CHEMICAL & Metallurgical ENGINEERING

APRIL • 1944

Volume 51 Number 4

In this Issue

An index to advertisers will be found on page 382

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

Branch offices: 520 North Michigan Avenue, Chicago 11; 68 Post Street, San Francisco 4; Aldwych House, Aldwych, London, W. C. 2; Washington 4; Philadelphia 2; Cleveland 15; Detroit 2; St. Louis 8; Boston 16; Los Angeles 13; Atlanta 3; Pittsburgh 22.

Return Postage Guaranteed

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

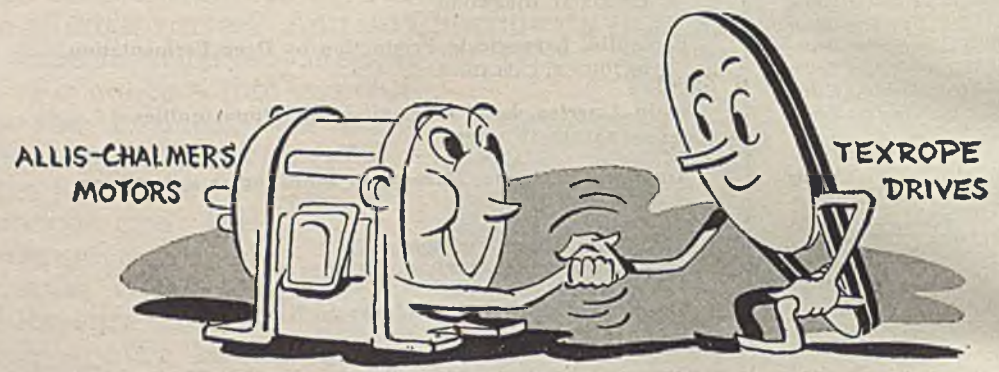
Publication Office
99-129 North Broadway, Albany 1, N. Y.

Editorial and Executive Offices
330 West 42nd Street, New York 18, N. Y.

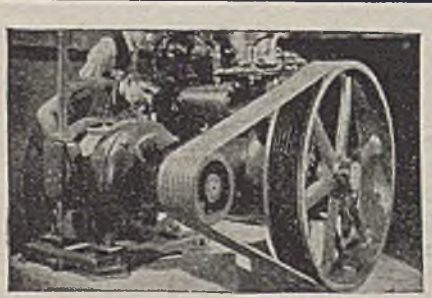
JAMES H. McGRAW, Jr.....*President*
HOWARD EHRLICH
Executive Vice-Pres. for Business Operations
JOHN ABBINK
Executive Vice-Pres. for Editorial Operations
CURTIS W. McGRAW
Vice-President and Treasurer
J. A. GERARDI.....*Secretary*
J. E. BLACKBURN, Jr.
Director of Circulation

Member A.B.P. Member A.B.C.
Cable Address McGRAWHILL, New York

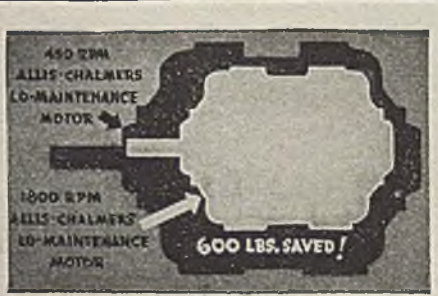
A-C "Team" Flexibility



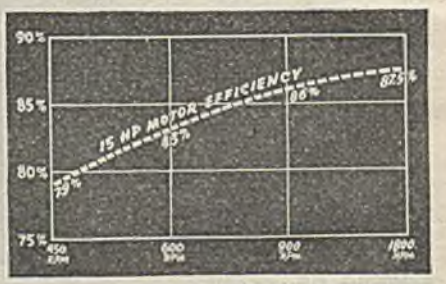
★ To drive low speed machinery with high speed motors (now that low speed motors are sharply restricted), Allis-Chalmers Texrope Drives can "gear down" motor speeds over a range of 7 to 1. As America's only builder of *both* motors and V-belt drives, Allis-Chalmers has long studied and advocated their use in proper com-



1 In most applications, an 1800 rpm motor with Texrope Drive will ably do the job of a lower-speed, direct-connected motor —at lower cost in money *and materials!*



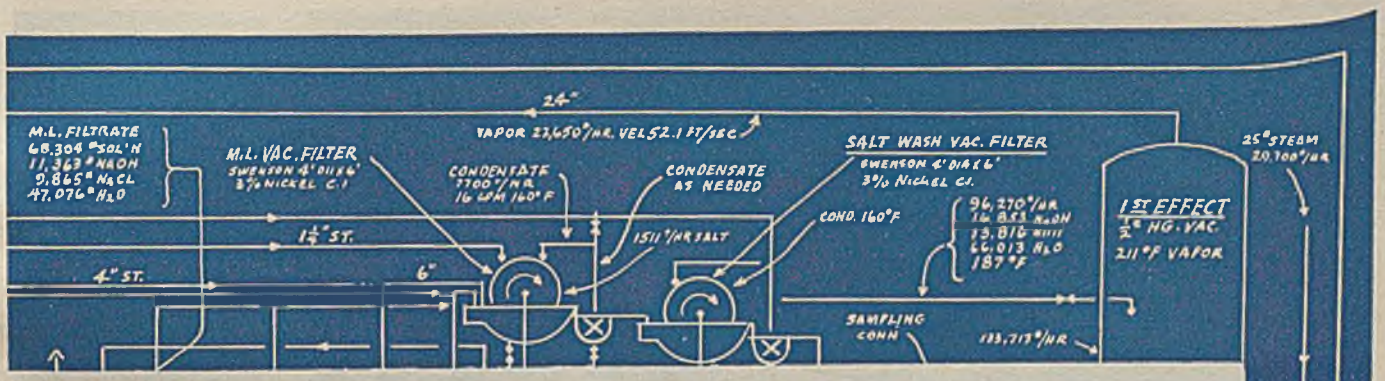
2 When you buy an 1800 rpm instead of 450 rpm 15 hp squirrel-cage motor, for example, 600 lb are saved. And *you* save well over $200 — with drive figured in!



3 Note that efficiency rises from 79% for the 450 rpm motor to 87.5% for the 1800 rpm motor. The 1800 rpm motor saves you over 30 kw/24 hr. day.

WE WORK FOR VICTORY — WE PLAN FOR PEACE

ALLIS-



Swenson-Engineered Chemical Reclaim System Used in the Manufacture of Viscose Rayon

In the production of viscose rayon, filaments are spun in a bath of acid, zinc sulfate, and/or glucose which must be kept above a definite minimum concentration. As the spinning progresses, acid becomes more and more dilute and the spin bath contains an increasing proportion of by-product Glauber salt.

Reclamation of the waste spin bath solution, crystallizing out the Glauber salt, and reconcentrating the acid, became a problem for Swenson engineers. They designed special acid-resistant evaporators, crystallizers, and filters for the purpose, permitting the recovery of these chemical values. The process is also used in the production of cellophane.

By means of further evaporation, filtration, and drying, the by-product Glauber salt is transformed into anhydrous sodium sulfate—a product for which there is a substantial market demand.

Thus Swenson Process Engineering has introduced two highly profitable chemical process operations in the production of viscose rayon and cellophane.

SWENSON EVAPORATOR COMPANY
Division of Whiting Corporation
15669 Lathrop Ave. Harvey, Illinois

ONLY SWENSON PROVIDES THIS FIVE-WAY SERVICE

1 Analysis of Requirements

2 Design and Layout

3 Manufacture of Equipment

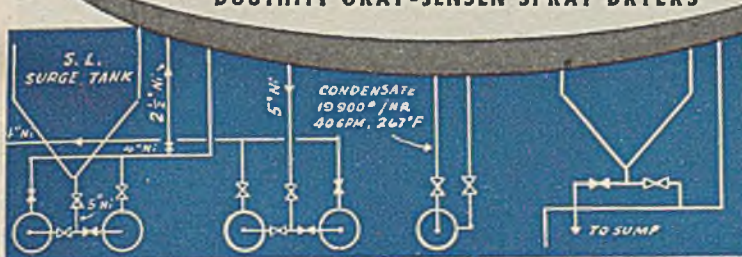
4 Test Operation

5 Periodic Check-Ups

SWENSON

EVAPORATORS • FILTERS • CRYSTALLIZERS

DOUTHITT GRAY-JENSEN SPRAY DRYERS



SWENSON EVAPORATOR CO
HARVEY, ILL., U.S.A.

Req. 88698	Title - FLOW SHEET &
Dr. SLEDGE	MATERIAL BALANCE
Ch'd FM	Capacity
Scale ½" = ONE FT.	For
Appr.	D-2285
Appr	

Reduce Power Interruptions with Timken Bearing Equipped Pillow Blocks

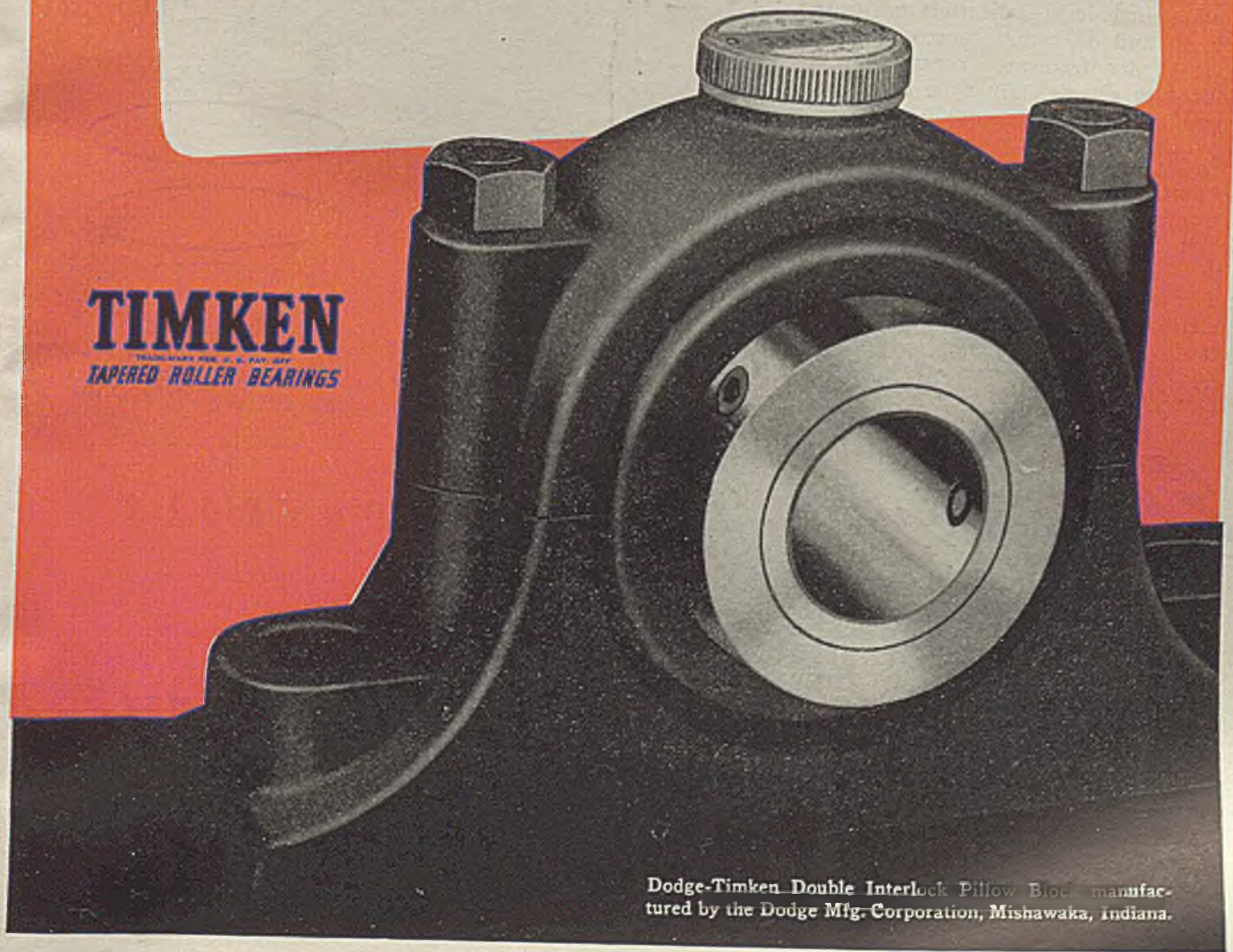
As long as there is power, you can depend on modern transmission units—pillow blocks and line shaft hangers—equipped with Timken Tapered Roller Bearings to keep it flowing steadily from source to application points.

Power interruptions due to transmission equipment inadequacy are eliminated along with power wastage, lubrication difficulties and excessive maintenance expense. Shafts last longer because they are protected against wear and whip.

It is of particular importance to the chemical and processing industries that Timken Bearings can be so effectively sealed that destructive fluids and abrasive materials are kept out of the bearings, which accordingly means longer life. The same closures that prevent foreign matter from getting in, stop lubricant from leaking out and thereby contaminating the product.

Is your power transmission system involving you in unnecessarily high costs? It will pay you to check up now and to replace wasteful units wherever they are found. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TAPERED ROLLER BEARINGS



Dodge-Timken Double Interlock Pillow Block manufactured by the Dodge Mfg. Corporation, Mishawaka, Indiana.

THE MAGIC FINGERS OF *Electronic* LEVEL CONTROL

"Feel" the correct level of liquids, powders . .

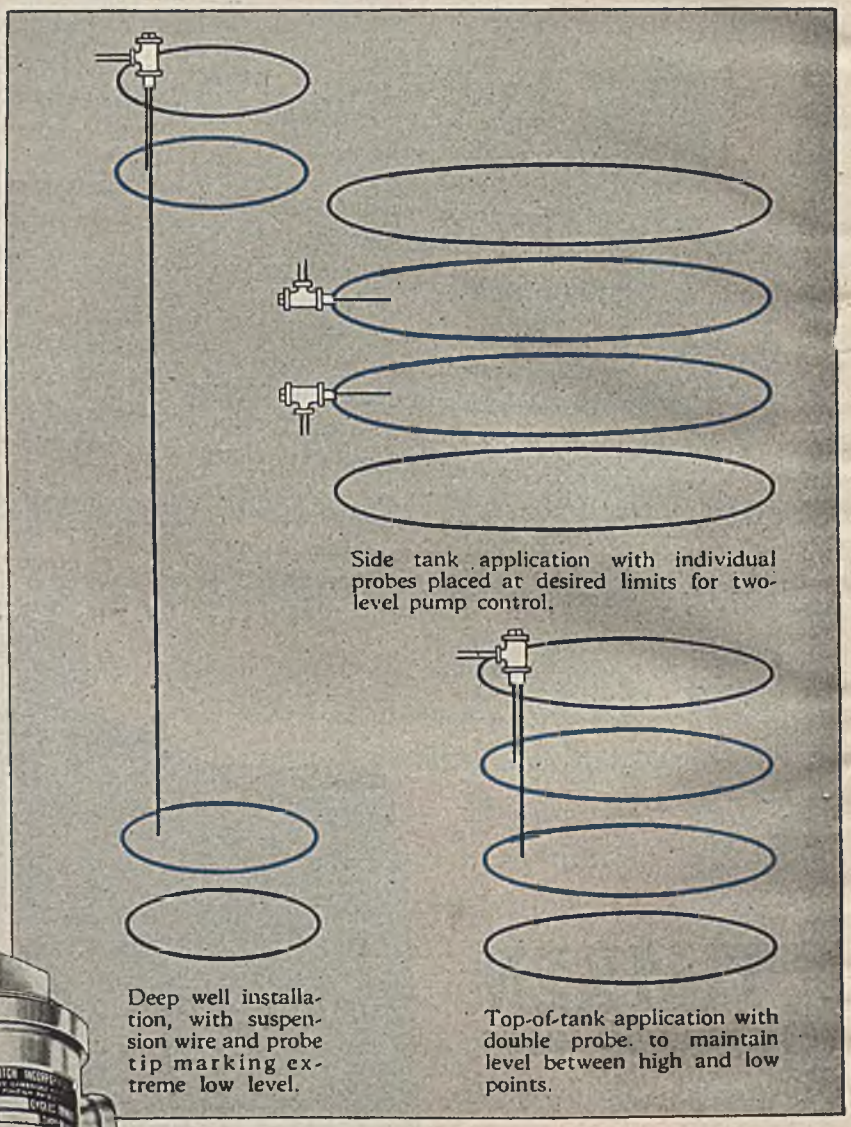
respond instantly — to start or stop pumps, open or close valves, operate signals.

Control is floatless, maintenance-free . . . no moving parts to wear or fail in operation . . . no floats or stuffing boxes.

Only a metal probe, electronic finger of Photoswitch, enters the tank. Liquid or powder, making or breaking contact with this probe, relays to the electronic control a minute electrical current, measured in microamperes. Amplified, it operates a heavy-duty switch to control signals, valves, or pumps — provide single-level indication and control, on and off pump control at two levels, boiler feedwater control, tank condensate signals, any type of pump programming arrangement.

Easily installed . . . sanitary for food installations . . . suitable for corrosives . . . safe with combustibles . . . Photoswitch Electronic Controls are effective with *all* liquids and powders, conductive and non-conductive — provide the modern, efficient solution to every level control problem.

Write today for Bulletin 1100.



Side tank application with individual probes placed at desired limits for two-level pump control.

Deep well installation, with suspension wire and probe tip marking extreme low level.

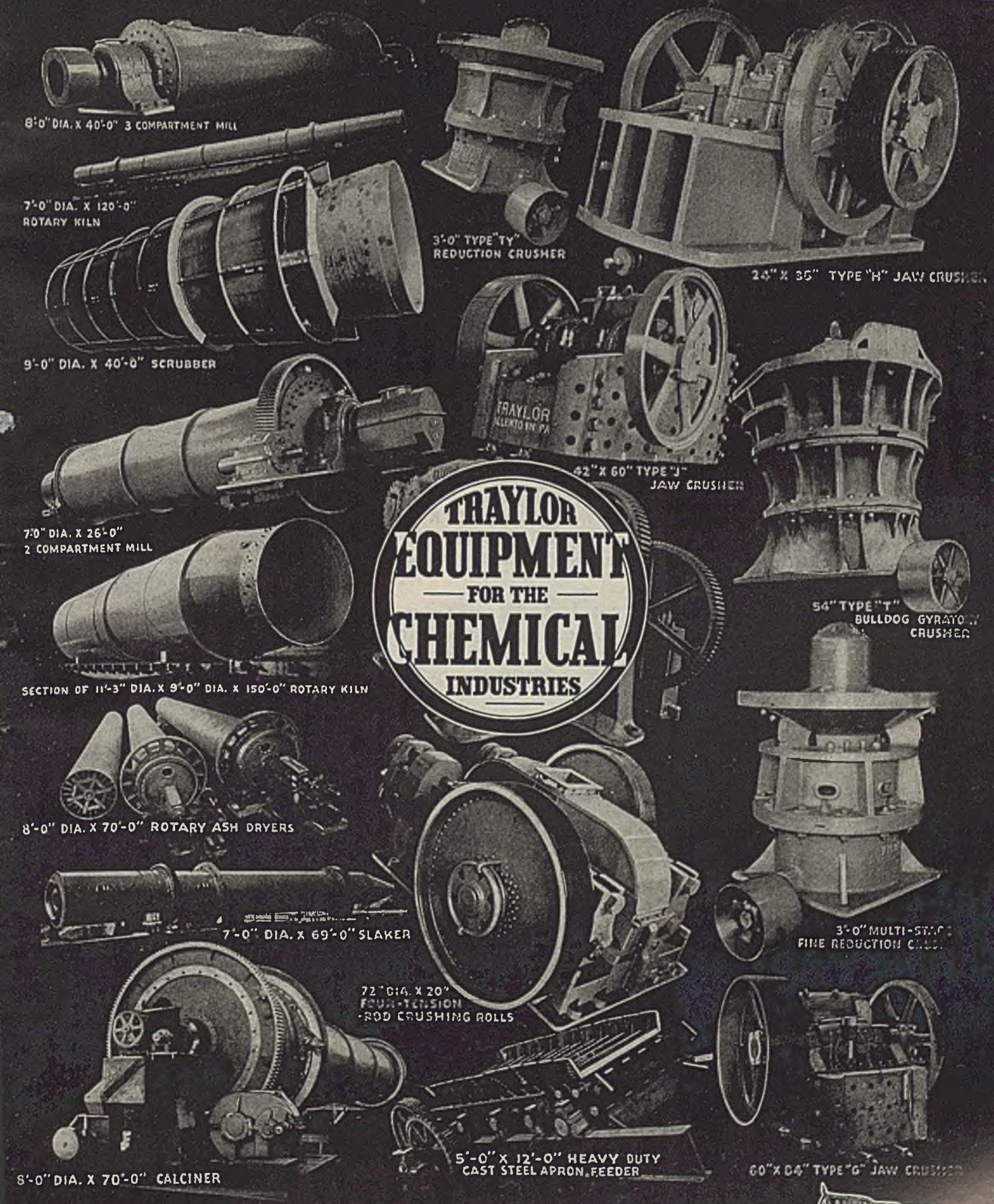
Top-of-tank application with double probe. to maintain level between high and low points.

Electronic LEVEL CONTROLS

Photoswitch Incorporated also manufactures photoelectric and electronic equipment for Turbidity Control, Smoke Density Indication, Counting, Automatic Inspection, Conveyor Control, Machinery Safeguards, Property Protection, and similar industrial applications.

PHOTOSWITCH
INCORPORATED

CAMBRIDGE 42, MASSACHUSETTS
District Offices in All Principal Cities
PHOTOELECTRIC AND ELECTRONIC CONTROLS FOR EVERY INDUSTRIAL PURPOSE



TRAYLOR EQUIPMENT FOR THE CHEMICAL INDUSTRIES

TRAYLOR

ENGINEERING & MANUFACTURING CO.

ALLENTOWN, PA., U.S.A.

X-Ray on wheels

this powerful Mobile 150 KVP X-Ray Unit brings non-destructive x-ray inspection to any part of your plant.

"ON THE SPOT" RADIOGRAPHY

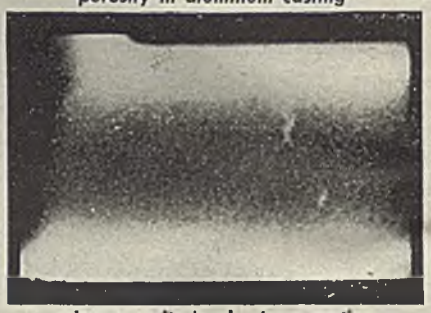
The Picker 150 KV Mobile Unit brings comprehensive facilities for X-Ray inspection directly to any point of production in your plant.

This compact, powerful, easily transportable apparatus fulfills every requirement for production inspection or spot checking of many diverse materials . . . metals, plastics, fabric, wood. Completely self-contained, requiring only a current source, the Picker 150 KV Mobile Unit provides positively controlled voltages from 15 KV to 150 KVP, with a radiographic capacity (with screens) up to 1½" of steel and 7" of aluminum. The rapidity of exposures ideally adapts this Unit to consecutive production inspection.

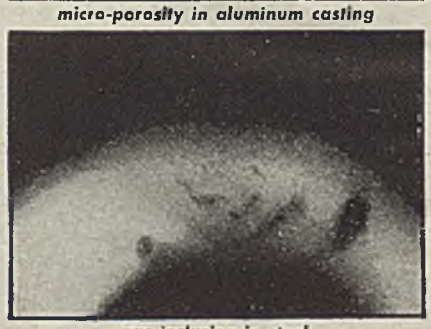
Write today for our bulletin on the Picker 150 KV apparatus, which gives details of construction, capacities and applications. Our engineering staff and research bureau is at your service for the study of any special problems concerning non-destructive radiographic examination.

Some typical examples of defects disclosed by non-destructive radiography

porosity in aluminum casting



micro-porosity in aluminum casting



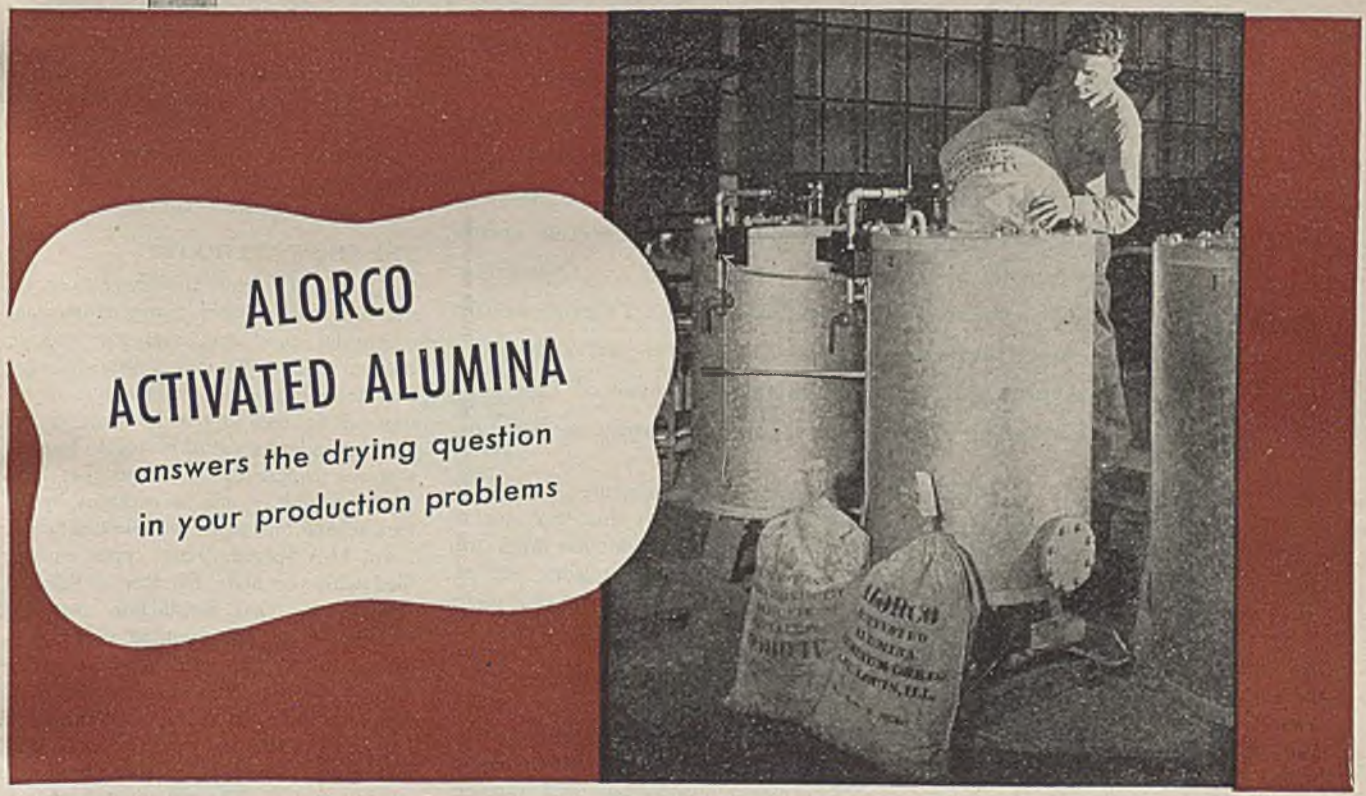
gas inclusion in steel

PICKER 150 KV
MOBILE X-RAY UNIT
Capacity 10 milliamperes at 150 KV continuous

PICKER X-RAY CORPORATION
300 FOURTH AVENUE • NEW YORK 10, N. Y.
WAITE MANUFACTURING DIVISION
CLEVELAND • OHIO
PICKER X-RAY OF CANADA, LTD.
MONTREAL • TORONTO

First "E" Award in the X-Ray Industry

IS IT A *Drying Day?*



One day, conditions are exactly right for processing work; materials dry quickly and behave as intended. The next day, everything goes wrong, because the weather has changed. Is this happening in your plant? It need not. The weather makers can control the humidity of air used in processing operations.

Alorco Activated Alumina serves as the drying agent in many of the machines used in this moisture control work. It is efficient, drying to low dew points. It is economical, one charge lasting for years. Activated alumina's high drying efficiency is restored simply by heating, an operation usually handled automatically by the machine.

Equally important to many processors is efficient, low-temperature drying of their materials. Here, again, Alorco Activated Alumina is on the job.

Machines for drying air, gases and liquids are available; your engineers don't have to take valuable time to design special equipment. We'll gladly advise you on the proper Alorco Activated Alumina for your purpose and refer you to builders of drying machines.

ALUMINUM COMPANY OF AMERICA
(*Sales Agent for* ALUMINUM ORE COMPANY)
1910 Gulf Bldg., Pittsburgh, Pennsylvania.

ALUMINUM ORE COMPANY

ALORCO

Aluminum and Fluorine Compounds

WATCHING WASHINGTON

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

Export associations in the alkali field are indicted as cartels . . . Beverage alcohol may be made at expense of synthetic rubber program . . . Magnesium follows aluminum in being curtailed . . . Donald Nelson has last word in industrial cutbacks . . . Alcohol is to be made from wood wastes, sweet potatoes and dried spuds . . . More anti-freeze will be made for next winter . . . Synthetic rubber calls for more research and development . . . Construction is authorized for more superphosphate . . . Olive oil substitute to be made from peanut oil . . . Corn-hog controversy of last year is repeated . . . Chemicals Division of WPB becomes a bureau.

MAY MADE CHIEF

THE BUREAU of Agricultural and Industrial Chemistry on Apr. 1 came under the direction of its new chief, Dr. Orville E. May, a career man who had recently been on a special war assignment as chemical coordinator of the Agricultural Research Administration. He replaces W. W. Skinner who retired at the age of 70 years after serving the organization for 40 years.

It is anticipated that Dr. May's designation as chief of the Bureau will result in few fundamental changes, since he has been active in its policy making and administration for a number of years. His designation as chief is a recognition of outstanding research leadership within the organization, and in the coordination of the work of the Bureau with that of other agencies in the Department of Agriculture.

CHEMICAL DEFERMENTS

THE American Chemical Society gathered together an influential group in Washington on Mar. 13 to discuss the effect on war industry of cancelling deferments of the young professional workers. The results of the conference were effectively presented to President Roosevelt by Dr. Charles L. Parsons, secretary of ACS. The President replied by a letter which acknowledged the urgency of reconsidering the special needs for scientific men in industry and research.

This action probably had as much to do as anything else with the proposed basis for deferring a limited number of young chemical executives in aviation gasoline, synthetic rubber, high-tenacity rayon, and essential rubber products. These four chemical industry needs were rated of top importance for the war effort, along with landing craft, airplanes, radar, and secret weapons. Only for this sort of absolutely essential production work will the government longer tolerate occupational deferments in industry of men under 26.

ASSOCIATIONS INDICTED

AS PART of its campaign against cartels in the alkali field, the Department of Justice secured indictments of two United States export associations and member companies. Also among the accused concerns is Imperial Chemical Industries, Ltd., predominant British enterprise, through its United States subsidiary of the same name. The Belgian firm, Solvay and Solvay & Cie., was named as a conspirator but was not made a defendant.

The action strikes directly at the export practices, under the Webb Export Trade Act, of two associations, United States Alkali Export Association, Inc., and California Alkali Export Association. In this connection, Assistant Attorney General Wendell Berge said: "The present suit is of major importance in the drive by the Anti-trust Division to eliminate the effect of cartels on American commerce. This is the first suit which the division has filed involving the activities of associations organized under the Webb Export Trade Act. That statute was passed by Congress to promote our international trade by enabling American manufacturers to form associations to compete with foreign manufacturers. We do not, of course, intend to interfere with any of the legitimate activities of such export associations, but many groups in this country are planning to utilize such associations to enter into cartel agreements with foreign companies, stifling competition throughout the world—activities which are not exempted by the Webb act from the operation of the Sherman (anti-trust) act. This suit should serve as a warning of our determination to prevent cartel groups from carrying out their illegal plans by use of the Webb act."

THE "HOW TO DO IT"

RUBBER Director Bradley Dewey has notified rubber goods manufacturers and companies producing synthetic and reclaimed rubbers that it is probable Selective Service will give no consideration of deferment to men under 26 years of age without endorsement of his office. In order that any request for endorsement for deferment be valid, it will be necessary to prepare at least four copies of Selective Service Form 42-A Special. Three copies must be filed with the State Director of Selective Service who has jurisdiction over the location where the essential man is employed. One copy must be sent to the Office of the Rubber Director, New Municipial Center Building, Washington, D. C., for action by the Rubber Director. The form should be prepared with the greatest of care. The statement should not be generalized, and each case should be dealt with on the basis of the individual registrant. In addition to the above form, there must be submitted to the Office of the Rubber Director at Washington a special certification.

MAGNESIUM GETS THE AX

HEAVY CUTS in the scheduled production of magnesium were ordered Mar. 16 at five plants. The official explanation of the cutback is as follows: "Production was ordered curtailed at this time for several reasons. In the first place, production currently is running between eight and ten million pounds per month in excess of requirements. This large surplus production is due primarily to the fact that the armed services have not consumed the quantity stated in their requirements. Surplus stocks of magnesium now total more than the amount required for two months at the rate of current consumption, WPB revealed. Furthermore, this action will result in savings of coal, gas, transportation and labor in areas where one or all of them are scarce."

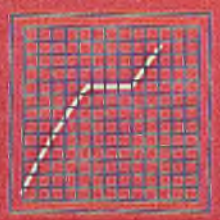
LAYING DOWN THE LAW

THE SCHEDULING of cutbacks in industry continues to be under WPB. Other agencies have wanted to grab some of this

HIGH SPEED

Only with Master Speedrangers can you obtain infinite speeds ranging up to 5,600 R.P.M.

You can enjoy all these Variable Speed advantages only with



INCREASE PRODUCTION

Use the right speed for each operation and increase production as much as 40%

PROVEN RELIABILITY

Their durability and stamina has been proven with millions of hours of service all over the world.

INFINITELY VARIABLE SPEED

Infinite variations in speed may be secured when unit is at rest or in motion.

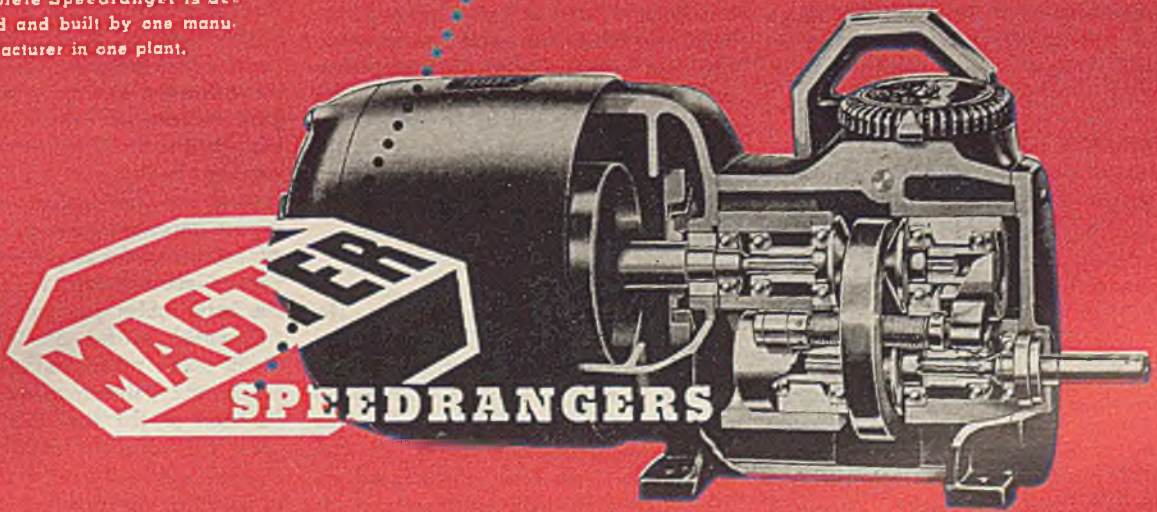
available in combinations of all these types

UNDIVIDED RESPONSIBILITY

Complete Speedranger is designed and built by one manufacturer in one plant.

COMPACT

Integral compact design saves space, saves money, improves appearance.



THE MASTER ELECTRIC COMPANY • DAYTON 1, OHIO

authority, but apparently Surplus Administrator Clayton is not one of them. Hence, for some time to come Washington expects that Donald Nelson will have the last word.

This situation makes doubly important the frank, almost blunt, reply by Nelson to Senator Maloney answering six questions with which the Senator apparently expected to embarrass WPB. Any executive of process industry concerned about the way in which his firm will be treated as compared with competitors, newcomers in the industry, and small business, can reasonably expect that the principles set forth by Nelson under the date of Mar. 7 will govern for some time to come. Some of those who hoped for a bit of preference in getting an early start on postwar business appear to be the ones most disappointed.

DON'T PUT OFF UNTIL TOMORROW

When a maximum price ruling becomes unfair because of changed conditions, OPA will listen to protests. But it emphasizes that a request for an increase in a ceiling price must be made promptly, generally within 60 days after the new grounds for protest develop. Thus a firm which can "get along" for a while may jeopardize its chance for an increased ceiling by delay in asking for it.

ALCOHOL FROM SPUDS

Several mid-West alcohol plants have been ordered to try out low-grade dried potatoes for industrial alcohol manufacture. About 19 carloads of surplus from the 1943 crop are available from beet sugar plants which dried the potatoes during their off season. Success will be achieved if the resulting alcohol capacity of the distilleries is not less when potatoes are used for mash. Cost considerations are not determining.

At least ten California wineries which made 5,000,000 gal. of industrial alcohol last year are to get no more Hawaiian molasses. It was hoped that these establishments could begin on Apr. 1 to use grain as the raw material. This development ordered by WPB during mid-March shows the constant shifting that is required to keep up with alcohol requirements.

CIVILIANS GET A BREAK

Plans for 1944 contemplate a better supply of anti-freeze for motor vehicles. It may be necessary to use as much as 52,700,000 gal. next winter, with a small percentage of the total held in reserve until Jan. 1 to relieve emergency conditions that may develop. Last year there were emergencies but no reserve pool to draw on.

Ethyl alcohol may be used to meet much of the need, but plans contemplate the possibility of greatly increased methanol production for use instead. Ammonia manufacturing facilities which can be converted to methanol manufacture are being studied by officials to see whether such changeover can be done quickly enough to meet the fall and winter requirements. It is roughly estimated that a plant which can make 100 tons per day of ammonia could on conversion make about 12,000,000 or more gallons of methanol. Thus the surplus capacity for synthetic ammonia is more than ample to meet the entire anti-freeze requirements of the country if changeover can be completed soon enough.

ALCOHOL BY NEW PROCESSES

Two definite projects for manufacture of alcohol were finally approved by WPB Requirements Committee and announced Mar. 21. Willamette Valley Wood Chemical Co. is authorized by priorities to build at Springfield, Ore., a plant to make alcohol from wood waste at an estimated investment of $2,247,000 with a potential annual capacity of 4,100,000 gal. of industrial alcohol. United States Sugar Corp. got priority to build at Clewiston, Fla., a plant at the cost of $2,056,000 with a rated capacity of 7,000,000 gal. The raw material for this plant will be sweet potatoes with high starch content, a variety not normally acceptable for household cooking.

Both plants represent the first commercial operations in the United States by the proposed processes. In each case, manufacturing operations are projected on conservative American estimates partly developed from reported European experience. In each case the plants are so designed as to permit further installations duplicating the original units, if practical operations justify such expansion.

QUOTAS ON LIQUOR IMPORTS

New pressure for resuming the manufacture of alcoholic beverages in the United States is being resisted by Washington. The demand for such beverage making is greater now than ever before because the imports of alcoholic beverages have been restricted severely. The purpose of the restriction is to prevent Cuba, Puerto Rico, and other such areas from consuming sugar or molasses which might otherwise come to the United States either for sweetener or for industrial alcohol. Washington still hopes that it can resist the political demand for resumption of beverage making. But everybody knows that this is an election year!

TVA WRANGLE

Long bitter enemies, Senator McKellar of Tennessee and Chairman David Lilienthal of TVA have staged in Washington several additional controversies during March and April. Involved is the question as to whether this agency shall continue its New Deal program and expand further in industrial operation on phosphorus and fertilizers. The Senator has sought to use that phase of the controversy both to curtail TVA and to make impossible the reappointment of Chairman Lilienthal whose term as a director of the corporation expires soon.

Washington observers think that Congress is in a mood to place certain new restrictions on TVA. But McKellar's influence in this direction has been much limited by his political break with Boss Crump of Memphis. The anti-New Deal features of the controversy are likely to be spotlighted again several times as Congress continues its effort to regain its share in the control of government operations. Apparently lost during late March was the effort to compel TVA to turn into the federal treasury all funds received from power operations and then to get new appropriations each year by specific Congressional approval. Such restrictive action would have greatly handicapped many of the operating portions of TVA, as well as returned to Congress the control of expansion policies which have lately been handled largely through executive orders, it is claimed "without full legislative authority."

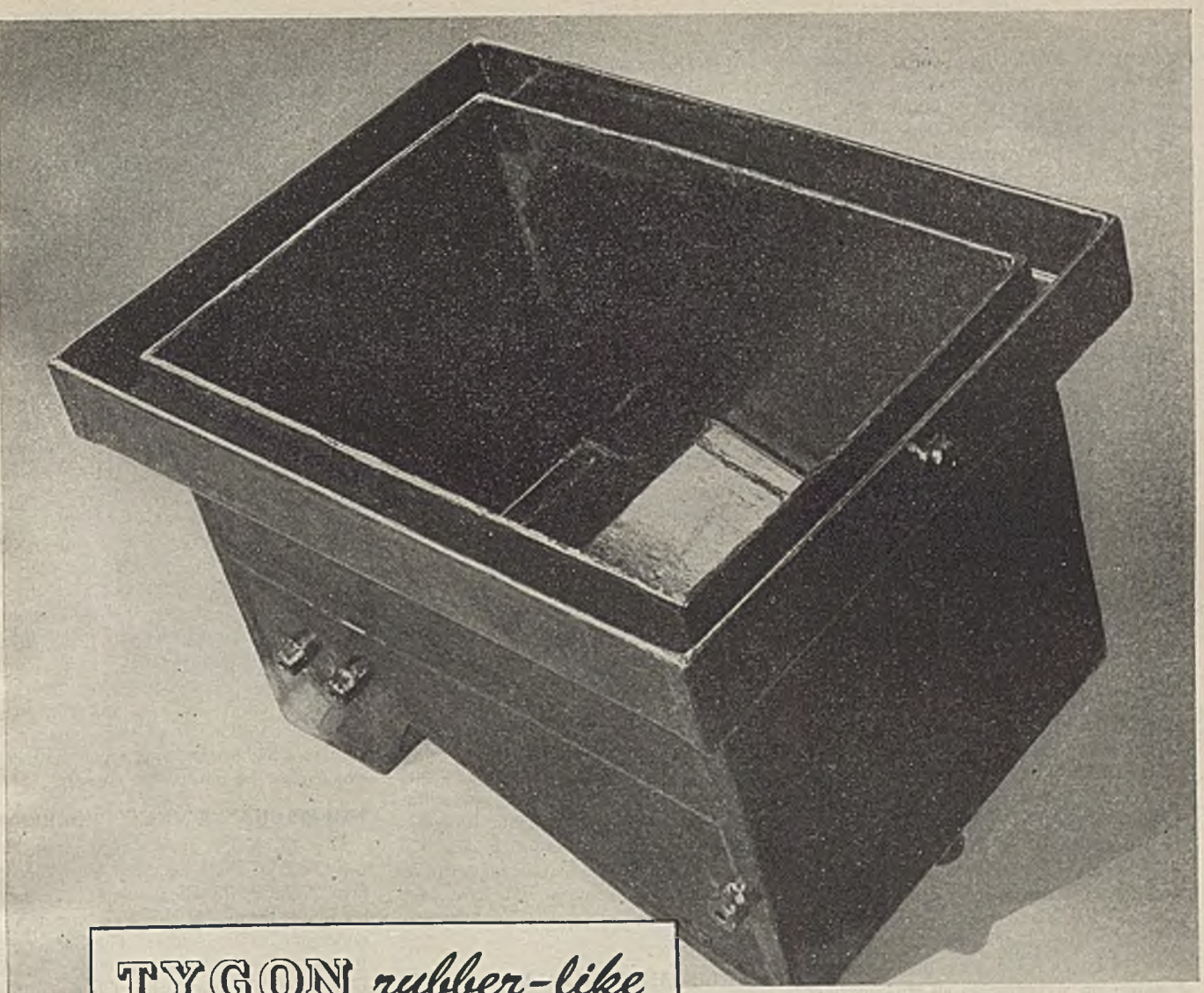
TAX BOOST LIMITED

New excise taxes have been imposed on quite a number of kinds of goods, including alcoholic beverages. Uncle Sam intends to police this situation to see that the new taxes on such goods are not multiplied as the goods pass through various merchandising channels to the customer. OPA has set itself the task of permitting only such rise in ceiling price as represents the actual new tax levy. It is warning the public against paying prices above the ceilings so restricted. Any enterprise which has had new taxes placed on its products must guard against excessive price increases, whether they are made by its own merchandising organization or by its customers.

ENOUGH RUBBER IF . . .

Progress Report No. 5 by Bradley Dewey, rubber director, gave a summary of the successful prosecution of the synthetic rubber program. Running through the document was a clear indication that great success has been achieved despite limited time available; but complete success can be expected only from further research and development work. Remaining are important questions on new methods of butadiene manufacture and purification, and important research to perfect the butyl rubber program.

Essential also for completion on schedule of usable rubber and its accessory materials are: Prompt completion of construction of the expanded facilities now scheduled; adequate supply of skilled operatives and well-trained technical staffs of chemists, chemical engineers, and phy-



TYGON *rubber-like* TANK LININGS

SUFFICIENT evidence is available after more than five years of use — to warrant forming certain conclusions about Tygon as a lining material:

1. Tygon effectively resists the attack of a wider range of corrosive substances than any other material except chemical ceramics and glass.

2. Tygon shows every indication of longer effective life in contact with solutions to which it is chemically resistant than rubber, synthetic rubber, or other materials now used as protective linings.

While closely resembling rubber in appearance — in feel — and in many physical characteristics, Tygon is not susceptible to the common ills which afflict rubber. It is neither sensitive to water or sunlight; nor is it affected by oils, grease, or fatty acids. It shows no chemical deterioration with age.

Tygon is a sturdy material — tough, durable, highly resistant to abrasion. It doesn't have to be handled with "kid gloves." If it should be accidentally gouged it can be easily and quickly repaired.

Tygon was made to give maximum protection for the longest period of time — protection to the shell from corrosive attack; protection to the solution from contamination.

Obviously, its initial cost is somewhat greater than for ordinary rubber or synthetic rubber linings, but experience has shown that, measured in terms of life-cost (the true measure of value) Tygon is the least expensive of all.

HAVE YOU TRIED TYGON PAINT?

Sheet Tygon stocks are liquefied by the addition of solvents to form acid-resisting Tygon Paint, possessing all the basic corrosion-resistant characteristics of the parent Tygon. It is used to paint the exterior surfaces of Tygon-lined tanks to protect them against occasional spillage, acid fumes, or condensates. It is ideal for fume ducts, pipe, structural steel work — in fact, for any surface exposed to fume attack. May be applied to steel, wood, or concrete by spray gun or brush. Available in black, white, clear and colors.

U. S. STONEWARE

Since 1865 • Akron, Ohio

IN CANADA: CHAMBERLAIN ENGINEERING, LTD., MONTREAL

sicists; freedom from work stoppages through labor or transportation difficulty; and maintenance of a supply of crude natural rubber for those classes of rubber products which cannot be made wholly from synthetic rubber.

DOING DOUBLE DUTY

THE EASIER supply of steel drums may be short lived. The United Kingdom is in the market for lard and is specifying that it shall be packed in steel drums rather than in barrels. Drums are used to support submarine nets around the island.

FACILITIES BOOSTED

ON MAR. 20 WPB announced that it had authorized construction during 1944 of facilities to produce 600,000 tons more superphosphate per year. About 175,000 tons of the new production capacity will be for triple superphosphate (calculated on the basis of 18 percent P_2O_5, the standard used in plant rating).

For the fertilizer year 1944–45, which begins July 1, the industry is promised sulphuric acid to make 9,000,000 tons of normal superphosphate. That will be an increase of a little more than 2,000,000 tons above the output expected for the current fertilizer year.

PEANUT FOR OLIVE OIL

ANNOUNCEMENT has been made of the development of a substitute for olive oil of the inedible type that is used in quantity in the manufacture of textiles. It is made from peanut oil by a two-step process. Designs for a pilot plant are being drawn up according to an announcement by the Department of Agriculture.

INKS GET OILS

PRINTING ink manufacturers no longer are restricted on use of fats and oils. The total use was so small as to make restriction no longer necessary, especially in view of the fact that the shortage of paper on which to use the ink has almost automatically restricted ink production also.

THE CORN-HOG CONTROVERSY

WHEN two plants of the wet grinders closed for lack of corn and other shutdowns threatened, WFA moved to relieve the situation by a 35 percent set-aside order issued to grain elevators in the five corn belt states. This is last year's problem all over again.

Requirements of the wet grinders amount to 2,500,000 bushels per week. Last year the problem was finally solved by the county agents who made the rounds and persuaded the farmers to release their corn after the government had guaranteed to protect them from changes in the ceiling price that might be made later. This year the situation is more acute. Carry-over was 500,000,000 bushels less than last year.

At the time the set-aside order was announced, five corn processors were named as "designated purchasers." WFA explained "the corn processing plants listed today as designated purchasers are engaged in the production of critical war materials for which corn is required. They have less than a two weeks' supply of corn on hand or purchased for future delivery." Other processors may be designated later.

Early solution to the problem of the corn grinders was not expected unless processors are permitted to pay the price that will make it equally or more attractive for the farmer to sell the corn than to feed it to over-weight hogs.

NO MORE PENICILLIN PLANTS

WITH 95 percent of new plant construction under the penicillin program begun last June having been completed and 90 percent of the operating facilities delivered, the Chemicals Bureau of WPB has announced that no further major expansions will now be approved. Officials said that only minor adjustments in approved projects necessary for the elimination of production bottlenecks will be considered at this time. However, WPB said it may be necessary to grant a limited amount of priority assistance to individuals with original processes for making penicillin. Members of WPB's Penicillin Producers Industry Advisory Committee are now studying proposals for exchanging technical and patent information and have been asked to make recommendations on civilian distribution.

MARCH CHEMICAL ALLOCATIONS

SHARP cuts in the allocations of phthalic anhydride were the most obvious changes in allocations for the month. The short position was a continuation of the situation which prevailed in February. Military requirements much higher than any amount previously requested were received after the February figures had been announced. No relief is in sight until next August when new facilities authorized last year will come into production. These will not be sufficient to supply military demands and additional facilities are being considered.

STOCKPILES TO BE CUT

THE JOINT chiefs of staff have put final approval on a new policy on stockpiles of strategic war materials which will curb this country's imports of such items. The action was taken after the War Production Board had warned of fears that great supplies of basic commodities would "overhang and disrupt the postwar market." High sources indicated that the new formula would not result in an abrupt decline in imports.

The effect will be to scale down somewhat the stockpiles that were considered necessary earlier in the war, one official pointed out. Three-year stockpiles once were thought necessary, he said, when foreign producing regions were falling into enemy hands almost weekly.

The new policy, which was approved by the WPB on Jan. 22, but not operative until the joint chiefs of staffs approved, permits a higher stockpile of any material which must be transported overseas.

WHERE CHANGE MEANS PROGRESS

DUE to changes in the organization of the Office of the Operations Vice Chairman of WPB, the Chemicals Division has become a bureau. At the same time it has undergone certain changes. The Chemicals Bureau is now divided into the Basic Chemicals Division, the Compounded Chemical Products Division, and the Chemicals Coordination Office. The executive committee of the Bureau now consists of Dr. D. P. Morgan, chairman; W. G. Whitman; W. F. Twombly; Lawrence Brown; Lt. Col. W. F. Sterling; and Lt. Com. R. B. Colgate. Other changes may be seen in the accompanying table.

CHEMICALS BUREAU

D. P. Morgan, *Director*

W. G. Whitman, *Assistant Bureau Director*
W. F. Twombly, *Assistant Bureau Director*
Lawrence Brown, *Assistant Bureau Director*

Basic Chemicals Division	Compounded Chem. Products Div.	Chem. Coordination Office*
W. G. Whitman, *Director*	W. F. Twombly, *Director*	Lawrence Brown, *Director*
Inorganics Branch	**Drugs & Cosmetics Branch**	**Facilities Branch**
J. W. Wizeman, *Chief* J. C. Leppart, *Deputy*	F. J. Stock, *Chief* J. T. Batson, *Deputy*	J. A. Lawson, *Chief* Andrew Ross, *Deputy*
Arom. & Intermed. Branch	**Protective Coatings Branch**	**Distribution Branch**
R. G. Ruark, *Chief* H. M. Harker, *Deputy*	T. J. Craig, *Chief* Wells Martin, *Deputy*	L. C. Leonard, *Chief* W. J. Canary, *Deputy*
Alcohols & Solv. Branch	**Plastics Branch**	**Program & Statistics Branch**
John Boyer, *Chief* F. E. Bennett, *Deputy*	Clinton Rector, *Chief* G. W. Wilcox, *Deputy*	Frank Talbot, *Chief* E. K. Burger, *Deputy*

* In the Chemicals Coordination Office, but not under any branch, are J. N. Hall, Transportation Officer; E. M. Houts, Allocations Officer; and Charles P. Given, Packaging Officer.

When every second counts

Through the windows of the waistline tower in any big railroad switch yard you see an unending stream of traffic pouring in both directions. The senior towerman may supervise close to two hundred moves in a single hour. At the rate of three per minute he must visualize every track, every siding, every spur and derail . . . he must make every second count.

Troops must be moved to embarkation ports . . . guns and ammunition transported to our armed forces . . . fuel oil for ships and gasoline for our air forces must be delivered without delay.

Increasing war demands threaten a critical situation for freight transportation, especially tank cars. You can help to avert it by speeding the turn-around of these cars . . . by making every second count.

COLUMBIA CHEMICALS

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

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

COLUMBIA SPOTLIGHT

1,000 U. S. BOMBERS over Berlin may consume 1,200,000 gallons of gasoline—the capacity of a train of 120 tank cars. A fighter plane uses 100 gallons of gasoline in an hour . . . our big four-engine bombers eat up just twice as much. And a single mechanized division in action may use two tank cars of fuel per hour. No wonder these cars are at a premium!

THE INCREASING TEMPO of the war in the Pacific and the absence of pipe lines to our west coast are placing additional burdens on the rail transportation by tank car of fuel oil and gasoline destined for this theater. Each American soldier overseas requires an average of 50 gallons of petroleum products per week. The delivery of supplies alone involves enormous quantities of fuel . . . each Liberty Ship burns about 40 tank cars of fuel oil for the Australasia round trip.

COLUMBIA TANK CARS are working overtime, too, supplying the Liquid Caustic Soda and Liquid Chlorine essential in the manufacture of so many war materials. Incidentally, Columbia introduced the special car which first made practical the transportation of 73% Liquid Caustic Soda without metallic contamination. Principal features of this car are the heavy insulation which keeps the liquor from freezing and the special lining. The use of 73% Liquid Caustic Soda has enabled Columbia customers to save many thousands of dollars.

THANKS to Columbia customers for their splendid co-operation in handling tank cars which—combined with Columbia's stepped-up loading schedules, increased supervision and expediting of equipment—resulted in a 1943 turn-around performance that was excellent in view of transportation conditions. We know that all customers will co-operate with us toward a still better record so necessary to the war effort.

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

WPB CURTAILS DISTRIBUTION OF SOME INDUSTRIAL EQUIPMENT

TWENTY-TWO CLASSES of industrial equipment previously available with an A-1-c rating, now require a minimum preference rating of AA-5 or better, according to Limitation Order L-123 as amended on March 4. Included in the classes of equipment affected are air filters, flexible metallic hose, tubing and fittings, and pressure vessels (including air receivers). The Order also covers some additional sizes and kinds of compressors formerly under Order L-100; high pressure blowers formerly under Order L-163; heat exchangers formerly under L-172; pumps formerly under Order L-246; and fans and blowers formerly under L-280.

The amended Order no longer applies to conveying machinery and mechanical power transmission equipment which are covered by Order L-193; portable (platform type) elevators and steel platforms, covered by L-287; safety switches and night switches, covered by L-315; or circuit breakers covered by L-300. The restriction on deliveries to orders rated AA-5 or better applies to deliveries from one department of an organization to another, if the equipment becomes a component for incorporation into other machinery which that organization may produce, or for installation and operation by such organization. Certain exemptions to these restrictions include repair parts, farm supplies, petroleum industry items covered by P-98-c, used items, etc.

LABORATORY PRIORITY

CURRENT POLICY OF WPB in administration of Order P-43 has now been written into the Order. Priority ratings assigned to a laboratory may be used to get material for the development of products designed primarily for future civilian markets, only if such activities will be carried on without diverting any manpower, technical skill or facilities from war work. Laboratories that have been assigned serial numbers by WPB may not use their AA-1 preference rating for activities connected with future civilian markets.

Experimental models or test runs of materials may be made. However, if designed primarily for future civilian markets, such experimental models or materials may not be exhibited to the public, and in any case, may not be distributed to promote sales or create consumer demands.

Laboratory construction jobs costing not more than $500 may be started under P-43 without applying for permission under L-41, and the cost of labor and equipment required for laboratory activities need not be included in computing the cost of a construction job.

VINYL SCRAP COMPOUND PRICED

EFFECTIVE MARCH 27, MPR No. 345 provides prices per pound for non-plastic materials which are laminated or impregnated with vinyl compounds. In determining the price, the weight of the scrap compound is reduced by ten percent and multiplied by the established price of the particular vinyl compound or mixture of compound contained. This allows purchasers a ten percent margin for extracting the vinyl compounds and reselling them.

NO EDIBLE OIL FOR PAINT OR VARNISH THINNERS

THE USE OF cottonseed, peanut, soy bean and corn oil (or their fatty acids) in the manufacture of products for thinning or reducing paints, varnishes, lacquers and other protective coatings is now prohibited by Amendment 6 to FDO No. 29, effective March 27. They already have been denied for use in paints, varnishes and lacquers.

SPECIFICATIONS ON CONDENSING UNITS REVOKED

BY REVOCATION OF schedule II to Order L-126, WPB removed standardization restrictions which limited the number of models of refrigeration condensing units for industrial and commercial refrigeration and air conditioning machinery that each manufacturer could produce. The most important feature of this action is that it permits the use of steel in the construction of bases for units having motors over 20 hp. in size. Previously, it had been necessary to erect concrete bases at the time of installation of the unit.

PULPWOOD AND CORDWOOD

CEILING PRICES for pulpwood produced in the northeastern region of the country have been increased by as much as $2.75 per cord in an effort to maintain and stimulate continued production. These higher prices are incorporated in revised MPR-361 and will be absorbed by pulp and paper manufacturers.

Amendment to MPR-348 provides increases of $0.50 to $1.10 per cord for southern cordwood which is actually in competition with pulpwood. This action was taken to parallel recent pulpwood price increases thus assuring continued production of other forest products.

PINE OIL ALLOCATED

ALLOCATION ORDER M-365 was issued by WPB on March 22, placing pine oil under complete monthly allocation as of April 1. This action was necessary because of an estimated 15 to 20 percent reduction in production, as well as an increase in demand caused by a shortage of phenol and carbolic acid.

OTHER RULINGS

Benzaldehyde has been placed under General Allocation Order M-300 for allocation on a monthly basis as of April 1.

Animal glue has also been placed under full allocation by including it in Order M-300. Concurrently with this action, WPB revoked Order M-367, formerly controlling the distribution of glue, and amended order M-368 which regulates the flow of hide glue stock for glue production to increase the flow of domestic raw materials to glue manufacturers.

Producers of methyl bromide need no longer list their customers on Form WPB-2947 when the end-use of the product is for fumigation, according to Direction 1 of Allocation Order M-340.

General Preference Order M-41 governing chlorinated hydrocarbon solvents has been revoked by WPB since the three chemicals chiefly involved, carbon tetrachloride, trichloroethylene, and perchlorethylene, have been placed under Orders M-371, and M-363.

An oversight in the provision of MPR No. 465 setting maximum prices for used storage vessels, has been corrected to make it clear that sellers may charge a portion of the original installation cost when in excess of $100 for all tanks covered by the regulation.

Fibrous glass textiles have been classed as undesignated products under the terms of General Scheduling Order M-293, delivery to be scheduled on the basis of specific WPB direction. At the same time, WPB revoked Order M-282 which formerly governed the delivery of these products.

Maximum prices in effect for sales of calcium carbide by the Defense Supply Corporation will also apply to sales made by Rubber Reserve Company, according to amendment 107 to Revised Supplementary Regulation 14 of the GMPR.

Amendment to Schedule I of Order L-107 permits manufacturers of unit heaters and convectors to substitute various sizes of heat-transfer elements provided they do not exceed the heat-transfer capacity of the substituted elements.

ALL-IN-ONE *Protection*

against

- CARBON MONOXIDE
- ORGANIC VAPORS
- ACID GASES . . AMMONIA
- TOXIC DUSTS, FUMES, MISTS

FOGS and SMOKES

Approved
BY THE U. S.
BUREAU OF MINES

M·S·A *All-Service** GAS MASKS *with* MODEL S CANISTER . . .

Model S Canister with Standard Canister in background

The M.S.A. All-Service Mask with Model S canister meets respiratory protective requirements against poisonous industrial gases, toxic dusts, mists, smokes, etc.—singly or in combinations (including carbon monoxide); is officially approved by the U. S. Bureau of Mines, and offers maximum comfort and convenience in service. Special features of the canister are its uniquely-designed large-area filtering element for smokes, dusts and fumes—of particular value under certain emergency conditions—and lower resistance to breathing.

The M.S.A. All-Service Mask is equipped with the famous All-Vision facepiece, which allows unobstructed vision at all angles, fits comfortably without drawing or binding, and affords a perfect gas-tight seal. Complete working freedom is permitted by the strong, durable harness, which is easily and quickly put on or removed.

Both the Model S All-Service Mask canister and the Standard All-Service canister are interchangeable in the harness. A strongly constructed fiber carrying case accommodates the mask equipped with either canister, together with a spare. To adapt All-Service cases now in use for the Model S canister, it is necessary only to remove a small fiber bracket. Write for complete details on the M.S.A. All-Service Mask with Model S and Standard canisters, in descriptive bulletin No. EA-8!

STANDARD MODEL ALL-SERVICE MASK

Providing protection for many years throughout industry against poisonous industrial gases, smoke and fumes encountered singly or in combination—including carbon monoxide—the M.S.A. All-Service Mask with Standard Model canister is still available. Officially approved (Approval No. 1405) by the U.S. Bureau of Mines.

MINE SAFETY APPLIANCES COMPANY

BRADDOCK, THOMAS AND MEADE STREETS · PITTSBURGH, PA.

*Trademark Reg. U. S. Pat. Off.

District Representatives in Principal Cities

Diamond Research Chemists

constantly on the job...

IN WAR OR PEACE . . . TO MAKE

DIAMOND PRODUCTS OF

GREATER VALUE TO YOU!

