decline for industry as a whole. Cutbacks in the military program together with labor shortages are mainly responsible for the downward trend.

***Chem. & Met.* Index for Industrial Consumption of Chemicals**

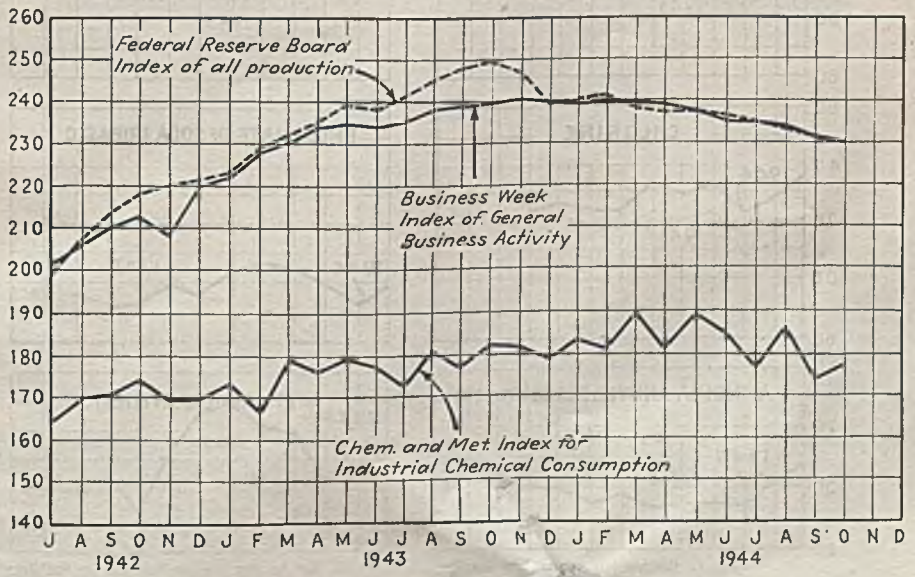
	Sept. revised	Oct.
Fertilizers	33.92	33.50
Pulp and paper	18.20	19.10
Petroleum refining	18.15	18.61
Glass	18.77	20.60
Paint and varnish	16.59	17.40
Iron and steel	12.89	13.47
Rayon	16.79	17.28
Textiles	10.54	10.80
Coal products	9.78	9.85
Leather	4.50	4.59
Industrial explosives	5.68	5.55
Rubber	3.00	3.00
Plastics	5.20	5.40
	174.01	179.15

Stocks of basic chemicals have not changed to any great extent throughout the year to date. At the beginning of the year, producers were holding about 244,000 tons of sulphuric acid and at the beginning of October they carried approximately 204,000 tons. Producers had on hand at the first of the year about 25,000 tons of soda ash and went into the final quarter of the year with stocks of 38,000 tons. Holdings of caustic soda in the same period dropped from 51,000 tons to a little less than 50,000 tons.

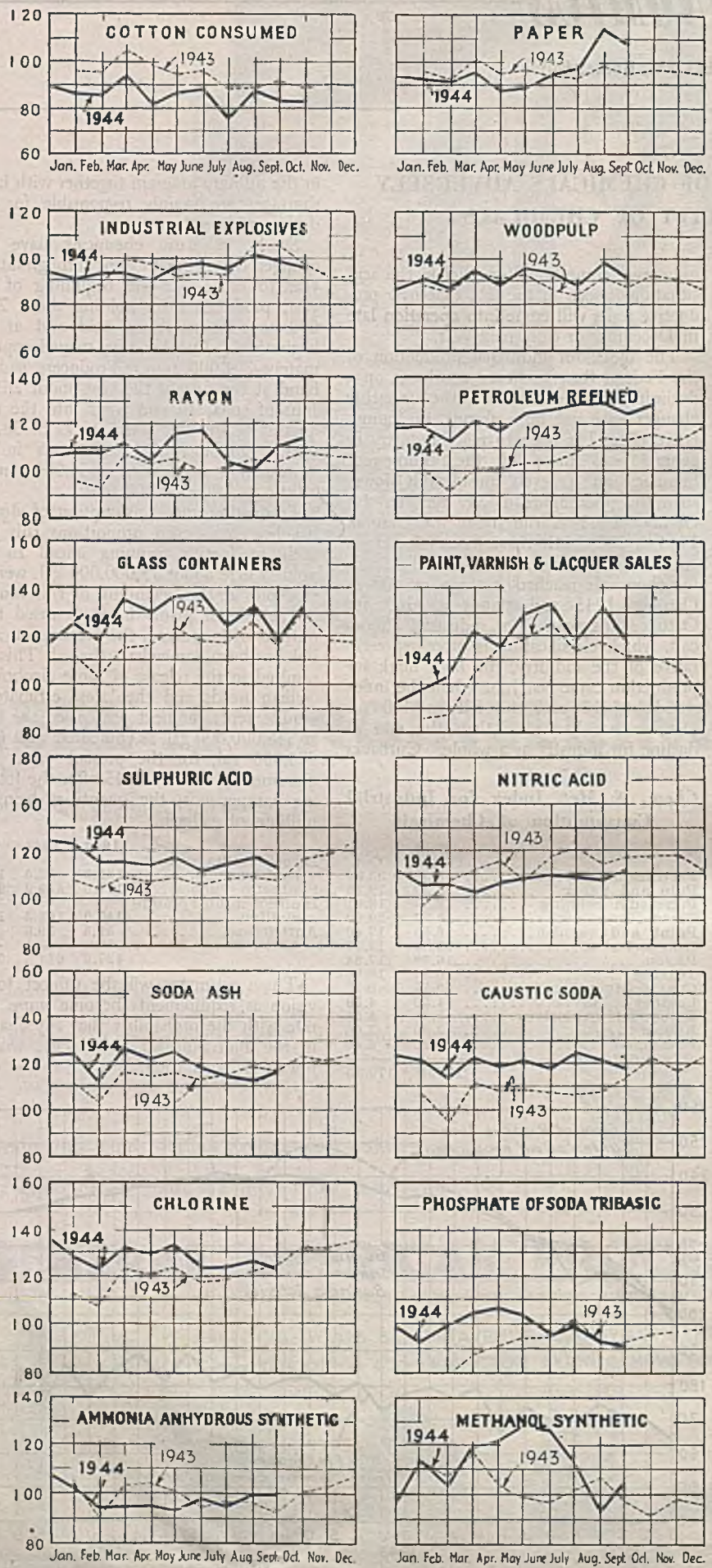
Production and consumption of alcohol has been of record proportions this year with production running ahead to the point where about 75,000,000 gal. were in stockpile at the beginning of this month. As petroleum plants have increased their outputs of butadiene, the pressure on alcohol has been somewhat relieved. This has resulted in the release of more alcohol for civilian needs and the latest estimate of requirements for next year place the total at 548,000,000 gal. as compared with 614,500,000 gal. for the present year. Requirements for 1943-1945 offer the following comparisons, the quantities being in millions of gallons:

