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Elbows	90° Short Radius	1"-30"	1½"-30"				
Elbows	45° Long Radius	½"-30"	¾"-30"*	1"-12"	1"- 8"	4"-24"	3"-12"
Returns	180° Long Radius	½"-24"	1"-24"	1"-12"	3"- 8"	4"-24"	3"-12"
Returns	180° Short Radius	1"-30"	1½"-30"				
Returns	180° Extra Long Radius	1"-2½"	1"-2½"				
Tees	Straight	¾"-24"	¾"-24"	1"-12"	1"- 8"		
Tees	Reducing Outlet	¾"-24"	¾"-24"	¾"-12"	1"- 8"		
Reducers	Concentric & Eccentric	[x⅜-24x20	[x⅜-24x20		[x⅜-12x10		
Caps		1"24"	1"-24"		1"- 8"		
Stub Ends	Lap Joint	1"24"	1"-24"				
Nipples	Shaped, 90° to Header	1¼"-12"	1¼"-12"				
Nipples	Shaped, 45° to Header	1¼"-12"	1¼"-12"				
Saddles			2"-24" **				
Laterals	Straight	1¼"-24"	1¼"-24"				
Laterals	Reducing-on Run	1¼"-24"	1¼"-24"				
Crosses	Straight	¾"-24"	¾"-24"				
Rings	Welding	¾"-12"	¾"-12"				
Sleeves	Welding		2"-24" **				

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Slip-On	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Lap Joint	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Threaded	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Blind	½"-24"	½"-24"	½"-24"†	½"-24"	½"-24"*	½"-24"	½"-24"
Socket Type	¼"-24"	¼"- 4"		¼"-3½"			
Reducing-threaded or slip-on	¾"-24"	¾"-24"	¾"-24"†	¾"-24"	¾"-24"*	¾"-24"	¾"-12"
Orifice—threaded		1"-24"	4"-12"	4"-12"	3"-12"	1"-12"	
Orifice—slip-on		1"-24"					
Orifice—welding neck		1"-24"	4"-12"	1"-12"	3"-12"	1"-12"	
Long Welding Neck	1"-24"	1"-24"	1"-10"	1"-10"	1"-10"	1"-10"	

†Dimensions on sizes thru 3½" same as for 600 lb. flanges.
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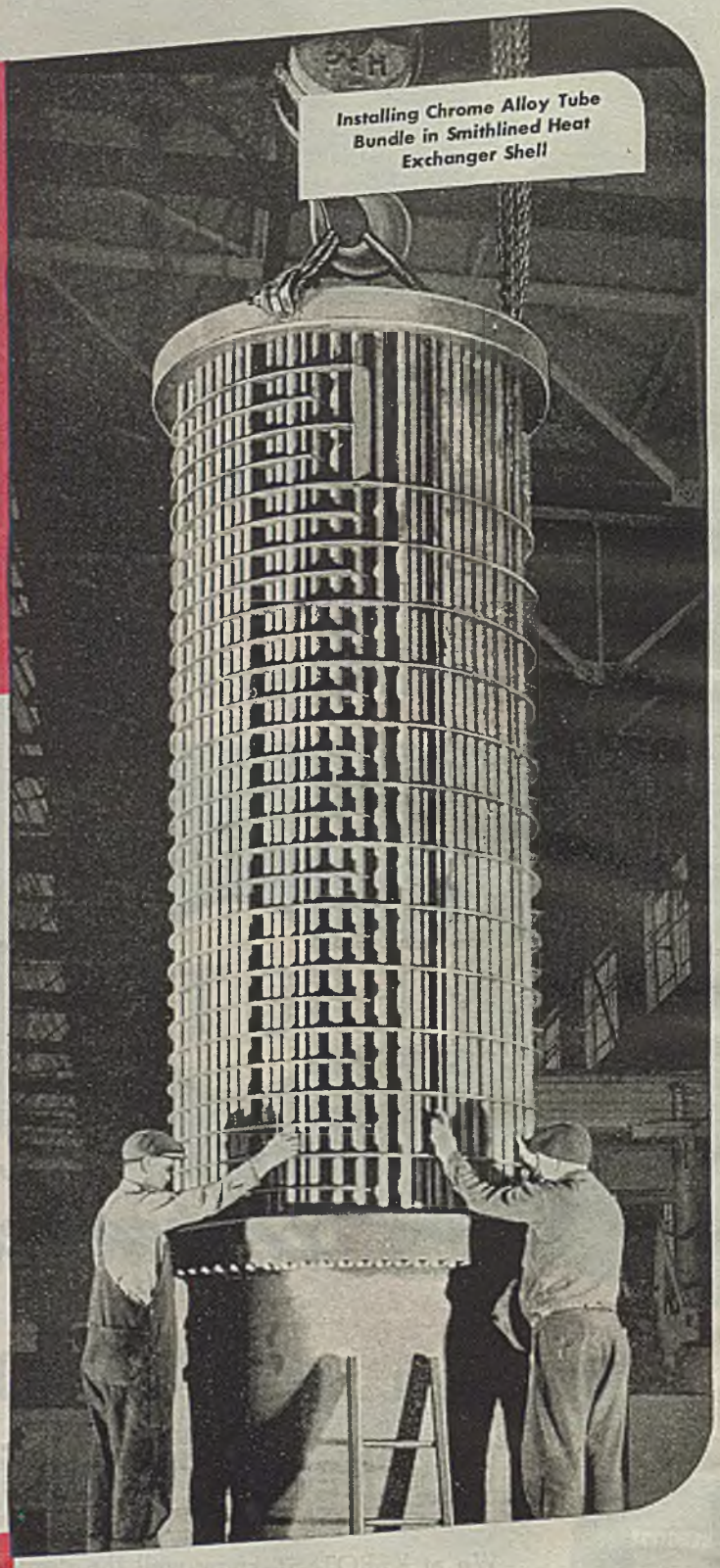

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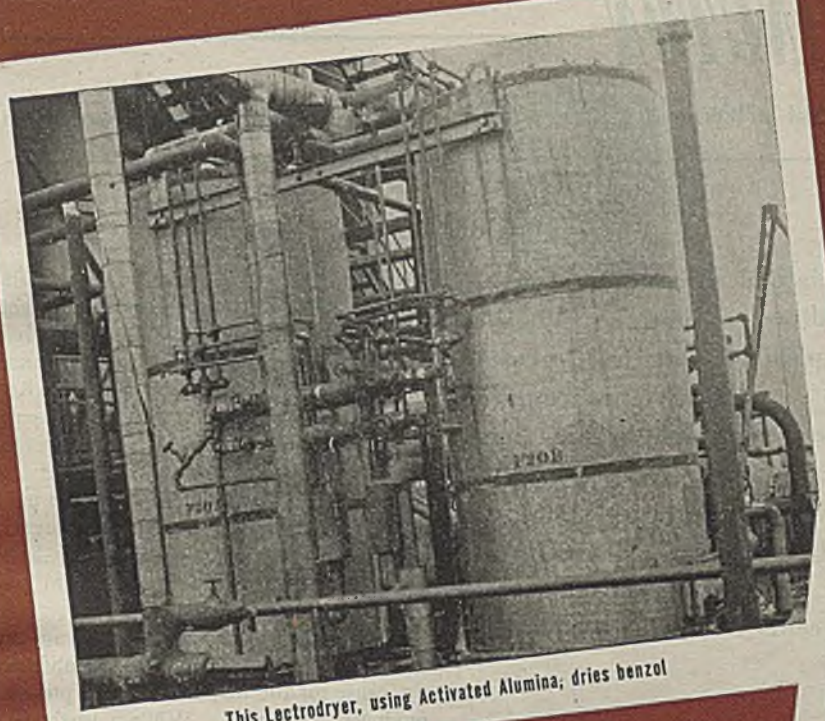
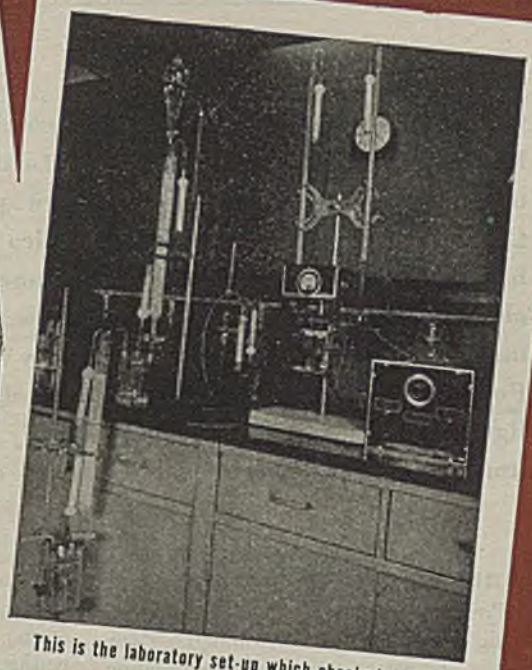


This Lectrodryer, using Activated Alumina, dries benzol



This is the laboratory set-up which checked results

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"How dry are we getting our benzol?"

A manufacturer using benzol in his processes was drying it with activated alumina. The discovery of some water in the benzol led to an investigation which uncovered and let them clear up several faults in their system.

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Representative samples of activated alumina, reactivated to a degree readily obtainable in commercial equipment, were placed in the two glass columns seen in the picture. The benzol was passed through the first of these columns into a dried glass container, protected from moist air. From there, it was drawn off for testing, the degree of dryness being determined by the sensitive apparatus illustrated.

Actual plant operating speeds and conditions were duplicated. After the benzol was passed through the activated alumina, it was substantially dry.

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WATCHING WASHINGTON

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

Government quietly plans to tackle problem of stream pollution . . . Expansion of chemical production facilities to continue well into next year . . . Who shall build new phthalic anhydride plants? Corn is imported from South America . . . Alcohol program for balance of this year and 1945 announced . . . Bungling of sugar allocation will affect process industries . . . Next winter anti-freeze market will be filled almost exclusively by glycol and methanol . . . Postwar requirements of magnesium discussed . . . Priorities on light metals eased . . . Soda ash supply will not improve for some time . . . Rubber is made for 12 or 13 cents

STREAM POLLUTION PLANS

POSTWAR plans for public works are being quietly made in Washington. New in the discussions are plans for prevention of stream pollution and the cleaning up of important waterways throughout the country.

Legislation to give large new authority on this subject to Public Health Service got near to enactment a few years ago. It is being taken out of the pigeon holes again and dusted off for new presentation to Congress. Enactment of some legislation seems likely next winter, probably by the new Congress.

These undertakings have significance for two groups in chemical process industries. Those who have in the past permitted objectionable effluent to go into rivers and harbors may find themselves under criticism. Those who have processes or equipment for prevention of stream pollution will be encouraged to get out and develop new business. The important thing, some observers say, will be for the two groups to get together. Joint action on sound engineering methods will be constructive and economic. Reforms accomplished by dictation from Washington probably will be much less practical and effective.

EXPANSION NEVER CEASES

CONTRARY to the general trend, the chemical industry continues to expand production facilities. The current rate is approximately $10,000,000 per month and it is anticipated that during 1944 over $100,000,000 of new construction projects will have been approved, according to D. P. Morgan, Chief of WPB's Chemical Bureau. Speaking before the Canadian Chemical Conference, Dr. Morgan said "Chemical construction since 1939 has aggregated close to a billion and a half dollars. Of this, $450,000,000 was for synthetic rubber, $350,000,000 in military explosives, $30,000,000 in other military uses, and $620,000,000 in industrial chemicals."

As would be expected, the authorizations reached their peak in 1942 and dropped off sharply toward the end of the year. It was assumed that construction of new facilities in the chemical industry would be over by the end of 1943 and statements to this effect were made by high officials.

Immediately the trend changed. Early in 1943 authorizations increased until the $10,000,000 per month rate was reached. Projects now before the Bureau Requirements Committee indicate that the expansion of facilities will continue well into next year approximately at the present rate.

A TWO FISTED ARGUMENT

NEW FACILITIES for the production of critically needed phthalic anhydride are going to be built, but exactly who is going to build them had not been determined late in June. This was the subject of a two-fisted, behind-the-scenes argument in Washington. Five months ago it was announced to the phthalic anhydride industry that additional facilities of some 12 to 15 million lb. a year were needed to meet the newly developed military requirements. Nothing happened.

In the meantime the Chemical Bureau, whose duty it is to see that the war requirements are met, authorized construction of new facilities that would increase the country's annual capacity by 21 million lb. Koppers Co., Pittsburgh Coke and Iron Co. and Standard Oil of California, newcomers to the industry, got the nod by default. The industry has gone over the head of the Chemical Bureau to Donald Davis and the WPB Requirements Committee, with the argument that the regular producers are ready to build the entire needed output which at this time has actually increased to 36 million lb. annually. The industry argues that organizations lacking the know-how should not be permitted to build and operate the new facilities.

Poor postwar prospects for the use of the entire expanded capacity probably was the cause for the hesitation of the present producers to expand. While a vastly enlarged postwar market is probable, it is doubtful if it can absorb the entire output of the projected facilities for some years.

CORN IMPORT CUSHION

ABOUT SIX million bushels of corn are being brought into the United States from South America during July to be entered at Eastern and Southern ports. Comparable imports are expected to continue during the rest of the year.

These imports would normally be bitterly opposed by all farm spokesmen of Washington. But they are now accepted as desirable for two major and unusual reasons. First, the corn is needed as feed in the South and along the Eastern Seaboard, especially for chickens and cattle. In the second place, the grain makes up for these regions the supply which would normally come from the corn belt, but that which can not so move now as it is needed for wet grinding to make starch, sirup and sugars. The imports are not, of course, being allowed to break the farm corn price.

Because of the corn shortage the corn grinding industry has been operating far below capacity much of the year. OPA finally recognized this as causing higher unit costs and authorized higher price ceilings on corn syrup, corn syrup solids, and corn sugar. These increases were in addition to the earlier price rise granted to offset the great cost of corn per bushel.

LONGER LIFE FOR LEATHER

FOR SEVERAL months a vigorous controversy has been waged in Washington regarding oil treating of sole leather, especially for men's and children's shoes. Tests

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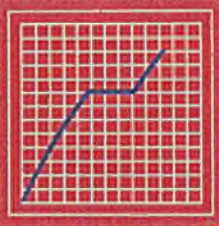

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reported by OPA indicate that such oil treated soles last from 25 to 50 percent longer. Army experience seems to have confirmed this conclusion. In one Italian case it was found that untreated soles lasted less than three days under field conditions. More talked of for ladies' soles is a nitrocellulose plastic because it increases adhesive characteristics on cemented soles. Special marking of treated soles to guide civilian purchasers is being planned.

PATENT BILLS BLOCKED

PATENT legislation seems definitely impossible in the present Congress because Sen. Homer T. Bone, Chairman of the Senate Committee on Patents, fails to have any action taken on any bills by his committee. Complaint is made by various Washington groups because the House Committee was able to function, and critics think that the Senate should not hold up all matters regardless of merit.

The American Bar Association would like Congress to pass a bill taking interference proceedings out of the Patent Office into the courts. Department of Interior officials want a bill under which they may reward government employees for inventions, but this bill will probably have to be expanded to cover employees of all departments before action will be taken. Certain special interests want to extend a pocket lighter patent on the ground that Judge Manton was influenced by money in his judgment on that particular patent. (The Judge was convicted.) Important members of the Patent Bar and apparently the Patent Office want the Senate to act on the bill which has passed the House, forbidding use of unpublished foreign activity as a basis of proof against priorities issued American patents.

QUICK ACTION PLANNED

RECOGNITION of the necessity for quick action in clearing factory floors of government-owned equipment and materials declared to be surplus war property led to the formation of a Space Control Committee by William L. Clayton, Surplus War Property Administrator. This committee is to coordinate the storage activities of government agencies engaged in the disposal of surplus war property. Clayton has named Col. John J. O'Brien, Office of the Chief of Engineers, War Department, chairman. Nine regional sub-committees will handle the work in the field.

FIBER PIPE STANDARDS

NEW COMMERCIAL standards for bituminized-fiber pipe has been formulated by the National Bureau of Standards and issued recently as its document CS116. The product is suggested as corrosion resistant for many purposes other than cable conduit, sewer pipe, and special drain pipe, for which this type of material is normally used. Advantages of the material mentioned by the Bureau are light weight, resistance to corrosion, low installation cost, and resilience permitting bending rather than breakage when subjected to strain, e.g. by shifting of surrounding earth.

THROUGH NORMAL CHANNELS

WASHINGTON has twice recently made important announcements regarding agencies to be used in the postwar plans of the government. William L. Clayton has emphasized that normal channels of commerce will be used wherever possible in the sales of surplus war property. Leo Crowley has made a comparable announcement that commercial exports from the United States are soon to be moving through private trade channels, especially for Caribbean destinations.

Apparently these two announcements are a sort of trial balloon to see whether industry is ready to pick up the load which must be carried. Privately, some executives state that if business does not do the job promptly and effectively then the government is going to organize its own agencies to do business.

ALCOHOL HOLIDAY

PERMISSION to resume alcoholic beverage manufacture was granted by WPB to liquor distillers for the month of August. The result will be manufacture of beverages equivalent to about 20 million gal. of industrial alcohol.

ALCOHOL FOR 1945

THE ALCOHOL program for the balance of this year and for 1945 was announced by WPB during June. To meet that program an entirely new set of production conditions had to be established. The revised estimates of requirements expected (as millions of gallons of 95 percent alcohol) are as follows:

	1943	1944	1945
Synthetic rubber ..	126	365	365
Direct military and Lend-Lease	103	79	89
Indirect military and civilian	148	160	160
Anti-freeze	51	30	20
	428	634	634

SUGAR CONTROVERSY RENEWED

SERIOUS bungling in sugar allocation has again been charged against War Food Administration. This promises to affect seriously several chemical process industries, including alcohol. Late June observation is Washington can identify two important trends which deserve chemical engineering notice.

First and most obvious of the difficulties for chemical engineering is the prospect that invert molasses may be cut off on account of the demand of the public for more sugar both for household use and for food manufacture. The public is now aware that again the sugar bowl and alcohol program are competing for approximately a million tons per year of raw sugar. It is easy to recall the controversy of two years ago when exactly similar difficulty was experienced and thus at once recognize the danger that lies ahead. A public demand for sugar may compel the use of quite different raw materials for alcohol and rubber, even though the general public wants tires quite as much as sweeteners.

Second, and equally pertinent politically in an election year, is the question of alcohol beverage manufacture. Pressure has continued in Washington for resumption of beverage alcohol, whiskey and other distilled liquor production. Both the public demand for a drink, and claims that this will reduce bootlegging, are influential. It was not surprising that these pressures made necessary the granting to beverage distillers of the privilege to make beverages during the month of August.

If that change were to be continued longer there would develop need for new raw materials for alcohol manufacture. The short holiday was possible only because butadiene from petroleum became more abundant than expected some months ago. No one expects that the rubber program will be allowed to slow down merely for want of alcohol.

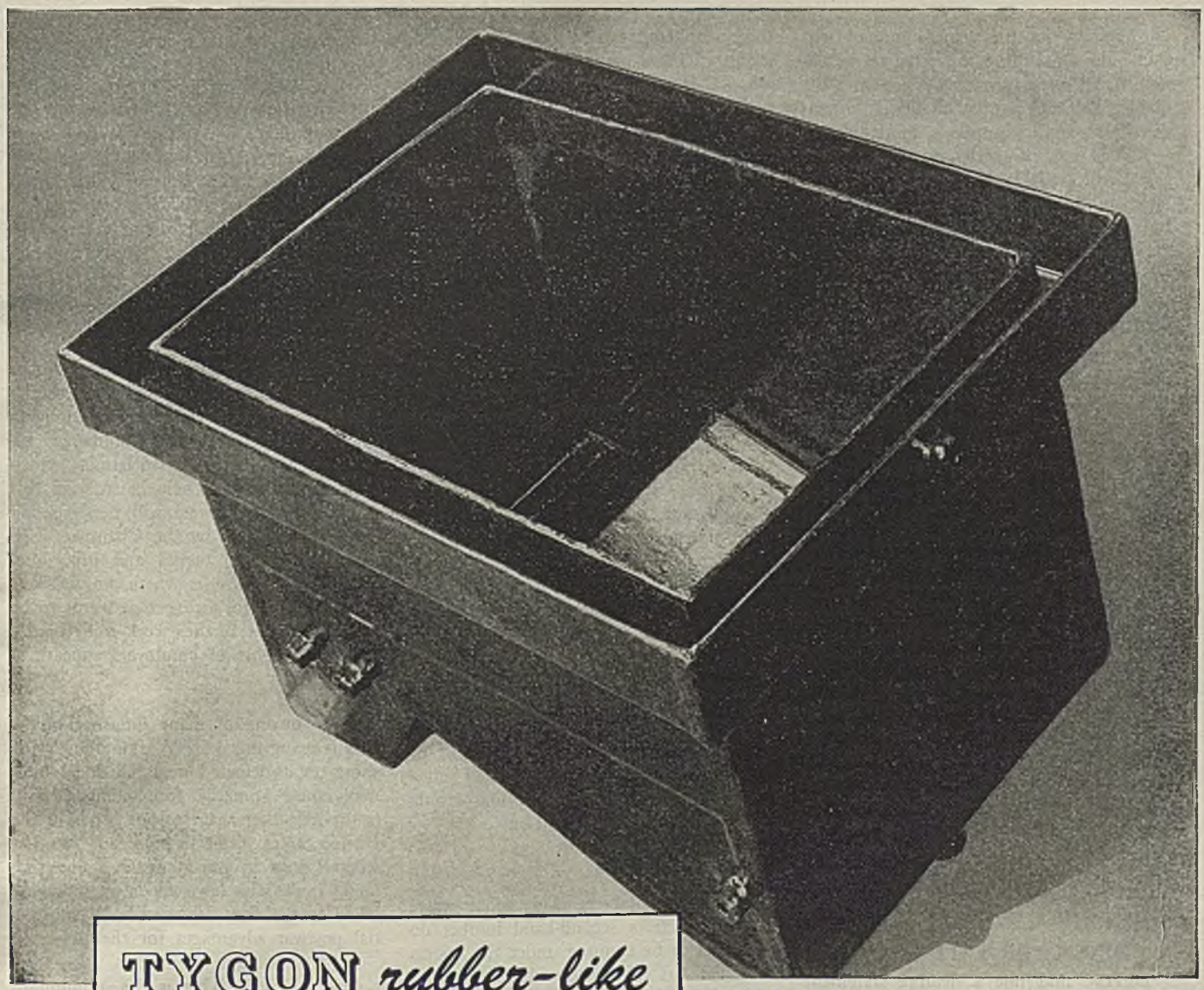
SHIFT IN ANTI-FREEZE

HUGE production of methanol has developed in the United States recently. Military uses are so significant as to preclude quantitative discussion of the trend. But large quantities are also being made available for general industrial purposes. Not the least of these is anti-freeze.

Motor cars need 60 million gal. a year of anti-freeze. Except for that alcohol already started on this commercial route, there may be little more so distributed in the near future. Methanol can, and doubtless will, take over the job of preventing freeze ups in automobile engines without difficulty. Actually the motorist need not know the difference, for methanol evaporates no more easily than alcohol according to competent official statements.

It appears that the 1944-1945 anti-freeze market will be filled almost exclusively by glycol and methanol. The latter will, of course, care for at least two-thirds of the total supply if alcohol is not available. Thus the WPB problem of alcohol allocation is materially simplified. In fact, the shift from alcohol for this purpose may be sufficient to prevent a shrinkage of the stockpile which was expected to be between 20 and 25 million gal. during 1944.

Fortunately there is more than enough



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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.

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idle capacity for the manufacture of synthetic ammonia to be converted to methanol to fill these needs. When a plant making 100 tons per day of NH_3 is so converted the annual output is approximately 9 million gal. of methanol. In view of the large available ammonia capacity it looks as though methanol production before the end of 1944 will be at a rate in excess of 100 million gal. per year. At the mid year the output was about 75.

MAGNESIUM PEAK PASSED

Production of magnesium during the first quarter of 1944 was approximately 123 million lb., a record for any three months. The production during the second quarter, ending in June, was definitely lower because of the production cutback ordered by WPB late in March. It is officially announced that the record of the first quarter "will probably remain as the peak for the duration of the war." Secondary recovery of magnesium has been unusually high during the spring, amounting to as much as 3.5 million lb. in March.

Estimates of postwar requirements of industry for magnesium are discussed frequently in Washington. The most optimistic forecast noted seems to be about one-third of the installed production capacity of the United States. The more conservative estimate is approximately ten percent of capacity and less than the privately held capacity of the principal producer, Dow Chemical Co.

ALUMINUM FOR EXPERIMENTS

During mid-June a definite statement was made at WPB that experimental use of light metals would be encouraged for postwar projects. This took the form of a great easing of priorities on aluminum and magnesium. From now on it is expected that experimental manufacture of new models using these light metals will be approved whenever this does not compel an unwanted cutback on some war project which needs the same manpower.

ALUMINUM: A GUINEA PIG?

There is talk in Washington of the possibility of removing aluminum from allocation in view of ample supplies. If this is done it may provide the pattern for the relaxation of controls over other metals. Such action would not ease the restrictions on the uses to which aluminum could be put. All it would do would be to let fabricators, who are permitted to use the light metal, buy it wherever possible in the open market instead of having all production channeled to the ultimate user as is the case at present.

SODA ASH STILL TIGHT

Cutbacks in the production of aluminum have not yet eased the shortage of soda ash being experienced by the glass industry. Glass manufacturers want dense ash and they need it in the northeastern states. The cuts in aluminum production are resulting in an abundance of light ash, but it is at Baton Rouge.

The glass industry was notified in June that for the last half of the year only a limited allocation of nitrate of soda can be made for the area east of the Rocky Mountains. Allocations of byproduct nitrate of soda will not exceed half of the annual consumption of one of two base years. The base period for glass containers or for glass melted in continuous tank furnaces and formed on automatic machines is the calendar year 1941. For lead glass tubing, boro-silicate types and all other types of glass, the base period is the year ending June 30, 1943. Only special technical and true optical glass will rate allocations of regular grade nitrate of soda and then only in limited quantities. Allocations to manufacturers west of the Rocky Mountains will be the same as for the first half of this year.

This announcement emphasizes the belief of the officials of the Chemical Bureau that the soda ash supply will not improve for some time. What many seem to have forgotten is that production of glass at some plants has doubled since 1939. Obviously the consumption of soda ash is somewhat in proportion.

BRIEF GLIMPSES

Wooden containers made from waste material or from second-hand lumber do not need to be counted under the quotas of containers alloted for shipping goods under WPB Limitation Order L-232. This ruling is intended to encourage the manufacture of such containers without use of primary or new materials by container users. But container manufacturers are not exempted in this way.

Synthetic rubber cost is now estimated by Rubber Director Bradley Dewey, at lower figures than ever before published. In two statements of June he mentioned 12 cents and 13 cents as cost which have been reached at certain Buna-S plants. These costs do not include all capital charges, development expense, or profit. But they do indicate tremendous progress by certain synthetic-rubber establishments.

Novel shift schedules are proposed by WPB's Office of Manpower Requirements in an effort to help manufacturers increase the effectiveness of production and reduce absenteeism where there are not enough available employees to provide regular workers on all three shifts of eight hours each. One of the most discussed proposals contemplates two shifts per day of ten hours each. WPB officials will gladly furnish results of experience under such schedules, both those using a five-day week and those attempting six-day operation.

Conventions for organizations which do not give direct war service are now more strictly under the ban of ODT. Director Johnson insists that travel facilities must not be used for ordinary meetings from now on. There is talk about taking steps to discipline agencies that insist on holding conventions "under the guise of war conferences." ODT does not consider that this is "essential travel."

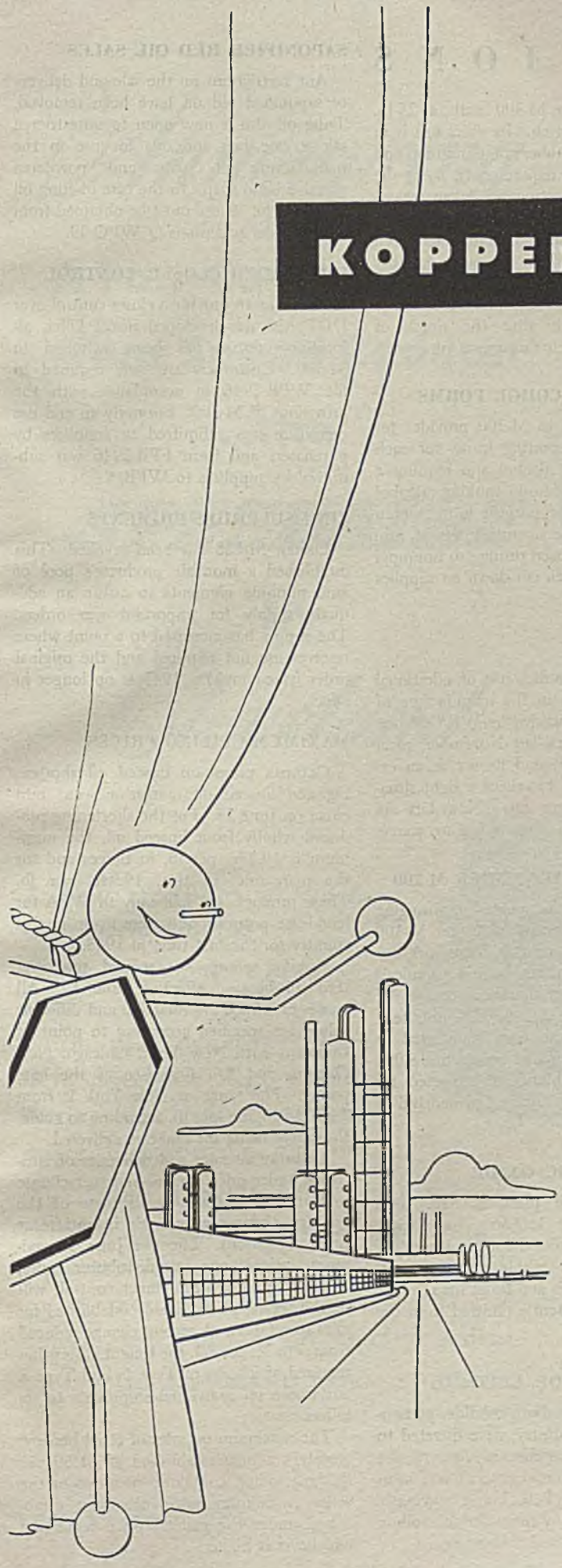
Employers petitions to National Labor Relations Board to determine whether a union is a majority representative are being urged by the Chamber of Commerce. Influential groups and associations which they think they can help in securing this privilege for employers will be given all the facts available by the Chamber, with suggestions as to tactics and procedure. The old system under which only workers could petition for an election seems to be weakening, but further work to recognize the equal rights of employers appears to be needed.

Early buying of many industrial materials is being urged by Washington. Many shortages anticipated next fall and winter may come primarily from difficulties of transport rather than lack of goods in the United States. Officials point out also that when breaks in war demands come suddenly those who have goods on order are likely to get first deliveries with substantial postwar advantages for themselves.

Study USES! This is the admonition of official Washington with reference to the new plans for referring workers to essential jobs. Chemical enterprise is urged to get acquainted with local Employment Service executives for two reasons. They can thus learn the rules for getting new workers. Also they can explain the special needs as to types of personnel which can be safely employed in chemical plants. By showing the peculiar requirements for these workers to the officials of USES it is hoped that the quality of available new employees will not depreciate unduly.

Inexperienced operators and long hours of use have accelerated the rate of depreciation of industrial machinery. WPB recognizes this fact and is trying to speed up repair parts especially for certain industrial beverage machinery. Any chemical enterprise experiencing troubles of excessive wear can cite WPB policy as a basis for stocking spare parts to prevent shutdown under such circumstances.

Potato alcohol was made from 3,200 tons of dehydrated potatoes which were the unsatisfactory food product from 19,200 tons of raw potatoes. The result was 300,000 gal. of alcohol.



KOPPERS *announces*

increased facilities

for the production of

Pyridine bases

(TAR BASES)

New plant facilities will make possible the production of increased quantities of pyridine bases, including alpha picoline; mixtures of beta picoline, gamma picoline and 2,6 lutidine; 2,4 lutidine; close boiling fractions boiling within the range 160-200°C.; quinoline and mixed quinaldines.

Pyridine bases are used in the production of pharmaceuticals including the sulfa-drugs, nicotinic acid and nicotinic acid amide; as solvents; as sources of copolymerizing materials for synthetic rubber; in the manufacture of textile waterproofing compounds and in compounding pickling inhibitors.

The greater availability of these pyridine bases should encourage the development of many other uses for them. Koppers will be glad to furnish samples of these bases and will assist in the selection of suitable grades for specific purposes. Request samples from Koppers Co., Tar and Chemical Division, Pittsburgh 19, Pa.

KOPPERS

THE INDUSTRY THAT SERVES ALL INDUSTRY

INTERPRETATIONS

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

DRY CELL BATTERIES

Dry cell battery and zinc battery shell industries, in conference with officials of WPB on June 20, were urged to exert every possible effort to expand dry cell battery production. Requirements of the Army and Navy are said to have increased so fast that unless production is stepped up and continued at an increasingly high rate, military operations will be seriously handicapped.

TALLOW AND GREASE

Industrial consumers of inedible tallow and grease after July 1, may accept delivery of these products by certifying their use directly to the supplier, eliminating the necessity of filing applications with WFA in Washington. WFO No. 67 allows a prior claim on inedible tallow and grease, up to 30 percent, for use in all industrial operations except in the manufacture of soap. Under the revision, users must certify to suppliers that none of the quantity accepted will be used in soap.

CARBON TETRACHLORIDE

Additional carbon tetrachloride has been made available for dry cleaning purposes for the third quarter of the year. The new monthly quota for this purpose will be 1,086 drums of 700 lb. each, beginning in August. Second-quarter allocations amounted to only 214 drums a month. Reduced demands for the chemical for military purposes made the increased allotment possible. However it is made plain that neither trichlorethylene or per-chlorethylene can be made available yet because of urgent military demands.

CHLORINE USE IN PULP

Announcement was made on June 15 that limitation order controlling the use of chlorine in pulp, paper and cardboard as a bleaching or oxidizing agent had been amended to include the interpretation issued by WPB Paper Division on Apr. 18. The amendment limits the brightness or reflectivity permissible for certain papers and generally clarifies the original order.

ACETYLENE BLACK PLACED UNDER ALLOCATION

On June 12, WPB announced that acetylene black had been placed under allocation effective July 1. The material is now subject to M-300 with a 25-lb. small order exemption. Its chief use is in battery dry cells, rubber compounding, and indirect military requirements. At the same time similar action was taken regarding ammonium silicofluoride which is chiefly used in aluminum and magnesium casting and in civilian use as a laundry sour. It will not be subject to small order exemption but will be allocated to other producers in bulk after the needs of foundries have been taken care of.

ISOPROPYL ALCOHOL FORMS

An amendment to M-300 provides for separate sets of reporting forms for each grade of isopropyl alcohol and requires a base-period report from rubbing alcohol manufacturers. The purpose is to tighten controls since some manufacturers of rubbing alcohol have been turning to isopropyl since they have been cut down on supplies of ethyl alcohol.

ROSIN IN SOAP

Provisions requiring use of additional quantities of rosin in the manufacture of soap have been amended by WFA. When the order was issued last November, rosin was in good supply and its use as an extender was needed to relieve a tight situation in soap making fats. Now fats are more plentiful and rosin is getting scarce.

MORE CHEMICALS UNDER M-300

In line with the policy of bringing chemicals under control of Order M-300 which provides a central framework for allocation of chemicals, barium chemicals were placed under allocation control of the order on June 21. Methyl isobutene and phosphorus also were transferred to the order. An estimated supply of 18,000 tons of barium chloride is expected for this year against an anticipated demand of 35,000 tons.

LEAD-FREE ZINC OXIDE

Four additional products have been authorized to use lead-free zinc oxide. Added to the permitted list are laboratory reagent chemicals, cellulose nitrate plastics, vulcanized fiber and toilet soap. These items were inadvertently omitted from the original order.

SODIUM CYANIDE CRITICAL

Consumers of sodium cyanide, particularly the plating industry, were directed to conserve present supplies in view of the critical shortage. This material has been allocated since last Feb. 1 and previously had been governed by the order controlling synthetic ammonia and derivatives.

SAPONIFIED RED OIL SALES

All restrictions on the sale and delivery of saponified red oil have been removed. Tung oil also is now open to unrestricted sale as are fats and oils for use in the manufacture of paste and powdered abrasive hand soap. In the case of tung oil authority for its use must be obtained from WFA under provisions of WFO-39.

DDT UNDER CLOSER CONTROL

In order to provide a closer control over DDT, the war-developed insect killer, allocation control has been switched to M-300. Customers are now required to file WPB-2946 in accordance with the provisions of M-300. Formerly an end use certificate was submitted to suppliers by purchasers and form FPB-2946 was submitted by suppliers to WPB.

ZINC SULPHIDE PIGMENTS

Order M-128 has been revoked. This established a monthly producer's pool of zinc sulphide pigments to assure an adequate supply for important war orders. The supply has increased to a point where reserves are not required and the original order issued in May 1942 is no longer in effect.

MAXIMUM CEILING PRICES

Ceiling prices on linseed oil shortening and linseed oil margarine went into effect on June 15. For the shortening produced wholly from linseed oil, the maximum is 19.75c. per lb. in tierces and for the margarine, in tins, 19.94c. per lb. These products are sold only to WFA for lend-lease purposes and were made in this country for the first time in 1943.

Specific ceilings for refined sunflower seed oil became effective June 17. All grades of refined are included and different values are specified according to point of shipment with New York, Chicago, New Orleans, and San Francisco as the base points. The range at New York is from 14.30 to 15.79c. per lb. according to grade, the prices being for tankcars delivered.

To bring all sales and deliveries of anti-freeze under price control and to facilitate uniform distribution to all parts of the country, changes were made in anti-freeze price regulations. Effective June 3 maximum prices on interdistributor sales, formerly exempt from direct control, will be the ceiling prices already established for sales to retailers. A second change reduced from 5 to 3c. per gal. the freight absorption required of jobbers of Type N and Type S anti-freeze on individual shipments to retailers.

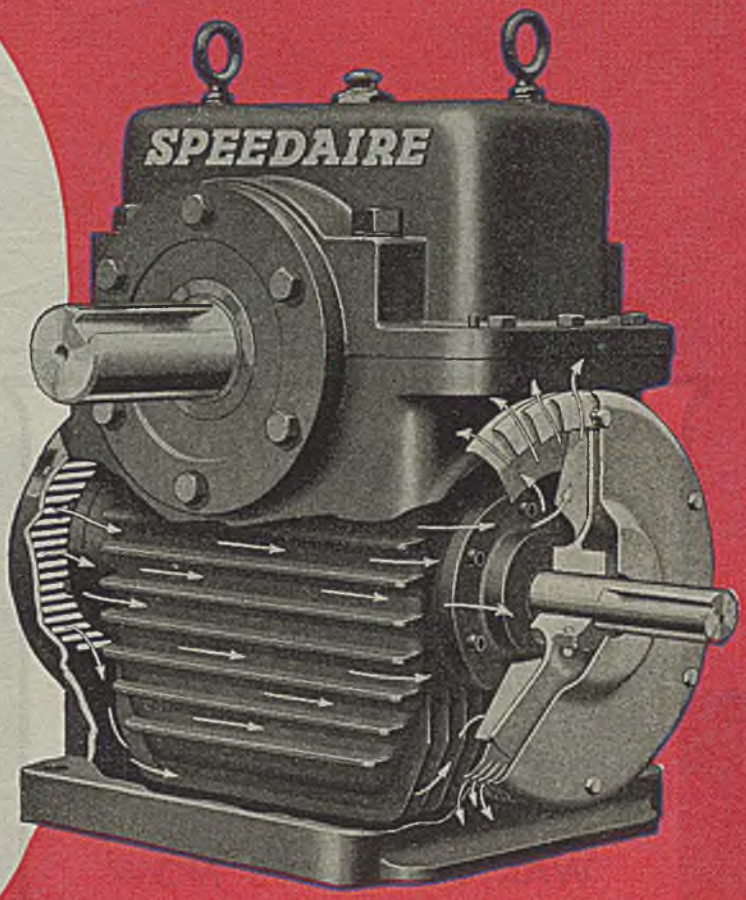
The maximum on sales of ethyl benzoyl acetate are now established at $1.80 per lb. f.o.b. plant, containers included or the sellers maximum price otherwise established under the general price regulation whichever is higher.

Announcing

A Fan-Cooled Worm Gear Speed Reducer ...the

SPEEDAIRE

by *Cleveland*



A new standard of worm gear performance!

Latest development in Cleveland's 32-year program of worm gear betterment—the new Speedaire Fan-Cooled Reduction Unit—gives you more horsepower per dollar.

Speedaire Units offer as much as twice the capacity of standard worm gear units of equal frame size, when operated with 1750 r.p.m. motors—because *Speedaire is Fan-Cooled.* Heat from the oil reservoir is dissipated by an exhaust fan drawing a high-velocity air stream across the inner housing wall. Easily installed, Speedaire incorporates the sturdy, rugged construction you associate with all Cleveland Units.

Write for the new Speedaire Catalog. Complete with photographs, drawings, charts, engineering data—you'll stay with it to the last page.

Speed your postwar planning with Speedaire. Investigate today.

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Cleveland SPEEDAIRE *Worm Gear Reduction Units*

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DIAMOND
Industrial
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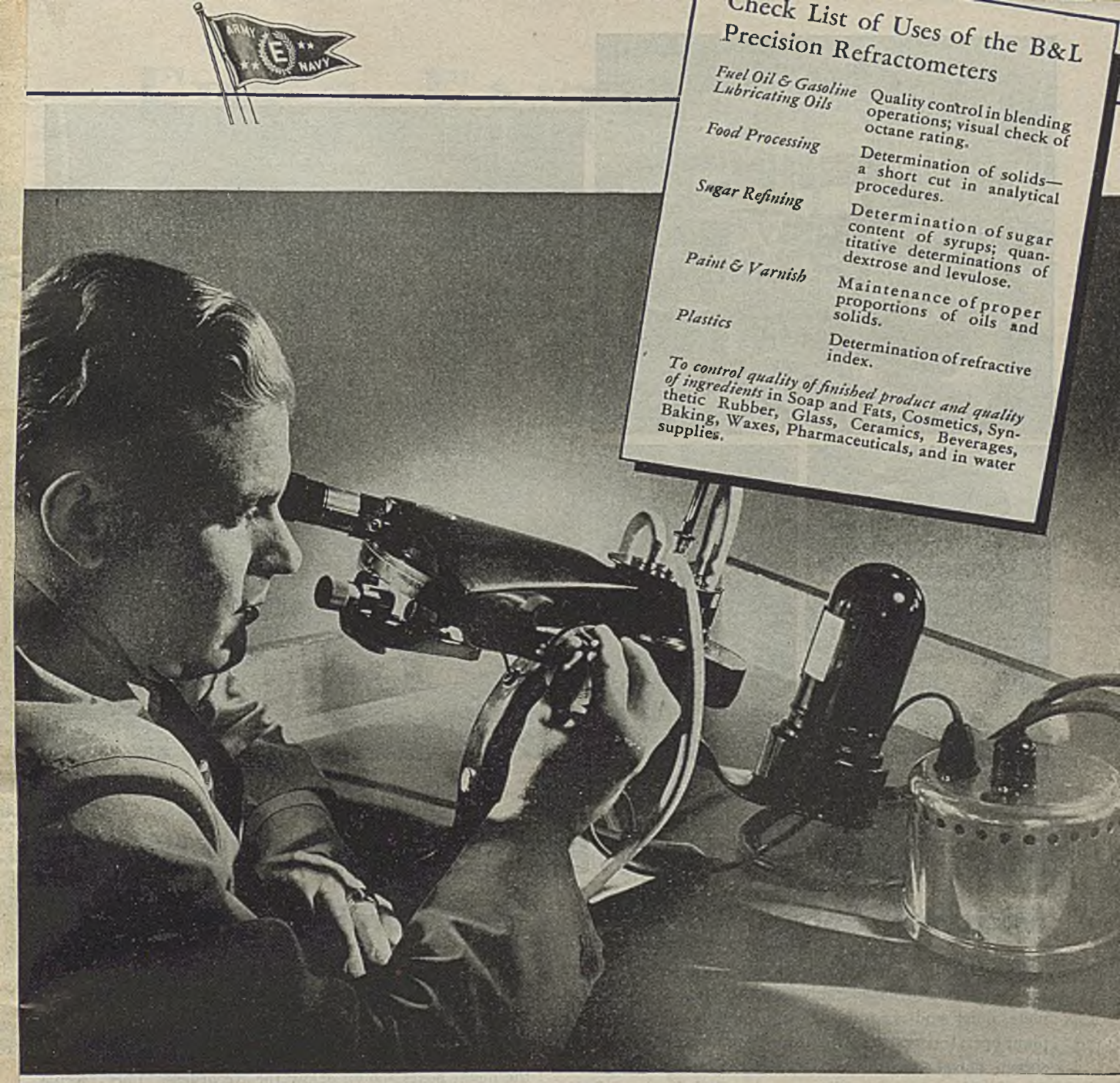


Check List of Uses of the B&L Precision Refractometers

Fuel Oil & Gasoline Lubricating Oils	Quality control in blending operations; visual check of octane rating.
Food Processing	Determination of solids—a short cut in analytical procedures.
Sugar Refining	Determination of sugar content of syrups; quantitative determinations of dextrose and levulose.
Paint & Varnish	Maintenance of proper proportions of oils and solids.
Plastics	Determination of refractive index.

To control quality of finished product and quality of ingredients in Soap and Fats, Cosmetics, Synthetic Rubber, Glass, Ceramics, Beverages, Baking, Waxes, Pharmaceuticals, and in water supplies.

Where Can You Use a Precision Refractometer?

Will there be a place in your post-war operations where a B&L Precision Refractometer can help you do a better job . . . or, if you are doing essential war work, is there a place where you could use one to advantage now?

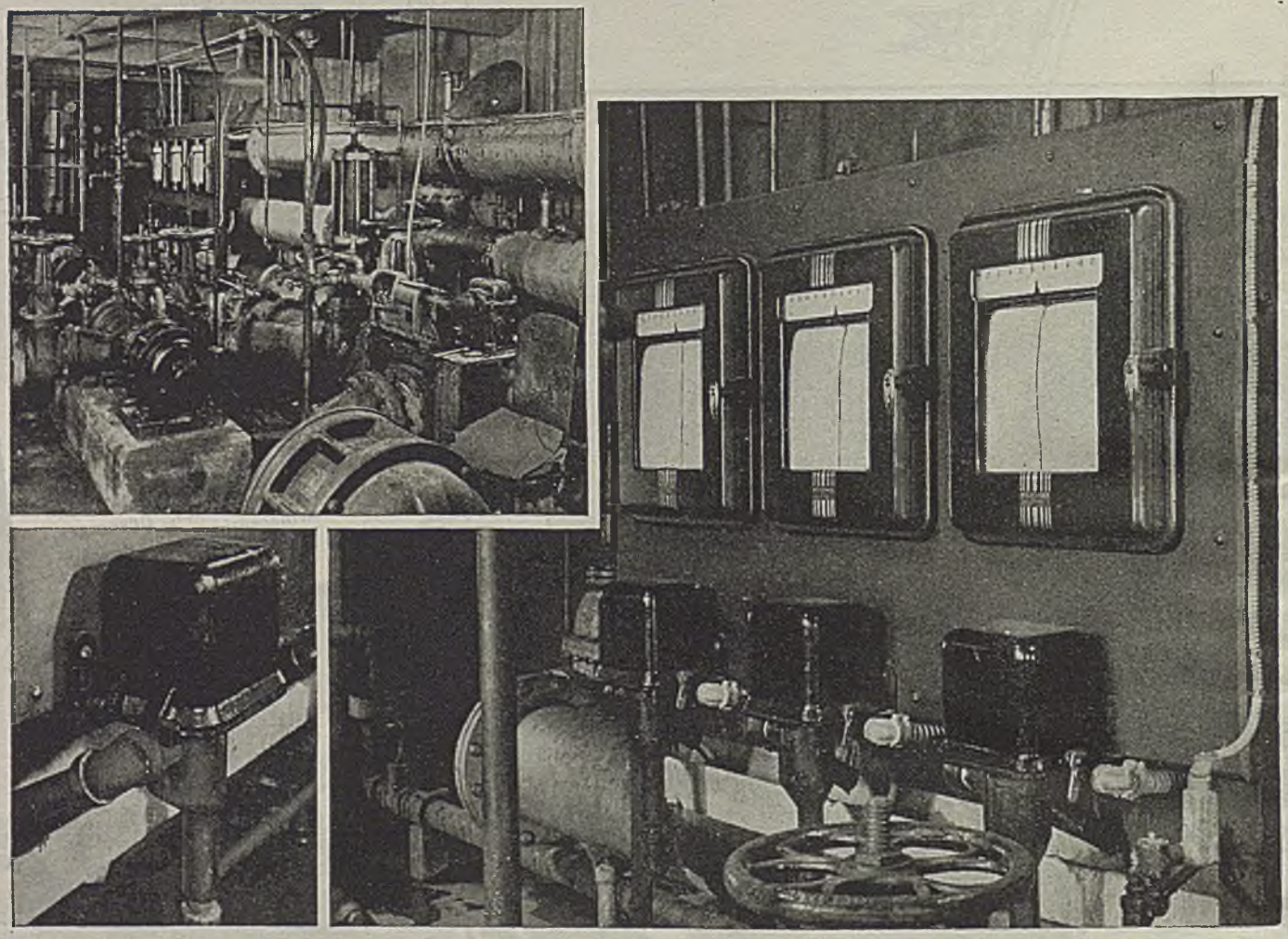
The B&L Precision Refractometer is an instrument of permanent accuracy and superior design. Operation is simplified by the small quantity of liquid required, quick temperature regulation and by a minimum of moving parts. The absence of compensator and bearing errors enables readings to 0.00003 for the C, D and F Lines, giving both index and dispersion values. Of vital importance, too, is the permanent responsibility of the maker. When and if repairs are needed you can always be sure that Bausch & Lomb will still be in business to furnish the parts or service you need.

BAUSCH & LOMB

OPTICAL CO., ROCHESTER, N. Y.

ESTABLISHED 1853

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



Typical views in the filter plant, Finishing Division of Arkwright Corp., Fall River, Mass. The three Micromax Recorders show, left to right, the pH of finished water at the clear well; pH of raw water coming into filter plant; pH of water just after alum and filters. Note electrode unit at left.

FOR HELP IN WATER CONDITIONING

Micromax Solves Arkwright's pH Recording Problem

Efficiency of water-treatment in the Arkwright Finishing Division has been considerably improved because of the complete, quick and accurate pH information which the filter plant operators get from the three Micromax pH Recorders shown above. Starting with raw water which varies from 5 to 9 pH, and treating it to a value slightly above 7, the plant had for years done a good job, but never before did it operate so easily and efficiently as since 1942, when the Micromax Recorders were installed.

Instruments selected by Arkwright for this service are our Strip-Chart Signalling Recorders; these are self-standardizing and fully automatic; they operate alarms if pH exceeds preset limits; they can be equipped at any time to handle automatic-control problems. They record in great detail, and their range is 2—12 pH, which gives ample working space on both sides of any pH value normally held in an industrial application.

The electrodes employed are our modern, flow-type glass and calomel units, sturdily made and securely housed in the metal boxes shown below the Recorders. They receive water by pipe and discharge into the trough for return to the mill's raw-water supply.

Different conditions from those at the Arkwright plant might of course call for different pH equipment, a Round-Chart Micromax, perhaps, and a different type of glass electrode. If you have a pH recording problem and will outline it, an L&N engineer will be glad to help select, from the various types of L&N equipment, that which will meet your needs.

Jrl Ad N-96-701(2)

depends on me!
A Slogan For Every American

LEEDS & NORTHRUP COMPANY, 4916 STENTON AVE., PHILA. 44, PA.
LEEDS & NORTHRUP
MEASURING INSTRUMENTS · TELEMETERS · AUTOMATIC CONTROLS · HEAT-TREATING FURNACES

FREE ENTERPRISE

The Obligation of Management and Labor to Cooperate...in War...in Peace

The Invasion is on! We have unleashed our full might for military victory. We have confidence that our great strength will bring success. We are strong because we have achieved unity in mobilization and in combat.

Though victory appears assured, we cannot rest until we have done everything in our power to speed the day when death and destruction are halted.

The home front is an important factor in this time element, for the fighting power of our Armed Forces depends upon their weapons. Napoleon's army fought "on its stomach"—man against man. Eisenhower's men fight on their tonnage—tanks, artillery, machine guns, heavy bombers.

As never before in the long succession of wars, the legends of heroic deeds on the battlefronts in this world conflict will be paralleled in history by the great accomplishments on the production fronts. Along with these heroic achievements of our Armed Forces, the world will long remember the record of our production accomplishments which have made us the stongest military power in the world, as well as the arsenal of democracy.

As the conflict reaches its climax, as battles grow fiercer and more destructive, our responsibility becomes greater and more critical. We must coordinate our productive efforts with the same ingenuity and the same precision with which our Armed Forces have coordinated theirs. We dare not waste the productivity of a single man or machine in these critical days.

As our landing craft are discharging our fighting men on the beaches of Europe and the Pacific, they must not want for equipment. No interference with war production for any reason can be justified. There must be no picket lines in America!

The landing of American troops in France virtually has stopped all strikes in the United States. This is important and encouraging news because the prelude to Invasion, unfortunately, has been an epidemic of strikes. Time lost through strikes, during the first four months of 1944, was double that lost during the same period last year. April saw more strikes than any other month since Pearl Harbor, and in May the record again was broken. Here is what happened within two weeks in May:

> Nine thousand men in six Chrysler plants in Detroit were out when a jurisdictional dispute in a "soda pop" war between the American Federation of Labor teamsters and the Congress of Industrial Organizations fired their discontent.
>
> A three-day sit-down strike occurred among 950 employees in the B. H. Aircraft plant over the refusal of the company to discharge a superintendent unsatisfactory to the union.
>
> Thirteen hundred men in the Chevrolet transmission and axle plant at Saginaw struck over a no-smoking rule and a change in shift-starting time.
>
> Two thousand employees at the Browne and Sharpe Manufacturing Company walked out when a woman was hired to fill a job long held by a man.
>
> Production of penicillin, blood plasma, and other medical supplies was halted at two Detroit plants of the Parke Davis Company as 1900 employees struck for a ten-cent raise.
>
> Over 25,000 lumber workers in the Pacific Northwest struck because the War Labor Board denied their demand for a wage increase.

At the end of the third week of May, 70,000 workers in 26 plants in Detroit were idle because of strikes.

Strikes in Detroit alone reduced production as much as a moderately successful German air raid would have done. Far more important than their effect on output is the effect of strikes upon national unity and morale. To our home front and to our Armed Forces, strikes belie our pledge to back the attack with all the power at our command. Hence, strikes limit our all-out war effort.

Prompt and decisive action is needed to keep America free from strikes for the remainder of the war. Stoppages of work on the production lines cannot be condoned while lives are being lost in fighting the enemy.

Most union leaders realize this need and are preparing to impose discipline upon their members who violate the no-strike pledge. The Warehouse Division of the International Longshoremen's and Warehousemen's Union (C.I.O.) recently declared: "Strikes in this time of war are treason against the nation and betrayal of the interests of labor." A message sent by William Green to all heads of American Federation of Labor unions stated:

> "D-day is here. From now on until Hitler is finally crushed, every worker enrolled in the army of production must consider himself a part of the invasion forces of the United States and conduct himself accordingly. I call on you in the name of the American boys who are risking their lives under enemy fire to maintain uninterrupted production under any and all circumstances. Until victory is won every worker must give the same all-out service that our Armed Forces are giving on the field of battle."

Strongest of all was the appeal of R. J. Thomas, president of the United Automobile Workers, to members of his union:

> "Our union cannot survive if the nation and our soldiers believe that we are obstructing the war effort . . . there can be no such thing as legitimate picket lines . . . I appeal to our membership. If you value your union, if you want to live and serve after the war, we must restrain ourselves and our hot-headed brothers today. If we do not, there will be no union after the war."

Union officers are entitled to vigorous support from management and government in their efforts to prevent strikes. Behind many a strike is an accumulation of unsettled grievances. Managements are overworked, and many union shop stewards are new and inexperienced and do not always do their part in turning down cases which lack merit. Both of these conditions make it easy for large backlogs of unsettled grievances to pile up. A special drive to clean up unsettled cases and to prevent new accumulations of them is one way by which managements and local union officials can help shorten the war.

The government too has a contribution to make to the prevention of strikes—both through the prompt disposal of disputes and through firm action against the leaders of strikes. The National War Labor Board and the Regional Boards are disposing of over five thousand cases a month and have made an excellent record in reducing their backlogs. Nevertheless, the boards still have many old cases; and about one out of four strikes has been an effort to get action from one of the labor boards. The boards are entitled to cooperation from employers and unions in keeping down their docket. In instance after instance, cases are dumped in the lap of the board before the union and employer have made a real effort to get a meeting of minds and to work out settlements.

In the present emergency, strikes are an expression of the lack of adequate understanding and team work between unions and management. Any future great upsurge in industrial strife likewise will be due to misunderstanding. After this war this country must not go through another "1919" when the time lost from strikes reached an all-time high. With 13 million workers, or almost half of the non-salaried employees of the country, in trade unions, the power and prestige of unions is greater than ever. *The long-run prosperity of the country requires that business and labor learn how to cooperate in supporting the policies which produce the largest possible profits and the largest possible payrolls.*

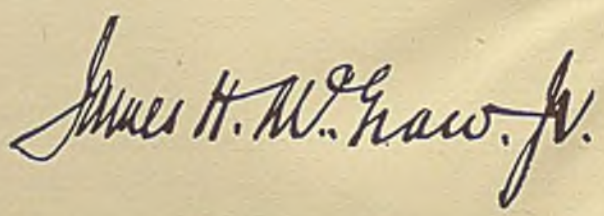
Although business is primarily interested in the largest possible profits, and labor is primarily interested in the largest possible payrolls, both objectives call for the same basic conditions. Payrolls depend upon the prospects for profits. If bad relations between business and labor or unwise public policies cause employers to take a pessimistic view of the outlook for profits, both employment and payrolls will be depressed.

Individual unions and individual employers always will have differences over wages and hours and the status of labor in particular plants or in particular occupations. Some disputes on such issues are inevitable, but resort to arbitration and calm intelligence can help greatly in avoiding strikes in the long run. Cooperation between labor and management is an economic necessity. In our kind of economy, payrolls and profits *both depend upon the willingness and the ability of business and labor to work together in creating the conditions under which enterprise flourishes.*

The foundation for intelligent and effective cooperation must be accomplished by skillful and imaginative managers in plants throughout the country who are willing to help unions with their problems, and who are able to interest union leaders and their members in the problems of business. Union members and their leaders are keenly interested as a rule in the efforts of management to win new markets. They know that jobs depend upon the success of managements in improving the product, adding new items to the line, and, less frequently, cutting costs and prices. Employees like to be kept informed about what management is doing, what problems it is meeting, and what success it is having. Most of all, they like to have an opportunity to contribute their ideas and suggestions.

The recent epidemic of strikes should not blind us to the fact that even today there are more plants where managements and unions are on good terms than ever before in the country's history. Consider, on the one hand, the extensive and constantly growing efforts of unions to train and develop shop stewards and, on the other hand, the efforts of employers to teach foremen how to carry out the new responsibilities imposed upon them by union agreements. Unions and managements together are learning how to operate together such technical devices as time study and job evaluation. Managements which, several years ago, opposed the provision of umpires to interpret union agreements and to settle deadlocked cases today are taking the lead in suggesting such arrangements.

The war is reaching a crisis, and all groups in the country must be aware as never before of their common interests. This presents an opportunity which should be seized to lay the permanent foundations for more effective team work in American industry. Let history record that the days when Europe was being liberated also were the days when unions and employers were making unprecedented progress in preparing American industry for the return of the service men by developing policies of cooperation between business and unions. Such cooperation will help achieve a peace worthy of our efforts and our sacrifices.



President, McGraw-Hill Publishing Company, Inc.

CHEMICAL
& Metallurgical
ENGINEERING

ESTABLISHED 1902 S. D. KIRKPATRICK, Editor

JULY, 1944

No. 1 on the Agenda

LAST August on this page we ventured the opinion that "Our War Lesson No. 1" should be a realization of the importance of science and technology in the national defense. We pleaded for ways and means to continue the vitally important research work that has become such an inseparable part of our military program. Naturally it was gratifying, therefore, to learn of the appointment on June 22 of a committee of outstanding scientists and high-ranking Army and Navy officers charged by the Secretaries of War and Navy with the responsibility for formulating plans for postwar research. Theirs is now the opportunity for great and distinguished national service. But where to begin? What shall they tackle first?

Without attempting in any way to prescribe the work of this committee, may we suggest the thoughtful consideration of issues raised recently by two of the nation's greatest scientists? First is a remark made on June 26 by Dr. Irving Langmuir, Nobel prize winner in physics, when he accepted the Faraday medal from the British Institute of Electrical Engineers. He said:

> "We need to recognize in this country the part that incentive plays in scientific developments. The English and the Russians have recognized it . . . but no official of our Government has offered a word on such scientific accomplishments. Rather, there have been attempts to penalize initiative. If such an attitude should persist after the war, which in itself is an incentive now, the outlook for science in the United States is indeed gloomy."

It is, of course, true that the war has provided the greatest possible incentive for an all-out effort in science and technology. Never before have so many scientists and engineers worked together under such tremendous pressure to produce new weapons and materials of warfare. After the war is won, the very natural reaction will be for these men to settle back into their normal peacetime pursuits. Yet if they do, the United States may well settle back into a subordinate place among the nations of the world.

Next, we would respectfully suggest that the committee read the masterly address made by Dr. George O. Curme, Jr., on receiving the famous Willard Gibbs medal from the Chicago Section of the American Chemical Society. He titled his remarks "Chemistry for the Many" and with characteristic modesty proceeded to draw from his own productive experience some lessons that should find the widest possible application. He, too, sees the great need to continue our war-stimulated researches:

> "To stop now or even to fail to progress scientifically as rapidly as possible would seem a most ruinous policy. We face the threat because scientific advance contributes to economic strength and thus, as current events show, can provide the aggressor with the sinews of war. If we are complacent and fail to turn the hidden treasures of nature into useful forms, others may not be so negligent. Then, should we again have to suffer the grave dangers and losses of war, we would lack much that we need. . . . Along with an army, navy, and air force, our nation must have a vigorous industrial economy as a basic protection in a troubled world."

Dr. Curme also sees clearly the importance of carrying forward into peacetime the techniques we have had to master in time of war. "Thus far," he says, "never have science, industry and consumer grasped the opportunity to work together constructively for the benefit of mankind. We have seen their tremendous effectiveness when harnessed together to destroy our enemies. Now we face a period when the full effect of this powerful team can be put into action."

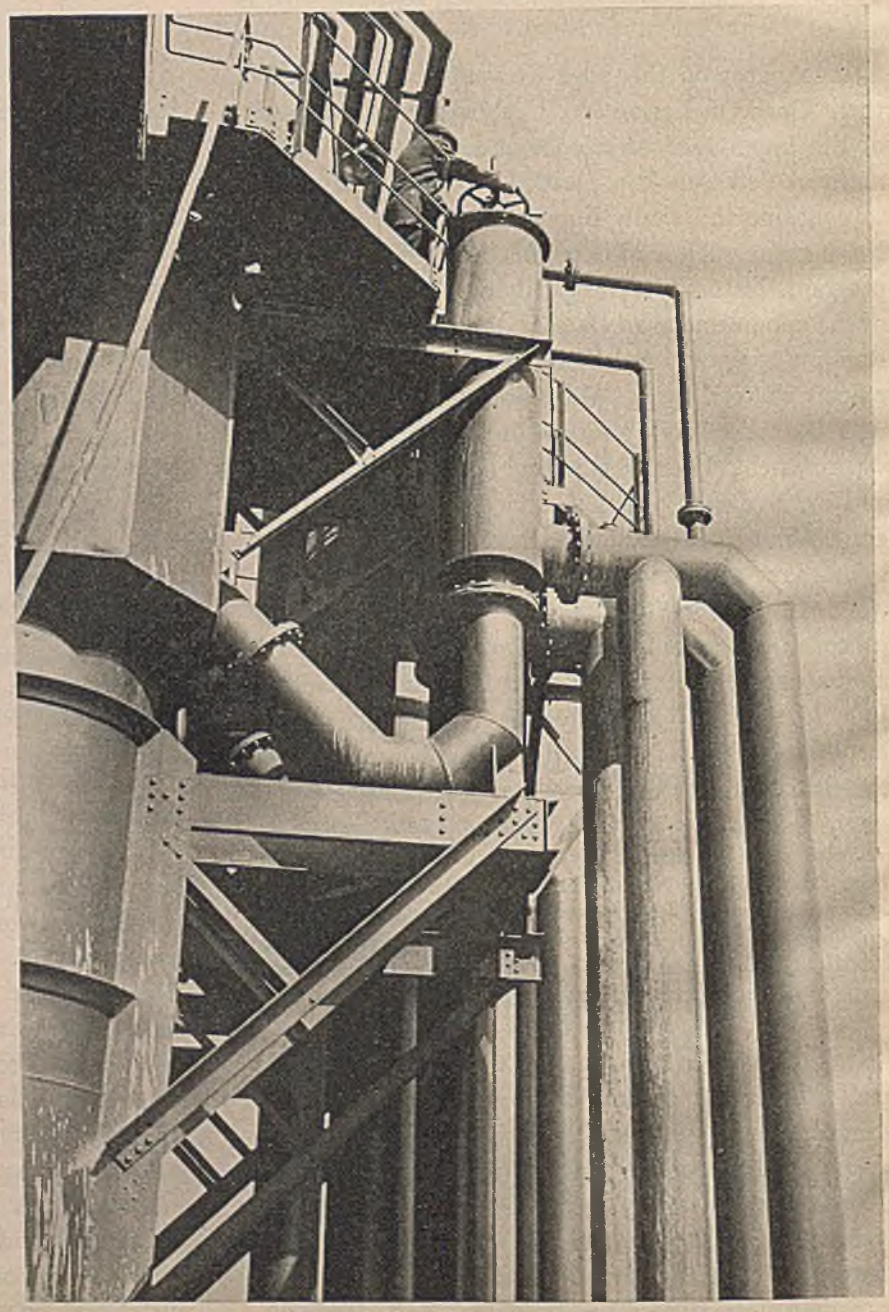
In short, what we have done under duress and at great disadvantage can be duplicated for the good of humanity if we can but set up the proper climate and conditions under which science and technology can develop and thrive in this country. With this in mind, may we express the hope that the Wilson committee will put in the No. 1 place on its long-time agenda the necessity for providing "Proper Incentives for Postwar Research"?

NORMAN G. FARQUHAR *Assistant Editor, Chemical and Metallurgical Engineering*

SULPHUR

Removal and Recovery from Coke Oven Gas

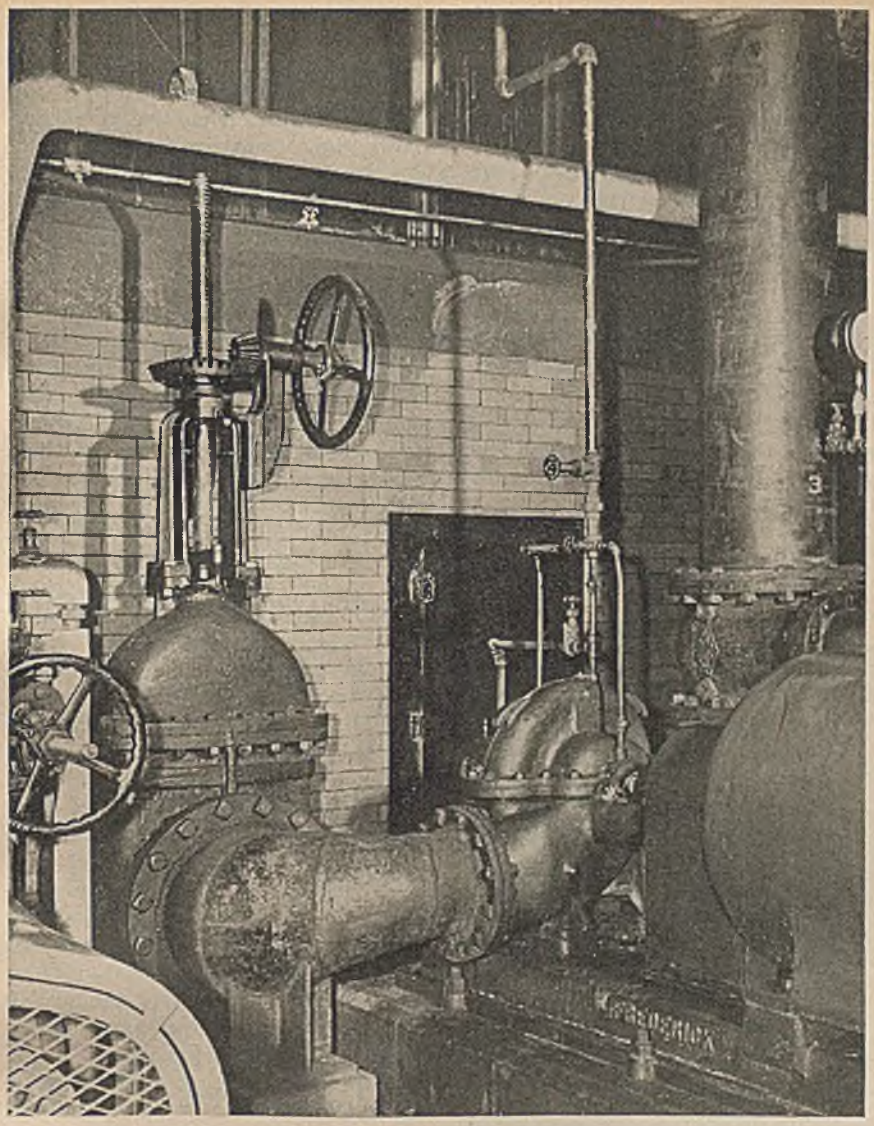
At the Ford Motor Co.'s River Rouge plant the sulphur compounds in coke oven gas have recently presented a problem of increasing severity due to their corrosive character. To overcome this difficulty the Thylox system was introduced for its removal. One outstanding difference in this process from others is that the sulphur is recovered in elemental form. This eliminates the difficulty of getting rid of hydrogen sulphide and provides a usable byproduct.–*Editors*



Up 120 ft. off the ground an operator adjusts the level in a thionizer by varying the threaded overflow pipe. Pipe sizes indicate the large volume of solution circulated

Sulphur compounds, including hydrogen sulphide and mercaptans, have long been known to be detrimental when they occur in combustible gas to be used for industrial purposes. This is particularly true if the gas is to be used for operations such as the heat treating of metals, since the oxidation products of these compounds are severely corrosive in character.

At the Rouge plant of the Ford Motor Co. in Dearborn, Mich., sulphur compounds in coke oven gas have presented a problem of increasing severity. The situation came to a climax about two years ago with construction of new plants for the manufacture of war equipment. Up to that time, Ford engineers had found it necessary to remove sulphur from about 12 million cu.ft. of coke oven gas per day for use throughout the plant. However, with the installation of a magnesium smelter and construction of an armor plate building, approximately 10 million more cu.ft. per day of sulphur-free coke oven gas was required to reduce corrosion on the



There are two 125-hp. centrifugal pumps in continual operation transferring the foul Thylox solution from the absorbers to the reactivation equipment

heat treating furnaces which are constructed with nickel-chrome steel rails, trays, conveying equipment, etc.

The old method for removing sulphur from coke oven gas utilized the so-called iron oxide boxes which contained iron oxide mixed with wood shavings. The gas to be purified was passed through these boxes which stripped it of hydrogen sulphide. However, instead of installing additional iron oxide boxes to handle the increased requirements, it proved cheaper to put in one absorption system to purify the total volume of gas coming from the coke ovens, approximately 54 million cu.ft. per day. The iron oxide boxes are still in use in some parts of the plant where extra care must be taken to eliminate all traces of sulphur products in the gas. However, they are cumbersome and expensive, requiring excessive labor charges for their maintenance.

Various other methods such as the sodium carbonate and the phenolate processes for the removal of sulphur from gas are used extensively, but one outstanding difference in the Thylox process is that the sulphur is recovered in elemental form. This eliminates the difficulty of getting rid of hydrogen sulphide and provides a usable byproduct. At present, in the Ford plant approximately 6 tons per day of 99 percent pure sulphur are recovered.

Although this recovery is incidental to purification of the coke oven gas, it is of importance because of the finely divided state of the sulphur as it is recovered. In colloidal form, it is considerably more valuable than ordinary sulphur as it can be utilized in the manufacture of fungicide powder. There is, of course, the difficulty of drying the sulphur without melting it, but it can be used in paste form for certain insecticides.

Pending solution of this problem, most of the sulphur from the Rouge plant has been consumed in sulphite pulp and paper mills in the preparation of cooking liquor. Since there is some arsenic in the recovered sulphur, it probably cannot be used in the manufacture of sulphuric acid for general use, although in many cases a trace of arsenic would not be objectionable.

Coke oven gas entering the Thylox unit has come through the main from the coke ovens, passed through a scrubber for tar removal, a primary gas cooler, Cottrell electric tar precipitators, and finally goes to the sulphate saturators for removal of ammonia. Thus the gas is practically 100 percent free from tar and ammonia, and does not cause excessive trouble in the absorption equipment.

The system is based on the absorption of hydrogen sulphide and other organic sulphur compounds in a solution of sodium thioarsenate, subsequent air oxidation on the resulting solution freeing the sulphur and leaving an active solution for further absorption.

Before entering the absorbers, of which there are two in parallel, the gas is cooled to approximately 70-75 deg. F. in order to increase the efficiency of the absorbers. Steel tank coolers 45 ft. high and equipped with wood hurdles are used for cooling the gas. Water is sprayed into the cooler at a temperature of about 70 deg. F., and all wash water is run off to the naphthalene pit for possible recovery of naphthalene. The gases cooled by this means pass directly into the absorbers which are somewhat larger tanks, 90 ft. high and 20 ft. in diameter, also equipped with wood slat platforms. Here the gases pass upward countercurrent to activated Thylox solution which is sprayed over the wood hurdles. When the gas leaves the absorbers, and returns to the plant mains, it is at a temperature of about 100 deg. F. and approximately 98 percent free of sulphur compounds. If further purification is required, the gas may be passed through iron oxide boxes, but for most purposes it is sufficiently pure at this point.

