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PREPAREDNESS BEGINS AT HOME

INDIVIDUALLY the chemical engineers and the executives of chemical process industries have heavy personal responsibilities with reference to preparedness. These are jobs which Washington will not study or direct. They are responsibilities for better industrial management and technical efficiency right in our own plants, working on present-day products and processes.

Wars are now fought by industry as much as by the Army and Navy. It is absolutely essential, therefore, that industry be maintained on an efficient basis despite any stress of present or future emergency. The national defense demands that all chemical manufacturing plants continue to function with promptness and efficiency. Nor does this apply only to munitions. Nearly every heavy chemical or basic organic chemical is a potential bottleneck as the national defense program moves into broader scope. At least a half billion dollars has already been appropriated or earmarked for projects that depend upon chemical engineering processes and materials.

Each plant executive must face the inevitable consequences of this broader program and study its implications in relation to his own business. He must anticipate the worst and be ready for it. He must assume possible interruption of raw material supplies. He must be prepared for unusual maintenance and repair work. He must make sure that ample protection is provided against industrial sabotage. He must plan for indefinite expansion of production, often with demands coming most unexpectedly.

Many companies know that during normal times they can get repair parts on very short notice. Thus they carry a minimum stock of spares. For emergency purposes a much larger storeroom inventory may now be necessary. New operating units such as spare pumps, motors and controls should be on hand to permit installation of a workable machine while repairs are being made on those that fail in service. Interruption of production must be kept at a minimum; yet at the same time we must guard against a frenzied buying wave of duplicated orders that will interfere with government demands being made on the equipment manufacturers. Here is need for honest planning, common sense and calm judgment.

Personnel problems will perhaps be the job of the greatest complexity and uncertainty. Many technical men will be drawn into war work if not into the uniformed forces of the country. Military experts are hoping to get the necessary men without interrupting essential industries. But no one can really expect that an ideal plan can be worked out or that even the best plan will work perfectly for every plant and industry. England is already having her difficulties on this score even though she thought she had provided adequately for the civilian services of chemists and engineers. We must not repeat her mistake.

Some far-seeing executives are beginning to train men for greater responsibilities than their present jobs require. Some subforemen are being trained so that they can, at a moment's notice, step into higher positions. Three or four men for each important job is the objective in such plants. Thus resignations, drafts for selective service, or demands for increased production capacity can be met in these works with a minimum of delay and without seriously disrupting personnel.

We of the chemical process industries must think through these problems and be ready. It is our job as individuals. Washington has nothing to do with this planning. It will merely expect good results regardless of difficulties imposed by any emergency.

FROM AN

TOWARD RUBBER SELF-SUFFICIENCY

"At the moment the production of synthetic rubber on a large scale (in the U. S. A.) has only a theoretical interest," according to London's *Chemical Age* (March 30, 1940). At the time that statement was made, it may have been substantially correct—but what a difference three months have made! It is no longer a question of whether or not the United States will make synthetic rubber on a large scale; it is a question of when and how much of such production will take place.

According to the U. S. Department of Commerce, only 1,700 tons of these materials were made last year (compared with a U. S. consumption of natural rubber amounting to 592,000 tons). But the du Pont company alone is now making neoprene at the rate of 3,300 tons per year and in a few months will have increased its capacity to 6,000 tons per year. Annual production capacity of Thiokol is at least 1,000 tons. Standard Oil Co. of Louisiana will be making Buna at the rate of 5 tons a day before the end of the year. Firestone is already making some Buna. Ameripol, a new synthetic rubber announced recently by B. F. Goodrich Co., will be in commercial production to the extent of 1,000 tons yearly beginning this Fall (and can increase to 36,000 tons in 12 months). Standard Oil Development Co. has recently disclosed the discovery of another synthetic Butyl rubber, and it is believed that a further announcement regarding its commercial production will be made in September.

All these figures will add up to a synthetic rubber capacity of more than 10,000 tons per year by the end of 1940. Without a rubber shortage, however, there is a serious question whether industry can consume 10,000 tons of synthetics. It is significant that last year industry consumed only 1,700 tons although considerably more was available. This would seem to indicate a big difference between production and production capacity.

Nevertheless, in the event of a rubber shortage, 10,000 tons capacity is an insignificant amount compared with the 200,000 tons estimated by the government as our minimum requirements for self-sufficiency. This is offset by the fact that plants could be built quickly—probably long before rubber inventories were exhausted. Some of our largest plants have been built in as short a time as three or four months. Likewise industrial leaders anticipate little difficulty in raising the $150,000,000 estimated as the cost of such a construction program. Therefore, it is pretty obvious that the question isn't "can we"; it is "shall we" gear our industrial machine for rubber self-sufficiency.

E. R. Bridgwater, du Pont executive, points out that each time the neoprene plant was enlarged (five times in as many years), changes in process and equipment were made to effect economies. Furthermore, he recently stated to the Senate Military Affairs Committee that his company builds synthetic plants today with the expectation and even the hope, that they will become obsolete in less than five years. In the event that $150,000,000 were spent for new plants in the immediate future, it is quite probable that this would tend to "freeze" developments in the industry for a good many years to come. In Mr. Bridgwater's words: "I fear that the construction of huge shadow plants would cause a cessation of new construction in the synthetic rubber industry for many years thereafter and, consequently, would retard the improvement of products, simplification of process and lowering of production costs which are now proceeding at a rapid rate."

Some would have us believe that we must necessarily make a decision between high prices for synthetics and risking a rubber shortage. Fortunately, we can take a middle course. Probably by conservation we could stretch our crude rubber inventories (now piling up) to last a couple of years even if *all* rubber supplies should be cut off (which is quite improbable). Some authorities declared that without technical difficulty we could step up rubber reclaiming so as to consume 40 per cent reclaimed instead of about 20 per cent now used. Adding to this 15 per cent synthetics and only 45 per cent crude, we could be independent of foreign supply.

And should it be necessary to embark on the proposed large expansion program, plans are being discussed to build plants (possibly with government aid) for which high capital charges—30 to 40 per cent might be authorized by the taxing authorities. That would mean writing off the entire investment in three or four years.

All told, the situation is far less critical than the sensationalists would have us believe.

EDITORIAL VIEWPOINT

MORE FEDERAL TAXES

CONGRESS HAS PASSED one new tax bill. It will impose new burdens on both industry and individual tax payers to the extent of over one billion dollars per year. It is only the beginning of the new burdens which are to be laid upon industry and individuals by the chaotic conditions of the world.

Either late in 1940 or early in 1941 there will be still further tax legislation. At that later time two types of levies will be imposed. One will be the normal money raising effort to prepare the Treasury for the stupendous preparedness drains now imposed. The second type of levy will be more or less punitive or restrictive. It will undertake to prevent the making of "war profits."

It will be a responsibility of chemical executives to undertake planning *now* as to how these future tax burdens are going to be met. They will very largely influence the cost of doing business. In many cases the burdens will bear on divisions of industry that have no part in preparedness. One cannot afford to wait for the passage of new tax bills to begin the figuring as to how the money can best be made available to pay the tax collector when he calls.

A JOB FOR PUERTO RICO

VARIOUS PROPOSALS for solving the economic problems of our insular possessions have been offered. One of these that the chemical process industries might encourage generally is the idea that the semi-tropical areas of Puerto Rico and other insular possessions should be utilized for the growth of certain agricultural raw materials which do not thrive in continental United States.

The Department of Agriculture and the Puerto Rico agricultural experiment station staffs should be able to select a number of such crops for which there is real need of new United States supplies. It is not necessary to go to the sugar crops, of which we have excessive supplies already. Far more promising are the cordage fibers, the castor bean, and a number of the other tropical or semi-tropical crops furnishing strategic materials or other commodities necessarily imported into the United States.

Possibly some American chemical manufacturers should take a hand in this situation right now. There is a distressing shortage of supplies of many of the semi-tropical botanicals. These are urgently needed for drug manufacture and for the preparation of other specialties. Synthetics are generally not available as substitutes.

It will be a fine thing if the chemical industries and officials interested in the well-being of Puerto Rico and other territorial units can get together and promote growing, marketing, and use of these materials near home. It would be especially fortunate if such developments can be based on sound economic plans that will not require either government subsidy or an assumption of permanently interrupted marine traffic from the Orient or Africa.

NEW ENGINEERING STANDARDS

ANDREY A. POTTER, dean of the country's largest engineering schools, sees a need for even broader training for the future of our profession. On the occasion of the dedication of Purdue University's new building for its School of Chemical and Metallurgical Engineering, he appraised the objectives of engineering and engineering education in these words:

> "Engineering is intended to utilize economically the findings of science in order to provide better and easier ways for satisfying human needs. An engineer who creates new knowledge or who utilizes existing scientific knowledge must at all times gives special consideration to costs and values, to the economical utilization of science and to the effect of the engineer's work upon human happiness. An engineer must have full appreciation of the economic as well as the technologic problems of his specialty and must recognize at all times the social consequences to which his work may contribute. Thus engineering curricula must stress not only science and technology, but also economics, sociology, psychology and the humanities."

This philosophy for enhancing the engineer's services to the public through better preparation and training stands in striking contrast to those who would lower the standards of the profession in order to protect the mediocre and the unsuccessful.

Organizing for

Major General W. C. Baker, Chief of Chemical Warfare Service, U. S. Army, Washington

Editorial Staff Report

E. W. Reid, Senior Research Fellow, Carbide and Carbon Chemicals Corp., Pittsburgh, Pa.

Edward R. Weidlein, Director Mellon Institute of Ind. Research, Pittsburgh, Pa.

D. P. Morgan, Chemical Economist, Scudder, Stevens and Clark, New York

Robert E. Wilson, President Pan American Petroleum & Transport Co., New York

IN THE LANGUAGE of national preparedness, most of the products of the chemical process industries are raw materials. This means, therefore, that in the set-up of the National Defense Advisory Commission, most of the chemical procurement problems come under Edward R. Stettinius, Jr., former chairman of U. S. Steel Corp. He has defined his job as being "responsible for insuring a continuous and adequate flow of materials from the source to the point of production."

The best distinction between his responsibility and that of his fellow commissioner, William S. Knudsen, General Motors executive, was given in the latter's picturesque words when he said he was not interested in raw materials "until I can cut them up." In other words, his concern is with manufacture and production for he is "in charge of coordinating production of primary defense materials,"—planes and engines, tanks, guns, trucks, etc. Each of these men, as well as the other five non-government members of the commission, has organized a consulting staff of advisers, drawn largely from industry.

E. R. Weidlein, director of Mellon Institute, is the principal chemical adviser on the staff of Mr. Stettinius, serving as chief of the Chemistry and Allied Industries Division of the Raw Materials Unit. He is assisted by D. P. Morgan, chemical economist for Scudder, Stevens & Clark of New York, and E. W. Reid, who has been senior research fellow for Carbide and Carbon Chemicals Corp. at Mellon Institute. Broadly speaking, the program under Dr. Weidlein will include the major fields of interest to chemical manufacturers, even including many who do not make chemicals as such, e.g., producers of synthetic rubber.

Robert E. Wilson, president of Pan American Petroleum & Transport Co., and of the American Oil Co. and subsidiaries, is chief of the Petroleum Section, a part of the Chemical Division. Other sections in the Raw Materials Unit include Metals and Minerals (under W. L. Batt), Agricultural and Food Products (under Clarence Francis), Rubber (W. L. Finger), Textiles (R. T. Stevens), Steel (W. S. Tower and J. D. East). Directly under Mr. Stettinius in the Raw Materials Division is a staff of industrial executives including Charles E. Adams, chairman of Air Reduction and U. S. Industrial Alcohol, who serves as senior administrative assistant, William L. Batt, president of SKF Industries and M. B. Folsom, treasurer of Eastman Kodak Co. as executive assistants and A. W. Morton, vice president of Koppers Co., as special assistant.

In the Production Division under Mr. Knudsen, John D. Biggers, president of Libbey-Owens-Ford Glass Co. is executive assistant, and E. F. Johnson, former General Motors and duPont executive, is assigned to ordnance and ammunition problems.

The lines of organization are not being drawn too sharply at first. This is to permit growth and flexibility. The National Defense Advisory Commission does not intend to set itself up as a great new independent body. It intends, rather, to use the existing agencies of government and industry—to act as a liaison agency and a catalyst for getting prompt action.

During the past two years a very comprehensive series of surveys of chemical needs was made for the Army and Navy Munitions Board by a group of industry committees. This group of committees functioned under the general coordinating influence of the Manufacturing Chemists' Association with E. M. Allen, president of Mathieson Alkali Works, as general chairman. The sub-chairmen of the various commodity committees formed with Mr. Allen a Chemical Advisory Board for the military executives. That group is renewing its activities at the request of the Defense Commission and it is expected that a resurvey of a number of commodities will be made immediately.

Dr. Weidlein began his service with some of his technical associates during mid-June. One of the first and most pressing tasks has been the handling of innumerable offers of cooperation. In commenting on this,

Chemical Preparedness

E. M. Allen, President Mathieson Alkali Works, New York

Charles E. Adams, Chairman Air Reduction Co. and U. S. Industrial Alcohol Co., New York

John D. Biggers, President Libbey-Owens-Ford Glass Co., Toledo, Ohio

Donald M. Nelson, Executive Vice President Sears, Roebuck and Co., Chicago

Allen W. Morton, Vice President Koppers Co., Baltimore, Md.

Dr. Weidlein makes it clear that the lack of prompt reply from his office and the delayed acceptance of offers does not evidence any lack of appreciation. It signifies merely the deluge of offers which have been received and the inability of a new unit to dig through this mass of information as quickly as it would like.

It has been determined as a general policy by the President and the Defense Commission that a set of priority schedules will be worked out for each major commodity which appears at all likely to be subject to supply difficulties. This does not mean that these priorities will be imposed at this time. Any such restriction will be delayed as long as possible. All of the President's advisers recognize that the normal commercial flow without regulatory control represents the best scheme for business functioning.

The various members of the Defense Commission are outspoken in their compliments to industry regarding its willingness to exercise self-restraint in the matter of procurement. One of the members of the Commission did, however, point out one helpful philosophy. He put this simply—"If you want one or two pieces of equipment or tons of a commodity, please don't order three or four in the hope of getting the needed smaller number." The multiplication of orders beyond actual need, or duplicate ordering from different producers with the expectation of cancelling some order later, might start a dangerous spiral.

Programming for new chemical manufacture actively under way since the first of July. At that time the major chemical bottleneck of preparedness is, oddly, military explosives. The American concept as to the quantity of propellants and high explosives needed has so radically changed during recent weeks as to make old plans altogether out of date. Rapid progress is being made by negotiation of the government with every available competent and experienced military explosives maker.

Right at this point is really the bottleneck in planning. This bottleneck is formed by the lack of dependable information regarding military needs for chemical commodities. Even the most expert of Army and Navy staffs cannot yet tell exactly how many tons of this or that will be required for each unit of men assumed to be under arms immediately or in the near future.

Research as a tool of preparedness is well recognized in the defense program. A National Defense Research Committee has been set up by President Roosevelt as an independent body, not as a part but cooperating with the National Defense Advisory Commission. It is headed by Dr. Vannevar Bush, president of Carnegie Institution of Washington and includes President J. B. Conant of Harvard, Dr. F. B. Jewett of Bell Telephone Laboratories, Dr. R. C. Tolman, California Institute of Technology, President Karl T. Compton of Massachusetts Institute of Technology and Commissioner C. P. Coe, of the U. S. Patent Office.

Chemical Warfare Service under Major-General Walter C. Baker, chief, has long had the benefit of industrial advice and cooperation in its procurement program. The country is organized into five procurement districts, each of which is headed by a district chief and a board of eight to twelve industrial executives. The district chiefs as of July 1, were as follows: Boston, Charles F. Adams, president, Union Trust Co.; New York, E. M. Allen, president, Mathieson Alkali Works; Pittsburgh, Dr. William O. Sherman, Carnegie-Illinois Steel Corp.; Chicago, George B. Dryden, president, Dryden Rubber Co.; San Francisco, William H. Berg, president, Standard Oil Co. of California.

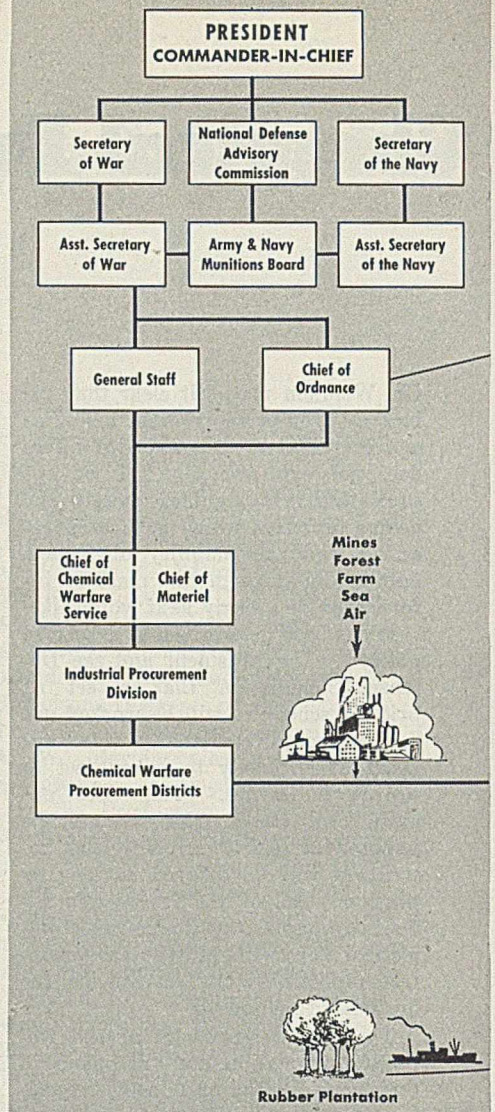
Donald M. Nelson, once chief chemist and later executive vice president of Sears, Roebuck & Co. and until recently head of the Treasury Procurement Division, has been made coordinator of all national defense purchases. This has been interpreted to mean that the National Defense Advisory Commission, to which he has been attached, will have full supervision of the important question of priorities.

What You Can Do For National Defense

M. E. BARKER *Major, Technical Division, U. S. Chemical Warfare Service*

Chem. & Met. INTERPRETATION

To answer the many requests for information and the voluntary offers of cooperation which the Chemical Warfare Service is receiving from organizations and individuals, its chief (Major General Walter C. Baker) has had this brief paper written by Major Barker. It is illustrated with a chart prepared under the direction of Captain Harry A. Kuhn, executive officer of the New York Chemical Warfare Procurement District. All readers concerned with the organization and functioning of the C. W. S. program will do well to review the articles that appeared in *Chem. & Met.* in March 1939 (pp. 139-41) and December, 1939 (pp. 754-6).—*Editors.*

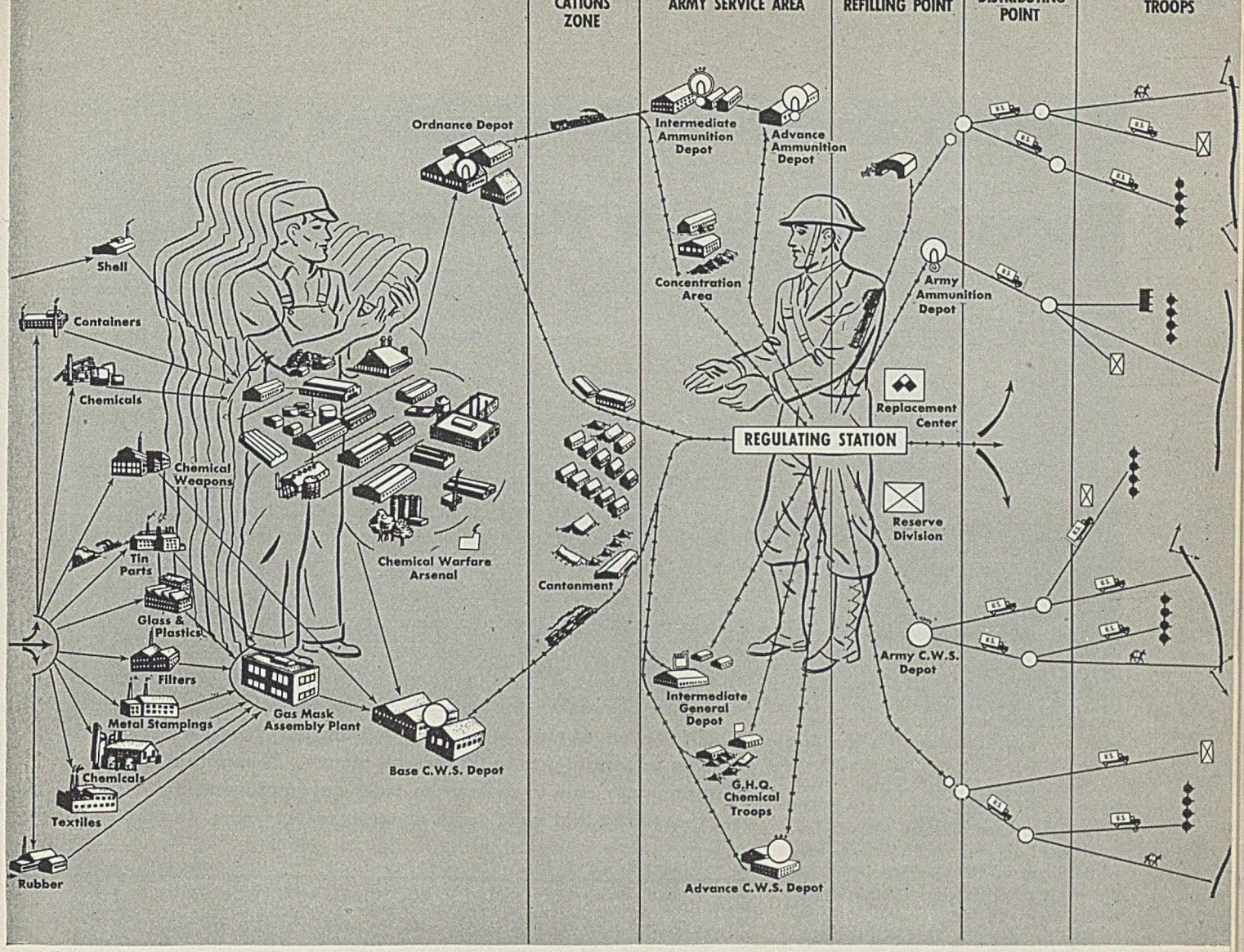


MODERN WAR requires several times as many men in the factory as it does on the firing line. Before the factory can go into production, a standardized article is necessary. Research, development, design and the operation of pilot plants must all precede standardization. Because of the vast quantities required only standardized products suitable for quantity production can possibly meet the test of a modern war.

Production of such large quantities means that materials and processes must be checked at every stage, and frequently it will mean that substitute materials must be used without overly decreasing the quality of the product. Since chemical engineers and chemists play a predominant part in the control of processes of this kind, it is evident that enormous industrial operations, required to support a modern war, would require the services of a vast number of technical men in industry.

In general, research and development is done by the various branches of the Army, such as the Chemical Warfare Service, the Ordnance Department, the Signal Corps, the Quartermaster Corps, and the like. These branches have the active cooperation of numerous industrial concerns in the work. After such development is completed, the requirements for the item to be manufactured are embodied in specifications. The manufacturer is required to produce the item in accordance with the drawings and the specifications furnished. In some cases, the specifications outline the performance of the article only, leaving the exact design and materials of construction to be decided by the manufacturer. Since many items must be manufactured and since the majority of these will be produced by firms who normally do not make that particular item, it is evident that a vast amount of adjustment work is going to be required by the industries concerned, or by independent testing and research groups working on their behalf. That indicates that the chief function of the commercial research laboratory and the commercial testing laboratory, in an emergency, will be to assist private manufacturers in getting into production and in maintaining the quality of their product during manufacture. Here is the major job of a considerable part of the chemical profession.

It is essential that manufacturers take such steps as may be practicable now to lay out a personnel program which will enable them to carry on their manufacturing work when, and if, Reserve Officers and Government consultants are called to active duty. There are some 3,000 or 4,000 members of the chemical industry holding Reserve commissions, most of them



Modern wars are fought in the factories of industry; thus for Chemical Warfare it has been estimated that at least 7 men are needed in the plants of chemical and process industries for every soldier on the firing line

in the technical branches of the Army. Mobilization plans are based upon the use of these men in Government establishments. Most of them have been trained for specific assignments which are in line with their professional work. In this way, the Government will be assured of adequate technical assistance in conducting the necessary research and development of all items; and in the manufacture of those materials which can be produced most economically and with greatest safety in Government arsenals. Consequently, the chemical industry must be prepared to share its trained and experienced personnel with the Government, and must arrange to break in new and substitute personnel. These Reserve Officers and consultants have given freely of their time during the past years in order to prepare themselves to serve their country in time of need. It is only reasonable and proper that chemical industry should make provision for the loss of these men during an emergency, and for their return to employment when the emergency is ended.

Should an emergency arise over and beyond that now foreseen in the building of the Regular Army, and require the procurement of a reasonable amount of war supplies, then it is certain that a tremendous burden will fall on industry which will necessitate expansion of existing plants and facilities, and will call for a sharing of the present trained personnel with Government establishments. Industrial concerns as well as testing laboratories and commercial research organizations, should therefore make a careful study of drawings and specifications for the items for which they, or their clients, have signed programs for procurement, in order that they may know the problems involved and may be prepared to test and inspect raw materials and the various products throughout manufacture.

All too often in the past, commercial concerns have taken Government contracts with the hope of beating down the quality of the article as called for in the specification. Present specifications are written, and have been approved by the industry concerned, with a view to the production of articles and materials of definite quality under wartime conditions. Military operations must be based on the receipt of adequate quantities of material of standard quality. The problem, therefore, of industry is to be prepared to produce large quantities of materials meeting the particular specifications for the item which each concern has agreed to furnish, or may in the future contract to supply. There can be no compromise on quality and performance of military products.

Process Economy Emphasized In Recent Beet Sugar Developments

RALPH W. SHAFOR *Manager Process Division, The Dorr Co., Inc., New York, N. Y.*

Chem. & Met. INTERPRETATION

In the economic readjustment that must necessarily follow World War II, the beet sugar industry has a vital interest. Sugar is an import item to the extent of about $125,000,000, a third of which imports comes duty-free from the Philippine Islands. A change in the status quo of the Philippines or any of the other sugar-producing centers, or a shift in tariff regulations might mean an upward or downward change in the rate of domestic production, which has been static for several years. Sugar from our Western beet fields plays an important part in the overall picture. Therefore, this seems an appropriate time to review the technical improvements in sugar beet processing that have come about in recent years.—*Editors.*

IN 1933 the writer discussed developments in sugar beet processing during the preceding twenty-five years (See A.I.Ch.E. Silver Anniversary Volume). Under the influence of depression-sugar prices, some additional developments have been brought out since that article appeared.

As a whole, the industry in North America has not grown—it produces now, as it did then, some 1.25 million tons of refined sugar per annum, some 25 per cent of that consumed in continental United States. Expansion being impossible, much attention has been directed toward improvement in technical matters, and while some of the developments are not yet fully established, several are noteworthy in that they indicate trends of thought, methods of approach, as well as in some cases, money saved. For the most part, improvements have come through a chemical engineering study of the unit operations involved.

Extraction of sugar from the beet cossette, which is usually semi-continuous in North American practice, has been made totally continuous in several European factories. The Berge battery—a Belgium development—seems to hold promise of meeting the needs of the economic requirements of the domestic industry, but no installations have as yet been made.

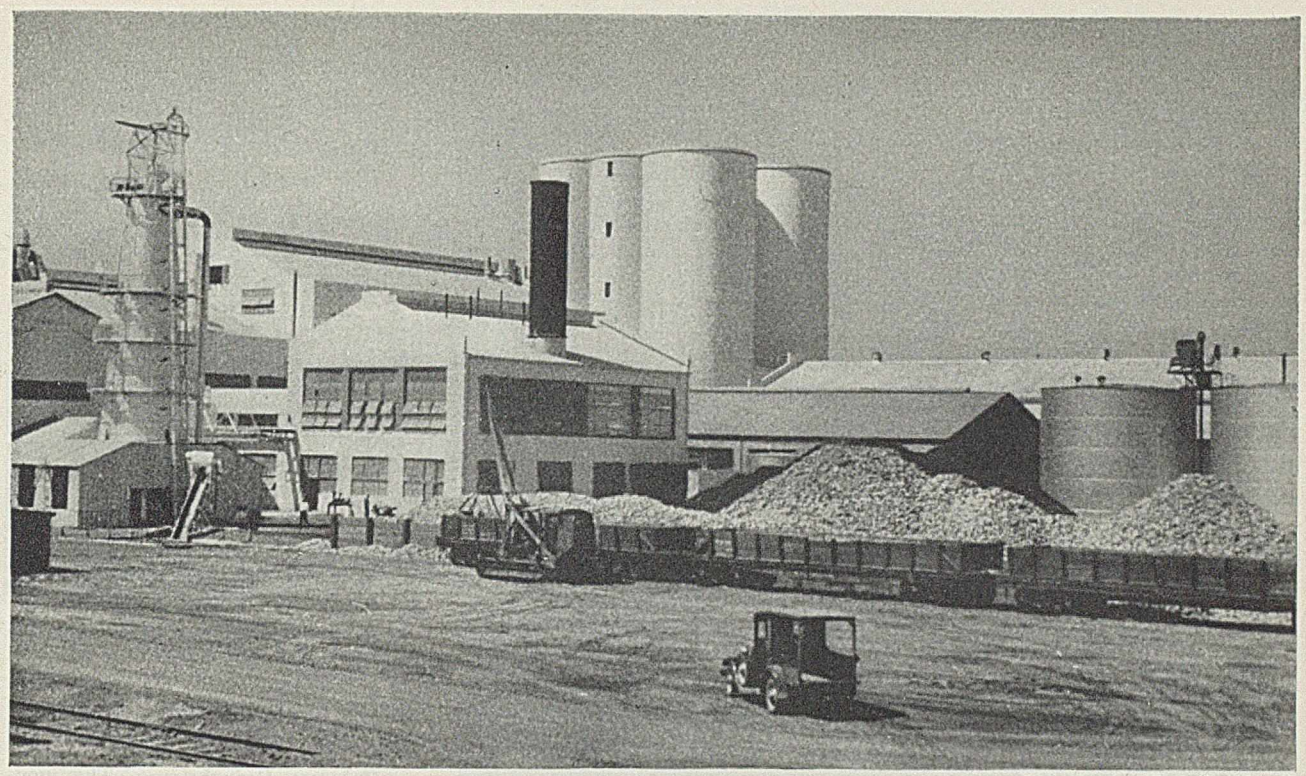
Juice Purification—Some progress has been made in this field through so-called "preliming" practices. Raw juices are being treated with lime to produce a pH within closely controlled limits at which an optimum amount of colloidal impurities are precipitated into irreversible solids so that they may be definitely removed by subsequent filtration operations. The results have benefitted the processor in two ways: (1), by reducing the amount of reagent lime required to yield a desirable purification of the juice, and (2), by improving somewhat the crystallization of the sucrose.

The Dorr Continuous Carbonation Process continues to find a wider application—being used in processing substantially 50 per cent of the 1939 crop—and the sedimentation thickener-vacuum drum filter combination continues to supersede less economic apparatus for the first carbonation filtration step.

Multiple-effect Evaporators and Steam Economy—Ten years ago the average North American factory used some 8,500 to 9,000 B.t.u. (in the form of fuel) in the production of 1 lb. of refined sugar. During the 1939 campaign, the consumption of fuel (in the form of natural gas) in the modern Woodland, Calif., factory of the Spreckels Sugar Co. averaged 5,740 B.t.u. per lb. of sugar produced, with definite indications that a figure of 5,000 is not unattainable.

Boiler efficiencies at Woodland are reported as being of the order of 84 per cent as compared with the general average in the industry of some 75 per cent ten years ago. Thus by far the larger portion (some 60 to 65 per cent) of the savings must be credited to economy in the use of steam for processing. In this factory the latter saving may be contributed almost entirely to (1) the quintuple-effect single-pass flume type pressure evaporator with tubes 18 ft. long (constructed by the Swensen Evaporator Co.) which employs high pressures and is new to the industry, and (2) to a carefully planned control, automatically actuated in most instances, of the flow of steam and evaporator vapors to the various heat-consuming operations.

Sucrose and other ingredients of normally purified sugar beet juices have a definite tendency to decompose at elevated temperatures. In old style horizontal tube evaporators where time of detention in contact with heating surfaces was quite extended, it was generally held that temperatures allowed in the first body should not be in excess of 110-115 deg. C. Results obtained in this new type of unit have, taking into consideration the short time of juice



Photos Courtesy "Facts About Sugar"

Modern in every detail, is the beet sugar factory of the Spreckels Sugar Co., Woodland, Calif.

detention, etc., shown that temperatures as high as 135-140 deg. C. are entirely practical.

The approximate pressures employed in the various bodies of the quintuple-effect evaporator at Woodland are indicated in the first column of Table I, while those in the so-called "standard" horizontal tube unit generally employed are shown in the second column.

Table 1—Gage Pressures at Various Stages, Lb. per Sq. In.

	Woodland	Standard
Exhaust steam.....	44	15.0
First vapor.....	30	8
Second vapor.....	14	2
Third vapor.....	2.1	−3
Fourth vapor.....	−1	−8
Fifth vapor.....	−13	−13

From the table it will be seen that the temperature of the second vapor with the new type of evaporator is approximately equivalent to that of the exhaust steam in the so-called standard evaporator of 1933. Thus if we list the more important steam-consuming operations and note opposite them the source of the heat employed in the old and new operations, the cause of the above saving immediately becomes apparent.

This comparison indicates at a glance the source of the processing economy. Live steam is replaced by first body vapor in one instance, and exhaust steam and first body vapor are replaced by second body vapors in six instances, while third body vapor is used in six instances to replace first and second body vapors. With the new arrangement, fourth body vapor has sufficient temperature to make worthwhile its use in preliminarily heating raw juice passing from the battery to first carbonation with corresponding saving of second and third vapors normally used for this purpose.

Crystallization of Sugar—Probably the most outstanding of the developments in this phase of the art has to do with means for crystallizing (by cooling) the last portions of sugar from the low raw "filmass." For those not thoroughly familiar with the art, it may be well to say that in common practice the processor, after having extracted all of the white sugar possible from his purified syrups, finally exhausts them by producing a raw sugar which is later redissolved and re-crystallized into white. The syrups from this product as extracted are extremely viscous and crystallization rates are slow. Ordinarily, the first 50 per cent of this sugar is crystallized by concentration at a temperature of approximately 70 deg. C. Because of the time factor and shape of the solubility curve it is more economic to crystallize the latter 50 per cent by slowly cooling the filmass in a suitable manner. This has heretofore been accomplished in a water-jacketed cylindrical crystallizer with a capacity of some 1,200 cu.ft., on the average, placed with its axis in a horizontal position and equipped with a mechanical stirring device. Heat transmission was poor and localized over-cooling pronounced with this apparatus. The average time required for cooling to obtain a satisfactory extraction with this type of unit was something like 48 hours.

The Lafeuille crystallizer now used

Table II—Steam and Vapor Distribution

	Woodland—1939	1930
Granulators	Live steam	Live steam
Beet slicers	Live steam	Live steam
Evaporators	Exhaust steam	Exhaust steam
Thin juice heater	First vapor	Exhaust steam
White pans	First vapor	Live steam
Intermediate pan	Second vapor	Exhaust steam
Sugar melters	Second vapor	Exhaust steam
Thin juice boiler	Second vapor	Exhaust steam
Cold waste heater	Second vapor	First vapor
Primary thin juice heater	Second vapor	First vapor
Second carbonation heater	Second vapor	First vapor
Standard liquor heater	Third vapor	First vapor
Thick juice heater	Third vapor	First vapor
Diffusion battery heaters	Third vapor	Second vapor
Secondary raw juice heater	Third vapor	Second vapor
Raw pans	Third vapor	First vapor
Testing raw juice heater	Fourth vapor	Not used.

in several factories completes this cooling operation in a period of from 8 to 12 hours and produces a crystal which separates from the syrup in the centrifugals more completely, on the average, than is possible with the old style units. The Lafeuille crystallizer consists of a horizontally placed shell which rotates on suitable trunnions and which is equipped with water cooling tubes arranged parallel to the axis and in a manner which extracts heat uniformly from all parts of the charge.

One Lafeuille crystallizer will do the work formerly accomplished (depending upon local conditions) by from 6 to 8 of the old style units.

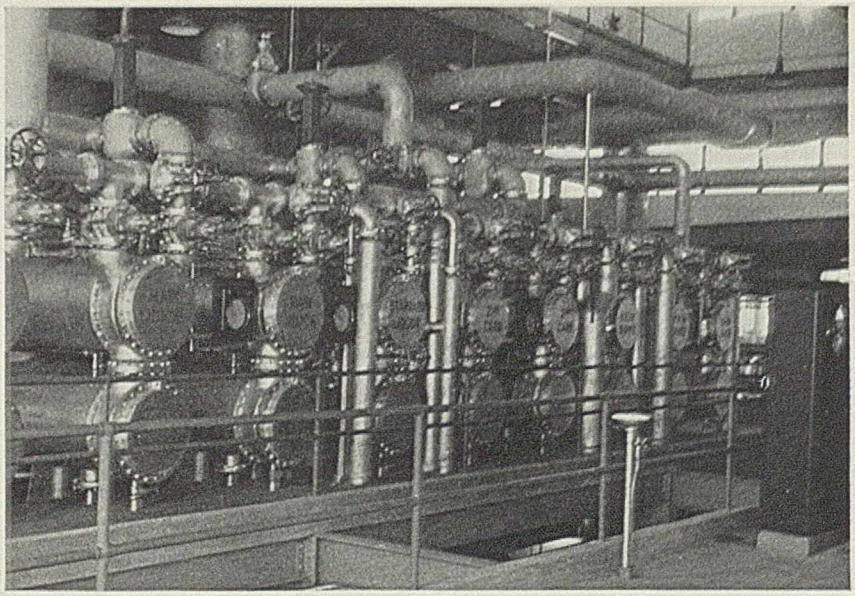
One modern factory is equipped with Werkspoor continuous crystallizers and is obtaining satisfactory results with 22-hour cooling periods.

Results obtained in this phase of the art reaffirm the importance in such operations of avoiding localized excess cooling and the value of accurate control. With the Lafeuille crystallizer, particularly, it is possible to equip with control instruments which at the will of the operator will extract a desired number of B.t.u. per hour from the charge with the assurance that no one portion of that charge will be cooled at the expense of another.

Separation of Crystals From Syrups—Marked improvements have been forthcoming in this field during the last decade. One of the primary factors affecting the separation of crystals from syrups is the viscosity of the latter. Supersaturations necessary for effecting the formation of crystals definitely increase vicosity of syrups and affect adversely (to a marked degree in the lower purity syrups) the separation of the crystals therefrom. Early work in this field eliminated such unnecessary supersaturation (and viscosity) by employing moderate dilution carefully controlled between the crystallizer and the centrifugal. More recently, however, means have been developed for effecting this result by controlling the temperature of the mixture fed to the centrifugal baskets. This method has yielded marked improvements in the efficiency of the separation and the capacity of the centrifugal units employed therefor.

BATCH TYPE CENTRIFUGAL

The batch type centrifuge with a 40-in. basket and operating at a speed of some 1,200 r.p.m. has long been standard in this service. Within the past ten years manufacturers of centrifugal equipment have stepped up the speeds to 1,400, 1,600 and 1,800 r.p.m. At least one manufacturer has experimented with speeds in excess of 2,000 r.p.m.



Juice heaters for raw juice, standard juice, second carbonation and thin juice at the Spreckles factory

This development has resulted (and the new machines are being used in an everwidening circle) in a large increase in the capacity of a single unit, a reduction in the installed cost of centrifuging equipment per unit of output, and a material saving in labor.

Further, with this equipment unwashed white sugars with purities of 99+ per cent are readily obtainable as compared with purities of 98 per cent in the older equipment. Obviously, the washing of the crystal to remove the last traces of syrup is a much simpler problem with the new machine and its 99 per cent purity unwashed product. Incidentally, too, whereas the old machine discharged a washed product carrying 1 to 2 per cent moisture, the new style unit delivers a product with from 0.5 to 1.0 per cent moisture. The subsequent drying operation is thus much simplified.

These new style units are daily producing raw sugars from the above mentioned crystallizing operation with purities of 96+ per cent as compared with purities of some 90 per cent with the former units. The value of such an improvement in separation is marked. It tends to improve the quality of the white sugar produced, it tends to reduce steam consumption, and to increase the capacity (in terms of tons of beets processed) of all the equipment involved in the sugar crystallization operation.

Molasses Desugarizing—The modern Spreckels continuous molasses desugarizing process is based on the old "Steffen" reaction in which finely powdered quick lime is used to precipitate the sucrose from a relatively dilute aqueous solution of beet molasses. The process is novel in that it successfully converts a heretofore batch-wise operation into a continuous one.

The Steffen reaction is exothermic, and unless temperatures are maintained at points below some 15 deg. C. during the reaction, side reactions enter to result in excessive consumption of reagent lime as well as poor extraction. In prior practice, which was effected almost universally in a batch-wise manner, heat was extracted from the solution as it was formed. With the Spreckels continuous process, however, the dilute molasses solution is pre-cooled to a point where the heat of reaction will not raise the temperature in excess of the upper limit. With this arrangement, it is possible to add the reagent instantaneously to the solution and allow the reaction to proceed with a short but thorough mixing of the two, as compared with prior practice in which the lime was added slowly over a fifteen minute period to a batch of solution.

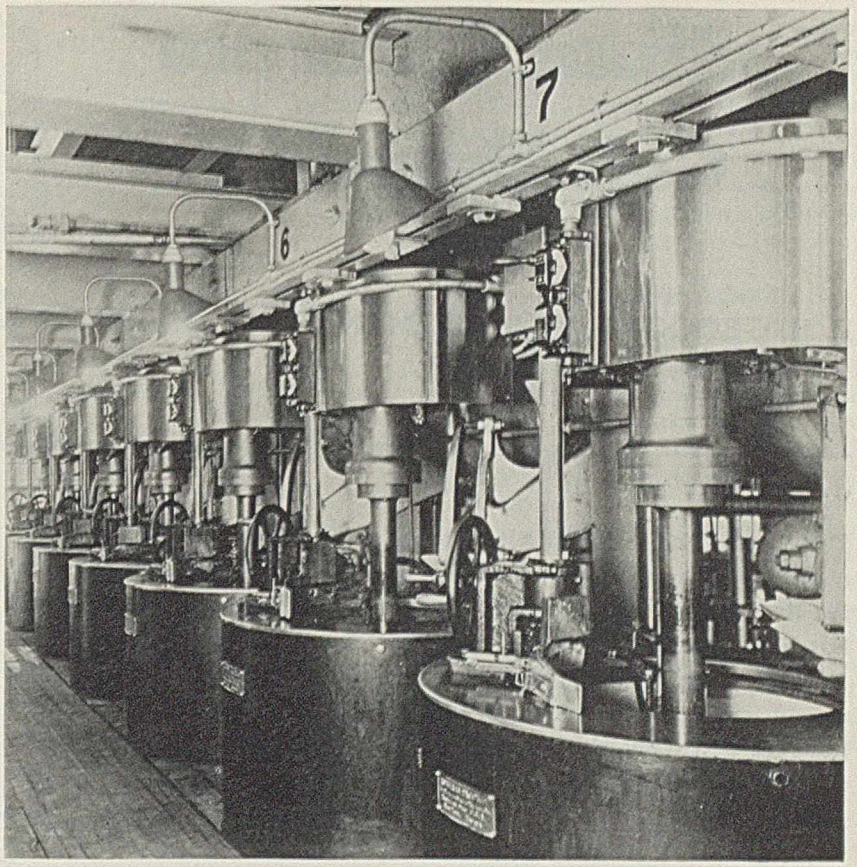
Thus far artificial refrigeration has proved a necessity in connection with the use of the Spreckels procedure.

Lime Re-burning—The North American industry consumes some 200,000 to 300,000 tons of quick

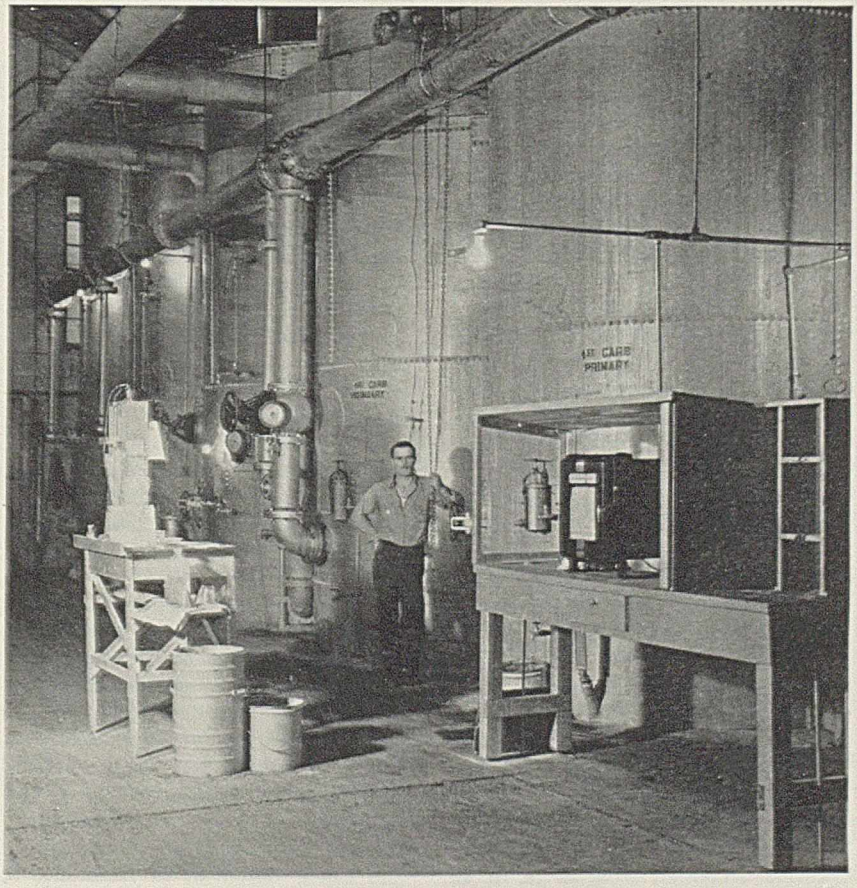
lime per crop (per year). All of this is produced under supervision of the factory management because the carbon dioxide gas as well as the lime is used in the purification of the beet juice (first and second carbonation operations). Because of the necessity for gasses carrying relatively high (30+ per cent) concentrations of CO_2, the coke-fired Belgium type of shaft kiln is almost universally employed.