	1943	1944	1945
Direct military and lend-lease	102.9	92.0	100.0
Synthetic rubber	126.0	329.2	228.0
Indirect military and civilian	147.9	163.3	180.0
Anti-freeze	50.8	30.0	40.0
	427.6	614.5	548.0

These estimates will be subject to revision as requirements become more definite with the probability that any changes in the allotment for civilian use will be toward a larger total.



PRODUCTION AND CONSUMPTION TRENDS

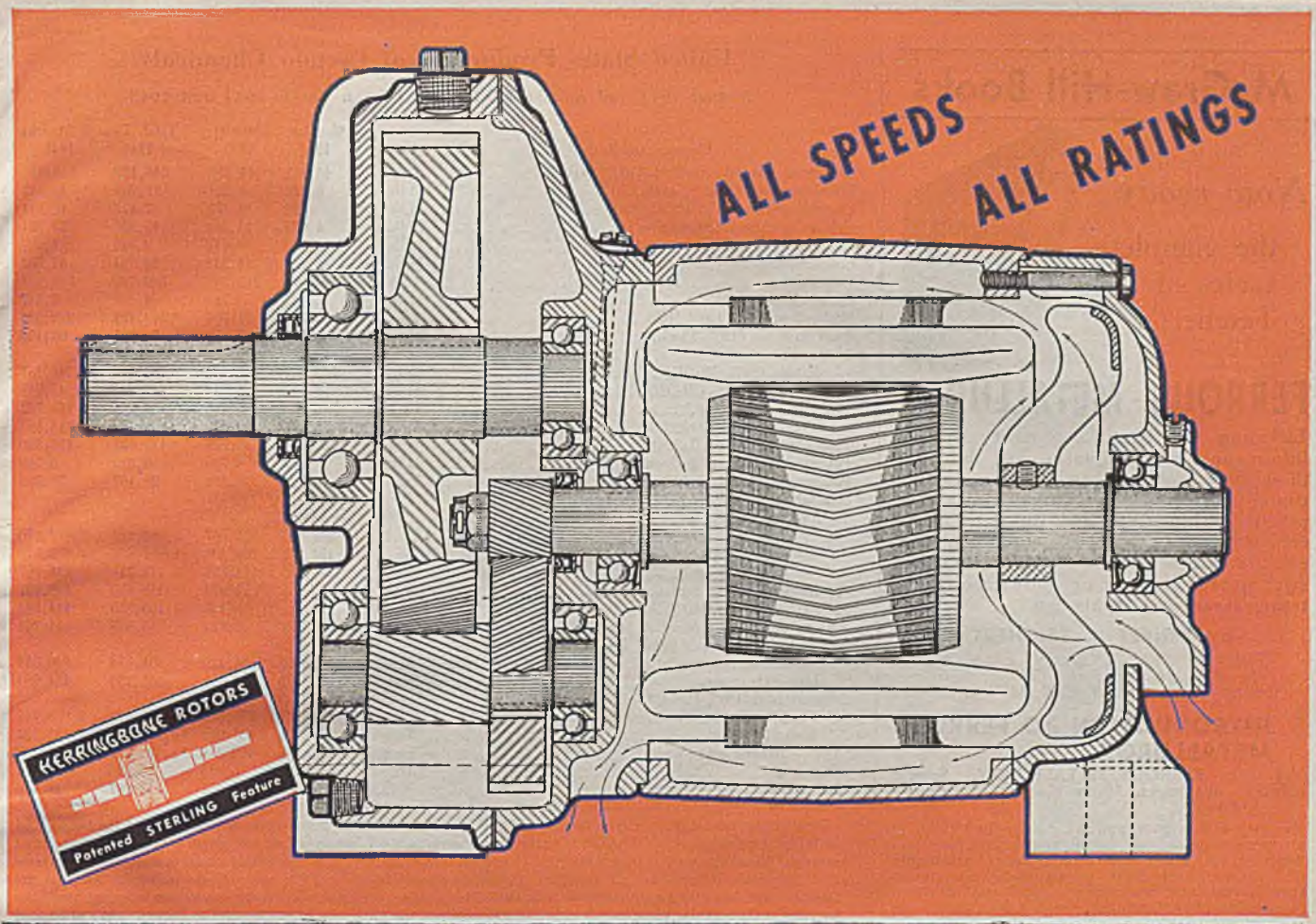


ONE FACTOR which continues to exert widespread influence in the chemical industry is the shortage of manpower. This is important not only within the chemical industry itself but also extends to most of the manufacturing lines which are large consumers of chemicals. The over-all effect is to bring about a declining trend in output and in distribution. The pushing up of production of munitions together with the announcement that this step will be progressively expansive for at least the early part of next year, may result in some increase in production of the chemicals involved but is mohe likely to result in the reservation of more of these chemicals for direct war needs with a consequent lowering in the amounts which will go into ordinary lines of manufacture.