In order to obtain optimum absorption conditions, it has been found necessary to maintain the proper pH value by adding small amounts of soda ash to the solution. There is also a certain amount of make-up required due to losses in the system such as leaks, evaporation and extraneous chemical reactions.

Passing from the absorbers, the solution which has picked up the sulphur compounds is transferred to the oxidizing unit where it is reactivated and sent back to the absorption system. To do this, there are two 125-hp. motor-driven centrifugal pumps each of which is capable of handling 150,000 gal. per hr. In addition, a third pump is maintained in good condition as a standby. Since operation began, it has been found advantageous to bypass approximately 25 percent of the foul solution directly to the absorber. All the foul solution is pumped through a heater in the pump discharge line where its temperature is raised to about 100 deg. F. by means of superheated coils. A steel tank

located about 125 ft. off the ground receives the pump discharge and feeds the rest of the system by gravity.

From this feed tank, the foul solution is led into the bottom of a primary thionizer, rises to the top and is then led into the bottom of a secondary thionizer. Solution overflowing the top of the secondary thionizer has been completely reactivated and is run off to a weir box just above the absorbers. Here the reactivated solution is mixed with the 25 percent of the foul solution which was bypassed. It is then fed through a seal to a distributor ring on top of the absorbers which distributes it through spray nozzles.

Action in the thionizers consists simply of air oxidation. A battery of air compressors is in continual operation supplying air to the thionizers at the rate of 200 cu.ft. per min. As this air bubbles up through the 120 ft. high thionizers, the absorbed sulphur compounds are oxidized and the freed sulphur lifted to the surface where it forms a froth. As this froth builds up, it spills slowly over the top of the thionizers into a trough which in turn directs it to a slurry tank where it is agitated and stored for further processing.

The first step in the recovery of the sulphur is to filter it on a standard rotary filter. A cake approximately ¼ in. thick is formed on the trough and then dropped into a stainless steel-clad autoclave which is steam jacketed. The filtrate from the operation is returned to the absoption solution system.

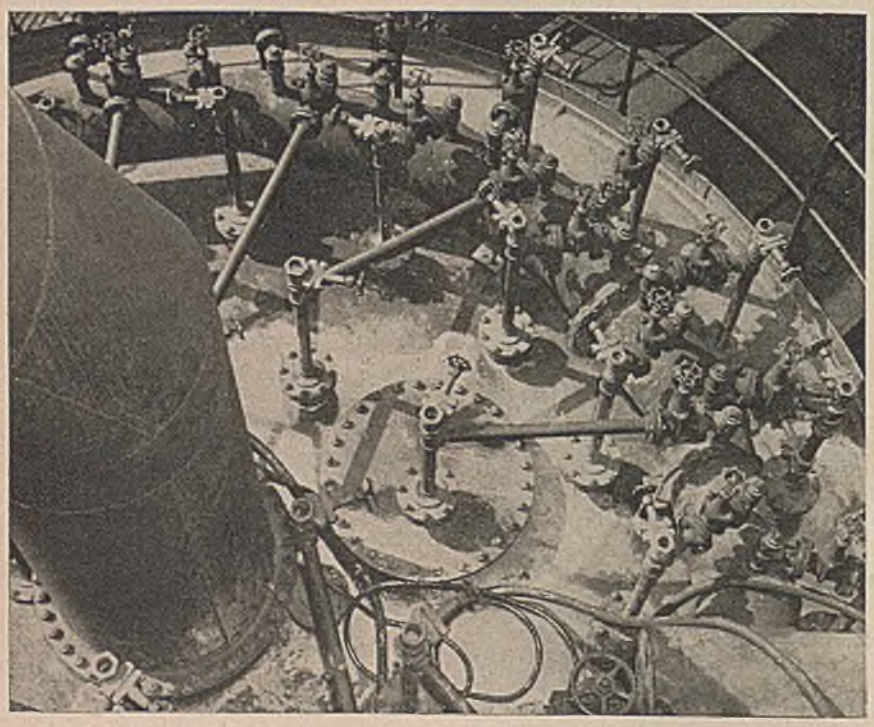
Steam at a temperature of 240 deg. F. is used in the autoclave and results in the melting of the sulphur which separates to the bottom half of the autoclave, leaving the scum and impurities on the top. Having been thus separated from the water and other impurities, the sulphur may be drained into a cast iron mold and allowed to solidify, or processed by a newer method developed at the Ford plant. In either case, the impurities are blown off to a steel tank to be reworked.

In the newly developed system, the molten sulphur is blown to an agitated steel tank where it is kept in a molten state. This tank also acts as a feed tank for a stainless steel belt about $\frac{1}{16}$ in. thick, 2 ft. wide and about 75 ft. long. The molten sulphur is allowed to flow freely from a 2-in. pipe onto the belt where it forms a cake about $\frac{1}{16}$ in. thick and 2 ft. wide. As the sulphur travels along, it is cooled through the belt by a series of water sprays playing on the underside of the conveyor. Before the sulphur has reached the end of the belt travel, it has thoroughly solidified and cracks off as the steel bends to go around the pulley. The sulphur in this form is readily handled in a hopper bin from which it can be distributed either for direct packaging, grinding or further processing.

As indicated above, Ford engineers are considering the feasibility of marketing the sulphur paste directly, thus eliminating some of these steps. In addition, they are considering the grinding of the sulphur cake to a sufficiently small size to permit its use in dusting powders.

While this Thylox process is referred to as an absorption, it is recognized that there is actually a definite chemical reaction taking place in the absorbers. This is why the "desorption" in the thionizers is not simply the liberation of the sulphur compound originally in the coke oven gas, but rather an actual oxidation of sulphur from chemical combinations in the absorbing solution.

A "doughnut" with its many valves and bleeders insures even distribution of the absorbing solution in the absorbers



COKE AND BYPRODUCTS IN 1943

DURING the year 1943 byproduct coke produced in the United States reached a grand total of 63,681,244 tons. Of this amount 35,293,774 tons were made in the Pennsylvania-Buffalo-Ohio area, 14,977,169 tons in the Illinois-Indiana-Michigan-Missouri area, 5,560,924 tons in Alabama and Tennessee, 5,002,860 in the New England-New Jersey-New York (east of Buffalo) area, and 2,846,517 tons in the Northwest and West.

The total production of gas-house coke in the United States in 1943 amounted to 862,104 net tons, valued at $6,745,791.

In 1943 there were produced 7,959,707 tons of beehive coke. The largest producing area was Pennsylvania with 6,974,690 tons.

Byproduct production was smaller during the year, with the exception of ammonia liquor. Ammonium sulphate dropped from 1,533,608,000 tons in 1942 to 1,525,289,504 for a loss of 8,319,000 tons. In the previous year 740,176,000 gal. of tar had been produced, which compares with a 1943 production of 737,858,972 tons. Creosote oil production in 1942 had been 42,220,000 gal. compared to 37,277,980 last year.

Prices on ammonium sulphate remained constant at $1.46 per 100 lb. (f.o.b. port) throughout the year. Benzol sold at 15c. per gal., toluol at 28c. per gal. and naphthalene flakes at 8c. per lb.

Preliminary Statistics of the Coke Industry in 1943*

	1943	1942
Production		
Ammonium sulphate, lb.	1,525,289,504	1,533,608,000
Ammonia liquor, lb.†	68,188,961	67,854,000
Tar, gal.	737,858,972	740,176,000
Creosote oil, gal.	37,277,980	42,220,000
Sales		
Ammonium sulphate, lb.	1,549,668,327	1,503,829,000
Ammonia liquor, lb.†	71,348,588	63,875,000
Tar, gal.	430,426,547	[445,597,000
Creosote oil, gal.	37,041,430	40,605,000
Value of sales		
Ammonium sulphate	$20,240,553	$19,460,000
Ammonia liquor †	$2,514,916	$2,238,000
Tar	$23,778,635	$24,156,000
Creosote oil.	$4,440,216	$4,837,000
Stocks, end of month		
Ammonium sulphate, lb.	58,862,206	87,353,000
Ammonia liquor, lb.†	1,981,951	2,031,000
Tar, gal.	36,972,692	31,739,000
Creosote oil, gal.	1,234,274	879,267

* Data reported by byproduct coke plant operators only. † NH_3 content.

GEORGE D. BIEBER *Economist, Research Department, Koppers Co., Pittsburgh, Pa.*

MARKET ANALYSIS

Chemicals for Rayon and Cellulose Plastics

Numerous articles have appeared in the literature appraising advances made in the manufacture of certain cellulose derivatives from the standpoint of increase in annual output. In this article, these developments are examined for their significance in terms of demands for chemical raw materials generated by the expansion in production of cellulose products.—*Editors*

REMARKABLE advances have been made in the production of cellulose derivatives in the United States during the past 70 years. Nitrocellulose sheets, rods and tubes, first made in commercial quantities about 1870, were in widespread use for approximately forty years before other synthetic plastics entered the field. Large-scale manufacture of rayon, formerly called artificial silk, commenced in 1911. Since this date there has been a phenomenal growth in the annual output of this product. Moreover, rayon was the only important synthetic fiber manufactured in this country until nylon was commercialized in 1938.

Similarly, the annual production of cellophane has risen rapidly since this material was first manufactured in large amounts about 1926. There has also been moderate growth in the quantities of sausage casings produced annually since that year. Although there have been o annual increases in the production of nitrocellulose plastics corresponding to rayon and cellophane, substantial quantities of nitrocellulose are now required for a variety of purposes. Cellulose acetate was first marketed in the form of sheets, rods and tubes in 1926 and as molding powders in 1929. The general acceptance of these plastics is confirmed by a large expansion in their annual output. Ethyl cellulose was added to the growing list of commercial cellulose derivatives in 1935, cellulose acetate propionate in 1937, cellulose acetate butyrate in 1938, and methyl cellulose in 1939.

The enormous demand for chemicals, generated by the large increase in the production of these cellulose products, is not generally recognized. The incomprehension is attributable largely to lack of statistics concerning the quantities of chemicals utilized annually in the manufacture of these synthetic materials.

Although official data are available in only a few instances, estimates which approximate the actual amounts of the various chemicals utilized annually can be calculated from production statistics by the use of conversion factors. Consumption data for rayon; nitrocellulose sheets, rods and tubes; cellulose acetate plastics; and pyroxylin-coated fabrics cited in this review are based upon annual statistics published by the Textile Economics Bureau and the United States Department of Commerce, except as elsewhere noted. Figures for the other cellulose derivatives are calculations from production data estimated by the writer. While many of the conversion factors were obtained from *Chem. & Met.*'s "Chemical Engineering Flow Sheets," other sources were also consulted.

The markets for chemicals considered in this study are limited to the years from 1933 to 1943, inclusive, as production statistics for certain cellulose derivatives are not available prior to this period. Raw materials used in the treatment of rayon prior to and following spinning operations are excluded, as well as most of the addi-

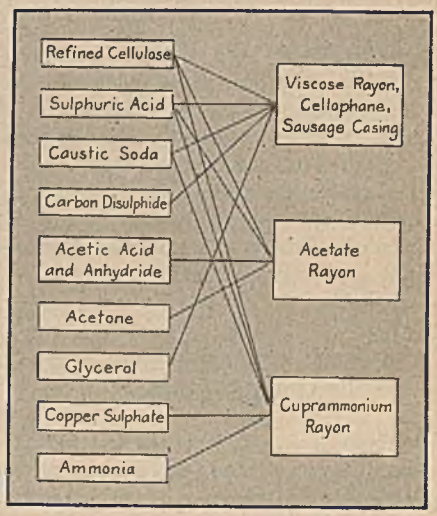


Fig. 1—Important chemicals utilized in the manufacture of rayon and allied products

Table I—Estimated Consumption of Chemicals in the Production of Rayon, Cellophane and Sausage Casings, 1933-1943[1]

Year	Refined Cellulose	Sulphuric Acid[2]	Caustic Soda[2]	Carbon Disulphide	Acetic Acid and Anhydride	Acetone	Misc.[4]	Total
1933	142	136	144	39	12	8	7	488
1934	142	159	147	40	11	8	7	514
1935	173	188	163	49	17	11	5	606
1936	192	205	170	54	19	13	7	606
1937	224	236	186	63	26	17	5	757
1938	188	199	156	51	25	16	7	642
1939	237	252	196	63	32	21	8	809
1940	292	292	230	77	44	30	9	974
1941	348	342	270	90	56	37	10	1,153
1942	396	389	300	101	59	40	10	1,295
1943	425	394	320	113	56	38	11	1,357
Total	2,759	2,792	2,282	740	357	239	86	9,255

[1] Thousands of short tons. [2] 100% basis. Calculated from *Chem. & Met.* estimates. [3] *Chem. & Met.* estimates. [4] Includes only ammonia, copper sulphate (without recovery), glycerol used in manufacture of cellulose film and nitric acid used for manufacture of nitrocellulose rayon in 1933-34. Identical quantities of glycerol assumed to have been used per unit of cellulose film produced throughout the period.

Table II—Estimated Consumption of Nitrocellulose in Plastics Products, 1933-1943

(Nitrocellulose Content)

Product	Total (Short Tons)	Relative (Percent)
Lacquers	171,500	51.8
Sheets, rods and tubes	60,700	18.4
Film and miscellaneous	58,300	17.7
Pyroxylin-coated fabrics	39,600	12.1
Total	330,100	100.0

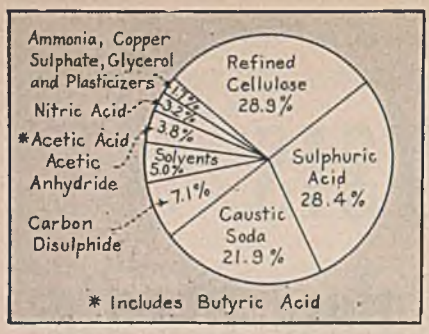


Fig. 2 — Estimated relative consumption of chemicals used in manufacture of certain cellulose products, 1933-1943

tional chemicals such as butyl acetate required to make commercial products from other cellulose derivatives. However, estimates of the quantities of plasticizers used in cellulose acetate, cellulose acetate butyrate, and nitrocellulose plastics and solvents required for pyroxylin-coated fabrics are included, as they can readily be calculated from production data. Pigments are not included.

RAYON, CELLOPHANE, AND SAUSAGE CASINGS

Rayon is manufactured by the (1) viscose, (2) acetate, and (3) cuprammonium processes. Cellophane and sausage casings are made in a manner similar to viscose rayon.* Since these processes are well known, they need not be considered at this point. Fig. 1 shows the important chemicals utilized in the manufacture of these products.†

Viscose rayon, cellophane and sausage casings represented about 75 percent of the 2,600.000 short ton output of rayon and allied products during the period from 1933 to 1943; acetate rayon was equivalent to approximately 23 percent; and cuprammonium rayon about 2 percent. Nitrocellulose rayon accounted for less than 1 percent of the total as production was suspended in 1934.

Table I reveals that refined cellulose, sulphuric acid, caustic soda, carbon disulphide, acetic acid and acetic anhydride, acetone, glycerol, copper sulphate, and ammonia are required in the manufacture of rayon, cellophane, and sausage casings. In 1933, 488,000 short tons of these chemicals were utilized in the production of these products. Consumption of these materials has increased rapidly since this year, exceeding 1,000,000 short tons for the first time in 1941. By 1943 the total had risen to 1,357,000 short tons.

Although the figure varies according to the relative output of each type of product manufactured, an average of approximately 3.5 lb. of chemicals were consumed for each pound of synthetic fiber, cellophane, and sausage casings produced.

NITROCELLULOSE PLASTICS

Nitrocellulose is utilized in the plastics industry in the production of (1) lacquers; (2) photographic film; (3) pyroxylin-coated fabrics; (4) sheets, rods and tubes; and (5) miscellaneous products. Table II presents the estimated total and relative consumption of nitrocellulose in the production of the above-mentioned commodities during the past 11 years.

About 48,000 short tons of chemicals were used in these segments of the plastics industries in 1933, but by 1943 the quantity has increased to 118,000 short tons (Table III). This total, however, was about 9,500 short tons below the 1941 peak of 128,600 short tons, attributable principally to the estimated lower output of pyroxylin-coated fabrics.

Approximately three pounds of raw materials are required for each pound of nitrocellulose plastics manufactured.

CELLULOSE ACETATE PLASTICS

Estimates of the quantities of refined cellulose, plasticizers, acetic acid and acetic anhydride, and sulphuric acid consumed in the manufacture of sheets, rods, tubes and molding compositions made from cellulose acetate and cellulose acetate butyrate are presented in Table IV.

There has been a very large growth in the consumption of these chemicals during the past decade, particularly in the production of molding compositions. Estimates in the table reflect the quantities of raw materials used in the production of sheets, rods and tubes only for years prior to 1938. In this year, however, molding compositions were responsible for 52 percent of the 8,700 short tons of chemicals utilized. These same products used 83 percent of all the raw materials consumed in 1941.

The total consumption of chemicals for the period was 145,700 short tons, or about two times the quantity of cellulose acetate and cellulose acetate butyrate utilized in the manufacture of these plastics. It is interesting to note that identical quantities of refined cellulose and plasticizers are required annually in the production of these plastics.

Consumption data for cellulose acetate propionate, ethyl cellulose, and film and dopes made from cellulose acetate are difficult to estimate as official production statistics are not available. It is believed, however, that at least 35,000 short tons of refined cellulose and other chemicals were utilized in the production of these derivatives in 1943.

TOTAL CONSUMPTION

Total quantiies of chemicals used in the manufacture of the cellulose derivatives discussed, exclusive of those included in the preceding paragraph, are shown in Table V. The amounts utilized rose steadily, with but one minor recession in 1938, from approximately 538,000 short tons in 1933 to about 1,509,000 short tons in 1943. The relative consumption of chemicals for the period 1933–43 is shown in Fig. 2.

Fig. 3 reveals that the major portion of the refined cellulose, sulphuric acid, caustic soda, and carbon disulphide was utilized in the manufacture of viscose rayon and allied products during the period under review. Most of the acetic acid and acetic anhydride and 46 percent of the solvents were consumed in the manufacture of acetate rayon, while 100 percent of the nitric acid and the remainder of the solvents were used in the manufacture of nitrocellulose products. Cellulose acetate, cellulose acetate butyrate, and nitrocellulose plastics consumed 100 percent of the plasticizers, while viscose rayon and allied products and cuprammonium rayon together consumed an identical percentage of the ammonia, copper sulphate, and glycerol.

Rayon, cellophane and sausage casings

Table III—Estimated Consumption of Chemicals in the Production of Nitrocellulose Plastics, 1933-1943[1]

Year[2]	Refined Cellulose	Nitric Acid[3]	Solvents[4]	Sulphuric Acid[3]	Plasticizers	Total
1933	9,000	14,600	14,900	7,300	2,200	48,500
1934	13,700	21,100	18,800	10,500	2,600	66,700
1935	19,300	29,700	22,500	14,900	3,400	89,900
1936	19,500	29,900	27,200	15,000	3,900	95,500
1937	20,900	32,200	28,800	16,100	4,300	102,300
1938	15,600	24,000	22,700	12,000	2,900	77,200
1939	19,100	29,400	27,500	14,700	3,700	94,400
1940	20,200	31,100	26,200	15,600	3,800	96,000
1941	26,000	40,000	36,000	20,000	5,600	127,000
1942	24,500	37,800	25,500	18,900	5,900	112,600
1943	26,200	40,200	28,000	20,100	3,600	118,100
Total	214,500	330,000	278,100	165,100	41,900	1,028,200

[1] Short tons. [2] Data for 1942 and 1943 (except 1942 estimates for pyroxylin-coated fabrics) based on production statistics estimated by the writer. [3] 100% basis. [4] Solvents utilized in production of coating compositions for fabrics.

* Cellulose sponges and similar materials are not included in this study.

† Consumption data for glycerol presented in this report are restricted to the quantities used in the manufacture of cellulose film.

used 89 percent of all chemicals consumed in the manufacture of products derived from cellulose. About 78 percent was utilized in the production of viscose rayon and allied products. Acetate rayon and nitrocellulose products each accounted for 10 percent of the total. The remainder was consumed in the manufacture of cuprammonium rayon and cellulose acetate and butyrate plastics.

ADVANCES

The advances made in the consumption of chemicals in the production of cellulose derivatives are both significant and astounding. In the first place, they were not conditioned primarily by economic prosperity. In fact, during the first part of the period analyzed, this country was in the midst of one of the worst business depressions ever experienced. Although many industries were using only a fraction of average annual physical volume of raw materials of the middle and late 1930's, consumption of chemicals in the manufacture of cellulose derivatives rose from 538,000 short tons in 1933 to 702,000 short tons in 1935, an increase of 130 percent. Moreover, this growth is still continuing at the present time due to active demands for both civilian and military goods manufactured from cellulose.

There are relatively few synthetic organic finished products made annually at the present time in larger quantities than the cellulose derivatives considered in this review. Furthermore, each pound of cellulose product produced creates an average demand for at least three pounds of raw materials.

Although quantitative data are not presented for these substances, the large expansion in the manufacture of cellulose products has generated a market for such raw materials as acetylene, chlorine, coke, salt and sulphur which are required for the production of the chemicals reviewed in this study. Appreciable quantities of caustic soda and other raw materials are also required in the preparation of refined

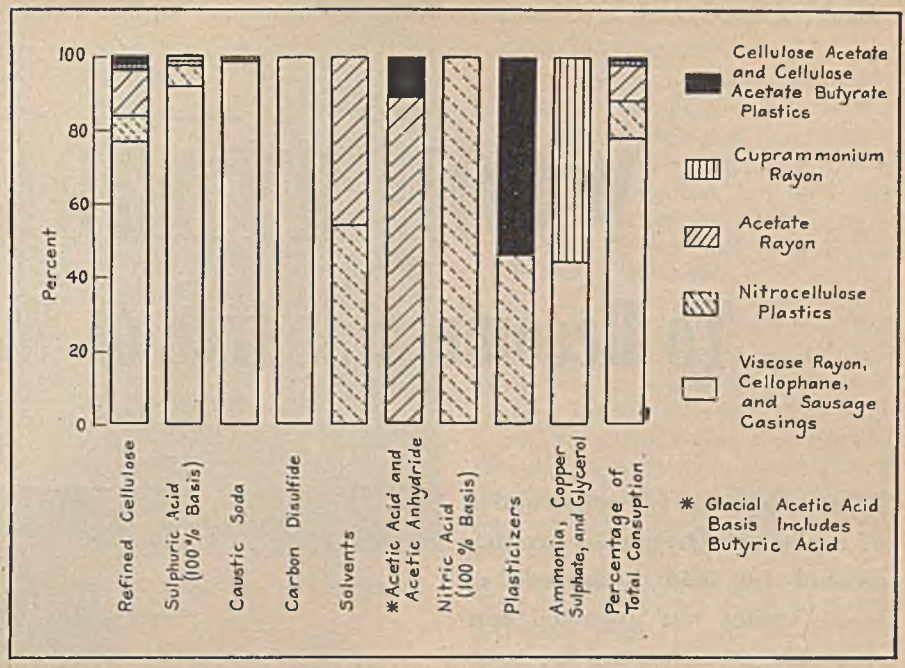


Fig. 3—Estimated relative consumption of chemicals by type of cellulose product manufactured

cellulose from raw cotton linters and raw wood pulp. Furthermore, substantial amounts of chemicals are utilized in the treatment of rayon to improve its properties and in the manufacture of lacquers, dopes and related materials from cellulose derivatives.

Increased demand for certain of these chemicals has in turn stimulated the manufacture of cellulose derivatives and other products through reduced raw-material costs brought about by economies inherent in large-scale production. This is particularly true of cellulose acetate rayon and cellulose acetate plastics, production of which was restricted initially by the high cost of acetic anhydride.

SUMMARY

The large expansion in the production of rayon and cellulose plastics has created an enormous demand for chemicals. In 1933, about 538,000 short tons of refined cellulose, sulphuric acid, caustic soda, carbon disulphide, solvents, acetic acid and acetic anhydride, nitric acid, plasticizers, ammonia, copper sulphate and glycerol were used in the manufacture of these cellulose derivatives. A decade later the total consumption had more than doubled. During the past 11 years, viscose rayon, cellophane and sausage casings utilized about 78 percent of the chemicals consumed by the industries under discussion. Acetate rayon and nitrocellulose products each used 10 percent, while cuprammonium rayon and cellulose acetate and cellulose acetate butyrate plastics consumed the remainder.

These advances are particularly significant as there are relatively few synthetic organic products made annually in larger quantities than the cellulose derivatives at the present time. Moreover, a market for at least two to three and one-half pounds of chemicals is generated for each pound of cellulose products manufactured.

Table IV—Estimated Consumption of Chemicals in the Production of Cellulose Acetate and Cellulose Acetate Butyrate Plastics, 1933-1943[1]

Year[2]	Refined Cellulose	Plasticizers	Acetic Acid and Anhydride[3]	Sulphuric Acid[4]	Total
1933	500	500	400	[5]	1,400
1934	1,000	1,000	900	100	3,000
1935	2,100	2,100	1,900	200	6,300
1936	2,600	2,600	2,300	300	7,800
1937	2,700	2,700	2,400	300	8,100
1938	2,900	2,900	2,600	300	8,700
1939	4,200	4,200	3,800	400	12,600
1940	4,800	4,800	4,400	500	14,500
1941	7,400	7,400	6,900	800	22,500
1942	8,800	8,800	8,100	900	26,600
1943	11,600	11,600	9,800	1,200	34,200
Total	48,600	48,600	43,500	5,000	145,700

[1] Short tons. [2] Data for 1942 and 1943 based on production data estimated by the writer. [3] Glacial acetic acid basis. Data for 1938-43 include butyric acid and butyric anhydride in terms of butyric acid equivalent. [4] 100% basis. [5] Less than 100 tons.

Table V—Estimated Total Consumption of Chemicals Used in the Manufacture of Certain Cellulose Products, 1933-1943*

Year	Total
1933	537,900
1934	583,700
1935	702,200
1936	763,300
1937	867,400
1938	727,900
1939	916,000
1940	1,084,500
1941	1,302,500
1942	1,434,200
1943	1,509,300
Total	10,428,900

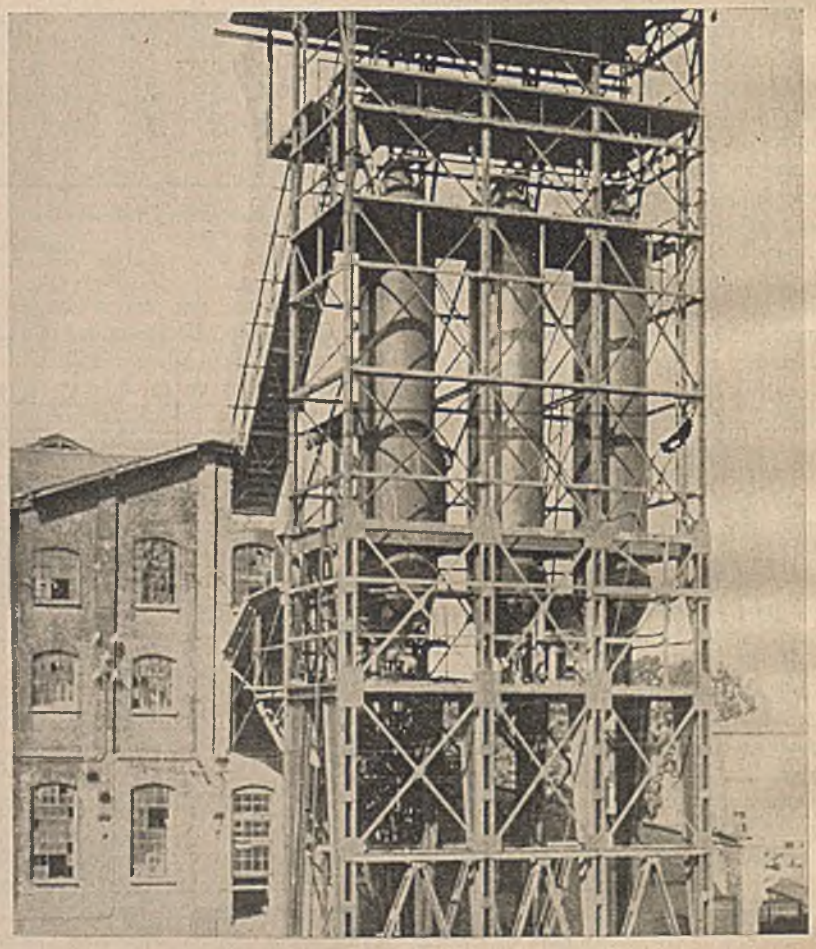
* Sum of Tables I, III & IV. Short tons.

CHAPIN COLLINS *American Forest Products Industries, Inc., Washington, D. C.*

WOOD HYDROLYSIS

To Become a Source of War Alcohol

Recent approval for construction of a plant in Oregon to produce alcohol by acid hydrolysis of wood wastes has attracted considerable attention on the process and its potentialities in this country. Herein the author briefly discusses German practices and outlines some of the processing and equipment features of the American-improved process that will probably be used in the Oregon plant.—*Editors*



Just after installation of three wood-sugar percolators at Tornesch, and before enclosure. Sawdust enters at top and, after hydrolysis, the sugar solution is recovered at the bottom

IN OLDER European processes, wood hydrolysis was carried out in sealed digesters with chips and sawdust being treated with dilute sulphuric acid under steam pressure. Cellulose was converted into sugars, enough fermentable glucose being recovered to produce about 25 gal. of 190-proof ethyl alcohol per ton of dry wood. Since roughly two thirds of the wood could theoretically be converted into sugars to produce close to 75 gal. of alcohol per ton of dried wood, this yield was relatively inefficient.

In contrast, the first Scholler process* plant at Tornesch recovered about 1,000 lb. of sugars from a ton of dry waste, sufficient to make about 50–60 gal. of alcohol or about 500 lb. of feed yeast (dry basis) containing 50 percent protein.

Steel percolators, 45 ft. high and 8 ft. in diameter, were charged with ten long tons of sawdust and other wood wastes under low steam pressure. Percolators were lined with acid-resistant brick. After the contents were pre-heated to 265 deg. F., a 0.5 percent solution of sulphuric acid was introduced at the top and forced through the wood under 165 lb. pressure. Sugar solution was withdrawn at the bottom.

Successive batches, alternating with rest periods, ranged from 3,000–2,000 gal. each. As the volume of these batches was reduced, pressure and temperature were increased. Final batches went through at about 375 deg. F. and 180 lb. pressure.

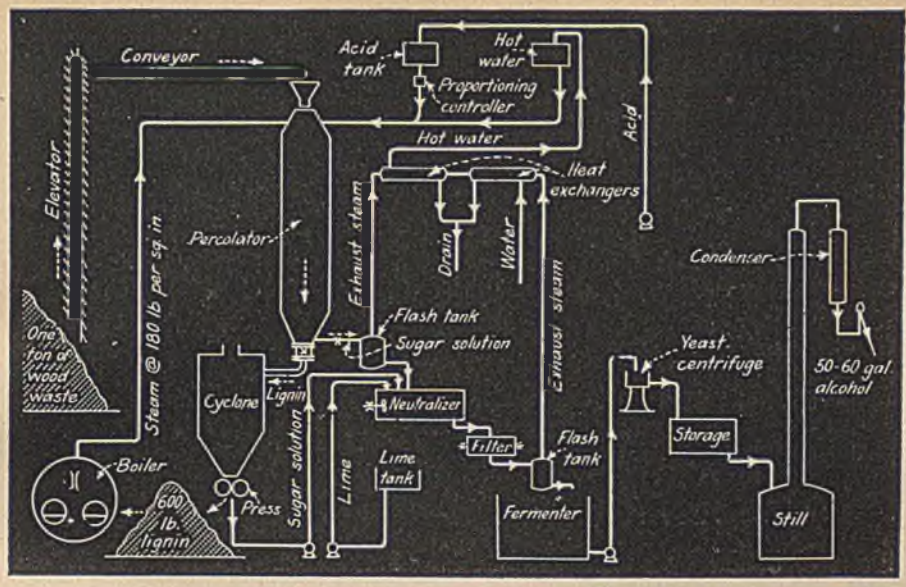
This 10-ton cycle resulted in about 20,000 gal. of wort of 5 to 6 percent sugar, about 80 percent fermentable. After neutralizing, the wort was filtered and then was ready for fermentation into alcohol or for yeasting into feeding yeast.

In each percolator was a residue of about 6,000 lb. of lignin (600 lb. per ton of wood) which was expelled by steam pressure into a cyclone. The lignin thus produced was a fine, brown powder. Wort, emerging from the percolators at about 334 deg. F., flowed through coil heat exchangers to preheat water used for subsequent batches. This entire cycle required about 20 hr., each acid batch remaining in the cylinder from 20–45 min.

AMERICAN DEVELOPMENTS

Current American interest in alcohol, intensified by astronomical war demands

* All weights are given on the basis of dry substance.



American-modified Scholler process for wood hydrolysis. This is in general the method that will be used in the Oregon plant

and by threatened shortages of grain, has been turning to sawmill wastes, of which between 20–30 million tons are available annually. Industrial alcohol requirements this year have been estimated at 630–640 million gallons, five times prewar needs.

In 1943 the Office of Production Research and Development of WPB requested the U. S. Forest service to test the hydrolysis process with American woods, providing $100,000 for this purpose. These tests were made in a pilot plant at Marquette, then owned by the Cliffs Dow Chemical Co., and were under the supervision of Dr. E. C. Sherrard and Dr. E. E. Harris. Dr. J. A. Hall of the Forest Service acted as liaison man between the Laboratory and OPRD.

Purpose of the Marquette tests, which were highly successful, was to prove German results and to adapt the process to American conditions. Modifications by the Forest Laboratory have cut the time of each cycle to a third, permitting a maximum of four cycles a day per percolator. While there may be some sacrifice of sugar per unit of wood, the daily output per percolator would be three or four times greater than in Germany. Time is saved by shortening the preheating period and by altering the initial steam pressure. Rest periods between batches are eliminated.

Impetus was given this development by the presence in this country of E. M. Schaefer, once head of the Tornesch firm which translated Scholler's process into industrial reality. Dr. Eduard Farber, one of Germany's leading wood chemists, is now in charge of lignin research for the Timber Engineering Co. and recently Carl Levy, the engineer who developed and operated the Tornesch plant, came to this country at the request of WPB.

At Tornesch, every effort was made to convert the last fiber of cellulose to sugar, solutions as dilute as 0.1 percent being recovered. Under American conditions, it is not considered economic to recover solutions below approximately 2.0 Brix.

Additional sugar is obtained by pressing the residual lignin. Neutralizing the acid content takes place hot and under pressure, which aids subsequent ferementation and facilitates removal of tars and other substances. Flash evaporation, in place of tubular heat exchangers, avoids fouling with tar and, by increasing the percentage of sugar, results in a more satisfactory solution for fermentation.

Vulcan Copper & Supply Co. has prepared an engineering report, based upon Marquette experiences, for a plant using 220 tons of dry wood wastes daily. Slabs and ends must be hogged to prevent channeling of the acid solution. Five percolators, lined with Herculoy instead of brick, would have a capacity of ten long tons each. Steam pressure would increase from 50 lb. for the first batch to 150 lb. for the final batch. Acid concentrations would range from 0.85–0.40 percent. There would be 8–15 batches, the total duration per cycle to be about six hours.

Lignin, after being blown into a cyclone, would be pressed to a moisture content of 50 percent and then used as fuel in the boiler. This use of lignin, however, is regarded as an expedient only until more profitable utilization can be developed on a mass scale. Such a plant would produce 65–75 tons of lignin daily.

Liquors from the percolators would be flashed to 35 lb., neutralized with lime, filtered and subsequently flashed again. Steam from flashings would preheat water for later batches. The wort then would contain six percent sugars, 80 percent fermentable. Fermentation, in the presence of nitrogen and phosphorus nutrients, would result in a beer two percent alcohol by weight.

Production of 52 gal. or more of 190-proof ethyl alcohol per ton of wood waste is expected from a 20-hr. fermentation. Thus, the projected 220-ton plant would produce more than 11,000 gal. of alcohol daily.

Daily requirements include 1,900,000 gal. of water; 1,106,000 lb. of steam at 190 lb. per sq. in.; 26,500 lb. of sulphuric acid; 900 hp. of electric connected load, and 1,700 cu. ft. per min. of compressed air.

Even with sawdust at $2 a ton, a high figure in major producing areas, it is believed that alcohol can be produced for less than 30 c. per gal., comparable to prewar industrial prices from cheap blacktrap molasses. More profitable utilization of lignin would reduce costs further.

The first American operation using this improved wood hydrolysis process has recently been approved for Springfield, Oregon, where large volumes of Douglas fir wastes are available. This plant will be operated by the Willamette Valley Wood Chemical Co. and will cost $2,250,000. Designed capacity will be for more than 4,000,000 gal. of alcohol yearly.

Bisulphite Treatment

THE BISULPHITE TREATMENT for low grade alcohol was developed by Hiram Walker & Sons, to provide a quick and economical means of treating high wines prior to distillation into 190-proof alcohol so the resulting alcohol will be of good quality and have a high permanganate time. This process as described below may be used royalty free by all distillers manufacturing alcohol for the U. S. Government for the duration of the war. While the specifications imposed by the Defense Supplies Corp- have been relaxed to the extent that permanganate time is less important, the coming summer months may see an increase in "peppery" alcohol and high wines and this treatment may be of value in meeting the specification that the odor of the product must be characteristic of ethyl alcohol.

The alkaline bisulphite treatments of low-quality spirits to increase permanganate time is applicable chiefly to those spirits which contain unsaturated compounds as the major impurity. These types of impurities in alcohols are usually very sharp and are associated with lachrimators in as much as smelling even small amounts of them produces watering in the eyes. In the alcohol industry the alcohol containing these impurities is usually referred to as being "peppery."

Information is distributed by the Alcohols and Solvents Branch of The War Production Board.

Record of Wartime Chemical PRODUCTION and COSTS

The record of the spectacular role the chemical industry has played in the defense of this country is beginning to come out. The achievements in expanding production of smokeless powder, TNT, ammonia, acetic acid and methanol, and in lowering costs of these and other wartime materials were announced in Congress by Representative A. J. Engel on June 21. As a member of the War Department Sub-committee of the Appropriation Committee he visited 22 plants for the purpose of studying costs. Part of his findings are given here. —*Editors*

PRIOR to 1939 there were practically no powder-explosive, shell-loading and bag-loading plants in America as compared to our tremendous future requirements. Then followed one of the most amazing records of accomplishment in the history of the industrial world. Smokeless powder plants, TNT and other explosive plants, shell-loading plants, bag-loading plants and chemical plants sprung up as if by magic. Today we have 58 plants constructed at a cost of nearly $2,500,000,000.

TNT pilot lines were making 26,000 lb. of TNT per line per day. It was estimated that the TNT lines could be made to produce 33,000 lb. per line per day. A new method was discovered which increased the TNT production from 33,000 lb. per line per day up to as high as 96,000 and 100,000 lb.

In April, 1941, 7.61 gal. of alcohol were required for each 100 lb. of smokeless powder produced. Today we are producing 100 lb. of smokeless powder with 1.9 gal. of alcohol. It is estimated that 50 million gal. of alcohol valued at $41,000,000 have already been released and we are saving in excess of 4,000,000 gal. of alcohol per month.

The following explosives and other chemical compounds are being produced in government-owned, company-operated plants:

Toluene	Ammonia
N-S	Methanol
Xylene	Formaldehyde
C-S	Ammonium nitrate
TNT	Ammonia catalysts
DNT	Nitric acid
Acetic acid	Oleum
Acetic anhydride	Sellite
Pentolite	Nitroglycerin
Ammonium picrate	Dimethylaniline
Tetryl	Diphenylamine
Lead azide	Nitrocellulose
Picric acid	Smokeless powder
RDX composition	Gas reforming catalysts
Hexamine	

During the month of January, 1941, the United States produced less than 11 million lb. of powder and explosives, approximately 5 percent of which was produced by the War Department and 95 percent by private industry. In January, 1944, more than a quarter of a billion pounds of powder and explosives were produced, 95 percent of which was produced by the War Department.

During the year 1941 this country produced 375,000,000 lb. of powder and explosives. In 1942 nearly 2 billion lb. were produced and in 1943 over 3 billion lb. During the first four months of 1944, the United States made more than twice as much powder and explosives as it produced during the entire year of 1941. Nearly 6 billion lb. of powder and explosives were produced during the years 1941, 1942, 1943 and the first four months in 1944.

PRODUCTION ON GRAND SCALE

TNT was made so fast by a new method that it was necessary to close down plants. Six billion pounds of smokeless powder, TNT, Pentolite, RDX, rocket powder and other explosives we dare not even mention, enough to make the heart of every Jap and German in Asia and Europe quake with fear, were made.

In 1941 there was practically no War Department chemical production. In 1942 War Department plants produced 583,510,000 lb. and 67,805,000 gal. of chemicals required to make powder and explosives. In 1943 these same plants produced 1,018,403,000 lb. and 137,172,000 gal. of the required chemicals while during the first four months of 1944 the War Department plants produced 386,713,000 lb. and 39,390,000 gal. of chemicals that were required in the making of powder and explosives. These figures do not include the tremendous amounts of these products that were purchased from private industries. Thus was written one of the most amazing chapters in industrial production, overcoming the greatest bottleneck in the most critical of all items.

The price on TNT during World War I ran from 26 to 55 c. per lb. TNT produced in government-owned, company-operated War Department plants during this emergency dropped from 29c. a lb. to 15c. to 10c. and it is now being produced for approximately 7c. a lb. Smokeless powder was produced during World War I at the Old Hickory Plant at 41c. to 62c. a lb. Single-base cannon powder dropped from approximately 21c. a lb. in January, 1943, to a little less than 17c. while double-based cannon powder cost was 26c. a lb. in January, 1944.

Wartime Price Trend

	1942	1944
Anhydrous ammonia..	$39.60 a ton	$28.80
Dimethylaniline	0.1960 a lb.	0.1089
Dinitrotoluene	0.0967 a lb.	0.0617
Diphenylamine	0.2459 a lb.	0.1755
Toluene	0.3040 a gal.	0.1906

Weldon Spring, Mo., was the first TNT plant erected. This plant had 18 lines. At the time the plant was erected this country used a grained TNT and the Weldon Spring plant produced all grained TNT. A new method was developed which made "flaked" TNT. This melted quicker and speeded up the production of the loading plants. The demand for grained TNT went down. It would have cost a minimum of $20,000 per line to convert the Weldon Spring plant into a flaking plant. Because of the change in method of production and change of conditions, there were more TNT lines than required. The Representative said "the War Department used good judgment in closing down the Weldon Spring plant, saving the manpower and expense of operating this plant."

The table gives an itemized statement showing the total operating cost, the total fixed-fee paid and the ratio of earned fee to actual costs of all the powder, TNT, explosives, shell-loading, bag-loading and other government-owned, company-operated plants up to Mar. 31, 1944.

Among the miscellaneous plants are one

shell-loading plant, oil, chemical, and other plants.

Total cost of operating the plants up to Mar. 31, 1944, was $1,477,130,000, while the total fixed fee of all the companies up to that date was $65,000,000 or 4.4 percent of the operating cost. If these companies average 70 percent excess profit taxes, then $45,500,000 of the $65,000,000 in fixed fees was paid back into the United States Treasury and the net cost to the government to produce this nearly one and one-half billion dollars worth of war material was $19,500,000 or 1.3 percent.

If these companies as a whole were in the 75 percent income tax bracket, then they paid back into the Treasury $48,750,000, leaving a net fee of $16,250,000 or a little more than 1 percent.

One of the larger companies which was in the 85 percent tax bracket produced over half a billion dollars worth of products. It was paid $22,000,000 which had to be added to the top of its income and was subject, of course, to the 85 percent tax. This left the company $3,300,000 fees for operating the plant during a period of nearly three years, producing over a half a billion dollars in products. Company administration and other expenses, of course, had to be charged against the fee in addition to taxes. I am not defending any cost-plus-fixed-fee contracts. I am merely presenting the facts as they work out in the powder, explosive, shell-loading, bag-loading plants and other government-owned, company-operated plants and as applied to old-line companies who had to add their fixed-fee on top of income profits in their regular operations.

TO WHOM CREDIT IS DUE

Who are these companies who did their part in this outstanding job of low-cost production? Heading the list are the old powder companies—E. I. du Pont de Nemours & Co., Hercules Powder Co., Atlas Powder Co. and Trojan Powder Co. Operating the shell-loading, bag-loading, chemical and other government plants are such old companies as the Tennessee Eastman Co., Coca Cola Co., Goodyear Tire and Rubber Co., Sherwin-Williams and many others listed. These companies have written powder and ammunition history during the past 30 months. They did an outstanding job not only of low-cost production but of eliminating the greatest bottleneck in the most critical of all critical items. The American people will never realize what has been accomplished. These companies have been indeed merchants of death—death to the enemy. Without their work the war could not have been carried on.

Industry Operators of Ordnance Plants

Atlas Powder Co.
Atmospheric Nitrogen Corp.
(Allied Chemical & Dye Corp.)
Brecon Loading Co.
(The Coca Cola Co.)
Certain-Teed Products Corp.
Chemical Construction Co.
Chrysler Corp.
Cities Service Defense Corp.
(Cities Service Co.)
Commercial Solvents Corp.
Concan Ordnance Co.
(Continental Can Co.)
Day & Zimmerman, Inc.
E. I. du Pont de Nemours & Co.
Ford, Bacon & Davis, Inc.
Fraser-Brace Engineering Co.
Gen. Chemical Defense Corp.
Goodyear Engineering Corp.
(Goodyear Tire & Rubber Co.)
Hercules Powder Co.
Heydon Chemical Corp.
Humble Oil & Refining Co.
J. M. Service Corp.
(Johns-Manville Corp.)
Lansdowne Steel & Iron Co.
Lion Chemical Corp.
(Lion Oil Refining Co.)
Lone Star Defense Corp.
(B. F. Goodrich Co.)
Military Chemical Works, Inc.
(Pittsburg & Midway Coal Mfg. Co.)
Monsanto Chemical Co.
National Aniline Defense Corp.
(Allied Chemical & Dye Corp.)
National Gypsum Co.
Nebraska Defense Corp.
(Firestone Tire & Rubber Co.)
Procter & Gamble Defense Corp.
(Procter & Gamble Co.)
Quaker Oats Ordnance Corp.
(Quaker Oats Co.)
Remington Rand, Inc.
Sanderson & Porter
Shell Chemical Co.
(Shell Union Oil Corp.)
Sherwin-Williams Defense Corp.
(Sherwin-Williams Co.)
Silas Mason Co.
Stewart-Warner Corp.
Tennessee Copper Co.
Tennessee Eastman Corp.
(Eastman Kodak Co.)
Todd & Brown, Inc.
Trojan Powder Co.
United States Rubber Co.

Another group entitled to credit comprises the officers in the War Department and particularly in the Ordnance Department who laid the plans, let the contracts, selected the contractors, designed and planned the plants that made this great production possible.

On Mar. 30, 1937, Maj. Gen. W. R. Tschappat, Chief of Ordnance, in testifying before the subcommittee said, "We are trying to get our plans so made as to assist industry as much as possible in case of emergency." In July, 1937, special planning sections were established for speeding up the preparation of plans for the production of non-commercial, but highly critical supplies.

These sections worked with the small peacetime powder and explosive industry and from 1938 to 1939 plans and specifications were actually drawn for typical powder, shell-loading and bag-loading plants as well as chemical plants. These were reviewed continuously and kept up to date. Although the first funds received by the Ordnance Department for the construction of plants for the manufacture of powder and explosives were not available until July, 1940, the government-owned, du Pont-operated plant at Charlestown, Ind., produced smokeless powder in March, 1941. Hercules began production of smokeless powder in April, 1941, at Radford, Va. Other plants were opened and started production in rapid succession.

POWDER PRODUCTION

As a result, there were produced 375 million lb. of powder and explosives in 1941, almost 2 billion lb. in 1942 and more than 3 billion lb. in 1943. The Chickasaw Ordnance Works near Memphis, Tenn., was built by the British. It was commenced on June 25, 1940, under contract entered into between the Tennessee Powder Co. and the du Pont company. This plant was completed and put in operation on Dec. 13, 1940.

Prior to June, 1942, the War Department construction and production was under the supervision of Louis Johnson, Assistant Secretary of War (June, 1937, to July, 1940), and since July, 1940, under the supervision of Robert P. Patterson, Under Secretary of War, with Maj. Gen. C. M. Wesson as Chief of Ordnance and Maj. Gen. C. T. Harris, Jr., as Assistant Chief of Ordnance, in charge of production. Judge Patterson has been doing an excellent job. To Maj. Gen. Wesson, former Chief of Ordnance, and to his assistant, Maj. Gen. C. T. Harris, Jr., must go credit for having had great vision and foresight. They had plans and specifications ready so that construction could proceed when money became available.

After Maj. Gen. Wesson retired in June, 1942, Maj. Gen. Levin H. Campbell, Jr., became Chief of Ordnance, and to him goes a major part of the credit for bringing about increased production at a reduced cost. Maj. Gen. Campbell has able assistants. Maj. Gen. Thomas Hayes, who has had charge of all manufacturing and production, Brig. Gen. Roswell E. Hardy who has been in charge of the ammunition production, and Col. J. P. Harris, his assistant all have done an outstanding job. So have Col. T. C. Gerber, Field Director of Ammunition, Lt. Col. Raymond Rebsamen, his executive officer, and John F. Daley, civilian deputy director.

Total Cost and Fixed-Fee to Mar. 31, 1944

	Operating Total Cost	Total Fee	Ratio of earned fee to cost
Shell-loading plants	$540,992,744	$12,915,669	2.4
Bag-loading plants	34,194,478	1,961,033	5.7
Miscellaneous plants	52,570,833	2,802,316	5.3
Smokeless powder	494,358,666	30,891,726	6.2
RDX-TNT	250,514,139	11,473,261	4.4
Ammonia	36,089,744	2,184,915	6.1
Fiber container industry	50,626,933	2,101,453	4.2
Ammonium picrate plants	17,782,473	671,914	3.8
Totals	$1,477,130,010	$65,002,287	4.4

WILBUR G. HUDSON *Mechanical Engineer, Chicago, Ill.*

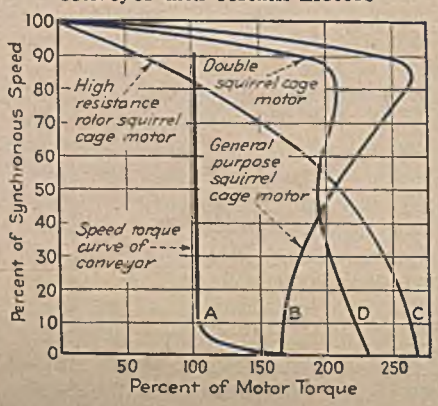
A Technical Analysis of the BELT CONVEYOR

Few pieces of equipment, conveyors or otherwise, are so commonly encountered in the process field as the belt conveyor. Mr. Hudson, who is the author of a recent book on conveyors and related equipment, here gives some of the highlights of his 35 years of experience with the belt conveyor. He describes belts and accessories, driving equipment and drive methods and lists the chief sources of trouble and their correction. He shows also how favorable belt conveying costs may be in comparison with some of the competing methods of mechanical handling.—*Editors*

OF ALL the machinery used for elevating or conveying bulk materials in the process industries, the belt conveyor easily holds first rank in importance. From an engineering viewpoint, also, it is important because of the savings, often amounting to several thousand dollars in a single installation, that are attainable through skillful engineering. Improvements have been striking not only in machinery details but also in the construction and durability of the belt itself. The longer the allowable length of the conveyor, the better the chance the belt has to stand up in service, but the limit of length depends on the maximum tension to which the belt can safely be subjected. As a rule the chief factor influencing wear is the impact at the loading point. If the distance from loading point to discharge point is 1,200 ft. and we use three 400-ft. conveyors operating at 400 ft. per minute, each point of each belt is subjected to impact once every 2 minutes. If we can use a single belt 1,200 ft. between centers we have such impact once every 6 minutes and, incidentally, we reduce the stresses due to bending the belt around head, foot, take-up and snub pulleys.

As a rule conveyor belts are built up on a carcass of cotton duck which furnishes the strength to transmit the pull. They are referred to as 28, 32, 36, 42 and 48 oz. belt. The designations give the weight of a section of duck 36 in. long by 42 in. wide. The several plies of duck are bonded together with rubber and the pull in pounds required to separate adjacent plies in a strip 1 in. wide is called the "friction." The friction ranges from 12 to 24 lb. according to the grade of belt. The rubber bond waterproofs the belt and must hold the plies together, but still not impair the flexibility required for rounding the pulleys. Otherwise the plies will separate. To protect the carcass the top or carrying side of the belt has a rubber cover, the quality and thickness of which are intimately related to the life of the belt. Cover thickness varies from $\frac{1}{16}$ to $\frac{1}{2}$ in. or more if the service is extremely severe; moreover there may be an open-mesh fabric layer or "breaker strip" beneath the cover to bind it to the carcass and limit the extent of a tear or cut. It is practically impossible to strip carcass from cover when a breaker strip is between the two.

Fig. 1—Speed-torque curves of belt conveyor and certain motors



The weight of duck and number of plies are factors in the strength of a belt, but the number of plies must not exceed that which will insure troughing, since a belt cannot train unless it rests on the horizontal middle roll of the three-pulley troughing idlers. Of equal importance for maximum life is the requirement that the maximum stress per inch width per ply shall not exceed that found advisable by the manufacturer of the belt. In the following table the smaller figure refers to average conditions and the larger figure to belts with highest grade of duck, friction and cover, in conveyors having long centers, slow starting acceleration, and large diameter drive, take-up and snub pulleys, i.e., ideal conditions.

	Max. stress, pounds per inch width per ply
28 oz. duck	25—28
32	30—32
36	33—36
42	42—48
48	52—60

The cord belt developed by the B. F. Goodrich Co. is an interesting departure from the fabric construction. The carcass consists of plies of longitudinal prestretched cords, each cord surrounded by or embedded in rubber and this rubber extends upward to provide the usual protective cover. At the bottom are one or two plies of 42-oz. duck to provide transverse stability. The breaker strip consists of transverse cords completely embedded in rubber. The advantages claimed include greater resistance to impact shock because of a greater percentage of rubber, easier troughing, and practical elimination of inelastic stretch since all plies except the breaker and base are cords parallel with the belt length.

In rating this cord belt for maximum stress the figure of 60 lb. per inch width

per ply may be taken, although such belts have been installed with satisfactory results at stresses as high as 80 lb. Before current rubber restrictions went into effect the specifications were in agreement with top quality fabric carcass belts, namely, 20–24 lb. friction and 3,500–4,000 lb. tensile cover. With the transcord breaker strip the 42-oz. belt would cost about 2 percent more than the figure given previously for a 8-ply fabric belt—a differential easily offset by the improved flexibility, greater allowable tensile stress, and resistance to damage by impact, as claimed by the manufacturer.

In making connections the cord belt should be vulcanized on the job, since clamps cannot hold except in conveyors with short centers and low belt stress.

One weakness of the conveyor belt is that the rubber is quickly destroyed by contact with oily material such as oil-sprayed coal. The cover rots after which the oil penetrates the carcass causing the plies to separate and distort. Soon the belt swells, will not trough, and must be discarded. Certain types of synthetic rubber eliminate this weakness so far as can be determined from observations extending over three years. Neoprene, for example, resists the destructive action of oil, dilute sulphuric acid, and many though not all of the industrial chemicals. It cannot resist strong oxidizing agents such as nitric acid, and is affected by coal tar solvents, aromatic hydrocarbons and chlorinated solvents. In a test made by DuPont on neoprene test samples of rubber and neoprene were immersed in S.A.E. lubricating oil at 82 deg. F. for 219 days. The tensile strength of the rubber dropped sharply as it swelled during the first 21 days, after which it continued downward at a lesser rate. Neoprene swelled but little and showed a total strength loss of only 11 percent compared with 52 and 68 percent for rubber. The buna derivatives just now are not resistant to oil and in fact are rather disappointing as showing from 75 down to 25 percent of the resistance to abrasion of the prewar rubber covers in the corresponding grades of belt. However they are all we can get at present and are steadily being improved.

CONVEYOR ACCESSORIES

Trippers—A tripper should have a long wheel-base, low overall height, anti-friction bearings and a slow traversing speed, say less than 60 ft. per minute. The motor-propelled tripper usually receives power from an overhead trolley, but sometimes this may be objectionable because of sparking in the immediate vicinity of dust rising from the discharge of the load. There are the alternates of a cable reel or remote control through magnetic clutches.

When the conveyor is unusually long a factor is introduced that may cause trouble if a self-propelled tripper is traversed by the usual chain drive from a countershaft to the forward axle. The resultant of the thrust of the belt against the two snub pulleys tends to lift the frame about the rear axle as a pivot, allowing the forward wheels to skid when the tripper should move backward. The correction is a heavy counterweight on the front end or interconnected axles. Moreover, there may be an unexpected tendency to drive the tripper forward with the belt, especially if the two tripper pulleys do not have anti-friction bearings. If the pulleys should bind, the tripper may start forward at full belt speed, causing a bad wreck. It is not difficult to arrange a lever projecting into the path of the tripper, which will actuate an emergency main motor stop should overtravel occur.

Effectual cleaning of the lower snub pulley and the belt between snub pulleys is an important factor. Gritty material packed upon the surface of the pulley will contribute to the destruction of the cover.

Scrapers sometimes are used instead of trippers, particularly with flat belts handling foundry sand. They can function with troughed belts by lifting the belt and passing it over a short flat-roller platform. Unless other factors enter, a tripper is better than a scraper except with light, non-abrasive materials such as wood chips, when the scraper does have some compensation in not snubbing the belt.

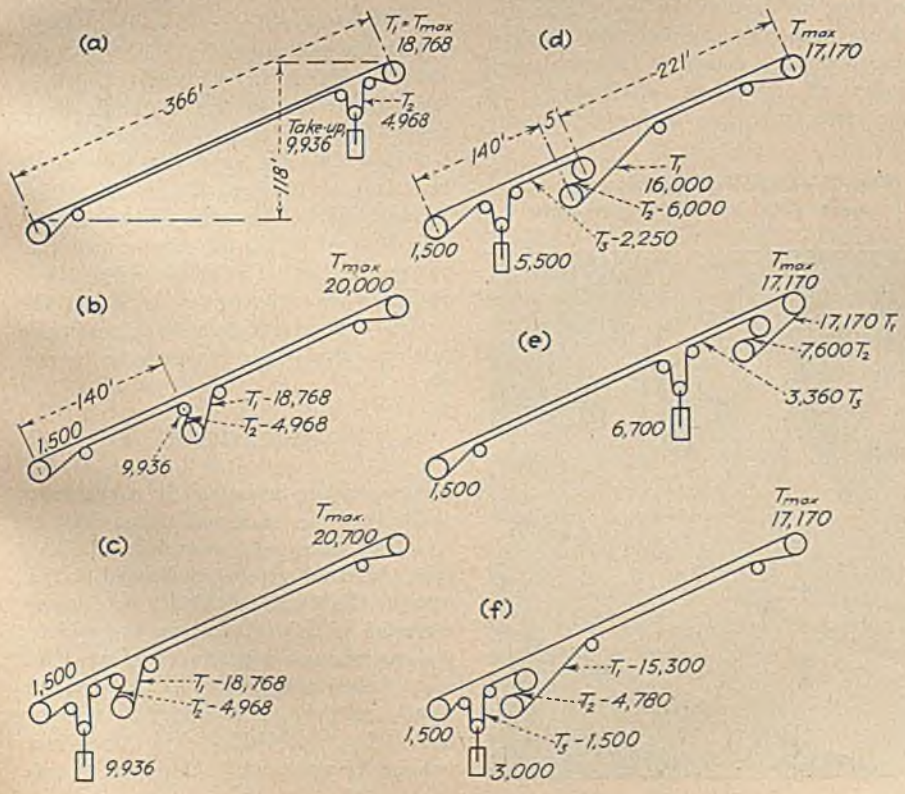
The feed—Unless fed from a preceding unit a belt conveyor should have a controlled feed so arranged that the load is a continuing stream corresponding to full capacity. A good type of track hopper-feeder has two reciprocating feeder plates which are inclined toward each other to facilitate the forward flow of the material stream and are interconnected to give an alternating but continuously converging flow. The feed rate is easily adjusted by changing the feeder plate slope. Either of the two hoppers may in an emergency be cut off.

The electromagnetic feeders such as Traylor, Utah and Syntron, have advantages in the facility with which the feed rate may be adjusted, the elimination of "moving parts," and their adaptability to screening out fines to form a cushion for the lumps. The apron feeder has certain advantages in requiring a minimum depth of pit, nor is it restricted in length. It is not so good for material that is fine and abrasive.

Whatever the type of feeder, it must be interlocked to stop when the belt stops and to be capable of starting only after the belt starts.

Magnetic Separation—When it is desired to cull out stray fragments of iron, a magnetic head pulley may replace the usual head pulley. The energizing current is small, from 400 watts for a 12-in. belt up to 6,000 watts for a 60-in. belt. The magnetic field holds the fragments against the belt for a few feet until they fall off beyond the discharge chute. There are two possible complications in this arrangement: (1) The belt cleaner may send them down with the material; and

Fig. 2—Analysis of various arrangements of single and dual belt drives



(2) the load must be spread thinly so that fragments riding the load may be pulled through the cascading discharge. That may mean a costly increase in the cost of a wider belt, which may be avoided by providing a short-centers wide belt with magnetic pulley ahead of the main belt.

Magnetic separation may be taken care of in an apron feeder. The entire head end of the element becomes magnetized and the fragments adhere for 5 ft. or so after the pans round the head. The discharge chute and side plates should be of non-magnetic material.

When an apron feeder carries its load at considerable depth the separation of submerged fragments may not be effective. If tramp iron is infrequent a powerful permanent magnet may be balanced just above the slowly moving mass so that when the magnet dips it trips the emergency stop. To facilitate locating the fragment a squirt of talcum powder is directed upon the mass, and after a few trials it is known just how far beyond the magnet the fragment is to be sought.

CONVEYOR DRIVES

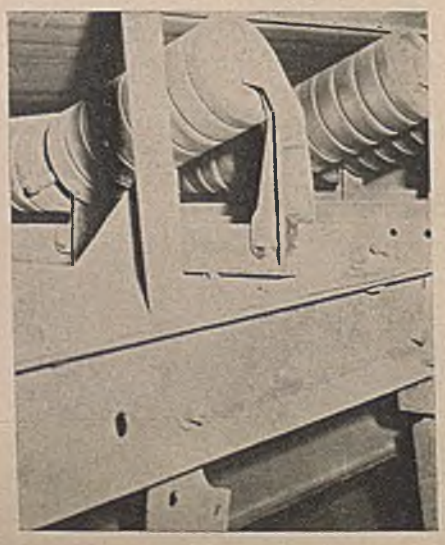
The belt conveyor requires a high starting torque, especially when the lubricant is chilled, as indicated in Curve *A*, of Fig. 1. Therefore, the motor should be one characterized by a high starting torque. The General Electric Co. points out that the "general-purpose" squirrel-cage motor, Curve *B*, has a low starting torque just where it should be highest. If the squirrel-cage motor has a high-resistance rotor there is considerable slip at full load and poor full-load efficiency, Curve *C*. The double squirrel-cage motor, Curve *D*, provides the desired characteristics. It has high starting torque and good running efficiency. The rotor has two sets of bars, the outer set having high resistance to give high starting torque with low starting current, and the inner set having low resistance. When at rest the rotor is at line frequency and the iron between the windings provides high reactance which forces the current through the outer high-resistance windings; but at high speed the frequency in the rotor (and reactance) is much lower so that the low-resistance inner windings carry most of the load current. Curve *D* thus is a composite of Curves *B* and *C*. At low speed, *C* predominates, and at high speed *B* predominates. This motor has a simple full-voltage starter and is used frequently on major installations. This is the so-called "high-torque, low-starting-current, double squirrel-cage motor."

Curve *A* does not illustrate the actual normal operating conditions in an inclined conveyor. It is usual to start the conveyor under no load and start the feed after the belt is up to speed. The power input then increases as the toe of the load stream approaches the top of the incline. Therefore, the vertical leg of the speed-torque curve will incline toward the right. The power required to move the empty belt plus that required to move the load horizontally usually is only a small fraction of the power required to lift the load, as noted below.

The motor is ordinarily connected to the head pulley through a speed reducer. In practice it not infrequently is desirable to provide for occasional adjustment in the speed of the belt so the conveyor will operate at the slowest speed at which it can carry the load. With drives direct connected through a reducer the speed cannot be changed except by a rather awkward substitution of a different head pulley. In a better arrangement the head shaft is connected to the reducer through roller chain and speed change is easily made by an inexpensive substitution of the driving sprocket. In dual motor drives, discussed later, the reducer may thus drive through a chain, although the horsepower involved is often in the higher range which would mean a very heavy chain since the chain speed is low.

The dual motor drive automatically adjusts the load on each pulley. The primary drive is by a synchronous motor and the secondary drive by a slip-ring motor. The synchronous motor is started on reduced voltage with time-limit acceleration through an automatic compensator. The slip-ring motor has a block of permanent resistance in the secondary circuit to insure fairly constant loading when running at full speed. The timed acceleration assures maximum torque when starting if the synchronous motor is unable to swing its share of the load. The synchronous motor determines the acceleration and then maintains constant speed under all conditions of loading. At the same time, the slip-ring motor automatically maintains a nearly constant horsepower output and adjusts itself to the load variation and stretch of the belt, taking only its share of the load under any operating condition unless a circumstance should arise in which it cannot function, such as the presence of ice or water on the belt.

Fig. 3—Link-Belt cushion tire impact rolls for belt protection



When the path of a conveyor inclines downward as in a retarding conveyor, complications enter and the problem should be referred for recommendations to the manufacturer selected, especially with regard to the proper size of motor and location of the drive. It is obvious that if the drive pulley is at the head (downhill) end, to which the thrust brings the slack, slip in the pulley may occur. If the drive is at the top, the position and weight of the gravity takeup call for careful consideration.

The method of driving enters into the problem, mentioned earlier, of attaining the maximum length for a given maximum tension. To illustrate, assume a conveyor 366 ft. between centers with a rise of 118 ft. for 1,500 tons per hour of pebble phosphate weighing about 100 lb. per cubic foot. This calls for a 42-in. belt at 460 ft. per minute, according to manufacturers' tables. Let us assume an eight-ply, 42-oz. belt with ¼- and ⅛-in. covers, which has a limit of 48 lb. per inch width per ply. If the pull (T_{max}) exceeds this figure we must go to a wider belt, a nine-ply belt, or use a heavier duck than 42 oz. From the manufacturers' tables the power requirement is—

To move the empty belt	10 hp.
To move the load horizontally ...	2
To lift the load	180
Total	192 hp.

The belt pull required is $192 \times 33{,}000/460 = 13{,}800$ lb. approximately, which is the effective tension, *E*. With the head pulley lagged and snubbed so the belt has a wrap of 240 deg. (Fig. 2*a*) there must be a slack-side tension (T_2) of $0.36 \times 13{,}800 = 4.968$ lb. Thus the T_{max} is $13{,}800 + 4{,}968 = 18{,}768$ lb., from which the pull per inch of ply is $18{,}768/(42 \times 8) = 56$ lb., so we cannot use an eight-ply, 42-oz. belt but must go to a 48-oz., eight-ply belt good for 60 lb. per inch width per ply.

DUAL DRIVE

Now suppose instead of the single drive at the head we use a dual motor drive at an intermediate point as in Fig. 2*d*. The power required remains unchanged at 192 hp., and the *E* value at 13,800 lb. Assume a tension of 1,500 lb. at the tail end to prevent excessive sag between idlers. The 42-oz. belt weighs about 18 lb. per foot of length, so there is an added tension of $145 \times 18 \times 118/366 = 848$ lb. which is reduced by about 98 lb. due to idler fric-

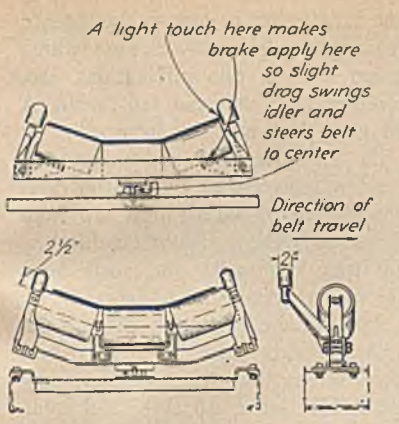


Fig. 4—Two successful designs of self-aligning idler for belt conveyors

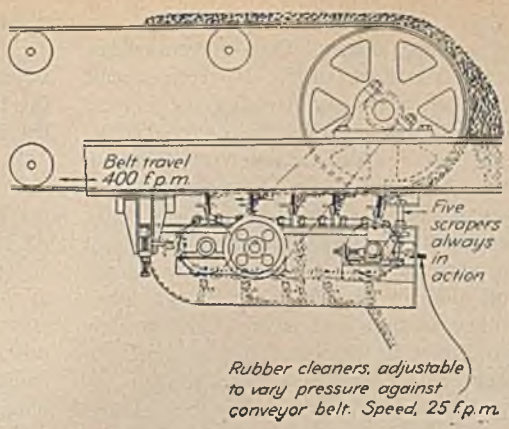


Fig. 5—Hudson belt cleaner is similar to a small scraper flight conveyor

tion; so the slack side pull T_3 is 1,500 + 848 − 98 = 2,250 lb. The tight side pull T_1 is 13,800 + 2,250 = 16,000 lb. approximately.

To equalize the tendency to slip on the dual pulleys we must have $T_1 : T_2 :: T_2 : T_3$ or $T_2 = \sqrt{T_1 \times T_3}$. Hence, $T_1 = 16{,}000$ lb., $T_2 = 6{,}000$ lb., and the traction at the primary pulley is 10,000 lb. With T_2 equal to 6,000 lb. and T_3 equal to 2,250 lb., the traction at the secondary pulley is 3,750 lb. Therefore, the horsepower at the primary pulley is $10{,}000 \times 460/33{,}000 =$ 140 hp., and the horsepower at secondary pulley is $3{,}750 \times 460/33{,}000 = 54$ hp.

In the dual drive T_1 is not T_{max}. The maximum tension occurs at the head pulley on account of the 226 ft. of belt in the return run, and $T_{max} = 16{,}000 + 1{,}170 = 17{,}170$ lb. The pull per inch width of ply is 51 lb. With a slight adjustment in the specified capacity or the speed, the 42-oz. belt will suffice.

The 42-oz. belt costs approximately $11.22 per foot and the 48-oz. belt about $12.24 per foot, so the saving is about $1,000. However, against this is the higher cost of the dual drive group—in this case about $2,500.

GREATER CENTERS DISTANCE

The point of this analysis is not to show whether there is a saving in dollars, but to bring out that with a given belt the dual drive may provide a substantially greater centers distance with the same T_{max}.

Of course, in the dual drive, it is not necessary to have major and minor units. Both motors may be 100 hp., but then we do not take advantage of the drive effort available at the first pulley where the pull is against the clean side of the belt, and unnecessarily load up the second pulley which drives against the dirty side. Sometimes tandem pulleys are geared together and driven by a single motor. The objection is that the second pulley must have a slightly slower speed, usually secured by making its diameter slightly smaller, but this differential is upset if any material should build up on the face of the second pulley. In this case it may hog the load, even wrecking the rim or arms.

Comparing the layouts in Fig. 2, it is seen that the most advantageous position for the single drive is at the head end. With the dual drive, regardless of where we locate it, the T_{max} remains unchanged, but the take-up weight is substantially less as the drive shifts toward the foot end.

In the average installation it is not usually as convenient to provide supports for a dual drive at the head as at some point along the run. As between the single drive at the head (Fig. 2*a*) and a dual drive at an intermediate point (Fig. 2*d*), the reduction in T_{max} is only about 1,600 lb., but if the drive must be located at an intermediate point (comparing sketches *b* and *d*), the reduction in T_{max} is 2,800 lb. and the pull per inch width per ply is 51 lb., compared with 60 lb. Of minor importance is the saving of 2 tons of counterweight.

On the other hand, in favor of the arrangement of Fig. 2*a*, compared with *d*, is the fact that with the single drive the belt makes one wrap around a drive pulley with the clean side in contact, while in the dual drive the belt makes three wraps, one of which is against the dirty side, and ahead of the drive it bends over two intermediate snub pulleys, also in contact with the dirty side, where the pull is heavy.

The dual drive is not always advantageous and there are frequent instances where its higher cost and more complicated supports are not justified.

Realizing the advantages involved in extremely long centers, the Goodyear Tire & Rubber Co. developed a belt in which the tension is taken by embedded parallel high-carbon, copper-plated, multi-stranded steel cables coated with rubber for maximum adhesion to the insulating gum in which they lie. The belt has two bottom plies of 32-oz. duck and one top ply with breaker strip, then the usual top and bottom covers. The cables range from $\frac{3}{64}$ in. spaced 20 per inch, up to $\frac{5}{32}$ in. spaced 6 per inch, giving a tension range of from 1,000 to 3,000 pounds per inch width of belt or the equivalent of from 25 to 60 plies of 42-oz. duck. The first belt of this type has been installed in the Iron Range and will eventually have a centers distance of 1,075 ft. with a lift of 250 ft. and a tension of 1,000 lb. per inch of width.

BELT PROTECTION

As stated previously, the impact of the load is a primary cause of belt destruction. If the material contains lumps or jagged fragments it is essential that precautions be taken to prevent the anvil-hammer action. The carcass provides the strength and the rubber cover the protection. The rubber will stand up indefinitely against abrasive wear if the fragments do not cut into it, but if it is pierced the defenseless carcass is exposed. Impact shocks may be minimized by screening through the fines as a cushion ahead of the lumps, but a better protection is a yielding support such as is provided by special types of impact idler. These may be cushion tire rolls (Fig. 3), rubber faced or pneumatic tire rolls, and any of these may be mounted on resilient supports to further reduce shock. A series of tests by one manufacturer gave the results shown below. Blows were made by a sharp-edged drop-hammer upon the rubber cover, and by a blunt-edged hammer upon the carcass of a seven-ply belt with $\frac{1}{16}$ in. top and $\frac{1}{8}$ in. bottom cover.

Belt Resting on	Cover Resistance	Carcass Resistance
6-in. steel roll.....	1.0	1.0
6-in. roll, 1-in. rubber cover	9.1	1.2
6-in. roll, 2-in. grooved rubber cover	30.0	4.0
14-in. roll, pneumatic tire (outside dia.)..	41.0	10.0
6-in. roll, unit rubber tire disks	28.0	4.4

As shown, with the belt resting on pneumatic tire rolls the cover showed 41 times, and the carcass 10 times, the resistance to destruction as compared with the result with the belt resting on an unyielding roll. The tests do not quite duplicate actual working conditions, but do indicate the advantages derived from resilient mounting in the loading zone. A more direct proof is given by R. S. Carter of the Goodyear Co. reporting on a belt feeder in the Grand Coulee conveyor system. Loading was by power shovel with bank gravel containing boulders as large as 36 in. The life of the feeder belt was two to three months. Pneumatic tire idlers were installed at the loading point and the belt life was increased to 18 months. during which 15 million tons was handled.

