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BUILDING PURCHASING POWER

FROM A CHEMICAL ENGINEERING viewpoint, the most encouraging news of recent years is found in the growing list of contracts awarded for new construction in process industries. It means that research and development will shortly be translated into large scale production. It means that chemical engineers are going to find jobs in design, construction, and operation. Of more than incidental importance is the impetus it gives to the production of capital goods—the source of so much of this country's purchasing power.

We still have a long way to go back to the $125,328,000 in contracts that were let in 1929 or to even the $52,741,000 in 1930, but it is extremely significant that the total for the first seven months of 1933 ($22,878,000) already exceeded the yearly totals for 1931 and 1932. Furthermore, some of the largest and most interesting projects have been announced since Aug. 1. Southern Alkali at Corpus Christi, Texas; Ethyl-Dow at Wilmington, N. C.; Monsanto's new alcohol plant at Everett, Mass.; and Trona's soda-ash and salt-cake project will immediately add at least $10,000,000. Freeport Sulphur is spending $3,000,000 on its new plant in Louisiana.

Sooner or later someone will raise the question: Doesn't all this building activity run counter to N.I.R.A.'s declared moratorium on increased capacity? Perhaps in a very literal sense it does conflict with an interpretation which some of the proponents of *status quo* would like to see adopted. There are those who would commit economic suicide by writing into their industry codes, provisions that put a penalty on inventiveness, freeze technical progress, and thereby perpetuate high cost manufacturing. Fortunately, however, that viewpoint is not shared by those who administer the law.

Gradually it is becoming apparent that the real depression was not so much in the industries that produce consumer goods, as in the so-called heavy industries that build plants and public works, replacement machinery and new equipment. Employment in these industries dropped 59.1 per cent from 1929 to 1932, and it is now generally accepted that for each man re-employed in these plants, three other men go back to work in producing raw materials, services and supplies. Therefore, the quickest way back would seem to be in the rehabilitation of the capital goods industries. "Recovery," according to a recent statement of Col. Leonard P. Ayres, "comes when other industries begin to spend money on replacements, renewal, and modernization of plant equipment." Another shrewd commentator, Walter Lippman, writes, "The capital goods industries * * * employ labor which not only buys textiles and other consumer goods, but makes products that do not have to be sold and used up. They create effective purchasing power faster than the production of consumer goods."

Chemical engineering enterprise has made an encouraging start in the right direction. There is still a long way to go, but in the laboratories and engineering departments of such new and growing industries, there are undoubtedly many other equally promising projects that should be started on their way. In every plant there is need for some modernization and improvement. If funds are available, now is the time to invest them in capital goods that will build purchasing power for others and at the same time produce profits for the investor.

EDITORIALS

T.V.A. Selects Its Chief Chemical Engineer

APPOINTMENT of Dr. Harry A. Curtis as chief chemical engineer for the Tennessee Valley Authority will do much to strengthen the confidence of those chemical industries deeply concerned with that huge program of social and industrial development. It will allay the fears of those inclined to believe that T.V.A. in its great anxiety to show results would blunder into projects of unsound or questionable technology. As a matter of fact, the whole history of the Authority to date is itself an answer to such critics. Its policy, since the beginning, has called for careful engineering studies, subject always to review and discussion by interested industries and individuals. By training, experience, temperament and ability, Doctor Curtis fits logically into the T.V.A. program.

Let's Make the Most Of This Chemical Show

AFTER MORE than two years of absence, years that were singularly productive of technical progress despite the pall that has enveloped the world, the Exposition of Chemical Industries is to be with us again. Opportunely, it is returning at a time when the sentiment of recovery should be well established, when the philosophy of the New Deal will have been hammered home, and the country ready for the supreme effort that will lift it from the morass into which it has wandered. The stage is set, the actors are nearly ready, and when Dec. 4 arrives the only thing remaining to insure a smash hit will be the determination on the part of all of us, exhibitors and visitors alike, to make the most of what the Exposition offers.

Great opportunities exist for all of us, and because the need is more acute, perhaps greater than ever before. For the exhibitor there is the chance to demonstrate his wares to an audience larger and more receptive than he could possibly reach by personal solicitation. An uncounted factor in this audience, and yet a most important one in determining the future success of the exhibitor, is the student, hundreds of him, who in many cases will be seeing real equipment for the first time, and forming those impressions that will later go with him into the plant.

For the chemical manufacturer, the technical man and the future technical man, there will be manifold opportunities to learn, and to modernize their thinking. Thousands of miles of travel and many hundreds of dollars of expense would not permit a similar coverage for either the maker or user of equipment. No amount of personal visiting could possibly open up the immediate and direct comparisons that the Show affords, nor present such a likelihood for the development of useful contacts and unexpected ideas.

Still another audience exists, not of such immediate importance, but one that will eventually require a vast amount of education. This is the lay audience, somewhat limited in recent years, but none the less to be expected in large numbers. Real education is needed for the public, not through the glib pen of the popular, sensational writer, but by means of concrete evidence, working models, charts and illustrations. Popular pride in, and support for, the industry is not only desirable but necessary. As miracle men we may inspire awe, but never confidence. If the industry is to reach and hold its rightful place in our economic scheme of things, it will do so through the public support and acceptance of an industry founded on the firmest of scientific bases and maintained always at the peak of efficiency.

Back to School For Graduate Work

LAST YEAR 374 graduates went back to the universities for further training in chemical engineering. The year before the number was 347; in 1930 it was 301; and in 1929 it was 285. The economic reasons for this steadily mounting interest in graduate study are self-evident but the significance of the trend is only gradually becoming apparent. Already there is a perceptible improvement in the qualifications of first-job aspirants. Furthermore, employers are beginning to find that men with graduate training have capacity for faster growth in technical achievements and professional responsibility than others with less education.

Universities situated in different environments are meeting this demand in different ways. The full-time graduate course is most common, but in recent years several institutions in larger cities have provided evening and other part-time courses. Prominent among these are the Massachusetts Institute of Technology, Columbia, University of Pennsylvania, University of Pittsburgh, and the Polytechnic Institute of Brooklyn. This whole movement in engineering education will bear watching. Perhaps it holds the answer to the question so often debated among engineers and educators—Is four years really long enough to master chemical engineering?

Honoring Another Electrochemical Pioneer

THIS YEAR, the Edward Goodrich Acheson award for distinguished service in the field of electrochemistry will be set aside to establish the Roeber Research Fund. Thus is honored the memory of Dr. E. F. Roeber, first editor of *Chem. & Met.*, one of the founders of the Electrochemical Society, and a member of that very small group of pioneers who gave so unselfishly and enthusiastically to the work of that organization. The late Prof. Joseph W. Richards was another of the group, and it is his long years of service as secretary of the society that are honored in the Joseph W. Richards Memorial Lecture. The mantle of inspiration and loyalty of both of these men was passed on to Dr. Colin G. Fink, whose generous action in founding this new fund is indeed in keeping with the best traditions of the electrochemists.

CODING CHEMICAL ENGINEERING

Chemical engineering as a profession probably lies outside of the provinces of the National Industrial Recovery Act. It is not a "trade or industry" and yet it is industrial and vitally concerned with the purposes for which the law was enacted. Chemical engineers as employees will, of course, serve under the variety of codes adopted by their separate industries. But when chemical engineers are themselves employers—whether as consultants, heads of commercial and testing organizations, equipment designers, manufacturers or distributors—it is apparent that they must provide their own codes for self government. In fact, if the chemical engineering employer signed the President's Re-Employment Agreement, he pledged himself "to cooperate to the fullest extent in having a code of fair competition submitted by his industry at the earliest possible date." It is of interest, therefore, to review the progress that has been made to date by the groups endeavoring to code chemical engineering.