DIAMOND ALKALI PRODUCTS FOR INDUSTRY

★ ★ ★

58% Light Soda Ash
58% Light Fluffy Soda Ash
58% Dense Soda Ash
Fused Soda Ash Briquets
Bicarbonate of Soda U.S.P.
Powdered, Granular
Bicarbonate of Soda,
Free-Flowing
Bicarbonate of Soda,
Technical
76% Caustic Soda
Solid, Ground, Flake
74% Caustic Soda
Solid, Ground, Flake
60% Caustic Soda
Solid, Ground, Flake
Liquid Caustic Soda
50% NaOH,
70% NaOH
Liquid Chlorine
Carbon Tetrachloride
Dry Cleaning Solvents
Laundry Soda
Cleaner and Cleanser
Textile Soda
Diamond Soda Crystals
Sesquicarbonate of Soda
Special Alkalies
All Strengths
Ground, Flake
High Test Alkali
B. B. Alkali
Diamond Detergent

★ ★ ★

COKE AND BY-PRODUCT DEPARTMENT

Coal
Coke
Domestic, Foundry
Benzol
Pure, Nitration
Chemical Limestone
Toluol
Pure, Nitration
Ammonia
Tar, Crude
Gas, Coke Oven
Crude Heavy Solvent
Motor Fuel
Xylol

★ ★ ★

STANDARD SILICATE DIVISION

Silicate of Soda, Liquid
All Grades
Water White 42°
Silicate of Soda, Glass
Silicate of Soda,
Concrete Special
Sodium Metasilicate
Sodium Orthosilicate
Sodium Supersilicate
Alkalate
Metalate
Ortholate

★ ★ ★

STANDARD CHROMATE DIVISION

P. O. Box 247,
Painesville, Ohio

Bichromate of Soda
Crystal, Granular,
Anhydrous, Liquid
Chromate of Soda
Anhydrous, Liquid
Ammonium Bichromate
Bichromate of Potash
Crystal, Granular
Potassium Chromate
Potassium Sodium
Chromate
Chrome Salt Cake
Tanning Salts

★ ★ ★

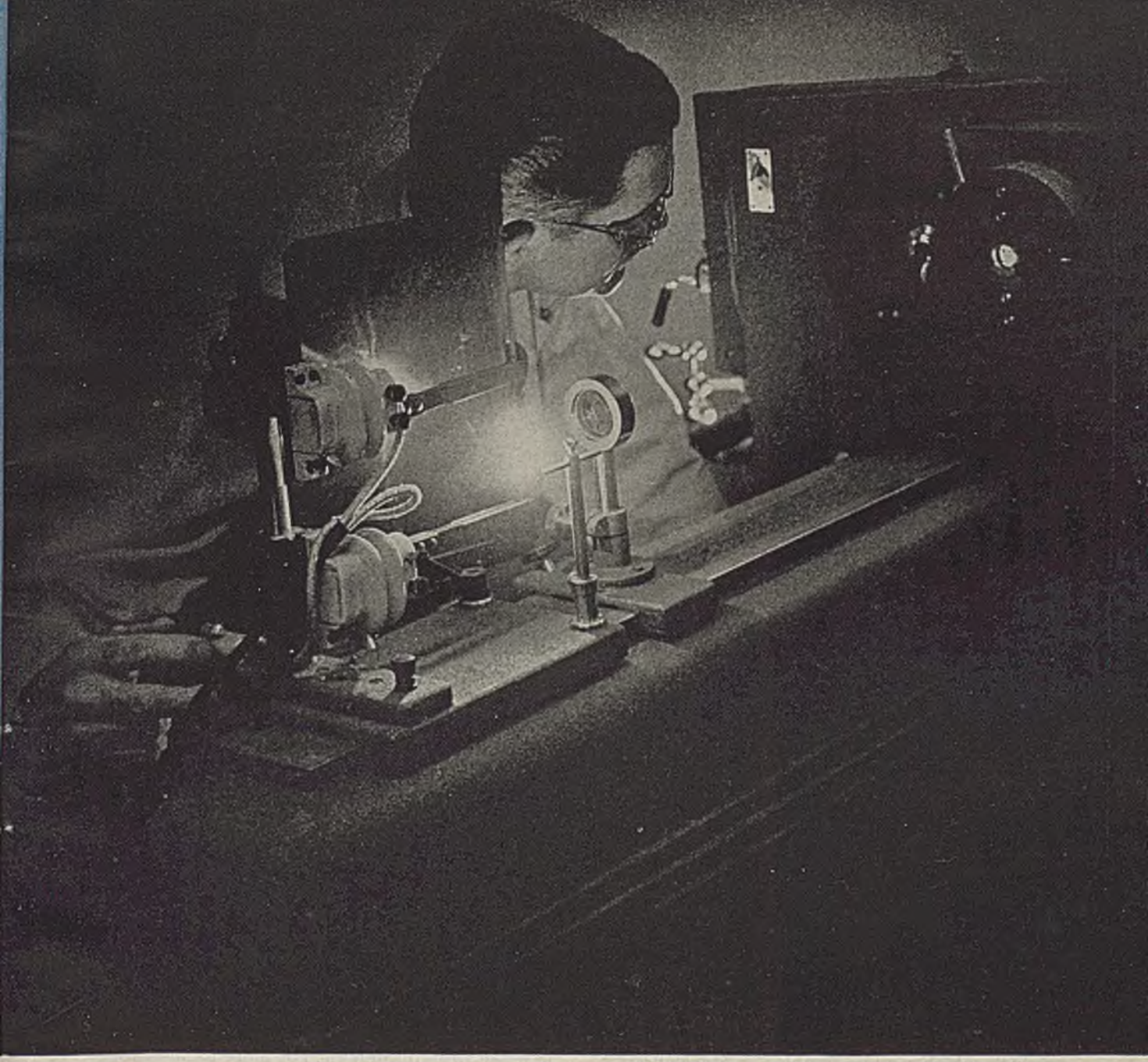
PURE CALCIUM PRODUCTS DIVISION

Address: Painesville, Ohio
Precipitated Calcium Carbonate
Pigments for Paint, Rubber and Paper according to following brands:

Swansdown
Suspenso
Kalite
Non-Fer-Al
Surfex
Paper Grade
Multifex
Kalvan
Millical

DIAMOND ALKALI COMPANY

Pittsburgh, Pa., and everywhere



The Spark that Lights the Flame of Victory

A pinpoint of fighting metal placed in the arc of the spectograph writes its own signature on a photographic plate. Inside the instrument, the light from that flame is broken up by a prism as a prism breaks up sunlight. Each element identifies itself by a series of characteristic lines, always the same for the same basic element. It reveals to the spectrographer each constituent, what impurities are present and in what quantities.

Thus spectrography helps in controlling inspection. It keeps tough fighting steels tough, helps in development of new fighting metals. Spectrography is used too in other fields . . . chemicals, foodstuffs, vitamins. It speeds research, control, and analysis. Today, spectrography is helping to build the tools of Victory as in peacetime it helps to make better cars and better breakfast foods.

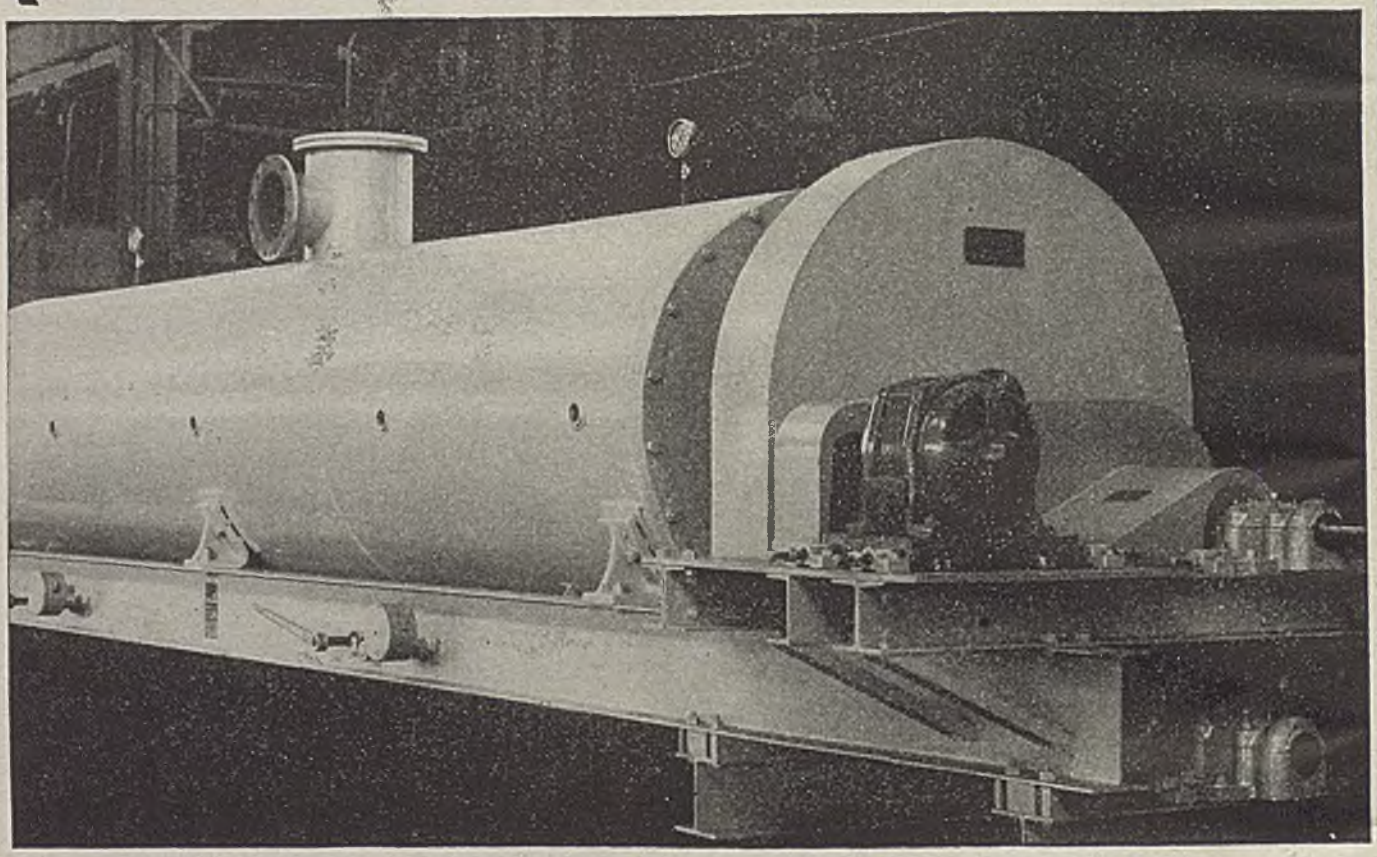
Because Bausch & Lomb had long experience with such precision optical equipment needed in education, research, and industry, it was ready for quantity production of precision optical instruments of war such as gunfire control instruments, binoculars, and aerial photographic lenses. When the last gun is fired, Bausch & Lomb will devote its enlarged experience to peacetime optical production. Through war and peace, Bausch & Lomb has continued . . . and will continue . . . to do the job it knows how to do best. *Here again optical science is seeing it through.*

For Bausch & Lomb Instruments essential to Victory—priorities govern delivery schedules.

BAUSCH & LOMB
OPTICAL CO. • ROCHESTER, N. Y.
ESTABLISHED 1853

AN AMERICAN SCIENTIFIC INSTITUTION PRODUCING OPTICAL GLASS AND INSTRUMENTS FOR MILITARY USE, EDUCATION, RESEARCH, INDUSTRY AND EYESIGHT CORRECTION

Rotary Vacuum Dryers



Reduce Drying Costs • Speed Production

SAVE TIME • LABOR • HEAT • SPACE

For drying dyestuffs, intermediates, reclaimed rubber, powdered or flaked metals and other products which may be tumbled, a Stokes Rotary Vacuum Dryer combines many advantages . . . is a truly versatile piece of equipment.

Conditions are always uniform when drying under vacuum. Overheating, contamination and oxidation are eliminated. Obnoxious gases are controlled. Explosion hazards are minimized. Low-cost heat is utilized. Often various operations such as mixing, drying, and extracting, may be combined.

Stokes engineers and builds both Rotary and Rotating Dryers, in capacities and special metals to meet all requirements. For more than 40 years we pioneered high vacuum methods and developed vacuum processing apparatus, high vacuum pumps, gauges and other auxiliary equipment to make high vacuum operation widely applicable, highly efficient and economical. Consultation is invited.

F. J. STOKES MACHINE COMPANY
5920 Tabor Road Olney P. O. Philadelphia 20, Pa.
Representatives in New York, Chicago, Cincinnati, St. Louis
Pacific Coast Representative • L. H. Butcher Company, Inc.

F.J.Stokes PROCESSING EQUIPMENT FJS Est. 1895

CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902

S. D. KIRKPATRICK, Editor

APRIL, 1944

Darker Days Ahead?

ONE FACT seems to have been overlooked—or its significance underestimated—by President Roosevelt and those in the high command who would rob our war industries of their younger scientists and engineers. They appear to have forgotten the lessons so painfully learned in other emergencies when this nation turned in desperation to these same young men and demanded their help in meeting the rubber crisis, in fighting off the menace of magnetic mines and submarines, in producing millions of barrels of superior aviation fuels and tons of new explosives and bazookas to blast and burn out the enemy strongholds. Because these men in the laboratories and pilot plants of industry performed virtual miracles in research and development is no reason to believe that they have solved all of the problems or produced all of the weapons and materials that are going to be needed to win this war. On the contrary, we could very well lose it by disrupting and destroying the morale and effectiveness of some of the nation's most resourceful defenders—its younger chemists, physicists and chemical engineers.

Secretary Stimson sensed this danger some time ago, but his warnings were ignored by Congress and apparently forgotten by the President and his generals in their threatened raids on the ranks of industry. Mr. Stimson made it clear that we are "approaching the war's most critical and difficult period" and that we shall need "not only increased production but a far more flexible production in order to meet the challenge of new types of weapons with which the enemy will certainly confront us when the invasion of Europe starts." On whom must the nation depend to provide that flexibility in production, to meet that challenge of new weapons with better products and processes for carrying out the emergency projects of the armed forces? All of our past experience in the case of radar, rubber and rockets points to the use of young technologists—men still in their twenties who have been well trained in the most recent scientific advances.

So far in this war we have not heard very much about chemical warfare, but, as General Porter ably points out in this issue, our own C.W.S. has been rendering invaluable services on nearly every battlefront. Furthermore, we know we are prepared to reply in kind to almost any type of chemical attack our enemies would like to try. Yet some of us would feel a lot better about our national security if we knew that our best American chemical brains were worrying less about fighting Washington and more about fighting the dastardly dangerous brains of our chemical enemies in Germany and Japan!

President Roosevelt, we are convinced, has not set out deliberately to aggravate the chemical manpower situation merely to force the passage of a national service act. His reply to Dr. Parsons of the American Chemical Society shows that he recognized the danger to the war effort if Selective Service were permitted "to take from their scientific work" the younger men who "possess special skill, training and qualifications in chemistry, chemical engineering, physics and other scientific fields."

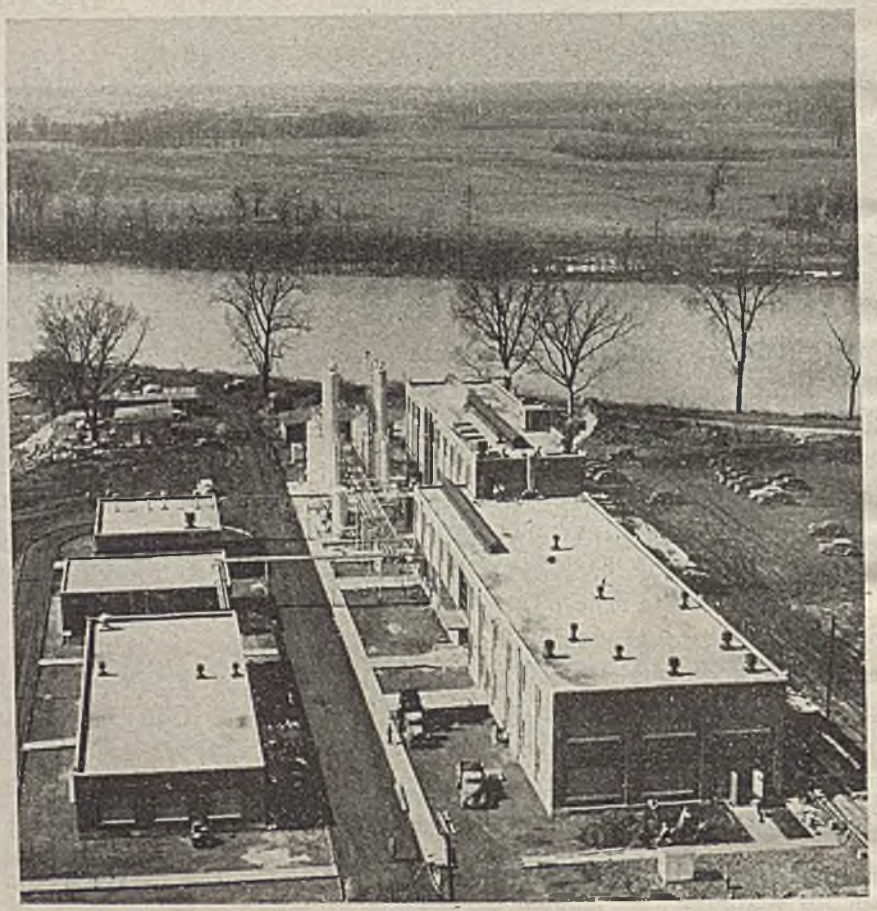
But the President is not a technical man. He is sheltered, perhaps necessarily and properly, against the approach of most technical advisors, at the same time being surrounded by those who are expert in social, political and legal problems. To such men the chemical and engineering professions are just two more pressure groups trying to protect their members from the draft! The only way we can prove that we are not is to convince the heads of the Army and Navy that some 40,000 of our young technologists can better serve their country as the "shock troops of industry" rather than as soldiers and sailors in the field. There may well be dark days ahead for all of us if we disband and discharge our emergency crews just when we are likely to need them most.

JOHN R. CALLAHAM *Assistant Editor, Chemical & Metallurgical Engineering*

PENICILLIN

Large-Scale Production by Deep Fermentation

At Terre Haute, on the banks of the Wabash, the world's largest plant for producing mold-derived penicillin has been in operation for several months. Engineered by E. B. Badger & Sons Co., financed and operated by Commercial Solvents Corp., this unit will process up to ten million gallons of fermentation liquid yearly to recover almost 500 billion units of penicillin. Yet a year's output will barely exceed one ton of dry product or less than one-half ton of pure penicillin. This process tapering, an extremely delicate fermentation, dehydration by high-vacuum sublimation, large-scale operations under the sterile conditions of a surgical operating room: such are some of the problems that were posed and have since been solved. —*Editors*



First large-scale plant in the world to produce penicillin by submerged fermentation is this Commercial Solvents Corp. unit at Terre Haute, Ind.

Out of the holocaust of war there frequently emerge developments that advance civilization by decades and, paradoxically, the science of saving lives often gets a stiff shot in the arm when the battlefields are bloodiest. To the everlasting credit of the sulfa drugs, blood plasma and modern speed, only about two percent of the wounded in this war have been lost as compared to more than seven percent in World War I.

Latest, and undoubtedly stiffest, of these shots is the development of penicillin, that yellow-brown "mold gold" discovered as a metabolic by-product of green *Penicillium notatum* by the Englishman Fleming and further investigated at Oxford by Chain and Florey. Never before in human history has there been developed a drug that could accomplish so much and yet about which so little is known.

Almost as marvelous as the wonder-working properties of penicillin is the utter speed with which its production program has been pushed, having moved from the stages of clinic, laboratory and pilot plant operations into full plant production within a matter of less than a year (see *Chem. & Met.*, pp. 103-105, March, 1944, for a general account of the program).

First full-scale plant in the world to pull into operations is that of the Commercial Solvents Corp. at Terre Haute, Ind., which began production by the submerged fermentation process less than five months after construction work first began. Actually, this firm received authorization from WPB to proceed with engineering and construction on August 2, 1943. The very first engineering discussions, minus a single blueprint, with E. B. Badger & Sons Co. were held on August 5. Actual construction work got under way September 15 and the plant began operations January 30.

On such a schedule, one would expect many a slip 'twixt construction and production. Such has definitely not been the

case, and from first to last the job has been outstandingly sound and successful.

To realize the difficulties involved, just remember: (1) This is the first large plant of its kind in the world, (2) information on the process was highly spotty and lacking in details, (3) research and pilot plant work proceeded simultaneously with construction of the full-scale plant, (4) the extreme urgency of the whole job, (5) the ornery proclivity of the micro-organism to insert variables into the process and to pose practically every known and many of the unknown problems of the entire drug production field, (6) the difficulty of conducting large-scale plant operations under the sanitary conditions of a surgical operating room.

That the plant went into production when it did and has since continued to produce with a minimum of difficulty is a near-miracle in itself. Success has been due, to a very large extent, by the "penicillin-or-bust" spirit in which the entire personnel of E. B. Badger & Sons Co. and of Commercial Solvents Corp. threw themselves into the job.

These men, almost literally, crossed their fingers and founded a cult of penicillin producers—anything not contributing directly to output of this drug was heresy. Commercial Solvents Corp., already in possession of a large staff of fermentation experts, threw half of its entire research and development personnel into the project, where they have remained for the past six months. Credit for the success should, to a large extent, be given to these mycologists, bacteriologists, biochemists, organic and physical chemists, and chemical engineers.

40 BILLION UNITS

Designed capacity of the plant is 40 billion Oxford units monthly. Engineers in charge of operations are conservatively non-committal, but it should cause no surprise if output goes comfortably beyond this goal. An Oxford unit is difficult to visualize,* but suffice it to say that 40 billion units of penicillin-sodium as produced by this plant are sufficient to provide complete treatment of a minimum of about 8,000 and a maximum of about 350,000 patients, depending upon the type and severity of infection.

Poundage-wise, the figures are downright startling. This plant, comprising five complete brick buildings and costing $1,750,000, will process 500,000–800,000 gal. of fermentation liquid every month. Yet the monthly output of dry product will be less than 100 lb! There's probably nothing like it in all the annals of chemical engineering achievement.

Incidentally, in this era of paternalistic pampering it is refreshing to recall that the entire project is being financed by Commercial Solvents Corp.—proof that American private enterprise has lost neither its courage nor its creativeness.

PROCESS OUTLINE

As practised at the Commercial Solvents plant, production of penicillin is divided into five principal steps: (1) submerged fermentation, (2) removal of mycelia and charcoal adsorption of the penicillin, (3) solvent purification and formation of the sodium salt, (4) freezing and high-vacuum drying, (5) packaging, testing and storage.

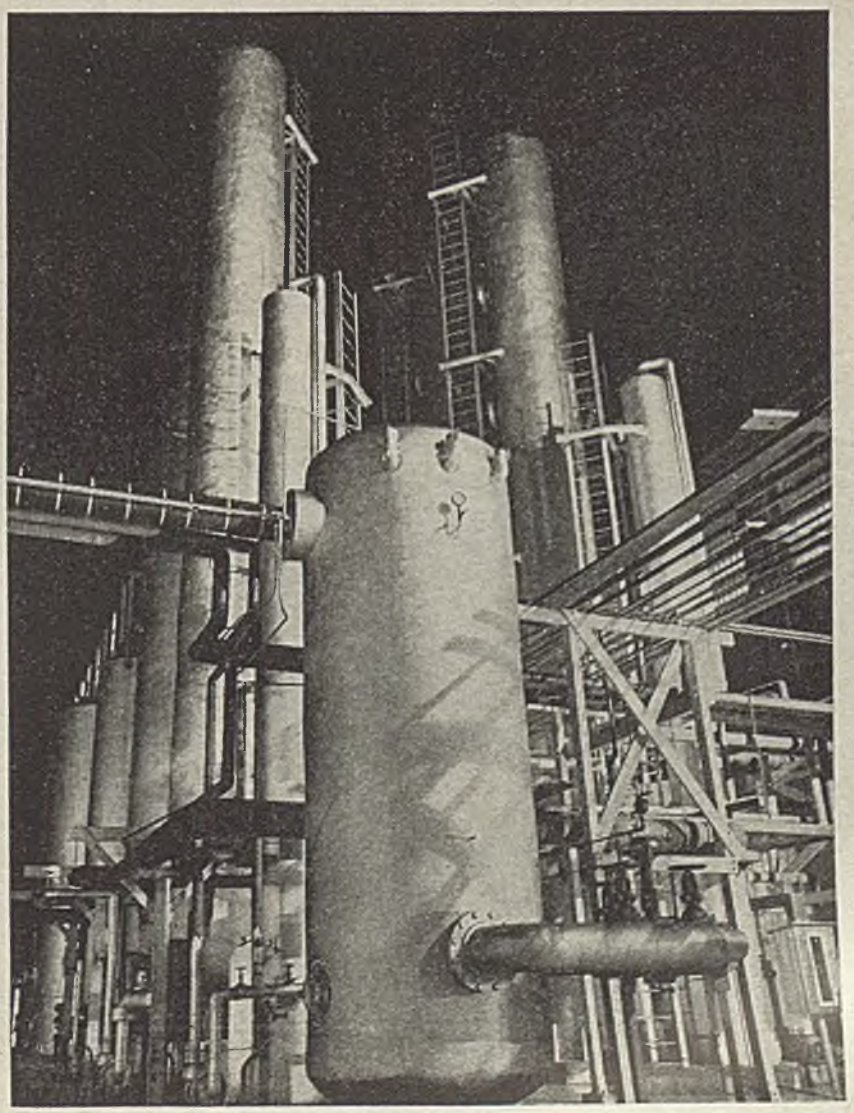
Corn steep liquor, a by-product of the corn refining industry, is received at the process plant, diluted to the proper strength with water, and then lactose up to four percent is added as a nutrient. This aqueous medium is then thoroughly sterilized by cooking with steam.

Just what causes corn steep water to be a superior medium for the fermentation is not known, nor has it yet been definitely proved that liquors from one variety of corn are superior to those from other varieties. Complete sterilization is absolutely necessary, for the slightest contamination with other organisms may inhibit almost completely the formation of penicillin.

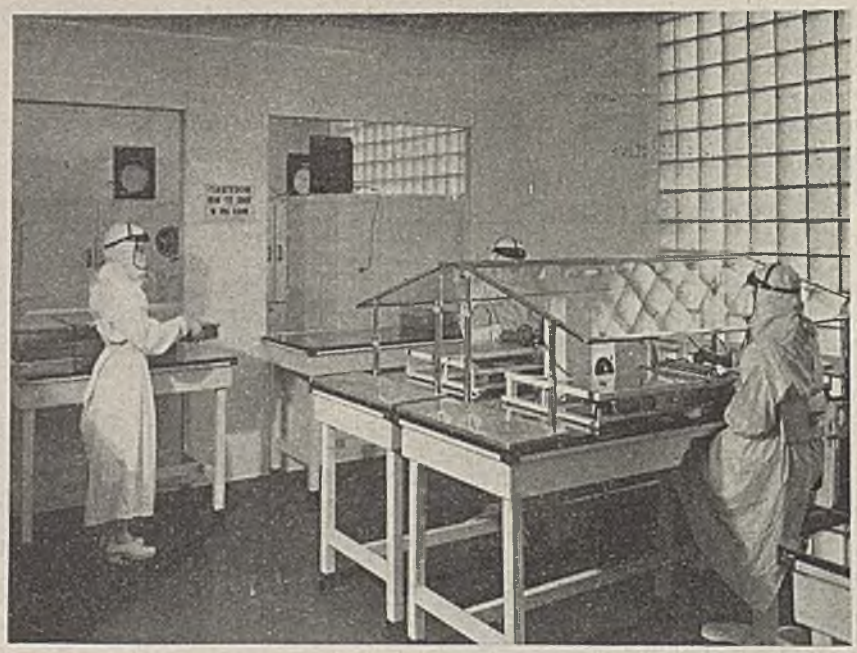
Individual fermenters have a capacity of 12,000 gal. and are constructed of carbon steel. Each fermenter batch is inoculated with a small amount of pure culture of *Penicillium notatum* carefully bred on agar slants in the media laboratory and germinated in seed tanks.

Original cultures were obtained from the U. S. Department of Agriculture Northern Regional Laboratory at Peoria, Ill., where just one of the many strains of this green mold had been carefully isolated and cultivated because of its ability to give higher yields of penicillin. *Penicillium notatum*, incidentally, is frequently found in the soil, but cultures are often obtained from decaying fruit and dairy products. One high-potency culture, for instance, was

Each 12,000-gal. fermentation batch of penicillin must be concentrated to about 15 gal. Amyl acetate solvent is recovered in this equipment



* The Oxford (Florey) unit is defined as "that amount of penicillin which, when dissolved in 50 ml. of meat extract broth, just inhibits completely the growth of the test strain of *Staphylococcus aureus*."



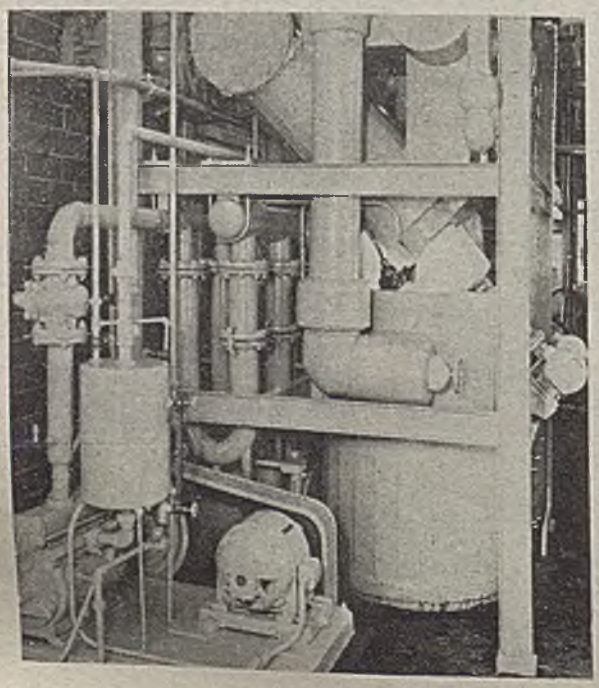
Penicillin-sodium solution is here pipetted into glass vials under sanitary conditions similar to those of a surgical operating room

obtained by the Northern Regional Laboratory from a decayed cantaloupe, another from a bit of cheese.

Mash from the seed tanks is put into the fermenter charge, after which the mold is allowed to grow and produce penicillin until the optimum amount is formed. The fermentation cycle lasts several days. During this time the temperature is carefully held at about 75 deg. F. by circulating cooling water in the jacket. Since the mold is aerobic, sterilized air is blown through the fermentation liquid throughout this period. The method is known as the submerged fermentation or deep tank process. Carbon dioxide is a by-product.

Properly pampered and after about a week's work, this lowliest of molds will thus produce a minute quantity of penicillin. If the cooking is not just right, however, almost anything but penicillin may be obtained. Sometimes the result is simply nothing in particular, especially if a slight bacterial infection occurs. At about 100 deg. F. the mold will not grow at all and below a certain pH level another antibacterial substance, notatin, may be formed at the expense of penicillin. A slight excess of acidity, alkalinity or heat will cause decomposition of the penicillin.

Cold traps and ice receivers are refrigerated to —80 deg. High-vacuum pumps are at the left



The 12,000-gal. fermented charge, containing large amounts of mycelia and a trace of penicillin, is dropped to one of three standard, open-type centrifugals having 48-in. stainless steel baskets. Here the mycelia are filtered off and discarded. Although the beer is exposed to the air in this operation, the chances for contamination are very small because of the speed of filtering.

Filtered beer, very slightly alkaline, is sent by a centrifugal pump into a closed, side-agitated carbon stainless steel adsorption tank where it agitated for a period of 15 minutes with approximately 2-2.5 percent activated carbon. Penicillin and certain other constituents are adsorbed on the charcoal. This operation must not be unnecessarily prolonged, else loss of penicillin will become excessive.

Carbon beer slurry is pumped to a battery of three standard design centrifugals having 48-in. stainless steel baskets. The filtrate is discarded to the sewer, while the carbon-penicillin is quickly dropped by gravity into one of two steel elution tanks provided with cone bottoms and side agitators.

SOLVENT PURIFICATION

Purification of the crude penicillin, which begins at this phase, is accomplished by a series of operations using organic solvents: (1) extraction of the penicillin from the activated charcoal and removal of the charcoal; (2) partial removal of impurities by a solvent-solvent treatment of the penicillin concentrate, together with a pH adjustment with acid; (3) separation of the solvents and a second treatment of the extract with a sodium salt and buffered phosphate; (4) separation and recovery of the solvents by distillation; (5) filtration of the aqueous solution of penicillin-sodium prior to filling operations. Sequence of these steps is shown in the flowsheet given on pp. 130-133 of this issue.

Equipment used in the solvent purification consists of small glass-lined, side-agitated tanks, whereas equipment up to this point has been mostly carbon stainless steel. The principal solvent is amyl acetate, although other organic solvents are also used.

A small amount of infusorial earth is used as a filter aid in removing the eluted charcoal. The centrifuges used for this purpose are of standard, vapor-proof design with 48-in. stainless steel baskets. Spent charcoal is discharged by means of a screw conveyor.

In the first solvent-solvent extraction of the penicillin concentrate, a small amount of an inorganic acid is added to adjust the pH. The emulsion from this operation is put through a super-centrifuge with a 6-in. stainless steel bowl revolving at about 15,000 r.p.m. The raffinate, containing some of the impurities, is distilled in standard type equipment at about 100 mm. pressure. Solvent from the charcoal elution amounts to about 250 gal., but volumes decrease progressively to about 15 gal. at the final extraction.

In the second solvent extractor, aqueous sodium bicarbonate and a buffered phosphate are added from a small feed tank. The penicillin reacts readily and completely to form a sodium salt, very soluble in water, which is put through a second super-centrifuge similar to that already described. The solvent is sent to a recovery still and purified for reuse in the conventional way.

Dissolved penicillin-sodium from the

final extraction is blown through a Seitz type biological plate-and-frame filter of stainless steel construction, where 24 special paper matte plates about 7 in. square remove any bacteria and pyrogens (fever-producing substances) that may still be present. This operation, which takes only a matter of a few minutes, is carried out in a sterile area and the filtrate is received in a sterilized stainless steel container of about 15-gal. capacity known as the "final bulk container."

To visualize some of the unusual problems encountered in these purification steps, just recall that each 12,000-gal. fermentation batch must be concentrated by solvent extraction to 15 gal. of penicillin-sodium solution which, after drying, will yield approximately 4.5-5.5 lb. of dry product.

PENICILLIN PARADISE

At this point the penicillin concentrate enters the sterile area of the plant. In fact, the operations of pyrogen filtration, bottle washing and sterilizing, filling, freezing, high vacuum dehydration, bottle capping, labeling and packaging are all conducted under the most sterile conditions imaginable in order to avoid all possibility of product contamination.

This sterile area comprises eight separate rooms having a cubical content of 30,000 cu.ft. Included is a super-sterile core of six rooms in which filling, capping and similar operations are carried out. All these rooms are air-conditioned, after which the air is sterilized. In addition, banks of about 250 germ-killing ultra-violet lamps are scattered throughout the area, making this the largest installation of its kind in the world.

All persons entering the super-sterile area must first go into a sterile lock and pass between a dense curtain of ultra-violet rays, wash their hands with surgical soap, and change their clothes for sterilized gowns, gloves, shoes and masks that must not leave the area. The masks are worn to prevent the possibility of oral contamination while the transparent plastic shields prevent injury to the eyes by ultra-violet light. To top these precautions, all filling, stoppering and capping operations are carried out under glass shields and sequences have been so arranged that the open filled bottles are exposed to the sterilized atmosphere only for a matter of seconds.

So thoroughly have the engineers at Commercial Solvents done this job that positively no known source of conceivable contamination has been overlooked. Light switches, which might collect dust, are eliminated and elbow hooks have been substituted for door knobs. Inside walls, all of which are of architectural glass, are washed down weekly with an antiseptic solution. This corner of Indiana is not only the largest sterile area in the world but, in addition, is probably one of the most aseptic.

FILLING OPERATIONS

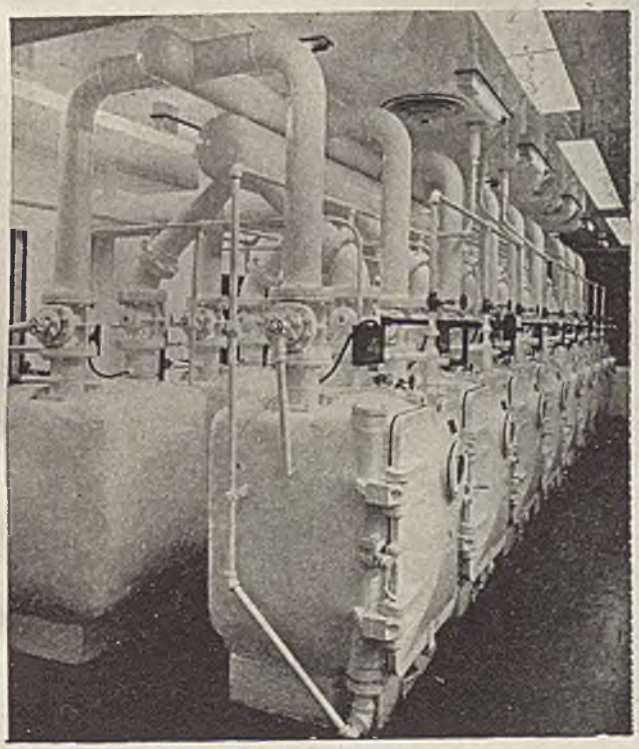
Filtrate from the biological filter, constituting the "final bulk" lot, is fed to two filling machines which draw out the aqueous penicillin-sodium and automatically pipette a given quantity into the previously sterilized bottles. Pyrogen-free distilled water is used in washing all bottles and for the product dilution. This filling operation is carried out in one of the super-sterile rooms under a glass plate, and the trays are so arranged that only one row of vials are exposed to the atmosphere at any one time. Actually, the filling operation is so rapid that the bottles are exposed for only about five seconds!

These bottles, which are the final containers, have a capacity of 22 c.c., but only approximately 5 c.c. of solution are injected. The excess capacity is to allow solution of the dry product right in the bottle at the time of use in the field. The filling rate is some 50-60 bottles per minute, and the accuracy of the amount pipetted is within 0.05 c.c. At this stage the solution contains about 20,000 Oxford units per c.c., so that each vial contains a total of about 100,000 units.

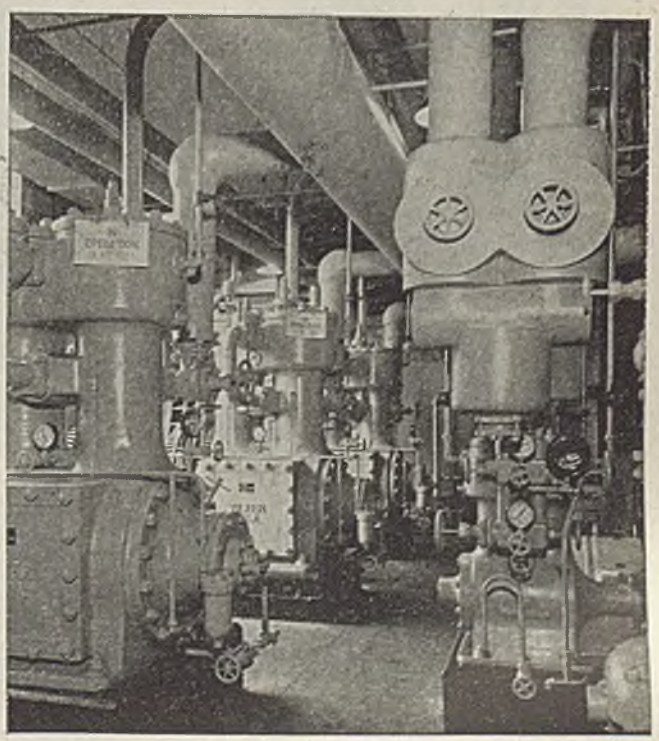
The covered copper trays of filled bottles are quickly carried into another super-sterile room and placed in a freezer. All operators working in this cold area wear ski suits. Incidentally, a total of about 375 tons of ammonia-system refrigeration are required for air-conditioning, storing and cold processing operations throughout the plant. After being frozen at a low temperature,

For an illustrated flowsheet of Commercial Solvent's submerged fermentation production of penicillin, refer to pp. 130-133, this issue.

In these dryers, penicillin-sodium is dehydrated by low-temperature, high-vacuum sublimation



A total of about 375 tons of ammonia refrigeration are required for cold processing and storage



the trays are quickly placed in the dryers and dehydrated at very low pressure.

SUBLIMATION DRYING

One of the most interesting parts of this extraordinary plant is the high-vacuum drying equipment. Penicillin-sodium is so unstable to heat that dehydration must be accomplished in the frozen state. In other words, the ice must be evaporated directly without going through the liquid phase. This is accomplished by the use of high-vacuum diffusion pumps similar to those now used in producing magnesium by the ferrosilicon process. For a discussion of the principles and applications of these pumps, see *Chem. & Met.*, pp. 102-105, October, and pp. 136-138, November, 1943.

Drying equipment at the Commercial Solvents unit consists of a battery of 15 standard-design dryers, each of which holds 12 trays or about 1,200 individual vials of penicillin solution. Dehydration to less than about 1-2 percent moisture is accomplished within a few hours.

After the trays of uncovered bottles are placed in the dryers, the system is evacuated down to about 300 microns within five minutes by means of single-stage mechanical pumps of the oil-sealed rotary type. These four "roughing" mechanical vacuum pumps are tied in by a common manifold to all the dryers.

After this rough evacuation, the dryers are connected to the high-vacuum manifold serving the diffusion pumps. These, operated so as to reduce the pressure further until dehydration is accomplished, exert a pull of about 10 tons on the dryer doors. Each dryer is equipped with a McLeod gage.

Vapors leaving the high-vacuum manifold go through a pair of cold traps or low-temperature condensers in parallel. These are jacketed steel cylindrical chambers set at an angle, provided with revolving scrapers, and refrigerated with ammonia to about —80 to —90 deg. F. Ice that collects on the walls is scraped off and falls into an ice receiver at the same temperature. These cold condensers relieve the strain on the diffusion pumps.

Anyone failing to understand just why these cold traps are necessary can get a stiff mental workout by calculating the volume to which one pound of ice will expand when vaporized at such extremely low pressures.

A total of four condensers, two ice receivers, and eight diffusion pumps are able to take care of the entire battery of dryers. The diffusion pumps consist of 4-in. diameter units of a multi-jet design and built of welded steel. Chlorinated hydrocarbons, having a lower vapor pressure than mercury, are used as the pumping fluid and are condensed on the walls of the pumps and reused. These diffusion pumps discharge to four oil-sealed, rotary high-vacuum pumps which compress the exhausted gas to atmospheric pressure and discharge it, thus enabling the diffusion pumps to take hold.

An important feature of the backing-up pumps is the oil purification system that continuously recirculates all sealing oil to remove condensed water and other contamination. Otherwise, these would flash back into the system and raise the fore-pressure to a point where the diffusion pumps could not operate.

Standard pipe has been used throughout in the manifold and high-vacuum systems. Welding and the making of joints, however, had to be done with the utmost care to avoid pin-hole leaks. The welding job at this plant was so perfect that not a single leak has ever been traced to this source.

CAPPING AND PACKING

After the penicillin-sodium has been dehydrated it is removed from the dryers into a small super-sterile room where rubber stoppers are inserted into the vials by the use of tweezers. This operation is carried out under a glass shield. Then an aluminum cover is crimped on by machine and a dust cap added, after which the product is ready for labeling and final packaging.

Looking down the packaging room, with its miniature conveyor belt, into the glass-enclosed capping room with its white-gowned operators, one gets the impression that here is a unique cross between a surgical operating room and an assembly line—actually nearer the truth than a comparison.

For the time being, practically all the penicillin produced is sent to the armed forces. Final specifications for packaging have not yet been issued, but tentative specifications for the services require five 100,000-unit vials for each partitioned box, ten of these per corrugated carton, and six such cartons per waterproof wooden shipping case.

Dry product, amorphous and yellow-brown in color, contains 1-2 percent water and 20-30 percent sodium salt of penicillin, the remaining 70-80 percent being principally unknown but harmless organic substances. Yet so potent is the substance that it still assays approximately 500 Oxford units per mg.

From the packaging line the product is sent to a cold storage room where at present it is kept at approximately 40 deg. F. for a period of about three weeks. This is necessary since the sterility test on a batch requires about two weeks for completion.

Toxicity tests on each lot are made on white mice and pyrogen tests on rabbits of the New Zealand white variety, selected because of the ease with which the veins of their ears can be found for injections. One entire brick building is devoted to the care and testing with these animals, of which there are 1,000 white rabbits and 2,000 white mice.

Conveyor system for final labeling and packaging operations, with vial stoppering in a super-sterile room in the background

WALTER F. HUPPKE *Chemical Engineering Consultant, Quito, Ecuador*

LATIN AMERICA

Land of Engineering Opportunities

Are you considering Latin America as a field in which to establish yourself when the war is over? If so, you will be interested in what the author has to say about the opportunities for young chemical engineers in the countries to the south. He writes with the authority of an American chemical engineer who became interested several years ago in Latin America and settled in Ecuador. Now he is a consultant for that government, and for private process industries in Ecuador and the U. S.—*Editors*

So you think you want to go to South America? Your first move should be to study the Enclyclopedia Britannica or similar sources, such as "The Migration of Industry to South America," by D. M. Phelps, in order to get a general idea about the customs, raw materials, industries and climate of each country, even those which seem to be of little attraction. You can then tentatively decide which locality interests you most. Travel and exploration books are, for the most part, a waste of time.

Next start learning Spanish, or Portugese if Brazil appeals to you. South American Spanish differs from the Castilian, usually taught in the United States, only in minor details. It should cost almost nothing to learn Spanish if you go at it with determination. There are several good practical books for Spanish self-taught, but it will help to go to a class and accustom your ears to the new sounds. In this way you will gain only a fair conversational ability, but improvement will come quickly once you live among the Latin American people. The important thing now is to learn to read and understand their newspapers. You will be surprised how easy it is to learn this language.

Now make a more detailed study of the industries and raw materials of the country you have selected. Statistics can usually be obtained from U. S. Department of Commerce reports or from commercial attaches. A good book on this subject is "Pan-American Economics," by Olsen and Hickman.

This is the time to start building up your contacts with people or concerns doing business in the region of your choice. If you live in any of our big commercial cities you can find some of the larger firms which send engineers or representatives to South America. These men have first-hand information and they are usually glad to discuss their experiences. Although government employees can be helpful, more practical information can usually be obtained from business men.

FOUR WAYS OF GOING

There are, broadly speaking, four ways you can become established in South America: (1) As a salaried employee of some large American concern. (2) As an employee of some Latin American government or business firm, (3) As a dealer or representative of an American manufacturer of chemicals, drugs, machinery or equipment. (4) "On your own" as a small manufacturer, consultant, or perhaps as a chemurgic farmer.

Advantages of going as an employee of an American concern are obvious—you will need little personal capital and will have an assured income. Usually the men who travel for large concerns can give good leads as to new projects in their territory.

Most firms require a contract covering from one to three years. They will pay your traveling expenses and after a certain time, will probably give you a two or three-months' leave in the United States, with traveling expenses paid. Starting salaries are usually a little higher than the corresponding base in the United States and you may have an opportunity to live in a company house. If you do not expect too many luxuries, you can save money in South American better than in this country.

Large-scale industrial projects are now under way in Argentina, Brazil and Mexico. Some of these need men with specialized experience as consultants or as engineers to supervise the design and construction of new equipment or of entire plants. The nearest consulate of these countries will be glad to tell you of new projects and proper persons to contact.

Some Representative American Firms with Latin American Operations

Firm	Country
American Viscose Co.	Brazil
Anaconda Copper Mining Co.	Chile
Armour & Co.	Brazil, Uruguay, Argentina
Colgate-Palmolive-Peet Co.	Argentina, Brazil
Consolidated Chemical Industries	Argentina
Corn Products Refining Co.	Brazil, Argentina
E. I. du Pont de Nemours & Co.	Chile, Argentina
Ford Rubber Co.	Brazil
Firestone Tire & Rubber Co.	Argentina
General Tire & Rubber Co.	Mexico
Goodyear Tire & Rubber Co.	Argentina
International Cement Corp.	Uruguay, Argentina, Brazil
International Printing Ink Corp.	Argentina
Johnson & Johnson	Argentina
Lambert Pharmacal Co.	Argentina
Lehn & Fink Co.	Argentina
Monsanto Chemical Co.	Brazil
Parke, Davis & Co.	Chile, Brazil, Argentina
Standard Oil Co.	Argentina, Chile

It is well to remember that preference is usually given to citizens of the particular country. Latin American universities are improving rapidly and are turning out technical men, although in the case of the engineering profession, their graduates, though very well trained in theoretical engineering, do not have the opportunities for training in applied engineering. For this reason, you are more likely to succeed if you are a specialist in some definite

field and are capable of training their engineers in your skill.

Do not get the idea that all Latin American projects are crude and on a small scale. The contrary is quite often the case and some South American tire factories, steel mills, chemical works and paper mills are more modern than the best in this country.

These are recent developments and the latest and best equipment is being installed from the ground up. In contrast, most of our heavy industry has been in operation for years, with improvements being made from time to time but no completely new units being installed. New building projects, such as are found in Sao Paulo, Rio de Janeiro and Buenos Aires, are usually more beautiful and modern than our best.

It is only when you see these strange contrasts, the ultra-modern and the primitive, that you can appreciate the tremendous opportunities in all of Latin America. It is certain that these countries are going to modernize rapidly. If we are not on the job to do it, somebody else most certainly will.

As a dealer or representative of a manufacturer of chemicals, drugs, machinery or equipment, you will need a certain amount of your own capital and a good knowledge of local market conditions. In the equipment or machinery line, you should have the ability to maintain a good servicing and repair department. Skilled workmen or mechanics are usually not available. You will also find it necessary to have a knowledge of local business laws, finance and customs. Most important of all, you should be able to mix with the townspeople and become well liked.

OUR NEW FRONTIER

The prospect of having an independent business "on one's own" is intriguing to many red-blooded Americans. In this respect, South America is one huge, undeveloped frontier more or less like our western states in the nineteenth century. We still have the frontier of South America available to people with the same spirit as our forefathers who developed the West.

However, because of modern science and transportation, most of the hardships our forefathers endured are now either non-existent or greatly minimized. But, there is still the land to be had for the work of developing it, and innumerable opportunities for small businesses to be established. It will be a big job to provide Latin America with the comforts of civilization such as are available in the United States, but it is a job requiring technically trained men with plenty of resourcefulness.

In the past, it has largely been Europeans who have pioneered in Latin America, and after the war there will be doubtless be another great exodus of people from Europe to that continent. These will be mostly skilled workmen, farmers or technical men with initiatives and resourcefulness, but accustomed to hard work and fairly low wages. They will learn the new language rapidly, settle down and make homes there. Characteristically, they will always remember their homeland and will send their trade in that direction, not to the United States. Isn't this a challenge to enterprising young Americans?

You should be able to live comfortably in Latin America on considerably less money than would be required in the United States. True, you cannot expect all the comforts obtainable in this country. However, this has its compensations, for when these do come you will appreciate them much more. Furthermore when the new things come to Latin America the entire layout will be ultra-modern, not just renovated or locally reconstructed.

CLIMATE

As much of the entire continent of South America lies in the tropics, you can expect the climate to be warm. However, for the most part these tropics are not sultry or debiliating. In fact, there are very few places as uncomfortable as it can get around New York, Washington or New Orleans.

Both altitude and location have a profound effect on the climate. If you are up only 2,000-3,000 ft., the temperature is likely to be quite mild. At 6,000-10,000 ft., as in most of Colombia, Ecuador and Peru, it is decidedly chilly, particularly in the evening. In Quito, Ecuador, right under the equator, it is usually necessary to have a fire every evening.

On the west coast, as far north as Colombia, the climate is milder than one might expect due to the cold Humbolt Antarctic current which bathes these shores and sweeps out to sea at Ecuador. Consequently, the climate on the seacoast is mild and pleasant all the year round.

How much capital is required to get a start in Latin America? The answer lies mostly in your own resourcefulness and the type of project you intend to develop. Most countries require a small amount of money in the bank or a return trip ticket to the United States before you will be admitted. Travel in South America is now done largely by air and a one-way ticket from the United States will cost $200 — $400. It is not much cheaper by boat.

Extraction of some of the essential oils from native plants has good possibilities. Edible oils are usually more expensive in South America than in the United States although the coconut and other raw materials are exported. A well-managed oil pressing plant or soap factory is always a good business.

Most farming is still done in crude fashion, and improved high-yielding varieties of fruits and vegetables are not very common. After the war, many of the tropical fruits can be dried or concentrated and shipped to the United States.

In spite of the ease with which plants grow, most countries in South America are not self-sufficient in the ordinary foodstuffs. Canning tomatoes for local trade, for instance, is usually a good business and a chemical engineer is well qualified to make a success of such an enterprise.

In many cities located in the Andes, fuel is scarce and expensive. Wood is the usual fuel and, because the native forests in the high mountains have been depleted near the more densely populated areas, it must be hauled some distance. There are deposits of semi-bituminous coal in most of these regions, but this material is too friable to be used as domestic fuel. A good fuel briquette is badly needed.

Structural materials for homes and small buildings consist of mud coated with white wash, and, although some of the buildings have stood for centuries, this material could be improved by the addition of asphalt emulsions, with local deposits of asphalt as the source of supply. There is a great oportunity for constructing modern and efficient low-cost homes, but the builder must be resourceful with the materials at hand and must know how to get along with his laborers.

In setting up a new project, you are not likely to be bothered unduly with transportation problems if you plan well in advance and keep on hand a good and varied stock of supplies. Most countries allow the importation of machinery and equipment for new industries on a duty-free basis. In fact, they may make extensive concessions to encourage such industries, such as granting free land and freedom from taxation for a time.

One of the most difficult problems is likely to be that of obtaining skilled workmen. For the most part, the natives have never seen modern machinery or production methods and they must either be trained from scratch or skilled personnel imported.

Many people hesitate to invest in South American businesses because they think the governments are too unstable and that security is lacking. There are occasional political upheavals in some of the countries, but these are unlikely to have any effect on private business if it is properly conducted. New businesses, however, should always make it a policy to take on the maximum local labor and operate in such a manner that the economy of the country is benefited: Even in the case of a small enterprise, it is wise to have some well liked local people as partners or members of the firm and to operate under a national title in order to avoid being conspicuously foreign.

In the United States there are many people with the same or better training

(Continued on page 105)

R. O. E. DAVIS U. S. Department of Agriculture, Beltsville, Md.

AMMONIUM NITRATE

Hazards in Handling as a Fertilizer

As a result of the conversion of war plants, large amounts of ammonium nitrate are being used as fertilizer, both directly and as an ingredient in mixed fertilizers. Hazards involved are outlined here.—*Editors*

AMMONIUM NITRATE is employed as a high explosive but requires a high velocity detonator in sufficient quantity to energize the mass. This material, under favorable conditions of pressure, rapid heating and retention of heat, may be exploded partially from heat alone at 207 deg. C. to 350 deg. C., or completely above 350 deg. C; but workers have failed to find any instance of explosion in ordinary containers or in bulk when involved in large conflagrations of buildings or cargo vessels.

Explosion by impact or friction is difficult and requires favorable conditions obtained by design. Sensitivity is decreased by presence of alkalis and alkaline earths, and increased by presence of acid, such as nitric formed in decomposition of ammonium nitrate at moderately low temperature. Ammonium nitrate-sulphate mixture in 50/50 proportion has given negative results in falling weight, friction and detonation tests, as was true also of mixtures with other ammonium salts and with superphosphate.

Explosibility is decreased by the presence of inert, non-oxidizable materials. An explosion tends not to be propagated throughout the mass unless energized from without. Thermal decomposition of ammonium nitrate, beginning below 100 deg. C., is endothermic, and not until the temperature of the decomposing salt reaches about 260 to 350 deg. C. does the reaction become sufficiently exothermic to produce heat in excess of that absorbed by adjacent quantities of decomposing salt. Below this the explosive wave is not propagated.

Larger grains or spherical granules tend to decrease the explosibility of ammonium nitrate, as well as of other explosives. Ammonium nitrate is not considered explosive under transportation and storage conditions, when it is stored in wooden receptacles or paper bags by itself and apart from other explosive substances.

Ammonium nitrate offers much the same fire hazard as sodium nitrate, that is, mostly an indirect hazard, from the liberation of oxygen at moderately high temperatures which tends to increase the intensity and spread of a fire.

The presence of 5 percent aluminum, iron or zinc powder does not increase its flammability appreciably. Experiments with 5 percent charcoal produced no burning by direct contact with a flame but with 11 percent charcoal it burned with very small flame. With 5 percent wood powder decomposition occurred without flame. With addition of paraffin up to 30 percent, heating on a steel plate caused fuming and decomposition, and a small flame in one test at 300 deg. C.

Bags impregnated with nitrate-sulphate 40/60 are no more combustible than ordinary burlap bags. Strips of paper and burlap impregnated with ammonium nitrate and sodium nitrate are more combustible than untreated fabric, but both nitrates increase combustibility to about the same extent. Impregnated wood, paper or fabric is more difficult to ignite than these materials alone, but after ignition, burning is more intense due to oxidation by ammonium nitrate. Copper is the only common metal that reacts appreciably with molten ammonium nitrate producing nitrite, less stable than nitrate, and increasing the tendency to violent conflagration or explosion.

RECOMMENDATIONS

Ammonium nitrate, untreated or treated, should be stored in a dry location, preferably fireproof, but in any event, away from combustible material. Laminated, waterproofed, paper or fabric bags may be used for packaging, and filling bags should be stacked to allow reasonable ventilation. Combustible materials or easily oxidized metals, especially copper, if finely divided, should not be stored nearby, as a preventive measure against accidental mixing with ammonium nitrate.

Ammonium nitrate should not be stored in bulk unless in a form definitely known not to cake in the time it will be stored. Bulk storage is often likely to result in severe caking, making it difficult to handle without blasting.

Caked ammonium nitrate should never be broken up by blasting with explosives. Caked material may be broken up mechanically, however, without apparent danger of detonation.

Commercial fertilizer mixtures containing ammonium nitrate require no special precautions, and may be handled in the same way as similar mixtures with sodium nitrate in them. It requires the presence of over 50 percent of ammonium nitrate with ammonium sulphate to make the mixture explosive under violent shock tests.

Bags that have contained ammonium nitrate should not be piled even temporarily in or near wooden buildings, as they are inflammable. Paper bags should be burned promptly after emptying. Fabric bags may be saved for other use if repeatedly soaked with water and drained until no evidence of salt shows on drying.

Bearing in mind that ammonium nitrate is explosive and supports combustion, it should be handled to avoid conditions that would make it dangerous. Ordinary caution should be practiced along the lines indicated, but no violent reactions need be anticipated from impacts, jars or friction as with more sensitive explosives.

Should ammonium nitrate be involved in a burning building or in a fire with other combustible material, ordinary fire-fighting methods should be used for extinguishing it. Water is generally the most convenient and effective. It will exert its usual cooling effect, and no reaction with ammonium nitrate is involved that will create noxious gases or increase conflagration. Fumes from burning ammonium nitrate should not be inhaled.

* From a report by Agricultural Research Administration; Division of Soil and Fertilizer Investigations; Bureau of Plant Industry, Soils and Agricultural Engineering; Beltsville, Maryland.

WILLIAM N. PORTER *Major General, Chief, Chemical Warfare Service, Washington, D. C.*

CWS Is in There Fighting

In the public mind the Chemical Warfare Service is associated primarily with military gases. This is but partly true. During this war CWS officers and men have not been sitting down in Edgewood waiting for the enemy to start using poisons on us. Instead, this valuable branch of our army has had its representatives on all fronts using with deadly effectiveness its own weapons — smoke generators, flame throwers and the lavishly praised 4.2 mortar.—*Editors*

It is high time for everybody to realize that the Chemical Warfare Service is in the thick of this world conflict. We are active with men and material in all theaters, from the beachhead in Italy to the jumping off place for bombing flights over Germany, and from Burma to those Pacific islands now being liberated. In fact, wherever American troops are fighting—on the ground, in the air, and even on the sea—will be found chemical warfare items and personnel trained to use them. The growing number of commendations and citations not only attest to the proved valor of officers and men of this Service in the field but also pay tribute to the chemical warfare material that flows to them from home. Reports from overseas contain high commendation for both the chemical soldier and equipment.

The effective combination of Chemical Warfare Service men and material is reflected in the notable record of achievement being chalked up for the 4.2 chemical mortar. This rifled weapon was evolved, is made, and is used by CWS personnel. Originally developed in 1924 to lob gas shells, an improved model made its battle debut on July 10, 1943, landing with the first assault waves on Sicily as a smoke and high explosive projector.

Dubbed the "goon" gun by members of a Chemical Warfare Battalion in that theatre, this mortar is more portable, quicker firing and handles larger loads than other comparable weapons. It can be moved speedily to places inaccessible to field guns, and has remarkable accuracy against tanks and machine-gun nests. The chemical mortar is, in effect, a modern two-edged sword. It can first smoke the enemy out of the ground amid a shower of burning phosphorus and then, with the same deadliness, blast men and vehicles in the open with high explosive. Also, it can create a smoke screen to provide "modern armor" for land and amphibious operations.

The Second Chemical Weapons Battalion was in constant action with this weapon during the entire 38 days of the Sicilian campaign and has continued in the line since Salerno. This battalion distinguished itself "by its immediate availability for, and its efficient accomplishment of, every smoke and other mission it was called upon to fire," said an official division and corps citation, which added: "Your record during these days will be an inspiration to all Americans. Your success can be attributed to high standards of individual organization and skill." Lt. Col. Robert W. Breaks, of Crawfordsville, Ind., who commanded the battalion at the age of 30, now wears the Purple Heart.

Numerous officers with chemical mortar battalions in Europe have received Silver Stars for gallantry in action. First Lt. Ralph T. Rankin, 28, of Oklahoma City, Okla., braved heavy German artillery shelling to direct the fire of his goon gun on a German self-propelled cannon, and his crew also broke up an attack of a German battalion, and fired smoke to protect raiding Rangers. Capt. Lowell E. Thompson, of Fort Worth, Tex., exposed himself to heavy fire in order to adjust a smoke screen that helped two infantry battalions escape encirclement. A chemical engineer by profession, and a graduate of the University of San Francisco, First Lt. George P. Baglietto received battlefield promotion for bravery.

The goon gun made such an impression on the enemy that curious prisoners asked to see the "automatic howitzer" or secret weapon that blew them out of their foxholes. "That its accurate fire has been an important factor in our success is borne out by the statements of enemy prisoners," read a citation received by a Chemical Battalion, whose ability to carry on for four straight months of continuous action "is a credit to every officer and man in the organization."

The chemical mortar has ripped concrete pillboxes, halftracks, fortified houses, tanks, infantry concentrations, machine gun nests and artillery positions. A squad from a battalion commanded by Maj. William S. Hutchinson, Jr., chased an enemy patrol with 4.2 shells from gully to gully and finally to a haystack where a final volley landed right in their midst. One mortar company, when no artillery was available, took on a battery of German 88's in Italy and wiped them out with only 12 rounds. Another mortar unit dropped a round of high explosives in the open turret of a German tank for a hole-in-one. One company knocked out two Mark VI Tiger tanks and four German halftracks in the toughest kind of fighting. Another time, a machine gun nest was burned out by igniting a wheat field with incendiary shell.

On the other side of the world, a mortar battalion commanded by Lt. Col. William H. Shimonek, 37, of Laurium, Mich., drove the Japs from their dugouts in the Solomon Islands with such dispatch that captured prisoners contended that they had felt secure until the fast-shooting "stovepipes" came along. The goon guns also removed Japs from their jungle strongholds on Arundel Island, off New Georgia; blasted a Jap airfield thousands of yards away on another island, and saw heavy duty on Bougainville.

Smokescreens constitute a major part of the goon gun's work. The white phosphorus which it shoots reacts with the air to form clouds of artificial fog. These mortars helped hide the Volturno River crossing and maintained another screen for several hours along a two-mile front to cover a division advance. In Sicily a thousand-yard smoke screen was continued for 14 hours, being lifted occasionally to per-

mit dive bombing by Allied planes. On occasion, smoke screens were laid down around German tanks to impede their fire. And also to shroud enemy positions so that the Infantry could take the latter at bayonet point.

The Chemical Warfare Service also provides other apparatus and ingredients, and in many cases the operating troops, to obscure movements and bases. Smoke made by this Service covered American troop landings and protected shipping and harbors in North African, Italian and Pacific operations, thereby saving lives.

The CWS mechanical smoke generator, which was nonexistent five months before the invasion of North Africa, has furnished the sky blankets which have rendered enemy aerial bombings of port facilities ineffective. Area smoke screening in North Africa was so successful that not a single harbor so protected suffered any real damage from the air.

When our "smoke gets in their eyes," the foe can't see to bomb with precision. On one occasion an enemy airman was heard to radio back to base that he couldn't find the target because of "that damned smoke." At the same time, down in the smoke belt, personnel were able to load and discharge cargo and carry on other routine in an atmosphere akin to fog.