Another cause of belt destruction is off-center operation. Formerly it was usual to space guide idlers along both sides. It did not take long to ruin the edges of

a belt when these idlers continued to function and it was realized that some method of holding the belt central automatically until adjustment could be made was essential. Two types of self-aligning idlers are shown in Fig. 4. These are pivoted units which swing slightly to drift the belt back into line should it deviate to one side or the other. The lower one is pivoted by a slight thrust of the belt edge against a small vertical idler located ahead of the pivoting rollers. The upper one provides a light braking of the inclined idler on one side or the other to swing the unit. Self-aligning idlers are intended to serve as an indication that adjustment is needed, not as a sustained correction of side drift.

Except when a tripper is involved it is not difficult to adjust a belt to run centrally. A slight shift of the idler sets just back of the point where the belt begins to drift is sufficient. However, a tripper may introduce odd variations in alignment. Sometimes the belt will drift to one side ahead of the tripper and to the other side after the tripper passes. If this difficulty persists after checking the alignment of idlers, loading central, splice square, belt troughing when empty, and tripper set in line and level, the trouble can be corrected by tilting the troughing idlers slightly in the direction of belt movement. However this tilt should be as slight as possible.

Any mechanical conveyor except the belt conveyor is effectually protected by a shear pin in the drive to release the motor should a sudden jam occur; but the belt is open to damage from causes unaccompanied by overload so the shear pin is of little use. Should a chute plate slip down and lodge it may slice the belt into two belts within a minute or two without increasing the motor amperage sufficiently to trip the circuit breaker. Furthermore, a small fragment adhering to the face of the drive or tripper pulley may introduce local strains sufficient to damage the belt carcass seriously. The remedy is a thin steel scraper. Material may drop from the carrying run to the return run and lodge against the take-up or foot pulley. The remedy is a decking beneath the upper run.

Of special importance is an effective belt cleaner. Any material adhering to the surface after discharge is plastered on the snub pulleys and return idlers, more or less crowning the rims and causing the belt to run off center. If there is a tripper in the line the snubbing pulley becomes dirty and the grit is pressed into the rubber cover by the heavy radial thrust of the belt. The usual high-speed rotary bristle brush sometimes is satisfactory and sometimes is not. With damp material the brush may clog up into a solid cylinder in which fragments may lodge and cut the cover. One manufacturer uses a high-speed spiral rubber cleaner, somewhat resembling an elongated spiral pinion. Another employs a rotating spiral scraper like the rotor of a lawn mower. One or more fixed scrapers may do the job. For very difficult cleaning, as for wet clay, diagonal scrapers of thin stainless steel are quite effective and may be aided by water jets. The author had excellent results with a cleaner resembling a short-centers scraper flight conveyor (Fig. 5), moving either against or with the belt. This thoroughly cleaned off difficult semi-frozen coal dirt when other methods had failed. Unfortunately it cannot be employed in the short run between the two pulleys of a tripper.

If a troughing idler pulley sticks it may become a serious menace as, eventually, a jagged edge is formed which may rip into the carcass. The old sleeve-bearing, grease-cup idlers gave plenty of trouble from this source, but the modern idler with anti-friction bearings and effective grease seals seldom sticks. In fact the modern idler suffers more from too much lubrication than from too little. The delicate seals may be forced out of adjustment enough to permit dirt to enter the roller bearings, or exuded grease may coat the rubber with a sticky layer.

Excessive tension in the belt, except in conveyors with short centers, may result from changes in temperature unless automatic or gravity take-ups are provided. Also screw take-ups have too short a range of adjustment.

If a belt is to operate under conditions of excessive moisture it is possible that mildew may eventually affect the fabric. Mildew does not affect rubber. The manufacturer should be advised of questionable conditions so that a suitably impregnated fabric may be furnished.

The difficulties mentioned above about complete the major causes leading to belt troubles. There are some others such as too steep an incline, skirt boards trapping fragrants against the belt surface, and driving a feeder from one end of a take-up shaft not automatically held square with the belt.

BELT MAINTENANCE

Operating and maintenance costs are difficult to assemble on a comparative basis. Mine operators and public works contractors are interested in ton-mile costs. On the other hand, chemical manufacturers, power plant operators, etc., are interested in costs per ton handled, and their conveyors are much shorter. All are interested in the factors of uninterrupted performance and elimination of risk to their men. Again, maintenance costs depend on the make-up of the belt and the material handled, the thickness of the rubber cover and its quality, the method of loading, the maximum tension under which the belt is operating, the diameter of the main pulleys, the spacing of the idlers, the thoroughness of the cleaning, and the intelligence or lack of intelligence of the operating crew—factors which never are alike in two installations. So, the ton-mile costs may not tell much. A few are given for what they are worth.

In the Iron Range a comparison was made a few years ago of the relative costs per ton-mile for handling iron ore from pit to surface. The costs for handling by electric tram (railroad) and shaft hoist at four mines averaged: supplies, $0.041; labor, $0.071; and total, $0.112 per ton-mile. At a fourth mine an inclined belt conveyor system gave these figures: supplies, $0.0235; labor, $0.0118; and total, $0.0353 per ton-mile. At another operation where the ore was loaded into 17-ton-capacity diesel-operated trucks and transported 4,700 ft. and up 200 ft., the ton-mile cost was $0.0643 which since has been reduced to about $0.05 by more efficient operation gained through experience. The figure includes tire costs based on an assumed life of 3,000 hours. The above comparisons are nicely in favor of the belt conveyor.

Not as a comparison: at one steam plant a 36-in. by 300-ft. conveyor inclined at 20 deg., handling crushed coal, showed for the period extending from 1929 to 1936 (during which 1,146,000 tons was handled with no replacements except one new belt) a maintenance cost of $0.0017 per ton handled. This is equivalent to $0.03 per ton-mile—probably a coincidence.

At another steam plant mine-run coal was handled by a 30-in. by 300-ft. conveyor, then crushed and carried onward by a 30-in. by 400-ft. conveyor with tripper, both units being on a flat incline. Here the maintenance cost totaled approximately $400 for 11 years, during which time 449,000 tons was handled, or at $0.0009 per ton. The original belts were still in good condition. When a new belt is installed, this per ton figure may be doubled.

In freedom from accidents to men the belt conveyor is excellent, but probably no better than for a flight conveyor. Furthermore, as stated, much depends on the men themselves. Looking back over 35 years the author recalls only one accident, this suffered by a man who reached under the belt for the grease cup on the opposite side of the tripper, and had the flesh stripped from his arm from shoulder to wrist.

In reliability of operation the belt conveyor compares favorably with others, although it is not so easily protected against accidental belt damage. In 1936 it was stated with reference to the well known Colonial Mines installation, which is protected as carefully as possible from all sources of trouble, that in a five-year period during which the conveyor operated 700 days, delays in excess of 10 minutes totalled less than 6 hours.

ROBERT H. RAMSEY *Associate Editor, Engineering & Mining Journal, New York, N. Y.*

Simplifying a Process Flowsheet With A NEW FILTER

In producing vanadium the U. S. Vanadium Corp. must separate a sodium vanadate solution quickly from a sand containing such a wide range of particle sizes that orthodox filtration methods have been found unsatisfactory. Use of percolation tanks complicated the flowsheet and a final solution was found in a new filter design worked out in conjunction with U. S. Vanadium engineers. The filter uses two drums, like a double-drum dryer, thus eliminating the feed tank.—*Editors*

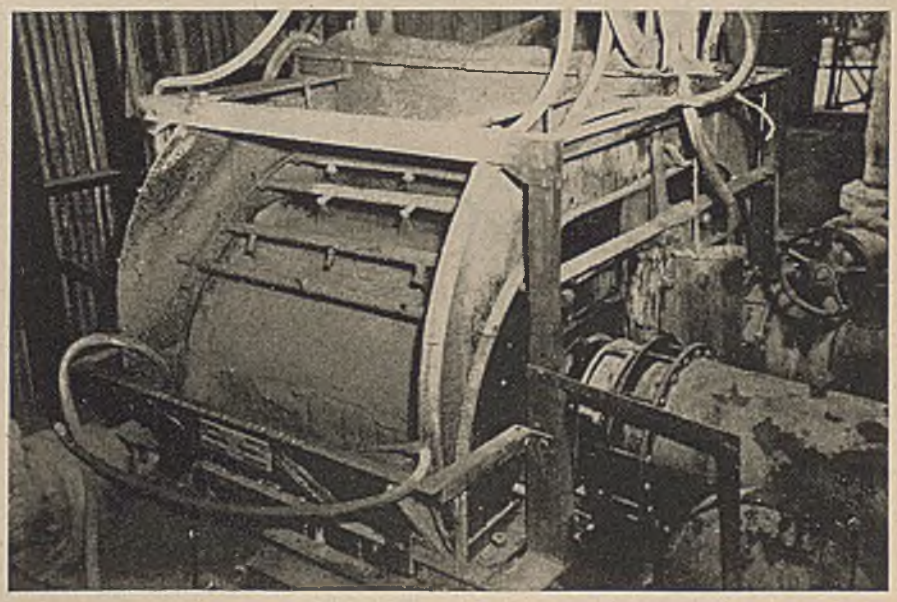


Fig. 1—No. 1 Syncro-Drum filter in U. S. Vanadium Corp. plant

THIS IS the story of an entirely new approach to the mechanical design of filtration apparatus, and of the filter that was built as a result. Developed originally as a solution to a troublesome problem in the sand leaching plant of U. S. Vanadium Corp., Uravan, Colo., this new filter (Fig. 1) appears to have considerable application in the process industries, for it handles a range of particle sizes heretofore thought impossible to treat by vacuum filtration without prior classification.

NATURE OF PROBLEM

The vanadium ore, in the treatment of which this filter was developed, consists predominantly of a sandstone containing about 2 percent vanadium, generally in the form of a vanadium-bearing mica and carnotite. That part of the vanadium recovery process with which the new filter is connected is indicated in the flowsheet of Fig. 2, which outlines the method before and after installation of the filter.

Briefly, the method consists in crushing the sandstone to minus 10 mesh in size, roasting it with sodium chloride, quenching the calcine in water in order to dissolve the sodium vanadate formed in the roasting, then separating the liquor from the sand. The clarified liquor goes to a precipitation plant and the sand goes to an acid leaching plant for further treatment.

The trouble with the process, as originally developed, lay in the fact that if the liquor in which the calcine is quenched is allowed long contact with the calcine, the resultant cooling causes a portion of the dissolved vanadium salts to re-precipitate. A rapid separation, including adequate washing of the sand and the liquor, is therefore desirable, yet no sort of vacuum filtration, the more obvious method, had been successful in accomplishing it.

Orthodox vacuum filtration could not be applied to this leached vanadium sand because of three factors: first, the wide range in particle size of the sand, which is minus 10 mesh to 7 percent minus 200 mesh; second, the rapid settling rate of the coarse fractions; third, the existence of sufficient slow-settling slime to form a definite slime zone in any reservoir containing the sand. It is unnecessary to grind the sand finer in order to get a satisfactory recovery of vanadium in leaching it, and it would be too costly to grind the sand fine merely to favor subsequent filtration equipment.

FILTER TROUBLES

In a drum-type filter, for example, no amount of agitation in the reservoir could maintain a homogeneous pulp therein, and the filter medium entering the reservoir had, therefore, to pass first through a slime zone before reaching the main pulp zone. Even with back pressure of air at this point, the resultant coating of this slime was enough to inhibit proper cake formation of the coarser particles. Disk filters and internally fed drum filters were subject to the same difficulty.

A top-feed, single-drum filter was also

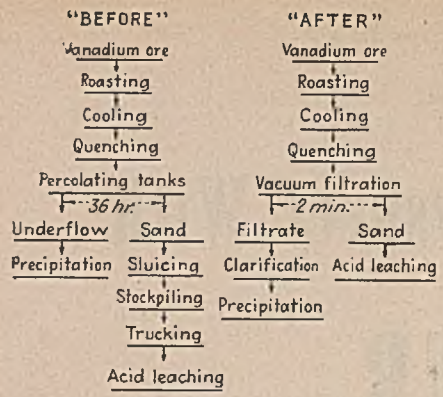


Fig. 2—Effect of Syncro-Drum filter in simplifying flowsheet in U. S. Vanadium Corp. plant, shown by "before" and "after" diagrams

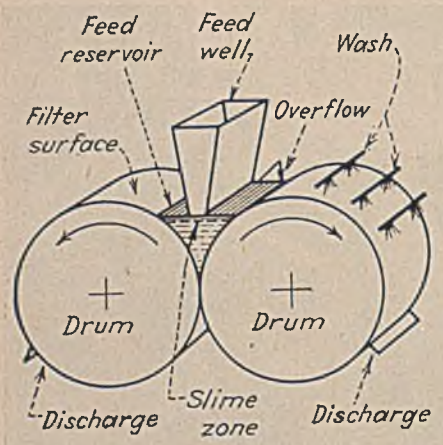


Fig. 3—Elements of the Syncro-Drum filter showing double drum, feed reservoir, feed well, wash sprays and scrapers

tried, and here the size segregation of the feed was less important. A new difficulty entered, however, in that, lacking a feed reservoir, the density of the feed to the top of the drum had to be such that the mother liquor displaced in forming a cake, plus the moisture remaining in the cake, must equal the percent of liquid in the feed. If an increasingly dilute pulp were fed, for example, the mixture might overflow, contaminating the cake already filtered. Increasing the rate of filtration by using media of greater porosity, to allow a margin of safety, resulted in a filtrate containing 4 or 5 percent solids, which made subsequent clarification a major problem. In addition, adjusting the rate of feed to the gradually decreasing filter rate, as medium pores became blinded, was difficult to accomplish.

Lacking a better solution to the problem, the company's practice had been to use a system of sand leaching percolation tanks, from which the sands were eventually sluiced to a tailing pile for drainage, after a 36-hr. treatment. The sand in this pile then had to be reclaimed by a dragline and trucks for shipment to the acid leaching plant.

SOLVING THE PROBLEM

In conjunction with the U. S. Vanadium engineers, the problem was tackled by Peterson Filters & Engineering Co., of Salt Lake City, Utah, with the idea of developing a filter in which the filter medium would strike the coarse sand before it met the slime zone, but in which close regulation of feed rate and density was not required. To skip over a lengthy period of experimentation in one sentence, the result was the Syncro-Drum filter, an apparatus that met these requirements exactly.

Fig. 3 shows the elements of the Syncro-Drum filter. The reservoir is confined above the two drums, but a control overflow back into the preceding circuit accommodates any surges in feed and automatically compensates for increasing resistance in the filter medium. The medium enters the slime zone last, and the cake of coarser particles that forms on the medium first tends to keep the slime away from the cloth. The result is a much more permeable cake than would be the case if slime were next to the medium and sand were above it. The filtration is so rapid that the cake can be washed by three sprays before it is discharged with a moisture content of 17 percent. A simple belt conveyor delivers the sand to the acid leaching plant.

This last fact is of importance in that the conveyor thus eliminates the former operations of sluicing, draining, and reclaiming the sand. Other economies and an increase of production have resulted from use of the new filter.

FILTER USE

The flowsheet of Fig. 4 shows the place of the Syncro-Drum filter in the present circuit. Two such filters are used, and either will sustain the entire load while the other is down 4 or 5 hours for a cloth change. However, both are ordinarily used, one as a primary and one as a washing filter. Note how surge tanks are placed to relieve operational fluctuations, and how constant-level tanks aid in controlling recirculated liquor so as to maintain a uniform strength of liquor for precipitation and a uniformly low soluble loss in the sand.

Hot calcine from the roaster cools somewhat in the drag cooler, but even after the sand is quenched in "B" liquor from the scrubber and recirculated "A" liquor, the resultant slurry is still at 75 to 80 deg. C. Hot water is added here to make up evaporation losses in quenching.

Note the overflow from the Syncro-Drum reservoir is used as a transporting medium to aid in bringing up fresh sand from the quench box. The density of the slurry pumped is thus reduced to 25 percent solids. It has been found that no troublesome circulating load of slime is thus built up by this maneuver. Although a certain amount does accumulate, it has never required a shut-down or a bleed-off to eliminate it.

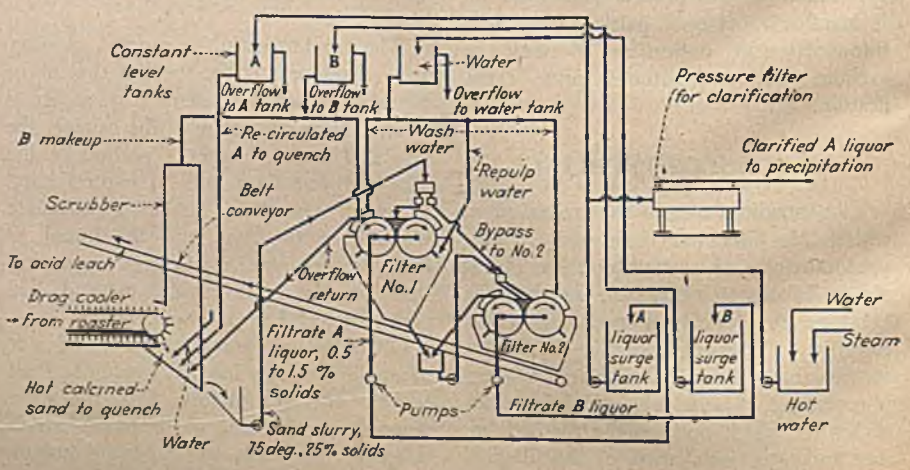
Hot water is used in the washing sprays as a control medium, and the strength of the "A" liquor can be held constant quite easily by varying the proportions of "B" liquor and hot water used in the wash. Various statistics of the filtering operation are given in Table I.

MECHANICAL DETAILS

Though embodying the basic fundamentals of a single-drum vacuum filter, the Syncro-drum arrangement presented some unique design problems. Accuracy in construction was demanded to a greater degree than in single-drum filters. Synchronization of the two drums is obtained through opposite-hand worm-wheel drives from a common worm shaft.

Maintenance of the over-drum reservoir requires a seal at the ends of the drums

Fig. 4—Flowsheet showing use of two Syncro-Drum filters in the sand-leaching plant of U. S. Vanadium Corp. at Uravan, Colo.



and at the point of tangency of the drums. The end seal is obtained by using cheek plates that bear against shoes built into the drum heads. Cheek plate pressure is adjustable and is set by noting the reading of an ammeter connected to indicate the load on the filter drive motor. An absolute seal is not desired because a slight leakage acts as a lubricant for the Micarta cheek plates.

The tangential seal at the drums' center is obtained by providing a back pressure at that point in each drum, so that the filter cloths are forced together. Leakage from center or ends is returned through drip pans to the quench box.

SPECIAL SCRAPER

A special scraper has been designed for this job. It involves a double-fulcrum adjustment rather than the common single-fulcrum scraper. The scraper is set at "3:30 on the clock" (i.e., at about 105 deg. from the vertical). No difference has been found in cake value between this scraper setting and a 6:00 o'clock (vertical) setting.

The valve arrangement is totally inclosed and provides a means of collecting filtrate without use of many flexible connections. A counter-thrust in the valve automatically compensates for the pressure that tends to disturb the seal at the wearing surface. Over a long period, this balancing effect leads to a lower maintenance cost than has heretofore been possible with this troublesome feature on rotary vacuum filters.

To summarize, it can be said that the design has called for accurate manufacturing techniques throughout, and the resultant machine is smooth in operation, and rugged. Laboratory investigation indicates that, from a capacity standpoint, the Syncro-Drum will be a relatively small filter. A maximum filter area of 108 sq. ft. in drums 3 ft. in diameter with a 6-ft. face is regarded at present as being the optimum maximum size.

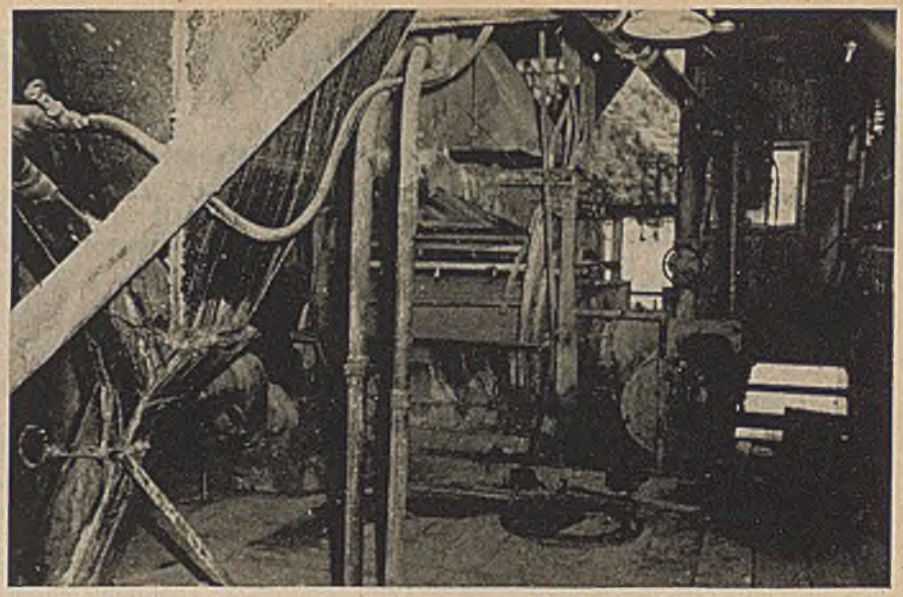


Fig. 5—No. 2 Syncro-Drum filter, with discharge hopper and spout of No. 1 filter shown in the left foreground

Table I — Operating Statistics for Syncro-Drum Filters at Plant of U. S. Vanadium Corp., Uravan, Colo.

Filter Data

Filter area	144 sq. ft.*
Drum speed	2 m.p.h.
Vacuum	12 in. Hg
Temperature of feed	70 to 80 deg. C
Temperature of filtrate	50 to 60 deg. C

* Four drums, 3 x 4 ft.

Comparison With Former Method

	Former	With Filter
Washing efficiency, percent	97	93
Loss of vanadium in feed, percent	0.030	0.015
Handling losses	Definite	None
Labor, man-hr. per ton-day	1.0	0.3
Power required, hp	56.5	73.5

Power Distribution

	Hp.
With filter	
Filters, 2 at 3 hp.	6
Hydroseal pump	3
Filtrate pump, "A"	2
Wilfley repulp pump	3
Filtrate pump, "B"	2
Surge tank pumps, 3 at 2 hp.	6
Vacuum pumps, 2 at 25 hp.	50
Blower	1.5
	73.5
Former method	
Sand pump	3
Liquor pumps, 3 at 2 hp.	6
Sluicing pump	7.5
Sand tailing pump	15
Dragline, estimated	25
	56.5

Table II — Probable Applications for Syncro-Drum Filters in Process Industries*

Phosphate rock	Fertilizers
Trisodium phosphate	Spodumene
Alumina	Feldspar
Calcium lactate	Mica
Potash from sylvinite	Basic magnesium carbonate
Ammonium sulphate	Cement rock
Reclaimed rubber	

* Based on laboratory investigations already undertaken.

OTHER APPLICATIONS

Study of the Syncro-Drum filter indicates that it possesses certain features other than the obvious mechanical ones, that enable it to fill a definite gap in the capabilities of filtration equipment thus far available. In the matter of size of feed, the Syncro-Drum can take particles of up to 0.4-in. in size, above which the drainage-type filters operate, down to all minus 48 mesh, below which the drum and disk filters are used. The vanadium sand feed, for example, contains both 10 mesh and minus 200 mesh material.

The Syncro-Drum also handles a wide range of pulp densities running from about 20 up to 70 percent solids, all the way, in short, from thickener feed up nearly to material suitable for a dryer. This range is made possible by the over-drum feeding, the reservoir, and the overflow return.

It should also be noted that this filter is the first machine to handle successfully material in the size range of minus 0.4 in. to plus 48 mesh at a vacuum of from 5 to 24 in. of mercury.

In considering further applications for the Syncro-Drum filter, therefore, it is likely that it will find its greatest uefulness in those processes involving the handling of wide-range particle size products. In ore treatment, these will be found where grinding to extremely fine sizes is not required in order to release the valuable mineral from its surrounding waste rock.

Dewatering wastes for disposal and concentrates for further treatment are uses that suggest themselves. These will become ever more common as separation processes of the heavy-media type come into more general use, inasmuch as such separations are usually made at a coarse size. In coal preparation plants there are many applications for the Syncro-Drum in dewatering usable fines and disposing of wastes. Table II shows a list of specific applications of the Syncro-Drum filter in which laboratory tests have indicated the suitability of the equipment.

CONCLUSION

The development of this filter is a concrete example of what can be accomplished by the combined efforts of the designer and the operator. Its possibilities could only have been fulfilled by experimenting with the filter on a commercial scale, as was actually done.

Full-scale trials would have been impossible without the determined effort of the staff of the U. S. Vanadium Corp. Particular acknowledgment is made by the filter inventors to the engineering staff under Blair Burwell, general superintendent (now vice president). In development of the article the author is indebted to C. L. Peterson, and C. J. Peterson of Peterson Filters & Engineering Co.

FROM THE VIEWPOINT OF THE EDITORS—

S. D. KIRKPATRICK, Editor • JAMES A. LEE, Managing Editor • THEODORE R. OLIVE, Associate Editor • HENRY M. BATTERS, Market Editor
JOHN R. CALLAHAM, Assistant Editor • NORMAN G. FARQUHAR, Assistant Editor • LESTER B. POPE, Assistant Editor

A GUIDING PRINCIPLE

Dr. George O. Curme, Jr., has contributed much to the development of the synthetic organic chemical industry, especially in the field of aliphatic chemicals. In his recent address accepting the Willard Gibbs Medal, Curme gave us a considered conclusion regarding research which may have for many of us as much value as any of the valuable synthetics which have been developed by his distinguished organization of research workers.

In that address Curme spoke of the responsibility on a research group for developing uses for new chemical products. Then he said: "We have always found some uses and users, but it has invariably turned out that the eventual large uses were other than those we had anticipated." And Curme suggests that his chagrin at this is shared by many other directors of research.

It is fortunate that this fundamental principle of product development should have been so clearly stated. It emphasizes the essential cooperation between producers and users of new chemicals. We venture to extend it to two corollary principles that are very clear after a careful reading of the address.

First, it is essential that new products be investigated to determine accurately their properties; and then these properties must be made known to all other chemical enterprises. This dissemination of information regarding properties should go far beyond the groups which are thought likely to be interested in the new raw materials.

Second, those who have a problem should be equally diligent in making their troubles known to workers in seemingly remote industries. New chemicals can be made to order these days. The skilled manufacturer can modify his present products and produce properties and performance almost without limit. He will do so when he knows that the new product will meet a real need. Publicity as to needs will encourage effort to meet the need, often in the most unexpected places.

Major advances now seldom come from the efforts of any one individual. Less and less do they come from the efforts of single companies. More and more, industry is becoming interdependent. Postwar research programs should be planned in accord with these facts.

IS THIS ETHICAL?

Smaller War Plants Corporation, operating as a subsidiary of the War Production Board, is making a commendable and substantial effort to provide small manufacturers with greater opportunity to do war business and later to re-establish small enterprises for the postwar period. Maury Maverick, as its able and aggressive chairman, is apparently injecting new life into what was a weak and ineffective part of the war program. All will be pleased with his progress provided his enthusiasm does not lead his associates into dubious and questionable activities.

Some of us have noted with real concern a procedure being used by certain of Mr. Maverick's staff which, to say the least, is not a pleasing prospect. We refer to the methods being used by SWPC to render a technical advisory service to small manufacturers—in itself a desirable effort and objective. The recent annual report of the corporation describes this procedure in the following language:

"It has been found that our technical consultants can obtain freer and more unbiased answers to particular problems from selected authorities than if the applicant concerned had written directly to these sources."

If this means that SWPC has obtained for its advisory services some men who better know how to get information than the employees of the small companies themselves, we would accept the idea and approve it. But the fact is that the sentence has also a different and unsavory meaning—one which has been observed by technical men in actual practice in a number of instances. They report that SWPC seeks to get from industry certain confidential information which their companies are willing to give to the Government but which they would not care to give to their present or prospective competitors—large or small.

It would indeed be a shabby procedure for the Government to use subterfuge in obtaining and distributing such confidential information. Continued pursuit of the questionable practice will close many doors to the inquiries of SWPC. The Government can no more afford to indulge in unethical methods than can private practitioners in corporate or consulting businesses.

FRIENDLY COOPERATION

There was a time when it seemed that the aviation-gasoline and synthetic-rubber program were locked in a life-and-death struggle over pumps, valves and manufacturing components. As their problems of conflicting priorities were gradually untangled and large-scale production got under way, the competition shifted to raw materials. Both programs began bidding for butylenes and late in June it became evident that the combined demands exceeded the supply. And it is to the credit of all concerned that a temporary but workable compromise was quickly effected.

Rubber Director Bradley Dewey ordered the diversion of 400,000 bbl. of butylenes from the synthetic-rubber program for the production of an extra 1,000,000 bbl. of aviation fuel. Thus the fighting forces overseas are to be provided during July and August with an additional supply

of 100-octane gasoline—perhaps not very much in the aggregate but an extremely important contribution in these critical times.

Fortunately stocks are such that the shift can be made without curtailing the production of tires and other uses of synthetic rubber. During July and August the alcohol-petroleum ratio for butadiene will stand at 70 percent from alcohol and 30 percent from petroleum instead of 60:40 as in June. After September 1, the ratio will be more nearly 50:50 with petroleum butadiene gradually displacing the more expensive material obtained from grain alcohol.

This inherent flexibility in the synthetic rubber program may also stand us in good stead as technical progress continues in the various plants and research laboratories. Already at least four promising improvements have resulted from industry and government studies. Some of these may soon be translated into operating processes. All of which adds up to the fact that the friendly cooperation which helped to solve the rubber problem is still one of our greatest national resources.

IDEAS FROM LAYMEN

In the Hollywood community the Crosby brothers, Bing and Bob, are noted and respected citizens. Guided by the patriotic motive of assisting our government in its search for new methods of prosecuting the war, they set up their own research foundation and originally, with the help of competent engineers from Cal Tech, they began the search for, and appraisal of, worthwhile ideas. Considering that most of these were to come from non-technical minds, it is interesting to note that a few already show promise of contributing to further advances in the chemical engineering field.

One such project has to do with the development of a small pump, capable of being made in portable form, yet pumping as much as 200 g.p.m. of fluids containing up to 90 percent of solids in the form of pulp or oil sludges. Solids as large as 2½ in. can be handled with only a 3 in. intake, according to our information. Certainly if these claims can be substantiated, there is a place for such a pump in a number of process industries. Another development has to do with a rotary-compressor-vacuum pump claimed to be designed according to an entirely new basic principle. A third has to do with the quick dehydration of food and similar products.

Too often, of course, we have all found that ideas from laymen are valueless due to lack of knowledge of basic principles of either design or fabrication. In rare instances, non-technical minds have been known to hurdle old obstacles and open up entirely new avenues for exploration. The rarity of this occurrence is indicated by the experiences of the Crosby Research Foundation. Of approximately 15,000 ideas and inventions that have been subjected to critical analysis by its staff of engineers, only six have attained production for war use, although a somewhat larger number has been accepted from the standpoint of originality, practicability, experimental status and production feasibility.

Original plans for the Foundation were that it would terminate with the end of the war. Experience to date, however, has indicated the possible postwar application of a number of projects of special interest to smaller companies that do not have the time and facilities for developing new products. There may also be a peace-time function for such a foundation to serve as a commercial clearing house for ideas in various stages of engineering development. Before *Chem. & Met.* would extend its blessing to such a proposal, however, we feel that its sponsors should be warned that the field is even more hazardous than horse racing and can be definitely anti-social in the hands of unscrupulous promoters.

PUBLIC SERVICE

Last month we had the privilege of publishing a unique report of a technical committee appointed by the Charleston, W. Va., Section of the American Institute of Chemical Engineers. The problem they tackled was that of the production of synthetic hydrocarbon motor fuels from other than petroleum. Thus in a community that has become justly famous because of its trinity of fuel resources—coal, oil and gas—well informed local citizens have shared with their neighbors their greater knowledge of future trends and developments in a field of great common interest. This is a type of public service on the part of chemical engineers which has been all too infrequent in the past. If we are to strive for the sort of public recognition that is accorded to the older professions, this type of activity may well be emulated in many other sections of the country. Professional recognition, as well as development, begins at home.

NEW INTER-FUEL COMPETITION

Synthetic liquid fuels as substitutes for petroleum can be made from shale, lignite, bituminous coal, or natural gas. The U. S. Bureau of Mines is getting funds to make fundamental studies and to establish and operate demonstration plants for these purposes. This will require chemical engineering of first quality. It will also require a careful appraisal of certain inter-fuel relations of economic and social significance.

Not the least of these problems will be the competition between coal and natural gas as raw materials for processing. The argument for coal is our huge low-cost reserves that need not be exhausted for many centuries. The argument for using natural gas is that this valuable fuel is now being wasted in stupenduous quantities because it occurs and is dissipated at points remote from consuming industries.

Some natural gas should be so used. Technical means for this usage should be studied and developed as effectively as possible by the Bureau. But the Bureau should also emphasize the need for conserving natural gas for future use in gaseous form. There are well established and economic methods for doing this. It is a bit hard to apply those methods. But the public interest demands that private gas and oil development enterprises should not be allowed to waste natural gas simply to get quick return from the liquid portion of the joint occurrence. It is not proper to assume that this gas must be wasted merely because it is remote from markets. Nor is it proper to assume that processing into liquid fuels is necessarily the right answer. The future need for gaseous fuel is a continuing challenge for more serious considerations by all chemical engineers.

CHEM. & MET. PLANT NOTEBOOK

THEODORE R. OLIVE, Associate Editor

$50 WAR BOND FOR A GOOD IDEA!

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

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

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

JUNE WINNER!

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

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

For an article dealing with a new chart for proportioning liquid or gas streams which has been adjudged the winner of our June contest.

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

May Contest Prize Winner

HOW SOLID CARBON DIOXIDE ASSISTS IN GRINDING LOW-MELTING WAXY OR PLASTIC SOLIDS

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Sprout, Waldron & Co.
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Efficient disintegration presents special problems whenever plastic and tacky solids are encountered. These difficulties are manifested in reduced output, particle size limitations, and plugged equipment. If the material has a low softening point in addition, conditions become more acute, especially in fine grinding, where the heat imparted may lead to melting. The virtue of reduced temperatures in processing such material is apparent, but provision for mechanical refrigerating facilities may be uneconomical or otherwise impossible. In view of the foregoing, the reduction of a waxy organic compound having a softening point of 150 deg. F., from slabs 1 in. thick to a fine powder, without the use of mechanical refrigeration, is of special interest.

ROUGH CRUSHING

The slabs were fed first to a precision type saw-tooth crusher. By limiting the reduction to ¼ in. product, 350 lb. per horsepower-hour was processed without an undesirable increase in temperature. This coarse material was then embrittled for further reduction by thorough cooling in direct contact with crushed dry ice. It was found that this operation could be carried out efficiently in a horizontal mixer, with a ribbon agitator mounted on outboard bearings and provided with packing glands to prevent loss of product or its contamination by lubricating oil. Agitation at 32 r.p.m. proved suitable, yielding a granular product ranging from ½ in. to dust, without accumulations on the inner walls of the mixer. Thus, in two simple operations, a waxy slab was transformed into a hardened, non-tacky, granular material, ready for final reduction to powder, as required.

It is to be noted that this method not only eliminates the need for mechanical refrigeration, but confines the cooling to preparation for fine grinding where a troublesome rise of temperature is likely to be encountered. Attrition mills, rolls, or pulverizers are suitable for carrying out the final reduction of the chilled mixer product. A single pass through an attrition mill, for example, has sufficed to grind a pre-chilled thermoplastic resin (⅜ in. to 20 mesh; softening point 160 deg. F.), giving a product 80 percent of which was finer than 28 mesh and 10 percent finer than 100 mesh.

By a suitable adjustment of conditions, this principle is generally applicable to low-melting, waxy or plastic materials, provided they are not prone to contamination by, or chemical reaction with, CO_2.

If dry ice is supplied in 1-in. to 1½-in. slabs, it too may be reduced in a saw-tooth crusher; otherwise a suitable ice crusher is recommended.

USING VALVE IN PIPE LINE AS A FLOW METER

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An ordinary commercial valve which is present in a pipe line may be readily converted into a meter for determining the rate of flow in the pipe. A diagrammatic sketch of this valve meter is shown

Fig. 1—Valve meter arrangement and Y values for 2-in. globe valve on a water line at 800 lb. per sq. in. and 60 deg. F.

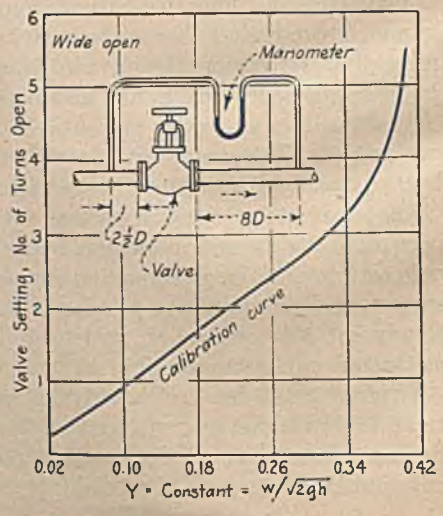

Fig. 1—Setting of log-log slide rule for friction factor $\phi(Re)$

Fig. 2—Setting of log-log slide rule for friction factor f

in the upper part of Fig. 1. Pressure connections two and one-half pipe diameters upstream and eight pipe diameters downstream from the valve are led to a manometer. The differential pressure is correlated with the rate of discharge at various valve settings or openings. For accurate results a valve meter should be calibrated in the actual service location, and a calibration curve drawn as shown in Fig. 1.

Some of the favorable features of a valve meter are: (1) It may be used as an adjustable orifice for conditions of widely varying flow. The area of the valve discharge opening can be changed as desired, making it possible to keep the differential pressure within a convenient range for measurement, regardless of daily or occasional changes in the rate of fluid flow[1, 2]; (2) the valve is already in the pipe line and hence introduces no additional resistance to flow when it is converted into a meter; (3) little initial cost is incurred; and (4) the cost of upkeep is small.

The calibration curve (Fig. 1) and the flow calculations are based upon:

$$w = Y\sqrt{2gh} \qquad (1)$$

where w = weight rate of flow, lb. per sec.; g = acceleration due to gravity, 32.2 ft. per sec. per sec.; h = differential pressure, ft. of fluid; and Y = a constant at any one valve setting as determined by calibration. This includes the area of discharge opening, density of fluid, and flow coefficient.

The valve handle is conveniently marked (one of the handle spokes may be used for this purpose) and carefully set at various openings. For example, the valve is first closed tightly, then opened ¼, ½, ¾, 1 turn, etc., and the discharge or flow and differential pressure measured at each of these settings. Then Y values are calculated from Equation (1) and plotted against the corresponding valve settings. This results in a curve such as that shown in Fig. 1 which was drawn from data on a 2-in. globe valve in an 80 lb. per sq. in. water line at 60 deg. F.

Results were obtained by this method with a probable error usually less than 3 percent.

When the valve is calibrated and the calibration curve drawn, it is ready for use as a flow meter as illustrated in the following examples:

1. Owing to increased production, an orifice plate in a 2-in., 80 lb. per sq. in. water line used for flow measurement, restricted the flow so that the maximum attainable was not sufficient. The orifice plate was removed and a 2-in. globe valve already in the line was calibrated for use as the flow meter (Fig. 1). What is the flow when the valve is exactly three turns open and the differential pressure is 8.8 in. of mercury under water? Here Y (from Fig. 1) = 0.32; h = 8.8 in. Hg under H_2O = 9.2 ft. H_2O; and $2g$ = 64.4 ft. per sec. per sec. Substituting in Equation (1), $w = Y\sqrt{2gh} = 0.32\sqrt{64.4 \times 9.2} = 0.32\sqrt{592.5} = 0.32 \times 24.4 = 7.8$ lb. per sec.; or the rate of flow is 56.2 g.p.m.

2. A temporary and periodic change in operation makes it necessary to reduce the rate of flow from 55–60 g.p.m. to 15–20 g.p.m. Since the same mercury manometer is to be used, a minimum 5 in. Hg differential pressure is desired. How many turns open should the valve be set? Here w = 15 g.p.m. × 8.34/60 = 2.08 lb. per sec.; h = 5 in. Hg under H_2O × 12.58/12 = 5.24 ft. H_2O; and $2g$ = 64.4 ft. per sec. per sec. Substituting in Equation (1), $Y = w/\sqrt{2gh} = 2.08/\sqrt{64.4 \times 5.24} = 2.08/18.38 = 0.11$. Referring to Fig. 1, for a Y value of 0.11 the valve setting is one turn open.

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2. Perry, "Chemical Engineers' Handbook," McGraw-Hill Book Co., Inc., New York, 2nd ed., 1941, p. 2037, Fig. 39.

READING FRICTION FACTORS FROM A LOG-LOG SLIDE RULE

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IN PRACTICE the equations[2] giving friction factors as functions of the Reynolds number, Re, are seldom used since engineers, when computing pressure drops for fluid flow purposes, prefer the more convenient charts[1,3,4,5] which yield friction factors good to ±10 percent. When such a chart is not at hand, as sometimes occurs in the field, it is possible to read approximate friction factors for turbulent flow in clean, new commercial iron pipe on a log-log slide rule from a single setting of the *CI* scale and one of the *LL* scales.

For values of the friction factor

$$\frac{\Delta P_f D}{u^2 L \rho} = \frac{\Delta Hf D}{u^2 L} = \varphi(Re)$$

as given in references (1) and (3), set the indicator at 10,000 on one of the *LL* scales (*LL*3 on some slide rules) and bring 2.63 on the *CI* scale under the hair-line. When values of Re/100 are read on the *LL* scale it is possible to read values of 10,000 $\phi(Re)$ on the *CI* scale as shown in Fig. 1. Thus, for a Reynolds number of 25,000, set the indicator over 25,000/100 or 250 on the *LL* scale and read 10,000 $\phi(Re)$ = 4.4 on the *CI* scale, from which the friction factor, $\phi(Re)$, is seen to be 0.00044.

For values of the friction factor, f, as given in references (4) and (5), align 4.21 on the *CI* scale with 10,000 on the *LL* scale. When vaules of Re/100 are read on the *LL* scale it is possible to read values of 1,000 f on the *CI* scale as shown in Fig. 2. In the case of a Reynolds number of 25,000, set the hair-line over 25,000/100 or 250 on the *LL* scale and read 1,000 f = 7.0 on the *CI* scale, from which f is found to be 0.0070.

The table compares approximate friction factors as read from the slide rule with the correct values read from the familiar charts and shows that the slide-rule values are about 5 percent low for Reynolds numbers near 5,000, and about 5 percent high for Reynolds numbers above 200,000. The slide-rule method, entirely empirical, is intended for turbulent flow in clean commercial iron pipe where the Reynolds numbers are between 5,000 and 1,000,000, the conditions and range of greatest interest to the chemical engineer.

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Comparison of Friction Factors Given by Slide Rule and by Charts

Reynolds Number	Friction Factor $\phi(Re)$		Friction Factor f	
	Ref. 1, 3	Slide Rule	Ref. 4, 5	Slide Rule
5,000	0.00065	0.00062	0.0104	0.0099
10,000	0.00054	0.00053	0.0087	0.0084
20,000	0.00046	0.00046	0.0074	0.0073
50,000	0.00038	0.00039	0.0061	0.0062
100,000	0.00034	0.00035	0.0054	0.0056
200,000	0.00030	0.00032	0.0049	0.0051
500,000	0.00027	0.00028	0.0043	0.0045
1,000,000	0.00025	0.00026	0.0040	0.0042

NEW CHART FACILITATES HUMIDITY CALCULATIONS

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Development Engineer
The Raybestos Div.
Raybestos-Manhattan, Inc.
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THE CHART presented herewith is most helpful in eliminating eye-strain in the determination of absolute and percentage absolute humidity and dew-point. The chart is based on the relation that the absolute humidity is equal to the saturation value at the wet-bulb temperature, in pounds of moisture per pound of dry air, minus the expression (0.26 divided by the latent heat at the wet-bulb temperature, times the wet-bulb depression in deg. F., that is, the difference between wet- and dry-bulb temperatures).

As an illustration of the use of the chart, determine the absolute and percentage absolute humidities and the dew-point for a dry-bulb temperature of 75 deg. F. and a wet-bulb temperature of 65.25 deg. F.

Enter the chart from Scale *A* at the wet-bulb temperature of 65.25 deg. F., tracing horizontally to Curve *B*, then vertically down to Scale *C*. At the last point read 0.0136 as the saturation value, which is the first term in the relation given above. Record this value.

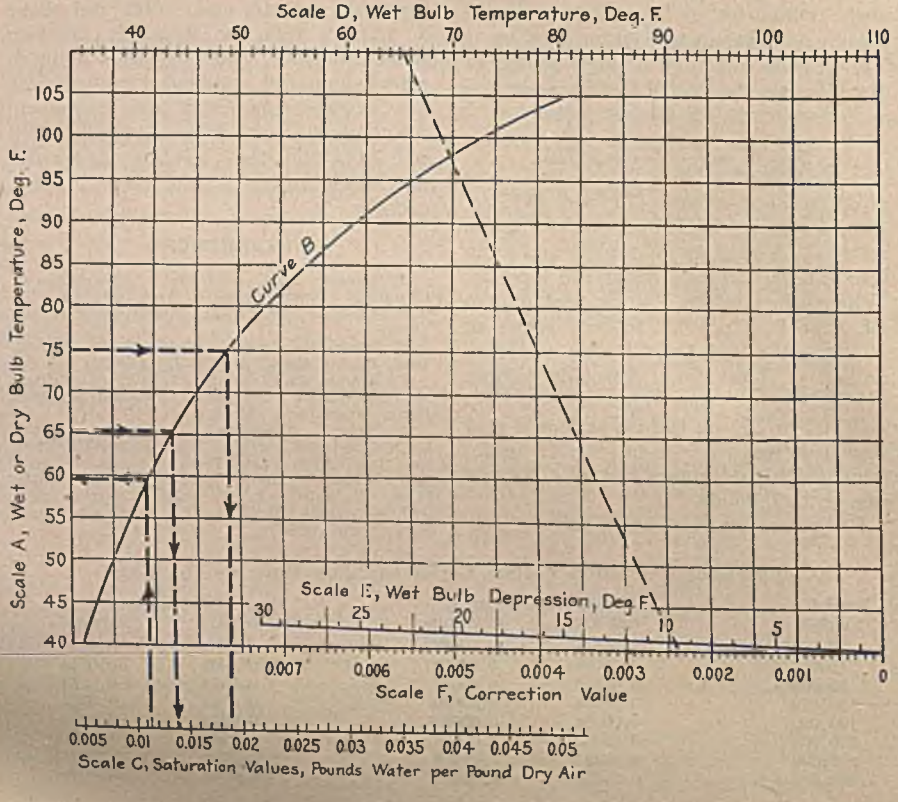
Then hold a straight-edge as shown between the wet-bulb temperature of 65.25 on Scale *D* and the wet-bulb depression, 9.75 deg., on Scale *E*, extending the line to Scale *F* which shows the value of 0.0024, which is also recorded. This last is the correction value or second term in the fundamental relation.

Subtract 0.0024 from 0.0136 and obtain 0.0112 lb. of water per pound of dry air as the absolute humidity.

To obtain the percentage absolute humidity enter the chart from Scale *A* at the dry-bulb temperature of 75 deg. F., tracing horizontally to Curve *B*, then vertically down to Scale *C*, at which point the value of 0.019 is read and recorded. This value is the saturation moisture content for air at 75 deg. Since the sample of air actually contains 0.0112 lb. per pound, the percentage absolute humidity is (0.0112/0.019)100 = 59 percent.

To obtain the dew-point, trace vertically upward from the absolute humidity value of 0.0112 on Scale *C* to Curve *B*, then horizontally left to Scale *A*, reading 59.5 deg. F. as the dew-point.

Chart for relating wet- and dry-bulb temperature to absolute and percentage absolute humidity and dew-point temperature



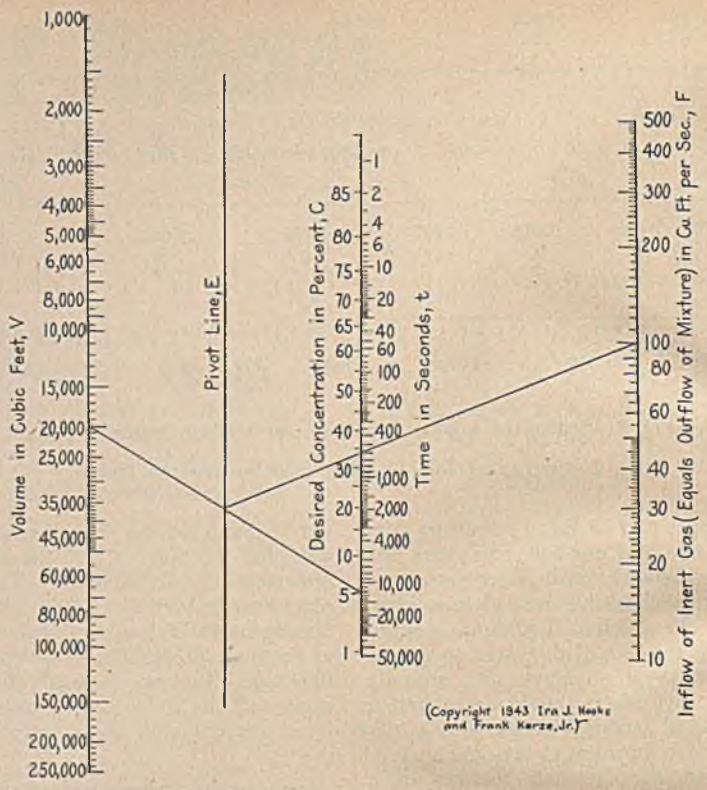


Chart for determining purging time when an inert gas is used to displace an unwanted gas from an inclosure

NOMOGRAPH FOR FINDING PURGING TIME

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New York University
New York, N. Y.

BY MEANS of the accompanying nomographic chart it is possible without calculation to determine the time required to purge process vessels or spaces of noxious gases or explosive gas mixtures, by admitting a known flow of inert gas and, at the same time, allowing an equal quantity of the mixture to escape.

Use of the chart is indicated by the sloping lines drawn on its face. A volume of 20,000 cu. ft. is to be purged of a noxious gas using a flow of 100 cu. ft. per sec. of inert gas. It is desired to reduce the noxious gas concentration to 5 percent. With a straight-edge connect the volume V = 20,000 with the desired concentration C = 5.00. Connect the intersection with the pivot line *E* and the rate of inflow scale F = 100 cu. ft. per sec., reading the required time t = 600 sec.

Provided the units are consistent, any other system of units may be used, and decimal or other multiple modification may be resorted to if required to increase the range of the chart.

REPORT ON.....

LATIN AMERICA

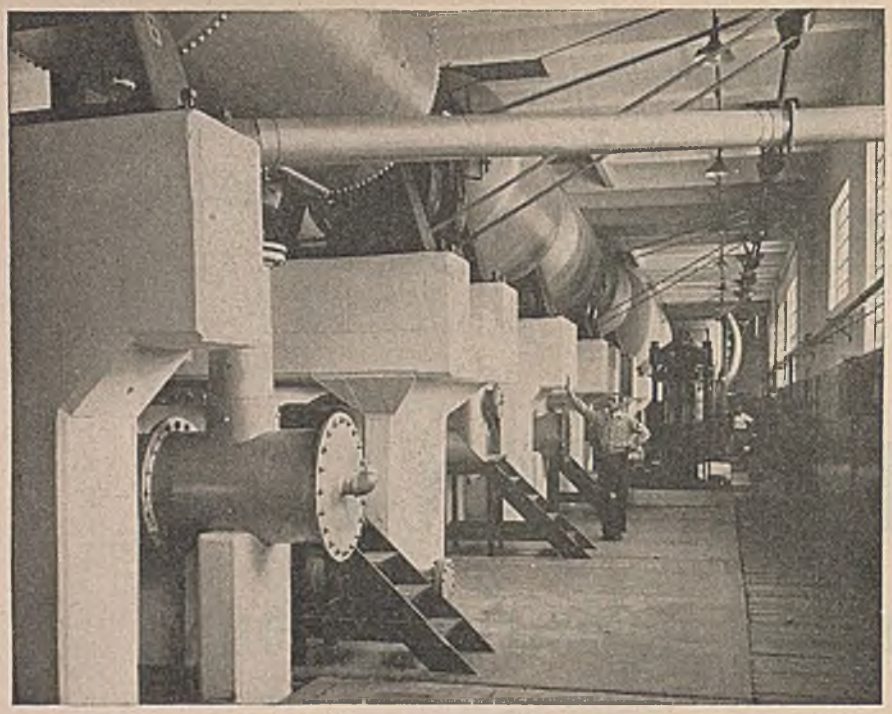
Plans Postwar Industrialization

Long progressing as agricultural nations, the Latin-American Republics have been slow to capitalize on their unbounded wealth of natural resources and the lack of a well-rounded output of consumer goods has made slower the trend toward higher standards of living. However, the last quarter of a century has brought considerable advancement in the industrial life of these countries and the pace has been greatly accelerated in the last five years and received such an impetus in the last two years that it seems destined to carry some of the republics to a full measure of self-sufficiency as well as make them important factors in world commerce. With the shutting out of many foreign countries from hemisphere markets, the American republics, banded together for national and industrial security, have come to depend more upon one another and have acquired a fuller knowledge of what each has to offer for the general industrial prosperity. This inter-commercial relationship is now being projected into postwar planning through the cooperative effort of government and industry representatives from all the Americas. The solution of such weighty problems as investments, stabilization of exchange, removal of trade barriers come within the scope of these high-ranking executives. For those who are interested in specific data on the groups and individual commodities entering into our commerce with the republics, this report, based on figures compiled by the U. S Department of Commerce, may prove helpful.

Representatives of government, industry and finance of the United States and of the Latin-American Republics recently convened in New York in a series of sessions intended to promote a program for the economic development of hemisphere resources through the cooperation of all the participating countries. Inter-American trade which had been growing perceptibly before the outbreak of hostilities abroad, received a decided impetus when their trading markets were more centralized by the closing of many customary channels of supply. Under the new conditions the Americas were forced to develop their own production wherever possible and to look more to one another for the goods which were essential to the sustenance of their individual economies.

When the United States entered the war, its vast war program called for the consumption of raw materials in such quantities that every possible source of hemisphere supply had to be tapped in order to bring about its successful completion. That the results to date have been so favorable bears witness to the responsive way with which the other republics reacted to our call for help, some of them curtailing their own use of vital materials in order to meet the more urgent needs of this country.

Lend-lease exports to the Latin Americas undoubtedly have been a stimulus to business in those countries, yet the report of the Administrator, Foreign Economic Administration, makes clear that our largest help was along lines to strengthen hemis-



Dissolvers used in producing nitrocellulose rayon at Sao Miguel, Brazil

phere defense and the benefits to us were largely of a military nature. The cumulative total of our lend-lease to the Americas through 1943 was $128,000,000. The first such agreement was made with the Dominion Republic in August 1941 and the last in May 1943 with Chile. Altogether 18 such pacts were entered into. No lend-lease aid went to the Argentine, and Panama was helped under special provisions for the protection of the Panama Canal. Of the total lend-lease outlay $18,260,000 consisted of industrial materials and agricultural products intended to encourage in the receiving countries continued production of raw materials essential to our war program. The remainder of lend-lease expenditure was in ordnance and ammunition, aircraft and parts, tanks and vehicles, and watercraft. In addition to military assistance, the other republics are furnishing us with a long list of important strategic materials.

TRADE BALANCES

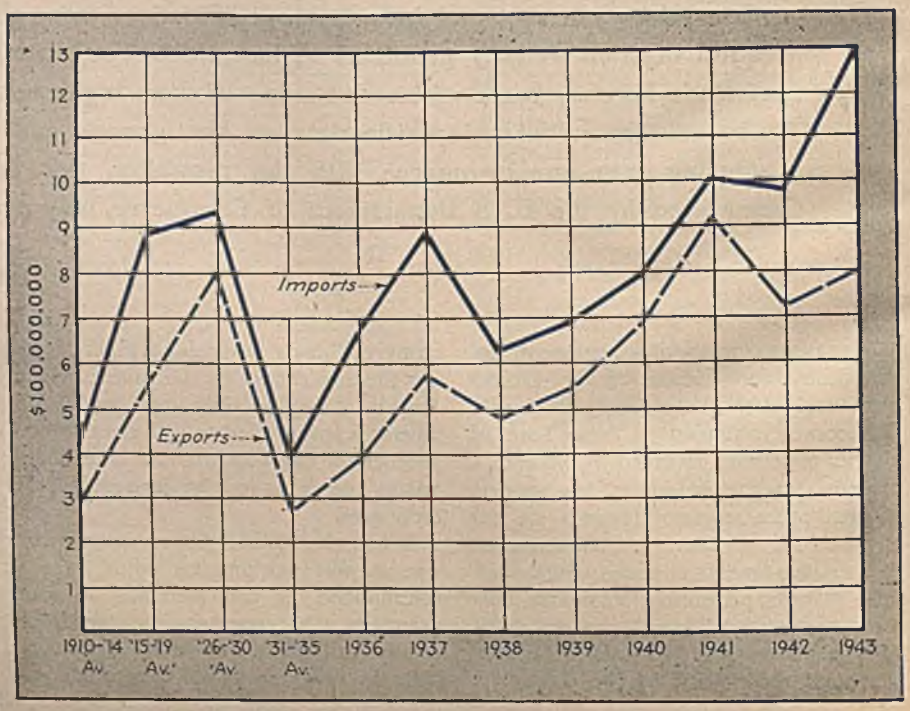
As a result of almost boom business at home, record exports to the United States, and the stimulus of lend-lease, the industries of the Latin Republics, manufacturing, mining, and agriculture have been elevated to unprecedented heights and inter-American commerce in dollar volume has reached record proportions. Naturally our surplus for export had to be subservient to the all important production goals required to keep our own, and the war machines of our allies, in vigorous motion and our purchases far exceeded our sales so the trade balance of the other republics has steadily climbed and continues to do so at a rate which should bring the trade and dollar credit of the republics close to the $4 billion mark by the end of the present year.

That the other Americas are so favorably situated financially, combined with the fact that the United States and the other republics are now accustomed to doing a two-way business on a large scale, appears to present a rosy prospect for what lies ahead in the postwar era. But the recent New York meeting held under the auspices of the Inter-American Development Commission was the outgrowth of a meeting of the American Foreign Ministers held at Rio de Janeiro in January 1942, at which it was agreed that a general conference should be held to consider postwar economic problems when, in the judgment of the members of the Commission, sufficient evidence was at hand to give assurance of a favorable termination of the war. Representatives of the Americas met in Panama in September 1939 to plan measures for their mutual protection and to discuss the economic problems which the European conflict brought upon them. The current status of each of the republics gives the answer as to how they dissolved those problems. They met in New York this year in the first scheduled conference to discuss the different type of problem which will come with the return of peace. How they will meet the newer problems will determine whether or not the full possibilities of postwar trade will be realized.

After the war, the Latin-American Republics will find themselves in somewhat the same position this country was after World War I. They will have expanded productive capacities for which home and export trade will have to be developed if full capacities are to be used. With war goods no longer in demand there may be a time-gap until civilian buying takes up the slack. Only scattered data regarding industrial growth in the separate countries are available to show their present status but all of them are producing much more than they did in 1939 but there still is a scarcity in many consumer lines which may form an excellent cushion when the war buying has passed.

While the larger countries, Mexico, Brazil and Argentina have shown the highest rate of gain, it is fairly typical to point out that more than 100 new enter-

United States trade with Latin-American Republics



prises were registered in Mexico in 1942 and industrial output for that year was valued at $250,000,000 compared with $180,000,000 in 1939. The chemical industry of Brazil grew from an output of $76,000,000 in 1938 to $105,000,000 in 1943. Argentina reported a gain of 55 percent in industrial workers from 1935 through 1941. On an average the industries of the republics are estimated to have increased 20 percent in the war period.

It is not only to retain this newly-won industrial stature but to expand it materially that the republics are seeking in their postwar planning. The other Americas have a population not much below that of the United States and a total area twice that of this country. Natural resources are practically limitless. This is the foundation upon which the other Americas will build in the postwar era. They ask our assistance to overcome difficulties incidental to putting their resources to work. The objective is to start new industries and to broaden the ones now in operation. Chemical production in some countries is favored by an ample supply of raw materials but is handicapped by a lack of consuming outlets.

Generally where new industries are being nourished, they are given protection from outside competition either in the form of tariff imposts or of other special legislation which works toward the same end. This has brought forth the contention that the attainment of self-sufficiency in many consumer goods in the Latin republics would react unfavorably on our export trade. The history of our foreign commerce gives definite refutation to this contention. The more highly industrialized a nation becomes and the more diversified its lines of manufacture, the larger are its requirements for raw materials and supplementary finished products in the markets of the world.

In the interchange of views on postwar planning some points have been touched upon where there is an apparent conflict of interests. Chile is rushing construction on a new nitrate of soda plant which will be completed for the 1944–45 fertilizer season. It is to be fully mechanized and will cost possibly up to $12,000,000. It will have a starting capacity of 200,000 tons a year which may later be increased by 50 percent. The management recently expressed its gratitude to the United States Government for its cooperation and stated that construction of the plant was possible only because it was possible to obtain in the United States much of the material and equipment. Nitrate plays such an important part in Chilean economy that anything which threatens its progress is looked upon with extreme disfavor. The introduction of nitrate of ammonia into the fertilizer trade in this country is now an object of concern to Chilean nitrate interests. Should government plants continue after the war to operate as a source of nitrogen supply, domestic requirements for nitrate of soda would be adversely affected. So far there has been no reliable indication of the disposition to be made of the government plants. Domestic production of synthetic nitrates also been mentioned but the fears seem to rest on government outputs and not on a wide increase in private production.

EXPORT TRADE

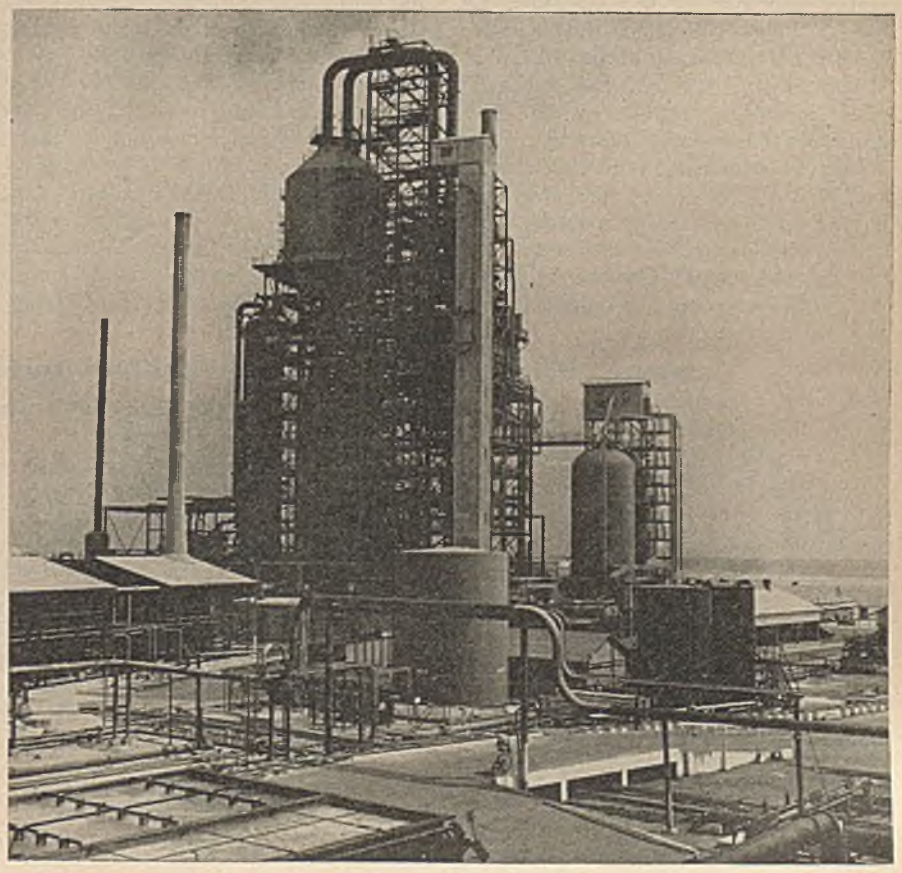
Conditions in the last three years have not been favorable for moving chemicals to the Latin American Republics. In the first place, there was a scarcity of many chemicals which were in most frequent demand and this necessarily held down the volume of sales. Cargo space also was limited and further complications arose from obtaining export permits and in obtaining them at times when they could be put into execution. Despite the obstacles our shipments to those republics in 1942 were almost on a level with those for the preceding year which means that they were considerably above the average of the prewar years. Trading in chemicals between the Americas had been gaining up to the time when hostilities broke out in Europe and was accelerated as the war area spread and either eliminated or curtailed offerings from other countries.

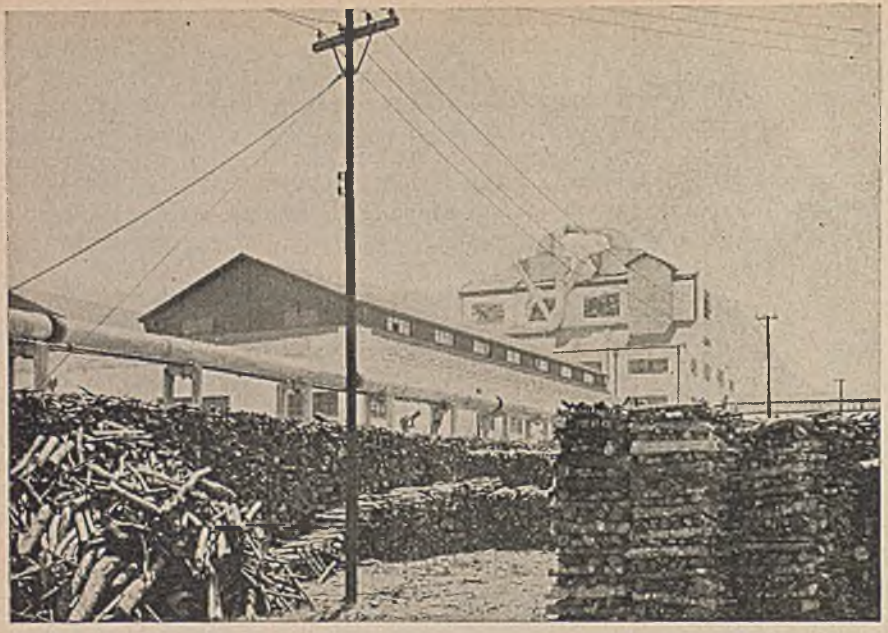
The Department of Commerce recently released statistics covering United States exports to the republics in 1942 and the detailed figures disclose just what chemical products the republics require from outside producers. The value of our shipments was close to $85,000,000 and the products included practically everything of a chemical nature manufactured in this country. About one-fourth of the total consisted of industrial chemicals.

Of the individual chemicals caustic soda comes first in this trade, both from the standpoint of volume and of value. Our shipments of caustic soda totaled 65,957 tons and the value was $4,127,166. Every one of the twenty republics was a buyer but Mexico, Cuba, Brazil and Argentina took about 80 percent of the total, Mexico alone taking 30,000 tons. Varying quantities of soda ash also went to each of the republics, the combined figure being 48,671 tons with a value of $1,598,226. Mexico imported 31,500 tons of ash but the other large importers were much less interested in ash than in caustic although Venezuela and Peru were outstanding exceptions.

Listing exports of industrial chemicals in the order of their tonnage rating, gives caustic soda, soda ash, calcium carbide, aluminum sulphate, sodium silicate, ammonium nitrate, calcium chloride, sodium bichromate, hydrochloric acid, sulphuric

General view of "cat" cracking plant at refinery of Lago Oil & Transport, Co., Ltd., at Aruba. This company is a subsidiary of Standard Oil Co. of of New Jersey





Plant for purification of cotton linters at Sao Miguel, Brazil. Wood in the foreground is used as fuel to generate steam for the plant

acid, sodium phosphate and sodium hydrosulphite as the ones most needed in Latin America.

Calcium carbide was shipped out to the extent of 13,428 tons and was in universal demand as each of the republics was an importer but more than one-half of the total went to Argentina. Sulphate of alumina also was widely distributed with 7,865 tons going out of this country. Brazil was the leading buyer with 944 tons marked for that country as against 840 tons for the Argentine. Of the 5,387 tons of sodium silicate exported, Cuba took 2,150 tons, Mexico 924 tons, Venezuela 577 tons and the remainder went in smaller amounts to the other countries. Chile took 3,090 tons of the 3,732 tons of ammonium nitrate exported, and Mexico received 614 tons, thus leaving but little for the other countries.

As a good part of South American coal-tar business was with Germany in prewar years, with France and Belgium also factors, the upturn in international trade conditions has been opportune for increasing our trade in these chemicals with the other Americas. For the group the 1942 tabulation evaluates this business at more than $7,600,000. Crudes, intermediates and finished products shared in this trade; the largest total came mostly from the fact that we sold 7,580,719 lb. of colors and dyes at a return of $6,928,965 which means that more than 90 percent of coal-tar business with the republics is in colors and dyes. Mexico, Brazil, Argentina and Colombia which have progressed most in the textile field were the principal buyers. All the republics are large buyers of pharmaceuticals and medicinal chemicals and this group was second only to industrial chemicals in the 1942 totals as approximately $15,000,000 worth of these products were purchased from us in that year. The list covers practically everything in the medicinal category but it is noteworthy that vitamins—valued at $3,461,514— topped the other general divisions.

Household chemicals and insecticides including bulk packaged goods have held a prominent place in inter-American commerce with average monthly shipments approximating $1,000,000. These comprised a long list of household remedies, pills, extracts, laxatives, plasters, gargles and ointments. The insecticide branch of the group is by no means unimportant. Attracting especial attention is copper sulphate which has wide application in the rural sections of the republics. The total sulphate exported by us to the other Americas in 1942 was 65,056,406 lb. valued at $3,057,574 which indicates that a goodly part of our production is consumed in Latin America. The country breakdown shows that Honduras was the purchaser of 21,553,450 lb. and Guatemala followed with 18,913,902 lb. Costa Rico, Mexico and Panama also were liberal buyers with their allotments running 7,153,558 lb., 5,980,706 lb., and 5,848,277 lb., respectively.

Calcium arsenate has come into more common use as a dusting agent particularly in Mexico and Venezuela and these two countries accounted for more than 3,600,000 lb. of the 3,928,108 lb. we shipped in 1942. Lead arsenate exports ran over 500,000 lb. with Mexico, Argentina and Cuba the principal buyers.

In the chemical specialty division outward shipments are reflecting the development of the plastics industry. Ester gum, alkyd resins, phenolformaldehyde resins, urea formaldehyde, methyl methacrylate, pyroxylin sheets rods and tubes and cellulose acetate molding compounds are some of the items which are in sizable demand. Increased tanning activities in the other Americas also are attested by our export figures of chromium tanning mixtures and specialty tanning compounds which together totaled more than $500,000 in 1942. Leather dressings and stains also are currently finding a good market.

From a percentage standpoint only a

Exports of Domestic Chemical Products to Latin-American Republics in 1942

Strategic and Critical Materials Not Included
(Thousands of Dollars)

	Coal-Tars	Medicinals	Household Chemicals and Insecticides	Chemical Specialties	Industrial Chemicals	Paints and Pigments	Fertilizers	Soap and Toilet Preparations	Not Allocated
Argentina	$1,541	$2,226	$466	$1,186	$3,607	$1,580	$18	$330	$630
Bolivia	86	49	138	61	326	72	.....	112	252
Brazil	2,573	1,926	480	796	3,053	1,334	31	545	424
Chile	679	798	178	412	1,778	482	25	108	453
Colombia	697	877	1,290	494	1,095	390	68	392	384
Ecuador	121	252	136	56	251	129	.....	159	92
Paraguay	5	15	24	2	18	12	1	24	2
Peru	356	664	589	875	842	302	7	183	727
Uruguay	151	360	85	165	415	253	2	80	15
Venezuela	92	719	848	489	610	635	16	367	326
Costa Rica	14	108	457	34	85	71	6	88	47
Cuba	376	2,730	1,609	1,349	1,730	835	689	500	267
Dominican Republic	22	129	134	58	155	134	8	131	112
El Salvador	33	171	190	43	114	58	8	120	95
Guatemala	60	156	1,030	69	128	127	3	113	48
Haiti	5	35	89	29	30	51	3	266	2
Honduras	6	81	1,177	38	48	53	.....	80	114
Mexico	1,968	3,042	1,827	1,895	6,525	1,781	327	576	776
Nicaragua	15	115	93	18	142	58	1	80	244
Panama	19	376	878	145	119	172	22	875	84
	$8,819	$14,889	$11,778	$8,244	$21,070	$8,528	$1,235	$5,129	$5,094

small part of our paints and pigments production is sold in the southern countries, yet the combined figure for such sales was more than $8,500,000 in 1942. Ready-mixed paints accounted for more than $2,000,000 with Mexico, Venezuela, Cuba and Colombia taking more than one-half of it. Calcimine cold water paints were more popular than the regular ready-mixed kinds but because of the lower selling price did not reach as high a valuation. Oil and spirit varnishes also do not have a wide sale and our shipments for that year were valued at about $300,000.

Pigments of various kinds sold more freely than the finished paints which is the result of larger paint production in some of the Latin countries. Mineral earth pigments including ochre and sienna moved in the largest volume with about 30,000,000 lb. going from this country principally to Venezuela. Lithopone sold to the extent of nearly 20,000,000 lb., and the bulk of this was destined for Argentina, Brazil and Chile.

Despite the vast progress made toward industrialization, the Latin republics remain agricultural nations. The huge arable acreage has made it unnecessary to practice intensive cultivation and the large outturn of agricultural products has come more from the large areas tilled rather than from high acreage yields. This has tended to put down the use of fertilizers. Partly because of this fact and partly because these countries have home production of a varied line of fertilizer materials, they are but frugal buyers in outside markets and our trade with them is smaller in fertilizers than in any of the other divisions of the chemical industry.