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ON AUG. 17 the Association of Consulting Chemists and Chemical Engineers filed with the N.R.A. its application for the presentation of a code of fair competition for its "industry" defined as "the industry of rendering professional services of consulting chemists and chemical engineers." In his letter of transmittal to General Johnson, the secretary of the association, Paul Mahler, raised the question of whether or not a code is necessary for this group:

> To dilute the professional labor in this business by merely adding chemists, granting that the wage money is available, serves no useful purpose and would do real harm. When business is good, clients are most numerous and professional employment increases naturally. No employer in the industry can increase the number of his clients or the remuneration derived therefrom by hiring chemists in advance of his needs. Like the lawyer and doctor, he must wait for his clients.

The association nevertheless recognized the need for improving practices on the part of consultants and in the absence of an official ruling from the N.R.A., a code was drawn with hours of labor fixed at 40 hours per week during any three months period with the further limitation of 48 hours in any one week. Minimum weekly wages were set at $15 in the North and $12 in the South. The association was designated the administrative agency for the code. By far the most significant provision is the inclusion of the Association's Code of Ethics and Interpretations, which if accepted become the governing law for all consultants within this classification.

The Code of Ethics has eighteen provisions of which one (No. 5. He shall advertise only in a dignified manner, being careful to avoid misleading statements) has already called for three official "interpretations" by the association. Other provisions have to do with unfair and improper methods of obtaining professional work, prohibition of secret rebates and commissions, methods of fixing fees, underbidding of competitors, settlement of controversies, etc.

The association designated its president, Samuel S. Sadtler, of Philadelphia, to serve as liaison officer with the N.R.A. It has approached and endeavored to secure the support of consultants outside of its memberships which on Aug. 1, 1933, numbered 45 individuals. Further information may be had from the Secretary, Association of Consulting Chemists and Chemical Engineers, 50 East 41st St., New York.

COMMERCIAL TESTING LABORATORIES

APART FROM the chemical engineering employers who serve as consultants and who may or may not maintain laboratories, there is a large group of commercial testing laboratories which, in a very real sense, constitute an "industry." Thomas A. Wright, technical director of Lucius Pitkin, Inc., has suggested the following definitions to indicate the essential differences between the professional consultant and the often overlapping industry of commercial testing:

> The term "Consulting Chemists and Chemical Engineers" means the business of furnishing for a fee or fees a professional chemical or chemical engineering service of the nature or in the form of advice, opinions, investigation, research, initiating, invention, devising, development, improvement or control of processes, equipment and materials, as distinct from the selling of materials whether raw or manufactured. It may or may not be incidental to and/or include the business of operating a Commercial Testing or Inspection Laboratory or Agency.
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> The term "Commercial Testing Laboratory" means the business of furnishing and selling a professional service—as distinct from the furnishing and selling of materials whether raw or manufactured—for a fee or fees, and which involves the analyzing, testing, inspection, measuring or measurements of materials, apparatus or devices produced, refined, manufactured, consumed, employed or used, bought or sold, by the public, a governing body, public or private institution, or other professions in industry or construction and also the supervision of operations carried out by others and of the nature of weighing, sampling and inspection.

A group within this field has drafted a preliminary code of fair competition which is being submitted for criticism and acceptance prior to filing in Washington. The group fostering the first draft of the code, consists of representatives from the Electrical Testing Laboratories of New York, Froehling and Robertson, Inc., of Richmond, Va., Arthur D. Little, Inc., of Cambridge, Mass., Lucius Pitkin, Inc., of New York, Pittsburgh Testing Laboratory of Pittsburgh and the United States Testing Laboratories of Hoboken, N. J.

The code itself is not yet released for publication, but in addition to hours and wages, it will probably include a number of provisions designed to prevent unfair methods of competition, misrepresentation, rebates and other undesirable practices. Since there is no existing trade association within this field, it is proposed that the code shall be administered through a Commercial Testing Laboratory Committee. Preston S. Millar, president of the Electrical Testing Laboratories, 80th St. and East End Ave., New York, has accepted responsibility for presenting this proposal in its present form to the industry.

CHEMICAL ENGINEERING EQUIPMENT

A MOST IMPORTANT, but previously unorganized, chemical engineering group is the manufacturers and distributors of equipment. Recognizing the need for concerted action in this field, H. D. Miles, president of the Buffalo Foundry & Machine Co., invited the principal companies to be represented at a meeting held at The Chemists' Club, in New York City, on Aug. 28. Approximately 40 firms sent delegates to an all-day session from which came the organization of The Chemical Engineering Equipment Institute.

A set of by-laws drafted by a committee under the chairmanship of A. E. Marshall, consulting engineer for the Corning Glass Co. defined the Institute as a voluntary, non-profit association, the objects of which shall be:

> To protect, promote, foster and advance the interests of the members as manufacturers, designers, erectors, and/or distributors of chemical engineering equipment; to increase the use of such equipment; to improve conditions under which industry is carried on; to develop fair and just competitive methods; to perfect machinery for the peaceful settlement of disputes between members, or between them and their customers; to protect the industry against unfair and unjust burdens and exactions; to collect and disseminate pertinent data relating to the industry; and generally to do such things as may be necessary to the foregoing results.

Membership in the Institute was immediately accepted by the following individuals representing equipment concerns: John V. N. Dorr, The Dorr Co., Inc.; D. W. Sowers, Sowers Mfg. Co.; Samuel Alsop, Alsop Engineering Corp.; Howard Farkas, The United States Stoneware Co.; John L. Hutton, T. Shriver & Co.; Percy C. Kingsbury, General Ceramics Co.; H. E. Jacoby, D. R. Sperry & Co.; G. W. Jarman, Jr., Separations Engineering Co.; F. Dougherty, Jr., F. J. Stokes Machine Co.; S. F. Spangler, Chemical Construction Co.; H. E. LaBour, The LaBour Co., Inc.; F. E. Finch, Hardinge Co.; W. O. Chase, New England Tank & Tower Co.; H. B. Caldwell, Swenson Evaporator Co.; H. D. Miles, Buffalo Foundry & Machine Co.; W. H. Scott, The Duriron Co., Inc.; J. E. Moul, The Turbo-Mixer Corp.; J. Credo, Louisville Drying Machinery Co. Subsequently, the following companies also joined the Institute: Bethlehem Foundry & Machine Co., Sprayco, Inc., E. B. Badger & Sons Co. and the Zaremba Co.

To provide temporary officers to carry on the work of the Association until its first annual meeting to be held in October, the following were nominated and elected unanimously: H. D. Miles, President: P. C. Kingsbury, Vice-President; and D. H. Killeffer, Secretary-Treasurer.

President Miles appointed a Code Committee consisting of J. E. Moul, Chairman; J. L. Hutton, S. F. Spangler, D. W. Sowers, and G. W. Jarman, Jr. After due deliberation and conferences with representatives of the Machinery and Allied Products Institute (with which the new group indicated its desire to affiliate), the Committee drafted a basic code of fair practice and submitted it to the membership on Sept. 5 with a copy of the by-laws of the Chemical Engineering Equipment Institute.