For outstanding service in area smoke screening in North Africa and Sicily, Capt. Joseph P. Todd, commanding a CWS Smoke Generator Company, received the Legion of Merit. "While working with British as well as American Port and Anti-aircraft defense forces, he planned, organized, and used his smoke generator installations in such manner that not a single hit was scored by enemy raiders in numerous assaults on shipping and port facilities in a harbor which was frequently crowded. When his company was moved to Palermo, acting as a smoke battalion commander, Capt. Todd surveyed and planned the whole area smoke defense. . . his superior deployment of his unit enabled it to make an excellent record. His ingenuity enabled him to keep units in repair despite a scarcity of spare parts."

Chemical smoke pots and smoke grenades are likewise used to advantage in smoke operations. These small "fog machines" have many purposes, from providing quick smoke bursts to chunking up holes in larger screens. There is also a handy floating smoke pot employed for covering landings, river crossings and other amphibious operations.

In the Pacific area, smoke screens have been used with marked success to conceal jumps by paratroops. The first tactical use of smoke from the air was on Sept. 1, 1943, when smoke tanks attached to planes set up a curtain for descending paratroopers who captured a Japanese airfield near Lae, New Guinea.

The newest members of the CWS smoke family are colored smokes. Released from can-like grenades, they fill the need for distinctive signals to designate targets, mark vehicle routes, etc.

The Chemical Warfare Service not only produced the incendiary bombs which General Doolittle's intrepid flyers showered on Tokyo in 1942, but is responsible for all of the fiery calling cards being left by our Air Forces on military targets in Europe and elsewhere.

The mounting intensity of our aerial bombardment has brought increased delivery of this CWS munition. At the beginning of the present war, incendiaries accounted for only a small fraction of our bomb loads; today they are closer to 50 percent since, in many situations, the fire bomb pays greater dividends per pound of weight carried in bomb racks than does its explosive comrade. Of all fires started by aerial bombardment, not more than 1 percent has been due to high explosive. All the rest has been caused by incendiaries.

Various types of incendiaries are made by the Chemical Warfare Service for aerial use, whether alone or in conjunction with high explosive "block busters." These incendiaries are most effective against warehouses, factories and other buildings but also spread conflagration when their flaming chemicals scatter through the rubble caused by high explosive.

The magnesium scatter-type bomb weighs less than four pounds. When tied in bundles, these wartime "firecrackers" scatter upon release and rain on the target, starting many individual fires. Although only one out of a dozen may be expected to land on something combustible, their wide dispersal can start many scattered fires almost simultaneously. Then there is the thermit bomb which burns rapidly at a higher temperature than the magnesium

Smokescreen put up over the harbor of Palermo, Sicily, by Chemical Smoke Generator Companies, Aug. 16, 1943

type and can penetrate oil and gasoline tanks. The white phosphorus bomb has much the same burning effect as the contents of a burst WP mortar shell. Not last and not least are large oil-type bombs which spatter their contents and cause considerable fire damage.

Thirteen hundred gasoline-jelly bombs, which contain a witches' brew of gasoline and rubber, were dropped from Flying Fortresses in the October, 1943, raid on Focke-Wulf plane assembly plant in Marienburg, East Prussia. More of these 100-pounders were dropped in the Armistice Day (1943) raid on Munster, Germany. Others fell on U-boat building yards at Emden in the blind bombing through heavy clouds on Sept. 17, 1943.

While primarily a ground weapon munition, white phosphorus is an incendiary as well as a smoke agent. As used in the shell for the 4.2 mortar or in a grenade, it dispenses small particles which ignite spontaneously in the atmosphere and adhere to flesh, clothing and other surfaces. Though the fire of these particles can be extinguished by water, burning is resumed as quickly as the water evaporates. White phosphorus has to be kept under oil or water or in air-tight containers to prevent its igniting through contact with the air. The smoke produced by white phosphorus is non-poisonous.

The flamethrower, which was introduced by the Germans in the first World War, is now regular equipment of all armies. It is an incendiary arm which squirts jets of intense fire almost as a hose can direct water under pressure. Out of action, it looks like a harmless gadget for spraying insecticide; in action it resembles a giant blowtorch. It is particularly adapted to jungle fighting. Dense growth is ideal for its comparatively short range. Hidden by undergrowth, and often under cover of smoke, the flamegun can be brought into position to play its firestream through the slits of enemy hideaways that continue to menace the lives of American soldiers and hold up our advance.

The Army's active portable flamethrower, which shoots blazing fuel or jellied oil, was designed and developed by the Chemical Warfare Service for the use of combat Engineers. However, in Pacific operations the Engineers have been so busy on construction and other jobs that the Infantry, Marines, and personnel of chemical sections have become proficient in its use. Its first recorded operation by our troops in the present war was on Guadalcanal in December, 1942. There, soldiers trained on the spot by Chemical Warfare Service officers under Lt. Col. Orbie Bostick, a chemical engineer of Montgomery, Ala., destroyed Jap pillboxes that had withstood aerial bombardment and naval shelling. In the fighting for Munda airfield, in the Solomons, the Marines used CWS flamethrowers to knock out some 67 sub-surface installations. The Marines again employed this chemical warfare weapon to reduce equally stubborn defenses on Tarawa. Fifty-four Jap bunkers were captured by its use in the New Georgia sector.

Flamethrowers were used on New Georgia in combination with Infantry operations. In one instance, they were employed in a single coordinated flanking and frontal attack. Another time, three connected pillboxes constructed of coral and coconut logs that had been immune to heavy artillery shelling were reduced within two minutes by flamethrowers. In some cases the Japs string chickenwire across the open portals to deflect shells and hand grenades. But this is useless against the penetrating, billowing blasts of the flamegun.

It was while fighting with the flamethrower on Horseshoe Hill, New Georgia, that Pvt. Frank Kordeleski, of Lorain, Ohio, won the Distinguished Service Cross. According to the citation: "When his company was pinned to the ground by incessant bursts of fire from well-defended Japanese positions, Pvt. Kordeleski strapped a flamethrower on his back and crawled forward through the underbrush until he was only 30 feet from the three pillboxes. He demolished all three and killed seven of the enemy before the fuel supply of his flamethrower was exhausted. Pvt. Kordelski crawled back to the battalion supply station, refueled his weapon and started out toward a fourth pillbox. While working his way forward a second time, he was wounded and had to be evacuated from the lines. His cool courage and expert use of his weapon raised the good morale of his comrades to a higher fighting pitch."

Ever since World War I, in which its First Gas Regiment made history, the Chemical Warfare Service has been charged with instructing the Army as a whole in offensive and defensive measures pertaining to all phases of chemical warfare. It has left nothing undone to see that our combat troops are highly proficient in the use of chemical warfare material and the application of chemical warfare techniques, at the same time providing them with the world's best protective devices against gas and other chemical agents.

Besides training and furnishing chemical warfare experts to the Army Ground Forces, the Army Service Forces and the Army Air Forces, the Chemical Warfare Service has developed special troops to operate smoke generators, chemical weapons, field laboratories, field clothing processing plants, supply depots, and to engage in decontamination and other highly specialized duties.

Because of the long haul to our battle fronts, this Service has an exacting task in anticipating and meeting material requirements. It must keep a jump ahead of the enemy in research, design, experimentation, development, procurement, storage and supply of chemical items. Overseas the problem of supply is complicated by distributing this material for its most effective use. This sector, too, has its heroes.

It was "through unusual foresight in anticipating the numerous operational demands, through tireless devotion to duty in planning the requirements of supply and distribution, and through application of

Flamethrower, as used at Munda, operated by a CWS officer, Aug. 7, 1943

superior professional attainments" that Col. Charles S. Shadle, Chemical Officer, Allied Force Headquarters, North African Theater of Operations, received the Legion of Merit.

During the Tunisian campaign, Technical Sgt. Alton S. Turner, of Dayton, Ohio, member of a Chemical Maintenance Company, "successfully organized and established a section supply dump, and through able leadership of his men, rendered highly valuable services in the maintenance of Chemical warfare facilities at advanced supply posts," declared a citation by General Eisenhower. It added that "improvement which he devised in a machine for servicing gas masks greatly expedited this work and effected a considerable reduction in its cost."

On the Burma front, Col. Adrian St. John, CWS, was presented with the Purple Heart by Lt. Gen. Stillwell in recognition of the former "snatching trucks and jeeps and other lend-lease equipment out of Rangoon directly under Japanese guns and placing them in the hands of the Chinese fighting force." Sgt. James M. Douglas, CWS, on duty with the Army Air Forces in the China-Burma-India theater, was awarded the Legion of Merit for "exceptionally meritorious conduct in the performance of outstanding service."

During the attack on Pearl Harbor, Maj. James E. Reilly, CWS, of Jackson Heights, New York, "organized ground defense positions so effectively that only one of his men was wounded." He received the Legion of Merit. Later, when Hawaii was especially alerted for gas, Chemical Warfare Service officers and men there worked night and day to provide adequate protection for the civilian population. The efforts of three CWS officers—Majs. Edouard R. L. Doty, Ronald Q. Smith and Roland P. Fournier —won them the Legion of Merit. Major Doty organized and trained more than 52,000 civilians within four months; Major Smith spurred reconditioning, making and issuing thousands of gas masks for civilians of all ages, and Major Fournier pressed a Civilian Conservation Corps into service for issuing the masks.

The CWS "goon" gun. A 4.2 mortar unit on Bougainville, January, 1944

From this account it should be apparent that the Chemical Warfare Service is not only active in many lines in this war but, at the same time, is unique among other arms in that it is intimately identified with its own material—from the test tube to the battle test. In other words, this branch of the Army Service Forces is the only service which conceives, manufactures, and uses its own weapons.

The motto of the Chemical Warfare School speaks for this Service as a whole. It is "Elementis Regamus Proelium" which, translated, means "Let Us Rule the Battle by Means of the Elements" (or "Chemicals," to be currently literal).

All of which is demonstration of the fact that chemicals have definitely gone to war, under the appropriate crossed retorts and benzene ring insignia of the *fighting* Chemical Warfare Service!

SOUTH AMERICA

(*Continued from page 100*)

as yours, but in most of South America you will find very few men with good training in applied engineering. Hence you should find opportunities in South America which are non-existent in this country.

Some of these opportunities may at first appear not to be worthy of an engineer, but if there is an opportunity of making money these will probably lead to a start in bigger things. To be successful, the engineer must be versatile and able to recognize latent opportunities even in the most humble type of work.

In the larger cities, you will find most of the modern convenience of the United States. However, sanitation and pure food laws are usually far behind American standards, and clean pasteurized milk is not always obtainable.

Living costs in the cities are normally lower than in the cities of the United States unless you go in for large quantities of imported canned goods or other commodities. Because of the war and the influx of large numbers of our government employees who are prosperous and have a liberal living allowance, costs are now abnormally high. These will return to lower levels when normal conditions are resumed. In the small communities not affected by the war, prices are much lower.

For recreation, you can depend on your usual summer activities such as tennis, golf, swimming, and mountain climbing in endless variety. For the nature lover and photographer there is no end of exploring the jungle for exciting plants and animals.

Even fairly small cities now have their movie houses that show Hollywood pictures (and not necessarily antiques). Radios bring news and entertainment by shortwave from neighboring countries, the United States and Europe.

The importance of being able to converse in the native language cannot be over-estimated, since this makes for greater faith and mutual comprehension. You must mix with the natives, go to their parties and invite them to yours; you cannot be snobbish and at the same time be well liked. Remember that South America is traditionally the "Land of Manana" and cannot be changed overnight. You will have a greater chance of success and will enjoy life more if you slow down your Yankee tempo to local conditions. The engineer who persists in remaining a "foreigner" will find failure his chief reward.

Lastly, do not expect to get rich quick and come back to the United States to retire. If you want to succeed you must go to Latin America with the idea of staying and becoming part of the country, or else you are likely to find that you are merely training a native engineer to take over your job. Latin America has a wonderful future and there are no reasons why you should not become a contented part of it.

RALPH GIBBS *Consulting Chemical Engineer, York, Pa.*

Rotary Kiln Gases as a Source of CARBON DIOXIDE

This article presents results of the author's preliminary study of the possibility of recovering carbon dioxide on a commercial basis from the enormous quantities of waste gases produced by rotary lime kilns. Final conclusions must wait on a thorough investigation, but it appears likely that 10 to 20 percent of the carbon dioxide evolved in rotary kilns burning lime and similar substances could be economically recovered, provided that the kilns were properly proportioned, and waste-heat boilers were installed to convert the waste heat into power.— *Editors*

Carbon dioxide is wasted to the atmosphere in enormous quantities by rotary kiln plants processing carbonate minerals, a fact which makes these plants worthy of study as sources of commercial carbon dioxide.

Some idea of the quantities of carbon dioxide involved can be had when it is learned that a single rotary kiln, producing 100 tons of lime per day with a fuel ratio of 1 to 3, evolves approximately 170 tons of carbon dioxide per day.

Several characteristics and features of such rotary kiln operations stimulate interest in connection with carbon dioxide recovery from these processes. On the surface, some seem to lend themselves admirably to a solution of the general problem. However, it is only after the possibilities have been thoroughly examined that some basis for establishing the feasability and limits of such recovery can be ascertained.

ROTARY KILN GASES

The gases issuing from rotary kilns reflect in composition the quality and quantity of the raw materials being processed. For the purpose of simplifying this study, it is proposed to premise the processing of dry, high-calcium limestone particles to produce a good grade of caustic lime, using a good grade of bituminous coal for fuel for the kiln.

In practice, the requirement of the mineral carbonate generally is met and found commercially acceptable if the residue, after calcination, is 57 to 60 percent of the weight of the original material.

Bituminous coal, in pulverized form, is generally used for fuel, and those grades having a good grindability and producing desirable flames are sought. The desirable types generally will have a heating value of around 13,500 B.t.u. per pound, dry basis, contain about 6 percent ash and have a carbon content of approximately 80 percent.

Modern rotary kiln firing practice enables very close control of the combustion process so that, for all practical purposes, combustion is balanced and only insignificant quantities of either reagent are in excess.

The carbon dioxide issuing from a rotary kiln comes from two different sources in this case, including that from the limestone, and that from the combustion process. Thus, for each ton of lime produced there are:

$$\frac{2{,}000}{A} - 2{,}000 = \text{Lb. of } CO_2 \text{ from the mineral} \quad (1)$$

$$B \times fr \times 2{,}000 \times \frac{44}{12} = \text{Lb. of } CO_2 \text{ from combustion} \quad (2)$$

where $A = 0.58 =$ assumed residue from unit quantity of the original mineral being calcined; $B = 0.80 =$ unit carbon content for bituminous fuel; and $fr =$ fuel-lime ratio expressed as a fraction.

Table I—Pounds of Carbon Dioxide per Ton of Lime for Various Fuel-Lime Ratios

Fuel-Lime Ratio	Lb. CO_2 per Ton Lime
1/1.4	5,640
1/2.0	4,380
1/3.0	3,403
1/4.0	2,915
1/5.0	2,622
1/6.0	2,427

Table II—Total Pounds of Kiln Gases per Ton of Lime at Various Fuel-Lime Ratios

Fuel-Lime Ratio	Total Lb. of Gases per Ton of Lime
1/1.4	17,095
1/2.0	12,390
1/3.0	8,744
1/4.0	6,920
1/5.0	5,826
1/6.0	5,096

Table III—Exit Gas Carbon Dioxide Content at Various Fuel-Lime Ratios

Fuel-Lime Ratio	Wt. Percent CO_2	Vol. Percent CO_2
1/1.4	33.0	23.9
1/2.0	35.3	25.8
1/3.0	38.9	28.9
1/4.0	42.2	31.8
1/5.0	45.1	34.3
1/6.0	47.7	36.8

Table IV—Calculated Temperatures of Gases Leaving Rotary Kilns, Deg. F.

Length of Kiln, Ft.	6 Ft. Dia.	7 Ft. Dia.	8 Ft. Dia.	9 Ft. Dia.	10 Ft. Dia.
80	1,350	1,698	2,080	2,477	2,858
100	1,138	1,377	1,683	2,018	2,360
120	971	1,180	1,432	1,714	2,018
140	875	1,047	1,259	1,503	1,774
160	805	953	1,143	1,346	1,585
180	757	883	1,038	1,227	1,476
200	716	826	966	1,135	1,327
220	684	783	910	1,062	1,233
240	659	748	861	1,000	1,159
260	638	719	822	948	1,097
280	621	697	791	906	1,004
300	605	676	762	869	995

Thus the total quantity of carbon dioxide produced during the processing of 1 ton of lime is:

$$\left(\frac{2{,}000}{0.58} - 2{,}000\right) + \left(0.80 \times fr \times 2{,}000 \times \frac{44}{12}\right) = \text{Lb. } CO_2 \text{ per ton of lime} \quad (3)$$

From the above relations, it is seen that the fuel-lime ratio *fr*, if altered, will alter the quantity of carbon dioxide per ton of lime. This is shown in Table I and graphically in Fig. 1.

For conditions of balanced combustion, it can be assumed reasonably that 10 lb. of air will be required for each pound of coal fired, and to compute the total quantities of gases issuing from the kiln the following relations will serve:

$$\underbrace{\left(\frac{2{,}000}{0.58} - 2{,}000\right)}_{\text{Gas from mineral}} + \underbrace{\left(fr \times 2{,}000 \times 10\right)}_{\text{Air}} + \underbrace{\left(fr \times 2{,}000 \times 0.94\right)}_{\text{Gassified from fuel}} = \text{Total weight in pounds per ton of lime produced} \quad (4)$$

This equation is used in computing the results shown in Table II, and graphically in Fig. 2.

From these data the quality (CO_2 content) of the gas issuing from the kiln can be computed by Equation (5):

$$\frac{\left[\left(\frac{2{,}000}{0.58} - 2{,}000\right) + \left(0.80 \times 2{,}000\, fr \times \frac{44}{12}\right)\right]}{\left(\frac{2{,}000}{0.58} - 2{,}000\right) + \left(fr \times 2{,}000 \times 10\right)} \times \frac{100}{(fr \times 2{,}000 \times 0.94)} = \text{Weight \% } CO_2 \quad (5)$$

These relations are shown in Table III, and graphically in Fig. 3. Volume percentages also are shown in the table.

GAS TEMPERATURES

Unfortunately there are so many factors influencing the temperature of the gases as they leave the kiln that exact relations are impossible to establish. About the best that can be done is to build up an empirical relation that will give results in the neighborhood of those found in practice under similar conditions. The relation proposed by the writer is:

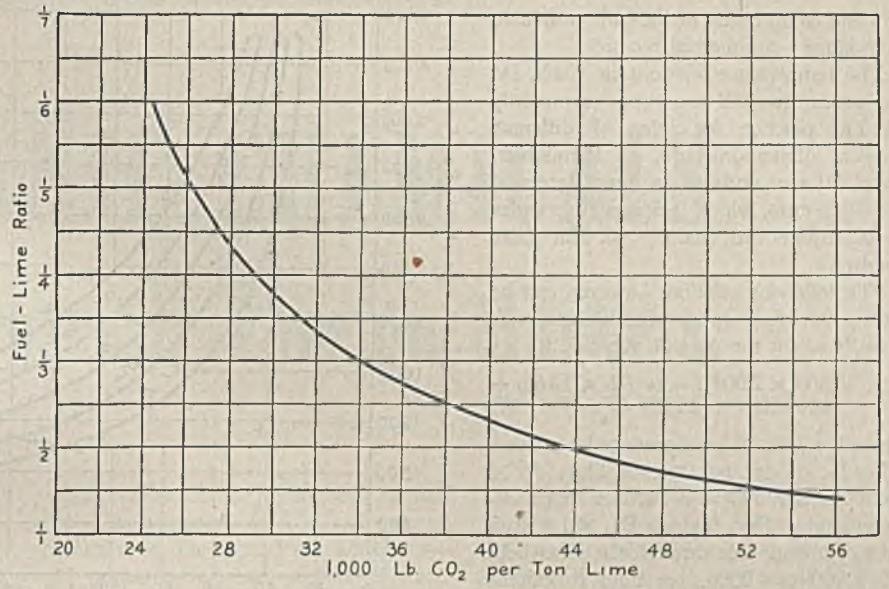
$$\log_e T = 3.623 - 10\left(\frac{L - 5D}{D^3 + 10L}\right) \quad (6)$$

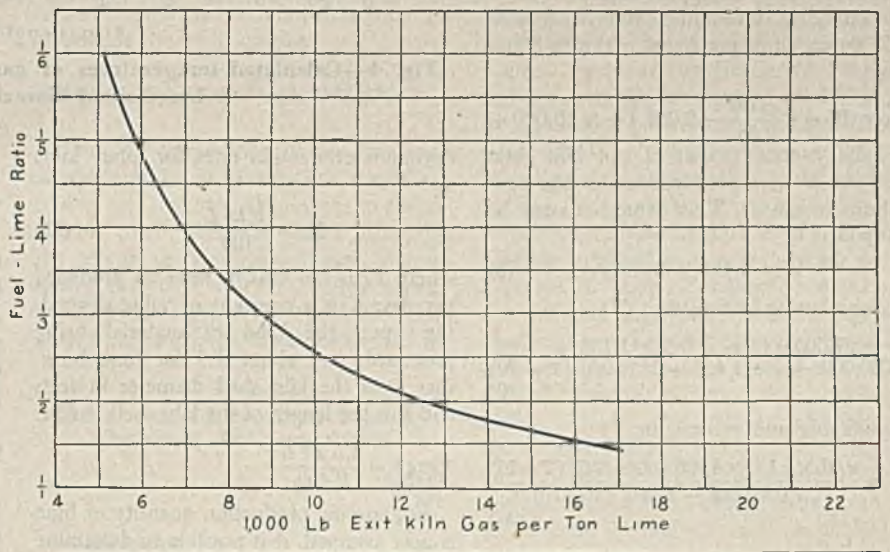
where T is in deg. F., and length L and diameter D are in feet.

Table IV shows the numerical results computed from Equation 6 and Fig. 4 shows them graphically.

GAS HEAT CONTENT

The heat content of the exit kiln gases is of great interest since there is a possibility of using waste-heat boilers to develop the power and heat necessary for the purifica-





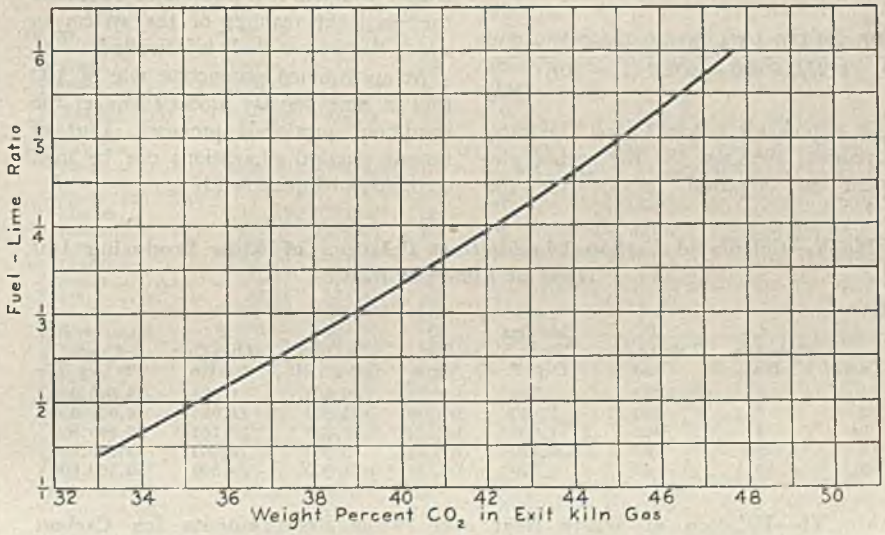


Fig. 1—Pounds of carbon dioxide per ton of lime produced for various ratios of fuel to lime fed to the kiln

Fig. 2—Total pounds of exit gases from the kiln per ton of lime produced, for various ratios of fuel to lime fed to the kiln

Fig. 3—Carbon dioxide content of kiln gases in weight percent for various ratios of fuel to lime fed to the kiln

tion and compression of the carbon dioxide to produce a commercial product.

The temperature relations in Table IV are based on fuel-line ratios commonly met in practice for kilns of different physical dimensions and, in themselves, reveal little or nothing, in direct terms of fuel–lime ratio, which is necessary in order to determine the quantity of kiln gases involved.

The following relation, however, can be set up as being approximately true, sufficiently so for the present purpose:

$$r \times 13{,}500 \times 2{,}000\ t = (\pi\, DL \times 1{,}150) + 4{,}000{,}000\ t + 0.26tW\ (T - 70) \quad (7)$$

where t = tons of lime produced per hour; W = lb. of gas per ton of lime; $(fr \times 13{,}500 \times 2{,}000\ t)$ = B.t.u. per hour developed by the fuel; $\pi\, DL \times 1{,}150$ = B.t.u. per hour lost through the kiln shell; $4{,}000{,}000\ t$ = B.t.u. per hour to calcine the mineral limestone; and $0.26\ tW\ (T\text{-}70)$ = B.t.u. per hour in the exit kiln gases.

Now, $W = \left(\frac{2{,}000}{0.58} - 2{,}000\right) + fr\ 20{,}000 + fr\ 1{,}880$ = total weight of exit kiln gases per ton of lime produced under the conditions assumed. This expression can be simplified to

$$W = 1{,}450 + 21{,}880fr \quad (8)$$

Substituting in Equation (7),

$$fr = 27{,}000{,}000t = \pi\, DL \times 1{,}150 + 4{,}000{,}000t + 26t\ (1{,}450 + 21{,}880fr)\ (T - 70) \quad (9)$$

Simplifying and rearranging,

$$fr = \frac{\pi DL \times 1{,}150 \times 4{,}000{,}000t + 337t\ (T - 70)}{27{,}000{,}000t - 5{,}690t\ (T - 70)} \quad (10a)$$

or

$$fr = \frac{\pi\, DL \times 1{,}150 + t\,[4{,}000{,}000 + 337\ (T - 70)]}{t\,[27{,}000{,}000 - 5{,}690\ (T - 70)]} \quad (10b)$$

In a previous article (*Rock Products*, November, 1942, p. 58) the author presented an empirical relation for the optimum production rates for rotary kilns as:

$$T_d = \frac{KD^3L}{100} \quad (11)$$

where T_d is the tons of material produced per day; K is a constant of value depending upon the kind of material being processed, and about 1.5 for lime burning; D is the kiln shell diameter in feet; and L is the length of the kiln shell in feet.

Thus $t = \frac{1.5\ D^3\ L}{2{,}400}$

If a specific production quantity of lime is now assumed, it is possible to determine the pertinent features of the system in which the present study is interested.

At an assumed production rate of 100 tons of lime per day processed under the conditions previously premised, kilns of various physical dimensions can be used according to Equation (12):

$$L = \frac{10{,}000}{1.5\ D^3} \quad (12)$$

These relations are shown in Table V.

In this table Columns A and B are related through Equation (12) for a production rate of 100 tons of lime per day. The data of Column *C* are from Fig. 4; of Column *D* from Equation (10); of Column *E* from Fig. 2; of Column *F* from Fig. 3; and of Column *G* from $0.26\ t\ W\ (T\text{-}400)$ = B.t.u. per hour. Table V can be further expanded as shown in Table VI.

The data in Column *H* have been determined by the fact that 3,600 B.t.u. is required to liberate 1 lb. of carbon dioxide from the absorbing solution. Column *I* shows the percentage of heat available in the waste or exit gases for the recovery of the carbon dioxide evolved. Column *J* shows the approximate boiler horsepower available in the heat of the exit gases. Column *K* shows the prime mover horsepower required to recover all the carbon dioxide either as solid or liquid. Column *L* shows the percentage of horsepower available from the heat in the exit gases, for recovering either solid or liquid.

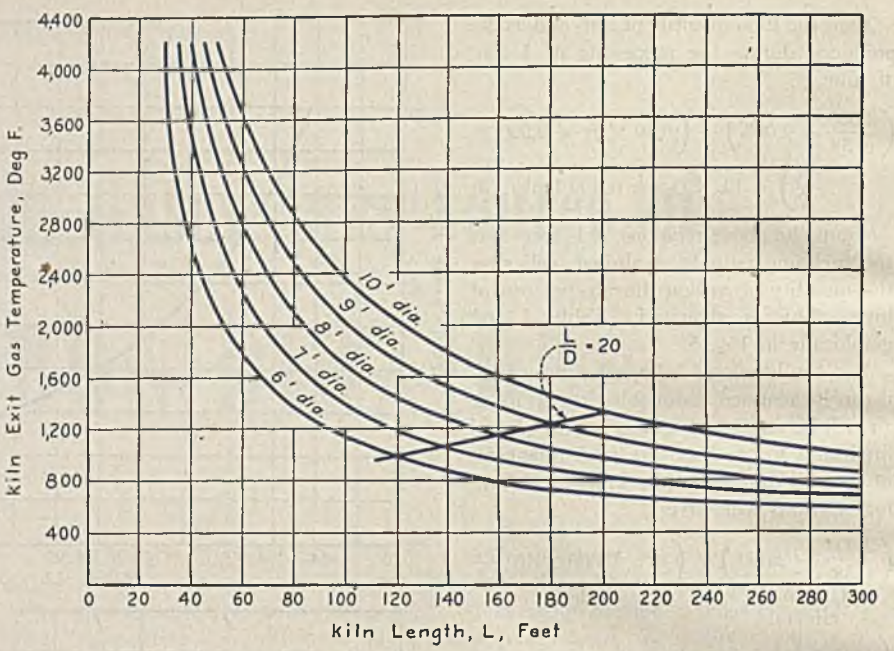


Fig. 4—Calculated temperatures of gases leaving rotary kilns for various lengths and diameters of the kiln

Table V—Calculated Carbon Dioxide-Heat Relations of Kilns Producing 100 Tons of Lime per Day

Case	*A* Kiln Dia., Feet	*B* Kiln Lgth., Feet	*C* Exit Gas Temp., Deg. F.	*D* Fuel Ratio	*E* Lb. Kiln Gas per Hr.	*F* Lb. CO_2 per Hr.	*G* B.t.u. per Hr. Above 400 Deg. F.
1	6	185	700	1/4.52	26,200	11,400	2,040,000
2	7	136	1,070	1/4.08	28,300	11,950	4,930,000
3	8	104	1,620	1/3.43	32,400	13,100	10,300,000
4	9	82	2,420	1/2.46	43,000	16,050	22,600,000
5	10	67	3,320	1/1.31	74,000	24,500	56,100,000

Table VI—Relation of Waste Heat and Power Requirements for Carbon Dioxide Recovery in Kilns Producing 100 Tons of Lime per Day

Case	*H* Heat Reqd. to Evolve All CO_2	*I* Percent of Heat Avail. as Waste Heat	*J* Hp. Avail. in Waste Heat	*K* Hp. Reqd. for Solid CO_2 Plant	*K* Hp. Reqd. for Liquid CO_2 Plant	*L* Percent of Hp. Avail. Solid	*L* Liquid
1	41,000,000	4.98	68.0	2,850	1,480	2.4	4.6
2	43,000,000	11.45	111.5	2,990	1,560	3.73	7.2
3	47,100,000	21.90	344.0	3,280	1,700	10.50	20.2
4	57,800,000	39.10	754.0	4,010	2,090	18.50	35.5
5	88,200,000	63.70	1,870.0	6,000	3,120	31.20	60.0

CONCLUSIONS

From the foregoing it appears there is an economic possibility of recovering from 10 to 20 percent of the carbon dioxide evolved in rotary kiln operations burning lime or similar substances, providing the kiln is properly proportioned and waste-heat boilers are installed to convert the available waste heat into power.

Although kilns short in length and large in diameter approach high possible recoveries of carbon dioxide, it is believed the extremely high temperatures at the feed end will cause practical operating problems difficult of solution.

J. N. TAYLOR *Chemical Unit, Bureau of Foreign Commerce, Washington, D. C.*

ORGANIC CHEMICALS

Their Postwar Foreign Markets

Now is the time for American manufacturers of organic chemicals to prepare for postwar foreign markets. We may congratulate ourselves on the way we have overtaken and passed all competitors in the production of organic chemicals, but as yet we have not made much progress in export business. The author not only brings out these facts but also reveals the important possibilities awaiting American exporters at the end of the war when freedom of communication and transportation will be resumed and restrictions on production will be removed or at least relaxed. —*Editors*

After a quarter-century of phenomenal growth and development, the organic chemical industry in the United States has reached another landmark and is now in a second period of expansion and development. In 1942 it produced two and a half times its 1937 output and about a third more than that produced in 1941. Current exports—including Lend-Lease shipments—account for a relatively small proportion of production, according to the author in his article in *Foreign Commerce Weekly*, Mar. 18, 1944.

The industry itself has not shown great interest in foreign trade, preferring to develop the enormous domestic market. It has not in the past taken full advantage of opportunities to sell its goods in the market places of the world. Organic chemical exports in 1937, a "normal" prewar year, constituted approximately only 3 percent of that year's domestic production. Even the greatly expanded global shipments in 1941 accounted for less than 4 percent of domestic production in that year. Consignments in 1942 of organic chemicals to the American Republics—used primarily for the support of their domestic economy—amounted to only 0.8 percent of the 1942 output.

PROJECTED POSTWAR MARKET

Upon the termination of the war there will quite probably be sufficient immediate military and urgent civilian needs to absorb much of the industry's surpluses. After the first year or so of peace, however, and assuming that 1948 will be the first normal foreign-trade year, it is probable that United States exports of chemicals and related products in that year will have increased 68 percent in dollar value over 1937 exports of $139,500,000 and that the coal-derived chemicals group will have increased 44 percent over the 1937 figure of $14,900,000. These gains are predicted on a study made by the Bureau of Foreign and Domestic Commerce and are included in the Bureau publication "Foreign Trade After the War." The figures are derived from hypothetical projections based on dollar availability and must not of course be considered as definite but simply as mechanical projections of export trends over a period of years. Comparative data are not available for non-coal-derived organic chemicals over a similar period. (Throughout this paper, data on exports of non-coal-derived chemicals exclude natural organics such as alkaloids, essential oils, sugars, fatty acids, casein, dextrin and glue but include alcohol and glycerin.) An approximation, however, of the 1937 export value of non-coal-derived organic chemicals is $7,500,000, and there is every indication that exports of this group will show a substantial increase when normal trade conditions again prevail.

United States Exports of Organic Chemicals, 1937 and 1941

Area and Principal Countries	1937	1941*	Percent Increase or Decrease 1941 Over 1937
Europe	$8,257,796	$9,870,098	20
United Kingdom	2,073,279	8,086,435	290
Belgium	2,237,410		−100
France	1,658,336	35	†−100
U. S. S. R.	44,255	516,602	1,067
Switzerland	106,603	446,485	319
Sweden	214,637	417,770	95
North America:			
Northern	4,953,491	13,383,886	170
Canada	4,825,454	13,225,636	174
Southern and West Indies	1,141,315	3,759,422	229
Mexico	698,319	2,698,926	286
Cuba	250,695	571,188	128
South America	1,435,670	9,832,480	585
Argentina	363,405	2,764,059	661
Bolivia	44,821	195,140	335
Brazil	387,127	3,021,775	723
Chile	255,578	1,492,460	484
Colombia	221,320	1,188,839	437
Ecuador	28,752	107,475	274
Paraguay	120	1,554	1,195
Peru	71,317	543,247	662
Uruguay	35,683	231,040	547
Venezuela	45,636	273,972	500
Asia	5,616,673	12,441,678	122
Japan	2,443,993		−100
China	2,021,036	990,440	−50
British India	319,555	4,841,564	1,415
Netherlands East Indies	86,665	3,816,278	4,303
Oceania	723,412	1,450,762	101
Australia	684,394	1,248,201	82
New Zealand	32,957	167,606	409
Africa	338,883	2,035,165	501
Union of South Africa	218,987	1,208,409	452
Egypt	7,259	385,844	5,215
Belgian Congo	3,079	127,165	4,030
Mozambique	54,945	74,962	36
World total	22,467,240	52,773,491	135

* Preliminary
† Exports in 1941 negligible as compared with 1937 figure.

Upon return to postwar normal conditions, the organic chemical industry will have before it a wonderful opportunity not only to continue its domestic expansion but also to send a larger proportion of its products abroad for further manufacture. There will undoubtedly be an intensive postwar demand for the industry's products in foreign areas where reconstruction activities will be in progress and in those countries recently industrialized or in process of industrialization.

In fact, if for no other reason than to maintain its wartime-expanded facilities at a high rate of employment, the industry should welcome an opportunity to increase its exports. A goal of 10 percent of its output would not be too high.

DIVERSIFIED DISTRIBUTION

In prewar years, products of the industry went to the four quarters of the globe. Geographically, Europe took more than a

third of our 1937 exports of organic chemicals; Asia, Africa, and Oceania collectively almost a third; North America over a quarter, while South America accounted for only a sixteenth. The best foreign markets were those where there was the greatest competition both from local manufactures and from products made in other countries. The highly industrialized countries of Europe, although embracing a comparatively small area, took more than Asia, Africa, Oceania, and South America combined.

PREWAR, WARTIME COMPARED

The picture of our wartime distribution of organic chemicals is somewhat distorted when compared with prewar distribution. Exports in 1941 included Lend-Lease shipments and other forms of cooperative economic distribution, with the consequence that certain areas and countries received larger supplies of organic chemicals than they would have in the ordinary course of trade under normal conditions.

Among the large number of organic chemical products composing global shipments, coal-derived dyes showed a considerable increase in the value in 1941 over 1937 exports. The major portion of this increase is attributable to Western Hemisphere trade, which registered a three-fold increase. Glycerin exports to countries in the Western Hemisphere also showed a three-fold value increase in 1941 over 1937. Shipments of acetic acid to Western Hemisphere countries increased in value 20 times over the 1937 figure, and acetone exports registered a ten-fold increase.

PAST RECORD, FUTURE PROSPECTS

Of the 1937 shipments of organic chemicals to Europe, 26 percent went to the United Kingdom, 27 percent to Belgium, and 20 percent to France. At that time practically all European countries were highly industrialized and, with the exception of Germany, consumed substantial quantities of imported chemicals. By reason of a large domestic production in the Reich, and the governmental control of foreign trade and means of international payments, prewar Germany offered no opportunities as a market for organic chemicals but was one of our chief competitors. Just what postwar controls will be applied to the enemy countries is not yet apparent, but, with the return to a comparatively normal way of life, it is quite likely that new alignments will have been made by 1948 with respect to the distribution of organic chemicals and that, in the process, Germany as well as other continental European countries may afford competition in world markets. The influence of the various European cartels, especially the European Dye Cartel, is a matter of conjecture.

The only Asiatic country with a well-developed organic chemical industry is Japan. A prewar start had been made in China, but that country was dependent primarily upon imports to satisfy its consumption requirements. In 1937, Japan received 44 percent of the United States exports of organic chemicals to Asia, and China, 35 percent. In Oceania, the larger portions of the United States exports went to Australia. The Union of South Africa received 65 percent of the United States exports to Africa.

Postwar prospects for trade with Asia, Oceania, and Africa are at the moment obscure. With Japan greatly reduced as a major competitive factor, however, it appears that Asiatic countries represent a potential market. India and the new China should not be neglected in planning export trade in the years following the establishment of peace. Australia, New Zealand, and South Africa are becoming more highly industrialized, but their expanded postwar consumption needs will not be satisfied by local production alone and must be augmented by imports.

LATIN AMERICA, LOGICAL MARKET

The Western Hemisphere presents a logical and promising market for postwar development. Northern North America accounted for 66 percent of the 1937 organic chemical exports from the United States to Western Hemisphere countries and 22 percent of total exports. However, southern North America (including Mexico, Central America, and the West Indies) accounted for only 15 percent of hemisphere exports and 5 percent of the total. The countries of South America represented 19 percent of shipments to hemisphere countries and only 6 percent of total organic chemical exports. Latin America presents a composite area offering a "potential" capable of considerable expansion.

Since 1937, United States exports of organic chemicals to this area have greatly increased as have also their requirements. With lessened competition from abroad, it is to these countries south of the border that we must look for greater development of our export trade in organic chemicals. This is especially true in view of the progress that is now taking place in the industrialization of many of the countries of that area.

Comparative data for 1937 and 1941 are not available for the hundreds of organic chemical items outbound to the American Republics, because many of the products now exported were not shown separately in 1937 statistics. Export data for 1941 showing outbound shipments of certain individual items indicate that substantial volumes of a variety of organic chemical products are going to the other American Republics.

INDUSTRIALIZATION WELCOMED

Industrialization of Latin American countries, accelerated by wartime necessities, should be welcomed by United States organic chemical manufacturers and exporters. The more highly the other American Republics become industrialized the greater will be their purchasing power, the higher their standards of living, and the more exigent the resultant need to import larger quantities of finished products as well as materials to be utilized for further processing by consuming industries.

OPPORTUNITIES TO THE SOUTH

The countries south of the Rio Grande are essentially *consumers* of organic chemicals and import the major portion of their requirements, an organic chemical industry as such not yet having attained the status of a definite branch of the chemical industry. Imports of certain organic chemicals into Latin American markets during recent years indicate the relative demand for these products. Dye imports into practically all of the American Republics registered increases in 1941 over previous years, as did also acetic acid, acetone, aniline, benzol, camphor, carbon tetrachloride, citric and tartaric acids, formalde-

United States Export of Specified Organic Chemicals to American Republics, 1941

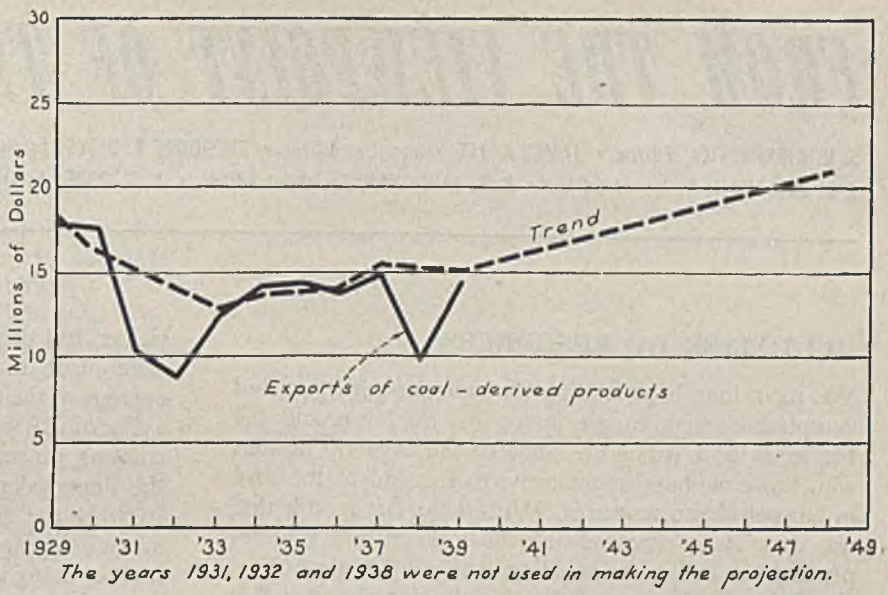
[In thousands of dollars]

Commodity	Argentina	Bolivia	Brazil	Chile	Colombia	Cuba	Ecuador	Guatemala	Mexico	Peru	Uruguay	Venezuela
Acetic acid	108	3	1	2	89	4	1	1	10	25	16	17
Acetone	70	(1)	1	3	7	7	(1)	(1)	29	2	4	2
Aniline (oil and salts)	2	...	21	(1)	11	1	...	...	13	1	(1)	...
Benzol	39	...	45	3	(1)	22	1	...	34	(1)	2	3
Carbon tetrachloride	31	(1)	17	6	2	2	(1)	(1)	1	4	21	1
Citric acid [2]	62	(1)	13	13	12	9	(1)	(1)	26	...	5	...
Coal-derived dyes	997	50	1,228	348	640	172	71	46	1,189	296	101	104
Cresylic acid and cresols [3]	(1)	4	1	43	1	(1)	...	...	11	2	(1)	(1)
Formaldehyde	17	(1)	34	1	10	4	1	(1)	4	1	3	(1)
Glycerin	1	1	3	133	21	55	1	1	115	1	(1)	1
Hexamethylenetetramine	11	...	8	(1)	1	4	(1)	(1)	1	(1)	(1)	(1)
Methanol	60	...	9	(1)	10	60	...	...	1	(1)	7	(1)
Naphthalene (crude) [3]	...	(1)	(1)	1	(1)	...	...	...	(1)	(1)	...	(1)
Phenol	5	...	30	7	1	(1)	(1)	(1)	2	1	(1)	(1)
Tartaric acid	(1)	(1)	5	1	46	8	1	2	26	2	(1)	39

[1] Less than $500.
[2] Separate classification established Aug. 29, 1941.
[3] Separate classification established July 1, 1941.

hyde, glycerin, hexamethylenetetramine, methanol, and the phenols. The United States was the principal supplier in 1941 and 1942. Additional information regarding the situation in the more outstanding South American countries is available in the Chemical Unit of the Bureau of Foreign and Domestic Commerce.

The outlook for the sale of organic chemicals in Latin America is particularly favorable where industrialization is in progress. Mexico, Brazil, Argentina, Chile, and Peru are outstanding examples. Among Brazilian chemical-consuming industries, plastics have recently assumed importance in the domestic economy of the nation. Previously, plastics were imported mainly in the form of finished articles, but in the last few years domestic plastics molding and the paint industries have developed extensively. There is a large dye consumption in Brazil by the textile industry, that country being the largest producer of textiles in South America.



U. S. exports of coal-derived products, 1929-1939 and trend of exports projected to 1948. (based on total U. S. exports)

CONSUMING CHANNELS

Other consuming channels in Latin America are textiles, soap and candle factories, tanneries, the paper industry, hat factories, bakery and dairy products, foods and beverages, cigar and cigarette factories, drugs and pharmaceuticals, dry cleaning establishments, polishes, inks, perfumes, sugar and confectionery, insecticides and disinfectants, photographic supplies, beer, smelters and concentration plants, petroleum refineries, cottonseed mills, flour mills, glass factories, rubber-goods plants, and manufacturers of iron and steel.

These important consuming industries have greatly expanded since 1941 in many of the American Republics, and, although new industrial programs are well under way and numerous products have been added to the growing list of manufactures, production is still insufficient to satisfy consumption needs. As industrialization proceeds and the purchasing power of the population grows, increasing quantities of organic chemicals will need to be imported.

PREWAR SOURCE OF IMPORTS FOR LATIN AMERICA

The United States participation in the Latin American trade in organic chemicals has increased considerably since the beginning of the war. In prewar years, however, the major portion of the business was enjoyed by European countries.

Naphthalene was supplied chiefly by European countries. Germany and Belgium supplied around 90 percent of Mexico's prewar requirements. Over 70 percent of both Chile's and Peru's naphthalene needs, over half of Brazil's and nearly half of Venezuela's were furnished by Germany. Imports into Argentina from Belgium constituted 80 percent of total Argentine naphthalene imports. The United Kingdom supplied practically all of the Argentine imports of carbolic acid and the major portion of Chilean imports of both carbolic and cresylic acids. Germany supplied all of Ecuador's cresylic acid requirements.

The formal signing in 1929 of the sales agreement by representative of dye manufacturers of Germany, Switzerland, and France allocated certain world areas—Germany maintaining a predominance in the oriental markets, France in the South American and Latin-speaking countries, and Switzerland obtaining a preferred position in the southern European countries. These allotments were not final, however, and in subsequent years German interests controlled much of the Latin American trade. In recent prewar years—1936 and 1937, for example—Germany supplied more than 60 percent of Argentina's dye imports, about the same percentage of Brazil's, between 60 percent and 70 percent of Chile's imports, over 70 percent of Ecuador's requirements, 80 percent of Peru's, and 65 percent of dye imported into Uruguay. Mexico imported 80 percent of its dye needs from Germany.

Of acetic acid requirements during prewar years, Germany contributed half of Argentine needs and the Netherlands over a third. About 90 percent of acetic acid imports into Ecuador were supplied by Germany, which also furnished over 60 percent of Uruguayan imports of acetic acid, approximately 90 percent of Chile's requirements, and three-fourths of Peru's imports.

Hexamethylenetetramine imports into Latin American countries were supplied principally by Germany, that country usually providing more than 50 percent of the total imports. In some cases—for example, Argentina, Mexico, Peru, and Uruguay—three-fourths of the supply requirements were obtained from Germany. Smaller amounts were imported into the American Republics from France and the United Kingdom. The United States participation in the business was comparatively small.

Acetylsalicylic acid needs of Argentina, Mexico, and Peru were practically all taken care of by Germany, which also enjoyed a preponderant share of imports into other Latin American countries.

SERVICING NECESSARY

The introduction of organic chemicals into the Latin American market has been accomplished, the door has recently been opened wider for United States participation, and the time is at hand for a more intensive cultivation of these and other world markets.

In addition to promoting the distribution of organic chemicals abroad, the United States exporter who takes his opportunity seriously must be ready and willing to give personal, technical service to his customer. Observance of this practice explains in large measure the success of European competitors in oriental and Latin American countries. United States exporters of organic chemicals should not only give technical assistance in the application of their products but they should operate through exclusive representatives or at least through local import merchants rather than attempt to deal through consuming industries.

Wherever possible the United States manufacturer and exporter and his foreign agent should exchange visits, in order that each may have a better understanding of the problems and needs of the other. No matter what the market area or country, sales policies must be adapted to local requirements, prices, and credit terms. Warehouse facilities and stock-carrying arrangements for items chiefly in demand are desirable for prompt servicing.

FROM THE VIEWPOINT OF THE EDITORS—

MULTIPLIER OF RESOURCES

We have long been waiting for someone with guts and gumption enough to get up on his hind legs and tell the world how wrong are some of the calamity howlers who think we have about come to the end of the road in our petroleum resources. Within the last month that was done most effectively by the brilliant and vigorous president of Pan American Petroleum and Transport Co., Dr. Robert E. Wilson. Following the dedication of Pan Am's great new "cat cracker" at Texas City, this able chemical engineering executive spoke in Galveston on "Technology as a Multiplier of Our Natural Resources." His address should have been broadcast on a national hook-up with every thoughtful citizen of this country listening in and taking careful notes.

Bob reminded us that this is not the first time people have been concerned about the future of our crude oil reserves. Right after the last war the U. S. Geological Survey predicted that the total recoverable reserves underlying the whole country were less than 7 billion barrels, of which probably less than half constituted "proven reserves" in the modern sense. That was about the time a top-ranking professor of chemical engineering in one of our leading Eastern universities wrote an A.C.S. Monograph on Shale Oil in which he predicted that within 10 years shale would be our main reliance for motor fuel. Kettering had told the A.P.I. in 1920 that the nation's fuel supply was the only cloud on the automotive horizon. The elder LaFollette was soon to forecast $1 a gallon for gasoline. Farm journals warned their readers that with the increasing diversion of kerosene they might soon be forced to go back to whale oil as their principal source of light. All this in these United States only 25 years ago!

What has happened since? Our cumulative production of petroleum from our 7 billion barrels of recoverable reserves has since totaled 23.5 billion barrels and yet, at the end of this 25-year period, we had really proven reserves in excess of 20 billion barrels. This, we must agree with Dr. Wilson, is the modern counterpart of the miracle of feeding the multitude with the five loaves and two little fishes and having the 12 baskets left over! It is no wonder that geologists quit trying to estimate the total recoverable oil which might yet be discovered. In 1943 this country produced more than four times as much crude oil, more than seven times as much gasoline, 13 times as much natural gasoline and five times as much natural gas as in 1918.

How were these results accomplished? First, of course, came the improvements in oil-finding technique through the development of geophysical methods of locating oil structures—particularly the gravity meter, the magnetometer and the seismograph. Next came improvements in production practices as typical oil fields that normally yielded less than a third of the oil in their sands in 1918 were made to give recoveries today of around three-quarters of their oil.

Back in 1918, thanks to the development of the Burton cracking process, gasoline yields had been increased to the unprecedented figure of 25.3 percent of the crude. In 1941 the yield for the country as a whole averaged around 45 percent. If the catalytic cracking units already built or being built in the United States were operated to produce the maximum quantity of high-quality gasoline, the country's average yield could be increased to 57 percent. Polymerization adds thousands of barrels of premium fuel from refinery gases that were formerly wasted or burned under boilers. Alkylation converts other gaseous constituents into blending stock for aviation gasoline, of which, according to Dr. Wilson, our total production is now about 80 times as great as in the last year of the last war; and it is infinitely better. Tetracthyl lead has increased the *available* horsepower of the automotive engines made in 1941 by an amount equal to 75 Boulder Dams.

What of the future? Confirmed pessimists, on reviewing all these achievements, can still say "But these are all discoveries that have been made once and hence cannot be made again—whence will come our new methods of finding and refining petroleum?" Dr. Wilson's only answer to that is that they will come from research and development organizations in the petroleum industry which in the past 25 years have been multiplied fifty-fold—from 200 technical men in petroleum research in 1918 to almost 10,000 today. These men have not lost their ingenuity. They will continue to function effectively as multipliers of our natural resources provided we protect them from the socialistic saboteurs who, under the guise of improving our patent system, would destroy all future opportunity for the free play of technology and competitive enterprise.

JOINT ACTION ON TRANSPORT

Joint action of competitors to save on delivery and hauling could not ordinarily be taken without danger of criticism by the Anti-Trust Division of the Department of Justice. But now such actions are feasible and desirable.

The problems of rail and motor carrier haulage will remain complicated for many months to come. Some of these cannot be solved any easier by joint action than by the skilled traffic manager working for one company alone. However, there are others that can be handled on a joint basis, and the Office of Defense Transportation urges every traffic man to consider such cooperation, even with his competitors. If through such effort it is possible to save even a few vehicle miles, the total of many such savings will help tremendously.

SHIFTING MARKETS

TREMENDOUS shifts in population have occurred under the pressure of new war employment in newly enlarged manufacturing centers. Some of these shifts are going to be permanent. Some of them will prove temporary. No one yet knows how many will be of each kind.

Many of the chemical industry market studies are going to be largely affected by these shifts. Many of the markets for ultimate consumer goods and for materials of construction for housing go to the areas where folks live. It is not too soon to begin to consider whether these population shifts may not occasion new areas of enlarged chemical demand. This is but one factor in the problem of postwar adjustment by process industries. It is not a negligible one. Some help in appraising these shifts in population may be had by studying the Bureau of Census "Map Showing Changes in Civilian Population of the United States, by Counties, April 1, 1940, to November 1, 1943," which was issued March 23, 1944, as Series P-44, No. 4.

FOR THE RECORD

FUTURE statisticians pondering over the musty records of the National Roster may some day derive some queer deductions from the data now being collected on the professional field of chemical engineering. "Engineering and Chemical Sciences Check List," Form 100-94, contains the following restriction on the classification of chemical engineers:

> "If you possess a knowledge of several types of unit operations because of familiarity with the specific chemical industry in which you are engaged, please classify your experience from the chemistry part of this list and do not check items below. However, if you are a specialist in a particular unit operation, please check the applicable item or items below."

Practically all chemical engineers "possess a knowledge of several types of unit operations," but only a few in our profession would wish to classify themselves as specialists in "a particular unit operation." The vast majority are employed in development and production work in various process industries and thereby become specialists in particular industrial fields.

Suppose, for example, a chemical engineer (or a mechanical engineer, for that matter) becomes skilled in the development of high-octane gasoline or synthetic rubber. The only way he can show that important specialization on the National Roster's form is to list himself as skilled in Organic Chemistry (40.7.39 or 40.8.29). Thus a chemical engineer skilled in petroleum refining or in rubber technology must either wrongly declare that his principal field is organic chemistry or that he is a specialist in some one of the many unit operations involved in these industries. Or, if he is a mechanical engineer, he might declare himself to be a specialist in "Machinery or Equipment, General" although there would be nothing in that classification to show the industry in which he was skilled.

Evidently Form 100-94 was prepared by someone strongly under the influence of the small and reactionary group which still clings to the belief that chemical engineering is only one of the many branches of chemistry. Despite the fact that in recent years many more men have been trained as chemical engineers than as chemists, professional chemical engineering is given only one-quarter of one page in this check list whereas chemistry receives two full pages.

Fortunately, we note that the approval on this particular form expires June 30, 1944, and this is, therefore, a good time to suggest that it be revised with the help of a group of competent chemical engineers familiar with the various industrial fields of specialization.

MORE STEEL IS ALLOYED

LAST year one out of every six tons of steel produced in the United States was alloyed. Thus the percentage made useful for special purposes by its alloy content was three times as great as in the peak of prewar years. It was more than four times as much as was treated with alloy during the last year of World War I.

Chemical engineers are among the most important users of alloy steels in America. They can take great comfort in the fact that the steel industry has learned how to use alloys much more efficiently and economically than ever before. The special requirements for corrosion resistance and for severe services will be better served in the future than in the past through this knowledge.

It becomes increasingly important for the chemical engineer who selects or designs or plans for equipment to acquaint himself with all of these facts. *Chem. & Met.* is planning to give important attention to this subject later in the year in another—the 11th—of its "Materials of Construction" issues. Meanwhile engineers who have had to do without or use substitutes for modern materials may well be thinking and planning for the day when more and better alloys will again become available. It cannot come too soon for some.

SEVEN SERIOUS SINS

LABOR SINS. So do others. The authority for these generalizations is the dynamic president of the Chamber of Commerce of the United States, Eric A. Johnston, who has listed the following "seven deadly sins which need eradication":

1. Union monopoly of jobs.
2. Crushing fines on union members.
3. Absence of meetings or free elections of officers.
4. Lack of proper public financial accounting.
5. Too many strikes.
6. Picket line violence.
7. Artificial restrictions on production.

But Mr. Johnston was very emphatic in his speech before assembled labor leaders that industry, too, is not guiltless. Nor should industry be less diligent in revising its own bad habits in management-labor relations.

WHAT ABOUT THE FOREMEN'S UNION?

LATELY we heard an able representative of labor say "Whenever you hear of management being worried about foremen joining a union, you can guess that something is wrong with management. When foremen feel they need protection against management, you already have a schism that should not exist." In other words, if management will get busy and heal that breach, there need be nothing to fear from unionization of foremen.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

War Bond Awarded Each Month

Until further notice the contest which was first announced in our November 1943 issue will be continued. For the best short article received each month and accepted for publication in the "*Chem. & Met.* Plant Notebook," a $25 Series E War Bond will be awarded, in addition to payment at our usual space rate for this department. The award for each month will be announced in the issue of the following month. The judges will be the editors of *Chem. & Met.* Any item submitted may be published in this department, but all items so published will be paid for at our usual space rate for such material.

The contest is open to all readers of *Chem. & Met.*, other than employees of the McGraw-Hill Publishing Co., Inc.

Any number of entries, without limit, may be submitted by one person. Articles must be previously unpublished, and should be short, preferably less than 300 words, but should include one or more illustrations if possible. Finished drawings are not required and literary excellence will not be a factor in the judging. Winning articles will be selected on the basis of appropriateness, novelty and the usefulness of the ideas described.

Articles may deal with any sort of plant or production "kink" or shortcut which in the opinion of the judges will be interesting to chemical engineers in process industries, as well as with cost reducing ideas, and novel means of presenting useful data. Material to be entered in this contest should be addressed to Plant Notebook Editor, *Chem. & Met.*, 330 West 42nd St., New York 18, N. Y.

February Contest Winner

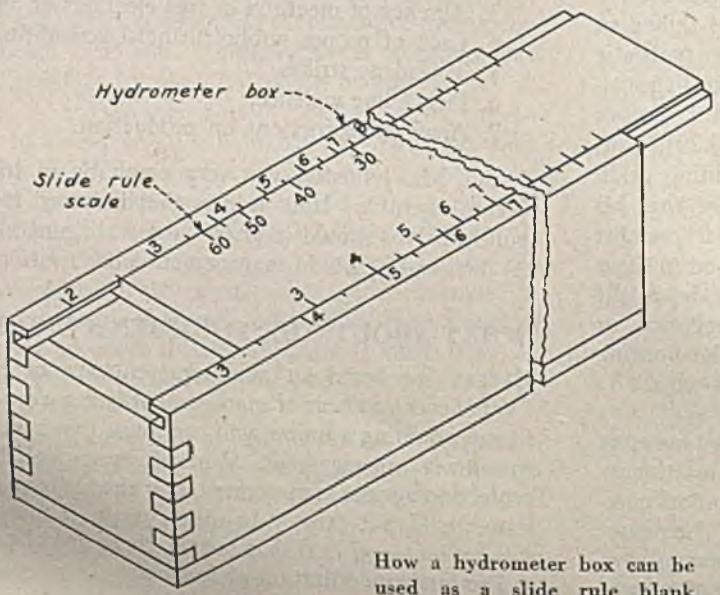
USING A HYDROMETER BOX TO SUBSTITUTE FOR A BLANK FOR SPECIAL SLIDE RULES

D. M. PEPPARD and D. S. DAVIS
Wyandotte Chemicals Corp.
Wyandotte, Mich.

IN PEACE TIME slide rule manufacturers were able to construct excellent special slide rules with engine-divided scales from designs submitted by chemical and other engineers. War-time necessity no longer makes it possible to use scales and even slide rule blanks in this manner but a fairly satisfactory substitute, easily available to any chemist or engineer, is the wooden box with the sliding top in which hydrometers are packed by the chemical equipment supply houses.

Such boxes come in several sizes and one of the most convenient for slide rule purposes is $1\frac{5}{8}$x$1\frac{5}{8}$x$15\frac{3}{4}$ in. shown in the accompanying illustration. The edges corresponding to the "A" and "D" scales on the usual slide rule are only 7/32 in. wide but are not too narrow for distinctive graduations if the numbering is placed immediately after the strokes instead of above and below them. The slide is $1\frac{1}{4}$ in. wide and offers ample space for two scales, definitive legends, complete directions for use, and a sample calculation.

The special scales can be constructed in accordance with the nature of the computation by methods previously described[1, 2]. The ordinary 10-in. slide rules (polyphase, duplex, or log-log duplex) will be found helpful in laying off logarithmic scales of moduli of $8\frac{1}{3}$, 12.5, and 25 cm. while the 20-in. rule of any type is ideal for logarithmic scales of moduli of $16\frac{2}{3}$, 25, and 50 cm. Graduations and numerals in pencil are adequate when protected by shellac, although the surface of the wood can be sized so that the markings can be made in ink if desired.



How a hydrometer box can be used as a slide rule blank

The combined box and special slide rule can also be used as container for pencils, pens, and other pertinent desk equipment. If the special purpose for which the rule is designed is the calculation of dissolved solids from specific gravity and temperature measurements (pp. 96 and 102 of Reference 2) the box-slide rule provides a safe and convenient haven for the hydrometer and thermometer, and the whole constitutes an exceptionally compact testing and computing unit for technical control work in the plant.

References

1. Austin, G. T., *Chem. & Met. Eng.*, 49, p. 90 (1942).
2. Davis, D. S., "Empirical Equations and Nomography," Chap. X, McGraw-Hill Book Co., Inc., New York (1943).

MARCH WINNER!

A $25 Series E War Bond will be issued in the name of

A. EDGAR KROLL
Chemical Engineer
Terre Haute, Ind.

For an article dealing with an improved method for making computations for orifice design which has been adjudged the winner of our March contest.

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

INTERFACIAL LEVEL CONTROL IN EXTRACTION COLUMNS

ALLEN S. SMITH and J. E. FUNK
Blaw-Knox Division of Blaw-Knox Co., Pittsburgh, Pa.

LIQUID-LIQUID extraction operations are carried out most efficiently by continuous counter-current contacting in a packed column. Two liquid phases of different densities coexist in the column. One phase is dispersed in the other which is continuous and fills the voids of the packing. A settling zone at one end of the column, free from packing, allows the dispersed phase to coalesce. An interface is established in this zone. Its position is predetermined and must be maintained constant.