In some factories where the molasses desugarizing operations are carried on more extensively than others, consumption of lime is appreciably larger—frequently as much as 100 tons per 24 hours. In factories of this type the need for some method of reburning lime so as to produce a usable product and a gas carrying a suitable CO_2 concentration has long been apparent. In one or two instances local conditions have permitted of reburning up to 15 per cent of the product because the amount of gas obtainable from the remaining 85 per cent was sufficient for purification operations.

During recent years, however, the Colorado Iron Works and the Holly Sugar Co. have collaborated on the development of a mechanically rabbled, hearth type of gas-fired muffle furnace using the Skinner roaster of the metallurgical industry as a starting point. As a result of this cooperative effort by the two companies, one commercial unit capable of producing lime for a factory treating 1,800 tons of beets and desugarizing 100 tons of molasses per 24 hours was installed and operated successfully during the last campaign. This unit produced a gas containing approximately 30 per cent CO_2 and a lime which was more active in the Steffen molasses desugarizing reaction than that produced from freshly burned limestone. While results to date are not finally conclusive, there seems to be little doubt of ultimate success.



White sugar centrifugals with 40-in. baskets



Continuous first carbonation station at Amalgamated Sugar Co. in Idaho

Sugar Storage—The bulk storage of refined sugar in silos, similar in construction and appearance to those employed for the storage of wheat, etc., continues to expand, some ten or twelve factories having been so equipped in recent years. Its use brings about lessened handling charges, eliminates almost entirely the necessity for reconditioning due to caking in storage, lessens the first cost of storage facilities, and utilizes labor during the inter-campaign period, thus reducing the seasonal demand of the industry.

Sodium Chlorate Cell Design

P. H. GROGGINS, A. L. PITTMAN, AND F. H. DAVIS, *Washington, D. C.**

Chem. & Met. INTERPRETATION

This is the concluding article in a series describing the development of the sodium chlorate cell, one of the most interesting projects the United States Bureau of Agricultural Chemistry and Engineering has had under way. In this last report consideration is given to the problem of cell design, particularly with the object of increasing the output per unit volume of electrolyte. Pilot plant experiments indicate that with rectangular cells a considerably higher output of chlorate per unit of cell volume was obtained.—*Editors.*

THIS IS THE THIRD in a series of papers dealing with research on the electrochemical production of sodium chlorate. In the first article (*Chem. & Met.*, Vol. 44, p. 302) emphasis was placed on the economies of chlorate production and in the second paper (*Chem. & Met.*, Vol. 45, p. 692) the discussion was confined largely to certain chemical, electrochemical and chemical engineering factors. In this new report consideration is given to the problem of cell design, particularly with the object of increasing the output of sodium chlorate per unit volume of electrolyte. Compared with data in the earlier reports the results of pilot plant experiments indicate that with rectangular cells a considerably higher output of sodium chlorate per unit of cell volume was obtained.

IMPORTANCE OF TEMPERATURE

The electrolytic process is accompanied by the generation of heat because of the overvoltages at the electrodes and because of the resistance of the electrolyte. The heat produced in a cell is a function of both ampere load and voltage. Other things being equal, the heat liberated per pound of chlorate is closely proportional to the total potential drop minus the theoretical decomposition potential. Since the voltage becomes greater with increased current density, it is clear that the task of controlling the operating temperature under conditions of equal cell amperages becomes magnified. It has been reported (N. V. S. Knibbs, and H. Palfreeman. *Trans. Faraday Soc.* Vol. 16, p. 422, 1921) that approximately 1.6 volts are required theoretically for the process. Assuming 820 amp. hr. per lb. of sodium chlorate as an average current consumption, the energy consumption will be (820 × 1.6) = 1.31 kw.-hr. (d.c.). The energy consumption in excess of 1.31 kw.-hr. (d.c.) will be converted largely to heat. Thus, when 3.00 kw.-hr. (d.c.) is used, the thermal equivalent of 3.00 — 1.31 kw.-hr. (d.c.) = (1.69 × 3,411) = 5,765 B.t.u. will be liberated per pound of chlorate.

The chemical attack on the graphite anodes becomes smaller with a decrease in cell temperature. The operation of cells Nos. 7 and 8 (ref. 1, above) showed that the graphite loss per ton of sodium chlorate in solution decreased from 21 lb. at 42 deg. C. to 11 lb. at 32 deg. C. The operation of small laboratory cells showed that a further diminution in graphite loss would be realized by lowering the operating temperature from 32 to 25 deg. C.

Accordingly, it was decided to reduce the cell temperature from 32 to 25 deg. C. A direct comparison at these temperatures was made in cell No. 2 operating at 500 amp. load and the following average results were obtained:

Table I

Variation of anode attack (grams C measured as CO_2 per lb. $NaClO_3$ in solution) with temperature and sodium chloride concentration

Grams NaCl per liter	60	90	120	150
Temp. Deg. C.				
32	10.3	6.2	5.5	5.2
25	8.5	4.0	3.2	2.5

The preceding data also show the marked increase in anode attack when the sodium chloride concentration falls as the result of electrolytic production of sodium chlorate. Because of this factor, in comparing the anode attacks in different cells or under other changed conditions, one must compute average attacks based on actual concentrations of sodium chloride. Twenty-five per cent brine was fed to the first of a series of four cells, (see ref. 2, above). The sodium chloride concentration in the cells was found to be: 236, 189, 140 and 87 grams per liter. The anode attacks in cell No. 2 of the present series, at the above-mentioned sodium chloride concentrations, were averaged. The average attack was found to be 5.5 grams of carbon, measured as CO_2 per pound or 68 lb. of graphite per ton of sodium chlorate in solution, at a cell temperature of 32 deg. C., and only 2.7 grams per pound or 34 lb. of graphite per ton at 25 deg. C. The graphite consumption per ton is based, as in Reference 2, on equal sludge and chemical losses

* Industrial Farm Products Research Division, Bureau of Agricultural Chemistry & Engineering, U. S. Department of Agriculture.

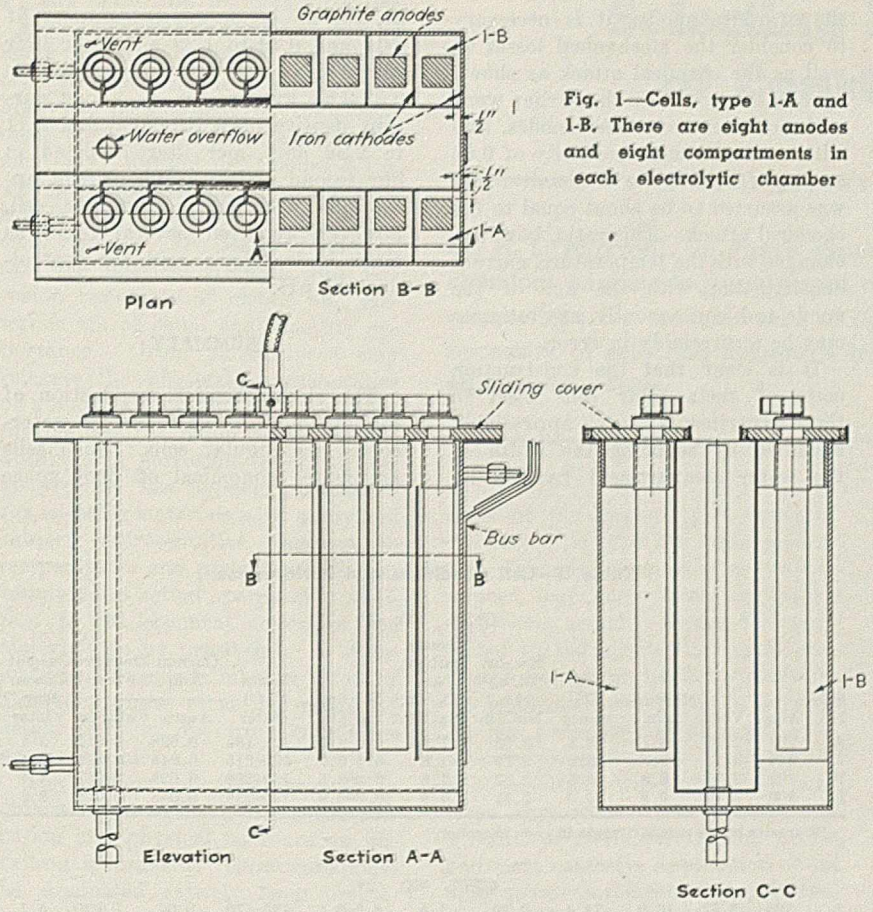


Fig. 1—Cells, type 1-A and 1-B. There are eight anodes and eight compartments in each electrolytic chamber

and on a 30 per cent anode stump loss. The data show that the per cent decrease in anode attack in going from 32 deg. to 25 deg. C. closely approximates the per cent decrease in attack previously found when the temperature was lowered from 42 deg. to 32 deg. C.

DESCRIPTION OF EQUIPMENT

Previously, cylindrical cells, 33 in. i.d. and 6 ft. or 4 ft. tall were employed. In this investigation a comparatively small rectangular iron cell tank 24.5 in. long, 15 in. wide and 24 in. tall was used, Fig. 1, 2 and 3. A centrally located water chamber divided the box into two electrolyte chambers A and B of equal size; i.e., 24.5 in. x 5 in. x 24 in., but in these studies they were purposely made dissimilar in internal design to permit the accumulation of a larger body of comparative data. The electrolyte chambers A and B were subdivided into a plurality of compartments by the cathode. Inside of A of each cell, the anodes were placed in corners formed at the junction of the cathodic side and compartment walls, while inside of B the anodes were placed centrally with respect to the side walls. The graphite anodes were attached to and depended from a movable cover which permitted adjustment of the gap between one anode face and an opposite cathode surface.

The cells were cooled by means of water circulated through the inside chamber and by the natural convection of air past the outer surfaces. It is to be noted that in these cells the water chamber was a separate vessel which was fitted into the rectangular structure and which extended to 1 in. of the base, thus providing an area of 1,175 sq.in. (7,600 sq.cm.) on the three water-cooled faces. When the total load was 500 amp., cells Nos. 2 and 3 carried 0.067 amp. and 0.011 liters of electrolyte per square centimeter of water-cooled surface. There was no difficulty in maintaining an operating temperature of 25 deg. C. with a 500 amp. load when cooling water of 10 to 18 deg. C. was available. Because of the simplicity of the design and the relatively large area of water-cooled surface, it appears that a similar manually operated cooling system could be employed in large-scale operations without encountering appreciable deviations from the desired working temperature. Since the cooling chamber was uncovered and fitted with an overflow, no rigid or complicated piping or electrical connections to or through the cover of the cell were necessary.

OPERATING TECHNIC

A saturated salt solution containing 5 grams of sodium dichromate per liter was delivered through inlets located on one end and near the bottom of each side while the chlorate solution was discharged separately from each of the electrolyte chambers through openings near the top on the far side of the cell. Increasing and approximately equal electrical loads were delivered to chambers A and B of a series of cells which were basically alike but which contained significant modifications in anode and cathode surfaces. In cell No. 1 (Fig. 1), there were 8 anodes and 8 compartments in each electrolyte chamber. In cell No. 2 (Fig. 2) half of the anodes were eliminated and the size of both compartments doubled by removing intermediate cathode walls. The cathode area of chamber A was diminished further by cutting the compartment walls so that they extended only to the middle of the chamber. In cell No. 3 there was a still further diminution of cathode area due to the slotting of the compartment walls as is shown in Fig. 3. Cell No. 4 was practically identical with that of No. 2B, except that perforated cathode walls used to separate the compartments.

Data obtained during the operation of the four cells are summarized in Table II.

DISCUSSION OF RESULTS

As was to be expected, an increase in the ampere load in all of the cells was accompanied by an elevation in the voltage. With one exception, the amount of reduction at the cathode was smaller as the cell load was increased to 200 or 250 amp. per side. Other data are, however, available indicating the generality of this trend. The over-all current efficiency of each cell increased as the per cent reduction decreased but the improvement became less at the higher loads. Except for cell No. 1, the required voltage in chambers A with anodes located in corners was lower than in the corresponding B chambers where the anodes were equidistant from the

side walls. Data in Table II indicate clearly the increase in power consumption of these cells when the anode current density exceeds 0.03 amp. per sq.cm.

The power consumption per pound of sodium chlorate in cell No. 1, containing 16 anodes in 16 compartments, was less than in the subsequent cells. Here, however, there was twice the investment in graphite electrodes and a somewhat more expensive cell construction. Another factor conducive to greater power consumption in cells 3 and 4 was the fact that the anodes had become progressively smaller in size, resulting in a high anode current density. The higher graphite attack shown in cell No. 4, Table I, was no doubt due largely to the increase in the operating temperature from 25 to 26.5-33 deg. C. The cooling water then available was about 23 deg. C. while the outside atmosphere was at times 35 deg. C., 95 deg. F.

In estimating the total attack on the graphite anodes it is necessary to consider the mechanical losses as well as the chemical attack as shown by CO_2 analyses. In the earlier work with comparatively new anodes, and with an anode current density of 0.02 amp. per sq.cm., the mechanical loss was assumed to be about equal to the chemical attack. This ratio, however, changes with the temperature, current density, and with the age of the anode and, consequently, any estimate may be appreciably in error.

It is clear that the construction costs of rectangular cells used in these experiments can be appreciably curtailed by reducing the width of the water compartment from 5 in. to 1 in. or less. Such a change would cut down material costs and would permit a more rapid circulation of water through the cooling chamber, thus affording a better heat transfer. When operating cell No. 1 at 0.028 anode current density, 5.4 amp. per liter, the kw.-hr. d.c. per pound of sodium chlorate for sides A and B was 2.58 and 2.52 respectively. This can be compared with 2.73-3.04 kw.-hr. for an anode current density of .019 and 0.73 to 1.29 amp. per liter reported in the first paper and to 2.32-2.63 kw.-hr. for an anode current density of 0.019-0.038 and 1.11 to 2.22 amp. per liter reported in our second article. The present operations with the rectangular cell, however, required several times as much hydrochloric acid for controlling the pH.

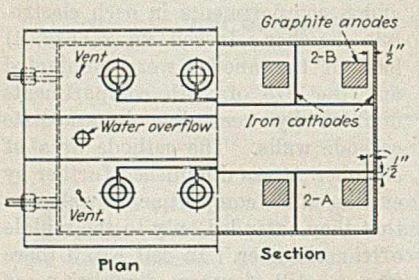


Fig. 2 Cells, type 2-A and 2-B. In this cell half of the anodes were eliminated and the size of both compartments doubled by removing intermediate cathode walls

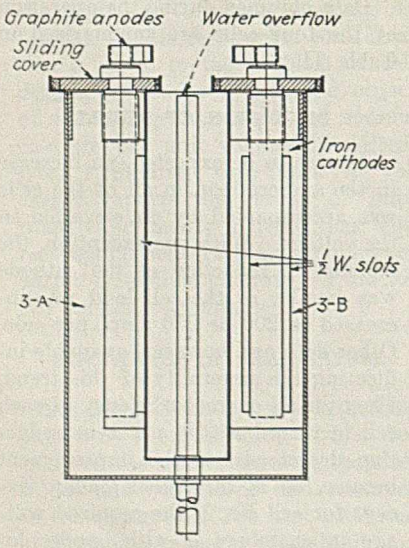


Fig. 3 Cells, type 3-A and 3-B. In this cell there was a still further diminution of cathode area

SUMMARY

The electrochemical production of sodium chlorate was studied in water-cooled rectangular cells. Such cells are more economical of floor space than cylindrical ones. Compared with the cells which served previously as bases for cost figures, the present cells produced from 5 to 7 times as much sodium chlorate per unit volume as those described in the first paper, and about 2.5 times as much as those depicted in the second. When costs are based on high amortization rates, it may be advantageous to operate cells at high current concentrations.

Table II—Cell Conditions and Performance

Side No.	Amp.	Volts	% Reduction	% Efficiency	Kw.-hr. (d. c.) /Lb. $NaClO_3$	Grams carbon as CO_2/Lb. $NaClO_3$	H+ion as pH	Grams NaCl /Liter	Current Density Amp./sq. cm. Anode	Cathode	Current Concn. Amp. /Liter
						CELL NO. 1*					
A	200	2.95	10.1	78.3	2.58	1.4	6.6	185	0.028	0.012	5.4
A	310	3.23	9.7	79.2	2.79	1.8	6.6-6.9	170-215	0.044	0.019	8.4
B	200	2.96	6.8	80.5	2.52	1.8	6.2-6.5	150-200	0.028	0.012	5.4
B	300	3.12	9.2	79.0	2.71	1.9	6.7-6.9	170-215	0.043	0.018	8.2
						CELL NO. 2*					
A	195	3.37	16.0	74.4	3.10	1.5	6.2-6.4	135-170	0.06	0.020	4.7
A	250	3.66	12.0	79.0	3.17	1.7	6.2-6.8	120-130	0.08	0.025	6.0
B	200	3.59	8.5	80.5	3.06	1.4	6.3-6.4	135-170	0.06	0.017	4.8
B	260	3.94	8.0	80.0	3.37	2.1	6.2-6.6	115-130	0.08	0.022	6.3
						CELL NO. 3*					
A	260	3.76	8.0	81.0	3.18	2.1	6.6	170	0.08-0.11	0.027	6.3
A	330	4.05	4.0	84.0	3.31	1.3	6.7	145	0.11-0.14	0.034	8.0
B	255	4.06	6.0	83.0	3.34	2.5	6.1-6.6	160-180	0.08-0.14	0.023	6.1
B	325	4.32	5.0	82.0	3.61	2.7	6.7-7.2	160-180	0.11-0.18	0.029	7.8
						CELL NO. 4*					
A	197	3.71	12.0	79.0	3.30	2.1△	6.7-6.8	170-200	0.08	0.019	4.7
A	322	3.79	8.0	80.0	3.25	2.4△	6.5-6.8	150-160	0.13	0.031	7.7
B	217	4.19	9.0	81.0	3.55	2.2△	6.7-6.8	170-200	0.12	0.021	5.2
B	285	4.22	7.0	83.0	3.47	3.1△	6.5-6.8	150-160	0.15	0.027	6.9

*8 anodes and 8 compartments in each chamber.

*4 anodes and 4 compartments in each chamber.

*4 anodes and 4 compartments in each chamber.

* 4 anodes and 4 compartments in each chamber.
△ Operating temperature 26.5° to 33° C.
1. Current readings are considered accurate to 2%, the same as in ref. (1) and (2).
2. Efficiencies are based on gas analyses which are about 2% higher than efficiencies based on liquor analyses, when operating with the present equipment.

Selecting Materials of Construction

Chem. & Met. INTERPRETATION

Dr. H. L. Maxwell, du Pont's expert in materials of construction for chemical engineering equipment offers some extremely worthwhile suggestions for the guidance of engineers who are faced with the necessity of selecting materials from which to fabricate a piece of equipment.—*Editors.*

THE SELECTION of metals for use in chemical equipment should be made with two major considerations in mind according to Dr. H. L. Maxwell, metallurgist of the Technical Division, Engineering Department, E. I. duPont deNemours & Co. who spoke before the Cleveland Section of the American Chemical Society recently. Dr. Maxwell stressed that the physical strength and corrosion resistance of metals and materials are of equal and exacting importance. Often an engineer may relegate the physical characteristics of a material to the background when the material at hand represents the optimum in corrosion resistance for his process. The engineer responsible for selecting materials must study and subject representative samples to temperatures and pressures to be encountered in actual operation in addition to the chemical action of the materials to be processed. A systematic and scientific interpretation of handbook data must be made, if actual tests at operating conditions are impossible.

The money and time invested in obtaining authentic samples for corrosion and physical tests are an unfailing investment. Guesswork must be eliminated entirely from preliminary tests. A system of "pedigreed samples" is recommended for any organization responsible for the selection of materials of construction. Such a collection may be assembled by obtaining authentic plates of several materials for possible use in future construction and cutting from 300 to 400 specimens from each plate. Each plate should receive similar finishing thus imparting like surface conditions to all samples. When multiplied by the many metals and materials available for use in chemical construction, the collection takes on large proportions. The materials may be cataloged according to their action under varying conditions, eliminating many unnecessary repeat tests when such conditions are encountered subsequently. Maintaining a set of such samples allows materials available for testing upon short notice and contributes much to the economy and accuracy of testing and selecting materials.

Basically, wear of metals results from the action of fine abrasive substances upon the metal surface, or from the continuous impact of particles, large or small, upon the metal surface. In cases of the first class, high carbon and high chrome irons are suggested. Chilled white iron is excellent for such applications. In cases of the impact type, steels of the austenitic type are quite successful. In many instances of continuous impact, manganese steels are known to become actually harder and more suited to the application upon continued use under impact conditions. No connection can be made between the two classifications of metal wear. In most cases, a metal suited for the one condition will not serve well when applied to the other condition.

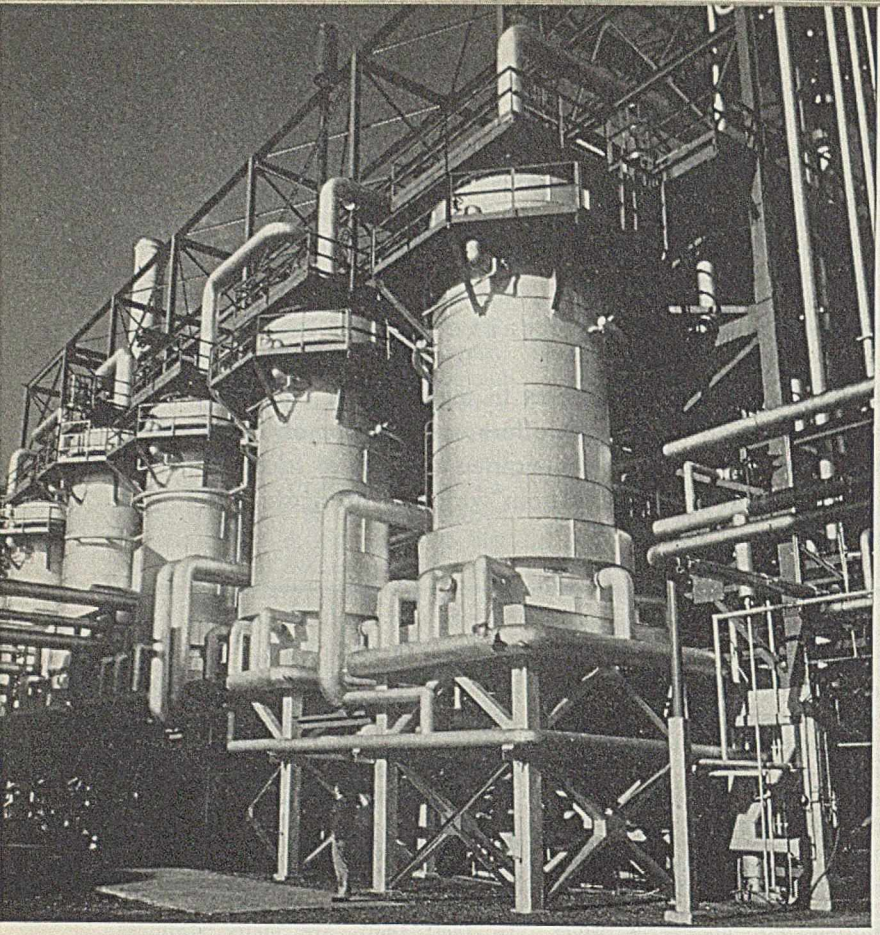
Stainless steels receive the widest and most extensive application of all alloy metals in the chemical and process industries and Dr. Maxwell segregates them into two general groupings, the ferritic and austenitic types. The ferritic type, consisting of from 4 to 28 per cent chromium, must undergo elaborate heat treatment whenever any welding or other thermal shock is applied to the vessel. The welding of only a small pipe onto a large tank will require extensive heat treatment of the entire vessel to save it. Seldom is such treatment applicable or available at the point of installation and many times a small change in process piping will require that the vessel be shipped many miles to a mill having means available for heat treating. The costs of dismantling, shipping and the time lost in such an operation all are of major consideration when selecting vessels constructed from such materials. Provisions should be made for the removal of such vessels from the plant when they are ordered, as foresight in the matter may prevent removal of the vessel piece by piece through the largest door or window of the plant at a later date.

Dr. Maxwell spoke highly of the 18 8-S Cb stainless steel, the so-called stabilized stainless, which can be welded without extensive heat treatment. He emphasized that one must remember that stainless is a descriptive term applied to an alloy steel and that necessarily it is a relative term. While stainless steels serve well under oxidizing conditions, the so-called stainless properties are nonexistent in the presence of many reducing agents. Stainless steel is improving constantly and a penetration of 0.0015 in. per month in nitric acid is considered a new standard. In fact, there are many stainless steels available with a penetration rate as low as 0.0006 in. per month.

With stainless steel costing approximately 40c. per lb., and tantalum costing approximately $50 per lb., it may be difficult to conceive the use of tantalum in processing operations. However, there are any number of applications where the use of tantalum has prevented the constant replacement of stainless and other metals. When using tantalum, one must remember that the scrap or recovery value is very low. The opposite is true of silver, the recovery of silver being approximately 99 per cent. The scrap value should receive important consideration when metals and materials are being selected for process equipment.

When selecting materials for use in vessels where heat transfer is a major consideration, he pointed out that the actual heat transmission values of the metals was secondary to the film coefficients involved on either side of the containing vessel. Whenever possible, he recommended actual laboratory testing of the various materials under consideration.

Selecting materials for chemical construction should not be the result of guesswork and hunches, or from brief preliminary tests, but should result from actual and thorough testing of authentic samples and the scientific interpretation of existing data when actual testing is impossible.



Catalyst cases in a Houdry unit at the Sun Oil Co.'s Marcus Hook refinery

A New

W. E. KIRST,

Chem. & Met. INTERPRETATION

Heat transfer media for high temperatures have always presented a serious problem to the chemical engineer—particularly in the petroleum industry where high temperatures and much heat exchange are involved. Dowtherm, hot oil and mercury have been used for many years and, within certain limitations, have been quite satisfactory. However, there are some uses for which these materials are not suited. A new heat transfer medium, a mixture of inorganic salts known as HTS, has been developed to fill some of these gaps. It is significant that its first big use has been in the Houdry catalytic cracking process.—*Editors.*

A MOLTEN MIXTURE of nitrates and nitrites of sodium and potassium, known as HTS, has recently come into large plant-scale use as a heating and cooling liquid. This mixture, which consists of approximately 40 per cent $NaNO_2$, 7 per cent $NaNO_3$, and 53 per cent KNO_3, by weight, has been adopted because it has a low melting point, a high heat transfer rate, and a thermal stability and a lack of corrosive action on steel at temperatures above those obtainable with Dowtherm, hot oil or steam.

Based on a paper of the same title presented by the authors before the Buffalo meeting of A.I.Ch.E., May 13-15, 1940.

While similar nitrite and nitrate mixtures have been employed for a great many years in molten baths for the heat treatment of metals and in small installations requiring heat removal at a high temperature level, their use as heat transfer salts on a large scale began with the installation of the Houdry units for the catalytic cracking and refining of petroleum. In 1937 this salt mixture was evaluated by Socony-Vacuum Oil Co. and Sun Oil Co. in semi-commercial cracking plants and the first full-size Houdry unit using molten salts began operation in February, 1939. According to the published descriptions of this plant, approximately 1,000,000 lb. of salt mixture are used in a single unit. There are now at least 12 of these large catalytic cracking plants in operation, and others being built.

The solid salts may be melted with 150-lb. steam, and are normally circulated through the steel piping by means of a vertical centrifugal pump. The salt temperature is maintained at 850 to 900 deg. F. by heat exchange between the catalyst case and either a crude-oil preheater or an exchanger serving as a boiler generating 450-lb. steam. A high rate of heat transfer serves to remove heat from the catalyst rapidly and hold it at the desired temperature within the required narrow limits.

Since this heat transfer fluid was adopted in the first Houdry cracking units, many new uses have been suggested. For example, it has been employed in the new Thermofor Kiln, developed by the Socony-Vacuum Oil Co. for the regeneration of decolorizing clays. In this process the clay is held at the desired temperature by pipes through which the molten salt is pumped in circuit with an exchanger for introducing or removing heat as the need may be. This salt mixture is also suitable for use in a high-temperature bath for cleaning high-melting plastics from metal parts. HTS appears attractive for many high temperature distillations, the heat to the still being supplied by circulating the molten salt through pipe coils in the base of the still.

AVAILABLE HEAT TRANSFER FLUIDS

The commercially important heat transfer fluids are shown in Table I, together with the temperature limits within which they are recommended. Brine and other fluids for sub-atmospheric temperatures are omitted from this table.

Steam, water, flue gas, and air are, within their limitations, the most widely used and cheapest heat transfer fluids. The upper temperature limit on steam is usually 460 deg. F.,

Heat Transfer Medium

W. M. NAGLE and J. B. CASTNER *Explosives Department, E. I. duPont de Nemours & Co., Wilmington, Del.*

corresponding to a pressure of 450 lb. per sq.in., although temperatures of 580 deg. F. (1,400 lb. per sq.in. gage pressure) can be obtained in commercial power plant installations. Flue gas temperatures can be much higher. They are, in effect, limited only by the material out of which the conduits are made. While the temperature range in which flue gas and air can be used as a heat transfer fluid is wide, these gases have several serious drawbacks in many chemical operations. Great volumes of gas are necessary to transfer relatively small amounts of heat, because the specific heat per unit of volume and the transfer coefficient are exceedingly low. Furthermore, temperature control is difficult and local overheating is liable to occur.

Mercury is, in many respects, an ideal heat transfer fluid for the temperature range above that of steam. However, a present cost of about $2.50 a pound, a high density, and the hazards offered by leaks of the toxic vapor have, in general, limited its use to a few central power stations.

Molten lead as a heat transfer fluid may be applicable in some small installations, in spite of the high melting point and specific gravity, but it has not attained any commercial importance.

"NS" fluid, a patented salt mixture containing aluminum and sodium chlorides, appears, from optimistic claims published in 1933 (See *Chem. & Met.* for July 1933, p. 353), to be a suitable heat transfer fluid for use at high temperatures. There has been a good deal of interest in this material but no commercial installation as far as we know. It is possible that fears of excessive corrosion have retarded or prohibited any industrial application.

Hot oil, Dowtherm, and HTS are the principal commercial heat transfer fluids now available for installations in which the temperature of steam is insufficient and in which flue gas is inapplicable, for any reason. The practical top limit for oil is somewhat over 550 deg. F., and that for Dowtherm is approximately 700 deg. F., above which temperatures these organic materials begin to coke and plug up pipe lines. The upper practical limit for HTS has not been established definitely. At present it appears to lie in the range between 900 and 1,100 deg. F. depending on operating conditions and economic factors. The salt mixture can be used as a heating or cooling fluid at atmospheric pressure and at temperatures that are 200 to 400 deg. F. higher than the top limit for Dowtherm.

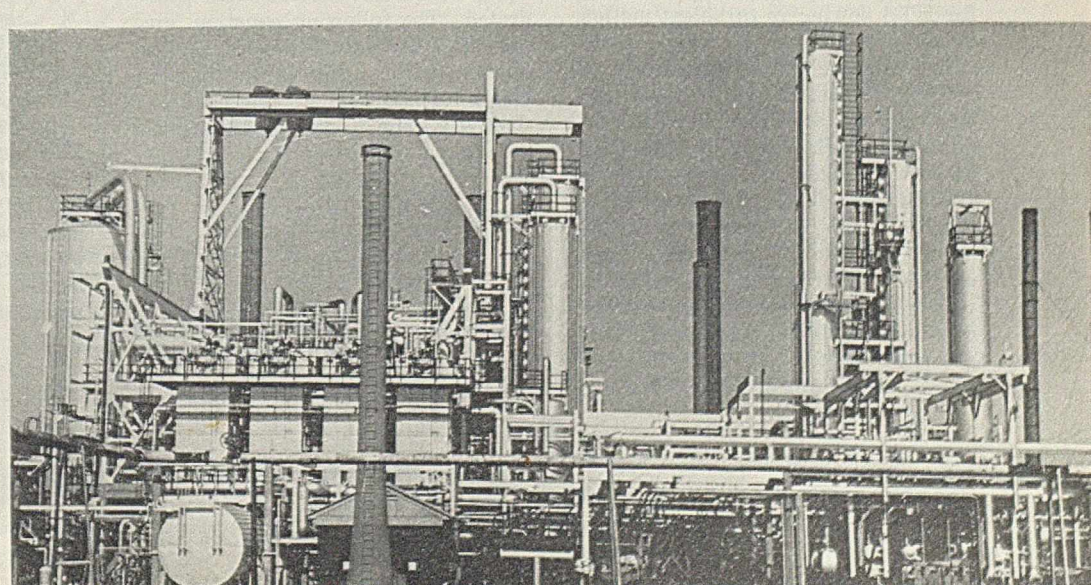
Table I—Important Heat Transfer Fluids

Fluid	Usual Temperature Limits, deg. F.	Pressure Lb./sq. in. Gage
Steam or water	32–460	0–450
Oil	30–550	0
Dowtherm A (75% diphenyl-oxide, 25% diphenyl)	54–700	0–135
Mercury	—37–1000 or higher	0–180 or higher
HTS	290–1000	0
Flue Gas or Air	Up to 800 in iron ducts, to 1,600 in special alloys	0

PROPERTIES OF HTS

A low freezing point is desirable to facilitate fusion of the transfer agent with plant steam, which often does not exceed 350 deg. F. in temperature. The freezing points of a large number of the possible $NaNO_2$-$NaNO_3$-KNO_3 mixtures have been determined. Mixtures having from 40–50 per cent $NaNO_2$ are liquids at temperatures below 290 deg. F., and therefore, can be melted readily with normal plant steam. The standard composition of 40 per cent $NaNO_2$, 7 per cent $NaNO_3$ and 53 per cent KNO_3 freezes at 288 deg. F. It should be pointed out that a small amount of moisture reduces sharply the freezing point of these mixtures. Consequently, before the freezing point is determined the salt should be melted and dried by heating at approximately 480 deg. F. until frothing ceases.

The specific gravity of HTS was measured over the temperature range of 300–1,030 deg. F. and found to vary from 1.97 to 1.68. The individual points are given in Fig. 1, and the density-temperature relationship is presented in the alignment chart of Fig. 2 for use in design calculations. The specific gravity determinations were made on a modified Westphal balance and checked by



More than 1,000,000 lb. of a new inorganic heat transfer medium, HTS, is reported to be in use in each of the 12 Houdry catalytic cracking units. This is a rear view of one of the Socony-Vacuum plants erected by E. B. Badger & Sons

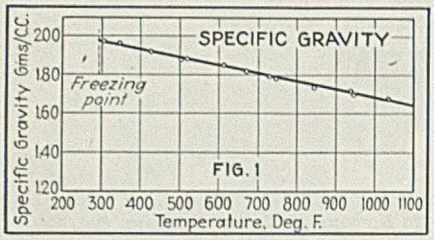


FIG. 1

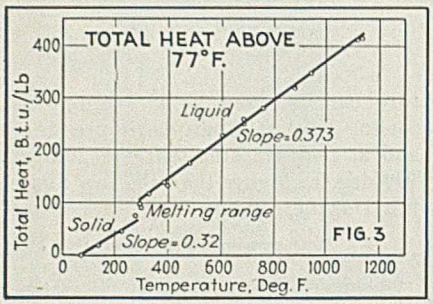


FIG. 3

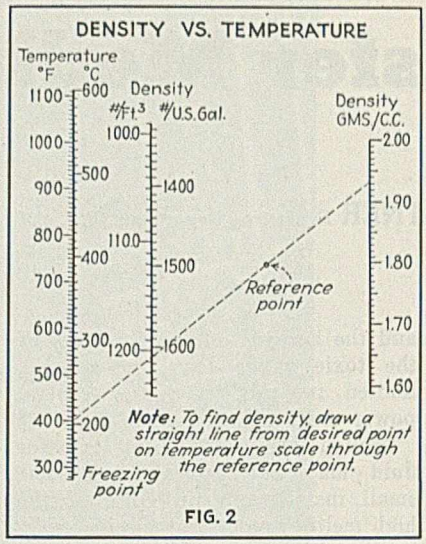


FIG. 2

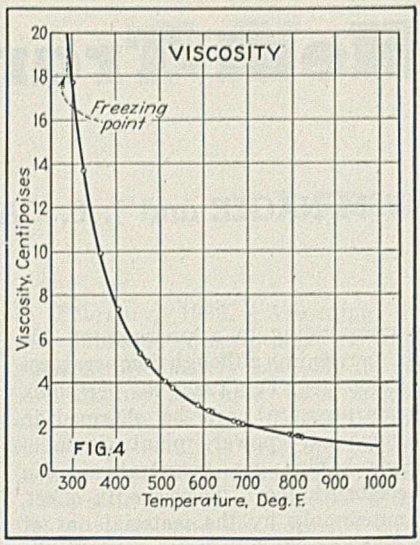


FIG. 4

weighing known volumes of the molten material held in a small metal cylinder.

From the slopes of the total heat-temperature lines, in Fig. 3 it can be seen that the specific heat of the solid salt mixture is 0.32, that of the melt, 0.373 cal. per gram and deg. C. (B.t.u. per lb. and deg. F.). The latent heat of fusion is approximately 20 cal. per gram or 35 B.t.u. per lb.

Viscosity of the liquid was computed from the kinematic viscosity and the previously determined density values for liquid HTS. The experimental data cover the range from 300 to 820 deg. F. Higher temperatures were not reached due to difficulties in supplying sufficient heat to overcome the radiation losses from the tall and incompletely lagged beaker. However, the data were plotted on logarithmic paper and extrapolated to 1,000 deg. F. with an accuracy that is believed sufficient for design purposes. The experimental points and the extrapolated curve are shown on the graph of viscosity versus temperature, Fig. 4.

HEAT TRANSFER COEFFICIENTS

Individual heat transfer coefficients for HTS flowing in turbulent motion inside circular pipes were determined over the temperature range of 580 to 960 deg. F. and at linear velocities up to 6 ft. per sec. The heat flows on which the coefficients were based were taken as a product of the specific heat, 0.373, the temperature rise, and the rate of flow of the liquid. These calculations were checked by measuring the electrical power supplied to the pipe. The maximum deviation between the heat absorbed by the salt and the electrical heat supplied, after correction for measured radiation losses, was 22 per cent, and the average deviation was 1 per cent. In order to determine if an appreciable amount of the current was carried by the molten salts, the electrical conductivity of liquid HTS was measured in a separate experiment. It was found that the conductivity, while appreciably greater than that of tap water, was not sufficiently high to permit the salt to carry more than 2 per cent of the current which passed through the iron pipe. The temperature difference between the inside wall of the heated pipe and the main body of the liquid was obtained by subtracting the calculated temperature drop through the pipe wall from the measured temperature difference between the outside pipe surface and the salt. This correction differs from the one ordinarily used in heat transfer tests, because resistance heat is not transferred through the pipe wall from the outside to the inside surface but is generated within the pipe itself. On the assumptions that the electrical conductivity of the iron pipe is uniform and that the radiation losses are negligible, suitable differential equations were derived and integrated. The following equation, giving the temperature drop from the outside to the inside of the pipe in terms of heat flow, thermal conductivity, and physical dimensions, resulted:

$$t_o - t_i = \frac{q}{2\pi Lk(r_o^2 - r_i^2)} - \left(r_o^2 \ln \frac{r_o}{r_i} - \frac{r_o^2 - r_i^2}{2}\right)$$

where

t_o and t_i = the temperature of outside and inside surface of pipe, deg. F.

r_o and r_i = outside and inside radii.

q = quantity of heat transferred to the salt, B.t.u./hr.

L = length of pipe, ft.

k = thermal conductivity of pipe metal, B.t.u./(hr.) (sq.ft.) (deg. F./ft.)

Substituting the dimensions of the apparatus and taking 24 as the thermal conductivity of steel in this temperature range, the above equation was simplified to

$$t_o - t_i = 0.000191\, q$$

In the calculation of the heat transfer coefficient h, the temperature difference between the inside pipe surface and the liquid is: the average temperature of the outside of the pipe minus 0.000191 q and minus the arithmetic mean of the inlet and outlet salt temperatures.

The thermal conductivity of the salt was not measured, and it was therefore impossible to compare the heat transfer data with those on other fluids using the customary logarithmic plot:

(DG/μ) vs. $(hD/k)/(C\mu/k)^{0.4}$

A chart has been prepared using the experimentally determined equation:

$$hD/\mu^{0.4} = 0.000442\,(DG/)\mu^{1.14}$$

where

h = heat transfer coefficient, B.t.u/hr.-sq.ft.-deg. F.

D = inside diameter of pipe, ft.

μ = absolute viscosity, lb./hr.-ft. = 2.42 x viscosity in centipoises

G = weight velocity, lb./hr.-sq.ft. of cross-section

This chart, Fig. 5 is a plot of hD versus DG at temperatures of 600, 700, 800, 900, and 1,000 deg. F. The lines are based on experimental data within the range of $DG/\mu = 3{,}000$ to 30,000, and on an extrapolation in accordance with the standard 0.8 exponent for the range above 30,000.

The practical use of Fig. 5 is illustrated by the following example. It

is desired to find the individual coefficient of heat transfer, h, for a 1-in. I.D. tube carrying a stream of the salt mixture at 800 deg. F. and a flow rate of 6,000 lb. per hr. The heat transfer coefficient is 858, obtained as follows:

$$D = 1/12 = 0.0833 \text{ ft.}$$

$$G = \frac{6{,}000}{\frac{\pi}{4}(0.0833)^2} = 1{,}100{,}000$$

$$DG = (0.0833)\ (1{,}100{,}000) = 91{,}600$$

From Fig. 5, for a value of $DG = 91{,}600$ at 800 deg. F.

$$hD = 71.5$$

$$h = \frac{71.5}{0.0833} = 858$$

Stability—At temperatures up to 800 deg. F., this nitrite-nitrate mixture is quite stable and can be expected to give excellent service for many years. At higher temperatures, 1,100 deg. F. for example, the salt undergoes a slow decomposition accompanied by a gradual rise in freezing point. Since it is desirable to keep the freezing point of the salt well below the temperature of plant steam, it may be necessary to replace a part of the charge periodically. The decomposition is largely a thermal breakdown of the nitrite:

$$5NaNO_2 \rightarrow 3\ NaNO_3 + Na_2O + N_2$$

Samples of the gas evolved by the salt after extensive heating at 1,100 deg. F. were found to contain over 98 per cent nitrogen. If air has too ready access to the molten salt in the high temperature range, an additional reaction

$$2\ NaNO_2 + O_2 \rightarrow 2\ NaNO_3$$

has been found to take place. This can be eliminated either by complete exclusion of air or by the use of an atmosphere of an inert gas such as nitrogen.

Corrosion Tests—A number of metals were tested in HTS at temperatures between 850 and 1,100 deg. F. The method consisted of weighing samples of known area and suspending them in the liquid, which was either quiet or gently agitated. Exposure times up to six weeks were employed. The corrosion data may be summarized as follows:

1. At temperatures of 850 deg. F. and below, open-hearth steel exhibits satisfactory resistance.

2. At temperatures from 1,000 to 1,100 deg. F., steel is not sufficiently resistant for most installations, and more resistant metals, such as high chromium and chromium-nickel steel and certain low-chromium alloys containing aluminum and silicon are recommended.

Safety Precautions—Operations involving large quantities of any liquid at temperatures where steel is at a dull red heat involve serious hazards from burns. In addition, HTS is composed of oxidizing salts and the reactivity of the melt with the process materials should be determined by actual test before any radically new installations are started.