Because of its tentative character, the code has not been released for publication but it has been framed with the intention of providing some means of correcting, as far as possible, the unfair trade practices that exist in this field. Therefore, as submitted to Washington, it will probably contain in addition to the mandatory sections and the fixing of hours and wages, a number of important provisions designed to prevent the sale of equipment below cost, to set up arrangements for the necessary accounting and costing methods, and to establish open price lists with penalties for failure to follow them. Of greater interest to chemical engineers will be the definition and limitation of experimental work and engineering services furnished without charge to actual and prospective buyers of equipment. It has been proposed that adequate charges should be made for installation and maintenance services. Trade practice provisions to cover rebates, bribery, untruthful advertising, espionage and "pirating of designs" are likewise to have consideration.

Copies of the tentative code as well as further information regarding membership in the Institute will be sent to any manufacturer or distributor of chemical engineering equipment on request to the Secretary-Treasurer, Chemical Engineering Equipment Institute, Chemists' Club, New York, N. Y.

CHEMICAL DISTRIBUTORS

REPRESENTATIVES of the distributors of chemicals in different parts of the country met at the Chemists' Club in New York on Sept. 8 to form an organization called the Institute of Chemical Distribution. The objects of the organization are to increase the efficiency of the distribution system of the American chemical and allied industries by studying costs and methods, surveying markets and users, and keeping its members informed of the facts, figures, and new developments in the distribution field; to promote cooperation and fair treatment among manufacturers and producers, dealers, and sales agents, common carriers and law makers; to prevent the restraint of trade and promote upright dealings within its own ranks, and to secure for consumers the economies and efficiencies resulting from honest, profitable and intelligent marketing of the chemical raw materials of industry.

The officers elected to serve for the first year are: Curtis R. Burnett, American Oil and Supply Co., President; A. A. Harrison, Borden and Remington Co., Vice-President; A. S. Barada, Barada and Page Co., Treasurer; C. P. Hall, C. P. Hall Co., Secretary, Akron, Ohio.

CHEMICAL MANUFACTURING INDUSTRIES

THE CODE of fair competition for the chemical industry, as originally drafted by the Chemical Alliance, Inc., and published in the August issue of *Chem. & Met.*, was revised in certain particulars on August 25, following an all-day conference in Washington with N.R.A. officials. Representing the Chemical Alliance were the following: E. M. Allen, Charles Belknap, W. B. Bell, Lammot duPont, George F. Handel, Glenn Haskell, George W. Merck, J. W. McLaughlin and E. H. Westlake. The government representatives included General C. C. Williams, deputy administrator of N.R.A. and his special assistants, F. J. Patchell and C. R. Baxter, as well as members of the industrial, consumer and labor advisory boards.

A number of changes in the code which were suggested either by members of the industry or officials of N.R.A. were incorporated in a revised code and immediately submitted to the membership of the Chemical Alliance for acceptance and approval. The most important of these include:

1. A provision making it necessary for companies to report in detail each week to the executive committee or the administrator when employees engaged in continuous operations are permitted to work more than forty hours. In no

case must the average for such work be in excess of 48 hours per week.

2. The basic minimum wage previously established at 40 cents for the entire country was changed to 35 cents in the South and 40 cents elsewhere, provided that if the hourly rate on July 15, 1929 was less than 35 cents and 40 cents, the rate should not be less than on that date and in no event less than 25 cents in the South and 30 cents elsewhere. Apprentices are to receive not less than 80 per cent of the minimum but an additional provision is made that the minimum pay for transient labor by the potash industry near Carlsbad, N. Mex., not exceeding 125 individuals, shall be not less than the maximum wage paid for such labor by the agricultural industry in the same general locality.

3. Statistics and other confidential data collected by the specified outside agency (National Industrial Conference Board has been so designated. Ed.) shall be "disseminated only in combination with other information of the same type and as the Alliance shall reasonably prescribe."

4. The duties of the Alliance in the administration of the code are delegated to its Executive Committee (instead of its Board of Directors) and the President of the United States is empowered to name three representatives to sit with the Committee but without voting power.

5. All members of the chemical industry covered by the code are liable for an equitable pro rata share of the expenses involved in its administration.

In addition to these changes which were embodied in the revised code, several other suggestions were made by various N.R.A. representatives. The code committee of the industry, however, stated quite definitely that they could not agree to these suggested revisions. They are as follows:

1. That the code shall contain a clause providing for overtime payment.

2. That a clause shall be added concerning the adjustment of wages for: (a) Those employees receiving more than the minimum wage; (b) Those employees whose weekly wages would be unduly affected by a reduction in hours of work.

3. That Article IX containing the so-called "merit clause" for the "selection, retention or advancement of employees" should be eliminated.

4. That Article XIII, which provides that those who assent to the code shall not be bound by any modification "except as each shall thereto subsequently agree," should be eliminated.

5. That Article XIV, which provides that the code shall expire on Dec. 31, 1933 or prior thereto should Congress declare the emergency ended, shall be eliminated.

Chemical Industry Presents Its Case and Its Code

IN PUBLIC HEARING before General C. C. Williams, Deputy Administrator of N.R.A., and his consort of industry, labor and legal advisors, the chemical manufacturing industry had its opportunity on Sept. 14 to explain, defend and solicit official support for its code of fair competition. Headed by William B. Bell, president of the Chemical Alliance, Inc., more than sixty representatives of all branches of the industry spent most of the day in the Old House of Representatives Office Building in Washington in discussing some of the more controversial provisions of what will some day be the law of the land.

General Williams was surrounded by his assistants, F. J. Patchell, chemical engineer, Major Charles R. Baxter, Lieut. Joseph F. Battley, and Miss Ada Green. Francis P. Garvan, president of the Chemical Foundation served as industry advisor; Major E. C. Eckel, consultant in the lime and cement industries, represented the labor advisory board, while Howard Newman and W. A. Gill were, respectively, the legal and research advisors. Under Chairman Lammot duPont, the industry's code committee supported Mr. Bell in his arguments for the code.

Early in the hearing, Mr. Bell outlined the history of the Chemical Alliance and its present relation to the industry. Its 238 member firms employ between 50,000 and 60,000 workers in the manufacture of heavy and fine chemicals, coal-tar products, plastics, alcohol and solvents, potash and miscellaneous organic and inorganic chemicals. All of the larger companies, with the exception of Allied Chemical & Dye Corp., are already members so that the Alliance today represents well over half of the industry. Mr. Bell's figures show that adoption of the chemical code will increase employment by 12 per cent, raise payrolls by 10 per cent, and bring the industry back to 97.5 per cent of its 1929 peak.

Of six witnesses who had asked to be heard in connection with the code, the most heated arguments came from a brief by Paul Scherer, chairman of the code committee of the Federation of Architects, Engineers, Chemists and Technicians, who protested against the labor provisions as applied to technical employees. Contending that the code would not result in the desired reemployment and raising of wages, Mr. Scherer urged that technical men should be employed on a basis of 30 hours per week, with minimum weekly wages for senior chemists (with six years' experience) to be $65, juniors (with one to five years) $45, assistants (without experience) $30 and apprentices to be $20—with double pay for overtime.