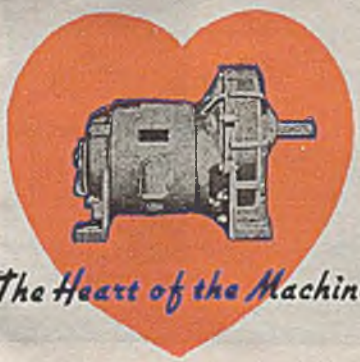
Other branches of the war program have cut down their requirements for chemicals as exemplified in the case of cutting aluminum production to bring it more in line with actual consumption. This has released considerable quantities of soda ash for use elsewhere. Despite the fact that the over-all aspect favors a moderate drop, at least temporarily, in both production and consumption of chemicals, the larger amounts of a varied line of raw materials for industrial use is important because it promises a more liberal supply of different finished products and makes it possible to make greater headway in turning out some new products and in developing prospective markets for them.

The stringency in the market for mercury will be relieved by drawing from the government stockpile. Until domestic production aided by imports, reaches a satisfactory point, the metal will be released from the holdings of the Reserve Corp. but only in amounts sufficient to meet existing war and essential civilian needs. Demand for mercury has been expanding for use in chemical warfare and in industry. The importance of government stockpiles, however, works both ways as recent withdrawals of lead have brought the surplus stocks to a low level and placing this metal under allocation is being considered. Production of basic carbonate of lead has been running in excess of 7,000 tons a month and producer stocks have been well depleted.

Crushing plants along the eastern seaboard are still handicapped by the small supply of flaxseed on hand although Canada has shipped some fairly large lots. The seed problem is giving concern not only for current requirements but also because greater reliance upon home-grown seed makes it necessary to increase the domestic acreage for the coming season and unless the situation changes, the outlook is for a decided decrease in the flax acreage. Different methods are being discussed to stimulate the planting of flax with some kind of subsidy apparently necessary to give the required stimulation. In the meantime the use of linseed oil is restricted and recourse must be made to other types of drying oils. October production of dehydrated castor oil was 7,085,000 lb. against 2,414,000 lb. in October 1943.



A CROSS SECTION OF AMERICA'S FINEST DIRECT POWER APPLICATION



STERLING SLO-SPEED (GEAR) MOTORS

The most economical and efficient method of securing a low speed power drive—an integral unit of simple design combining Motor Excellence . . . Sound Gear Engineering . . . Compactness . . . Strength . . . Low Cost . . . Durability . . . Safety . . . Quietness and High Efficiency.

A Thoroughly Tried and Proven Product . . .

Thousands are in use on all types of applications and operating under all conditions.

STERLING ELECTRIC MOTORS, INC.