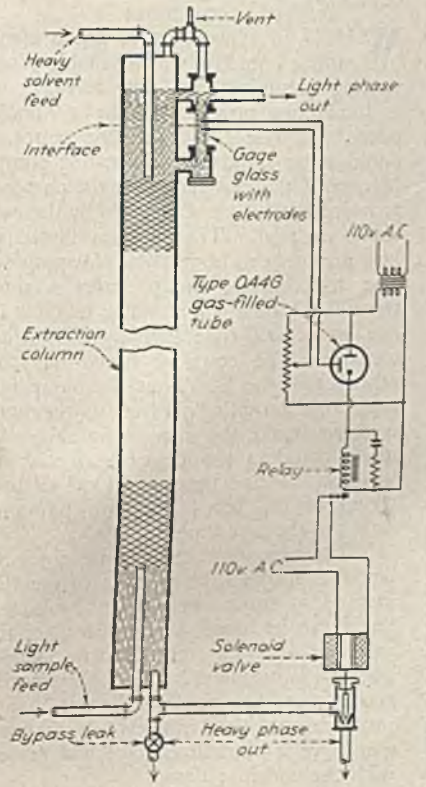
The interface has commonly been established and maintained by use of an inverted U loop. The heavy phase is discharged from the bottom of the column through the loop. The interface is maintained at the predetermined point by adjustment of the loop height. Variation in feed composition or pumping rates causes fluctuations in density difference between the two phases. The position of the interface, therefore, oscillates slowly and lags behind feed variations. Unless the interfacial level is constant, considerable loss in yield and quality of the product occurs since an extraction column has a large holdup.

An electronic relay used to actuate a solenoid valve in the discharge line of the heavy phase has improved operation of one column. Interfacial level variations have been reduced to ±¼ in., and visual check of the level is unnecessary.

The method depends upon the fact that if an interface exists, the electrical conductivity of the two liquids at the interface will be different. The method should, therefore, be applicable to any liquid-liquid extraction process. A pair of electrodes of any resistant metal, tungsten for example, is sealed in a sight glass as indicated in the figure. The area and spacing of the electrodes must be determined by trial if specific conductance measurements have not been made. When the liquid of greater conductance shorts the electrodes the electronic relay actuates the solenoid valve, and allows the heavy phase to be discharged from the column.

The electronic relay was constructed from the design of Rudy and Fugassi (*Ind. Eng. Chem., Anal. Ed.*, 12, p. 757, 1940). Similar units may be purchased. If the column is grounded it is necessary to use an insulating transformer in the 110-v. feed line to the relay. The leads to the electrodes from the relay must be well shielded, or separated, and insulated to avoid induced currents and leakage. The solenoid valve was type P3A made by the Automatic Switch Co. The control unit has been used with two-phase systems of hydrocarbons and various alcohols.

Interfacial level control



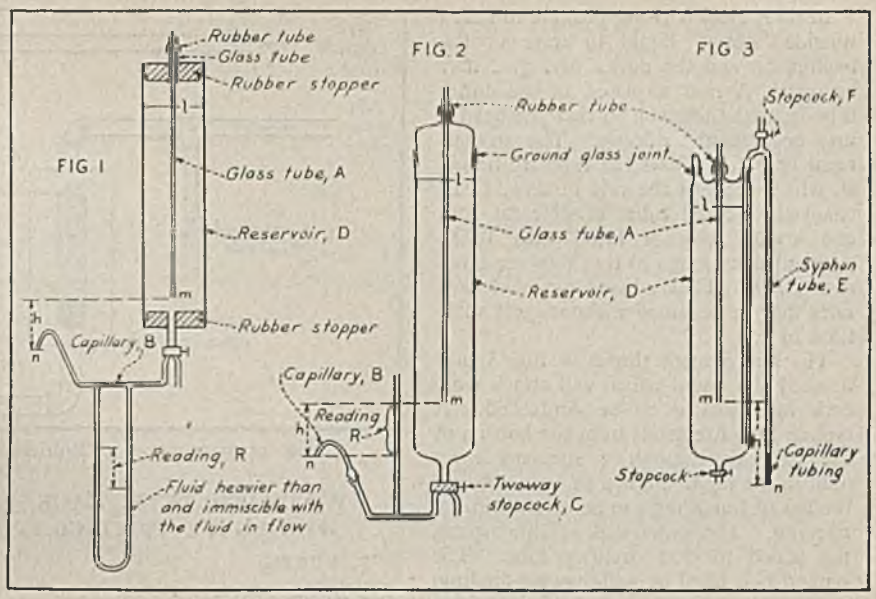


Fig. 1—Constant-flow device equipped with a manometer for flow-rate measurement
Fig. 2—Constant-flow device with riser for flow measurement
Fig. 3—Constant-flow device for cases where liquid attacks stopcock lubricants

CONSTANT-RATE FEEDERS FOR PROCESS LIQUIDS

CLYDE McKINLEY
General Aniline & Film Corp., Easton, Pa.

A RELIABLE APPARATUS for adding liquid at a constant rate to a reaction vessel is often needed in experimental work and in small scale industrial equipment, but an inexpensive commercial instrument may not be obtained for liquid flow rates in the range of 10 to 1,000 cc. per hour. Liquids are often added to reactors at approximately constant rates by controlling the flow by means of a stopcock or pinch-clamp. This technique is very tedious when applied to operations of several hours' duration and further has the disadvantage that considerable fluctuation from the average flowrate may take place over short intervals of time.

The devices described here enable one to maintain uniform flow rates as low as 10 cc. per hour automatically over long periods of time. Liquids such as water, toluene, sulphuric acid, and solutions of chemicals in organic or inorganic solvents may be easily handled.

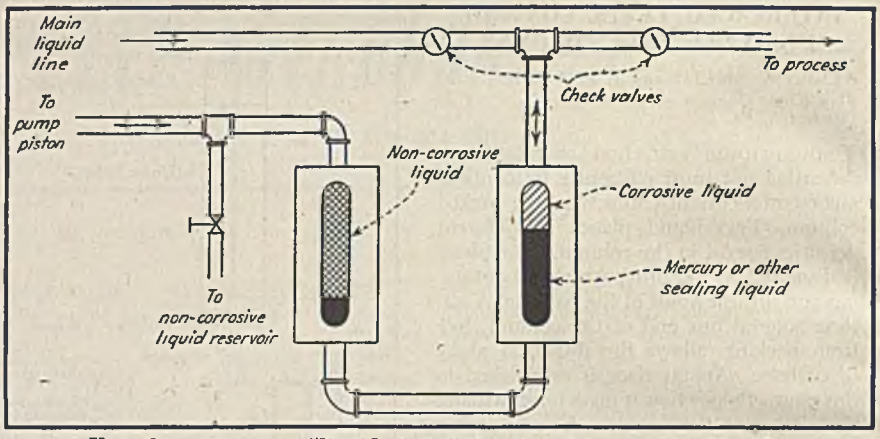
The flow of a fluid will remain constant if the pressure head available to cause flow, and the frictional resistance to flow, are constant. The flow in the apparatus of Fig. 1 is restricted by the capillary *B*, and the head remains constant and equal to *h* in the following manner. The reservoir *D* is filled with the liquid to be controlled and the upper rubber stopper is seated firmly so that the reservoir is sealed from the air except for the tube *A* which extends nearly to the bottom of the reservoir. Enough liquid is drawn from the reservoir through stopcock *C* to allow air to pass downward in tube *A* until it bubbles out at *m*. Stopcock *C* is then turned 180 deg. so that flow will take place through the capillary tube and out at *n*. Liquid is now flowing from the reservoir at a rate governed by the head *h* and the size and length of the capillary tube *B*.

Flow rates may be adjusted to the desired value by moving *A* up or down. The head *h* remains constant because air is entering the reservoir at *m* continuously as the liquid leaves at *n*. The pressure at point *m* is atmospheric since the tube *A* is filled with air and the pressure at point *n* is also atmospheric, hence the difference in the height of points *m* and *n* is a measure of the pressure head available to cause flow to take place. A manometer may be used as an aid in adjusting the rate of flow. The manometer reading *R* may be made very sensitive to changes in flow rate by choosing for the "heavy" liquid one with a density only slightly greater than that of the fluid in flow.

The reservoir *D* may be of any desired size, and calibrated or not. For example, it may be made of a length of glass tubing, a straight-sided separatory funnel, a large bottle, or a large calibrated burette.

In some cases it is not possible to find a suitable "heavy" liquid to serve in the manometer and the device of Fig. 2 may be used. A riser is placed in the outlet tube from the reservoir so that the head *h* may be measured directly. The arrangement of Fig. 2 allows the capillary tubing *B*, which controls the rate of flow, to be changed. Several tubes of different sizes and lengths may be fitted with 10/30 standard taper joints so that they are interchangeable. Thus a wide range of flow rates may be obtained without great variations in *h*.

The arrangement shown in Fig. 3 may be used if a liquid which will attack stopcock lubricants is to be controlled. A syphon tube *E* extends from the bottom of the reservoir through a standard taper joint in the top and down to a point below the lowest liquid level to be reached in the reservoir. The outer end of this syphon has sealed to it a capillary tube. The syphon *E* is filled by withdrawing air from it through stopcock *F* until liquid from the reservoir has displaced the air nearly to the stopcock. During this operation the syphon must be closed from the air at *n* by holding a cork tightly against the end of the capillary tube. F is closed when the syphon is full and liquid will flow under the influence of the pressure head *h*. Flow may be stopped by introducing a bubble of air into the syphon through *F*, or A may be lowered until *m* is below the level of *n*. Fig. 3 does not show a manometer or other device for measuring the head but the head can be estimated quite closely by approximating the difference in height between *m* and *n*. The arrangement of Fig. 3 may be quickly applied to flow control from a 5-gallon bottle or similar large reservoir and may be used for operations such as dialysis in which a constant rate of flow for several hours or days is desired.



Use of mercury as a "liquid piston" for pumping corrosive liquids

PNEUMATIC LEVEL GAGE FROM PIPE FITTINGS

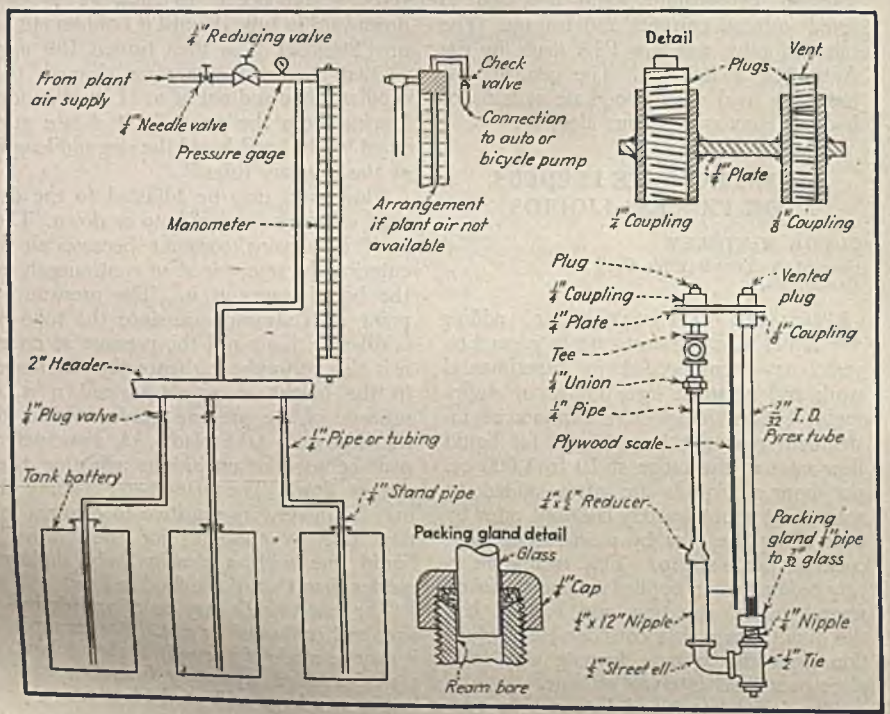
J. F. FURRH
Instrument Foreman
Monsanto Chemical Co.
Marshall, Tex.

STANDARD PIPE and fittings such as will be found in any chemical plant warehouse can be used to build a satisfactory pneumatic level gage. The whole job can be completed in a few hours, as against the months of delivery time at present for purchased gages. The design is indicated in the accompanying sketch, which shows at the left the complete assembly, with bubble pipes installed in several tanks, and at the right several details. The details are self-explanatory.

The mercury chamber is constructed of standard pipe and fittings, while the gage glass is a standard laboratory size. The packing gland for the bottom of the glass is the only part requiring machine work, and this can be made in a few minutes by any machinist, using a standard pipe cap and nipple. The U-tube is held together at the top by a connection made of a piece of $\frac{1}{4}$-in. flat iron through which a $\frac{1}{4}$-in. and a $\frac{1}{8}$-in. pipe coupling are welded. The scale can be made of sheet metal or plywood, and painted. A cover, if desired, can be made in a few minutes of sheet metal or plywood. In calibrating, knowing the gravity of the liquid to be measured, the mercury column can easily be graduated in feet or gallons of the liquid.

Materials required include nothing not clearly indicated on the sketches, with the exception of about 3 lb. of mercury. The entire cost of the gage should not exceed about $35, and it can be installed on either one tank, or a battery. Using the plant air supply with a suitable reducer the gage will indicate continuously, or in lieu of plant air, a small hand pump can be used to give spot readings.

Pneumatic tank gage of pipe and fittings, with construction details



LIQUID PISTON FOR PUMPING CORROSIVE LIQUIDS

LOWELL T. BURKE
Oakmont, Pa.

WHEN it is necessary to pump a corrosive liquid for which suitable pump packing materials are not available, it is sometimes possible to use a "liquid piston" as a seal between the corrosive liquid and a standard reciprocating pump. Mercury is the best liquid for the purpose, provided that it is not attacked by the corrosive material. The diagram illustrates how mercury can be used for this purpose. The reciprocating pump forces a noncorrosive liquid such as water or oil into one leg of a U-tube partially filled with mercury. The corrosive liquid fills the other leg of the U. Thus the pump imparts a reciprocating motion to the noncorrosive liquid, the mercury and the corrosive liquid in the U, while the check valves in the main line convert the reciprocation of the last liquid into pumping action in the main line.

When mercury reacts with the corrosive liquid, it may still be possible to use this method in some cases if a suitable seal liquid can be found to use instead of the mercury and the non-corrosive liquid. The seal liquid must have a higher specific gravity than the corrosive liquid, to prevent mixing with it in the U, and it must also have a negligible solubility in and with the corrosive liquid.

REPORT ON.....

GOVERNMENT DISPOSAL

Of Surplus Stocks and Facilities

Proper disposal of government-owned surplus war stocks, plants and facilities, now attracting serious attention, promises to develop into one of the most stubborn government-industry-political headaches of the postwar era. How can these holdings, estimated at $100 billion and one of the largest of any government at any time, be disposed of so as to retain their maximum usefulness and yet involve a minimum of loss to the taxpayers as well as a minimum of threat and competition to private enterprise? How, ask the engineers and executives of the chemical process industry, will our postwar markets be affected by government-owned facilities for producing chlorine, anhydrous ammonia, aluminum and magnesium, sulphuric acid, synthetic rubber, aviation fuels? How, ask construction engineers and equipment firms, will the dismantling and relocation of such facilities affect our operations? It is still for too early to answer these questions, even broadly. Yet certain policies on disposal procedures now being formed in Washington are bound to be highly influential in shaping our postwar economy. This report outlines these basic trends so that process industry executives and engineers can now plan ahead of time.

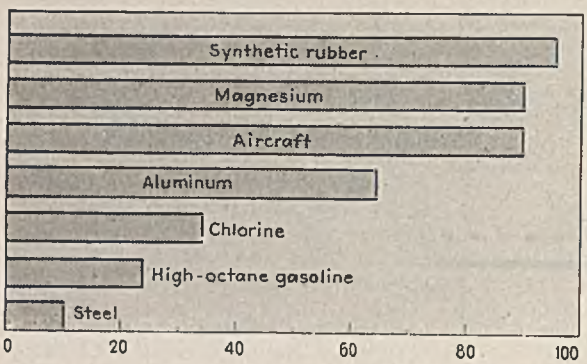
THIS WAR of machines and technologies has made the United States government, with the possible exception of the Soviet Union, the biggest property owner of all history, the Croesus of the twentieth century. By the end of the conflict our government will own nearly $100 billion worth of goods, factories, land and facilities which have been acquired for war but which will not necessarily be needed after peace comes.

These holdings are so extensive and complex that any sort of accurate breakdown at this stage is extremely difficult. Appraisal of the situation is complicated by the fact that the entire program is still in a state of flux. Nothing like a detailed inventory can be obtained until the war is won and our government and industry engineers can relax from the duties of actual production to survey what they have built, produced and stocked. Nevertheless, tentative as they may be, the facts now available are interesting in that they serve to indicate the enormousness of the effort forced upon us by our enemies.

This report undertakes to survey in a preliminary fashion the problems involved in the disposal of these surplus government stocks and facilities. It undertakes to reflect the wishes and opinion of some important officials of Washington who now have or hope to have a part in the disposal program. It is not possible yet to say which theories or which plans will be adopted. Nor is it necessary to know at this time the exact ultimate official procedures. Far more important is a review of two things: (1) Who is involved and what they are seeking to do; (2) what goods, lands, plants or facilities are under the control of the various agencies.

Review of those questions now will permit the chemical engineer and industry executive to begin thinking about the relationship of this disposal job to specific industries and to individual companies. It is not too soon to begin that thinking and

"There is no need for a postwar depression. Handled with competence, our adjustment after the war is won should be an adventure in prosperity."



Government-owned productive capacity ranges from 96 percent for rubber to 10 percent for steel

the planning which stems from it. No final or comprehensive conclusions can yet be reached, but the factors can be studied, facts gathered and appraised, and company or industry-wide plans made. Only then can intelligent and constructive influence be exerted by the chemical engineering profession to make the job of surplus disposal as much in the public interest as possible.

Only the closest cooperation of industry and government can achieve that important objective. One cannot hope for perfection even with the maximum of cooperation. However, constructive programs can now be formulated which will minimize the shock of surplus disposal on normal business activities. Such plans, if wisely made, can also minimize the loss to the taxpayers of goods and facilities sold at less than the original cost.

This is a stupendous task, but one that must be faced and carried through during the months and years to come.

ELEPHANTINE, AT LEAST

During the course of this war our federal government has completed or scheduled more than 2,500 industrial projects to produce war goods. The number of prime contracts over $50,000 total 110,000, located in 18,000 individual plants, and are valued at some $146 billion. Seventy percent of the government's total investment in projects will cost over $10 million each; 12 percent in projects of $100 million or more. Average cost of the government-owned plant erected during the war is $6 million.

The cost of the 2,500 or more new projects for producing war goods is between $25 and $30 billion. A little more than half of this total was direct disbursement under RFC activities, principally through Defense Plant Corp. In addition, private industry has spent between $5 and $10 billion more. Thus it appears that war investment in plants and plant facilities is more than half the value of all pre-war manufacturing plants and equipment of the United States. Exact figures on commitments are not available, but tables on this page give the rough magnitude of holdings in certain industries.

Since only about half of the pre-war production facilities has been converted to war goods manufacture, it is apparent that new plants and equipment constructed during the war will have a profound effect upon the $30 billion worth of pre-war manufacturing plants with which they will be in competition. This will be particularly true in certain of the metals and chemical commodities.

Of the approximate $60 billion of stocks that government agencies will have on hand at the war's end, only about $15 billion or less will be food, clothing, trucks, tools, chemicals, medical supplies, transportation, engineering and communication equipment and other goods for which there will be civilian markets. War contractors will have about an additional $10 billion of inventories, the bulk of which will be specialized raw materials, goods in process and finished products. Probably not more than one-fifth of these inventories will be marketable or usable for civilian purposes.

Table I—War Industrial Projects and Facilities of the United States[1]

	Number of Government Projects[2]	Approximate Cost (Millions) Government	Private[3]
Aircraft	353	$3,150	$245
Shipbuilding	227	2,145	100
Motorized vehicles	72	425	80
Guns	209	816	}
Ammunition	315	1,069	} 230
Explosives	81	2,872	12
Iron and steel	240	1,231	555
Non-ferrous metals	135	1,160	305
Machine tools	186	155	140
Machinery, electrical equipment	331	475	310
High-octane gasoline	36	176	725
Synthetic rubber	68	500	...[4]
Chemicals	128	660	...[4]
Miscellaneous manufacturing	287	292	200
Non-manufacturing	200	444	1,390
Total	2,868	$15,630[5]	$4,292[5]

[1] Includes 67 projects valued at $167 million owned by the United Kingdom. The number of projects and their costs are variable because of the constant addition and cancellation of projects, variations in the definitions of "projects," duplication of classifications, and lack of uniformity in defining "war" facilities.
[2] Without adjustments for duplications where the same plant makes products in more than one of the groups. With a rough adjustment, the number of projects totals 2,615.
[3] Approximated only. Figures for synthetic rubber and chemicals not included.
[4] Detailed figures not available. [5] Total government and private costs are now at least $30 billion.

Table II—Holdings of the Defense Plant Corp., the Nation's Largest Property Owner

	Number of Facilities*	Commitments (Millions)
Aircraft	548	$2,880
Aluminum	96	784
Aviation gasoline	36	176
Chemicals and alcohol	128	93
Machine tools	163	82
Magnesium	47	444
Minerals	62	157
Ordnance	78	310
Radio and scientific	100	69
Ships	68	151
Steel and pig iron	166	901
Synthetic rubber	68	658
Flying schools	72	45
Miscellaneous	185	419
Machine tool pools	.....	2,102
Total	1,778	$9,289

* Includes an adjustment of 39 duplications where the same plant is making products in more than one group. These figures are indicative only.

Americans once thought that the building of the Panama Canal was the ultimate in achievement. Yet, during 1944, the production of materials of war in this country will probably be equivalent in cost to the building of a Panama Canal almost every two days throughout the entire year. The 47,000 sq.mi. of land acquired by the government during the war alone will approximate in area that of all the six New England states.

WHITE ELEPHANTS?

When peace arrives, what will become of our behemoths of war—those bloated plants and industries created by the demands of war but which will become the problems of our postwar economy? Which will be reconverted or otherwise utilized, which will become white elephants? It is still too early to answer these questions, but let us look at a few cases that concern the chemical and process industries.

America's production of magnesium last year was roughly 185,000 tons, which went primarily into bombers and incendiary bombs, whereas total civilian use of this metal in 1939 was less than 3,900 tons. If, at the end of the war, we are turning out magnesium at the full plant capacity of 295,000 tons a year, two-thirds of that production will be going into incendiary materials and export, one-third into fabricated parts for aircraft. Market for the two thirds will be wiped out at the end of hostilities, probably leaving us with a giant stockpile of unused ingots. The remaining one-third must either be absorbed by the commercial aircraft industry and other civilian customers or else find space in warehouses. The commercial aircraft industry, according to some pessimists, cannot absorb more than 5–8 percent of the metal that formerly went into military planes. Further markets

for large civilian uses exist principally in the minds of postwar planners.

Requirements of aluminum for civilian use in 1939 were 180,000 tons, whereas productive capacity by the end of 1944 will amount to almost 1,700,000 tons, thus giving an excess of capacity over civilian use in 1939 of over 1,500,000 tons. The original aluminum program was scheduled to give production from 42 privately-owned pot lines, 34 of which would be owned by Alcoa and 8 by Reynolds, and 38 pot lines owned by the Defense Plant Corp. Total cost of the 96 aluminum facilities of all types owned by DPC is placed at $784 million. What will happen to these plants?

With a total projected output of 868,900 tons of synthetic rubber, some 96 percent or all but about 33,500 tons will be produced in government-owned plants. Major private plants include a 9,000-ton neoprene plant owned by du Pont, and capacity for 24,500 tons of Buna N owned by Standard Oil Co.

The total new program for manufacture of aviation gasoline involves expenditures in the neighborhood of $900 million, of which some 75–80 percent is being spent by industry, largely through three-year loans from the government. The program through 1944, for instance, involves some 96 major projects, including units for catalytic cracking, isomerization, fractionation and alkylation. Some 22 of these will be government-owned plants.

DE-SOVIETIZING UNCLE SAM

Obviously, first step in government preparation for the disposal of facilities is the taking of an itemized inventory of the character, location and condition of the properties involved. Such an inventory has been under way for some months but is expected to require until the middle of 1945 or later for completion.

Meanwhile, though the war is far from won, major cutbacks in requirements for certain types of munitions are already releasing some plants and production facilities for disposal. Chief cutbacks during the coming months will be in small arms and ammunition, tanks, certain types of anti-aircraft equipment, non-combat aircraft and artillery fire-control equipment.

More than offsetting these, however, will be the vastly increased production of combat aircraft, high-octane gasoline and an enlarged program for chemicals that may reach a schedule 20 percent greater than last year. By and large, plants and facilities for such commodities will not become available for disposal or reconversion until after the war's end.

A few of the actual cases wherein non-chemical facilities have already been converted into chemical processing show the flexibility of certain plants that can, with ingenuity, be exploited for purposes other than those for which they were originally designed. Such an example is that of the San Jacinto shipyard at Houston, Texas, originally used for constructing concrete barges. This yard, comprising approximately 40 acres, has been sold for $200,000 to E. I. du Pont de Nemours & Co., who will adapt the plant for the manufacture of phenothiazine insecticide.

The Eau Claire, Wis., ordnance plant has been resold to the U. S. Rubber Co., who will use it for making tires. Similarly, the operating contract held by Kelly-Springfield for the Allegheny ordnance plant at Cumberland, Md., has been terminated and this company plans to use certain of the facilities for tire making.

Recently, when the Scioto fuse-loading plant at Marion, Ohio, was shut down, an arrangement was made with the Henry Kaiser Co. to take over one of the buildings for the purpose of manufacturing a chemical warfare item.

One of the best examples of conversion of a chemical plant is that of the Cactus ordnance works at Dumas, Texas. Originally designed for the manufacture of anhydrous ammonia, this plant has now been converted to production of a vital component of 100-octane aviation gasoline.

Table IV—Convertibility of Government-Owned War Facilities to Peacetime Usage

Government Investment (Billions)	Convertibility to Peacetime Use	Examples
$4–5	No peacetime use.....	Smokeless powder, ammunition loading, munitions
1.5	No conversion.....	Arsenals, navy yards
5.5	Minimum of conversion.....	Chemicals, steel, aviation gasoline, synthetic rubber, electrical equipment
3.0	Physical reconversion.....	Airplanes, aircraft engines, tanks, munitions, assembly lines
1.0	.....	"Scrambled" plants

SURPLUS DEFINED

Surplus disposal, like a complex mosaic of great size, is a problem of many parts and pieces. To appreciate the subject one first must stand at a distance and look at the composite problem. Then it is necessary to move up closer in order to inspect the various parts to see the pieces of which each is made. Finally, there comes the question of action, or proposal for action, regarding each individual part.

Surplus property can be defined as that which the government now has or will later have beyond its normal needs for prosecution of the war and for service to the public. Already there are many goods and facilities which are no longer needed for war. Later on vastly greater quantities will be definitely identified as surplus. For the overall consideration, therefore, let us consider anything from scrap materials to complete factories as a part of the surplus property of the government.

First, it is important to determine how and when a particular item is or may be defined as "surplus." The procedure varies, according to the kind of item and the time of appraisal. For example, the government has all along been disposing of surplus scrap or unusable materials such as metals, textiles and tools. Some of these were acquired through operations of the government itself; some became worn out through government use; others became surplus through changing demands or specifications which made the goods no longer suitable for their original use.

Most government departments have always had supplies of such "scrap," and they have always had means of declaring the property surplus and disposing of it to industrial purchasers. Future handling of government surplus, especially of the unusable goods and equipment, may be taken care of in just this fashion on a much larger scale.

One of the immediate problems for chemical process industry is the study of surplus arsenal capacity which has been op-

Table III—Many of These Magnesium Plants Will Become Postwar Casualties

	Location	Ownership[1]	Planned Capacity, Tons[2]	Process
Basic Magnesium, Inc.....	Las Vegas, Nev.....	DPC	56,000	electrolytic
Dow Magnesium Corp.....	Velasco, Texas.....	DPC	36,000	electrolytic
Dow Magnesium Corp.....	Marysville, Mich.....	DPC	36,000	electrolytic
Mathieson Alkali Works.....	Lake Charles, La.....	DPC	27,000	electrolytic
Electro Metallurgical Co.....	Spokane, Wash.....	DPC	24,000	ferrosilicon
Dow Chemical Co.....	Freeport, Tex.....	50% DPC	20,000	electrolytic
Ford Motor Co.....	River Rouge, Mich.....	DPC	20,000	ferrosilicon
Diamond Magnesium Co.....	Painesville, Ohio.....	DPC	18,000	electrolytic
International Minerals & Chemical Corp.....	Austin, Tex.....	DPC	12,000	electrolytic
Permanente Metals Corp.....	Permanente, Calif.....	Self	12,000	carbothermic
Permanente Metals Corp.....	Manteca, Calif.....	DPC	10,000	ferrosilicon
Dow Chemical Co.....	Midland, Mich.....	Self	9,000	electrolytic
New England Lime Co.....	Canaan, Conn.....	DPC	5,000	ferrosilicon
Magnesium Reduction Co.....	Luckey, Ohio.....	DPC	5,000	ferrosilicon
Amco Magnesium Corp.....	Wingdale, N. Y.....	DPC	5,000	ferrosilicon

[1] These 13 Defense Plant Corp. plants have already cost the Government some $370,000,000. Five of the plants are still below capacity, six above. Current rated capacity is at 293,000 tons yearly.

[2] Cut-backs already in effect are as follows: Electro Metallurgical Co., 50 percent; Permanente Metals Corp., Manteca, Calif., 50 percent; Ford Motor Co., 50 percent; Mathieson Alkali Works, 100 percent; Amco Magnesium Corp., 35 percent. Actual operating capacities are frequently greater than the designed capacities.

erating in the manufacture of explosives and ammunition. These include plants for fixation of nitrogen as ammonia, sulphuric acid manufacture, and elaborate plants for making smokeless powder, TNT, or other explosives. Others are ammunition loading or shell filling facilities. The surplus of all types of such facilities is now so recognized because ammunition demands of the country are less now and in prospect than they appeared when these arsenals were planned and built.

War Department facilities such as these arsenals become available for disposal according to a procedure long used by the Army. When a certain division or unit finds that it has surplus facilities, it reports this fact through the corps commander to the chief of the Army Service Forces. That office then makes inquiry of the various divisions and corps which constitute ASF to see whether any of the other units would like to have this property. When it has been released by all, the property is then referred to the Chief of Engineers for disposal. One of the technical divisions in this office takes over the task of finding prospects and determining the best available plan for disposal.

This general procedure was started for a number of arsenal properties during January and February. Thus far the plan has not been completely abandoned but is operating with respect to the type of plants and equipment mentioned above. Some transactions are likely to be completed under this plan, but others will doubtless be referred to the appropriate sales agency in the Reconstruction Finance Corp. for final negotiation and settlement. Meantime, any facts which the Engineer Corps can gather will be just that much aid for the officials who finally arrange the disposal contracts.

ENGINEER ADVISORS

The division of the Engineer Corps charged with surplus property disposal has recognized that private enterprise does not want to run arsenals in peacetime. Still less do they want to own them and keep them idle. It was obvious, therefore, that some competent advice must be sought as to the prospective peace value of these huge chemical factories.

A small advisory committee of experienced construction engineers has been named by the Chief of Engineers to advise this staff. Also drawn in as advisors have been experienced chemical engineers acquainted with industrial facilities and the needs of American enterprise..

Subcommittees of this advisory group are now working on various phases of the problem. For example, they are trying to find out what can be done with idle TNT facilities other than to demolish them and sell the parts and equipment as used machinery.

This procedure of seeking industrial advice has not been generally adopted as yet by those government agencies that will be charged with actual disposal problems. It is anticipated, however, that almost every agency that has an ultimate part in the disposal question will be compelled to seek experienced chemical engineering aid.

It is probable that much of the chemical engineering will be done by consultants engaged according to the projects under consideration and selected to fill the gaps in the experience of the regular government employees. In many cases, advice will be sought of the companies that built the plants for the government on the theory that these concerns know for whom they ordinarily build such facilities and therefore should know who might buy second-hand plants.

In seeking advice of construction companies, it is recognized that these firms have something to lose if old government facilities are taken over by industry. It is equally evident that construction firms will be needed for redesign and extensive remodeling, or even rebuilding, of government equipment when its use is changed from a wartime product to one of peace significance.

Those who recall the problems of surplus disposal after 1918 will realize that in the immediate postwar years this business will be one of the most important parts of the work of the construction and equipment industries. As one engineer put it, "We might as well do this work because somebody will do it. We cannot hope for new business in many lines until much of the surplus plant problems of the government have been solved."

BARUCH BIBLE

Disposal of ordnance facilities have been discussed first since they represent one of the most imminent problems which will confront engineers of process industry. The discussion of the preceding paragraphs illustrates, however, more about the uncertainties of the situation than about the actual plans and policies to be followed. All of which is inevitable at this stage.

Most significant as to the future is "Report on War and Postwar Adjustment Policies," the lucid and comprehensive

"The essential point to remember about these contract settlements is that they must be fair—fair both to the Government and to the contractor. What is fair can be determined just as well in a matter of weeks as in years."

GENESIS OF POSTWAR INDUSTRY

Baruch-Hancock Recommendations on Administration Set-Up

1. Immediate creation of a Surplus Property Administrator in the Office of War Mobilization to be appointed by the Director, with full responsibility and adequate authority for dealing with all aspects of surplus disposal.

2. This Administrator to be chairman, with full and final authority, of a Surplus Property Policy Board representing these agencies: War, Navy, Treasury, Reconstruction Finance Corporation, Maritime Commission, War Production Board, Bureau of the Budget, Food Administrator, Attorney General, Federal Works Agency, State Department, and Foreign Economic Administration.

3. The work of actual disposal to be assigned to four major outlets, each operating in a clearly defined field, with no overlapping and following policies to be laid down by the Surplus Administrator: (a) consumer goods – other than food – to the Procurement Division of the Treasury; (b) capital and producer goods in general – all types of industrial property, including plants, equipment, materials and scrap – to a single corporation within the Reconstruction Finance Corporation, consolidating the present Reconstruction Finance Corporation subsidiaries dealing with government properties; (c) ships and maritime properties to the Maritime Commission; (d) food to the Food Administrator.

statement prepared by Bernard M. Baruch and John M. Hancock under the date of February 15.* This work is clearly an official pattern by which the government expects to cut up war surpluses and remake the goods into peacetime costumes for industry. The statements of the Baruch report and the administrative plans made under it present the only definite program which can be studied at this time.

The Baruch report is likely to become a bible for both creed and procedure for all government officials. It represents far more than the findings of this elder statesman and his capable collaborator. It actually represents a composite of official opinion, including many compromises on plans and procedures, as it prevailed during the first months of this year. Fortunately for the American people, it offers little compromise on the basic principle of the integrity of American business as an essential for postwar well-being of this country.

Some of the outstanding principles formulated in the report are reprinted here as reminders of the basic thinking of Mr. Baruch. Perhaps most important of all of these principles is the frequently reiterated belief that surplus government property can be utilized for the good of the American people as a whole without destruction of business. Those industrialists discouraged or driven almost to nervous collapse by the difficulty of postwar settlements would do well to reread occasionally the words of assurance and optimism which run inescapably throughout the whole report.

TEN COMMANDMENTS OF SURPLUS DISPOSAL

Baruch-Hancock Outline of Basic Principles

1. Sell as much as possible as early as possible without unduly disrupting normal trade.

2. Listen to pressure groups, but act in the national interest.

3. No sales, no rentals to speculators; none to promoters.

4. Get fair market prices for the values with proceeds of all sales going to reduce the national debt.

5. Sell as in a goldfish bowl, with records always open to public inspection.

6. As far as practicable, use the same regular channels of trade that private business would in disposing of the particular properties.

7. No government operation of surplus war plants in competition with private industry.

8. No monopoly; equal access to surpluses for all businesses: preference to local ownership, but no subsidizing of one part of the country against another.

9. Scrap what must be scrapped, but no deliberate destruction of useful property.

10. Before selling surplus equipment abroad, assure America's own production efficiency on which our high wages and high living standards rest.

NEO-NEW DEALISM

Latter-day New Dealers find small comfort in the Baruch report. This was the intention of the authors, who go out of their way to discourage those who would use government surplus as a means of keeping the government in business. There is not only the seventh basic rule: "No government operation of surplus war plants in competition with private industry," but there is also a clear warning that the government must not participate in postwar business through the subterfuge of leasing. It is probably safe to conclude, therefore, that the present proposal is to have the government get out of business completely as fast as surpluses can be sold.

It is equally evident that those who think differently are not going to be easily discouraged by Baruch's decision and warning. It will be important for those who have dealings with the government with respect to surplus property to insist that this cardinal principle be recognized by suitable contract arrangements, not only for immediate safeguarding but also for future protection.

One experienced and capable Washington interpreter offers some good advice on this point. He emphasizes that 1944 is an election year in which the tide is evidently running in the direction of conservatism. Those who seek to retain the New Deal group in office are therefore compelled, whether they like it or not, to put on the cloak of conservatism and swing strongly to the "right." This observer warns that there will be another return swing to the "left" if the old group remains in power, either in executive or legislative position. Enforceable contract terms must therefore be written into surplus purchase contracts where the threat of later government competition may be feared. That, it must be admitted, is something much easier to write about than to do.

"The business of all of the disposal agencies should be conducted as in a goldfish bowl, with the facts on all sales open to public inspection at the point of sale and each agency submitting reports, summarizing these sales regularly to Congress through the Surplus Property Administrator."

WHAT CONGRESS WANTS

Congressional committees have for some time been investigating postwar and surplus disposal questions. Even before the Baruch report was issued, there had been comparable findings prepared by Senator George and his co-workers in a special Senate committee. Bills which have been introduced in the two houses of Congress will in many particulars merely make into law some of the more important Baruch recommendations. This is not an accident.

Congress must set up a few principles to govern administrative action. Some interpreters feel that most of the property disposal to be done cannot be accomplished with full legal force until Congress does grant more authority. This certainly is an important, and probably correct, interpretation with respect to the sale of plants and real estate.

Congress must also consider the international aspects of surplus disposal. It is not likely that the legislators will allow the President and his group of advisors to make all the findings regarding future business relations with the rest of the world as affected by property settlements. A great deal of goods movement under Lend-Lease can be accomplished for surplus utilization. But the disposal of capital goods by transfer of complete plants from the United

* Copies of the Baruch report are offered for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C., at 20 cents per copy. Recommended reading for every engineer.

A COMPLETE FINANCIAL KIT

Baruch-Hancock Formula for Freeing Working Capital

1. Immediate payment – the full 100 percent – for all completed articles.

2. On the uncompleted portion of the contract, immediate payment – the full 100 percent – of the government's estimate of "factual" items where proof ordinarily is simple, such as direct labor or materials, and of other items on which the government is able to satisfy itself, up to 90 percent of the contractor's total estimated costs.

3. Immediate payment – the full 100 percent – of settlements with subcontractors as soon as approved.

4. Payment by the government of interest on termination claims, until settled.

5. As insurance against delays in validating claims, a new, simplified system of T (Termination) loans by local banks, with government guarantees, to be available to all war contractors, primes and subs.

6. For those unable to obtain such loans from their local banks in thirty days, the government to make loans directly.

7. Until the new T loans are authorized by Congress, extension of V and V T loans to all eligible borrowers.

8. Finally, for hardship cases unable to use any of the tools outlined above, expedited settlements.

States to foreign locations is a larger question on which Congress will want to have something to say.

IN WHOLE OR PART

Various agencies which now control surplus plants would naturally prefer to get rid of a complete plant for postwar purposes. That will not always be feasible. In many cases the product for which the plants are designed is not a commodity of peacetime usefulness. Furthermore, it is not always possible to arrange for postwar use of facilities for new products on so huge a scale as war activities have required.

Neither do all plants and facilities have salvage value. Some were so constructed as to be useful only for the particular purposes for which they were built. Examples are some of our special ordnance installations. Others were equipped with special machinery of such size that there would be little peacetime demand for articles that could be made. Examples are found in the plants to make heavy, long-range gun barrels. The best and most important of these may be kept as stand-by plants, read for use in the event that we should again be required to undertake a huge armament program. The War and Navy Departments have already made some plans along this line. Nevertheless, the government is hoping that where possible, a complete plant can be sold and the purchaser can then take the responsibility for partial dismantling.

For those plants which cannot be sold as a whole, efforts will be made to sell units or parts, either for use where now located or for dismantling for re-erection elsewhere. Thus, once again, the government will probably become a tremendous factor in the used machinery market. Those interested in the problem will find it advantageous to review the comparable experiences after the last war.

Some of our war plants are the most modern that architects could design. In general, they are well-lighted, well-ventilated, have high ceilings and floors capable of carrying the heaviest machinery. They are the finest plants in the world and are far superior to what a few years ago were the finest in the United States. For these very reasons, many of them are "too big and too good" as well as too expensive for normal competitive use.

It must be recognized that the value of the plant or facility is not its cost to the government. In the first place, construction costs are considerably greater in wartime than in peace. Many buildings were rushed up on a round-the-clock schedule, adding up to 20 percent to labor costs. Secondly, the facilities were specially designed for the production of particular war items, and an equal expenditure for facilities specially designed for peacetime goods would produce a plant superior for that purpose.

Government must, therefore, be prepared to lease or sell these facilities in accordance with a realistic understanding of their true value to those interested in acquiring them. If the government asks too much for these facilities, they will not be acquired by private business, and their entire cost will have to be written off as a loss to the nation.

GLOBAL INDUSTRY

International relations are bound to be strained as one part of the surplus disposal problem is studied. One group will wish that capacity in excess of domestic needs be furnished to foreign agencies for use elsewhere in the world. That policy will obviously have reverberations on export opportunities of United States manufacturers. It will probably take an act of Congress to determine the extent to which Uncle Sam can establish foreign competitors for American business by such sales of equipment abroad.

There has been considerable discussion in Washington over the possibility of providing the Soviet Union with long-term credits to cover the cost of huge heavy equipment orders likely to be placed in the United States. The probable amount of these credits is less than $2 billion, though the Russians are asking for twice that figure. In addition, United States huge purchases of raw materails abroad have built up a substantial dollar balance, especially in the Latin American republics.

In some cases the government has already considered the dismantling of plants as a whole for shipment abroad. Numerous requests have been made by other governments for such manufacturing facilities. A few feasible actions have been taken, but these have not been widely publicized as yet. Actually, the decisions thus far reached are mere experiments in administration.

Even the sale of consumers' goods abroad will temporarily restrict export markets. That difficulty, however, is not regarded as one of great importance in most industries. It is evident that domestic demands for certain consumer goods will exceed the supplies which can be

---

"This red flag of warning is raised: leasing must not become a hidden device for the Government to compete with private plants; it must not become a hidden device for subsidies—by any name—to anyone. Once plants leave the Government's hands they must then stand entirely on their own feet competitively."

manufactured within the United States for some time to come. It is expected, therefore, that there will be little opposition to selling goods of that character abroad when they are actually surplus.

However, there is a secondary factor just now developing. This is the argument that these surpluses should be made available cheaply for American consumers. Congress will probably have to referee this controversy. But it is not as big as might seem likely, in view of the tens of billions of dollars' worth of consumer goods involved.

Actually, most of these goods are not too well suited to the American consumers' tastes, but they will be welcome abroad where any goods are better than nothing. It may be, therefore, that foreign sales of certain surpluses will go on even when domestic supplies of this general class of goods are still a bit scarce. Producers of raw materials like chemicals will not be as much concerned as will establishments interested in actual consumer goods. But even in the raw materials field these questions cannot and must not be ignored.

MONOPOLY BUGABOO

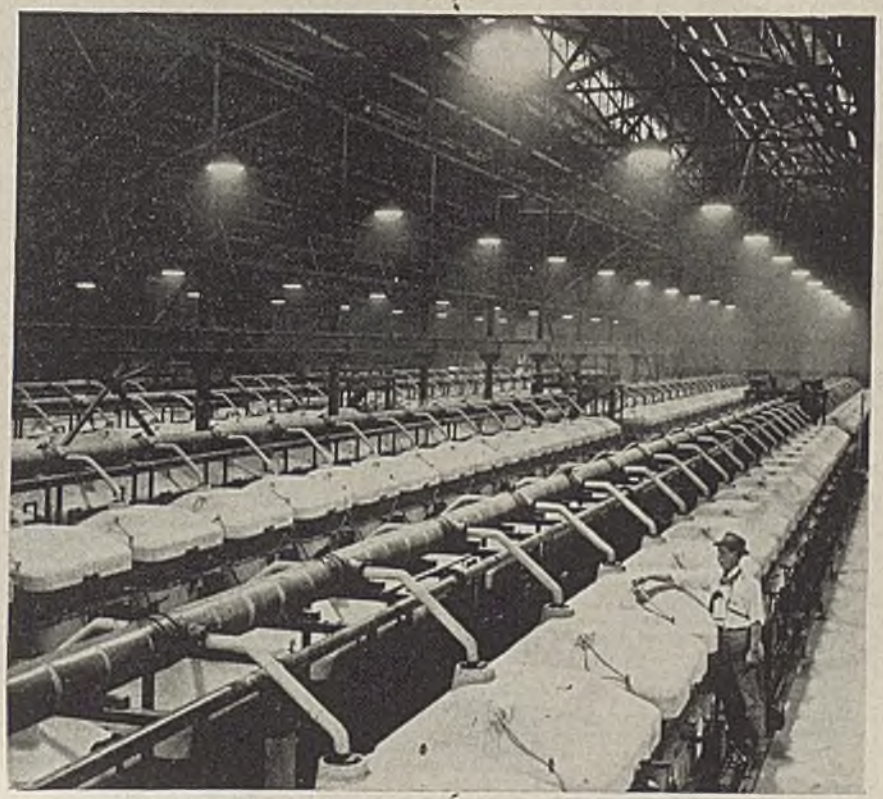
The government now owns half or more of the manufacturing capacity for numerous commodities. For example, it has built much of the aluminum, magnesium, and ammonia-synthesis facilities of the country. What is done with these plants will largely determine who becomes dominant in these manufacturing fields after the war is over. Naturally, these questions are of paramount importance to industry.

Some government men, including high officials, have argued that the government should utilize its facilities for breaking monopolies, which these folk charge are existent in certain commodities. Those of this disposition think that even if companies formerly important are seriously injured or even destroyed by sales of government plants to competitors, such would be good for the public.

Mr. Baruch has heard these arguments pro and con. On this subject he is outspoken. He accepts the theory that government should not create monopolies by use of its property. He believes that government sales cannot properly be used to destroy honest and law-abiding enterprises, no matter how large they may have been. Size alone constitutes no crime. Some middle course between the two extremes is likely to be followed.

SALES TECHNIQUE

When the Baruch report was released, the broad principles of the Administration's sales program were evident. Almost simultaneously the President, by executive order, set up the machinery for surplus disposal, making Under-Secretary Will Clayton the general executive in charge.



Government plants now produce a third of the nation's chlorine output

Soon thereafter it was announced that sales of surplus property would be arranged through four principal channels. Capital goods, whether real estate, complete plants, or plant equipment and machinery, were to be sold under a program to be established by RFC. Surplus goods of the types ordinarily bought for the government by the Procurement Division of the Treasury Department would be sold by that agency. Incidentally, that is a more or less normal procedure with peacetime property. Food surpluses and related agricultural materials are to be handled, according to the original plan, by the War Food Administration. This ties the disposal of grain and food raw materials, together with the manufactured foods,

Such government-owned ammonia plants are potential postwar footballs

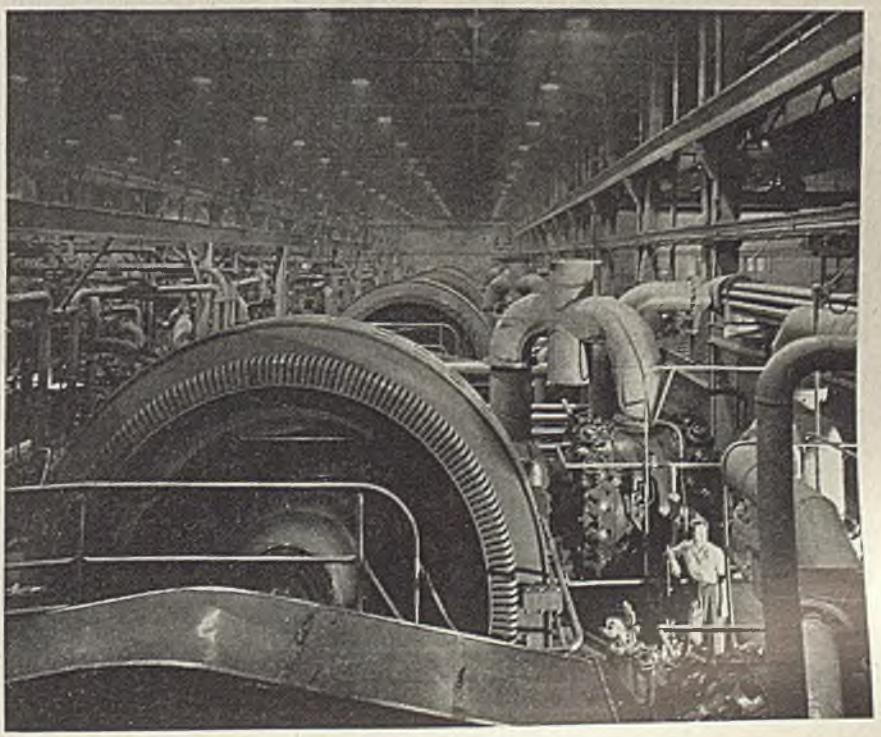


Table V—These Planned Alumina and Aluminum Plant Facilities Can Produce Almost Ten Times Our Prewar Consumption of Aluminum

	Location	Ownership	Government Cost (Millions)[1]	Planned Capacity Tons[2]
Alumina				
Aluminum Co. of America	E. St. Louis, Ill.	Self	$.....	420,000
Aluminum Co. of America	Mobile, Ala.	Self	.....	650,000
Aluminum Co. of America	Baton Rouge, La.	DPC	15,900	500,000
Aluminum Co. of America	Hurricane Creek, Ark.	DPC	23,725	777,500
Reynolds Metals Co	Listerhill, Ala.	Self	.....	100,000
Kalunite, Inc.	Salt Lake City, Utah	DPC	4,954	35,000
Alumina from Clay				
Aluminum, Inc.	Marysvale, Utah	RFC	.....	18,000
Ancor Corp.	Harleysville, S. C.	DPC	2,911	18,250
Chemical Construction Co.	Salem, Ore.	DPC	4,336	18,000
Monolith Midwest Corp.	Laramie, Wyo.	DPC	3,885	23,000
Sinter Units				
Aluminum Co. of America	Baton Rouge, La.	DPC	10,421	[3]
Aluminum Co. of America	Hurricane Creek, Ark.	DPC	10,340	[3]
Aluminum Co. of America	E. St. Louis, Ill.	DPC	9,300	[3]
Aluminum Co. of America	Mobile, Ala.	DPC	12,400	[3]
Aluminum Ingot				
Aluminum Co. of America	Alcoa, Tenn.	Self	.....	170,300
Aluminum Co. of America	Badin, N. C.	Self	.....	55,300
Aluminum Co. of America	Massena, N. Y.	Self	.....	81,800
Aluminum Co. of America	Niagara Falls, N. Y.	Self	.....	20,800
Aluminum Co. of America	Vancouver, Wash.	Self	.....	85,800
Aluminum Co. of America	Burlington, N. J.	DPC	17,200	53,700
Aluminum Co. of America	Jones Mill, Ark.	DPC	29,200	70,600
Aluminum Co. of America	Los Angeles, Calif.	DPC	24,300	89,100
Aluminum Co. of America	Queens, N. Y.	DPC	32,738	149,500
Aluminum Co. of America	Riverbank, Calif.	DPC	12,754	53,800
Aluminum Co. of America	Spokane, Wash.	DPC	23,500	108,000
Aluminum Co. of America	St. Lawrence, N. Y.	DPC	19,700	52,300
Aluminum Co. of America	Troutdale, Ore.	DPC	19,500	70,300
Reynolds Metals Co.	Listerhill, Ala.	RFC	15,883	49,900
Reynolds Metals Co.	Longview, Wash.	DPC	6,500	31,000
Olin Corp.	Tacoma, Wash.	DPC	6,500	20,400

[1] Total cost of the 96 aluminum facilities of all types owned by DPC is placed at $784,000,000.
[2] No additional capacity, but will allow use of low-grade bauxite.
[3] Some of these plants can operate at considerably above rated capacity; cut-backs are already in effect at many of them. Actual producing capacities are not necessarily the same as planned capacities.

close to Lend-Lease and UNRRA relief activities.

Further development of the job for selling industrial goods makes it clear that at least three classes of such activities are to be organized under RFC. These correspond to the three kinds of businesses which that banking agency ordinarily handles in its services to government and industry. Chemical process industry will be interested in these three activities:

1. Plant and machinery disposal will be carried out through DPC. This agency has financed the building of plants and the expansion of plant facilities. This will include real estate, complete plants, and manufacturing equipment and facilities normally used in plants.

2. Metals Reserve Company will handle the disposal of surplus ores, metals, scrap, and related commodities. These are the goods which it has been buying for the government, both after import and through subsidized domestic production.

3. Defense Supplies Corporation will handle other industrial commodities, probably including chemicals. It has been the purchase or procurement agent for the government with respect to such goods in many circumstances. Hence, its staff is already acquainted with the sources of supply and the industrial requirements of the nation for these commodities.

Whatever organization is set up within RFC for surplus disposal, the program will remain flexible so that it may be accommodated to new conditions as they arise. It is expected that some parts of the program of property selling will be farmed out to other government departments which have the goods and are acquainted with the markets in which they are bought and sold. Mr. Clayton has complete authority to do this. But whatever agency handles business details, the principles under which the selling is done will be those fixed by Mr. Clayton in his capacity as Surplus War Property Administrator. Furthermore, it is important to note that Mr. Clayton personally has final responsibility and authority for all actions. His advisory committee is definitely only advisory. Only persons who have authority to give him instructions are the President and War Mobilization Director Byrnes.

The three principal avenues of disposal will be advertisements for bids, public auctions and negotiations for sale.

ACTION BY PRIVATE FIRMS

Many industrial organizations hope to expand their activities along certain lines in the postwar period. Few can tell exactly at this early stage either the magnitude of an expansion or the limitations on new activities which the future will make necessary. Any decisions made now by private enterprise are certainly just as tentative as are government plans.

Despite this uncertainty, it seems logical that every company should formulate a hoped-for program as early as is feasible. Some competent and diplomatic spokesmen of that company can then explore the possibilities of doing business with the government for the mutual benefit of the taxpayer and the company. Before very long there will be competent persons available in each of the operating agencies with whom spokesmen of industry can talk turkey.

It must be remembered, however, that plans made by industry must be kept flexible if they are to take advantage of changing conditions in the government program. Any executive who goes to Washington determined to do business only in one way would probably better stay home. Arrangements between industry and government for the utilization of government surpluses will require a lot of mutual dickering and adjustment.

EXERCISE OF OPTIONS

Many firms in the chemical process industries have options to buy facilities which have been built with government funds for war manufacturing. Settlement of such contracts, in many cases, will be just as difficult as carrying out of negotiations where no option to purchase is involved.

Government men assigned to the settlement of contracts are often restricted by severe rules which they cannot change. Some of these rules are needlessly harsh for many cases. But this very harshness has a purpose. In some cases it has even an advantage to the person who thinks he is unjustly treated. The benefit is that however unfair a rule may seem to some, it means that everyone is being treated alike.

Thus, the rules that prevent a quick and easy settlement of some contract will also work to prevent a competitor from getting an easy opportunity to compete unfairly. This is important for all, because otherwise a careless or unfairly "easy" settlement officer might give privileges to certain companies that would be highly detrimental to all others in the same field.

It will be necessary to make many adjustments regarding purchase of war facilities by companies that have been serving as operating agents. Fortunately, it appears that thus far the effort of the government is solely to make these facilities useful in the postwar period with a minimum of loss to the taxpayer. But it will be many years before all of these cases are finally settled. And unfortunately, some of them are probably going to be settled a bit unfairly despite all of the sincere efforts of both government and industry to do a good job. Indications are that such inequalities will be few.

PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

IMPROVED SCREEN

DESIGNATED as the End-Tension Deck, a new method of tensioning the screening surfaces in Low-Head, Aero-Vibe and Ripl-Flo vibrating screens has been developed by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis. The new deck can be used for both wet and dry screening, as well as for washing and dewatering operations. An important result claimed for the new design is the ability to maintain an even bed depth. This is accomplished by use of a series of longitudinally tensioned, transversely flat screen surfaces. The screen, is tensioned by clamp bars at the ends of the screen, and by intermediate adjustable bars when more than two screen sections are used. Sections of the deck may be turned end-for-end and upside-down for longer life. Transverse supporting bars on the underside of the deck are covered with molded rubber strips and act as individual drip strips to assist in draining of the material in washing and dewatering processes. For uniformity of feeding and wear, a distributing plate is provided at the feed end.

New deck design for vibrating screens

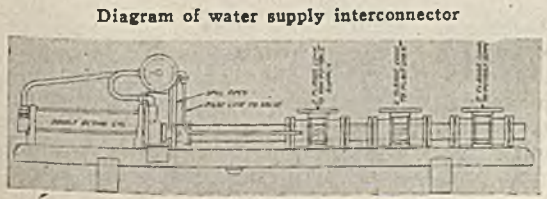
WATER SUPPLY INTERCONNECTOR

A HYDRAULIC valving mechanism, known as the Sure-Shift Interconnector, has been developed by the Industrial Interconnector Co., 2150 Niagara St., Buffalo 7, N. Y., for delivering water from either of two inlets to a common outlet. The choice of inlets is automatically made according to the hydrostatic pressure prevailing in the inlet customarily used. Should this pressure drop below a predetermined point, usually about 20 lb. per sq. in., the water supply is automatically shifted to the standby source. Upon resumption of pressure in the customary source of water, the supply connection shifts back to the original position. An example of use would be where an unpurified supply was customarily used for condenser cooling. Should pressure in this supply drop below the desired point, the interconnector would automatically connect the potable water supply into the system, avoiding need for shutting down the condenser.

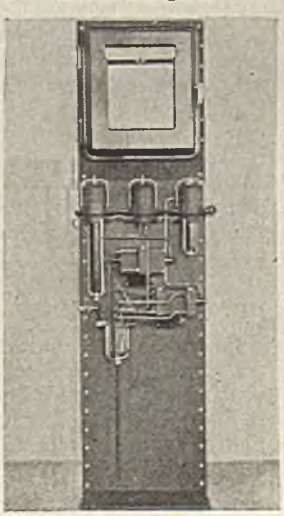
The interconnector system consists of three chambers or valve bodies; a closed tube sliding through all three, with groups of holes at two points; a hydraulic power cylinder to move the slide tube; and a special type of four-way valve to actuate the power cylinder in the desired direction. The customarily used line is connected by a small pipe to a control diaphragm actuating the four-way valve. As long as the pressure of the customarily used line exceeds the desired minimum, the diaphragm keeps the four-way valve in such position that the pressure of water in the reserve line, supplied to the double-acting cylinder, holds the slide valve in accustomed position.

Should the pressure in the customarily used line drop below a predetermined point, the reduced pressure in the four-way valve diaphragm will cause the valve to reverse itself, admitting water under pressure to the opposite end of the power cylinder, and moving the slide tube to the opposite extreme, thus connecting the plant line to the reserve water supply. The shift-over requires approximately 15 sec. and needs no manual attention. It is claimed to be impossible for the potable supply to become contaminated with the non-potable supply, since the valve bodies are separated so that if the packing of any one should leak, the water cannot possibly get into another line. This safeguards public health, and complies with various sanitary codes.

Diagram of water supply interconnector



Four-point analyzer for combustion gases



FOUR-POINT ANALYZER

AS MENTIONED briefly in our report of the recent Chemical Exposition, Cambridge Instrument Co., 3732 Grand Central Terminal, New York, N. Y., has developed a four-point thermal conductivity gas analyzer for the continuous recording of oxygen, carbon dioxide, carbon monoxide and hydrogen in combustion processes. The instrument was developed for application in chemical, metallurgical and oil refining processes, for continuous analysis of flue gases, inert atmospheres and similar purposes. The analyzer requires no chemicals, fragile glass parts or moving parts in the analysis cells, and its upkeep is said to be of a routine nature, not needing the services of a technically trained man.

The instrument is of the thermal conductivity type, comparing the sample either with a reference gas, or with the sample itself after absorption or combustion, in each of four conductivity cells in sequence. The instrument operates direct from an alternating-current line, drawing in a continuous sample by means of a water aspirator which also meters the sample. The sample then passes through each of the four cells in series, with suitable operations performed on it between cells so that a composition change characteristic of the various constituents is accomplished. The exact detail of this procedure varies with the constituents of the sample, but may involve either chemical absorption or the combustion of one or more constituents.

The recorder, which may be located at any desired distance from the sampling point, is automatically connected to each analysis cell in sequence for a period of one minute for each cell, after which the cycle repeats. Each record is given in a distinctive color and number on the 10-in. record chart, without lag between the readings of successive gases.

SPRING TYPE HANGERS

MADE in 14 sizes with a load range from 84 lb. to 4,700 lb. is a new line of pre-engineered spring hangers recently announced by the Grinnell Co., Providence, R. I. This wide range of sizes now makes it possible, according to the manufacturer, to select a stock size of hanger from a simple table after the load has been computed. The new hanger is of all-steel welded construction, meeting the pressure piping code. A swivel coupling provides adjustment and eliminates the necessity of

using a turnbuckle. The design is compact, minimizing necessary headroom. An integral load scale and travel indicator is provided to simplify installation. Each size of hanger permits a uniform variation in supporting force of not more than 12½ percent in ½ in. deflection of the spring.

SIDE-ENTERING AGITATOR

Ability to repack the shaft under pressure, without draining the tank, is an important feature of a new side-entering agitator recently introduced by the H. K. Porter Co., Pittsburgh 1, Pa. The new design is considered so important by the manufacturers that it is to be used eventually to replace the company's standard line in sizes from ½ to 30 hp.

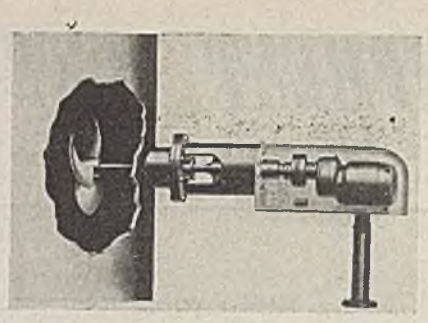
To enable outside repacking, a new external packing gland is used, having a seal attached to the shaft inside the tank, which may be drawn into a seat, thus sealing off the contents of the tank so as to permit repacking without loss of liquid. The shaft is carried on roller bearings which operate against a ring attached to the shaft to prevent thrust from being transmitted to the motor bearings. By means of undercuts, the design is said to make it impossible for leakage to reach these bearings, thus eliminating need for special lubricants. The new unit has all moving parts protected from the elements, for installation outdoors without additional protection. A hinged weather-proof cowl on the motor gives easy access for necessary maintenance.

FRICTION CLUTCH

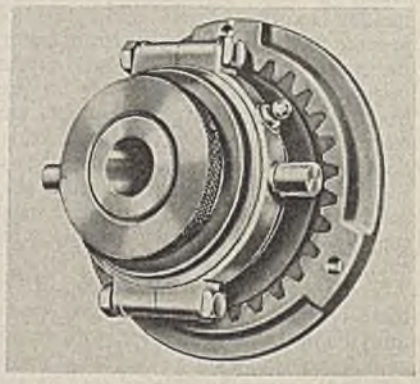
For the transmission of small amounts of power a new Rolling-Grip friction clutch has been introduced by the Dodge Manufacturing Corp., Mishawaka, Ind. The clutch is built in two sizes, one for transmitting ¾ hp. at 100 r.p.m., the other for 1 hp. at 100 r.p.m. A novel method of applying pressure between the friction surfaces for causing engagement is used, which requires no toggles, links, pins or cotters or other highly stressed mechanical parts. Instead, a number of polished hardened steel balls are forced into a V-shaped groove by a hardened steel cam. Forcing the balls toward the center of the shaft widens the V-shaped groove, thus producing a heavy power-transmitting pressure on the friction surface. The new clutch is readily adapted to various operating conditions. For example, for dry operation it is equipped with asbestos fiber friction disks, while if it is to operate in oil, a number of thin metal disks may be substituted for the asbestos disks. The cam and thrust ring contours may also be changed to alter the clutch characteristics for various kinds of service.