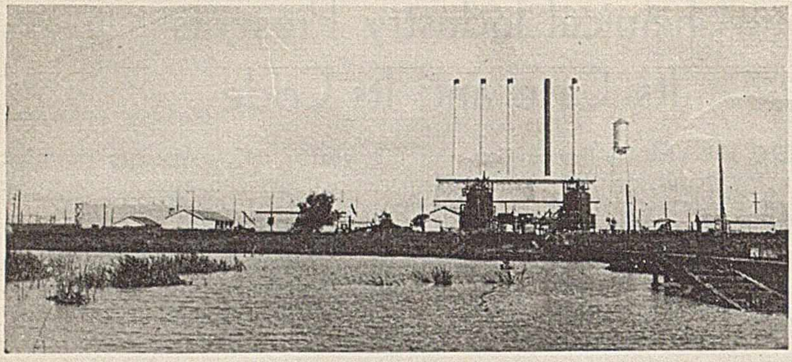
Two pleas from the domestic potash industry for special exemptions from the minimum wage provisions failed to receive very cordial support from General Williams and Major Eckel. George W. Harris, president of the Potash Co. of America, said that the emergency character of his company's mining operations at Carlsbad, N. M., made it impossible to limit work to 8-hr. shifts. In the same connection, Mr. Albright of the U. S. Potash Co. declared that payment of the wages specified in the original code would disturb agricultural conditions where the native Mexican laborers normally receive less than $1 per day.

Charles H. Stone of Charlotte, N. C., asked for a lowering of the minimum wage in the South to 20 cents per hour so that his company could continue to employ negro labor for heavy manual work, declaring that if the code is put into effect Southern plants will be forced to put in machinery that will almost entirely displace the services of inefficient labor. Major Eckel objected strenuously to a continuation of any labor rates of less than 25 cents per hour. General Williams said he hoped that N.R.A. would put an end to low wages in the South, forced by competition with negro labor.

Chemical statistics, always a bone of contention, came in for further discussion when Albert R. Palmer, attorney for Chas. Pfizer & Co., presented an amendment to the code to provide that confidential data should be submitted only in such combination as to conceal the source. Mr. Bell indicated willingness to accept this change.

Sulphuric acid, which has bobbed up in three codes—fertilizer, zinc and chemical—was discussed by H. I. Young, chairman of the byproduct acid committee of the American Zinc Institute, who desired special exemption for that branch of his industry, and by E. H. Westlake of the Tennessee Copper Co., who submitted that all branches of the industry should be treated alike. General Williams indicated the likelihood that this would be the case, probably by putting all in the chemical code.

After reading and discussing, article by article, each provision of the proposed code, Mr. Bell made a strong and dramatic appeal for N.R.A. to consider chemical industry as an essential arm of the government, necessary both in times of peace and war. He told how the industry had developed in this country because the World War demonstrated our great needs in the national defense and he urged that nothing should be done that would impair its efficiency.



Jefferson Lake Oil Co.'s lake shore power plant, Barba, La.

By LAWRENCE O'DONNELL
General Superintendent
Jefferson Lake Oil Co., Inc.
New Iberia, La.

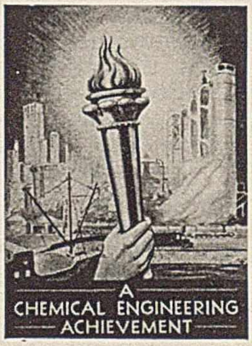
Mining Sulphur Under Water In Louisiana

AFTER a ten-year sojourn in other parts, where it gained in experience and perfection, the original Frasch process returned in 1932 to Louisiana, the state of its origin. Home again, it was destined to carry on new pioneer work—the mining of sulphur from beneath Lake Peigneur, adjacent to Jefferson Island. With many authorities emphatically condemning the possibility of mining sulphur in this location, the successful consummation of the project in spite of the numerous obstacles involved, is an achievement in which we feel our pride is fully justified.

Sulphur in the Gulf Coast country is found in the cap rock overlying salt domes. Oil is also found in the cap rock or on the sides of domes. Due to immense pressure, beds of salt at depths of close to 5 miles have become plastic and, in the form of a plug, have forced their way through faults or fissures to a point close to the surface of the ground. Jefferson Island is one of a group of five islands rising above the marsh. Its elevation is caused by a salt plug distorting the underground and surface strata. It is believed, in fact, that there are two separate domes at Jefferson Island, one under the hill and the other under the basin of the lake. No doubt in some past era the dome under the lake was also characterized by an elevation, but due to the solution of the salt by migratory waters, the ground has subsided, leaving the basin which forms the lake. The size of the Lake Peigneur dome is approximately that of the lake, about 2 miles long and 1 mile wide.

Salt at Jefferson Island rises to within 95 ft. of the surface. A shaft has been sunk and salt is now being mined at the rate of about 8,000 cars per year by the Jefferson Salt Mining Co.

The Jefferson Lake Oil Co., Inc., after drilling a number of dry oil wells around the edge of the dome, decided as a last resort to make a location in Lake Peigneur. At a depth of about 650 ft., limestone cap rock was struck. At 660 ft. the bit picked up traces of sulphur and continued deeper with increasing quantities of sulphur to a thickness of 208 ft. when anhydrite terminated the sulphur zone. At a depth of 871 ft. pure rock salt was struck. It was indeed a surprise and a pleasant one to find a salt dome under Lake Peigneur, for the high purity of the sulphur encountered, together with the great thickness of the deposit, gave all indications of a very rich find.



Sulphur Formation at Lake Peigneur

Before we go on with the actual development, it may be worth noting just how the sulphur is deposited in the strata below the lake. The cap rock, which is above the salt, is divided into three parts. At the top is a thin layer of porous limestone containing much calcite. Underlying this is the sulphur zone. This zone is of varying thickness and contains limestone, similar to that in the upper zone, together with calcite and sulphur of non-uniform richness and irregularly distributed thickness. The sulphur is sometimes found in thin layers, again in very small crystals, even microscopic in size, again as large crystalline masses in columns extending upward through the beds. It is sometimes found in the shape of stalactites and in the openings and crevasses made by circulating waters. Sometimes it appears as perfect crystals, nearly transparent and bright yellow in color. Again, these crystals are pale amber (color, apparently, has nothing to do with the purity). In other parts of the deposit amorphous sulphur is found, powdery and soft in appearance and of a pale yellow color. Large volumes of hot sulphide waters are circulating in the sulphur zone. Below the sulphur zone is a layer of anhydrite or calcium sulphate. This zone is very thin and is directly over the salt. All of these zones merge into each other and at times are difficult to outline definitely.

It is interesting to consider just how this sulphur was formed. There are a number of theories, but perhaps the most reasonable is that the sulphur was derived from calcium sulphate. Since large quantities of methane and hydrogen sulphide are found in the sulphur zone, the following reactions might have taken place:

$$CaSO_4 + CH_4 = CaCO_3 + H_2S + H_2O$$
$$H_2S + \frac{1}{2}O_2 = H_2O + S$$

That this was the mechanism is verified by actual experience; namely, the carbonate increases as the sulphate decreases with an increase in the sulphur present. The reactions take place in the presence of hot circulating sulphide waters, causing the waters to deposit the sulphur in the form of bands, crystals, columns and thin layers.

Building the Plant

In May, 1931, after excellent sulphur indications had been found in a number of wells, the Jefferson Lake Oil Co. decided to produce this sulphur commercially, and proceeded with the construction of a plant. The first foundations of the new plant were laid Oct. 18, 1931, and the first sulphur was successfully produced on Oct. 20, 1932. Production has since continued. A great deal of financial difficulty was encountered in the construction of this plant as it was built during the current depression. However, the directors and those interested in the company had confidence in the outcome of the venture.