NEW YORK • CHICAGO • LOS ANGELES

REPRESENTATIVES IN PRINCIPAL CITIES

STERLING ELECTRIC MOTORS

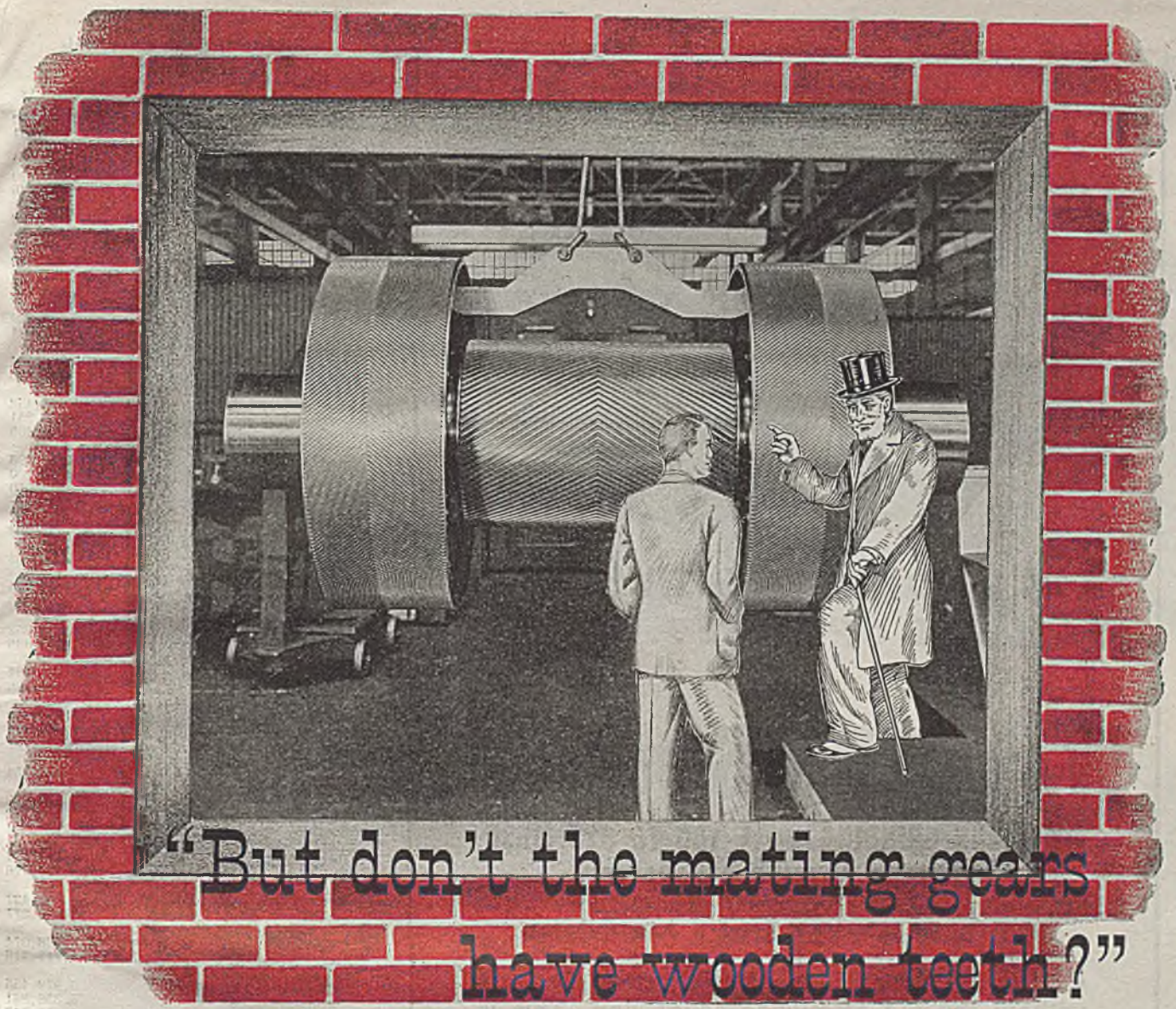
for Greater Perform-ability

United States Production of Certain Chemicals

August 1944 and August 1943; Eight-Month Totals 1944 and 1943

Chemical and Basis	Units	August 1944	August 1943	Total, First 8 Months 1944	Total, First 8 Months 1943
Anhydrous ammonia, synthetic (100% NH_3)	Tons	44,931	44,398	346,120	359,752
Bleaching power (35–37% avail. Cl_2)	M lb.	3,426	4,304	37,202	42,813
Calcium acetate (80% $Ca(C_2H_3O_2)_2$)	M lb.	846	2,155	7,497	13,541
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	4,673	11,641	42,256	52,831
Calcium hypochlorite (70% avail. Cl_2)	M lb.	1,180	912	9,329	7,487
Calcium phosphate (100% $CaH_4(PO_4)_2$)	M lb.	5,999	4,848	39,754	41,502
Chlorine	Tons	104,074	100,562	840,723	782,251
Chrome green (C.P.)	M lb.	426	749	4,036	5,247
Hhdrochloric acid (100% HCl)	Tons	31,711	28,864	[6] 242,421	222,595
Lead oxide, red (100% Pb_3O_4)	M lb.	8,229	7,859	71,335	67,108
Methanol;					
Natural (80% CH_3OH)	Gal.	319,337	443,172	2,764,914	3,245,787
Synthetic (100% CH_3OH)	M gal.	4,849	5,648	47,860	44,748
Molybdate orange (C.P.)	Lb.	85,051	186,224	924,761	1,209,583
Nitric acid (100% HNO_3)	Tons	38,471	40,895	306,132	318,887
Phosphoric acid (50% H_3PO_4)	Tons	51,354	56,710	[6] 473,537	425,300
Potassium bichromate & chromate (100%)	M lb.	477	730	5,010	6,758
Potassium hydroxide (100% KOH)	Tons	3,771	3,464	29,167	26,705
Soda ash (commercial sodium carbonate)					
Ammonia-soda process (98–100% Na_2CO_3)					
Total wet and dry[1]	Tons	368,833	377,607	3,050,623	2,877,576
Finished light[2]	Tons	194,278	202,136	1,659,418	1,482,616
Finished dense	Tons	124,120	114,356	973,711	924,987
Natural[3]	Tons	15,897	12,974	118,675	104,931
Sodium bicarbonate (100% $NaHCO_3$)	Tons	12,112	15,161	106,855	114,063
Sodium bichromate & chromate (100%)	Tons	6,378	6,380	55,305	54,264
Sodium hydroxide, liquid (100% NaOH)					
Electrolytic process	Tons	101,084	36,020	801,116	640,354
Lime-soda process	Tons	57,507	55,609	455,256	434,061
Sulphuric acid (100% H_2SO_4)[3]					
Chamber process	Tons	260,777	256,553	2,129,378	2,033,744
Contact process[4]	Tons	513,970	451,018	[6] 3,912,755	3,552,187
Net contact process[5]	Tons	450,590	409,818	[6] 3,484,081	3,186,918
White lead	Tons	7,335	5,655	55,866	44,276
Zinc yellow	M lb.	2,452	2,101	18,987	16,676

Data for this tabulation have been taken from the "Facts for Industry" series issued by the Bureau of the Census and the WPB Chemicals Bureau. Production figures represent primary production and do not include purchased or transferred material. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. For 7-mo. figures see *Chem. & Met.*, Oct. 1944, p. 219. [1] Total wet and dry production including quantities diverted for the manufacture of caustic soda and sodium bicarbonate and quantities processed to finished light and finished dense soda ash. [2] Not including quantities converted to finished dense soda ash. [3] Data collected in cooperation with the Bureau of Mines. [4] Includes oleum grades. [5] Excludes spent acid. [6] Includes a revised July figure.