HYDRAULIC PULLER

A new hydraulic tool known as the Simplex Jenny center-hole hydraulic puller has been introduced by Templeton, Kenly & Co., 1020 South Central Ave., Chicago 44, Ill., to facilitate maintenance jobs such as the pulling of reciprocating-pump cylinder liners. It may be used for all kinds of pulling, pushing and lifting applications in the removal and insertion of liners, bushings, valve seats, boiler tubes and pipes.



Outside-packed side-entering agitator



New Rolling-Grip friction clutch

Five models are available in capacities from 30 to 100 tons. Three models have single hydraulic pumps, and two have high- and low-speed pumps which may be operated separately, alternately, or together. Since the device is made with a center hole through which a pull rod is inserted, it pulls straight, vertically, or horizontally, without side thrust or self-binding friction, and without the need for other equipment or rigging. Its action is similar to that of any hydraulic jack, in that the ram is pushed or raised by operating a pump. However, in the case of the Jenny, the ram is tubular, enabling a bolt or rod to be inserted through the ram before either pushing or pulling. The unit is self-contained, and is self-retracting when the release valve is opened.

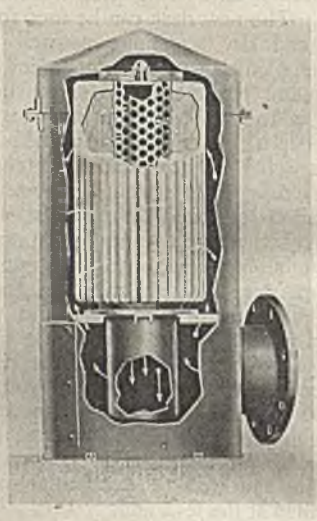
IMPROVED AIR FILTER

A new intake filter for compressors and internal combustion engines, designed for outside installation where the intake air is cooler than in buildings, has been developed by the Dollinger Corp., Rochester, N. Y. The unit may be installed and subsequently serviced at ground level, either out-of-doors, or in the engine room itself, if preferred, while the air intake opening may be located elsewhere at whatever point is considered most suitable. Servicing is said to be extremely simple, as the filter insert can be lifted out through a removable panel and cleaned either by brushing, by compressed air, or by washing.

RUBBER CLOTHING

Industrial clothing coated with rubber, synthetic rubber or other synthetic materials has been added to the line of the B. F. Goodrich Co., Akron, Ohio. In addition to firemen's and policemen's coats, general purpose work coats, industrial coats and workers' leggings, work jackets, pants and hats will be produced under limitations imposed by the War Production Board concerning the amounts of natural crude rubber, reclaimed or synthetic rubber which can be utilized.

Hydraulic puller in operation



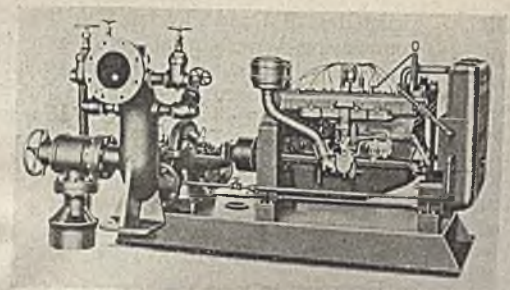
New intake air filter

ARC WELDER

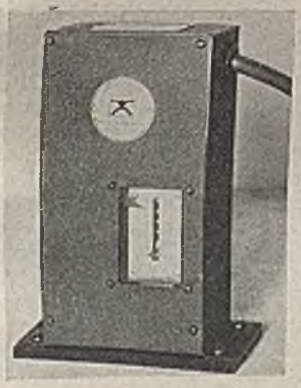
Rated at 200 amp., a new Shield-Arc engine-driven welder of light-weight, rugged construction, driven by a 29-hp. motor, has been announced by The Lincoln Electric Co., Cleveland, Ohio. The new unit, which is supplied complete with a base and canopy, has a current range from 40 to 250 amp. Dual control of the welding current is accomplished by adjustment of series fields and generator speed. Designed for metallic arc welding, with either bare or coated electrodes, the new model is also capable of supplying the uniform welding current required for carbon arc welding, according to the manufacturer. The equipment is provided with a generator controller or "job selector" said to assure accuracy of open circuit voltage and to permit precise control of the engine speed at from 1,150 r.p.m. to 1,500 r.p.m. as required for welding.

FIRE PUMP UNIT

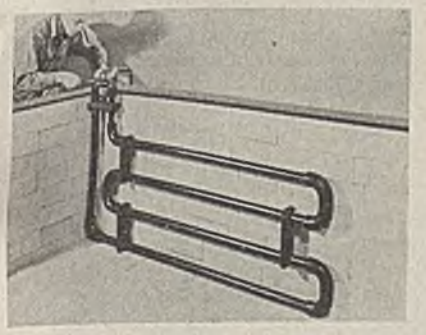
Supplementing its line of approved centrifugal fire pumps, Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5, Ill., has announced a line of standardized gasoline-engine-driven fire pumping units of 500, 750 and 1,000 g.p.m. rated ca-



Engine-driven fire pump



Electric pressure switch



Graphitic carbon heating coil

pacity. These pumps are intended for use where electric power or steam pressure is not available, and for emergency standby protection to supplement electric-motor or steam-turbine-driven pumping units in event of sabotage or other contingency. It is claimed for the new equipment that the engine is quickly and easily started, comparable to the starting of an automobile. Full engine power is said to be developed within a minimum of time. Equipment may be supplied with devices for automatic operation, starting from pressure switches or thermostats. Compared with the larger marine-type engine-driven fire pumping units, the new units are said to be economical in cost and readily adaptable to the use of two, three or more standardized units in cases where larger capacity is desired. The new line of pumps is said to conform fully to the specifications of the National Board of Fire Underwriters and the National Fire Protection Association, also carrying approval of the Underwriters' Laboratories, as well as the inspection department of the Associated Factory Mutual Fire Insurance Companies. The equipment is supplied complete with all necessary service tools and control instruments.

Air motor for mixing

Front and side views of new gaging device

PRESSURE SWITCH

For pressure control in the range from 5 to 5,000 lb. per sq. in., the Hercules Electric & Mfg. Co., 2416 Atlantic Ave., Brooklyn 33, N. Y., has developed a new electric pressure switch of simple and compact design. The mechanism consists of a direct-acting gage for measuring hydraulic pressure, coupled to what is described by the maker as a very sensitive electric switch. The entire device, shown in an accompanying illustration, has overall dimensions of approximately 10x7x3 in.

NEW TANK GAGE

To avoid the necessity of gaging tanks through open hatches, with the resulting loss of valuable vapors, and also possible hazard to the gager, the Oceco Division of the Johnston & Jennings Co., 877 Addison Rd., Cleveland 14, Ohio, has introduced the new Oceco Gaugit (pronounced gage-it), a device consisting of a sampler-bob equipped with a thermometer, a fingered tape guard, and a gaging tape which is reeled past a sight glass on top of the unit.

As shown in the accompanying illustration, the gager, with both access doors closed, opens a 4-in. gate valve and lowers the sampler-bob into the tank. When that portion of the tape, where the level of the liquid of the tank is expected to be found, comes into view in the sight glass on top of the Gaugit, the gaging valve is closed, thus preventing the escape of tank vapors. The tape access door is then opened and gaging paste is applied to a section of the tape. After the door has been closed again and the gaging valve reopened, the tape is reeled out slowly until the sampler-bob contacts the bottom of the tank. This opens the upper valve in the sampler-bob, so as to take in a sample of the tank's contents as the tape is reeled in. The gager stops reeling at the point where the gaging paste has been "cut," takes a reading, then closes the gaging valve, opens the tape access door, and wipes the tape clean of paste. After the access door has been closed, and the gaging valve opened again, the sampler-bob is reeled in, reclaiming the tape guard from the gate valve, until the bob hits the safety bumper in the sampler housing. The 4-in. gate valve is then closed, the door of the sampler-chamber opened, the temperature recorded, and the contents of the bob drained in a container through a valve in the bottom.

AIR MOTORS

For a wide variety of applications where the presence of flammable or explosive dusts, gases or vapors often makes the use of electrical equipment inadvisable, Leiman Bros., 112-28 Christie St., Newark, N. J., has developed a line of rotary air motors covering a broad range of speeds and horsepowers. These motors operate at air consumptions from 1 cu. ft. per min., up, at pressures from 10 to 100 lb., developing power from 0.03 hp., up. Speeds range between 50 and 1,800 r.p.m., under immediate control of the air valve. The latter, a three-way valve, is also used for reversing in applications where rotation in both directions is desired.

CARBON HEATING COIL

A graphitic carbon steam heating coil, for the heating of corrosive solutions such as pickling, electroplating and metal etching baths, including muriatic acid, and other chlorides, has been developed by the Heil Engineering Co., 12901 Elmwood Ave., Cleveland, Ohio. The coil is made in several standard sizes and in various shapes for a variety of uses. It is said to be completely impervious to chemical action, being entirely non-metallic, and to have a heat conductivity between that of steel and copper. The company is prepared to supply other heating equipment made of the same material, including steam-jet heaters, bayonet type heaters, nozzles, heater sheaths and electric immersion heaters. The new coils are suitable for steam pressures up to 50 lb. per sq.in.

INDUSTRIAL DUST COLLECTOR

Type CK is the designation of a new industrial unit dust collector of self-contained construction which has recently been developed by the Pangborn Corp., Hagerstown, Md. The new unit is built in three sizes with capacities of 1,000, 2,000 and 3,000 cu. ft. of air per min. These units are said to be suitable for all dry dust control applications within the specified capacity. They employ two-stage separation, the first stage a centrifugal separator, and the second stage a filter. The design emphasizes flexibility in arrangement to permit adaptation to a variety of field conditions. The equipment is completely self-contained, occupying a

minimum of floor space. Shaking of the filter section is accomplished mechanically, either under manual control interlocked with the exhauster motor to prevent simultaneous operation of both exhauster and shaker motors; or with automatic control, using an electrical timer to operate the shaker motor automatically for a short time each time the exhauster motor stops.

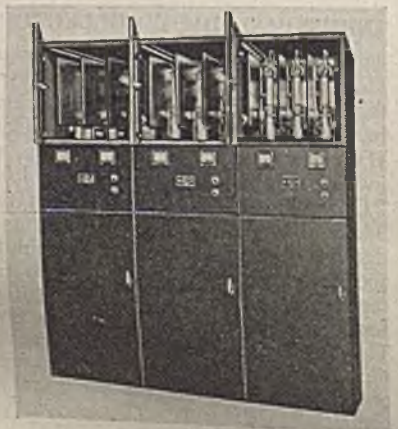
SYNCHONOUS MOTOR CONTROL

FOR THE PURPOSE of controlling synchronous and induction motors, Electric Machinery Mfg. Co., Minneapolis 13, Minn., has introduced the new E-M Hi-Fuse control which combines starting service with short-circuit protection through the use of split-cycle-operating, high-interrupting-capacity power fuses. Owing to the high speed at which the fuses clear fault current and their current-limiting action, the motor switch does not have to be of the more costly high-interrupting-capacity type. Hence, this capacity is gained at moderate cost while the fuses simultaneously serve as power disconnects. The new control is said to afford complete protection for the motor against abnormal operation in starting or running. For synchronous motors the equipment provides a special polarized field control which by means of polarized relays gives smoothness and maximum power, according to the manufacturer, in synchronizing the motor.

HIGH CAPACITY FILTER

HIGH CAPACITY, fineness of filtration, light weight, low cost and simplicity of design are combined in the new Micronic filter designed and developed by Adel Precision Products Corp., Burbank, Calif. This filter, developed for use in the hydraulic systems of large aircraft, is believed by the maker to have applications in many industrial processes. The filter removes particles of 5 microns and larger and is designed for operation at temperatures ranging from 65 deg. F. below zero, to 165 deg. F. above. The model illustrated measures 6x8½ in., weighs 2 lb., and has 3,800 sq.in. of filtering area. It is rated at 1,800 g.p.h., on the appropriate hydraulic fluid. Normally made from dural alloy for aircraft use, other alloys such as stainless steel can be employed. Also available are 2- and 4-in. sizes, with capacities of 450 and 900 g.p.h.

Control for synchronous and induction motors



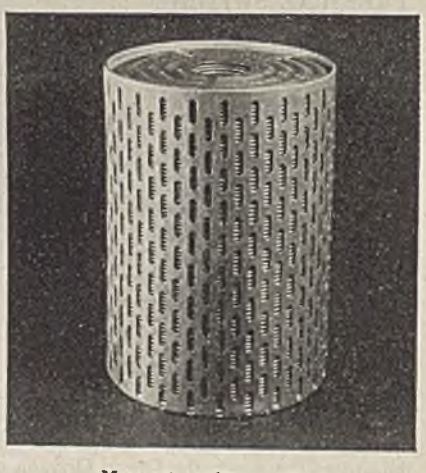
MAGNETIC VOLTAGE SELECTOR

ALTHOUGH developed especially for a new electroplating process for a.c. anodizing of aluminum, a new magnetic voltage selector manufactured by Zenith Electric Co., 152 West Walton St., Chicago 10, Ill., is said to be suitable for many other uses where like application of current is required. The new selector is intended for transferring in steps from 2 to 40 volts. The arrangement is such that, when transferring, the main contact opens before the secondary contact opens, and closes after the secondary contact is closed, thus effectively eliminating arcing. The new unit employs automatic main magnetic contacts and automatic main switch contacts for nine positions at 2½-volt intervals, from 2 to 40 volts.

DRUM LIFTER

TWO NEW LIFTERS, designed for handling barrels and drums, horizontally or vertically, have been introduced by the Never-Slip Safety Clamp Co., Mamaroneck, New York. Lifter B-1, designed for lifting barrels and drums in a vertical position, consists of a double lazy-tongs arrangement, connected to an encircling chain which is dropped over the drum and grasps it securely for lifting. When the drum is lowered to the floor a cross-bar contacts the drum top, causing the mechanism is open and release the drum. Adjustment for various diameters of containers is automatic. The second lifter, designated as B-2 and illustrated in the accompanying view, consists of a pair of tongs to which curved supporting plates are attached for securely grasping drums in a horizontal position. The standard capacity of these lifters is 1,200 lb., but special sizes can be produced to order by the manufacturer.

High capacity filter unit



Magnetic voltage selector

PHOTOGRAPHIC PRINTER

DESIGNED to take fulll advantage of the time-saving features inherent in semi-photographic reproduction processes, a new printer known as Model 55C and especially adapted to this type of work, has been announced by the Charles Bruning Co., 42-33 Ninth St., Long Island City, N. Y. Used with the new semi-photographic materials, this printer is said to provide clear and faithful duplicates of anything typed, printed, photographed or drawn, including pencil tracings, blueprints, layouts, maps and engineering data. The new printer is said to make clear, sharp reproductions from worn and soiled originals. Although taking material up to 42 in. wide, the printer occupies a floor space of only 40x62 in. It is equipped with a variable speed drive for speeds from zero to 18 ft. per minute and has an exposure control shutter varying the exposure space from zero to 14 in. A 9-in. Pyrex contact cylinder revolves, carrying the original and sensitive material held in contact with it by 22 individual 2-in. bands.

Lifter for horizontal drums

Continuous photographic printer

for practical

GAS PROCESSING EXPERIENCE!

GIRDLER PROCESSES

for manufacture, purification, separation and dehydration . . .

Consult Girdler on your problems concerning hydrogen sulfide, carbon monoxide, carbon dioxide, natural gas, refinery gases, liquid hydrocarbons, hydrogen, nitrogen.

Originators of the Girbotol Process

Knowledge, skill and technique with which to tackle a *new* problem involving gases, gaseous mixtures or liquid hydrocarbons is an invaluable asset. *Only* by long experience in this field may a difficult problem be solved quickly, effectively. GIRDLER engineers *have* processing experience. They have originated and developed many new *practical* processes — extensively used today. Their abilities and GIRDLER facilities are immediately available. Use this practical GIRDLER experience for *your* problems!

The GIRDLER CORPORATION
Gas Processes Division • Louisville, Ky.

CHEMICAL ENGINEERS AND CONSTRUCTORS

PENICILLIN BY DEEP FERMENTATION

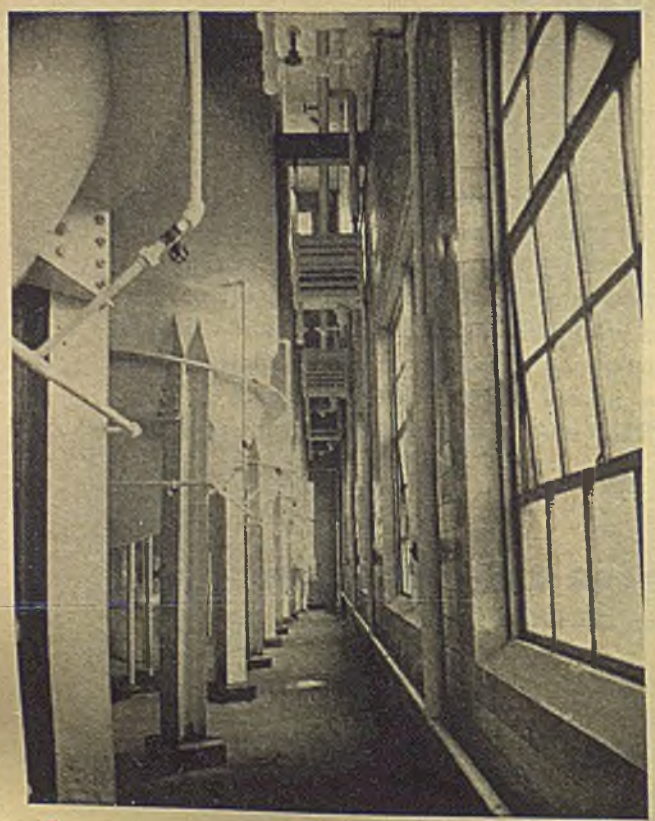
PRODUCTION of penicillin by the deep fermentation process is now being carried out on a large scale by Commercial Solvents Corp. at Terre Haute, Ind. In operation since January 30, this unit is the first full-scale plant in the world to produce this mold-derived drug. The plant, having a yearly designed capacity of 480 billion Oxford units, has been financed by Commercial Solvents Corp. and engineered by E. B. Badger & Sons Co.

In the deep fermentation process, a sterilized medium consisting of corn steep water, lactose and nutrients is charged into 12,000-gal. fermenters, inoculated with a pure culture of *Penicillium notatum* and allowed to ferment at about 75 deg. F. for several days. Sterilized air is blown through the charge during fermentation. Mycelia are removed by centrifugals and the filtered beer pumped into a tank where it is agitated for about 15 minutes with 2.0-2.5 percent activated carbon.

Carbon-adsorbed penicillin is centrifuged and the spent beer discarded. Penicillin is removed from the carbon by means of an organic solvent, after which the penicillin concentrate is adjusted with an inorganic acid and then put through super-centrifuges. Extract from these is pumped into a second solvent extractor and treated with a buffered phosphate and sodium bicarbonate. Here the penicillin reacts quickly to form the sodium salt, very soluble in water.

Aqueous penicillin-sodium is separated from organic solvents by a scecond supercentrifuging, after which it is blown through a small biological plate-and-frame filter to remove all bacteria and pyrogens that might be present. By this time, a 12,000-gal. fermentation batch has been concentrated to about 15 gal. The material is then pipetted into vials, frozen and dehydrated at low temperatures by sublimation through the use of high-vacuum, multi-jet diffusion pumps. A chlorinated hydrocarbon is used as the condensing agent. Cold condensers refrigerated to —80 to —90 deg. F. and equipped with revolving scrapers remove water vapors as ice, thus relieving the strain on the diffusion pumps.

All filling and packaging operations are carried out under super-sterile conditions to prevent the possibility of contamination. Each vial of dry product contains approximately 100,000 Oxford units. For a more detailed description of this plant, its equipment and operation, refer to pp. 94–98, this issue.



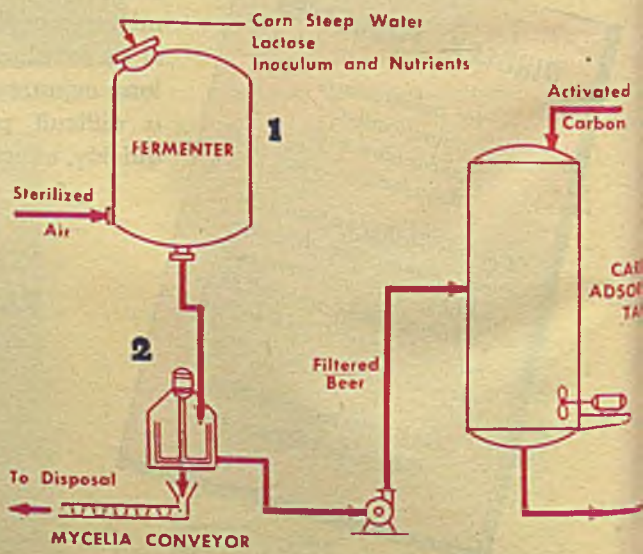
1 In these deep tanks, *Penicillium notatum* ferments several days at about 75 deg. F. to produce penicillin

A Chem & Met FLOW SHEET

CHEMICAL & METALLURGICAL ENGINEERING

April, 1944

PAGES 130 to 133



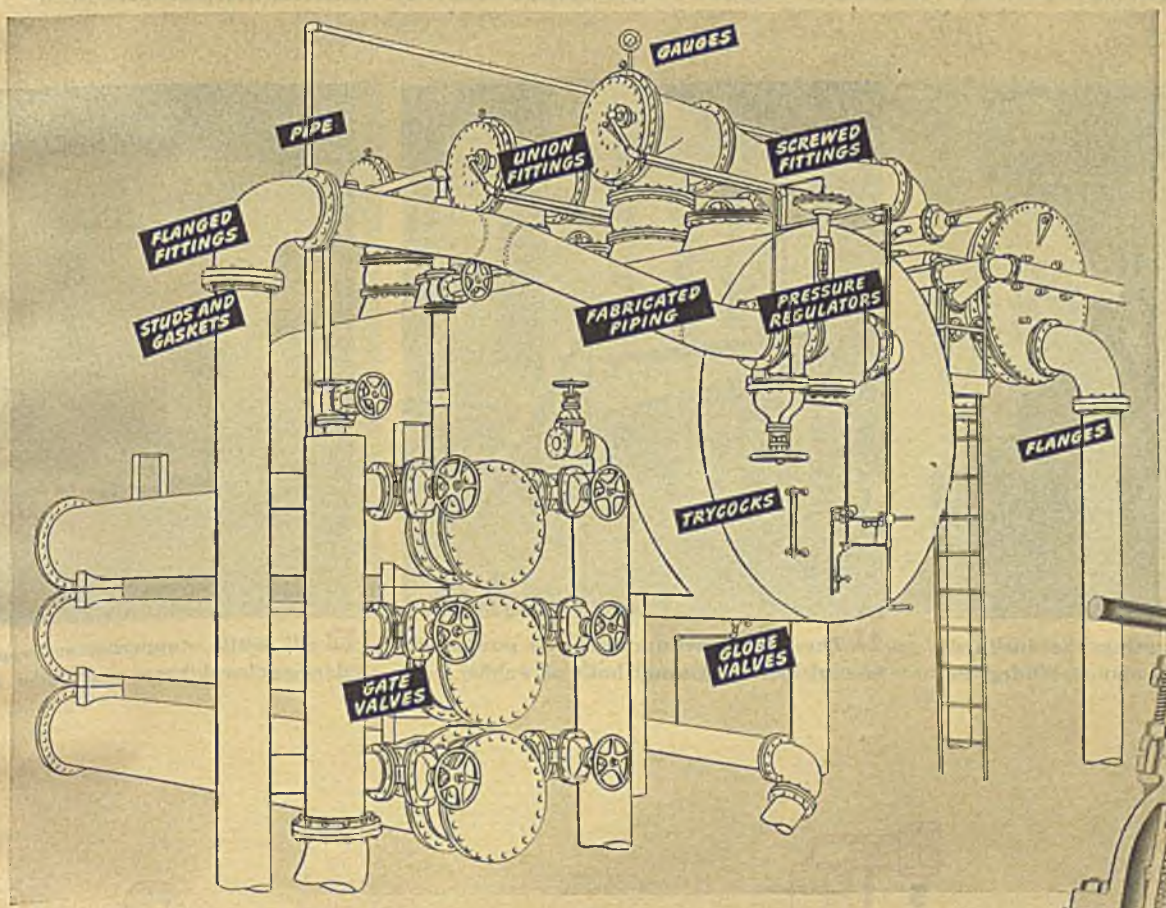
From pipe to piping systems —you can get it from CRANE

ONE SOURCE OF SUPPLY . . . ONE RESPONSIBILITY FOR ALL MATERIALS

SO complete is the Crane line that you can depend on it always, for every need in piping. Whether it's brass, iron, or steel equipment—a single fitting or complete piping system—Crane gives you the world's greatest selection for every service. The installation below shows Crane completeness —it's Crane-equipped 100%.

One source of supply means simplified ordering and maintenance procedure and easier control of parts stocks. One responsibility for the quality and craftsmanship of all materials assures the best installation. These are the important advantages you gain—plus the benefit of Crane Co.'s 89-year manufacturing experience—when you *always* specify Crane.

CRANE CO., General Offices: 836 South Michigan Avenue, Chicago 5, Illinois

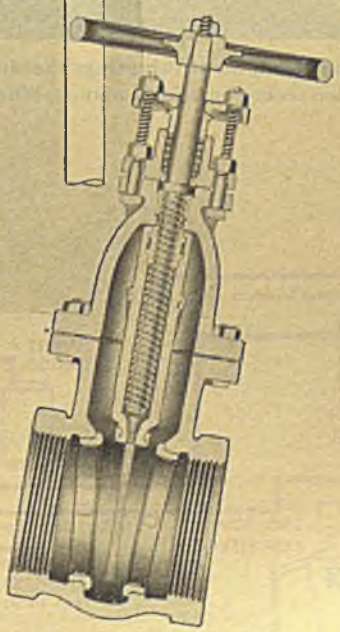


Water Treating Unit in Chemical Processing Plant

ONE STANDARD OF QUALITY

Adequate quality of one high standard in every part, makes the whole system equally dependable. Such quality is typified by Crane Iron Gate Valves. Stronger body design resists line strains. Straight-through ports give streamline flow. A deeper stuffing box lengthens packing life. Adequate stem power gives positive seating, while extra long guides keep disc travel true.

STANDARD IRON BODY WEDGE GATE VALVES



CRANE

VALVES · FITTINGS · PIPE
PLUMBING · HEATING · PUMPS

PENICILLIN BY DEEP FERMENTATION

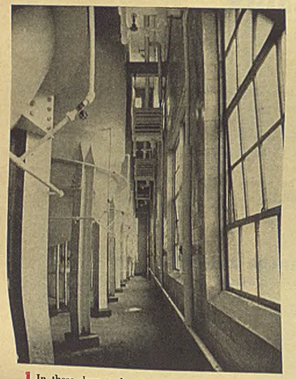
PRODUCTION of penicillin by the deep fermentation process is now being carried out on a large scale by Commercial Solvents Corp. at Terre Haute, Ind. In operation since January 30, this unit is the first full-scale plant in the world to produce this mold-derived drug. The plant, having a yearly designed capacity of 480 billion Oxford units, has been financed by Commercial Solvents Corp. and engineered by E. B. Badger & Sons Co.

In the deep fermentation process, a sterilized medium consisting of corn steep water, lactose and nutrients is charged into 12,000-gal. fermenters, inoculated with a pure culture of *Penicillium notatum* and allowed to ferment at about 75 deg. F. for several days. Sterilized air is blown through the charge during fermentation. Mycelia are removed by centrifugals and the filtered beer pumped into a tank where it is agitated for about 15 minutes with 2.0-2.5 percent activated carbon.

Carbon-adsorbed penicillin is centrifuged and the spent beer discarded. Penicillin is removed from the carbon by means of an organic solvent, after which the penicillin concentrate is adjusted with an inorganic acid and then put through super-centrifuges. Extract from these is pumped into a second solvent extractor and treated with a buffered phosphate and sodium bicarbonate. Here the penicillin reacts quickly to form the sodium salt, very soluble in water.

Aqueous penicillin-sodium is separated from organic solvents by a second supercentrifuging, after which it is blown through a small biological plate-and-frame filter to remove all bacteria and pyrogens that might be present. By this time, a 12,000-gal. fermentation batch has been concentrated to about 15 gal. The material is then pipetted into vials, frozen and dehydrated at low temperatures by sublimation through the use of high-vacuum, multi-jet diffusion pumps. A chlorinated hydrocarbon is used as the condensing agent. Cold condensers refrigerated to —80 to —90 deg. F. and equipped with revolving scrapers remove water vapors as ice, thus relieving the strain on the diffusion pumps.

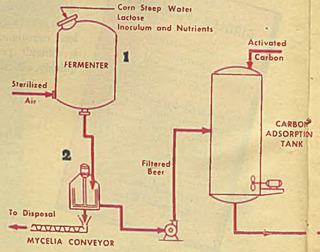
All filling and packaging operations are carried out under super-sterile conditions to prevent the possibility of contamination. Each vial of dry product contains approximately 100,000 Oxford units. For a more detailed description of this plant, its equipment and operation, refer to pp. 94–98, this issue.

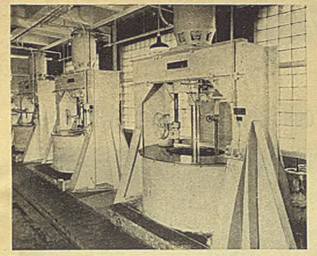


1 In these deep tanks, *Penicillium notatum* ferments several days at about 75 deg. F. to produce penicillin

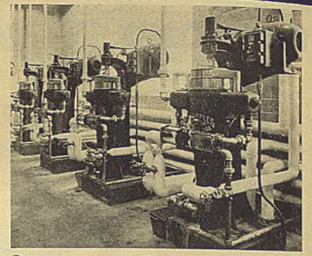
A Chem & Met FLOW SHEET

CHEMICAL & METALLURGICAL ENGINEERING
April, 1944
PAGES 130 to 133

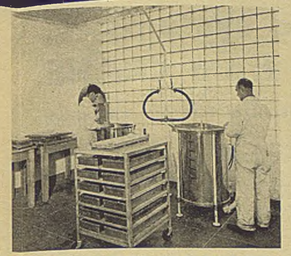




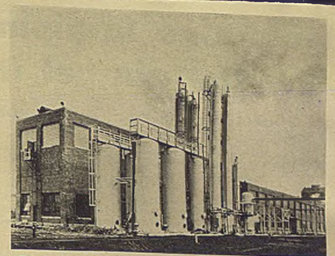
2 Fermented liquor is separated from mycelia in stainless steel centrifugals with 48-in. baskets such as those shown here



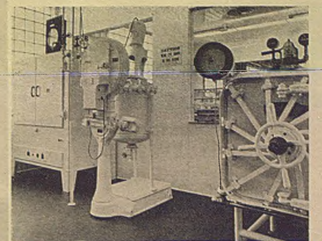
3 Super-centrifuges, revolving at about 15,000 r.p.m. are used to separate solvents in the concentration steps



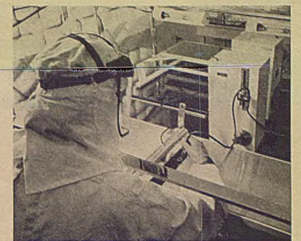
4 All bottles used in the process must be thoroughly washed, rinsed in pyrogen-free water and sterilized



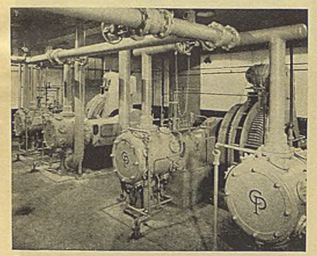
5 A general view of the plant, showing raw material storages and solvent recovery equipment. Amyl acetate is the principal solvent



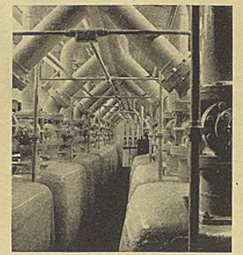
6 In the sterilizing room, containers and other equipment are treated in order to prevent any possible contamination



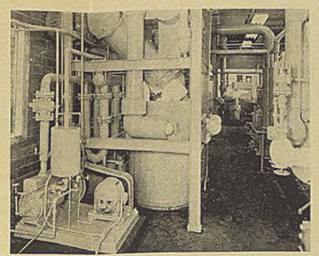
7 Pipetting machines, operated under super-sterile conditions, inject 5 c.c. penicillin-sodium into each vial



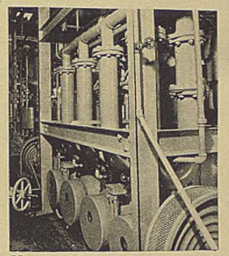
8 Compressors furnish about 375 tons of ammonia-system refrigeration for storage, freezing and cold processing



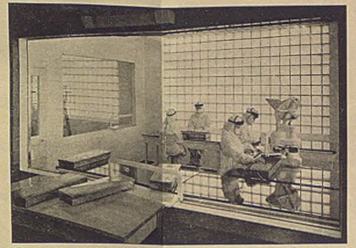
9 These manifolds connect the high-vacuum dryers to the roughing and diffusion pumps



10 Vacuum producing equipment, showing the inclined cold condensers with ice receivers held at about —80 deg. F.

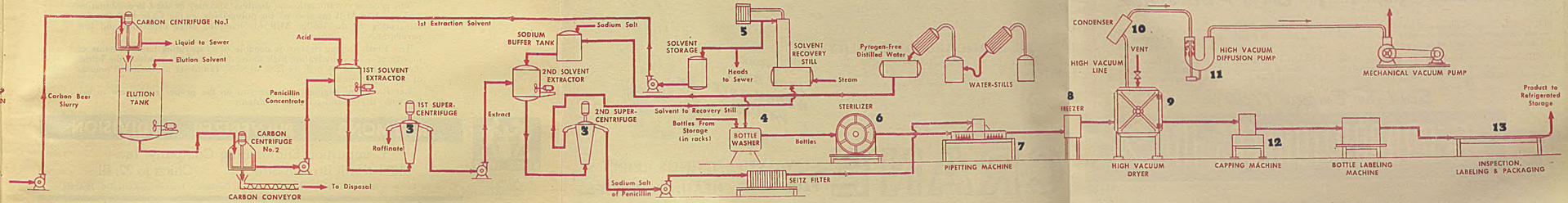


11 These high-vacuum diffusion pumps are of multi-jet design and built of welded steel



12 All bottle stoppering and capping operations are carried out in a glass enclosed room and under the most sterile conditions imaginable

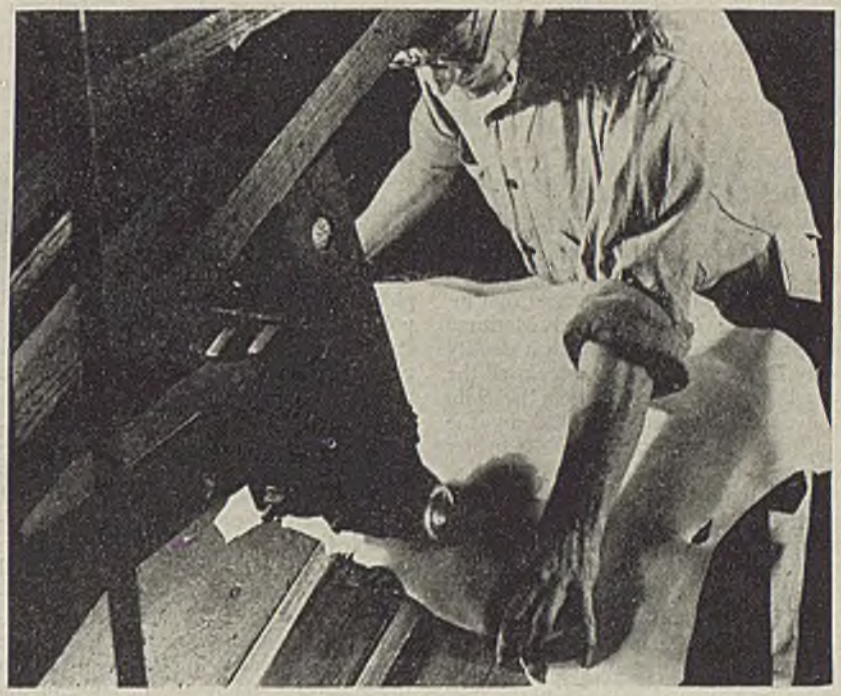
13 View of the final labelling and packaging conveyor system, showing the dryers on the left. The ultra-violet lamps serve to keep the air sterile at all times



NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

CONTENTS



The "kicking mule" glazes skins. A white tanning agent, Zircotan, eliminates blue which developed when white leathers were subjected to glazing

SOFTENER AND PLACTICIZER

A SOFTENER and plasticizer, which is said to give GR-S synthetic rubber stocks improved resilience and lower heat generation, has been announced by Sun Oil Co., Philadelphia, Pa. This compounding agent, Circosol-2XH, has peculiarly effective action on GR-S. It is a petroleum hydrocarbon in the form of a heavy viscous liquid, clear, transparent, and with a pale green color as observed by transmitted light. Composed of hydrocarbons of comparatively high molecular weight, its low volatility precludes any fuming and losses during mixing in the Banbury or processing on mills.

GRINDING COOLANT

GRINDING results never before believed possible are claimed by Quaker Chemical Products Corp., Conshohocken, Pa., for its new product, Nicrogrind No. 132. This compound mixes with water to form a grinding fluid which is said to eliminate pickup, grinding checks, glazing, burning and distortion on all grinding, honing and superfinishing operations. Other results claimed are the development of superfine finishes free from glaze, elimination of two out of every three wheel dressings, faster cutting, and as much as 300 percent increase in wheel life. Nicrogrind No. 132 is so fundamentally different, according to its manufacturers, that an entirely new approach to grinding operations—involving a new concept of wheel and coolant application—is necessary to take full advantage of its possibilities.

TANNING AGENT

ONE OF the recent developments of Rohm & Hass Co., Philadelphia, Pa., is known as Zircotan. It is a white mineral tanning agent. Chemically, it is essentially basic zirconium sulphate. Used alone as a tanning agent, it is said to produce a lightfast leather of excellent quality and with white cut throughout. Skin tanned with Zircotan produces a premium cream white leather of superior quality that blends to advantage with brown leather in two-tone shoes. The new tanning agent helps to furnish a worthy successor to the cream-white genuine buck leather available in decreasing quantities before the war, and now "out for the duration."

LEAD FLUOBORATE SOLUTIONS

OF INTEREST in the expanding field of lead electroplating are the lead fluoborate solutions being offered by the Special Chemicals Division of Pennsylvania Salt Mfg. Co., Philadelphia, Pa., under the trade names Pennsalt LF 42 and LF 50. Available in 42 percent and 50 percent Pb $(BF_4)_2$ concentrations, these solutions are stabilized with excess fluoboric $(HBF)_4$ and boric (H_3BO_3) acids in balanced percentages. For use, they are diluted with water to the desired concentration. Electroplating baths prepared from these solutions are stable, give a smooth, fine-grained, dense deposit with a cathode current efficiency of essentially 100 percent and permit plating directly on steel. Corrosion resistant surfaces so produced replace critical metals, such as cadmium, zinc, chromium, copper and nickel. It is available in commercial quantities, in glass carboys.

SOIL STABILIZER

RAIN ON DIRT roads doesn't mean much any more according to the Hercules Powder Co., Wilmington, Del., which has developed a new and inexpensive method of waterproofing soil. By this method the top 6 in. or so of the surface may be "stabilized" with Stabinol, a resin compound derived from pine rosin. Surface water will drain off or evaporate, rather than seep through the treated soil. Subsurface water will not rise because the chemical treatment upsets the natural phenomenon of capillary action. The new material is a dry powder which is dusted directly on the

surface of the soil by hand, shovel or mechanical spreader and disk-harrowed to the depth required. The treatment is already being used on military roads and airports here and abroad. The amount of Stabinol will vary with the chemical and physical properties of the particular soil as well as with the severity of the exposure to be encountered. A highway in a Southern state required 6 lb. of the resin stabilizer to the square yard for a compacted depth of 6 in. whereas an athletic field in another state was stabilized to a depth of only 3 in. and in the proportion of 1½ lb. of stabilizer to a square yard of soil. Usually the amount of Stabinol is about 1 percent of the soil treated.

FIBROUS GLASS BOARD

USE BY Owens-Corning Fiberglas Corp. of an improved thermo-setting plastic binder employed to bond glass fibers, has made it possible to provide a rigid hull insulating board for Navy and Maritime Commission vessels which, with a density of only 7¾ lb. of the cu.ft., possesses all the thermal insulating qualities of the 9-lb. density board formerly supplied by the manufacturer for this purpose. The lighter board will effect a material weight saving in the vessels in which it is installed, and because it requires a lesser quantity of glass fibers, will aid the manufacturer in supplying the greatly increased quantities of the board called for by the Navy.

PLASTICIZER SUBSTITUTE

SHORTAGE of the critical materials forming the usual plasticizers for cellulose acetate is being effectively relieved by PHO, a development of the Neville Co., Pittsburgh, Pa., according to that organization. The material can replace up to 50 percent of the usual plasticizers for cellulose acetate such as triacetin and the phthalic and phosphoric esters, all difficult to obtain under present restrictions. It is a viscous, resinous liquid, so that the total plasticizing oil content of PHO-made compositions is somewhat higher than when the ordinary plasticizers are used alone.

One outstanding improvement in cellulose acetate compositions brought about by the use of PHO is the reduction of water permeability either as the liquid or as water vapor. Cellulose acetate is one of the more water permeable film forming materials, and the reduction of this characteristic brought about by PHO opens new uses for this useful cellulose derivative.

Cellulose acetate, when highly plasticized with the new product, with or without the usual plasticizers, yields tough rubbery solids which can be calendered into sheets or used as thermoplastic adhesives. These are characterized by flexibility over a wide rane of temperatures.

FLUOBORIC ACID

FLUOBORIC ACID, HBF_4, is offered by Special Chemicals Division of Pennsylvania Salt Mfg. Co., Philadelphia, Pa., under the trade name Pennsalt FA-42 as a 42 percent solution containing a slight excess of boric acid for stabilization. It is a clear colorless solution having a sp. gr. of 1.33. Known in the literature also as borofluoric acid and borohydrofluoric acid, its suggested uses are in the control of acidity in fluoborate electroplating baths, preparation of various metallic fluoborates, pickling agent and preparation of catalysts for esterification, polymerization, and condensation reactions. It is available in commercial quantities, in glass carboys.

RESIN PLASTICIZER

ANNOUNCEMENT of a resin plasticizer possessing high resistance to oils, gasoline and heat, and already showing unusual promise in polyvinyl chloride cable compounds and cable lacquers, wire enamels, vinyl resin fabric coatings, hot-melt compositions and aircraft gaskets and caulking and sealing compounds, marks a new step in chemistry's effort to perfect and enlarge the application of synthetic rubbers. Known as Paraplex G-25, and developed by the Resinous Products Chemical Co., Philadelphia, Pa., this synthetic resin is a saturated polyester, thermoplastic and chemically stable, and can be used for all polyvinyl chloride resins and elastomers of the acrylonitrile-butadiene type.

The resin is readily soluble in esters, ketones, aromatic hydrocarbons and chlorinated hydrocarbons. It is soluble in aromatic naphthas such as Solvesso No. 2, but is insoluble in aliphatic hydrocarbons. Although the resin will not dissolve in alcohols, it will absorb up to 25 percent ethanol and 30 percent butanol. It is highly compatible with the vinyl chloride resins, synthetic rubbers of the buna N type, cellulose nitrate, chlorinated rubber, and certain thermosetting resins of the phenol-formaldehyde types. Paraplex G-25 is also compatible with buna S, neoprene, cellulose acetate propionate and polyvinyl butyral. In solution form it is incompatible with ethyl cellulose, cellulose acetate and cellulose acetate butyrate. Paraplex G-25 is supplied as a soft, tacky, viscous liquid, which pours slowly at room temperature. It shows the following properties:

Specific gravity	1.06
Acid number	3.0 (maximum)
Color	15 (maximum)
Odor	Faint, Characteristic
Freezing point	13-15 deg. C.
Viscosity (50% in ethylene dichloride) (Gardner-Holdt Scale)	Q-V

CELLULOSE DERIVATIVE

NOW IN small-scale production, sodium carboxy-methyl-cellulose, a cellulose derivative, has been announced by Hercules Powder Co., Wilmington, Del. This water-soluble chemical is available in experimental quantities only. Properties of the material make it a stabilizer and emulsifying agent. The material should be useful where hydrophilic colloids possessing marked suspending, thickening, stabilizing and film-forming properties are required, according to the company. Some of its possible applications are to thicken textile printing pastes, to emulsify emulsion paints, and lacquers, and to provide a protective colloid for oil-in-water emulsions.

PLASTIC WINDOW SCREENS

ONE OF the many newer uses for plastics is window screens. The Dow Chemical Co., Midland, Mich., have come out with the statement that their Saran, vinylidine chloride resin, may be used in making screens. Its corrosion resistance alone has been sufficient to create a definite demand in certain geographical areas. Plastic screens were installed about a year ago in the Los Angeles and Freeport plants of the Dow company. High humidity, salt air, fog, and even salt sprays encountered in coastal regions result in corrosive conditions. In the case of the two installations mentioned, corrosion is furthered still more by the presence of chemical fumes. Under such conditions iron screens have been found to rust to the point of failure in as little as 10 to 14 months. Other metallic screens, such as copper, enjoy a much longer life expectancy, but corrode heavily in a few weeks or months, closing the mesh of the screen and resulting in reduced visibility, ventilation and light transmission. The life expectancy of the plastic screen is said to be many years. While the entire production of Saran screen is now being taken for military purposes, at least three fabricators will bid for the postwar civilian market.

COPPER AMMONIUM FLUORIDE

IN EXPERIMENTAL quantities, Pennsylvania Salt Mfg. Co., Philadelphia, Pa., is now offering copper ammonium fluoride in two strengths, 10 percent copper and 15 percent copper. Both materials have been approved as complying with chemical requirements of the U. S. Army Corps of Engineers Tentative Specification No. T-1542A and both are represented by the approximate formula $Cu(NH_3)_4F_2$. The 10 percent material is a dark blue solution carrying considerable solids (approximately 30 percent), and has an analysis approximating 10-11 percent Cu., 5-5.5 percent F., and 10-12 percent NH_3. The solids in the material are soluble in dilute ammonia. The 15 percent material is a more recent development and is a stable, dark blue solution of uniform composition, essentially free from suspended matter. In addition to savings in freight charges, this material, due to its uniformity, permits withdrawal and use of portions of the contents of shipping container without fear of low-strength baths. The analysis of this material approximates 15-16 percent Cu., 7.5-8 percent F., and 15-17 percent NH_3. Application is in the mildew-proofing of such textile materials as cotton, jute, sisal, linen and hemp. It is applied from aqueous solution in a single bath treatment and is compatible with standard water repellants. Commercial packages are wax-lined, oak barrels.

HIGH ADHESION PUTTY

AN IMPORTANT step toward the irreducible minimum of "skin friction" is seen in an announcement by the E. I. du Pont de Nemours and Co.'s finishes division, Parlin, N. J., which has developed a flexible, high-adhesion aircraft putty for filling dents and cracks between riveted aluminum sheets forming aircraft wings. The new Du Pont No. 228-711 aircraft putty has a buttery consistency and stays in place. It displays no tendency to flow, and therefore maintains the desired surface contour. It does not sag on vertical sur-

Questions we are often asked

ABOUT GLASS-LINED STEEL

What Factors Enter into Successful High Duty Agitation in Glass-Lined Steel?

"High Duty Agitation can be successfully carried on in Glass-Lined Equipment when agitator and drive are engineered with due consideration to physical and chemical properties of materials of construction, conditions under which equipment is to operate and installation is followed by proper maintenance," says O. W. Greene, Development Engineer.

The practical application of high duty agitation in glass-lined equipment depends primarily on basic stuffing box design and selection of proper lubricant and packing. Proper accessibility for maintenance of lubricant and packing in correct condition is also an important requisite.

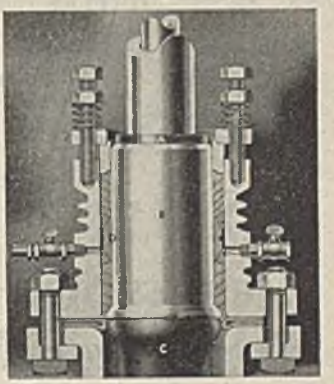
In working out the stuffing box design, consideration must be given to the requirements for a true running shaft in the stuffing box and the difficulty of obtaining glass covered shafts sufficiently true to form a good stuffing box.

The earliest Pfaudler designed stuffing box, thousands of which are in use, is a compactly designed unit with a short section of glass covered shaft in the box. It is adjusted to best running trueness and has a carefully machined extension of the agitator above this portion. In this design, with proper maintenance of packing and lubricant, the plain steel extension of agitator shaft is protected and the glass covered portion covered by the packing, provides a barrier against corrosion.

For service where pressures or chemical conditions are severe or where extra long agitator is required, Pfaudler high duty stuffing boxes plus drive arrangements which provide unusually large and true running drive shafts are proving highly satisfactory.

In this stuffing box design, Pfaudler has been able to overcome both the difficulty of getting a true bearing with glass and deterioration of the steel shaft. This is ingeniously accomplished by a construction in which a replaceable corrosion-resistant sleeve covers the plain steel end of agitator. The stuffing box bearing acts as a lubrication distributing ring and gives a no-play bearing in the stuffing box.

As mentioned before, lubrication and maintenance of packing are vital to the operation of these units and Pfaudler design keeps the drive high above the stuffing box, so that the entire stuffing box can be raised above the agitator stem for inspection, lubrication and repacking without dismantling the drive. The selection of lubricants and packing and the frequency of lubrication depend, of course, upon the reaction involved and the pressures encountered.

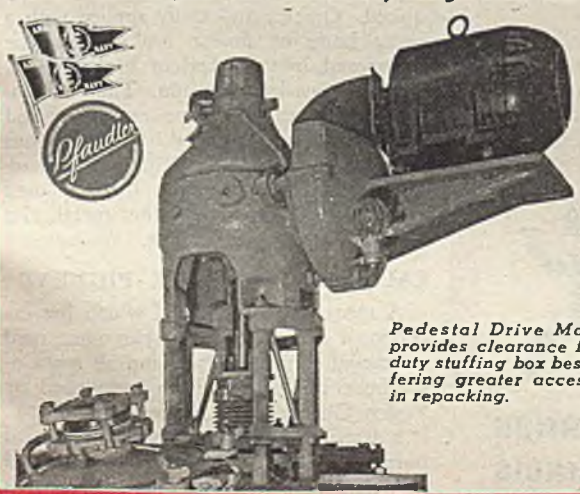


Cross section of Pfaudler high duty stuffing box (A) Agitator Stem. (B) Hastelloy or other alloy sleeve. (C) Enameled portion of agitator shaft. (D) Stuffing box bearing.

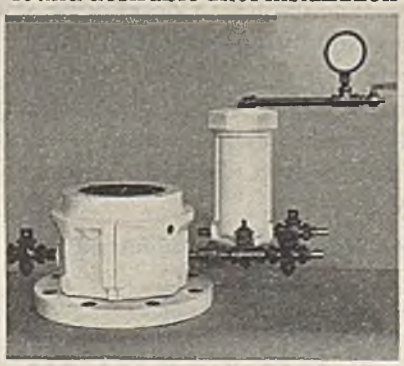
The packing best suited for hydrochloric acid, for example, may be entirely unsatisfactory where other corrosive acids are present. In some installations periodic lubrication over widely spaced intervals may be sufficient to keep the packing in good condition, whereas in others, almost continuous lubrication is necessary.

Pfaudler designs provide for these varied applications and units are obtainable for manual, semi-automatic and full automatic lubrication. These units are also so designed that should water cooling be found desirable after installation of agitator, a clamped-on water jacket can be supplied to present units.

If high duty agitation can speed up your processes or improve quality, send us complete operating information and our engineers will be glad to work out a complete installation for you that is efficient and economical.



Pedestal Drive Mounting provides clearance for high duty stuffing box besides offering greater accessibility in repacking.



Clamped on water jacket, semi-automatic oiler for stuffing boxes used under extremely corrosive conditions.

faces. Both fast-drying and exceptionally low in shrinkage, the putty weighs about one-fifth less than conventional putties, always an important factor in aircraft. The product is under test by a number of major plane manufacturers. Now available only for war uses, the Du Pont aircraft putty is expected to have post-war value for such applications as the finishing of rough metal castings and railroad coaches.

RESIN TAPE ADHESIVE

WARTIME use of plywood in combat planes and boats has been seriously hampered by the lack of a weatherproof tape to repair splits or cracked thin veneers, but the recent development of an adhesive known as Tego Tape provides a solution to the problem and enables manufacturers to utilize many of the veneers which were formerly discarded. This new tape, a thermosetting resin of the phenol-formaldehyde type, restores the mechanical strength of the original veneer without in any way impairing its ultimate weather resistance. While Tego Tape is a phenolic material, the War Production Board has permitted its delivery without allocation, provided that detailed statements as to its end use are filed. It was developed through the cooperative efforts of the Haskelite Mfg. Co., Grand Rapids, Mich., and the Resinous Products & Chemical Co., Philadelphia, Pa. It is manufactured and sold only by the latter company.

BLACKOUT REMOVER

BLACKOUT paint may now be removed in several areas as regulations have been relaxed. Turco Products, Inc., Los Angeles, Calif., is offering Turco Re-Lite, a special blackout paint remover. It is a liquid of heavy body and formulated to cling without runs on any surface, thus providing close control with a brush and the possibility of treating window panes and painted electric globes without touching adjacent painted surfaces.

IRON CEMENT

FOR REPAIRING broken, cracked or defective metal castings, piping, and the like, making joints, seams and loose parts secure, and stopping leaks in boilers, furnaces, firepots and other metal equipment, Fix-Iron has been developed by the So-Lo Works, Loveland, Ohio. It is in powder form, and mixed with water as used. No heat is required. Quickly and easily applied with a putty knife or similar tool, it may be hammered into cracked or broken parts. It rapidly hardens like iron. The new material possesses the same expansion and contraction properties as iron itself, thus assuring a permanently tight joint, regardless of temperature changes. It can be used on iron, steel, brass and other metal, also on wood with equal success.

CALCIUM CARBONATE PIGMENT

A PIGMENT, Witcarb R, which has exceptional reinforcing properties when used in natural rubber, reclaim and all types of synthetic rubber, has been introduced by Witco Chemical Co., New York, N. Y. It is described as an extremely finely divided pure precipitated calcium carbonate, and is the result of long and intensive research and development work carried on in co-

operation with leading rubber manufacturers. Since Witcarb R is especially well adapted to the reinforcement of GR-S (buna S), its introduction at this time is particularly opportune, for it imparts exceptional tensile strength and tear resistance to GR-S compounds and is particularly valuable in stocks that require high rebound, extra elongation and low modulus. Many mechanical formulations require no additional pigmentation other than Witcarb R which processes equally well in synthetic and natural rubber formulations.

ALUMINUM FLUORIDE

ALUMINUM fluoride (AlF_3) is now being produced by Pennsylvania Salt Mfg. Co., Philadelphia, Pa. Analyzing approximately 86 percent AlF_3, it is a fine, free flowing white powder with a bulk density of 50 lb. per sq.ft., and is very slightly soluble in water, acids and alkalis. Suggested uses are as a flux in aluminum manufacture; in ceramic ware as an ingredient of white enamels for porcelains, potteries, etc., as a control agent in alcoholic fermentation.

STRONG VISCOSE STAPLE FIBER

A VERY fine viscose rayon staple fiber of the Avisco or extra-strength type has been announced by American Viscose Corp., New York, N. Y. This fiber, to all practical purposes as fine as silk, is of principal and immediate interest to the fine goods cotton system mills and the spun silk or schappe spinners. The new fiber is described as 1.0 denier Avisco and is produced in appropriate standard lengths suitable for the different spinning systems on which it is used. Basically, it is said to permit the spinning of yarns of far finer sizes than heretofore possible with standard type rayon staple fibers. In addition, it materially increases the strength of spun rayon yarns and fabrics as compared with the yarns and fabrics made with standard type viscose rayon staple fibers. Tests have also demonstrated that the new fiber provides superior creping qualities in fabrics made with high-twist spun rayon yarns.

Commercial applications already reported include flat knit fabrics, simple glove fabrics, tricot knit dress goods, fine broadcloths, foundation fabrics, and various types of sheer handkerchief, dress and shirting materials. These are available in constructions featuring yarns as fine as from 50/1 to 80/1 and 100/2 cotton counts.

DETERGENT

AN ACID-TYPE detergent cleans steel for organic finishes and serves as a conditioner and rust inhibitor. It is offered by Oakite Products, Inc., New York, N. Y. The new detergent provides improved adhesion for paint, lacquer and other finishes. Heretofore it has been restricted to war plants, but it is now available for civilian use as well.

OIL AND GREASE ABSORBENT

AN OIL AND GREASE absorbent known as Speedi-Dry, has been developed by Refiners Lubricating Co., New York, N. Y. It may be applied one-half inch thick on the floors and around machines in plants. It is nonflammable, even when oil soaked, and can be disposed of in any type of con-

tainer. Repeated applications will draw oil from 3 in. of concrete. It may be used on workers' clothes, and oil soaked machine belts. It is said to absorb oil and grease from them over night.

FIREPROOF UPHOLSTERY

PLASTIC fireproof upholstery, developed by United States Rubber Co., New York, N. Y., has been ordered by the Navy as mandatory equipment for all combat ships, to provide added protection against fire. The upholstery covering which will be used on furniture of all new Navy combat ships and old ships returning to service after repairs, is non-smoldering, gasoline and oil-resistant and extremely durable under wide temperature ranges. It is also being used as turret lining and seat covering in both bomber and fighter planes.

To prove its resistance to high temperature, it was exposed for three hours at 180 deg. F. without becoming soft and tacky. To prove its resistance to low temperature, it was subjected to a temperature of —40 deg. F. withoaut cracking when sharply creased. After exposure to oil for an hour, it showed no permeation of the fluid or other ill effect. After exposure to gasoline for a minute, it showed no permeation of the fluid or other ill effect.

In a flexibility test, it was subjected to 2,000 double flexes in a Navy flexing machine and flexed in alternate directions at a speed of 86 flexes a minute without showing any signs of cracking or separation of the coating from the base fabric. In addition, it had to pass other exacting tests proving its durability, toughness of coating, high abrasive resistance, good aging qualities, resistance to salt water and perspiration oils.

PAINT PLASTICIZER

A RESIN chemical developed by Hercules Powder Co., Wilmington, Del., is helping to lower the Navy's "barnacle bill" —the cost of keeping boats in drydock while the barnacles are scraped off their hulls. New anti-fouling paints currently being tested contain poison that prevent barnacles for cementing themselves to a ship's hull. The resin, Hercolyn, acts as a plasticizer in these paints, keeping them open and soft, leaving the poisons free to protect the surface of the vessel. These anti-barnacle paints are being developed to combat one of the oldest problems of the sea, for barnacles can cut a ship's speed by 25 percent. A growth of barnacles can weigh as much as 30 tons on the hull of a 10,000-ton vessel.

PLASTIC RESIN BOARD

DEVELOPED to meet urgent war emergencies by United States Rubber Co., New York, N. Y., a new plastic resin board which is being successfully used by both Army and Navy will probably find many post-war uses not only in airplane manufacture but in many other lines including luggage, wall paneling, flooring, table tops and house furnishings.

The plastic resin board is washable and not affected by gasoline, oils, acids, most alkalis or alcohol. It can be made highly decorative. Artistic effects can be created by changing the color or design of the fabric or paper base used, the hard, trans-

parent, protective surface of the resin assuring permanence to the finished material. Colorful printed or woven design can be seen through a surface which may have either a dull or a brilliant luster. The color of the resin may also be changed.

Advantages of the plastic board for airplane manufacture are its light weight, half that of aluminum, its great tensile strength and its ability to withstand strains and excessive vibration. Because of these properties, it is now being used for heliocopter cabin structures.

This plastic board is now the principal material used to support bullet-sealing fuel cells in airplanes and is also used for de-icer tanks.

LUBRICANT

A CHEMICAL combination which creeps into infinitestimal openings has already saved time in many war-busy plants and kept hard-to-replace parts from falling under the chisel and hammer. In one case a frozen shaft threatened to tie up production for half a day or more. The application of Kano Kroil resulted in production being resumed in 15 min. A bridge had been exposed to the elements for 20 yr. when the engineer found it necessary to remove some bolts. After applying Kano Kroil the bolts were removed quickly and successfully. For years an engine block had been lying around at a Florida beach, exposed not only to the elements but to the action of salt water. The material was applied to the studs which were then removed without breaking. Laboratory tests show that Kroil creeps into spaces as small as a millionth of an inch. Actual working tests prove that it saves time, temper and materials by loosening frozen metal parts quickly and effectively without harm to metal. Manufactured by Kano Laboratories, Chicago 1, Ill.

IMPROVED SYNTHETIC RUBBER

AN IMPROVED general-purpose synthetic rubber of the butadiene type, resulting from discoveries made in the laboratories of the B. F. Goodrich Co. has been announced. Through the cooperation of Col. Bradley Dewey, Rubber Director, who had urged all possible speed in the development of additional new and improved types of synthetic rubber, permission has been obtained from appropriate government agencies so that substantial production of the new material can be undertaken immediately in one of the plants being operated by the Goodrich company for the government. For reasons of security, complete information on the new material will not be available to the public until after the war, it was stated. Introduction of a certain abundant natural material into rubber-making processes resulted in this superior synthetic. The improved rubber approaches natural rubber in characteristics during processing.

Tires made of this rubber, now undergoing extensive tests, show reduction in tread cracking and increased resistance to road wear, the announcement said. These are qualities in which other synthetic rubbers have shown deficiencies, especially in large tires for heavy service. Having greater tackiness, or adhesive properties during processing, this rubber lessens manufac-

ing difficulties experienced in handling other substitute rubbers. The B. F. Goodrich development is also said to shorten the amount of time now required to prepare synthetic rubbers for product manufacture, a factor of importance throughout the rubber industry now producing at near-capacity to meet mounting war and essential civilian requirements.

BENZENE SULPHONAMIDE

OF INTEREST to those engaged in synthetic work is the announcement of the Wyandotte Chemicals Corp., Wyandotte, Mich. of the immediate availability of benzene sulphonamide in both technical and purified grades. Although known for almost 100 years, benzene sulphonamide has not as yet found any large-scale uses. It is one of many old organic compounds having "undiscovered commercial potential."

Unlike the acid amides, benzene sulphonamide reacts readily with aqueous alkalis to give reactive salts of marked interest in synthetic research. The compound exhibits many of the typical reactions of amines and is quite stable.

Properties of Benzene Sulphonamide

	Technical Grade	Purified Grade
Color	Light tan, granular material with faint odor.	White crystals, almost colorless
Melting Point	140–156 deg. C.	154–154.5 deg. C.
Sol. in H_2O	Approx. same as purified grade	0.25% at 10 deg. C. 2.0% at 50 deg. C. 25.0% at 100 deg. C.
Sol. in Organic Solvents	Approx. same as purified grade	Soluble in most organic solvents
Purity	85–90%	98–100%

Wyandotte Chemicals Corp. states that limited laboratory and commercial quantities of technical and purified benzene sulphonamide are available at present and that both grades are potentially available in large quantities for important uses.

POLYSULPHIDE RUBBER

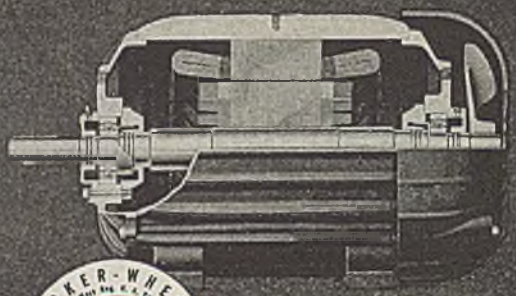
A NEW Thiokol polysulphide rubber known as Thiokol Type 'ST' has been introduced by Thiokol Corp., Trenton, N. J., and in experimental end use research has been demonstrated to possess qualities of resistance to 'cold flow', as well as other properties of interest and value to the rubber industry.