Taking the 1942 records as a standard, our business with the republics averages about 20,000 tons a year with a value of $1,300,000, this including mixed fertilizers and raw materials. Mexico and Cuba are our largest customers in fertilizers with Cuba taking the bulk of such materials as sulphate of ammonia, superphosphate, and potash salts, as well as prepared mixtures. Incidentally our shipments of potash salts made up about one-third of the fertilizer tonnage sent to the other Americas.

Unit for crystallizing nitrate of soda at the Pedro de Valdina plant in Chile

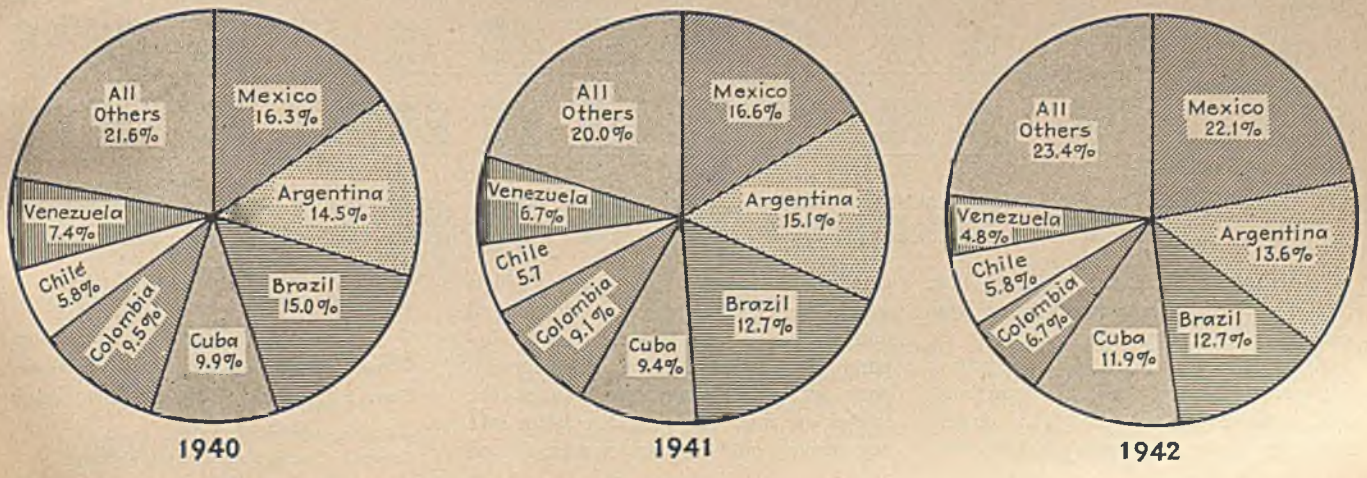
Turning to soap and toilet preparations, a more favorable record is found. Exports to the Americas in this classification reached a value of more than $5,000,000 with more than 75 percent of it credited to toilet preparations. Per capita consumption of soap does not run high in some of the republics and can be satisfied from home production which has the advantage of a wide range of native raw materials ranging from animal fats to vegetable and essential oils. From both a volume and value standpoint, laundry, toilet, and powdered soaps were the most important.

Haiti and Mexico were far in front as buyers of laundry soap with a more equitable distribution of toilet and fancy brand which found favor in Panama, Haiti, Venezuela, Cuba, Colombia, the Dominican Republic, Ecuador, Costa Rica, and Bolivia in that order. Soap powders were in demand mostly from Panama, Brazil, and Cuba.

IMPORT TRADE

Under normal conditions our purchases from the other republics run largely to raw materials and finished products which are not competitive with our own types of output. The unprecedented demands arising from our military program, however, altered this situation in the last few years and our buying activities were extended toward acquiring many materials normally competitive but which were badly needed to supplement our own production. This went so far as to curtail our purchases in some other lines because scarcity of shipping space forced preference for the more essential materials. The overall result was the continuance of the rising trend for our imports from the Americas which started in 1939. Unofficial

Relative importance of Latin-American Republics as buyers of U. S. chemicals



Exports of Domestic Merchandise to Latin-American Republics By Commodity Groups

Strategic and Critical Materals not Included
(Thousands of Dollars)

	Group-00	Group-0	Group-1	Group-2	Group-3	Group-4	Group-5	Group-6	Group-7	Group-8	Group-9	Total
Argentina												
1942	$228	$1,726	$622	$4,587	$3,749	$8,937	$5,369	$17,119	$12,804	$11,555	$4,424	$71,120
1941	249	1,059	968	5,484	1,925	1,617	6,775	33,385	32,687	12,802	4,862	107,813
1940	120	282	527	3,189	3,237	7,734	5,726	34,822	39,555	7,828	3,362	106,382
Bolivia												
1942	302	92	200	348	1,230	735	1,107	2,026	3,276	1,096	468	10,880
1941	554	135	358	716	932	712	983	2,097	3,792	985	538	11,802
1940	214	51	128	295	429	320	701	1,596	2,991	627	335	7,687
Brazil												
1942	132	888	1,034	2,275	1,862	3,027	11,911	16,261	46,577	11,162	8,769	103,898
1941	156	919	2,432	3,933	3,074	5,341	15,934	32,287	59,630	14,785	7,515	146,006
1940	76	454	1,884	2,691	1,629	3,108	13,282	27,278	47,326	8,119	3,796	109,643
Chile												
1942	78	359	181	1,095	5,242	1,554	3,505	7,890	12,724	4,913	3,120	40,661
1941	109	356	188	2,988	6,758	1,368	6,437	11,203	19,697	4,908	2,768	56,780
1940	107	234	86	1,714	4,124	1,247	5,445	10,354	14,755	3,150	1,830	43,046
Colombia												
1942	554	497	1,079	1,469	4,551	2,626	1,522	2,930	6,438	5,687	2,404	29,757
1941	1,027	847	1,499	4,198	9,783	2,819	3,110	9,908	19,496	7,729	3,688	64,104
1940	1,374	656	1,544	2,424	5,752	2,122	2,104	9,986	17,216	5,156	2,784	51,118
Ecuador												
1942	149	108	1,259	270	1,237	575	533	850	1,975	1,196	620	8,772
1941	236	112	725	419	876	352	638	1,303	2,307	931	409	8,308
1940	223	80	456	348	372	236	409	1,151	2,038	595	393	6,301
Paraguay												
1942	6	1	3	34	101	79	42	753	367	103	165	1,654
1941	2	3	8	53	82	63	113	340	262	58	80	1,064
1940	2	1	5	26	27	37	102	246	616	86	60	1,208
Peru												
1942	412	434	439	699	2,368	1,500	1,660	3,731	9,478	4,545	1,962	27,228
1941	560	483	638	2,504	1,662	1,942	1,641	5,514	10,657	4,175	1,490	31,266
1940	241	255	442	1,079	974	1,520	1,108	4,812	8,564	2,563	1,038	22,596
Uruguay												
1942	94	304	242	675	3,075	1,027	1,501	3,201	4,170	1,526	1,230	17,045
1941	75	127	258	802	2,445	847	1,697	4,216	5,364	1,385	957	18,173
1940	36	23	130	500	439	492	927	4,333	3,060	800	386	11,126
Venezuela												
1942	3,613	1,068	3,532	1,263	6,325	1,753	2,099	8,636	11,564	4,103	2,717	46,673
1941	4,551	1,239	5,129	2,605	5,506	2,217	3,839	13,550	19,742	5,667	3,125	67,170
1940	4,019	1,037	4,231	1,902	3,339	2,113	3,420	16,155	24,475	4,004	3,354	68,049
South America												
1942	5,568	5,477	8,591	12,715	29,740	21,813	29,249	63,397	109,373	45,886	25,879	357,688
1941	7,519	5,280	12,203	23,702	33,043	23,278	41,167	113,803	173,634	53,425	25,432	512,486
1940	6,412	3,073	9,433	14,168	20,322	18,929	33,224	110,733	160,596	32,928	17,338	427,156
Costa Rica												
1942	304	145	711	190	1,530	532	817	553	904	970	337	6,993
1941	592	294	1,027	515	1,890	574	1,118	2,209	2,757	1,233	600	12,809
1940	423	228	864	348	1,055	846	1,148	2,544	2,469	1,039	463	11,427
Cuba												
1942	9,065	2,965	29,453	3,187	3,165	8,740	11,208	7,544	12,158	10,085	5,240	102,810
1941	8,548	2,321	25,599	4,757	24,873	6,403	10,480	12,922	15,037	8,030	5,690	124,660
1940	5,074	2,063	17,139	3,219	14,182	4,836	7,548	9,462	11,477	5,340	3,794	85,034
Dominican Republic												
1942	105	167	653	173	3,420	918	788	656	739	963	445	9,027
1941	211	221	725	389	2,360	496	917	1,103	1,461	722	504	9,109
1940	230	169	574	204	1,028	381	899	1,077	1,351	561	389	6,863
El Salvador												
1942	52	162	427	104	1,957	287	304	233	566	832	477	5,401
1941	44	189	367	231	1,528	228	548	661	949	659	418	5,822
1940	34	154	294	153	1,024	130	413	695	862	482	388	4,629
Guatemala												
1942	121	197	790	220	1,597	622	1,605	860	928	1,734	523	9,197
1941	139	220	653	338	2,259	577	1,237	1,352	1,519	1,684	584	10,562
1940	134	192	597	270	1,644	505	979	1,421	1,603	1,225	471	9,041
Haiti												
1942	175	70	529	246	2,398	117	213	230	325	510	262	5,075
1941	237	63	495	264	2,293	175	414	405	690	414	260	5,710
1940	205	68	492	224	1,468	182	307	453	657	316	198	4,570
Honduras												
1942	115	142	380	103	1,331	347	565	545	523	1,597	180	5,828
1941	152	267	518	241	1,284	631	788	1,574	1,308	1,601	439	8,803
1940	133	201	539	194	520	407	562	1,574	1,334	1,475	296	7,235
Mexico												
1942	3,690	2,444	8,260	4,018	12,813	13,217	12,502	17,223	39,514	18,717	12,655	145,053
1941	3,192	2,089	7,705	4,963	8,539	8,491	11,754	21,823	61,838	14,123	10,079	154,596
1940	2,110	1,025	2,367	3,065	4,938	5,848	8,331	16,992	35,124	8,805	5,809	94,414
Nicaragua												
1942	59	113	456	180	1,027	120	333	414	593	766	319	4,380
1941	98	163	415	266	2,027	185	673	1,143	2,556	964	437	8,927
1940	70	99	350	153	850	87	558	854	2,167	493	364	6,045
Panama												
1942	2,072	843	3,787	1,908	6,503	1,329	1,493	1,225	2,285	2,690	2,674	26,809
1941	1,096	635	2,686	1,376	3,556	1,163	1,654	2,681	15,570	2,194	2,087	34,578
1940	625	409	1,562	946	2,028	1,037	1,099	2,142	6,453	1,362	1,307	18,970
Central America												
1942	15,758	7,248	45,446	10,329	35,741	26,229	29,828	29,483	58,535	38,864	23,112	320,573
1941	14,309	6,462	40,190	13,340	50,609	18,923	29,583	45,873	103,685	31,624	21,098	375,696
1940	9,038	4,608	24,778	8,776	28,737	14,259	21,844	37,214	64,497	21,098	13,479	248,328
Total to Latin-American Republics												
1942	21,326	12,725	54,037	23,044	65,481	48,042	59,077	92,880	167,908	84,750	48,991	678,261
1941	21,828	11,742	52,393	37,042	83,652	42,201	70,750	159,676	277,319	85,049	46,530	888,182
1940	15,450	7,681	34,211	22,944	49,059	33,188	55,068	147,947	225,093	54,026	30,817	675,484

figures place a valuation of more than $1,300,000,000 on shipments to us from the 20 republics last year.

A breakdown of the 1943 shipments is not yet available but the U. S. Department of Commerce has released figures for general imports into this country in 1942 with detailed information for the products which are classified as non-strategic and non-critical. Totals for the general imports differ from those reported for imports for consumption inasmuch as the former are inclusive while the latter take into account only those which were cleared

Commodities included in the individual groups:

Group 00—Animals and animal products, edible.

Group 0—Animals and animal products, inedible.

Group 1—Vegetable food products and beverages.

Group 2—Vegetable products, inedible, except fibers and wood.

Group 3—Textile fibers and manufactures.

Imports For Consumption From Latin-American Republics By Commodity Groups

Strategic and Critical Materials Not Included

(Thousands of Dollars)

	Group-00	Group-0	Group-1	Group-2	Group-3	Group-4	Group-5	Group-6	Group-7	Group-8	Group-9	Total
Argentina												
1942	$19,438	$18,604	$7,361	$13,830	$7,321	$131	$13	$260	$736	$1,564	$2,135	$71,393
1941	14,460	43,254	4,378	22,311	68,598	216	163	1,963	16	2,861	451	158,561
1940	5,972	19,638	2,853	14,220	32,743	93	117	2,226	2	1,278	327	79,469
Bolivia												
1942	.....	9	6	1	.....	.....	.....	.....	.....	.....	3	19
1941	.....	150	110	75	2	.....	3	26,537	.....	.....	16	26,893
1940	2	39	23	74	1	.....	.....	4,465	.....	.....	8	4,612
Brazil												
1942	2,247	8,207	90,534	16,043	2,373	411	571	24	.....	346	650	121,406
1941	2,733	12,602	106,976	33,702	7,018	469	11,224	4,745	5	585	1,026	181,085
1940	2,058	6,668	65,839	19,781	1,933	413	4,843	2,373	2	332	8	104,350
Chile												
1942	237	915	1,400	161	182	.....	2	2	17	17,763	197	20,876
1941	155	1,365	1,300	123	1,815	2	23	92,795	1	13,056	141	110,776
1940	140	722	888	118	995	1	1	38,555	.....	15,358	539	57,367
Colombia												
1942	.....	275	70,766	319	33	11	11	1	.....	.....	385	71,801
1941	.....	545	46,514	326	60	14	3,818	1,051	.....	.....	448	52,776
1940	.....	249	44,843	179	33	4	707	961	.....	.....	142	47,118
Ecuador												
1942	.....	119	3,266	257	1,315	9	1	.....	2	1	62	5,032
1941	.....	211	4,106	529	1,136	518	85	531	.....	3	115	7,234
1940	.....	100	3,033	451	590	214	.....	163	.....	.....	522	5,073
Paraguay												
1942	357	93	.....	453	23	.....	.....	2	.....	3	1	932
1941	972	389	4	2,019	58	2	.....	1	.....	16	2	3,463
1940	449	168	1	1,286	3	1	.....	.....	.....	2	35	1,945
Peru												
1942	38	441	985	940	3,487	2	3	5	.....	20	121	6,042
1941	21	885	2,432	627	4,368	125	12	12,415	.....	455	207	21,547
1940	21	580	832	501	2,138	65	2	11,064	.....	22	139	15,364
Uruguay												
1942	1,788	1,213	20	1,587	688	.....	5	12	.....	125	46	5,484
1941	2,193	3,686	37	1,486	29,788	1	3	9	.....	183	26	37,412
1940	1,090	1,457	34	2,338	11,913	1	3	5	.....	143	34	17,018
Venezuela												
1942	7	215	10,245	200	6	21	3	1	.....	.....	281	10,979
1941	6	579	6,986	394	3	51	38,298	19	.....	25	612	46,973
1940	4	365	5,205	129	.....	14	36,440	16	.....	7	950	43,130
South America												
1942	24,112	30,091	184,583	33,791	15,428	585	609	307	755	19,822	3,881	313,964
1941	20,540	63,666	172,843	61,592	112,846	1,398	53,629	140,066	22	17,184	3,044	646,830
1940	9,786	29,086	123,551	39,077	50,349	806	42,113	59,828	4	17,142	2,704	375,446
Costa Rica												
1942	.....	146	2	5,535	.....	5	.....	1	.....	.....	45	5,734
1941	144	3	8,367	102	.....	12	.....	3	.....	.....	87	8,718
1940	198	5	3,541	62	.....	935	.....	.....	.....	.....	112	4,853
Cuba												
1942	2,144	1,433	133,155	12,898	294	78	42	9	13	457	780	151,303
1941	3,269	3,222	141,539	9,905	1,165	513	127	9,653	24	448	1,222	171,087
1940	1,086	1,212	87,072	9,397	1,606	314	85	5,553	13	305	678	107,321
Dominican Republic												
1942	177	245	7,439	188	11	73	11	.....	.....	.....	8,411	16,555
1941	221	336	8,739	71	16	105	2	16	1	.....	200	9,707
1940	91	201	4,793	13	12	68	3	47	1	1	165	5,305
El Salvador												
1942	.....	9	11,744	115	16	.....	.....	.....	.....	.....	146	12,030
1941	.....	8	7,022	110	22	.....	.....	1	.....	.....	46	7,209
1940	.....	5	6,907	60	17	2	.....	1	.....	1	13	7,006
Guatemala												
1942	.....	37	13,832	1,167	9	81	2	5	.....	.....	128	15,761
1941	.....	98	11,015	1,147	13	199	2	.....	.....	.....	211	12,685
1940	.....	36	10,209	528	4	.....	.....	10	.....	.....	137	10,924
Haiti												
1942	.....	127	3,931	126	128	70	1	.....	.....	.....	64	4,447
1941	.....	145	6,075	159	729	42	.....	5	.....	20	91	7,466
1940	.....	77	2,702	72	695	15	.....	1	2	.....	59	3,623
Honduras												
1942	.....	24	4,855	126	.....	31	.....	1	.....	.....	119	5,156
1941	.....	31	8,102	18	.....	214	.....	3	.....	.....	202	8,570
1940	.....	27	9,115	1	.....	138	.....	4	.....	.....	240	9,525
Mexico												
1942	12,462	4,030	21,931	8,268	8,646	1,334	518	260	736	1,564	2,135	61,884
1941	8,680	2,352	17,507	8,161	11,401	880	13,115	36,409	66	856	1,976	101,403
1940	789	1,801	10,903	5,227	6,156	374	13,802	15,136	47	507	2,164	56,906
Nicaragua												
1942	.....	60	3,841	126	.....	38	.....	.....	.....	.....	50	4,115
1941	11	63	2,458	142	.....	388	.....	.....	.....	.....	91	3,153
1940	8	60	2,470	104	.....	117	.....	1	.....	.....	86	2,846
Panama												
1942	.....	.....	1,738	2	1	1	.....	2	.....	.....	55	1,799
1941	.....	97	4,327	20	3	4	.....	17	.....	.....	260	4,728
1940	.....	30	4,094	22	13	178	.....	8	.....	.....	94	4,439
Central America												
1942	14,783	6,111	202,468	28,551	9,105	1,711	574	278	749	2,021	11,933	278,284
1941	12,325	6,355	215,151	19,835	13,549	2,357	13,246	46,107	91	1,324	4,386	334,726
1940	2,172	3,454	141,806	15,486	8,493	2,141	13,890	20,761	63	814	3,758	212,838
Total to Latin-American Republics												
1942	38,895	36,202	387,051	62,342	24,533	2,296	1,183	585	1,504	21,843	15,814	592,248
1941	32,865	70,021	387,994	81,427	126,395	3,755	66,875	186,173	113	18,508	7,430	981,556
1940	11,958	33,440	265,357	54,563	58,842	2,947	56,003	80,589	67	17,956	6,462	588,284

Group 4—Wood and paper.

Group 5—Nonmetallic minerals.

Group 6—Metals and manufactures, except machinery and vehicles.

Group 7—Machinery and vehicles.

Group 8—Chemicals and related products.

Group 9—Miscellaneous.

through customs during the year. The invoice value of these general imports was given as $580,845,228, and the group comprising vegetable food products and beverages contributed the major share accounting for more than 67 percent of the total.

The relative importance of this group may be inferred from the fact that it includes such staples as sugar, coffee, cocoa, molasses edible and inedible, and edible vegetable oils. Data for inedible molasses include 1,546,929,120 lb. valued at $29,119,499 and a second entry total-

ing 203,051,406 gal. for which no value was reported. There also was no explanation for reporting the first lot in terms of pounds and the second lot in gallons. In both cases Cuba is credited as shipping more than 90 percent of the total with the Dominican Republic, Mexico, Haiti and Peru following in order. It will be recalled that shipments of molasses were suspended over the first part of 1943 because of lack of vessels for moving the available stocks. This came at a time when the alcohol situation was acute and forced the alcohol producers to convert their plants to the use of grain.

Because other Americas are not large producers of chemicals and the United States is able to supply the greater part of its own requirements, our import trade in such products forms only a small part of our dealings with the republic. Our general imports of chemicals and related products in 1942 reached a valuation of $21,454,579, of which the natural product, nitrate of soda, was by far the most important item. Nitrate imports for that year were 889,145 tons valued at $17,183,166 and all but 55 tons from Mexico came from the primary markets of Chile. In addition we received from Chile 14,272 tons of potassium-sodium nitrate with a value of $377,703. We also bring in appreciable amounts of varied fertilizer materials especially of animal origin, including dried blood, animal ammoniates, and guano with Argentina, Brazil, Uruguay and Paraguay as the leading suppliers.

Next to nitrate of soda, arsenious acid or white arsenic is the ranking chemical imported. All this material comes from Mexico where it is recovered as a result of mining operations and our receipts in 1942 were 29,802,866 lb. with a value of $859,836. While this material is not classed as strategic, it has found important outlets in the war effort as well as in its customary channels and the Mexican contribution was highly desirable since other sources of supply were cut off.

The campaigns we have conducted for the conservation of fats and greases for the manufacture of glycerine and the order to soap makers and oil-splitters to recover glycerine to the fullest extent emphasize the importance we have attached to this material. Here again the republics to the south of us have given valuable assistance by sending their surplus stocks to this country. The 1942 figure for such shipments was 5,474,665 lb. carrying a value of $586,135. Cuba, Argentina, Uruguay were the supplying countries.

Another chemical which has been in small supply in our market is tartaric acid and the scarcity would have been accentuated had we not been able to obtain raw material supplies from Argentina, Brazil, Chile, Mexico and Peru. Those countries sent us 3,112,735 lb. of argols wine lees and potassium bitartrate in 1942 and we also brought in 1,388,064 lb. of crude calcium tartrate from the Argentine and Chile.

Inter-American import trade in paints and pigments does not run to large figures. Principal items imported in 1942 were 724,865 lb. of zinc sulphate, 297,233 lb. of iron oxide, 510,267 lb. of crude ochre and 24,124 lb. of dry zinc oxide, all from Mexico as well as 529 tons of crude barytes from Cuba and a small amount of mineral earth from Ecuador.

Coal-tar products do not figure to any great extent in our import trade but Mexico has furnished us with sizable quantities of creosote oil, benzol, naphthalene and xylol. Its largest contribution, however, is classified as coal-tar explosives except smokeless powder and this amounted to 373,300 lb. valued at $100,790.

OILS AND OILSEEDS

For some time the United States has been striving to increase home production of various oils and fats. Despite progress in that direction, the necessity for importing oils still remains and many oil-bearing materials are not native to the United States and hence must be imported. With Philippine copra and coconut oil out of the running and tung and other oils from the Far East practically unobtainable, it was necessary to redouble efforts to keep our supply of edible and inedible fats and oils up to the essential requirements. This placed more than usual dependence upon the Latin American products. Cottonseed oil was offered more freely than the other types and our 1942 receipts amounted to 32,338,127 lb. of the refined product which came principally from Brazil and Mexico with El Salvador and Guatemala shipping a small part of the total. Argentina was the source of 63,973,329 lb. of sunflower oil, 766,925 lb. of corn oil, as well as giving us most of the 328,970 lb. of peanut oil which reached this country.

Although the flaxseed acreage in the American Northwest has been expanded in the last few years, the outturn has not been large enough to cover home requirements and as has been the case for years, we make up this deficiency almost entirely by importing from South America. In 1942 such imports amounted to 9,480,680 bu., for which we paid $11,577,951. Argentina supplied 8,307,928 bu., Uruguay 1,161,198 bu., and Mexico filled in with the balancing 11,554 bu.

When tung oil shipments from China were discontinued an intensive search was initiated to find other oils which might be substituted. Research brought on the market a specially treated castor oil which soon gained wide acceptance in fields where drying oil is a requisite. The greater demand for castor oil thus created in turn called for large stocks of castor beans. Probably because of the strategic rating, castor beans are not included in the detailed report on imports. However our statistics show that domestic consumption in 1942 was close to 130,000 tons and as stocks in this country increased considerably, it is evident that our imports were in excess of consumption. The greater part of the beans consumed in this country originate in Brazil.

A varied line of other oilseeds were purchased to round out our oil-crushing operations, the aggregate being slightly under 30,000 tons. Largest among the miscellaneous total were babassu nuts and kernels which are crushed in this country to make the edible and industrial oils. The quantity of nuts and kernels imported—largely kernels—was approximately 24,000 tons.

The growth of crushing capacity in the Argentine was made evident by the fact that whereas our imports of flaxseed were relatively low, we increased our commitments on linseed oil to 27,758,217 lb. which is in line with reports that Argentina will further expand crushing plants and become a factor in the world oil markets when they are again opened up for competitive offerings. There also was a noticeable gain in traffic in sunflower seed oil with the Argentine again the producing country and shipping us 7,106,517 lb. United States buyers had shown a keen interest in oiticica oil because of the excellent results obtained through its use but the crop in Brazil fell below expectations and only 1,218,315 lb. were shipped to this country. Other vegetable oils swelled the total of Latin American shipments to more than 37,000,000 lb.

The above review of import trade has been restricted solely to items for which specific data for quantities and values have been given, since similar information for strategic, critical and military items has been withheld for reasons of security but the composite value of our imports of the latter materials in 1942 is reported as $396,619,165, making the overall total of our imports $977,464,393. Many of the products defined as strategic and critical gained the appellation because the supply was not large enough for combined military and civilian needs and distribution controls were found necessary. With a return to normal conditions, these materials will be in active demand for it is in finished goods which require such materials as components that inventories are lowest. Hence the overall total of our current purchases from the Latin American republics need not be radically adjusted to represent a true potential.

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PROCESS EQUIPMENT NEWS

THEODORE R. OLIVE, Associate Editor

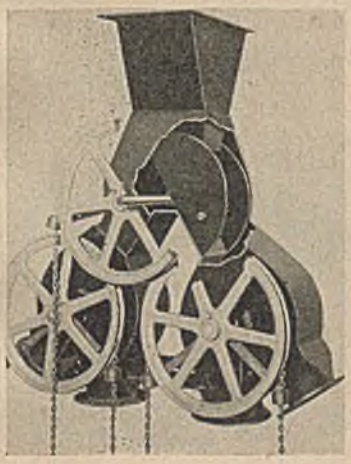
WELDING ELECTRODE

FOUR recent additions to its line of welding electrodes have been announced by the Anthony Carlin Co., 2717 East 75th St., Cleveland, Ohio. Grade P-61 is a shielded-arc, general-purpose electrode for d.c. welding of mild steel in all positions, designed for use with high current. P-103 is a shielded-arc a.c. electrode suitable for all-position welding. This type is also used for welding low-alloy, high-strength steels used primarily for high strength properties. P-170 and P-180 are bare and wash-coated electrodes of straight-polarity d.c. type.

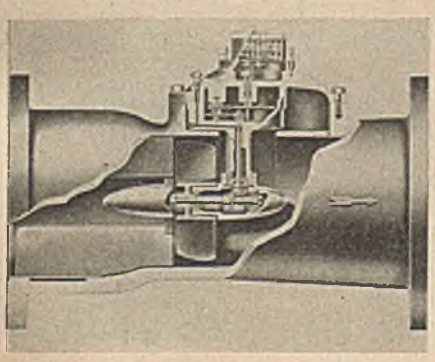
MAIN LINE METER

FOR THE MEASUREMENT of large flows of water in 6-in. lines, and larger, Builders-Providence, Inc., 9 Codding St., Providence 1, R. I., has developed the Propeloflo meter, a propeller type flowmeter incorporating an eight-blade phenolic plastic propeller molded in one piece. Rotation is transmitted through spur and bevel gears, with the shaft rotating in ball bearings to assure maximum power to drive the indicating and recording devices or proportioning chemical feeders. A venturi throat evenly distributes the force of the flow against the full area of the propeller, resulting in improved accuracy over a wide flow range, according to the manufacturer. Spiral flow is eliminated by straightening vanes just upstream from the propelier. The propeller hub, bracket and nose are streamlined to reduce flow disturbance and divert fine grit, sand or scale away from the mechanism. A one-shot lubricating system, readily accessible stuffing box, and design for easy removal of the propeller mechanism, are said to facilitate maintenance.

Non-leaking four-outlet flop gate



Model PRF Propeloflo meter



CONCRETE BREAKERS

FOR BREAKING up equipment foundations as well as for such uses as demolishing pavements, the Syntron Co., 610 Lexington Ave., Homer City, Pa., has developed a new type of completely self-contained, gasoline-operated concrete breaker said to be comparable in power to the larger-sized compressed air paving breakers. The new machine, which weighs 96 lb., is designed for easy operation by one man. It is completely self-contained, requiring no air compressor, air hose, ignition battery, ignition coil and cable or other source of power, or other accessories. In principle, it consists of a two-cycle gasoline engine in an inverted position, with two pistons, one an engine piston and one a hammer piston. The engine piston is connected to the crankshaft at the top of the hammer and drives the flywheel, ignition magneto and a fan for forced air cooling. Starting is by a rope pull, like an outboard motor. Throttle control of the blow permits placing the tool on the spot it is desired to work, without jumping around. According to the manufacturer, using a solid star drill, with water to flush the cuttings out of the hole, the hammer will drill rock to a depth of 30 in. Comparatively low fuel consumption is claimed enabling the fuel tank, containing a mixture of gasoline and oil, to hold sufficient fuel for several hours operation.

Gasoline-driven concrete breaker

IMPROVED BIN GATE

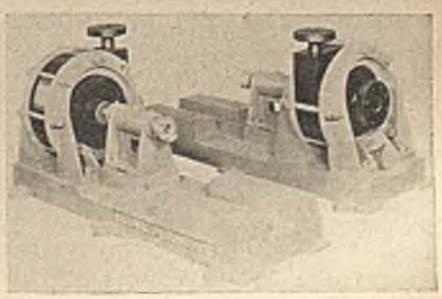
DESIGN IMPROVEMENTS said to prevent any leakage down the wrong bin-discharge leg, even when handling dusty or powdery materials, are incorporated in a new non-leaking multiple-outlet flop gate for bins recently introduced by the C. O. Bartlett & Snow Co., Cleveland 5, Ohio. This gate is a modification of the well known inverted "Y" type. As shown in the accompanying illustration, it contains a number of pivoting chutes having semi-circular sides, instead of the usual pivoting plates. Material passing through the gate, regardless of its type, is wholly contained within the chute and is said to have no opportunity to pass down and out the wrong leg through the clearances which must of necessity be provided in pivoting-plate construction. The chutes are readily operated with a chain and chain wheel and are held in position by gravity until changed. The gates have self-damming spouts and are available with two, three, four, or more outlets, in any capacity desired.

KARBATE PUMPS

AFTER a number of years of experimental use, the National Carbon Co., Cleveland, Ohio, has announced that the Karbate centrifugal pump is out of the experimental stage and has been standardized in three sizes. Karbate is a carbon stock made impervious to seepage of liquids under high pressures and is reported resistant to practically all corrosive liquids. Longer life for the pump and freedom from metallic contamination of the liquids being handled are claimed. Unlike pumps constructed of many acid-resisting materials, Karbate pumps are not subject to possible damage where sudden variations of liquid temperature induce thermal shocks.

Construction of the standardized line is such that the liquid handled is in contact

New Karbate centrifugal pumps



only with Karbate, a Karbate sleeve covering the steel shaft and being cemented to the impeller disk rather than to the shaft itself. The shaft end is covered with a Karbate cap. Use of a stuffing box is eliminated by substitution of a rotary seal.

BELT TYPE PILER

SEVERAL IMPROVEMENTS are incorporated in a new portable, inclined, belt-type conveyor for loading, unloading, stacking and elevating of cartons, cases and bags, which is now being marketed by Standard Conveyor Co., North St. Paul, Minn. A new method is used for lowering and raising the carrier frame. The adjustable part of the frame is fully counterbalanced, as appears from the accompanying illustration, and can be adjusted either from the floor or from the top of the pile. The absence of supporting structures under the adjustable boom makes it possible for this part of the piler to project over the pile or into a car or truck without interference. The new piler is made in three sizes with the high end of the carrier adjustable up to heights of 7½, 8½ and 9½ ft. This provides for the bagging of commodities up to 12, 13 or 14 ft. The machine can handle individual commodities up to 100 lb., or a total uniformly distributed load of 25 lb. per foot. Motor-driven, it is provided with a cable for plugging into any convenient electric power outlet.

LIQUID LINE STRAINERS

IMPROVEMENTS in design and construction have been made in two types of liquid strainer developed by Spraying Systems Co., 4023 West Lake St., Chicago 24, Ill. The Type TW liquid strainer shown at the left in the accompanying illustration, is intended primarily for installations involving the use of several nozzles on a single feed line. This strainer offers a particularly large open screen area in relation to the pipe area, thus permitting freer flow of the liquid without requiring cleaning as often as ordinary strainers. This strainer employs a cast iron body and brass wire screen but is also available in all-brass or in all-stainless-steel construction. Various meshes are supplied according to requirements.

The Type Q line strainer, shown at the right in the accompanying illustration, is intended principally for single nozzle installation. The maximum capacity of the strainer is 1 gal. per minute of water, brine, oil and liquids of similar viscosity. The screen is removable for cleaning and, like the TW type, the Type Q is available in several materials.

MOTOR-GENERATOR SET

A NEW LINE of high-frequency motor generators has been announced by the Kato Engineering Co., Mankato, Minn. In these the motor and generator have the frame cast integral. Two distinct armatures mounted on a common shaft are used. Many combinations of a.c. voltages and frequencies can be had in this unit, such as either 400 or 800 cycles. The motor winding may be tapped to deliver 60 or 120 cycles at either 1,800 or 3,600 r.p.m. Capacities up to 1,000 watts can be furnished. The unit is light in weight and compact, weighing approximately 110 lb.

SPOT HEATERS

MANY peacetime applications are anticipated by the H. & A. Manufacturing Co., 86-100 Leroy Ave., Buffalo 14, N. Y., for the wide line of specialized electric contact heaters which it has developed for use in numerous wartime applications. These heaters, which are designed specifically around each application, have been used principally thus far in heating the bolt or firing mechanism on machine guns used at extreme low temperatures; the hydraulic actuating mechanisms on airplanes at high altitude; and the storage batteries in army tanks in below-zero operation. These heaters are light in weight, operate at low wattage, are said to be safe in the presence of explosive vapors, withstanding severe vibration and are said to maintain exact temperature within close limits. They can be made in nearly any size, contour and capacity.

Their efficient performance is credited to the fact that thermal losses are well controlled and heat transfer efficiently accomplished so that a unit weighing only a few ounces can raise the temperature of 30-odd pounds of steel 90 degrees above sub-zero external temperatures. These results are obtained partly by methods of insulating and housing the heating element and partly by unusual means of attaching the heaters to the objects heated. Generally, the face of the heating plate is held in compressive, resilient contact against the surface to be heated without nuts or bolts, usually being "sprung" on to the object. The units are produced in capacities from 35 to 400 watts.

AIR-SUPPLIED HOOD

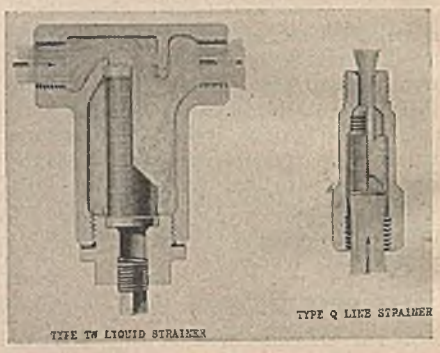
PROTECTION of the eyes, ears, face, neck and respiratory organs of workers against harmful and irritating mists, vapors, fumes, and dusts is the function of the Taeco hood announced by Wesley A. Gibbons Co., Birmingham, Mich., for use in process and other industries, and for spray painting. Compressed air at low pressure, from the same supply used for a spray gun or similar equipment, for example, is fed into the hood through a distributing tube which is held in position at the operator's waist by a belt clip. A removable diffuser allows the air to expand and discharge at the top of the hood, whence it floats down over the operator's head. Two models are available. One kind, called the Vapo hood, and designed primarily for spraying paint and other liquids, has the eye mask cut out to prevent hampering the operator's vision by misting. Air flowing out through the eye opening keeps vapors from entering. The other kind, known as the Fumo hood, has the eye mask closed, requiring the air to escape at the neck.

ELECTRIC HOIST

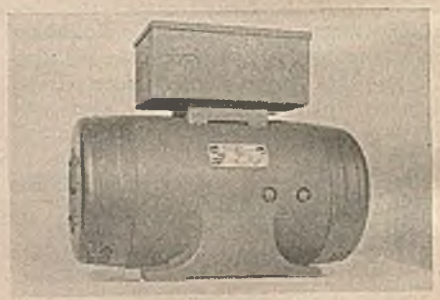
DESIGNED for users preferring chain hoisting, the small "Handi-Lift" developed by the Hoist Division of Harnischfeger Corp., Milwaukee 14, Wis., is said to offer

Adjustable belt type piler

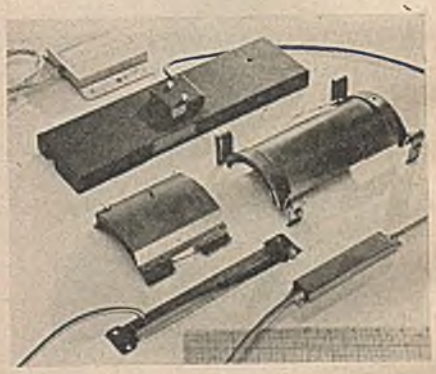
New pipeline strainer



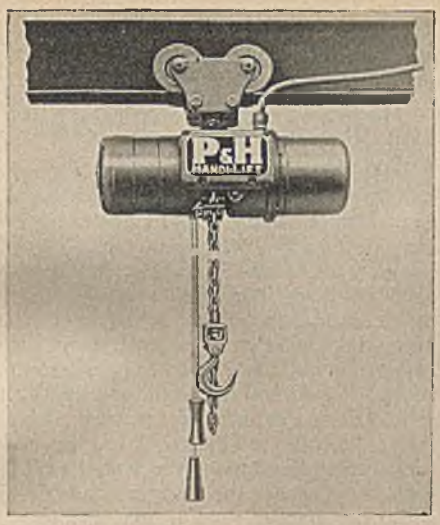
High-frequency motor generator



A few typical types of H. & A. electric contact heaters

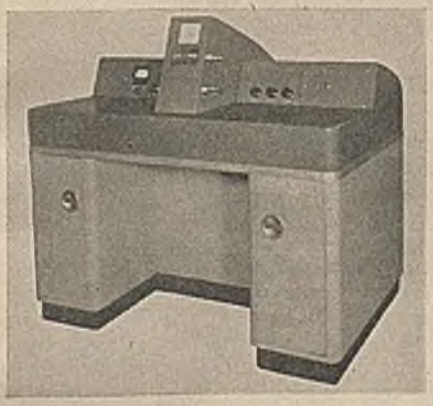


New air-supplied hood

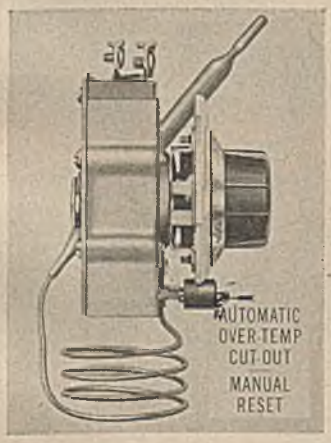


New 500-lb. electric chain hoist

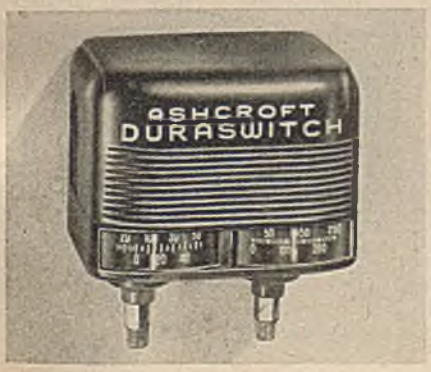
Console type electron microscope



Electric temperature controller



Combination pressure, temperature control



many new features in the low-price electric chain-hoist field. Increased utility is claimed owing to quick interchangeability to bolt, hook, or trolley mounting, the changeover requiring the loosening of one bolt only. In trolley service the hoist can be suspended either parallel or crosswise to the beam for greater flexibility. Since the hoist is fully inclosed, it can be used, according to the manufacturer, under any condition of weather, dust, moisture or acid fumes. Although rated at 500 lb., the hoist is said to have unusually high reserve capacity. Operation is by pull cord, actuating a simple lever toggle arrangement which leaves one hand free to guide the load. Safety limit stops are provided with dual braking by means of a large spring-set electric motor brake which automatically releases when the hoist is operated and sets instantly with current shut-off. The flood lubrication system is designed for infrequent attention as are other parts of the device. The unit operates on three-phase 60-cycle 220- or 440-volt current and is shipped complete, ready to install.

ELECTRON MICROSCOPES

Two improved electron microscopes, successors to the original instrument first commercially developed by the Radio Corp. of America in 1940, have recently been announced by the R.C.A. Victor Division of this organization at Camden, N. J. One of the new instruments is an improved model of the original vertical type, while the other is a compact console type, said to be the first of its sort. The latter instrument is expected by the manufacturer to have particularly wide application to smaller industrial laboratories which might not ordinarily be able to utilize the larger model because of limited budget and space.

FLOW INDICATOR

To enable operators to determine visually whether fluids are flowing in piping systems, Fischer & Porter Co., 918 County Line Road, Hatboro, Pa., has developed a complete line of sight-flow indicators. For ordinary applications there is a flapper type with a hinged flapper which swings outward or upward to register the passage of a fluid. A "drip-lip" type having a clearly visible lip so arranged as to register small or intermittent flows has been developed for certain applications. Indicators for opaque flows, or with electric contacts to actuate external alarm devices, are also being produced. A new wheel type contains a wheel equipped with turbine type blades which immediately shows low flow rates and changes in rate of flow. Sight flow windows for ordinary and high pressures, special corrosion-resisting types and illuminated flow indicators are also included in this group.

TEMPERATURE CONTROLLER

A manual-reset cut-off device which guards against overheating is a feature of the new H 1 electric temperature control which is now being offered by the Commercial and Industrial Division of Robertshaw Thermostat Co., 30 Church St., New York 7, N. Y. This device consists of a standard double-pole, single-throw electric temperature control, equipped with an auxiliary single-pole, single-throw switch which will automatically cut off all current as soon as the desired operating temperature is exceeded by 30 deg. F. in liquid, or 50 deg. F. in air, due to negligence, fusing of the thermostatically operated contacts, etc. During normal operation the control opens both sides of the circuit but in case of excessive temperature the safety contact opens one side of the circuit only which is sufficient to disconnect the heating element. After operation of the over-heating cut-off device, the circuit is re-made by pushing in the reset button. The contact is then completed and held in place by a safety catch which is not disturbed by normal operation and does not act until excessive temperature creates an additional expansion of the diaphragm sufficient to lift the safety catch. A limit control without the temperature controlling mechanism is also available.

CONTROL GAGE

For pressure control, or for both pressure and temperature control, the Electro Mechanical Division of Manning, Maxwell & Moore, Bridgeport, Conn., has announced the new Ashcroft Duraswitch which is a dependable electric switch in combination with an Ashcroft pressure gage. Two types are available, the Series E-100 which is for pressure only, and the Series E-200, which is for both pressure and temperature applications. Instruments indicate the temperature and pressure measured and also include pointers for setting the point of switch operation. The second type, for both pressure and temperature applications, is available as a pressure control and pressure gage combination, or a temperature control and thermometer combination, in single or duplex types.

EQUIPMENT BRIEFS

According to an announcement of the Radio Corp. of America, Camden, N. J., high-frequency electronic heating can now be used successfully in the initial drying stage on penicillin extract. Where previously this extract has been dehydrated entirely from the frozen condition in all installations, so far as is known, the new process effects a partial dehydration with electronic heating, prior to final dehydration from the frozen condition. It is claimed that the new process, which will be made available to all manufacturers, can accomplish in 30 minutes what the usual freeze-drying process does in 24 hours. It is also said to be far cheaper. Dr. George H. Brown, research engineer of R. C. A., who developed the high-frequency dehydrator, states that his experiments in cooperation with E. R. Squibb & Sons, have consisted in boiling the purified penicillin solution in glass bulbs at a temperature of 50 deg. F. under moderate vacuum. Energy is provided by a self-contained 2,000-watt electronic generator which removes about 90 percent of the water, greatly reducing the bulk of the

solution. The remaining solution is then freeze-dried to powder in ampules or vials for shipment. The electronic apparatus, occupying a floor space 3x5 ft., and 7½ ft. high, consists of three large glass bulbs connected in vertical series and attached to a pump which maintains a relatively low vacuum. The new process is said to reduce operating costs by the value of one ton of dry ice per day in an average size plant, in addition to reducing the maintenance costs.

NEO-MOLD Co., 2183 East 18th St., Cleveland 15, Ohio, has developed a new process of flame spraying of bronze on steel which has been employed in the manufacture of pistons for Aerol landing struts for airplanes. This is claimed to be the first successful application of sprayed bronze for this purpose, enabling a machinable coating, 0.045 in. in thickness, to be applied prior to machining and finishing operations. The coating so applied has extremely fine porosity and thus retains oil, becoming self-oiling after short use. The same process is now being applied to all types of pistons for compressors and pumps. It is claimed that the method can be used for the successful application of any metal to any other metal, for example, bronze on aluminum to produce light, machinable, oil-bearing and long-wearing parts.

A NEW 375-watt reflector-type infra-red heat lamp has been added to the Birdseye line of Wabash Appliance Corp., 335 Carroll St., Brooklyn, N. Y. Known as Birdseye RE-40, the new lamp produces higher drying temperatures than were possible with available 250-watt sizes. The line now includes sizes of 125, 250 and 375 watts for flexible control of temperatures.

SEVERAL new or improved pumping units have been announced by Blackmer Pump Co., Grand Rapids 9, Mich. Included is a small-capacity twin pumping unit with direct-connected electric motor, each pump having a capacity of 3 g.p.m. at 100 lb. per sq. in. pressure. Another is a new line of special vane-type rotary pumps with capacities from ¾ to 10 g.p.m. and another, a 300-g.p.m. pumping unit powered by a 25-hp. diesel, designed for handling oil sludge and fitted with steam-jacketed heads to lower the viscosity of the pumpage.

DIRECT-CURRENT engine generators in sizes from 1 to 200 kw. are now available from the Century Electric Co., St. Louis, Mo., for direct assembly to the engine frame or for belted drive. The generator is constructed to bolt directly to the engine housing and engine shaft. One end is supported on the engine bearing, the other on a ball bearing in the generator frame. Voltages range from 15 to 600 volts.

RESEARCH by the National Carbon Co., Cleveland, Ohio, has made it possible to put two new and larger graphite electrodes on the market. These are, respectively, 24 and 30 in. in diameter, the first graphite electrodes of these sizes to be produced commercially anywhere in the world, according to the makers. They follow some six years of experience with the production of 20-in. graphite electrodes by the company. The greatest problem in going beyond the 20-in. size was loss of strength. The problem is reported to have been met, however, and the 30-in. electrodes are claimed to be proportionately as strong as the 18-in. size. The availability of the new sizes is expected to make possible important developments in furnace design.

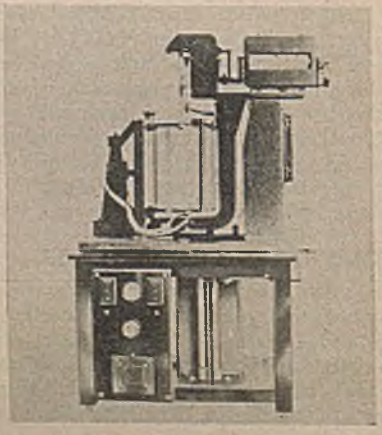
ALUMINUM-BRONZE ROD

FOR MAKING welding deposits of great strength and hot ductility, combined with resistance to corrosion, the Wilson Welder & Metals Co., 60 East 42nd St., New York, N. Y., has announced a new coated aluminum-bronze electrode, Wilson No. 200, designed for use either as a shielded-arc electrode or for use as a filler rod in carbon-arc welding. Deposits made with these new electrodes are said to be superior to standard manganese bronze with respect to corrosion resistance, and equal to it in strength, hardness and ductility. The new rod is said to have almost universal application in the welding of most bronzes, malleable and cast iron or steel. It can also be used for welding dissimilar metals such as cast iron to brass, steel to malleable iron, or for joining any two metals which are weldable with aluminum bronze.

ROCKWELL DILATOMETER

FOR RECORDING temperature - dilation changes and temperature-time changes simultaneously during heating and cooling cycles of solid materials, such as ceramics and metals, the Bristol Co., Waterbury 91, Conn., has announced the Bristol-Rockwell Dilatometer, Model A-134. The instrument simultaneously inks two records on a chart with rectangular coordinates for ease of interpretation and filing. The ball-bearing multiplying mechanism exerts very light pressure on the sample and provides smooth, accurate records of the temperature-dilation of the sample, according to the manufacturer. A split furnace is provided, designed for temperatures to 2,500 deg. F., which can be pulled away from the sample for quenching or cooling, without disturbing the record. Its inside dimensions permit the use of any size or shape of sample up to 1⅝ in. diameter by 5 in. long.

Improved dilatometer



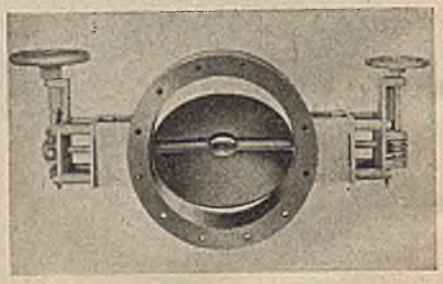
TWO-IN-ONE VALVE

TO PERMIT either the flow of a small volume of fluid with a high pressure drop; or of a large volume of fluid with a low pressure drop, R-S Products Corp., Wayne Junction, Philadelphia 44, Pa., has developed its Type No. 608 butterfly valve which incorporates a double butterfly element, the smaller mounted centrally in the larger. The valve is claimed to permit close control and shut-off of volume and pressure and to be readily adapted for power operation. As will be observed from the accompanying illustration, the large beveled vane seats against the body of the valve, while the smaller vane is free revolving. Four to six revolutions of the handwheel completely opens or closes either valve vane. This valve is made in various combinations of sizes, for operating pressures from 15 to 900 lb. per sq. in.

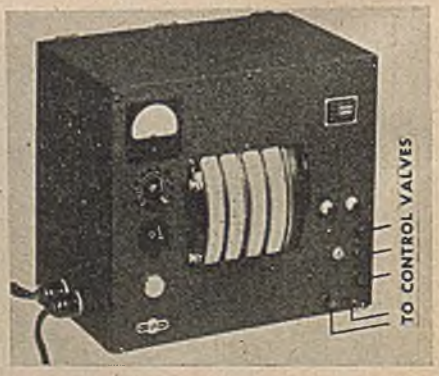
ELECTRIC MANOMETER

MINUTE pressure measurements are indicated electrically by means of a new electric manometer recently announced by Trimount Instrument Co., 37 West Van Buren St., Chicago 5, Ill. The instrument employs a sensitive pressure measuring device which operates on a null-point principle, utilizing a wheatstone bridge electrical circuit. The pressures are indicated in inches and tenths of inches of water on a drum indicating unit. The instrument has a range of 0 to 100 in. of water, with a sensitivity of one-quarter to one-tenth of 1 in., and an accuracy of plus or minus one-tenth of 1 percent, according to the manufacturer. Lower ranges are also available, such as 0 to 5, 0 to 30, and 0 to 50 in., having corresponding better degrees of sensitivity.

Two-in-one butterfly valve



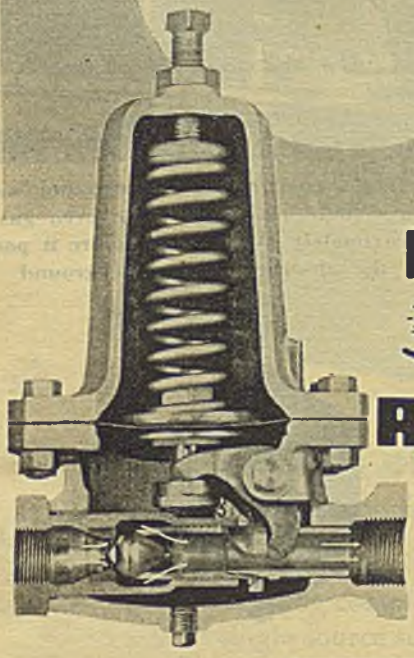
Electric pressure indicator



EXTRA LARGE CAPACITY
TIGHT CLOSING CHARACTERISTICS
CLOSE DELIVERY PRESSURE CONTROL
WIDE RANGE OF ADJUSTMENT

Combine to Give You..

SMOOTH OPERATION
SPEEDIER PRODUCTION
NO SPOILAGE



CASH STANDARD *Streamlined* TYPE 1000 PRESSURE REDUCING VALVES

The "1000" valve is single seated and its valve makes line contact with its seat ring which accounts for its tight closing characteristics. The unusually long diaphragm spring insures sensitive pressure control.

Steam, water, air, oil, etc. flow through this valve in a straight line—nothing is in the path of flow to cause turbulence — therefore, peak flow is never a problem.

TURBULENCE LIKE THIS *Eliminated*

The inner valve is streamlined — no back eddies to hinder flow — valuable when you want all possible fluid to go through the valve to meet peak demand.

YOU GET THIS *Streamlined* PATTERN

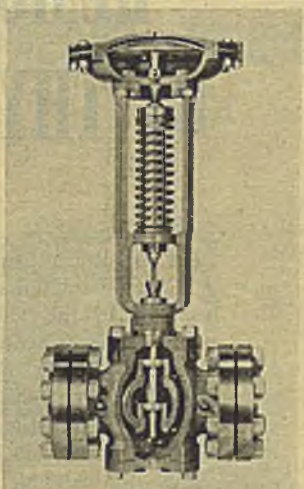
Turbulence eliminated by venturi approach to the valve seat — it means better flow. The inlet pressure is confined to a small cylindrical chamber, the same being advantageous for high pressures.

Write for bulletin "1000" that fully explains the cost-saving benefits that begin with installation and last for years.

CASH STANDARD CONTROLS.. VALVES

A. W. CASH COMPANY
DECATUR, ILLINOIS

OTHER VALVES *from the* CASH STANDARD LINE



Cash Standard Type 34 Pressure Reducing Valve. For practically all fluids. Has roller bearing, also roller guides that kill side strains and stop packing trouble —no lost motion.

Sizes: ½" to 12" inclusive. Highest initial pressure 800 lbs.; reduced pressure vacuum to 150 lbs. Bodies: iron, bronze, steel. Trim: iron, bronze, stainless steel. Ends: screwed, flanged, ammonia type, welding type. Bulletin 968.

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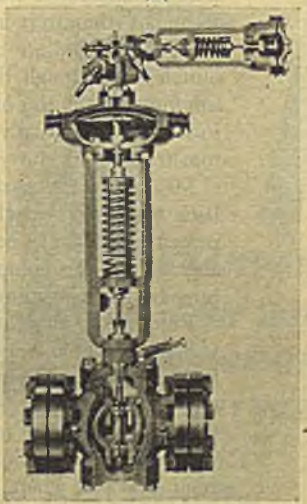

Cash Standard Type 30-AP Valve gives precise control of fluid pressures, through a pilot connected to the pressure under control. For steam, water, air, and most fluids.

Can be a pressure reducing valve or a back pressure valve depending on the way the control lines are connected. Pressures up to 600 lbs. Sizes ½" to 12" screwed; 1" to 12" flanged ends; wide variety of metals.

☆

REMOVAL OF H_2S BY THYLOX PROCESS

AT THE Rouge plant of the Ford Motor Co. in Dearborn, Mich., sulphur compounds are removed from the coke oven gas by the Thylox process of the Koppers Co. This process removes hydrogen sulphide and organic sulphur compounds from gases by absorbing them in an alkaline solution of sodium thioarsenate, and differs from other purification processes in that the sulphur is recovered in elemental form as a usable byproduct. The Ford installation is one of the largest of this kind in the world, handling over 50,000,000 cu.ft. of coke oven gas per 24 hr. day. Purification of the gas became imperative some time ago on installation of a magnesium smelter and armor plate building where considerable amounts of nickel-chrome steel were used.

The coke oven gas, from which ammonia and tar have previously been removed, is cooled by water sprays, then passed under positive pressure through 22 ft. by 90 ft. absorbers constructed of steel plate and equipped with wood slat platforms. In these absorbers a solution of sodium thioarsenate maintained at the proper pH by addition of soda ash, is sprayed over the platform to absorb the gaseous sulphur compounds.

To reactivate the absorbing solution, it is pumped to feed tanks from which it flows by gravity through primary and secondary thionizers arranged in series. These thionizers are 120 ft. high and are continually fed by compressed air which bubbles up through the fouled Thylox solution oxidizing the sulphur. At the top of both thionizers, a froth of free sulphur forms and continually flows over the top into a hopper bottom trough to a slurry tank which in turn feeds a rotary filter.

Meanwhile the purified solution from the thionizers is run back to a weir box where it is fixed with fouled solution (75 percent pure—25 percent fouled) and sprayed into the absorbers. This composition of absorbing solution apparently provides for maximum absorption of the sulphur compound.

Filter cake from the rotary filter contains both sulphur and various insoluble impurities, and is dropped to an autoclave for separation. The sulphur is melted by application of steam and sinks to the bottom leaving the scum on top. At this point, two processes may be used for recovering the sulphur.

The original method merely requires running out the sulphur to a pan where it solidifies, and transferring the impurities to a blow off tank. However, a newer method now in use provides for blowing the molten sulphur to a feed tank from which it is piped to a water-cooled stainless steel endless belt. At the end of the belt travel, as it goes around the pulley, the solidified sulphur is cracked to small pieces of cake which fall into a hopper for final distribution.

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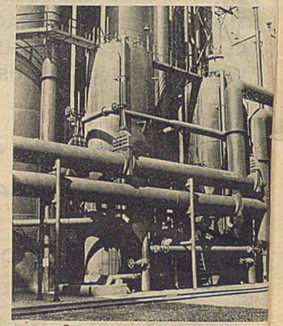
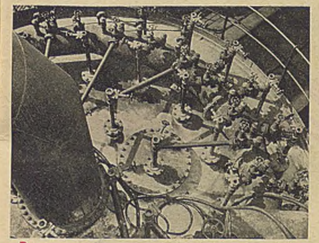
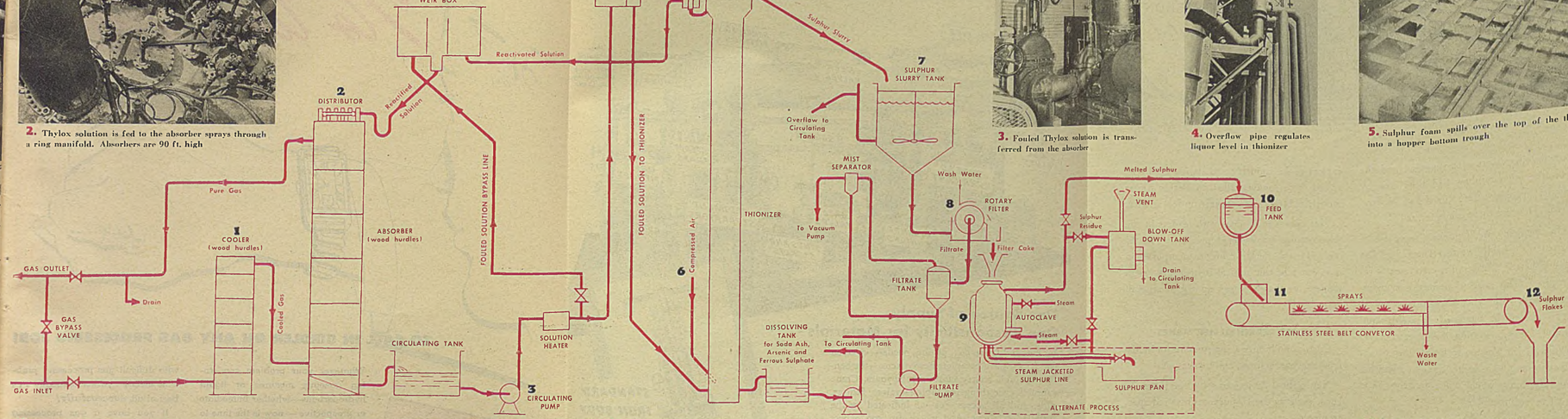


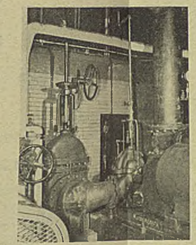
1. In the coolers in the foreground, water sprays cool the impure coke oven gas to approximately 100 deg. F. before it passes into the absorber in the background

A Chem & Met FLOW SHEET

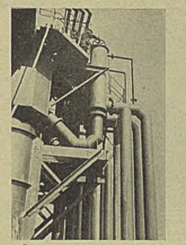


2. Thylox solution is fed to the absorber sprays through a ring manifold. Absorbers are 90 ft. high



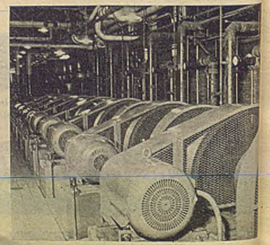


3. Fouled Thylox solution is transferred from the absorber

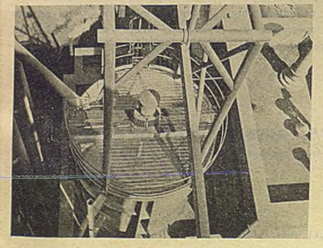


4. Overflow pipe regulates liquor level in thionizer

5. Sulphur foam spills over the top of the thionizers into a hopper bottom trough

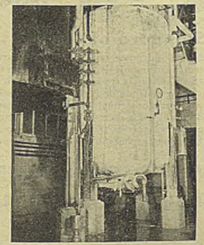


6. Air for oxidation of the foul solution thionizers is provided by compressors



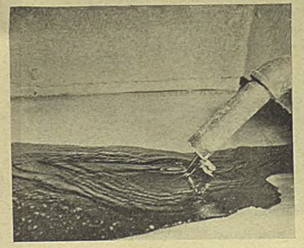
7. An agitated slurry tank receives the thionizer overflow and feeds an Oliver rotary filter

8. Sulphur tape approximately ¼ in. thick is discharged from the drum of a rotary filter

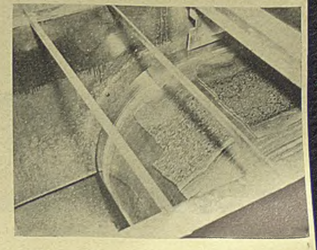


9. In an autoclave, steam at 240 deg. F. melts sulphur

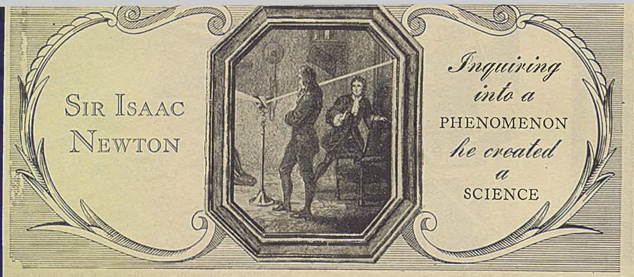
10. Molten sulphur is piped from a jacketed feed tank to the belt cooler



11. Sulphur flows out onto top of water-cooled stainless steel endless belt to form a tape ⅛ in. thick



12. As the belt goes round the pulley, sulphur cracks and falls into a hopper for final distribution



THE flashing colors of a diamond and the clear tints of a rainbow had been seen by countless people before Sir Isaac Newton asked, "How are these colors formed?"

His memoir on "Opticks" records the answer in a quaintly worded Theorem: "The light of the sun consists of rays differently refrangible." This conclusion, based on many experiments with crude glass prisms and a pencil of sunlight slanting into a shuttered room, laid the foundation of all spectroscopy. Further, it led Newton to invent the reflecting telescope, because he thought that his prismatic colors would make an achromatic lens forever impossible.

Today, Sir Isaac Newton's successors are exploring new worlds of astronomy, chemistry, metallurgy, photography and vision with lenses and prisms in instruments of constantly increasing accuracy. Many of these modern explorers—in industry, education and the armed forces—have called on Perkin-Elmer for help in blazing new trails in optical science.

This exchange of ideas with leaders in the sciences plus war-inspired production methods will enable Perkin-Elmer to incorporate in post-war scientific optical instruments extra refinements that will open up new avenues of investigation.

WHAT PERKIN-ELMER MAKES

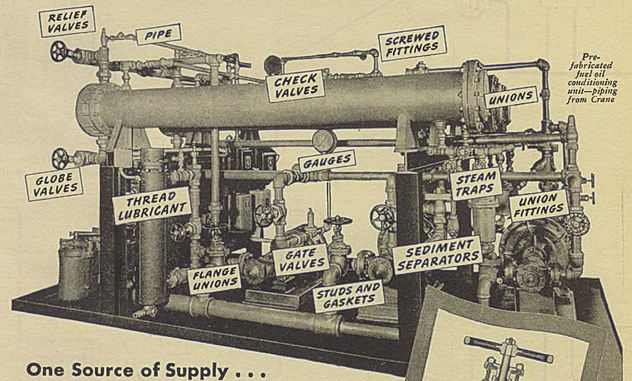
Custom-built optical instruments for industrial analysis, control, and inspection.

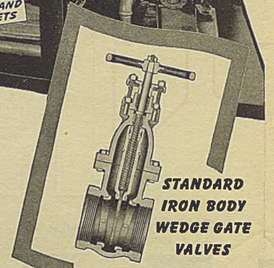
New optical devices to solve specific problems, such as the all-purpose infra-red spectrometer.

Special elements such as fine lenses, prisms, flats, photographic objectives, interferometer plates, retardation plates, Cornu prisms, Rochon prisms, Nicol prisms.

THE PERKIN-ELMER CORPORATION
GLENBROOK · CONN.

Complete systems or single fittings... Crane meets every piping need





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In buying day-to-day piping needs—or when you're planning complete new systems—the benefits of single source supply can be yours. Crane supplies everything for piping—valves, fittings, pipe, and all accessories—as indicated by the installation above. And where can you expect more complete selection than in the world's largest line of flow-control equipment for every service.

Ordering—handling parts stocks—maintenance—all these operations are simplified when you Crane equip. More important, one responsibility for quality and craftsmanship of piping materials is a primary aid to good installation. Crane meets that responsibility with 89 years of manufacturing experience.

CRANE CO., 836 S. Michigan Ave., Chicago, Ill.

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Because there is adequate quality in every part, the whole system is thoroughly dependable when it's Crane equipped. Such quality is typified by Crane Iron Body Gate Valve design: Strong body sections resist severest line strains. Straight-through ports give streamline flow. A deeper stuffing box lengthens packing life. Extra long guides keep disc travel true, while balanced stem design maintains smooth and positive operation.

CRANE

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

It's time Now

TO CALL IN GIRDLER ON ANY GAS PROCESSING JOB

Whatever your problem concerning gaseous mixtures or liquid hydrocarbons—whether immediate or prospective — now is the time to take advantage of Girdler's consulting service. Our highly skilled and experienced staff of engineering and construction specialists has established a fine record of dealing with difficult gas processing problems swiftly . . . economically . . . best of all, *successfully!*

If you have a gas processing problem affecting wartime operation or reconversion plans, the time to benefit by Girdler service is *now!* Write today for helpful and complete information.

GIRDLER PROCESSES
for manufacture, purification, separation and dehydration . . .
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Originators of the Girbotol Process

The GIRDLER CORPORATION
Gas Processes Division · Louisville 1, Ky.
CHEMICAL ENGINEERS AND CONSTRUCTORS

NEW PRODUCTS AND MATERIALS

JAMES A. LEE, Managing Editor

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SHELLAC SUBSTITUTES

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The unusual elasticity and strength of this resin indicate that it will find other applications. For example, fiber-glass bonded with this resin has a tensile and bending strength equal to that of rather strong metals—75,000 to 80,000 lb. per sq. in. In other words, this plastic is stronger than cast iron which has a tensile strength of 15,000 to 50,000 lb. per sq. in., stronger than sheet brass with a tensile strength of 40,000 to 70,000 lb. and as strong as many steels.

COUMARONE EMULSION

AFTER extensive experimentation in practical use, a water soluble, coumarone-indene resin emulsion, Nevilloid C-55, has been perfected by the Neville Co., Pittsburgh, Pa. It is said to be the first coumarone-indene emulsion offered commercially. The new product will stand dilution with water and exhibits resistance to break by freezing. It has been cooled to 10 deg. F. and heated to 77 deg. F. for three cycles without showing a break. Its film is continuous and cohesive and will withstand considerable flexing. It possesses valuable properties for use with latex, and can be incorporated with latices of natural rubber, GR-S or Hycar OR without prior dilution or without causing coagulation of the rubber by the addition of a 10 percent aqueous sodium hydroxide solution only, in an amount sufficient to give a pH of 10.

PORCELAIN ENAMEL FINISH

AFTER MORE than 20 years of development Pemco Corp., Baltimore, Md., announces the release of the first commercially successful one coat white, one fired, direct to steel, porcelain enamel. This new product has been named MIRAC. It requires no special bond or pickling equipment, nor does it need special handling. MIRAC has excellent adherence and can be fired at 1,500 deg. F. with the result, a brilliant highly opaque finish.

ETHANOLAMINE

A LIQUID with a characteristic amine-like odor, methyldiethanolamine, has been produced by Carbide and Carbon Chemicals Corp., New York, N. Y. Completely miscible with benzene as well as with water, this product is a tertiary amine with two reactive alcohol groups. These groups offer opportunities for the introduction of other groups and should be valuable in the preparation of a great variety of nitrogen-bearing compounds — especially those in the pharmaceutical field.

On dehydration and ring closure, methyldiethanolamine forms methyl morpholine. It also shows possibilities as a raw material in the manufacture of textile chemicals, dyestuffs, insecticides and mul-sifying agents.

Specifications

Specific gravity at 20/20 deg. C.	1.039 to 1.045
Boiling range: below 240 deg. C., %	<2
below 260 deg. C., %	>93
Max. water, % by weight	1.0
Equivalent weight	118 to 122

Physical Properties

Molecular weight	119.10
Specific gravity at 20/20 deg. C.	1.043
Coefficient of expansion at 20 deg. C.	0.00073
Boiling point at 760 mm. Hg. deg. C.	247.2
Vapor pressure at 20 deg. C., mm. Hg	<0.01
Freezing point, deg. C.	−21.0
Solubility in water at 20 deg. C.	Complete
Solubility of water in, at 20 deg. C.	Complete
Viscosity at 20 deg. C., centipoises	101
Average weight per gal. at 20 deg. C., lb.	8.67

OBSERVATION PANELS

LAMINATED plate glass observation panels, known as prismatic viewing blocks, have been developed by Libby-Owens-Ford Glass Co. of Toledo, Ohio. The panels are designed to permit tank commanders to survey battle action without exposing themselves to enemy fire. Excepting armor-piercing shells, they are repellant to all high velocity projectiles and for the first time employ the refractive properties of bullet resistant plate glass to gain a periscopic effect.

WETTING AGENTS

SEVERAL types of wetting agents and detergents, called Tritons, have useful application in compounding rubber latices and in the textile and leather industries. Triton 770, an aqueous solution containing 20 percent of an aralkyl ether sulphate, is stable in neutral and alkaline solutions even when heated, and in acid solutions unless heated at a pH below 3.5. It will emulsify oils and greases and suspend solid particles. Although Triton 770 foams readily, it does not form a heavy lather and can be used in many places where ordinary soap cannot. Its spreading properties are reported to be good. Tests showed marked lowering of surface and interfacial tension. Triton K-60, an aqueous dispersion of a quaternary ammonium salt, is supplied as a paste at 25 percent solids. A cationactive compound, it is stable in solutions of strong acids and is not precipitated in hard water or by water-proofing agents. It retains its activity in concentrated acids and salts. Both of these materials are produced by Rohm & Haas Co., Philadelphia 5, Pa.

EMULSIFIER

A PURE white, edible glyceryl monostearate in bead form, completely dispersible in hot water, is Bemul, produced by the Beacon Co., Boston, Mass. Bemul is also entirely soluble in alcohols and hot hydrocarbons and has a pH (3 percent aqueous dispersion at 25 deg. C.) of 9.3 to 9.7. It melts at 58 to 59 deg. C. (capillary tube) and is non toxic and practically odorless. Because of its non-toxicity, purity and freedom from alkalis, Bemul is of interest to manufacturers of cosmetics, pharmaceuticals and foodstuffs (including paste emulsions of edible oils, shortenings, cooking oils and fats). In addition to being an emulsifying agent, it improves the smoothness, whiteness and grain of shortenings and similar products, as well as reducing the amount of shortening necessary. It also forms a protective coating for edible hygroscopic powders and similar crystals and tablets which absorb moisture from the air and have a tendency to lump, cake and decompose, on standing. Bemul can also be used as an emulsifying agent for waxes, oils and cream polishes, as a pour point depressant for

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Specifications

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Boiling range: below 240 deg. C., %	<2
below 260 deg. C., %	>93
Max. water, % by weight	1.0
Equivalent weight	118 to 122

Physical Properties

Molecular weight	119.16
Specific gravity at 20/20 deg. C...	1.043
Coefficient of expansion at 20 deg. C.	0.00073
Boiling point at 760 mm. Hg, deg. C.	247.2
Vapor pressure at 20 deg. C., mm. Hg	<0.01
Freezing point, deg. C.	−21.0
Solubility in water at 20 deg. C.	Complete
Solubility of water in, at 20 deg. C.	Complete
Viscosity at 20 deg. C., centipoises	101
Average weight per gal. at 20 deg. C., lb.	8.67

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lubricating oils, as a constituent of textile sizes, in the polymerization of synthetic rubber, an anti-oxidant coating for metals and as a preliminary binder for clays and abrasives prior to firing.

PLASTICIZER

A LIGHT-AMBER, viscous, non-flammable plasticizer called Clorafin 42 has been evolved by the Hercules Powder Co., Wilmington, Del. The product is made by the reaction of chlorine upon paraffin wax in glass-lined chlorinators under carefully controlled conditions. Clorafin 42 is a substantially neutral, relatively stable product because it is freed as completely as possible of byproduct hydrogen chloride, and is stabilized immediately after chlorination by the addition of an effective stabilizing agent. It does not polymerize or oxidize or undergo any change to solidify or harden and is soluble in a wide range of organic solvents. The plasticizer is insoluble in water and the lower aliphatic alcohols but dissolves completely in ketones, esters, higher alcohols, nitroparaffins and hydrocarbons, both aliphatic and aromatic. It is not only compatible with resins and other solid materials when used alone but can be used in combination with some other plasticizers of both a chemical and oil nature, and with some cellulose derivatives and waxes.