"But don't the mating gears have wooden teeth?"

A natural question to ask—back in, say, 1875.

In those days, to secure quiet operation, one member of a pair of gears was often made with wooden teeth mortised into the iron rim. A spare set had to be kept on hand at all times because the wooden teeth wore out rapidly.

But with the development of higher speed machinery, so-called mortise gears became inadequate. They were superseded by gears with the teeth machine-cut in the metal rim—fore runners of the high precision, quiet operating gears built by the thousands for the Navy, the Maritime Commission, and our Nation's vital war industries.

The difference between early machine-cut gears and the precision gears we know today is largely the result of improved cutting methods. While it is true that our knowledge of the laws governing tooth shapes has continually increased, the greatest advances in the last half century have been in gear generating machines.

Development of the Farrel-Sykes method of gear generation made possible the *Gear with a Backbone.* This unique process permits the cutting of continuous herringbone teeth, *without* a center groove. Because the two helices are joined in the center, the entire face width is put to work, providing extra strength and high load-carrying capacity in smaller space. Inherent characteristics of design, plus high precision in manufacturing processes, promote the smoothness and quietness of operation so necessary for today's high speed machinery, and contribute to increased life, continuous operating efficiency and maintenance economy.

We shall be glad to send descriptive bulletins on the Farrel *Gear with a Backbone* and the machines by which the teeth are cut, as well as information about any of the other products illustrated below.

FARREL

FARREL-BIRMINGHAM CO., INC.
ANSONIA, CONN., BUFFALO, N. Y.

Farrel-Birmingham

Synthetic Organic Chemicals
September 1944

Item	Quantity
Acetanilide	
Consumption	30,170
Stocks	372,331
Acetic acid (synthetic) [1]	
Production	22,277,754
Consumption	14,912,999
Stocks	7,083,246
Acetic acid [2]	
Production	3,053,550
Stocks	1,403,125
Acetic anhydride [3]	
Production	40,837,920
Consumption	31,037,071
Stocks	12,295,443
Acetylsalicylic acid (aspirin)	
Production	786,429
Stocks	928,794
n-Butyl acetate	
Production	4,768,894
Stocks	2,917,308
Creosote oil, tar distillers (gal.) [4]	
Production	6,933,432
Consumption	973,851
Stocks	12,610,906
Creosote oil, byproduct (gal.) [5]	
Production	4,121,993
Consumption	27,169
Stocks	973,050
Cresols, meta-para [6]	
Production	641,437
Stocks	231,462
Cresols, ortho-meta-para [6]	
Production	999,005
Cresylic acid, crude	
Production	2,018,219
Stocks	1,368,620
Cresylic acid, refined [6]	
Production	3,368,852
Stocks	2,242,335
Diethyl ether (all grades)	
Production	5,984,137
Stocks	2,247,306
Ethyl acetate (85 percent)	
Production	7,767,058
Consumption	1,465,814
Stocks	5,222,257
Lactic acid (edible)	
Production	382,754
Lactic acid (technical)	
Production	182,336
Consumption	12,833
Stocks	356,664
Methyl chloride (all grades)	
Production	2,417,784
Stocks	370,776
Naphthalene, byproduct [7]	
Production	8,685,427
Stocks	2,972,277
Naphthalene, tar distillers [8]	
Production	17,038,074
Stocks	10,717,716
Naphthalene, refined [9]	
Production	5,979,455
Consumption	5,356,861
Stocks	1,815,117
Oxalic acid (technical)	
Production	1,590,158
Stocks	361,790
Phenobarbitol and sodium salts	
Production	11,302
Stocks	38,904
Phthalic anhydride	
Production	10,611,285
Consumption	3,976,542
Stocks	3,154,151
Riboflavin (for human use)	
Stocks	39,214
Sulfa drugs (total) [10]	
Production	152,328
Stocks	1,179,751

Data from U. S. Tariff Commission Chemical Division and WPB Chemicals Bureau. All data in pounds except as noted. Where no figures are given, data are confidential. [1] Production of recovered acetic acid confidential. [2] Acetic acid production by direct process from wood and from calcium acetate. Compiled by Bureau of Census. [3] Includes anhydride from acetic acid by vapor phase process. Statistics are realesed quarterly. For July—production 29,112,652; consumption: 32,540,867; stocks: 9,957,558. For August—production: 41,361,179; consumption 31,796,359; stocks: 11,745,833. [4] Data from distillers of purchased tar only. [5] Produced only by byproduct coke-oven operators. Data collected and compiled by Bureau of Mines. [6] Represents data for total production. Statistics reported by coke-oven operators combined with those of tar distillers. [7] Production statistics represent only material produced for sale by byproduct coke-oven operators and combine the three grades of crude naphthalene—solidifying at less than 74, 74 to 76, and 76 to less than 79 deg. C.—to avoid disclosing operations of individual companies. [8] Production by tar distillers only. Three grades combined as in footnote 7. Production for sale only in case of less than 74 grade. Production both for consumption within producing plant and for sale in case of other two grades. Production for consumption for less than 74 deg. F. grade is excluded to minimize duplication. [9] 79 deg. C. and over. [10] Includes acetylsulfathiazole.

CHEM. & MET.

Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	108.81
Last month	108.81
December, 1943	109.50
December, 1942	108.92

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 December 11.