Compression set tests conducted to compare Thiokol 'ST' with Thiokol 'FA' have shown that if similar blocks of crude Thiokol 'ST' and Thiokol 'FA' are subjected to identical constant pressure for a given number of hours the recovery of 'ST' is markedly superior. Tests demonstrate that along with the improvement in cold flow resistance, 'ST' possesses much better processing characteristics and excellent flexibility at low temperatures. This latter property is obtained without the addition of liquid plasticizers, a fact which makes 'ST' of especial interest to the aircraft industry inasmuch as added liquid plasticizers are readily extracted by aviation fuels and hydraulic brake fluids.

Other characteristics of paramount interest to the rubber industry are the new polymer's low volume swell in hydrocarbon fuels and its workability within a wider range of temperatures than previous polysulphide rubber types. Moreover, higher operating temperatures have been found to be not nearly so detrimental to 'ST' as to 'FA'.

FOR

Sulphur & Sulphuric Acid Handling Plants
Rubber Mills
Cotton Mills & Gins
Lime Kilns
Sugar Refining
Aluminum Plants
Turpentine & Rosin Plants
Tanneries
Drug Manufacturing
Paint & Varnish Plants
Breweries
Ceramics Plants
Food Processing
Fertilizer Handling
Cement Mills
Oil and Fat Recovery
Flour Mills



CROCKER-WHEELER Motors-Generators

SEALEDPOWER
(Cowl-cooled) . . . available for all polyphase alternating current circuits, 2 to 15 horsepower. Write for detailed literature, or call our nearest office.

FOR

Wet Mines
Feed Mills
Coke Plants
Wood Working Mills
Textile Mills
Paper & Pulp Mills
Glass Manufacturing
Packing Plants
Laundries
Galvanizing & Pickling Processes
Dye Houses and Bleacheries
Soap Manufacturing
Crushing & Grinding Mills
Coal Tipples and Pulverizers
Foundries
Cement Mills
Grain Elevators, Etc.

Now a Corrosion-Resistant SEALEDPOWER Motor

PROTECTED AGAINST: acid fumes, alkali fumes, splashing or dripping corrosive liquids, air-borne moisture, steam, corrosive gases, conducting dusts, metallic chips, etc.

PROTECTED BY: a corrosion-resistant frame, cooled by a built-in corrosion-resistant fan. The windings are *doubly* protected from damage by Crocker-Wheeler's vacuum-impregnation process which seals *each* coil individually against moisture, fumes or dirt.

BRUTALLY TESTED! The seal's effectiveness is proved by laboratory tests (at right) and by hundreds of satisfactory installations.

1 SEALEDPOWER motor was placed in tank containing several inches of water and run continuously for 8 hours (see photo). it stood idle in water overnight, then was run 8 more hours. During motor's operation, the external ventilating fan drenched the outside of the frame with water. At end of test, the motor was disassembled and found to be *completely dry* inside.

2 A dense atmosphere of extremely fine French chalk was kept circulating around the motor and through its ventilating system for many hours. No trace of chalk was found inside upon disassembly.

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 • ST. LOUIS • WASHINGTON • LOS ANGELES

CHEMICAL ENGINEERING NEWS

PROGRESS IN HIGH-OCTANE GASOLINE PROGRAM

In a statement made last month, Petroleum Administrator Harold L. Ickes paid high tribute to the chemical engineering which had made possible the large increase in production of 100-octane gasoline in the last two years. He said that 65 percent of the increase in the United Nations in the two years following Pearl Harbor had been figuratively wrung out of a hat by chemical magic and mechanical adjustments. He described our situation, when we entered the war, as so desperate that we could not wait for new plants to be built so in spite of the fact that 41 major units were completed by the end of last December, only 35 percent of our increased production in 1942 and 1943 and only 20 percent of total production, came from new plants. He also said production in the two-year period had increased 100 percent without counting the new facilities.

At the same time Deputy Petroleum Administrator Ralph K. Davis made public a chart showing how the increase in output had been achieved. In his division of methods he apportions the increase as coming 22.8 percent from the use of cumene as blending agent; 14 percent from mechanical improvements and miscellaneous; 13.8 percent from conversion of catalytic cracking units to aviation fuel; 9.1 percent from the use of codimer as blending agent; 3.5 percent by the addition of 0.6 cc of tetraethyl lead; 1.3 percent by the use of toluene and other blending agents. This makes a total of 64.5 percent from what he terms "refinery ingenuity". The remaining 35.5 percent came from new facilities.

ALUMINUM PLANT SUGGESTED FOR PACIFIC COAST

In a recent interview, John McBride, clerk of the Committee on Irregation and Reclamation of the House of Representatives, summarized the aluminum situation on the Pacific Coast by saying that the only way to assure continued operation of these plants was by installing, preferably on the lower Columbia River, facilities for reducing bauxite to alumina. He contended that war-time necessity dictated the location of existing reduction plants while the location of the five aluminum ingot plants and one fabricating plant in the Northwest was in line with both war and peace economy with abundant electric power as the dominating influence.

Mr. McBride pointed out that under the present arrangement, alumina is shipped by rail from producing points to the aluminum mills at an emergency freight rate of $8.65 a ton and as it takes about two tons of alumina to produce one ton of aluminum, this means a penalty of about $17 a ton against aluminum produced on the Pacific northwest. In his opinion, ships which now bring bauxite from South America to the Gulf and Mississippi River plants could, at little additional cost, carry it to the Columbia River, the principal difference being the Panama Canal tolls.

ELECTROCHEMICAL SOCIETY MEETS AT MILWAUKEE

The 85th convention of the Electrochemical Society was held April 13, 14, 15, at Milwaukee. The technical sessions were on powder metallurgy, electrometallurgy, batteries and corrosion.

S. D. Kirkpatrick, editor of *Chem. & Met.*, was elected president of the society,

Sidney D. Kirkpatrick

and W. C. Moore of the U. S. Industrial Chemicals, Inc., Stamford, Conn., was elected vice president. The treasurer, W. W. Winship, and the secretary, Colin G. Fink, were re-elected.

Honorary membership in the society was bestowed on Paul J. Kruesi, president of

William Cabler Moore

Southern Ferro Alloys Co., Chattanooga, Tenn., and Willis R. Whitney of the General Electric Co., Schenectady, N. Y. The young author's cash prize and book prize went to Walter G. Berl of Carnegie Institute of Technology, Pittsburgh.

CHICAGO CHEMICAL SHOW TO BE HELD IN COLISEUM

Under the chairmanship of M. H. Arveson, Standard Oil Co. of Indiana, a committee from the Chicago Section of the American Chemical Society is making preparations for the third National Chemical Exposition which will be held at the Chicago Coliseum, Chicago, Nov. 15-19. Other members of the committee are Edward Bicek, Illinois Institute of Technology; Victor Conquest, Armour & Co.; L. E. May, Sherwin-Williams Co.; C. S. Miner, Jr., Miner Laboratories; R. C. Newton, and H. E. Robinson, Swift & Co.; and B. B. Schneider, Schneider & Dressler. L. M. Henderson, Pure Oil Co., and president of the Chicago section is a member of the committee ex-officio.

The two preceding exhibitions were held in Chicago Loop hotels but a survey of prospective exhibitors indicated that more display space must be provided than the hotels could offer. Hence the Coliseum was selected where more than 50,000 sq.ft. of floor space will be available, all of which is on one floor. Headquarters have been opened at 330 South Wells St. and Marcus W. Hinson who served as manager for the other shows will again act in that capacity.

HARRY L. SUTTON TO DIRECT DU PONT PROJECT IN TEXAS

Following the announcement of last month that E. I. du Pont de Nemours & Co., Inc., had taken option to buy an 822-acre tract containing the San Jacinto shipyard property of the U. S. Maritime Commission near La Porte, Texas, the company has reported that Harry L. Sutton will serve as field project manager to supervise work at its projected chemical plant on the Houston-Galveston ship canal. The Maritime Commission, owner of the 40-acre San Jacinto shipyard contained in the tract, is disposing of its equipment there. Du Pont will retain the gate house, office building, hospital, cafeteria, warehouses, docks, highways, railroads, and all mains for water and gas, in addition to electrical lines and a power substation. Construction and adaptation of the shipyard facilities will begin very soon and the first production unit be called the Houston works of the Grasselli Chemicals Department and will make phenothiazine.

In addition to the shipyard property, 782 acres are being purchased from H. C. Cockburn of Houston. Mr. Sutton will supervise the survey of this tract.

THE CHEMISTS' CLUB DROPS EMPLOYMENT BUREAU

The Board of Directors and The Bureau of Employment of The Chemists' Club, Inc., New York, have issued an announcement to the effect that the Bureau of Employment, long conducted by the Club, will cease operation on April 29.

PROGRESS REPORT ON RUBBER PRODUCTION AND DEMANDS

In March, Rubber Director Bradley Dewey issued a progress report which included a comprehensive review of the basic situation, the status of construction and expansion programs for synthetic rubber, the availability of rubber chemicals, together with estimates for 1944 production and consuming requirements. Of the current status he said the three butadiene-from-alcohol plants, comprising 11 units each of 20,000 tons rated annual capacity, ran during January and February at over 160 percent of their rated capacity. The Neoprene plants and several of the plants for manufacturing butadiene from butylenes and styrene have demonstrated their ability to run at well over rated capacity.

He stated that one-fifth of the presently estimated production of Buna S will be made from butadiene produced at Port Neches and Houston. Also that research has made it possible to produce Butyl rubber in the now finished plants at Baton Rouge and Sarnia at approximately 50 percent of the capacity. It is estimated that by the end of the year all the Butyl plants will be producing at an over-all average of at least 75 percent of their rated capacity.

Referring to the difficulties which some plants have experienced, he said the use of second-hand equipment proved false economy and some of the plants found it necessary to replace such equipment. Experience also developed some deficiencies in design and as a result five of the plants are rebuilding major sections of their equipment.

In 1943 production of synthetic rubber, including Neoprene and Buna N at private plants amounted to 234,244 long tons. For 1944 the estimate is for a total of 868,900 long tons comprising the following, the figures referring to 1,000 long tons:

	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	Total
Buna S	145	185	210	225	765
Butyl	3.2	5	6	12	26.2
Neoprene	13.3	13.3	13.3	13.3	53.2
Buna N	5	6.5	6.5	6.5	24.5
Total	166.5	209.8	235.8	256.8	868.9

Domestic consumption of rubber in 1943 is reported at 440,700 long tons and exports amounted to 100,900 long tons, thus making a total disappearance of 541,600 long tons. For the present year domestic requirements are given as 778,000 long tons with exports at 204,000 long tons or a total of 982,000 long tons. It is explained that the export figures for 1944 include the rubber content of exported fabricated rubber goods and the totals for domestic requirements have been correspondingly adjusted.

The report cited the importance of reclaimed rubber by pointing out that one ton of reclaim is needed for every three tons of rubber used. Uses of reclaim are varied and run the full gamut of rubber products so that it will be incumbent upon the reclaiming industry to provide approximately 320,000 long tons in the present year. The largest part of this will go into camelback, tires, heels, and soles.

DOW CHEMICAL CO. OPENS OFFICE IN DETROIT

Following announcements early in the year that the Dow Chemical Co. had opened offices in Boston and Philadelphia, it is now announced that an office was opened in Detroit on April 1. This makes a total of 12 offices now maintained by Dow throughout the country. Walter J. Truettner who has been associated with the Dow Magnesium Corp. since February 1942 has resigned as secretary of the Marysville plant to take charge of the Detroit office. Ralph B. Ehlers who has been serving as assistant chief engineer of Dow Magnesium Corp. is located in the new office in charge of magnesium distribution and service in southeastern Michigan. Other members of the office are Paul M. Jensen, in charge of plastics and Fielding H. Yost, Jr., in charge of industrial chemicals and pharmaceuticals.

McGRAW-HILL PRINTS DIGEST FOR MEN OVERSEAS

An *Overseas Digest*, the first edition of which was issued last month by the McGraw-Hill Publishing Co., has been inaugurated in response to an appeal for reading matter for troops overseas. The *Digest* is designed to interest the thousands of technical men in the Army and Navy who may want to keep abreast of developments in the engineering, manufacturing, and business worlds which they have temporarily left behind.

CONVENTION CALENDAR

National Petroleum Association, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, April 20–21.

Federation of Paint and Varnish Production Clubs, spring technical meeting, Netherlands-Plaza Hotel, Cincinnati, Ohio, April 21–22.

American Oil Chemists' Society, annual meeting, Hotel Roosevelt, New Orleans, La., May 10–12.

American Institute of Chemical Engineers, semi-annual meeting, Hotel Cleveland, Cleveland, Ohio, May 14–16.

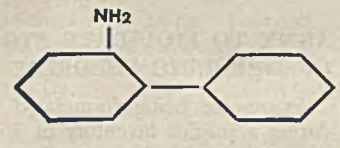
American Association of Cereal Chemists, annual meeting, Nicollet Hotel, Minneapolis, Minn., May 23–25.

American Society for Testing Materials, annual meeting, Waldorf-Astoria, New York, N. Y., June 26–30.

YES, we'll gladly send samples of these available, low-priced MONSANTO CHEMICALS!

In addition to their long-established uses, these two low-cost Monsanto Chemicals have vast potential value in new applications and as replacements for materials made scarce by the war. If your company wishes sample quantities of these chemicals, they will be sent promptly upon request by wire or on your company letterhead. MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second Street, St. Louis 4, Missouri.

ortho-AMINODIPHENYL
(TECHNICAL)



Mol. Wt. 169.10

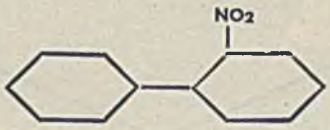
Standard Form: Fused solid.

Specifications: Purplish crystalline mass; crystallizing point 47.0°C. min.; assay 94.5% min. Distillation range: first drop, 295.0°C. min.; 95% (1-96 ml), 8.0°C. max.; dry point, 310.0°C. max.

Where ortho-AMINODIPHENYL may be used

1. Intermediate for chemical synthesis.
2. Intermediate in synthesis of dyestuffs such as quinoline yellows, lithol reds and hydron blues.
3. As a constituent of Phenol Formaldehyde resins.
4. A solvent, where a high molecular weight amine is advantageous.

ortho-NITRODIPHENYL
(TECHNICAL)



Mol. Wt. 199

Specifications: Light yellow to reddish crystalline mass. Crystallizing point 34.5°C. min

Where ortho-NITRODIPHENYL may be used

1. Intermediate for chemical synthesis.
2. In the manufacture of dyestuff intermediates such as 2,2′ Diphenyl Benzidine and its derivatives.
3. Plasticizer and component in resin compositions.
4. As a component and intermediate in insecticides.

MONSANTO CHEMICALS

SERVING INDUSTRY... WHICH SERVES MANKIND

OIL CHEMISTS WILL MEET IN NEW ORLEANS

PLANS have been completed for holding the 35th annual meeting of The American Oil Chemists' Society at New Orleans, May 10-12. The Roosevelt Hotel has been selected as headquarters and all technical sessions, committee meetings, and the annual dinner will be held at the hotel. Dr. George W. Irving, Jr., of the Southern Regional Research Laboratory heads the local committee in charge of arrangements. In addition to the general papers there will be a symposium on the physical properties of fats and oils which will include papers on X-ray and ultraviolet spectroscopy, specific and latent heats, viscosity and plasticity, and the practical application of physical methods of processing including liquid-liquid extraction and continuous solidification of lubricating greases.

Robert M. Walsh, principal agricultural economist in the Division of Statistical and Historical Research of the Department of Agriculture and editor of *The Fats and Oils Situation* will deliver a paper on the economics of fats and oils.

ARMY TO LIQUIDATE STOCKS OF MERCURIC CHLORIDE

PLANS are being formulated for liquidating a surplus inventory of 364,450 lb. of mercuric chloride according to an announcement from the Chemicals Bureau of WPB. Officials said it is their desire to dispose of the surplus with a minimum dislocation of the producing industry. They also said there is reason to believe that excess stocks of this chemical are being held by other government agencies. The surplus specifically mentioned is said to represent a normal supply for five months based on the 1943 rate of sales or an eight months supply based on the 1942 rate. However, there was government buying in both those years so that the total undoubtedly represents a high percentage of annual civilian requirements. In view of this situation it is held probable that allocation of chlorine for making chloride will not be continued.

CANADIAN ASSOCIATIONS WILL HOLD ANNUAL CONFERENCE

THE occasion of the annual general meetings of the Canadian Chemical Association, the Canadian Institute of Chemistry, and the Society of Chemical Industry will be the Canadian Chemical Conference which will be held at the Royal York Hotel, Toronto, June 5-7. The host will be the Toronto Chemical Association which represents the various chemical organizations of that vicinity.

The program includes extensive discussions on current and future problems including the future of chemical organizations in Canada, postwar planning, and war-time achievements in chemistry. In addition there will be technical sessions devoted to subject divisions such as paint and varnish, biochemistry, chemical engineering, food chemistry, plastics, pure chemistry, and rubber.

CANADA HAS PASSED PEAK PRODUCTION OF CHEMICALS

In a recent report in the Canadian House of Commons on war appropriations, the Hon. C. D. Howe, Minister of Munitions and Supply, stated that Canada had reached peak production of chemicals and explosives during 1943. He said the only explosive for which demand had increased was RDX and curtailment in the ammunition program would require a cut of about 20 percent in the total output of explosives. In line with declining requirements, production of cordite has been discontinued at two plants. Production of TNT and other explosives at a plant in Nobel, Ontario, also has been stopped. He stated that demand for chemicals such as, ammonium nitrate and hexachlorethane will continue in 1944 at about the same level as in 1943.

Referring to controls, he said some relaxation was made possible through changes in the war program. Glycerine, formerly in short supply is now available for some commercial uses. Some coal-tar also has been released for civilian use. Soda ash is still scarce and Canada is dependent upon imports from the United Kingdom and the United States. He cited Canada as an important source of supply of sulphuric acid and ethyl alcohol for the United States.

NEW PRODUCTIVE CAPACITIES FOR SUPPLYING FREON

Coming into production almost a month ahead of the anticipated time, the new addition to the Deepwater, N. J. plant of the Kinetic Chemical Co. commenced delivery of freon-12 refrigerant gas around the middle of March. This added about 600,000 lb. to March output making total production for that month at Deepwater approximately 2,500,000 lb., which was increased to close to 2,900,000 lb. in April. The company also has under construction a new plant on property owned by the Grasselli Chemicals Division of E. I. du Pont de Nemours & Co., Inc., at East Chicago, Ind. This plant will have a capacity of about 2,000,000 lb. of freon a month and is expected to get into production before September. Despite the increase in supply, war demands for freon are so heavy that it has been found necessary to curtail some of the civilian uses, notably that of air conditioning railroad equipment.

NEW PLANT TO MAKE HIGH TENACITY RAYON YARNS

According to an announcement of the War Production Board, an opportunity will be given Oscar Kohorn to put into application a formula he has developed for making stronger rayon yarns than any hitherto made. Assurance has been given Oscar Kohorn & Co., Ltd., that priorities will be given for the establishment of an experimental plant to make high tenacity rayon yarns. The plant will be located at Scranton, Pa. and will be financed entirely by private capital, the total outlay being estimated at $200,000 to $300,000.

FREE ENGINEERING COURSES FOR SERVICE MEN

THE School of Engineering of Columbia University is opening its spring session courses free of charge to qualified men and women engineering students who have been discharged from the armed forces. Dr. Nicholas Murray Butler, president of the university stated that this plan is designed to bridge an emergency period since large numbers of men and women have been released from service with no government plan as yet to provide for the completion of their education. He pointed out it is important that those who have outstanding scientific and technical ability complete their education without delay for if the war is prolonged their services will be essential in carrying on war production. Furthermore postwar demands will require a very high level of technical competence and a more widely and completely educated personnel than was essential in the past.

NO MAJOR EXPANSIONS FOR PENICILLIN PROGRAM

WITH 95 percent of new plant construction under the penicillin program begun last June, having been completed and 90 percent of the operating facilities delivered, the Chemicals Bureau of the War Production Board announced on March 28 that no further major expansions will now be approved. Only minor adjustments in approved projects necessary for the elimination of production bottlenecks will be considered at this time. However, it may be necessary to grant a limited amount of priority assistance to individuals with original processes for making penicillin.

CHEMICAL EMPLOYEES ACTIVE IN WAR BOND DRIVE

EMPLOYEES in the field of chemical industries in New York made an enviable record in the purchase of war bonds in the recent Fourth War Loan drive. Incomplete returns from the heads of the committees in this field reveal that more than $50,000,000 worth of war saving bonds were sold to these employees. In the campaign the industry had as its chairman, Charles S. Munson, president of Air Reduction Co., Inc., W. C. Keeley, vice president of the same company was co-chairman of the chemical division. The chemical division was one of 13 organized under commerce and industry of which William E. Cotter, counsel for Union Carbide & Carbon Corp., was director.

U. S. Production, Consumption and Stocks of Chemicals, January 1944*

Chemical and Basis	Unit†	Production	Made and Consumed	Stocks
Acetylene:				
For use in chemical synthesis	M cu. ft.	324,855	81,190	[1]
For commercial purposes	M cu. ft.	146,814		
Synthetic anhydrous ammonia (100% NH_3)	Tons	46,487	39,994	5,384
Bleaching powder (35%–37% avail. Cl_2)	M lb.	5,505	1,923	1,622
Calcium acetate [80% Ca $(C_2H_3O_2)_2$]	M lb.	1,190	[2]	318
Calcium arsenate [100% $Ca_3(AsO_4)_2$]	M lb.	2,496	430	7,976
Calcium carbide (100% CaC_2)	Tons	[3] 53,710	[4]	[3] 12,360
Calcium hypochlorite (true) (70% avail. Cl_2)	M lb.	1,098	[2]	952
Calcium phosphate—monobasic [100% $CaH_4(PO_4)_2$]	M lb.	5,532	[2]	4,854
Carbon dioxide:				
Liquid and gas (100% CO_2)	M lb.	25,148	2,124	5,039
Solid (dry ice) (100% CO_2)	M lb.	37,380	661	6,886
Chlorine	Tons	106,333	61,146	8,613
Chrome green (C.P.)	M lb.	561	73	884
Hydrochloric acid (100% HCl)	Tons	29,048	16,499	2,773
Hydrogen	Millions of cu. ft.	1,914	1,581	[4]
Lead arsenate (acid and basic)	M lb.	7,212	163	6,321
Lead oxide—red (100% Pb_3O_4)	M lb.	9,218	651	5,103
Methanol (natural) (80% CH_3OH)	Gal.	374,611	[4]	189,926
Methanol (synthetic) (100% CH_3OH)	M gal.	6,007	[2] [3]	5,777
Molybdate orange (C.P.)	lb.	114,594	2,057	142,540
Nitric acid (100% HNO_3)	Tons	37,621	34,376	8,570
Nitrous oxide (100% N_2O)	M gal. S.T.P.	7,041	.....	3,816
Oxygen	M cu. ft.	1,560,716	34,310	[1]
Phosphoric acid (50% H_3PO_4)	Tons	65,154	58,421	11,954
Potassium bichromate and chromate (100%)	M lb.	763	[2]	579
Potassium chloride (100% KCl)	Tons	103,125	[2]	25,702
Potassium hydroxide (caustic potash) (100% KOH)	Tons	3,558	902	2,153
Soda ash (commercial sodium carbonate):				
Ammonia soda process—				
Total wet and dry[5] (98%–100% Na_2CO_3)	Tons	393,474	.....	.....
Finished light[5] (98%–100% Na_2CO_3)	Tons	221,112	51,090	22,628
Finished dense (98%–100% Na_2CO_3)	Tons	121,236	3,238	9,288
Natural[5]	Tons	13,479	.....	1,910
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	13,498	[2]	4,591
Sodium bichromate and chromate (100%)	Tons	7,029	[2]	772
Sodium hydroxide, liquid:				
Electrolytic process (100% NaOH)	Tons	100,619	26,597	37,514
Lime-soda process (100% NaOH)	Tons	57,596	[2]	15,592
Sodium phosphate:				
Monobasic (100% NaH_2PO_4)	M lb.	2,375	[2]	591
Dibasic (100% Na_2HPO_4)	Tons	4,008	[2]	684
Tribasic (100% Na_3PO_4)	Tons	5,996	136	1,549
Sodium silicate (water glass):				
Liquid (40° Baume)	Tons	106,684	[4]	242,098
Solid (all forms combined)	Tons	8,210	2,527	9,042
Sodium sulphate:				
Glauber's salt and crude salt cake[7]	Tons	64,174	7,285	70,463
Anhydrous (refined) (100% Na_2SO_4)	Tons	11,513	[2]	9,363
Sulphur dioxide (100% SO_2)	M lb.	5,685	3,286	3,841
Sulphuric acid:[7]				
Chamber process (100% H_2SO_4)	Tons	287,266	.....	273,000
Contact process[8] (100% H_2SO_4)	Tons	500,988	.....	.....
Net contact process[9] (100% H_2SO_4)	Tons	454,975	.....	.....
White Lead	Tons	6,914	1,976	9,321
Zinc yellow (C.P.)	M lb.	2,230	237	496

* Preliminary data from Chemicals Bureau of WPB and Bureau of the Census. † All tons are 2,000 lb. [1] Not yet available. [2] Revised. [3] Data cannot be published. [4] Not available. [5] Total wet and dry production including quantities diverted for manufacture of caustic soda and sodium bicarbonate and quantities processed to finished light and finished dense soda ash. [6] Not including quantities converted to finished dense soda ash. [7] Data collected in cooperation with Bureau of Mines. [8] Includes oleum grades. [9] Excludes spent acid. * Estimated.

U. S. Production, Consumption and Stocks of Synthetic Organic Chemicals, January 1944[1]

Item	Quantity
Acetanilide (tech. and U. S.P.):	
Production	439,148
Consumption	270,368
Stocks	757,278
Acetic acid (synthetic):[2]	
Production	25,251,912
Consumption	19,569,465
Stocks	9,517,218
Acetic anhydride:[3]	
Production	[4]
Consumption	[4]
Stocks	[4]
Acetyl salicylic acid:	
Production	753,887
Stocks	749,336
n-Butyl acetate:	
Production	5,699,444
Consumption	149,275
Stocks	2,298,399
Creosote oil (gallons):[5]	
Production	11,305,961
Consumption	810,998
Stocks	19,155,075
Creosols, meta-para:[6]	
Production	562,320
Stocks	151,606
Creosols, ortho-meta-para:[6]	
Production	584,661
Stocks	304,561
Cresylic acid, crude:	
Production	1,965,334
Stocks	1,306,714
Cresylic acid, refined:[6]	
Production	2,723,855
Stocks	1,982,414
Diethyl ether (all grades):	
Production	4,967,093
Stocks	2,463,017
Ethyl acetate (85%):	
Production	9,914,309
Consumption	1,513,656
Stocks	5,105,921
Lactic acid (edible):	
Production	427,944
Stocks	345,584
Lactic acid (technical):	
Production	246,138
Consumption	10,009
Stocks	172,358
Methyl chloride (all grades):	
Production	1,291,121
Stocks	1,078,377
Naphthalene, crude:[7]	
Production	15,072,813
Stocks	9,827,554
Naphthalene, refined:[8]	
Production	7,268,318
Consumption	4,061,657
Stocks	3,042,885
Niacinamide:	
Production	23,287
Consumption	3,856
Stocks	42,378
Oxalic acid (technical):	
Production	1,490,234
Stocks	681,722
Phenobarbital and sodium salts:	
Production	22,484
Stocks	66,415
Phthalic anhydride:	
Production	8,573,942
Consumption	2,570,729
Stocks	1,564,253
Riboflavin (for human use):	
Production	9,783
Stocks	24,179
Sulfa drugs (total):	
Production	653,798
Consumption	198,104
Stocks	1,392,334

[1] Data from Chemical Division, U. S. Tariff Commission, and Chemicals Bureau, WPB. All data in pounds except as noted. Production: consumed in producing plants or sold; consumption: in producing plants only (where no quantities are given data are confidential because publication would reveal operations of individual companies); stocks: as of Jan. 31. [2] Statistics for natural acetic acid (direct process from wood) reported to the Bureau of the Census: Prod., 2,770,624 lb.; stocks, 1,093,523 lb. For acetic acid from calcium acetate: Prod., 741,709 lb.; cons., 16,530 lb.; stocks 420,635 lb. Production of recovered acetic acid is confidential. [3] Includes anhydride from acetic acid by vapor phase process. [4] Statistics will be released quarterly. [5] Includes data from distillers of purchased coal-tar only. Total production, including that by byproduct coke-oven operators, 14,271,353 gal. Stocks: 20,535,897 gal. [6] Includes statistics reported to Bureau of Mines by byproduct coke-oven operators. [7] Less than 79 deg. C. Includes grade solidifying at less than 74 deg. C. produced for sale only. Also includes 74-76 and 76-79 grades. Data represent some duplication. Data on crude coke-oven operators not included. For Jan., quantities reported to Bureau of Mines: Prod., 3,863,175 lb.; stocks, 2,447,785 lb. [8] 79 deg. C. and over.

NEWS FROM ABROAD

PATENT REFORM AND CONTROL OF CARTELS PROMINENT AMONG BRITISH RECONSTRUCTION PROBLEMS

Special Correspondence

THE British chemical industry is particularly interested in two problems of economic policy which have recently come up for much public discussion. Both of them are questions in which Great Britain and the United States are jointly interested but have so far gone entirely different ways. One of the two problems is the future of the cartel, especially in its international aspects and with regard to government control. The other problem is that of patent protection and its possible modification by compulsory licensing. As far as cartels, trusts and other market-controlling combines are concerned, the official British view differs materially from United States policy as expressed in the Sherman Anti-Trust Act. There are no restrictions on mergers and combinations for the purpose of reducing sales competition; the government has indeed played a prominent part in setting up international controlling agencies for the production and supply of such commodities as tin, rubber and sugar. With regard to patents, on the other hand, British law provides a check against the abuse of monopoly powers by entitling the Comptroller of Patents to compel the patentee in certai clearly defined cases of monopoly abuse t grant manufacturing licenses to other firm on terms fixed by himself.

It is no mere coincidence that the re form of British cartel and patent legisla tion finds particularly ardent supporter and critics in the chemical industry, fo nowhere else are problems of cartel an patent protection of quite as great im portance. The issue involved in the paten dispute has been clearly set out in tw memoranda published on behalf of Im perial Chemical Industries Ltd., the lead ing British chemical combine which ha not only a large research organization o its own but also benefits from a patents and processes agreement with E. I. du Pont de Nemours & Co., Inc. and Boots Pure Drugs Co. Ltd., another big chemical manufacturing firm which possesses a network of retail stores throughout the British Isles. Boots takes the side of those who wish to introduce compulsory licensing, whereas I.C.I. tends to defend the present system of patent protection.

Boots maintains that the present patent law does not provide adequate protection

against monopoly abuse. While the Comptroller of Patents has the right to issue licenses without the consent of the patentees in cases of proved abuse, the procedure is impracticable and unsuitable because proceedings in the law courts may take a very long time. The supporters of patent law reform argue further that suppression of inventions by patent registration would be impossible if patentees were under an obligation to issue licenses on a royalty basis where they now enjoy monopoly protection for sixteen years. Efficient manufacturers would be able to utilize inventions to the benefit of the community and even improve such inventions. Research would receive a further stimulus and a severely-felt bar on progress would be removed.

The opponents of compulsory licensing base their attitude on such arguments as these, taken from the I.C.I. memorandum: Under a compulsory licensing law a large competitor could obtain a license and, because of his greater resources, undersell the small manufacturer who has developed the product. Unless the manufacturer can foresee with some certainty a reasonable return on his outlay, he will not in many cases commence manufacture. If the grant of a patent conferred no monopoly rights, there would be very little incentive to research whatever. A great number of concerns would see no cause for carrying out a long and expensive research program if they were always assured of a license under any inventions made by others. In cases of obviously attractive inventions there would inevitably be a number of licensees so that production would take place in relatively small units and consequently with high manufacturing costs even in the most efficient plants, and the prospect of price-cutting competition would make manufacturers reluctant to take up even apparently attractive processes. Less money would be made available for research, and competitive manufacturers would apply for licenses only after the original firm has done all the development work.

In reply to these arguments it may be pointed out that the inventors will always have an advantage over later manufacturers, if only by the time lag, and that if exclusion of monopoly rights removes one attraction of original research work, the royalties can be fixed so as to give the inventor an adequate reward for his work. Under wartime conditions some monopoly rights of peacetime have been abandoned willingly by patentees, and research has in fact not been adversely affected but if anything encouraged by the exchange of ideas and processes. But there is no doubt that if patent protection is deprived of its monopoly character other factors determining competitive strength are likely to gain in relative importance. Possession of a large marketing organization, which is in any case a great asset, will give a great advantage to a manufacturer, while arrangements for monopoly utilization of patents and processes between several big firms would naturally become impossible. It is at this point that the patent protection controversy touches upon the question of international agreements for elimination or curtailment of competition.

The question of international cartels is

largely a political issue, and when the subject was recently brought up in the House of Lords it was argued that the international cartel system helped Germany very much in her preparations for the present war in that manufacturing secrets and formulas were obtained from other parties to international agreements. Such benefits are of course reciprocal, but Germany, it was argued, profited more from them because the British and American cartels were not part of a government plot to engineer war. It is doubtful whether this line of argument would find many supporters in normal times, but that the problem of trusts and cartels will be very important in postwar reconstruction is generally agreed, and the British government has taken steps therefore to secure a conference among the United Nations on this important subject. British Ministers are now preparing a paper setting out the official policy with regard to international and national cartels. In the meantime I.C.I. as an important partner in international arrangements has expressed its willingness to register all such agreements with government department. Such registration would certainly do much to alleviate suspicions based on the "secret" nature of most private international arrangements.

INTERNATIONAL PHASES

In this as well as in the patent question it is, however, realized that international agreement between governments will be required for an effective solution. The plans for a patent law reform in Great Britain therefore suffered a setback when the National Patent Planning Commission set up by the United States Administration rejected the idea of modifying patent legislation on the lines propagated by British reformers with regard to international arrangements. On the other hand, cooperation between British and American firms cannot but arouse suspicion and opposition as long as United States policy in these matters differs materially from that adopted by most European and also by British Empire countries. When the war comes to an end, most countries with a chemical industry will have at their disposal a manufacturing capacity far in excess of local demands. They will, on the other hand, be faced with the need for expansion of exports to pay for imports of raw materials and foodstuffs. As far as Great Britain in particular is concerned, the case for much larger exports becomes all the stronger because of the loss of investment income from abroad due to the use of foreign investments for wartime payments for munitions and raw materials. The export urge will be so strong that in default of international agreements all import markets will be flooded with manufactures from competing producers who must dispose of their output at whatever price they can obtain. The disequilibrium between supply and demand is likely to be so acute, at least for some time after the war, that it threatens to upset the whole market unless careful plans are made beforehand.

There is the further complication arising from wartime changes on the Continent of Europe where the leaders of the

German economy have done all in their power to entangle and integrate industries in the ocupied countries in a vast production system directed from Germany. The I. G. Farbenindustrie has become the center of a vast organization into which leading chemical producers in other European countries have been absorbed, sometimes as subsidiaries, sometimes as integral parts of the German organization, without regard to local requirements in the regions they used to serve. On the other hand, chemical research on the Continent of Europe has gone ways of its own, ways which owing to the accent laid on substitution may not always be of particular interest with regard to postwar developments but which have profoundly changed the material conditions of international chemical trade. In view of its great military importance, the chemical industry of Continental Europe cannot just be left alone, and international arrangements will be needed to insure steady progress without the dangers resulting from excessive fluctuations. The question is not really whether international cooperation is desirable in the chemical trades, for it is inevitable, but at what level it is to be effected: by government agencies as at present, possibly through joint production and even marketing boards, or by private firms, and if by the latter, how safeguards can be introduced for adequate consideration of the interests of consumers and small manufacturers. At present it is only possible to show up the problems waiting for a solution, but it may be hoped that when government policy in these matters has been clarified and made public, the chemical associations of Great Britain and the United States will come together to settle these questions.

TIRE FACTORY IN LIMA USES NATIVE RUBBER

THE TIRE factory at Lima, Peru, is turning out about 100 tires a day made from natural rubber grown in the country's own forests in the upper Amazon Basin. The factory is operated by Compania Goodyear del Peru and began production in July 1943. Rubber from the Amazon forests moves to the factory over the trans-Andean highway recently completed as far as Pucallpa. Before the completion of this road it would have been necessary to ship more than 2,000 miles down the Amazon River to Belem, Brazil, then by steamers through the Panama Canal to the Pacific coast of Peru.

SHORTAGE OF SULPHATE OF AMMONIA IN INDIA

IN THE years prior to the war, consumption of sulphate of ammonia in India had been growing steadily until it reached a total of 96,000 tons in 1939. Since then imports have declined and as domestic plants have a capacity of only 30,000 tons, there has been a shortage of this material. Studies are now being made not only to relieve the situation but also to place the country on a permanent basis of self-sufficiency. The Food-Grains Policy Committee estimates that 350,000 tons could be added to present capacity. Difficulty in

importing the necessary equipment, however, offers a problem which undoubtedly will defer any definite planning.

CANADIAN COMPANY BUILDING UNIT FOR OXALIC ACID

WORK is in progress at the plant in Hamilton, Ontario, of the Canadian Aniline and Extract Co., Ltd., on a new unit which will be used for the manufacture of oxalic acid. The plant is expected to be in operation in a few weeks. In the last year the company installed four new distillation units for production of chemicals consumed at the plant and also put up an addition to house drying and powdering equipment.

PENTAERYTHRITE PRODUCTION STARTED IN SWEDEN

A PLANT for the manufacture of pentaerythrite is being established in Sweden by Bofors. While this material will be used as a basis for making explosives, it is expected to have many civilian uses including that of an estering agent for pine oil. The company also is experimenting with production of synthetic resins.

BRAZIL EXPECTS SMALL GAIN IN CARNAUBA WAX SUPPLY

ESTIMATES on the supply of carnauba wax from the State of Bahia, Brazil for 1944 place probable production at 500 metric tons. This would represent a slight increase over the 450 metric tons produced in 1943. As there is no local consumption, the total supply is available for export. Stocks on hand at the beginning of February were only 10 metric tons at Bahia and about 30 tons at interior points.

SALES OF CHILEAN NITRATE DECLINED LAST YEAR

WORLD sales of Chilean Nitrate of soda for the fiscal year ended June 30, 1943, decreased somewhat in volume according to the annual report of Lautaro Nitrate Co., Ltd. Total sales for the period amounted to 1,243,040 tons compared with 1,371,284 tons in 1941-42. The company's share of this total was 420,823 tons. It also sold 376,954 kg. of iodine.

NEW COBALT DEPOSIT FOUND IN SPAIN

WHAT IS considered to be the richest cobalt deposit in Spain recently has been uncovered in the eastern section of the Province of Oviedo, about 20 kilometers west of Panes. Analysis showed cobalt content to be 5.9 percent. While the ore contains arsenic, a satisfactory method of commercial extraction of cobalt has been found and it is estimated that production may reach 200 tons a month.

LARGER PRODUCTION OF PALM OIL IN BELGIAN CONGO

THE South African press is authority for the statement that current rate of production of palm oil in the Belgian Congo is 110,000 tons a year. In 1938, the annual

production was only 74,000 tons. Scientific treatment of fruit and improved factory processes for extraction of oil have contributed to the larger outputs and also have improved the quality of the oil.

EIRE MAY USE NEW PROCESS FOR SUPERPHOSPHATE

PRODUCTION of a concentrated superphosphate without the use of sulphuric acid has been investigated by the Emergency Scientific Bureau in Eire. Consideration has been given to a process which uses phosphoric acid. The Bureau has not experimented with the manufacture of superphosphate from serpentine but has been concerned principally with converting the insoluble phosphate from Clare to a citric-soluble form. Tests have shown that a material with a high degree of solubility can be produced by treating the ground phosphate rock with sodium carbonate.

NEW FULLERS EARTH SUPPLY FOUND IN MOROCCO

A NEW deposit of fullers earth has been discovered near Oujdan, in northeastern Morocco. Prior to this discovery, Morocco was estimated to have deposits of about 600,000 metric tons of this material. In 1938 several thousand metric tons were shipped to France. Figures for later years are not available but it is estimated that the country can supply France with 20,000 tons which it formerly obtained from Germany each year.

ARGENTINA PLANS TO EXTEND LINSEED OIL OUTPUT

REQUEST has been made by the Argentine Minister of Agriculture that domestic plants increase production of linseed oil, using seed from both the 1942-43 and 1943-44 crops. If the proposed increase is carried out a total of 1,500,000 metric tons of linseed will be crushed yielding 35,000 tons of linseed oil each month. The first estimate on the current seed crop indicates an outturn of 1,800,000 tons with present stocks about 658,000 tons.

NEW CHEMICAL PRODUCTION PLANNED IN SPAIN

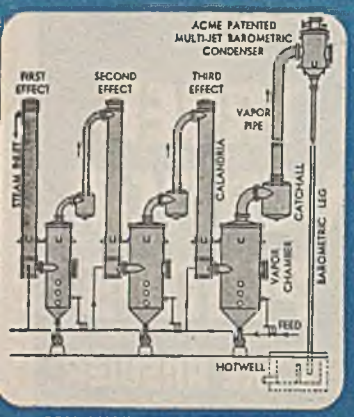
SEVERAL new chemical plants are to be established in Spain, a European technical publication announces. Hijos de Luca de Tena expect to have an annual output of 100,000 kilograms of citric acid at their factory in Seville. The cyanamide plant of M. D. Reynals, at Santander, will produce 20,000 tons annually. Output from a new sodium silicate works at Valencia will total 360 tons a year, it is stated.

MATCH COMPANY FORMED IN PANAMA

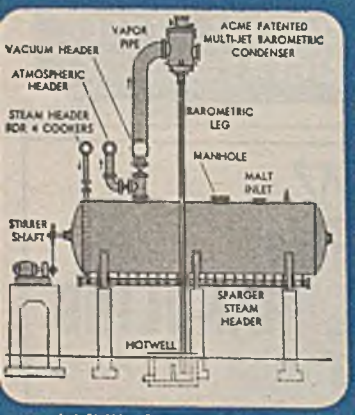
A PLANT for the manufacture of wax matches has been established in Panama. It will be operated by Fabrica Nacional de Fosforos de Barletta y Compania, Ltda. The company has a capital of $150,000 divided equally between Panamian and Cuban interests.

7 REASONS WHY . . .

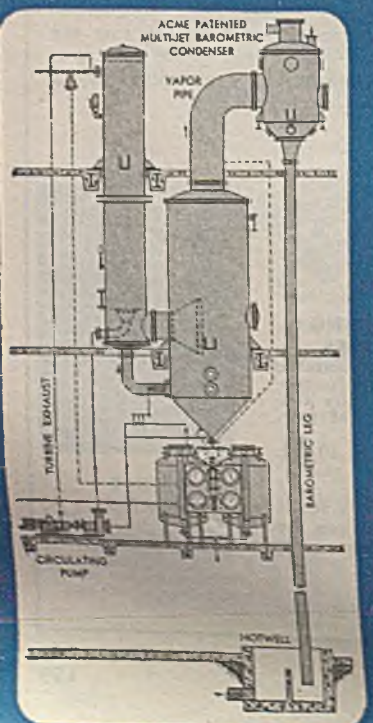
ACME *Patented* MULTI-JET BAROMETRIC CONDENSERS OPERATE WITH MAXIMUM ECONOMY!



CONDENSER FOR EVAPORATORS



VACUUM COOLING SYSTEM



CONDENSER FOR VACUUM PAN

Designed for vacuum processes where the condensate is not retained, the Acme Patented Multi-Jet Barometric Condenser combines the economies of both wet and dry operation. This patented unit offers the following exclusive features:

1. **COUNTER-CURRENT FLOW** that produces higher vacua (hitherto feasible only with dry operation).
2. **CONVERGING JETS** that expel the incondensible gases from the top of the condenser without the use of vacuum pump or ejector (the principal advantage of wet operation).
3. **A PATENTED SEAL** that prevents the escape of vapors until they reach the top of the condenser, thus making it possible to combine advantages (1) and (2) in one piece of equipment.
4. **POSITIVE CONTROL** of both involute and converging jets that attains maximum condensation at a minimum expenditure of water, even under fluctuating loads.
5. **LOW INITIAL COST** of equipment and installation.
6. **SIMPLE DESIGN** includes no moving parts, will not clog, and requires virtually no maintenance cost.
7. **CONVENIENT OPENINGS** for quick, easy inspection.

Bulletin MJ-44 "Acme Patented Multi-Jet Barometric Condensers" sent upon request

Where vacua over 27" Hg. are to be attained, we recommend the use of an Acme Counter-Current Barometric Condenser with suitable vacuum pump or ejector. The complete Acme line embraces every important type of condenser and ejector. Our engineers are prepared to study the requirements of any process and to make suitable recommendations for the most efficient operation.

ACME *Processing Equipment*

ACME COPPERSMITHING & MACHINE CO., ORELAND, PA.

FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

MAX KUHNER, the wizard of the steam boiler division of the Riley Stoker Corporation spends his evenings with a loose-leaf scratch pad. By emergency, an idea may flash before he reaches the nut stage (no insinuations!) and then the doodle is formed on Mrs. Kuhner's white table cloth. When curfew rings, the floor of his den looks like Fall in the woods except that the leaves are white and covered with wierd configurations. Max' nimble wit has evolved many wondrous steam generators which have spread his repute to international extent. His works are well known in Russia as they are in the Americas. He makes his own path through the wilderness and has thus built huge and awe-inspiring steam generators that have set new summits in size and efficiency. (See "Power" Oct. 1943).

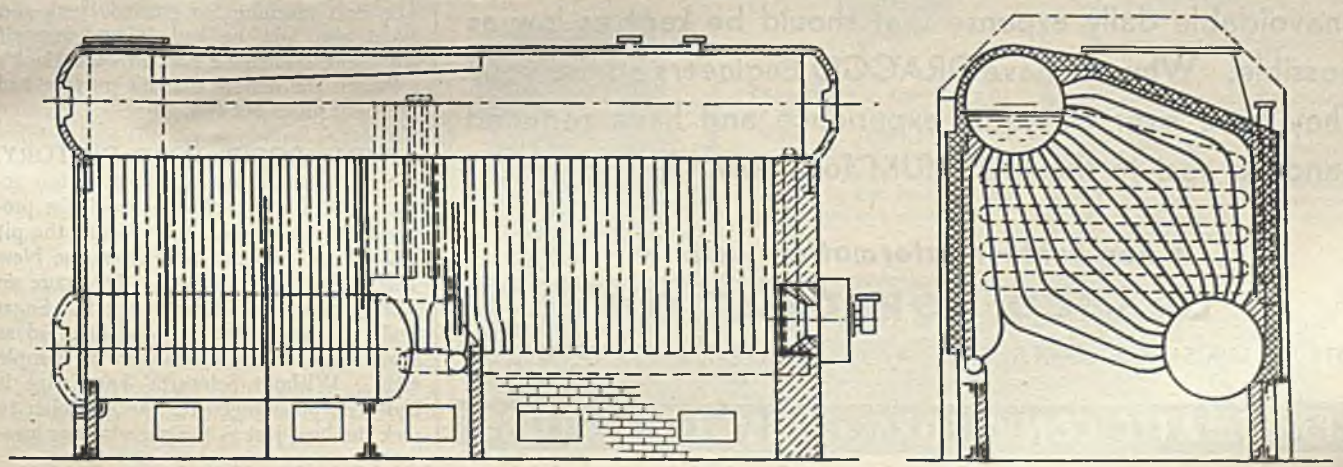
One evening before Pearl Harbor, a brain storm suggested a "package" boiler. In case the call for the mastodons should slump, he could descend to the "rediculous" and thereby keep the wolf from the door. While he was relaxing he drew a 10½ foot square which is the maximum cross section permitted for shipping. Then he fashioned a 3-ft. drum in the center at the bottom and another directly above. The doodling continued but the distance between the drums was too small for a practical tube arrangement. He was stymied. At this stage son Fred had just finished his elementary geometry lesson. He threw his arm around his dad's neck and leaned over his shoulder to ascertain the cause of the knitting of the brows. Like a flash the boy suggested that the sum of the legs was greater than the hypotenuse. This started a new series of doodles and the boy is now the patentee of an original idea. The design has just recently been resurrected and an order came in for 30 boilers with 300 more in the offing.

"THE MAN WHO DOES NOT FIND joy in his work will not find it anywhere," according to Elbert Hubbard. There is excitement and romance in searching for the first job and happiness when the right one is found. God's plan discloses itself in youthful inclination, but making the goal is frequently a matter of trial and error. Around 1900, the fresh grads considered it a sin to remain stationary for longer than six months. It was desirable to base the development upon a versatile foundation. The job did not imply an obligation to stay. Education did not proceed under present elaborate programs at company expense but rather by the urge of the apprentice himself. Indenture had gone out of fashion and the rate of pay just about covered the price of board and room and books. The lowness of pay was even an advantage as it could be fully earned and it left independence of movement with a clear conscience. The present costly "abundance" did not exist to demand luxuries beyond earnings. However, effort and sacrifice are still essentials of success. Every man follows a different and interesting pattern as recounted below. The experiences are actual and not excerpted from McGuffey's reader.

"PROFESSOR" CARL LEONARDT started his contracting career at the head of a wheel barrow gang. In '91 he did the masonry work at the Chino sugar house in California and then followed right through all of Oxnard's subsequent houses. Concrete mixing was a strong-arm job when Carl Leonardt started his contracting career. At Ames, Nebraska, he performed the work by means of a homemade rotating wooden drum about six feet in diameter. It was heralded far and wide as a product of "yankee ingenuity". Sinsheimer was his field manager both at Oxnard and Ames. His foreman at Ames, and able abettor, was Mike Claasen, a big raw-boned German who talked like an Irishman—and had an Irish wife. He possessed a permanent deformation of the proboscis, acquired presumably through impetuosity and boldness. Carl had the strength of an ox. At Ames there were two factions, the Irish and the German, and Carl bore allegience to the latter. The antipathy between the nationalities was accentuated by jealousy engendered by Carl's one-sided generosity. Whenever he went to Omaha, he always brought back a barrel of beer exclusively for the edification of his own gang. On Sunday afternoons the boys got drunk and occasionally wrecked the bunk house. One Sunday one of the prominent proponents of the Irish persuasion proclaimed that he was about to pay a professional visit to Leonardt and he invited the comrades to remain without and await developments. Directly he passed the door into Carl's construction shanty, there was an awful crash and out came the Irishman head-first thru the window, taking the sash with him. Carl was a man of action and hard as steel. Later he became the outstanding contractor of Los Angeles and attracted the largest and most difficult contracts in Southern California, including power plants and large public and private buildings. He also founded the South Western Portland Cement Company with plants in various parts of the country. He was a pioneer in reinforced concrete construction. His son grew into a construction superintendent of surpassing ability. One day while performing his task atop a steel skeleton, he slipped, crashed to the ground and lost his life. The loss of his son broke Carl's heart. Life had no further attraction for him.

IT IS TOLD that his son-in-law greatly revered the Old Man and frequently made

Max Kuhner's "package boiler" designed with 10½ ft. square cross-section to permit shipping assembled



extra (and sometimes mischievous) effort to bring gladness to his heart. On an occasion when Carl undertook a journey to Chicago, the son-in-law surreptitiously arranged with the dining car steward to entertain the Old Man at dinner and "reverse the charges". Carl was minutely described so that the steward would recognize him as soon as he crossed the threshold. The steward performed superbly. He told Carl that, because of his prominence, he was to be the guest of the Southern Pacific Railroad. Carl appreciated the honor to such an extent that he accepted the steward's ministrations not only for the first dinner but throughout the 72-hour journey. The son-in-law had underestimated both Carl's pleasure and the volume of his appetite.

S. W. (SID) SINSHEIMER who built the original Holly Sugar Corporation's factories and later became President of the American Crystal Sugar Company won his bachelor's degree at California in '95. He had a desire to enter the beet sugar industry and accordingly presented himself at the gate of the time-keepers' shanty at the Chino, California factory. There were 75 men in front of him, all clamoring for a job. All day he stood in line. As night approached, one applicant after another dropped out of line till Sid alone was left. At midnight he told the gate keeper that he was quartered at Burgermann's rooming house and would keep an ear cocked for a message in case a call should come in for a man. Sure enough at 2 A.M. a press puller succumbed to the heat and Foreman Pepper (son of the Senator from Kansas) sent for Sid. The stipend was ten cents per hour and it was the toughest job in the factory. Here Dr. Portius discovered Sid and took him into the laboratory. From then on progress was rapid.

WHILE SID WAS BUILDING the Swink factory in Colorado, a padre from La Junta organized a modest mission and made weekly trips to administer religious comfort to the families. The seed storage house was given over to serve as the meeting place. When cold weather set in and began to chill the fervor, Sid dug down into his jeans and built a little chapel for the padre and provided a stove and a winter's supply of coal.

SID WAS NOT AVERSE to an occasional game of poker. In one of these after-payday games, Sid captured Hank Knapke's fortnightly earnings of $68.00. The next morning Sid greeted Hank and asked him how he had enjoyed himself last night. Then he handed back Hank's roll with the remark that his purpose had not been profit but fun.

AT THE ROCKY FORD FACTORY, the first year's output of molasses was accumulated in an earthen reservoir for processing in the second year. When the pit had filled, a request came from the New York office for an analysis. To secure an average sample, Sid built a raft. Sugar Boiler Rollins served as gondolier, Sid as captain and chemist Schwartz as sample taker. Without Schwartz' knowledge it had been prearranged for the gondolier to rock the boat just as the chemist was lean-

ing over the edge to get the sample. Sid was then to affect a stampede and bump the chemist into the molasses. The plan was put into effect but the agile chemist dodged and Sid himself slid into the gool

WHILE STROLLING down Broadway one day in New York, meditating about the administration of his factories, Sid adventitiously met Bill Hoodless, manager of the Pennsylvania Sugar Refinery. In the show window a purveyor of gentlemen's accessories was exhibiting a line of luxurious canes. After the greetings were over, Sid entered the store and bought two gold headed walking sticks at fifty dollars each, one for Bill and one for himself. Thus equipped the twain proceeded to march down Broadway, the while settling some important affairs of mutual interest.

FRED TAYLOR, VICE PRESIDENT of the Utah-Idaho Sugar Company was born on an Idaho cattle ranch. The winter of 1888, unprecedented in severity, nearly liquidated the family homestead. Accordingly at thirteen, Fred found it expedient to shift for himself. He maintained full-time occupation by alternating seasonally as cowboy, sheep-shearer and stage coach driver. At 23 he reached the pilot job on the stage coach line of Monida & Yellowstone in Montana, which was comparable glamorously with driving a 20th century limited and required equal skill. In the Fall of '98 he made a holiday journey to the metropolis of Ogden where Eccles' new beet sugar factory was about to start its first campaign. The enthusiasm got him and he took to the beet sheds with a poker. From here he followed the beets through all the routine processes till at the end of the campaign he reached the crystallizer floor, one story below the top. His whirlwind progress was too fast for the paymaster. Responsibilities increased while the basic pay of fifteen cents per hour remained inconsequentially stationary. The next Spring he was sent to the Lehi factory to acquire the intricacies of Henry Vallez' triple osmose process and to master the art of boiling sugar. Early in the same summer he joined Guy Dyer for a campaign at Los Alamitos, California where the harvest starts three months earlier. In the Fall he was back in Ogden in charge of the pan floor, having thus progressed in one year from the lowly job of pushing beets into the flume to the topmost position in the alchemy of the art. This job brought him an honorarium of ninety dollars per month paid in gold. He regarded the windfall with awe and humility, amazed that he could have merited so generous a reward. The pioneer plant at Ogden multipled into the Amalgamated Sugar Company and Fred emerged from the superintendency of one of the plants to the staff position of general manger. He studied law on the side which meant "burning the midnight oil" and developed high skill as a public speaker. His reputation as an expert in sugar production brought him to Washington during the first world war to serve on the President's sugar control board. When the cane refiners needed a manager of their Institute, they selected beet sugar expert Fred for the job.

NAMES IN THE NEWS

H. R. Smith

L. S. Fryer

C. D. Blackwelder

Halwyn Reynolds Smith, for the past four years a consulting chemical engineer in Southern California, has been appointed Pacific Coast Editor of *Chem. & Met.*, and will make his headquarters in the Los Angeles offices of the McGraw-Hill Publishing Co. Since 1939, Mr. Smith has been a registered professional chemical engineer in Colorado, having completed his chemical engineering education in Denver University in 1936. He had previously worked for Armour & Co. in Chicago, the United States Department of Agriculture in Salt Lake City and, most recently, for the Consolidated Aircraft Corp. of San Diego where he was engaged on the adaptation of plastics to aircraft construction.

Mr. Smith plans to spend the month of April 15–May 15 in the New York offices of *Chem. & Met.* and on his return will attend the meeting of the American Institute of Chemical Engineers in Cleveland and will renew contacts in Denver and Salt Lake City. In his new position he succeeds to that held for many years by Dr. Paul D. V. Manning, who resigned late in 1941 to become vice-president in charge of research for the International Minerals & Chemical Corp. of Chicago.

Anthony J. Rolleri has been appointed production manager of the Newark plant of Maas & Waldstein Co., producers of industrial finishes. He joined the company 34 years ago.

Henry H. Bitler and **Frank H. Reichel** have been elected directors of the American Viscose Corp. Mr. Bitler is manager of acetate rayon and vinyon production for American Viscose. Dr. Reichel is president of Sylvania Industrial Corp.

W. N. Williams, formerly assistant to the president of Westvaco Chlorine Products Corp., has been elected vice president in charge of production. Mr. Williams, a Westvaco director since 1941, joined the company in 1924.

Louis S. Fryer, production manager of Industrial Rayon Corp. for the past four years, has been named vice president and production manager. A graduate of New York University in chemical engineering, Mr. Fryer joined Industrial Rayon in 1931, following nine years spent in research and development work with other rayon producers and consulting engineers. His headquarters are at the general offices of the company in Cleveland.

J. W. Raynolds, deputy director of the Chemicals Bureau, WPB, has resigned as of Mar. 15. Mr. Raynolds, prior to his association with the WPB, was a Fellow of the Mellon Institute and president of the Raolin Corp. W. F. Twombly, chief of the Aromatics and Intermediates Section of the Chemicals Bureau, will succeed Mr. Raynolds in his capacity as assistant director in charge of the Drugs and Cosmetics, Protective Coatings and Plastics Sections.

Harry C. Claflin, recent graduate of the Case School of Applied Science, has been appointed to the technical staff of Battelle Institute, where he will be engaged in Chemical research. Other recent appointments include **Samuel L. Case** as research metallurgist and **Nicolas Baklanoff** as translator of technical literature and patents.

Willard H. Dow, president of the Dow Chemical Co., **James A. Rafferty**, president of the Carbide & Carbon Chemicals Corp., and **Charles F. Burgess**, president of the Burgess Battery Co., were awarded honorary doctor of engineering degrees by Illinois Institute of Technology Feb. 21 at its 50th anniversary convocation.

J. Paul Oliver has been appointed administrative technical assistant of the Research Division of Cardox Corp. Mr. Oliver, a graduate of the University of Iowa, has been superintendent of the Cardox electrochemical plant at Claremore, Okla., for the last two years.

C. Davis Blackwelder has been elected a vice president of the Reynolds Metals Co. He will be in charge of engineering and will be located at the home offices of the company in Richmond, Va. He recently withdrew from the partnership of J. E. Sirrine & Co., engineers, with whom he had been connected for 21 years.

William W. Small has joined the Power Specialty Co., of Houston, Tex., as an application and service engineer. Mr. Small is a graduate of Texas A. & M. College from which he received a B.S. degree in chemical engineering.

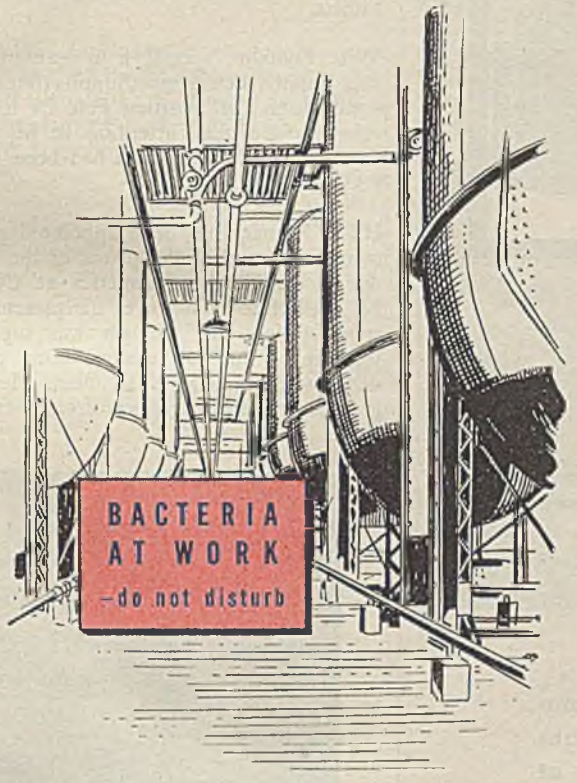
Joseph F. O'Brien has been appointed assistant to the president of Vulcan Iron Works where he will have charge of all matters relating to operation and production.

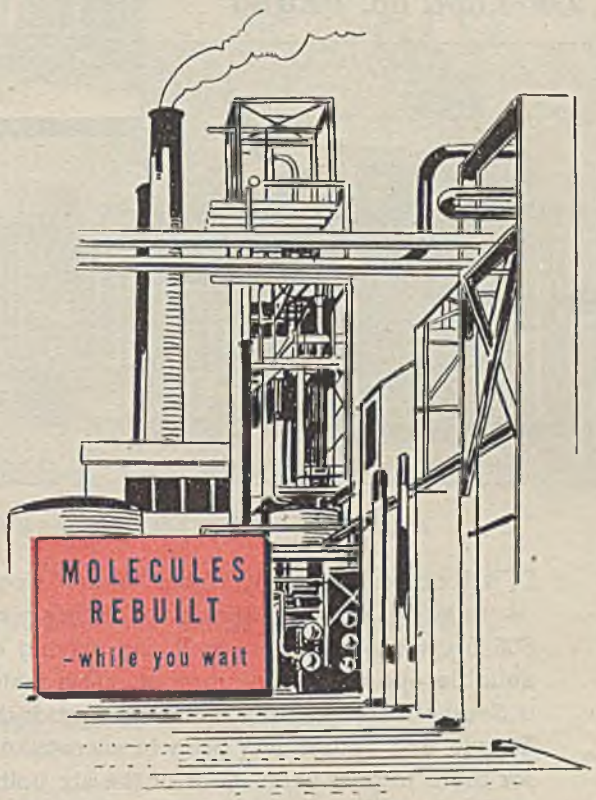
J. F. Hunt has been appointed general manager in charge of operations for Orefraction, Inc., Pittsburgh, Pa. Mr. Hunt has spent 19 years in the ceramic industry, having previously been associated with General Electric Co., Mullins Mfg. Corp., and more recently with Titanium Alloy Mfg. Co.

J. W. Frasche has been named plant manager of the new tire factory being constructed in Miami, Okla., by the B. F. Goodrich Co. A graduate of Iowa State College, Mr. Frasche has been with the Goodrich organization for 15 years.

Stanley Asp, on leave of absence from his position of research chemist for Filtrol Corp., has been advanced from a captain to a major in the Engineers Base Headquarters Co. Major Asp is now serving in the European theatre.

Frederick H. Heiss, chemist, Calco Chemical Division, American Cyanamid Co., has been transferred from the company's home offices at Bound Brook, to the Chicago sales office where he will be concerned





Microbes and Men

There are two ways to produce fine chemicals—Commercial Solvents uses both.

One process is biological—cultures of friendly little "bugs" convert corn, molasses, and other reproducible products of the field into alcohol, butanol, acetone, riboflavin, and now penicillin.

The other process is chemical synthesis—heat, pressure, and catalysts are used to create new molecular combinations. From synthesis comes ammonia, methanol, nitroparaffins, and their many derivatives.

With these two processes . . . and the men with the know-how to operate them . . . Commercial Solvents is producing an ever increasing volume of chemicals essential to military and civilian needs.

Our Technical Service Division will be glad to work with you on the development of chemicals to meet your special requirements.

CSC

COMMERCIAL SOLVENTS
Corporation
17 East 42nd Street, New York 17, N. Y.

with the sale and service of its products to paint, printing ink and pigment consumers.