The method of sulphur mining used at Barba, La., is the Frasch process as invented by Herman Frasch at Sulphur, La., in 1891. With this method the sulphur is melted in the cap rock by means of superheated water and is then raised to the surface in a molten state by the use of compressed air. Since enormous quantities of water are necessary to provide sufficient heat for large-scale mining by the process, the power plant is one of the most important factors in the development of a sulphur project.

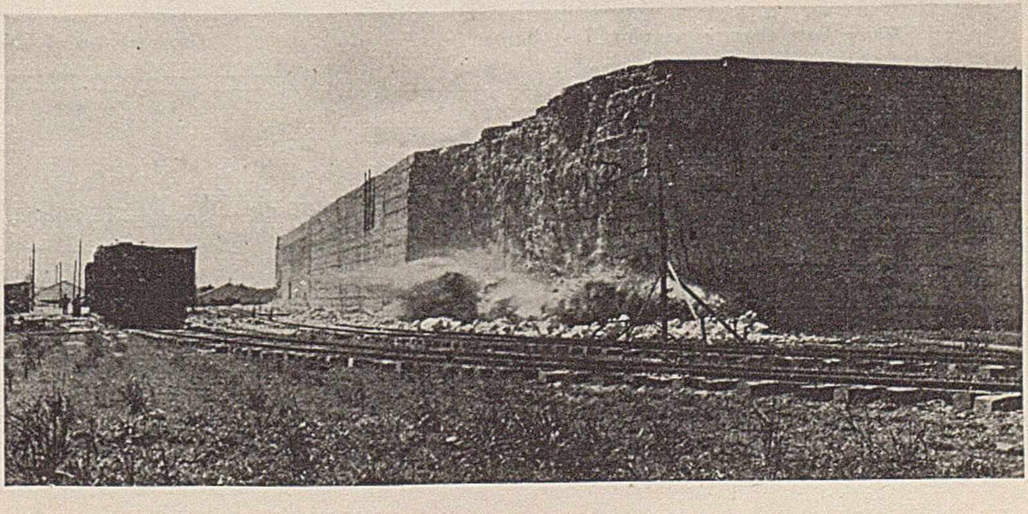
Our power plant was designed to provide about 1,500,000 gal. of water per 24 hours. This water must be free of all scale and foreign substance, so as not to plug the lines that distribute it to the field and the individual wells. The temperature of the water is about 320 deg. F., and its pressure must be above 100 lb. gage so as to maintain this temperature.

Since the mining operations are being conducted in the middle of Lake Peigneur, the question arose as to the best location for the power plant. As it would have been very costly to build in the lake near the site of mining operations, it was decided to construct the plant on the shore of the lake and pump the water a distance of about a mile to the mining operations. The situation chosen on the lake shore has an elevation higher than the surrounding territory. This high ground afforded sufficient bearing for spread-foot foundations and effected considerable saving through elimination of piling. There were also other advantages to the site. For one, it was necessary to lay only 3 miles of railroad spur to bring construction materials to the location. Furthermore, the plant is on a graded highway, only about 3 miles distant from both Delcambre and Erath, La., where ideal living conditions are provided for the workmen.

With the erection of the plant, a reservoir of 20 acres area and of 50 million gal. capacity was constructed as storage for water to provide for continuous operation. Water from this reservoir is pumped directly into the water-treating plant by means of two 600-g.p.m. pumps. The water-treating plant comprises two 40,000-g.p.h. Cochrane units. These are of the hot-process type, using lime and soda ash for treatment. Water to be treated is continually analyzed by a competent chemist to insure zero hardness. After treatment the water is passed through six filters filled with non-silicate filter material.

Water Heating

During the softening process the water is heated to a temperature of about 218 deg. F., using mainly exhaust steam from the turbine-driven pumps. A continuous blow-down of 5 per cent from the boilers is also discharged into the water-treating plant, thereby conserving the heat energy in the blow-down and re-treating the blow-down water before it is returned to the boilers.



One of the "vats" with walls removed, at the moment of blasting

Two water circuits are maintained after the water leaves the softener. In one system the water passes directly into the boilers; in the other it passes into the high-pressure mine-water heaters. The boiler water is further treated with sodium sulphate, so as to correct the sulphate-carbonate ratio and prevent caustic embrittlement. Anhydrous sodium phosphate is also added to the boiler water to reduce the hardness to zero and prevent silicate scale. Sludge from the water-treating plant is discharged into a mud pit to be used as drilling mud in the sulphur wells to be drilled in the lake.

Steam at about 100 lb. pressure is provided by five Babcock & Wilcox Class H boilers, each of 600 hp. capacity. The boilers are designed to operate continuously at 200 per cent rating. They are of fusion-welded drum construction and are the first boilers of this type to be used in the South.

The greatest part of the steam passes from the boilers into the mine heaters. These heaters are of the Cochrane jet type and operate at 100 lb. gage pressure. Here the 218-deg. water from the water-treating plant is heated to about 320 deg., at which temperature the water is pumped from the heaters to the mine by means of mine-water pumps. These pumps raise the pressure of the water to about 250 lb. gage.

Pumps and Compressors

All pumps are Cameron centrifugals driven by G.E. Curtis impulse-type, single-stage turbines, exhausting at 5 lb. back pressure. This pressure of exhaust steam is necessary to maintain a temperature of 218 deg. in the water-treating plant.

High-pressure air for the mine is furnished at 500 lb. gage pressure by Ingersoll-Rand steam-operated, three-stage compressor units.

Temperature recorders are provided throughout the plant to record the various temperatures of fresh water, treated water, and mine water. Other instruments such as steam-flow meters, pressure gages, recording thermometers and oil meters permit the operating engineers to keep a continuous check on the operating efficiency of the plant.

In designing the plant lay-out, every consideration had to be given to continuous operation, for after the plant is once started up it is absolutely impossible to shut it down. If it were to be shut down for any period of time the sulphur in the lines would freeze as would the sulphur in the wells, thereby causing immense financial loss and damage in the mining operations. For this reason, duplicate pumping equipment, heaters and boilers have been provided throughout the power plant system. The piping arrangement was designed so that any duplicate pump could operate at any time, and with any heater. Although the pressure is only 100 lb., extra-heavy valves and fittings are provided throughout so as to insure continuous operation.

Developing the Mines

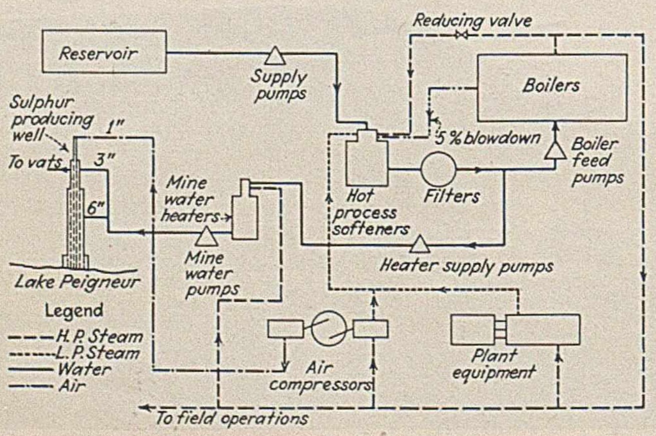
It was necessary to do a great deal of pioneer work in the production end, as this was the first time in the history of sulphur mining that the operations were to be carried out in the middle of a lake and over water.