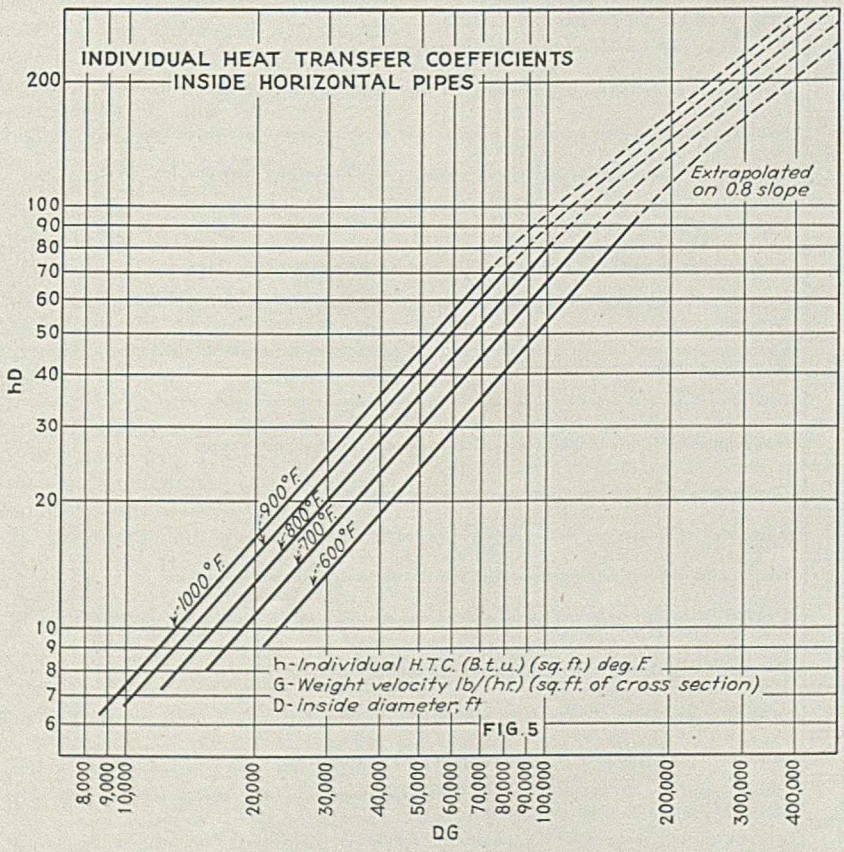


FIG. 5

EXPLOSIBILITY OF HTS

Attempts to detonate HTS and HTS-paraffine mixtures at room temperature with 0.5 lb. of blasting gelatine were unsuccessful. In similar tests on HTS at 1,100 deg. F. the salt was still insensitive. In other trials, motor gasoline, cracked gasoline, gas oil, and crude oil mixed with flowers of sulphur were released beneath the surface of an open pot of the molten salt at 1,100 deg. F. Also crude oil was poured on the surface of both lead and HTS at 1,100 deg. F. with equivalent physical actions. In all cases, the hydrocarbons vaporized rapidly and burned, and, in the tests in which oil or gasoline was released beneath the surface, a considerable amount of the salt was thrown out on the ground. Analysis of the mixture after the tests showed there was little chemical reaction with the salt. The main effects were due to the high temperatures involved and contact between hot oil vapors and air. In other tests gasoline vapors were bubbled slowly through the molten salt at 1,100 deg. F. for a 2-hr. period, 92 per cent of the gasoline being recovered unchanged. With ground petroleum coke held beneath the surface at 1,100 deg. F. in iron and stainless steel baskets a definite reaction was obtained between the organic matter and the salt mixture. In all cases, however, some reaction appeared to take place and, therefore, safety precautions should be based on the assumption that organic materials react with the hot salt mixture to evolve gaseous products of combustion. Wood chips, paper, and rags should not be permitted to drop into the molten material for they will burn readily. Moreover, melting tanks should have good ventilation to remove combustion products resulting from any failure to exclude organic matter, for although these gases consist mainly of N_2, CO_2, and H_2O, they also contain traces of poisonous CO and NO. It is evident, of course, that the work just described cannot be construed as a blanket guarantee that HTS is safe under all conditions of use. Each new application must be considered separately and suitable tests developed to demonstrate the lack of hazards.

Planning for Cost Reduction

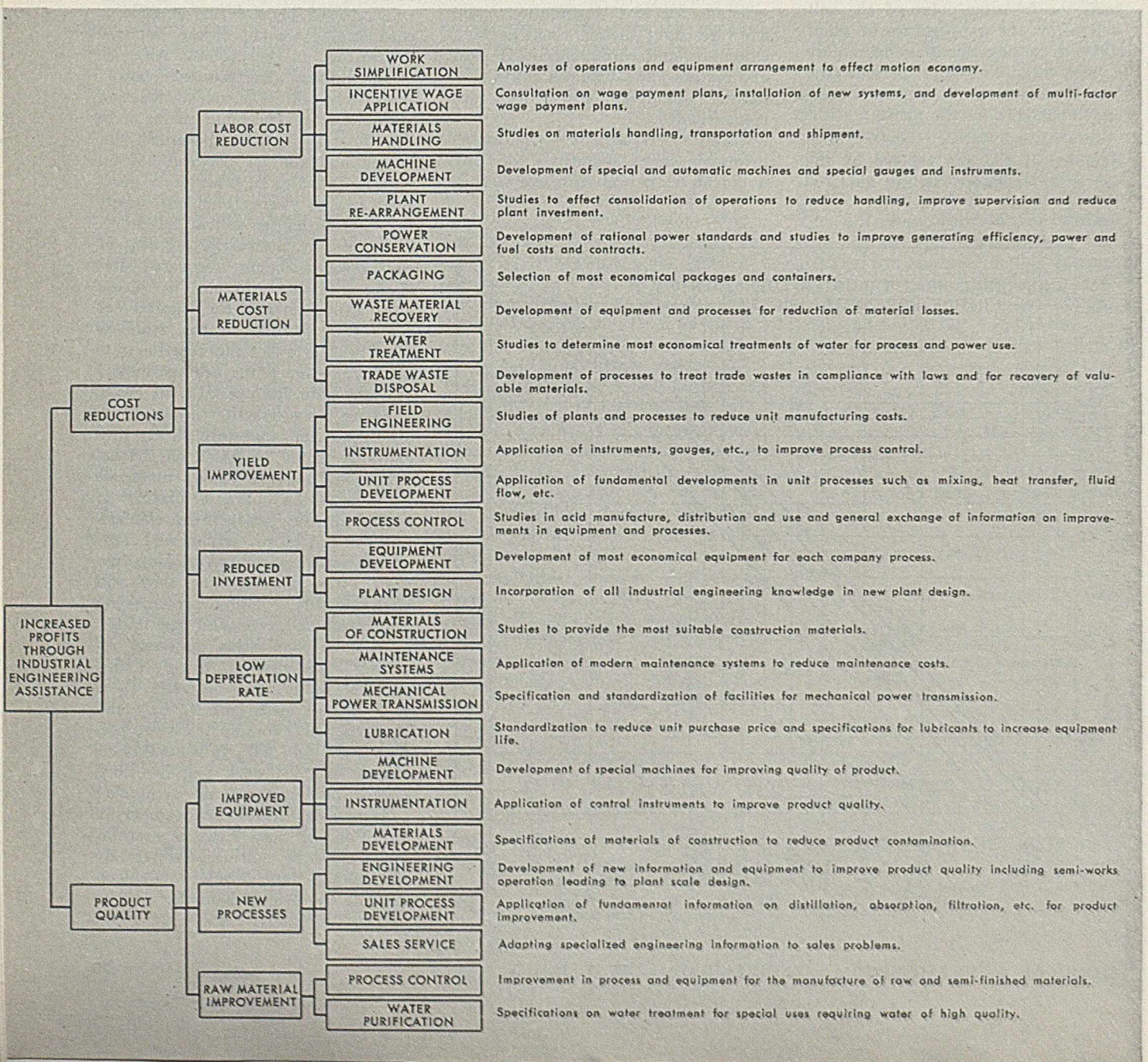
Chem. & Met. INTERPRETATION

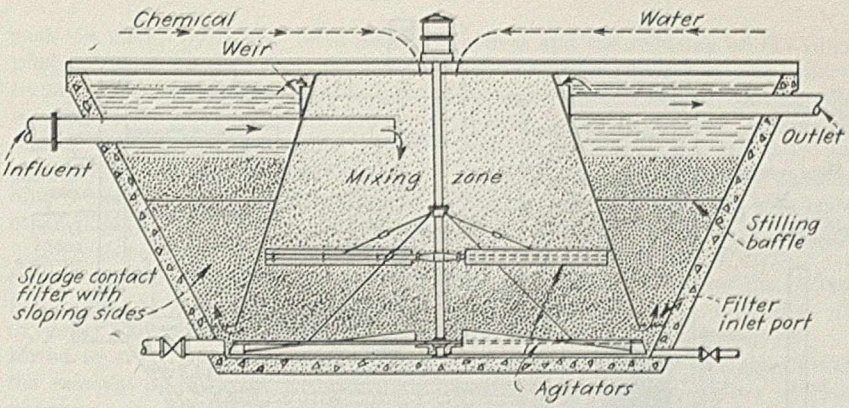
A well organized plan for cost reduction is a necessity in both small and large process industry plants. Any progressive organization must work on the assumption that every operation, every piece of equipment and every process can be improved indefinitely.—*Editor.*

ORGANIZATION for cost reduction was the subject of a conference of American Management Association's production division held in New York, May 22-23. How a large corporation, with plants of all sizes in all parts of the country, has organized its cost reduction and methods improvement work was discussed by representatives of E. I. du Pont de Nemours & Co.

D. F. Carpenter, director of manufacture, Remington Arms Co., introduced the subject by pointing out the management concept of the problem involved, and the importance of a dual program for operating improvements: First, through the supervisory organization; and second, through the establishment of an industrial engineering group whose major assignment is the improvement of methods.

G. M. Read, assistant manager of du Pont's industrial engineering division then told how his department was organized and the various factors affecting cost reduction. The division comprising a large group of chemical and mechanical engineers carry on investigations for plant management of current processes and equipment, including experimental development work on equipment, and process modifications with the main objective of lowering production cost and improving quality of products. Experience has indicated that eight major factors cover the most important elements through which engineering assistance can be used to reduce operating cost. These factors, with their various subdivisions, are indicated in the outline below.





Precipitator two compartments, the mixing zone and the upflow contact filter with sloping sides

New Trends in Boiler Feedwater Treatment

FREDERICK G. STRAUB *Department of Chemistry, University of Illinois, Urbana, Ill.*

Chem. & Met. INTERPRETATION

Modern designs for steam production have placed increased responsibilities on chemical engineers in charge of feedwater treatment; higher steam pressures, increased heat transfer rates and other trends have brought special problems and required the development of new methods of treatment. Prof. Straub, well known authority on the subject, reviews the latest developments.—*Editors.*

"IF ANY APOLOGY is due for discussing the somewhat perennial subject of boiler water, it might be fair to say, perhaps, that the matter is coming to be treated in a more rational manner; that much of the quackery and mysticism that has so long prevailed is being superseded by a more scientific and sensible consideration of the problem[9]." During the intervening period of more than four decades, since this was penned, a continuation of the "scientific and sensible consideration of the problem" has enabled the chemical engineers to keep pace with the various water treating problems which have presented themselves.

The advent of higher steam pressures, increased rates of heat transfer and decrease in the number of steaming units in the power house has placed increased responsibility for proper boiler feedwater treatment on the chemical engineer. Partridge and Purdy[11] have very ably described the problems confronting the chemical engineer in the modern power plants. The most common classification of these problems is:

1. Scale
2. Corrosion
3. Embrittlement
4. Carryover

The first two difficulties may be experienced at almost all points in the water-steam cycle of the power plant whereas the last two occur only in the steam boiler. There are many methods of boiler water treatment which prove suitable for one or all of these problems. However, the methods of attack may be roughly classified as treatments used internal or external to the boiler. In the more recent years it has proved advisable to use a combination of both the external and internal treatments.

Scale—The external softening of water for the removal of scale forming materials such as calcium, magnesium and silica has received increased attention with marked results in the last few years. The recirculation of sludge[5,14] with increased rate of softening in the cold process lime softener has resulted in the wider application of the cold process softener as a primary treatment ahead of zeolite and hot process softeners. This change in reaction rate has been accomplished by taking advantage of the increased rate of chemical reaction which results when the sludge resulting from the precipitation within the softener is thoroughly mixed with the treating chemicals and the water being treated. The sludge is agitated by means of revolving paddles or blades at the bottom of the softener. This brings the treating chemicals, the sludge and the incoming water all in intimate contact. The water then flows up at diminishing velocity through a floating sludge blanket. This is accomplished by the design of the softener compartments. The water leaves the sludge blanket almost crystal clear and the chemical reaction is complete. Thus in a comparatively short space of time a clear, soft and stable water has been produced in the cold with a minimum of chemicals. A filter is usually used after these softeners; as a precaution, however, the time interval between washing the filters is greatly lengthened. Very little if any precipitation is formed on the filter beds. The application of proper coagulants and control of pH value in this method has also resulted in

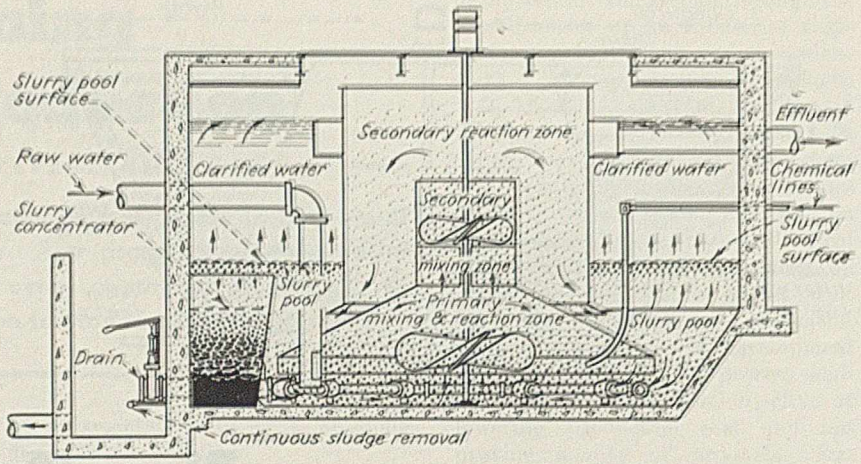
Based on a paper presented at the Buffalo-Niagara Falls meeting of the American Institute of Chemical Engineers, May 13-15, 1940.

marked reduction of the silica content of some waters being treated.[18,8]

The modification of the zeolite method of softening so as to be able to use the hydrogen as well as sodium cycles has given a new method of elimination of the positive and in some cases the negative ions also from the water.

The older zeolite softener involved the use of the siliceous zeolite containing sodium aluminum silicates. These were not stable in acid or strongly alkaline waters. This made it necessary for close control of the pH value of a water being treated in the older base exchange softeners. New softening materials for use in the base exchange softeners now allow its use in acid or alkaline waters. These bodies are called "Organolites," "Zeo-Karb," "Exchange Filters," "Demineralization" and so forth. They operate under two conditions, either on the sodium or the hydrogen cycle. Their use is similar to that of the older zeolites and they may be regenerated with a salt or brine solution. Under such conditions they are said to be operating on the sodium cycle and to give a treated water having the same composition as one treated with the older type zeolites. They do, however, have the advantage of being non-siliceous and thus preclude the possibility of increasing the silica content of the water. They are also more stable over wider range of pH changes than the older zeolites. Under the conditions of the sodium cycle they convert the calcium and magnesium bicarbonates to sodium bicarbonates and the sulphates or chlorides to sodium sulphate or chloride.

If they are regenerated with an acid solution such as sulphuric acid instead of a salt solution, they are said to be operating on the hydrogen cycle. After they have been treated with acid they give an effluent in which the calcium and magnesium bicarbonates are converted to carbonic acid (H_2CO_3) and the chlorides and sulphates to hydrochloric and sulphuric acid respectively. The carbonic acid readily breaks down to form carbon dioxide and water. The carbon dioxide is readily removed by blowing air through the water (degasification). The effluent from the hydrogen cycle is acid in nature and could not readily be used for boiler feedwater. The usual procedure followed is to pass part of the raw water through one tank operating on the sodium cycle, which gives an alkaline water containing sodium bicarbonate. The rest of the water is passed through the hydrogen cycle and the effluent from the two softeners mixed in the proper proportions so as to give the desired alkalinity. The mixed water is then degasified. The equipment used in the acid cycle must be properly protected to prevent acid attack on the metal parts.



Cross section of equipment for accelerating water softening process

The water resulting from the use of a combination sodium and hydrogen cycle will give a reduction in total solids depending on the relation between the bicarbonates and the chlorides and sulphates in the raw water. As the bicarbonates increase, there is more reduction in total solids. At the same time the cost of treatment increases since more sulphuric acid is used. This treatment is in general more expensive than the older zeolite process. The equipment cost is higher since acid resisting coatings must be used and the newer softening materials are more expensive. This increased cost, however, is more than offset in many installations by the reduction in total solids with resulting decrease in blow down and ability to use more makeup.

These new base exchange softeners are low in silica whereas the older type of zeolites had a high silica content. The use of these materials thus prevents the contamination of the treated waters with silica. The hydrogen cycle has proven quite effective in removing ammonium compounds from the water.

Of course, none of these methods removes all the hardness, and additional chemical treatment is often essential to prevent scale formation. The most common method in use has been the use of phosphates for prevention of sulphate or carbonate scale. Silica scale has been encountered in boilers having areas of high heat transfer and fed with waters containing appreciable silica. The method of attack for silica scale prevention being emphasized at the present time is the removal of silica from the water prior to entering the cycle. This has involved the use of coagulants such as iron, aluminum and magnesium salts, which under proper pH control prove quite effective in lowering the silica content[8,13]. In general these methods have been somewhat expensive. The use of the nonsiliceous zeolites and anthracite coal filters serve to prevent the pick up of silica which was so common years ago. In some installations the use of finely divided iron and iron or zinc salts[19] has aided in retarding silica scale formation. However, the use of any material which causes a precipitate or deposition within the boiler, whether phosphate, iron or zinc has quite often resulted in sludge deposition in areas of sluggish circulation with resultant loss of tubes. Consequently the trend has been toward the most efficient external removal of scale or sludge forming material with the minimum of internal treatment for the higher pressure, higher rated plants. It has been found that the silica deposits form only in areas of high heat transfer and by changing the operating conditions so as to eliminate these spots of excessive heat transfer the scale has been prevented.

One type of scale encountered in many plants has been deposits in feed line, turbine condensers and heat exchangers. This has resulted in decrease in operating efficiency as well as increase in maintenance cost. In the past this has been prevented by treating with small amounts of organic materials. More recent studies have shown[12] the effectiveness of very small amounts of inorganic chemicals

such as meta, pyro and tetra-phosphates. This use of what has been termed "threshold treatment" has shown that the use of a few p.p.m. of this type of salt will prove quite effective in preventing scale in turbine condensers, heat exchangers and other points.

Corrosion—The corrosion most commonly experienced in the power plant has resulted from dissolved oxygen. The modern plants have resorted to every method available for the removal of the oxygen from the water prior to entering the boiler feed lines. This has resulted in almost universal chemical treatment being resorted to for the elimination of the last trace of oxygen left after deaeration. Chemicals such as iron, ferrous hydroxide, sodium sulphite[7,17] and various organic materials are being extensively used.

In areas which are "partially dry" or "steam blanketed" corrosion occurs at an accelerated rate[9,16]. The only safe method of elimination of this type of corrosion has been the elimination of the dry areas by changing circulation or points of high heat input with the subsequent wetting of the complete tube area.

Embrittlement—Embrittlement in steam boilers results in the failure of the steel in the riveted areas and the areas in the vicinity of the rolled tube ends. This failure has been attributed to the action of the sodium hydroxide in the boiler water concentrating in the capillary spaces present in these areas and attacking the highly stressed boiler metal with the resultant cracking of the steel. Methods of chemical treatment have been worked out whereby the embrittling action of the water may be stopped. This has involved the maintenance of definite amounts of sulphates and chlorides or organic material[10,15] in the lower pressure boilers and the reducing of the silica content in the higher pressure boilers. In the newer welded drums the riveted areas have been eliminated and the tube ends are the only remaining areas of potential danger. The methods of rolling the tube ends so as to keep the tube in contact with the drum or header surface on the inside tends to reduce the potential possibility of concentration of the boiler water in these areas.

A recent survey made in the United States indicates that failure of this type has not been experienced in boilers operating at pressures above 600 lb. irrespective of water treatment. However, all of these boilers had either inside calked seams or welded or forged construction.

In the lower pressure boilers no cases of embrittlement have been encountered in boilers where the recommended A.S.M.E. (sodium sulphate to total alkalinity) ratios have been maintained. Many instances of embrittlement have occurred when these ratios have not been maintained. Consequently the boiler code recommendations may be said to have aided materially in preventing this type of trouble.

Carryover—The presence of small amounts of solids in the steam quite often results in difficulty in the form of turbine blade deposits. In order to reduce the total solids in the steam without reducing those in the boiler water, methods of steam cleaning or purification have been developed. One method in general makes use of the principle of washing or scrubbing the steam with the water being fed to the boiler. If this water enters the boilers at the temperature of the boiler water and is brought in intimate contact with the steam, the boiler water in the steam will be replaced with feedwater. Since the feedwaters usually have a total solids content less than one-tenth of that of the boiler water, the total solids in the resulting steam will be reduced to a low figure without changing those in the boiler water. In addition to reducing the total solids, the composition of the solids is also changed. Thus a boiler water containing sodium hydroxide might give a steam having an appreciable sodium hydroxide content, but after being washed with a feedwater having a low sodium hydroxide content the sodium hydroxide content of the steam might be eliminated.

In some recent installations it has been possible to remove sufficient entrained boiler water to reduce or eliminate the steam washing[3]. This has involved the use of a large number of so-called cyclone separators within the boiler drum. In these separators the boiler water is mechanically separated from the steam so that the steam contains an extremely small amount of entrained water.

Recent experience indicates the necessity for further study relative to the effect of impurities in the steam on the endurance limit of the metals used for the steam turbine blades. It may prove necessary to adopt types of blade materials which are non-reactive with the impurities.

The results which have been obtained in the newer steam power plants show that there has been a close cooperation between the chemical engineers, the designing engineers and the operators. This cooperation has started from the early design of the plant and extends through its ultimate operation. It has resulted in the prevention of many difficulties and aided in obtaining increased efficiency in the steam power plant.

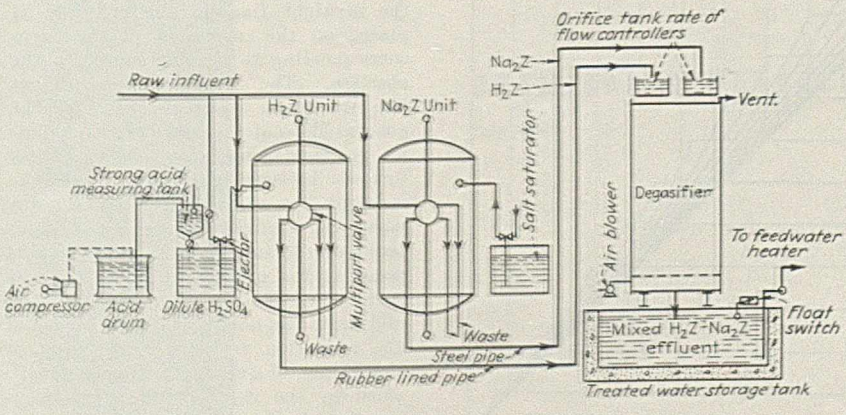


Diagram of connections of Zeo-Karb and Na units with degasifier

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Chem & Met PLANT NOTEBOOK

Timesaving Ideas for Engineers

HOPPER INTERSECTION ANGLE SOLVED WITH COMPOUND ANGLE GRAPH

P. W. JACOBSEN Bakelite Corp., Bound Brook, N. J.

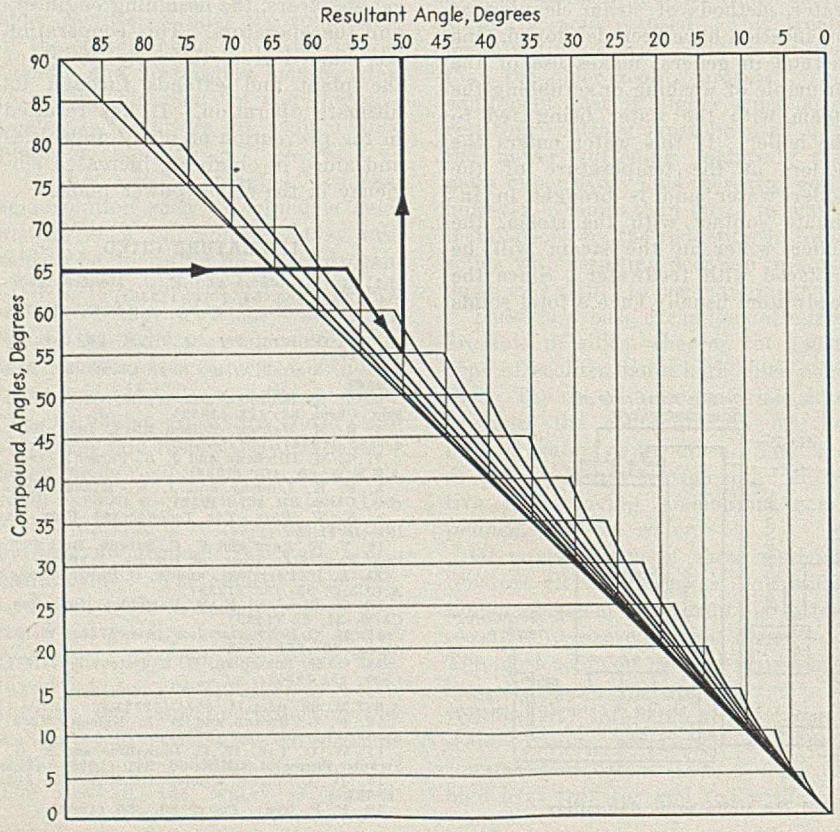
IN THE DESIGN of gravity flow equipment for crystalline, pulverized and broken solid materials it is important that surfaces over which the material must flow should not have a slope less than the angle of repose of the material. This problem is encountered in the design of hoppers of all sorts, and in chutes or ducts for conveying granular materials, such as molding powders. With such powders, for example, the slope of a duct or bin wall should not be less than 55 deg. if the material is to flow without the use of a vibrator.

The difficulty in laying out drawings for such equipment is in determining the angle made by the intersection of the two walls of a hopper, or the true slope of a chute or duct which may appear slanting in both elevation drawings. A moment's consideration will show that the intersection of two sloping walls of a hopper will have an inclination with respect to the ground which is less than the slope of either of the two walls; and hence that material may "hang up" in the dihedral even though the walls themselves have sufficient slope. This fact is emphasized by Sandstrom (*Chem. & Met.*, Jan. 1940, p. 23). The calculation of this angle is a nice problem in geometry.

The accompanying chart, however, saves this calculation. Suppose that a duct lay-out is being made, showing projections of the floor of the duct which slant in both elevations. It would be possible to rotate the drawing by methods of descriptive geometry until one view was parallel to the paper, when a protractor would show the correct angle of the duct floor. But with the chart the procedure is much simpler. The angles made by the duct floor with the horizontal in the two elevations are measured and the chart entered at the left at the larger component angle, such as 65 deg. Follow horizontally from 65 deg. to the curve which has its top on this horizontal line. Then follow down that curve until it intersects the horizontal line from the smaller component angle, for example, 55 deg. From this point read vertically to the resultant scale, where it is found that the angle made by the intersection between the two planes is 50 deg., which is the true slope of the floor of the duct.

The problem is the same, of course, when the slopes in the two elevations represent not the path of a duct or other plane sloping away from the surface of the paper, but are the slopes of two sides of a hopper.

Compound angle graph for determining slope of intersection of two sloping planes



Simple Graphical Integration

JAMES H. WIEGAND University of Michigan, Ann Arbor, Mich.

DETERMINING the area under a curve in graphical integration is done by breaking the area into a series of vertical rectangles, each of which has its height chosen so that the area of the rectangle is approximately equal to that under the corresponding section of the curve. The positioning of the top line of this rectangle is done by eye and to get accurate results the triangle must be narrow and of a width depending on the slope of the curve at that point.

A more rapid method which allows regular increments to be chosen, while keeping the same accuracy, and avoids actually drawing rectangles on the graph is as follow: A straight line is scratched on a piece of celluloid such as a triangle or an irregular curve. The celluloid is then laid on the graph, scratched side down, giving a visible straight line on the paper which may be adjusted as needed. A unit increment along the abscissa is chosen and the straight line on the celluloid is placed on the increment of the curve corresponding to the increment on the abscissa. The slope of the straight line should be about the same as the general slope of the curve at that point, its position being such that the areas formed between the curve and the straight line are balanced. The point where the straight line crosses the midpoint of the increment is read as this point is the average ordinate for the increment. The straight line is then slid on to the next equal increment and the operation repeated. The sum of the values of average ordinates multiplied by the value of the unit increment used gives the area required.

CHEM & MET REPORT ON

Mechanical Power Transmission

TO PLANT MANAGERS, SUPERINTENDENTS AND CHEMICAL ENGINEERS

Estimates indicate that at least 3 per cent of the total equipment investment in a typical process industry is in mechanical power transmission equipment. If a reasonable average life is six years, it is clear that misapplication which may cut the life to say four years can take a tremendous toll in unnecessary maintenance and replacement. This report cannot claim to be a short course in power transmission engineering; on the other hand it goes at least part of the way toward its objective of indicating what is available and how it is used.

CHEMICAL & METALLURGICAL ENGINEERING

July 1940 Series A, No. 4

TITLE OF REPORT Mechanical Power Transmission

TO Chemical Engineers

FROM Chem & Met Editors

DATE May 1940

In no part of industry is the problem of mechanical power transmission more diverse or complex than in the chemical process field. Drives range from fractional to hundreds of horsepower while types of driven equipment require speeds between the lowest and the highest. To add to the difficulty, high temperature, corrosion and abrasion are often met.

CONCLUSIONS

In spite of unfavorable conditions, however, such a broad range of equipment is now available that it may be stated with confidence that a workable solution exists for every power drive requirement, provided it can be recognized and properly diagnosed. The problem then is principally one of selection, which although often a job for the specialist, can still be accomplished in many less difficult cases by chemical engineers acquainted with the tools at hand.

The Work and the Tools

IT HAS BEEN estimated by Perry and Staniar (*Chem. & Met.*, Dec. 1934, p. 625) that in an average process industry at least 3 per cent of the equipment investment is for mechanical power transmission, and that the average life of such equipment when properly selected is six years. This indicates an annual depreciation of at least one half per cent of the total plant investment, but added replacement costs and increased maintenance when improperly selected equipment fails to give a reasonable life may well amount in a single plant to thousands of dollars per year. Thus, chemical engineers and plant executives have an important stake in power transmission machinery, and large savings are to be made from a proper appreciation of this fact.

Probably the most useful method of classifying mechanical power transmission equipment is that of Staniar (William Staniar, *loc. cit.* and "Mechanical Power Transmission Handbook," McGraw-Hill Book Co., 1936) who states that mechanical transmission falls into two systems, the flexible and the rigid. Flexible systems are those in which the principal power transmitting element is capable of slipping or at least has a considerable amount of "give" under shock loads or high-torque starting. Included are all methods of belt transmission, chain drives and most types of variable speed changers. Rigid systems on the other hand are those in which direct connection or gearing between driving and driven machines rule out all possibility of flexibility except that which can be provided by a flexible coupling or a centrifugal or slip clutch or some other overload device. Both flexible and rigid systems can be fully protected against overload. Where severe vibration exists, however, only the flexible system may serve, for a rigid system communicates and may reinforce vibration, often leading to high maintenance and early replacement of bearings, journals and gears.

It has been reliably estimated that approximately 52 per cent of all drives in process plants employ belts, while about 40 per cent of the drives are geared or direct, and 8 per cent use chain. Leather and rubber-impregnated cotton are the most widely used belt materials. Other types include impregnated stitched cotton duck, impregnated woven cotton, camel's hair, balata, and certain combinations and special types.

Leather Belts—Leather belts are made in single, double and triple ply construction by cutting the tanned leather into strips, tapering or "scarfing" the ends and cementing them together. Joints are staggered in multi-ply belts, such types being available in widths as great as 72 in. Both oak and mineral tannage are used, as well as mineral retanning of oak-tanned hides.

Oak-tanned leather may be hot glued, in which case the belt will not withstand moisture, steam, acid or temperature above 115 deg. F.; at slightly higher cost, a waterproof pyroxylin cement may be used to

produce a belt of similar characteristics but capable of high moisture resistance. Oak leather retanned by a mineral process has a greater power transmitting capacity than straight oak leather, is usually somewhat stronger, is considerably more expensive, and has a good degree of resistance to mineral oils, acid fumes and vapors, as well as water and steam to 130 deg. F. For heavy, slow drives, special two-ply belts are sometimes used, the pulley side ply being mineral retanned leather which imparts a high frictional grip, with the outer ply of oak leather which is used for its rigidity. Leather belts may be made endless or they may be joined with any of the customary methods of belt fastening. All leather belts require periodic dressing, using compounds which are best procured from a belt manufacturer.

Rubber Belts—Frictioned-surface rubber belts are constructed of cotton duck or cotton cords "frictioned" with rubber. Flat belts are made of one or more folds of duck with folded edges (or of a number of layers with raw edges) the various layers being impregnated with a rubber compound and the whole vulcanized under pressure. Rubberized cotton cords laid parallel and encased in a rubberized duck envelope are also used, this method permitting the production of endless belts without joints. Still another variety are belts combining duck and cord construction. Rubber belts are made with two to twelve plies in widths to 84 in. Such belts resist moisture and steam to about 120 deg. F., but are not resistant to mineral oil. They deteriorate in acid fumes unless rubber covered. Special oil-proof belts with covers incorporating neoprene and other synthetic rubber-like materials are now available. Non-endless belts may be joined with any of the customary belt fastenings. Periodic dressing is usually required.

V-belts—A modern variety of rope drive which has attained tremendous popularity for short-center work is the V-belt which is constructed somewhat similarly to the combination cord and fabric type of flat rubber belt except that in cross section it is ordinarily trapezoidal. Special modifications include one type having a transversely corrugated inner surface and another type with the side walls slightly concave in the unbent condition. The corrugations improve flexibility and both types are designed to avoid excessive bulging of the material in its mid-section as the belt bends into the V-groove in the pulley or sheave. V-belts operate by wedging into the sheave groove and gripping its side walls. Sometimes, however, V-belts are run over a grooved sheave at one end and a larger flat pulley at the other, an arrangement which is satisfactory when the relative sizes of the pulleys is such as to reduce the arc of contact below about 110 deg. wrap on the smaller pulley.

V-belts possess the same type of resistance as flat rubber belts and may also be obtained with oil-resistant covers. These belts are generally endless, although special metal fasteners are now obtainable.

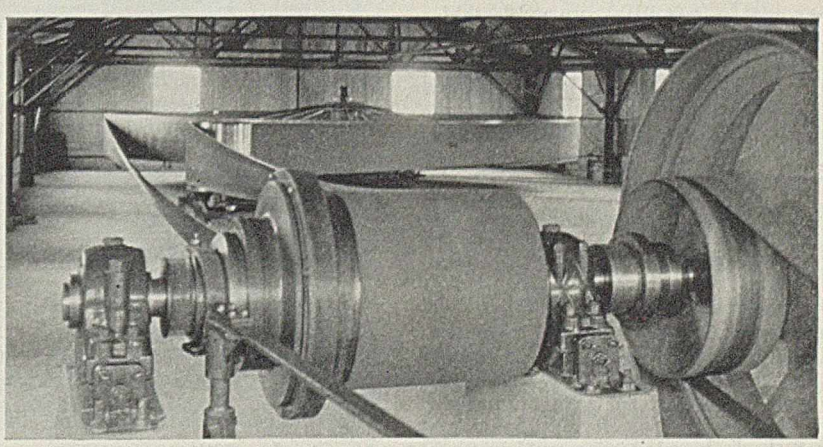
Other Belts—Stitched canvas belting is made of extremely heavy impregnated duck with the plies stitched together. Such belting is strong, flexible, elastic and resistant to water, heat to 140 deg. F., steam and oil, but not to acids or caustics. Solid woven cotton belting is a type solidly woven to the desired thickness and impregnated with a lubricating compound. It is quite resistant to acid fumes, mineral oil and to caustics as well as to heat to 200 deg. F., steam, moisture and grit. Camel's hair belting is made of cotton and camel's hair, woven under heavy tension and impregnated with protective materials. Belting of this type has a high coefficient of friction, extremely high strength, flexibility and elasticity and is resistant to steam and moisture, heat to 300 deg. F., and acid fumes. It is injured by caustics, however.

A gum similar to gutta percha and known as balata is used in one type of folded, impregnated duck belt, particularly for damp service. Balata belts withstand abrasive conditions and temperatures below 110 deg. F., but are unsuited for resistance to acid fumes, caustics or mineral oil.

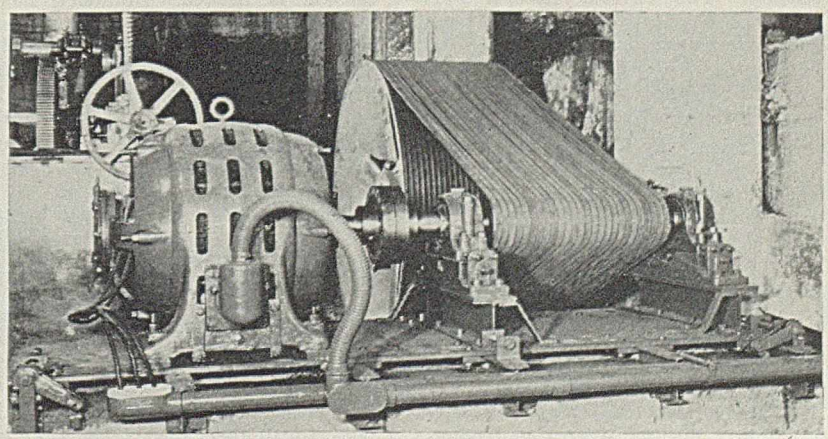
Various special beltings are also on the market, including link leather belts; belts with friction surfaces of chrome-tanned leather strips riveted to a backing of fabric or leather; and cemented, metal-stitched canvas belts.

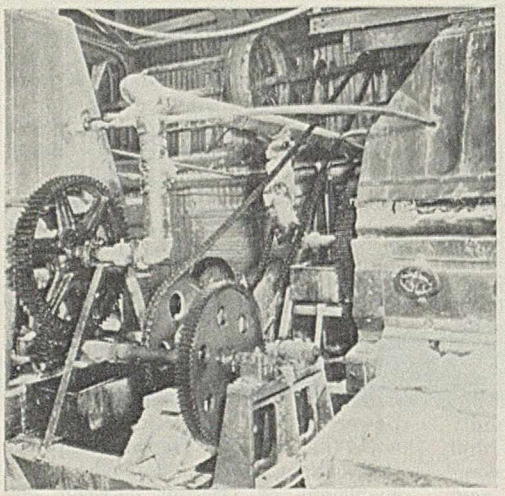
Belt Service—A belt transmits power through frictional contact with the pulleys. Hence the power that can be handled depends on the coefficient of friction between belt and pulleys, the unit pressure between belt and pulleys, and the area of contact. Thus the width of the belt, the materials of belt and pulleys, the sizes of the pulleys, and the belt tension all are controlling factors. A drive pulley too small in comparison with the driven pulley, especially on a short-center drive, will reduce the transmittable power markedly. Centrifugal force at higher belt speeds, say over about 4,500 f.p.m., has the same effect owing to reduc-

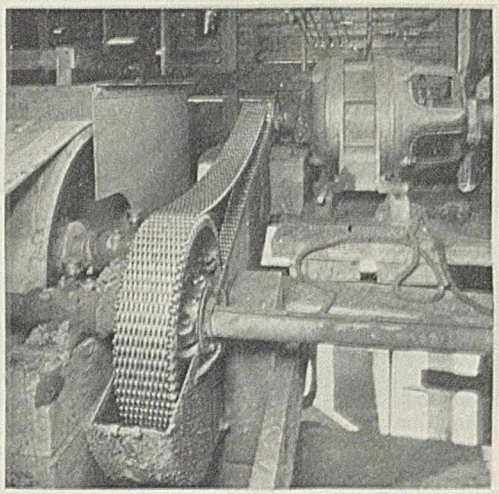
Suggestive of the versatility of rubber belting is this quarter-turn drive of 26-in. belt on an oil well pumping band wheel



This V-belt drive applied to a pulp beater employs 26 Dayton Cog Belts







Extreme left—Chain Belt Co. roller chain driving zinc sulphate dryers in a chemical plant

Left — 30-hp. Link Belt silent chain drive on a belt conveyor for coal; upper half of the casing is removed to show the silent chain

Below — Pivoted motor base (Rockwood drive) of a type designed especially for ceiling drive

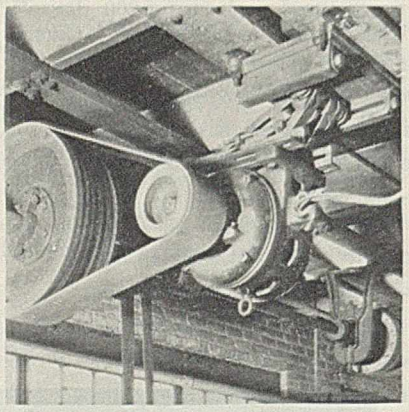
tion of belt pressure on the pulleys. Too narrow a belt is a common cause of trouble. Increasing the initial tension of a belt will of course tend to offset too high a speed, too narrow a belt, or too little contact, but it does so at the expense of reduced belt life and increased bearing load, possibly leading to bearing failure. Even greater belt widths and lower tensions than those recommended by the manufacturers are generally desirable for lowest belt cost over a period of years.

Selection—Belting manufacturers, as well as handbooks, provide tables facilitating selection. Factors considered include belt type and material, belt width, pulley diameters and center distances, slope of the drive, atmospheric conditions, pulley materials, type of driver, type of load and character of overloads.

SHORT-CENTER FLAT BELTS

Obviously the problem of maintaining belt tension and contact is nowhere nearly as difficult on a long-center drive as with short centers. For one thing the decrease in contact arc becomes less as the center distance increases; for another, in long-center horizontal drives the weight of the belt and its sag are important factors in maintaining contact and tension. The obvious exception is in drives which approach the vertical, for under vertical or nearly vertical conditions the belt tends to drop away from the lower pulley. With belts more than 15 deg. from vertical, this difficulty is unimportant.

Idler Pulleys—Many methods have been developed for maintaining contact and tension, particularly of short-center flat belts. Commonly, the motor mounting is adjustable to permit taking up belt stretch. Idler pulleys are also used to a large extent, sometimes rigidly attached and capable of adjustment, but more frequently floating on the belt and weighted or loaded with springs, so as to give desired wrap and tension.



Pivoted Motor Bases—In recent years there has been a decided tendency to improve short-center driving by using pivoted motor bases to maintain the desired belt tension despite permanent stretch or temporary lengthening during operation. High transmission efficiency and greatly reduced maintenance are consistently reported for such drives.

Bases of this type, of which the Rockwood is the best known variety, mount the motor on a platform attached adjustably to a fulcrum in such a way that any desired part of the weight of the motor can be carried by the belt to give whatever tension is needed. Standard bases may be mounted on the floor or wall, and with slight modification of design, on the ceiling. For vertical drives, either above or below the motor, a further modification provides the base with adjustable springs which counterbalance all or a part of the weight of the motor.

Another type of pivoted motor base cradles the motor below the pivot and employs the motor reaction to provide belt tension.

CHAIN DRIVES

Transmission chain is of two general types: roller and silent. There are several grades of roller chain, that for higher speeds being known as "finished-steel" and the grades for progressively lower speeds and rougher work as "light-steel" and "rough-steel." In addition, malleable iron non-roller chains may be had, principally for slow, light drives and conveyor work. Finished-steel roller chain is built up of a series of pin links and roller links assembled by inserting the pins of the pin links through the bushings on which are the rollers of the roller links. There are various weights of finished-steel roller chain, as well as chain having from one to eight or more roller strands. Cut-tooth steel or cast iron sprockets are used. This type of chain is made in pitches from $\frac{1}{4}$ to $2\frac{1}{2}$ in. For best results and low maintenance it should not be operated at more than 1,400 f.p.m. nor with sprocket ratios of more than about 8 to 1.

Silent chain may be operated at higher speeds than roller chain, up to 2,000 f.p.m. for conservative use, and speeds as high as 3,500 f.p.m. if necessary. Below 1,200 f.p.m. roller chain is ordinarily used for economy. Silent, or inverted-tooth, chain is formed of flat links of double pointed shape, joined in various ways including solid pins, double-rocker pins and segmental bushings and pins. Cut-tooth steel or cast iron sprockets are used. Whereas roller chain is self-guiding, silent chain is not and various guiding methods including flanged sprockets and guide links are required. Like roller chain, pitches range from $\frac{1}{4}$ in. to $2\frac{1}{2}$ in., with chain widths, depending on pitch, from $\frac{1}{2}$ to 20 in. or even more. At least 90 deg. of wrap on the smaller pulley is necessary. For substantially horizontal drives, a method of tension adjustment is not ordinarily needed, but for more nearly vertical drives, an idler or adjustable motor base is generally employed.

Chain Cases—High-speed chain drives as well as those operating under abrasive or corrosive condi-

tions (unless the chain is of a proper corrosion resistant material such as bronze, Monel or stainless steel) are inclosed in oil-retaining casings which are usually quite dust-tight. So far as lubrication alone is concerned, roller chain can be operated open, up to about 600 f.p.m., and silent chain to 1,300 f.p.m. However, the severe conditions of process plant usage often demand inclosure even at lower speeds.

RIGID DRIVES

To a considerable extent individually driven machinery in process plants is driven rigidly, either through some form of reduction gearing, or direct. The latter method is of course limited to those applications where a motor of suitable speed is available. Colloid mills, centrifugals, centrifugal pumps, fans and blowers are often direct driven. Except for small equipment where shaft alignment constitutes no problem, direct and speed reducer drives generally employ a flexible coupling. In applications where high starting torque or shock loads are encountered, rigid driving methods often employ some form of starting coupling.

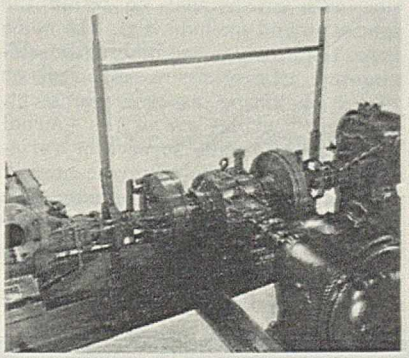
Flexible Couplings—Flexible couplings are made in a great many types, two of which are illustrated herewith. All compensate for a greater or lesser amount of angular misalignment, and many can also handle lateral misalignment as well. Two principles are employed: flexibility through elasticity, and flexibility through sliding of lubricated parts. Some couplings use one principle and some both. Among the common types are the following: (1) Two parallel cast iron flanges keyed to the driving and driven shafts, with pins between the flanges over which an endless rope or leather belt is laced to join the shafts. (2) Two parallel flanges carrying pins on the adjoining faces, the pins of one entering flexible rubber or fiber bushings socketed within the other. (3) Two gear-like members abutting within an oil-filled cylindrical member which contains internal teeth loosely engaging those of the gear-like members. (4) Two abutting, radially slotted hubs joined by a spring in the form of a cylindrical grid, which passes through the slots. (5) Two abutting sprockets joined by a moderately tight wrap of chain.