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	.14½–
tanks, ton.	59.00 – 69.00
Ammonium carbonate, powd. tech., casks, lb	.09½– .12
Sulphate, wks., ton	28.20 –
Amyl acetate, 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 –
Diethylene 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	.032–
Furfural, tanks, lb	.09½–
Glaubers salt, bags, 100 lb	1.05 – 1.108
Glycerine, c.p., drums, extra, lb	.15½– .18½
Lead:	
White, basic carbonate, dry casks, lb	.08½–
Red, dry, sck., lb	.09½–
Lead acetate, white crys., bbl., lb.	.12½– .13
Lead acetate, powd., bag, lb	.11½– .12
Lithopone, bags, lb	.04½– .04½
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 – .07½
Muriate, 60% bags, unit	.53½–
Nitrate, bbl., lb	.05½– .06
Permanganate, drums, lb	.19½– .20
Prussiate, yellow, casks, lb	.16 – .17
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
Acetate, del., 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

Quick!

Positive SQUEEZ-GRIP KILLS FIRE in seconds

Here in four simple hand movements we come to grips with modern fire protection. Carbon dioxide gas, the fastest non-damaging fire extinguishing agent, is stored under high pressure in portable cylinders. The rapid release of the fire killing gas with the new SQUEEZ-GRIP valve saves time and gas. There is no wheel to turn. No need to set the cylinder down to operate it. C-O-TWO gas can be discharged or stopped as quickly as you can close or open your hand. In fact, it's so easy to use that even a woman or a child can operate it and extinguish a fire in seconds.

SQUEEZ-GRIP, originated and developed by C-O-TWO, is now used by all the Armed Forces. C-O-TWO manufactures a complete line of Portables, Hose Units and Smoke Detecting Systems.

KILLS FIRE—SAVES LIVES—*It's Safer—It's Faster—It's Modern*

C-O-TWO FIRE EQUIPMENT COMPANY

NEWARK 1 NEW JERSEY

Sales and Service in the Principal Cities of United States and Canada

AFFILIATED WITH PYRENE MANUFACTURING COMPANY

CHEM. & MET.

Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

This month	145.56
Last month	145.56
December, 1943	145.24
December, 1942	140.89

Chlorate, kegs, lb	.06½–	.06½
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–	
Oxide, 5% leaded, bags, lb	.07½–	
Sulphate, bbl., cwt	3.85 –	4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13½–	$0.14½
Chinawood oil, tanks, lb	.38½–	
Cocoanut oil, ceylon, dr. N. Y., lb	.0884	
Corn oil crude, tanks (f.o.b. mill), lb	.12½–	
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12½–	
Linseed oil, raw, car lots, bbl., lb	.155–	
Palm, casks, lb	.0865–	
Peanut oil, crude, tanks (mill), lb	.13 –	
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tank, lb	.11½–	
Menhaden, light pressed, dr., lb	.116–	
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, bbl., lb	.12½–	
Tallow extra, loose, lb	.08½–	

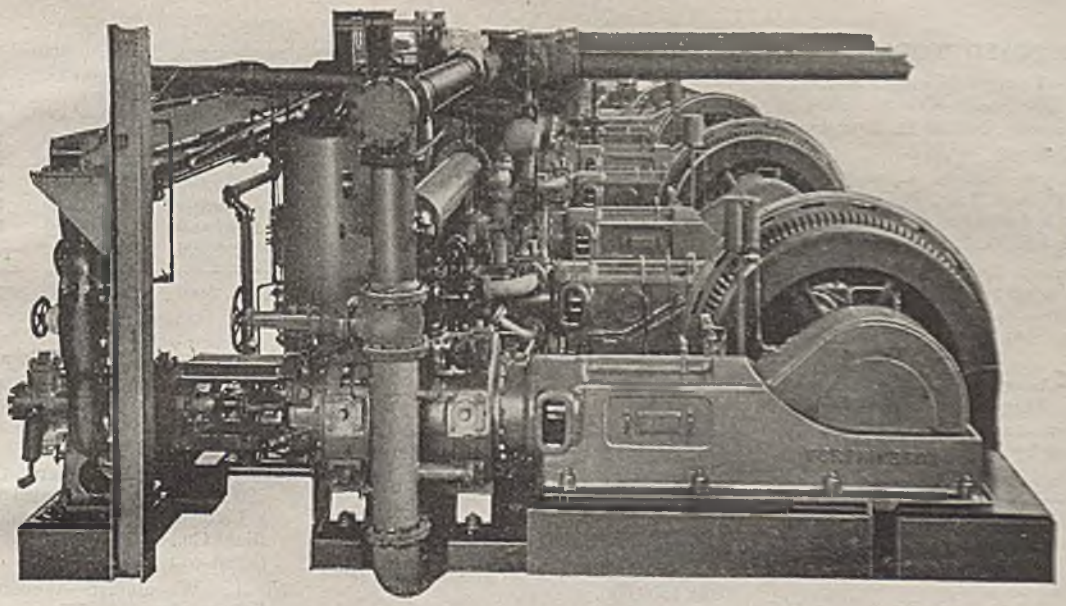
COAL-TAR PRODUCTS

Alpha-napthol, crude, bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.15 –	.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., kegs., 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
Dinitrotoluol, bbl., lb	.18 –	.19
Dinitrophenol, bbl., lb	.22 –	.23
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. A., 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	.26 –	.33
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	$0.18 –	$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	2.25 –	2.30
Chrome, yellow, C. P., bbl., lb	.14½–	.15½
Gum copal, congo, bags, lb	.09 –	.30
Manila, bags, lb	.09 –	.15
Damar, 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	6.71 –	
Shellac, orange, fine, bags, lb	.39 –	
Bleached, bonedry, bags, lb	.39 –	
T. N. bags, lb	.31 –	
Turpentine, gal	.89½–	

SQUEEZING THE MOST PROFIT OUT OF ALL FORMS OF CO_2



Worthington 3-Stage CO_2 Compressors, direct-connected motor drive, installed at a large dry ice plant

. . . with Worthington-engineered equipment

If you handle CO_2 in any form, the chances are you know about the intimate connection between the CO_2 industry and Worthington . . . how Worthington has been identified with the building of machinery for CO_2-liquid and dry ice plants since the early days of the commercial development of the CO_2 industry . . . how Worthington has built America's most modern dry ice plants.