With the power plant situated on the shore of the lake, about a mile from the center of mining operations, it was necessary to build a trestle from the power plant to the point of mining. Creosoted piling and timbers were used for the construction of this trestle which carries five pipe lines: hot water, steam, cold water, air and sulphur. The hot-water line, steam line and sulphur line are insulated with 3 in. of mineral wool covered by galvanized iron. Many carloads of mineral wool were used in this installation. Large expansion joints had to be provided for the lines as the pipe expands under temperature about 2 ft. in every 1,000 ft. The lines terminate at the sulphur station where booster pumps are located for forcing water down into the wells. Here also is the steam-jacketed collecting sump of 40 tons' capacity, used to accumulate sulphur from the wells. Steam-jacketed centrifugal sulphur pumps transfer the liquid sulphur from the bin to the storage vats, which are on the shore of the lake near the rail-road terminal. The sulphur solidifies in these vats. It is then blasted down and loaded into cars by means of a locomotive crane. These vats are about 160x500x40 ft. high.

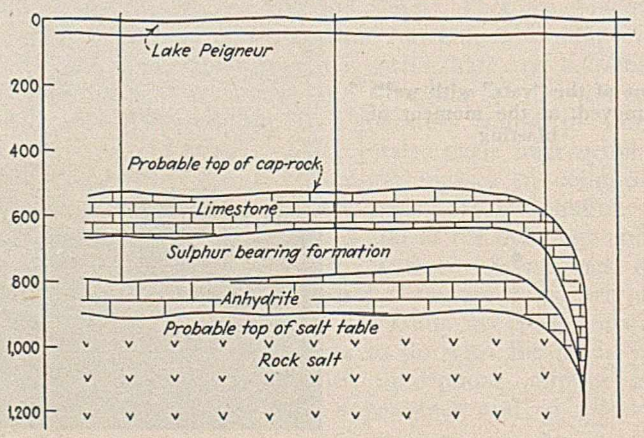
Mining Operations

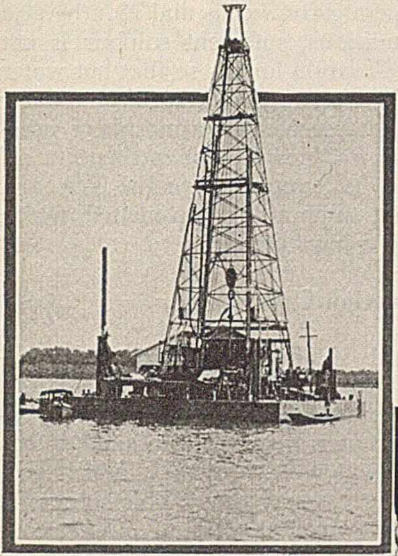
Successful working of the Frasch process depends on keeping the underground strata of the dome at sufficient temperature to melt sulphur. This makes it necessary that the strata also be pressure-proof, as sufficient

Water flow chart as employed at Barba

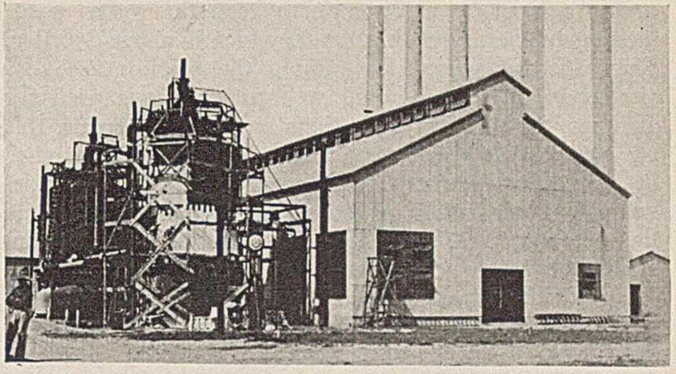


Cross-section of Lake Peigneur dome

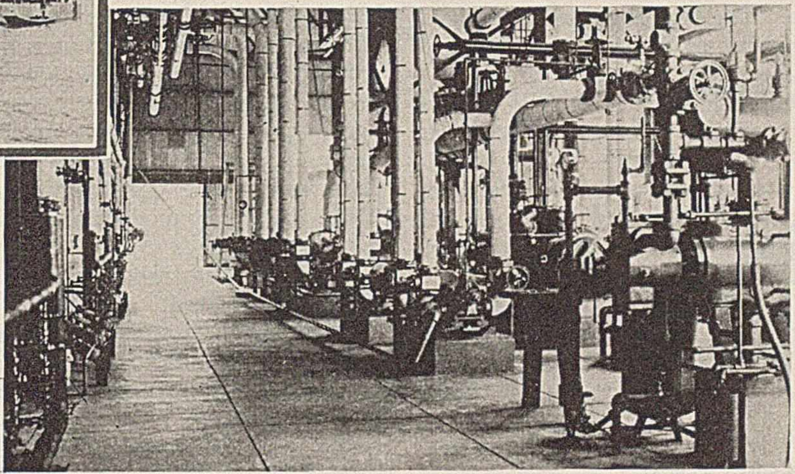




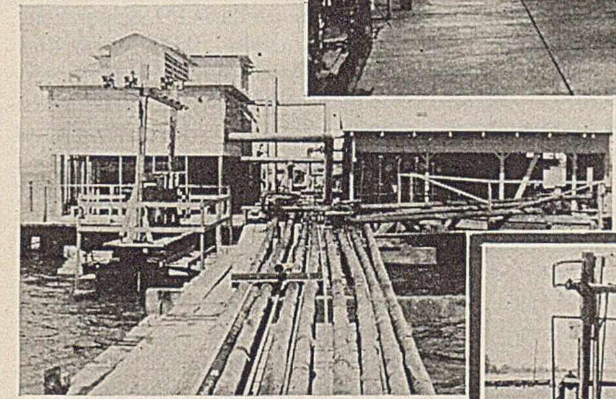
Specially designed floating drilling brage on Lake Peigneur



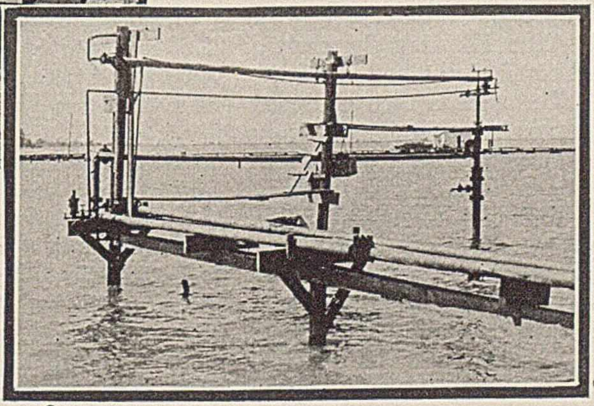
Power plant and Cochrane water softeners; one is being insulated