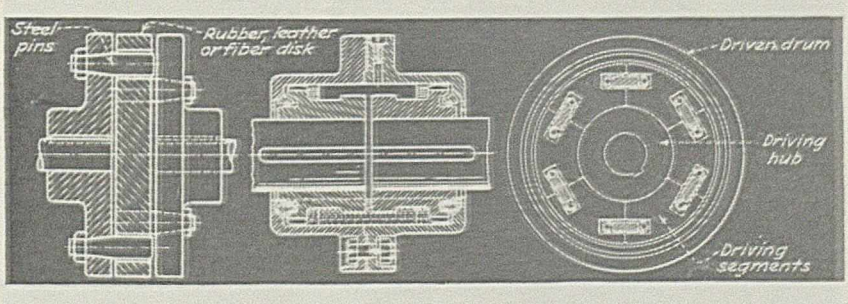
Clutches—Clutches are employed for connecting and disconnecting shafts and driving mechanism at will. The three general types include jaw, mechanical friction, and magnetic friction clutches. Jaw clutches which comprise pairs of hubs with either square or spiral jaws, can be used only for connecting slow-speed shafts or shafts at rest. Friction clutches are made with both wood and asbestos composition friction elements and are of many types, including single and multiple disk and plate clutches similar to an automobile clutch; clutches with radial expanding or contracting bands or jaws; and finally clutches with mating conical surfaces. Friction clutches are used either to engage aligned shafts or are built into a pulley, sheave, sprocket or gear for cut-off or reversing.

Magnetic Clutches—Magnetically operated friction clutches are often used for heavy loads such as ball mills and are adaptable to automatic control. Two flange-like elements are employed, one serving as the armature and the other, containing a magnetic coil, as the magnet. One or more friction linings large enough to assure shockless starting are situated between the flange elements. Direct current to energize and engage the clutch is conducted to the coil through slip rings.

Over-Running Clutches—Dual and two-speed drives may be handled with over-running or "free-wheeling" clutches which automatically engage when the driving shaft tends to exceed the speed of the driven shaft, but disengage when the driving shaft slows down or stops. A centrifugal pump, for example, may be driven by either a motor or a standby tur-

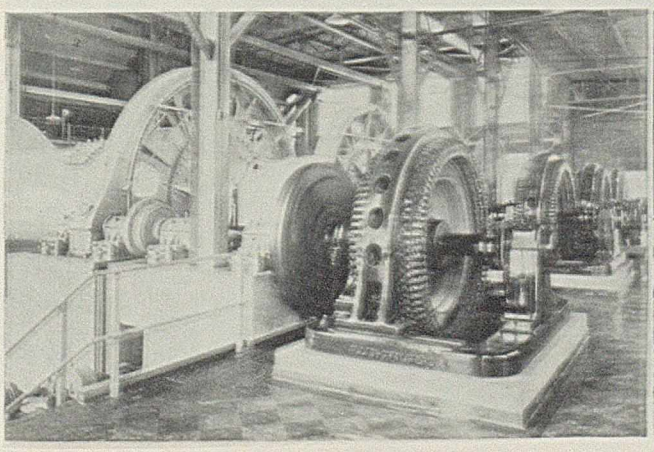
Two Kinney interchange clutches used to permit alternate driving of two Kinney pumps handling different liquids



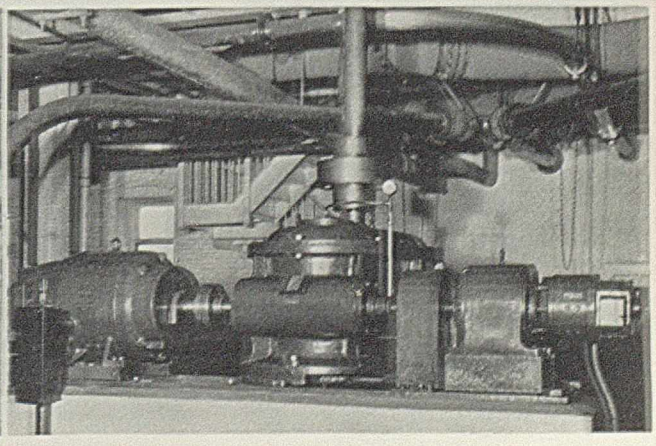


Left—Several typical couplings including, from left to right: Jones pin type and Poole internal-tooth oil-filled flexible couplings; and a Dawes centrifugal starting coupling

Magnetic clutch for coupling a synchronous motor to a large Allis-Chalmers grinding mill in a portland cement plant



Foote Bros. two-speed double-motor-driven vertical agitator drive applied to a brewery lauter tub

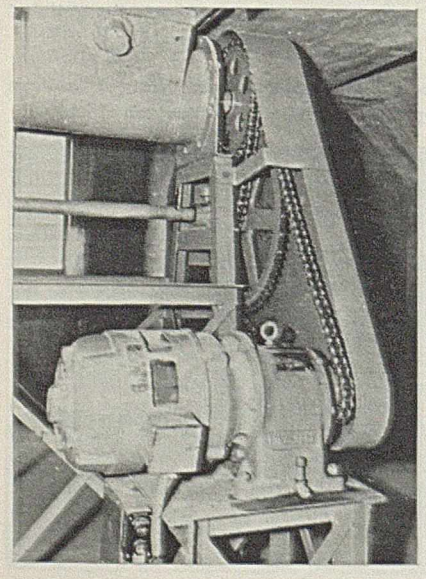


bine or diesel, each connected to the double-extended pump shaft through an over-running clutch. Either prime mover may be used, the other automatically disengaging when it is de-energized. Such clutches employ wedging members, usually rollers which engage between a driving drum and a driven cam-like hub with one direction of rotation, but disengage immediately with opposite rotation.

Starting and Overload Couplings—Most driven machinery has considerable starting friction and/or inertia and hence has a starting torque which is much higher than the running torque. To start such a load without some special mechanical starting device requires a special motor, i.e., a slip-ring a.c. motor or one of the high starting-torque type. On the other hand, when it can be used, a standard induction motor with across-the-line starting is much to be desired from a cost standpoint. Modern automatic starting couplings permit use of such a motor. These couplings are of the friction type, with the pressure automatically applied by centrifugal force. The motor is permitted to come up to speed before the load is applied, after which the load accelerates gradually to running speed. Owing to the chance for slip under load, such clutches also protect the motor against shock and overloads.

The most usual construction employs a driving hub carrying one or more brake bands or a set of friction shoes, within a driven drum attached to the load shaft. Such devices are generally made in two types. Built as a flexible coupling, they serve to join driving and driven shafts. Built into a motor pulley, sprocket or sheave, they are used to start belt- or chain-driven loads.

Fairbanks-Morse motor with integral speed reducer driving a conveyor through a double roller-chain reduction



Hydraulic Couplings—One type of starting and load-limiting coupling which with slight modifications is also available as a variable speed drive is the hydraulic coupling. In principle it is similar to the fluid clutch used on automobiles and consists essentially of two saucer-shaped elements containing vanes, the open sides of the saucers facing each other but not in mechanical engagement. The saucer elements, one of which is the driving and the other the driven side, are contained within a casing filled with oil. Centrifugal action induced by the vanes of the driving side forces the oil into the similar passages of the driven side where its kinetic energy is given up in producing rotation of the load. At rated capacity, approximately 2 per cent slip is required, the remaining power input appearing as heat.

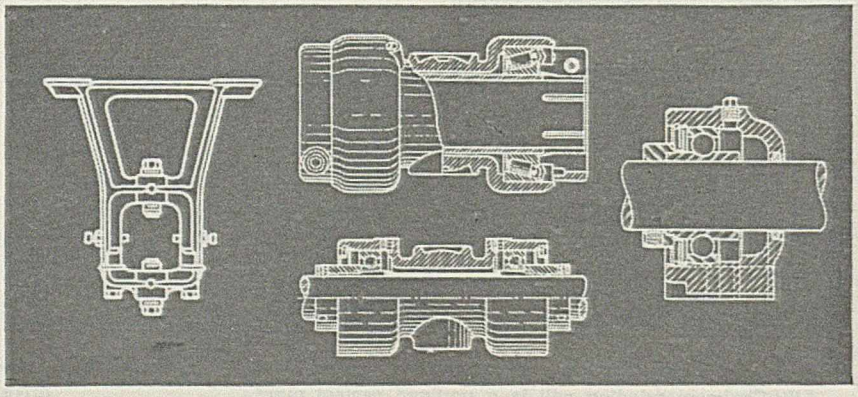
SHAFT BEARINGS

Bearings—Shaft bearings are ordinarily sleeve, anti-friction or oilless types. The first is either hand or self-lubricated; the second, self- or pressure-lubricated; and the last, unlubricated except by the lubricant contained within the bearing material. (For lubrication methods see *Chem. & Met.* Report A-2, March 1940, p. 171 ff.) All types are obtainable both as hanger or pedestal bearings, and as pillow blocks. Journal (sleeve) bearings are babbitted or lined with some other bearing alloy. Metals employed in such alloys include copper, tin, lead, zinc and antimony.

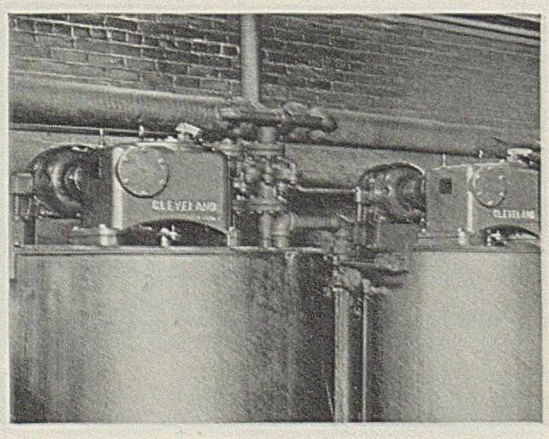
Journal bearings, which are suitable for shaft speeds to about 256 r.p.m., may consist of a solid or split sleeve arranged for hand, wick or ring oiling. Anti-friction bearings, used for shaft speeds up to 1,000 or more r.p.m., include both ball and roller types of which there are several variations. Most types cannot be split which necessitates special provision for installation. Ball bearings are generally used for lighter loads and higher speeds, while for heavier loads several types of roller bearing are employed, including those with long spiral-wound "flexible" rollers (which are obtainable in split bearings); tapered rollers; cylindrical rollers; "spherical" rollers, having barrel-shaped elements giving line contact with the spherical ground races; and needle or quill bearings making use of long, small-diameter rollers where space is limited.

Ball bearings are now frequently of permanently lubricated construction with grease seals to retain the lubricant and exclude dirt. In some types the bearings are inherently self-aligning. In others a spherical or rubber mounting assures alignment.

Oilless bearings are of the journal type and are made in several variations. One type is a bronze or cast iron bushing drilled with numerous holes which contain a lubricating material. Another is of impregnated wood or lignum vitae. A recently



Above — Typical four-point support shaft hanger; and several anti-friction bearings including (center) tapered roller and ball-bearing shaft bearings and (right) a Fafnir grease-sealed ball bearing pillow block



Right—Part of an installation of Cleveland worm gear reduction units applied to vertical agitator drives

developed variety is molded of a powdered bearing metal, sintered and impregnated with oil.

SPEED REDUCERS

Speed reduction at lower speeds is sometimes accomplished by open gearing, but the present trend in rigid transmission systems is definitely toward the use of inclosed-gear speed reducers which are available in any desired speed reduction (or increasing) ratio, for output in line with or parallel to the input shaft, or at right angles to it; for horizontal or vertical motor drive; for direct connection; or as an integral part of the motor. Spur, worm, helical and herringbone gears and their combinations are all in use, with anti-friction bearings in most types. Both planetary and non-planetary types are built in in-line models. Worm reduction gears have shafts perpendicular to each other, while herringbone and helical geared units have either parallel or in-line shafts. An important recent trend is the now extensive use of integral constructions of motor and speed reducer which are built for both horizontal and vertical drives. Agitators, for example, are frequently so driven.

VARIABLE SPEED DEVICES

Many types of variable speed changers have been developed although comparatively few of these are still in general use.

Mechanical Speed Changers—The variable-pitch conical disk drive (Reeves type) and numerous recent modifications of it are used for the largest number of variable speed-changing applications. This basic type consists of two pairs of conical disks, one pair on the input and one pair on the output shaft, so arranged that as one pair is moved closer together, the other pair moves farther apart by a corresponding amount. A broad belt of laterally rigid construction contacts the disks on its *edges*. Speed changes are effected by simultaneously varying the pitch diameters of the two sheaves. A positive drive modification of this idea, the P.I.V. gear, has radial grooving on the conical disks and a steel belt with laterally sliding metal fingers composed of numerous strips which enter the grooves and give positive engagement.

In recent years numerous simplified modifications of the Reeves idea have appeared, employing one or more V-belts operating on adjustable sheaves with variable pitch diameters. In one type the motor is mounted on a sliding base and the motor pulley is a spring-loaded double-cone sheave which spreads to a smaller pitch diameter when the center distance between motor and jackshaft is increased so as to pull the belt farther into the sheave. In another type, simultaneously adjustable conical sheaves for one or more V-belts are used on both input and output shafts.

Many devices for automatic or remote control of the speed ratio have appeared in recent years.

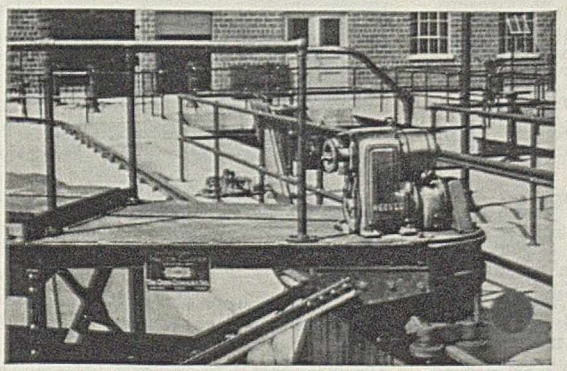
A second basic mechanical type of speed changer is found in several modifications all of which are planetary, and analogous to a planetary speed reducer in which, however, rollers are substituted for gears. These machines employ a stationary race comparable to the ring gear; a number of planetary rollers of conical or double-cone shape, mounted on a spider to which the input power is applied, this assembly being comparable to the planetary gears; and some means, either frictional or gearing, of communicating the rotation of the planetary rollers to the output shaft. Speed changes are accomplished by varying the diameter of the conical planetary rollers in contact with the stationary race.

Another mechanical type giving slightly non-uniform motion suitable for feeders and conveyors is the Morse speed control, a positive device using a variable-throw eccentric to communicate "ratcheting" variable impulses to a group of over-running clutches geared to the output shaft.

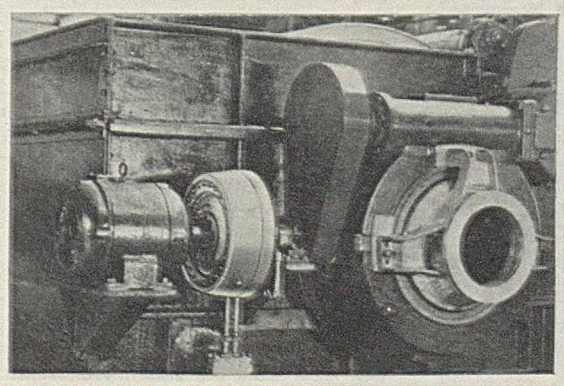
Hydraulic Drives—In general there are two methods of hydraulic transmission of power: the hydraulic coupling already described, and the method employing a variable-capacity hydraulic pump driven by a motor, which in turn drives a variable- or fixed-capacity fluid motor. As was mentioned, the hydraulic coupling is capable of giving infinitely variable speed at constant output torque. This is accomplished by pumping a greater or lesser amount of oil from the coupling to a storage tank. The less the oil content, the lower the output speed. Such couplings are obtainable in many modifications for specific purposes and are used for driving vacuum filters, large fans, and similar applications.

Considerable use has been made in recent years of hydraulic equipment of the second type mentioned, namely, variable delivery pumps and fluid motors. Pumps of this type employ multiple pistons, the stroke of which can be adjusted by various methods.

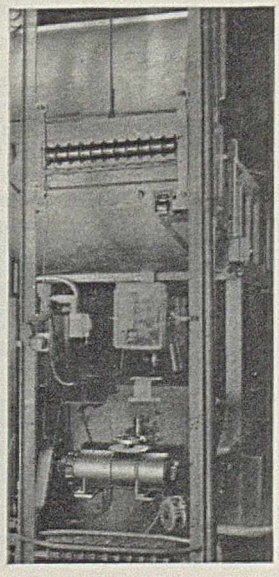
Reeves Motodrive vertical variable speed reducer driving a Dorr traction-type thickener



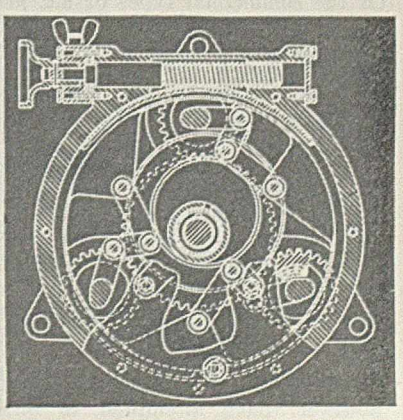
American Blower "scoop control" (variable speed) hydraulic coupling driving a vacuum filter

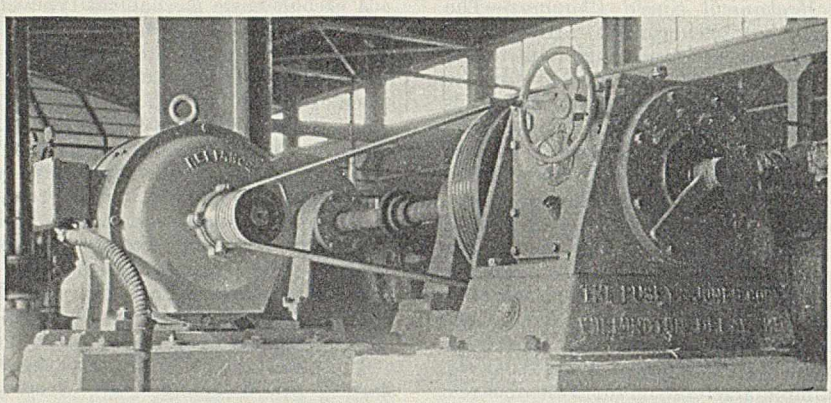


Stephens - Adamson JFS variable speed reducer driving a film processing machine

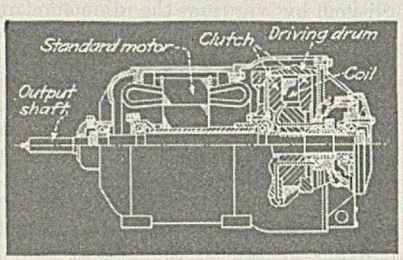


This Morse Chain Co. variable speed drive uses an eccentric and ratcheting action for speed reduction





Above — Typical of many variable speed applications is this Reliance d.c. motor driving a 234-in. paper machine shake-head at 450-1,800 r.p.m.



Left — An eddy-current slip clutch built into this Louis Allis a.c. motor gives a wide range of speed variations. This device has been given the name of Ajusto-Spede motor

One type uses a rotating cylinder block with radial pistons, mounted within a ring against which the ends of the pistons bear. The eccentricity of the cylinder block can be altered from zero to a maximum with respect to the ring. Rotation of the block causes a reciprocation of the pistons proportional to the eccentricity. Another type is similar to a rayon piston spinning pump, having parallel pistons in a rotating cylinder. The pistons are driven by a wobble plate, the angle of which can be altered. Hydraulic transmissions of the pump and fluid motor type are at present being built self-contained to an increasing extent with the input and output units in a single casing.

VARIABLE SPEED MOTORS

Although strictly speaking motors are not a part of mechanical power transmission, nevertheless motors capable of giving a variety of speeds under control of the operator are in many applications directly competitive with mechanical speed changers. Of the commercial types of a.c. motor, the brush-shifting and wound-rotor types are capable of sufficient speed variation for some purposes, although comparatively expensive and inefficient at lower speeds. For a few speeds in steps, such as two or four, multi-speed induction motors are available. Direct-current motors are the most successful for variable speed applications, but with direct current not often available industrially, use of d.c. motors has been much curtailed owing to the need for employing a motor-generator in a.c. powered plants.

A number of recent developments, however, have attempted to offset this cost disadvantage in smaller applications. The Crocker-Wheeler variable speed a.c. motor is, in effect, a combination of a.c. and d.c. motor, with a separate induction type speed regulator to give wide-range speed variation. A "packaged" modification of the well-known Ward-Leonard system introduced in the smaller sizes is the Reliance V-S drive which comprises a small vertical motor-generator supplying a variable voltage to a d.c. motor which drives the load. Fiber-board, textile, glass working and such paper machinery as slitters are at present being driven in this manner.

The recently developed General Electric "speed variator" is similar in principle, employing a d.c. motor, adjustable voltage m.g. set and generator field control for capacities to 15 hp.

Another recent development is to use a constant speed a.c. induction motor, driving its load through an electrical equivalent of a mechanical slip clutch. In the Louis Allis design, the slip clutch (in the smaller sizes) is built into the motor. The Electric Machinery type uses a separate eddy-current clutch connected by shafting to the motor and to the load.

POWER TRANSMISSION MODES

As has been explained previously, mechanical power transmission methods group themselves into flexible and rigid types. However, nothing has been said of an equally important classification of driving methods: individual and group driving. An individual drive involves the use of one prime mover to drive one piece of machinery, by whatever method of transmission is chosen. A group drive, on the other hand, involves the connection of several pieces of driven machinery to a single prime mover, again connected by whatever method, either rigid or flexible, that may be chosen.

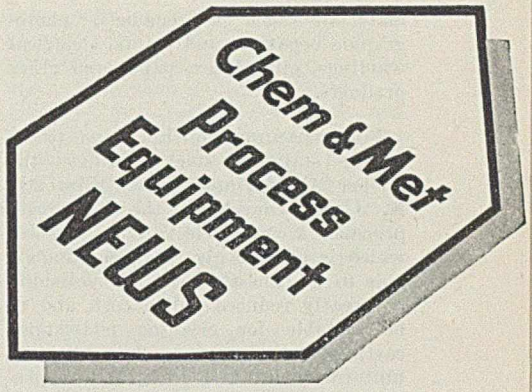
For a number of years past, until comparatively recently, there was a decided trend away from earlier group driving methods toward the use of individual drives. In part this was due to deficiencies of then existing equipment, and in part to the tendency to improve the appearance of plants by eliminating belts and line shafting.

At present, however, the trend has to a considerable extent reversed owing to intensive study that has been given to the possibilities of what has been termed modern group drive. Thus the respective fields for both individual and group driving have now been well established. It is recognized that group drives, employing as they do a single large and efficient motor, offer better electrical characteristics than are obtainable with a number of smaller, less efficient motors. At the same time, owing to the decreased cost of one large motor compared with several smaller ones, group drives generally permit a considerable decrease in total investment. Using either belts or chains, group drive is particularly applicable to batteries of such equipment as mixers, paint mills and pumps.

According to Staniar, however, individual drive is likely to be found preferable for equipment in the higher power classifications, say above 5 or 6 hp. running load, or where starting torque is especially high. This is also true when the atmospheric conditions are particularly bad from the standpoint of abrasive dusts or corrosive fumes.

We wish to acknowledge our indebtedness to the following firms who supplied information and in some cases illustrative material for the preparation of this report: The Louis Allis Co., Chain Belt Co., The Cleveland Worm & Gear Co., The Dayton Rubber Mfg. Co., Diamond Chain & Mfg. Co., The Fafnir Bearing Co., Fairbanks, Morse & Co., The Falk Corp., Foote Bros. Gear & Machine Co., General Electric Co., Hydraulic Coupling Div. of American Blower Corp., Kinney Mfg. Co., The Link Belt Co., Morse Chain Co., Norma-Hoffmann Bearings Corp., The Oilgear Co., Reeves Pulley Co., The Reliance Electric & Engineering Co., Stephens-Adamson Mfg. Co., Vickers Incorporated, Vulcan Iron Works, Westinghouse Electric & Mfg. Co., and T. B. Wood's Sons Co.

Machinery, Materials and Products



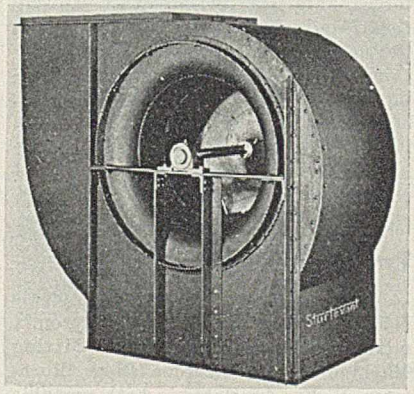
Ventilating Fans

HIGH EFFICIENCY over a large operating range is claimed for a new fan for heating, ventilating and general industrial use, introduced under the name of Silentvane Design 7, by the B. F. Sturtevant Co., Hyde Park, Boston, Mass. Reduced power consumption, quiet operation and low maintenance are claimed. The fan, constructed of heavy steel plate reinforced with angle irons features low speed and little vibration. Mechanical efficiency is stated to be in excess of 70 per cent over 53 per cent of the performance range; 75 per cent over 41 per cent of the range; and 80 per cent over 21 per cent of the range. Self-limiting power characteristics are claimed. Various styles and arrangements in wheel diameters to 87 in., for static pressures up to 16 in. w.g., are available.

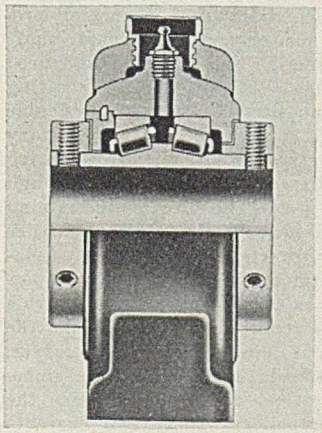
Anti-Friction Pillow Block

A BEARING described as the Dodge-Timken double-interlock pillow block, manufactured by the Dodge Mfg. Corp., Mishawaka, Ind., has recently been put on the market. The new pillow block has been designed for simplified mounting on ordinary commercial shafting for less heavy loads than those requiring this company's clamp sleeve type of bearing. The new pillow block uses a special duplex Timken roller bearing, the inner race of which is extended to facilitate complete closure. The shaft is clamped to the race ring by set screws, both expansion and non-expansion types being available. Lubricant is retained by labyrinth seals.

Improved ventilating fan



Double interlock pillow block



Continuous Centrifugal

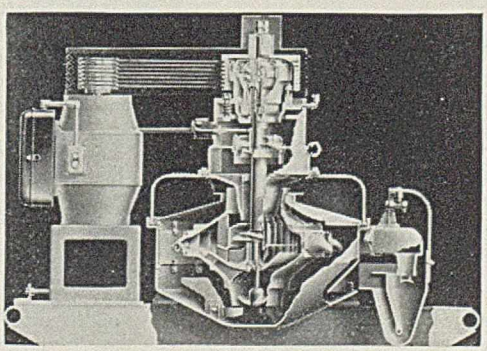
A NEW TYPE of continuous centrifugal concentrator known as the Merco type A-24 has been developed by the Merco Centrifugal Co., 343 Sansome St., San Francisco. Designed originally for the desanding of rotary oil well drilling muds, it is also suggested for other applications. This machine is at present being used in the manufacture of starch and appears to be of interest in the refining of finely ground clays, edible oils and pigments.

The machine is of the continuous discharge type in which the bulk of the heavy ingredient is concentrated in a small amount of the lighter ingredient. For example, with rotary muds the machine applies a settling force of 110 times gravity and concentrates substantially all of the sand in a small portion of the mud, returning the sand-free mud to further drilling operations. This settling force is low compared with other Merco models.

As appears from the accompanying sectional view, the machine consists of a casing within which is the centrifugal bowl, driven by and supported on a vertical shaft. The periphery of the bowl is formed into pockets, each terminating in a nozzle. Toward the center is a series of vertical vanes which serve to give angular velocity to the feed and at the same time prevent racing of the lighter ingredient as it approaches the overflow. A saucer-shaped diaphragm separates the pump portion of the bowl from the separating portion.

The heavier material concentrated in the lighter constituent at the periphery discharges continuously from the peripheral nozzles. However, in order to avoid packing and failure to discharge from these nozzles, a larger amount is permitted to discharge than is desired and the surplus returned through the bottom of the bowl by means of the impeller shown. By thus returning part of the discharge, the feed can be limited to any desired minimum in order to increase the retention period in the bowl. The nozzles can be made large enough to prevent clogging and the heavier ingredient can be concentrated to any desired extent. The concentrated product is withdrawn at a rate giving the desired concentration through the gravity control discharge mechanism at the right.

Cutaway view of Merco continuous centrifugal



Equipment Briefs

SEVERAL new spray nozzles have been announced by Spraying Systems Co., 4021 West Lake St., Chicago, Ill. A new pneumatic atomizing nozzle is available with internally mixed round or flat spray and is designed to be screwed directly into a pipe where liquid is maintained at a constant level, the same pipe serving as an air supply header. A new flat spray nozzle is made in several different spray angles for capacities from 3 to 7 g.p.m. at 40 lb. pressure. A number of new non-clogging Whirljet nozzles are made in corrosion resisting materials including stainless, Monel, lead, hard rubber and other materials for capacities to 2.5 g.p.m. at 10 lb. pressure.

FOUR NEW infra-red drying lamps in 250 to 1,000 watt sizes, designed for industrial and commercial drying and heating jobs, have been announced by the Westinghouse Lamp Division, Bloomfield, N. J. With the exception of a 250-watt lamp made in the reflector type, these lamps should be used in conjunction with especially designed aluminum or gold-plated reflectors. The reflector type, however, incorporates its own metallic reflecting coating within the specially shaped blown glass bulb. These lamps are rated for a life in excess of 5,000 hours and are designed for the drying of numerous

materials such as enamels, photographic negatives and prints, electrical windings, glue, latex, paper and other products.

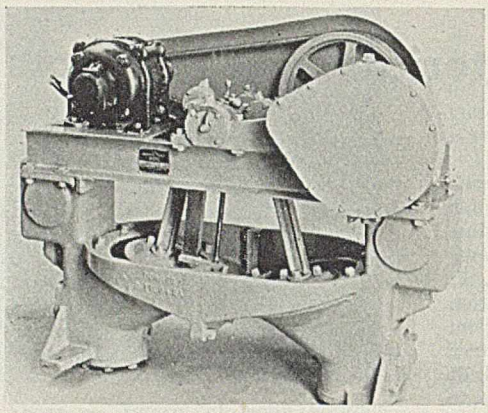
FOR CLEANING, polishing and passivating stainless steel castings, the Cooper Alloy Foundry Co., Elizabeth, N. J., has developed the Lustracast process, a new electrolytic process which is said to give a sheen comparable to the finest mechanical polishing at greatly reduced polish cost, and to be suitable for cleaning odd-shaped castings, to improve machinability by uniform removal of scale, and to prolong casting life through the lessening of surface contamination and contact corrosion. Salt spray tests conducted on castings finished by this process are claimed to indicate a considerable advantage as compared with conventional sandblasting and pickling methods.

CONTROL of machine vibration and reduction of the resulting noise is the function of the new controlled spring isolator recently announced by Johns-Manville, 22 East 40th St., New York, N. Y. This vibration isolator, developed for use on the bases of motors, generators, pumps, ventilating fans and similar equipment, consists of a coil spring and a rubber load pad with an adjustable rubber snubber inside the base to control excessive motion. Such isolators are made in two sizes, one for loads from 60 to 190 lb. per isolator; and one for loads of 250 to 720 lb. per isolator. Heavy machines may be isolated by use of groups of the units.

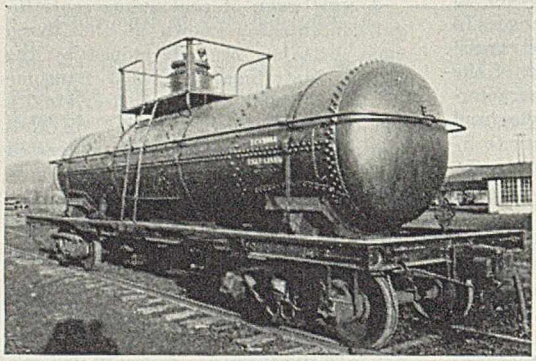
Duplex Diaphragm Pump

TYPE V is the designation of a compact duplex diaphragm pump recently developed by the Dorr Co., 570 Lexington Ave., New York, N. Y. This new pump, designed for handling of sludges, pulps and slimes containing appreciable quantities of solid material, is provided with means for adjusting the stroke, and hence the rate of discharge, during operation. An importaant feature of the construction is the ability of the pump to operate against small pressure heads; another is its much greater compactness and lower headroom as compared with previous designs.

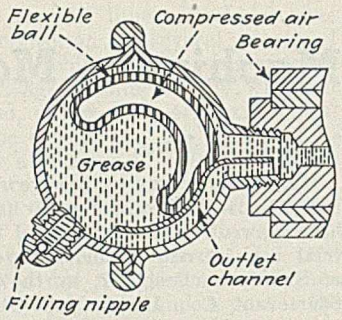
The pump is of the two-chamber V-type, the chambers being provided with individual suction and discharge valves, rubber diaphragms and plunger rods. The plunger rods are moved directly up and down at right angles to the diaphragms by a rocking member, driven by a connecting rod terminating in a crank on a horizontal counter shaft. The stroke of the plungers may be varied from § in. to 3 in. during operation, and the stroke being used is indicated on a dial. All bearings are of the anti-friction type and all castings of Meehanite semi-steel. Lead-impregnated rubber balls are used for the valves and hard rubber rings for the seats. The present pump size is 4 in. with a 6 in. size to be available later.



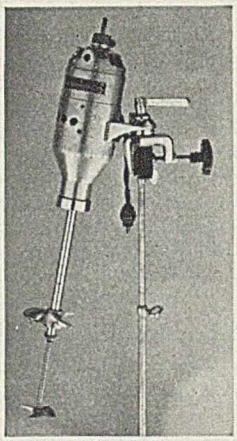
V-type diaphragm pump



Lead-lined tank car built for General Chemical Co.



Cross section of automatic lubricator



New Gyromix mixer

Lead-Lined Cars

IT HAS BEEN announced by the Treadwell Construction Co., 618 South 12th St., Midland, Pa., that this company is now fabricating homogeneously lead-lined tank cars for chemical industry use, exclusively for the account of the National Lead Co. The cars are built in strict accord with I.C.C. requirements, employing riveted tanks of 7,000 gal. capacity, an acid dome equipped with all latest safety appliances and a method of homogeneous bonding of lead to the steel tanks which is said to prevent the lining from separating under severe service. These cars are manufactured for both vacuum and pressure service.

Automatic Lubricator

DECIDEDLY NOVEL in design, a new automatic lubricator for the continuous feeding of lubricant to bearings, regardless of viscosity or temperature changes, has been announced by the Simplex Mfg. Co., 1504 Broadway, Detroit, Mich. This lubricator is intended for replacement of grease fittings or oil cups on all kinds of machinery. It is essentially a spherical steel shell with a grease fitting, containing a hollow neoprene ball and an outlet channel for preventing the ball from clogging the outlet. When grease or oil is forced into the fitting with conventional equipment, the pressure collapses the neoprene ball, compressing its contained air and storing energy for feeding the lubricant. Since the bearing, once full, will take lubricant only when in operation, the feed rate is infinitesimal in accordance with the rate of consumption.

Two-Motion Mixer

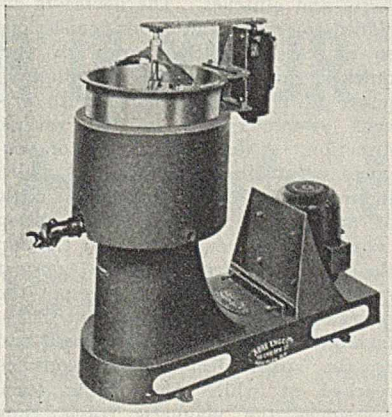
AN INTERESTING mixing principle is evident in the new line of Gyromix mixers developed by the Gyro Mixing Machine Co., 500 Taylor Bldg., Rochester, N. Y. Available in both portable and side-entering models, the new mixer features a design incorporating two concentric mixing shafts carrying propellers, the central high-speed shaft using a smaller and the outer low-speed shaft using a larger propeller rotating in the opposite direction. This double motion is secured through a planetary reducer, the smaller propeller being driven direct and the larger through the ring gear. The effect of the mixing is described as follows: The smaller propeller directs a rapid stream of material through the mix against the bottom or sides of the tank. As this stream circulates back through the mix, it is intercepted by a larger, slower stream rotating in the opposite direction and propelled by the larger propeller. These two currents

moving at different speeds in opposite directions are claimed to produce an unusually thorough mixing action.

Multi-Processing Unit

ONE OF THE latest types of processing unit developed by the Abbe Engineering Co., 50 Church St., New York, N. Y., is a design intended to combine two or more operations in one. For example, operations of milling and dispersing may be followed by vacuum deairing, drying, crystallizing, gas absorption, physical or chemical reactions, etc. The machine is a cylindrical container of any desired metal, in which is an Abbe-Lenart agitating and dispersing mechanism, consisting of a ribbed mixing disk, a stator ring and a stationary baffled and slotted inner cylinder. The rotating disk forces material through the aperture between it and the ring, then upward through the charge and into the vortex of the inner cylinder through slots and over the top. An independent top motor-driven scraper, as shown, is available for thick materials. A heating or cooling jacket and a heavy domed cover also are obtainable for the operations following mixing and dispersion. Available sizes range from 1½ to 330 gal.

Multi-purpose processing unit



Man-Cooling Fan

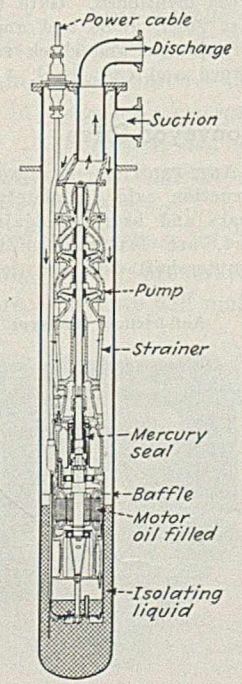
DIAMETERS from 12 to 36 in. are available in a line of portable man-cooling fans announced by the Truflo Fan Co., 515 Main St., Harmony, Pa. The fan illustrated is one of 36 in. diameter, which is 48 in. high to the centerline of the fan wheel. It has a 32 in. diameter base and a 3 hp., 1,150-r.p.m. motor. The four-blade fan is of solid cast aluminum.

Stuffingboxless pump

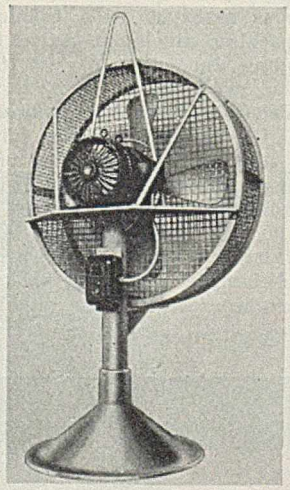
THROUGH a slight change in the design of the submersible-motor deep-well pump introduced by the Byron Jackson Co., 2150 East Slauson Ave., Los Angeles, Calif., which was described on page 502 of our September, 1938 issue, the manufacturer now has available a new design of stuffingboxless pump for other than deep-well applications. This is a pump of the deep-well turbine type in which the motor is placed below the pump. Instead of a stuffing box, a mercury seal is used to isolate the interior of the motor from the liquid being pumped. In the new modified design, the pump, instead of being placed at the bottom of a long well pipe, is inclosed in a casing just long enough to accommodate pump and motor. A suction nozzle connects with the casing at the top, and a discharge nozzle with the topmost stage of the pump. For connection with the bottom outlet of a tank installed on the ground, the pump must, of course, be supported in a pit. For protecting the motor shell, an isolating liquid immiscible with the liquid being pumped and heavier than it is placed in the bottom of the casing.

The new pump is stated to be particularly suitable to the handling of highly volatile liquids such as petroleum products, butane and propane, at temperatures up to 150 deg. F. It is intended particularly for use in isolated or hazardous locations and is available for almost any head and capacity from 15 g.p.m. upward, for motor sizes from 3 to 350 hp. Stuffing box and packing are eliminated and a positive liquid level on the suction is not required. Lack of pulsation, no need for attendance, and high overall efficiencies are claimed.

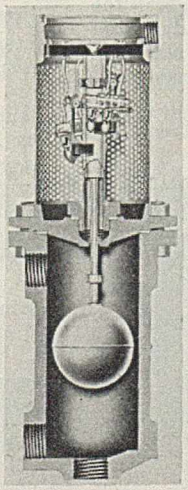
Stuffingboxless pump



Man-cooling pedestal fan



Level controller



Electric Level Control

SIMPLICITY of construction is featured in the new Schaub Magnetrol, a liquid level control recently designed by Fred H. Schaub Engineering Co., 325 West Huron St., Chicago, Ill. As appears from the accompanying cross sectional view, the control consists of a float chamber and a float, the latter operating one or two mercury switches through a magnetic linkage. Thus the float chamber is permanently sealed and has no mechanical connection with the switching mechanism.

The switching action is obtained through the rise and fall of a piston attached to the float rod, and moving up and down in an inclosing tube. As the piston reaches a predetermined level, it comes into a magnetic field produced by a permanent magnet located outside the inclosing tube. The magnet is then drawn toward the piston, causing a mercury-to-mercury switch to tilt. Two models are available, one with single and one with double switching action. Through the elimination of bellows, stuffing boxes, packing and rotary shafts, the device is said to avoid binding or sticking and to be unaffected by temperature or operating pressure.

New Products

RECENTLY ANNOUNCED by the R. & H. Chemicals Dept. of E. I. duPont de Nemours & Co., Inc., Niagara Falls, N. Y., several different grades of polyvinyl alcohol, designated as PVA, are now commercially available. These materials are distinguished by solubility in water, great film forming strength, adhesive properties, and thermal stability. Films, coatings and molded articles made from these products are stated to be tough, flexible and elastic, as well as notably resistant to oils, greases, fats, hydrocarbons and most organic solvents. Polyvinyl alcohols are white to creamy-white powders which can be heated indefinitely in air to 140 deg. without decomposition, but darken slightly at about 160 deg. after prolonged heating. If desired, films and coatings made from these materials may be made substantially water resistant by various methods, including heat treatment, and treatment with a variety of chemicals. Among the uses already investigated are paper coatings, manufacture of adhesives, and protection of metal sur-

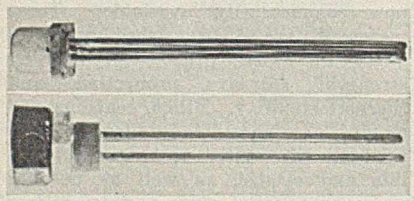
faces during manufacture. PVA tubing is being used for resistance to paint and petroleum products. The materials find application also in leather treatment, agricultural sprays, cosmetics and protective gloves.

UREA RESINS for laminating purposes and for bonding of plywood and veneers have been announced by the Synvar Corp., Wilmington, Del. Such resins are not intended for exposure to weather and moisture, which requires phenol bonding resins now available. The new resins are suited for both hot and cold press use.

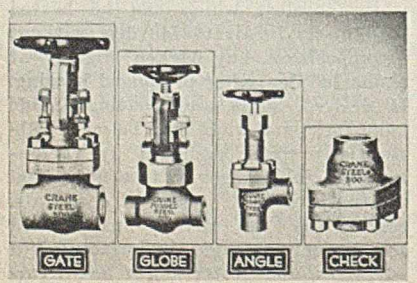
AFTER EXTENSIVE RESEARCH, the Allis-Chalmers Mfg. Co., Milwaukee, Wis., has announced Silimite, a special form of activated lime containing magnesia, which is stated to be highly effective in removing silica in hot-process water softeners. The calcium content of the lime is utilized in softening, while the other constituents are claimed to be effective in silica removal. The product is slaked in accordance with a definite procedure and together with soda ash is introduced into the softener which is then operated in a normal manner. The reduction in silica thus achieved is said to be of particular value in high pressure steam plants in the avoiding of silica deposits in boilers and the prevention of silica carry-over to turbines.

MANY USES are claimed for a new series of photo-hardening coatings containing colloidal graphite which has recently been developed and patented by Acheson Colloids Corp., Port Huron, Mich. These coatings are said to be highly adherent to virtually all materials, electrically conductive and to possess excellent dry-lubricating properties. The coatings are suggested for producing electrical resistance elements and conductive coatings from non-conductors; for boiler dressings to counteract corrosion; for protection of nickel against mercury vapor; for protection of readily oxidizable alloys; for lubricating coatings; for impregnating gaskets to prevent adhesion. Coatings may be applied by dipping, spraying or brushing, and harden under exposure to light, either artificial or natural. Basically the coatings consist of colloidal graphite, small amounts of an organic colloid such as glue or gelatine, and a hardening agent such as potassium bichromate suspended in water. Other materials are added for specific purposes.

Flanged and screw immersion heaters



New small steel valves



Immersion Heaters

SEVERAL new immersion heaters have recently been announced by the Westinghouse Electric & Mfg. Co., Mansfield, Ohio. One is a flange head oil immersion heater designed particularly for high pressure systems. The non-circulating type has a rating of 1 to 3 kw. for 115 or 230 volts and the circulating type is rated at from 5 to 8 kw. for 230 volts. A screwed-in type with terminal box for heating mineral oils, paraffine and alkaline cleaning solutions is available in similar ratings. A new Corox heater made in 5 and 10 in. immersion sizes is rated at 2 and 4 kw. at 115 or 230 volts.