EQUIPMENT PLUS KNOW-HOW ARE NEEDED

There's more than just equipment involved in the building of a CO_2 processing plant. Sure, old CO_2 hands say Worthington makes the best compressors for squeezing full value out of it . . . but you need more than that. You need the benefits of the know-how that comes from bumping up against the many variables involved in CO_2 processing and finding the right answers.

Variables? Few industries have more. Various sources . . . five of them; various methods of production . . . various pressures and temperatures . . . various sources of power . . . and a lot more. Worthington knows how to analyze them.

WORTHINGTON TAILOR-MAKES THE PLANT TO FIT YOUR NEEDS

That's why you'll find the Worthington organization well equipped with engineers and machines to treat your case individually . . . study your project in the light of its peculiarities . . . and design for you the CO_2 plant you need to strike the right balance between first cost and operating cost.

So, if there's anything about CO_2 processing on your mind, involving machinery or plant design, maybe you can get the answer only from Worthington. Write today.

WORTHINGTON PUMP AND MACHINERY CORPORATION, HARRISON, N. J.

FIVE MORE REASONS WHY WORTHINGTON LEADS IN INDUSTRIAL REFRIGERATION

WORTHINGTON BEHIND THE NAME

1. Horizontal compressors for ammonia, propane, butane

2. Angle engine compressors

3. Centrifugal compressors

4. Absorption refrigerating machines

5. Shell and tube refrigera equipment

NEW CONSTRUCTION

	Current Projects		Cumulative 1944	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$45,000	$40,000	$1,025,000	$3,708,000
Middle Atlantic	3,720,000	350,000	12,777,000	17,564,000
South	2,662,000	.....	17,278,000	25,878,000
Middle West	180,000	1,185,000	21,226,000	31,320,000
West of Mississippi	9,080,000	3,530,000	53,362,000	73,398,000
Far West	.....	1,796,000	12,899,000	16,052,000
Canada	500,000	260,000	10,087,000	7,231,000
Total	$16,187,000	$7,161,000	$128,654,000	$175,151,000

PROPOSED WORK

Ky., Louisville—Tobacco Byproduct & Chemical Corp., 1350 South 17th St., plans to construct a 1 story, 60x180 ft. dryer building. Estimated cost $65,000.

La., Baton Rouge—General Chemical Co., 40 Rector St., New York, N. Y., plans to construct a hydrofluoric acid plant here. Estimated cost $700,000.

O., Barberton—Sun Rubber Co., 9 Fairview Ave., plans to rebuild its 1 story, 100x200 ft. factory here. R. S. Firestone, 175 West Bowery St., Akron, Archt. Estimated cost $50,000.

O., Cleveland—American Gas Assn., Raymond M. Conner, Mgr., 1030 East 62nd St., Cleveland, plans to rebuild its testing laboratory destroyed by an explosion. Estimated cost $40,000.

O., Cleveland—O'Neal Paint Products, Inc., 13228 Madison Ave., Cleveland, contemplates the construction of a 40x125 ft. paint factory and a 40x75 ft. storage building. Estimated cost $50,000.

O., Mineral City—Federal Refractories Corp., Brimfield Rd., Akron, plans to rebuild its factory recently destroyed by fire. Estimated cost $40,000.

Okla., Guymon—Cabot Carbon Co. of Massachusetts, Guymon, plans to construct a carbon black plant. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $1,500,000.

Pa., Bradford—Kendall Refining Co., Bradford, Pa., plans to construct a top story addition to its laboratory. T. K. Hendryx, 409 N. Craig St., Pittsburgh, Archt. Estimated cost $45,000.

Pa., Philadelphia—Publicker Commercial Alcohol Co., 1429 Walnut St., plans to construct additional plant facilities. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $3,675,000. United Engineers & Constructors, Inc., 1401 Arch St., Engr.

R. I., Cranston—Atlantic Tubing & Rubber Co., S. Weinstein, Cranston St., is having plans prepared by E. Migliori, 509 Westminster St., Providence, for a 1 story, 100x125 ft. factory. Estimated cost $45,000.

Tex., Dallas—Pratt Paint & Varnish Co., 426 Factory St., plans to construct a 2 story factory. George Dahl, Insurance Bldg. Annex, Dallas, Archt. Estimated cost $40,000.

Tex., Harlingen—Coastal Chemical Co., Inc., c/o Niagara Sprayer & Chemical Co., Middleport, N. Y., and 421 N. C. St., Harlingen, plans to construct a 1 story chemical plant unit. Estimated cost $40,000.

Tex., Karnack—Monsanto Chemical Co., 1700 South Second St., St. Louis 4, Mo., plans to increase capacity of Longhorn Army Ordnance plant. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $7,500,000.

West Virginia—Goodyear Tire & Rubber Co., East Market St., Akron, O., plans to construct a Vinyl chloride copolygerm producing plant at Natrium, Marshall Co. Estimated cost $1,460,000.