Specific Properties

Chlorine content, %	42 to 43
Color, Gardner scale	Max. 12
Viscosity at 25 deg. C., poises	22.2 to 31.5
Specific gravity at 25/25 deg. C.	1.1620 to 1.1746
Weight per gal. at 25 deg. C., lb.	9.72 to 9.82
Stability*	1.5
Iron content, ppm.	5 to 15
Flammability	Non-flammable†

* Max. percent HCl liberated. Determined by measuring the percent of HCl freed on bubbling air through a 20-g. sample contained in a 22-mm. by 175-mm. test tube while being heated for 4 hr. at 175 deg. C. in conformity with the method of the Jeffersonville Quartermaster Depot. † Cannot be ignited by direct contact of gas flame.

ORGANO-SILICON RESINS

FIRST commercial production of Silicones (see *Chem. & Met.*, p. 149, March, 1944), new organo-silicon polymers, has been announced by Dow Corning Corp., Midland, Mich. Development of Silicones on a semi-production basis has been in progress for a considerable time. Several of these products are now being made available for applications essential to the war effort. Dow Corning products include water-white fluids for high- and low-temperature use, electrical varnishes and insulating resins for high-temperature operating electrical equipment, and lubricating greases for high-temperature and chemical resistant uses. These products, because of their unusual properties, are said to have solved many problems where conventional materials have failed.

Water-white liquid polymeric Silicones have unusual chemical and physical properties. These materials, which are very interesting from an engineering standpoint, are now available under the name of Dow Corning Fluids. They are manufactured in various viscosities ranging from liquids as thin as water to those which barely flow at room temperature. Their most outstanding property is an exceptionally low rate of viscosity change with temperature, compared to that of previously used liquids. Certain types are made that do not freeze at dry ice temperatures and these same products can be used at temperatures up to 400–500 deg. F.

Silicone resins for electrical insulation extend the range of operating temperatures possible in electrical equipment beyond the limit of thermal stability of conventional organic materials. One of the resins is available as a coating and impregnating varnish which may be applied to Fiberglas cloth, asbestos cloth, and asbestos paper by conventional dipping and drying methods. It requires baking at a temperature of 250 deg. C. for one to three hours to cure to a non-tacky state. Another is an impregnating varnish which sets with heat at 200 deg. C. These materials do not carbonize or darken when subjected to prolonged heating at the curing temperatures. In combination with Fiberglas, asbestos and mica, these Dow Corning impregnating and coating resins permit the design of many types of electrical equipment for higher safe operating temperatures with consequent increase in capacity, reliability, and life performance.

THERMOPLASTIC

A NEW thermoplastic called Cerex X214, the first developed that holds its shape and strength in boiling water, has been produced by Monsanto Chemical Co., St. Louis, Mo. By virtue of its ability to withstand sterilization it is widely applicable in household and industrial fields. Cerex X214 has found a place in war work for surgical and airplane instruments, and particularly in radar, radio and other military electronic equipment where substances of light-weight and heat-resistant properties are in demand. Combining high resistance to heat with resistance to strong, corrosive chemicals, the new material has a heat distortion point of 220 deg. F., 8 deg. above the boiling point of water. As mentioned previously the high heat resistance of molded Cerex X214 is not accompanied by the necessity of higher injection molding temperatures. Heat is supplied to the molds by steam or electrical resistance units. The same nozzle and heater arrangements in use for several other resins are suitable and in general sprue runner and gate require little change for adaptation for this resin.

ETHYLHEXANEDIOL

A HIGH-BOILING, colorless glycol called ethylhexanediol, has been produced by Carbide and Carbon Chemicals Corp., New York, N. Y. The commercial material has a faint odor, reminiscent of witch hazel. Its viscosity is between that of ethylene glycol and glycerol, but it differs from these polyalcohols in its very limited solubility in water.

Its low voltality and limited water solubility make it employable as an insect repellent and it also shows promise as an intermediate for making perfume fixatives, plasticizers and synthetic resins. Both its alcohol groups can be esterified although the secondary one does so less readily and under strenuous conditions it will dehydrate to an unsaturated compound. The heavy demands of the armed forces for this product will probably limit its availability during the war to strictly military applications.

Specifications

Max. acidity, % as acetic	0.01
Specific gravity at 20/20 deg. C	0.9390 to 0.9430
Boiling range, deg. C.	240 to 250
Max. color, A.P.H.A. units	50

Physical Properties

Molecular weight	146.22
Specific gravity at 20/20 deg. C.	0.9422
Vapor pressure at 20 deg. C., mm. Hg	<0.01
Refractive index at 20 deg. C., n_D	1.4511
Boiling point at 760 mm. Hg, deg. C.	244
Freezing point, deg. C.	below −40
Solubility in water at 20 deg. C., %	4.2
Solubility water in, at 20 deg. C., %	11.7
Viscosity at 20 deg C., centipoises	323
Flash point, deg. F.	260
Average weight per gal. at 20 deg. C., lb.	7.84

DYESTUFF SOLVENT

TO BE used as a solvent for basic, acid and vat dyestuffs involved in textile printing and generally designed to replace all or part of the glycerol, acetin, diacetin or triacetin concerned in dissolving textile colors, Kromfax solvent has been produced by Carbide and Carbon Chemicals Corp., New York, N. Y. The product is a non-volatile, hygroscopic, practically colorless liquid, neutral in reaction and completely soluble in water. Kromfax, it is said, is useful in pasting hard-to-make-soluble basic dyestuffs in direct printing, and offers stability to the pastes.

Specifications

Specific gravity at 20/20 deg. C.	1.1810 to 1.1860
Max. acidity, mg. KOH per g. sample	1.0
Max. alkalinity ,mg. H_2SO_4 per g. sample	1.0
Max. water, % by weight	1.0
Max. ash, % by weight	0.02
Color (Pt-Co scale)	60

Physical Properties

Molecular weight	122.18
Specific gravity at 20/20 deg. C.	1.1840
Vapor pressure at 20 deg. C.	<0.01
Refractive index at 20 deg. C. n_D	1.5213
Boiling point at 50 mm. Hg	194
Freezing point	−11.2
Solubility in water at 20 deg. C.	Complete
Solubility of water in, at 20 deg. C.	Complete
Flash point (open cup), deg. F.	320
Average weight per gal. at 20 deg. C., lb	9.853

MERCAPTOETHANOL

A LIQUID with the properties of both an alcohol and a mercaptan, mercaptoethanol is produced by Carbide and Carbon Chemicals Corp., New York, N. Y. This water-white liquid, sometimes called monothioglycol, is entirely miscible with water, ether, benzene, and most organic solvents. It is of interest in the preparation of rubber chemicals, pharmaceuticals, pickling inhibitors, flotation agents, insecticides, dyestuffs, synthetic resins and plasticizers for these resins. Its potential value as a water-soluble reducing agent that attacks protein-disulphide linkages is of particular note. Solvent powers of mer-

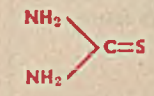
THIOUREA

IMMEDIATE SHIPMENTS
...Either LCL or Carloads

WHETHER you need Thiourea for current production or for experimentation in connection with your long-range planning, you can get it immediately from Monsanto. Some of the many uses for Thiourea are listed at the right...your experimentation may reveal new applications or may lead to the discovery of entirely new products or processes. For samples, data, prices and technical assistance in applying Thiourea to your product or to your postwar planning, contact the nearest Monsanto office, or write: MONSANTO CHEMICAL COMPANY, Organic Chemicals Division, 1700 South Second St., St. Louis 4, Missouri.

District Offices: New York, Chicago, Boston, Detroit, Charlotte, Birmingham, Los Angeles, San Francisco, Montreal, Toronto.

MONSANTO THIOUREA



Also known as thiocarbamide, sulfocarbamide and sulfourea

White free flowing crystals

Moisture:	0.5 maximum
Ash:	0.05 maximum
Iron:	8 P.P.M. maximum
Specific Gravity:	1.406

TEN PRESENT and POTENTIAL USES OF THIOUREA

Starting Point in:

1. Manufacture of resins
2. Manufacture of medicinals
3. Manufacture of synthetic chemicals
4. Manufacture of Thioglycolic Acid
5. Manufacture of adhesives
6. Photographic compositions
7. Compositions for treating rayon
8. Dyestuff synthesis
9. Oxidation inhibitors
10. Manufacture of insecticides

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

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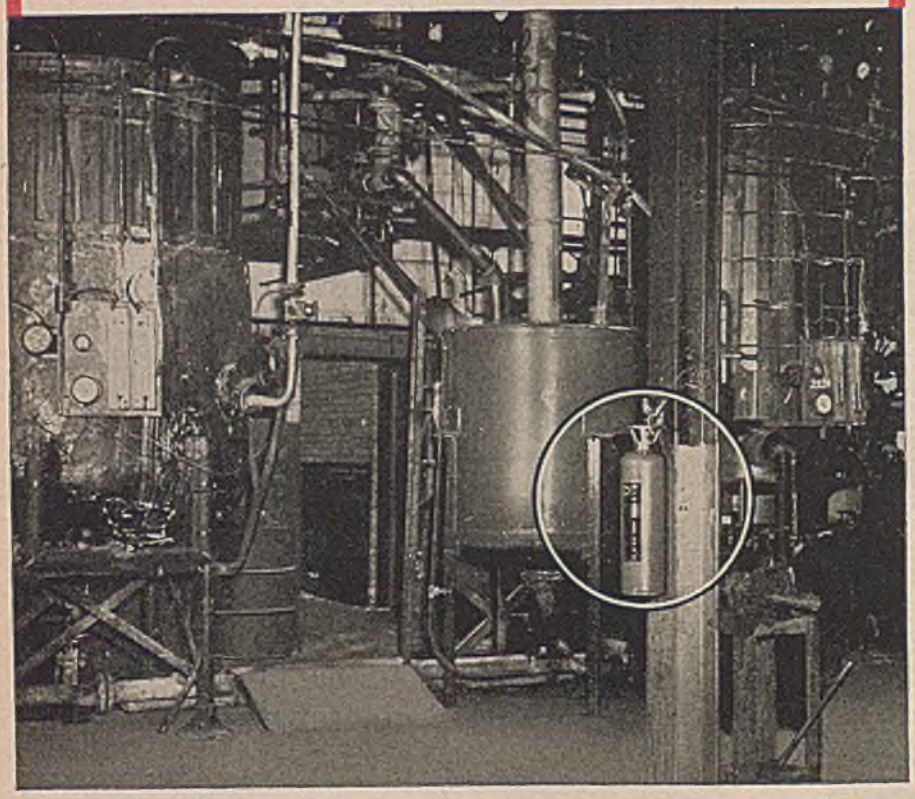
FREE EXPERIMENTAL SAMPLES

MONSANTO CHEMICAL COMPANY, Organic Chemicals Division
1700 S. Second St., St. Louis 4, Mo.
Without cost or obligation on my part, please send: ☐ Experimental Sample of Thiourea; ☐ Data on application of Thiourea to
(NAME OF PRODUCT)

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

Note: A technical service specialist will call at your request

PLUS-FIFTY DUGAS DRY CHEMICAL STOPS FIRES...FASTER!



Wherever you find particularly dangerous fire hazards—whether liquid, gaseous, or electrical—you often find DUGAS Fire Extinguishers standing guard.

Reason: fire gets a fast knockout when PLUS-FIFTY DUGAS Dry Chemical hits flames.

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CHART showing characteristics of all types of approved hand fire extinguishers sent free on request.

PLUS-FIFTY duGas REG. U. S. PAT. OFF. DRY CHEMICAL

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MODEL 30-T HAND EXTINGUISHER

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

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captoethanol make it of concern in sulphur dyestuffs, whereas certain of its derivatives are intermediates for wetting agents. Mercaptoethanol forms metallic salts that have undetermined applications in the metal-refining industries.

WETTING AGENT

One of the new products offered by Carbide and Carbon Chemicals Corp., New York, N. Y., is Tergitol Penetrant 4 Paste, a slurry of Tergitol Penetrant 4. This paste is an aqueous gel consisting of 50 percent of the sodium sulphate derivative of the higher synthetic alcohol 7-ethyl-2-methylundecanol-4 and contains practically no inorganic salts or mutual solvents.

Tergitol enhances the activity of bactericides and increases the efficiency of antiseptics four- to ten-fold. In addition it has possible applications as a detergent of the "soapless soap" type. With alkaline salt detergent-builders, such as phosphates and silicates, its cleansing power can be made equal to that of the sulphates of the straight-chain alcohols.

It should be borne in mind that bactericides and antiseptics using Tergitol Penetrant 4 Paste as a component must be cleared as a "new drug" with the Federal Food and Drug Administration and with such state regulatory bodies as may have jurisdiction.

Physical Properties

Molecular weight	316.43
Appearance	Paste-like
Solubility in water, dry salt at 20 deg. C., %	About 4
Flash point	Non-flammable

RESIN OF IMPROVED ODOR

Nevillac OA, a new liquid resin of improved odor has been introduced by the Neville Co., Pittsburgh, Pa., as the first of a series of improved grades which are being developed to enlarge the Nevillac resins group. The other additions to the group will be announced during the year. Nevillac OA is similar to Nevillac 10° (PHO) differing chiefly in improved odor and superior color retention, and slightly in several other characteristics. These include lower specific gravity and consequently somewhat lesser weight, and less viscosity.

Fields of use of the new Nevillac will include adhesives of the waterproof, optical, shoe, packaging and pressure sensitive types; paper coatings both water proof and grease proof and for ordnance wrap; paints and varnishes including laminating varnishes; artificial leather and leather finishes; raincoats; printing and duplicating inks; and possibilities for generally broadened applications due to its improved characteristics.

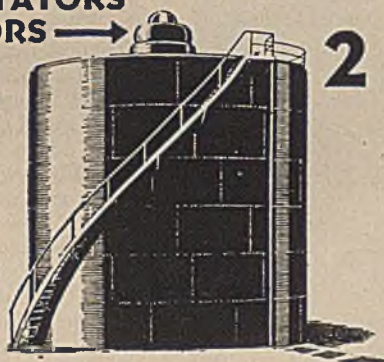
Physical Properties

Specific gravity at 30 deg./15.6 deg. C.	0.980 to 1.00
Viscosity (Gardner-Holdt) at 25 deg. C.	W (average)
Distillation by volume	Essentially between 300 and 375 deg. C
Max. % off at 300 deg. C	5%
Refractive index at 20 deg. C	1.5355
Odor	Sweet, characteristic
Color	Pale amber
Color retention	Good (much better than Nevillac 10 deg. (PHO))

The new product is soluble in almost all organic liquids (except water and

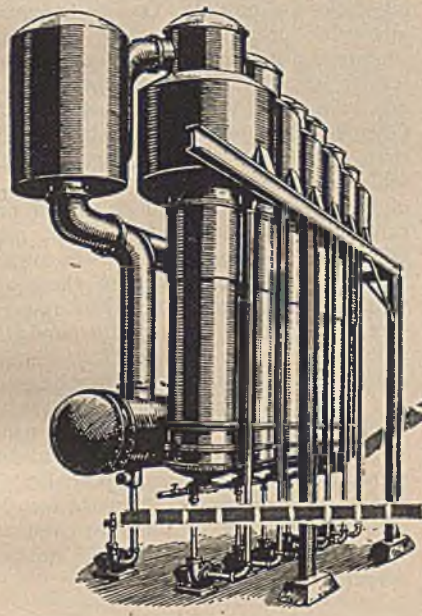
If you need any of this PROCESS EQUIPMENT

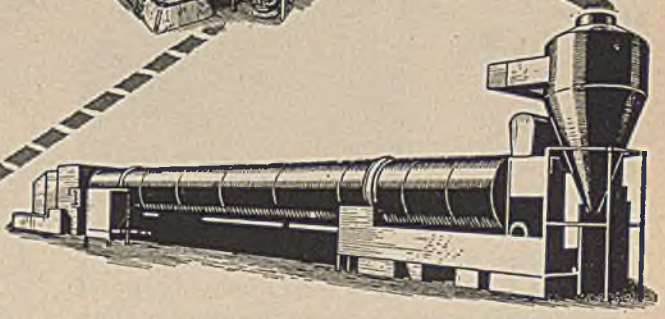
1 MIXERS, AGITATORS AND AERATORS



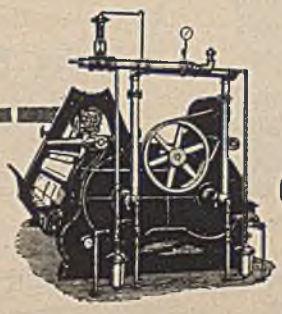
2 TANKS AND PRESSURE VESSELS

3 VACUUM OR PRESSURE FILTERS





4 ROTARY DRYERS, COOLERS, KILNS



5 VACUUM EVAPORATORS

6 DRUM DRYERS OR FLAKERS

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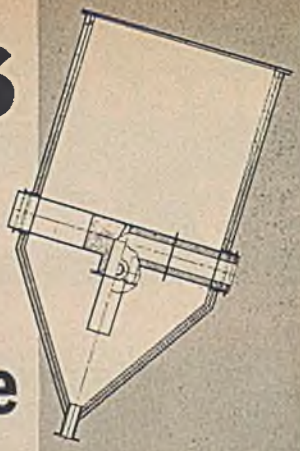

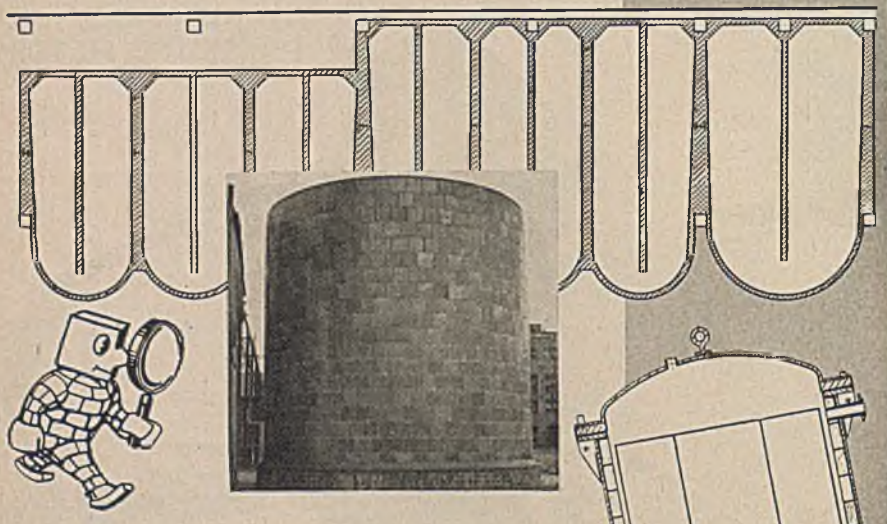

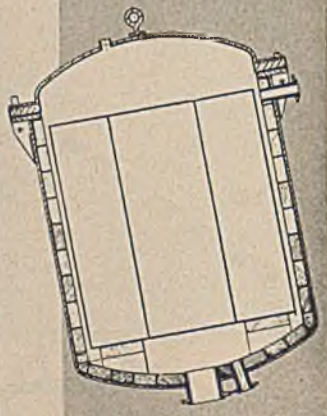

During this period, we have successfully lined substantially every known type of process vessel, from the smallest plating tank to the largest acid storage tank; and from the smallest pickling vat to the most elaborate and complicated reactor.

You can benefit by this long and varied experience when planning your rehabilitation or modernization program.

Every STEBBINS job is a "custom-built" job... designed to meet your individual operating and process requirements.

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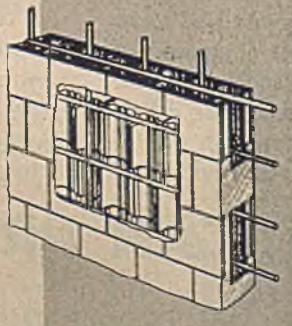

Stebbins Engineering and Manufacturing Company

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glycols) including alcohol, hydrocarbons, ketones, esters, ethers and chlorinated hydrocarbons. It is completely compatible with most synthetic resins including cellulose esters and ethers, vinyl acetate, vinyl butyral, zein, coumarone-indene resins, GR-S rubber, Hycar rubber, and partly compatible with polyvinylchloride and vinyl acetate and chloride copolymer.

LOW DENSITY RESIN

W. C. Goggin, manager, and R. R. Bradshaw, Molding Engineer, of the Plastics Development Division of the Dow Chemical Co., presented a joint paper to the Chicago meeting of the Society of the Plastics Industry on Polyfibre. This product is stated to provide the engineer with a new design material with which to reach unusually low densities. With Polyfibre, strong articles having densities as low as 0.4 are now possible. The polystyrene type Polyfibre responds more rapidly to heat than bulk polystyrene but also requires lower molding temperatures. Thus, the time to heat and cool the mold is reduced. As a result rapid compression molding cycles are possible. One of the most interesting properties resulting from the compression molding of Polyfibre is that of impact strength. Bulk polystyrene moldings have a relatively low impact strength. Oriented Polyfibre has not only high tensile strength but high impact strength. Threefold increases in impact strength over that of bulk polystyrene moldings are not uncommon, it was reported. Polyfibre may be molded by unique new methods to give unusual properties. Some of these advantages were stated to be: (1) Low-pressure bag molding of large thermoplastic polystyrene parts is now practical; (2) inexpensive molding equipment may be used; (3) large moldings of controlled specific gravity ranging up to 1.05 may be made; (4) controlled specific gravity gradients throughout the moldings are possible; (5) greatly improved impact strengths may be obtained; (6) new low dielectric constants are available; and (7) directional strength properties may be controlled.

FILTER-AID MATERIAL

A large part of our success in clearing the seas of the submarine menace has been due to the escort type of carrier vessels built by Kaiser in the Vancouver, Wash., ship yards for the U. S. Maritime Commission and operated by the Navy. While not much can be told at this time about this new type of vessel, certain items of information have been released concerning its operation. One such item is the satisfactory results being obtained in these ships by the use of Sorbo-Cel, a high flow rate filter-aid material, manufactured by Johns-Manville, New York. Sorbo-Cel is used for removing oil from the steam engine condensate intended for return to the boilers, the presence of which would cause foaming, priming and hot spots. Sorbo-Cel is made from diatomaceous silica powder which has been especially processed so that it has the property of removing and retaining in the filter cake finely emulsified oil globules when an aqueous suspension of these globules is passed through a layer of Sorbo-Cel deposited upon the filter.

To date, successful results have been had with any pressure filter of conventional design and rigid filter medium. The filter is precoated with a charge (10-20 lb. per 100 sq.ft.) of Sorbo-Cel in water and then filtering is carried out with a suitable amount (1 to 2 lb. per lb. oil to be removed) of Sorbo-Cel in the oily water going to the filter. This new treatment removes oil from the condensate more completely and positively than any yet devised. A specific case would be the condensate from a Skinner Unaflow engine operating under high super-heat steam conditions. Due to the oil used for lubrication, the condensate is a tight, fine emulsion containing 25-75 parts per million—that is, 0.0025-0.0075 percent oil in water. A filter operated (as described above) on this condensate at 140 deg. F. would run upon at least a 24-hr. cycle to not more than 20 lb. top pressure. The flow could be maintained at 90.0 gal. per sq.ft. per hr. for the entire cycle. Filter-aid consumption would be 1.5 lb. per lb. oil. Oil removal would be practically complete—to at least less than $\frac{1}{10}$ part per million in the filtrate and probably to 0. Accurate determination of very small oil contents is an almost impossible analysis.

Sorbo-Cel also is being used with success on other Navy vessels using reciprocating engines of the Unaflow type which must be lubricated, among which may be mentioned those of the L.S.D. (Landing Ship, Dock) type.

Other reciprocating types not operating under super-heat steam conditions are often not lubricated, dependence being placed on the water in the wet steam acting as a lubricant. Such practice causes ring wear but it avoids oil-in-water boiler troubles. The use of Sorbo-Cel to remove oil from the condensate will permit the use of oil in the engine with a consequent reduction in ring wear.

GLASS BONDED MICA

THE PROPERTIES and applications of Mycalex was the subject of a paper by A. J. Monack, chief engineer, Mycalex Corp. of America, before the Chicago meeting of the Society of the Plastics Industry He outlined the need for developing improved insulating material, particularly at ultra frequencies, in which field Mycalex has contributed so importantly. Mycalex, he said, is a glass bonded mica, composed of finely powdered mica and glass. It is formed at high temperature and pressure but no curing time is required. Solidification must occur under pressure, however, and for this reason it is necessary to hold the material in the press for periods of time proportional to the thickness of the particular shape being manufactured. Mycalex should not be considered as a substitute for other materials, Monack declared. "If Mycalex will perform more satisfactorily than other insulation in a given application, if the cost differential is counteracted by better performances, fewer rejections, longer life, more expedious deliveries, or a greater factor of safety, if this material enables the design engineer to develop apparatus or equipment not heretofore possible because of insulation limitations, then Mycalex should be given serious consideration."

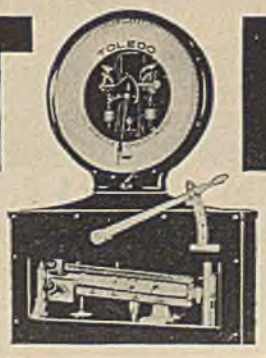
Above—View taken in the newly constructed plant at Commercial Solvents Corporation, Terre Haute, Indiana, showing the room in which vials are filled with Penicillin—C.S.C.

● Penicillin—one of the greatest discoveries of modern medical science —*looks to Toledo* for unerring printed weight records during the long, complicated production process.

In this modern new plant, Toledo Printweigh keeps *accurate* weight control of the concentrated solution—the precious product which is obtained in mere 20-gallon lots from each of the huge fermenting tanks.

Similarly—in every conceivable branch of industry today—Toledos are specified for utmost *accuracy, speed* and *dependability* in weighing, balancing, force-measuring, counting ... Toledo Scale Company, Toledo, Ohio.

TOLEDO



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CHEMICAL ENGINEERING NEWS

COMMITTEE NAMED TO PLAN POSTWAR RESEARCH

A COMMITTEE of scientists and high-ranking Army and Navy officers has been nominated by the Secretary of War and the Secretary of the Navy to formulate plans for postwar research on military and national defense problems. Charles E. Wilson, executive vice chairman of the War Production Board and former president of the General Electric Co., is chairman of the committee, which includes Dr. Karl T. Compton, president, Massachusetts Institute of Technology; Dr. Jerome C. Hunsaker, chairman of the National Advisory Committee for Aeronautics; Dr. Frank B. Jewett, president of the National Academy of Science; Dr. M. A. Tuve, Office of Scientific Research and Development; Maj. Gen. Oliver P. Echols, Assistant Chief of Air Staff Material, Army Air Force; Maj. Gen. Albert W. Waldron, Chief of Requirements Section, Army Ground Forces; Brig. Gen. William F. Tomkins, Director, Special Planning Division, War Department General Staff; Brig. Gen. Theron D. Weaver, Director of Industrial Demobilization, Army Service Forces; Rear Adm. J. A. Furer, Coordinator of Research and Development; Rear Adm. E. L. Cochrane, Chief of the Bureau of Ships, Rear Adm. G. F. Hussey, Jr., Chief of the Bureau of Ordnance, and Rear Adm. D. C. Ramsey, Chief of the Bureau of Aeronautics, all of the U. S. Navy.

APPROPRIATION FOR WORK ON SYNTHETIC LIQUID FUELS

APPROPRIATIONS for the work of the Bureau of Mines to start on a large scale its investigations on synthetic liquid fuels are now assured. While authority has not yet been gained for large-scale contracting expected a month ago, Congress has passed a grant of $5,000,000 for the work of the coming fiscal year. Oil shale processing will be undertaken by R. A. Cattell but under the more immediate direction of A. J. Kraemer and Boyd Guthrie. Immediate steps will be taken to enlarge the small-scale work at the Pittsburgh station but most of the pilot plant work on coal will be done at the Bruceton substation. It is probable that some preliminary work on gas making from lignite will be continued in a small way in the Dakota region.

FERTILIZER MEN DISCUSS GOVERNMENT RELATIONS

AT THE twentieth annual meeting of the National Fertilizer Association, held in Atlanta last month, H. B. Baylor, president of the Association reported that the industry had made a splendid wartime record in its cooperation to meet the food program which had been established by the War Food Administration. Dale C. Kieffer of the Agricultural Chemicals Section reported favorably on the outlook for the supply of raw materials but said the nitrogen situation was problematical.

Both government and industry representatives referred to the friendly relationship which had existed between the industry and the various government agencies but Charles J. Brand pointed out that AAA distribution of fertilizer had increased from 67,000 tons in 1938 to 1,190,000 tons in 1943. He also referred to its larger shipments of agricultural lime and to the greater activity of TVA in supplying farmers with superphosphates.

At the meeting of the board of directors officers were reelected as follows: H. B. Baylor, International Minerals & Chemical Co., president; Weller Noble, Pacific Guano Co., vice president; and Charles J. Brand, executive secretary.

BUTADIENE PLANTS CLOSED TO AID GASOLINE PROGRAM

LATE last month it was announced by Col. Bradley Dewey that he would cut back the manufacture of synthetic rubber so that seven plants making butadiene from petroleum could be closed temporarily. The purpose of this shutdown is to enable these petroleum refineries to divert raw material into the aviation gasoline program and thus speed war supplies of that commodity. The seven companies affected are: Humble Oil & Refining Co., Baytown, Texas; Neches Butadiene Products Co., Port Neches, Texas; Cities Service Co., Lake Charles, La.; Phillips Petroleum Co., Borger, Texas; Shell Chemical Division, Shell Union Oil Co., Torrence, Calif.; Sinclair Refining Co., Houston, Texas; and Standard Oil Co. of Louisiana, Baton Rouge.

The shutdown for two months of these plants is expected to permit manufacture of about one million barrels of airplane fuel from butylene. It will reduce the output of buna-S by an estimated 30,000 tons this year. It will not change the alcohol program nor prevent the August beverage holiday.

STANDARD OIL OF CALIFORNIA FORMS RESEARCH CORPORATION

THE Standard Oil Co. of California has formed the California Research Corp. to take over the present functions of Standard's patent and research and development departments. R. G. Follis, vice president of Standard of California in charge of research and manufacturing, will be chairman of the new subsidiary and R. A. Halloran, now manager of the recsearch and development department, will be president.

The new company's primary purpose will be to unify and place more resources at the disposal of the expanded program to improve present products used by the Army and Navy, and to devise new weapons and processes.

TEXTILE CHEMISTS START RESEARCH AT LOWELL

THE executive committee on research of the American Association of Textile Chemists and Colorists met recently in Lowell, Mass., to inspect facilities which had been offered at the Lowell Textile Institute for setting up a research laboratory there. The proposal was approved and the Association is going ahead with the installation of the necessary equipment. In order to crystallize the research work for the next year, 14 specific research projects were set up and will be assigned to the respective committees.

Left to right: Major General Amos A. Fries (retired), former chief of Chemical Warfare Service; R. T. Haslam, Standard Oil Co.; and Brigadier General Alden H. Waitt, chief CWS for Operations at the Show in New Jersey June 13, sponsored by CWS and Standard Oil Co. of New Jersey

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The sole badge of office of the presidency of the Chemists' Club of New York changes hands with the passing of the symbolic coffee pot. C. R. Downs, left, new president, receives from C. R. De Long, retiring president, the ancient copper pot which has passed ceremoniously from outgoing to incoming president since the inception of the custom in 1915 when M. C. Whitaker received it from the donor Thomas R. Duggan

POSTWAR CHEMICALS PROSPECTS THEME OF ACS MEETING

INDUSTRIALISTS from the chemical and allied fields will participate in the 108th meeting of the American Chemical Society which will be held in New York under the auspices of the Society's North Jersey Section, Sept. 11-15. The meeting, featuring wartime research, problems of the chemical industry, and postwar activities of the chemical professions, is expected to be the largest in the history of the Society.

Rubber, petroleum, food, plastics, fertilizer, cellulose, gas and fuel, medicinal chemistry, and education are among the general fields of discussion. Catalysis will be a central theme of the proceedings of the petroleum division, which will also hold a round table on bench-scale techniques in addition to general sessions under the chairmanship of Dr. Cecil L. Brown of the Standard Oil. Co. of La.

Cellulose and cellulose plastics will be discussed at joint sessions of the cellulose, colloid, physical and inorganic, and paint, varnish and plastics divisions. Five sessions will be held by the division of rubber chemistry, of which Dr. Harold Gray, technical supervisor of the tire division of the B. F. Goodrich Co. is chairman.

Dr. Horace E. Riley of the research division of Bakelite Corp. and head of the North Jersey Section, has been appointed general chairman of the convention. Dr. August Merz, advisory executive of the Calco chemical division of American Cyanamid Co., has been named honorary chairman. Robert E. Waterman, vice president of the Schering Corp. is general vice chairman, and J. R. Little, research chemist in the General Laboratories of the U. S. Rubber Co., Passaic, is treasurer.

CHEMICALS LEAD BEAVER COUNTY, PA., INDUSTRIES

WITH the development of new war industries such as the Rubber Reserve Corp. of the Koppers United at Kobuta, Pa., the man-year production value of chemical industries in Beaver County has climbed to the top with a figure of $10,664 per man annually.

This is revealed in a master postwar blueprint for Beaver County recently compiled by Michael Baker, Jr., of Rochester, Pa., who was selected by the County Commissioners to prepare a comprehensive and exhaustive study of the physical, sociological, and economic make-up of this area

CONVENTION CALENDAR

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

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

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

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

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

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

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

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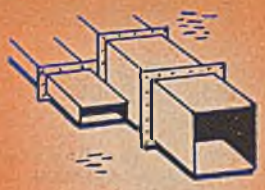

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Whether the gas flow is a few c.f.m.—or *millions*—the COTTRELL will handle any recovery job, from smallest to largest!

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There are no moving parts in the collecting structure of a COTTRELL, therefore no wear. Installations made more than 30 years ago are still operating without substantial change or loss of efficiency!

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COTTRELLS are saving millions of dollars a year by recovering values otherwise lost and by elimination of dust and nuisances. If you have a gas cleaning or suspension recovery problem, find out the many important advantages COTTRELL Precipitators offer. Our trained engineering staff has had years of experience in all phases of suspension control. Let us consult with you.

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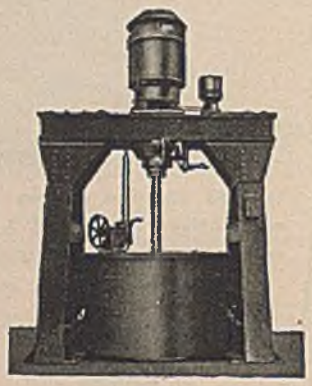

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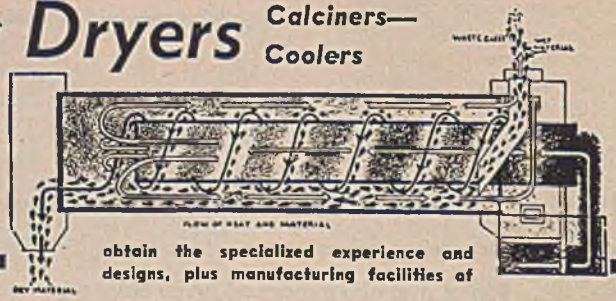

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for an evaluation of its potential development.

Metal and metal products with $157,503,700 invested, and employing a total of 37,267 persons with a yearly payroll of $89,097,500 still produces by far the greatest value of finished products amounting to $356,274,000. But the report shows that the value of the chemical and allied products turned out in Beaver County by only 352 employees pushed this industry to the top with a man-year production value of $10,664, compared with the metal industries with $4,407 production value per man per year.

One of the conclusions drawn by this report, which proposes an expenditure of $52,000,000 and provides for 3,000,000 man-days of work in a five-year private and public improvement program after the war for Beaver County, is that this area has a big future in tomorrow's postwar world in the development of plastics.

HERCULES OPENS LABORATORY IN GEORGIA

A NEW insecticide laboratory of brick and glass brick construction, for the biological and chemical testing and control of Thanite as a further service to manufacturers of insecticides, has been placed in operation at Brunswick, Ga., by Hercules Powder Co. Thanite, developed by Hercules chemists through research on turpentine and pine oil, has established itself as a toxic agent of importance to manufacturers of household sprays and livestock sprays.

J. D. Rebstock, who recently joined the Naval Stores Department as an entomologist, after 18 months' service in East Africa, has been named supervisor.

TITANIUM INTERESTS CITED ON PATENTS CHARGE

THE Department of Justice has filed in New York a civil complaint seeking to enjoin three companies from continuing a world-wide network of agreements controlling the titanium industry. The National Lead Co., its subsidiary, the Titan Co., Inc. and E. I. du Pont de Nemours & Co. are the companies named and it is alleged that they formed agreements which established a complete monopoly of patents in the titanium industry. In the complaint it is asked that there be compulsory royalty-free licensing of all patents utilized in carrying out the alleged restraints and an injunction against renewal of the agreements.

HOLLAND PLANS REPLACEMENT OF PUMPS AND EQUIPMENT

AFTER liberation Holland will have to undertake the biggest reclamation project in her history and American machinery will likely play a prominent part in the gigantic rehabilitation. According to Aneta, Netherlands News Agency, the Netherlands government is seeking new pumps and powerplant equipment to reclaim the areas already flooded by the Nazis plus the thousands of additional acres which the enemy is expected to inundate.

GOODRICH EXPANDS VINYL RESINS PRODUCTION

The chemical division of The B. F. Goodrich Co. is increasing production of its Geon vinyl chloride resins by an expansion of its plant in Louisville, Ky., scheduled for completion early next year. The plant expansion was requested by the War Production Board and will be rushed so that additional production of the vinyl chloride resins will be available for the war effort. These resins are among the most critical of all chemical materials, with 100 percent going to war uses, principally in the insulation and sheathing of wire and cable.

William S. Richardson, general manager of the division stated that new facilities for production of these resins have been designed for maximum flexibility of output, so that the straight vinyl chloride polymers, copolymers, or vinyl chloride latex can be produced alternatively as the demand occasions changes in output. He also announced that the company's chemical plant in Niagara Falls is being rearranged, so that the recently introduced 200 series of its Geon resins, vinyl chloride-vinylidene chloride copolymers, can be produced alternatively with the straight polyvinyl chloride. This is scheduled for completion by Aug. 1.

EXHIBITION OF PLASTICS AFTER THE WAR

A national exposition of the plastics industry is being planned to be held either in Chicago or New York at the earliest convenient date after the termination of the war. This announcement was made by George Scribner, president of the Society of the Plastics Industry. The project is a recommendation of the Society's postwar planning committee and the exhibition will include a complete display of the new materials which have been developed during the war that are now under secrecy orders.

PILOT PLANT FOR MONTANA PHOSPHATE ROCK

The International Minerals & Chemical Corp. of Chicago is building a pilot plant south of Hall, Mont., to explore the milling quality of phosphate rock, according to Walter Pope who is representing the corporation in the Montana region.

READERS' VIEWS & COMMENTS

To the Editor of Chem. & Met.

Sir:—From whatever angle it may be considered, 15,574,000 kilowatts is an enormous amount of energy. This is the ultimate generating capacity of all the electrical developments at present planned for the Pacific Coast.

As a comparison may be mentioned that in the Middle Atlantic States the ultimate planned for power capacity there is 12,737,000 kw. It is evident that the Pacific Coast today tops the East's power resources.

A significant consideration regarding this

If your responsibility is MAINTENANCE* read this

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A solid steel bar half-coated with CO-RES-CO. After 20 days partially immersed in 10% *nitric acid*—more than half the unprotected steel was eaten away. The CO-RES-CO coated portion remained *unaffected.*

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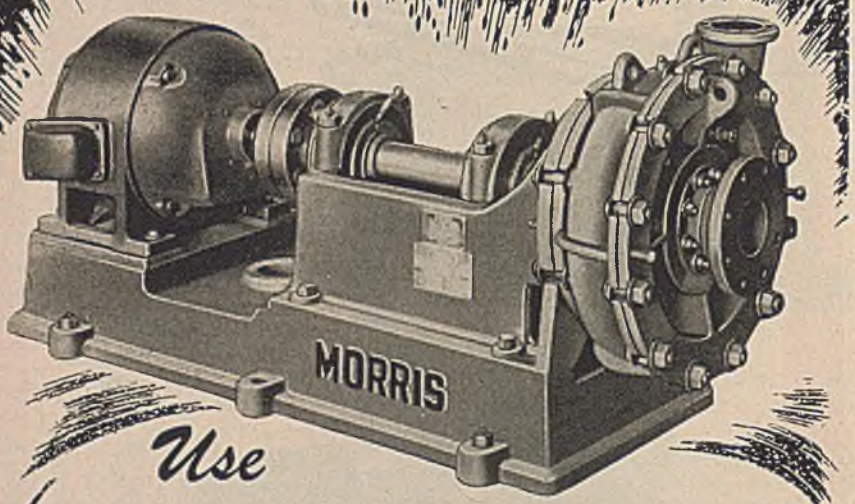

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CENTRIFUGAL PUMPS

Western power is that a large part of it is and will be available at prices lower than anywhere else in United States. On this account there are offered here untold opportunities for electrochemical and electrometallurgical industries, dependent as they are on low energy cost.

Looking into a still distant future, one learns that the Columbia River basin alone will ultimately be delivering some 15,000,000 kw.—an amount nearly as large as the total power developed and planned for the whole Pacific Coast. Considered with other potential power sources such as those of Alaska where conditions are identical to those of Norway, the Western rivers, when developed to full capacity, will create an electrical empire of the Pacific Coast such as the world never dreamed possible. With this growth will follow the development of completely new industries as well as new ways of operating old industries.

It is only a short 25 years ago that the first steps in electrochemical developments took place on the Pacific Coast. Frightened and shy steps they were, a definite break with Pacific Coast industrial tradition. Mining and allied industries had been the prevailing ones. Those faltering first steps were looked upon by the large Eastern interests as though the Pacific Coast were poaching on their preserves.

The first electrochemical plant to be built on the Pacific Coast was that of the Great Western Electrochemical Co. of Pittsburgh, Cal., now a large and successful unit of the Dow Chemical Co. Its output at that time was limited to caustic soda and bleaching powder.

The few hundred kilowatts this plant consumed at the start are a drop in the bucket, when compared with the large blocks of power being consumed today by electrochemical and electrometallurgical industries of the Pacific Coast.

Electrochemical industries alone on the Pacific Coast take today 50,000 kw., about half of the amount similar industries utilize at Niagara Falls, a center for electrochemical developments for more than 50 years.

One single industry, aluminum, is using 600,000 kw. of the Columbia River power. This is not all, power generated in the central part of California is also employed in the manufacture of this metal. Today one third of the nation's supply of aluminum is produced in the Pacific Northwest.

Calcium carbide and ferroalloys, such as ferrosilicon, ferrochrome, ferromanganese and others, are today produced from Pacific Coast power, utilizing Pacific Coast raw materials.

Magnesium, the metal that in truth has made this war a "light metals war" is produced here utilizing power derived from sources that were only dreamed of a quarter of a century ago.

In view of the above, it is no wonder that those who 25 years ago predicted that the Pacific Coast would one day become a leading center of electrochemistry can not only be gratified, but may also say "We told you so."

The Pacific Coast is today an electrochemical empire!

JOHN WOODS BECKMAN
Chemical Engineer
Oakland, Calif.

NEWS FROM ABROAD

BRITISH RESEARCH AIMED AT LARGER USE OF COAL AS RAW MATERIAL FOR CHEMICALS

Special Correspondence

ENGLAND'S dependence on coal and its dire consequences have been brought forcibly to the notice of the British public. Coal rationing on a systematic basis was avoided only at the last minute, on account of the cumbrous and expensive administration it would have required rather than because it was unnecessary. Instead, monthly supply quotas have been fixed for household coals, and industry had to accept a sharp percentage cut in its usual receipts. Labor shortage in the pits made it imperative to release conscripted miners from the army and to direct into the mines young men called up for military service. Yet, the per capita output of the coal industry has fallen, there has been more absenteeism than elsewhere, and strikes have occurred in more than one mining district. Nor is the outlook for the future any more agreeable. The costs of production have risen as a result of higher wages, less efficient labor, and work on inferior seams. The industry, in prewar days ridden with mass unemployment, has now to contend with a great deal of internal strife and cannot hope to compete successfully in export markets without a thorough reform. Naturally the question is asked what chemistry can do to help solve these problems.

The coal producer's approach to the question of the chemical utilization of his product is, of course, quite different from that of the chemical engineer. To the British engineer before the war coal was a source for certain materials which could be obtained from it more easily or more cheaply than from other raw materials. He was interested in coal byproducts but not in the main article, in derivatives but not in crude coal. It was only shortly before the war that after long hesitation and with considerable encouragement from the government, British chemical firms engaged in large-scale experiments for the conversion of coal into other commodities, and even these were soon abandoned in favor of processes starting from certain neglected coal derivatives. Since then, however, organized research has done much to make good the shortcomings of the past, but even optimistic workers in this field believe that it will be several years before new developments on a large scale can be expected. Meanwhile coal interests approach the problem of chemical utilization from an entirely different angle.

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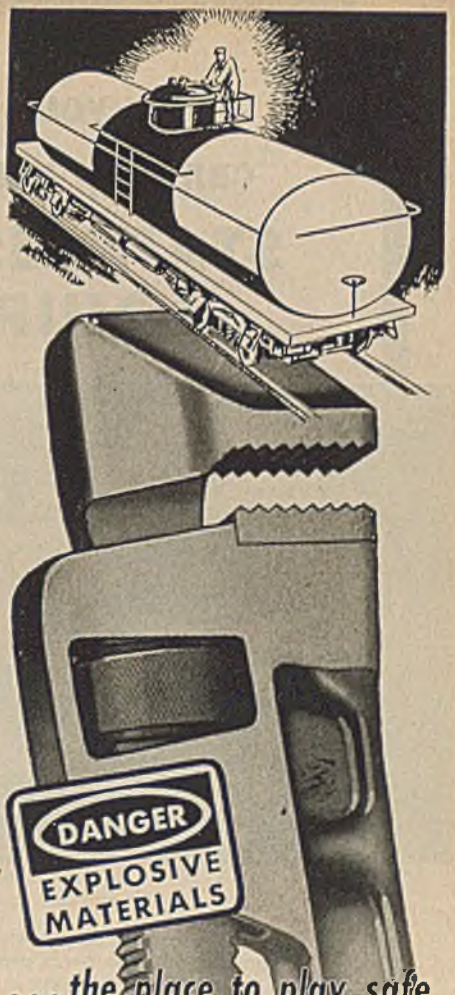

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"What to Look for When You Specify Stainless Steel for Your Processing Equipment" — a valuable guide for engineers — sent on request to those who write us on their company stationery.

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EST. 1889

for the present trend of chemical research fostered by the coal mining industry itself. Realization of the importance of the economic aspect and a tendency to regard coal as a mere raw material, like crude petroleum, which must be worked into an economically usable form before being used and should not be treated as a source from which to extract only a few valuable derivatives in small quantities. Complete conversion of coal into other materials has, of course, been practiced on a substantial scale in continental Europe, and work there has provided British research workers with much stimulating information. Yet, such experience as it has been possible to gather so far in existing British plants and laboratories suggests that different ways may have to be used in future.

From a recent paper read by J. G. Bennett, Director of the British Coal Utilization Research Association, to the Institution of Chemical Engineers, it appeared indeed that on principle no theoretically possible solution for the chemical treatment of coal is excluded.

Utilization of the remarkable plastic properties of coal is considered a research objective of the utmost importance, though no process of commercial importance has yet emerged. The solvent fractionation of coal, combined with ash separation as in the Pott-Broche process used by the German Stinnes combine, is important at present only as supplying a raw material for hydrogenation, for the extract obtained from coarsely ground bituminous coal under pressure has a high hydrogen content and is stated to give an 80 octane motor spirit when hydrogenated. The treatment of coal with chlorine has important possibilities which have not yet been fully explored, it is thought, because of lack of financial resources. About hydrogenation a great deal is known in Germany and also in England where the results achieved at the Billingham plant are generally considered to have been disappointing. Its chief disadvantages are the necessity of using large quantities of expensive hydrogen and the heavy capital charges resulting from the use of extremely high pressures.

In spite of these drawbacks, hydrogenation is not intrinsically unsound from an economic point of view and may prove very valuable if these high costs can be reduced, possibly by preliminary treatment for which there is almost unlimited scope. The synthetic gas processes of which that developed by Fischer and Tropsch is best known, are also regarded as at present economically inadequate because of the loss of about half of the coal in making synthetic gas. In the case of hydrogenation it is thought that the price of gasoline would have to rise to 30c. per imperial gal. to make hydrogenated motor spirit competitive. In the case of synthesis 30–40 percent of the high-value hydrocarbons only are obtained from coal, and since coal at the pithead is in any case dearer than crude oil at the well in terms of calorific value, there is little hope of synthetic fuel oil processes becoming established in present conditions.

While British research workers thus look with a great deal of skepticism on the work which has occupied so large a place in

Germany during the past ten years, they are rather more optimistic about possibilities for the improvement of the old-established carbonization processes. So far the yield of high-value chemical products by high-temperature carbonization is very small, but then the normal process is very crude, and since stress has always been laid on the production of coke, gas and improved fuels, past experience is no guide to future possibilities. It is thought certain that from an ordinary British coal "it should not be beyond the powers of the organic chemist to recover more than 1 percent or 2 percent of the simpler hydrocarbons, phenols and bases and to make less gas and polycyclic hydrocarbons of little value and, above all, less coke." This is certainly no overstatement, and if the coke and gas industries are reorganized, there should be ample scope for improvement in this old and yet promising field.

Economic considerations have influenced chemical research into questions of coal utilization in yet another way. The interruption of certain imports and the need to start certain new productions have led to the introduction of electrical processes for such materials as light metals and carbide. Although these wartime developments can hardly provide a reliable basis for peacetime calculations, it would seem that such electrical processes on the basis of coal cannot be rendered competitive. The question has therefore been asked whether the required high temperatures could not be obtained in some other way, and this work has not been entirely unpromising.

Four possibilities have been investigated: nearly theoretical combustion of coke with 19–20 percent CO_2, giving an effective flame temperature of about 1,900 deg. C.; the use of highly preheated air, giving temperatures of over 2,000 deg. C.; the use of oxygen, giving temperatures of up to 2,500 deg. C.; and the use of oxygen and high preheat, giving almost unlimited possibilities. The first two alternatives are believed to be capable of realization in the near future. With regard to the other two, the cost of oxygen will be a decisive factor. There are considerable possibilities in the use of combined systems where mechanical energy can be obtained at relatively low cost. These should make it possible to obtain an 80:20 nitro-oxygen, which could be used to produce very high temperatures.

It must be pointed out again that these are research developments. Their translation into industrial practice will require more work on a laboratory and semi-industrial scale, vast new installations with equally large financial expenditure, and a measure of cooperation and concentration for which the British coal industry may not yet be psychologically prepared. But it is interesting to note how greatly research programs and ideas are even now influenced by economic considerations and how vast is the scope of the envisaged chemical developments. Nor is this work confined to the coal and chemical industries. The Chancellor of the Exchequer announced in his budget speech a technical inquiry in regard to oil taxation with a large scope. The government is willing to consider such questions as research and small-scale experimental development of

Cutting Slurry Handling Costs in Coal Washing

The operations of a midwestern coal company involve handling 600 to 1,000 gallons per minute of coal washery slurry which has a high pyrites and sulphur content. An analysis shows 100% minus 3 mesh, 85% minus 6 mesh and a specific gravity of approximately 1.5. About 45 tons of solids per hour are handled. The conditions involve a 36′ lift and discharging through 700′ of 6″ wood stave pipe.

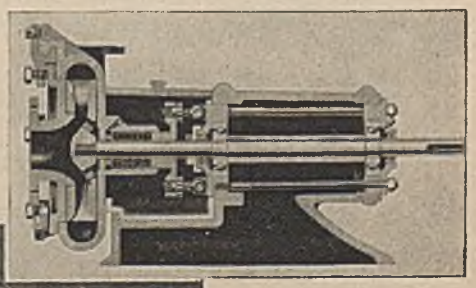
In August, 1942 the company wrote us:

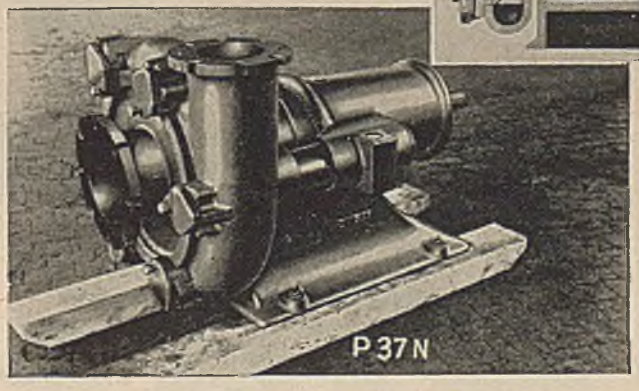
"We have been using for the past six or seven years a 4″ rubber lined pump. The lining was entirely unsatisfactory due to the short life of the rubber and continual replacement. We then changed this pump over to a nickel steel alloy shell, and eliminated the rubber lining by the use of steel wearing plates. However, we were still wearing out a case about every six months and an impeller about every three months, which amounts to a high maintenance cost."

Subsequently an Amsco-Nagle 6″ Type "T," frame 19, manganese steel fitted pump like the unit pictured below was installed in this plant. We are now informed:

"The Amsco-Nagle pump was put into operation in January, 1943 and has operated 2½ shifts (20 hours per day) without trouble. The only replacements (after 11 months) have been a new suction plate and a new impeller. The previous pump operated only about half as many hours daily. The present pump has never been repacked. It was necessary to pack the former pump every few days."

Where abrasive or corrosive liquids are handled, Amsco-Nagle pumps are the economical solution. Ask for Bulletin 940.





Above: sectional view of Amsco-Nagle Type "T" Pump. At left: Type "T" Pump of the design used to handle coal washery slurry.

Send for Bulletin 941-W on Amsco Conservation Welding Rods.

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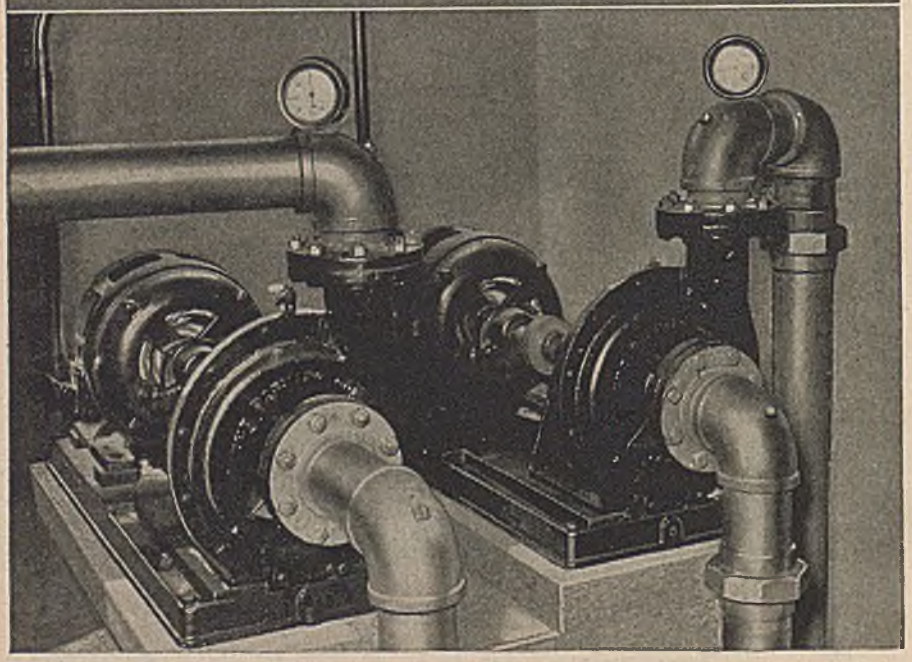


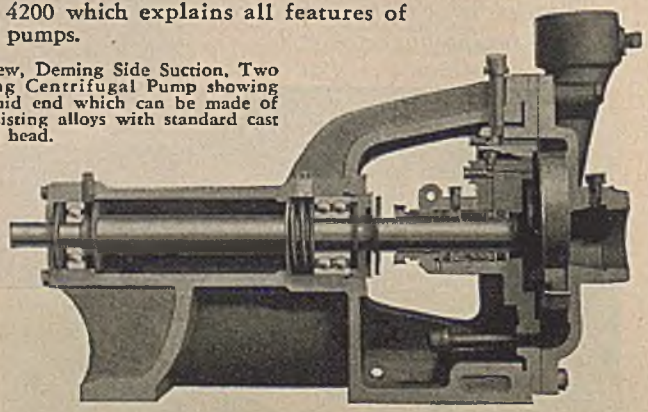
Deming Two Ball Bearing Centrifugal Pumps

One of numerous features of Deming Side Suction, Two Ball Bearing Centrifugal Pumps is the statically and dynamically balanced three vane, non-clogging type of impeller. This feature of accurate balancing of the impeller assures uniformity of smooth operation at all speeds within range of each size of pump.

Another important feature is the perfect alignment between stationary and moving parts. These pumps operate as smoothly and easily at any speed from 860 to 3500 r.p.m. against heads up to 260 feet.

Send for Bulletin 4200 which explains all features of these *standardized* pumps.

Sectional view, Deming Side Suction, Two Ball Bearing Centrifugal Pump showing separate liquid end which can be made of corrosion-resisting alloys with standard cast iron support head.



Twenty-one different sizes range from 1 to 10 inches in size with capacities from 10 to 3600 gallons per minute against heads up to 260 feet.

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PUMPS AND WATER SYSTEMS

The Deming Company • Salem, Ohio

oil production from coal by new processes, in order to "secure that a very important branch of the chemical industry in this country is to be enabled to carry on its work in reasonably favorable conditions." The government agrees, too, that petroleum technology has great possibilities for Great Britain and that in the past heavy taxation of raw material has subjected it to peculiar disabilities and handicaps.

The whole subject is still in an early stage of development when its final contours cannot yet be clearly discerned, but it is clear that both government and industry agree on the need for increased attention to all possibilities for processing oil and, particularly, coal in the British Isles. Such attention is necessary, not only to provide chemical and plastics manufacturers with a cheap raw material, but to end the deadlock in the coal mining industry itself which has made itself in questions of organization, labor relations, investment and many others and to raise Britain's export capacity while at the same time reducing her import needs. Petroleum products before the war accounted for a large part of the outgoing payments. Reduction of this item by increased utilization of domestic coal or importation of crude petroleum instead of refined products may be considered essential to maintain the balance of payments undisturbed in the changed conditions of the postwar world.

TANNING MATERIALS SCARCE IN SPANISH MARKETS

SMALL quantities of synthetic tanning agents are being manufactured in Spain but at prices which would be prohibitive in normal times. However, the scarcity of bichromates and chrome salts has given temporary impetus to this industry. Present yearly requirements of synthetic tanning agents may be placed at a minimum of 200 metric tons, which the domestic industry cannot meet.

Some local tanneries obtained permission in January 1944 to import German substitutes; others are attempting to obtain shipments of synthetic tannins from the United States.

Although several factories in Spain have been authorized to prepare bichromates and chromium salts, only one plant so far has produced a satisfactory product. This plant has a capacity of less than 500 kg. daily, partly in liquid form, so that 500 kg. represents only about 250 kg. of soda in crystal form. This quantity is too small to have any effect on the market.

SPAIN INCREASES SHIPMENT OF OLIVE OIL

SHIPMENTS of edible olive oil from Malaga, Spain, in March 1944 totaled 6,580 metric tons as compared with 4,841 tons in the corresponding month of 1943. This is an increase of 1,739 tons. Total shipments from the same port for the first

quarter of 1944 were 14,874 tons, compared with 8,946 tons for the corresponding quarter in 1943.

Shipments of inedible olive oil decreased from 108 tons in March 1943 to 29 tons in March 1944. Likewise shipments for the entire first quarter showed a marked decrease—from 538 tons in the first quarter of 1943 to 52 tons in the first quarter of this year.

NEW PAPER MILL OPERATING IN TURKEY

A NEW paper mill began operating during the first quarter of 1944 at Izmit, Turkey. Annual production will include 700 tons of cigarette paper and 12,000 tons of newsprint and printing paper, and it is reported that the plant is to be equipped with machinery for the manufacture of 3,000 tons of thin wrapping paper annually.

This is the second paper mill to be established at Izmit, and it is stated that the combined production of the two plants will be approximately 25,000 tons of paper, or approximately 85 percent of the country's requirements.

CHILEAN MATCH INDUSTRY USES IMPORTED CHLORATE

POTASSIUM chlorate is used in Chile in the production of matches for both Chilean and Bolivian consumption, in the manufacture of pharmaceutical preparations, and in the textile industry as a reagent in dyeing cotton and wool. It is also employed by the Chilean Army for pyrotechnics.

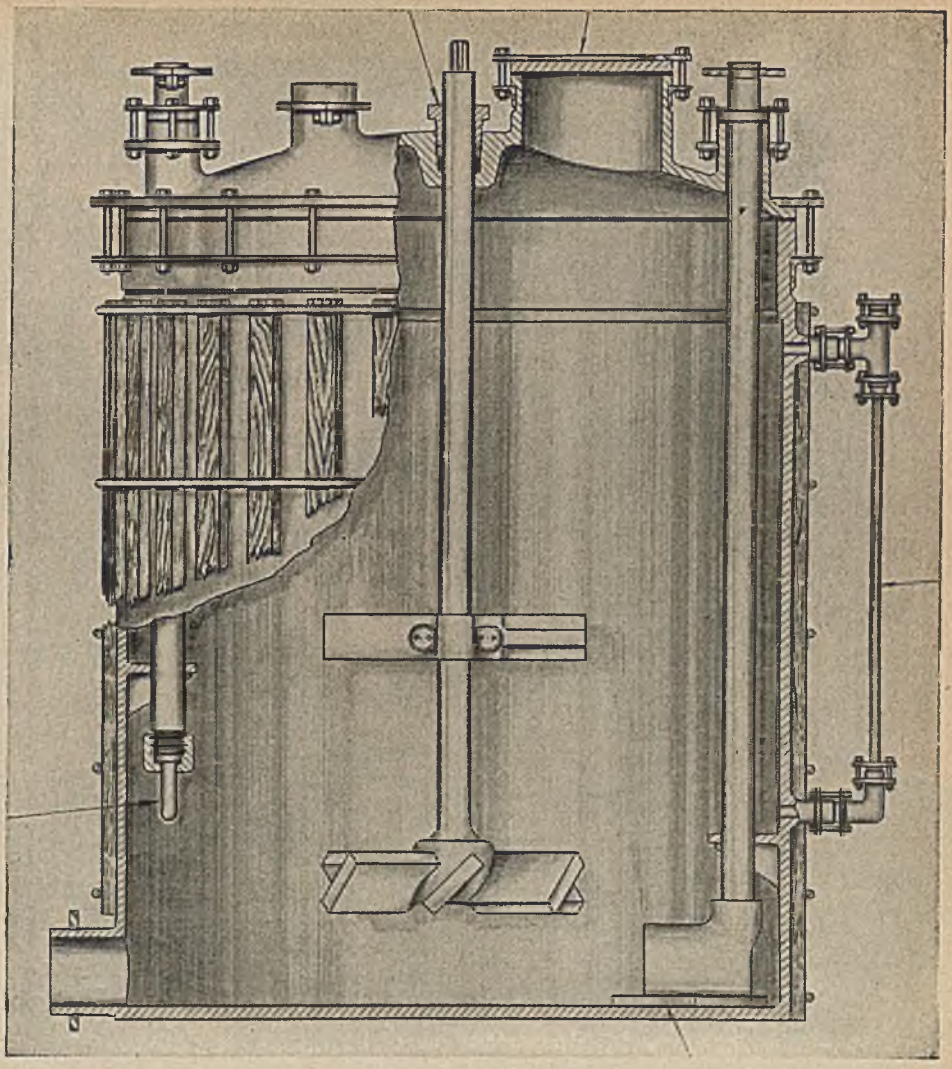
In prewar years, this material, which is not produced in Chile, was imported principally from European sources, particularly from Sweden and Finland. Imports from Finland ceased in 1940, however, and shipments amounting to 79,961 kg. were received from the United States in that year. Shipments from the United States since that time have been much smaller.

ESTIMATES FOR URUGUAYAN OIL SEED CROPS

THE Uruguayan Ministry of Livestock and Agriculture has released new estimates of areas under oilseed cultivation and production from the 1943-44 crop, with only one item revised slightly downward. The new estimates are as follows: linseed area, 139,624 hectares, production 98,977 tons; sunflower-seed area, 50,641 hectares, production 37,648 tons; and peanut area, 5,193 hectares, production 4,468 tons.

INDIA CURTAILS ACREAGE OF CASTOR SEED

THE area sown to castor seed in India for the 1943-44 crop is estimated to be 1,202,000 acres which represents a drop of 12 percent from the estimated acreage for the preceding season. While growing conditions have been reported as favorable, the estimated yield is 109,000 tons or a decrease of 29 percent from last years outturn of 147,000 tons.



FIGHTING CORROSION?
YOUR CHANCES OF WINNING ARE GREATER
WITH HAVEG

HAVEG molded plastic chemical equipment *is resistant throughout its entire mass* to practically all acids, bases and salts, to chlorine and to many solvents and other chemicals, excepting those of a highly oxidizing nature.

HAVEG has strength, toughness and durability. It is unaffected by rapid temperature changes. It can be used continuously at temperatures as high as 265°F (130°C).

HAVEG *Standard Equipment* includes cylindrical and rectangular tanks; towers; pipe, valves and fittings; fume duct; and relative items. Special equipment is readily made due to HAVEG'S adaptability to molding without involving expensive molds. Bulletin F-3 gives complete engineering, design and application data on all types of HAVEG equipment. Send for your copy.

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CHICAGO 11 — 1201 Palmolive Building
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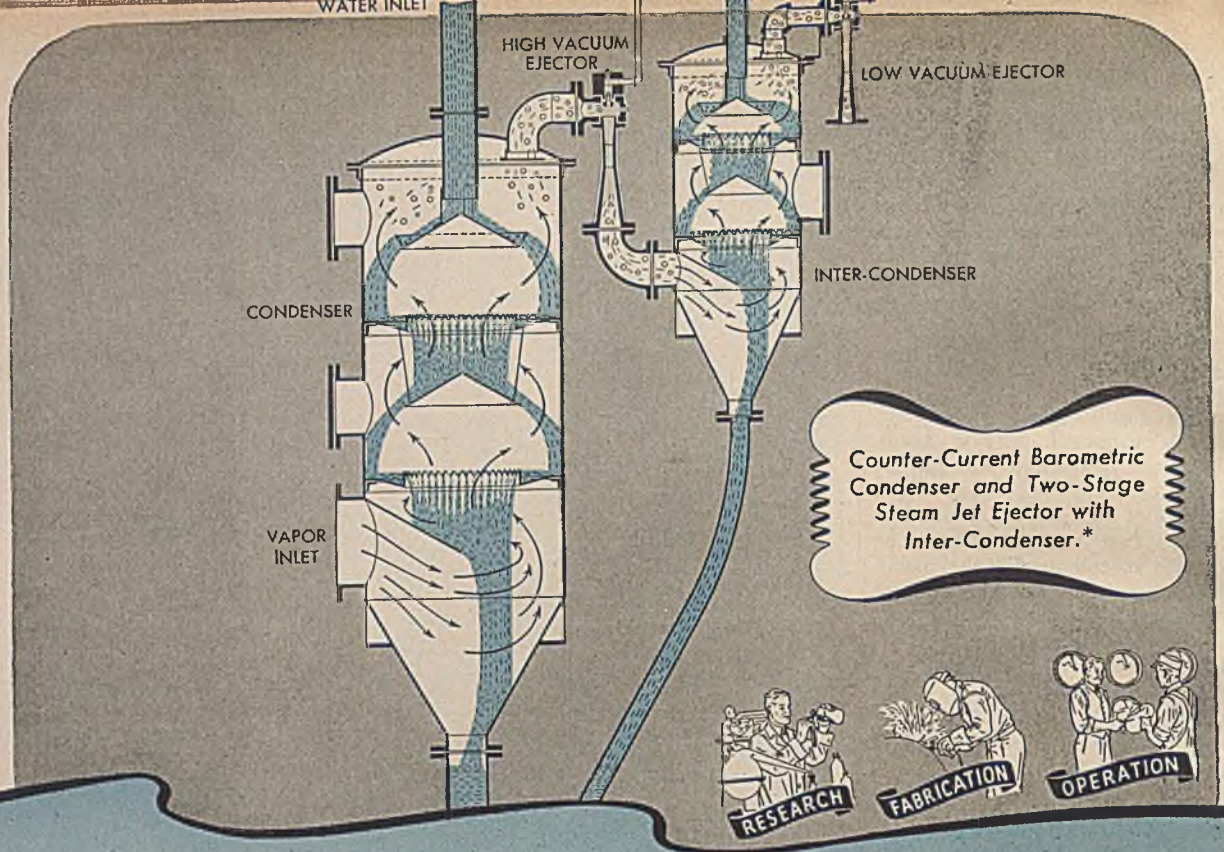
LOS ANGELES 13 — 601 W. Fifth St.



*Counter-Current Barometric Condenser and Two-Stage Steam Jet Ejector with Inter-Condenser.**

ACME COUNTER-CURRENT BAROMETRIC CONDENSERS

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

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

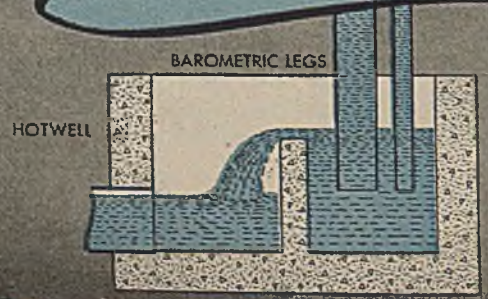
ACME STEAM JET EJECTORS

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

1. Simple in construction; no moving parts; built for long life.
2. Stable operation even under varying loads.
3. More efficient in design; higher vacua at lower costs.
4. Lower initial cost; negligible maintenance cost.

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

** Can be furnished with One-Stage Steam Jet Ejector instead of as shown, depending on vacuum desired and cooling water temperature . . . For vacua of 29" Hg. and higher a Steam Jet Booster is furnished in conjunction with the unit illustrated.*



ACME Processing Equipment

ACME COPPERSMITHING AND MACHINE COMPANY, ORELAND, PENNSYLVANIA

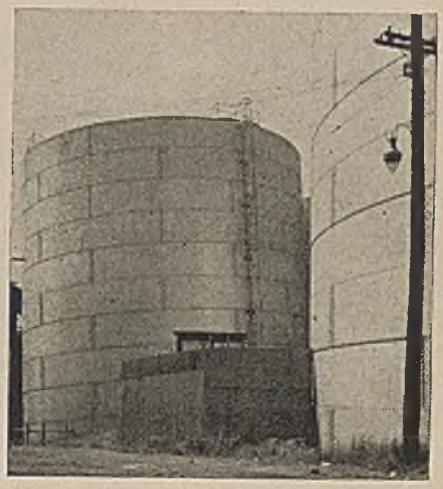
FROM THE LOG OF EXPERIENCE

DAN GUTLEBEN, Engineer

TANK DESIGN requires no mathematical intricacies. If the shape is cylindrical, arithmetic determines the plate thickness in a jiffy. If the tank must be rectangular, the flat plate walls require stiffening either with exterior buckstays or with the less costly internal ties. The ancient flat "eye-bars," pinned with one bolt between a pair of angle "crows feet" riveted to the walls, sometimes fail as indicated by bulges in the plates. To avoid corrosion as well as erosion, it is preferable to pinch the bar tightly between the angles by means of two bolts or rivets. Vibration is set up by steam injectors and the tie fails. In the language of rough-and-ready Jack, the versatile repair man, who takes pride in the breadth of his vocabulary, the failure is due to "crystallization caused by the bombardation of the steam injectors." This is no reflection on Jack! A practical long-lived tie is a round bar, oversize for stiffness and corrosion resistance. This bar projects through opposite walls of the tank, where it is fitted with reinforcing washers and liberally welded inside and out. The circular shape presents the least area for corrosion per unit of cross section.

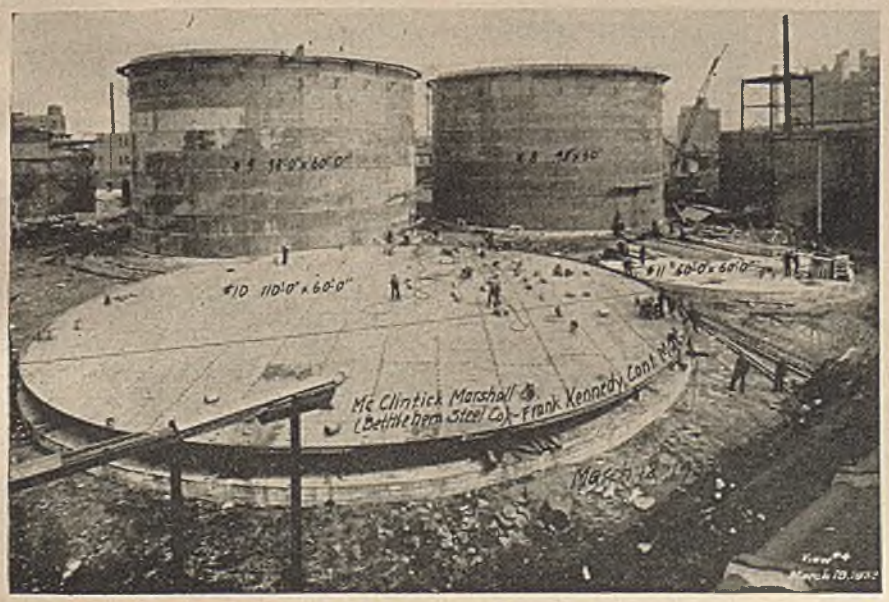
PARTITIONS IN TANKS have thoughtlessly been made the same thickness as the outside walls. The error of this feature was discovered fifteen years later when the superintendent started complaining that the syrups were mixing. The partition plate, being attacked on both sides by more or less corrosive liquids, requires extra thickness. Roofs of hot liquid tanks as well as the upper perimeter above the liquid level, are subject to corrosion by condensing vapor. The steel roof can be protected by a covering of thin copper plate. Wood covers are unsanitary. Hard asbestos has been used for a number of years and gives promise of being effective. Lead lining and lead paints are to be avoided in tanks used for food products. Galvanizing has a short life. When stainless clad steel becomes practically available, the millenium will have arrived. Enamel paints provide against rust but their life is short.