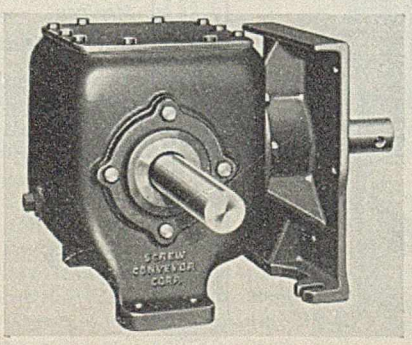
Small Steel Valves

SIZES from ¼ to 2 in. inclusive are available in a new line of steel valves for steam and oil services, made in gate, globe, angle, and check designs, and offered by the Crane Co., Chicago, Ill. Inside-screw, outside-screw-and-yoke construction, union and bolted bonnets with screwed, socket weld and flanged ends are all produced, making available a total of 76 valves of the types mentioned. Gate valves are of cast steel, globe and angle valves of forged steel and check valves of both forged and cast steel.

Conveyor Drive

ANTI-FRICTION BEARINGS and construction said completely to seal the gears and bearings against dust and dirt, are featured in the new Ace countershaft box end for screw conveyors which was recently announced by the Screw Conveyor Corp., Hammond, Ind. Shown in the accompanying illustration, this box end is available for wood or steel boxes from 6 to 18 in. sizes, with miter or 2 to 1 ratio bevel gears. Timken roller bearings are used to carry both thrust and radial loads. The box end is stated to be interchangeable with all old types.

Anti-friction conveyor box end



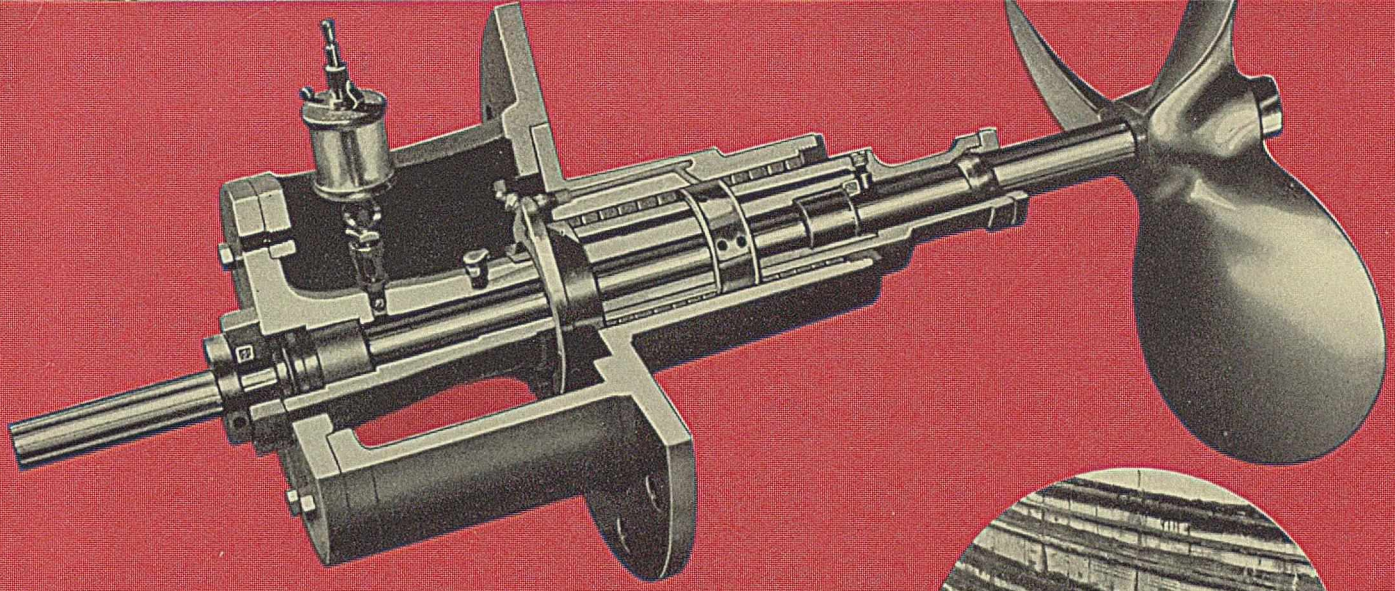
Equipment Briefs

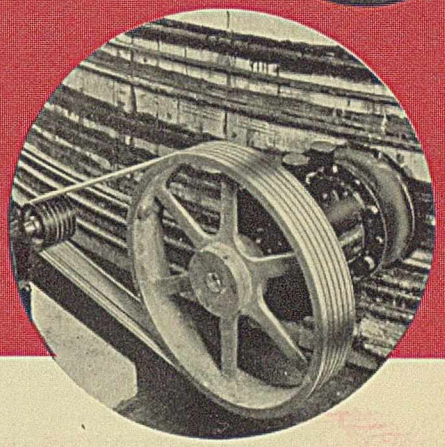
AN INTERESTING METHOD of protecting workmen engaged in paint spraying operations is available in a new hood offered by the Jackson Electrode Holder Co., Detroit, Mich. This hood, which covers the head and shoulders, is of black rubberized fabric with a special supporting gear. An opening before the operator's eyes provides unobstructed vision and an air supply from the plant airline issuing through vents over the operator's eyes, creates a draft outward from the hood, sweeping fumes, spray and dust away from the eye opening.

A SIMPLE DEVICE for controlling the stopping of motors, known as a plugging switch, has recently been announced by the General Electric Co., Schenectady, N. Y. The new switch employs an Alnico magnet as its fundamental part, eliminating frictional parts and clutches. The device is designed to reverse the power connections so as to bring the motor to rest quickly, but to remove the plugging power at the correct moment to prevent re-acceleration in the reverse direction. A driven Alnico rotor produces a rotating magnetic field which induces eddy currents in the walls of an aluminum cup. The reaction caused by these currents turns the cup through a limited rotation against spring pressure, thus engaging the plugging contacts. The amount of rotation is proportional to the speed and as the speed decreases a point is reached at which the spring force overcomes the magnetic force, thus tripping the device and disconnecting the power.

WHAT IS DESCRIBED as a balanced-action packless diaphragm valve has recently been announced in sizes from ¼ to 1⅛ in., depending on style, by the Henry Valve Co., 1019 North Spaulding Ave., Chicago, Ill. The new valves have no stem packing, operating pressure being applied through a flexible diaphragm. Ordinarily, in valves incorporating this construction, the valve disk is raised by spring pressure when the handwheel is backed off, and is claimed to be capable of sticking shut

(*Please turn to page 519*)





A new and unusual principle of stuffing box design features the A.O.C.-50. A hollow cylinder open at one end is permanently attached to the shaft with the open end pointing towards the outside of the tank. The outer surface of this cylinder operates in a stuffing box. Extending into the hollow cylinder from outside the tank is a suitable bearing member. Thus, the stuffing box and forward bearing occupy the same linear dimension, yet are mechanically separated. Shaft centration cannot be affected by condition of stuffing box. Packing lasts longer. Sizes ½ to 25 H. P. require Vee-Belt or silent chain drive. All machinable materials.

IF YOU MIX CORROSIVE LIQUIDS OR IF YOUR TANK IS NEVER EMPTY...

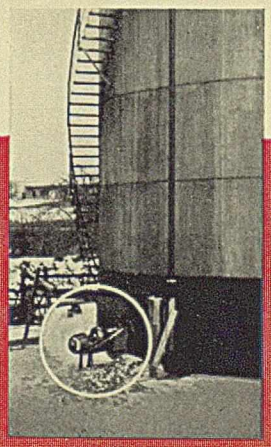
Here's the mixer you need

Mixing acids is a tough test of equipment for, heretofore, acids have always found their way through the stuffing box into the bearings, necessitating frequent replacements. To meet this condition, our engineers developed the "LIGHTNIN" A.O.C.-50 which has been proven in many installations.

The secret of its effectiveness lies in the patented "folded back" stuffing box which prevents tank contents, no matter how acid, from getting at bearings to damage them in any way. As a result, *the A.O.C.-50 outlasts any other type mixer on corrosive work.* Shafts and propellers are, of course, of any acid resisting material you specify.

Due to the folded-back feature, this stuffing box is easily repacked from outside the tank. This makes it the ideal unit for use in cases where your *tank is never empty, except in emergencies or if the product is hazardous to life or explosive, etc., or if for any other reason, you cannot consider going into the tank or removing the mixer for periodical repacking.*

Because of the variety of materials specified, these mixers are not carried in stock. Advise us of your conditions and we will make recommendation.



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WHAT SIZE DO YOU NEED?

In our sense are "LIGHTNIN" Mixers. "small tank" mixers "LIGHTNIN" Mixers are in successful operation for light fluids on tanks larger than any used in standard chemical processes. Consult us regarding your processes. If we can help you, we will make recommendations. If we cannot, you will be advised at once.

MIXING EQUIPMENT CO., INC.
1028 Garson Avenue, Rochester, N. Y.

Please send me the literature checked below:

B-60 — Side Entering Units B-65 — Top Entering Units
B-62 — Portable Mixers B-67 — Laboratory Mixers
Mi-11 — Work Sheet

Name Title

Company

SYNTHETIC AMYL ALCOHOL AND ACETATE

JUST OUTSIDE of Wyandotte, Mich., is the only plant in the world producing synthetic amyl alcohol and from it the acetate. Here the Sharples Solvents Corp. produces 10,000,000 lb. of these products annually.

The process consists of three major steps: (1) The chlorination of pentane to produce amyl chlorides; (2) the hydrolysis of amyl chlorides to form amyl alcohols; (3) the acetylation of amyl alcohols to produce amyl acetate.

One ton per hour of chlorine gas is fed continuously into a two mile per minute stream of hot pentane vapor through an especially designed throat, and the mixture is passed through a fire-still to complete the reaction, then chilled and fractionated to separate various components. The hydrolysis of the amyl chloride to the alcohol is effected with the aid of oleic acid as a catalyst. A departure from the conventional design of equipment was adopted since intimate contact of the reacting materials could be readily effected without violent agitation and, when once established, separation was slow. Accordingly, digesters were built in the form of towers and agitation provided by circulating pump having a large liquid handling capacity.

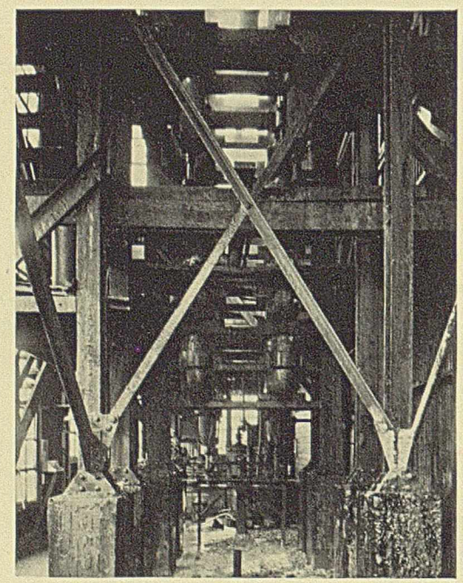
The equipment employed in the acetylation unit is standard in design and consists simply of a copper kettle and fractioning column with auxiliary field tanks for alcohol and acetic acid. This acetylation has also been made into a continuous operation. Sulphuric acid is the catalyst. The reaction is strictly reversible and, to force it to proceed in the desired direction, the water formed is removed.

Rectification of the crude ester is a batch process. A steel kettle with a copper column is used. Fractionation is carried out at a slow rate until the heads, chiefly amyl alcohol, are removed and then the rate of takeoff is increased. Heads are returned to the acetylation.

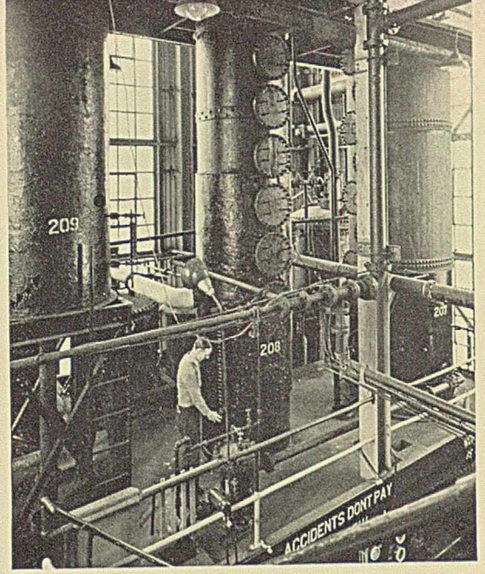
The accompanying photographs show the essential equipment in the plant of the Sharples Solvents Corp.

CHEMICAL & METALLURGICAL ENGINEERING
JULY, 1940 • Pages 493–496

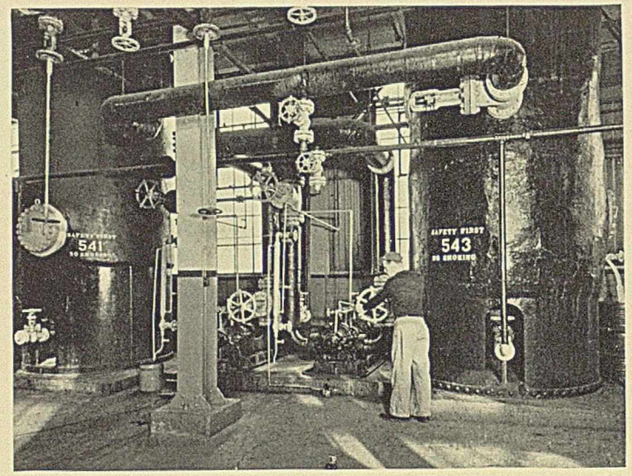
1. Lower floor of the chlorination unit showing twin pentane charging and reflux pumps



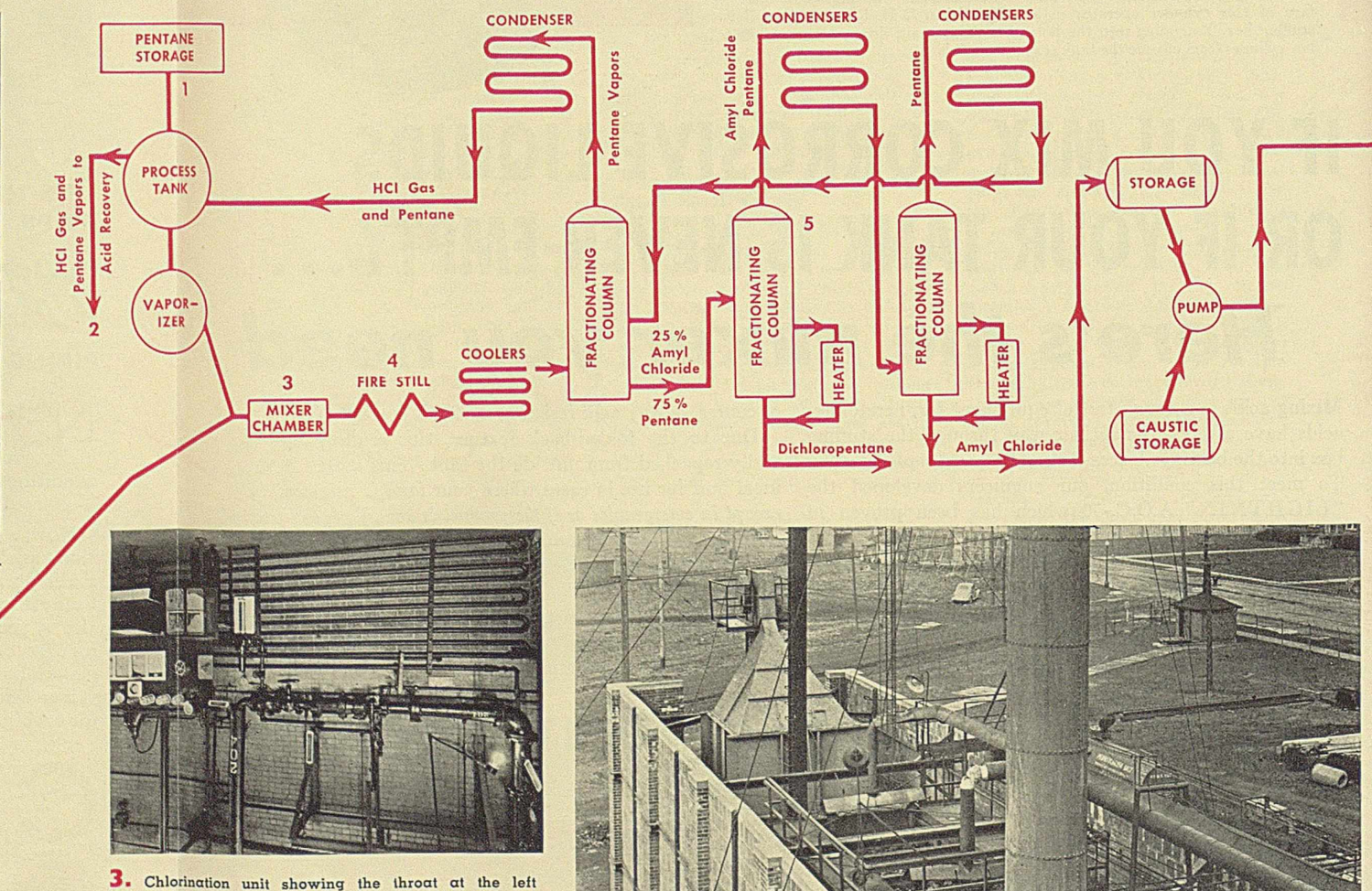
2. Looking up through the tourills in the acid recovery plant



5. Fractionating columns in the chlorination unit where unreacted pentane is separated from amyl chloride and amylene dichloride is also removed

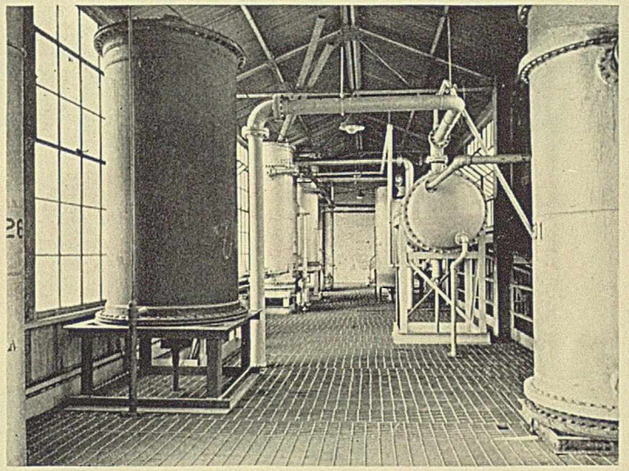


6. Close-up of digesters where the amyl chloride is converted to amyl alcohol. Pumps for circulating the digester mass are shown between the digesters

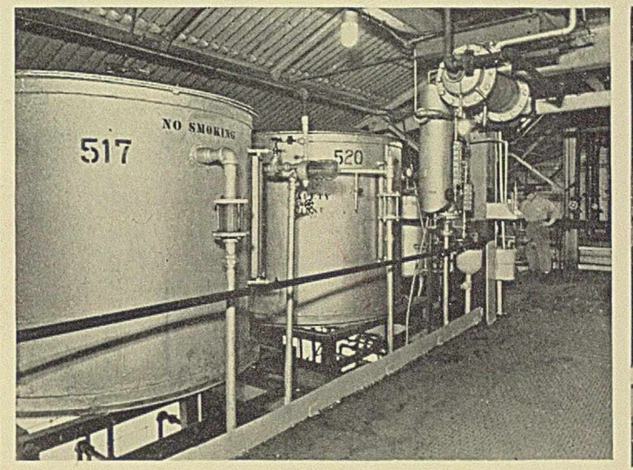


3. Chlorination unit showing the throat at the left where the pentane and chlorine are mixed before passing to the fire-still; meter for measuring chlorine flow; and, on the right, the panel board with control gages

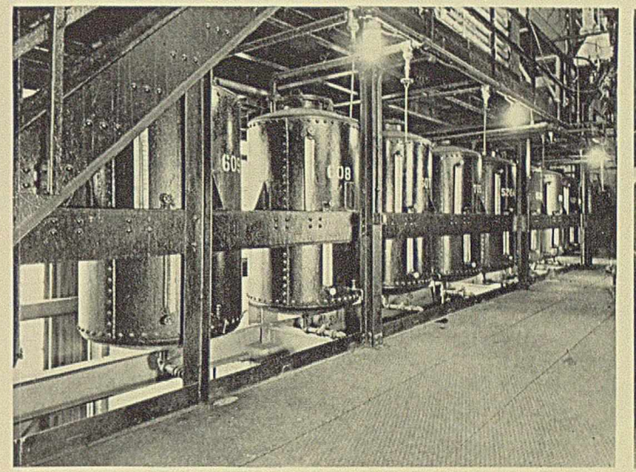
4. Fire-still, showing vapor lines to harps. Notice high brick wall to decrease possibilities of backfiring from coal fire if a leak develops in adjacent operating units



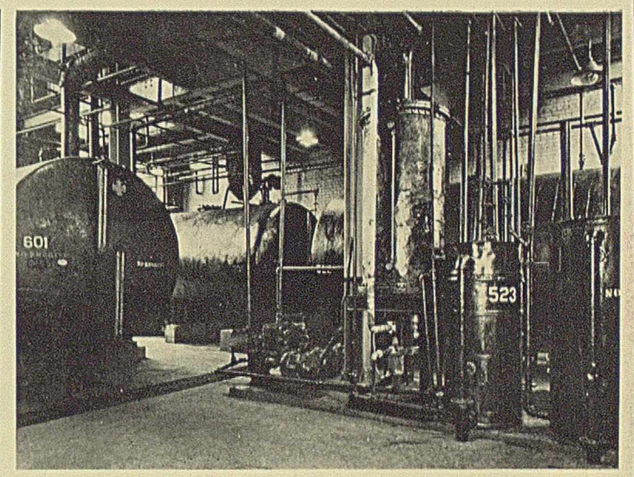
7. Condensers in connection with the amyl alcohol unit. These are situated on the top floor of the process building



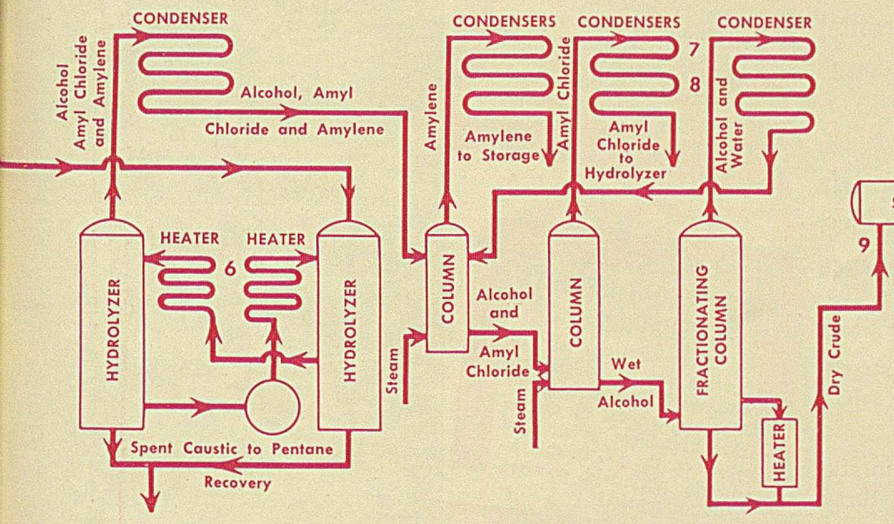
8. Mezzanine floor in the alcohol unit showing decanter for separating the alcohol-water-amyl chloride mixtures

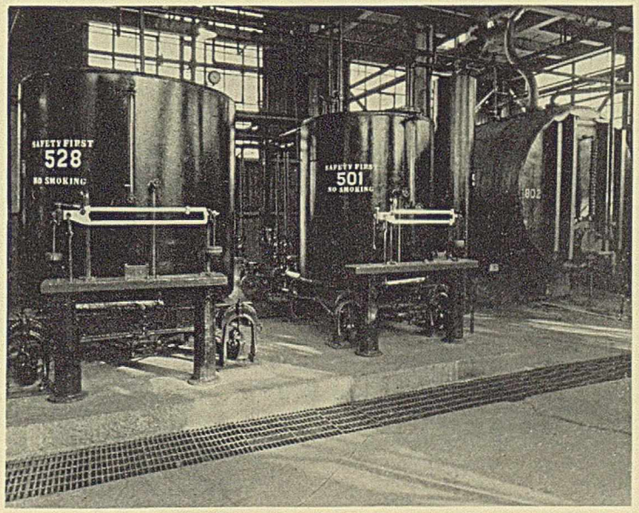


9. Bank of receivers where crude alcohol from the decanter is collected prior to passing on to storage tanks

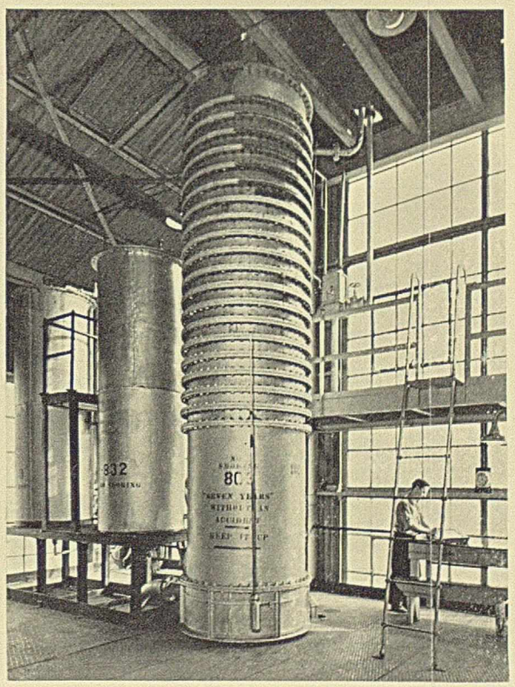


10. On the left is shown the alcohol still where the crude alcohol is fractionated to the desired distillation range

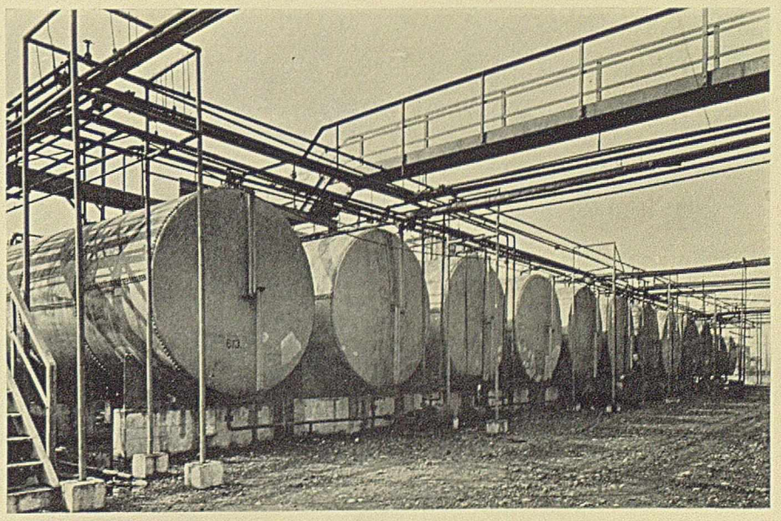




11. Feed tanks for measuring the charge to the digesters; charging pumps in the background. To the extreme right is the acetylation kettle



12. General view of the acetylation column and charging tanks. Gage on front of column indicates column level



13. One section of the battery of storage tanks used for the storing of amyl chloride, crude and finished amyl alcohols, and amyl acetate

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THREE ANSWERS!

1 **Are You Using Motors that Give Your Machines Best All-Around Performance?**

2 **Are You Protecting Your Production Schedules (and Your Profits) from the Danger of Shutdowns Due to Motor Failures?**

3 **Are You Getting the Long Life and Low Upkeep Expense that Allis-Chalmers Lo-Maintenance Motors Offer You?**

AS A MOTOR USER, do you ask yourself these three vital questions when you select motors for your machines?

If you do, you'll be interested in the case histories shown here . . . three answers to these questions . . . three out of the thousands of users that have acclaimed Allis-Chalmers Lo-Maintenance Motors for their outstanding performance, low maintenance, and long life!

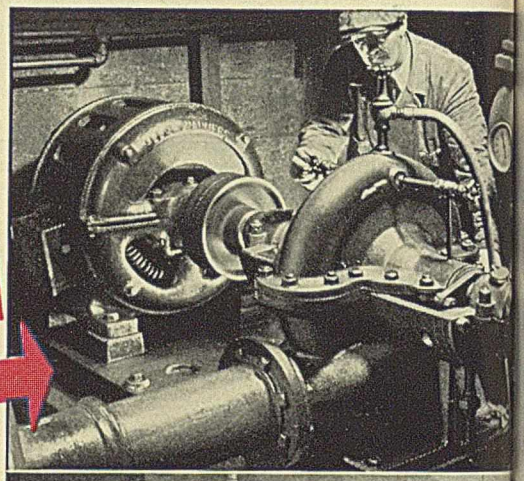
For, in each Lo-Maintenance Motor, you get more than a motor that delivers just a certain rated horsepower. High carbon steel frame . . . indestructible rotor . . . distortionless stator . . . no skimping on materials — these are extra-value features that give you full-measure performance.

To get complete details, see the trained power engineer in the district office near you . . . or write Allis-Chalmers, Milwaukee . . . today!

A 1257

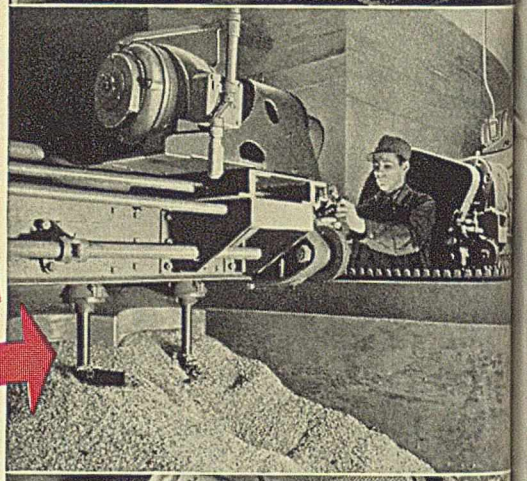
20 YEARS AT HARD LABOR!

Twenty years on the job . . . 24 hours a day . . . in a spot exposed to heat and moisture . . . with not one cent spent for repairs—that's the day-in and day-out history of this Lo-Maintenance Motor operating in a midwestern brewery.



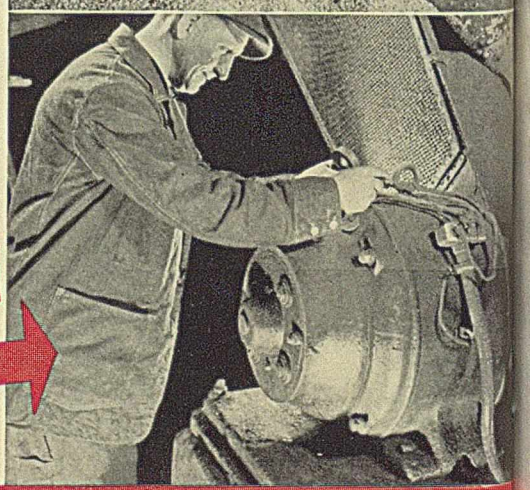
NO TIME-OUTS FOR REPAIRS!

Operating continuously 24 hours a day . . . this Allis-Chalmers Lo-Maintenance Motor is typical of the 86 that have been seven hard years on the job in this industrial plant with no time-outs for repairs!



25 MOTORS . . . 36 YEARS EACH!

Fighting some of the worst operating conditions any motors could meet—that's what 25 Lo-Maintenance Motors, one of them pictured here, had to do for 36 years in a gas house . . . without running up costly repair bills!



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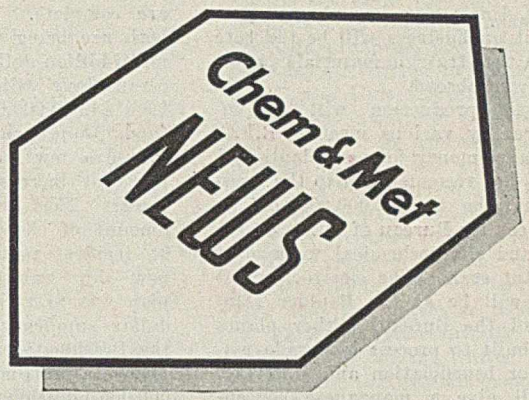
ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

DEFENSE planners are as thick about Washington as grasshoppers in a Kansas grain field. And some of them are almost as much nuisance to the official workers. It is recognized, however, that the intentions are good of most of those who rush to Washington to offer their assistance. Relatively few come with profiteering motive. But many are disappointed that the machinery must necessarily move slowly. Definite answers to the question "How can we help?" are not promptly forthcoming. This is a natural, almost inevitable, consequence of the magnitude of the job which is being undertaken.

Elsewhere in this issue is described the chemical unit of the Defense Commission. That unit has established splendid liaison with chemical industry through renewal of committee action by those who have previously been advising the Assistant Secretary of War's office. Most of the further surveys of chemical need and available chemical supply will be arranged through that medium.



News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

Government Contracts

Several new methods of making government contracts for purchases have been devised. Most of the buying will be done by the Procurement Division of the Treasury Department, under the direction of Donald Nelson (see *Chem. and Met.*, June 1940, page 432). Thus coordination of Army, Navy, and special defense buying is assured.

Negotiation of contracts is now legal. But competitive bids will still be taken where goods can be manufactured in ample quantity by several concerns. Only where serious bottlenecks in supply develop is it expected that negotiated contracts will be necessary. Thus, the Treasury is protected against paying needlessly high prices, but still can do business promptly when shortage threatens.

Contracts are being negotiated also for building of plants for the government account. A flat construction fee will be paid to the builder who will be expected to provide designs and supervise construction with the expectation of operating the plant for the government when it is completed. The operating contracts will also be on a fixed fee basis. All this, the government hopes, will avoid the evils of the old fashioned "cost plus" contracts. "It will make speed and efficiency as much of interest to the contractor as to the government."

Almost unlimited sums are also available for loans to companies needing new capital for the efficient carrying out of government contracts. RFC will be the loaning agency, following its customary technic, but having somewhat greater freedom as to when and how much may be loaned. Repayment of the government money by delivery of goods which the government wants is one of the most advantageous plans being worked out during early July. That plan will permit a company to repay the government with the product of its plant at a credit price agreed upon in advance. Thus the many complicated questions of capital charges, obsolescence, and other features that plague during income tax calculations may be largely eliminated.

One issue still in controversy between the tax units and the defense planners relates to matters of "profit." The Treasury wishes to keep capital charge allowances low and to enforce the limits as to percentages of profit permitted on Army and Navy contracts. Military planners dissent whenever this group of rulings gets in the way of prompt action. They are anxious to keep the cost of goods to the government as low as possible, but they are still more anxious to have the goods made available promptly as needed. Further cutting of tax red tape on these points must be accomplished before fully satisfactory basis for negotiations can be set up.

New Taxes

The tax bill which became effective on the signature of the President on June 25 is only a beginning of the new burdens to be imposed on industry. By that bill the income levies on corporation profits were increased by about one-sixth. This was made up of the increase in the basic rate by one per cent and the super tax of ten per cent. Engineers and executives must note particularly that this increased rate applies to 1940 incomes. Incidentally, the increased levies on individual incomes also apply to this year's earnings.

Senator Harrison says that the next tax bill will also apply to 1940 incomes; and it is likely to increase taxes on business by an even larger amount than this first defense tax measure. The effect on this year's cost must be figured by every process industry executive as significant, and large, though still of indeterminate size.

Among the first items to have Congressional study will be a set of excess profit taxes. Those, it is planned, will curtail earnings of industry either by taking away any amount earned above recent years' net income, or by taking away all of the earnings greater than some named percentage on the invested capital. It may take nearly a year to work out full details of this sort. If it does, some portion of this excess earnings levy will probably not apply until the income of next year. But even now there is talk about making that kind of tax also retroactive to 1940 income.

Increased excise taxes have been imposed on corporate securities and on those engaged in brewing, rectifying, and other related activities; and on numerous commodities that are made by process industry including rubber tires and tubes, toilet preparations, matches, gasoline, lubricating oil, and other petroleum products, and most of the alcoholic beverages.

Strategics Buying

Much of the materials buying of the strategic-commodity type will be arranged through two subsidiary corporations formed during the first few days of July. One of these is to be the Rubber Reserve Co. with immediately available funds of $65,000,000. It will serve for the government and in cooperation with industry in the stocking of rubber for both public and private control. The second such company is the Metals Reserve Co. It will

Chem & Met Pictured Flow Sheet

have initially a fund of $100,000,000 of which there was tentatively committed at the outset $75,000,000 for tin alone. If either of these companies runs out of funds, Uncle Sam has plenty more. The limit on business will be the rate at which the strategic materials can be bought from abroad.

Domestic production will be encouraged by various means. R.F.C. will advance money for new plants and Congress has recommended to the President that he use $2,000,000 of his blank check for Bureau of Mines beneficiation and electrochemical work on a pilot plant scale. The electrochemical activity will be at the Boulder Dam station of the Bureau. Other plants may be built to process low-grade materials for beneficiation and sintering. This will give a manganese concentrate suitable as a substitute for imported high-grade ores. The President, of course, already had authority to allocate this or any larger or smaller sum; thus the recommendation of Congress was merely a political spotlighting of Congressman Scrugham's desire to have manganese exploited in Nevada.

It is well known that with the emergency price levels for manganese it is possible for several present responsible firms to commercialize their research and development work. It may well be that several going plants will be so established using well known large reserves of low grade manganese. The product will, of course, be primarily for the stock pile; but more important in the thinking of the Defense Commission is the fact that contracts for this work will encourage the establishment of real plants that could be utilized on greatly increased scale in the event of actual military need without any dependence on imported ore.

Chemical Plant Needs

Exact sums required for chemical, explosive, and related plants planned by the defense organization cannot yet be identified. However, there is available an excellent outline of the Army wishes in this regard. This was presented by Colonel James H. Burns, executive officer in the Assistant Secretary of War's office, when discussing this matter before the appropriations committees of Congress. The accompanying tabulation shows some of the major items most specifically programmed thus far.

Funds for all these contracts have not yet been appropriated, but there will be plenty of money to do anything necessary as soon as negotiations are complete. The Army and Navy both are being talked of in terms of multi-billion dollar projects. The two-ocean Navy will, of course, require at least $4,000,000,000 in addition to the funds appropriated in the normal course a few months ago when a 11 per cent increase was voted by Congress. That means a tremendous amount of chemical raw material as an incident to the prosecution of the new ship program. The new Army plan was first thought of as a billion dollar supplement, but early in July the President sent to Congress a supplemental outline that was for $4,000,000,000 additional.

From these stupendous figures it is evident that chemical process industry is to be confronted with military supply responsibilities far beyond anything previously discussed. The total program will require 2, 3, or 4 years for completion, but the immediate spending will certainly be of the order of two or three billion dollars per year, *in addition to* the plans that were made in regular appropriation bills.

The Chemical Warfare Service, long the orphan unit of the Army, is getting new nourishment rapidly. In the defense appropriations approved before July 1 there were more than $27,500,000 specifically provided to that Service. This provides "for purchase and manufacture, testing of chemical warfare gases and other toxic substances, gas masks or other offensive or defensive materials or appliances; for investigation, research, design, experimentation and operation; purchase of chemicals including apparatus and instruments," etc.

Defense Research Plans

To stimulate and coordinate physical, chemical, and engineering research in the interest of defense, the President named during mid-June a new National Defense Research Committee. This is under the chairmanship of Dr. Vannevar Bush, president of the Carnegie Institute of Washington, with Dr. R. C. Tolman as vice chairman. Other members are Dr. Frank B. Jewett of Bell Laboratories and president of the National Academy of Sciences; Dr. James B. Conant, president of Harvard University; Dr. Karl T. Compton, president of Mass. Inst. Tech.; and Commissioner of Patents Conway P. Coe. Also to serve on the board will be an official representative of the Army and one from the Navy.

The functions of this group will include liaison between Army, Navy, and government civilian research needs and facilities; the promotion of research outside the government to support the defense program; and the exercise of those functions which under the law most people assumed would be carried out by the National Academy of Sciences and National Research Council.

Apparently the Bureau of Standards will be the lead dog of the government team about to be hitched up. But some of the other government bureaus may be tied to other specific units of the defense program. For example, the Bureau of Mines and the U. S. Geological Survey are working closely with the strategic minerals unit of the National Defense Commission. And the Bureau of Agricultural Chemistry and Engineering, with its Regional Laboratories, seems likely to tie up with Mr. Chester Davis, a member of that Commission who is charged with the planning and protection of agriculture.

News Miscellany

Tennessee Valley Authority would like to build a brand new government-owned nitrogen fixation plant at Muscle Shoals. The old one partially transformed into a phosphoric acid plant is supposed by law to be in stand-by condition; but the executives of TVA "do not choose to run" it if they can help it. The Defense Commission will have an embarrassing decision to make when it decides whether the government is to be put further into the fertilizer business by building a new nitrogen plant as a part of the Valley project.

The President's announcement of a Western Hemisphere trade cartel was premature. It apparently was intended to boost British moral. Very few departmental executives affected knew of the President's plan until it was announced. Thus much scurrying about to support it has been necessary during late June and early July. Lack of knowledge as to how far the United States can go with the cooperation of Argentina, Chile, and Mexico (to name only three of the most delicate relations) is as big an obstacle to further planning as are the economic forces. No one has yet worked out how America can set up a workable plan with other nations having the same exportable surpluses as we do. The plan is full of political dynamite, especially in the mid-West where agricultural surpluses are always an "issue."

All alcohol and alcoholic beverage questions are now to be handled in the Alcohol Tax Unit of the Bureau of Internal Revenue. A reorganization plan which went into effect at the end of the fiscal year (June 30) has put the old Federal Alcohol Administration into this tax group.

Bureau of Mines Helium production and investigation for Army and Navy..... $40,000

Proposed Program if and when Funds are Available

Ordnance Department

No. of Plants	Type of Plants	Cost of Equipt. & Mach. Tools	Total Cost
4	Smokeless Powder	$128,000,000	$188,000,000
4	TNT	30,000,000	42,000,000
2	Tetryl	4,000,000	6,000,000
2	Picric acid and Explosive D..	6,000,000	8,000,000
2	Cotton purification	4,000,000	6,000,000
2	Ammonium Nitrate	14,000,000	18,000,000
1	Ammonia	9,000,000	15,000,000
Chemical Warfare Service			
1	Existing Arsenal	.....	4,000,000
1	New Arsenal	.....	26,500,000
26	Commercial plants	.....	9,000,000
Total Chemical Warfare Service Plants			$39,500,000

WAGE-HOUR INTERPRETATIONS AND EXEMPTIONS

The Wage-Hour Administration has interpreted the 26-week contract provision in the Fair Labor Standards Act to mean that employes may not work more than 1000 hours in any consecutive 26-week period.

Employers may operate under one or two contracts annually by this interpretation, but the 1000-hour limitation must be observed over all intermediate periods of 26 weeks, as well as for the two specific periods of the contracts; i.e., the first week of the second contract period plus the last 25 weeks of the first must not exceed 1000 hours worked.

Where only one 26-week contract is in operation, employers will be required to meet the weekly 42-hour (40 hours beginning next fall) limits for other periods of the year.

Contracts under this section, in the W-HA interpretation, can be made only with unions certified by National Labor Relations Board specifically for this purpose, in addition to certification for collective bargaining.

Additional exemptions from hourly provisions of the Act may soon be granted to concerns handling, packing, storing, preparing and canning fresh fruits and vegetables as seasonal industries.

Hearings on a broad inquiry into industry complaints of present restrictions were completed early this month before Merle D. Vincent, director of the W-HA hearings branch. Mr. Vincent would not estimate when his recommendations would be ready for Administrator Philip B. Fleming's study, nor hint what he would propose.

In addition to present 14-week exemptions held by packers and canners under the act, these industries asked to be classified as seasonal industries to permit additional hour exemptions. Samuel Syme, representing the Dried Fruit Association of California, also appeared to point out that while dried fruits represent 50 per cent of the citrus crop, his industry at present has no exemptions.

Among cannery groups appearing at the last hearing July 1 were the New Jersey and Minnesota Canners' Associations. Opposition to further modification of the act came only from the United Cannery, Agriculture, Packing and Allied Workers of America, affiliated with the C.I.O.

STRATEGIC MATERIALS PLACED UNDER EXPORT LICENSE

The President's proclamation listing 11 chemicals, with other basic materials and their products, and munitions, as requiring licenses for export from the United States after July 5 is the final step in conservation of strategics before actual embargo.

From a practical standpoint, the actual listing of some of the articles for license is expected to serve as a virtual embargo on exports, particularly in view of President Roosevelt's frequently repeated comments imposing "moral" restraints upon exporters of tin, rubber, manganese, chrome ore etc.

Where repeated export licensing is requested for articles officials consider may be needed here, formal embargo probably will follow.

Chemicals made subject to licenses for export by the July 2 proclamation are: Ammonia and ammonium compounds, chlorine, dimethylaniline, diphenylamine, nitric acid, nitrates, nitrocellulose having a nitrogen content of less than 12 per cent, soda lime, sodium acetate, anhydrous, strontium chemicals, and sulphuric acid, fuming.

In addition, the proclamation listed these basic materials and all products containing them: aluminum, antimony, asbestos, chromium, cotton linters, flax, graphite, hides, industrial diamonds, manganese, magnesium, manila fiber, mercury, mica, molybdenum, optical glass, platinum group metals, quartz crystals, quinine, rubber, silk, tin, toluol, tungsten, vanadium and wool.

Also made subject to export licenses are arms, ammunition and implements of war as defined in the proclamation of May 1, 1937; aircraft parts, equipment and accessories, and armor plate, other than that listed in the May 1, 1937, proclamation, and optically clear plastics and optical elements for fire control instruments, aircraft instruments etc.

Export licenses for designated products will be issued through the Secretary of State acting under specific directions of the Administrator of Export Control. Col. Russell L. Maxwell, U. S. Army, was named administration.

CHICAGO CHEMICAL EXPOSITION MAKES GOOD PROGRESS

Reservations for space at the National Chemical Exposition which will be held in Chicago, Dec. 11-15, have been received in large volume and nearly one-half of the available room already has been engaged by those who will be represented. It is also stated that a majority of the exhibitors fall under the classification of chemical manufacturers or of manufacturers of laboratory apparatus used in chemical research.