W. Va., South Charleston—Carbide & Carbon Chemical Co., 30 East 42nd St., New York 17, N. Y., plans to extend the water treating plant and install chlorinator equipment at its plant here. Estimated cost $387,200.

W. Va., Chester—Continental Kilns, Inc., Chester, has acquired the plant of the Davidson Porcelain Co. here and plans to install a new kiln. Estimated cost $50,000.

Ont., Kitchener—B. F. Goodrich Rubber Co. of Canada, Ltd., 251 King St., W., plans to construct Plant Bldg. No. 5. Estimated cost $300,000.

Ont., Long Branch—Sherwin-Williams Co. of Canada, Ltd., 2875 Center St., Montreal, Que., Can., plans to construct a paint factory here. Estimated cost $75,000.

Ont., Toronto—Gelatin Products, Ltd., 258 Chilver Rd., Windsor, Ont., Can., plans to construct a 1 story plant at Danforth Ave. and Kingston Rd., Toronto. Estimated cost $45,000.

Ont., Toronto—Rainbow Plastics, Ltd., c/o R. B. Burgess, 320 Bay St., plans to construct a plant. Estimated cost $40,000.

Sask., Regina—Chemical Products Co., Ltd., Regina, Sask., plans the construction of a plant. Estimated cost $40,000.

CONTRACTS AWARDED

Calif., Gardena—Rubber Reserve Co., 20021 South Vermont Ave., has awarded the contract for an addition to its styrene plant to Stone & Webster Engineering Co., 20021 South Vermont Ave. Estimated cost $1,796,000.

Conn., Windsorville—Apothecaries Hall Co., 28 Benedict St., Waterbury, has awarded the contract for an addition to its plant here for the manufacture of fertilizer to H. Wales Lines Co., 134 State St., Meriden. Estimated cost $40,000.

Ia., Des Moines—Firestone Tire & Rubber Co., 1200 Firestone Pkway., Akron, O., has awarded the contract for a 1, 2, and 3 story tire plant to George Sollitt Construction Co., 109 North Dearborn St., Chicago, Ill., at $1,700,000. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost including equipment $4,500,000.

Minn., St. Paul—National Cylinder Gas Co., C. E. Bodin, 2340 University Ave., has awarded the contract for the construction of two 1 story factory buildings to J. S. Sweitzer & Son., 739 Pillbury Ave., St. Paul. Estimated cost $45,000 each.

Mo., St. Louis—Monsanto Chemical Co., 1700 South Second St., St. Louis 4, has awarded the contract for the construction of a 1 story, 61x100 ft. addition to its plant to Fruin-Colnon Contracting Co., 502 Merchants Laclede Bldg., St. Louis 2. Estimated cost $450,000.

Mo., St. Louis—St. Louis Briquette Co., 4004 Chouteau Ave., has awarded the contract for an addition to its plant to Stauder Construction Co., 6101 Adkins Ave., St. Louis. Estimated cost including equipment $40,000.

N. J., Garfield—Heyden Chemical Co., 290 River Rd., has awarded the contract for a 3 story manufacturing building to Edward Riehl Co., 5 Delaware Ave., Paterson. Estimated cost $300,000.

N. J., Woodbridge—Woodbridge Sanitary Pottery Corp., 50 Green St., has awarded the contract for a 13x265 ft. tunnel kiln to Allied Engineers Div. of Ferro Enamel Corp., 4150 East 56th St., Cleveland, O. Estimated cost $50,000.

O., Sandusky—U. S. Engineer, 21st St. and Virginia Ave., N. W., Washington, D. C., has awarded the contract for building extensions, installing residual acid lines at Plum Brook Ordnance Plant, to E. D. Badger & Sons Co., 75 Pitts St., Boston, Mass., at $1,104,546. Trojan Powder Co., Hunsicker Bldg., Allentown, Pa., will operate.

Tex., Altman—Continental Carbon Co., Altman, has awarded the contract for a carbon black plant to United Engineers & Constructors, Inc., Ship Channel, Houston, Tex., and Philadelphia, Pa. Estimated cost $1,250,000.

Wis., Beloit—C-Z Chemical Co., 1447 Argall St., has awarded the contract for a 3 story, 50x60 ft. addition to its factory and a second and third story addition to present building to Glenn D. Webermeier, 950 Hackett St.

Wis., Eau Claire—U. S. Rubber Co., Eau Claire, has awarded the contract for a 1 story, 68x162 ft. plant addition to George A. Fuller Co., 111 West Washington St., Chicago, Ill.

Ont., Baden—Dominion Linseed & Oil Co., Baden, has awarded the contract for two additions to its plant to Oscar Wiles, 5 Maurice St., Kitchener. Estimated cost $40,000.

Ont., Hamilton—Proctor & Gamble Co. of Canada, Ltd., Burlington St., has awarded the contract for a plant for the manufacture of soaps, shortening, etc., to W. H. Cooper Construction Co., Ltd., Medical Arts Bldg. Estimated cost $50,000.

Ont., Toronto—Canadian Swift Co., Ltd., 1960 St. Clair Ave., has awarded the contract for 2 story, 67x113 ft. and 5 story 30x60 ft. glue factories to Carter Construction Co., Ltd., 419 Cherry St., Toronto. Estimated cost $130,000.

Que., Bertherville—Melcher Distilleries, Ltd., 437 St. James St., Montreal, has awarded the contract for 2 story, 35x135 ft. addition to its plant to Douglas Bremmer Construction Ltd., 2049 McGill College Ave., Montreal. Estimated cost $40,000.