LARGE OUTSIDE STORAGE TANKS for sugar syrup require the syrup to be cooled and provision to be made for ventilation. Before we learned this, the vapor from the warm syrup condensed against the cold roof and trickled back to dilute the surface of the syrup, thereby inviting fermentation. The Old Man observed through the manhole that bubbles were evolving from the surface which was then ten feet below the roof. Impulsively he descended on the ladder to investigate. The CO_2 took away his breath but he had enough presence of mind to beat it back up the ladder. He got his arms and shoulder above the manhole and collapsed but by that time the chronicler had him anchored. The incident bordered on tragedy but it had the refreshing quality of proving that the Old Man is subject to the same crazy brainstorms that occasionally infect us run-of-mine plant engineers. The tendency of the syrup to ferment is avoided by cooling it, ventilating the space under the roof and installing special bacteria-destroying lights. Cooling is economically and safely accomplished by the aid of a vacuum cooler, wherein the syrup is sprayed into a tank in which a vacuum is maintained. This avoids the possibility of contamination with cooling water (being salty in New York) that could occur in a tubular cooler. The vacuum furthermore has the effect of extracting acrid aromas.



After 11 years, the tanks had settled 5 ft. on one side and 2½ ft. on the other, but the foundation remained in a straight plane

Building outdoor molasses tanks on concrete pancakes. Substituted for pile foundations, each concrete pad saved over $150,000



THE DARKEST BROWN SUGAR contains some iron dissolved from contact with tanks and pipes. This quality could be extolled even as the California raisin growers once implied great dietetic value in the iron content of their product. The average man's demand daily is about ten milligrams, which is about equal to one fifth of the weight of a small one cent postage stamp. If the customer desires to sweeten his tea with iron sufficient for his needs, he would have to use about a pound of dark brown sugar per day. There is no measurable quantity of iron in white refined sugar. Commercial refined sugar possesses a purity of around 99.98 percent, the departure from perfection being mostly moisture.

THE ORIGINAL FERMENTERS, designed without benefit of experience, 28 ft. in diameter, having a suspended dished bottom and containing 500 tons of corrosive liquid, were structurally satisfied by iron plates of ⅜-in. thickness. The battle of maintenance with paints and tin spraying to save the factor of safety endured for fourteen years and then the tanks were junked. Comparison of the weights of the new and the old plates indicated that the average loss was $\frac{1}{16}$ in. of plate but there

WHEN THE PRESSURE IS ON....

. . . use CELLU-LINED to keep it moving!

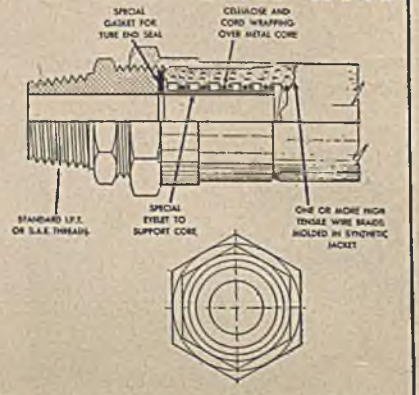
EFFICIENT operation of many types of equipment is being assured by the use of Cellu-Lined hydraulic hose.

Frequently time and money consuming breakdowns are avoided by using Cellu-Lined flexible hose where *oil,* the lifeblood of machinery, must flow under pressure. Costly delays are eliminated by using Cellu-Lined where protection against interior deterioration is required. Maintenance is kept at a minimum where strength in the flexible hose is important.

Cellu-Lined flexible metal hose affords these advantages because it combines the oil-resistive and sealing qualities of laminated cellulose sheets, with the added protection and strength afforded by metal braids embedded and centered in the synthetic rubber covering.

Chicago Metal Hose Corporation engineers will be glad to co-operate with you in applying the advantages of Cellu-Lined to your equipment. Write for complete information today.

CELLU-SEAL COUPLINGS FOR CELLU-LINED HOSE



Flexible Metal Hose for Every Industrial Use

CMH **CHICAGO METAL HOSE CORPORATION**
MAYWOOD, ILLINOIS
Plants: Maywood and Elgin, Ill.

were pits of exaggerated corrosion. For the new tanks, rivets were replaced by welding and $\frac{3}{16}$ in. of extra plate thickness was added to anticipate corrosion. This added about 10 percent to the cost and is expected to more than double the life. The rivets of the original tanks projected like lightning rods to collect the corrosive forces. (See *Chem.&Met.*, Mar. 1938, p. 136.)

IN THE ARRANGEMENT of tanks, placing flat bottoms directly on floors should be avoided unless the floor is removed so as to expose the plate for maintenance as well as for sanitation. An advantageous arrangement is a dished bottom for complete drainage and flushing, the tank being supported either by legs or hangers. In our distillery the alcohol tanks were designed to hang from the columns. The purpose was primarily to permit economical erection with the steel structure without interfering with the subsequent pouring of the concrete floors. The government inspector saw another and important advantage, namely that the suspended tank precluded the possibility of concealed connections. He requested drawings of the bonded tanks to submit to Washington as a model! The chronicler, of course, appropriated the inspector's view as the special reason for this feature of the design! This same device is applied to pan storage tanks to which is added a double bottom for heating. For these tanks there should also be installed a small circulator projected through the side near the bottom to replace the popular but contaminating air sparger for preventing settlement of crystals as well as local overheating. The circulator should project through a manhole cover to allow easy removal for repair and repacking. Round corners are preferred for the same reason that influences the fastidious housekeeper to demand them in her kitchen utensils. Standard accessories for all tanks are large manholes. (See Log of May and Nov., '43.)

LARGE OUT-DOOR molasses tanks, built on the pier in the Delaware River to receive shipments by steamers, needed pile foundations. The piles were capped of mean tide level with a disk of reinforced concrete 18 in. thick. On top of this a cylindrical reinforced concrete wall was built eight ft. deep and filled with gravel. These foundations cost $15.53 per M gal. of tank capacity and the 50 ft. by 50 ft. tanks cost $14.51. The site of tank farm No. 2, located a quarter mile from the dock, is a fill of earth, ashes, tin cans, garbage and brick bats laid over old wooden tanning vats. A pile foundation would have cost $200,000. The Cuban mills were selling molasses at $\frac{1}{8}$ cents per gal. and when no buyers appeared, the molasses was dumped into the Atlantic Ocean. Furthermore, a pile foundation would have delayed the chance to buy this low-priced molasses and thus in effect have added to the cost of the foundations. The surface was therefore leveled and on top of this a circular concrete pancake was built 24 in. thick, reinforced top and bottom with 1-in. square rods on 12-in. centers both ways. A 15-in. steel pipe from tidewater terminated at the tank

from five ft. below the top of the foundations and the connections from the ends of the pipe to the bottom of the tanks were made of hose to anticipate settlement of the tanks. The first filling (nearly 3 tons per sq. ft.) caused settlement which reached a maximum of 8 in. per day! After eleven years, equilibrium was reached. The tanks had settled about five ft. at one end and 2½ ft. at the other. Fortunately, the foundations settled in a straight plane. One started to buckle but when it reached 1½ in. out of line, settlement continued evenly. Some day we shall jack up the tanks, build a circular concrete retaining wall at the perimeter of the foundation slab and fill with gravel. Thus for $40,000 we shall lift the tanks to the permanent level where an expenditure of $200,000 would have placed them in 1933. The difference will recompense for the unsightliness and the neighborhood slams at our engineering incompetence! Anyhow the cost of the tanks was returned the first time they were filled. By the time the last of the molasses was consumed, the price had risen to eight cents per gal. The tanks, 60 ft. deep, the largest being 110 ft. in diameter, cost $6.88 per M gal. of capacity, while the foundations cost $1.87. The land added $3.74 (one quarter the price of dock property) and the pipe line pump, etc., made a further addition of $1.95.

THE CONCRETE PANCAKE, containing 1,000 cubic yards, was delivered from Warner's central mixing plant in one day. While the construction was underway, the neighborhood kids showed resentment because of interference with their "ball orchard." To express their feelings, they heaved brick bats at the workmen. The surveyor with a transit, having a powerful telescope, managed to coax one of the guilty brats near enough to induce him to have a look through the glass. The telescope was focused on an inebriate who had just come out of Widow Malloy's joint. He was waddling down the sidewalk about a quarter mile away and his efforts to maintain an even keel were not too successful. When the telescope brought this scene right before the kid's eyes, he let out a yell that fetched the whole pack to the spot. The surveyor thus took opportunity to tell the boys that the march of progress demanded mutilation of their playground but at completion of the construction work, a backstop would be built and the unoccupied portion of the ground put in shape for their use. The gang leader promptly spoke up in praise of the construction work that provided employment for the dads of the neighborhood. The boys continued as sidewalk superintendents but heaving brickbats ceased.

BEFORE THE LAST of the tanks was completed, the first one was filled. Contract Manager Frank Kennedy, representing tank builder McClintick-Marshall, called on the Old Man to advise that he was troubled about the settlement of the tanks and feared that the roof might cave in. He was concerned lest his final payment might be held up as had been the case at some other jobs even though his House was not responsible for the foundation. The Old Man allayed his fears by

SPEED CONTROL Quiz

a quick summary of what can be accomplished with REEVES Speed Control . . .

Q. *What is the range of speed variation?*

A. REEVES units are available in speed variations from 2:1 to 16:1 ratios inclusive, although most installations require no more than a 4:1 range. Actual driven speeds can be secured, through reduction or increase, to provide as low as fractional r.p.m. or as high as 12,000 r.p.m.

Q. *What horse power capacities?*

A. Sizes from ¼ to 90 h.p.

Q. *How about transmission of power—is it positive at all speeds?*

A. There are countless installations of REEVES units where the slightest amount of slippage would invalidate all benefits—such as on cut-off saws, rayon spinning, etc. The answer is yes—the transmission of power is absolutely positive at all speeds.

Q. *How about remote control? Operator is often at considerable distance from the drive.*

A. REEVES Electric Remote Control is available with one or more push button stations, which can be located wherever convenient.

Q. *What are the torque characteristiscs?*

A. Constant torque; power transmitted is proportionate to speed. REEVES units do not drop off sharply in h.p. at any low speeds. Constant h.p. with variable torque rated units also available.

Q. *Can speeds be changed automatically?*

A. Yes. Actuation for automatic control can be taken from many sources, depending on material being processed. REEVES Hydraulic Automatic Control is especially suited to wide applications, being highly sensitive to change in controlled material. Pressure of only 2 or 3 ounces will produce desired changes in speed. Mechanical and differential also available. All are based on REEVES broad experience in installing automatic variable speed control.

Q. *Are units easy to service?*

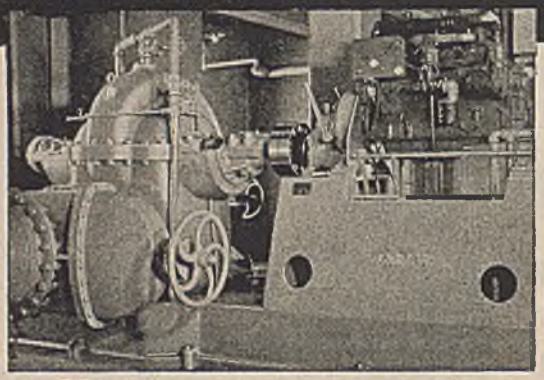
A. Here's what one user says: "Anybody with a wrench and screw-driver can keep a REEVES Transmission running." And this user has 3 units that have been operating in his plant since 1904.

For more information, send for 128-page Catalog CM-435.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

REEVES SPEED CONTROL

PERFORMANCE . . .



The final test of PACKING value

Materials . . . construction . . . manufacturing skill and care . . . experience . . . these are all important standards by which to judge a packing; but in the last analysis, actual service records are the final test.

Here are some records of G-T Packing service, taken at random from our files. Space does not permit more than a few, but we shall be glad to give additional details on services similar to your particular conditions:

"We find that PALMETTO (for steam, hot water, gases) is lasting longer and holding tighter with less friction than any of the numerous packings we have ever tried."

•

"With packings previously used, pump shaft sleeves had to be replaced every three months. Do not notice any wear since changing to PALCO (for cold water) four years ago."

•

"PELRO (for solvents, oils) has exceeded our wildest hopes in preventing leakage without increasing shaft temperature, and shows the greatest dependability we have ever found in any packing."

•

"SUPER-CUTNO (for acids) is giving us double the service of other packings formerly used."

Performance records like these PROVE that you, like thousands of other Engineers all over the world, will find that G-T Packings can materially reduce your operating costs.

THIS IS THE **8th** of a series explaining why G-T PACKINGS give better service.

8 REASONS for the Superiority of G-T Packings

1. SIMPLE LINE . . . makes correct selection easy
2. COMPLETE LINE . . . an exactly suitable type for every service.
3. SELF LUBRICATING . . . each individual strand saturated with lubricant
4. SPECIAL LUBRICANTS . . . lubricant for each service specially compounded in our own plant
5. SELECTED YARNS . . . provide tensile strength and resist high temperature
6. CONSTRUCTION . . . assures maximum endurance, longest life, lowest friction
7. EXPERIENCE . . . 80 years of manufacturing experience
8. PERFORMANCE . . . proven in thousands of plants of every type

GREENE, TWEED & CO.
Bronx Blvd. at 238 St., New York 66, N.Y.
PLANTS: New York, N. Y. and North Wales, Pa.

PALMETTO *for steam, hot water, air.* PALCO *for water.* PELRO *for oils.* CUTNO *for alkalis.* SUPERCUTNO *for acids.* KLERO *for foods, etc.* PALMETTO SUPERSHEAT **PACKINGS**

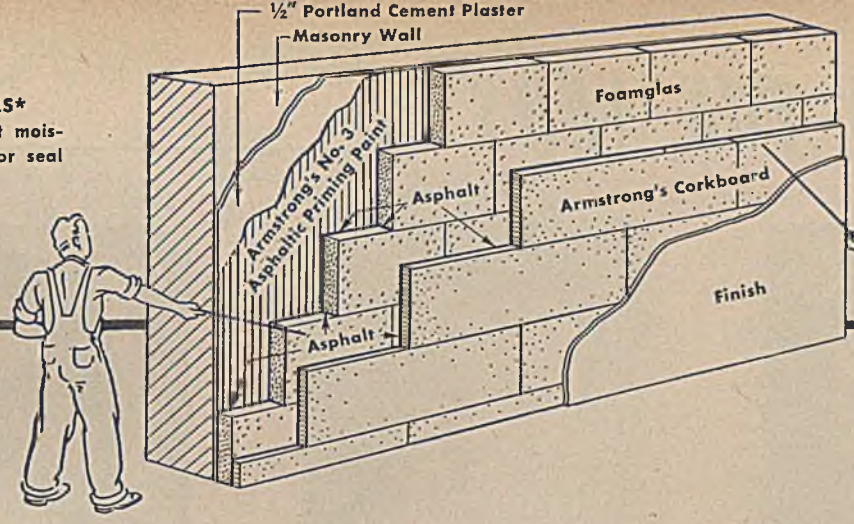
G-T *self-lubricating* PACKINGS

telling him, "If the roof fails, we'll set it up again. You carried out your job with dispatch and in satisfactory manner. When you present your bill, it will be promptly paid." While the steamer was pumping molasses at the dock, the old hose burst. However, there was no loss as a check valve is installed at the Delaware River end of the pipe. The ship's pumper noted the drop in pressure and shut down the pump. A neighbor a few miles down the river had a similar hose failure one night but had not provided a check valve. Before word reached the shore watchman, half a tank of molasses flowed back into the river.

HEAVY MOLASSES going through a pump from the hold of the ship becomes charged with air bubbles through stuffing box leaks. The bubbles rise slowly, increasing in size as pressure reduces, and finally burst at the surface and build a blanket of foam. By agreement between seller and buyer, a certain period of time is stipulated to allow the air to escape before the volumetric measurement is taken. Even so the bubbles continue to rise and thus the volume decreases after payment is made. To avoid inaccuracy as well as the long waiting period, measurement is now made by a mercury-loaded manometer that determines the pressure at the bottom of the tank. The weight of the molasses is proportional to this pressure and, by the application of the specific gravity, it can be converted into gallons. Volumetric measurements of five tankers aggregated 6,023,300 gal. against 5,832,000 gal. by weight, indicating 191,300 gal. of air bubbles. In order to serve each of the four tanks on farm No. 2, five instruments had to be purchased. The little neighborhood ruffians crawled under the fence and absconded with one. However, they must have found the junk value too small to warrant repetition.

•

RECENTLY I was unwittingly buttonholed by Clarence Seigel just as he returned from Wilmington. Clarence is a builder of considerable skill who built W. H.'s house and my apartment. W. H. said in the 25 years past he has never seen Clarence entirely sober. He grabbed me by the arm so that I was constrained to listen. Clarence inquired after W. H.'s health. When I told him that W. H. was loaded with work, his mind sensed only the word "loaded" and he expressed surprise about a strong-willed man like Bill Hoodless! I recall one day about 15 years ago, Clarence, a little shrimp of 110 pounds avoirdupois, was celebrating in anticipation of a banquet scheduled for the evening. His judgment grew defective and so he became drenched in a terrific downpour, and in this condition he came down to Shackamaxon Avenue for a spot of relaxation. C. R. (270 lb. avoirdupois) lent him a dry suit of clothes that fitted like a balloon. However he proceeded happily to the banquet and doubtless was the lion of the evening. Just as I shook him off he told me he had completed the large defense housing operation at Wilmington and was now open for a job. "Tell Hoodless that if he needs an expert constructor who has never taken a drink in his life, I'm his man."



FOAMGLAS*
for permanent moisture and vapor seal

CORKBOARD
for highest insulating efficiency

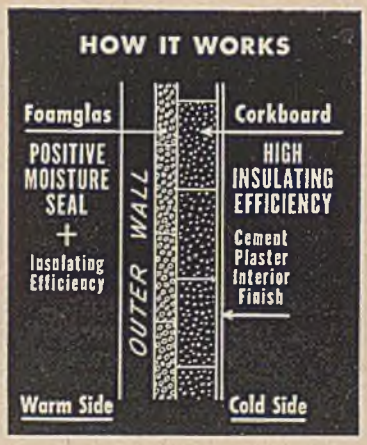
ARMSTRONG ANNOUNCES A NEW LOW-TEMPERATURE CONSTRUCTION

for permanently high insulating efficiency

A NEW type of low-temperature insulation construction that is positively and permanently sealed against moisture infiltration has now been developed by Armstrong. It combines Armstrong's Corkboard with Foamglas and takes advantage of the best properties of both insulations.

It is essentially standard corkboard construction with the addition of an outer shell of Foamglas to perform the sealing function.

Foamglas is well equipped to do this job since it is glass in foamed or cellular form with each tiny cell completely isolated from adjoining cells. Hence the material is absolutely moistureproof, vaporproof, and fireproof.



The use of Foamglas in the construction thus fortifies the natural moisture resistance of corkboard and supplements its well-recognized high thermal efficiency. The construction assures permanently high operating efficiency.

FOR COMPLETE INFORMATION about this new construction—including engineering drawings and erection specifications—write today to Armstrong Cork Company, Building Materials Div., 3307 Concord St., Lancaster, Pa.

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

ARMSTRONG CORK COMPANY

Insulation Headquarters

NAMES IN THE NEWS

Eugene Holman

Elmer F. Hinner

C. G. Kirkbride

Eugene Holman, has been elected president of the Standard Oil Co. (N.J.) to succeed Ralph W. Gallagher who was made chairman of the board.

Donald B. Keyes has been named director of the Office of Production Research and Development. Dr. Keyes succeeds president Harvey Davis of Stevens Institute who resigned last month.

Norman G. Farquhar has resigned from the editorial staff of *Chem. & Met.* to accept a position with Ford, Bacon & Davis where he has been assigned to confidential government work. A graduate of M.I.T., Mr. Farquhar was with National Aniline Division of Allied Chemical & Dye Corp. before joining *Chem. & Met.*

Byron M. Bird has joined the staff of the Jeffrey Manufacturing Co., Columbus, Ohio, as technical consultant on coal preparation and ore dressing matters.

Frank Howard has been elected president of Berkeley Chemical Corp., manufacturers of pharmaceutical and fine chemicals. Mr. Howard is also general manager of Millmaster Chemical Co., New York City.

H. R. Hanmer, director of research for the American Tobacco Co., has been elected the 23rd president of the Virginia Academy of Science.

Roman Chelminski, formerly associated with the Dorr Co. in this country and in Europe, has joined the staff of the General American Process Equipment where he will be an assistant to C. L. Knowles, technical director.

Ludwig Rosenstein has resigned his position with the General Chemical Co. to set up his own office as a chemical consultant in the Chrysler Building in New York City.

Elmer F. Hinner has been promoted by Hercules Powder Co. to the position of assistant general manager of the Virginia Cellulose Department.

Ernest Mahler, executive vice president of the Kimberly-Clark Corp., Neenah, Wis., has been elected to the board of directors of the Allis-Chalmers Manufacturing Co. He takes the place of R. G. Hutchins, New York, who retired after 31 years of service on the board. Mr. Mahler, a chemical engineer, has been with Kimberly-Clark since 1914.

Christian V. Holland of the chemical engineering department of Merck & Co., Rahway, N. J. is now assistant to the vice president, Henry W. Johnstone. Mr. Holland will continue at the company's Rahway offices.

A. S. Behrman has become associated with the Velsicol Corp. as vice president and director of research. Lt. Col. Behrman has returned to inactive duty (reserve) status after two years of active army service.

Raymond R. Hull, formerly deputy chief of the Nitrogen Unit of the WPB Chemicals Bureau, has been promoted to chief to succeed Edmund Rowland who has resigned.

Laurent J. LaBrie, formerly chief of the OPA Heavy Chemicals Unit, has been appointed technical director of the Chicago and New York plants of Paisley Products, Inc. Mr. LaBrie is a chemical engineering graduate of the University of Pennsylvania.

Ralph L. Dodge has been appointed control manager of the Ammonia Department of E. I. du Pont de Nemours & Co. Dr. Dodge succeeds Samuel J. Thomison who has been granted a leave of absence pending his retirement September 1 after 40 years of service with the company.

C. G. Kirkbride has been appointed professor of chemical engineering at the A. & M. College of Texas. His duties are to include graduate instruction and the direction of research required for the Masters and Doctors degrees. Professor Kirkbride will also devote a considerable portion of his time to developing cooperative research projects with industrial organizations throughout Texas.

Leslie A. Wetlaufer, a research group leader in the Du Pont Co.'s fabrics and finishes department, has been transferred to the personnel division and placed in charge of the company's college recruiting program.

William F. Lamoreaux has been appointed to the position of research metallurgist for the Cooper-Bessemer Corp.

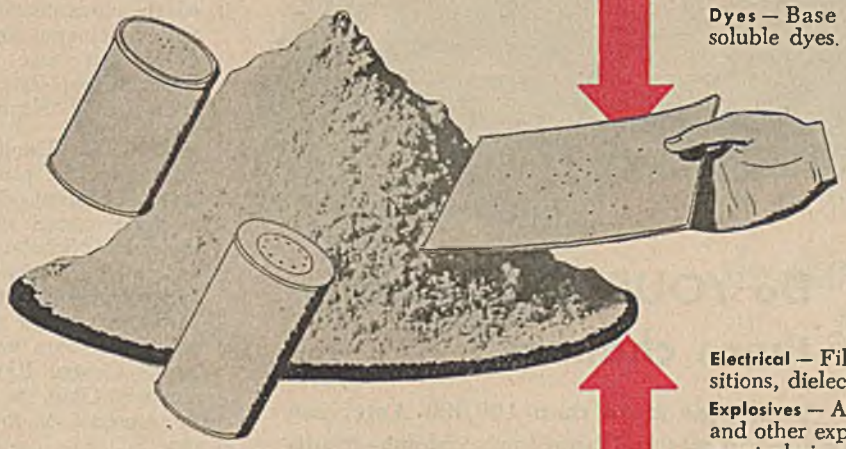
Edward L. Miller has been appointed manager of engineering, in charge of design engineering and research departments, by American Machine & Metals, Inc., East Moline, Ill. He succeeds C. W. Anderson recently promoted to vice president and general manager of the company's new subsidiary, U. S. Gauge Co., Sellersville, Pa.

Max B. Miller, director of the Petroleum Administration for War's Construction Division, has resigned from that position. George Gibson, assistant director of the Construction Division, succeeded Mr. Miller.

W. R. Hucks, with the operating division of the Rubber Reserve Co. since 1942, has been named production manager of all government synthetic rubber plants. Mr. Hucks was manager of the raw materials division of The B. F. Goodrich Co. before accepting the government assignment.

Donald B. Williams has recently been appointed assistant chief metallurgist at

Good products are often Bettered with DICALITE Mineral Fillers



Dicalite Mineral Fillers supply needed bulk without material weight increase. They can add strength, toughness and abrasion-resistance to a product; can reduce the heat and electrical conductivity. Besides these physical effects, Dicalite fillers very often aid in the manufacturing operation as well. Two typical examples: they improve pigment dispersion and speed up grinding in paint manufacture; they improve fiber formation and increase the drying rate in making paper and paperboard products.

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Catalysis — Carrier for catalyst in cracking petroleum products, in hydrogenation of oils, etc.

Chemicals — Absorbent in chemical processing, packing material for carboys and containers, source of silica.

Cleansers and Polishes — Filler and mild polishing agent in kitchen cleansers; automobile, cutlery, furniture, glass and metal polishes; also in buffing compositions.

Dyes — Base for Lakes and Water-soluble dyes.

Electrical — Filler in battery box compositions, dielectrics.

Explosives — Absorbent for nitroglycerin and other explosive ingredients, and in pyrotechnic compositions.

Insecticides — Carrier for either liquid or powder insecticides, and absorbent for disinfectants.

Matches — Filler for matchheads and also striking compositions.

Paint, Varnish, etc. — Inert flatting agent and extender for all types of paint products, varnishes, enamels, lacquers, primers, etc.

Paper — Filler in paper and paperboard products, for pitch and asphalt control, bulking, faster drying and other advantages.

Plastics — For molded, cast or laminated plastics, phonograph records, synthetic resins, etc.

Printing — Filler in printing ink rollers and roller core paint, and in printing ink.

Rubber — Filler in natural and synthetic rubber compounds, particularly mechanical rubber goods.

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the Duquesne Smelting Corp., Pittsburgh, Pa. Mr. Williams formerly was associated with Carnegie-Illinois Steel Corp.

Gordon J. Wiest, sanitary engineer, has joined the technical service department of the Pennsylvania Salt Manufacturing Co., Philadelphia, Pa.

Harold E. Simpson has been appointed to the incumbency of an industrial fellowship in Mellon Institute sustained by the Mississippi Glass Co. The investigations of the fellowship will be concerned with glass, used principally for fenestration and for other structural purposes, and methods of finishing and decorating such glass.

Russell H. Dunham has resigned as chairman of the board of directors of Hercules Powder Co. He will remain director and chairman of the finance committee. Charles A. Higgins, president, was elected chairman of the board. He will fill both offices.

William O. Stauffer, who has been research superintendent, Ammunition Section, Remington Arms Co. Technical Division, has been named senior group leader, Electro Chemicals Department, E. I. du Pont de Nemours & Co.

Richard C. Dunlop, assistant research director of the plastics division of Monsanto Chemical Co., has been named associate research director of the division under Dr. Nicholas N. T. Samaras, newly appointed divisional research director. Howard Nason, also an assistant director of research of the division in Springfield, Mass., has been transferred to the company's Central Research Laboratories at Dayton, Ohio, to become director of development of the laboratories in that city.

J. F. Mitchell-Roberts, manager of the foreign and export division of Oliver United Filters, Inc., has resigned his position with that company to make his home in California.

Wayne L. Benedict and Kenneth Swartwood, formerly with Universal Oil Products Co., have formed a partnership with offices in Danville, Ill., where they are now offering technical patent service.

Harry Kline was recently made manager and technical director of the phenolic plastics division of Reichhold Chemicals, Inc. Prior to his affiliation with R.C.I. in January of 1943, Mr. Kline spent nearly twenty years with the Bakelite Corp., specializing in research and development work on phenolic resins and compounds.

John M. Ort has been appointed director of laboratories of the American Pharmaceutical Co., Inc. Dr. Ort was formerly with the research and development laboratories of E. R. Squibb & Sons.

Richard H. Turk, executive vice president of the Pemco Corp. of Baltimore, has been elected president of the Porcelain Enamel Institute.

Clark C. Van Fleet was named manager of the $3,000,000 alcohol-from-wood-

waste plant to be built by the Willamette Valley Wood Chemical Co. at Springfield, near Portland, Ore., when offices were opened there recently. Mr. Van Fleet, was associated for many years with Shell Oil Co.

Marcel A. Cordovi, formerly research assistant, Welding Research Council of the Engineering Foundation, has joined the metallurgical staff of the Babcock & Wilcox Tube Co. as research metallurgist.

Thomas J. Kearney, formerly technical advisor to the director of sales of Detrex Corp., has been promoted to assistant chief engineer in charge of industrial equipment design and detailing.

John A. Faler, assistant chief engineer of the Detrex Corp., has been appointed to take charge of extraction equipment development.

OBITUARIES

William Malcolm Corse, 66, widely known consulting chemical engineer and metallurgist, died at his New Hampshire home June 3.

Charles S. Lincoln, 59, chief design engineer of the crushing and cement and mining divisions of the Allis-Chalmers Mfg. Co., died May 24.

Ben Alexander, 49, lumberman and president of the Masonite Corp. died in Rochester, Minn., July 6.

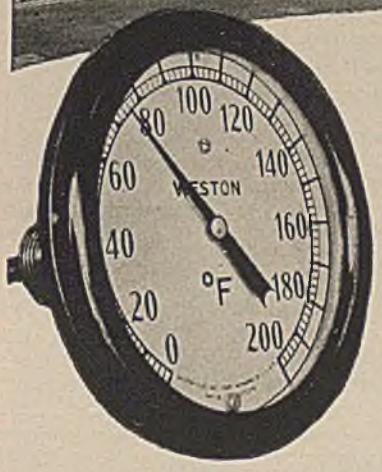
Horace Chamberlain Porter, 67, consulting chemical engineer, died June 14.

Alfred B. Clark, for many years president of the J. O. Ross Engineering Corp. in New York City died suddenly on May 27 while in Atlantic City attending the Foundry Manufacturers Convention.

Edward N. Trump

Edward N. Trump, 86, chief engineer of the Solvay Process Co. for 51 years, died in Syracuse, N. Y., last month.

C. C. Levy, industry engineer with the Westinghouse Electric and Manufacturing Co., died suddenly at his home in Wilkinsburg, Pa., last month.



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INDUSTRIAL NOTES

Ampco Metal, Inc., Milwaukee, has built and equipped a plant at Burbank, Calif., where West Coast activities of the company will be concentrated. E. H. Wilson is works manager of the new plant, P. P. Bergmann is plant superintendent and O. D. Cooper, field service engineer.

Chemical Mfg. and Distributing Co., Easton, Pa., announces that Kenneth A. Syfrit has joined the company to take charge of sales development covering 10 southeastern states.

Sam Tour & Co., Inc., New York, has moved its offices and laboratories to 44 Trinity Place.

Fisher Governor Co., Marshalltown, Iowa, has appointed The Sullivan-Mears Co. as its exclusive representative in Kansas and western Missouri with headquarters at 215 Pershing Rd., Kansas City, Mo.

General Alloys Co., Boston, has added J. Edward Donnellan to its staff in the capacity of vice president in charge of sales. Mr. Donnellan had been associated with the American Society for Metals in Cleveland.

Boston Woven Hose & Rubber Co., Boston, has advanced John H. Rowe from manager of the Chicago office to vice president in charge of western sales covering the territory from Chicago to the Pacific Coast.

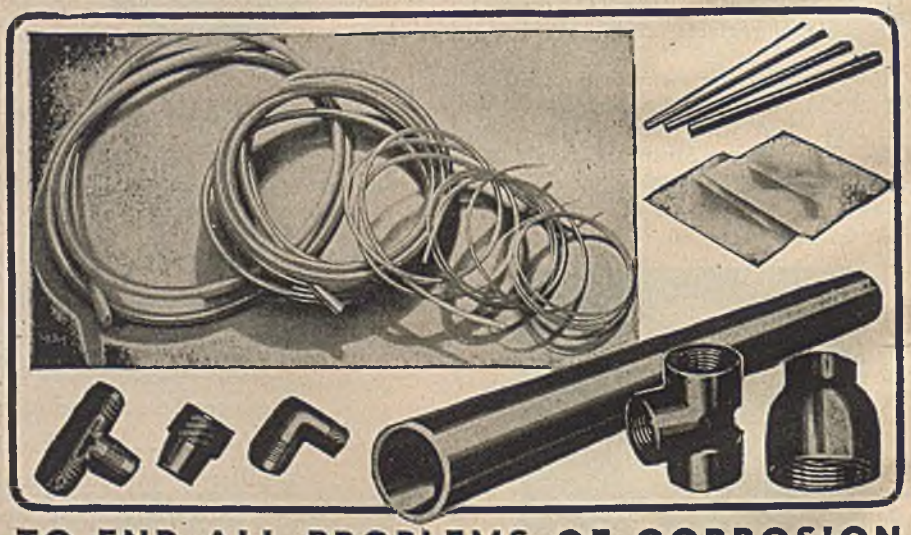
The General American Transportation Corp., Chicago, has formed the General American Process Equipment as a division of the corporation. An office has been opened at 420 Lexington Ave., New York, where the Conkey Filter Co. and former officials of that company will be associated with the new division.

Fisher Scientific Co., Pittsburgh, has opened an office, warehouse, and service center at 2109 Locust St., St. Louis with Bernard G. Hoerr as general manager and John W. Aldinger sales manager.

Resin Industries, Santa Barbara, Calif. has been formed to serve the West Coast in the field of synthetic elastomers. Grant C. Ehrlich is president of the new company.

H. K. Porter Co., Pittsburgh, has appointed M. D. Bensley general manager of the plants of the company at Mt. Vernon, Ill. The three plants which recently became Porter subsidiaries are Mt. Vernon Car Mfg. Co., Wheel Foundry Division of Mt. Vernon Car, and J. P. Devine Mfg. Co.

The Carborundum Co., Niagara Falls, has opened three new branch offices—at Buf-



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falo with G. S. Rogers in charge, at St. Louis with Gordon O. Watson as manager, and at San Francisco, W. T. McCargo as manager.

The Philip Carey Mfg. Co., Cincinnati, has made C. B. Pooler vice president in charge of manufacturing. The company operates 9 plants in this country and Canada.

Detrex Corp., Detroit, has promoted Leroy Camel to the position of sales manager of the alkali division. He formerly was manager of the eastern section of the division with offices in Cleveland.

Stokes & Smith Co., Philadelphia, has appointed the E. M. Noel Co., 74 Brookline Ave., Boston, as its New England representative. L. M. Selleck will be in charge of the special packaging division.

Abbott Laboratories, Chicago, has engaged Frank J. Cole to direct its expanding safety program. Mr. Cole was safety engineer for Lumbermans Mutual Casualty Co. and later for Belmont Radio Corp.

Brown Instrument Co., Philadelphia, has moved V. H. Hiermeier from the Chicago office to St. Louis where he will serve as industrial manager of the precision industrial division of the Minneapolis-Honeywell Regulator Co.

The Inland Steel Container Co., Chicago, formerly Wilson & Bennett Mfg. Co., has appointed John T. Rossett vice president and general manager of operations. Mr. Rossett formerly was eastern manager of operations.

Barber-Colman Co., Rockford, Ill., is now represented in the Nebraska territory by the Wain Engineering Co., Omaha.

Ilg Electric Ventilating Co., Chicago, has placed S. E. Heyerick in charge of purchases. He had been assistant to the late Walter H. Hallsteen.

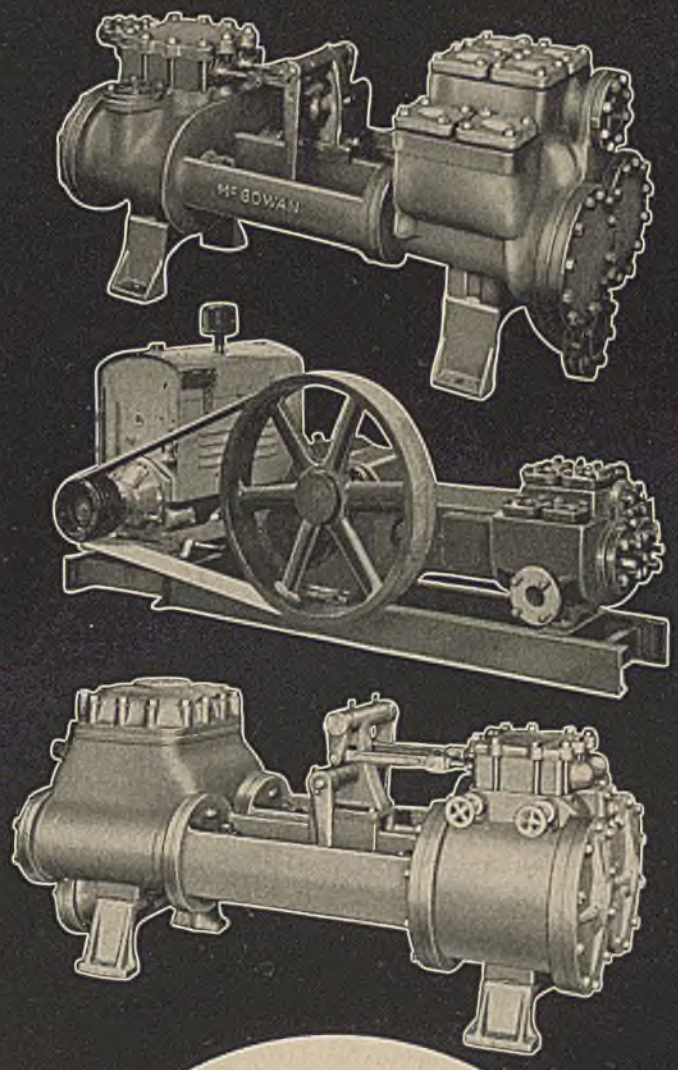
Interchemical Corp., New York, has added Edward R. Maize, Jr., to its organization in an executive sales capacity. Mr. Maize had been vice president of the Beacon Chemical Corp. of Philadelphia.

Walter Kidde & Co., Belleville, N. J., has opened a new sales and engineering office at Beverly Hills, Calif. John M. Noble who has been manager of the aviation department of the company has been appointed district manager of the new office.

Cochrane Corp., Philadelphia, has acquired exclusive sales rights to the line of rotameters manufactured and hitherto sold by Rotameters, Inc. No change will be made in the personnel of the two companies.

The B. F. Goodrich Co., Akron, has opened a new department, rubber suspension sales, with John D. Beebe as manager. Charles W. Staacke has resumed his duties as belting sales engineer after several months assignments on special war work.

McGOWAN PUMPS
for Chemical Plants



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HOUSTON . . . . FAirfax 8089	SEATTLE . . . . . CApHel 7670
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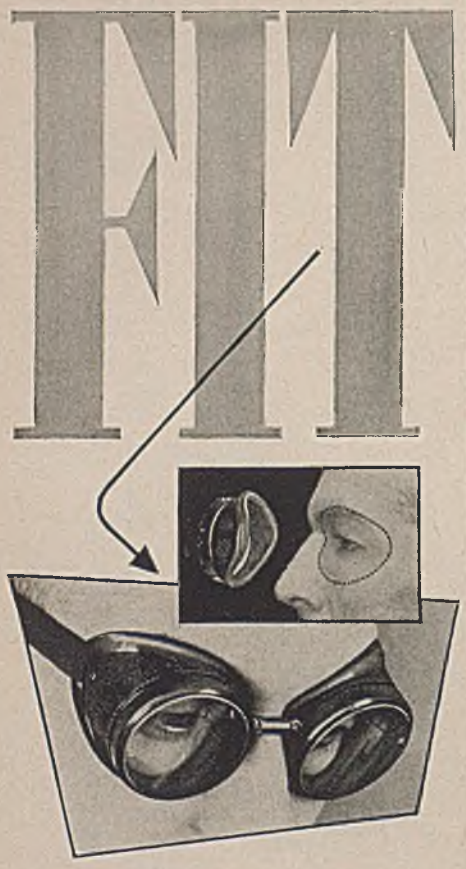

For riveting, chipping, grinding, workers have indicated great appreciation of Willson's TAW10 Cup Goggles. The comfort they get from superb fit is a big reason why.

The ventilated cups are molded to match the contours of the eye areas (see cut). In these remarkably comfortable goggles, clear Super-Tough lenses provide their famed protection; with Willsonite Super-Tough lenses available for glare. Willson's TWA10 is one of the most popular goggles serving industry. It is only one of hundreds of styles of safety goggles in the complete Willson line of eye, head and lung protection.

THIS PHOTO SAYS "O.K."

Every Willson Super-Tough lens is *tested* in the Polariscope, to determine uniformity of heat treatment, degree of toughness. Photo shows pattern cast by a lens that has perfect strain distribution. If a lens shows any deviation from this pattern, out it goes. This is only one of many tests made to make sure that Willson safety equipment is really safe.

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CONVENTION PAPER ABSTRACTS

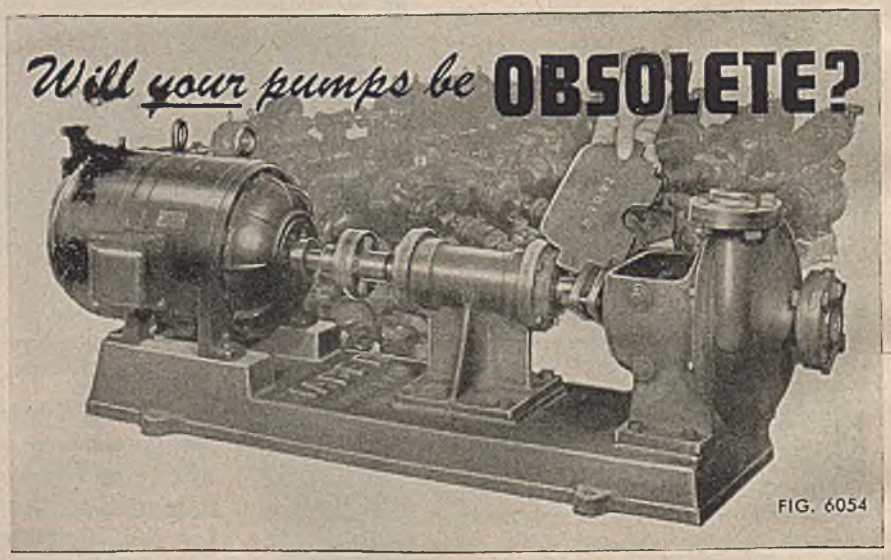
GAS PICKLING

THE GAS pickling process was developed and placed in commercial operation in time to play its part in war production, in preparing cold reduced steel strip to receive a very light and very adherent coating of zinc for corrosion protection. Zinc coatings as ordinarily applied will not resist fracture and spalling in drastic forming operations. Also, in the prewar period there was no generally available process for applying satisfactory zinc coatings to cold-reduced steel strip. Development of the gas pickling process was originally undertaken to meet these deficiencies.

Basic concept of gas pickling involves the treatment at red heat of a more or less oxidized steel surface with a gas containing hydrogen chloride and little or no water vapor, resulting in the formation of vapor chlorides of iron. As contrasted with conventional pickling in acid solutions, gas pickling is evidently successful in removing oxides and other impurities which may be buried in surface fissures or in the grain boundaries of the steel, at the same time producing a characteristic etch pattern on the surface entirely different from that secured with acid pickling. The combination of chemical cleanliness and the physical configuration of the surface is apparently responsible for improved adherence secured with coatings of almost any type on steel surfaces prepared by gas pickling.

The atmosphere used for gas pickling may contain from 10 to 30 percent anhydrous HCl, and the balance may be neutral or oxidizing gas. Low water vapor content in the atmosphere is desirable since water vapor is an end product in gas pickling of iron oxide and its presence therefore tends to slow up the desired reaction. Several methods of preparing a gas of this type were tried before one was developed which was sufficiently simple and economical. It was discovered that by burning a mixture of hydrocarbon fuel gas with chlorine and air in proper proportions, the hydrogen of the fuel gas would combine preferentially with the chlorine, and the carbon of the gas with the oxygen of the air to give an atmosphere having a high concentration of hydrogen chloride with little or no water vapor. When using methane as the fuel gas, the possible concentration of hydrogen chloride is around 40 per cent. It was later found that best results were secured with a lower concentration, permitting more accurate control of the pickling action, and the present practice is to dilute this atmosphere with a neutral flue gas from which water vapor has been removed, to secure a pickling atmosphere with not over 20 percent hydrogen chloride.

The cold washed gas from the flue gas generator is mixed with the hot gas from the chlorine burner, giving a mixture temperature very close to the temperature of the muffle into which the mixture is discharged. The strip is preheated in a sepa-



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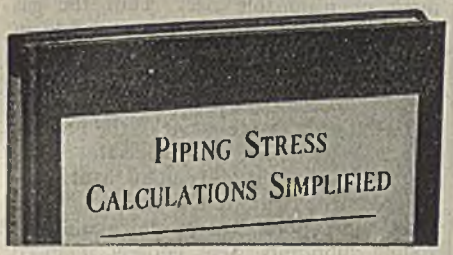

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HERE are simple and direct calculations for estimating stresses in high temperature piping systems, serving as "pattern" forms with specific directions by which any competent draftsman can figure stresses. An ingenious schematic procedure using only elementary arithmetic not only reduces the amount of labor required for complex piping systems but also greatly reduces the possibility of error and makes possible important computations with no mathematics other than arithmetic.

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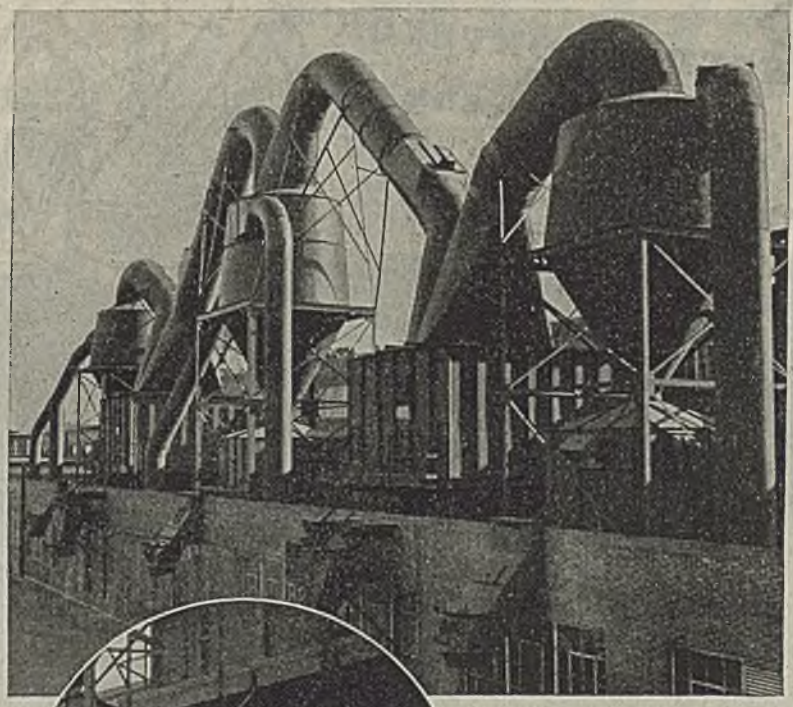

General view of installation.

Detailed view of dustless unloading device.

MAXIMUM EFFICIENCY IN DUST CONTROL SYSTEM

Above view shows a combined installation of preliminary cyclone and cloth screen dust control units collecting wood shavings, chips and fine dust from total air volume exceeding 125,000 cubic feet per minute. This installation serves the wood working operation in connection with the production of Gunstocks for U. S. Service Rifles. The system features dustless unloading of collected material and "heat" saving through return of cleaned air from cloth collectors to building.

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rate furnace, using an oxidizing atmosphere to burn off rolling oils. After passing through the muffle of the gas pickling furnace, the strip is cooled and quenched, leaving the unit with a uniform etch and a chemically clean surface. The entire operation of preheating and gas pickling is accomplished in a fraction of a minute. This permits high operating speeds with equipment of reasonable size. Thus the gas pickling operation can be accomplished in line with high speed coating processes, and with only one handling operation for strip coils.

In the early development of the process, it was realized that the temperature used for pickling would also anneal hard cold-reduced strip with results satisfactory for most applications. It was also found that rolling lubricants were entirely removed from the strip during the heating and pickling operation. As a result, the gas pickling line processes strip exactly as received from the cold reduction mill, eliminating the cleaning or degreasing, and the box annealing ordinarily required to prepare strip for coating. The process, which was originally conceived to make possible a very special kind of galvanized coating, may yet prove to be the most economical way of producing galvanized steel strip for any application even where the superior adherence is of no additional value.

Carroll Cone, Surface Combustion Corp., before American Gas Association, Rochester, N. Y., March 30, 1944.

TECHNOLOGY AND MANAGEMENT

PROGRESS of invention and commercial exploitation has been steadily from rule of thumb and expirical methods to a greater and greater dependence on rigorous scientific investigation. This is particularly true of the older fields. No industry with a century or so of history, as, for example, the making of rubber products, dyes, or prime movers of any sort, can maintain itself competitively without the best scientific foundation and continuous research.

This does not mean that the garret inventor is out of date; new ideas of apparent value are still coming from the brain of the individual. Without doubt, it is still true that in the older fields, brilliant new ideas are born in the minds of brilliant individuals. In general, however, the mature field is best cultivated for new developments with the tools of organied scientific research. As a result, it is natural and inevitable and even, probably, socially desirable that these mature fields should be occupied by larger organizations, while younger and more restricted areas still offer rich rewards for individual initiative.

For large-scale research we have new tools and new opportunities. We have more trained men and women than ever before. We have new calculating mechanisms for mathematical analysis which make both the impossible and the impracticably possible, practicably possible.

The very accumulation of literature and the organization of libraries facilitates the progress of research, whether organized or individual, and the war with its throwing together of large numbers of men in the attack on common problems has furnished

a stimulus of personal contact which works to the same end of accelerating the pace of research.

For the time being, at least, the results obtained in the last few years are not appearing in their end results of products for public use. The restrictions put on production for other than war purposes in this time of war are, of course, the controlling factor.

Even after the war, the placing on the market of spectacular new products may not meet the public expectation. In many products, as notably in the case of automobiles, the requirements are going to be so large and so pressing that there will be no time to revise plants and invest in new productive facilities for radically new products. The public demand will be overwhelmingly for large production in quantities of satisfactory goods, and that can only be met by producing the best type of prewar goods in heavy production.

The existence of this pent-up demand for immediate production will be a fortunate circumstance, since it will allow a breathing spell in which new designs, based on new discoveries, can be designed and put into marketable form, pilot plants built, and the product tested in service before large-scale manufacture is undertaken. We may look, therefore, for a postwar lag in the production of the radically new in most lines of manufacture.

The necessity for lag between the most advanced known and what is publicly offered for sale is often misunderstood by the public. A design being brought to completion on the drafting board never arrives at its absolutely finished form. Day by day, week by week, month after month, new and good ideas can be incorporated in it. After the product is on the market and has come into general use, it is necessary to make some changes from time to time, and the temptation continuously exists to make these improvements continuously and on a large scale. Here again, business judgment requires that these changes be not so large or so many as to imperil the possibility of profit.

A company which does not keep the improvements resulting from invention and research under control in their commercial application is almost sure to get into financial difficulties.

Holdings-back of new ideas and their releases in accumulations at infrequent periods may give to the public the appearance of holding inventions arbitrarily out of use. Such practice, however, is not censurable in the long run, whether from the interest of the manufacturer or the general public.

In general, when management faces the problem of research, it must keep the following points in mind. First, it must be willing to have only the occasional research project turn up commercial possibilities. Second, it must be prepared to look at the results with imagination. Frequently, something new and valuable has turned up which is a little outside of the result being sought. A shift of viewpoint is required for proper appreciation. Third, the results of successful research must be put into commercial exploitation at the proper time. This proper time will be neither too early to allow a satisfactory

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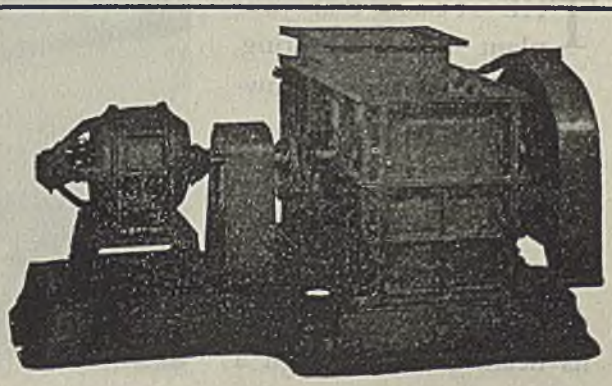

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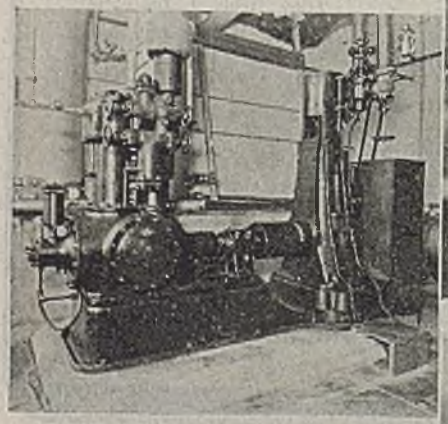

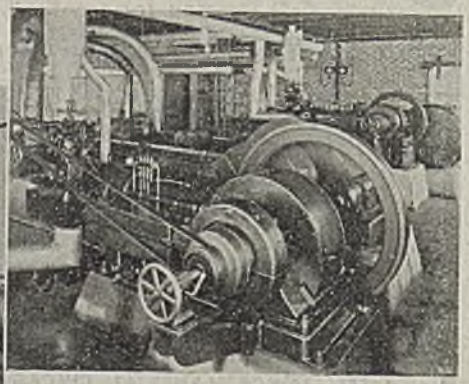

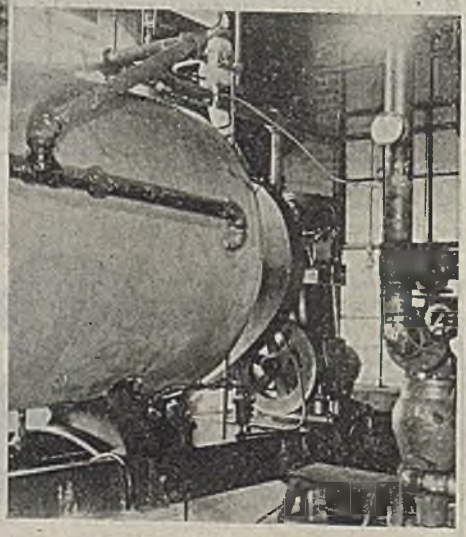

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product to be put on market, nor so late that markets have been lost and large sums spent in the endeavor to reach an unattainable perfection.

Ralph E. Flanders, Jones and Lamson Machine Co., before American Chemical Society, Cleveland, April 4, 1944

INSURANCE PLANTS

PLANTS, built during peace years and designed to provide necessary "know how" for making synthetics and substitutes required during war, will prevent unforeseen catastrophes from crippling our essential industries. Had a proposal that was made in the summer of 1940 to build a Government rubber plant of 50,000 tons capacity, been heeded, we would have been able to design and construct facilities much more rapidly and we would have had a capacity of at least a half a million tons of synthetic rubber operating by the spring of 1943. This would have speeded the war supply program, and no one, he claimed, would have questioned the expenditure for such an insurance plant.

In times of war, it is highly essential that we have in this country the "know how" of all major developments that may be of use, even though there is no assurance that plants based on these developments will be able to operate economically after the war is ended.

Developments taking place at the present to insure the U. S. with the proper knowledge for operation of necessary essential industries are wood waste hydrolysis to produce sugar which in turn is fermented to alcohol, glycerine from black strap molasses, liquid fuels from coal through hydrogenation and from shale oil by distillation, fuels from waste hydrocarbon gases by the Fischer Tropsch process, production of aluminum from clay, and the synthesis of certain materials for the production of buna S rubber.

In the last war, we had an even more perfect example of the lack of insurance plants, in the synthetic organic industry. Fortunately, that war was a short one as far as we were concerned and we never felt the worst effects of our inadequate supply of synthetic organic materials. Fortunately, also, that industry was a profitable one in peacetime so the huge development of synthetic organic chemicals occurred in this country after the last world war without material Government aid.

On the other hand, it has been noticed in this war, time and time again due to the enormous demand for certain organic chemicals such as formaldehyde, acetic acid and aromatics, that in spite of our huge synthetic organic chemical industry we are poorly equipped to meet the emergencies. Perhaps the outstanding example in this field is the synthetic materials necessary for the modern 100-octane gasoline. This lack has a marked effect on the war supply program and has materially cut down our speed of action on the fighting fronts.

It is a relatively simple matter to convince industry or Government to put up funds for developments that seem essential in wartime, but once peace is declared, we may revert to our old time attitude. It is the duty of the scientists of the Nation to continue urging the erection of small plants for security purposes. They should not stop

there, however. It is all very well to start an idea but if it is never finished and nothing is really done about it, the whole effort comes to naught. The chemists and chemical engineers, for example, should continue to cooperate and as a group see to it that the development is carried to its logical conclusion. This does not mean the setting up of a new governmental organization with extension powers and vast funds, but merely a cooperation between industrial concerns and existing government agencies. This is not regimentation, but just the opposite.

It should be remembered that this cooperation to build and operate insurance plants in this country can be started in a very humble and modest way and should automatically grow, depending on the effectiveness of the results in particular cases. It is the technical world, however, not industry and not government, that should promote this idea and be responsible for its success, because only the technical men will appreciate the significance of such an undertaking.

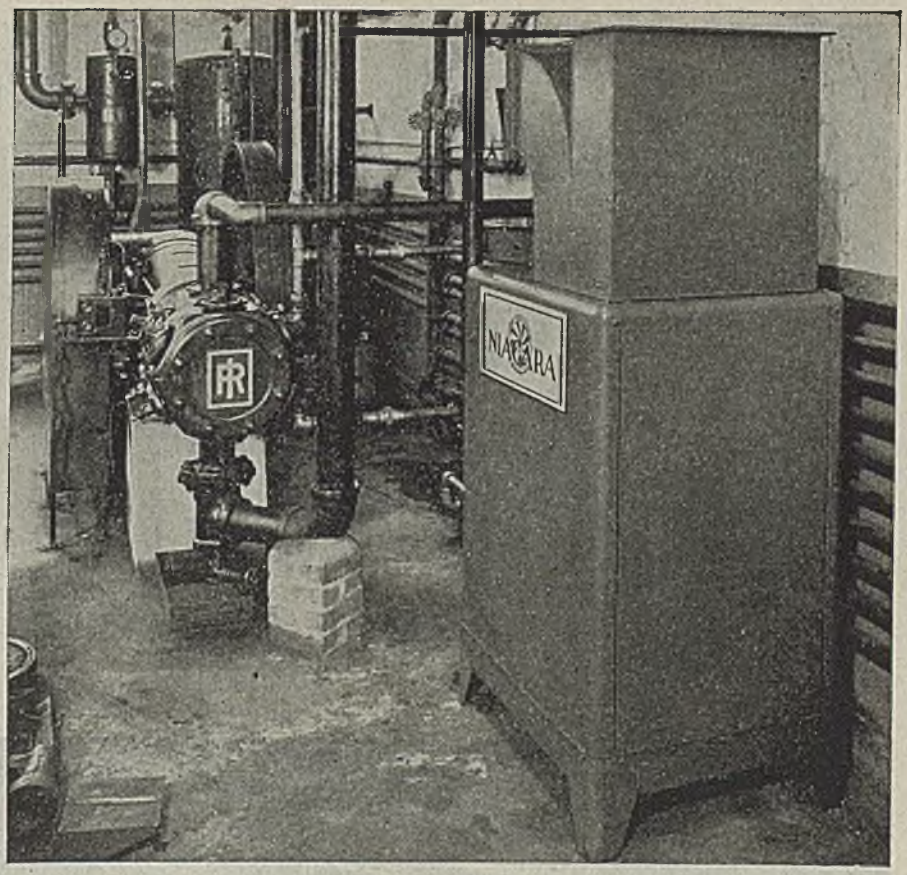
D. B. Keyes, WPB, before American Institute of Chemical Engineers, Cleveland, May 15, 1944.

TECHNICAL TRAINING AND PROFESSIONAL EDUCATION

Too often technical training has been confused with technical education. The training of skilled workers for repetitive operations in industry or for certain military tasks, which may be organized as job training in the manual arts, is vastly different from the intellectual development sought in technical education. Under wartime pressures certain jobs for skilled workers have been more critically and thoroughly analyzed and further sub-divided. New and unusual training methods for them have been utilized and highly satisfactory results have been obtained. Some of these achievements will undoubtedly greatly affect all manual arts training in the future, but they have little significance for technical education.

The defense and war training programs of the U. S. Office of Education have effectively met certain needs of industry for young men and women trained at the sub-professional and technological level. More than a million and a half have taken these courses throughout the country and many of them have found their way into industry or into technical jobs in the military services. The experience of wartime has indicated a great need for training at this level. If American industry is to operate under a postwar schedule of full production, there will certainly be a continuing need for such training.

Technical education at the college level has developed into a type of career training which, although differentiated by the broad fields of scientific applications and of engineering practice is characterized by programs and standards so universally adopted that recently created accrediting agencies have been able to approve a very large majority of the institutions offering such programs. This career training has been geared to the needs of industry and public works and has been molded by professional objectives, standards, and ideals. It has been planned to articulate with a post collegiate



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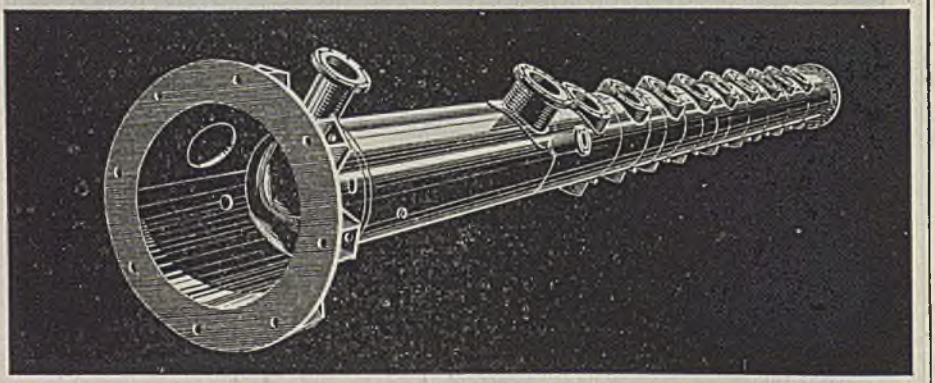

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apprenticeship leading to the attainment of full professional stature or to administrative and managerial responsibilities. The professionalized programs which colleges have offered in the technical fields have prepared graduates for some junior or subprofessional tasks immediately after graduation and have laid a foundation in the mastery of basic principles upon which professional growth could be built.

Wartime conditions have also emphasized certain needs in industry that in recent years have been becoming more apparent. When the demand for chemists began to accelerate at the beginning of the war it was evident that industry preferred to recruit those graduates from four-year programs who had completed a professionalized curriculum rather than those who had pursued undergraduate work in the elective system of the liberal arts college.

When we come to the problems of projecting enrollments in college attendance and of estimating the supply of technical personnel need in industry, no one but a clairvoyant can see their answers clearly. If we are to operate a yearly national economy above one hundred billion dollars the demand for technically educated men will be much greater than ever before. The gaps in the normal flow of technically trained men into industry caused by the manpower demands of the war must be filled.

Many men who would not otherwise have become interested in technical education have been inducted into it under the Army and Navy programs. Many who have not carried their programs of education to desired terminals will return to them after the war, undoubtedly under some aid from the state or national government. Transition programs to articulate the work of the veteran with the regular schedule will be necessary. Cooperation with industry in the placing of these men after graduation will be increasingly important.

All of these facts indicate that the technical schools will be extended to the utmost in the postwar period. Of this I am certain, the future presents technical education with the greatest challenge of a long era of distinguished service to society.

H. S. Rogers, Polytechnic Institute of Brooklyn, before American Chemical Society, Cleveland, April 4, 1944.

CIVILIAN MORALE

We know that our fighting men are of the unbeatable American breed, and that both in quantity and in quality their weapons and equipment are superior to the enemy's. Nevertheless, the fight will be hard and perilous and it must be won in the shortest possible time in order that the lives of thousands of American youths may be saved and the economic strength of the nation conserved for the future. Each of us must do his full part to speed victory. On each of us today there is a strong compulsion not merely to maintain the vigor of his personal war effort, but to make an extra effort.

Furthermore, we need to make sure that not only what we do, but what we say, is in the interests of total victory. It seems to me that too many are allowing

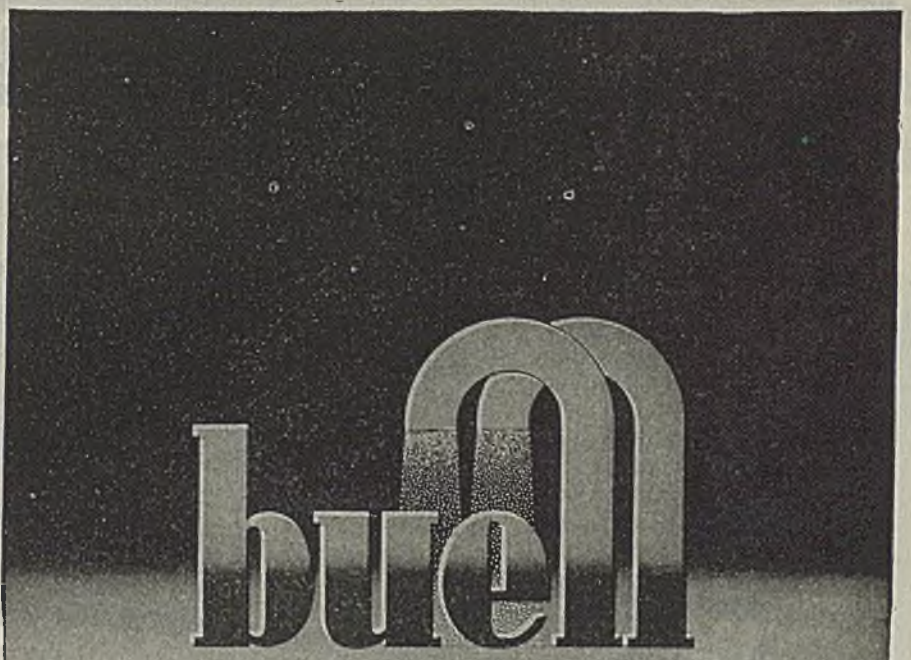
themselves to indulge in pessimistic gossip about the way the American people feel toward the war. I have no doubt that each of us knows some individuals who are doing less than their full share. But it is easy to be misled by individual instances of unpatriotic behaviour into thinking that the national morale as a whole is low. That is simply not so. By and large, the morale of the people is good. The facts show it. The figures of war production would not be where they are if the morale of the people were not good.

Much of the idle gossip about low morale has been aimed at the employers of the country. They are often portrayed as self-seeking men rolling in war profits. No doubt there are such men among them, but they are few. The state of mind of the great bulk of employers is very different. The great majority of business men have been less concerned with the amount of their profits than with the job to be done. All over the U. S. today employers are operating under difficult conditions never suffered during peacetime. Thousands of them are making products new to their experience and making them well, even brilliantly. It seems undeniable that the great bulk of the employers of America have shown their willingness to make sacrifices in the national interest.

The same is true of the workers of the country. Undoubtedly, labor, like other major groups, has at certain points allowed its group problems temporarily to obscure its interest in the war. But these lapses have not been representative. The workers of the nation as a whole have made sizable sacrifices in the cause of victory. Hundreds of thousands of war workers are willingly living in crowded cities in quarters far below their previous standards in order to work in war plants. While some are making high wages, others are earning little more than before the war, and working hard and long hours, often in hazardous occupations. It is easy, too easy, to forget that in the year 1943 over 18,000 workers lost their lives at their jobs. Nearly 2,500,000 men and women were maimed or injured or contracted occupational diseases. Hundreds of thousands of workers have risked their lives beyond the call of duty without the public recognition of heroism which goes with military action.

Naturally, many people in all walks of life are physically and mentally tired today as a result of prolonged work at heavy tasks. But by and large the American people have shown exceptional ability to withstand fatigue without letting it impair their war effort. I doubt whether among the adult civilians of America there are more than a million or so who are so selfish as to put personal interests above the public interest during this time of national danger. The plain fact is that those people do not represent the nation.

We must face the fact that with a six-day week, the matter of fatigue is a very real problem, especially in the case of older workers. But it is not the only cause of absenteeism. Although we have no easy formula, no magic solution for dealing with absenteeism, there are steps that can be taken. One such step might well be a wider acceptance and more



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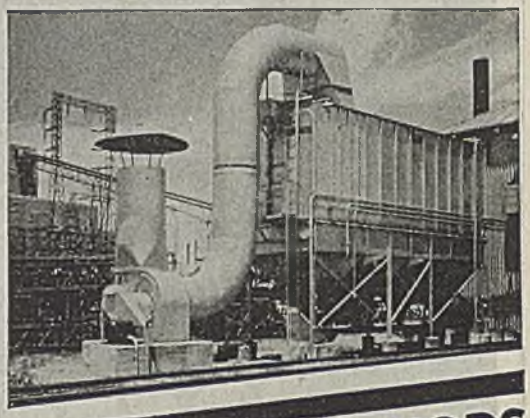

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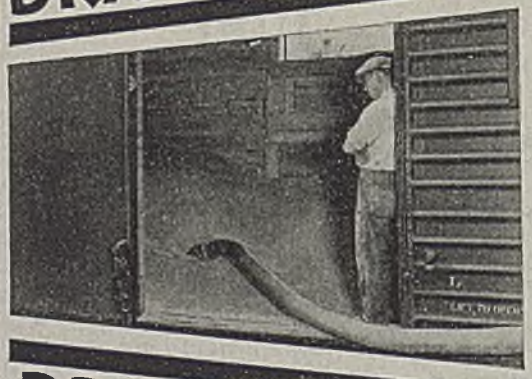

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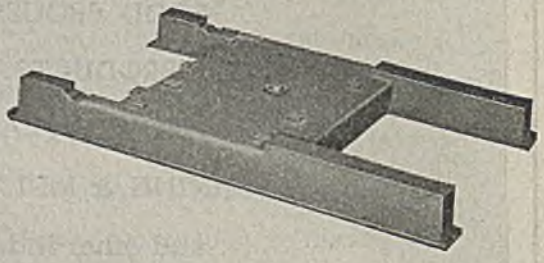

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thorough use of the labor-management committee plan of the War Production Board. Today, in war plants throughout the country, there are about 4,300 labor management committees, which through the constructive ideas which they bring to light, are contributing substantially to increased efficiency and higher production.

Experience in other countries has shown the virtual impossibility of controlling absenteeism by law or by applying such measures as fines or loss of deferment from military service. The most effective solution of the problem of absenteeism will be found by those companies which look for the solution within themselves, rather than by those who look to Government measures of discipline or punishment.

Donald M. Nelson, WPB, before Coal Mine War Conference of the American Mining Congress, Cincinnati, May 2, 1944.

RECONVERSION POLICIES

Reconversions have been so far, and can reasonably be expected to be in the future, of two general kinds. The first is that of a whole industry or of a group of companies in it resuming at the same time. The other is that of the individual company beginning or increasing civilian production without regard to other companies. The rate at which given companies are to operate; their starting time as related to that of other companies; whether or not the unproduced quota of a company prevented by war work or other causes from resuming is to be accumulated and added to its current rate at a future date; what if any advantage is to be given to small companies, and if so, what determines that a company is small for this purpose; when shall the new company, not previously a producer in the industry, be permitted to begin production and at what rate;—these are considerations of the very greatest emotional and economic concern to the ownership and the employed personnel of all the plants concerned, to the communities in which the plants are located, to the vendors to these plants, to the distribution and service organizations in the field, and to the consumers whose dollars are customarily spent in accordance with certain very decided brand preferences which may call for proportions of goods by individual makers quite contrary to what might be planned by a public agency.

The most common conception of reconversion is that of all the companies in a given industry resuming production at a given time either at the rate prevailing in some nearly normal base period or at some given percentage of that rate. In the absence of other more compelling considerations, that is the policy. But war production, which comes first, must not be warped to its harm to fit however desirable postwar production patterns. And it is almost too much to expect that, in more than a relatively few of the more than 100,000 concerns to be reconverted, the so-called "historical quota" basis can be used without modification to fit some more compelling necessities of the situation. In the minor reconversions by whole industries tried so far, the War Production Board has accomplished them with sub-

stantial adherence to this principle of putting an industry back in business in about the same position it was when taken out of civilian production.

While relatively few industries can be expected immediately to resume as a whole on any given percentage of a base period, the study of all of them continues in the WPB industry divisions and in the appropriate ones of the 750 industry advisory committees. This will bear real fruit when production capacity in more substantial amount is available for conversion.

There are increasing opportunities for individual companies, either within or without recognized industry patterns, to absorb surplus materials and idle time—and even to utilize some controlled materials and components—in the making of their old products or others that may be suggested to them by lists of consumer items indicated by WPB surveys as being currently desired. Application to the nearest WPB field office or to the appropriate WPB industry division in Washington will develop what the possibilities are of proceeding now with proposed production, which of course must be accomplished without interference with the war effort.

L. R. Boulware, Operations Vice Chairman, WPB, before American Marketing Association, Philadelphia, June 8, 1944.

ELECTRONICS

WAR has apparently provided an ample testing ground to convince the skeptics that electronic equipment is not fragile or delicate. Satisfactory service in ships, tanks, and aircraft should be ample evidence that the electron tube can safely be allowed to take its place in industry. The customers have been sold—if not oversold.