The management has requested the cooperation of exhibitors to bring displays which will be calculated to spread information regarding the properties, uses, and special applications of the products on display. Also stressed is the importance of having booth representatives who, by training will be competent to answer questions relating to the technical and economic phases of the products shown.

The exposition is sponsored by the Chicago section of the American Chemical Society. It will be held at the Stevens Hotel and the manager is Marcus W. Hinson with headquarters at 110 North Franklin St.

TARIFF ACT PROTECTS HOLDERS OF PROCESS PATENTS

Congress has plugged the hole made by the courts in the Amtorg Trading Corp. case by limiting importation of products produced, processed or mined by a process covered by claims of unexpired valid United States patents. The legislation, awaiting presidential approval, gives to American holders of process patents the same protection under the Tariff Act of 1930 as holders of product patents. Importation of products processed by methods patented in this country without consent of patent holders will be banned where they have the "effect or tendency . . . to destroy or substantially injure an industry . . . in the United States, or to prevent the establishment of such an industry."

Hit particularly by the legislation is expected to be importation of calcium hypochlorite from the Orient—a product now made by a process which a domestic manufacturer contends infringes upon its patented process.

WATER WORKS ASSOCIATION CHANGES NAME

At a meeting of the executive committee of the Water Works Manufacturers' Association, held on June 28, the new constitution and by-laws presented at the annual meeting of the Association in Kansas City last April were adopted. This was the result of a mail ballot. This action meant the changing of the name to Water and Sewage Works Manufacturers' Association. Four classes of membership also were set up: Class A, comprising those engaged in both water works and sewage activities; Class W, those engaged in water works activities; Class S, those engaged in sewage works activities; and Class B, a limited sectional membership.

The special committee on sewage works activities, composed of W. W. Brush, W. T. Chevalier, J. A. Kienle, and Wm. J. Orchard, chairman, that has been in operation since the fall of 1939 was continued and charged with taking steps to put the changes into operation.

POTASH INSTITUTE APPOINTS NORTHWEST REPRESENTATIVE

The American Potash Institute, Inc., Washington, D. C., has announced the appointment of Errett Deck as its northwest representative. In this capacity, Mr. Deck will supervise the Institute's agricultural educational program in the States of Washington, Oregon, and Idaho. He replaces Clay A. Whybark who resigned to take a position as agronomist with Hunt Bros. Canning Co.

With headquarters in Puyallup, Wash., Mr. Deck will work in close cooperation with experiment station officials, county agents, vocational teachers, canning companies, and the fertilizer trade.

CONTROL OVER OCCUPIED TERRITORIES IMPROVES ECONOMIC POSITION OF THE REICH

From our German correspondent

IT IS impossible to estimate with any degree of accuracy how much industrial capacity has been destroyed and how much is still producing in Nazi-occupied territories. Nor can the long-term economic advantages or disadvantages to the Reich be calculated before there is a definite delimitation of territories.

In Western Polish areas, for instance, resources and communications are being developed in a way that indicates the intended complete permanent Anschluss of this territory if Germany wins the war. Denmark, Norway, the Low Countries, and French-held territories are viewed differently, however, in Berlin. Although their political fate is not yet decided, they are forced to gear their economies for the duration of the conflict to contribute to the Nazi war machine. What will happen after the war if the Nazis win is not clear. It is increasingly apparent nevertheless that if Germany is victorious, Europe can expect a complete economic reorganization according to lines determined in Berlin.

Aside from the obvious military advantage, the occupation of western Europe has brought Germany a decisive immediate economic advantage, even though possession of the territory brings up other problems, such as feeding the most densely-populated regions in Europe and supplying raw materials and markets for their industries. Even assuming that many plants and materials were destroyed or carted away by the defenders, the larger part of industrial capacity and raw materials of these countries is still existent and at the disposal of the Reich.

The facilities of the Grand Duchy of Luxembourg, for example, were turned over practically intact to the invader. Luxembourg in 1937 produced 7.8 million tons of iron ore—equivalent to total Nazi imports from Sweden—and 2.5 million metric tons of steel. Since the Duchy was part of the German customs Union before 1914—Belgian since the World War—many of its blast furnaces were originally designed to utilize Ruhr coke, and its industries to a large extent still complement German Westphalian industries. The reorientation should be swiftly and smoothly accomplished here.

In Belgium the Louvain iron ore deposits as well as a number of first-class iron, steel, and textile factories fell to Germany. Though some key factories were reported destroyed by retreating armies, most of them remained intact. The textile industries, of course, will suffer from being cut off from raw material imports. In 1938 Belgium had to import 556,000 metric tons of fiber and 11,000 tons of yarn, and 11.4 million tons of metals. Since some of the necessary ores will now be forthcoming from German-occupied Lorraine, this shortage should not cause great difficulties.

Belgium has come, in spite of its small area, to be one of the world's leading industrial nations because of its conveniently located deposits of iron, coal, zinc, and lead, and its skilled industrial population, as well as its fortunate situation in relation to overseas trade routes. Belgium's chief industrial products are rayon, glass, pottery, automobiles, iron, steel, explosives, linen, lace, etc.

Belgian Chemical Industry

These industries have required considerable amounts of chemicals, which has led to the development of an important Belgian chemical industry supplying large domestic needs as well as exports. The Belgian fertilizer industry, accounting for 30 per cent of the total chemical industry, produces relatively large quantities of ammonium sulphate, calcium nitrate, ammonium nitrate, potassium nitrate, calcium-carbonate-ammonium nitrate, and ammonium-sulphate nitrate. Basic slag is an important byproduct, while the output of superphosphates has advanced rapidly in recent years. Over 25 factories were producing sulphuric acid in Belgium, and in 1938 they exported 315,000 tons, largely to Germany, France, and the Netherlands. Belgium is also one of the world's principal producers of gelatin and animal glues, of special interest being dry glues produced since 1937 from rabbit skins.

The development of the world famous Solvay soda products led at an early date to the establishment of a large number of secondary industries in Belgium utilizing these products. It is of interest, however, that since Solvay has become an international organization the tendency has been to let the capacity of the older Belgian works at Couillet and Jeneppe remain stationary, and even to import soda products from foreign Solvay works, especially from France. Although Belgium contributed to world chemistry the ammonia-soda process, actual production has been relatively limited because of the lack of native salt.

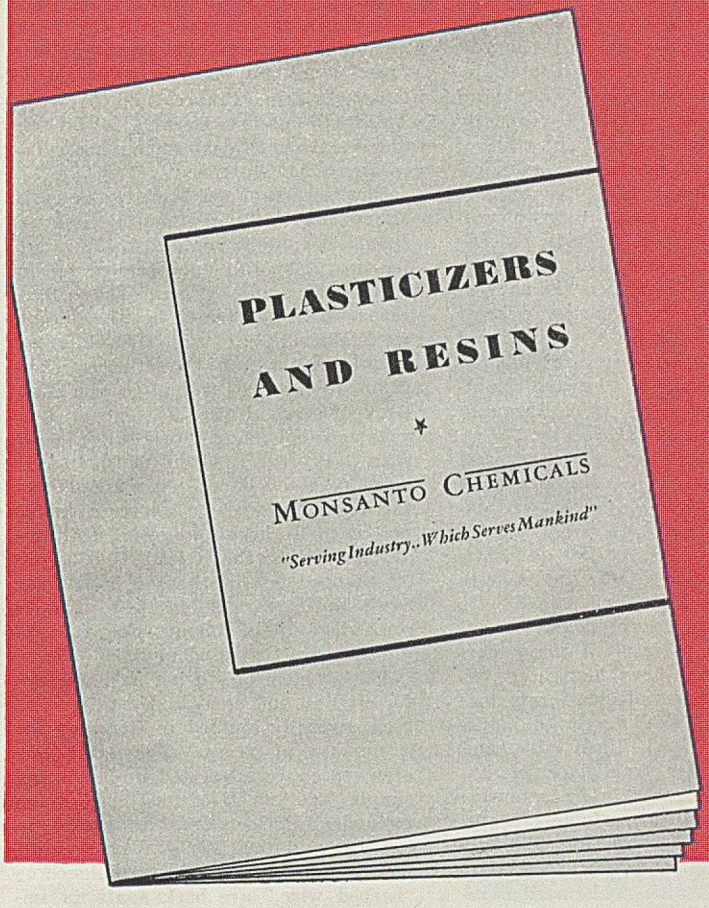
In seizing the Netherlands the Reich acquired large supplies of gold as well as warehouse stocks of rubber, sugar, copra, and tin ore from the Nether-

Byproducts Obtained from Coke-Oven Operations in the United States, 1939[1]

(Exclusive of screenings or breeze)

Product	Production	Sales		
		Quantity	Value	
			Total	Average
Tar.....gal.	554,406,216	344,534,382	$16,585,734	$0.048
Ammonia:				
Sulfate.....lb.	1,160,548,288	1,153,901,833	13,153,642	.011
Ammonia liquor (NH_3 content.....lb.	48,264,021	48,034,809	1,480,879	.031
	.....	.....	$14,634,521	.....
Sulfate equivalent of all forms.....lb.	1,353,604,372	1,346,041,069	.....	.....
Gas:				
Used under boilers, etc.....M cu. ft.	[2] 675,143,201	28,714,866	1,967,142	.069
Used in steel or affiliated plants.....M cu. ft.		237,890,694	24,301,060	.102
Distributed through city mains.....M cu. ft.		144,876,573	42,891,370	.296
Sold for industrial use.....M cu. ft.		22,229,157	2,716,883	.122
		433,711,290	$71,876,455	.166
Light oil and derivatives:				
Crude light oil.....gal.	[3] 170,963,199	9,383,907	727,765	.078
Benzol, crude and refined.....gal.	25,305,714	24,621,650	3,248,548	.132
Motor benzol.....gal.	79,607,150	75,082,362	6,934,550	.092
Toluol, crude and refined.....gal.	19,767,200	20,484,568	3,974,367	.194
Solvent naphtha.....gal.	4,788,836	4,660,311	794,323	.170
Xylol.....gal.	4,089,090	4,393,400	1,018,589	.232
Other light-oil products.....gal.	6,247,201	4,193,125	336,072	.080
	[4] 139,805,191	142,819,323	$17,034,214	.119
Naphthalene, crude and refined.....lb.	48,460,171	46,551,432	727,947	.016
Tar derivatives:				
Creosote oil, distillate as such.....gal.	18,479,962	13,573,393	1,470,608	.108
Creosote oil in coal-tar solution...gal.	975,887	.....	.....	.....
Pitch of tar.....net tons	215,414	2,109	13,905	6.593
Other tar derivatives.....	.....	.....	1,734,810	.....
Phenol.....gal.	99,365	71,080	28,949	.407
Sodium phenolate.....gal.	288,974	286,949	21,936	.076
Other products[5].....	.....	.....	685,355	.....
Value of all byproducts sold.....	.....	.....	[6] 124,814,434	.....

[1] Includes products of tar distillation conducted by coke-oven operators under same corporate name, except, however, phenol and other tar acids produced at Clairton, Pa. [2] Includes gas wasted and gas used for heating retorts. [3] Refined on premises to make the derived products shown: 163,947,167 gallons. [4] Total gallons of derived products. [5] Ammonia thiocyanate, asphalt paint, cyanogen sludge, calcium ferro-cyanide, light carbolic oils, pyridine oil, sodium carbolate, sodium prussiate, spent soda solution, sulfur, and vented vapors. [6] Exclusive of value of breeze which was $7,271,050.



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MONSANTO CHEMICALS

SERVING INDUSTRY . . . WHICH SERVES MANKIND

lands Indies. The Dutch Limburg coal mines, untouched by recent military operations, produced 13 million tons of coal in 1939, and the output of the Maurits mine there is the largest of any in Europe. Those Dutch industries dependent upon imports of tropical raw materials will virtually have to shut down for the duration of the war or until overseas communications are resumed. In Dutch harbors there are located extensive shipbuilding facilities, whose capacity is estimated at over 500,000 BRT. Although its own chemical industry is not extensive, the Netherlands has enjoyed a favorable position in world chemical trade, especially as a trans-shipper, because of its favorable geographic location in relation to the chief European chemical manufacturing centers.

The occupation of northern and western France under the armistice terms places important industries under German control. Chief resources are coal produced in the Pas de Calais and Nord district mines, the minette iron ores in Lorraine, and potash salts in Alsace. The heavy industries important for the prosecution of the war, insofar as they have not been destroyed, will have adequate raw material supplies. Well-developed industries, such as wool, linen, silk, and cotton will suffer from lack of imported raw materials. The extensive branches producing perfumes, soaps, and luxury articles will suffer because of expected diminution of export possibilities. Production and market readjustments will be severe and will probably take some time, and if the war is of short duration may not even become effective.

Ninety per cent of Norway's industries and population are located in German-occupied territory, and the Reich is making efforts to bring the economy back to normal. Minerals found in Norway include varying amounts of iron, copper, nickel, zinc, lead, molybdenum ore, titan ore, and graphite. About 1500 miles of railway track, including most of the main lines, have already been reconditioned for full service. The leading Norwegian nitrogen works, Norsk Hydro, in which I. G. Farben has an interest, has now resumed operations after having been closed temporarily. The molybdenum mines at Fjotland are reported working at capacity, as are also the fish canning industries.

Denmark has for years been subject to dual economic pressure by both Germany and England. Already in 1939 the Reich supplied 56 per cent of her iron and steel imports, and 64 per cent of her chemical imports. German chemical exports to Denmark were 29 million Kronen in 1939 as against 21 million in 1938. British trade with Denmark involved chiefly shipments of coal and industrial products in return for food and dairy supplies. The Reich has been supplying Denmark with steadily increasing amounts of coal in exchange for the same food products. Denmark's food surplus has been diverted to the Reich, but the shortage of imported fodder will probably lead to slaughtering of many cattle. The Reich can now obtain all the milk, butter, cheese, eggs, and meat products these countries formerly exported to Great Britain, France, and overseas. This will assure Germany's fat requirements until next spring, according to an official statement.

The German Food Ministry recently announced that this month Germans should be able to obtain regular butter up to the full quota called for by their margarine cards. The cheese ration will be increased by 25 per cent, while the supply of eggs will be 50 per cent larger than last September. The grain reserve, according to the Ministry of Agriculture, is as great as a year ago. Planting acreages are larger than last year. About 600,000 acres more potatoes have been planted, and the vegetable acreage has increased 25 per cent. To keep up agricultural production within the Reich, 700,000 tons of nitrogen fertilizers have been made available for farmers in 1940. This is equivalent to the amount used in 1939 and is twice that used in 1932.

The problem of storing food reserves for civilian and army consumption has been carefully studied in Germany for a number of years. The army has been especially interested in developing simple yet effective food preserving methods. Dried vegetables served to the army in the World War, and referred to by German soldiers as "barbed wire," are back again in improved form. Since 1935 the army has been building up supplies of dried potatoes and vegetables through artificial drying. Drying of fish and meat has not yet been overly successful.

Although it involves more equipment in handling, freezing processes to preserve fresh foods have proved more satisfactory. Quick-freezing processes have been favored for three reasons: food values are believed to be preserved better, a greater variation in army diet can be offered, and tin-can and transport costs can be cut down.

Germans claim that Professor Plank of Karlsruhe laid the theoretical foundations in 1916 for the quick-freezing processes, but the practical large scale application occurred in the United States. The American Bird's-Eye process has been utilized in the Reich on a large scale since 1939 under license with the Solo Feinfrost process of the Margarine Verkaufsunion. A number of German factories are already using the Bird's-Eye process as well as a German-developed Heckermann process. Rheinmetall-Borsig A. G., Berlin, has constructed equipment for quick-freezing, especially of fish caught by fishing fleets and preserved at sea. Lindes Eismaschinen A. G., Wiesbaden, is developing another process. At present it is estimated that one-fifth to one-sixth of the food which is preserved in Germany is treated according to one of the quick-freezing processes.

Refrigeration has always been a

problem in Europe because of the high costs. It is estimated that 5 per cent of the 30,000 million RM of food used annually in the Reich is lost by being spoiled. Ammonia for commercial refrigeration is being replaced by American-developed "Freon." The same substance is manufactured in Germany by I. G. Farbenindustrie under the name "Frigen," which is widely used in freezing units of domestic refrigerators.

That the chemical industry has held up relatively well during the war is indicated in I. G. Farben's annual report, closing December 31. I. G., which controls the majority of German chemical production, reports that exports were more satisfactory during the first four months of the war than might have been expected. In spite of being cut off from overseas trade, exports were maintained at previous levels through increased sales in Europe. I. G. Farben's gross revenue for 1939 was 786 million RM, an increase of 120 million RM over 1938. Net profits were 56 million RM, and an 8 per cent dividend was declared. The balance sheet grand total of 1,900 million RM, an increase of 250 million RM over 1938, partly represented new participations and new plants.

LIST OF STRATEGIC MATERIALS UNDERGOES REVISION

The Army and Navy Munitions Board prepared early in 1940 the following revised list of strategic and critical materials:

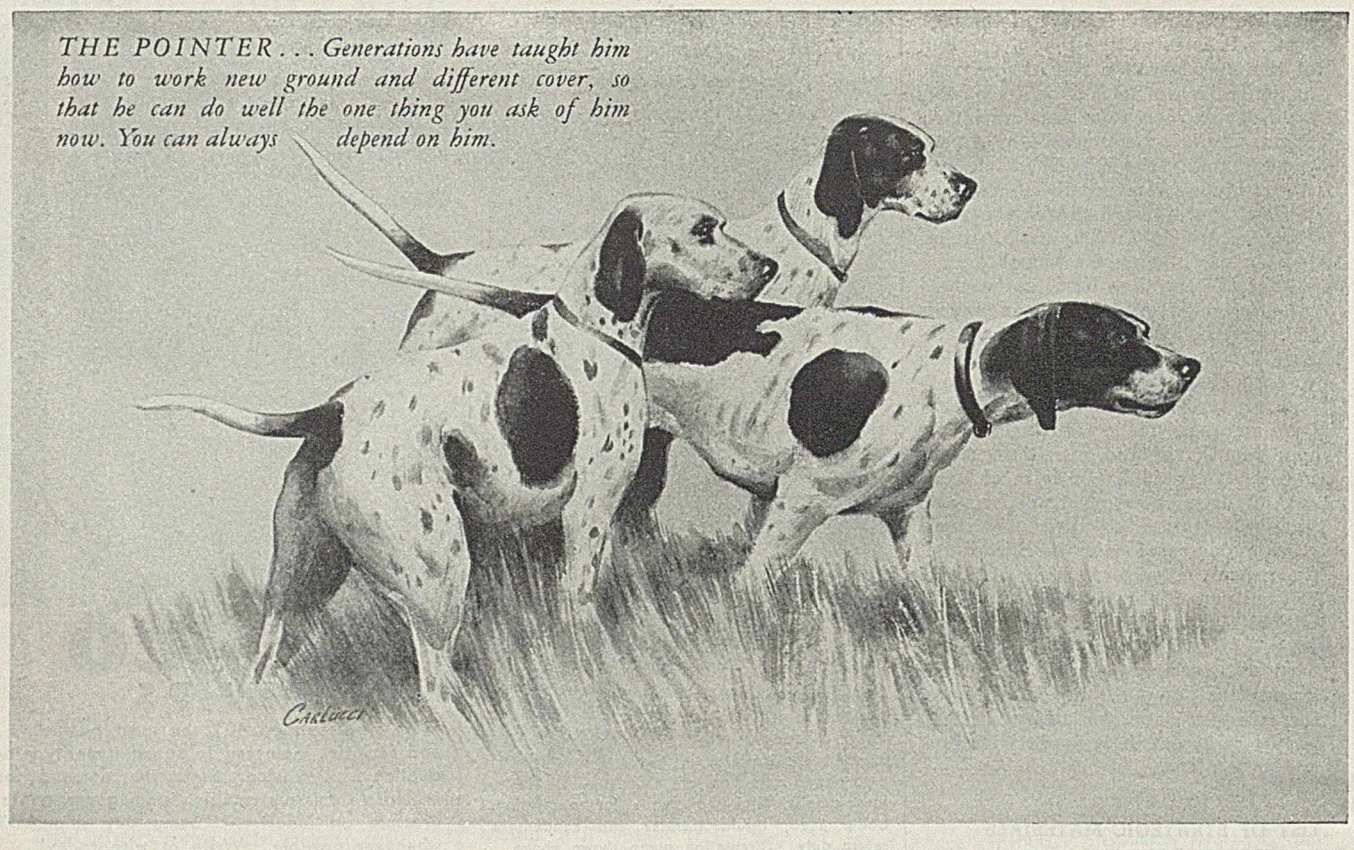
List of Strategic Materials: Antimony, chromium, coconut shell char, manganese, ferro-grade, manila fiber, mica, nickel, quartz crystal, quicksilver, quinine, rubber, silk, tin, tungsten.

List of Critical Materials: Aluminum, asbestos, cork, graphite, hides, iodine, kapok, opium, optical glass, phenol and picric acid, platinum, tanning materials, toluol, vanadium, wool.

In preparing these lists, three commodities—aluminum, optical glass, and wool—were removed from strategic to critical classification. Also there were eight commodities moved from critical to essential status, viz.: cadmium, coffee, cryolite, flaxseed, fluorspar, nux vomica, scientific glass, and titanium. However, the Board does not longer give quite the same attention to the so-called "essential" commodities, and it may be that such third list will no longer be considered significant.

SHORTAGE OF CHEMISTS FOR BRITISH INDUSTRY

Great Britian is finding difficulty in meeting the growing demands for chemists which has sprung up in industries working at top speed to fill out war-time demands. More than a year ago a Central Register was formed for the enrollment of persons with technical, scientific, and professional qualifications but the names thus provided are not proving sufficient for the emergency.



Trained to Point

Generations back of us of Reading-Pratt & Cady there's been rare ability to appreciate the vision of men in your industry—plus ability to get down to brass tacks and see that you get valves that help the dreams come true.

That's in the record of Pratt & Cady since '78 and of Reading since 1902.

New ideas and original valve designs—engineering skill and modern production—were bound to develop from that sort of living. And they provide mighty valuable background when we come to the point now—tackle the job of supplying valves to solve your problem today.

We would enjoy working out recommendations with you. Will you write us when valves are up for discussion?

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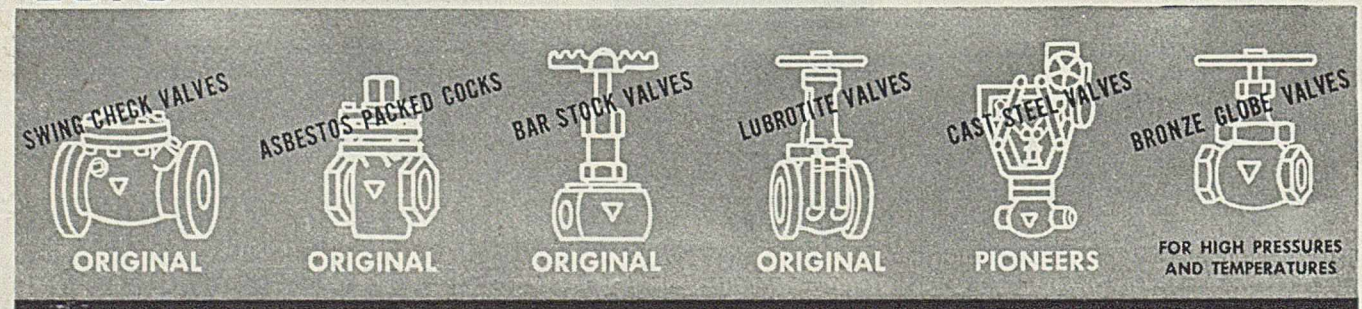


AMERICAN CHAIN & CABLE COMPANY, Inc.

PERSONALITIES

Lincoln T. Work

Edward C. Uhlig

✦ LINCOLN T. WORK, associate professor of chemical engineering at Columbia University, has been appointed director of research of the Metal & Thermit Corp., New York, N. Y. All of the corporation's research and development activities including work in electric arc and Thermit welding, pigments, metals and alloys and various phases of chemical and metallurgical engineering will be under his supervision.

✦ A. W. SKERRY, former manager of the E. I. du Pont de Nemours Co. plant at Seneca, Ill., has been named manager of the Tennessee Powder Co.'s plant now under construction near Memphis, Tenn.

✦ EDGAR M. QUEENY, president of Monsanto Chemical Co., announced June 28 that effective July 1 and until the November election he will serve his company only half-time so that he can devote the balance of his time and energy in behalf of the presidential candidacy of Wendell L. Willkie.

✦ PETER J. W. DEBYE, Nobel prize winner in chemistry in 1936 and director on leave of the Kaiser Wilhelm Institute of Physics at Berlin-Dahlem, has been appointed professor and chairman of the department of chemistry at Cornell University. Dr. Debye, a native and citizen of the Netherlands, has been George F. Baker visiting lecturer in chemistry at Cornell during the last term. Prof. Jacob Papish, who has been chairman of the department, will continue as vice chairman.

✦ T. J. WIEGAND has been appointed manager of the trade sales division of the Glidden Co., according to the announcement of Dwight P. Joyce, vice president. Mr. Wiegand comes to the Glidden Co. with a broad experience in merchandising. For 18 years he was associated with the National Refining Co. of Cleveland.

✦ EDWARD C. UHLIG, chief chemist and head of the Brooklyn Union Gas Co.'s laboratory since its inception in 1904 was honored recently at a dinner held in commemoration of his retirement from active service, July 1. Two hundred of his closest friends in the company and industry were present at the dinner. The party included many company officers, friends employed by other utilities and fellow officers in the Gas Club.

✦ ROBERT L. CLAUSE has been elected to a newly created position of executive vice president of the Pittsburgh Plate Glass Co. John A. Wilson, general superintendent of the plate glass factories of the Pittsburgh organization, will become manager of glass manufacture and D. G. Hill, assistant to the vice president, will become superintendent of plate glass factories.

✦ F. H. STEELE has become a member of the sales engineering staff of Fansteel Metallurgical Corp. and will specialize in the sale and service of tantalum acid-proof equipment on the Eastern seaboard with headquarters at Jersey City, N. J.

✦ ETTORE PERETTI has been appointed assistant professor of metallurgy in the School of Mines, Columbia University, to take over the instruction in non-ferrous metallurgy formerly given by Dr. Edward F. Kern who retired this year. Dr. Peretti has been teaching metallurgy in the Montana School of Mines since 1936.

✦ FLOURNOY C. JOHNSON, formerly superintendent of the Armour Fertilizer Works at New Orleans has retired after 50 years service to industry.

✦ H. C. DIEHL, head of Seattle, Wash., Frozen Pack Laboratory of the Bureau of Agricultural Chemistry and Engineering, has been appointed chief of the commodity processing division of the Western Regional Research Laboratory at Albany, Calif.

✦ MARTIN J. CONWAY, who has been fuel engineer for Lukens Steel Co., Coatesville, Pa., since August, 1926, has been transferred to the sales department of the company as special engineer for the petroleum industry. He was born in England and was graduated from Oxford University in 1914 with degrees in mechanical engineering and chemical engineering.

✦ W. B. VANARSDEL has been ap-

CALENDAR

AUG. 20-23, Technical Association of the Pulp & Paper Industry, fall meeting, Olympic Hotel, Seattle, Wash.

SEPT. 9-13, American Chemical Society, fall meeting, Detroit, Mich.

OCT. 2-5, Electrochemical Society, fall meeting, Ottawa, Canada.

OCT. 7-10, American Gas Association, Atlantic City.

DEC. 2, 3, 4, American Institute of Chemical Engineers, New Orleans, La.

DEC. 11-15, National Chemical Exposition, Chicago, Ill.

pointed chief of the engineering and development division of the Department of Agriculture's Western Regional Research Laboratory at Albany, Calif. As chief of this division Mr. Van-Arsdel will head the engineering development of processes worked out in the Western Laboratory and the study of industrial opportunities for expanding outlets for farm products. In 1938 he was detailed to assist in the technologic planning of the Department's four regional research laboratories.

Charles L. Faust

✦ CHARLES L. FAUST, chemical engineer of the Battelle Memorial Institute and Carl A. Zapffe, metallurgist of that organization, are recipients of the 1940 Proctor Memorial Award of the American Electroplaters' Society.

✦ DELBERT E. JACK has been appointed general sales manager of The Duriron Co., Inc., Dayton, Ohio, to succeed W. H. Scott, who is retiring. Since graduating from the University of Colorado in 1923, Mr. Jack has been closely identified with the design and application of chemical plant equipment and has handled the Duriron sales in the San Francisco area.

✦ FRANK T. MURPHY has been appointed manager of sales for the St. Louis district of the Globe Steel Tubes Co., Milwaukee.

✦ HARRY K. CLARK has been elected by the board of directors of the Norton Co. to the office of vice president and general manager and Andrew B. Holmstrom to the office of vice president and works manager. These appointments were to fill vacancies caused by two resignations. Aldus C. Higgins, president, who also held the office of general manager, resigned the latter responsibility, and George N. Jeppson, treasurer and vice president who also held the position of works manager, resigned from that office. Mr. Higgins will retain the office of president and Mr. Jeppson will continue as treasurer and vice president.

✦ ALLEN W. MORTON, vice president of Koppers Co. in charge of the American Hammered Piston Ring Division, has been appointed by Edward R. Stettinius, Jr., chairman of the Advisory Commission to the Council of National Defense, as a full-time special assistant on the commission.

✦ A. E. FORSTER has been appointed by the Hercules Powder Co. as assistant general manager of the Naval Stores Department. He joined Hercules in 1925 as a member of the explosives service division on the West Coast.

✦ LESLIE S. GILLETTE, vice president of Hazard Advertising Corp., was elected president of the New York Sales Managers' Club to succeed William A. McDermid.

✦ J. V. N. DORR, on May 31, received the honorary degree of Doctor of Engineering from the South Dakota School of Mines in recognition of the contributions he had made to metallurgical practices, and on June 7 he received a similar honorary degree from the Michigan College of Mining and Technology.

Martin J. Conway

✦ J. HOWARD FLINT has become associated with Mason, Fenwick & Lawrence, patent and trade-mark lawyers, Washington, D. C.

✦ A. H. KRUGER has joined the R-S Products Corp. of Philadelphia as sales manager for their Industrial Furnace Division, after an absence of about seven years, during which time he was associated with the Industrial Furnace Division of the Philadelphia Drying Machinery Co.

✦ OSWALD SCHREINER, for many years engaged in soil fertility work of the Department of Agriculture, has been appointed adviser on soil problems to the chief of the Bureau of Plant Industry, Dr. E. C. Auchter. Dr. O. C. Magistad has been named assistant chief of the Bureau.

✦ WILLIAM M. BARR, chief chemical and metallurgical engineer, for the Union Pacific Railroad has been elected president of the American Society for Testing Materials. Following his university work he was chief chemist for Mallinckrodt Chemical Works; professor of engineering chemistry, Iowa State College, manufacturing research chemist for Mallinckrodt and later manager of the Eastern Works of that company. In 1916 he entered the employ of the Union Pacific Railroad as consulting chemist. Dr. Barr was a member of the A.S.T.M. executive committee 1934 to 1936 and was vice president from 1938 to 1940.

✦ HERBERT J. BALL, head of the department of textile engineering, Lowell Textile Institute, Lowell, Mass., has been elected vice president of the A.S.T.M.

✦ ROGER C. GRIFFIN, of Arthur D. Little, Inc., Paul D. Merica, of International Nickel Co., Jerome Strauss, Vanadium Corp. of America, Stanton Walker, National Sand and Gravel Association, and C. H. Fellows, Detroit Edison Co., have been elected to the executive committee of the American Society for Testing Materials.

✦ T. F. WILLIS, chief, Research Division, Bureau of Materials, and M. E. DeReus, junior engineer, respectively, of the Missouri State Highway Department, were awarded the Charles B. Dudley medal at the recent meeting of the American Society for Testing Materials.

✦ T. D. JOHNSON, JR. of Birmingham, Ala., and a recent graduate from Princeton University, has joined the fine chemicals department of E. I. du Pont de Nemours & Co. He will be located at Deep Water, N. J.

✦ KENNETH MORGAREIDGE, former graduate research fellow and chemistry instructor at the University of Rochester, has been appointed to the staff of the vitamin laboratories of the National Oil Products Co., Harrison, N. J. He assumed his new duties on July 1.

✦ W. J. BUECHLING is now chief metallurgist at the Copperweld Steel Co.'s new steel plant at Warren, Ohio. He was previously connected with Central Alloy Steel Corp. and Republic Steel Corp.

✦ JAMES D. LYNCH, who recently graduated from Clarkson College, Potsdam, N. Y., has accepted a position with the Monsanto Chemical Co. and will be located in St. Louis.

✦ ARTHUR L. STERN has been appointed sales engineer for the Philadelphia and surrounding territory by the Magnetic Engineering & Mfg. Co., of Clifton, N. J.

✦ WILLIAM M. GIBSON has been appointed superintendent of the American Asphalt Paint Co.'s plant at Kankakee, Ill. He was with the Cook Paint & Varnish Co. for ten years and with Rinshed-Mason for 3½ years.

✦ E. H. ANCHORS, formerly branch manager for the Air Reduction Sales Co. at Atlanta, Ga., has been appointed manager of the Oklahoma City District.

OBITUARY

✦ WILLIAM WALLACE BUFFUM, treasurer and director of The Chemical Foundation, Inc., died at the Mountainside Hospital in Montclair, N. J., on June 22, after a brief illness of a heart ailment. Mr. Buffum was born at Friendsville, Pa., on August 25, 1888. From 1917 to 1921 he was chief accountant in the Washington office of the Alien Property Custodian. Since 1921 he had been a member of The Foundation. He took an active interest in the furtherance of chemical education in this country in the organization of the American Institute of Physics and in the development of newsprint from Southern pine. He was also greatly interested in the utilization of chemistry in the fight against various diseases such as cancer, tuberculosis, etc.

✦ JOHN W. IRVINE, 63 years of age, died May 25 of a heart attack at his home in Pittsburgh. He was superintendent of Pittsburgh Piping & Equipment Co. and was one of the original employees of the company when it was founded 37 years ago.

✦ WILLIAM A. HARSHAW, founder and chairman of the board of the Harshaw Chemical Co., died at the age of 79, at his home in Highwood, Gates Mills, Ohio, on June 4. The son of a farmer, Mr. Harshaw guided the company bearing his name to rank of one of the largest of industrial chemical manufacturing concerns in the Cleveland area and gained national recognition in that field. In addition to company activities, Mr. Harshaw served as a trustee of the Case School of Applied Science.

✦ JAMES THOMAS DONALD, founder and president of the consulting industrial chemists firm of J. T. Donald & Co., died at Montreal Neurological Institute on June 11 of injuries suffered in an automobile accident. He was in his 84th year.

✦ LOUIS E. MURPHY, formerly president and chairman of the board of E. F. Houghton & Co., Philadelphia, died on June 26, at his summer home at Mantalocking, N. J., from a short illness culminated by double pneumonia. He was 66 years of age. He had been connected with the Houghton organization for 52 years, having started as an errand boy in 1888.

FACTS ON FILTERING

Representative case histories on widely varied clarification problems condensed from field reports of Johns-Manville Filtration Engineers

Vitamin-Oil Clarity Improved, Settling Time Eliminated

(Reported by J-M Engineer O. A. Mockridge)

NEW JERSEY DISTRICT— This pharmaceutical company formerly clarified vitamin oils by settling. As demand increased, this method proved impractical. Either deliveries had to be delayed because of its slowness, or settling time reduced so much that clear oil was unobtainable.

An experimental filter was installed and several tests run off. Using 1% Hyflo, these tests showed that filtration would provide brilliant clarity at a flow rate of 5 gal. per sq. ft. of filter area per hour. A 665 sq. ft. plate-and-frame filter press with 2″ frames was recommended. Results bear out this recommendation. In actual large-scale operation, this filter is averaging about 3325 gal. per hour. Clarification is complete, and officials have expressed thorough satisfaction.

East India Gum Clarified Ten Times Faster

(Reported by J-M Engineer H. G. Martin)

SAN FRANCISCO DISTRICT— Recent tests in a leading varnish plant indicate that substantial savings can be made by filtering East India Gum solution. Standard practice is to settle the solution, strain it and then centrifuge it. In the plant studied, this requires ten man hours of labor per 300-lb. batch. Evaporation losses are heavy, and there is a loss of almost ten gallons of solvent per batch in sludge and tailings.

Tests were run using 4% Hyflo filter aid. In one hour, 21 lbs. of solution were filtered to perfect brilliance.

Area of the filter used was 1 sq. ft. Based on this run, a press with about 20 sq. ft. of filter area can easily handle a 300-lb. batch in one hour, with no losses from evaporation or sludge. Operator is greatly impressed with the simplicity and economy of filtering with Hyflo, and is planning to install this method shortly.

Celite Mineral Fillers Make Good Products Better

Paint, paper, plastics, polishes are just a few of the hundreds of products made stronger, tougher, better with J-M Celite Mineral Fillers.

Celite is entirely mineral . . . absolutely inert. Unlike ordinary fillers, it is made up of microscopic hollow shells that are unusually porous . . . absorb twice their own weight of liquid. Their fluffiness and light weight frequently permit Celite Fillers to replace 2 to 6 times the weight of heavier fillers.

There is a type and grade of Celite for every requirement. And J-M Engineers are always available to help you select the one best suited to your needs. For details, write Johns-Manville, 22 East 40th Street, New York, N. Y.

$450 Per Year Saved by 8 lbs. of Filter Aid per month

(Reported by J-M Engineer J. C. Honey)

TORONTO DISTRICT—For two years, this company had been having trouble with filtration of their brass electroplating solutions. Filters plugged quickly. Clarification was highly unsatisfactory. Conditions were so bad that company officials had about decided to eliminate the filtering operation altogether.

No filter aid of any kind was being used. Investigation revealed that either Celite No. 503 or Hyflo would completely end all difficulty. After a test run, Celite No. 503 was selected, and officials are more than pleased with results. Filtration is greatly simplified and solutions come through perfectly clear.

The cost of using Celite averages only $1 a month. Yet, company men estimate that this returns more than $450 a year in cash savings and through improved quality of finished products.

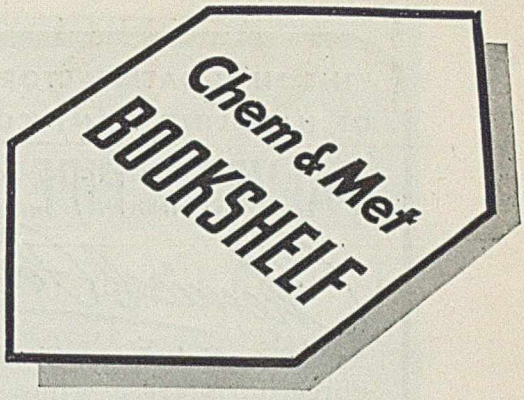
How Can You Improve Your Filtering?

Hundreds of plants have stepped up flow rates or improved quality with the help of J-M Filtration Engineers and modern high-flow-rate Celite Filter Aids. As you can see from the cases cited here, changes in existing methods are usually simple and economical . . . quickly pay for themselves in lowered operating costs. If your filtration operations haven't been checked recently, why not call in a J-M Engineer? No obligation, of course. Just write Johns-Manville, 22 E. 40th St., New York, N. Y.

JOHNS-MANVILLE CELITE FILTER AIDS

FILTER-CEL . . . STANDARD SUPER-CEL . . . CELITE NO. 512 . . . HYFLO SUPER-CEL . . . CELITE NO. 501 . . . CELITE NO. 503 . . . CELITE NO. 535

New Titles, Editions and Authors



CONVERSION OF PETROLEUM. By *A. N. Sachanen.* Published by Reinhold Publishing Corp., New York, N. Y. 413 pages. Price $6.

Reviewed by *M. E. Clark*

SUBTITLED "Production of Motor Fuels by Thermal and Catalytic Processes," this book is a real contribution to petroleum literature. It is not a book for the layman for it presumes a knowledge of organic chemistry and an elementary if not a working knowledge of refining fundamentals. Perhaps it might best be classed as an advanced textbook, for in effect, Dr. Sachanen has studied and analyzed for the reader literally hundreds of patents and technical papers. He actually cites about 550 authors from which he has drawn material.

The book contains only seven chapters, the longest, Thermal and Catalytic Reactions, comprising about a quarter of the volume. Other chapters are: Factors of Cracking, Factors of Hydrogenation, Cracking Equipment, Cracked Gasoline, Treatment of Cracked Gasolines, and Cracked Products Other than Gasoline. The treatment of these subjects is in general a tying together of the results of various researches. Reactions and reaction conditions are described. The author considers the thermodynamics of each reaction, particularly in regard to free energy. After various means of accomplishing a given result are described, e.g. catalytic polymerization, the author describes each commercial process in detail with the aid of a flowsheet, e.g. phosphoric acid, Houdry, sulphuric acid, etc.

In some cases he pits one process against another, considering advantages and disadvantages in regard to raw materials, products, investment and other factors of process economics. Because Dr. Sachanen represents only one petroleum refiner, Socony-Vacuum Oil Co., this reviewer looked for evidence of a biased viewpoint and found none in a brief study.

One expects a book to be considerably out of date by the time it is published. This one, surprisingly enough, is not. Even the very latest developments in alkylation up to the time of publication (preface is dated February 1940—book received here May 1940) are included. The author even goes so far as to predict that the total production of alkylated paraffines in the U. S. will reach approximately 11,000 bbl. per day by the middle of 1940—a fact that perhaps can be checked now by some refiners.

The only real question this reviewer might raise about the author's work has to do with his choice of nomenclature. He has defined "cracking" as "the thermal or catalytic-thermal treatment of petroleum products at temperatures higher than 400 deg. C. (752 deg. F.)." In this reviewer's opinion, it is pretty well conceded by chemical engineers that cracking is the shortening of the carbon chain and the term the author has defined is "pyrolysis." Perhaps this is a small point but it does seem that nomenclature in this field is already complicated enough without introducing new definitions. Under Dr. Sachanen's definition, thermal alkylation, hydrogenation, isomerization and even some polymerization should properly be called cracking.

But this objection notwithstanding, Dr. Sachanen has written a fine book. It is intended for the theorist, the scholar, the researcher, the technical man seeking advanced knowledge before or after launching himself into the petroleum refining industry. In general, it is not intended for the practical man, that is, the man whose day to day job is concerned solely with production.

In these days of rapidly changing technology, every petroleum engineer or chemical engineer concerned with petroleum would do well to read this book and let it take its proper place on his reference shelf—between his organic chemistry text and Nelson's "Petroleum Refinery Engineering."

ELECTROCHEMICAL ENGINEERING

INDUSTRIAL ELECTROCHEMISTRY. Second edition. By *C. L. Mantell.* Published by McGraw-Hill Publishing Co., New York, N. Y. 656 pages. Price $5.50.

Reviewed by *S. Skowronski*

THE FIRST edition of this book was published in 1931 and the present second edition has been enlarged by 25 per cent to cover the improvements in technical practice which have taken place and the new processes which have been established since that date. The author has rewritten many of the chapters and the present volume is more than just a new edition, it is practically a new book.

Following the scheme of presentation of the first edition, the subject matter is divided into six major parts. Part 1, Theoretical Electrochemistry, necessarily had to be brief and include the basic fundamental laws underlying electrochemistry as well as a comprehensive chapter on the scope and historical development of the art. Part 2, Technical Electrochemistry, deals with electrolytic reduction and oxidation processes in both the organic and inorganic fields, and describes various types of primary and secondary cells as well as rectifiers. Part 3, Electrolytics, takes up in detail electroplating, electroforming, electro-refining and electrowinning, both in aqueous solutions and fused baths, as well as the manufacture of chlorine, caustic and hypochlorites. Part 4, Electrothermics, describes the various types of electric furnaces and the manufacture of the many electric furnace products. Part 5, Electrochemistry of Gases, includes electronics. Part 6, Engineering, is an excellent section on materials of construction, power generation and economics.

The book is well illustrated and contains an unusual number of graphs and flow sheets. The tabulation of operating data of various industries which was a feature of the first edition has been brought up-to-date and enlarged by the addition of 29 new tables. A decided improvement over the former edition is the inclusion of more references to the original literature.

Dr. Mantell is to be complimented on the thoroughness with which he has covered the new processes and the new edition gives its readers a good conception of the improvements and development of the electrochemical industry during the last decade. The first edition has been a standard textbook and work of reference since its publication; rewritten, enlarged and up-to-date, the second edition will continue to be so.

THE KINETICS OF CHEMICAL CHANGE. By *C. N. Hinshelwood.* Published by the Oxford University Press, New York, N. Y. 274 pages. Price $4.50.

Reviewed by *G. F. Kinney*

CHEMICAL KINETICS, rapidly coming of age anyway, is helped considerably in the process by the appearance of a new Hinshelwood. This new volume is a logical development of the original "Kinetics of Chemical Change in Gaseous Systems" of 1926 and two succeeding editions, but is far more than just another edition. The character of the book has changed; instead of an encyclopedia of comparatively unrelated material it has become a broad review of general principles, well organized and clearly outlined.

One advantage of the Hinshelwood books has resulted from the author's ability to handle difficult abstractions gracefully and this new volume is no exception. It gives a balanced, clear and deceptively simple account of the fundamental facts and theories of chemical change. The first part of the book is devoted to elementary statisti-

cal mechanics and to the kinetic and statistical theory that is the basis for the treatment of reaction kinetics. Selected examples and representative reactions are studied, and although most of these take place in the gaseous state, no longer is much importance made of the distinction between reactions in the gaseous state and in other states.

The volume is addressed, not to the experts, but to anyone with the background who is interested in learning the broad aspects of this branch of natural philosophy. It is difficult to imagine a better introduction. Workers in the field of chemical kinetics already own at least one of the earlier editions. This new volume, because its broader viewpoint so organizes the field, deserves equal recognition in its own right.

WHAT PRODUCTIVITY MEANS

PRODUCTIVITY, WAGES, AND NATIONAL INCOME. By *Spurgeon Bell.* Published by The Brookings Institution, Washington, D. C. 344 pages. Price $3.