Wirt Franklin, special field assistant to the Deputy Petroleum Administrator resigned from that position Feb. 29 to devote his undivided attention to his personal affairs. Mr. Franklin had been with PAW since August 1941.

H. P. Munger has been appointed plant manager of two of the plants of the Van der Horst Corp. of America at Olean, N. Y. Before taking over his present responsibilities, Mr. Munger was superintendent of the new electrotinning plant of Republic Steel at Niles, Ohio. He is a graduate chemical engineer from Georgia Tech.

Harris & Ewing

W. W. Skinner

W. W. Skinner, chief of the Bureau of Agricultural and Industrial Chemistry of the Department of Agriculture, retired on March 31 after 40 years in the federal service. Long an advocate of research in the industrial utilization of farm products and byproducts, Dr. Skinner has played an active part in establishing the department's four regional research laboratories as well as other laboratories in which the industrial and food uses of farm products are studied.

Fred H. Amon, technical director of the Carbon Black Operations of Godfrey L. Cabot, Inc., is now acting as technical consultant in the Office of the Rubber Director. He is spending about half of his time in Washington.

Frederick E. Moskovics has been appointed industrial consultant to the A. O. Smith Corp. of Milwaukee.

Melvin E. Clark, a former assistant editor of *Chem. & Met.* and until Feb. 1, chief of the Program Coordination Section of the Chemicals Bureau, WPB, has returned to the employ of Wyandotte Chemicals, Inc., and is temporarily located at the San Francisco office with his home at 116 Harding Ave., Los Gatos, Calif.

L. A. Belding, formerly manager of the high-pressure tank car division of General Transportation Co., is now with the Henry

J. Kaiser Co., of Oakland, Calif., engaged in the development of new transportation facilities.

Warren W. Leigh has resigned as special assistant to the Deputy Rubber Director of WPB to join Ralph C. Busbey in organizing the firm of Busbey & Leigh, management consultants, in Akron, Ohio.

Junius David Edwards, assistant director of research, Aluminum Research Laboratories, was recently named recipient of this year's Pittsburgh Award by the Pittsburgh section of the American Chemical Society.

O. H. York, chemical engineer with Metal Textile Corp., has been put in charge of developing chemical applications for knitted metal mesh.

Arthur C. Cope

Arthur C. Cope, associate professor of chemistry at Columbia University, has been announced the winner of the $1,000 American Society Chemical Award in Pure Chemistry for 1944. Dr. Cope was cited for outstanding research in organic chemistry which was said to be of timely value in the fields of plastics and drugs. The ACS Prize, provided by Alpha Chi Sigma, was founded in 1931 by the late A. G. Langmuir to encourage fundamental research by young chemists working in North America.

V. N. Krivobok, an authority on stainless steel, has become associated with the Development and Research Division of The International Nickel Co. Dr. Krivobok's work will consist mainly in development of markets for alloy and stainless steels and to assist steel manufacturers in expanding markets for postwar products.

Robert H. Bollinger, chemical engineer in abrasive classification and process development for Bausch & Lomb Optical Co., Rochester, N. Y., has received a commission in the U. S. Naval Reserve. Mr. Bollinger attended Rutgers University where he completed the ceramics curriculum in 1941.

George F. Rugar has joined the staff of the Research and Development Division of Diamond Alkali Co. Dr. Rugar's duties will include study of industrial applications

for new products. He was formerly with Hooker Electrochemical Co. Other new Research Department additions announced by Diamond include John Meiler who will be in charge of the department's work in the wood chemical field, and Lewis Welshans who will supervise the department's activities involving magnesium oxide and magnesium derivatives.

C. A. Hemingway has been elected a vice president of Witco Chemical Co. Mr. Hemingway, who has been associated with the company since 1922, will continue in charge of their Cleveland office.

John M. Schweng has been appointed to the staff of Turco Products, Inc., where he will serve as chemical research engineer and director of bacteriological research.

Glen David Bagley, a leader of the experimental engineering group of the Union Carbide & Carbon Research Division, has been awarded the Jacob F. Schoellkopf Medal for 1944 by the Western New York Section of the American Chemical Society.

W. W. Highberger, 37, of the Chemical Warfare Service, U. S. Army, reported missing in action in the European theatre a year ago, is now listed as lost in action. Lieutenant Highberger has been posthumously awarded the Order of the Purple Heart and the decoration has been presented to his widow, Mrs. Dorothy F. Highberger. Lieutenant Highberger received his commission in September, 1942, while he was associated with The Mathieson Alkali Works.

Darwin T. Aldrich, John W. Brodhacker, and Carlos L. Gutzeit have recently joined the research department of Commercial Solvents Corp. at Terre Haute, Ind. Mr. Aldrich, formerly instructor at Purdue University, will be in the bacteriological division. Mr. Brodhacker, a recent graduate in chemical engineering from Missouri School of Mines, has been assigned to the engineering group. Dr. Gutzeit, formerly with Best Foods, Inc., Standard Oil Development Co. and Shell Oil Co., will be in the organic chemicals section of the research department.

A. Grodner has accepted the post of chief enginer of Alloy Fabricators, Inc., Perth Amboy, N. J., in charge of the design and construction of process equipment for the chemical, food and pharmaceutical industries. Mr. Grodner was formerly associated with the Process Equipment Department of the Blaw-Knox Division.

W. K. Priestley, formerly chief of process engineering at the Bristol plant of the U. S. Rubber Co., has been promoted to the position of development engineer. Other recent promotions at the Bristol plant include L. E. Dickinson, chief chemist to chief process engineer; W. H. Dibble, assistant chief chemist to chief chemist, and J. F. S. Abbott to chief latex engineer in charge of latex development and control.

George H. McGregor, until recently senior chemical engineer in the Pulp and Paper Section of the U. S. Forest Products Lab

oratory, Madison, Wis., has joined the staff of Swenson Evaporator Co., Division of Whiting Corp., Harvey, Ill., in the capacity of manager of their pulp mill equipment department. Mr. McGregor will have charge of sales of Swenson equipment for the paper and pulp industry, including black liquor recovery systems, evaporators, and pulp washers.

Louis J. Curtman, professor of chemistry at City College, head of the qualitative analysis division of his department, has retired after 37 years of teaching.

J. S. F. Carter

J. S. F. Carter has been appointed engineer in charge of design and engineering service for the Process Division of S. D. Hicks & Son Co., Inc., Boston, Mass.

Harold M. Miller has joined the Sheffler-Gross Co. as field engineer. Mr. Miller is a graduate of The Washington and Lee University and has spent ten years with the Sinclair Refining Co. Prior to joining Sheffler-Gross he was with the Blaw-Knox Co. in connection with their synthetic rubber program, where he was engaged in the design, supervision and installation of instruments and controls.

OBITUARIES

James L. Goodwin, president of the Whitlock Mfg. Co., Hartford, Conn., died Jan. 28, 1944. Mr. Goodwin was active in the company up to the time of his death but had been in ill health for some time.

Leroy S. Palmer, 56, dairy scientist and chief of the division of agricultural biochemistry of the Department of Agriculture at the University of Minnesota, died March 8 from a coronary occlusion.

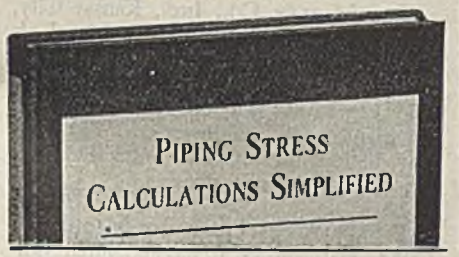
John C. Robinson, president of the Robinson-Wagner Co., chemical manufacturers, died Feb. 25 at Port Chester, N. Y., at the age of 50.

Merrill M. Thompson, electrochemist for the National Cash Register Co., Dayton, Ohio, died Feb. 26. At the time of his death he was chairman of the Electrodeposition Division of the Electrochemical Society and a member of the Board of Directors.

New McGRAW-HILL BOOKS

filled with information to help you immediately

See them free!



Piping Stress Calculations Simplified

By **S. W. SPIELVOGEL**, Consolidated Edison Company of New York. 83 pages, 8½x11, 45 illustrations, **$2.50.**

Brings the ordinary layout problem within the grasp of many who wish practical answers to immediate piping layouts. Here are simple and exact calculations for estimating stresses in high temperature piping, serving as "pattern" forms with specific directions by which any competent draftsman can figure stresses. There are complete, step by step, numerical solutions to many different piping stress problems—single and multi-plane problems containing straight, curved, inclined and corrugated branches, and pipe lines with variable cross sections.

Aviation Gasoline Manufacture

By **MATTHEW VAN WINKLE**, Instructor in Chemical Engineering, University of Michigan. 275 pages, 5½x8½, 39 illustrations, 82 tables, **$3.00.**

Here is your guide to the relatively new field of aviation gasoline manufacture, reviewing the theoretical and technical essentials of the many processes now producing this type of fuel commercially. This book treats the manufacture of base stocks, high octane hydrocarbons, the finished fuels, special fuels and the characteristics of such fuels in use in aircraft engines. It also covers processes used, specifications, etc.

Thermodynamics of Firearms

By **CLARK S. ROBINSON**, Massachusetts Institute of Technology, Lt. Col. Ordnance Reserve, U. S. Army. 179 pages, 6x9, **$2.50.**

Outlines a complete scientific method for the study of the functioning of firearms with the aid of only basic thermodynamics. It begins with basic thermodynamics, then makes clear the effective application of these principles to studies of the behavior of propellant explosives in firearms-calculations in pressures, velocities, charges, rates of explosion, etc.

So You Want To Be A Chemist?

By **HERBERT COITH.** 128 pages, 5x7½, **$1.50.**

Here is a book which shows the manifold activities of the chemist and chemical engineer in industry—how they work and what they can accomplish—in a helpful, stimulating and thoroughly readable form. With numerous illustrative examples, the author discusses the qualities that make for success in the industrial fields and also shows clearly how the chemist fits into the scheme of things, and how his work is related to that of other people.

McGRAW-HILL BOOK CO., INC.
330 W. 42 St., New York 18, N. Y.

Send me the books checked below for 10 days' examination on approval. In 10 days I will pay for the books, plus few cents postage, or return them postpaid. (Postage paid on cash orders.)

- ☐ Spielvogel—Piping Stress Calculations Simplified $2.50
- ☐ Van Winkle—Aviation Gasoline Manufacture $3.00
- ☐ Robinson—Thermodynamics of Firearms $2.50
- ☐ Coith—So You Want To Be a Chemist? $1.50

Name .....

Address .....

City and State .....

Position .....

Company .....M. 4-44

INDUSTRIAL NOTES

THE CARBORUNDUM CO., Niagara Falls, has made Charles W. Sprenger district manager for the metropolitan district with headquarters at 601 West 26th St., New York. Joseph C. Steele has been appointed district sales office manager at New York to succeed E. W. Martin who has been made regional sales office manager for the eastern districts.

THE A. B. FARQUHAR CO., York, Pa., announces that J. H. Wood has been added to the sales staff of the hydraulic press division. He will work in the central coastline states with headquarters in the Broad Street Suburban Station Bldg., Philadelphia.

KOLD-HOLD MFG. CO., Lansing, Mich., has appointed H. W. Whitmore chief engineer. Mr. Whitmore comes to the company from the Automatic Products Co., Milwaukee and prior to that connection he had been associated for ten years with the general refrigeration division of Yates American Machine Co., Beloit, Wis.

LINK-BELT CO., Chicago, has appointed Sr. Sergio Ortiz Toro, Caracas, Venezuela, as its agent for the entire Republic of Venezuela. Senor Toro recently moved his family to Caracas and is acting there as consulting engineer to the sugar industry.

PHILADELPHIA GEAR WORKS, Philadelphia, announces that James N. Morrell is now sales manager of Limitorque valve control division and Thomas V. Withington is assistant sales manager. William F. Plume has succeeded Mr. Withington as chief engineer and Robert E. Richards has been appointed assistant chief engineer.

THE MARLEY CO., INC., Kansas City, Kans., has established a new divisional office in the Esperson Bldg., Houston, to provide direct sales and service coverage for the Texas gulf coast, northwestern Louisiana, and southwestern Arkansas. Ray T. Jenkins from the Tulsa divisional office heads the new division.

WORTHINGTON PUMP AND MACHINERY CORP., Harrison, N. J., has appointed William O. Wilson as commercial vice-president. In his new capacity Mr. Wilson will be responsible for commercial activities in the Chicago, St. Louis, Kansas City, and St. Paul territories with headquarters at 400 West Madison St., Chicago.

THE MIDVALE CO., Nicetown, Philadelphia, has elected Henry H. Ziesing as vice-president in charge of sales to replace Stuart Hazlewood who has resigned after 41 years service with the company.

PEMCO CORP., Baltimore, has expanded its research facilities through the addition of new equipment and increasing personnel. Dr. G. Spencer-Strong is in charge of the research work.

H. K. Porter Co., Inc., Pittsburgh, has acquired the Mt. Vernon Car Mfg. Co. and its subsidiary, the J. P. Devine Mfg. Co., both with plants at Mt. Vernon, Ill.

The Foxboro Co., Foxboro, Mass., has placed Charles Schwarzler in charge of its export department to succeed the late Henry B. Moelter. Mr. Schwarzler formerly was manager of the sales promotion department.

Hooker Electrochemical Co., Niagara Falls, has moved John S. Coey from the manufacturing department, where he has been engaged for the last seven years, to the sales development department.

General Controls Co., Glendale, Calif., has opened a new branch office at 376 Nelson St., S. W., Atlanta, Ga. Roger W. Allen who has specialized in technical and industrial sales in the southern states is in charge of the office.

Wickwire-Spencer Steel Co., New York, has appointed H. C. Allington as sales research engineer. He will be in charge of development of markets with particular emphasis in the petroleum field.

Wheelco Instruments Co., Chicago, has been acquired by Fred A. Hansen and Cary H. Stevenson, vice-presidents of the Lindberg Engineering Co., and several associates. The business will be continued at the same location with officers of the new company being, Fred A. Hansen, president; Cary H. Stevenson, secretary and treasurer; and Richard Schoenfeld and Theodore Cohen, vice-presidents.

Service Engineering Co., Summit, N. J., and with an office at 52 Vanderbilt Ave., New York, has been formed by Howard B. Bishop to provide management services and, in some cases, finance the development of new products and processes in the chemical engineering field. Charles H. Welling is associated with Mr. Bishop as manager of the company.

Electric Machinery Mfg. Co., Minneapolis, has elected W. H. Feldman as president and general manager, Mr. Feldman has been connected with the company for 22 years, having been in charge of district sales at Cleveland and Chicago before his appointment as general sales manager in 1927. In 1936 he was elected a director and the following year was made vice-president in charge of sales.

Allen-Bradley Co., Milwaukee, is now represented in the southern Indiana and western Kentucky territories by Rietze & Co. with headquarters at Louisville.

Phillips Petroleum Co., Bartlesville, Okla., has appointed Frank Andrews sales manager of the Philblack division. He has been with the company for 15 years and since 1940 served as sales manager of Hycar Chemical Co. The Philblack division is concerned with a new channel black developed by the company and for which a new plant has gone into production. A new divisional office has been opened in the First Central Tower, Akron, for handling the sale of the new product.

OLD TIMER.....

His skill is an important

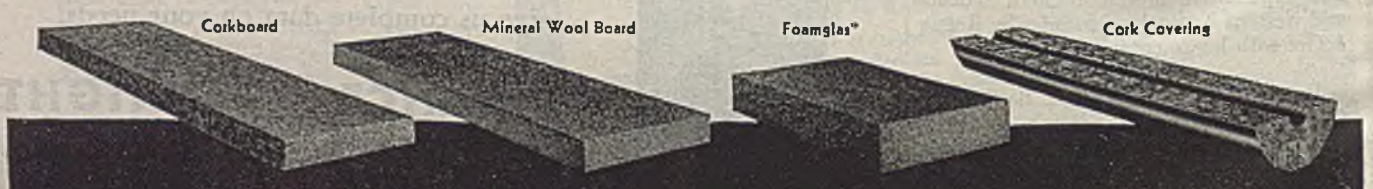
ARMSTRONG EXTRA

THIS mechanic has been erecting insulation for more than thirty-five years! He has had the best teacher you can get—experience. When he does a low-temperature insulation job, he makes sure that voids are eliminated, joints are tight and properly lapped, skewers properly placed, and finishes evenly applied. He knows how to build for dependable service.

There are many of these "old timers" in the skilled erection crews maintained by all Armstrong district offices and distributors. It's important to have their erection "know how" on the job, because insulation performs no better than the way it's erected.

The efficiency of Armstrong's low-temperature insulating materials has been proved, too, by many years of service. For complete information about Armstrong's Corkboard, Foamglas,* Mineral Wool Board, and Cork Covering, write today to Armstrong Cork Co., Building Materials Division, 3304 Concord St., Lancaster, Pa.

*Reg. U. S. Pat. Off. Pittsburgh Corning Corp.



ARMSTRONG CORK COMPANY

Insulation Ⓐ Headquarters

CONVENTION PAPER ABSTRACTS

FOAMING TENDENCIES OF SOLUTIONS OF PRIMARY ALIPHATIC AMINES

MEASUREMENTS of the foaming tendency of aqueous solutions have been extended to include a number of primary aliphatic amines. Foaming tendency is signified by the experimentally determined foam height or foam volume. The volume of foam produced by bubbling a gas through a porous disk in a glass column is independent of the diameter of the column for any given solution, and foam heights can be correlated by comparison of cross-sectional areas.

Foam heights were measured as a function of concentration for a number of amine solutions. A maximum in the foam height-concentration curve occurred in all cases. The magnitude of the maximum increased on going from solutions of *n*-propyl to *n*-heptyl amine, whereas the concentration at which the maximum occurred decreased in the same order. Branching of the chain tended to lower the magitude of the maximum foam height while leaving the concentration relatively unchanged, as observed for a number of butyl, amyl, and hexyl amines.

The surface tension of the foaming solution cannot be correlated directly with its foam height. The maximum in a foam height concentration curve does not even occur at concentrations where there is a marked change of surface tension with concentration in the case of nitrogen compounds as aniline, pyradine, and benzyl amine. Qualitative explanations may be made by consideration of diffusion rates of the solute molecules.

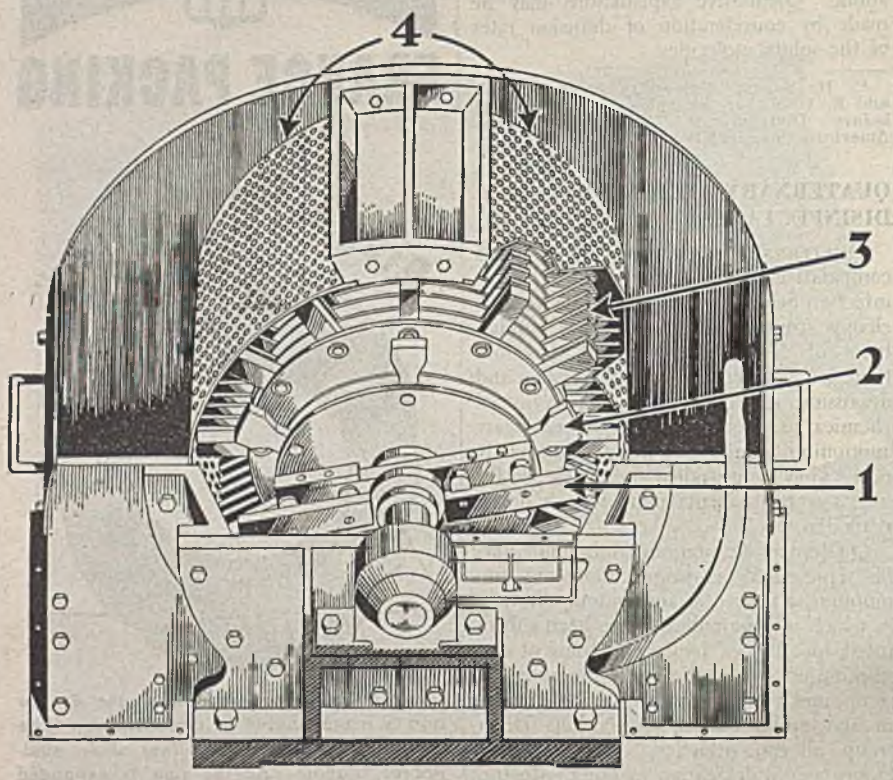
C. H. Sorum, University of Wisconsin, and E. V. Kleber, Sharpies Chemicals, Inc., before Division of Colloid Chemistry, American Chemical Society, April 6, 1944.

QUATERNARY AMMONIUM DISINFECTANTS

QUATERNARY ammonium salts are a comparatively new development in the disinfection field, representing quite a decided change from the older and more familiar types of disinfectants. For that reason, there has been considerable interest in and discussion regarding them. As industrial chemical products, however, the quaternary ammonium compounds are not particularly new. They were studied and developed for use as wetting agents more than a dozen years ago.

Quaternary ammonium compounds may be represented as simple inorganic ammonium salts such as ammonium chloride, in which organic radicals have been substituted for all four hydrogen atoms of the ammonium group. A typical example is a compound containing two methyl groups, an aryl group radical, and a long chain group, all four attached to the nitrogen, to give a complex cation together with the chloride anion. The long chain group usually has oil soluble characteristics so

DUAL SCREENS



AND

DUAL DRUMS

The dual screens of the Prater Gradual Reduction Grinder (4) definitely increases screening area from the usual 45% of the ordinary mill to 70% of grinding area. Also, the screens can be more efficiently designed. There is no need for reinforcing the Prater Screens against the shocks of material in the breaking (1) and crushing (2) stages. That is all done in the primary drum, where the materials bounce against tough steel castings.

Then the crushed material is fed around the entire periphery of the rotor to the final sizing blades (3) of the main grinding drum. The particle size is such that the greater part of the area can be devoted to screening. Because the dual screens are away from preliminary breaking and crushing they can be designed for true screening efficiency, as there are no large and heavy particles hammering the dual screens. This hammering in the usual mill distorts the screens and lowers screening efficiency still further.

The immediate value of the 70% screening area is immediately apparent to the grinding engineer—but there are many other factors in this principle of dual screens and dual drums, that are worthy of the study by the man interested in production control and low power cost.

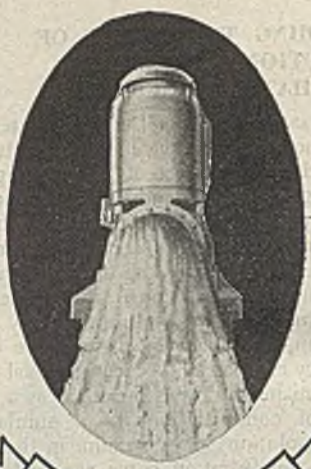
Write for information.

Address:

PRATER
PULVERIZER COMPANY
1825 S. 52nd AVE. CHICAGO, 50, ILLINOIS

Or

BROWN & SITES COMPANY
50 CHURCH STREET NEW YORK, NEW YORK



PEERLESS

The name that speaks Volumes on the Water-front

10 TO 220,000 G.P.M.

Peerless Pumps

PEERLESS PUMP DIVISION
Food Machinery Corporation
301 W. Ave. 26, Los Angeles 31, California
1250 W. Camden Ave., S.W., Canton 6, Ohio
OTHER FACTORIES: San Jose 5, and Fresno 16, Calif.

that the compound as a whole has the construction that would be expected to have, and does have, surface active properties. The compounds are not to be confused with salts of tertiary amines, which similarly may have surface active properties, but are much less effective germicidally and are comparatively unstable and easily decomposed. The quaternary ammonium compounds are exceptionally stable and can be stored indefinitely.

The quaternary ammonium compounds are characteristized by exceptionally high bactericidal activity, although there can be wide variations in the activity of different compounds within the group. In fact, a slight change in composition may increase activity against one organism and decrease activity against some other organism. Other advantages besides the high bactericidal activity are the relatively low toxicity, absence of any appreciable odor, and stability after long storage. There is no appreciable loss of activity whether stored at room temperature or at more elevated temperature, either as a pure, dry powder, as concentrated paste, or as a solution. Such solutions may be made with water, alcohol or a mixture of both. The aqueous solution has a pale straw color and a very bitter taste. Several series of patch tests of concentrated solutions have demonstrated practically complete freedom from dermatitis effects.

As would be expected, such cation active salts react with the anion of a soap or similar wetting agent to form an insoluble and inactive complex. But these quaternary ammoniums are in themselves wetting agents. Furthermore, they are compatible with detergents other than soaps—for example, trisodium phosphate and certain synthetic wetting agents which do not act as electrolytes when dissolved in water. The quaternary ammoniums are germicidally active throughout a wide pH range. The pure compounds themselves produce an acid solution when dissolved in water, but can be made neutral or alkaline with soda ash or caustic without loss of stability or activity.

Some of the Navy's applications for this type of disinfectant are given in their specifications as follows: (1) general disinfecting uses; (2) disinfecting surgical instruments; (3) disinfecting gas masks and other personal equipment; (4) disinfecting clothing prior to laundering; (5) disinfecting washrooms and toilets; (6) anti-fungal uses; (7) for use with specified detergents for cleaning.

P. G. Bartlett, Rohm & Haas Co., before 30th annual meeting, National Association of Insectide and Disinfectant Manufacturers, New York, Dec. 7, 1943.

DIGESTER PRESSURE RELATION IN SULPHITE PULPING

THE BENEFITS of more rapid cooking or any of its variations realized by use of high strength acid in the sulphite digester are well known, but the fact that the pressure capability of the digester is the limiting factor of these returns has not been emphasized. For a given pressure and temperature there is an optimum strength of acid. Above this strength the benefits are lost in relief. Below this strength the chemical cannot take full ad-

vantage of the pressure possibilities. At a pressure of 95 lb. and a temperature of 135 deg. C. the optimum strength is in the range of 6.25 percent free SO_2 (7.5 percent total SO_2). Raising the pressure to 110 lb. raises this optimum to about 7.75 percent free SO_2 (9.0 percent total SO_2). With acids of 10 percent free and over there appear to be further benefits from penetration. Both from the experimental work and observation of commercial operation, it appears that at 135 to 140 deg. C. a shortening of the cook by 15 min. can be realized by increasing pressure 5 lb., provided that the acid strength is adequate to take advantage of the pressure.

W. F. Holzer, Crown Zellerbach Corp., before 29th TAPPI Annual meeting, New York, N. Y., Feb. 15, 1944.

ALUMINUM SUPPLY

THE ALUMINUM supply program during this past year has been one of feast and famine. Fortunately for the war effort, the famine phase is over and the aluminum production is now in the happy position of being abundantly able to supply all the requirements of the armed services, with a monthly surplus which has built up a substantial stockpile. The government is arranging to hold through Metals Reserve Co. some 250,000,000 lb. of primary metal and 75,000,000 lb. of secondary metal as insurance against any contingencies which may arise. In addition to this government stockpile, the stocks in the system may be broadly stated to be something over 750,000,000 lb. in ingot and fabricating plants and probably a somewhat smaller amount at the aircraft plants in inventories and in process. It appears, therefore, that an amount of aluminum approaching two billion pounds exists in the United States today, exclusive of the finished metal in airplanes and equipment already delivered and in service. The situation is so comfortable that we have recently effected a curtailment of ingot capacity amounting to some 330,000,000 lb. a year.

All of the sixteen aluminum ingot plants in the country, of which nine were constructed for the government, are now in operation and a number of them are exceeding their capacity production estimates. Similarly, the two large new government-owned alumina plants in Arkansas and Louisiana are operating and are now prepared to produce to capacity, using exclusively low grade high silica domestic bauxite.

By April 1943 the metal shortage had been overcome and a British loan was repaid before the end of June. Beginning in late spring a then-growing metal surplus permitted an increase in allotments of lend-lease material to our allies in excess of the original schedules. The War Production Board was able to liberalize the Aluminum Order, permitting some uses of the metal which had been restricted since 1941.

By the end of 1943 aluminum was being supplied at the rate of approximately 3,400,000,000 lb. per year as compared with the 1941 supply of 843 million lb. At the same time domestic bauxite production really hit the stratosphere. Coming largely from the state of Arkansas, its production had increased from the pre-Pearl Harbor rate of approximately 900,000 tons

per year to an annual rate of 8,500,000 tons. The program as planned included two million tons per year scheduled to be furnished to Canada on the promise that the shipping situation might not permit the importation of any South American bauxite to the North American continent. This scale of operations, which had been believed by many to be unachievable, permitted the building of a government stockpile that at the end of 1943 totalled more than two million tons.

Production of alumina in the new government plants is also being curtailed to a figure well below peak capacity. Using bauxite of a grade and quality which was considered before the war to be too low for satisfactory use in the Bayer process, these plants are operating efficiently and economically.

The country's limited reserves of bauxite ore have not during the year suffered the rapid depletion which was feared a year ago. Intensive exploration during 1943 has put in sight more bauxite of a useable grade than has been consumed. It is now estimated that some five year's supply at the expected rate of 1944 consumption may be considered as reasonably well assured in the country. However, if the present high rate of mining should continue, it is likely that within two or three years it may be impossible to maintain this rate of production from the deeper and more scattered ore bodies that recent exploration has developed.

In anticipation of such a probable decrease in the rate at which bauxite can be mined, the Aluminum and Magnesium Division has sponsored the erection of four semi-commercial pilot plants designed to produce alumina from clay and other non-bauxitic aluminous materials. One of these, using the Kalunite process in Salt Lake City, has been completed and is producing some alumina from alunite. The plant is encountering the many difficulties expected in a new and untried process but is making progress in solving its problems. Two alkaline process plants, one to treat clay and limestone at Harleyville, South Carolina, by the Ancor process, and one to use anorthosite and limestone at Laramie, Wyoming, in a process developed by the Monolith Portland Midwest Company, are in process of construction. A fourth, to employ an ammonium sulphate process developed by the Chemical Construction Corporation on Oregon clay is being built at Salem, Oregon. These proving plants each have nominal capacity of fifty or sixty tons of alumina per day.

Philip D. Wilson, Aluminum-Magnesium Division, WPB, before Aluminum Association, New York, N. Y. Jan. 19, 1944.

PROTECTION OF RESEARCH RESULTS

RESEARCH results can be protected either by secrecy or by patents. Usually the former is either impractical or impossible. Further, secret research results can be lost by others' duplication. On the other hand, patents protecting research can be used (1) to preserve the results for the patentee's own use, (2) to provide insurance against adverse patenting, (3) to make possible the sale or licensing of the research, and (4) to make possible exchanges of patent rights.

Patent protection secured on research can be no sounder than the research itself. The principles of sound research are well recognized, but particularly to be emphasized are a thorough knowledge of related prior art in patents as well as the general literature, and the careful recording of ideas as well as data. The chemist's notebook is essential to the protection of his research and should be kept in permanent form, dated, be self-explanatory, and regularly witnessed by another chemist.

Sound chemical patent work is likewise essential to the protection of research results. Too often it is not effective of a gap between the research chemist and the patent attorney. This gap is in the recognition of patentable material, experimental work to bound the inventive concept, and experimental work to establish and sustain "invention."

Research chemists ordinarily experience difficulty in recognizing patentable material because of unfamiliarity with the standards of invention set by the United States Patent Office. The accurate bounding of an inventive concept is essential to secure full patent protection on research, and consists of experimental testing of the useful limitations of the various variables involved in the concept. The chemist should guard against the very natural tendency to indulge in too extensive reasoning by analogy. Such reasoning should be actually tested by experimental work. Timing is important in this phase of the work, but factual accuracy is equally important. Supporting the attorney's efforts in the prosecution of the application consists in furnishing proof to establish the dates when the invention was made and in furnishing data to distinguish the claimed invention from the prior art.

C. B. Hollabaugh, Hercules Powder Co., before Division of Chemical Education, American Chemical Society, Cleveland, Ohio, April 3, 1944.

ALUMINA FROM CLAY

THE AMMONIUM sulphate process for treating clay is not new. It has many modifications, but most of them employ the following essential steps: (1) sulphating the alumina in the clay by baking with ammonium sulphate or ammonium acid sulphate; (2) water leaching to extract aluminum sulphate and ammonium sulphate; (3) crystallization of ammonium alum, and (4) conversion of alum to aluminum hydroxide by ammonia gases given off during baking.

Ammonium alum is only slightly soluble at room temperatures but becomes nearly ten times as soluble when the temperature is raised to 100 deg. C. For this reason the leaching must be done with hot solutions.

An acid leach is not necessary to give good extraction of the alumina, but the acidity of the solution must be controlled to avoid hydrolysis. The pH value at which hydrolysis occurs decreases as the concentration of aluminum sulphate and the temperature are increased. Hydrolysis does not occur in alum solutions at a pH value less than 2. The precipitate produced on hydrolysis is probably a basic ammonium alum rather than aluminum hydroxide.

The principal impurities found in the leach solution are iron, sodium, potassium,

magnesium, titanium and calcium as sulphates, plus small amounts of phosphorus and silica, either in solution or suspension. Most of the iron in the clay can be kept out of the solution by fixation during the bake. The remaining impurities are eliminated during the alum crystallization and precipitation of the hydroxide. Ammonium alum solutions are ideal for crystallization since about 90 percent of the alum in a saturated solution can be crystallized out when cooling from 100 to 20 deg. C. Magnesium, calcium, ferrous iron, titanium and phosphorus do not crystallize with the alum and are left in the mother liquor.

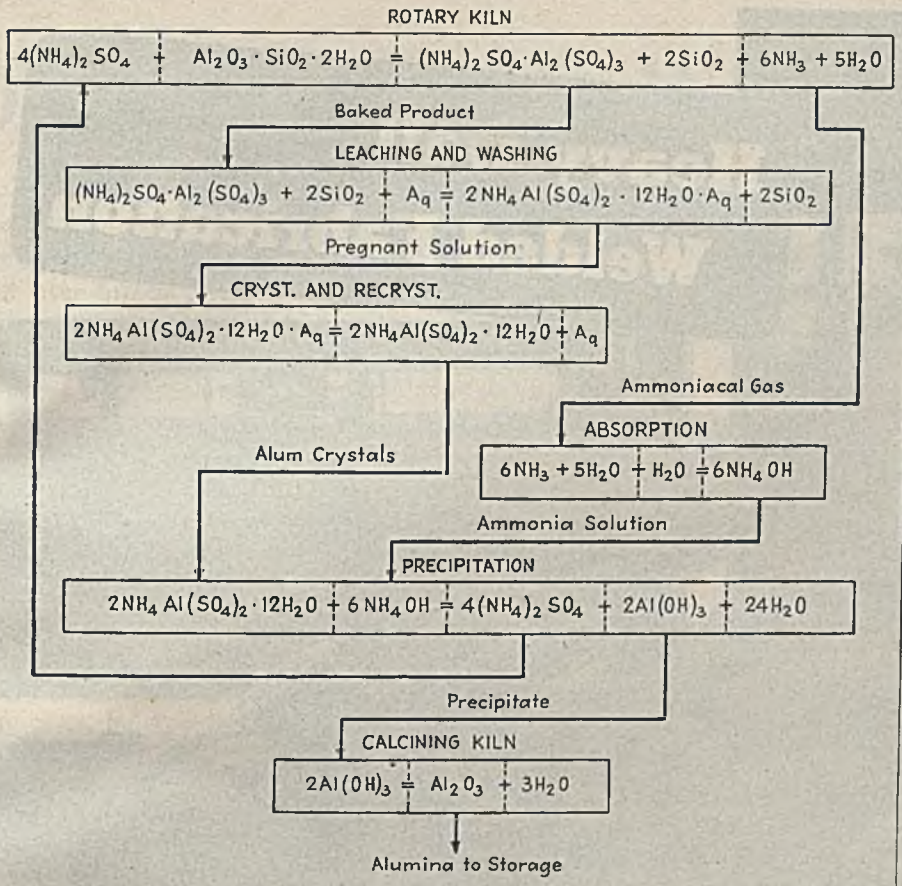
If sulphur dioxide is passed through the pregnant solution to reduce ferric ion to ferrous, ammonium alum crystals spectrographically free from iron can be obtained by two recrystallizations.

Most sulphate processes involve thermal decomposition of the aluminum sulphate; in this process the ammonia gases are used to precipitate the aluminum from the solution as the hydroxide. The problem is to produce a precipitate that can be settled and filtered. Unless the proper conditions are maintained, the precipitate is gelatinous. If the alum is added to an ammoniacal solution as solid crystals and the pH is maintained sufficiently high during precipitation, the precipitate settles and filters readily. There seems to be a definite limit to the quantity of water that can be eliminated from the precipitate by mechanical means. The filter cake usually contains about 25 percent of the solids, which is approximately equivalent to the weight ratio corresponding to replacement of aluminum sulphate by aluminum hydroxide in the original alum crystal. Some improvement in filtering technique may be possible, but a large proportion of free water seems to be an inherent characteristic of the aluminum hydroxide precipitate.

The potash and soda remaining in the alum may be eliminated during the precipitation. When the process was first being considered, there was some uncertainty as to whether or not a large part of the precipitate was a basic sulphate. Some basic sulphate is always present in the precipitate as shown by the difficulty of completely removing the sulphate by washing, but it has been definitely shown that if the conversion is carried out under proper conditions, virtually all the precipitate is aluminum hydroxide. Any sulphate remaining in the final filter cake may be driven out during the final calcination to convert the aluminum hydroxide to non-hygroscopic alumina.

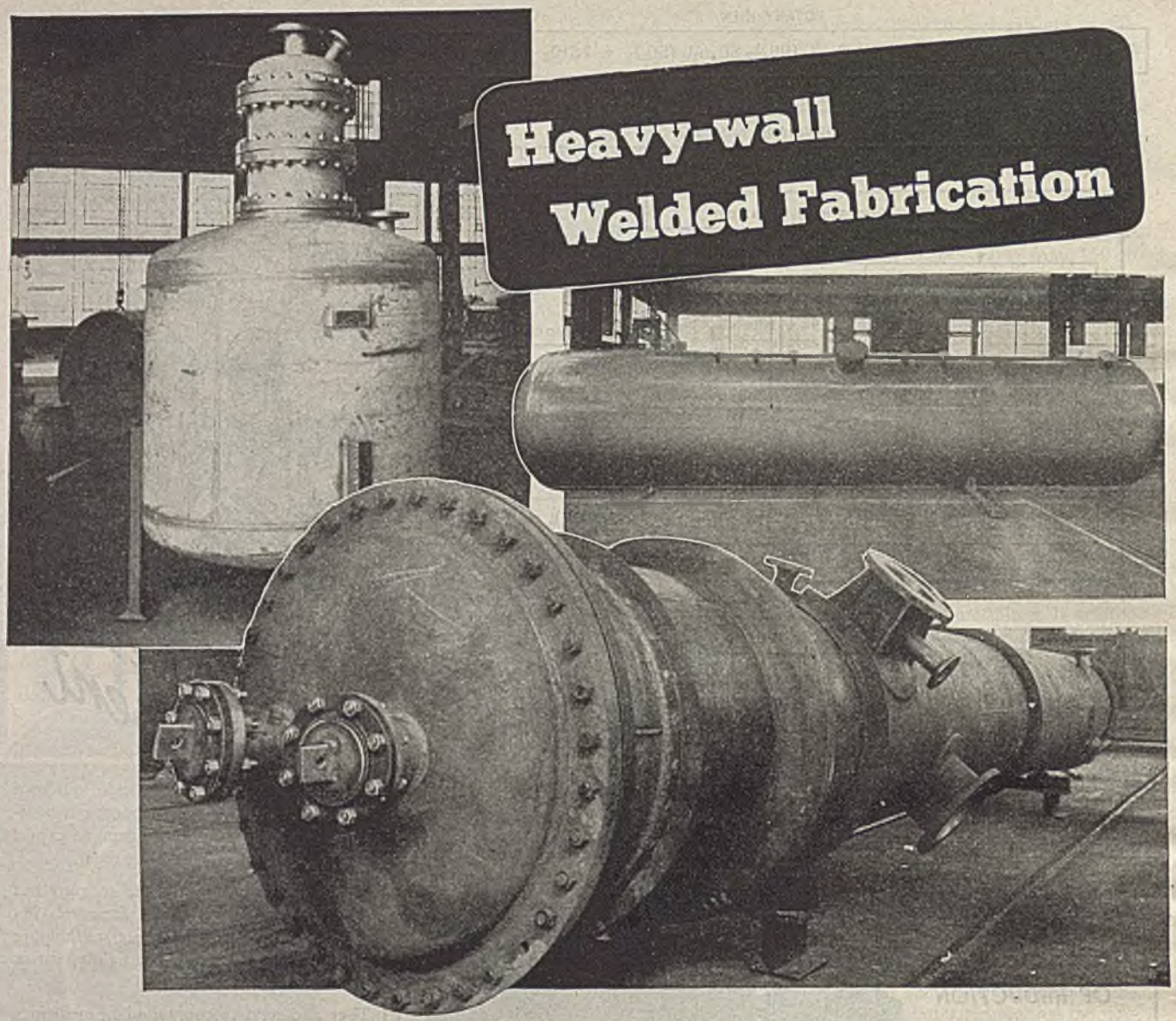
The amount of heat required for the process is quite high, but it compares favorably with that of other sulphate processes. Because of the unusually high heat of formation of aluminum sulphate, all sulphate processes require a large expenditure of heat. This is probably the greatest disadvantage of the process, particularly since most of the large clay deposits occur in the Pacific Northwest, where a large supply of cheap fuel is not available.

Investigation of the ammonium sulphate process has progressed to a point where the technical feasibility of the process has definitely been established and fairly complete data are available on all important



steps. Further laboratory work remains to be done, however.

H. W. St. Clair, S. F. Ravitz and A. T. Sweet, Bureau of Mines, before Annual Meeting, American Institute of Mining and Metallurgical Engineers, New York, Feb. 23, 1944.



to your specifications . . . by EDGE MOOR

Edge Moor is equipped to furnish any type of heavy-wall pressure vessel to your individual designs, specifications or requirements—in metal thicknesses from 1″ up to 2½″. Materials include carbon and stainless steels, high chrome, nickel, Hastelloy, Monel, Herculoy, clad metals, nickel steel, Inconel, Everdur, Colalloy and other metals and alloys.

The Edge Moor shops have complete facilities for stress-relieving, annealing and X-Ray and are approved by leading insurance companies for fusion welding to meet all codes and tests. Work is being regularly produced to ASME Code paragraph U-68 requirements.

Write for Edge Moor Bulletin 113 which illustrates and describes typical examples of equipment we have produced for chemical and petro-chemical plants. If your requirements are specific, send your drawings and specifications for quotation.

PROCESS EQUIPMENT FABRICATORS:

EDGE MOOR IRON WORKS, INC.

BRANCH OFFICES: NEW YORK 20, N. Y.: 30 ROCKEFELLER PLAZA
CHICAGO 2, ILL.: ONE NORTH LA SALLE STREET

MAIN OFFICE: EDGE MOOR, DELAWARE

Disposal of Government War *Plants and* Equipment

In the last four years, the Federal Government has spent over fifteen billion dollars on war plants—two-and-one-half times as much as was spent by private investors.

Of this fifteen-billion-dollar government investment, about one-third has gone into facilities for the manufacture of aircraft and for ship construction and repair; another third has gone into plants for production of combat ordnance; and the remaining third has gone into a variety of facilities for making synthetic rubber, metal products, machinery, and miscellaneous equipment.

Most of these plants are in industries that are expanded far beyond peacetime requirements. Furthermore, their convertibility to other civilian uses will, in many cases, be complicated by their specialized equipment and layout, by their tremendous size, and by their uneconomic location. At the moment, it looks as if roughly one-third of the government-owned plants and equipment can be converted fairly readily to peacetime operation, and will, therefore, be easily disposable to private enterprise.

The discovery of unsuspected uses for war plants and equipment may well raise the disposable proportion to one-half or more. The government, at the end of the war, may own about one-eighth of the commercially-usable industrial capacity of the country. It will be by far the largest owner of machine tools; it will own enormous aluminum capacity, magnesium capacity, many miles of pipe lines, and more ships than the entire private shipping industry.

What the government does with its war plants will have a profound effect on the free enterprise system and on all workers, employers, investors, and consumers who have a part in that system. If this problem is handled badly, we may find ourselves enmeshed in a trend toward monopoly and government operation of industry. If the problem is handled well, we shall have taken a big step toward freedom of action in a competitive society, toward full opportunities for business enterprise, toward well-paid productive jobs for workers, and toward a higher standard of living for us all.

Recently, three important events have signalled encouragement. They are the report of Senator George's Committee, the Baruch report, and the report of Senator Truman's Committee. These reports are noteworthy for their competent sizing up of a complex problem, for their recognition of the major responsibility of government in making a successful transition to peace, for their insistence on wise policy and good administration, and for their genuine concern that our productive powers be given full opportunity in a free private enterprise system. These reports agree on basic principles and many specific lines of action. There are, however, important areas of policy formation, organization, and procedure—especially in regard to plant disposal—which remain to be blue-printed.

In formulating the policies and practices to be followed in dealing with government war plants, our major goal must, of course, be a high level of production and employment in private business after the war.

Government operation in competition with private employers and privately-employed workers will not be desirable because it will make investment unattractive to private capital and will limit opportunities for private employment. On the other hand, sales to private buyers which result in increasing the concentration of industry will also be undesirable. We must use this opportunity to strengthen the competitive enterprise system and to move away from, not toward, the concentration of economic power in either public or private agencies.

To accomplish these objectives, a program of action such as follows will be necessary:

1. An adequate reconversion organization will be needed in the government, but its powers and responsibilities should carefully be defined by Congress. Fortunately, an able Administrator of Surplus War Property already has been appointed. It will be essential for him to work in closest cooperation with Congress and with the Armed Forces and other executive agencies. The Office of War Mobilization, and ultimately the President, must be responsible for seeing that the Surplus War Property Administration is not sidetracked by the operating agencies and is not dominated by their sheer size. Funds must be supplied generously to the Surplus War Property Administrator, so that he can set up an organization adequate to cope with this huge and complex job. Business, too, must be generous in loaning top-flight executives for postwar government service.

2. One of the first acts of the Surplus War Property Administration will have to be to assemble a complete inventory of government war plants and equipment, to make possible the planning and control of the disposal process, and to form the basis of catalogues of property available for sale.

3. Cooperation between the executive and legislative branches of the government will be needed to develop at least tentative plans with respect to matters of public policy which are of special importance to a successful transition to peace. Among these matters are the size of the military establishment to be maintained in time of peace, the stand-by facilities and reserves of materiél necessary for our security in case of future war, and our policy regarding import and production of synthetic rubber and other critical and strategic materials.

4. The Surplus War Property Administrator should

obtain from the Armed Forces, acting under congressional directives, specification of those plants which are needed to supply our peacetime Army and Navy and to provide the essential reserve capacity in case of war.

5. The Surplus War Property Administrator should select certain war plants as depots in which to store the huge surpluses of inventories and equipment which will have to be removed from private and government-owned factories in order to make possible their conversion to civilian use.

6. Those plants which are not desired by the Army or the Navy, which are not needed for storage, and which clearly will be unsuitable for peacetime utilization should be scheduled for dismantling and disposal piecemeal.

7. The two or three billion dollars' worth of government facilities intermingled with private plant should receive attention with a view to early sale, temporary continuance or use under lease, or early removal.

8. The various plants and pieces of equipment available for sale to private business should be classified conveniently, catalogued, and advertised to prospective buyers or lessors. Before the Surplus War Property Administrator offers, for private sale, plants and equipment not desired by the Army or the Navy, he should ascertain whether the plants or equipment are desired by other branches of the government or by public corporations such as the T.V.A.

9. Whenever property can be sold at prices approximating depreciated reproduction cost, that will be by far the best solution. Generous time-payment terms should be offered. In many cases the government may be unable to sell the property for reproduction cost less depreciation, for the simple reason that no one would think of reproducing it. The property may already be partly obsolete or, because of its size, location, or other characteristics, may only be moderately well suited for commercial use. This should not prevent the government from selling it, provided a price which fairly represents the worth of the property can be obtained. The best test of that worth is the price produced by active bidding under favorable market conditions.

10. When property cannot be sold at a fair price, temporary leases with options to buy should be employed to get the facilities into productive use. This should not, however, be done on terms which would cause unfair competition or create clearly excessive capacity in an industry. And the lease must be temporary; it must not be the means to prolong government control or ownership.

11. The government should offer the strongest possible resistance to local groups or industry groups seeking subsidies for continued operation of war properties. Subsidies will burden the Treasury and lead to inefficient use of resources. They will be justified only to maintain facilities needed for national security.

12. The plants and equipment offered for sale and lease should include sufficient quantities in small enough lots to satisfy the demands from small business. The war has tended to concentrate production in larger plants. After the war, we should seek a wider distribution of the government war facilities.

13. Insofar as possible, war buildings and equipment should be offered for sale in units which can be purchased by businesses in peacetime industries. Many of these industries have had to get along during the war without adequate replacement and expansion, and will be ready to buy if they are able to get what they want from the government. This is a particularly desirable market for surplus government property since these industries are, for the most part, not faced with the problems of excess capacity.

14. Property, such as machinery and other movable equipment, which is in excess of our domestic requirements or is more urgently needed by other countries, should be exported. We shall need, and can take, large supplies of raw materials in return.

15. Property which is not needed by the Armed Forces, which cannot be sold or leased on terms which would be fair to competing plants, which cannot be dismantled and distributed piecemeal, and which cannot be sold abroad, should be scrapped as soon as its non-disposability is apparent. The disposal of war plants should be completed within three to five years.

16. All negotiations for sale or disposal should be matters of open public record. As Mr. Baruch has said, the process must be conducted in a goldfish bowl. This is as much for the protection of business as for the protection of the government.

These courses of action do not include everything that must be done, but they do indicate the general lines along which our surplus war plant disposal must proceed if it is to avoid precipitating needless transition unemployment.

The gravest danger of all will be red tape, intergovernmental conflict, and inadequate administration. It would be a great misfortune for the executive and legislative branches to quarrel over details of organization when they agree on the basic principles to be followed in handling the problem. Obviously, the Surplus War Property Administration must cooperate with Congress and look to it for policy guidance. Just as obviously, the disposal problem will involve great difficulties of administration which must not be complicated by congressional interference. We shall need the best we can get in careful policy making, detailed planning, good organization, and courageous action. This is a matter of vital importance to every American. The stakes are too high to tolerate poor administration or petty politics.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

FOREIGN LITERATURE ABSTRACTS

TETRABENZYL AND TETRAPHENYL SILICANES

TETRABENZYL silicane was synthesized by a new method by Soshestvenskaya by treating sodium fluosilicate with Grignard's reagent. Grignard's reagent was also used recently for the synthesis of certain silico-organic compounds of the $Ar_3Si\text{-}SiAr_3$ type, the $R_3Si\text{-}SiR_3$ type and the Ar_4Si type.

Tetraphenyl silicane was synthesized with a good yield by a modification of Polis' method, so as to eliminate the formation of byproducts. This compound was also obtained by means of the Grignard reaction both from silicon tetrachloride and sodium fluosilicate.

Synthesis of tetraphenyl silicane from silicon tetrachloride was carried out analogously to that of tetrabenzyl silicane: 14 g. of magnesium, 93 g. of bromobenzene, 230 cc. of absolute ether and 10 g. of silicon tetrachloride were used, resulting in 9.5 g. (48 percent) of tetraphenyl silicane (after three recrystallizations from benzene) with a melting point of 229-230 deg. C.

Synthesis from sodium fluosilicate was carried out almost analogously to that of tetrabenzyl silicane with only this difference—the Grignard reagent was used in excess (double the theoretical quantity), and the reaction mixture was heated on the oil bath for a longer period (3-4 hours instead of 1). 4 g. of magnesium, 26 g. of bromobenzene, 120 cc. of absolute ether and 3.8 g. of sodium fluosilicate were used, resulting in 2.3 g. (33.9 percent) of tetraphenyl silicane with a melting point of 229-230 deg.

Digest from "Investigations on Silico-Organic Compounds," by Z. Manulkin and F. Yakubova. *Zhurnal Obschei Khimii* X, No. 14, 1300-1302, 1940. (Published in Russia.)

SYNTHETIC FORMIC ACID

SINCE the beginning of the war an investigation has been conducted on the variables affecting the synthesis of formic acid from carbon monoxide. In experiments at Mulheim-Ruhr the apparatus used was an autoclave lined with copper and provided with a manometer protected from the carbon monoxide. The autoclave was heated electrically and fitted with an agitator with adjustable speed. In general, the initial pressure was 1,000 atm. and the rate of temperature rise was the same in all experiments. On completion of the reaction, the autoclave was cooled as rapidly as possible and the formic acid content of the solution estimated. The carbon monoxide used contained 1-1.5 percent hydrogen and small quantities of nitrogen.

It was shown that formic acid can be obtained in high yields by direct action of carbon monoxide on water in the presence of certain catalysts, and that at each temperature there exists an equilibrium between the concentration of the formic acid

in the solution and the pressure of the carbon monoxide. The best catalysts are mineral acids, particularly sulphuric and phosphoric acids. Of the various salts tested, copper sulphate and copper chloride were found best, but these salts are reduced under reaction conditions and the corresponding mineral acids liberated.

There are optimum concentrations for the acid solutions used as catalysts. When these concentrations are exceeded, equilibrium in the process is attained more slowly under any given temperature and pressure condition, and the concentration of the formic acid solution obtained is lower. At constant pressure of monoxide, the yield of formic acid increases with decrease in reaction temperature. The most suitable temperature range has been found to be 160-180 deg. C. Improved results could be expected if catalysts could be found which are effective at still lower temperatures. It has been shown, for instance, that with an initial pressure of 2,000 atm. and a temperature of 160 deg. C. a solution can be obtained which contains 46 percent by weight of formic acid. If the process could be carried out at about 140 deg. C. it should be possible to produce directly a 57 percent solution of formic acid.

High pressures of carbon monoxide are essential for getting good yields of formic acid. At pressures of 500-2,000 atm., it was found that the formic acid concentration was approximately proportional to the pressure. In one series of experiments in which the temperature was 160 deg. C., the formic acid yields were as follows: 2.75 N at 500 atm.; 5.5 N at 1,000 atm.; and 11 N (46 percent of formic acid by weight) at 2,000 atm. Even better results could be expected at still higher pressures of carbon monoxide.

No formation of carbon dioxide and hydrogen from the reaction mixture was observed at temperatures below 300 deg. C.

Digest from "Formic Acid by Direct Synthesis," by H. Pichler and H. Buffleb, *Brennstoff-Chemie*, 23, No. 6, 73-77, 1942. (Published in Germany.)

DIFFERENTIATION OF UNVULCANIZED RUBBERS

NATURAL rubber softens at above 120 deg. C. and on increase in temperature it is transformed into a thick brown oil which does not become solid and elastic on cooling. At about 300 deg. C. this oil is decomposed into a large number of products with boiling points ranging from 18 to 300 deg. C. The specific gravity of rubber is 0.93 and its nitrogen content about 0.4 percent. Rubber ignites readily and burns with a very smoky flame, emitting a characteristic, faintly aromatic odor. Disintegrated rubber swells when shaken with gasoline. Rubber which has been previously masticated on cold rollers gels more readily than unworked material, as a result of the breakdown of the large molecules by the cold working. Solutions of masticated rubber show lower viscosities than those of unworked rubber of equal concentration.

Buna S is used where resistance to wear and abrasion is required and buna SS where high resistance to oils and solvents is called for. The specific gravity of these two bunas is 0.92. Each contains 0.02 percent of nitrogen. Buna S and buna SS contain 6.2-6.9 and 6.9-8.1 percent of acetone-

soluble matter respectively. They burn with a smoky flame, but the hyacinth-like smell of burning polystyrene is completely masked by the odor of added plasticizers. Fragments of these bunas are incompletely dissolved by gasoline so that a spawn-like structure results. The effect of mastication is much less than with natural rubber.

The oil- and gasoline-resistant perbunan is formed when acrylonitrile is co-polymerized with butadiene. Its specific gravity is 0.92 and its nitrogen content 6.7-7.3 percent. Matter soluble in petroleum ether amounts to some 3 percent, and consists mainly of stabilizers and anti-oxidants. In contrast to natural rubber and the bunas substitutes, perbunan is soluble in ketones such as acetone. Perbunan burns with a smoky flame. The odor produced on burning, while difficult to define, is more aromatic than that of natural rubber. It is readily distinguished from that of burning buna S or SS.

The specific gravity of Neoprene is 1.27 and it has a characteristic clinging odor. On warming to 50-60 deg. C. it becomes softer and more tacky than masticated rubber. At room temperature and particularly at 0 deg. C. it is considerably harder than rubber, buna, or perbunan under similar conditions. Neoprene does not burn.

Chemical characteristics of Thiokol are similar to those of perduren. Its specific gravity is 1.62 and it has a sulphur content of about 82 percent. It is insoluble in gasoline, benzene, and fuel oils, but dissolves in trichlorethane.

Digest from "Differentiation between Natural Rubber and Substitutes," by P. Kluckow, *Chemische Zeitung*, 109, March 1941. (Published in Germany.)

POLYSACCHARIDE DEGRADATION

METHYLATED polysaccharides are decomposed into simple methylated sugars by anhydrous formic acid in the presence of a small amount of acetyl chloride. The methylated polysaccharides swell in this mixture and are hydrolyzed at 20° for 200 hours until a constant rotation value is obtained. After the formic acid and acetyl chloride have been distilled off, the residue is converted into the methylglucosides by means of methyl orthoformate, methyl alcohol, and a trace of hydrochloric acid or acetyl chloride. The methylglucosides are separated by high vacuum distillation. This procedure is not suitable for free or acetylated polysaccharides, for methylated wood, or proteins.

Digest from "The Degradation of Methylated Polysaccharides," by K. Freudenberg, T. Ploetz and W. Jakob, *Ber.* 75, No. 12, 1694-6, Feb. 10, 1943. (Published in Germany.) [From Bulletin of the Institute of Paper Chemistry, 14, No. 6, 189, Feb. 1944.]

SUGAR DETERMINATIONS

IN ORDER to determine the hydrolytic scission products of starch, a method had to be found by which glucose, maltose, and sugars of the isomaltose type could be differentiated. Isomaltose behaves differently from maltose in the determination with Barfoed reagent. The acetic acid in this reagent is replaced by a strong acetate-acetic acid buffer and the reaction mixture is heated on a boiling water bath. At pH 5 the reduction of glucose is strong, but it decreases with decreasing pH and stops at pH 4. The weak reduction of maltose is

not characteristic of disaccharides, because melibiose reduces just as strongly as glucose and, although 1,4-sugars reduce weakly, 1,6-sugars reduce strongly. A substituent in the 6-position, therefore, has less effect upon the behavior of a sugar than one in the 4-position. 2,3,4,6-Tetramethylglucose at pH 5.7 does not reduce copper acetate at all but it reduces Fehling solution. A decomposition of the methylated sugar takes place in a strongly alkaline solution, whereas in an acid solution it is not decomposed and no reduction takes place, in spite of the presence of the reducing aldehyde group. Diacetone-d-mannose, which is stable in alkaline solution, does not even reduce Fehling's solution. It is possible, therefore, to determine with copper acetate whether a disaccharide contains a 1,4- or a 1,6-linkage, if these are the only two in question. If, after methylation and hydrolysis of a trisaccharide, 1 mole each of tetra-, of 2,3,6-tri- and of 2,3,4-trimethylglucose are obtained, then the trisaccharide contains a maltose and an isomaltose linkage. This, however, does not prove whether the trisaccharide contains a 1,6—1,4-CHO (I) or a 1,4—1,6-CHO (II) structure. If the trisaccharide reduces Barfoed solution slowly, as maltose does, it contains the I structure; if it reduces quickly, as glucose does, a II structure is present.

Digest from "Sugar Determinations With Copper Acetate," by K. Myrbäck and E. Leissner, *Ber.* 75, No. 12, 1739-43, Feb. 10, 1943. (Published in Germany.) [From Bulletin of the Institute of Paper Chemistry, 14, No. 6, 189, Feb. 1944.]

BYPRODUCT LUPININE

Lupinine is one of the inactive constituents of the insecticide, anabasine sulphate, which is made from the plant *Anabasis aphylla*. The application and manufacture of this insecticide is increasing rapidly in Soviet Russia so that a new source of lupinine is available to the chemical industry. This alkaloid is promising as a raw material for the synthesis of various pharmaceuticals. The Academy of Sciences (USSR) has already made lupicaine which is promising commercially and work is being done on other derivatives of lupinine.

A new and simple method has been proposed for the isolation of lupinine from the anabasine mixture. Lupinine reacts readily with metallic sodium, yielding sodium lupinate. The reaction is best carried out in a solution of petroleum ether and the yield is 97 percent. Free lupinine is obtained by decomposition of the lupinate with water or the lupinate can be used as such directly for syntheses. This method takes less time and requires a smaller quantity of reagents than any of the methods used heretofore.

Digest from "New Method for Isolation of Lupinine from Technical Anabasine Sulfate," by A. Sadykov and G. Lazuryevsky, *Zhurnal Obsohei Khimii*, XIII, No. 4-5, 319-321, 1943. (Published in Russia.)

RESORCINOL CONDENSATION

Original work has been done on the development of Arreguine's reaction for the condensation of resorcinol with citric acid. This reaction is carried out as follows: a 5 percent solution of $KMnO_4$ is added to 3-4 drops of citric acid solution until the liquid becomes yellowish, whereupon 0.1 g. of resorcinol and concentrated H_2SO_4 is added until a bright red color

appears. The mixture is cooled, agitated with ether, decanted and diluted with 10 cc. of water. It is then alkalized with ammonia and a characteristic blue fluorescence appears. The oxidation product of citric acid with $KMnO_4$ condenses with the resorcinol resulting in the formation of the blue fluorescent compound. A green fluorescence was produced when citric acid was replaced by various acyclic organic acids such as formic, oxalic, tartaric, succinic, lactic, pyruvic and acetic acids. The acid was fused with resorcinol and anhydrous zinc chloride. The resulting product, varying from orange to vermilion in color, dissolved in alkalis with a green fluorescence. This reaction will also take place with such acid-forming compounds as aldehydes, ketones, anhydrides and acid halides.

Digest from "Condensation of Resorcinol with Acyclic Acids," by Ewaldo Nicolau Curtlin, *Anais da Associacao Quimica do Brazil*, 1, No. 2, 88-95, 1942. (Published in Brazil.)

ISOPRENE DERIVATIVES

Halogen derivatives of isoprene are of considerable interest as a possible raw material for synthetic rubbers. Although the dihalogen derivatives have as yet received very little attention, their properties are very promising. 3, 4-dichloro- and 3, 4-dibromo-3-methyl butene-3 ol-2 were synthesized by chlorination and bromination, respectively, of dimethyl acetylenyl carbinol in chloroform.

A low boiling 3, 4-dichloro-2 methyl butadiene-1, 3 and cis and trans 3, 4-dibromo-2-methyl butadiene-1, 3 were produced by dehydration of dimethyl dihalogen vinyl carbinols. The attached table shows the constants of certain of these derivatives as compared to the corresponding halogen derivatives of butadiene. The isoprene derivatives have a higher boiling point but a considerably lower specific gravity and index of refraction.

All these compounds were found to have little tendency to polymerize. Depending on the conditions, they could be made to yield either soft, rubber-like polymers, resinous or powdery polymers. The action of an alcoholic or aqueous alkali solution on dimethyl-dihalogen vinyl carbinols resulted in a clevage at the bond between the second and third carbon atoms, yielding acetone, ethylene dihalides, and acetylene monohalides.

Digest from "Investigations in the Field of Conjugated Systems: Synthesis and Properties of Dihalogen Derivatives of Isoprene," by A. A. Petrov. *Zhurnal Obeschei Khimii* XIII, No. 4-5, 331-8, 1943. (Published in Russia.)