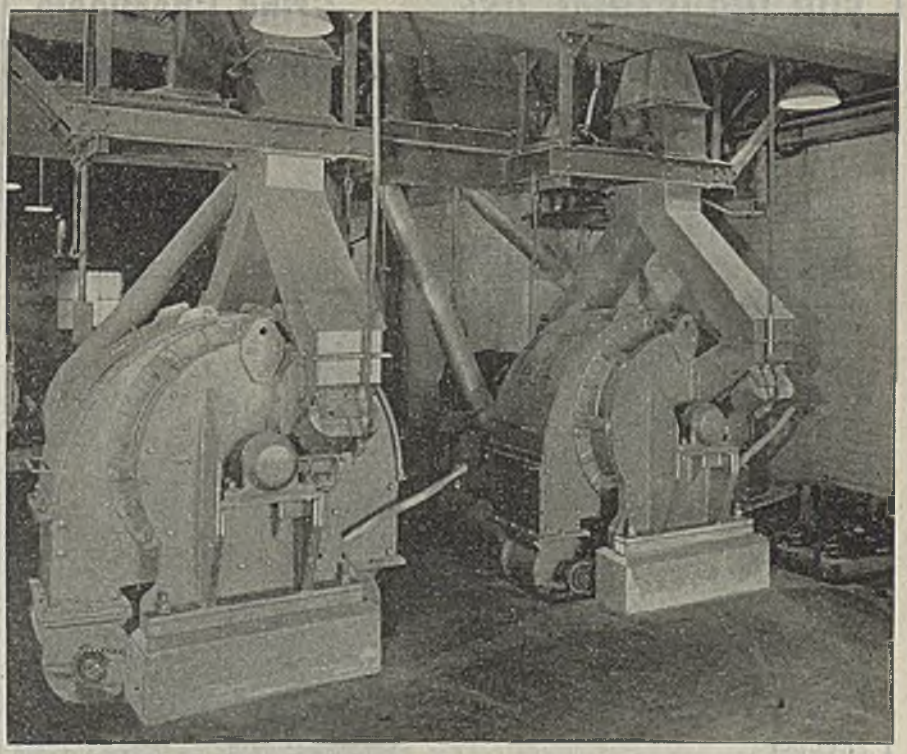
The great danger to the present electronic development can be briefly stated as a lack of men trained to design, sell, apply, and maintain electronic equipment for industrial use. Electronic equipment unfortunately is different from other electrical equipment, and the power-trained engineer is usually not equipped to handle it.

There are believed to be fewer than one hundred men in this country today, equipped by training and experience able to design and apply electronic devices to industry in general. These men must be trained not only in electronic devices, but it is much more important that they also be trained and experienced in the processes, equipment and techniques used in industry, to be able to give the purchasers adequate technical advice.

It is this shortage of capable engineers, to which the radio trained technicians released from the armed forces will be able to add little, that is the real obstacle over which our forthcoming electronics boom may stumble.

An engineer thinks of a resistor, an inductance or a capacity as a circuit constant, which can be purchased as having a certain value and which will have that same value at all times. An electron tube is not such a precision device. When new, they are considered satisfactory if they do not vary more than about plus or minus 20% of the standard rated values. During life the tube characteristics are continually chang-

AT ARCHER-DANIELS-MIDLAND PRATER DUAL FEED DUAL SCREEN PULVERIZERS PROCESS TO CLOSE SPECIFICATIONS FOR UNIFORMITY OF FINE GRANULATION . . .



Archer-Daniels-Midland sets high standard for fine granulation and uniformity of product. After exhaustive tests Prater Dual Feed Dual Screen Pulverizers were chosen to reproduce these standards at the Decatur, Illinois, plant. Illustrated above are two of a battery of four Prater Dual Feed Dual Screen Pulverizers, that working in tandem uniformly produce the fine granulation and uniformity that marks Archer-Daniels-Midland products.

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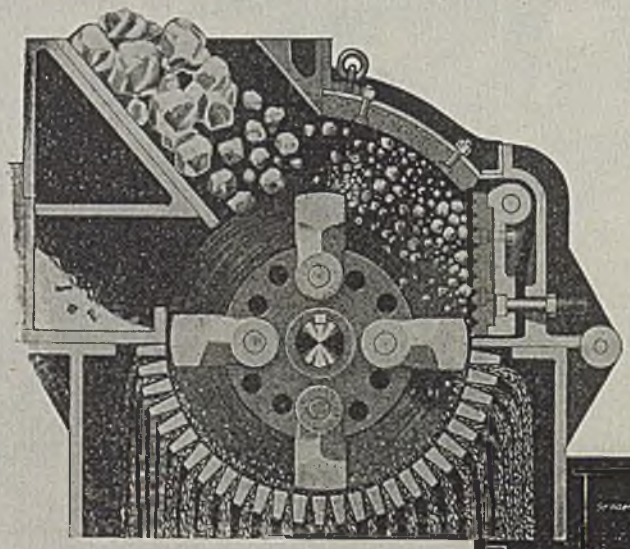
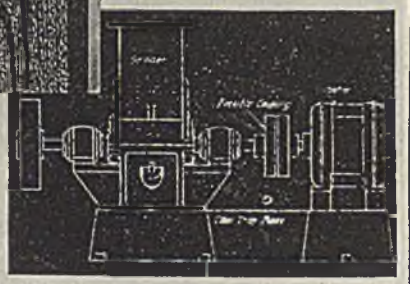


Sectional view of Williams over - running hammermill with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.



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ing, causing changes in circuit performance, unless the design was given sufficient safety factor. Failure to allow for the electron tube as a circuit variable is one reason electrical engineers with power training frequently have trouble designing and applying electronic devices.

A device may work perfectly with a certain set of tubes at the factory, and later when the customer must replace some of the tubes it becomes inoperative. Another difficulty occurs in not allowing for the change of tube characteristics during life of the tubes, and as a result the calibration of the device is found to be in error later, even though perfectly correct at installation.

It is almost always possible to design electronic devices to be independent of the characteristics of the tubes used. As a rule it calls for a higher order of engineering ability, and may raise the cost slightly. The results will be found worth the additional cost, since a well engineered design is indicated.

Performance substantially independent of tube characteristics is especiallly important in a control. A change in tube characteristics may cause a shift in the control point, or a tube failure may cause the control to run away, if the design is not made independent of the tubes.

The weak spot in many electronic applications is not in the electronic circuits but in the mechanical parts used to actuate the electronic control, or in the mechanical parts used to perform the desired operation. These are the features that the electronic engineer will know least about, because they may be peculiar to one application.

The field of automatic control offers possibly the largest opening for electronic equipment in power generation. The advantages of zero input torque, high speed, limitless output torque, and almost unbelievable precision should give electronics a great opportunity. It is here, however, that the greatest engineering skill in application will be required, if electronics is not to receive an irreparable setback at the very beginning.

The war is giving us electronic control devices in considerable variety, but their application to industrial control will not be as easy as the press agents would have us believe. The requirements of performance, safety and dependability are very high and it will be in the application, not in the electronic circuits themselves, that the difficulties will be encountered. Watch for them there and allow the electronic engineer to worry about the tubes.

J. D. Rider, Iowa State College, before Midwest Power Conference, April 14, 1944.

CHLORINATION PROCEDURES IN THE LABORATORY

IN SPITE of the importance of chlorination in organic chemistry, experiments involving chlorination are not ordinarily included in the elementary organic chemistry course. This omission is probably due to the difficulties and dangers involved in supplying a large class with chlorine from tanks, and to the unpleasant characteristics of many chlorination reactions. It has long been known that sulfuryl chloride may be used as a chlorinating agent in the

aromatic series. More recently means have been found to extend the usefulness of the reagent to the aliphatic series. Not only does sulfuryl chloride offer the advantages involved in handling a liquid rather than a gas, but it reacts much more smoothly than chlorine with typical organic substances. A number of chlorination procedures using this convenient chlorinating agent have been developed for student use. Among these may be mentioned the chlorination of n-heptane, cyclohexane, benzene, and toluene (both nuclear and side-chain). These preparations are carried out by the average student in the organic chemistry course without difficulty, using the simple apparatus usually supplied. It is suggested that the use of sulfuryl chloride as a laboratory chlorinating agent offers many advantages, and that one or more of these chlorination experiments may be profitably introduced into the elementary organic course.

H. B. Cutter and H. C. Brown, Wayne University, before Division of Chemical Education, American Chemical Society, Cleveland, Ohio, April 5, 1944.

ENGINEERS IN 1944

If some of our people, in private or public occupations, are still not fully aware that this war, until won, is now the nation's business, their business, they will become aware of it in the months ahead. Our military authorities tell us that the next year will be the critical period, for which all the previous movements of our armed forces have been only strategic preparation. The "big push," in Europe, in the Orient, will be no parade for us to watch and cheer from distant side lines. We at home shall have to do our utmost to support the vast forces which are now getting ready for the real death struggle.

Our own part, as engineers, in the support of our armed forces, is of crucial importance. This is, behind the battle lines, a war of engineers. We have come to know what our engineers are doing in Europe and Africa and Asia, where the fighting has been going on.

Never before has the war service of engineers been so vitally important—in designing and building the machines of war and the machines to make them and the plants where they are made; in planning and providing the processes of production and the means of transportation; and in the most essential operations in the very arenas of combat overseas.

We feel this, not boastfully, not without appreciation of the services and sacrifices of others. It is only that we take pride that our profession can help so greatly in this people's war, can make an even larger contribution than in any previous war, toward victory.

Even more will the peace be a peace of engineers. In postwar America, in the postwar world, they will have opportunities and responsibilities beyond any they had in the prewar years. The reconstruction of a war-torn world involves not only the restoration of the means of self-support in ravaged countries but also the development of industrial resources in many non-industrial countries. It involves in America the reorganiation of production to provide full employment and to reach markets large

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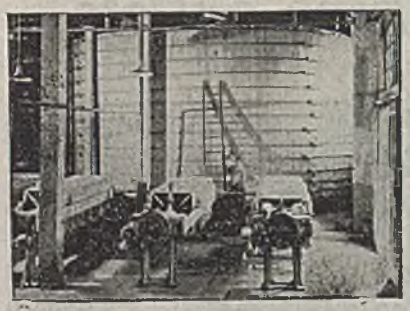

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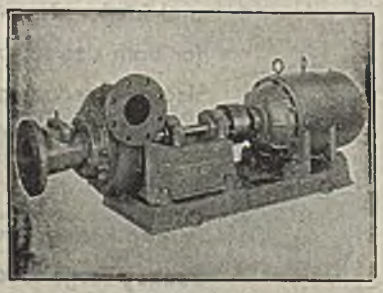

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enough to maintain a high level of production and employment.

This war is more than an interlude between periods of peacetime economic activity and engineering progress. We are right now in a period of intense inventive effort and accelerated scientific and engineering developments. The urgency of war has speeded up the clock. In some lines, the probable developments of 20 or 30 years have been telescoped into three. If this war is over by 1945, we shall not start ahead from where we left off in 1940, when we entered upon our defense program—we shall start ahead from 1945. There will be not only a tremendous accumulation of needs for engineers to meet, but also an extraordinary accumulation of new engineering knowledge.

There's the challenge—and the opportunity—that we face now and that will pile up before us in the year ahead. And as we pass the turning point in the war we must prepare for the efficient application of our resources to the problems of peace.

R. M. Gates, President ASME, before American Society of Mechanical Engineers, Birmingham, Ala., April 4, 1944.

INTERNATIONAL TRADE VIEWED BY AMERICAN LABOR

THE OUTSTANDING postwar problem, both national and international, is to find ways and means to meet in a spirit of justice and human kindness the proper economic aspirations of both nations and individuals in order that the temptation to international war may be removed.

The question presented to every American is whether the United States will shape her life largely in her own way, and in accord with her ideals, or whether she will become inextricably involved in old world interests, habits of thought and economic affairs.

Europe has undergone fundamental changes that may outlast the war. The synthetic production of textile fibers, rubber, gasoline and plastics, the development of processed wood substitutes for metals are only the better-known changes.

American organized labor in the North American continent seeks to maintain the independence of labor unions and business enterprises. In contrast, organized labor in Europe and in the United Kingdom seeks to nationalize basic industry and, by various so-called socialistic measures, tends to change and modify the character of an independent labor movement, in the unfounded hope of capturing control of the state.

This increasing dependence upon the state on the part of organized labor in Europe and the United Kingdom is shared by organized European industry. To an extent not appreciated by either American business or American labor, European and British industry has become increasingly reconciled to dependence upon the state.

There is no convincing evidence that after the war the principal countries of the world will have either the means or the desire to abandon state control of foreign trade and foreign exchange. Emergency conditions will remain for some years in the domestic fields of reconstruction and reemployment, as well as in international trade and financial relations.

World trade after the war will be dominated by state foreign trade agencies and by great corporate and cartel groups. Gigantic corporations, with annual sales and expenditures in excess of the annual budgets of most nations in peace time, cannot be termed "private" or free enterprise. Nor can such terms be applied to rigid international cartel groups which eliminate outside producers and frequently dictate their terms even to smaller nations.

The future of the small and medium-sized manufacturer, and, of the worker, in industries where competition still exists in vigorous forms, is endangered today to a greater extent than ever before in history. The great domestic market provided by the farmers is threatened first by the loss of foreign markets. The former export and domestic markets of competitive American industries are similarly threatened.

American exporters face the prospect of exclusion from former export markets, irrespective of their competitive prices and the superiority of their products.

American producers for the domestic market face the prospect of overexpanded foreign industries, mining companies and agricultural producers seeking to unload, in the United States, war stocks and the products of excess production capacity by state-subsidized export campaigns.

Trade barriers have been adopted by individual nations undoubtedly for different reasons. It is fair to presume they were enacted and adopted in the attempt to protect and promote the interests of the nations concerned. But, the United States has resorted to but one. We do subsidize shipping engaged in foreign trade. However, these shipping companies are operated by private persons and corporations, and, are uninfluenced by government authorities in favoring American trade.

Trade in the postwar period we fear, will not be governed upon an individual and private basis, nor will it be governed by production costs or by prices, domestic or foreign. Instead it will be controlled by the political and economic objectives of each nation concerned with maintaining domestic employment. It is our further judgment that in time, when an expanded production capacity will again be realized by the leading industrial and commercial nations abroad, that the nations confronted with surpluses will be prepared for large scale export dumping.

We should be prepared at all times and under all circumstances to protect our own market and our own people and be ready to meet whatever emergency may arise. So far as lies within our power and influence, let us aid other nations and peoples to attain higher standards of life and of work, and enlarge and enrich the markets of the world. In so doing, let us not be unmindful that the interests of America are of foremost consideration. But regardless of whatever policy or relationship is to govern, let it be formulated and arrived at in open concert, by a democratic procedure, and not by bureaucratic methods or means.

Matthew Woll, vice president, American Federation of Labor, before Manufacturing Chemists' Association, New York, June 1, 1944.

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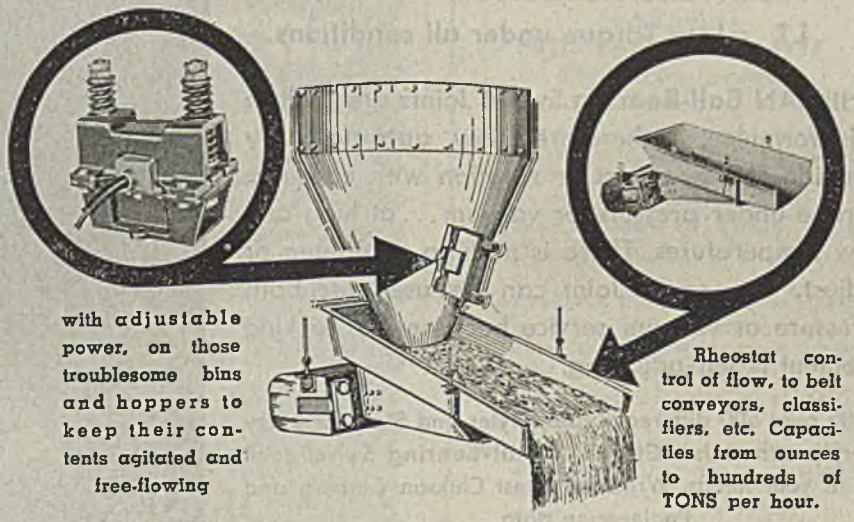

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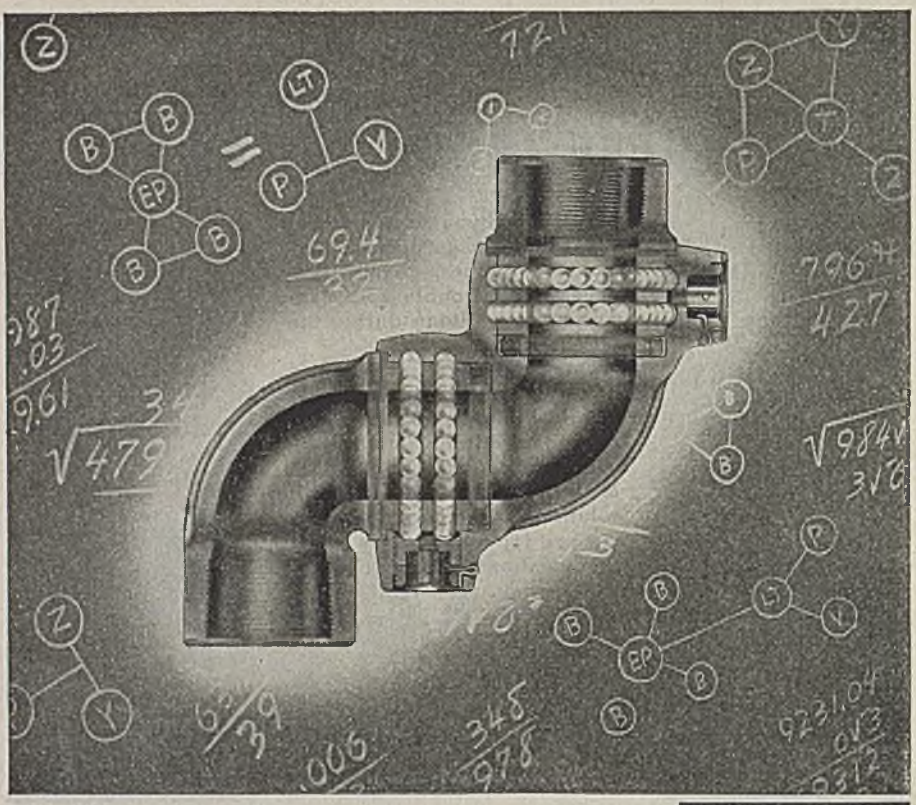

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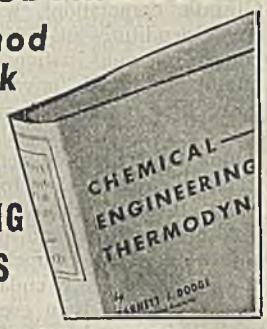

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FOREIGN LITERATURE ABSTRACTS

FREE LIME IN CEMENT

AN ORIGINAL method was developed for analyzing the free lime content of Portland cement by titration with ammonium acetate. Three samples of cement were used and the free lime content was determined by two methods. The results are given in the attached table.

The procedure for the acetate method was as follows: 1 or 2 g. of cement was pulverized and placed in an Erlenmeyer flask containing 60 cc. of an alcohol-glycerin solution and 0.5 cc. of phenolphthalein indicator. The mixture was agitated thoroughly, a reflux condenser was attached to the flask and the contents of the flask boiled 20 min. They were then titrated, while still warm, with an N/10 solution of ammonium acetate until the rose color disappeared. The liquid was returned to the condenser, boiled another 20 min. and again titrated. This operation was repeated until no color reappeared after boiling for an hour. The solution of ammonium acetate was also titrated with calcium oxide obtained by calcination of calcium oxalate as a check.

In the phenol method, 1 or 2 g. of cement was pulverized and placed in a flask containing 25 cc. of an alcohol-phenol solution. A reflux condenser was attached and the liquid boiled 4 hr., agitating it at least once every half hour. The flask was then detached and the liquid filtered by suction, washed 3 times with 10 cc. of absolute alcohol and boiled to eliminate the alcohol. 100 cc. of warm water and several drops of methyl orange were then added and the mixture titrated with N/10 H_2SO_4.

Digest from "Determination of Iron, Titanium and Free Lime in Cement," by Francisco J. Maffei, *Anais da Associacao Quimica do Brasil*, II, No. 4, p. 195-201, 1943. (Published in Brazil.)

Free Calcium in Cement, Percent CaO as Determined by Maffei

Analysis	Sample 1-M		Sample 1-N		Sample 1-O	
	Acetate	Phenol	Acetate	Phenol	Acetate	Phenol
1	1.24	1.10	0.37	0.21	1.11	0.96
2	1.13	1.20	0.26	0.30	1.23	0.99
3	1.02	0.99	1.15	0.42	1.20	1.15
4	1.25	0.99	0.25	0.25	1.28	0.97
5	0.86	0.93	0.15	0.24	1.14	1.05
6	....	0.93	....	0.26	....	1.09
7	....	1.38	....	0.54	....	(0.64)
Mean	1.10	1.07	0.23	0.31	1.20	1.63

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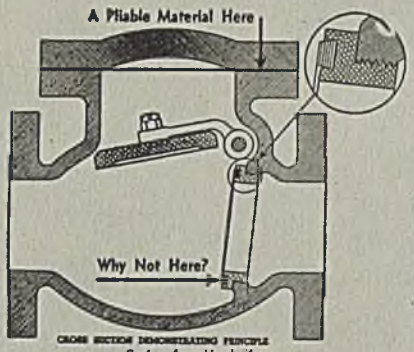

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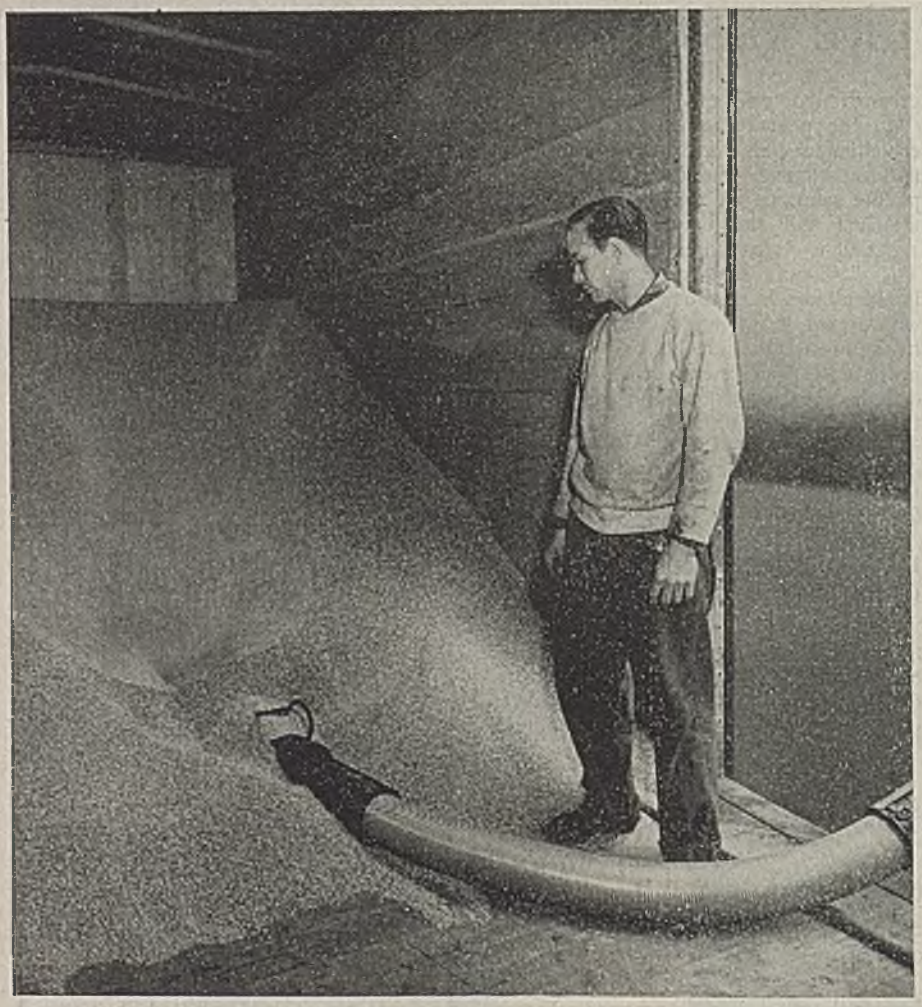

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non of prereaction can be observed empirically in a motor driven by external power, but which works without any ignition, and can best be recognized by the evolution of heat. Recently a new process for carrying out the experiments has been worked out. It has been shown, for instance, that the temperature rise depends to a large extent upon the mixture proportions, the kind of fuel used and especially its octane number, and on certain operating conditions. The method is so sensitive that differences of only two octane units can readily be detected.

In order to perfect the experimental procedure, chemically pure compounds had to be investigated first. This was necessary since the method for the determination of octane number becomes difficult in the presence of both aromatic and paraffin hydrocarbons. If certain assumptions are first made, the newly developed processes can be used directly for the determination of the octane number in such a manner that this can be shown directly from the thermometer reading.

Digest from "Investigations on the Preliminary Reactions in the Otto Engine," by E. Muhlner, *Chem. Zentr.* II, 2446, 1942. (Published in Germany.)

STRUCTURE OF CELLULOSE

A CRITICAL review of available data leads to the conclusion that possibly not only one unit cell model of cellulose exists, but several of them. It is also possible that different positions of the primary valence chains are in equilibrium with each other. On this basis and from a consideration of the results with monomeric carbohydrates, the most probable model is that which provides the most complete saturation of secondary valences.

Digest from "X-ray and Electron-Microscopical Methods for the Determination of the Molecular Structure and Their Application to High Molecular Fibers" by E. Schiebold, *Jentgen's Kunstseide u. Zellwolle*, 24, No. 12, 628–32, Dec. 1942. (Published in Germany.) [From *Bulletin of Institute of Paper Chemistry*, 14, No. 8, 235, Apr. 1944.]

HYDROXYL IN ACETYLENE FLAMES

HYDROCARBONS are of great interest in the study of hydroxylation and since acetylene is one of the simplest hydrocarbons it was chosen for the study of hydroxyl in flames. The concentration of free hydroxyl in flames was measured by the line absorption method described by Kondratyev (1939). Emission spectra were also investigated. A rarefied acetylene flame was produced in a quartz tube which was 72.5 cm. long and had a diameter of 2 cm. This tube passed through a series of three furnaces which were heated electrically by means of nichrome wire, making it possible to maintain a flame three times as long as usual. The temperature was maintained at 660 deg. C.

Amount of water formed in acetylene mixtures was determined by freezing and weighing and was found to have a linear relationship to the pressure. In mixtures containing 30 percent or more acetylene the condensate consisted of white flakes and a transparent oily liquid with a strong odor of formalin and acrolein. The amount of carbon dioxide formed also

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5. **Cleanliness:** Open rolls of roller mill throw dust and flecks into the air. With ball mill all grinding is enclosed within the cylinder.

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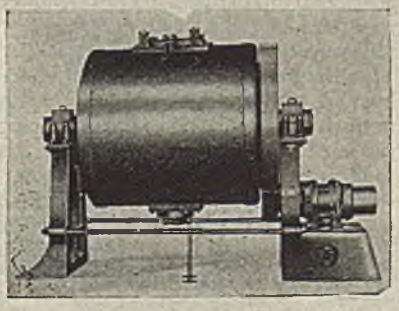

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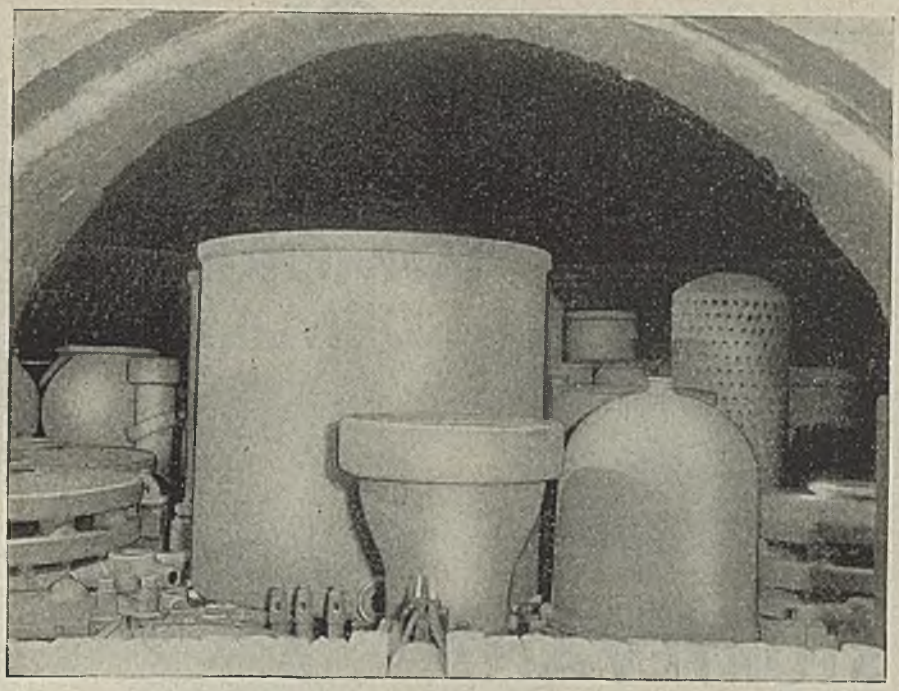

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It is quite an experience to peek into Knight kilns and see the great variety of chemical stoneware pieces they contain.

In these kilns temperatures of over 2200° F. thoroughly vitrify chemical ware designed by Knight engineers and fashioned by Knight craftsmen. One wonders for what purposes these diverse and intricately patterned pieces of equipment will be used.

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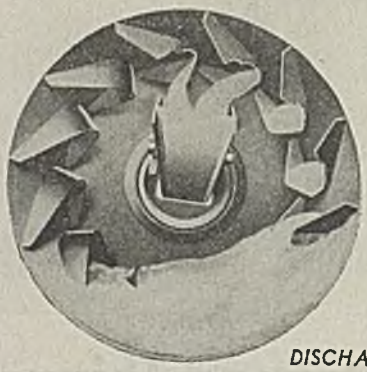

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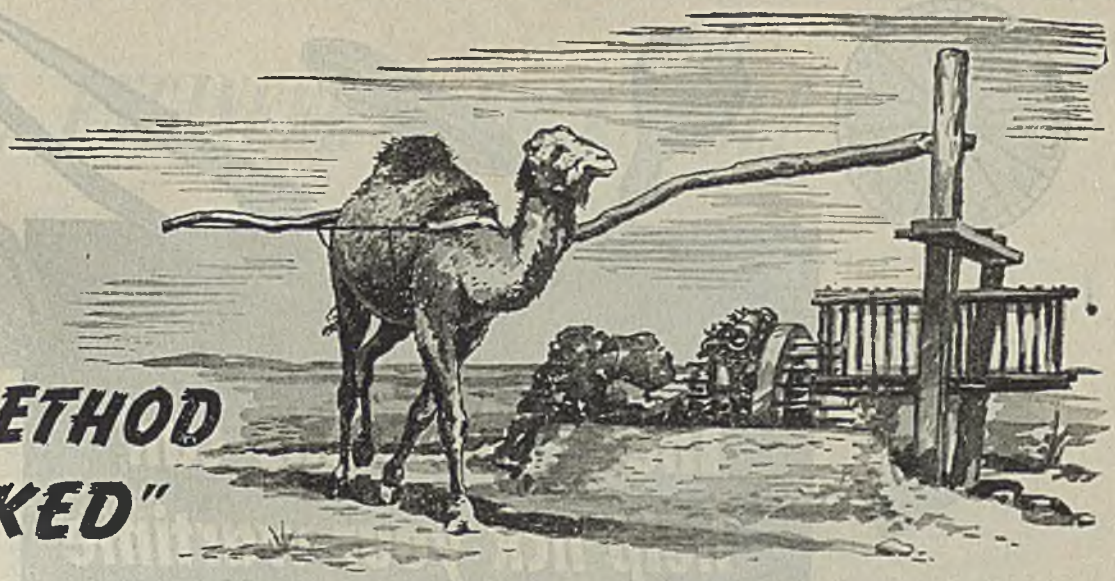
had a linear relationship to the pressure. The stoichiometrical mixture of acetylene and air was found to have the greatest concentration of hydroxyls and may be assumed to also have the highest rate of combustion. Since the absorption was very weak, the temperature of the flame could not be determined by hydroxyl absorption as in the case of hydrogen flame. Although exact data for the concentration of hydroxyl in acetylene flames could not be obtained, the concentration was known to be several times lower than in the case of hydrogen flames. The distribution of the intensity of the emission spectrum of band 3064A showed that the temperature of the rarefied acetylene-air flame was lower than that of the hydrogen flame. Since the hydroxyl concentration increases in proportion to the reaction rate, it was considered likely that water formation in all flames proceeds chiefly, if not entirely, through formation of hydroxyl radicals. Acetylene-air flames produce the highest concentration of hydroxyl in a stoichiometric mixture but hydrogen oxygen flames produce the highest concentration at less than the stoichiometric proportion of hydrogen. An investigation of the emission spectra of hydroxyls in rarefied acetylene-air flames led to the conclusion that the radiation spectra of hydroxyls may be used to determine the absolute concentration of both excited and non excited hydroxyls. This will make it possible to detect much smaller concentrations of OH than by means of absorption spectra.

Digest from "Hydroxyl in Acetylene Flames," by L. I. Avramenko, *Acta Physicochimica* (USSR), 18, No. 1, 58-68 1943. (Published in Russia.)

FIBER STRENGTH AND STRUCTURE

Artificial fibers prepared from cotton and ramie nitrates by spinning from their solutions had the same degree of polymerization as the non-nitrated native fibers, yet possessed considerably lower physical strength properties. This shows that, in addition to the D. P., the arrangement of the thread molecules is responsible for the excellent physical strength properties of the native fibers. The experience that the strength properties of viscose rayon increased with the concentration of the viscose was confirmed. Under the same spinning conditions, cellulose of a higher D. P. yielded a better fiber than one of a lower D. P. Fibers prepared from molten polyamino-caproic acid polymer showed a very considerable increase in strength with relatively little increase in chain length. That this result is not caused by cross bonding of CO and NH groups is deduced from the fact that fibers with such properties were also obtained from polyesters if spun from the molten material. An attempt to apply spinning from the molten material to ethylcellulose resulted in fibers which, in spite of a D. P. as low as 100, showed relatively good physical properties.

Digest from "Relation Between Chain Length of Thread Molecules and the Physical Strength Properties of Fibers Made Therefrom" by H. Staudinger, *Jentgen's Kunsteide u. Zellwolle*, 24, No. 10, 511–12, Oct. 1942. (Published in Germany.) [From *Bulletin of Institute of Paper Chemistry*, 14, No. 8, 255, Apr. 1944.]



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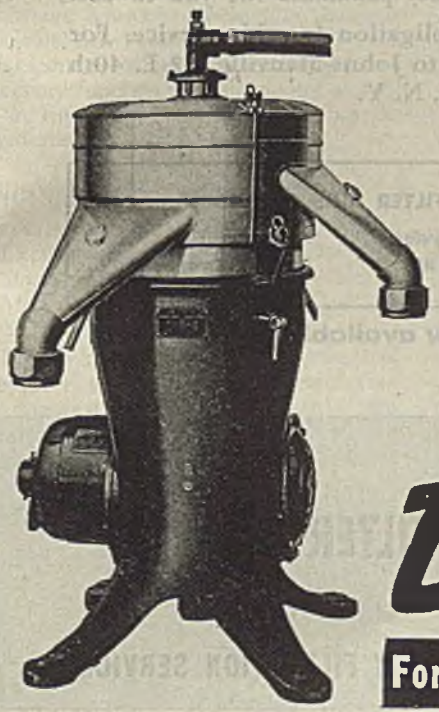

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CHEMICAL ENGINEER'S BOOKSHELF

LESTER B. POPE, Assistant Editor

A BEGINNING

MAGNESIUM: ITS PRODUCTION AND USE. *By Ernest V. Pannell. Published by Pitman Publishing Corp., New York and London. 137 pages. Price $4.*

Reviewed by S. D. Kirkpatrick

MR. PANNELL is the well-informed British metallurgical engineer who gave us the timely review of European magnesium production which was published in the January 1941 issue of Chem.&Met., pp. 78–81. In the present very modest little treatise, he brings together pertinent information on both production and fabrication, with emphasis on the engineering and industrial aspects as contrasted with the scientific and metallurgical phases of magnesium. That greater attention is given to British and German experience is only to be expected but the author has apparently followed American developments quite closely up until our entry into the war. Unfortunately, most of our progress in both production and utilization has been made since 1942 and is not adequately reflected in this first edition.

In the most enlightening report on magnesium issued March 13, 1944, by the Truman Committee (U. S. Senate Report No. 10, part 17, 78th Congress, 2nd Session), it is urged that an educational program should be started immediately to familiarize civilian industry with "the advantages of magnesium and the techniques involved in its use." This little book is an excellent start in that direction. As more current information becomes available, Mr. Pannell's book could readily be expanded to serve a very useful and necessary function in this country as well as in England where magnesium has enjoyed greater acceptance.

ENGINEERING CHEMISTRY

QUANTITATIVE CHEMICAL METHODS FOR ENGINEERING STUDENTS. *By Otto M. Smith and L. F. Sheerar. Published by McGraw-Hill Book Co., New York, N. Y. 118 Pages. Price $2.50.*

INTENDED to give a wider knowledge of the practical application of chemistry in its quantitative engineering respects, this manual is aimed primarily at students of engineering to supplement the quantative courses given in their field. At the same time it demonstrates the necessary principles associated with the chemistry of engineering materials, it undertakes to direct the student toward gaining contact with the materials which all engineers employ and practical skill in the use of analytic tools. It emphasizes the necessity for paying heed to cost and practicality. Instruction in the methods of chemical reference work is included.

N, P, O, S, Se & Te

SYSTEMATIC INORGANIC CHEMISTRY. *By Don M. Yost and Horace Russell, Jr. Published by Prentice-Hall, New York, N. Y. 423 pages. Price $6.*

Reviewed by F. C. Nachod

A GREAT number of excellent textbooks exists in the field of metals, but non-metals have been treated quite frequently as step-children, and thus the work by Drs. Yost and Russell will find enthusiastic reception. The reason becomes clearer by analyzing the full title: "Systematic Inorganic Chemistry of the Fifth-and-Sixth-Group Nonmetallic Elements." The abbreviated title as it appears on the cover is misleading and a better more concise title for the book should have been selected. However, it is a new type of text and reference book. Instead of being merely descriptive as has been customary in many inorganic works, the authors have critically selected data from the literature and in stressing the physico-chemical approach to inorganic chemistry, have provided for a very useful book. The subject matter comprises the chemistry of nitrogen, phosphorus, oxygen, sulphur, selenium and tellurium. Three appendixes containing a bibliography, general constants, and the periodic system add to the value. The book will be equally important to the research worker, the teacher, and the student. It can be recommended without reservation.

REPRINT WITH BIBLIOGRAPHY

INFRARED SPECTROSCOPY — INDUSTRIAL APPLICATIONS AND BIBLIOGRAPHY. *By R. Bowling Barnes, Robert C. Gore, Urner Liddel and Van Zandt Williams. Published by Reinhold Publishing Corp., New York, N. Y. 236 pages. Price $2.25.*

INFRARED spectroscopy is finding new applications in industry and promises to become a tool of great usefulness just as emission and absorption spectroscopy. Many in the field will welcome the fact that the article which appeared in *Industrial and Engineering Chemistry, Analytical Edition*, 15, No. 11, 659–709, now reappears in book form, amplified by a bibliography with over 2,700 references. All data presented refer to work carried out by the authors with their instrument. It would have been interesting to know about other instruments and work carried out at other laboratories and critically compare data and possible deviations rooted in the experimental set up. Probably little information aside from the authors' systematic work is yet available, and critical comparison must be postponed until the method finds more widespread use.

FROM THE SAGE OF K.C.

FROM A CHEMIST'S DIARY. *By Roy Cross. Published as Bulletin 29 of Kansas City Testing Laboratory, Kansas City, Mo. 315 pages. Price $3.*

Reviewed by S. D. Kirkpatrick

THE DEATH not long ago in Topeka, Kansas of William Allen White brought to mind an eminent member of the chemical profession whose active life has in many ways paralleled that of the great Kansas editor. After Dr. Roy Cross graduated from the University of Kansas in 1905, his friends and family suggested that he should "go East" for further study before engaging in the practice of the profession of medicine for which he had been trained. Instead he decided to embark on a career in chemistry and when he found he could not find an employer he started his own company. In association with his older brother, the late Walter Cross, he founded the Kansas City Testing Laboratory that has since been the home and guiding motive of a productive career which has affected people and industries all over the world.

More than 60 United States patents attest to his productivity as an inventor and developer of commercial processes. More than 200 industrial plants, mostly in the petroleum and natural gas industries, have been built to his design. He produces oil from his own oilwells where he puts into practice his own theories and conservation processes. He owns and manages a large acreage of farmland—yet nearly every week day will find him working in his well insulated and isolated office-library-laboratory on the second floor at 700 Baltimore Ave. in Kansas City.

Should you care to know more about the very catholic interests of this interesting man as well as the wholesome personal philosophy that has guided his whole career, this reviewer respectfully suggests the reading of this remarkable diary. It is almost impossible to review it except to say that it is Roy Cross, his life, hopes and aspirations, his thinking on professional problems in the field of chemical engineer-

RECENT BOOKS RECEIVED

Ancient and Medieval Dyes. By W. F. Leggett. Chemical. $2.50.

Experimental Spectroscopy. By R. A. Sawyer. Prentice-Hall. $5.

Explosives, Their Anatomy and Destructiveness. By C. S. Robinson. McGraw-Hill. $1.50.

Principles of Powder Metallurgy. By Franz Skaupy. Philosophical Library. $3.

Soybean Chemistry and Technology. By K. S. Markley & W. H. Goss. Chemical. $3.50.

The Standardization of Volumetric Solutions. 2nd ed. By R. B. Bradstreet. Chemical. $2.75.

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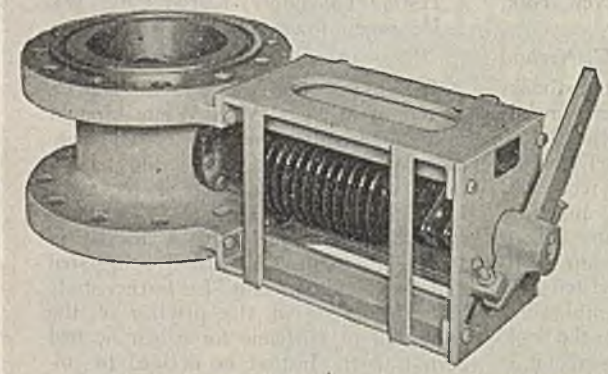

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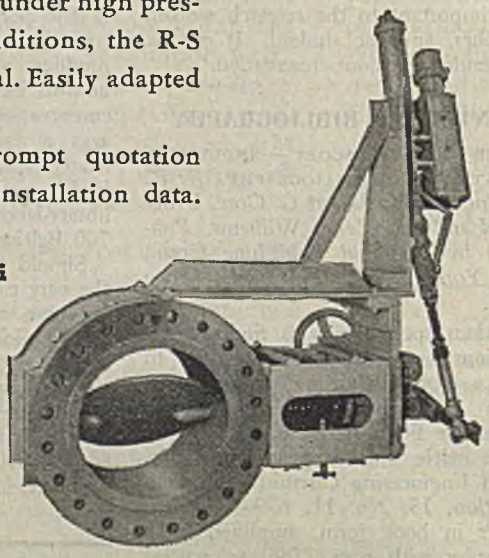

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ing, his views on industry and agriculture, his world-wide travels and diversifications —even a chemical engineer's answer to William Allen White's historic question, "What's the Matter with Kansas?" In all there are 95 individual and highly individualistic essays packed into the 315 pages of this diary of a consultant whose 40 years of investigations have covered "almost everything that can be seen, smelled, tasted or touched."

ELECTROMECHANICAL PRODUCTS

MATERIALS AND PROCESSES. *Edited by James F. Young. Published by John Wiley and Sons, New York, N. Y. 628 pages. Price $5.*

AN ENGINEER is always confronted with the task of selecting suitable materials for the design of unit apparatus for carrying out processes. Much will depend on the right selection in order to make the designed equipment a success. This book is a guide for selection of materials. Of course this is a very large field, and it should be borne in mind that only certain phases of the subject can be adequately discussed within the frame of this text. The editor has stated in his preface that "this textbook considers chiefly the materials and processes used in manufacturing electromechanical products." This is understandable, inasmuch as the text is one of the series written in the interest of the General Advanced Engineering Program.

First part of the book, materials, gives an introduction to metallurgy, and physicochemical principles are stressed. The nature of pure metals, alloys, mechanical properties of metals, iron and steel, nonferrous metals and alloys, heat treatment, corrosion, magnetic and electrical properties of metals, electrical insulation, and plastics and their molding are discussed in this part. The second half, devoted to processes, deals with casting, powder metallurgy, hot and cold working, welding and allied processes, machining, gaging, inspection and quality control, and cleaning, plating and finishing of metals.

The book is primarily meant as a guide and should not be relied upon as comprehensive information for any given problem. So only 26 pages are devoted to corrosion phenomena. However, the book should be of value to the engineer, the designer and the draftsman if the limitations pointed out are kept in mind.

FLOW OF MATTER

A SURVEY OF GENERAL AND APPLIED RHEOLOGY. *By G. W. Scott Blair. Published by Pitman Publishing Corp., New York, N. Y. 196 pages. Price $4.*

Reviewed by Robert Simha

THIS book by a British author forms an interesting attempt to present with a minimum of mathematical effort the stress-strain-time behavior of that large class of materials which can be approximated neither by that of an elastic solid nor that of a Newtonian fluid. Thixotropy, structural viscosity, dilatancy and related phenomena are consequently included. The treatment is based upon what the author calls the "analytical" as well as

upon the "integral" method, according to whether or not an answer is sought in terms of superpositions of purely elastic and purely viscous contributions.

The author begins with a brief historic introduction to experiments and considerations of a rheological nature put forward since the time of the Egyptians. The book is then divided into two parts. After a brief summary of the familiar relations existing between the elastic constants and of some of the attempts made to relate viscosity to the nature of the liquid state, types of deviation from Hookean or Newtonian response encountered are discussed and questions referring to nomenclature considered. Interesting data by the author about the relation between some rheological properties of cervical secretions and physiological cycles in animals are included. In the remainder of the first half of the volume methods of measurement are discussed and a rheological table is presented in which various materials are characterized roughly in terms of eight rheological properties. References to 23 methods used apart from subjective handling make this chapter particularly useful to the practical rheologist.

In the second part some of the results obtained by the "analytical" and "integral" methods in formulating general stress-strain-time relations are reviewed. The discussion of the latter method is based mainly on the empirical power relations first proposed by Nutting. The last four chapters are wholly concerned with psycho-physical aspects of rheological questions. This part of the book is the most original one and deals to a large extent with the author's own work on the relation between data obtained in an objective manner and subjective judgments. This leads him to conclude with considerations on the application of Gestalt psychology to the analysis of rheological data. No misprints have come to the reviewer's attention with the exception of an error in the equations in the middle of page 147, where the negative one should be placed in the respective exponents.

This work forms a useful guide for the reader who desires to find out what problems are dealt with in the field of rheology. The extensive bibliography will aid in this endeavor. Those engaged in rheological measurements for one reason or another, will find much of interest in this survey.

RECENT BOOKS & PAMPHLETS

Occupations in Plastics. By Max Alpert. Published by Occupational Index, Inc., New York University, New York 3, N. Y. 6 pages. Price 25 cents. Brief descriptions of 15 different jobs, the abilities and preparations required, average earnings, methods of getting a job, and the principal manufacturing areas.

Corn Facts and Figures. Prepared and issued by the Corn Industries Research Foundation, 5 East 45th St., New York 17, N. Y. 46 pages. A statistical resume of information on corn production and the utilization of corn, both as feed and for industrial corn products.

Sintering of Ore and Blast-Furnace Flue Dust; A Bibliography. By Leo Filar. Published by Carnegie Library of Pittsburgh. 31 pages. Reprinted from "The Blast Furnace and Steel Plant."

Code of Minimum Standards, Constitution and By-Laws of the National Council of Technical Schools. Published by the Council, 839 Seven-

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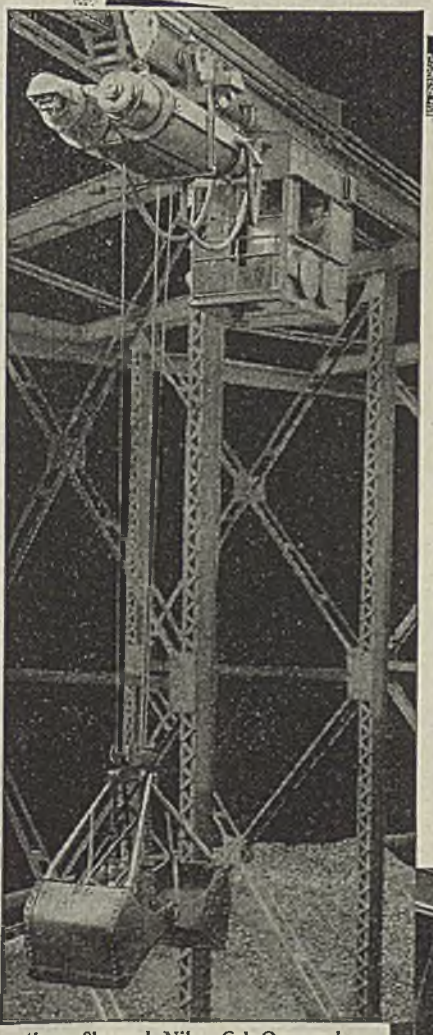

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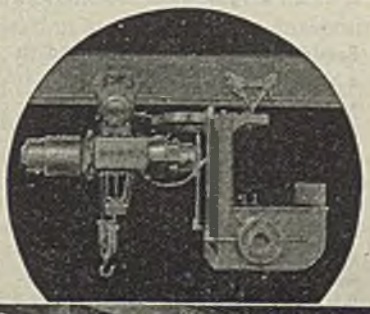

Above: Shepard Niles Cab-Operated Monorail equipped with clamshell bucket. For indoor or outdoor service.

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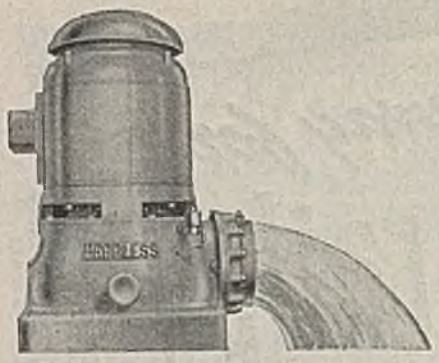

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Fourth St., N.W., Washington 6, D.C. 17 pages.

Wear. By D. Landau. Published by the Nitralloy Corp., 230 Park Ave., New York 17, N.Y. 46 Pages. A description of the mechanism of wear phenomena and influencing factors.

Suggested Procedure for Conducting First-Aid and Mine Rescue Contests. By G. W. Grove. For sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. Price 15 cents. 92 pages. Revision of Bureau of Mines Technical Paper 579 (1937).

Charles Tennant. By Sir William Alexander. Published by American-British Chemical Supplies, 180 Madison Ave., New York 15, N.Y. 24 pages. Gratis. The story of original Charles Tennant work in the field of chemistry. First of a series of Endowed Memorial Lectures.

Toxicity and Potential Dangers of Penta-Erythritol-Tetranitrate (PETN). By W. F. Van Oettingen and others. Public Health Bulletin No. 282, for sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. 39 pages. Price 10 cents. Results of studies undertaken in order to safeguard the health of workers engaged in the manufacture and handling of this powerful explosive.

Manual of A.S.T.M. Standards on Refractory Materials. Published by the American Society for Testing Materials, 260 So. Broad St., Philadelphia 2, Pa. 201 pages. Price $1.50. Contains standards and other pertinent information and data including new standards for air-setting refractory mortars, fire-clay plastic refractories both for boiler and incinerator service, methods of test for measuring the shrinkage, spalling, and workability index of fire clay plastic refractories, and a method for measuring the thermal conductivity of insulating fire brick.

Dow and Magnesium. Published by the Dow Chemical Co., Midland, Mich. 76 pages. A statement filed by the President and General Manager of Dow with the Special Committee of the United States Senate Investigating the National Defense Program.

Common Blunders of Modern Business. Report No. 154 published by George S. May Business Foundation, 111 So. Dearborn St., Chicago 3, Ill. 10 pages. Faults, mistakes and shortcomings of present day business with some suggestions as to their correction.

The A. B. C. of Luminescence. Published by the New Jersey Zinc Co., 160 Front St., New York 7, N.Y. 24 pages. Principles and their application in activated fluorescent and phosphorescent pigments.

The Grade Terminology Problem. By Iler J. Fairchild. National Bureau of Standards, Miscellaneous Publication M173, available from Superintendent of Documents, U. S. Government Printing Office, Washington 25, D.C. 29 pages; price 10 cents. Grade terms, designation and bases for grading or rating for 64 commodities and characteristics selected as broadly representative of the various grading systems used in the U. S.

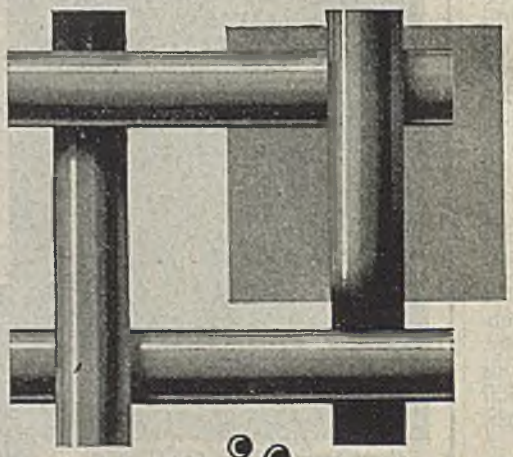
Inflammability and Explosibility of Powders Used in the Plastic Industry. By Irving Hartmann and John Nagy. Bureau of Mines Report of Investigations 3751. 38 pages. Results of a study undertaken as part of a program designed to promote safety in industrial operations.

Mineral Wool; Blanket Blocks, Insulating Cement, and Pipe Insulation for Heated Industrial Equipment. Commercial Standard CS117-44 available from Industrial Mineral Wool Institute, 441 Lexington Ave., New York 17, N.Y. 30 pages Gratis. High temperature insulation standards promulgated by the Bureau of Standards and designed to serve best interests of industrial and commercial consumers.

Picking Products That Pay. Report No. 153 published by the George S. May Business Foundation, 111 So. Dearborn St., Chicago 3, Ill. 15 pages. A study by the Foundation to help businesses "know your costs."

New York Means Business. Published by Department of Commerce, State of New York, Albany, N. Y. 48 pages. Describes industrial facilities and contains data about business opportunity in the Empire State.

Symposium on the Significance of the Hardness Test of Metals in Relation to Design. Published by American Society for Testing Materials, 260 S. Broad St. Philadelphia 2, Pa. 60 pages. Price 75 cents. A symposium presented at the 46th annual meeting, June 1943.



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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering any publications noted in this list always give the complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. All publications are in paper covers unless otherwise specified. When no price is indicated, the pamphlet is free and should be ordered from the Bureau responsible for its issue.

Neoprene (GR-M). Safeguarding Workers Handling Synthetic Rubber in the Rubber Industry. Rubber Series No. 1. U. S. Department of Labor. Price 10 cents.

Fifteenth Report to Congress on Lend-Lease Operations, for the Period Ended March 31, 1944. Price 30 cents.

Book Republication Program, List II. Titles licensed for republication with a subject index and list of names and addresses of licensed publishers (of foreign books). Office of Alien Property Custodian.

Simplified Practice Recommendations. Alphabetical List Revised to June 1, 1944. Letter Circular LC-750. National Bureau of Standards. Mimeographed.

Paint and Varnish Removers. Letter Circular LC-749. National Bureau of Standards. Mimeographed.

Mercury. U. S. Tariff Commission. War Changes in Industry Series Report No. 4. Mimeographed.

Tungsten Deposits in the Boriana District and the Aquarius Range, Mohave County, Arizona. By S. W. Hobbs. Geological Survey Bulletin 940-I. Price 40 cents.

Painting Exterior Walls of Porous Masonry. National Bureau of Standards Letter Circular LC747. Mimeographed.

A List of Publications on 2,2-Bis (Parachlorophenyl)-1,1,1—Trichloroethane (Called DDT) from 1874 to April 30, 1944, Inclusive. By R. C. Roark. Bureau of Entomology and Plant Quarantine. Mimeographed.

Food Consumption Levels in the United States, Canada and the United Kingdom (Report of a special Joint Committee set up by the Combined Food Board). War Food Administration. Price 20 cents.

Experiment Station Research on the Vitamin Content and the Preservation of Foods. By Georgian Adams and Sybil L. Smith. U. S. Department of Agriculture. Miscellaneous Publication No. 536. Price 10 cents.

Lead Production, Consumption and Stocks Since the War. May, 1944. Tin and Lead Division, War Production Board. Mimeographed.

Styrene Dibromide: A Substitute for Pyrethrum in Insecticidal Oil Used for Control of Earworms in Sweet Corn. By G. W. Barber and J. Wilcox. Bureau of Entomology and Plant Quarantine, No. E-619. Mimeographed.

Map of the Oil and Gas Fields of the State of Wyoming. By William G. Pierce, Jane Hanna, and Roselle M. Girard. Purchase from Director, Geological Survey, Washington 25, D. C. Price 50 cents.

Map of Arkansas Bauxite District, Pulaski and Saline Counties, Ark. By R. C. Shelton and E. B. Parmelee. 1 sheet, 31 by 14 inches. Purchase from Director, Geological Survey, Washington 25, D. C. Price 50 cents.

Nickel-Silicate and Associated Nickel-Cobalt-Manganese-Oxide Deposits near Sao Jose do Tocantins, Goiaz, Brazil. By W. T. Pecora. Geological Survey Bulletin 935-E. Price $1.00.

Manganese Deposits in Part of the Sierra Maestra, Cuba. By C. F. Park, Jr., and M. W.

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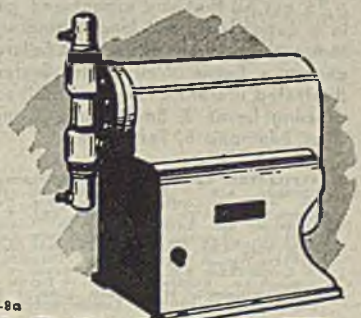

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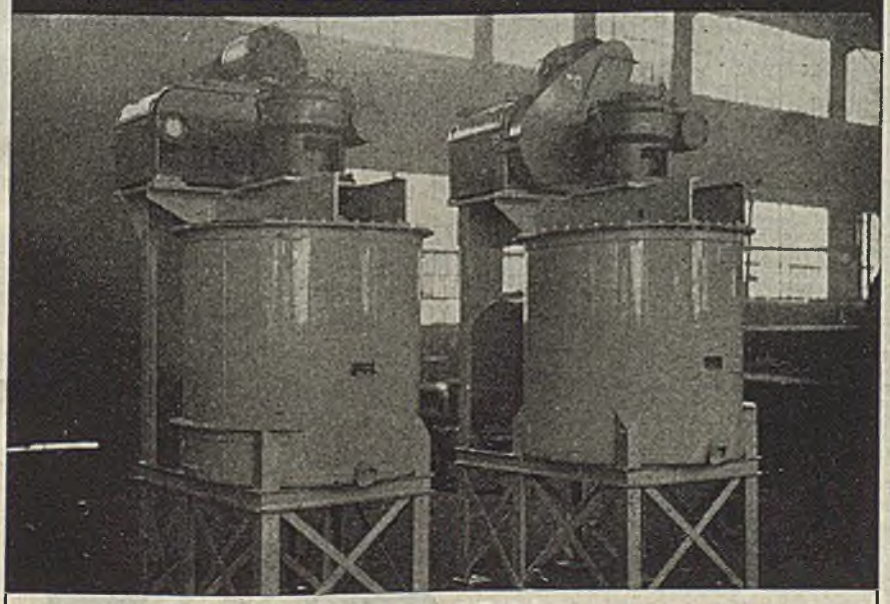

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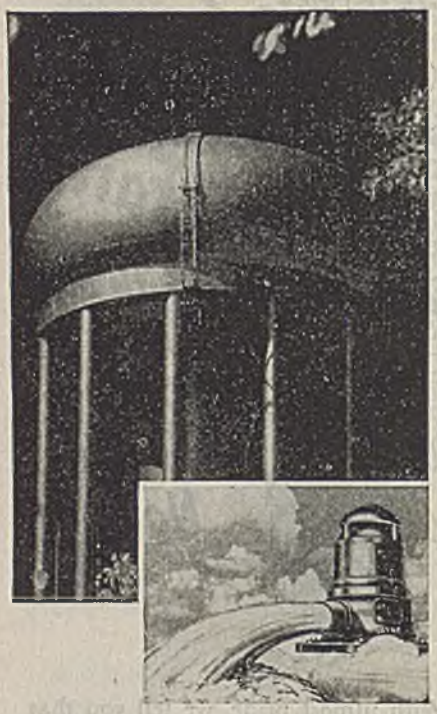

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Cox. Geological Survey Bulletin 935-F. Price 75 cents.

Strategic Minerals Investigations, 1942. Geological Survey Bulletin 936. Price 10 cents.

Bibliography of North American Geology, 1929–1939. By E. M. Thom. Part 1, Bibliography; Part 2, Index. Geological Survey Bulletin 937. Price, Parts 1 and 2 in one buckram-bound volume, $2.50.

Water Levels and Artesian Pressure in Observation Wells in the United States in 1942. Part 3, North-Central States. Geological Survey Water-Supply Paper 946. Price 40 cents.

Coal Carbonization: Carbonizing Properties of Medium-Volatile Coals of Different Types. By D. A. Reynolds and J. D. Davies. Bureau of Mines Report of Investigations R. I. 3749. Mimeographed.

Periodic Pincer to Control Flow of Wet Ore Pulp Through an Orifice. By G. Dale Coe and Will H. Coghill. Bureau of Mines Report of Investigations R. I. 3750. Mimeographed.

Fluorescent Minerals Used in Lighting and Elsewhere. By Oliver C. Ralston and A. George Stern. Bureau of Mines Information Circular I. C. 7276. Mimeographed.

Some Suggestions on Care in the Use and Handling of Explosives in Coal Mines. By Lloyd G. Fitzgerald. Bureau of Mines Information Circular I. C. 7278. Mimeographed.

Loss of Life Among Wearers of Oxygen-Breathing Apparatus. By G. W. Grove. Bureau of Mines Information Circular I. C. 7279. Mimeographed.

Tentative Inspection Standards for Anthracite Mines. Revised March 1944. Bureau of Mines Information Circular I. C. 7282. Mimeographed.

Permissible Mine Equipment Approved During 1943. By E. J. Gleim. Bureau of Mines Information Circular I. C. 7283. Mimeographed.

Possible Hazards Attending the Use of Engines Operated on Butane Fuel in Mining and Tunneling. By L. B. Berger and H. H. Schrenk. Bureau of Mines Information Circular I. C. 7284. Mimeographed.

Safety Blasting Practices in a New York Quarry. By Norman King and Allen D. Look. Bureau of Mines Report of Investigations R. I. 3752. Mimeographed.

Anthracite Mine Fires; Their Behavior and Control. By G. S. Scott. Bureau of Mines Bulletin No. 455. Price 40 cents.

Development and Use of Certain Flotation Reagents. By R. S. Dean and P. M. Ambrose. Bureau of Mines Bulletin No. 449. Price 15 cents.

Mineral Statistics.. Preliminary figures for 1943 production of metals, minerals, and mineral products have recently been released in the Mineral Market Reports of the U. S. Bureau of Mines as one- or two-page mimeographed press releases of the "MMS" series. The following subjects have been reported on: Gem Stones; Salt; Mineral Earth Pigments and Manufactured Iron Oxide Pigments; Lead and Zinc Pigments and Zinc Salts; Mercury; Gypsum; Boron-Minerals; Carbon Black; Mineral Wool; Talc, Pyrophyllite, and Ground Soapstone; Natural Sodium Sulphates and Carbonates; Bromine; Natural Calcium Chloride; Lithium Minerals; Vermiculite; Graphite; Kyanite, Andalusite, and Dumortierite; Celestite; Feldspar.

Pacific Northwest Opportunities. A graphic summary published by Bonneville Power Administration giving data on power, natural resources, present and prospective industrial development, and other information intended to stimulate interest of industry in the Pacific Northwest states. Considerable information on the chemical industries is included. Copies of the report are available from Bonneville Power Administration, Guardian Building, Portland, Oregon, without charge.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog on the following items: Plastic; light-diffusing (for) lighting-fixtures—L-P-384. Sutures, surgical; silk and nylon—GG-S-816. T Squares; plastic, wood, and wood-and-plastic—GG-T-711b. Gaskets; rubber (natural or synthetic), molded, sheet, and strip—HH-G-156a. Packing; asbestos, sheet, compressed—HH P-46a. Packing; diaphragm—HH-P-61c. Aluminum-alloy (AL-61) (aluminum-magnesium-silicon-copper-chromium); bars, rods, shapes, and wire—QQ-A-325. Price 5 cents each.

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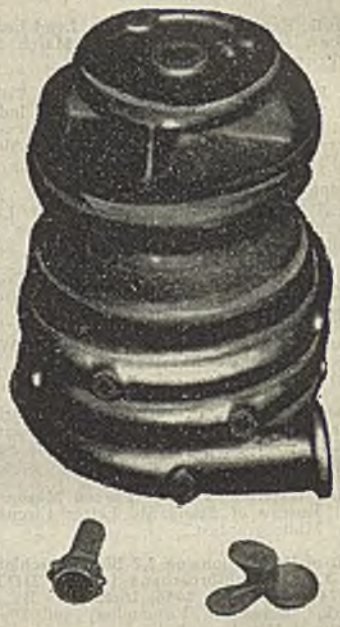

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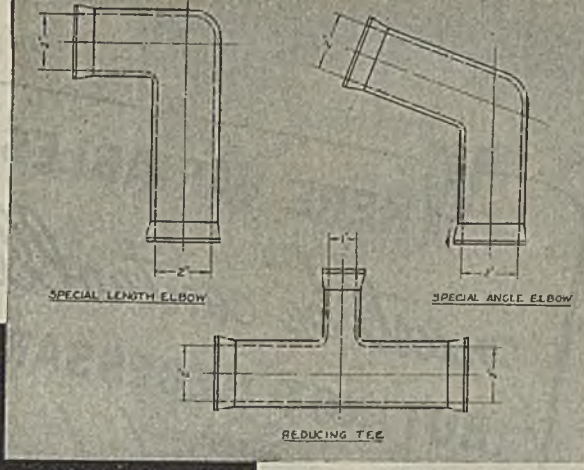

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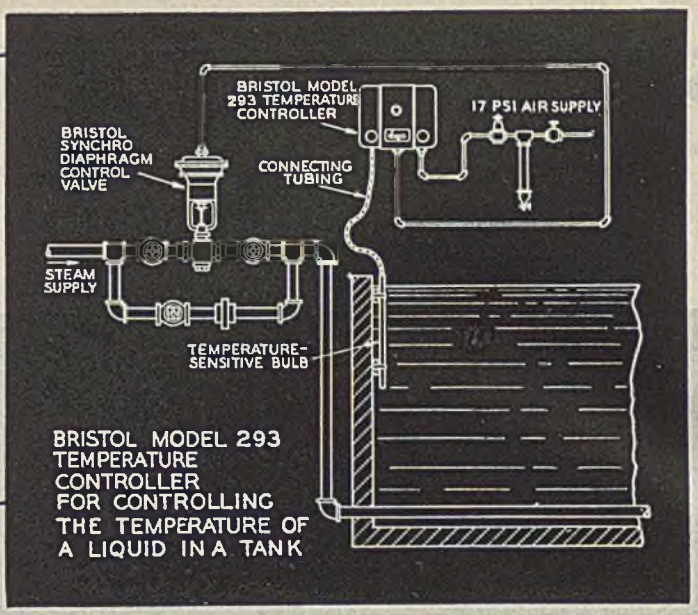

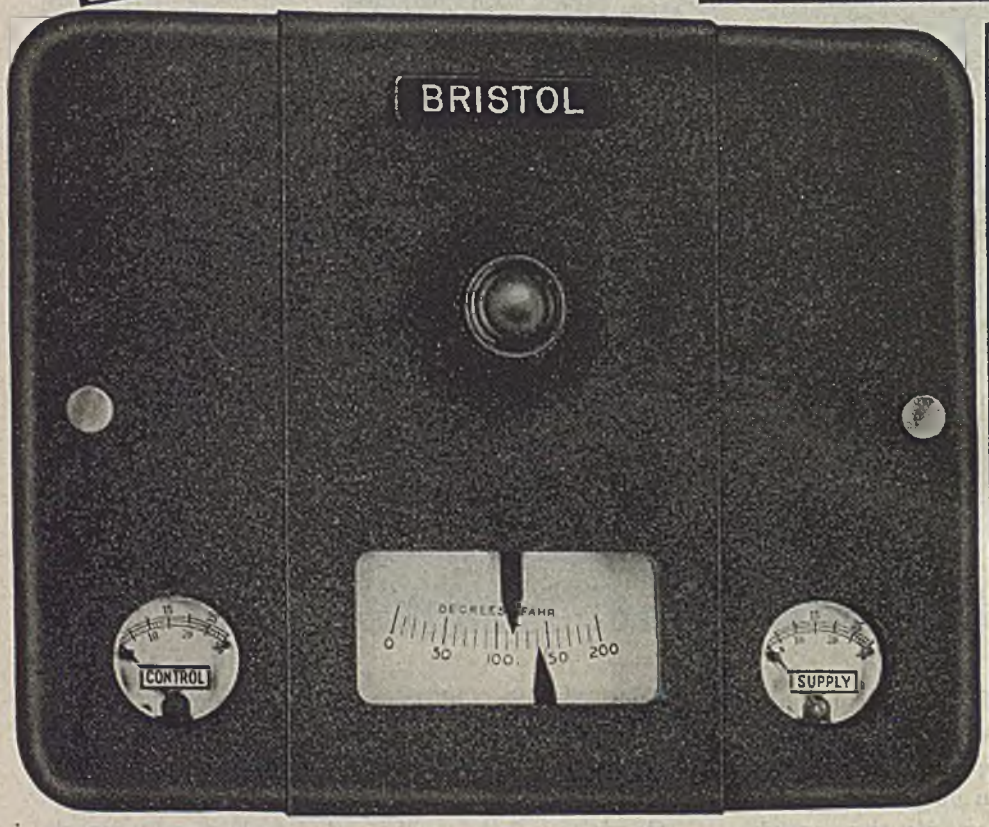

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Belts. Chain Belt Co., Milwaukee, Wis.—8-page illustrated bulletin covering Rex Z-Metal chain belts. Lists properties of Z-Metal and types of chain belts available. Bulletin 437.

Cable Terminators. Delta Star Electric Co., 2400 Block, Fulton St., Chicago 12, Ill.—Describes sealed type single- and three-conductor equipment cable terminators, with construction details, dimensions and electrical characteristics. Bulletin 4405.

Continuous Printer. Charles Bruning Co., Inc., 100 Reade St., New York 13, N. Y.—4-page folder discussing characteristics of this concern's line of continuous photographic printers. Supplies current requirements, speed information. Bulletin A-1001.

Controllers. Grove Regulator Co., 1190 67th St., Oakland 8, Calif.—8-page illustrated bulletin describing this company's steam pressure reducing controller, Model 77. Covers design, construction, principle of operation, the Powreactor Dome, and the capacities of valves for use on steam. Bulletin No. 124-A.

Electronic Products. North American Philips Co., Inc., 100 East 42nd St., New York 17, N.Y.—24-page illustrated booklet intended as a general introduction to this concern and its products, its present status and future aims and its affiliations. Bulletin CB.

Electronic Relay. General Electric Co., Schenectady, N.Y.—8-page booklet presenting the purpose and operation principles of an electronic relay control. Contains explanatory drawings and gives detailed information on several typical applications. Bulletin GEA-4214.

Enameling. Frit and Porcelain Enameling Sheet Manufacturers, 19 West 44th St., New York 18, N.Y.—12-page booklet dealing with the preparation of metal for enameling, cleaning processes, control of pickling solutions.

Equipment. Carrier Corp., Syracuse, N.Y.—8-page folder containing condensed data on equipment for temperature and humidity control, refrigeration and industrial heating, and miscellaneous equipment. Bulletin AC-162.

Gear Speed Reducers and Cut Gears. D. O. James Manufacturing Co., 1140 West Monroe St., Chicago, Ill.—376-page, stiff cover, bound, combination catalog containing complete specification data, rating tables under varying conditions, dimension tables, information on loads, mounting positions of continuous-tooth herringbone and planetary gear speed reducers, right angle spiral bevel, right angle spiral bevel herringbone and planetary gear speed reducers, worm gear speed reducers, motorized worm gear speed reducers and flexible couplings, combination automatic backstop and flexible couplings. Includes detailed price charts. Profusely illustrated. Catalog No. 1000 R.

Heating Elements. H. A. Mfg. Co., Inc., Engineering Dept., 86-100 Leroy Ave., Buffalo 14, N.Y.—16-page illustrated booklet presenting applications of specially designed electric contact heaters in the war effort.

Heat Killers. Coppus Engineering Corp., Worcester 2, Mass.—Bulletin giving information on recent designs in man-cooling equipment with data on characteristics and applications. Bulletin 160-6.

Heavy-Media Separation. American Cyanamid Co., 30 Rockefeller Plaza, New York 20, N.Y.—4-page pictured leaflet concerning this company's progress in developing, and future applications of, heavy-media separation in ore treatment.