Reviewed by *R. S. McBride*

THE JACKET which advertises this book gives an excellent statement of its scope and significance. "This book is concerned with the fundamental issues involved in technological and economic progress. It analyzes the relations between fixed capital investment, man-hour productivity and the volume of output in major groups of industry and in selected divisions of manufacturing. It indicates how the gains from increasing productivity are distributed among the groups participating in production and the consuming public; and the effects of the existing distribution upon employment and national income."

As the sixth number in the comprehensive series of volumes from The Brookings Institution, this book will be welcomed by every engineer and executive of process industry who is responsible for studying the fundamental trends of his company or his industry. The book is a very creditable addition to the series and will be fully as valuable as any of its predecessors. A substantial part of the volume relates to railroad, electric light and power, and non-manufacturing enterprise. But the principles there discussed are no less applicable than those in the chapters of direct concern to the chemical engineer. There are chapters of this sort which deal with iron and steel, paper and allied products, cotton textiles, tobacco products, and an important number of minor sections for other chemical engineering enterprise. Any reader will, however, make a mistake who tries to use only those portions which appear to deal with his industry. The principles set forth in the valume as a whole are vastly more important than any such particulars.

At the present time one of the major social issues which cannot be ignored, even under the pressure of European

War influences, is the problem "Who gets the benefits of increased productivity?" Labor is constantly making new claims, some of them apparently wholly unjustified. The executive and engineer of process industry should be prepared to face such problems in his own plant or industry with an accurate knowledge of the meaning of the movements. With the aid of this book he will come closer to an understanding. And the result will be an opportunity for cooperation with proper employee claims and information to help refute those not justified. The factual treatment and impartial source of the book will be important assets in its use.

PURGING OF GAS PIPING AND GAS APPARATUS. Published by American Gas Association, 420 Lexington Ave., New York, N. Y. 40 pages. Price 50c. to members, $1 to non-members of A.G.A.

THIS DOCUMENT gives procedures recommended by the technical committees of American Gas Association for safe operation when purging or placing gas piping appliances into service or removing them from active service. The precautions described are a valuable guide to safety in similar operations in many types of chemical engineering equipment containing explosive or flammable gas or gas mixtures. Chemical engineers will do well to place a copy of the booklet in the hands of their operating superintendents and foremen who have any occasion for carrying out such operations. An analogous publication was issued some time earlier by the same committee giving the procedures recommended by the A.G.A. for the "Purging of Gas Holders." The technic then recommended is analogous to the present operating methods but more readily adaptable to use with gas storage equipment.

VARNISH MAKING. Published by Chemical Publishing Co., New York, N. Y. 231 pages. Price $6.

Reviewed by *W. R. Fuller*

WITH the addition of an introductory chapter on the History of Varnish Manufacture, this book comprises the papers read at the Second Conference of the British Oil and Colour Chemists' Association. The busy reader can well afford to skip the first chapter, which has no apparent connection with the remainder of the book. The papers are divided into two groups; those dealing with varnish raw materials and the chemical and physical changes that occur in varnish manufacture and the drying of varnishes, and those treating manufacturing processes and equipment. The papers of the second group have little interest or value to the American reader; the meat of the book is entirely in the papers of the first group.

The individual papers of the first group average high in quality. Each gives a brief summary of the subject covered, the treatment being theoretical in viewpoint. The subjects in order of

discussion are: Maleic Acid Resins, Some Physical Aspects of Resin and Oil Systems, Chemical Reactions in Varnish Making, Alkyd Resins, "Oil-Reactive" Phenol-Formaldehyde Resins, Oxidation and Polymerisation of Drying Oil Varnishes. The Occurrence and Chemistry of Agathic Acid. These papers presuppose a good background in varnish technology, hence will prove of limited interest to the general reader. They should interest the varnish chemist principally as a review and interpretation.

As a group these papers reflect the inherent shortcomings of all symposiums: illogical sequence, obvious gaps and lack of balance between various aspects of the subject. Lack of balance is exemplified by the allotment of approximately half as much space to alkyd resins as to maleic acid resins.

EFFECT OF SULPHUR DIOXIDE ON VEGETATION. N.R.C. No. 815. Published by National Research Council of Canada, Ottawa, Canada. 447 pages. Price $15.

FOR more than ten years an elaborate program of research was carried out by Canadian experts, to a considerable extent in cooperation with United States government specialists, to measure the fume damage to agriculture and the forests which might be reached from the Trail, B. C. smelter. Most of the financial settlements were perfected by decisions of an international Trail Smelter Arbitral Tribunal which rendered a formal report more than a year ago. At that time a limited publication was given to some of the technical findings. Now a very complete scientific and technical report is made available in this new document from National Research Council of Canada.

The increasing scale of industrial operations which result in sulphur dioxide or other objectionable fumes has been noted in many parts of the United States. Perhaps nowhere else has there been such a serious problem of damage to crops and forests as at Trail. But the technical results here reported will have real industrial significance in a number of other cases troubled by "smoke farmers."

Nearly half of the volume relates to the results of field studies, including a discussion of the methods of fume measurement in the field and the methods of identification of cause of injury to vegetation. Some studies on the relationship between sulphur fumes and soil character are also very significant. The balance of the volume deals with controlled experiments on fumigation or exposure of plants or trees. In many cases full-scale field studies of an experimental nature of controlled addition of known gases give checks of considerable scientific value.

Any chemical engineering executive whether connected with a metallurgical enterprise or not will find this volume invaluable if his company experiences any such difficulty either on its own property or the property of neighbors.

DICTIONARY OF METALS AND THEIR ALLOYS. Edited by *F. J. Camm.* Published by the Chemical Publishing Co., New York, N. Y. 245 pages. Price $3.

CHEMICAL dictionaries, handbooks and other publications contain information on metals and alloys but this British compiled dictionary represents the first effort to bring all the data together in one volume. The editor states in his preface that the book contains information about every known metal and almost every type of metallic alloy. From the point of view of American chemical engineers, the attempt was not very successful. Data for the elements include the usual constants as well as occurrence, properties, uses and a brief history of discovery; this information, however, is readily available in more complete form. The descriptions used for alloys are unsatisfactory; they include percentage composition and generalities about uses. Data on specific gravities, thermal conductivities and melting points are available for many alloys and should have been included. Many unfamiliar and unimportant British alloys are included, while American alloys such as Dowmetal and Everdur are ignored or described by a generality such as that used for Rezistal: "Name given to a group of iron-chromium-nickel-silicon alloys of American origin." There are some minor inaccuracies. For example, the definition of stainless steel excludes the widely used 18–8 and Duriron is described as being a silicon steel.

Approximately one quarter of this British book has been given over to workshop directions for rustproofing, electroplating, heat treatment and the like. Such recipes, directions and information may be found in other more complete sources. By elimination of this less pertinent material, space would have been available not only for more complete treatment of the various alloys but also for the inclusion of many which were omitted.

CORRECTIONS

In the article by Drs. E. J. Barta and H. J. Garber which appeared in the May 1940 issue of *Chem. & Met.* the pressure term, $760/P$, was inadvertently inverted in Equations (1) and (2) on page 288. These equations should read as follows:

$$V_d = \frac{359}{M}\frac{760}{P}\frac{(t+460)}{492}$$

$$= 554.5\,(t+460)/\,(MP) \qquad (1)$$

$$V_s = 359\,\frac{760}{P}\,\frac{(t+460)}{492}\left(\frac{1}{M}+\frac{H_s}{m}\right)$$

$$= \frac{554.5}{P}\,(t+460)\left(\frac{1}{M}+\frac{H_s}{m}\right) \qquad (2)$$

An error was made in the editorial interpretation of the article by T. J. Thompson and Alan S. Foust, on page 410 of the June 1940 *Chem. & Met.* In the eleventh line we should have said that the thermal conductivity of Pyrex is *higher* than published values.

RECENT BOOKS and PAMPHLETS

Machine Shop Training Course. By F. D. Jones. Published by The Industrial Press, New York, N. Y. 2 volumes, 1026 pages. Price $6. (Separate volumes $4 each.) Covering both elementary and advanced machine shop practice, these books tell **why** as well as **how** and are suitable for shop courses, self instruction and technical or trade school use. The treatise deals with all standard types of machine tools and illustrates their use by typical applications. Numerous illustrations accompany the text.

Proceedings. Vol. XXI. Published by the Chemical Engineering Group of the Society of Chemical Industry, London. 160 pages. Since the beginning of the war there has been no time for British chemical engineers to hold meetings of their group. Therefore, this 1939 report contains papers presented prior to the outbreak of hostilities. They include symposiums on gas purification and safety in chemical works. Other papers discuss creep of non-ferrous metals, bearing metals, paint research, plant construction and factory black-outs.

Introduction to Electrical Machines. By A. W. Hirst. Published by Blackie and Son, Ltd., London. Available from the Chemical Publishing Co., New York, N. Y. 122 pages. Price $2.25. First of a series of electrical engineering textbooks, this small volume is intended to meet the needs of students and engineers. It presents discussions on electromagnetism, insulation, losses, wave forms, harmonic analysis and other pertinent topics. Treatment is largely mathematical.

The Welding Engineer's Pocket Book. Revised edition. Published by the Chemical Publishing Co., New York, N. Y. 240 pages. Price $1.50. A small, handy book of condensed information on arc, resistance, oxy-acetylene and thermit welding. Other subjects discussed include testing of welds, protection of workers, lead burning, brazing and light sheet metal welding. This so-called "First American Edition" was written and printed in Great Britain.

Bulletins of the Kaiser Wilhelm Institute for Iron Research. Twenty-three bulletins of metallurgical, physical, chemical and mechanical interest. Prices are from three to five marks each. Representing the top notch of ferrous metallurgy, the bulletins and the research work they describe were done with the usual thoroughness. Their study is recommended, but it will be difficult for anyone to obtain them under present conditions.

The G.M.I. Series. The Oregon State Department of Geology and Mineral Resources is issuing a new series of brief reports which include the result of field investigation by members of the staff. The first one just issued is G.M.I. Short Paper No. 1, entitled "Preliminary Report upon Oregon Saline Lakes," by Dr. O. F. Stafford. G.M.I. Short Paper No. 2 is "Industrial Aluminum; A Brief Survey," by L. M. Motz. Each of this series may be obtained for 10 cents from the Oregon State Department of Geology and Mineral Industry, Portland, Ore.

Mineral Abstracts. The California State Division of Mines, Department of Natural Resources, San Francisco, Calif. has begun the issuance of a series of mimeographed bulletins under the general title of "Mineral Abstracts." These bulletins are compilations of all published reports on each particular subject and will be issued from time to time. So far, three have been issued which are "Pumice and Volcanic Ash," 50 pages, price 36 cents; "Sulphur," 33 pages, price 26 cents; "Tungsten," 33 pages, price 26 cents.

Applied Chemistry Reports, Vol. XXIV. Published by Society of Chemical Industry, London. 756 pages. A comprehensive review of the advances made by chemical industry during 1939.

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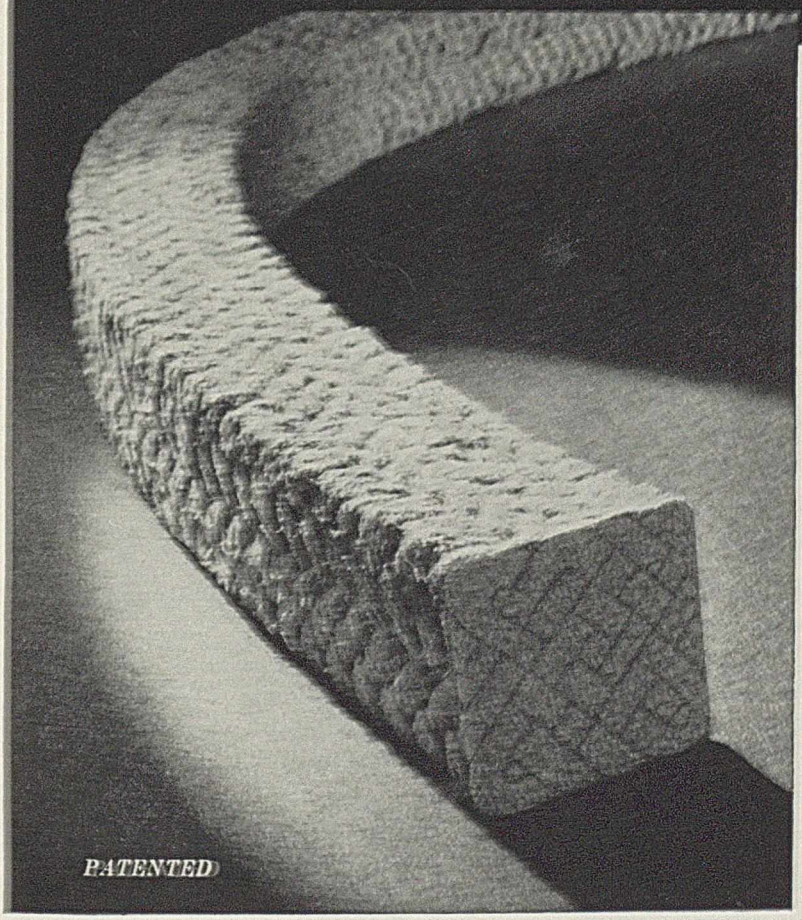

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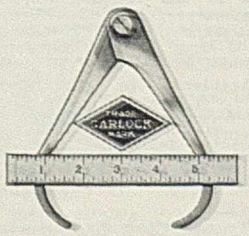

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Twenty-five chapters cover all phases of activity in all countries. These reports are published annually and are very well indexed.

Sick Absenteeism in Industry. Published by Air Hygiene Foundation of America, Inc., Pittsburgh, Pa. 29 pages. Price 25 cents. This report is the first step in a program the purpose of which is to reduce losses suffered by management and labor through sick absenteeism.

Textile Testing. By J. H. Skinkle. Published by Chemical Publishing Co., New York, N. Y. 267 pages. Price $3. With more than half of its pages devoted to physical testing, this book will be of limited interest to those not directly connected with textiles. Chemical testing occupies most of the remaining pages and the book concludes with a brief section on microscopical testing, an appendix of numerous tables, and the index. Directions for tests are clear and brief; sample calculations are included. Given this book, a laboratory technician soon could perform numerous tests. Other sources, however, would have to be consulted for theory behind the reactions used.

Investigations in Ore Dressing and Metallurgy. Published by Canadian Bureau of Mines. Booklet No. 797. 132 pages. Price 50 cents. Thirteen investigations of Canadian ores reported in detail.

Refractories Investigations in Mellon Institute. 20 pages. Gratis. Intended principally for interested persons who have not had the opportunity to see the Refractories Fellowship in operation, this well illustrated booklet tells what has been done and what is being done at the Institute.

GOVERNMENT PUBLICATIONS

Documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from bureau responsible for its issue.

The Relative Toxicity of Lead and Some of Its Common Compounds, by Lawrence T. Fairhall and R. R. Sayers. U. S. Public Health Service, Public Health Bulletin No. 253; 25 cents.

Chronic Manganese Poisoning in an Ore-Crushing Mill, by Robert H. Flinn, et al. U. S. Public Health Service, Public Health Bulletin No. 247; 15 cents.

Clay Investigations in the Southern States, 1934–35. An extended summary of the results obtained on projects conducted by the Geological Survey under grants from the Federal Emergency Administration of Public Works. U. S. Geological Survey, Bulletin 901; $1.00 (paper cover, including various maps).

Microscopic Determination of the Ore Minerals, by M. N. Short. The second edition of a document that has long been regarded as one of the authoritative texts on laboratory and field testing of minerals. U. S. Geological Survey, Bulletin 914; $1.00 (paper cover, including numerous color illustrations).

Geology of the Alaska Railroad Region, by Stephen R. Capps. U. S. Geological Survey, Bulletin 907; $1.25 (paper cover).

Stains of Sapwood and Sapwood Products and Their Control, by Theodore C. Scheffer and Ralph M. Lindgren. U. S. Department of Agriculture, Technical Bulletin No. 714; 20 cents.

Development and Use of Baking Powder and Baking Chemicals, by L. H. Bailey. U. S. Department of Agriculture, Circular No. 138 (Revised May 1940); 5 cents.

Fertilizer Experiments with Rice in California, by Loren L. Davis and Jenkin W. Jones. U. S. Department of Agriculture, Technical Bulletin No. 718; 5 cents.

The Liming of Soils, by Edmund C. Shorey. Gives chemical, physical, and biological changes brought about in soils by liming. U. S. Department of Agriculture, Farmers' Bulletin No. 1845; 5 cents.

Investigations on the Physical and Chemical Properties of Beeswax, by Charles S. Bisson, George H. Vansell, and Walter B. Dye. U. S. Department of Agriculture, Technical Bulletin No. 716; 5 cents.

Naval Stores Report, 1939–40. Production, Distribution, Consumption and Stocks of Turpentine and Rosin of the U. S. by Crop Years. U. S. Department of Agriculture, Bureau of Agricultural Chemistry and Engineering; mimeographed.

Borax Fire-Retardant Paints, by Arthur Van Kleeck. U. S. Department of Agriculture, Forest Products Laboratory. Available only from Forest Products Laboratory, Madison, Wis.; mimeographed.

Unemployment Benefits Report. The Federal Social Security Board is now issuing a series of monthly compilations of significant decisions on appealed benefit claims under State unemployment compensation laws, known as "The Benefit Series." Originally prepared to inform State employment security agencies of the interpretations made by other States, this series is now available to the public on a subscription basis, beginning with Volume 3, at $5 per year; a limited number of Volumes 1 and 2 is available also ($1 for Vol. 1 and $2 for Vol. 2).

Manual on Industrial-Injury Statistics, by Max D. Kossoris. Bureau of Labor Statistics, Bulletin No. 667; 35 cents.

National Labor Relations Board Rules and Regulations, Series 2, As Amended, Effective March 13, 1940. National Labor Relations Board unnumbered pamphlet; 10 cents.

Trade-Union Policy and Technological Change, by Harry Ober. Works Projects Administration, National Research Project No. L-8. Available only from Works Projects Administration, 1734 New York Ave., N. W., Washington, D. C.

Public Aids to Transportation. The Federal Coordinator of Transportation has just issued four volumes of reports, as follows: Vol. 1—General comparative analysis, and public aids to scheduled air transportation; Vol. 2—Aids to railroads and related subjects; Vol. 3—Public aids to transportation by water; Vol. 4—Public aids to motor vehicle transportation; $2.40 the set of 4 volumes.

Activities of Selected Federal Agencies, 1933-1939. Gives historical and statistical data relating to the activities of the principal new and emergency agencies. Available only from Office of Government Reports, United States Information Service, 1405 G St., N.W., Washington, D. C.; mimeographed.

Phenomena in the Ignition of Firedamp by Explosives, Part 1—Particles from the Detonation, by S. L. Gerhard and Wilbert J. Huff. U. S. Bureau of Mines, Technical Paper 603; 10 cents.

Quarry Accidents in the United States, 1937, by William W. Adams and Virginia E. Wrenn. U. S. Bureau of Mines, Bulletin 426; 15 cents.

The Potash Situation, by Bertrand L. Johnson. U. S. Bureau of Mines, Information Circular 7117; mimeographed.

Cars for Transporting Explosives, by C. W. Owings. U. S. Bureau of Mines, Information Circular 7115; mimeographed.

Commercial Travelers' Guide to Latin America, Part III—Mexico, Central America and Caribbean Countries. A new guide to Latin America as a service to commercial travelers of the United States. Bureau of Foreign and Domestic Commerce, Trade Promotion Series No. 208; 40 cents.

Market Research Sources, 1940. A guide to information on domestic marketing, revised every other year in order to bring together projects of cur-

rent value in the field of marketing. Bureau of Foreign and Domestic Commerce, Domestic Commerce Series 110; 25 cents.

Stability of Fiber Building Boards as Determined by Accelerated Aging, by Daniel A. Jessup, Charles G. Weber and Samuel G. Weissberg. National Bureau of Standards, Building Materials and Structures Report BMS 50; 10 cents.

Regulations No. 7 relating to Labeling and Advertising of Malt Beverages. As Amended to January 1, 1940. Federal Alcohol Administration; 5 cents.

Protection Against Habit-Forming Drugs. A survey of law enforcement and other activities of the Treasury Department in dealing with the narcotic problem. U. S. Treasury Department; 5 cents.

Statistics of Income for 1938. Preliminary report on individual income tax returns filed from January through June, 1939. Bureau of Internal Revenue; 5 cents.

Statistics of Income for 1937, Part 1. —Compiled from individual income tax returns, fiduciary income tax returns, estate tax returns and gift tax returns filed during 1938. 25 cents.

Wage-Hour Ruling. The Wage and Hour Division has issued their Interpretative Bulletin No. 8, as revised June, 1940, giving a new ruling regarding limitations on the work week of employees under semi-annual or annual work contracts. Available only from Wage and Hour Division, U. S. Department of Labor; mimeographed.

Electric Power Statistics, 1939. This report (FPC S-4) and its Supplement (FPC S-7), to be issued shortly, give statistical data showing the production of electric energy, installed capacity of generating plants, consumption of fuel and the movement of electric energy across state lines for 1939. Available only from Federal Power Commission, Washington, D. C., at 25 cents each.

Trade Agreement Reports. The U. S. Tariff Commission has issued a second group of a series of reports on industries affected by the trade agreements program. These relate to cement and concrete products; fishery products; fruit and fruit products; grain and grain products; vegetable and vegetable products; alcoholic beverages; leather; leather footwear. U. S. Tariff Commission, Washington, D. C.; mimeographed.

United States Imports in 1939 of Products on which Concessions Were Granted in Trade Agreements, gives preliminary import statistics for the entire year 1939. This supplements an earlier report which gave statistics for only eleven months of 1939. U. S. Tariff Commission, Washington, D. C.; mimeographed.

Blown, Drawn, and Dropped Lenses for Sun Glasses. National Bureau of Standards, Commercial Standard CS79-39; 5 cents.

Tissue Paper. National Bureau of Standards, Simplified Practice Recommendation R46-39; 5 cents.

Structural Properties of Wood-Frame Wall and Partition Constructions with "Celotex" Insulating Boards, by Herbert L. Whittemore and Ambrose H. Stang. National Bureau of Standards, Building Materials and Structures Report BMS 42; 10 cents.

Classification of Acoustic Materials. A descriptive list of available material giving properties. National Bureau of Standards, Letter Circular 585; mimeographed.

Safety Rules for the Installation and Maintenance of Electric Utilization Equipment. Comprises part 3 of the National Electrical Safety Code dealing with utilization equipment. National Bureau of Standards, Handbook H33; 15 cents.

Metal-Mining Practice, by Charles F. Jackson and J. H. Hedges. U. S. Bureau of Mines, Bulletin 419; 60 cents.

Survey of American Listed Corporations, Volume III. This third volume gives information on 9 industry groups as compiled from reports filed with the Securities & Exchange Commission. The industries included in Volume III are: Distilled beverages, paints and varnishes, vegetable oil, drugs and medicines, toilet preparations and soap, cement, clay products, building materials other than clay products and cement, and building equipment. Available only from Securities & Exchange Commission, Washington, D. C.

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.

Alumina Ware. The Thermal Syndicate Ltd., 12 E. 46th St., New York, N. Y.—Bulletin No. 6—4-page leaflet describing the chemical and physical properties of this company's pure alumina crucibles, combustion boats, tubes and other pieces.

Boxcar Loaders. Stephens - Adamson Mfg. Co., Aurora, Ill.—Bulletin 240—4-page folder describing the characteristics and applications of this company's boxcar loaders and pilers.

Chemicals. Commercial Solvents Corp., 17 E. 42nd St., New York, N. Y. A small leaflet describing the properties of four basic nitroparaffines now available for the first time on a commercial scale. Contains a table of physical properties.

Construction Materials. Artstone Rocor Corp., 45th St. and 1st Ave., Brooklyn, N. Y.—12-page booklet describing this company's complete line of stucco, plaster, mortar, flooring paint, waterproofing and specialty products.

Dust Control. Pangborn Corp., Hagerstown, Md.—4-page folder listing this company's customers and describing dust collector installations.

Fans. Truflo Fan Co., Harmony, Pa.—Bulletin No. 140—4-page folder describing five different types of this company's standard man-cooling fans. Contains engineering data and specifications.

Fans. Wagner Electric Corp., 6445 Plymouth Ave., St. Louis, Mo.—Supplement to Bulletin SU-22, Section B, describes the new Home Cooler fan, which is said to have industrial applications.

Filters. Denver Equipment Co., 1400-17th St., Denver, Colo.—8-page catalog describing this company's rotary vacuum filters with photographs, engineering drawings and tabulated data.

Fittings. Elastic Stop Nut Corp., 2332 Vauxhall Road, Union, N. J.—4-page folder describing this company's self-locking nuts, the principle of their operation and many places in which they are applicable. Illustrated with diagrams and photographs.

Fittings. Tube-Turns, Inc., 234 E. Broadway, Louisville, Ky.—A 64-page catalog and data book describing this company's new line of seamless steel welding tees and giving complete information on practically all types of welding fittings and forged steel flanges.

Grinding. Hardinge Co., York, Pa.—Bulletin No. 100—6-page folder describing company's main products. All are illustrated with cutaway views and diagrams showing the principles of operation.

Indicators. Electrical Facilities, Inc., 4224 Holden St., Oakland, Calif.—2-page leaflet describing the construction and application of the Knopp phase sequence indicator.

Instruments. The Bristol Co., Waterbury, Conn.—Several new bulletins are announced. No. 555 deals with portable recording voltmeters and ammeters. No. 524 is on industrial glass thermometers. A line of thermometer and pyrometer controllers for industrial furnaces is described in Bulletin 548, and a new bulletin on recording voltmeters and ammeters is No. 543.

Instruments. Burling Instrument Co., 241 Springfield Ave., Newark, N. J.—4-page leaflet describing this company's heat controllers for temperatures between −100 deg. F. and 1,400 deg. F. Contains engineering data.

Instruments. Cambridge Instrument Co., Inc., 3732 Grand Central Terminal, New York, N. Y.—Two 4-page folders, one describing the Cambridge Thermionic pH recorder, the other describing this company's electron ray pH meter.

Instruments. Herman H. Sticht Co., Inc., 27 Park Place, New York, N. Y.—Folder No. 700—Mailing folder illustrating this company's line of tachometers and speed indicators.

Instruments. Roller-Smith Co., 1766 W. Market St., Bethlehem, Pa.—Catalog 4120—8-page bulletin describing this company's line of 3 and 4 in. panel instruments (ammeters, voltmeters, wattmeters) with full engineering data.

Instruments. Wheelco Instrument Co., 1929 S. Halsted St., Chicago, Ill.—Bulletin S2-2. 16-page folder describing this company's complete line of thermocouples, thermocouple wire, lead wire, insulators, protective tubes, etc. Contains many engineering data and drawings. Also Bulletin No. G-2000-4 (4-page folder) describes recording and indicating controllers.

Insulation. The Okonite Co., Passaic, N. J.—32-page booklet on research showing by means of photographs and captions how a new rubber-like wire insulation is developed.

Lubrication. Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.—18-page story of lubrication, includes fundamentals, bearing designs, method of oil application, selection of lubricants, grease lubrication and diagnosing bearing troubles.

Metal Treating. Monsanto Chemical Co., Merrimac Div., Everett, Mass.—12-page bulletin describing this company's Ferrisul (anhydrous ferric sulphate) for etching of steels and pickling of stainless steels, copper and copper alloys.

Meter. York Oil Burner Co., Inc., York, Pa.—New 4-page folder describing this company's Iris shutter metering valve—a variable orifice for measuring or regulating the flow of fluids.

Metering. The Esterline-Angus Co., Inc., Indianapolis, Ind.—Bulletin No. 440—16-page article about this company's Telemetering system, describing the equipment, its principles of operation, mechanical details and applications.

Meters. Fischer & Porter Co., 110 West Penn St., Germantown, Philadelphia, Pa.—Catalog Section 10A—elaborate 12-page bulletin describing this company's Rotameter, its principles, design, construction and application. Process flow sheets and customer names are used to illustrate applications.

Meters. Photovolt Corp., 10 E. 40th St., New York, N. Y.—8-page report describing the operation, characteristics and applications of this company's Photrix small spot photometer.

Mineral Jigs. Denver Equipment Co., 1400-17th St., Denver, Colo.—Bulletin No. J2-B—16-page illustrated booklet containing flow sheets and other information relative to the application of jigs in various mineral recoveries.

Molybdenum Steel. Climax Molybdenum Co., 500 Fifth Ave., New York, N. Y.—4-page folder containing two articles, one on steels for locomotive boiler service and another on alloy valves for handling acids. Regular June 1940 issue of the Molymatrix.

Motors. Century Electric Co., St. Louis, Mo.—4-page folder describing this company's split phase motor. Features a cutaway illustration showing all parts.

Motors. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—Illustrated leaflet No. F-8551, describes this company's gasoline pump motors of the FR type.

Nickel. The International Nickel Co., Inc., 67 Wall St., New York, N. Y.—The June 1940 issue of this company's publication, **Nickel Steel Topics.** As in the case of previous issues, this 12-page booklet is written in a newsy interesting style, illustrated with photographs.

Plasticizers and Resins. Monsanto Chemical Co., Organic Chemicals Div., St. Louis, Mo.—Entirely revised edition of company's previous booklet on this subject. Contains 40 pages of information including graphs, tables of characteristics and specifications for this company's plasticizers.

Power Transmission. E. F. Houghton & Co., 3rd, American and Somerset Sts., Philadelphia, Pa.—One-page leaflet describing the advantages of this company's Okay Tred leather belting.

Power Transmission. Ideal Commutator Dresser Co., 1253 Park Ave., Sycamore, Ill.—Leaflet describing this company's variable speed transmission and motor base. Company also announces new leaflet on Instant Heat electric solderer and electrical products such as pliers, cutters, strippers, etc.

Power Transmission. Johnson Bronze Co., New Castle, Pa.—The first three in a series of data sheets dealing with Ledaloyl—a self-lubricating sintered bearing—have been issued by this company. They cover method of installation, operating temperature and chemical and physical characteristics.

Power Transmission. New Departure, Bristol, Conn.—A data sheet on this company's vertical tension pulley bearing, Type TP 13-500; contains drawings and data.

Power Transmission. Reeves Pulley Co., Columbus, Ind.—8-page folder describing how this company's speed control equipment has helped to eliminate "bottle necks" in industry.

Power Transmission. The Fafnir Bearing Co., New Britain, Conn. 44-page presentation in pictures and captions of the story of this company's ball bearing power transmission unit. Done in two colors, the booklet uses diagrams as well as installation views.

Proportioning Pumps. Milton Roy Pumps, 3160 Kensington Ave., Philadelphia, Pa.—The first three of a series of proportional feed diagrams being issued by this company is available, showing proportional feeding of sulphuric acid, of chemicals and of boiler water treating chemicals.

Pumps. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—A 4-page reprint (No. R-6108) has been issued by this company on the effect of water conditions on the selection of pump materials.

Pumps. D. W. Haering & Co., Inc., 2308 S. Winchester Ave., Chicago, Ill.—The June 1940 issue of the H-O-H Lighthouse contains an article describing the Nelson chemical pump.

Refrigerant. E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. 5th edition of this company's 92-page loose-leaf engineering book on methyl chloride. Contains information on chemical, physical, physiological and refrigerating properties of the chemical. Many tables, charts, photographs and engineering data are included. Booklet also describes briefly the manufacture of methyl chloride.

Refrigeration. Carrier Corp., Syracuse, N. Y.—Four 4-page folders describing this company's new line of V-type refrigeration condensing units. Drawings and data are included. Ask for Bulletins CR-139, 140, 138, and 148. Company also announces Bulletins 13E, describing a new line of electric bulk ice-makers.

Rotary Pumps. Fairbanks, Morse & Co., Chicago, Ill.—Bulletin No. 5135—12-page catalog with engineering data on this company's complete line of rotary pumps. Contains many illustrations and a list of the fields of service.

Rubber Goods. B. F. Goodrich Co., Akron, Ohio—24-page catalog of mechanical rubber goods manufactured by this company. Extensive engineering data, specifications, illustrations and other information are included.

Safety Clothing. Industrial Gloves Co., 900 Garnetd Blvd., Danville, Ill.—1940 Catalog of 18 pages on this company's Steel-Grip line of safety clothing, including more than 3,800 items such as gloves, mittens, finger-guards, hand-pads, welder's protective equipment, aprons, asbestos clothing, foot and leg guards and complete protective suits of various kinds.

Scales. Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill.—4-page leaflet describing a new full-capacity beam for motor truck scales recently developed by this company, with information on advantages and capacities.

Spray Equipment. The Eclipse Air Brush Co., 398 Park Ave., Newark, N. J.—Catalog 77—32 pages covering this company's line of spray equipment for manual and automatic operation; also section devoted to Pneumix air-motored agitators.

Stainless Steel. Electro-Metallurgical Co., 30 E. 42nd St., New York, N. Y.—July 1940 issue of the Electromet Review contains an article on stainless steel construction in a dairy plant. Four-page folder.

Stainless Steels. Jessop Steel Co., Washington, Pa.—Folder describing this company's stainless and heat-resisting alloys, with information on properties, corrosion and heat resistance of several types.

Stainless Steels. Republic Steel Corp. 3100 E. 45th St., Cleveland, Ohio. Four elaborate new bulletins on Enduro stainless steels have been announced. Form ADV 361 is a 28-page booklet of a general nature describing the properties and applications of Enduro in many fields of industry. Form ADV 362 is a 24-page booklet restricted to 18-stainless steels, their properties and applications. This book includes a table showing the corrosion resistance of three types of stainless in the presence of more than 200 corrosive chemicals. Form ADV 363 is a 24-page booklet restricted to straight chromium types of stainless steel. Form ADV 364 is a 16-page booklet describing heat resisting and high strength types of Enduro. All of these are elaborate bulletins giving full engineering information in a handy usable form. Tables, charts and graphs are used extensively as well as photographs.

Steel. Jos. T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill.—258-page 1940 stock list and steel buyer's guide devoted to new products, new analyses, new sizes, a complete listing of all this company's Certified Steel products, and numerous valuable data tables.

Stoppers. R. W. Rhoades Metaline Co., Rhoades Bldg., Long Island City, N. Y.—Leaflet describing neoprene and rubber stoppers for numerous laboratory uses.

Sugar Refining. Darco Corp., 60 East 42d St., New York, N. Y.—14-page bulletin on the refining of cane sugar with this company's activated carbon, describing the carbon and the process in which it is employed (with large flow sheet), and giving information on accomplishments of such refining. A cost analysis is included.

Transformers. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—Two new pieces of literature, a four-page leaflet and a 16-page bulletin (No. B-6096) describe this company's distribution transformers. The latter is done in two colors, is well illustrated in picture and diagram, and contains engineering information.

Tubing. Irvington Varnish & Insulator Co., 34 Argyle Place, Irvington, N. J.—Bulletin describing Irv-O-Lite, a new low-cost extruded tubing.

Valves. Crane Co., 836 South Michigan Ave., Chicago, Ill.—Catalog 40-S—306-page catalog on steel valves and fittings and kindred steel specialties and accessories, with engineering data on high-pressure and temperature piping problems. This new catalog complements the company's general catalog No. 52.

Valves. Julien P. Friez & Sons, Division of Bendix Aviation Corp., Balti-

more, Md.—Leaflet describing a new line of single-port magnetic gas valves, made in sizes from ⅛ to ¼ in. for controlling furnaces, gas humidifiers, diaphragm valves, etc.

Valves. Homestead Valve Mfg. Co., Coraopolis, Pa.—Bulletin 25140—4-page leaflet describing briefly various types of valves made by this company, including several special types.

Valves. Homestead Valve Mfg. Co., Inc., Coraopolis, Pa.—Small folder describing in diagram and picture the construction and applications of Homestead-Ross air shut-off valve.

Valves. Merco-Nordstrom Valve Co., 400 N. Lexington Ave., Pittsburgh, Pa.—A new 48-page condensed price list, Bulletin B-109, covering all types and sizes of Nordstrom valves.

Valves. Philadelphia Gear Works, Philadelphia, Pa.—66-page catalog on Limitorque automatic valve controls, giving information on controls for operating valves from 3 to 96 in. in diameter.

Water Treatment. Cochrane Corp., 17th St. and Allegheny Ave., Philadelphia, Pa.—Publication 2975—4-page leaflet on this company's decarbonator for the removal of gases such as carbon dioxide and hydrogen sulphide in the preparation of boiler feedwater. An important application is said to be in removing carbon dioxide from acid-treated-zeolite softened water.

Water Treatment. Wallace & Tiernan Co., Newark, N. J.—Technical Publication No. 207—19-page bulletin on taste and odor control with "break-point" chlorination, employing a much higher degree of chlorination than customary, for breaking down taste-producing organic matter and leaving residual chlorine at a minimum.

Welding. Air Reduction Sales Co., 60 E. 42nd St., New York, N. Y.—Catalog No. 103—32-page illustrated engineering catalog describing the properties and applications of this company's electrodes and welding accessories.

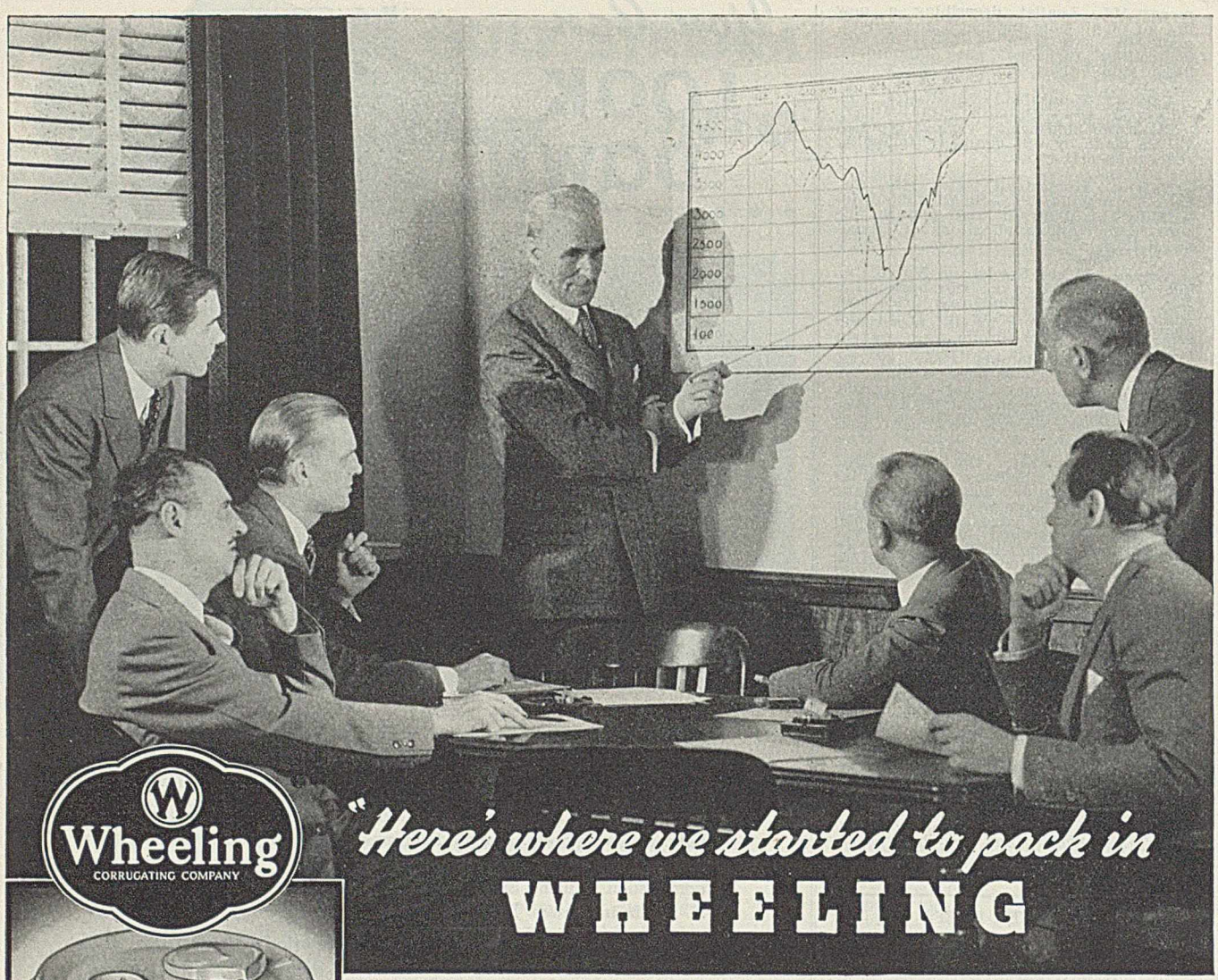
EQUIPMENT BRIEFS

(*Continued from page 492*)

when higher pressures are above the valve seat. The new construction eliminates this possibility through incorporation of a pressure equalizing channel which becomes operative at the instant of opening and is claimed to assure positive operation.

FOR SMALL PRODUCTION and laboratory work, the Mixing Equipment Co., Rochester, N. Y., announces the Type F laboratory mixer, which features an adjustable speed friction drive for propeller speeds up to 1,750 r.p.m. A totally inclosed motor is used, said to be safe where flammable materials are present. Viscosities up to 300 centipoises may be agitated according to the manufacturer, without overloading the motor. Batches up to 5 gal. of thin liquids or 2 gal. of medium thick liquids can be handled.

TO MEET safety requirements in stair treads, the Eastern Malleable Iron Co., Wilmington, Del., has announced treads made of Hy-Tenso X, a new non-slip abrasive safety metal, claimed to have a load-bearing strength equal or superior to cast or fabricated steel, yet to possess corrosion resistant qualities superior to cast iron. Non-slip abrasive grains are thoroughly impregnated in the surface and over the nose of the tread.



Steel CONTAINERS"

• Sales react quickly when the trade learns that your product includes the last word in safe, convenient packaging. Wheeling Steel Containers—available in 1- to 70-gallon capacities—will give your product the ultimate in utility, accessibility, and security. Among our many items, we are sure to have the right container, with the right closure—and at the right price. Tell us what you pack, and we'll gladly submit samples.

WHEELING
CORRUGATING COMPANY

General Offices: WHEELING, WEST VIRGINIA

OFFICE AND WAREHOUSES IN PRINCIPAL CITIES

CHEMICAL CONSUMPTION FOR FIRST SIX MONTHS GAINED 19 PER CENT OVER 1939 PERIOD

Chem & Met ECONOMICS and MARKETS

A RATHER sharp advance in the rate of activities at different manufacturing plants in the last two months resulted in a larger movement of chemicals into finished products and June rounded out a six-month period in which domestic consumption of chemicals was approximately 19 per cent above that reported for the corresponding half of last year. The preliminary index for consumption of chemicals is 143 for June as against 116.35 for June 1939. The revised index for May is 139.67 and for May 1939, 116.49.

Operations at iron and steel plants, at pulp and paper mills, and at oil refineries figured prominently in moving the index upward in June. A fairly constant rate has been maintained at rayon plants in recent months and the textile industry has shown a spotty condition with fairly large consumption of cotton and rayon and a steadily declining use of silk. Woolen mills which previously had been working under the 1939 rate became more active in June.

Chem. & Met. Index for Consumption of Chemicals

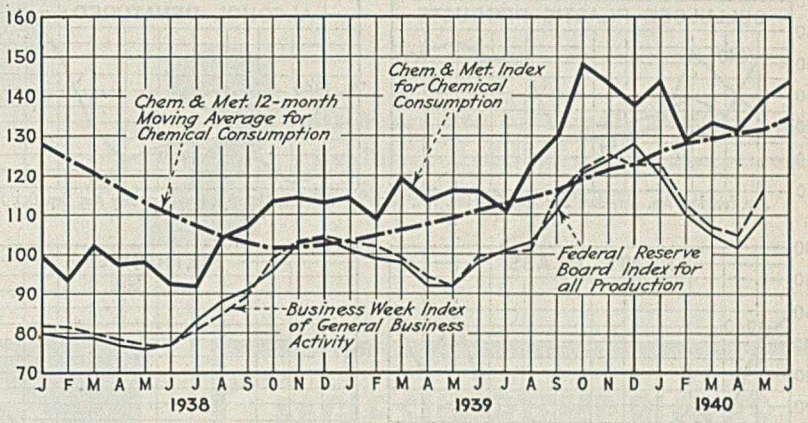
	April revised	May
Fertilizer	26.83	27.27
Pulp and paper	19.10	19.60
Glass	12.54	12.76
Petroleum refining	13.82	14.50
Paint and varnish	12.22	14.11
Iron and steel	7.83	9.28
Rayon	11.34	11.41
Textiles	7.81	7.92
Coal products	8.14	8.61
Leather	3.59	3.51
Explosives	4.55	5.03
Rubber	2.96	3.03
Plastics	2.56	2.64
	133.29	139.67

The upward revision of the index number for May came largely from the marking up of earlier estimates of pulp and paper production and from counter-seasonal increases in fertilizer manufacture. Superphosphate production in May is reported at 356,543 tons while the April output was only 351,776 tons.

There are indications that manufacturing operations will suffer little, if any, let-down throughout the hot-weather period, although July started off with a tendency to cut down the amount of oil refined and rayon mills were closed for the opening week. Placing of specified chemicals on the list where export licenses will be required should have but little effect on export business as these selections do not figure heavily in our export statistics and it may happen that licenses will be granted for shipment to countries which have been the largest buyer of them. The war situation in Europe and our armament program are two factors which will have an important bearing upon industrial activity. Neither of these factors can be definitely appraised at present but it is assured that the armament program, irrespective of total appropriations and their allocations, will place a tax upon domestic production and consumption of chemicals. In the first place many chemicals will be in greater demand because they are basic in wartime preparations and secondly, many finished products will be required in large volume and chemicals are necessary raw materials for their manufacture.

Freight carloadings for the third quarter of this year are placed at 9 per cent above the actual loadings of the corresponding period of last year in the estimates which have been compiled by the 13 shipper's advisory boards. According to the estimate 23 of the commodities will move in larger volume than in 1939 with declines expected for six. Percentage gains for some of the individual groups are as follows: chemicals and explosives, 7; iron and steel, 28.8; automobiles, trucks, and parts, 24.5; paper, paperboard, and prepared roofing, 15.7; and lime and plaster, 9.7.