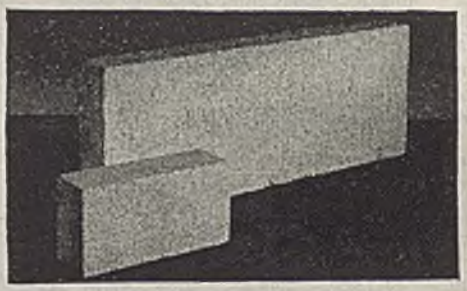
Constants of Some Dihalogen Derivatives of Isoprene

Formula	B. P., deg. C.	Pressure, mm.	d_4^{20}	n_D^{20}	MR_D Calc.	MR_D Actual	EM_D
$CH_2=CH-CCl=CHCl$...	46.75–47.5	85	1.1931	1.5049	29.47	30.56	1.22
$CH_2=C(CH_3)-CCl=CHCl$	60.5–61	85	1.1386	1.4840	34.09	34.41	0.32
$CH_2=CH-CBr=CHBr$...	46–46.5	10	1.9481	1.5792	35.27	36.15	0.88
$CH_2=C(CH_3)-CBr=CHBr$ a)	51.2–52	10	1.7808	1.5468	39.88	40.34	0.42
b)	66.5–67	10	1.8307	1.5665	39.88	40.28	0.40

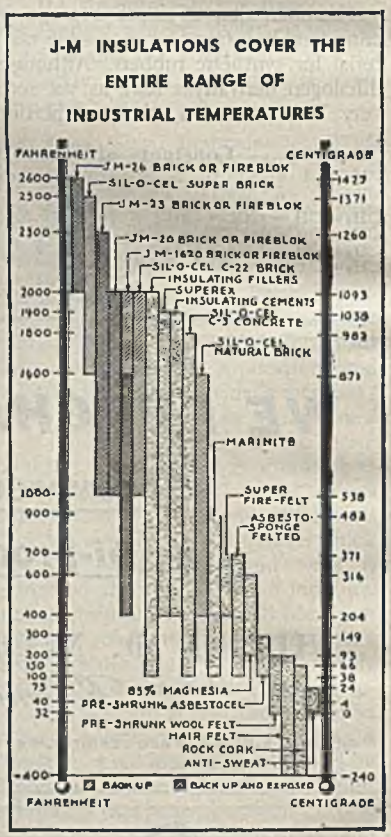
Solutions TO YOUR TOUGH INSULATING PROBLEMS!

WHATEVER your insulating problem, there's a Johns-Manville insulation that can solve it efficiently and at minimum cost. For, over the past 86 years, J-M's extensive laboratories have pioneered in the field of industrial insulation. Today J-M offers a wide line of insulating materials, each designed for some specific insulation need, for temperatures up to 2600°. For example:

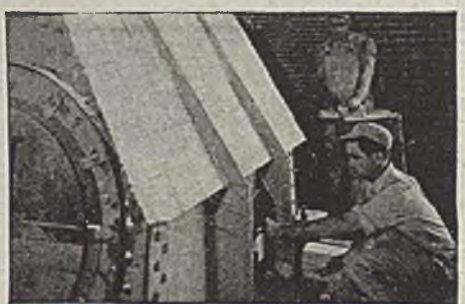
For temperatures to 600° F. J-M 85% Magnesia has been for many years the most widely used block and pipe insulation for temperatures to 600° F. and, in combination with Superex, for higher temperatures. Maintains high insulating efficiency. Standard block sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick.



Furnace insulation up to 2600° F. J-M Insulating Brick and Insulating Fire Brick are available in 7 types, temperature limits from 1600° F. to 2600° F. All provide light weight, low conductivity. New Insulating Fireblok, now ready in all four Fire Brick types, are 5 times larger for speedier, more economical installation.



For steam lines up to 700° F. Use J-M Asbesto-Sponge Felted Pipe Insulation for efficiency, high salvage and resistance to abuse. For temperatures over 700° F. use with Superex. In 3-ft. lengths 1″ to 3″ thick.



Insulation for temperatures to 1900° F. J-M Superex Blocks have long been standard for this service. High heat resistance, low thermal conductivity. Sizes 3″ x 18″, 6″ x 36″ and 12″ x 36″; from 1″ to 4″ thick.

For more details on these materials, and on the complete J-M Insulation line, write for Catalog GI-6A. Address: Johns-Manville, 22 East 40th Street, New York 16, New York.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville INDUSTRIAL INSULATIONS

FOR EVERY TEMPERATURE... FOR EVERY SERVICE

CHEMICAL ENGINEER'S BOOKSHELF

DATA ON METALS

MECHANICAL PROPERTIES OF METALS AND ALLOYS. *By J. L. Everhart, W. Earl Lindlief, James Kanegis, Pearl G. Weissler and Frieda Siegel. National Bureau of Standards Circular C447, Available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 481 pages. Price $1.50.*

Reviewed by James A. Lee

IN RESPONSE to a request in 1920 from the Smithsonian Institution for the assistance of the National Bureau of Standards in the revision of the Smithsonian Physical Tables, a compilation of the available information on the properties of materials was undertaken. It was found that many of the requests received at the Bureau for data on the mechanical properties of metals could be answered by reference to the tables compiled for the Smithsonian Institution and they were published as Physical Properties of Materials, Circular C101 of the National Bureau of Standards. The first edition was compiled by H. A. Anderson. In response to continuing demand for information of this type, a second considerably expanded edition was prepared in 1924 by S. N. Petrenko.

The preparation of the present circular was undertaken to bring the information up to date by the inclusion of data on the numerous new alloys which have been introduced since 1924. Because of the increasing importance of knowledge of the properties of metals at high and low temperatures, the tables dealing with materials under these conditions have been expanded. In response to requests for information on electrical and thermal conductivities and thermal expansion in connection with welding problems, tables dealing with these properties have been added. The tables have been rearranged to assist the engineer in locating quickly data on any desired alloy.

FIREWORKS

PYROTECHNICS—CIVIL AND MILITARY. *By C. W. Weingart. Published by Chemical Publishing Co., Brooklyn, N. Y. 220 pages. Price $5.*

Reviewed by Jules Bebie

THIS book is of special interest to people making or contemplating the making of fireworks. It presents the know-how of this craft and industry and is divided into four parts as follows: Ingredients; Manipulation, Tools and Appliances Used; Articles of Manufacture and Formulas; Exhibition Fireworks. Many illustrations throughout the book effectively support the explanations and instructions given in the text.

Part 1 lists about forty of the chief ingredients employed in pyrotechny and gives some brief information concerning their source, properties, specifications, prices and uses. Only two references are made to application in military pyrotechnics. Under aluminum, ammonium chloride, gun powder, yellow phosphorus, no mention is being made of their use for military purposes.

The second part deals with the tools and appliances for the making of cases for candles, shells, rockets and gerbes, as well as with the various operations involved in loading and finishing those devices, such as ramming, matching, priming, wiring, etc.

The third and principal part of the book (134 pages), is devoted to the fabrication of the common types of fireworks, including torches, Roman candles, sky rockets, pin wheels, serpents, mines, stars, comets, balloons, smoke and spark pots, etc. Formulas are given for the respective pyrotechnic compositions and instructions on the technique for their preparation and loading. Airplane flares, wing tip flares and rocket smoke tracers are the only military pyrotechnic devices included in this chapter. Under smoke screens only titanium tetrachloride is mentioned. No reference is made to the three other smoke producing agents which are official in Chemical Warfare Service nor to the devices used for dispersion such as military candles and smoke pots.

In part four brief reference is made to the design and manufacture of more intricate pieces of fireworks such as rocket wheel, revolving globe, mosaics, lattice poles, etc., and it concludes with a detailed description of the making of Chinese firecrackers.

The author of the book is a specialist in the field of pyrotechny and as he states in the preface the formulas given are those in actual use and the machines and tools shown are those in use. This makes the book valuable to makers of fireworks and as a record of authentic information on this specialized branch of chemical technology. Information on military pyrotechnics is meager and for the general reader the book is overpriced.

RECENT BOOKS RECEIVED

Applications of Electrochemistry. Vol. II. 2nd ed. By W. A. Koehler. Wiley. $5.

The Chemistry of Cellulose. By Emil Hauser. Wiley. $7.50.

Lange's Handbook of Chemistry. 5th ed. By N. A. Lange, G. M. Forker & R. S. Burington. Handbook Publishers. $6.

Materials and Processes. Ed. by J. F. Young. Wiley. $5.

Modern Synthetic Rubbers. 2nd ed. By H. Barron. Van Nostrand. $6.50.

The Organic Chemistry of Sulfur. By C. M. Suter. Wiley. $10.

Physico-Chemical Methods. 4th ed. By J. Reilly & W. N. Rae. Van Nostrand. $17.50.

Plastic Working in Presses. 3rd ed. By E. V. Crane. Wiley. $5.

Practical Metallurgy for Engineers. Revised ed. Houghton. $3.

LATIN-AMERICAN SPANISH

ENGINEERS' DICTIONARY, SPANISH-ENGLISH AND ENGLISH-SPANISH. *By Louis A. Robb. Published by John Wiley & Sons, New York, N. Y. 423 pages. Price $6.*

Reviewed by M. G. Callaham

RECENT interest in South America has resulted in the appearance of a number of technical Spanish-English dictionaries. Yet Robb's Engineers' Dictionary is the first to be compiled in the living language of the developing South American countries rather than in the language of Spain, a country that can offer little more than a romantic past.

Although the author is modest in his claims and insists that his dictionary is chiefly for civil engineers, it is actually an excellent reference for chemical and other engineers. The vocabularies of most previous dictionaries are more suitable to the technical salesman, whereas this dictionary contains terms of interest to active engineers. These terms can be depended upon for their accuracy, since they have been compiled with painstaking care by a practising engineer over a period of more than 25 years.

It has both a Spanish-English and English-Spanish section with approximately 23,000 words in each section. The proportion of ordinary, non-technical words is exceptionally low, which increases its reference value as compared with those technical dictionaries which are highly padded with a large proportion of easy-to-find common terms. It is amusing to note that this dictionary, being printed on very good paper and having excellent typography, is about one third the bulk and almost half the price of a recently published technical Spanish dictionary which claims to have 25,000 words in each section.

The Engineers' Dictionary covers a wide variety of subjects, including excellent and numerous terms in civil engineering, mining, geology, mechanics, machinery, electricity, chemistry and other fields of particular interest to engineers. There are even such terms as "bactericide" (which does not appear in one of the earlier and supposedly more comprehensive technical dictionaries). The chemical vocabulary is ample for anyone with even a smattering of chemistry, since these terms are very much alike in Spanish and English.

All the English terms are in idiomatic, American English. Not only is the Spanish vocabulary South American but the author also indicates the special meanings a term may assume in different countries, which is both an unusual and extremely useful feature. For example, the Spanish term "escape," which generally means "leak; exhaust, outlet," is used in the sense of a railroad "siding" in Mexico. "Nave," meaning "ship," is a shed in Cuba.

Every engineer who adds this dictionary to his library can rest assured that he has a really scientific and reliable reference that will not get out of date for many

years. It is a pity that this dictionary was preceded by some compilations the sole purpose of which was to exploit the times, but Mr. Robb can be congratulated on having done a job that far surpasses anything in its line.

QUANTITATIVE ANALYSIS

A Short Course in Quantitative Analysis. *By Hobart H. Willard, N. Howell Furman and John F. Flagg. Published by D. Van Nostrand Co. Inc., New York, N. Y. 253 pages. Price $2.50.*

Advanced Quantitative Analysis. *By Hobart H. Willard and Harvey Diehl. Published by D. Van Nostrand Co., New York, N. Y. 457 pages. Price $4.75.*

Reviewed by F. C. Nachod

The first text, based on Willard and Furman's "Elementary Quantitative Analysis" as a framework, represents a good short course of the subject matter. A number of drawings illustrate various techniques very well so that the book can be used also for self-study, i.e. in absence of a lecture course or recitation periods. If the text is to be used in the education of assistants in industrial laboratories, a short paragraph (with illustrations) on the chainomatic balances would be valuable.

The advanced text is designed to be a companion volume the above mentioned Willard and Furman text on elementary analysis. It contains a great deal of detail. After the introduction and general operations, chapters are devoted to the analysis of iron ore, iron, steel and alloy steels, to the determination of alkali metals, of the elements in the eight groups, and even to atomic weight determinations. This last chapter is questionable as to its general usefulness, as it is believed that anybody confronted with such a task would still have to look up the basic researches of Hoenigschmid and others.

Expressions such as "The molecular weight of calcium carbonate," on page 129, should definitely be discouraged in an advanced text, when discussing compounds which due to their ionic structure have no "molecular weight" but a formula weight.

HIGH OCTANE

Aviation Gasoline Manufacture. *By Matthew Van Winkle. Published by McGraw-Hill Book Co., New York, N. Y. 275 pages. Price $3.*

Reviewed by W. L. Nelson

The increasing importance of aviation in both peace and war cannot be denied. Under the duress of war the development of aviation gasoline manufacture has progressed too rapidly for general comprehension, even to fast for recording. Under such conditions the most that can be asked is an analysis of scattered trade or even news literature and in this respect Van Winkle does a valuable service in presenting this excellent review of important literature. Although manufacturing changes are occurring more rapidly than books can be published and although much of the information in the literature consists of proposals rather than practice, the very urgency of the situation makes any digest of double value.

The conscious effort in Chapter III (Specifications) and Chapter IX (Performance) and throughout the entire book to indicate the operational significance of the test-properties of aviation gasoline is creditable. All too frequently our interest in purely technical matters and the intricacies of plant operation, leads us away from the performance of the plant product. This important consideration is not neglected. The chapters on the manufacture of base stocks (V) and anti-knock hydrocarbons (VI) are perhaps the least satisfactory because published information is meager and because hopes and facts are confusingly interlocked in much of the literature.

With the end of the war the petroleum industry will be confronted with the utilization of the enormous manufacturing facilities now producing military fuel. This book contains the background, the seeds of action, for approaching this task. Barring the unlikely development of new type engines which do not need anti-knock fuels, much of this equipment will continue to operate for the production of high-octane gasoline. Other parts of the equipment may form the basis for the manufacture of organic chemicals and the parts of the book that pertain to hydrocarbon manufacture may form in part the basis for this conversion.

Aviation fuel manufacture is more intricate than anything heretofore attempted by the industry, and hence plant men who are familiar with only topping, cracking and oil manufacture, should not neglect the developments disclosed in this book.

RECENT BOOKS & PAMPHLETS

Classified Directory, 1944. Published by Association of Consulting Chemists and Chemical Engineers, 50 E. 41 St., New York 17, N. Y. 89 pages. Gratis. Revised and enlarged edition listing members of the Association together with services they are prepared to render.

Unloading Anhydrous Hydrofluoric Acid from Cylinders. Manual H-2, published by Manufacturing Chemists' Association, 608 Woodward Bldg., Washington, D. C. 6 pages. Price 10 cents. Describes recommended methods for handling and discharging steel pressure cylinders containing anhydrous HF.

Microbiological Control — Industrial Waters. Technical publication 245, published by Wallace and Tiernan, Belleville, N. J., 12 pages. Industrial water chlorination—cooling waters, process waters, chlorine metering in chemical processes and sanitary effects of industrial water treating.

Engineering Education in the Soviet Union. By J. E. Tolpin, Universal Oil Products Co., Chicago, Ill. 17 pages. Industrial background, labor, general education, vocational training, engineering colleges. A reprint from the *Journal of Engineering Education.*

Bibliography and Abstracts on Electrical Contacts. Published by American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa. 137 pages. Price $5. An extensive compilation of references to the literature on electrical contacts, together with a large number of abstracts of the material cited.

Fats, Oils, Detergents. Published by Interscience Publishers, 215 Fourth Ave., New York, N. Y. Price $36 per year. An abstract service of 12 issues per year to cover chemistry and technology of oils, fats, greases, waxes, and other detergents. First issue (48 pages) contains table of contents and several abstracts from American, British and Swiss sources.

National Product, War and Prewar. By Simon Kuznets. Published by National Bu-

reau of Economic Research, 1819 Broadway, New York 23, N. Y. 54 pages. Price 50 cents. Our Economy in War, Occasional Paper 17.

Electronic Physics. By L. G. Hector, H. S. Lein and C. E. Scouten. Published by The Blakiston Co., Philadelphia, Pa. 355 pages. Price $3.75. A second-term physics textbook covering electricity and light. Two-color line drawings are used extensively to stress and clarify important points.

Directory of War Agencies, February 21, 1944. War Service Bulletin No. 104. Available from U. S. Chamber of Commerce, Washington 6, D. C. Price 25 cents.

Training Teamwork. Published by War Manpower Commission, Apprentice-Training Service, Washington, D. C. 12 pages. In two parts, operations of Joint Apprenticeship and Training Committees in several plants are reported, and an explanation of the ways in which joint committees operate.

The Aliphatic Alcohols: Their Toxicity and Potential Dangers in Relation to Their Chemical Constitution and Their Fate in Metabolism. By W. F. von Oettingen. Public Health Bulletin No. 281, available from Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 253 pages. Price 35 cents.

Rubber Red Book. 1943 edition. Published by *The Rubber Age*, 250 W. 57 St., New York 19, N. Y. 579 pages. Price $5. Directory of manufacturers, machinery and equipment, products and services. Includes a Who's Who in the rubber industry.

The Constituents of Wheat and Wheat Products. By C. H. Bailey. Published by Reinhold Publishing Corp., New York, N. Y. 332 pages. Price $6.50. A. C. S. Monograph No. 96. Descriptive biochemistry.

Conservation of Fuel for War. By Oliver Bowles. Available from The Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N. Y. 21 pages. Describes loose, granulated, blanket, block, board and pipe covering types of mineral wool insulation with examples of equipment and places where each product may be used to obtain best results.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, 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.

Production of Industrial Explosives in the United States During the Calendar Year 1942. By W. W. Adams and V. E. Wrenn. Bureau of Mines. Technical Paper 658. Price 10 cents.

Annual Report of Research and Technologic Work on Coal, Fiscal Year 1943. By A. C. Fieldner and others. Bureau of Mines. Information Circular I. C. 7272. Mimeographed.

Investigation of the National Defense Program. Third Annual Report of the Truman Committee. Senate Report No. 10, Part 16. 78th Congress, 2nd Session. Price 75 cents.

Magnesium. Investigation of the National Defense Program (Truman Committee).

Senate Report No. 10, Part 17. 78th Congress, 2nd Session Price 10 cents.

Report on War and Post-War Adjustment Policies, February 15, 1944. By Bernard M. Baruch and John M. Hancock. Price 20 cents.

Fourteenth Report to Congress on Lend-Lease Operations, for the Period Ended December 31, 1943. Price 20 cents.

United States Consumption of Food in Terms of Fats, Proteins, Carbohydrates, and Calories, 1939-43. U. S. Tariff Commission.

Directory of Consumers' Cooperatives in the United States, as of January 1, 1943. Bureau of Labor Statistics. Bulletin No. 750. Price 15 cents.

Bureau of Standards Publications. The publications which have been issued by the Bureau of Standards since its founding are now almost completely listed in a set of three documents as follows: Circular C24, 7th Edition (covering the period 1901 to June 30, 1925), Price 25 cents; 1925-1931 Supplement to C24 (covering the period July 1, 1925 to December 31, 1931), Price 25 cents; 1932-1941 Supplement to C24 (covering the period January 1, 1932 to December 31, 1941, with subject and author indexes covering the period 1901 to 1941), Price 50 cents. Complete list $1.00.

Polarimetry and Its Application to the Sugars and Their Derivatives. List of Publications by the Staff of the National Bureau of Standards. Letter Circular LC-741. Mimeographed.

Census of Pulp Mills and of Paper and Paperboard Mills: 1943. Bureau of the Census. "Facts for Industry" Series 24-1-2. Mimeographed.

Control of Mole Crickets by Use of Poisoned Baits. By C. B. Wisecup and N. C. Hayslip. Department of Agriculture. Leaflet No. 237.

A Victory Gardener's Handbook on Insects and Diseases. By W. H. White and S. P. Doolittle. Department of Agriculture. Miscellaneous Publication No. 525.

Granular Ammonium Nitrate. Department of Agriculture. Leaflet No. AWI-81.

Uses and Dosages of Cryolite for Insect Control. Bureau of Entomology and Plant Quarantine. No. E-610. Mimeographed.

Bland Apple Sirup. By H. H. Mottern and R. H. Morris. Bureau of Agricultural and Industrial Chemistry. No. AIC-37. Mimeographed.

Food Program for 1944. War Food Administration. Price 15 cents.

Economic and Political Aspects of International Cartels. Senate Committee Monograph No. 1. 78th Congress, 2nd Session. Price 15 cents.

Precipitation of Copper from an Acid Mine Water. By F. S. Warman and A. H. Roberson. Bureau of Mines. Report of Investigations R. I. 3746. Mimeographed.

Studies on Explosives and Explosions, Fiscal Year 1943. By Wilbert J. Huff. Bureau of Mines. Report of Investigations R. I. 3745. Mimeographed.

Geology and Ore Deposits of the Cottonwood-American Fork Area, Utah. (incl. 18 maps in separate case). By F. C. Calkins and B. S. Butler. Geological Survey. Professional Paper 201. Price (text and map case), $3.50.

Stratigraphy and Fauna of the Louisiana Limestone of Missouri. By James Steele Williams. Geological Survey. Professional Paper 203. Price 50 cents.

Vanadium-Bearing Magnetite-Ilmenite Deposits Near Lake Sanford, Essex County, New York. By J. R. Balsley, Jr. Geological Survey. Bulletin 940-D. Price 60 cents.

Manganese Deposits of the Lyndhurst-Vesuvius District, Augusta and Rockbridge Counties, Va. By M. M. Knechtel.. Geological Survey. Bulletin 940 F. Price 30 cents.

Mechanical Properties of Metals and Alloys. By John L. Everhart and others. Bureau of Standards. Circular C447. Price $1.50.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog on the following items: Insulation; Laminated-Asbestos, HH-I-561a. Soap; Saddle, P-S-609. Paint; Ready-Mixed, Olive-Drab, TT-P-81a. Sodium-Dichromate; Technical-Grade, O-S-595. Carbon Tetrachloride; Technical-Grade, O-C-141. Price 5 cents each.

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Acid Proof Cement. Electro Chemical Supply & Engineering Co., Paoli, Pa.—2-page form giving in outline the characteristics, applications, reactions, and technical data of Brimsto acid proof cement.

Air Flotation. Sutton, Steele & Steele, Inc., Dallas, Texas—4-page bulletin entitled "Separating Dry Commodities by Specific Gravity," illustrating separation by difference between bulk density of stock and its contaminations. Also describes this concern's Air Float Stoner.

American Steel. American Iron and Steel Institute, 350 Fifth Ave., New York, N. Y.—24-page booklet, "Weapons That Win", describing the new war roles for American steel, and the part played by its more than 90,000,000 tons of productive capacity on the balance scales of the war. Illustrated.

Austenitic Manganese Steel. American Manganese Steel Division, American Brake Shoe Co., Chicago Heights, Ill.—16-page booklet, "Manganese Steel for Oil Field Service," describing and illustrating the applications of austenitic manganese steel, its properties and advantages, in oil field service use. Bulletin 244-P.

Automatic Control. The Bristol Co., Waterbury 91, Conn.—6-page bulletin describing Bristol Pyromaster potentiometer pyrometer controllers, both thermocouple and radiation types. Illustrated. Bulletin DM008.

Axial-Flow Fans. Buffalo Forge Co., Buffalo, N. Y.—20-page illustrated bulletin describing the various types and applications of this company's axial-flow fans. Bulletin 3229B.

Boiler Cleaning. Water Service Laboratories, Inc., 432 W. 126th St., New York, N. Y.—4-page form illustrating and discussing very briefly this concern's "Boil-Out" boiler cleaning service for internal cleaning of heating boilers.

Bonding Process. U. S. Stoneware, Akron, Ohio—12-page illustrated booklet describing the Reanite bonding process for uniting metal to metal, or rubber, synthetic rubber, plastics, leather or wood to metal, or to each other. Bulletin 1800.

Bulk Material Conveying. Ajax Flexible Coupling Co., Westfield, N. Y.—Bulletin covering Ajax Lo-Veyors with data on applications of open and covered pan and tubular types covering many industries including abrasives, ceramics, foods, chemicals, foundries, and others conveying dry aggregates. Bulletin 32.

Chemical Thermometers. Faichney Instrument Corp., Watertown, N. Y.—52-page illustrated booklet on the company's etched stem thermometers. Includes clinical, chemical, and laboratory types and also gives a temperature conversion table. Catalog No. 44.

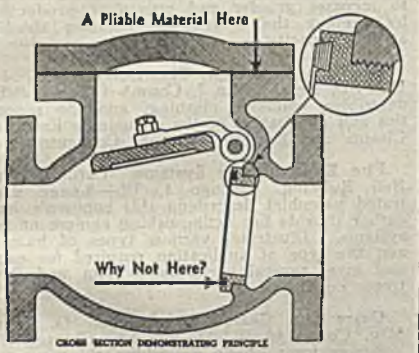
Combustion Equipment. Hauck Mfg. Co., 124-136 Tenth St., Brooklyn, N. Y.—112-page data book, "Hauck Industrial Combustion Data," for anyone concerned with the selection, installation, operation and maintenance of combustion equipment, either oil or gas, on furnaces, ovens, kilns, retorts, and other heat processing equipment.

Conveyors. Robins Conveyors, Inc., Passaic, N. J.—24-page pamphlet presenting the facilities, operations, and products of the company. Illustrated.

Electric Trucks. Baker Industrial Truck Division, The Baker Raulang Co., 2168 West 25th St., Cleveland 13, Ohio—20-page spiral bound electric truck catalog. It is an illus-

WHEATLEY'S

"Syn-Rub-Seal"



Pat. Applied For

SYNTHETIC RUBBER SEAL FULL OPENING, SWING CHECK

VALVE

Equipped with Wheatley Synthetic Seal —a synthetic rubber ring dovetailed and fitted into a removable bronze seat also dovetailed to accept this rubber ring. When the bronze clapper falls against this rubber, a perfect seal is formed regardless of what irregularities have deposited on the seat or in the fluid, such as sand, scale and cuttings which under pressure ordinarily would completely cut out a hard-surfaced seat.

Preferred by the United States Engineers on projects handling high octane gasoline.

Sizes 2" to 24"
Pressures
125 lbs. to 2000 lbs.
Series 15-30-40-60
and Ludlow
FBE - SBE - SOE & FOE
Steel-Iron-Bronze

- The rubber ring conforms to all deposits and obstacles and makes it possible for this valve to seal under the worst conditions.
- Seals regardless of viscosity.
- Operates equally well on kerosene or crude.
- Absolutely silent in operation. Ideal for refineries and pumping stations where the slapping of metal check valve clappers is annoying.
- No lapping or grinding of seats necessary.
- Renewable bronze seat ring, into which the rubber ring is inserted, can be replaced by the standard metal to metal seat, if desired.

Write for Bulletin No. CM-1

WHEATLEY
PUMP and VALVE MFR.
Hale Station, Sand Springs Road
TULSA, OKLAHOMA

ONE-HAND ACTION

Portable, lightweight, Randolph "4" is designed for one hand, self-aimed operation. With no hoses to twist, valves to turn, horns to raise—this extinguisher is PANIC PROOF.

Especially adapted for bracketing in shops, shipyards, power plants, automotives.

IN fighting machine, electric, flammable liquid fires—ACTION counts! With the Randolph "4", it's ACTION you get—*quick—thorough—easy!*

Just AIM—touch the trigger—and powerful carbon dioxide charges into the flames—smothers the fire in a penetrating, icy blanket.

Randolph "4" carbon dioxide is SAFE. Does not conduct electricity—will not damage food, equipment, or machinery. *Approved, labeled by Underwriters' Laboratories, Inc.*

Mobilize your fire protection with Randolph "4". For prompt delivery, phone your nearest supply house or write Randolph Laboratories—today.

NOW PUBLISHED—*Send for free, illustrated booklet "Sharpshooting at Flames." Explains latest techniques in fighting fires with carbon dioxide.*

RANDOLPH LABORATORIES, *Inc.*

8 EAST KINZIE STREET, CHICAGO 11, ILLINOIS, U.S.A.

trated handbook of information on material handling with power trucks. Electric truck catalog 52.

Electronic Feeder Control. Mosher Electronic Controls, 130 W. 42nd St., New York, N. Y. —4-page illustrated form describing this concern's electronic feeder control which is said to increase grinder and pulverizer production by keeping the equipment operating steadily at full capacity.

Emulsion Cleaning. The Enthone Co., 442 Elm St., New Haven 2, Conn.—4-page bulletin describing emulsion cleaning, and the properties and application of the company's Emulsion Cleaner and Emulsion Cleaner Concentrate.

Fire Extinguishing Systems. Cardox Corp., Bell Building, Chicago 1, Ill.—8-page illustrated pamphlet describing this concern's bulk carbon dioxide fire extinguishing equipment and systems. Illustrates various types of hazards and the type of application required for each, and gives typical performance data under extreme conditions.

Gears and Geared Drives. D. O. James Mfg. Co., 1140 W. Monroe St., Chicago, Ill. —8-page form briefly describing this concern's gears and gear reducers and their facilities for their production.

Haulage Vehicles. Clark Tructractor Division, Clark Equipment Co., Battle Creek, Mich. —72-page vest pocket catalog illustrating and carrying specification data on every model of Clark Tructractor industrial haulage vehicles.

Heat Diffusers. Carrier Corp., Syracuse 1, N. Y.—4-page folder describing advantages of four models of Carrier blower-type heat diffusers in heating and ventilating large areas. Includes charts of BTU constants, steam ratings, and dimension drawings of horizontal suspended units, vertical suspended units, and floor-mounted units. Bulletin 30-C-45.

Heat Treatment. Surface Combustion, Toledo 1, Ohio—24-page illustrated, spiral-bound booklet, "Heat for the Glass Industry." It briefly describes and illustrates various types of modern equipment for the heat treating of glass.

Hydraulic Presses. The Hydraulic Press Mfg. Co., Mount Gilead, Ohio—38-page booklet describing and illustrating the types and applications of the hydraulic press in various industries including rayon and plastics. Bulletin 36.

Impression Die Forgings. The Steel Improvement and Forge Co., Cleveland, Ohio—36-page reference data book entitled "The Improvement of Metals by Forging," containing technical data on types of forgings, forging design principles, forging processes, the metallurgy of forging, and metal specifications and physical properties of various widely used steels. Employs charts, photographs, and detail drawings.

Induction Heating. The Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland 1, Ohio—32-page illustrated booklet describing 16 industrial uses of high frequency electrical induction heating and telling of progress in this art in 1943.

Industrial Rubber Products. The Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.—A folder detailing this concern's products manufactured for the mining industry.

Industrial Wire Cloth. Buffalo Wire Works Co., Inc., 320 Terrace, Buffalo, N. Y.—8-page bulletin offerring explanatory information and tables on how to select and specify all types of industrial wire cloth. Bulletin 603.

Inspection Chart. The Lincoln Electric Co., Cleveland, Ohio—A graphically illustrated welding inspection chart designed so that operators and inspectors can tell at a glance whether welds are being properly made. Includes a description of Fleet-Fillet welding technique.

Mercurial Thermostats. Bender Scientific Glass, Inc., 2529 North Carlisle St., Philadelphia 32, Pa.—Bulletin illustrating and describing this company's straight and angle type thermostats. Bulletin 344.

Metallizing Accessories. Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y.—Catalog describing metallizing guns, wires, surface preparing tools, and other metallizing accessories. Catalog 428.

Metallurgical Laboratory Apparatus. Central Scientific Co., 1700 Irving Park Road, Chicago 13, Ill.—20-page illustrated booklet describing this concerns equipment for the analysis of metals in industrial laboratories. Bulletin 76.

Modern Plants. Ford, Bacon & Davis, Inc., 39 Broadway, N. Y.—12-page pamphlet illus-

trating several new developments that have come out of the record breaking construction of new plants in the past three years. Bulletin 564.

Pilot Plants. Blaw-Knox Div., Blaw-Knox Co., Blaw-Knox, Pa.—24-page illustrated booklet discussing in detail the company's pilot plants for chemical process development. Also covers the modern methods of chemical technology and the sequence of steps in chemical plant evolution. Catalog 1957.

Plastic Refractory. Basic Refractories, Inc., Cleveland 15, Ohio—4-page bulletin illustrating and describing the concern's 695 Plastic, a highly refractory, strong magnesia plastic for taphole construction and hot repairs. Bulletin PI-44.

Polyvinyl Resins and Plastics. The B. F. Goodrich Co., Akron, Ohio—4-page illustrated folder describing the properties, characteristics, and applications of Geon resins and plastics.

Power Transmission. Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.—44-page booklet describing this concern's line of fractional horsepower V-belts and sheaves. It offers simplified engineering data for fractional horsepower drives, and includes working formulas from which such drives can be correctly engineered. Amply illustrated. Bulletin B6249.

Process Plants. Acme Coppersmithing & Machine Co., Oreland, Pa.—12-page illustrated pamphlet describing Acme process plants and process plant equipment.

Proportioning Pumps. Proportioneers, Inc., Providence 1, R. I.—16-page catalog and handbook on proportional feeding equipment, showing specific applications of the company's pumps for continuous automatic proportioning of fluids. Flow diagrams included. Bulletin 1100.

Quench Baths. Ajax Electric Co., Inc., Frankford & Delaware Ave., Philadelphia 23, Pa.—16-page illustrated reprint of the article "Isothermal Quench Baths Applied to Commercial Practice." 20 figures included.

Soldering Compound. Metallizing Company of America, 1330 W. Congress St., Chicago 7, Ill.—1-page bulletin containing applications, directions, and general information on Mogul Flux. Bulletin 17.

Spray Nozzles. Spraying Systems Co., 4023 W. Lake St., Chicago 24, Ill.—32-page catalog illustrating and describing in detail characteristics, dimensions and performance data of standard spray nozzles and related equipment. Includes descriptions of humidifying assemblies, roof spraying systems, and cooling tower assemblies. Gives tables of useful engineering data. Catalog 22.

Speed Reducers. Winfield H. Smith, Inc., Springville, Erie County, N. Y.—24-page illustrated booklet containing sections on applications of WHS Worm Gear Speed Reducers, some installations, and illustrations of other special units and products. Bulletin 244(5M).

Stainless-Clad Steel. Jessop Steel Co., Washington, Pa.—Catalog containing information on analyses, applications, manufacture, fabrication, styles of heads and standard size of sheets and plates. Also sections on deep drawing, grinding, polishing, cleaning, gas-cutting, riveting, soldering, and welding.

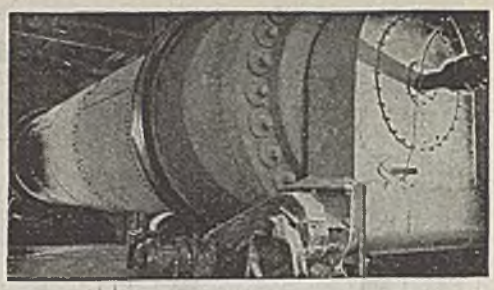
Synchronous Motors. Electric Machinery Mfg. Co., Minneapolis 13, Minn.—4-page bulletin illustrating motor construction and design, and discussing synchronous motor control. Bulletin 173.

Vitreous Silica. The Thermal Syndicate, Ltd., 12 East 46th St., New York. N. Y.—4-page bulletin describing Vitreosil crucibles, dishes, muffles, pots, retorts, tanks, and trays. According to the manufacturer this non-catalytic, non-porous material is immune to extreme chemical, thermal, and electrical conditions. Bulletin 8.

Water Softeners. Elgin Softener Corp., Elgin, Ill.—16-page illustrated bulletin describes zeolite water softeners and other water conditioning equipment. Also covers iron removal, filtration, aeration and boiler water conditioning. Bulletin 603.

Wire Cloth. Buffalo Wire Works Co., Inc., 320 Terrace, Buffalo, N. Y.—2-page form on Buff-Aloy abrasive resistant wire cloth for sand, stone, gravel and abrasive industries. Illustrated. Form No. 601.

Wire Grommet V-Belt. The B. F. Goodrich Co., Akron, Ohio—4-page folder on this concern's line of V-belts featuring general information concerning its new wire grommet type. Illustrated.



LOUISVILLE PIGMENTS DRYER DOES 50% MORE WORK— AT 23% OF FORMER COSTS!

Here's a beautiful example of what *proper engineering* can do to increase the capacity and to reduce the operating costs of production machinery. The dryer formerly used in the process described above was three times as large, and cost twice as much, as the Louisville Dryer which replaced it. It might have proved to be a very efficient and economical dryer in some other operation where the materials and conditions were entirely different. But in *this* application it was simply the wrong dryer for the right job!

FORMER DRYER	
Installed cost	$40,000
Annual production (tons)	6,000
Drying cost per ton	$3.72
(Space required, 1500 sq. ft.)	
LOUISVILLE DRYER	
Installed cost	$20,000
Annual production (tons)	9,000
Drying cost per ton	$0.83
(Space required, 500 sq. ft.)	
YEARLY SAVINGS OF LOUISVILLE DRYER, IN OPERATING COSTS ALONE	$14,850

Every Louisville Dryer is individually engineered for the individual job it is sold to do. Our calculations are then tested in our own pilot plant. The result is that when you buy a Louisville Dryer, you automatically get the most *economical drying* that specialized engineers can devise. Oddly enough, that often means more economical *buying*, too. May we send you all the facts? *Address:* Louisville Drying Machinery Co., *Incorporated*, 451 Baxter Ave., Louisville 4, Ky. (Subsidiary of General American Transportation Corp.)

CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

MODERATE INCREASE REPORTED FOR PRODUCTION AND CONSUMPTION OF CHEMICALS

INDUSTRIAL production as measured by the index of the Federal Reserve Board still is moving upward but the rate of increase has slowed down. The adjusted index for last December was 241 with the January rating going to 242 and the preliminary figure for February to 243. The sharp drop in the latter part of last year has not been fully reversed but the trend again is toward higher levels. On the other hand the Board's index for production of chemicals—using that term to include related products—continues the downward trend which started last November. The index for January was 360 and for February 356. This is in contrast to what the Board reports as industrial chemicals as production of the latter, with the exception of a slight setback in December, has moved up each month for a long time. The rising movement still is in evidence as the number for February moved up to 399 from the 397 reported for January. Here again, the monthly fluctuations are on a more moderate scale than they were last year.

The *Chem. & Met.* index for industrial consumption of chemicals in February is 181.14 with a revised number of 182.74 for January. Last year the corresponding numbers were 166.41 and 173.20 which indicate that normal lines are operating more actively than they did a year ago. This is especially true for some of more heavily weighted industries, such as fertilizer where efforts are being made to conform with a predetermined expansion program. Attempts to push up production of pulp and paper also are meeting with some success in the face of many adverse conditions.

The marked difference between an index for total production of chemicals and one for consumption in ordinary industrial channels is more understandable when one considers that production of ethyl alcohol is about six times what it was in the prewar era and that the greater part of this new output goes directly into war channels. The same is relatively true for other chemicals such as butadiene, styrene, and toluol. Much of the expanded production of plastics also is reserved exclusively for war needs. The fact that a wider use would be found for these chemicals in civilian lines if the supply situation would permit, serves to prove that these products will find a good market when the war outlets no longer exist.

The release of official figures for production of many of the more important chemicals makes it possible to measure monthly changes in output in a definite way. Enough data are available for different branches of chemical manufacture to offer a view of the industry as a whole. The totals for January as compared with those for December indicate some falling off in production of chemicals which are important in making high explosives. It is noted that activities at synthetic ammonia plants were slower than in December and also that more synthetic methanol was being turned out, which may mean that more of the latter will be allocated for anti-freeze uses. Production of such staple products as soda ash and sulphuric acid seems to be moving ahead on a fairly uniform monthly basis with the probability that acid outputs will increase later in the year when some new sources of supply get into action.

In connection with the status of general industry, it is noted that the movement of goods as forecast by anticipated freight car loadings will be about 3 percent above those for the corresponding period of 1943.

Chem. & Met. Index for Industrial Consumption of Chemicals

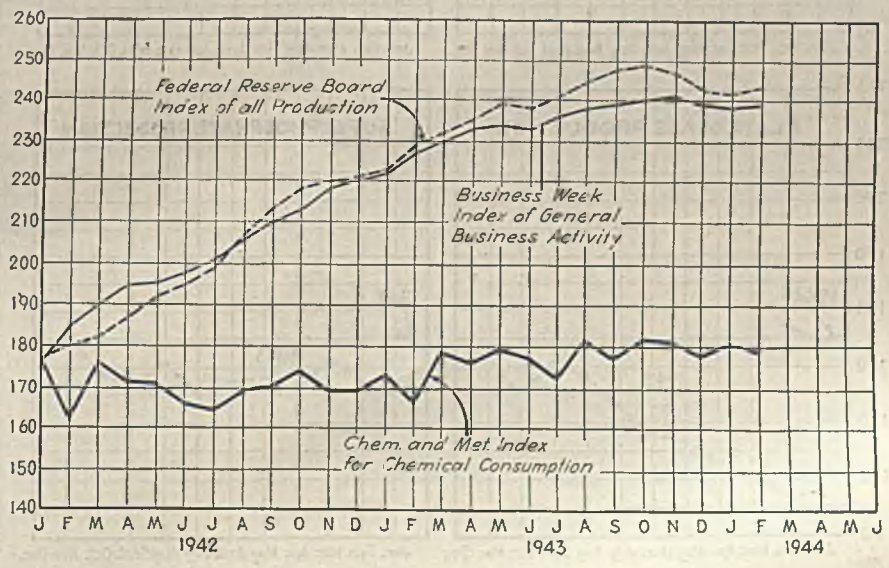
1935 = 100

	Jan. revised	Feb.
Fertilizer	42.65	44.30
Pulp and paper	19.40	18.70
Petroleum refining	17.38	16.42
Glass	20.10	19.50
Paint and varnish	14.24	14.82
Iron and steel	13.75	12.83
Rayon	16.41	16.38
Textiles	10.70	10.47
Coal products	10.12	9.90
Leather	4.40	4.20
Industrial explosives	5.19	5.32
Rubber	3.00	3.00
Plastics	5.40	5.30
	182.74	181.14

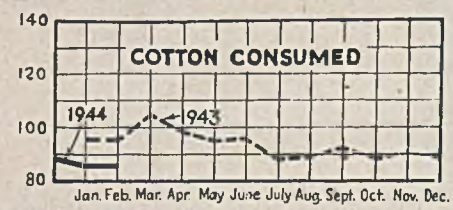
The advisory boards no longer include chemicals in their classification of commodities, hence no comparison with last year is offered. Of 28 commodity groups, the boards expect increased shipments in 17 and smaller shipments for 11. Expected increases in terms of percent are coal and coke, 13.6 fertilizers of all kinds, 5.5; sugar, syrup and molasses, 5.1; salt, 3.5; manufacturers and miscellaneous, 3.7.

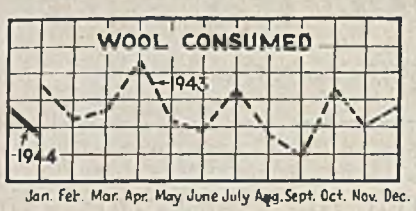
Among the commodity groups for which smaller shipments are predicted is petroleum and petroleum products for which a drop of 21.8 percent is forecast. A part of this anticipated drop may be accounted for by the fact that more petroleum will move this year by way of pipelines. A drop in shipments of cotton also is expected and to the extent of 13.3 percent. In view of the fact that large orders for cotton goods for Army accounts have been placed recently and that others are in prospect the drop in textile output has been disturbing and some stimulants may be used to bring activities back to their rate of two years ago. This probably would mean some priorities for replacement equipment, some grantings of deferment to essential workers and some readjustments in sales prices where higher producing costs have wiped out profit margins. Cotton mills are to adopt a 48-hour week.

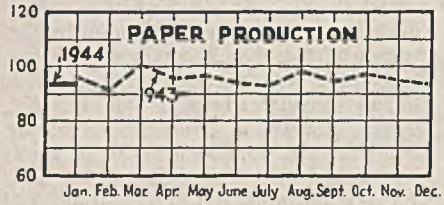
Some consuming industries, notably textile and paper, have been concerned with getting supplies of cornstarch. Last summer a similar situation existed when grinding plants were forced to close because they could not get corn to grind. At least three large mills have been closed in the last month for the same reason. It has been announced that more corn has been set aside for processing but this does not in itself promise relief unless the corn is started to move to consuming plants and is kept moving.

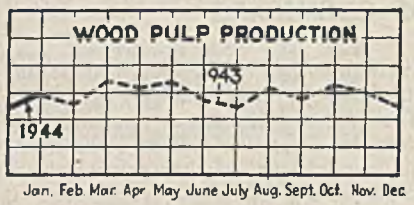


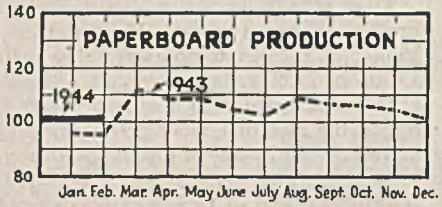
PRODUCTION AND CONSUMPTION TRENDS

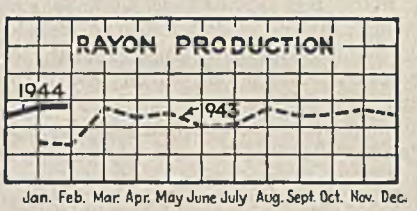


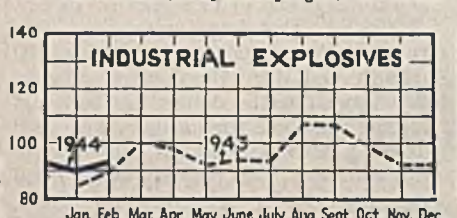


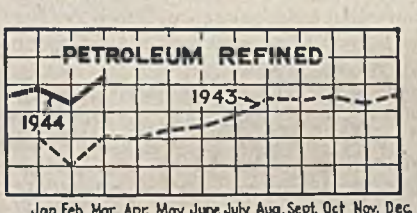


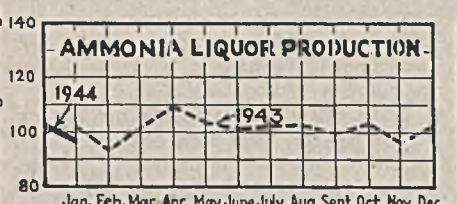


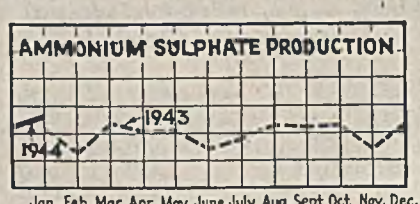


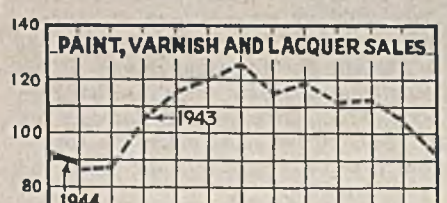


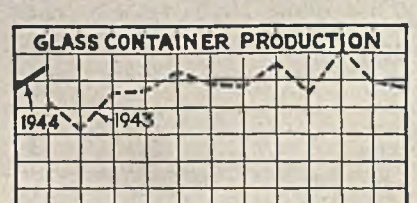


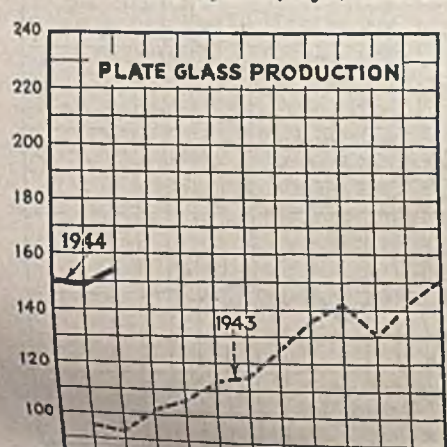


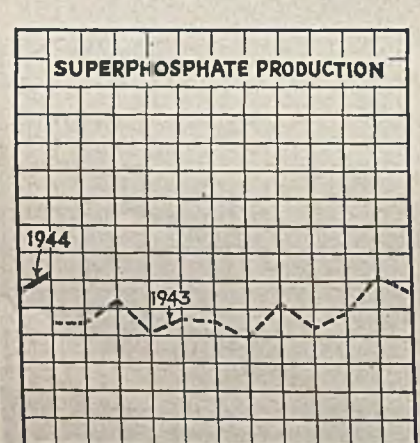












100 = Monthly Average for 1942

SCARCITY of experienced workers appears to be common throughout the industries which are large consumers of chemicals. In some cases this has been responsible for bringing plant operations below the levels of a year ago. Textile products are in demand but outputs are curtailed or at least are far below capacity rates. Cotton and wool are available in an ample way but rayon is none too plentiful owing to the greater use of yarn for specialized military purposes. From first quarter operations it may be deduced that consumption of chemicals in making textiles this year will fall considerably below the 1943 figures.

In the pulp and paper field much stress is still placed on the importance of getting out more pulp wood and in gathering larger stocks of waste paper. Despite the placing of minimums for paper and paperboard outputs, there is uncertainty about the availability of raw materials in sufficient quantity to make the minimums possible. However results so far have been encouraging. Minimum production for paper and paperboard for the first quarter was set at 4,196,511 tons and it is now reported that production in the second quarter amounted to 4,335,353 tons.

Makers of paint and varnish have been favored with a larger supply of some raw materials but found greater difficulty last month in maintaining a satisfactory working force and also more trouble in securing containers for shipment of their finished products. A large part of paint production is designed for military use which guarantees a large tonnage shipped out each month. Civilian requirements may not come up to normal this season as painting of private properties may be cut because of the scarcity of painters. Producing plants likewise will be forced to make some readjustments due to the fact the plea to keep use of linseed oil up to the 70 percent mark did not meet with approval.

The petroleum industry has been setting new records constantly with respect to the amount of crude oil processed each month. A new high was again reached in March. The war effort is responsible for a good part of the rising trend as some of the normal outlets have been materially curtailed. Refineries are not yet being worked at full capacity so that further highs are probable.

Most branches of the fertilizer industry are working under pressure. Tag sales have run unusually high and give promise of a record movement of mixed goods. Surmounting difficulties with labor and transportation of phosphate rock, makers of superphosphate are striving to turn out the large volume which WFA has been calling for.

The rubber industry is now a notable consumer of chemicals since production of synthetic is largely chemical and processing operations require a varied line of chemicals. Furthermore total consumption of rubber of all kinds will be larger this year according to present schedules. This has caused an especially active demand for carbon black.

FOR NON-FERROUS CHEMICAL PLANT NEEDS: *Check materials*

TYPICAL APPLICATIONS of Revere Copper and Copper-Base Alloys:

Heat Exchangers and Condensers	Mixers
Evaporators	Storage Tanks
Pressure Vessels	Reactor Vessels
Receivers	Fractionating Columns
Catalyst Tubes	and the like

We supply copper and copper-base alloys in: SHEET, STRIP, PLATE, ROD, BAR and SHAPES, TUBE and PIPE, WELDING ROD.

But whatever your problem may be in non-ferrous metal equipment, we can help you in THREE ESSENTIAL WAYS:

1 *Advise You* in the proper selection and fabrication of Revere copper and copper-base alloys so as to save time, increase output and reduce costs wherever possible.

2 *Give You* advice on Welding Techniques—practical assistance which will help in the completion of equipment when needed and thus insure uninterrupted service.

3 *Send You* our new MANUAL: "Revere Copper and Copper Alloys—Technical Information for Product Designers". Invaluable to anyone working with NON-FERROUS metals. 54 pages: 106 graphs relating to physical and metallographic properties under varying conditions; new chemical and physical properties chart; illustrated information on welding techniques, etc.

• • •

For these services or other advice, address: Executive Offices. No obligation, of course.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Avenue, New York 17, N. Y.

CHEM. & MET.
Weighted Index of Prices for CHEMICALS
Base = 100 for 1937

This month	109.55
Last month	109.49
April, 1943	108.83
April, 1942	109.54

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 April 13.

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	.10¾ – .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
Aqua ammonia, 26°, drums, lb	.02½ – .03
tanks, ton	65.00 –
Ammonia, anhydrous, cyl., lb	.16 –
tanks, lb	.04½ –
Ammonium carbonate, powd. tech., casks, lb	.09½ – 12
Sulphate, wks, ton	28.20 –
Amylacetate tech., from pentane, tanks, lb	.145 –
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium carbonate, bbl., ton	60.00 – 65.00
Chloride, bbl., ton	79.00 – 81.00
Nitrate, casks, lb	.11 – .12
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching power, 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	.14 – .15½
Epsom salt, dom., tech., bbl., 100 lb	1.90 – 2.00
Ethyl acetate, tanks, lb	.11½ –
Formaldehyde, 40%, bbl., lb	.05½ – .06
Furfural, tanks, lb	.09 –
Glaubers salt, bags, 100 lb	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18¾ –
Lead:	
White, basic carbonate, dry casks, lb	.08½ –
Red, dry, sck. lb	.09½ –
Lead acetate, white crys, bbl., lb	.12½ – .13
Lead arsenate, powd., bag, lb	.11½ – .12
Lithopone, bags, lb	.04½ – .04½
Magnesium carb., tech., bags, lb	.06½ – .06½
Methanol, 95%, tanks, gal	.58 –
Synthetic, tanks, gal	.28 –
Phosphorous, yellow, cases, lb	.23 – .25
Potassium bichromate, casks, lb	.09½ – .10
Chlorate, powd., lb	.09½ – .12
Hydroxide (c'stic potash) dr., lb	.07 – .0 ½
Muriate, 60% bags, unit	.53½ –
Nitrate, bbl., lb	.05½ – .06
Permanganate, drums, lb	.19½ – .20
Prussiate, yellow, casks, lb	.17 – .18
Sal ammoniac, white, casks, lb	.0515 – .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	15.00 –
Soda ash, light, 58%, bags, contract, cwt	1.05 –
Dense, bags, cwt	1.15 –
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06
Bicarbonate, bbl., cwt	1.70 – 2.00
Bichromate, casks, lb	.07½ – .08
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bl., lb	.03 – .04

CHEM. & MET.
Weighted Index of Prices for
OILS & FATS
Base = 100 for 1937

This month	145.24
Last month	145.24
April, 1943	146.03
April, 1942	143.89

Chlorate, kegs, lb	.06½ - .06½
Cyanide cases, dom., lb	.14½ - .15
Fluoride, bbl., lb	.07 - .08
Hyposulphite, bbl., cwt	2.40 - 2.50
Metasilicate, bbl., cwt	2.50 - 2.65
Nitrate, bulk, cwt	1.35 -
Nitrite, casks, lb	.06½ - .07
Phosphate, tribasic, bags, lb	2.70 -
Prussiate, yel. bags, lb	.9½ - .10
Silicate (40° dr.), wks., cwt	.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	.30½ -
Zinc, chloride, gran, bbl., lb	.05½ - .06
Oxide, lead free, bag, lb	.07½ -
5% leaded, bags, lb	.07½ -
Sulphate, bbl., cwt	3.85 - 4.00

OILS AND FATS

Castor oil, No. 3 bbl., lb	$0.13½ - $0.14½
Chinawood oil, bbl., lb	.38 -
Coconut oil, ceylon, tank, N. Y., lb	nom
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	.15½ -
Palm casks, lb	.09 -
Peanut oil, crude, tanks (mill), lb	.13 -
Rapeseed oil, refined, bbl., lb	nom
Soya bean, tank, lb	.11½ -
Menhaden, light pressed, dr., lb	.1305 -
Crude, tanks (f.o.b. factory) lb	.089 -
Grease, yellow, loose, lb	.08½ -
Oleo stearine, lb	.09½ -
Oleo oil, No. 1	.11½ -
Red oil, distilled, dp.p. bbl., lb	.11½ -
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., kgs., lb	.54 - .56
Benzyl chloride, tech., dr., lb	.23 - .25
Benzol, 90%, tanks, works, gal	.15 -
Beta-naphthol, tech., drums, lb	.23 - .24
Cresol, U.S.P., dr., lb	.11 -
Cresylic acid, dr., wks., gal	.81 - .83
Diphenyl, bbl., lb	.15 -
Diethylaniline, dr., lb	.40 - .45
Dinitrophenol	.23 - .25
Dinitrotoluol bbl., lb	.18 - .19
Dip oil, 15%, dr., gal	.23 - .25
Diphenylamine, dr. f.o.b. wks., lb	.60 -
H-acid, bbl., lb	.45 - .50
Hydroquinone, bbl., lb	.90 -
Naphthalene, flake, bbl., lb	.07 - .07½
Nitrobenzene, dr., lb	.08 - .09
Paracresol, bbl., lb	.41 -
Para-nitraniline, bbl., lb	.47 - .49
Phenol, U.S.P., drums, lb	.10½ - .11
Picric acid, bbl., lb	.35 - .40
Pyridine, dr., gal	1.70 - 1.80
Resorcinol, tech., kegs, lb	.75 - .80
Salicylic acid, tech., bbl., lb	.33 - .40
Solvent naphtha, w.w., tanks, gal	.27 -
Tolidine, bbl., lb	.86 - .88
Toluol, drums, works, gal	.33 -
Xylol, com., tanks, gal	.26 -

MISCELLANEOUS

Casein, tech., bbl., lb	$0.21 - $0.24
Dry colors	
Carbon gas, black (wks.), lb	.0335 - .30
Prussian blue, bbl., lb	.36 - .37
Ultramarine blue, bbl., lb	.11 - .26
Chrome green, bbl., lb	.21½ - .30
Carmine, red, tins, lb	4.60 - 4.75
Para toner, lb	.75 - .80
Vermilion, English, bbl., lb	2.75 - 2.80
Chrome yellow, C.P., bbl., lb	.14½ - .15½
Gum copal Congo, bags, lb	.09 - .30
Manila, bags, lb	.09 - .15
Demar, Batavia, cases, lb	.10 - .22
Kauri, cases, lb	.18 - .60
Magnesite, calc., ton	64.00 -
Pumice stone, lump, bbl., lb	.05 - .07
Rosin, H., 100 lb	5.41 -
Turpentine, gal	.88 -
Shellac, orange, fine, bags, lb	.39 -
Bleached, bonedry, bags, lb	.39 -
T. N. bags, lb	.31 -

NEW CONSTRUCTION

	Current Projects		Cumulative 1944	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$40,000	$40,000	$864,000
Middle Atlantic	$5,150,000	240,000	5,725,000	6,585,000
South	9,080,000	600,000	9,985,000	8,554,000
Middle West	170,000	2,050,000	295,000	8,492,000
West of Mississippi	5,825,000	3,794,000	15,265,000	12,475,000
Far West	80,000	900,000	620,000	5,480,000
Canada	80,000	.....	2,740,000	1,825,000
Total	$20,385,000	$7,624,000	$34,670,000	$44,275,000

PROPOSED WORK

Ark., Harrison—Advance Mining & Engineering Co., Harrison, plans to construct a zinc processing plant near here.

Ark., Malvern—Malvern Brick & Tile Co., Malvern, plans to reconstruct its brick plant recently destroyed by fire. Estimated cost $45,000.

Ark., Yellville—Hall Mountain Mining Co., Yellville, plans to construct a zinc processing plant here.

Ark., Yellville—S & G Zinc Co., Yellville, plans to construct a 200 ton zinc milling plant in Searcy Co.

Idaho—Idaho Falls—Idaho Falls Potato Starch Co. plans to construct a potato starch plant here. Estimated cost $80,000.

Ind., East Chicago—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., plans to construct a 1-story brick plant to be operated by Kinetic Chemicals, Inc., du Pont Bldg., Wilmington, Del. Estimated cost $90,000.

La., Lake Charles—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., plans to construct a plant to produce industrial alcohol from waste refinery gas on site of Continental Oil Refinery Co., to be operated by Petroleum Chemicals, Inc., Lake Charles. Estimated cost $9,000,000.

N. Y., Olean—Socony-Vacuum Oil Co., Inc., 1103 Elk St., Buffalo, is having revised plans prepared for an addition to its crude oil refinery; also contemplates a new high-octane gasoline refinery unit. Estimated cost $150,000 and $5,000,000 respectively.

N. C., Charlotte—Arnold Hoffman & Co., W. Bunch, Mgr., plans to enlarge its chemical plant on North Tryon St. Estimated cost $40,000.

Ohio, Marietta—Casto Rubber Co., Dr. G. Casto, Pres., Spencer, W. Va., plans to construct an addition to its plant for the manufacture of synthetic rubber. Estimated cost $40,000.

Tex., Amarillo—United Carbon Co., Sayre, Okla., plans the removal of the existing carbon black plant at Sayre and reconstruction and expansion of same in the vicinity of Amarillo.

Tex., Houston—E. I. du Pont de Nemours & Co., 1200 Walnut St., plans to construct a phenothiazine manufacturing plant. Estimated cost $5,500,000.

Tex., Houston—Texas Rubber & Specialty Corp., 920 Adele St., plans to rebuild its plant here. Estimated cost $40,000.

Tex., Odem—Stanolind Oil & Gas Co., Fair Bldg., Fort Worth, plans to construct a pressure maintenance plant. Estimated cost will exceed $40,000.

Tex., Sunray—Continental Carbon Co., Sunray, plans to construct a modern furnace black carbon plant unit. Estimated cost will exceed $40,000.

W. Va., Spencer—Casto Rubber Co., Dr. G. Casto, Pres., plans to construct a 1-story synthetic rubber manufacturing plant. Estimated cost $40,000.

Wis., Kaukauna—Sangamon Paper Mills plans to reconstruct its 2-story, 60x260 ft. paper mill recently destroyed by fire.

Ont., Dryden—Dryden Paper Co., Ltd., 7 Duke St., plans to construct 52x72x82 ft. and 52x72x62 ft. additions to its plant.

Ont., Rockwood—Greystone Chemical Co., Ltd., Rockwood, plans to construct a 1-story, 50x125 ft. plant.

CONTRACTS AWARDED

Conn., Naugatuck—Naugatuck Chemical Div. of United States Rubber Co., Elm St., has awarded the contract for the construction of a Latex storage unit to W. J. Megin, Inc., 51 Elm St. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $40,000.

Ill., Chicago—Enamelers & Japanners, 2900 West Belmont Ave., have awarded the contract for the construction of a 1-story factory addition to G. Kehl & Sons, 1225 North Maplewood Ave. Estimated cost $50,000.

Ia., Des Moines—Spencer Kellogg & Sons, Inc., 105 West Adams St., Chicago, Ill., has awarded the contract for the construction of an extraction plant at its soy bean plant to James Stewart Corp., 343 South Dearborn St., Chicago Estimated cost $250,000.

Miss., Natchez—Armstrong Tire & Rubber Co., Natchez, has awarded the contract for the construction of an addition to its plant to Harmon Construction Co., 1138 N. W. 4th St., Oklahoma City, Okla. Estimated cost $350,000.

N. J., Garwood—Plating Products Manufacturing Co., 847 South Ave., has awarded the contract for a 1-story plating factory to W. D. Snyder & Son, 96 Michigan Ave., Kenilworth. Estimated cost $40,000.

N. J., Gloucester—The Ruberoid Co., 500 Fifth Ave., New York, N. Y., has awarded the contract for a plant and warehouse to Wigton-Abbott Corp., 1225 South Ave., Plainfield. Estimated cost $100,000.

N. J., New Brunswick—New Brunswick Rubber Co., Super Highway, has awarded the contract for a 1-story addition to its plant to Frank Lamb Co., 256 Newkirk Ave., Trenton. Estimated cost $50,000.

N. J., North Brunswick—E. R. Squibb & Sons, 745 Fifth Ave., New York, N. Y., have awarded the contract for a laboratory addition on Georges Rd., to Wigton-Abbott Corp., 1225 South Ave., Plainfield. Estimated cost $50,000.

N. C., Navassa—Virginia-Carolina Chemical Co., Navassa, has awarded the contract for rebuilding its sulphuric acid plant to Leonard Construction Co., 37 South Wabash St., Chicago. Estimated cost $250,000.

Ohio, Cleveland—Industrial Rayon Corp., H. Rivitz, Pres., West 98th St. and Walford Ave., has awarded the contract for compressor house, crystallizer building, etc., to George A. Rutherford Co., 2725 Propect Ave. Estimated cost $2,000,000.

Tex., Corpus Christi—American Cyanamid & Chemical Corp., Corpus Christi, has awarded the contract for a processing building unit to J. W. Bermingham, 601½ Mesquite St., at $44,300.

Tex., Houston—Southern Acid & Sulphur Co., 7621 Wallisville Rd., has awarded the contract for a superphosphate fertilizer and chemical plant to United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, Pa. Project will be financed by Defense Plant Corp., Washington, D. C. Estimated cost $3,500,000.

Wash., Bellingham—Puget Sound Pulp & Paper Co., Bellingham, has awarded the contract for a ethyl alcohol production plant to Howard S. Wright & Co., Inc., 407 Yale Ave., N., Seattle. Estimated cost $900,000.