Power plant interior with pumps at right, boilers at left

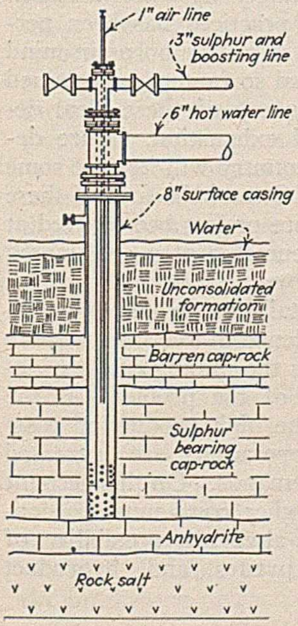


Sulphur station on the lake, supply and sulphur lines in foreground

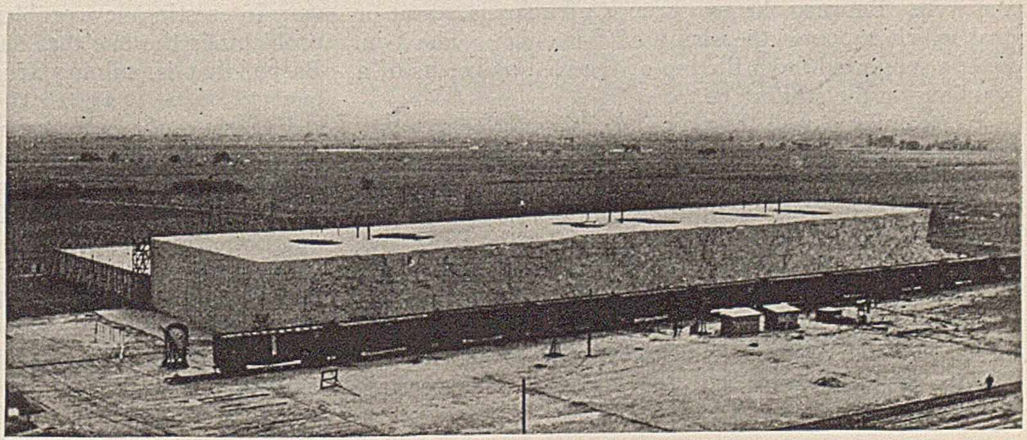


How an operating sulphur well appears; the lines for air, water and sulphur connect with the sulphur station above at the left; the under-water structure is as shown at the lower left

How sulphur-well casings are installed



"Vat" No. 4, in the background, is being filled with sulphur, while No. 3 has been stripped for blasting and loading into cars by means of steam shovels



pressure must be maintained to keep the water at the melting temperature of sulphur, which is above 240 deg. Since the wells used for mining the sulphur are very similar to oil wells, an oil well rotary rig is used for drilling. In the first operations on Lake Peigneur, this rig was installed on top of piling, but this was found to be a very expensive process, so a drilling rig was developed which could be placed on top of a barge and floated from well to well. This barge is of steel construction and is permanently equipped with a complete set of drilling machinery. All machinery on the barge is operated by electricity supplied by submarine cable at 2,300 volts. The barge is held in position by means of four 8-in. pipes at its corners, passing through the barge and into the lake bottom. The barge is maintained level by a very accurate distribution of the drilling machinery. Since the level of the lake rises as much as a foot in a 10-hour period, a telescopic joint was devised to take care of this change in elevation during connection to the casing of the well.

Whereas it takes three or four days to move the average drilling rig, this rig has been moved from one well to another in as short a time as 10 minutes. Although the barge cost in the neighborhood of $8,500, it is estimated that as much as $5,000 is saved per well by its use. Seventy wells have been drilled successfully. A number of the large oil companies have copied the barge and it has been used in other marine operations in drilling for oil.

Equipping a Well

In operating with this barge, a surface casing is first set to shut off the lake water and silt. This is a 12-in. pipe about 40 ft. long. A 10-in. hole is then sunk rapidly to cap rock, a distance of 600 ft. An 8-in. casing is set in the hole and cemented. After allowing the cement to set, the hole is drilled and cored to the bottom of the sulphur-bearing formation. The well is then equipped for sulphur mining, the equipment including a 6-in., a 3-in. and a 1-in. line, set concentrically. An 8x6-in. stuffing box is provided at the surface so that the 6-in. line can expand in the 8. Similarly a 6x3-in. and a 3x1-in. stuffing box are provided. Two sets of holes are drilled in the 6-in. pipe at about the bottom of the sulphur-bearing formation. The lower group is used as a strainer for the sulphur as it enters the 6-in. pipe. When it is melted the sulphur drops to the bottom of the well, as its specific gravity is twice that of water. The upper group of holes is used as an outlet for water pumped into the well. Between the two groups of holes is a seat or seal which supports the string of 3-in. pipe. The 1-in. pipe is supported from the top of the well by means of a coupling on the stuffing box.

In steaming a well the procedure is as follows:

The water from the plant at about 320 deg. is forced down into the well between the 3-in. and the 6-in. pipes at a pressure of about 100 to 250 lb. This water, having a specific gravity of 0.9, rises to the top of the dome, melting sulphur as it rises. The melted sulphur (specific gravity about 2) drops to the bottom of the well where it is forced up the 3-in. pipe a short distance by the dome pressure. The compressed air of varying pressure under 500 lb. raises the sulphur to the surface. Under certain conditions, sufficient sulphur will be melted by the water to permit the well to operate for weeks and months at a time. Under other conditions, sufficient sulphur is not melted and the sulphur elevation lowers so that hot water enters the 3-in. pipe. Coming to the surface such water flashes into steam when it reaches the atmosphere pressure and the well is said to "blow." Air is then cut off from the well and water is pumped down the 3-in. and 6-in. pipes until sufficient sulphur is again melted, which usually requires about a 3-hour period.

Production Capacity

Based on the experience of older sulphur mining operations, the power plant at Barba was designed for a capacity of about 300 long tons of sulphur per day. The production has been far greater than this amount; it has reached over 1,400 long tons per day at times and is now averaging over 1,200 long tons per day. This success is due in part to a thorough understanding of mining conditions at the Lake Peigneur dome by the field operating crew, and in part to most efficient operation of the power plant. The very modern and efficient machinery also is a contributing factor. In the mining operations every consideration has been given to the principles of thermodynamics involved.

Since the beginning of production on Oct. 20, 1932, nearly 200,000 long tons of sulphur has been produced. This sulphur as it comes from the wells is 99.92 per cent pure. One well has produced nearly 50,000 tons and is still producing continuously. At present, the Jefferson Lake Oil Co. is one of the world's largest producers. Within a period of a few months its operations have passed from a highly speculative venture, condemned by many of those associated with the industry, to a position in first ranks of sulphur producers.

Besides the sulphur shipped to domestic users, a great deal is exported to France, Germany, England, South America, Africa and Australia as well as to other foreign countries.

Future of Frasch Process

Successful mining of sulphur since 1893 has involved the solution of hundreds of seemingly insolvable mechanical problems. The process as practiced has been perfected to the last detail. But it should be borne in mind that most of the sulphur produced so far has been mined under ideal conditions. Since many of these ideal deposits are on their way toward exhaustion, future developments in the Gulf coastal country will involve some very interesting new problems. One of the first of these problems is the one that has more or less been solved at Barba, that is, mining from beneath water and marsh lands.

Even here there are many details yet to be contended with; among these is the subsidence of the lake bottom. Another problem to be solved is the mining of deep deposits. In the solution of all of the problems is the question of costs. Added to the high production costs accompanying severe mining operations are increased taxation and excessive royalty demands. On this account all new departures involving higher costs must be considered carefully, for there is always a possibility of increased competition from pyrites and byproduct sulphur.