While no break-down according to materials involved, is available, it is probable that the movement of chemical products is affected by the increasing tonnage delivered in trucks. All freight transported by trucks in May showed a tonnage increase of 5.3 per cent over the total for the preceding month and was the highest for any month so far this year.

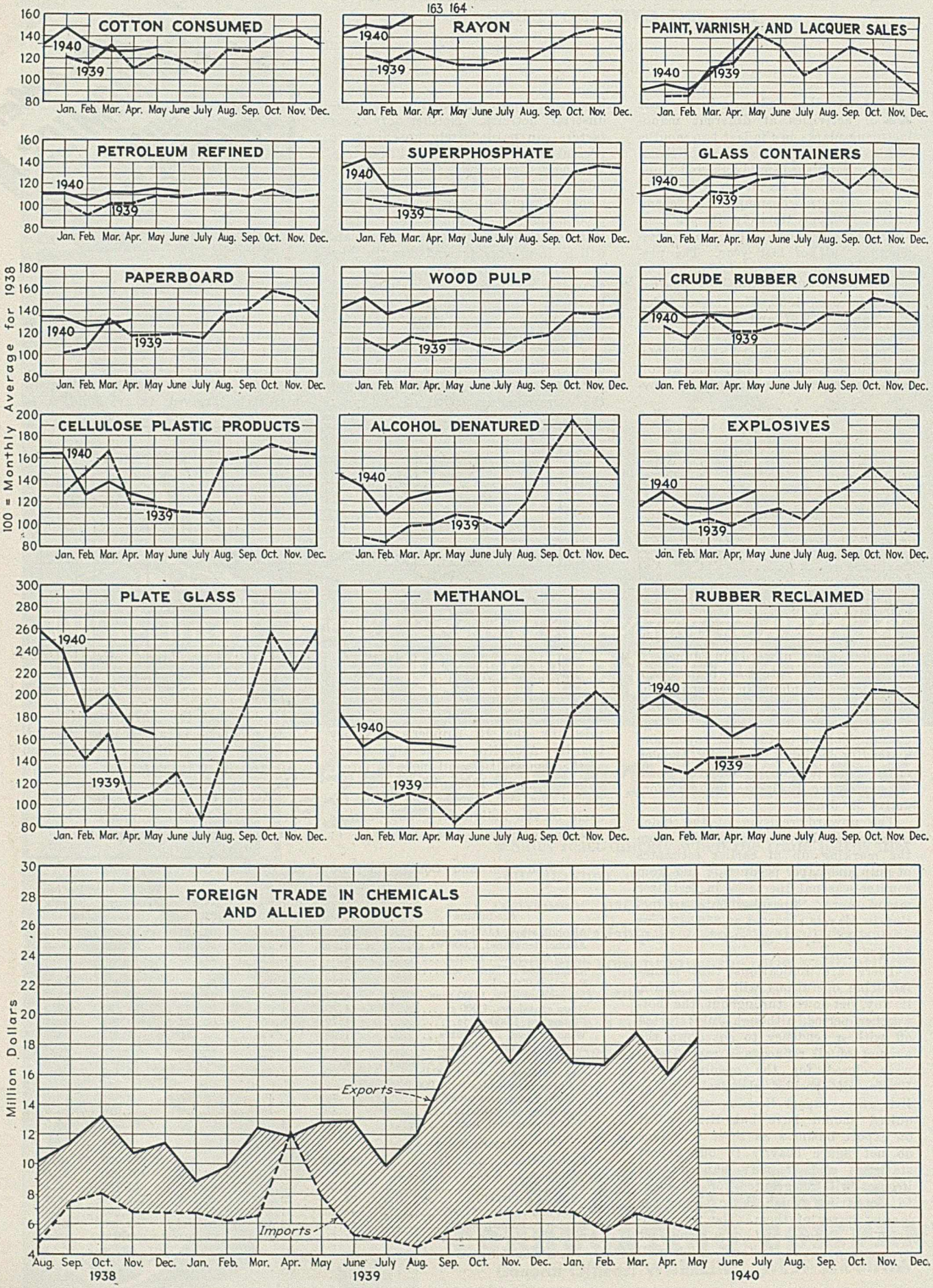


Production and Consumption Data for Chemical-Consuming Industries

	May 1940	May 1939	Jan-May 1940	Jan-May 1939	Per cent of gain for 1940
Production					
Alcohol, ethyl, 1,000 pr. gal.	20,953	18,655	103,191	85,667	20.5
Alcohol denatured, 1,000 wi. gal.	10,037	8,490	48,413	37,098	30.5
Ammonia, liquor, 1,000 lb.	4,417	3,022	22,589	18,126	24.6
Ammonium sulphate, tons	57,697	33,065	282,193	206,905	36.4
Benzol, 1,000 gal.	10,375	5,456	51,034	35,261	44.7
By-product coke, 1,000 tons	4,244	2,396	21,077	15,194	38.7
Glass containers, 1,000 gr.	4,701	4,516	22,277	19,683	13.2
Plate glass, 1,000 sq. ft.	11,721	8,036	68,822	49,469	39.1
Window glass, 1,000 boxes	1,068	729	5,710	4,133	38.1
Methanol, crude, 1,000 gal.	437	354	2,290	1,796	27.5
Methanol, synthetic, 1,000 gal.	3,409	1,779	17,593	11,192	57.2
Nitrocellulose plastic, 1,000 lb.	800	1,036	4,997	5,440	8.1*
Celluloseacetate plastics, 1,000 lb.					
Sheets, rods, and tubes	702	491	3,305	3,961	16.6*
Molding compound	893	782	5,097	4,078	25.0
Rubber reclaimed, tons	17,552	14,070	91,893	67,335	36.5
Consumption					
Cotton bales	636,467	606,090	3,279,493	2,959,929	10.8
Silk, bales	18,997	26,150	114,413	165,850	31.0*
Wool, 1,000 lb	23,589	26,096	142,505	151,738	6.1*
Explosives, 1,000 lb	34,475	29,315	162,593	139,306	16.7
Paint and varnish, $1,000	43,463	41,854	167,916	159,307	5.4
Rubber reclaimed, tons	15,719	12,584	84,192	63,173	33.3
Rubber crude, tons	51,619	45,484	256,724	232,977	10.2

* Per cent of decline.

Production and Consumption Trends



"This Dark Mineral Wool* gives EAGLE Insulating Materials extraordinary efficiency!"

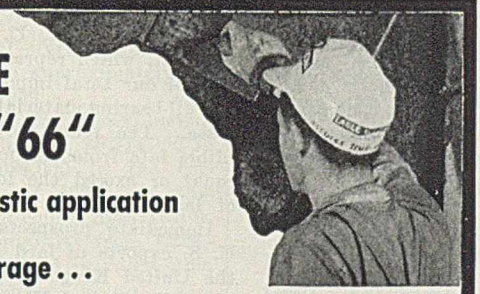
*Pioneered by Eagle-Picher . . . the natural color is a distinctive dark gray.

1 **It is chemically inert.** Moisture does not cause this distinctively dark gray mineral wool to deteriorate — an important feature in maintaining stability.

2 **Its fibers are extremely resilient and flexible.** Full efficiency is retained because dead air cells do not crush together.

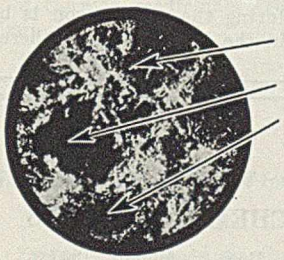
EAGLE super "66"

. . . for plastic application



High Coverage . . .
Minimum Shrinkage

Because it is made from Eagle-Picher's remarkable dark gray mineral wool, Eagle Super "66" is effective for temperatures as high as 1800° F. Dry coverage—50-55 sq. ft. 1-inch thick per 100 lbs. Extremely adhesive. Easy to apply in any thickness.



EAGLE SUPERTEMP BLOCKS

Easy to cut as a loaf of bread

Engineers are hailing Supertemp Blocks—fabricated of dark gray mineral wool—as a great improvement. Effective for temperatures as high as 1700° F. Exceptionally clean and easy to handle. Applied with maximum speed.

See Sweet's Catalog for specifications of extensive line of Eagle Insulating Materials — all types — including Insulseal (waterproofing cement) and Insul-Stic.

EAGLE PICHER

EAGLE INDUSTRIAL INSULATION

THE EAGLE-PICHER LEAD COMPANY
CINCINNATI, OHIO

PRICE CHANGES FOR CHEMICALS WERE MORE NUMEROUS IN THE LAST MONTH

WHILE price schedules for the majority of chemicals have been extended to cover delivery over the third quarter, quotations for a number of products were revised in a two-way movement. As had been previously announced a fractional advance for carbon black went into effect for July forward shipments. White arsenic, which had held an unchanged price position for years, was marked up about the middle of June. Toluol has been in a strong position for several months and higher prices have been named for third quarter deliveries. Other chemicals which have been advanced in price include: tartaric acid, cream of tartar, ethyl alcohol, because of the increase in the withdrawal tax, and mercury and mercurials. In contrast, lower prices became effective for benzol, xylol, barium carbonate, and rosins. The new change was represented by a slight advance in the weighted index number for chemical prices. In any consideration of prices, however, it must be noted that whereas the values named for contract deliveries are observed, many selections are in a sold-up position and trading in the spot market is restricted because of that fact and also sales are made at prices considerably above the openly quoted levels.

With expansion reported for many of the large consuming industries, demand for chemicals has been more active but this has been largely taken care of by shipments against contracts. Inquiry in the spot market seems to center more in the materials which are in limited supply. There is considerable interest in the chemicals which will be affected by the defense program but it is probable that such supplies will fit in with a procurement program in such a way as not to disturb the market or interfere with regular deliveries to industry.

Among recent announcements regarding new production of chemicals are: a new plant under construction for the Eastern Gas and Fuel Associates at Everett, Mass., to produce ammonium thiocyanate; the American Cyanamid & Chemical Corp. is operating a new plant at Warners, N. J. for the manufacture of sodium and potassium ferricyanides; the General Chemical Co. has added potassium cyanide to its list of products; and E. I. duPont de Nemours & Co. is now offering polyvinyl acetates and polyvinyl resins.

The annual report on naval stores issued by the Department of Agriculture shows that for the fiscal year ended March 31, domestic consumption of turpentine was 476,888 50-gal. bbl., of which 314,304 bbl. consisted of gum turpentine and 162,584 bbl. of the wood product. This compares with 277,501 bbl. and 142,513 bbl. respectively for the preceding fiscal year. Domestic consumption of rosin for the 1939-1940 period was 1,373,063 500-lb. bbl., divided 720,823 bbl. gum, and 652,240 bbl. wood, as against 700,520 bbl. gum and 468,207 bbl. wood for the preceding year. These figures indicate that wood turpentine is holding its relative position while wood rosin is commanding a larger part of the domestic consuming market. Incidentally, exports of gum turpentine and rosin so far this year are under the totals for the corresponding period of last year while both wood turpentine and rosin have registered gains in the export field.

The monthly report of the Bureau of the Census prepared in cooperation with the National Association of Credit Men places manufacturers sales of paint and varnish at 20.3 per cent over those for the preceding month and at 3.7 per cent over those for May 1939. Other chemical products are reported at down 1.5 per cent from April but up 11 per cent over May 1939. It is also announced that these reports are not regarded as sufficiently representative and they will be discontinued.

United States imports of certain vegetable oils from the Netherlands, on the other hand, have been cut off, as well as fish-liver oils from countries bordering the North Sea. With the extension of war to Southern Europe and North Africa, U. S. imports of olive oil, which represent about 5 per cent of our total imports of fats, oils, and oil-bearing materials, may virtually cease. The reduction in imports of edible fats from Europe probably will equal or exceed the losses in exports of lard, soybeans, and other fats.

Immediate prospects for expanding U. S. exports of lard and soybeans to the United Kingdom are not promising. The United Kingdom is reported as having large stocks of vegetable oils and whale oil on hand, and Norwegian whale oil produced in the Antarctic during the past season is being stored in the Western Hemisphere for

CHEM & MET.

Weighted Index of

CHEMICAL PRICES

Base = 100 for 1937

This month	98.60
Last month	98.57
July, 1939	97.02
July, 1938	99.91

Deliveries of most chemicals are going forward at unchanged prices for the third quarter. There were several revisions during the month, however, but advances were largely offset by declines with no decided trend although the undertone appears stronger.

future British needs. If the war is prolonged, however, it is possible that British requirements for American fats would become more pronounced, particularly if the oilseed crushing activity on the east coast of England is reduced by war activities and if the Mediterranean route remains closed to British shipping.

Foreign demand for chemicals and related products continued very active in May and resulted in exports reaching the highest value recorded during the current year, according to figures of the Department of Commerce. While demand was very wide, with practically every country of the world except certain of the warring nations participating, shipments to countries of North and South America were especially heavy. Total exports of chemicals and related products were valued at $22,000,000 compared with $19,350,000 in April and $14,660,000 in May 1939.

Exports of chemicals and related products during the nine months following the outbreak of hostilities in Europe, from September 1939 to May 1940, were valued at $189,350,000 compared with $124,000,000 in the corresponding months of 1938-39, a gain of 50 per cent, indicating that exports of such products during the current year may reach a quarter of a billion dollars.

Practically every item entering into the chemical and related product export list was in keen demand in May, particularly coal-tar dyes, medicinals, chemical specialties, industrial chemicals and sulphur of all kinds. Exports of fertilizers continued to lag and shipments of naval stores, paints and paint material were approximately the same as in May 1939.

Exports of coal-tar products, including dyes, were valued at $3,318,000 in May against $1,088,000 in the corresponding month of 1939. In this group, shipments of colors, dyes, stains, etc., increased in quantity from 1,224,000 to 2,338,400 lb. and in value from $470,000 to $1,315,500.

Medicinals and pharmaceuticals continued in active demand, particularly from countries of Latin America where stocks of German medicinals are said to be running low.

CHEM & MET.

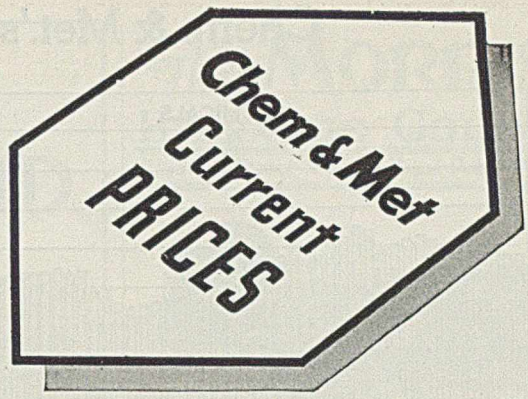
Weighted Index of Prices for

OILS & FATS

Base = 100 for 1937

This month	**72.37**
Last month	73.36
July, 1939	70.33
July, 1938	76.11

Tallow and some of the oils sold at higher prices toward the close but earlier reductions in price were not fully made up and the weighted index number continued to decline. The position of china wood oil has become more complicated with shipments uncertain.



INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.07½–$0.08	$0.07½–$0.08	$0.05½–$0.06¼
Acid, acetic, 28%, bbl., cwt	2.23 – 2.48	2.23 – 2.48	2.23 – 2.48
Glacial 99%, drums	8.43 – 8.68	8.43 – 8.68	8.43 – 8.68
U. S. P. reagent	10.25 –10.50	10.25 –10.50	10.25 –10.50
Boric, bbl., ton	106.00–111.00	106.00–111.00	106.00–111.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys., lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb	.90 – 1.00	.90 – 1.00	.70 – .75
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.07 – .07½
Lactic, 44%, tech., light, bbl., lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Muriatic, 18°, tanks, cwt	1.05 –.....	1.05 –.....	1.05 –.....
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –.....	18.50 –20.00
Oxalic, crystals, bbl., lb	.10¾– .12	.10¾– .12	.10¾– .12
Phosphoric, tech., c'bys., lb	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –.....	13.00 –.....	13.00 –.....
Sulphuric, 66°, tanks, ton	16.50 –.....	16.50 –.....	16.50 –.....
Tannic, tech., bbl., lb	.54 – .56	.54 – .56	.40 – .45
Tartaric, powd., bbl., lb	.39¼–.....	.37½–.....	.27½–.....
Tungstic, bbl., lb	nom.	nom.	2.35 –.....
Alcohol, amyl	.....–.....	.....–.....	.....–.....
From Pentane, tanks, lb	.101–.....	.101–.....	.101–.....
Alcohol, Butyl, tanks, lb	.09 –.....	.09 –.....	.07 –.....
Alcohol, Ethyl, 190 p'f., bbl., gal.	5.98 –.....	4.54 –.....	4.54 –.....
Denatured, 190 proof	.....–.....	.....–.....	.....–.....
No. 1 special, bbl., gal. wks.	.29½–.....	.29½–.....	.26½–.....
Alum, ammonia, lump, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Potash, lump, bbl., lb	.03¾– .04	.03¾– .04	.03¾– .04
Aluminum sulphate, com. bags, cwt	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt	1.60 – 1.70	1.60 – 1.70	1.30 – 1.55
Aqua ammonia, 26°, drums, lb	.02½– .03	.02½– .03	.02 – .03
tanks, lb	.02 – .02¾	.02 – .02¾	.02 – .02¾
Ammonia, anhydrous, cyl., lb	.16 –.....	.16 –.....	.15½– .16
tanks, lb	.04½–.....	.04½–.....	.04½–.....
Ammonium carbonate, powd. tech., casks, lb	.09 – .12	.09 – .12	.08 – .12
Sulphate, wks., cwt	1.40 –.....	1.40 –.....	1.40 –.....
Amylacetate tech., from pentane, tanks, lb	.11½–.....	.11½–.....	.10½– .10½
Antimony Oxide, bbl., lb	.13 –.....	.12 –.....	.10 –.....
Arsenic, white, powd., bbl., lb	.03½– .03½	.03 – .03½	.03 – .03½
Red, powd., kegs, lb	.17 – .18	.17 – .18	.15½– .16
Barium carbonate, bbl., ton	52.50 –57.50	52.50 –57.50	52.50 –57.50
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb	.08½– .10	.09 – .10	.07 – .08
Blanc fixe, dry, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f. o. b., wks., drums, cwt	2.00 – 2.10	2.00 – 2.10	2.00 – 2.10
Borax, gran., bags, ton	43.00 –.....	43.00 –.....	48.00 –51.00
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	1.90 –.....	1.90 –.....	1.65 –.....
Arsenate, dr., lb	.06½– .06¾	.06½– .06¾	.06¾– .07
Carbide drums, lb	.04½– .05	.04½– .05	.05 – .06
Chloride, fused, dr., del., ton	19.00 –24.50	21.50 –24.50	21.50 –24.50
flake, dr., del., ton	20.50 –25.00	23.00 –25.00	23.00 –25.00
Phosphate, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05 – .06	.05 – .06	.05 – .06
Tetrachloride drums, lb	.04½– .05½	.04½– .05½	.04½– .05½
Chlorine, liquid, tanks, wks., lb	1.75 –.....	1.75 –.....	1.75 –.....
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb	1.84 – 1.87	1.84 – 1.87	1.67 – 1.70
Copperas, bgs., f. o. b., wks., ton	18.00 –19.00	17.00 –18.00	15.00 –16.00
Copper carbonate, bbl., lb	.10 – .16½	.10 – .16½	.10 – .16
Sulphate, bbl., cwt	4.60 – 4.85	4.60 – 4.85	4.25 – 4.50
Cream of tartar, bbl., lb	.34½–.....	.32½–.....	.22 –.....
Diethylene glycol, dr., lb	.22 – .23	.22 – .23	.22 – .23
Epsom salt, dom., tech., bbl., cwt.	1.80 – 2.00	1.80 – 2.00	1.80 – 2.00
Ethyl acetate, drums, lb	.07 –.....	.07 –.....	.061–.....
Formaldehyde, 40%, bbl., lb	.05½– .06	.05½– .06½	.05½– .06½
Furfural, tanks, lb	.09 –.....	.09 –.....	.09 –.....
Fusel oil, ref. drums, lb	.16 – .17	.16 – .17	.12½– .14
Glaubers salt, bags, cwt	.95 – 1.00	.95 – 1.00	.95 – 1.00
Glycerine, c.p., drums, extra, lb	.12½–.....	.12½–.....	.12½–.....
Lead:			
White, basic carbonate, dry casks, lb	.07 –.....	.07 –.....	.07 –.....
White, basic sulphate, sck., lb	.06½–.....	.06½–.....	.06½–.....
Red, dry, sck., lb	.07½–.....	.07½–.....	.0735–.....
Lead acetate, white crys., bbl., lb	.11 – .12	.11 – .12	.10 – .11
Lead arsenate, powd., bag, lb	.08½– .11	.08½– .11	.10 – .10½
Lime, chem., bulk, ton	8.50 –.....	8.50–.....	8.50 –.....
Litharge, pwd., csk., lb	.06½–.....	.06½	.06½–.....
Lithophone, bags, lb	.036– .04	.036– .04	.04 – .04½
Magnesium carb., tech., bags, lb	.06¼– .06½	.06¼– .06½	.06 – .06¼

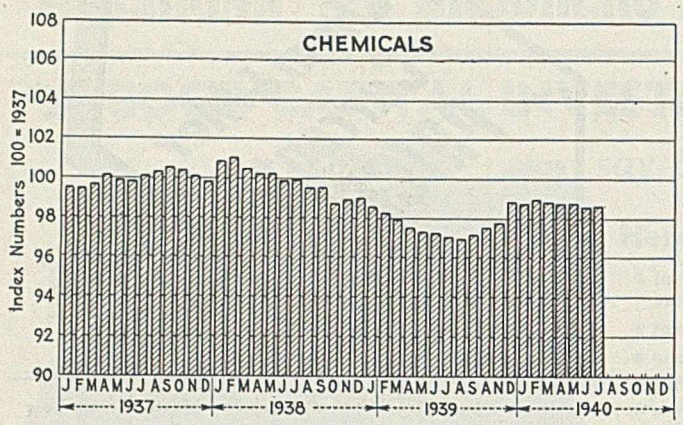
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to July 11

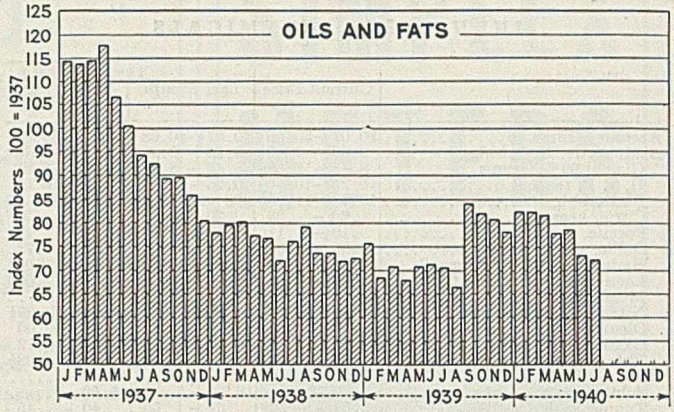
	Current Price	Last Month	Last Year
Methanol, 95%, tanks, gal	.29 –.....	.29 –.....	.31 –.....
97%, tanks, gal	.30 –.....	.30 –.....	.32 –.....
Synthetic, tanks, gal	.30 –.....	.30 –.....	.33 –.....
Nickel salt, double, bbl., lb	.13 – .13½	.13 – .13½	.13 – .13½
Orange mineral, csk., lb	.10½–.....	.10½–.....	.10½–.....
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb	.08¼– .09	.08¼– .09	.08¼– .09
Carbonate, 80–85%, calc. csk., lb	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	.09½–.....
Hydroxide(c'stic potash) dr., lb.	.07 – .07¼	.07 – .07¼	.07 – .07¼
Muriate, 80% bgs., unit	.53½–.....	.53½–.....	.53½–.....
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb	.18½– .19	.18½– .19	.18½– .19
Prussiate, yellow, casks, lb	.15 – .16	.15 – .16	.14 – .15
Sal ammoniac, white, casks, lb	.05 – .06	.05 – .06	.05 – .05½
Salsoda, bbl., cwt	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	23.00 –.....	23.00 –.....	13.00 –15.00
Soda ash, light, 58%, bags, contract, cwt	1.05 –.....	1.05 –.....	1.05 –.....
Dense, bags, cwt	1.10 –.....	1.10 –.....	1.10 –.....
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, works, bbl., lb	.04 – .05	.04 – .05	.04 – .05
Bicarbonate, bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.06½– .07	.06½– .07	.06½– .07
Bisulphate, bulk, ton	16.00 –17.00	15.00 –16.00	15.00 –16.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03½– .04
Chlorate, kegs, lb	.06½– .06½	.06½– .06½	.06½– .06½
Cyanide, cases, dom., lb	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.07 – .08	.07 – .08	.07½– .08
Hyposulphite, bbl., cwt	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	2.35 – 2.40	2.35 – 2.40	2.20 – 3.20
Nitrate, bulk, cwt	1.45 –.....	1.45 –.....	1.45 –.....
Nitrite, casks, lb	.06½– .07	.06½– .07	.06½– .07
Phosphate, tribasic, bags, lb	2.25 –.....	2.25 –.....	2.10 –.....
Prussiate, yel. drums, lb	.10½– .11	.10½– .11	.09½– .10
Silicate (40° dr.) wks., cwt	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr., lb.	.02½– .03½	.02½– .03	.02½– .03
Sulphite, crys., bbl., lb	.02½– .02½	.02½– .02½	.02½– .02½
Sulphur, crude at mine, bulk, ton	16.00 –.....	16.00 –.....	18.00 –.....
Chloride, dr., lb	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb	.07 – .08	.07 – .08	.07 – .07½
Flour, bag, cwt	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb	.51 –.....	.51 –.....	.52 –.....
Crystals, bbl., lb	.39½–.....	.41½–.....	.38 –.....
Zinc, chloride, gran., bbl., lb	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl, lb	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb	.08½–.....	.07½–.....	.06½–.....
Zinc oxide, lead free, bag., lb	.06½–.....	.06½–.....	.06½–.....
5% lead sulphate, bags, lb	.06½–.....	.06½–.....	.06½–.....
Sulphate, bbl., cwt	3.05 – 3.25	2.75 – 3.00	2.75 – 3.00

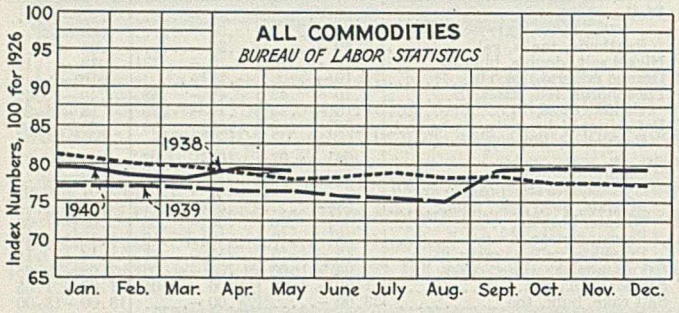
OILS AND FATS

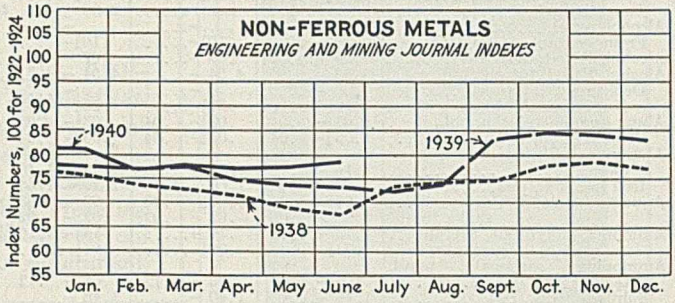
	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb	$0.11½–$0.12	$0.11½–$0.12	$0.08½–$0.10
Chinawood oil, bbl., lb	.25 –.....	.24 –.....	.22 –.....
Coconut oil, Ceylon, tank, N. Y., lb	.03½–.....	.03 –.....	.03 –.....
Corn oil crude, tanks (f. o. b. mill), lb	.05½–.....	.05½–.....	.05½–.....
Cottonseed oil, crude (f. o. b. mill), tanks, lb	.05¾–.....	.05½–.....	.05½–.....
Linseed oil, raw car lots, bbl., lb	.094–.....	.10 –.....	.091–.....
Palm, casks, lb	.04–¾.....	.04¼–.....	.03¾–.....
Peanut oil, crude, tanks (mill), lb.	.05½–.....	.05½–.....	.05½–.....
Rapeseed oil, refined, bbl., gal	1.05 –.....	1.05 –.....	.80 –.....
Soya bean, tank, lb	.04¾–.....	.04¾–.....	.04¼–.....
Sulphur (olive foots), bbl., lb	.09 –.....	.08½–.....	.06½–.....
Cod, Newfoundland, bbl., gal	nom.	nom.	.32 –.....
Menhaden, light pressed, bbl., lb.	.071–.....	.073–.....	.064–.....
Crude, tanks (f. o. b. factory), gal	.33 –.....	.33 –.....	.26 –.....
Grease, yellow, loose, lb	.04 –.....	.03¾–.....	.04¼–.....
Oleo stearine, lb	.06 –.....	.05½–.....	.06 –.....
Oleo oil, No. 1	.06½–.....	.06½–.....	.06¾–.....
Red oil, distilled, d.p. bbl., lb	.06½–.....	.08 –.....	.07½–.....
Tallow extra, loose, lb	.04½–.....	.04½–.....	.04½–.....

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52 –$0.55	$0.52 –$0.55	$0.52 –$0.55
Alpha-naphthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.15 – .16	.15 – .16	.15 – .16
Aniline, salts, bbl., lb.	.22 – .24	.22 – .24	.22 – .24
Benzaldehyde, U.S.P., dr., lb.	.85 – .95	.85 – .95	.85 – .95
Benzidine base, bbl., lb.	.70 – .75	.70 – .75	.70 – .75
Benzoic acid, U.S.P., kgs., lb.	.54 – .56	.54 – .56	.54 – .56
Benzyl chloride, tech., dr., lb.	.23 – .25	.23 – .25	.23 – .25
Benzol, 90%, tanks, works, gal.	.15 –.....	.16 – .18	.16 – .18
Beta-napthol, tech., drums, lb.	.23 – .24	.23 – .24	.23 – .24
Cresol, U.S.P., dr., lb.	.09½– .10	.09½– .10	.10 – .11
Cresylic acid, dr., wks., gal.	.58 – .60	.58 – .60	.69 – .71
Diethylaniline, dr., lb.	.40 – .45	.40 – .45	.40 – .45
Dinitrophenol, bbl., lb.	.23 – .25	.23 – .25	.23 – .25
Dinitrotoluenol, bbl., lb.	.15½– .16	.15½– .16	.15 – .16
Dip oil, 15%, dr., gal.	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, bbl., lb.	.25 – .27	.32 – .36	.32 – .36
H-acid, bbl., lb.	.45 – .50	.45 – .55	.50 – .55
Naphthalene, flake, bbl., lb.	.07 – .07½	.06½– .07	.05½– .06
Nitrobenzene, dr., lb.	.08 – .09	.08 – .09	.08 – .09
Para-nitraniline, bbl., lb.	.47 – .49	.47 – .49	.47 – .49
Phenol, U.S.P., drums lb.	.13 –.....	.13 –.....	.14½–.....
Picric acid, bbl., lb.	.35 – .40	.35 – .40	.35 – .40
Pyridine, dr., gal.	1.70 – 1.80	1.70 – 1.80	1.55 – 1.60
Resorcinol, tech., kegs, lb.	.75 – .80	.75 – .80	.75 – .80
Salicylic acid, tech., bbl., lb.	.33 – .40	.33 – .40	.33 – .40
Solvent naptha, w.w., tanks, gal.	.27 –.....	.27 –.....	.26 –.....
Tolidine, bbl., lb.	.86 – .88	.86 – .88	.86 – .88
Toluene, drums, works, gal.	.30 –.....	.30 –.....	.27 –.....
Xylene, com, tanks, gal.	.26 –.....	.27 –.....	.26 –.....

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech., bbl., lb.	.12 – .13	.13 – .14	.08 – .11
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors			
Carbon gas, black (wks.), lb.	.028– .30	.028– .30	.02½– .30
Prussian blue, bbl., lb.	.36 – .37	.36 – .37	.36 – .37
Ultramarine blue, bbl., lb.	.11 – .26	.11 – .26	.10 – .26
Chrome green, bbl., lb.	.21½– .30	.028– .30	.21 – .27
Carmine red, tins, lb.	4.85 – 5.00	4.85 – 5.00	4.00 – 4.40
Para toner, lb.	.75 – .80	.75 – .80	.75 – .80
Vermilion, English, bbl., lb.	nom.....	nom.....	1.57 – 1.58
Chrome yellow, C.P., bbl., lb.	.14½– .15½	.14½– .15½	.14½– .15½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.06 – .06½	.06 – .06½	.06 – .06½
Gum copal Congo, bags, lb.	.08 – .30	.08 – .30	.06 – .30
Manila, bags, lb.	.09 – .15	.09 – .14	.09 – .14
Damar, Batavia, cases, lb.	.10 – .22	.10 – .20	.08 – .24
Kauri, cases, lb	.18 – .60	.18 – .60	.18½– .60
Kieselguhr (f.o.b. N.Y.), ton.	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc, ton.	50.00 –.....	50.00 –.....	50.00 –.....
Pumice stone, lump, bbl., lb.	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb.	.03 – .04	.03 – .04	.03 – .04
Rosin, H., bbl.	4.65 –.....	5.50 –.....	6.35 –.....
Turpentine, gal.	.32½–.....	.32 –.....	.30 –.....
Shellac, orange, fine, bags, lb.	.26 –.....	.27 –.....	.19 –.....
Bleached, bonedry, bags, lb.	.25 –.....	.25 –.....	.18 –.....
T. N. Bags, lb.	.14 –.....	.13½–.....	.10 –.....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
300 mesh (f.o.b. Ga.), ton.	7.50 –10.00	7.50 –10.00	7.50 –11.00
225 mesh (f.o.b. N.Y.), ton.	13.75 –.....	13.75 –.....	13.75 –.....

Industrial Notes

The WHITE TAR CO. OF NEW JERSEY, INC., Kearny, N. J., has awarded to Koppers Co. a contract for the design and erection of a naphthalene refining plant to replace units burned some time ago.

CHEMIST ADVISORY COUNCIL, INC., New York, has moved its office from 300 Madison Ave. to 60 East 42d St.

GLYCO PRODUCTS CO., New York, has moved its office in Philadelphia to 36 Kenilworth St. Leonard S. Levitt is in charge.

THE FLUOR CORP., LTD., Los Angeles, is erecting a new plant and office building on a 12-acre site at 2500 South Atlantic Blvd.

AMERICAN CYANAMID CHEMICAL CORP., New York, has acquired an exclusive license under all Bennet, Inc. patents, subject to existing outstanding licenses, together with that part of the Bennett, Inc. business relating to the manufacture and sale of sizes.

ELASTIC STOP NUT CORP., Elizabeth, N. J., has moved its offices and transferred its manufacturing equipment to its new plant at 2332 Vauxhall Road, Union, N. J.

MARINE CHEMICALS CO., LTD., South San-Francisco, has changed its corporate name to Marine Magnesium Products Corp.

EASTERN GAS AND FUEL ASSOCIATES, Everett, Mass. is completing a plant for the manufacture of ammonium thiocyanate cystals. The plant eventually will have an annual capacity of 1,800 tons a year.

GREENE, TWEED & CO., New York, announces that Walter Josephson, Jr. has become associated with the company as sales engineer.

CUTLER-HAMMER, INC., Milwaukee, has moved its office in Pittsburgh to 355 Fifth Ave. T. S. Towle is in charge of the office.

W. B. CONNOR ENGINEERING CORP., New York, has appointed James E. Orr advertising manager of its Dorex division.

THE LABORATORY OF MICROCHEMISTRY, New York, of which Dr. Carl Tiedcke is director, has doubled its space and greatly increased its facilities at 366 Fifth Ave.

CHAIN BELT CO., Milwaukee, has appointed G. B. Flanigan as New York district manager to succeed W. H. Quinn who died recently after 17 years association with the company.

Chem & Met New CONSTRUCTION

	Current Projects		Cumulative 1940	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	.....	$40,000	$280,000	$788,000
Middle Atlantic	$180,000	1,230,000	8,250,000	7,045,000
South	580,000	15,250,000	12,415,000	32,685,000
Middle West	325,000	115,000	7,150,000	2,990,000
West of Mississippi	2,025,000	880,000	21,015,000	16,001,000
Far West	40,000	.....	4,990,000	2,068,000
Canada	12,370,000	85,000	21,010,000	665,000
Total	$15,520,000	$17,600,000	$75,110,000	$62,242,000

PROPOSED WORK

Chemical Plant—Dow Chemical Co., 9 Main St., San Francisco, Calif., plans to expand its plant at Pittsburgh, Calif. Estimated cost will exceed $40,000.

Chemical Plant—R & H Chemical Division of E. I. du Pont de Nemours & Co., Buffalo Ave., Niagara Falls, N. Y., will soon award the contract for the construction of a 3 story, 70x115 ft. plant at Niagara Falls. E. Rykenborn is in charge of work. Estimated cost will exceed $40,000.

Chemical Plant—Rohm & Haas Co., 222 West Washington Sq., Philadelphia, Pa., will soon award the contract for an 8 story, 55x75 ft. addition to its chemical plant. Tilden & Pepper, Lewis Tower Bldg., Philadelphia, Archts. Estimated cost will exceed $100,000.

Cosmetics Factory—Antoine de Paris Canada, Ltd., c/o J. B. Mesquita, 315 Jay St., Brooklyn, N. Y., plans to construct a factory for the manufacture of cosmetics at Toronto, Ont., Can. Estimated cost $50,000.

Explosives Plant—Department of National Defense, Ottawa, Ont., Can., contemplates the construction of a plant to manufacture nitro-cellulose explosives. Estimated cost $12,000,000.

Factory—American Viscose Co., Nitro, W. Va., plans to construct an addition to its factory. Ballinger Co., 105 South 12th St., Philadelphia, Pa., Archt. and Engr.

Factory—Canadian Johns-Manville Co., Ltd., Sun Life Bldg., Montreal, Que., Can., plans to construct an addition to its factory at Asbestos, Que. Norman Farrar, c/o Owner, Engr. Estimated cost $40,000.

Glass Factory—A. Nihon, 133 St. Paul St., W., Montreal, Que., Can., plans to remodel and enlarge factory building on Ouimet Ave., St. Laurent, Que., to be used for the manufacture of glass. Estimated cost $200,000.

Ink Factory—In-Tag division of International Chemical Corp., 3140 South Canal St., Chicago, Ill., plans to construct a 1 story addition to its factory at South Yellow Springs St. and Driscoll Ave., Springfield, O., for the manufacture of fast drying rotogravure ink. Estimated cost $100,000.

Leather Products Plant—Ithaca Leather Products Co., Turner Pl., Ithaca, N. Y., plans to construct a plant. Estimated cost including equipment $40,000.

Oil Refinery—Magnolia Petroleum Co., Beaumont, Tex., plans generfal development, extensions and modernizing of refinery units in vicinity of Beaumont. Estimated cost $1,500,000.

Oil Refinery—E. J. Shaffer, Hutchinson, Neb., plans to construct an oil refinery near Falls City, Neb. Estimated cost $75,000.

Paper Plant—Montag Bros., Inc., 182 Marietta St., S. W., Atlanta, Ga., plan to construct a 4 story addition to their plant. Robert & Co., Bona Allen Bldg., Atlanta, Engr. Estimated cost will exceed $40,000.

Pigment Plant—Northern Pigment Co., Ltd., 7 22nd St., New Toronto, Ont., Can., is having plans prepared by James, Proctor & Redfern, Engrs., Excelsior Life Bldg., Toronto, for an addition to its plant. Estimated cost $40,000.

Plant—E. I. du Pont de Nemours & Co., Inc., Wilmington, Del., plans to construct plant buildings at Morgantown, W. Va. Estimated cost will exceed $500,000.

Recycling Plant—Carter-Cragg Oil Co., subsidiary of Standard Oil Co. of New Jersey through Carter Oil Co., Tulsa, Okla., P. O. Box 1540, Fort Worth, Tex., contemplates the construction of a recycling plant in the Long Lake Field near Marquez, Centerville, Tex. Estimated cost $150,000.

Recycling Plant—Paul H. Pewitt, Longview, Tex., plans to construct and equip a 50,000,000 ft. recycling plant between Center and Joquin, Shelby Co., Tex. Estimated cost $260,000.

Rubber Factory—General Tire & Rubber Co., 1708 East Market St., Akron, O., plans to construct a 5 story factory addition. Estimated cost between $150,000 and $200,000.

Rubber Factory—Midland Rubber Co., 211 A Ave., N. E., Cedar Rapids, Ia., is receiving bids for the construction of a factory. Estimated cost $40,000.

Silica Brick Plant—Niles Fire Brick Co., Niles, O., plans to rebuild its silica brick division plant recently destroyed by fire. Estimated cost $50,000.

Starch Factory—Dominion Starch Products, Ltd., 20 Bates St., Montreal, Que., Can., plans to construct a starch factory at Brockville, Ont. Estimated cost $40,000.

CONTRACTS AWARDED

Alkali Plant—Mathieson Alkali Co., Inc., Buffalo Ave., Niagara Falls, N. Y., has awarded the contract for 1 and 3 story, 38x56 ft., 25x87 ft. and 34x70 ft. factory buildings to C. C. Bremer & Co., Seneca Ave., Niagara Falls. Estimated cost will exceed $40,000.

Chemical Plant—Shawinigan Chemicals, Ltd., 7 Transmission St., Shawinigan Falls, Que., Can., has awarded the contract for an addition to its plant to Grant Copping, 151 Fourth St., Shawinigan Falls. Estimated cost $40,000.

Cleaning Compound Factory—Clensel Products, Inc., 25 Broadway, New York, N. Y. has awarded the contract for a 1 story, 90x275 ft. factory at 7025 West 66th Pl., Chicago, Ill., to Clearing Industrial District, 6455 South Central Ave., Chicago. Estimated cost $75,000.

Coke Factory—Philadelphia Coke Co., Richmond St., Philadelphia, Pa., has awarded the contract for reconstructing its factory to Koppers Co., Koppers Bldg., Pittsburgh, Pa. Estimated cost $40,000.

Cotton Oil Plant—Buckeye Cotton Oil Co., c/o R. B. Scheer, Supt., Floyd and K Sts., Louisville, Ky., has awarded the contract for a 3 story, 36x64 ft. preparation building, 6 story, 36x47 ft. extraction building, 1 story, 64x120 ft. warehouse, to Sullivan & Cozart, 314 Armory Pl., Louisville. Estimated cost $75,000.

Cottonseed Oil Mill—Swift & Co., 4115 South Packers St., Chicago, Ill., has awarded the contract for construction and completion of an eight-press mill capable of crushing from 15- to 18,000 tons cottonseed per year, at Portageville, Mo., to Muskogee Iron Works, Inc., Muskogee, Okla. Estimated cost including equipment $40,000.

Factory—American Decalcomnia Co., Inc., 4326 West 5th Ave., Chicago, Ill., has awarded the contract for a 1 story, 49x120 ft. factory to Cohen & Weinstein, 4957 West Washington St., Chicago. Estimated cost $40,000.

Factory—E. R. Squibb & Sons Co., 25 Columbia Heights, Brooklyn, N. Y., has awarded the contract for a 12 story, 84x141 ft. with 6 story, 62x84 ft. wing addition to its plant to Turner Construction Co., 420 Lexington Ave., New York, N. Y. Estimated cost $600,000.

Fertilizer Plant—Canadian Industries, Ltd., 1135 Beaver Hall Hill, Montreal, Que., Can., has awarded the contract for a 1 story, 90x182 ft. addition to its plant at Halifax, N. S., to Brookfield Construction Co., 169 Hollis St., Halifax. Estimated cost $45,000.

Gas Plants—Boston Consolidated Gas Co., Boston, Mass., has awarded the contract for the construction of modern equipment for purification of manufactured gas for its plant at Everett, Mass., to Koppers Co., Koppers Bldg., Pittsburgh. Project will include Thylox plant for the removal of sulfur and a plant for the removal of gum.

Glass Factory—Brockway Glass Co., R. L. Warren, Pres., Beadle Bldg., Brockway, Pa., has awarded the substructure contract for 1 and 3 story, 110x622 ft., glass factory to J. C. Yenter, Commerce Bldg., Tyrone, Pa.; structural steel, etc., to Guibert Steel Co., 1716 Youghiogheny Ave., Pittsburgh. Estimated cost $500,000.

Gun Powder Factory—Tennessee Powder Co., Memphis, Tenn., will construct a factory with local labor under supervision of E. I. du Pont de Nemours & Co., Du Pont Bldg., Wilmington, Del. H. Eaton, Du Pont executive, Memphis Hotel, Memphis, will be engineer in charge. Estimated cost $15,000,000.

Oil Refinery—Texas Co., c/o D. Creswell, Refining Dept., 135 East 42nd St., New York, N. Y., has awarded the contract for a furforal plant for purification of lubricating, oils, etc., at Port Arthur, Tex., to Lummus Co., 420 Lexington Ave., New York, N. Y. Estimated cost $800,000.

Paper Plant—Costania Paper Co., Johnsonburg, Pa., will alter and remodel its plant. Work will be done by separate contracts under supervision of T. K. Hendryx, Archt., 165 Interstate Pkway., Bradford, Pa. Estimated cost $50,000.

Pharmacal Warehouse—York Pharmacal Co., 4957 Fyler Ave., St. Louis, Mo., will construct a 1 story, 100x176 ft. addition to its warehouse. Work will be done on sub-contracts basis. Estimated cost $40,000.

Rubber Mill—Goodyear Tire & Rubber Co., 1144 East Market St., Gadsen, Ala., has awarded the contract for a 1 story, 100x360 ft. addition to its mill to A. K. Adams & Co., 542 Plum St., N. W., Atlanta, Ga. Estimated cost $175,000.