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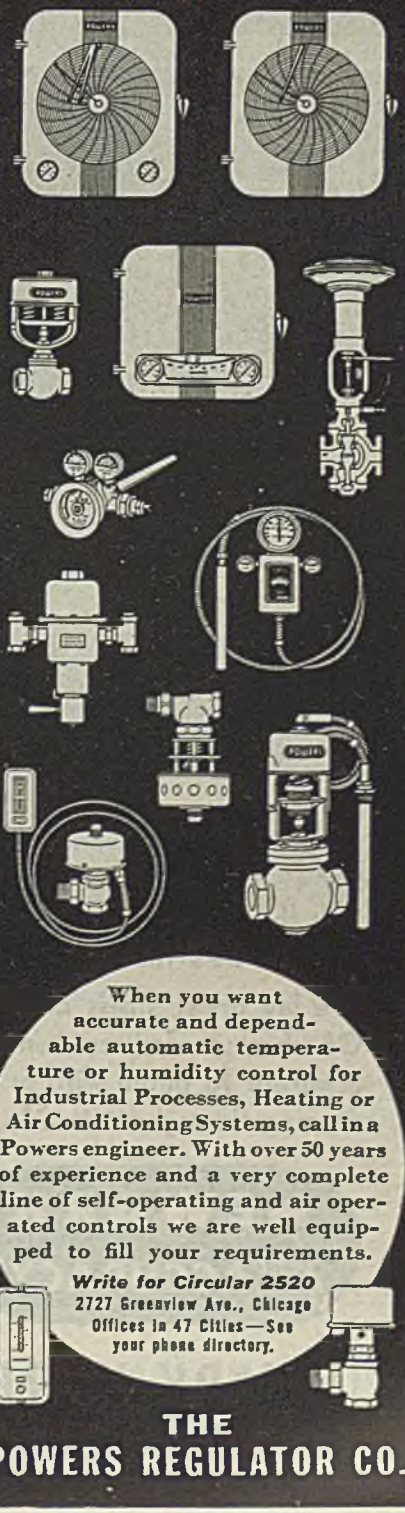

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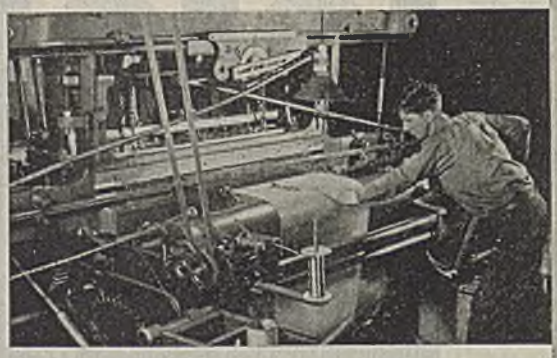

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ing Glass Co., Corning, N.Y.—4-page leaflet, No. 838, describing the characteristics of 96 percent silica glass No. 790, for high temperature use; Bulletin No. 843, 4-page price list for Pyrex tubing; 8-page Bulletin No. 844, presenting the properties of Pyrex resistant glass with a table of physical constants; 12-page Bulletin No. 839 with detailed data on installation of Pyrex piping; 4-page Bulletin No. 840 on adaptor connections; and 2-page Bulletin No. 841 on valve specifications.

Photoelectric Control. Photoswitch Inc., 77 Broadway, Cambridge 42, Mass.—4-page bulletin describing a photoelectric control for transparency measurement of liquids, gases, films, filters, plastics and similar materials. Bulletin 316.

Pressure Filtration. Niagara Filter Corp., 3080 Main St., Buffalo, N.Y.—6-page bulletin illustrating sizes of and variations in design, in pressure filtration equipment, also giving operation information. Contains drawings illustrating numerous types and check list of filter applications. Bulletin C-444.

Protective Coatings. Prufcoat Laboratories, Inc., 63 Main St., Cambridge 42, Mass.—4-page bulletin dealing with specifications for new construction, maintenance, and equipment painting with Prufcoat, a protective coating for metal and concrete, said to prevent corrosion due to acids, caustics and corrosive fumes in most concentrations at normal temperatures and in many cases at elevated temperatures up to 230 deg. F.

Pumps. Blackmer Pump Co., Grand Rapids 9, Mich.—6-page illustrated folder describing this concern's line of rotary pumps and their operation. Design data included. Bulletin 304.

Pumps. Roots-Connersville Blower Corp., Connersville, Ind.—4-page illustrated bulletin devoted to this concern's Cycloidal Rotary Pumps and showing various driving arrangements and typical installations. Bulletin 61-B11.

Pumps. Worthington Pump and Machinery Corp., Harrison, N. J.—4-page illustrated bulletin concerned with vertical coolant and circulating Monobloc centrifugal pumps for general circulating services and the handling of coolants containing particles of abrasives and fine chips. Includes diagrams and performances and design data.

Pumps. Worthington Pump & Machinery Corp., Harrison, N. J.—4-page folder describing functional characteristics of Type HD single-stage volute centrifugal pumps for refinery service. Includes cross-section and dimensional drawings. Bulletin W-341-B9.

Refrigeration Compressors. Worthington Pump & Machinery Corp., Harrison, N. J.—4-page folder showing outstanding features of roller bearing compressors with labeled design drawing and specification listings. Bulletin C-1100-B18.

Sediment Strainer. American District Steam Co., North Tonawanda, N.Y.—1-page price bulletin dealing with a new Y-type sediment strainer in the 125 lb. standard, added to the ADSCO line of steam specialties. No. 89-4.

Tanks. Heil Engineering Co., 12901 Elmwood Ave., Cleveland 11, Ohio—4-page folder of new information relative to tank heating and agitating problems. Tabulates jets for specified purposes and presents a sketch showing jet arrangements in tanks. Bulletin 43.

Tanks. Tivit Products Co., 8024 South Vermont Ave., Los Angeles 44, Calif.—8-page illustrated bulletin dealing with steel, lead lined steel, stainless steel, glass lined steel, monel metal, and copper galvanized Tivit Tanks designed and built for automotive parts cleaning, aircraft engine overhaul, degreasing, rust proofing, plating, galvanizing and other metal processing and industrial chemical operations.

Testing Equipment. Foster D. Snell, Inc., 305 Washington St., Brooklyn 1, N. Y.—6-page booklet entitled, "Calibration of Testing Equipment," outlining the purpose and mechanism of verification of testing equipment.

Tool Control. George S. May Business Foundation, 111 South Dearborn St., Chicago 3, Ill.—6-page report entitled "How Accountancy and Engineering Share in Effective Tool Control," details and illustrates methods of handling and conserving tool inventory through accounting and engineering cooperation. Report No. 150.

Tube Cleaners. Elliott Co., Springfield, Ohio—24-page bulletin describing this company's line of cutter heads—their uses, dimensions and motors to which they are adapted—and motors driven by air, steam or water. Special tube cleaners, drills, couplings and brushes are mentioned as well as varied appli-

cations of standard equipment. Includes cutaway illustrations, explosion shots and general information on tube cleaner care. Bulletin Y-18.

Unit Heaters. Carrier Corp., News Bureau, Syracuse 1, N.Y.—2-page sheet covering this concern's No. 46S unit heaters which are said to insure wide heating coverage and flexibility of use. Also contains chart dimensions, steam ratings, and B.t.u. constants. No. 46S-6.

Utility Conveyors. Lamson Corp., Syracuse 1, N.Y.—4-page pamphlet illustrating a new package conveyor-elevator, with drawings demonstrating its various plant applications. Form 443.

V-Belt Drives. Dayton Rubber Manufacturing Co., Dayton, Ohio—Four-color, pocket-size catalog dealing with V-belt drives for standard motor speeds, and with V-flat drives. Includes supplementary drive tables, data on special drives, list prices, dimensions and interchangeability lists. Includes installation and maintenance information. Catalog No. 280.

Vacuum Switches. Electronics Dept., General Electric Co., Schenectady, N.Y.—4-page illustrated bulletin presenting the features, advantages, typical applications and ratings of this company's vacuum switches. Tables and diagrams of general information are included.

Valves. Grove Regulator Co., 1190 67th St., Oakland, Calif.—4-page illustrated bulletin describing the features, applications, uses, and operation of this concern's automatic stop valves. Diagrams and design data included. Bulletin No. 515.

Valves. Grove Regulator Co., 1190 67th St., Oakland, Calif.—4-page illustrated bulletin concerning the Grove combination reducing and automatic shut-off valve, a complete pressure control system. Describes design, operation and installation. Bulletin No. 400.

Valves. W. S. Rockwell Co., 50 Church St., New York 7, N.Y.—24-page illustrated catalog covering this company's blast-gate slide valves and butterfly valves for the control of air, gas and liquids. Tables, charts and diagrams of design and application data are included. Catalog No. 406.

Valve Selection Chart. Reading-Pratt & Cady Div., American Chain & Cable Co., Inc., Bridgeport 2, Conn.—2-page chart which explains the conditions to consider when selecting a valve, and breaks down these conditions to determine how they effect the operation of the valve.

Ventilators. American Steel Band Co., 223 Fourth Ave., Pittsburgh, Pa.—16-page bulletin embodying information on gravity type roof ventilators made by this concern. Also describes fan ventilators and presents useful capacity charts for estimation purposes on gravity-type, power fan and continuous ridge ventilators.

Water Analysis. W. H. & L. D. Betz, Gillingham and Worth Sts., Philadelphia 24, Pa.—44-page illustrated booklet presenting a variety of apparatus and chemicals for industrial water analyses for plant control. Features test sets required for such determinations as hardness, alkalinity, phosphate, sulphate, dissolved oxygen, pH value, silica and others.

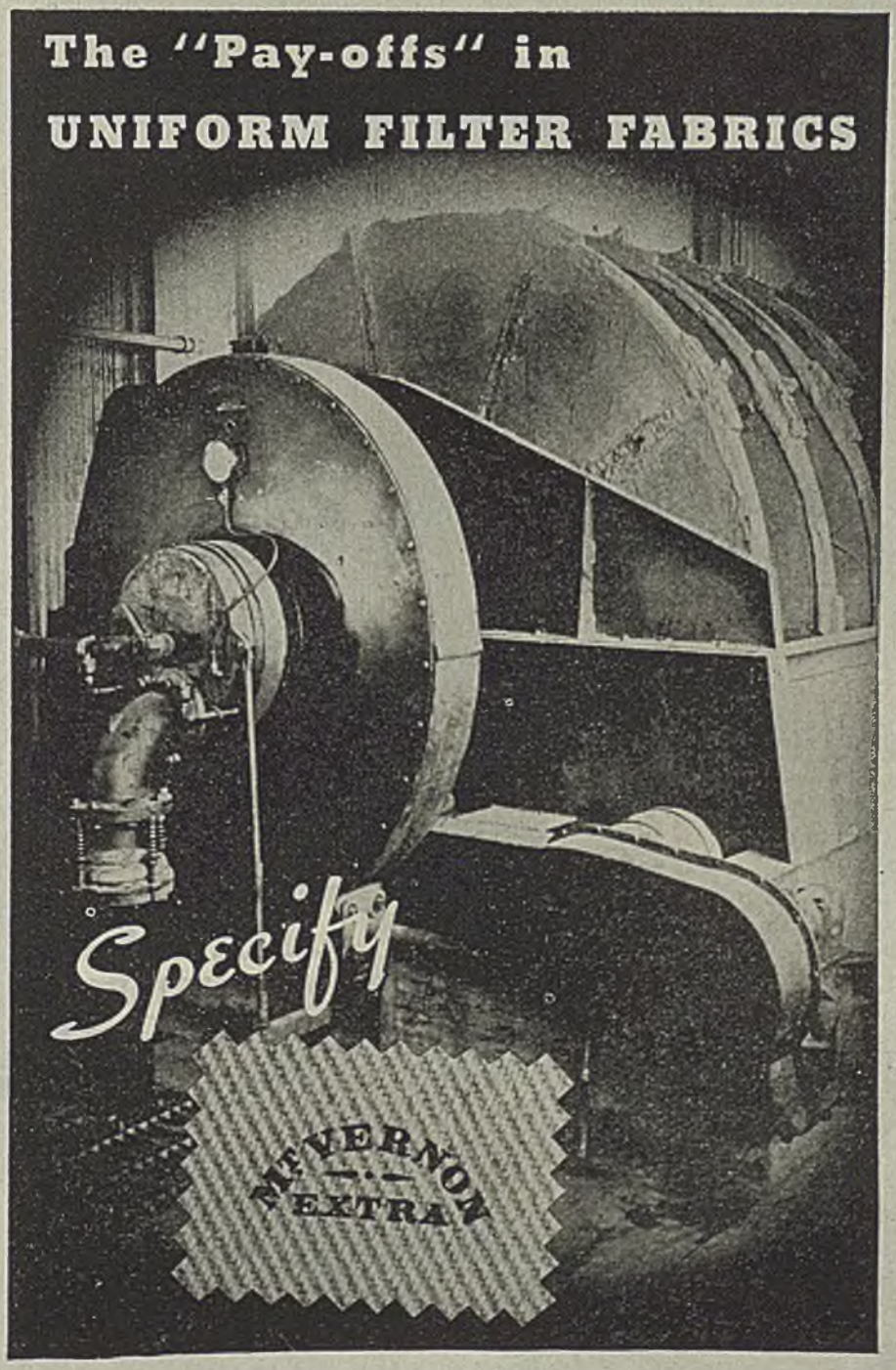
Water Cooling Towers. The Marley Co., Inc., 3001 Fairfax Rd., Kansas City, Kan.—38-page spiral bound booklet designed to present engineering principles of water cooling with cooling towers. Includes data on selection, application, operation and maintenance of cooling towers and some typical applications. Contains flow diagrams and cross sections. Bulletin No. 806.

Water Treatment. Worthington Pump & Machinery Corp., Harrison, N. J.—6-page folder containing description of ion-exchange processes for controlling the composition of water. Illustrates equipment designed for this operation. Bulletin W-212-B4.

Waxes. Distributing & Trading Co., 444 Madison Ave., New York 22, N.Y.—Booklet listing thirty-six kinds of substitute, replacement and extender waxes, their specifications and current prices.

Welding. Air Reduction Sales Co., 60 East 42nd St., New York 17, N.Y.—20-page revised price list, "Gas and Electric Welding Supplies and Accessories," which includes such data as sizes, dimensions, weights, stock numbers, forwarding information and recommended uses for products.

X-ray Unit. North American Philips Co., Inc., 100 East 42nd St., New York, N.Y.—4-page illustrated folder describing this company's "Searchray 150" industrial X-ray unit, its uses, special features and operation procedures. Bulletin S150.



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CHEMICAL ECONOMICS

H. M. BATTERS, Market Editor

INDUSTRIAL CONSUMPTION OF CHEMICALS CONTINUES ON AN UPWARD COURSE

Because monthly production data are now made public for many of the more important chemicals, it is possible to form a more accurate opinion about the total volume of output. Based on the figures so far available, production of what may be termed the customary products, is holding close to a 10 percent gain over the output for the comparable period of last year. This does not take into consideration the sharp increase of the chemicals which are largely consumed in the manufacture of synthetic rubber. Hence the over-all result should measure the rate of increase at more than 10 percent. Consumption of chemicals and related products in regular industrial lines is making progress, partly following some increase in outputs for civilian purposes and partly because of wider outlets in various phases of the war effort. For instance, rayon manufacture has been pushed up, yet a good part of the additional output has been marked for military use.

The *Chem. & Met.* index for consumption of chemicals in regular industries continues to move forward although the improvement from April to May did not change to any extent in the daily rate of operations so that it may be that activities are becoming standardized according to current capacities and the monthly changes will result from variations in working hours rather than from operating rates. The index for May is 187.57 against a revised figure of 180.76 for April. In 1943 the indexes for May and April were 179.58 and 176.16 respectively.

For a long time producers have been concerned with problems of distribution tied up with the general packaging situation. This problem is becoming progressively more acute. In the last month all shipments have been affected by further restrictions placed on the use of corrugated and solid fiber containers. Shortage of rolling mill capacity has resulted in a reduction in the supply of tin cans which will be felt in the chemical industry in the latter part of the year. Paints and paint products have been adversely affected by the order limiting quotas in most lines which customarily use tin cans in their distribution schedules.

The rapidly deteriorating position of steel under the impact of increased war requirements is reflected in the recent amendment to the steel shipping drum order. New quotas were set at slightly below the former levels but drum manufacturers may use all the sheet that they can get hold of. The order also clarifies the uses for which used drums may be employed. Any improvement in this general situation is contingent upon changes in the steel supply. Distribution of drums will continue on the basis of essentiality.

Fertilizers, refined sugar, and tankage are helped by the improved supply of burlap synonymous with increased shipping between this country and India. The combination of a shortage of cotton bags and the easier burlap position has led to changes to permit greater use of burlap. Furthermore, the chemical industry will not be restricted in its use of paper bags for shipping essential chemicals.

Agricultural interests have been asked to take early deliveries of their summer requirements of arsenical insecticides and this may give some encouragement to production. The reasons back of this request are found in uncertain transportation facilities, manpower and container shortages.

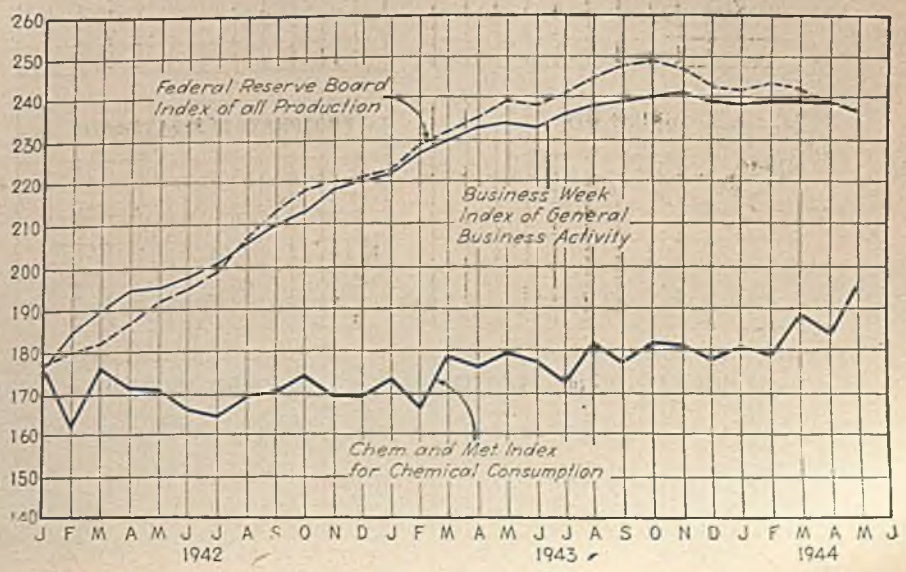
***Chem. & Met.* Index for Industrial Consumption of Chemicals**
1935 = 100

	April revised	May
Fertilizers	41.05	41.20
Pulp and paper	19.40	19.95
Petroleum refining	17.18	18.04
Glass	19.30	21.11
Paint and varnish	17.00	16.70
Iron and steel	13.45	13.67
Rayon	15.77	17.61
Textiles	10.19	10.94
Coal products	9.95	10.00
Leather	4.10	4.15
Industrial explosives	5.17	5.80
Rubber	3.00	3.00
Plastics	5.20	5.40
	180.76	187.57

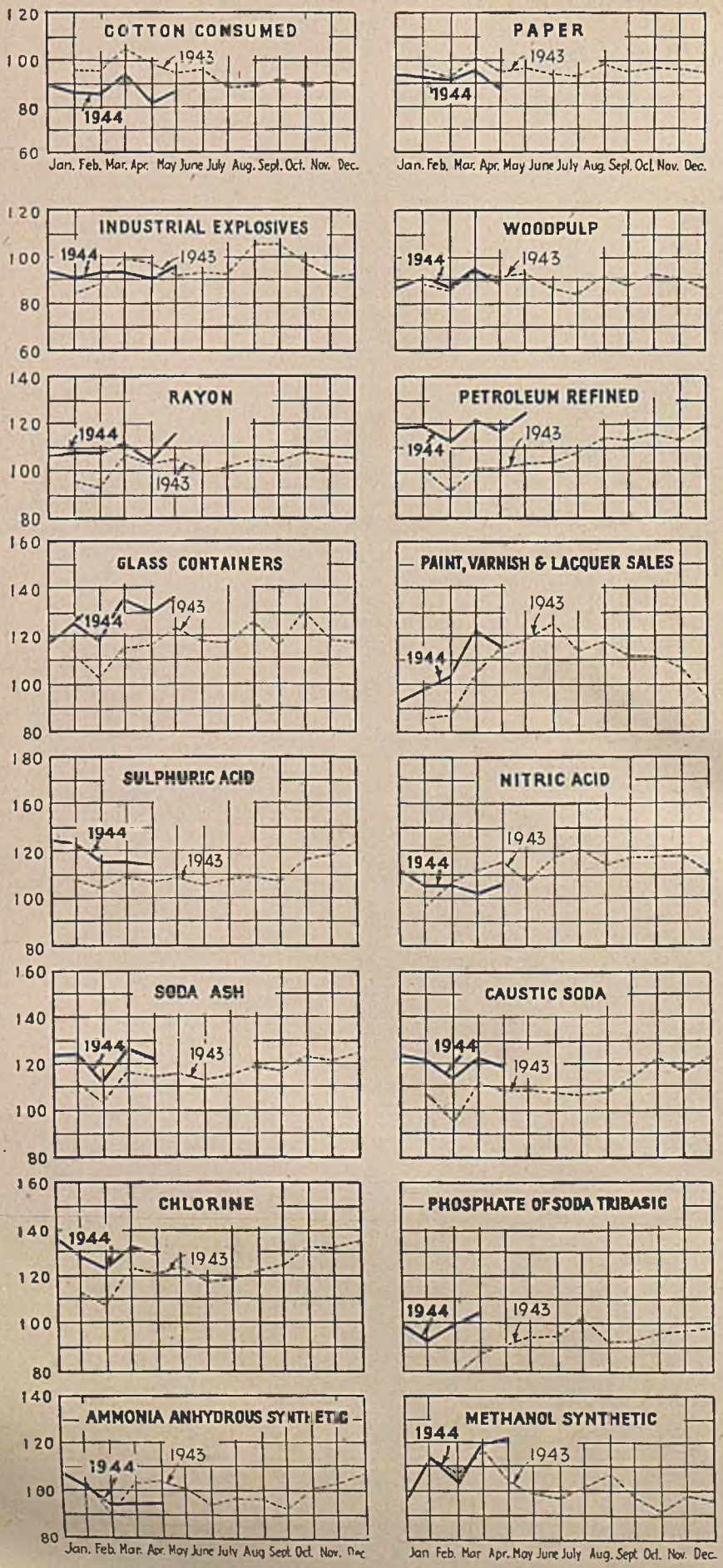
It is further pointed out that where other materials may be shipped in used containers, this is not feasible for bulk packaging of these insecticides because of their poisonous nature.

Along similar lines, farmers are urged to accept early delivery of fertilizer on the ground that by following such a policy they can be practically assured of obtaining their full requirements. Producers of fertilizer are in a position to supply more than they could last season but it is explained that while production of fertilizer is classed as essential the distribution to consumers carries no such rating.

Many industries which are large consumers of rosin are being handicapped by the scarcity of this material. Not only was this year's crop cut down by a shortage of workers in the woods but the marketing movement was slowed earlier in the season by unfavorable weather conditions and more recently there has been a disposition to withhold stocks. The result has been a much less than usual arrival at the principal distributing points and bidding for available supplies started a sharply rising price trend which terminated at the close of June by the placing of a temporary price ceiling on all grades of rosin. The temporary regulation is to be effective for two months but probably will be followed by a more general order before the end of that time. The maximums range from $5.10 per bbl. for grade B to $6.50 for grades WW and X. A survey of the situation places estimated demands, both domestic and foreign, for the season ending next March 31 at 2,207,000 bbl. and the supply for distribution is estimated at 1,650,000 bbl. Hence a deficit of more than 550,000 bbl. is indicated. Incidentally the regulation directing soap makers to use a specific percentage of rosin has been recalled.



PRODUCTION AND CONSUMPTION TRENDS

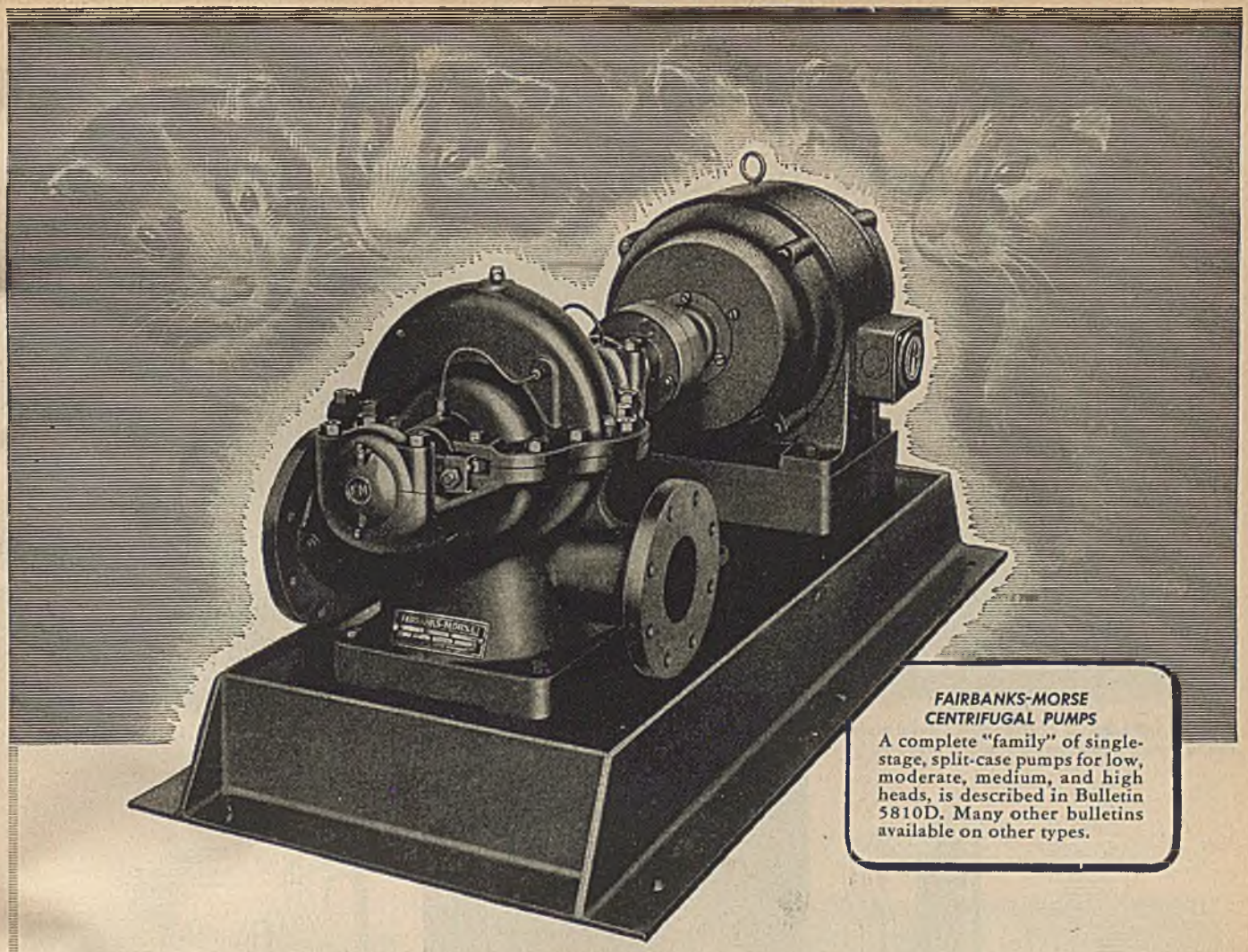


With the exception of textiles, the large chemical-consuming industries are maintaining favorable positions as compared with last year. Cotton mills however, are lagging and despite efforts to speed up production, mill takings of the staple are running far below the peak levels reached in the past. Shipments of rayon yarn and staple are large but the increase is not reflected in the fabrication of rayon textiles. Some improvement has been noted in consumption of carpet wools but total wool disappearance is considerably under mill capacities.

Pulp and paper mills are making a favorable showing compared with the 1943 rate of operations but are likewise off from the high levels reported for 1942. Receipts of pulpwood in May were 27 percent larger than they were in the same period of last year but so much doubt is felt regarding the outlook that any real expansion in pulp production is not anticipated. In fact the bogy set for pulpwood for the third quarter of this year is 2,821,000 tons as against a supply of 2,885,000 tons for the second quarter. Of the third quarter supply, only 2,547,000 is expected from domestic sources, the remainder to be made up from imports plus some lowering in inventories. Third quarter output of paper is fixed at 2,026,000 tons which represents a slight gain over the preceding quarter while paperboard production is put down at 2,316,000 tons or 10,000 tons less than it was in the second quarter.

The fertilizer industry is proceeding pretty much along planned lines which means that the outlook can be translated into fairly definite figures. As was pointed out at the recent convention, domestic production of normal and concentrated superphosphate was equivalent to 4,210,000 tons of 18 percent material in 1939, more than 7,000,000 tons in 1943 and will be approximately 8,560,000 in the current year. These figures give evidence that acidulating plants will move along without any check in operating rates and the trend will be upward when additional manufacturing facilities become available so that from the standpoint of consumption of chemicals, the fertilizer trade may be regarded as most promising.

The raw material situation has not eased enough to guarantee full production in all lines. Soda ash which is important because of the diversified manufactures into which it enters, is in limited supply despite the fact that production in the first four months of this year—not including natural ash—amounted to 1,542,192 tons as compared with 1,410,574 tons for the like months of 1943. This represents a gain of more than 9 percent but in the first four months production of dense ash was 484,860 tons or only 4.7 percent over the output reported for Jan.-Apr., 1943. Stocks of dense ash at the beginning of this year were 8,172 tons but dropped to 1,724 tons by the end of April. The tight position of dense ash will be relieved by the recent order which permits allocations of nitrate of soda for the manufacture of glass in the territory east of the Rocky Mountains.



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A complete "family" of single-stage, split-case pumps for low, moderate, medium, and high heads, is described in Bulletin 5810D. Many other bulletins available on other types.

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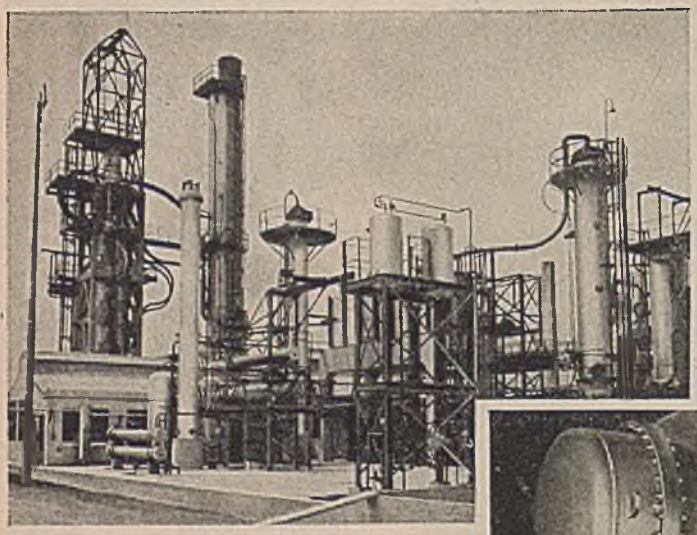
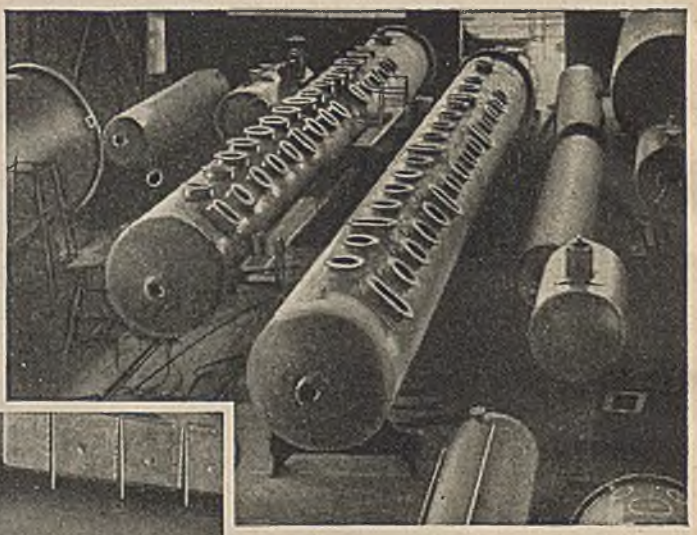
Pumps

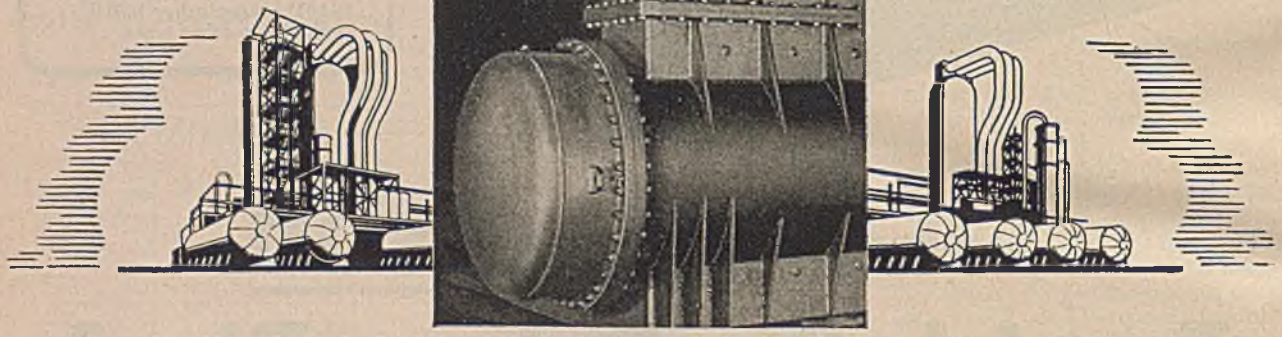
How Chromium Steels
help to speed refinery production



Cracking still tubes of 18-8 chromium-nickel stainless steel withstand high temperatures and pressures.



Vessels lined with 12 per cent chromium steel withstand corrosion, and save weight.



The 4 to 6 per cent chromium steels containing a small amount of molybdenum are being used for heat exchanger tubes and condenser pipe.

● Chromium steels are resistant to corrosion, abrasion and oxidation and have high strength even at elevated temperatures. Because of this combination of properties, the use of chromium steels in oil refinery equipment keeps costly and time-consuming shutdowns for repair and replacement at a minimum and makes for fast, uninterrupted, economical operation.

The 4 to 6 per cent chromium steels are used for tubes, pump bodies, and transfer lines; the 12 to 14 per cent chromium steels for reaction chamber liners, pump parts, and valves; the 18-8 chromium-nickel stainless steels for furnace tubes and distillation equipment, including trays, bubble caps, header boxes, and valves; and the 25-12 chromium-nickel steels for furnace parts, fractionating towers, and other applications where resistance to higher temperatures is involved. The illustrations show a few applications which may suggest where you can use chromium steels to speed up production of essential petroleum products.

We do not make steel of any kind, but we have for over 37 years produced Electromet ferro-alloys used in making steel. With the knowledge accumulated from this experience, we are in a position to give you impartial assistance in the selection of a chromium steel to suit your particular needs.

BUY UNITED STATES WAR BONDS AND STAMPS

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United States Production, Consumption and Stocks of Chemicals, April 1944

(Data from Bureau of the Census, U. S. Department of Commerce, and Chemicals Bureau, WPB)

Chemical and Basis	Units*	April 1944 (Preliminary) Production	April 1944 (Preliminary) Made and Consumed	April 1944 (Preliminary) Stocks	March 1944 Production	March 1944 Made and Consumed	March 1944 Stocks
Acetylene: For use in chemical synthesis	M cu. ft.	[1]	[1]	[1]	329,681	77,280	11,114
For commercial purposes	M cu. ft.	[1]	[1]	[1]	154,084		
Synthetic anhydrous ammonia (100% NH_3)	Tons	43,191	36,982	2,834	43,242	39,537	2,884
Bleaching powder (35%–37% avail. Cl_2)	M lb.	5,343	1,498	1,487	[2] 4,929	[2] 1,630	[2] 1,445
Calcium acetate (80% Ca $(C_2H_3O_2)_2$)	M lb.	775	[3]	358	[2] 1,048	[3]	[2] 373
Calcium arsenate (100% $Ca_3(AsO_4)_2$)	M lb.	4,099	[3]	8,530	3,392	[3]	8,203
Calcium carbide (100% CaC_2)	Tons	[1]	[4]	[1]	68,653	[4]	24,988
Calcium hypochlorite (true) (70% available Cl_2)	M lb.	1,241	[3]	605	1,223	[3]	736
Calcium phosphate — monobasic (100% $CaH_4(PO_4)_2$)	M lb.	3,882	[3]	5,558	6,064	[3]	5,375
Carbon dioxide: Liquid and gas (100% CO_2)	M lb.	[1]	[1]	[1]	30,008	2,493	4,344
Solid (dry ice) (100% CO_2)	M lb.	[1]	[1]	[1]	49,460	1,075	12,162
Chlorine	Tons	106,764	72,385	7,942	[2] 108,524	62,169	6,572
Chrome green (C.P.)	M lb.	524	104	1,020	[2] 463	[2] 84	[2] 1,067
Hydrochloric acid (100% HCl)	Tons	29,671	15,723	4,158	29,475	16,469	2,428
Hydrogen	Millions of cu. ft.	[1]	[1]	[4]	2,091	1,764	[4]
Lead arsenate (acid and basic)	M lb.	[1]	[1]	[1]	[2] 10,283	[2] 218	[2] 5,689
Lead oxide — red (100% Pb_3O_4)	M lb.	8,855	645	4,946	9,287	397	4,985
Methanol: Natural (80% CH_3OH)	Gal.	340,614	[4]	310,035	[2] 362,661	[4]	[2] 257,375
Synthetic (100% CH_3OH)	M gal.	6,320	[3]	7,128	6,270	[3]	5,939
Molybdate orange (C.P.)	Lb.	114,147	11,561	158,501	163,994	11,763	162,185
Nitric acid (100% HNO_3)	Tons	38,161	33,999	6,890	36,509	32,911	7,534
Oxygen	M cu. ft.	[1]	[1]	[3]	1,696,487	41,402	[3]
Phosphoric acid (50% H_3PO_4)	Tons	57,765	54,521	12,458	[2] 65,484	[2] 55,559	15,067
Potassium bichromate and chromate (100%)	M lb.	638	[3]	410	[2] 676	[3]	[2] 486
Potassium chloride (100% KCl)	Tons	103,709	[3]	30,895	105,658	[3]	10,508
Potassium hydroxide (caustic potash) (100% KOH)	Tons	3,494	700	1,720	4,016	824	2,394
Soda ash — Ammonia soda process:							
Total wet and dry [5] (98%–100% Na_2CO_3)	Tons	385,085	.....	.....	399,758	.....	.....
Finished light (98%–100% Na_2CO_3) [6]	Tons	206,990	48,661	21,380	218,657	51,804	20,493
Finished dense (98%–100% Na_2CO_3)	Tons	124,727	2,396	12,669	126,886	2,189	6,717
Natural [7]	Tons	13,778	.....	1,724	16,726	.....	2,023
Sodium bicarbonate (refined) (100% $NaHCO_3$)	Tons	12,791	[3]	5,535	15,089	[3]	4,922
Sodium bichromate and chromate (100%)	Tons	6,920	[3]	1,403	[2] 7,511	[3]	[2] 1,847
Sodium hydroxide, liquid: Electrolytic process (100% NaOH)	Tons	99,052	22,480	35,736	[2] 101,349	24,174	33,149
Lime-soda process (100% NaOH)	Tons	58,037	[3]	14,741	[2] 57,625	[3]	12,721
Sodium phosphate: Monobasic (100% NaH_2PO_4)	M lb.	[1]	[3]	[1]	2,513	[3]	690
Dibasic (100% Na_2HPO_4)	Tons	[1]	[3]	[1]	4,850	[3]	849
Tribasic (100% Na_3PO_4)	Tons	[1]	[1]	[1]	6,855	174	1,577
Sodium silicate (water glass): Liquid (40° Baumé)	Tons	88,315	[4]	94,146	[2] 93,902	[4]	[2] 90,687
Solid (all forms combined)	Tons	10,809	2,796	8,455	[2] 9,326	2,979	[2] 6,801
Sodium sulphate: Glauber salt and crude salt cake [7]	Tons	[1]	[1]	[1]	65,172	7,054	72,930
Anhydrous (refined) (100% Na_2SO_4)	Tons	[1]	[3]	[1]	6,408	[3]	6,571
Sulphur dioxide (100% SO_2)	M lb.	[1]	[1]	[1]	5,969	3,274	3,252
Sulphuric acid: [7] Chamber process (100% H_2SO_4)	Tons	263,066	.....	287,855	275,317	.....	[2] 278,088
Contact process [8] (100% H_2SO_4)	Tons	480,675			485,531		
Net contact process [9] (100% H_2SO_4)	Tons	428,712	.....	.....	438,867	.....	.....
White Lead	Tons	6,206	2,480	8,694	7,531	3,467	9,164
Zinc yellow (C.P.)	M lb.	2,690	318	928	2,418	138	852

* All tons are 2,000 lb. [1] Not yet available. [2] Revised. For liquid sodium silicate, revised data in short tons are: Jan. '44 production, 68,606; Feb. '44, 75,032; stocks, Jan. '44, 96,398; Feb. '44, 90,827. [3] Data cannot be published. [4] Not available. [5] Total wet and dry production. [6] Not including quantities converted to finished dense. [7] Data collected in cooperation with Bureau of Mines. [8] Includes oleum grades. [9] Excludes spent acid.

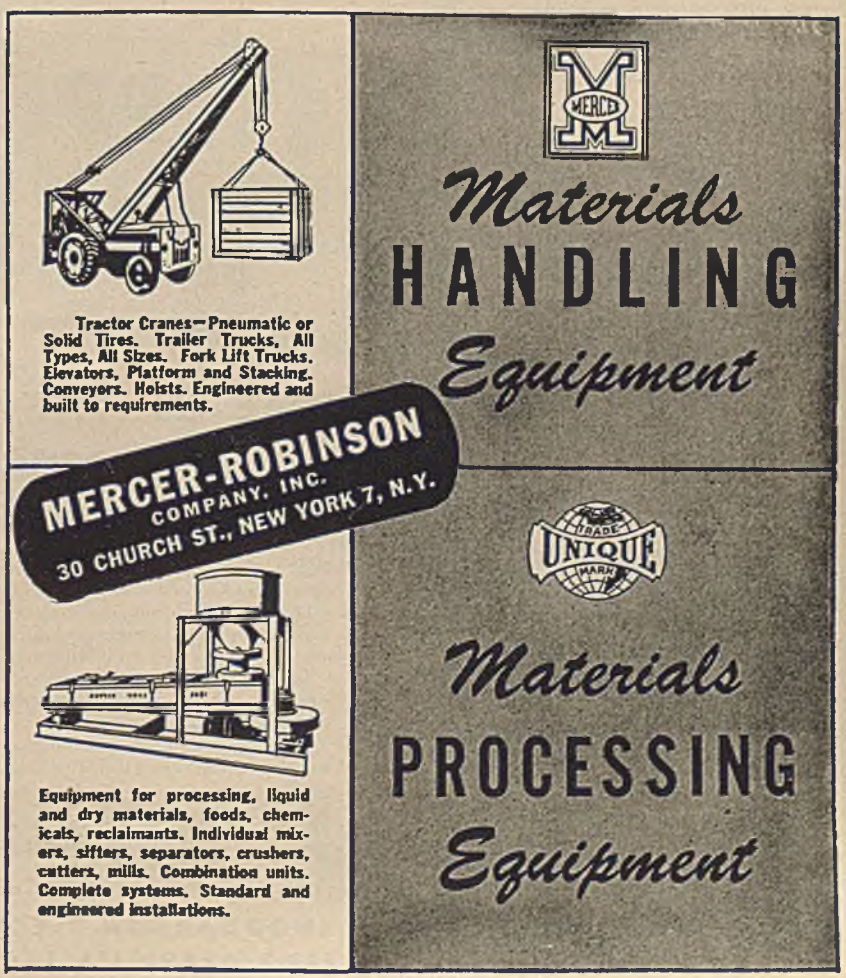

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Fig. F-80

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MONARCH MFG. WKS, INC.
2730 E. WESTMORELAND ST.
PHILADELPHIA 34, PA.

U. S. Production, Consumption and Stocks of Synthetic Organic Chemicals, January-April 1944[1]

Item	January	February	March	April
Acetanilide (technical and U.S.P.)				
Production	439,148	599,572	699,295	643,396
Consumption	270,368	262,304	368,643	289,051
Stocks	757,278	796,064	737,310	917,388
Acetic acid (synthetic)[2]				
Production	[3]25,234,708	23,835,226	27,719,588	24,471,598
Consumption	[3]19,555,315	17,210,363	17,999,378	17,156,759
Stocks	[3]9,436,835	8,004,120	9,192,322	9,263,196
Acetic acid (natural and from calcium acetate)[4]				
Production	3,512,324	3,338,767	3,289,140	3,448,145
Consumption	16,580	18,230	.....	.....
Stocks	1,529,208	1,509,517	1,279,686	1,060,371
Acetic anhydride[5]				
Production	39,966,091	38,720,059	41,686,408	published
Consumption	29,550,413	29,373,446	32,184,310	quarterly
Stocks	9,645,759	9,922,038	10,244,794	
Acetylsalicylic acid				
Production	753,887	764,005	829,951	676,095
Stocks	749,336	814,695	881,272	596,025
n-Butyl acetate				
Production	5,699,444	6,231,619	7,913,081	6,235,207
Consumption	149,275	.....	.....	.....
Stocks	2,298,399	2,808,377	2,596,717	3,145,099
Creosote oil, tar distillers (gal.)[6]				
Production	11,305,961	11,233,805	11,633,703	10,869,901
Consumption	810,998	1,013,396	1,013,209	828,796
Stocks	19,155,075	23,969,329	25,724,682	26,522,738
Creosote oil, byproduct (gal.)[7]				
Production	2,965,392	3,236,392	2,983,970	3,562,500
Consumption	160,186	36,021	93,488	65,254
Stocks	1,380,822	1,711,595	1,516,362	1,955,584
Cresols, meta-para[8]				
Production	562,320	648,718	537,482	640,698
Consumption	.....	.....	147,562	.....
Stocks	151,606	301,729	167,351	294,448
Cresols, ortho-meta-para[8]				
Production	574,661	758,389	971,533	655,213
Stocks	304,561	325,759	211,190	.....
Cresylic acid, crude				
Production	1,965,334	2,237,695	2,014,785	2,141,226
Stocks	1,306,714	1,600,825	1,265,794	1,438,474
Cresylic acid, refined[8]				
Production	2,723,855	3,747,714	3,737,173	3,342,989
Stocks	1,982,414	2,107,819	2,365,739	2,154,511
Diethyl ether (all grades)				
Production	4,967,093	4,217,884	5,547,268	5,484,234
Stocks	2,463,017	2,394,500	3,463,471	2,741,646
Ethyl acetate (85 percent)				
Production	9,914,309	9,016,264	10,176,203	7,675,579
Consumption	1,513,656	1,304,683	1,585,029	1,201,397
Stocks	5,105,921	4,728,572	6,029,911	5,323,248
Lactic acid (edible)				
Production	427,944	288,344	304,732	381,579

ONE OF THE MANY POSSIBLE FLASHTRON APPLICATIONS!

FLASHTRON — THE HEART OF MODERN ELECTRONIC CONTROL

● For all types of machinery manufacturers, Flashtron opens up an entirely new vista of electronic control.

Due to the fact that Flashtron requires only very small energizing currents...precision control that is swift and certain comes into play by an infinitesimal movement of contacts.

Instantaneous reversible control is provided by Flashtron since its output circuits accommodate motors, solenoids or other power control devices.

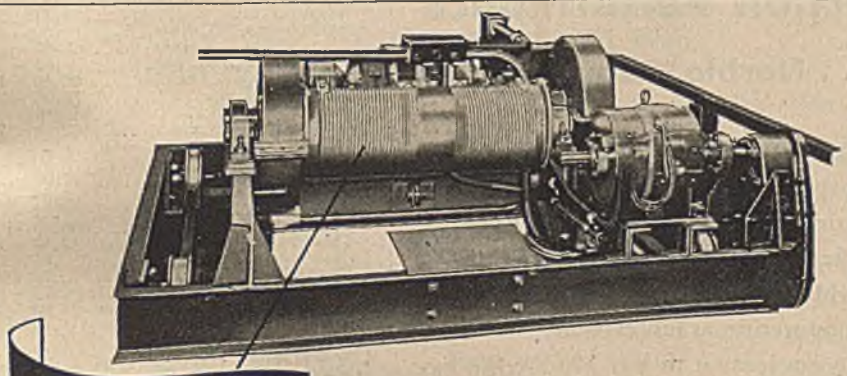
We invite control manufacturers, as well as users, to get the interesting Flashtron story.

Model T-50 x 40
Power Source—115 Volt 60 c. p. s.
Control Circuit—Operation of one pair of contacts produces orientation of power output.
Output—Two circuits supply 115 Volts up to 40 V. A.—Only one output circuit functions at any given instant. Other sizes available, special order.

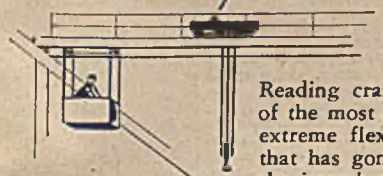
THORDARSON
CONTROL DIVISION
THORDARSON ELECTRIC MFG. CO.
500 W. HURON STREET • CHICAGO 10, ILL.

Item	January	February	March	April
Lactic acid (cont.)				
Stocks	345,584	369,851	334,257	307,900
Lactic acid (technical)				
Production	246,138	315,674	256,698	322,810
Consumption	10,009	15,655	18,788	21,863
Stocks	172,358	219,212	155,841	240,820
Methyl chloride (all grades)				
Production	1,291,121	1,317,988	1,990,710	2,136,340
Stocks	1,078,377	934,583	700,022	718,323
Naphthalene, byproduct [9]				
Production	9,368,375	9,121,505	8,682,110	8,288,927
Stocks	2,447,785	2,990,248	2,892,682	3,227,748
Naphthalene, tar distillers [10]				
Production	15,072,813	15,744,644	17,616,262	17,013,390
Stocks	9,827,554	8,270,015	8,474,152	9,371,842
Naphthalene, refined [11]				
Production	7,268,318	7,768,540	8,180,156	7,578,823
Consumption	4,061,657	4,163,541	4,543,373	4,423,257
Stocks	3,042,885	2,783,416	2,910,302	2,604,018
Niacinamide				
Production	23,287	.....	.....	.....
Consumption	3,856	3,954	.....	.....
Stocks	42,378	48,705	51,227	10,320
Oxalic acid (technical)				
Production	1,490,234	1,447,985	1,517,309	1,367,874
Stocks	681,722	764,709	443,151	452,486
Phenobarbital and sodium salts				
Production	22,484	25,361	20,797	21,283
Stocks	66,415	72,870	46,380	52,325
Phthalic anhydride				
Production	9,205,342	9,675,900	10,345,136	10,607,574
Consumption	2,570,729	2,621,906	2,546,644	2,537,067
Stocks	1,564,253	1,735,855	1,982,944	1,780,311
Riboflavin (for human use)				
Production	9,783	8,856	12,351	8,982
Stocks	[3] 24,151	26,170	31,504	35,759
Sulfa drugs (total) [12]				
Production	653,798	663,816	630,775	520,867
Consumption	198,104	237,139	124,205	91,671
Stocks	1,392,334	1,346,134	1,469,082	1,606,434

[1]All data in pounds except as noted. Statistics collected and compiled by the U. S. Tariff Commission and issued jointly by the Commission and the War Production Board. 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 the last day of the month. [2]Statistics of production of recovered acetic acid are confidential. [3]Revised. [4]Collected and compiled by the Bureau of the Census. [5]Includes anhydride from acetic acid by the vapor-phase process. [6]Includes statistics reported by distillers of purchased tar only. [7]Statistics represent oil produced by byproduct coke-oven operators collected and compiled by the Bureau of Mines. [8]Includes statistics reported to the Bureau of Mines by byproduct coke-oven operatoors and those reported to the U. S. Tariff Commission by tar distillers. [9]Statistics represent naphthalene produced for sale by byproduct coke-oven operators and are collected and compiled by the Coal Economics Division of the Bureau of Mines. The grades, melting at less than 74 deg. C., 74 to 76 deg. C., and 76 to less than 79 deg. C., represent production for sale. [10]These statistics are for threee grades of crude naphthalene: The grade solidifying at less than 74 deg. C., produced for sale only; the grade solidifying between 74 and 76 deg. C.; and the grade solidifying at more than 76 but less than 79 deg. C. As there is some conversion between grades, the data include some duplication. [11]79 deg. C. and over. [12]Statistics of production, consumption, and stocks of acetylsulfathiazole are included with those of sulfa drugs.



SAVE ON FIRST COST WITH **READING** UNIT CRANE DESIGN



Reading cranes can be fitted exactly to the requirements of the most difficult materials handling job because of the extreme flexibility of their unit design. The engineering that has gone into the simple, accessible arrangement and the interchangeable parts of the crane, eliminates the need for special design work on every job.

This means you get a crane that meets your requirements exactly without any extra design costs. You save in first cost, and you get exactly the performance needed by the job. For complete information write for "The Why and How of Faster Production."

READING CHAIN HOISTS · ELECTRIC HOISTS OVERHEAD TRAVELING CRANES

READING CHAIN & BLOCK CORP. 2105 ADAMS ST., READING, PA.

TONNAGE SCREENING WITHOUT SCREENS

on low priced products

WITH AIR TABLES . . .

THERE are many bulk articles that cannot be economically fine-screened because of the cost of replacing screen cloth. Sutton, Steele & Steele Air Tables handle large quantities per hour with no screen cloth—hence, no screen cloth replacements.

A striking example

FOR instance—granite fines running 22% minus 100 mesh were made by Air Tabling into two divisions, of which one (or 72% of the original) ran 95% plus 100 mesh while the other (or 28% of the original) ran 87% minus 100 mesh, at the rate of 4½ tons per hour, at a cost of a few cents per ton.

CONSULT US about the use of Air Tables either as Concentrators of different materials, or as Graders of homogeneous materials, or as Controllers of bulk density. We will gladly run samples.

SUTTON, STEELE & STEELE, INC.
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SALES OFFICES
SEPARATIONS ENGINEERING CORPORATION
110 EAST 42nd STREET, NEW YORK, N. Y.
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ENGINEERING BUILDING, CHICAGO, ILLINOIS
FLOUR EXCHANGE BUILDING
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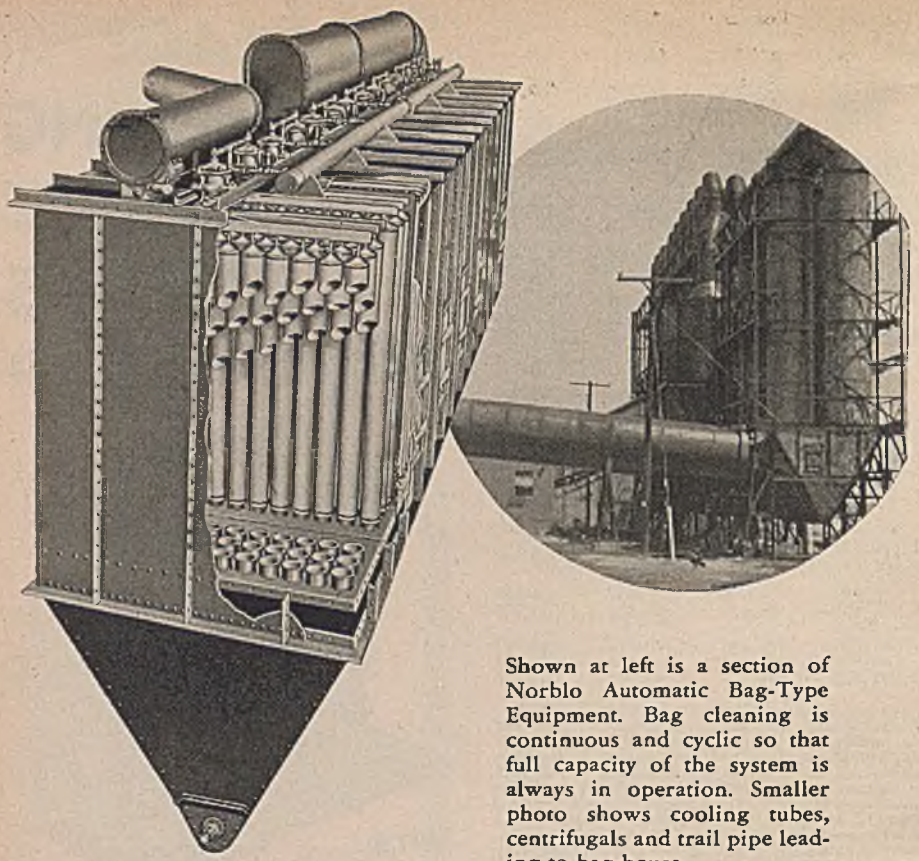
SAN FRANCISCO, CALIFORNIA
THE S&S PROCESS FOR BETTER PRODUCTS-FASTER



Shown at left is a section of Norblo Automatic Bag-Type Equipment. Bag cleaning is continuous and cyclic so that full capacity of the system is always in operation. Smaller photo shows cooling tubes, centrifugals and trail pipe leading to bag-house.

Dust Collection Performance

Is What You Buy . . . Norblo Guarantees It

Properly applied the most efficient dust collection is most profitable. War production, especially in the smelting fields, has shown that Norblo Automatic Bag-Type Dust Collection frequently paid for itself in the first three or four months of operation. It proved also that Norblo bag-type equipment is able to take it in continuous 24-hour operation at full capacity.

The performance of Norblo equipment in war production has provided data and standards which, henceforth, must be reckoned with in post-war investment in dust collection systems. Norblo engineered performance is guaranteed on a basis that makes possible accurate, dependable costs and intelligent profitable investment. It also makes possible comparison of alternative systems.

For your post-war planning or rehabilitation of existing plant you need the kind of data Norblo engineers are glad to give you. Just say you are interested.

Norblo

DUST COLLECTION SYSTEMS

THE NORTHERN BLOWER COMPANY

6411 BARBERTON AVENUE CLEVELAND 2, OHIO

CHEM & MET.
Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

This month	109.50
Last month	109.59
July, 1943	109.03
July, 1942	109.33

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 July 10

INDUSTRIAL CHEMICALS

Acetone, tanks, lb	$0.07 –
Acid, acetic, 28%, bbl., 100 lb	3.38 – $3.63
Boric, bbl., ton	109.00 –113.00
Citric, kegs, lb	.20 – .23
Formic, cbys, lb	.10½– .11
Hydrofluoric, 30%, drums, lb	.08 – .085
Lactic, 44%, tech., light, bbl., lb	.073– .075
Muriatic, 18°, tanks, 100 lb	1.05 –.....
Nitric, 36°, carboys, lb	.05 – .05½
Oleum, tanks, wks., ton	18.50 – 20.00
Oxalic, crystals, bbl., lb	.11½– .12½
Phosphoric, tech., tanks, lb	.04 –.....
Sulphuric, 60°, tanks, ton	13.00 –.....
Tartaric, powd., bbl., lb	.70½–.....
Alcohol, amyl	.... –.....
From pentane, tanks, lb	.131–.....
Alcohol, butyl, tanks, lb	.10½– .18½
Alcohol, ethyl, denatured, 190 proof	.... –.....
No. 1 special, tanks, gal. wks.	.50 –.....
Alum, ammonia, lump, bbl., lb	.04½–.....
Aluminum, sulphate, com. bags, 100 lb	1.15 – 1.40
Ammonia, anhydrous, cyl., lb	.16 –.....
tanks, lb	.04½–.....
Ammonium carbonate, powd. tech., casks, lb	.09½– .12
Sulphate, wks, ton	28.20–.....
Amylacetate, tech., from pentane, tanks, lb	.145–.....
Aqua ammonia, 26°, drums, lb	.02½– .03
tanks, ton	65.00 –.....
Arsenic, white, powd., bbl., lb	.04 – .04½
Barium, carbonate, bbl., ton	65.00 – 75.00
Chloride, bbl., ton	75.00 – 78.00
Nitrate, casks, lb	.09½– .11
Blanc fix, dry, bags, ton	60.00 – 70.00
Bleaching powder, f.o.b., wks., drums, 100 lb	2.50 – 3.00
Borax, gran., bags, ton	45.00 –.....
Calcium acetate, bags	3.00 –.....
Arsenate, dr. lb	.07 – .08
Carbide, drums, ton	50.00 –.....
Chloride, flake, bags, del., ton	18.50 – 25.00
Carbon bisulphide, drums, lb	.05 – .05½
Tetrachloride drums, gal	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb	1.75 – 2.00
Copperas, bgs, f. o. b., wks., ton	17.00 – 18.00
Copper carbonate, bbl., lb	.19½– .20
Sulphate, bbl., 100 lb	5.00 – 5.50
Cream of tartar, bbl., lb	.57 –.....
Diethlylene glycol, dr., lb	.14½– .15½
Epsom salt, dom., tech., bbl., 100 lb	1.90 – 2.00
Ethyl acetate, tanks, lb	.11½–.....
Formaldehyde, 40%, tanks, lb	.036–.....
Furfural, tanks, lb	.09 –.....
Glaubers salt, bags, 100 lb	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18½–.....
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– .04
Magnesium carb., tech., bags, lb	.06½– .06½
Methanol, 95%, tanks, gal	.58 –.....
Synthetic, tanks, gal	.28 –.....
Phosphorus, yellow, cases, lb	.23 – .25
Potassium bichromate, casks, lb	.09½– .10
Chlorate, powd., lb	.09½– .12
Hydroxide (c'stic potash) dr., lb	.07 – .0½
Muriate, 60% bags, unit	.53½–.....
Nitrate, bbl., lb	.05½– .06
Permanganate, drums, lb	.19½– .20
Prussiate, yellow, casks, lb	.17 – .18
Sal ammoniac, white, casks, lb	.0515– .06
Salsoda, bbl., 100 lb	1.00 – 1.05
Salt cake, bulk, ton	15.00 –.....
Soda ash, light, 58%, bags, contract, 100 lb	1.05 –.....
Dense, bags, 100 lb	1.15 –.....
Soda, caustic, 76%, solid, drums, 100 lb	2.30 – 3.00
Acetate del., bbl., lb	.05 – .06
Bicarbonate, bbl., 100 lb	1.70 – 2.00
Bichromate, casks, lb	.07½– .08
Bisulphate, bulk, ton	16.00 – 17.00
Bisulphite, bbl., lb	.03 – .04

CHEM & MET.
Weighted Index of Prices for
OILS & FATS

Base = 100 for 1937

This month	145.24
Last month	145.24
June, 1943	145.55
June, 1942	143.60

Chlorate, kegs, lb	.06½ –	.06½
Cyanide cases, dom., lb	.14½ –	.15
Fluoride, bbl., lb	.07 –	.08
Hyposulphite, bbl., 100 lb	2.40 –	2.50
Metasilicate, bbl., 100 lb	2.50 –	2.65
Nitrate, bulk, 100 lb	1.35 –	.....
Nitrate, casks, lb	.06½ –	.07
Phosphate, tribasic, bags, lb	2.70 –	.....
Prussiate, yel. bags, lb	.09½ –	.10
Silicate (40° dr.), wks., 100 lb	.80 –	.85
Sulphide, bbl., lb	.02½ –	.....
Sulphite, crys, bbl., lb	.02½ –	.02¾
Sulphur, crude at mine, long ton	16.00 –	.....
Dioxide, cyl., lb	.07 –	.08
Tin crystals, bbl., lb	.39½ –	.....
Zinc, chloride, gran, bbl., lb	.05½ –	.06
Oxide, lead free, bag, lb	.07½ –	.....
5% leaded, bags, lb	.07½ –	.....
Sulphate, bbl., cwt	3.85 –	4.00

OILS AND FATS

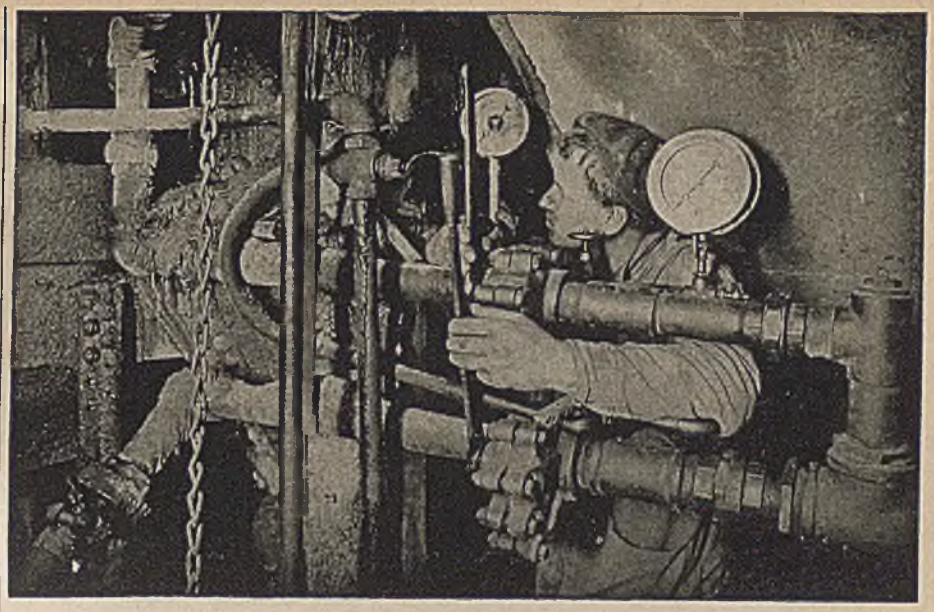
Castor oil, No. 3 bbl., lb	$0.13½ –	$0.14½
Chinawood oil, bbl., lb	.38 –	.....
Coconut oil, ceylon, tank, N. Y., lb	nom	
Corn oil crude, tanks (f.o.b. mill), lb	.12½ –	.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12½ –	.....
Linseed oil, raw, car lots, bbl., lb	.151 –	.....
Palm casks, lb	.09 –	.....
Peanut oil, crude, tanks (mill), lb	.13 –	.....
Rapeseed oil, refined, bbl., lb	nom	
Soy 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, lb	.11½ –	.....
Red oil, distilled, dp.p. bbl., lb	.11½ –	.....
Tallow extra, loose, lb	.08½ –	.....

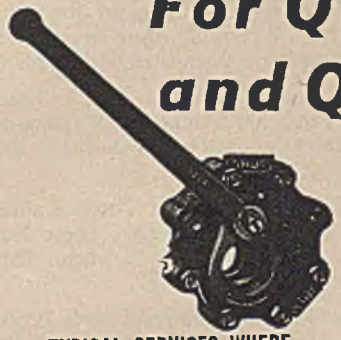
COAL-TAR PRODUCTS

Alpha-napthol, crude bbl., lb	$0.52 –	$0.55
Alpha-naphthylamine, bbl., lb	.32 –	.34
Aniline oil, drums, extra, lb	.1 –	.16
Aniline salts, bbl., lb	.22 –	.24
Benzaldehyde, U.S.P., dr., lb	.85 –	.95
Benzidine base, bbl., lb	.70 –	.75
Benzoic acid, U. S. P., kgs., lb	.54 –	.56
Benzol, 90%, tanks, works, gal	.15 –	.....
Benzyl chloride, tech., dr., lb	.23 –	.25
Beta-naphthol, tech., drums, lb	.23 –	.24
Cresol, U. S. P., dr., lb	.11 –	.....
Cresylic acid, dr., wks., gal	.81 –	.88
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 naphths, 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	5.80 –	.....
Turpentine, gal	.87½ –	.....
Shellac, orange, fine, bags, lb	.39 –	.....
Bleached, bonedry, bags, lb	.39 –	.....
T. N. bags, lb	.31 –	.....





For QUICK OPENING and QUICK CLOSING Valve Operation

A 70-degree turn of the operating wrench completely opens or closes the Straight-Lever Type of Everlasting Valve . . . and the operation is easy, because the wrench gives ample leverage.

Add to this valuable time-saving feature the many other important advantages of the Everlasting Valve . . . its drop-tight seal, its self-grinding action at each motion, its provisions against damage to disc and seat, and its "everlasting" wearing qualities . . . and you have a valve that is literally unequalled for many services on process lines, emergency shut-offs, equipment outlets, boiler blow-off, etc.

TYPICAL SERVICES WHERE EVERLASTING VALVES EXCEL . . .

Outlets of storage and measuring tanks

Throttles of hammers and hoists

Presses for plastics

Washers for laundries, cleaners and dyers

Spray lines to rolls

Blow-offs of condensers, economizers, vulcanizers, purifiers, compressed air tanks

Suitable for acids, alkalies, caustics, cellulose, coal tar, emulsions, syrups, and other liquids; also gases and vapors

Write for Bulletin

EVERLASTING VALVE COMPANY

49 FISK STREET JERSEY CITY 5, N. J.

Everlasting Valves

for everlasting protection

NEW CONSTRUCTION

	Current Projects		Cumulative 1944	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$40,000	$40,000	$770,000	$1,592,000
Middle Atlantic	900,000	834,000	6,807,000	8,767,000
South	2,100,000	125,000	12,085,000	15,551,000
Middle West	.....	.....	485,000	26,366,000
West of Mississippi	440,000	2,575,000	17,975,000	16,951,000
Far West	2,526,000	90,000	7,299,000	7,506,000
Canada	468,000	90,000	7,807,000	5,677,000
Total	$6,474,000	$3,754,000	$53,228,000	$82,410,000

PROPOSED WORK

Calif., Los Angeles—The Texas Co., 929 South Broadway, plans the construction of a pilot unit for hydrogenation of carbon monoxide at its refinery here. Estimated cost $880,827.

Calif., Vernon—Pioneer-Flintkote Co., 5500 South Alameda St., plans to construct additional facilities for paper processing. Estimated cost $700,000.

Colo., Denver—Gates Rubber Co., 999 South Broadway, is having plans prepared by Wm. N. Bowman Co., Archts., Insurance Bldg., for the construction of a 4 story, 175x185 ft. manufacturing plant.

La., Haynesville—Ohio Oil Co. and Gulf Refining Co. & Associates, Haynesville, plan the construction of a gasoline and cycling plant here. Estimated cost $2,100,000.

Mass., Springfield—Monsanto Chemical Co., 812 Monsanto Ave., plans the construction of a story, 62x80 ft. factory. Estimated cost $40,000.

Minn., Chatfield—Max Shapiro, 324 First Ave., S. W., Rochester, plans the construction of a soybean processing plant. Estimated cost $60,000.

Mont., Conrad—Farmers Union Vegetable Oil Cooperative, Conrad, contemplates the construction of a crushing plant. Estimated cost $60,000.

Pa., Punxsutawney—Speer Carbon Co., A. S. Bemis, Supt., St. Marys, has had plans prepared for the construction of a manufacturing plant addition. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $900,000.

Tex., Brownfield—Columbian Carbon Co., North Houston-Rosyln Rd., Houston, plans the construction of a carbon black plant here.

Tex., Edinburg—T. F. Murchison et al, Alamo National Bldg., San Antonio, plans the construction for a recycling plant in this area. Estimated cost will exceed $200,000.

Tex., Wichita Falls—Continental Oil Co., Wichita Falls, plans to reconstruct damaged portion of its alkylyzation plant here. Estimated cost will exceed $40,000.

Utah, Coalville—Mountain Fuel Supply Co., Rock Springs, contemplates the installing facilities and equipment for processing gasoline at its plant here. Estimated cost $944,851.

B. C., Victoria—Sidney Roofing & Paper Co., Ltd., L. Mahew, Managing Dir., Industrial Reserve, plans to construct a factory. Estimated cost $75,000.

Man., Altona—Cooperative Vegetable Oils, Ltd., Altona, plans to construct a new plant building. Estimated cost including equipment $65,000.

Ont., Peterborough—Canadian Raybestos Co., Ltd., 7 Perry St., plans to construct a factory here. Estimated cost $40,000.

Ont., Toronto—Canadian Pad & Paper Co., Ltd., 240 Madison Ave., plans to construct a factory. Estimated cost $40,000.

Ont., Toronto—Goodyear Tire & Rubber Co. of Canada, Ltd., Lake Shore Rd., plans alterations to its plant here. Estimated cost $48,120.

Que., St. Laurent—Industrial Glass Works Co., Ltd., 55 Ouimet Ave., plans to construct a glass manufacturing plant. Estimated cost $150,000.

Sask., Lloydminster—Lloydminster-Saskatchewan Refineries plan to construct an addition to plant here. Estimated cost $50,000.

CONTRACTS AWARDED

Calif., Bakersfield—Ohio Oil Co., 437 South Hill St., Los Angeles, has awarded the contract for the construction of a gasoline and recycling plant to The Fluor Corp., 2500 Atlantic Blvd., Los Angeles. Estimated cost will exceed $40,000.

La., New Orleans—Gulf Distilling Corp., Gretna, has awarded the contract for the construction of ten steel fermenters to have a capacity of 200,000 gal. each, to Ingalls Iron Works Co., Masonic Temple Bldg. Estimated cost $125,000.

Md., Indian Head—Bureau of Yards & Docks, Navy Dept., Wash., D. C., 18th St. and Constitution Ave., N. W., has awarded the contract for the construction of a permanent chemical laboratory at the Naval Powder Factory, here, to James Stewart & Co., Inc., Washington Bldg., Wash., D. C., at $529,500.

Mass., Worcester—Brewer & Co., 12 East Worcester St., has awarded the contract for reconstructing its 4 story laboratory and warehouse at its vitamin manufacturing plant, recently destroyed by fire, to E. J. Cross Co., 150 Prescott St., Worcester.

N. J., Newark—Celanese Corp. of America, 290 Ferry St., has awarded the contract for a 1 and 2 story, 54x200 ft. addition to its plant to Edmund R. Stearns, Inc., 84 Glen Ridge Ave., Montclair, at $94,074.

Ore., Portland—Chipman Chemical Co., Bound Brook, N. J., has awarded the contract for the construction of Unit No. 1 of a chemical plant here to George H. Buckler Co., Lewis Bldg. Estimated cost $50,000.

Pa., Creighton—Pittsburgh Plate Glass Co., Grant Bldg., Pittsburgh, has awarded the contract for the construction of a 3 story, 106x180 ft. assembly building here to the Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $160,000.

Pa., Philadelphia—Atlantic Refining Co., 260 South Broad St., has awarded the contract for an industrial plant to Schestman Bros., 260 Broad St. Estimated cost $50,000.

Tex., Rusk—McCrossing Engineering Co., 120 Wall St., New York, N. Y., has awarded the contract for the construction of a chemical plant and blast furnace to F. H. McGraw & Co., 15 East 42nd St., New York, N. Y. Project will be financed by Defense Plant Corp., Wash., D. C. Estimated cost $2,500,000.

Tex., San Antonio—Alamo Pottery, Inc., Malone Ave. and Frio City Rd., will construct a pottery or ceramic manufacturing plant. Work will be done by force account and subcontracts. Estimated cost $75,000.

B. C., Vancouver—United Distillers, Ltd., 8900 Shaughnessy St., has awarded the contract for 2 story, 28x42 ft. laboratory with 35x85 ft. foundations to Associated Engineering Co., Ltd., 445 Granville St., Vancouver; four steel storage tanks to Dominion Bridge Co., Ltd., 275 West First Ave. Estimated cost will exceed $50,000.

Que., Temiskaming—Canadian International Paper Co., Ltd., Sun Life Bldg., Montreal, has awarded the contract for an addition to its pulp storage building to Bennett, Pratt, Ltd., 30 Bloor St., W., Toronto, Ont. Estimated cost $40,000.