CHEMICAL INDUSTRY RESISTS THE DEPRESSION

What Do the Figures Show?

By C. C. CONCANNON and A. H. SWIFT

Chemical Division, Bureau of Foreign and Domestic Commerce, Washington, D. C.

CHEMICAL INDUSTRY as a whole has withstood the depression better than most others and ended the year 1932 in a relatively satisfactory condition. During the first quarter of 1933 the trend was downward, but since then it has been completely reversed. Employment in the chemical industries has improved and prices for many chemical products have advanced. Chemical foreign trade today is at a low level, but the United States has been holding its own in comparison with its five leading competitors. Viewed in summary, the year was one of corporate consolidations, reductions in the costs of operation and in the book values of properties, increased efficiency, through both technical and commercial research, expansion of present uses of products, development of new uses for old commodities and growth in the marketing of synthetic and other new materials.

The term "chemicals and related industries" has many interpretations and includes a multitude of branches and products. As arbitrarily defined by the Bureau of the Census, more than 20 manufacturing industries fall directly within this field, and most of these industries make numerous commodities. Many industries outside of this group use chemical processes to such a large extent or make chemicals as byproducts or are so related to fields recognized as strictly chemical that they are often regarded as chemical or "process industries." Among these are the rubber, pulp and paper, sugar refining, petroleum refining, metallurgical and ceramic industries.

The United States continues to be the world's largest consumer, producer and importer of chemicals and allied products, but it must take second rank to Germany as an exporter. During the past decade American technicians and manufacturers by constant progress in the development of coal-tar and other synthetic organic chemicals have built up an industry capable of supplying almost all of the chemicals consumed in American industry. It is unofficially estimated that over 90 per cent of the chemicals produced in this country are used as raw materials of other industries.

Census statistics for the chemical and related industries (the grouping here being slightly different from that made by the Bureau of the Census itself) are summarized in Table I. Table II shows the total value of the production of each of the major groups of chemicals and related commodities, regardless of the industry in which the individual concern making each commodity may be classified. Totals do not include products made for further manufacture in the same establishment, thus eliminating as far as possible the duplication that unwittingly creeps into many statistical tabulations on chemical industry.

Table I—Chemical and Related Industries[1]—Most Recent Census Statistics

Year and industry	Establishments	Wage earners (average for the year)	Wages	Cost of materials, fuel, and purchased electric energy	Value of products
			In thousands of dollars		
The group as a whole					
1921	7,582	199,363	210,013	1,122,646	1,960,351
1923	7,707	254,779	282,350	1,465,385	2,648,987
1925	7,597	247,173	288,842	1,533,847	2,831,169
1927	8,039	263,665	310,882	1,572,487	3,035,551
1929	8,906	298,143	350,936	1,744,976	3,507,419
1931	7,962	241,966	260,064	1,135,722	2,513,529
1931					
Alcohol, ethyl	27	997	1,331	13,132	21,741
Baking powders, yeast, etc.	45	2,881	4,798	20,746	47,027
Blackings, stains, dressing	156	1,501	1,666	6,941	20,343
Bluing	20	95	94	402	1,179
Bone black, carbon black, lampblack	62	1,039	1,344	5,022	9,535
Candles	23	713	711	2,481	5,396
Chemicals, not elsewhere classified	558	48,522	66,360	246,068	533,175
Cleaning and polishing preparations	388	2,449	2,969	16,979	48,007
Compressed and liquefied gases	349	2,844	3,896	10,135	41,806
Druggists' preparations	392	9,476	10,552	32,208	109,448
Drug grinding	23	661	711	5,457	9,159
Explosives	78	4,733	5,572	19,519	46,258
Fertilizers	599	14,551	12,146	106,481	154,350
Glue and gelatin	72	2,559	3,325	15,460	27,516
Grease and tallow, not including lubricating greases	238	4,067	5,225	17,533	29,241
Lubricating oils and greases, not made in petroleum refineries	168	2,115	2,960	22,809	41,704
Ink, printing	171	2,247	3,479	14,532	32,188
Ink, writing	23	347	363	1,463	3,535
Linseed oil, cake, and meal	28	1,837	2,278	50,306	62,883
Oils, essential	12	128	199	2,707	3,505
Oils, not elsewhere classified	65	961	1,394	19,970	25,922
Paints and varnishes	1,039	22,521	29,425	193,737	350,726
Patent and proprietary medicines and compounds	1,298	13,475	14,885	68,416	254,514
Perfumes, cosmetics, etc.	663	10,748	10,446	46,556	158,175
Rayon and allied products	32	38,735	38,231	36,181	132,632
Salt	53	4,728	5,549	10,864	31,430
Soap	248	14,163	17,740	121,829	257,719
Tanning materials, dyestuffs, etc.	116	1,962	2,390	15,521	26,469
Turpentine and rosin[2]	953	28,257	7,280	5,793	16,506
Wood distillation and charcoal manufacture	63	2,654	2,745	6,474	11,440

[1]The following industries which are included in the census group of "Chemicals and related industries" are not included in this table: Ammunition; fireworks; cottonseed oil, cake, and meal; mucilage; and vinous liquors; but lubricating oils and greases, not made in petroleum refineries, and the turpentine and rosin industries, which are not included in the census group, are here included.
[2]Crop year ended Mar. 31 following year specified.
Source: Bureau of the Census.

Some chemicals are made in every state in the Union, but since in some cases only one or two plants manufacture the commodities in question, totals for every state cannot be given without disclosing confidential information. Approximate totals accounting for 99 per cent of the U.S. chemical production are shown in Table III.

Two major branches of chemical industry are concentrated in the South. Alabama, Florida, Georgia and South Carolina produced 94 per cent of the rosin and turpentine made during the crop year ended March 31, 1932. Fertilizers, being heavy tonnage goods, are usually made near the larger consuming sections, and it is not surprising, therefore, to find that the six states of Alabama, Florida, Georgia, North and South Carolinas and Virginia manufactured nearly one-half of the commercial fertilizer made in the United States in 1931.

Higher priced chemical products—goods in which transportation is not an important item, such for example as paint and varnish, medicinal and toilet preparations—likewise show considerable concentration in the manufacturing states of New York, New Jersey and Pennsylvania. Forty per cent of the paint and varnishes and nearly one-half of the medicinal and toilet preparations used in the United States were made in these three states in 1931. About one-half of all of the products included in the group "Chemicals n.e.s." (see Table II for individual industries so classified) are also made in these three states, while other large producing states are Illinois, Michigan, Ohio, West Virginia and Virginia.

Recent Trends in Production and Consumption

Potash.—American potash independence assumed realistic form with the recent and successful exploitation of the important deposits in New Mexico. In 1932 the United States tied with Spain for third place in the world production of potash. According to the Bureau of Mines, the potash produced in the United States in 1932 amounted to 143,120 short tons of potassium salts, equivalent to 61,990 tons of pure potash. The sales by producers amounted to 121,390 tons of potassium salts (55,620 tons K_2O). Potash materials of domestic origin sold by producers were valued at $2,102,590. About 41,000 tons of potassium salts (28,000 tons K_2O) remained in producers' stocks on Dec. 31, 1932.

The principal sources of the potash salts produced in 1932 were from salines at Trona, Calif.; molasses distillery waste at Baltimore, Md., and the potash mines and refinery near Carlsbad, N. M. The first refined salts were shipped from Carlsbad in 1932. The dust from cement kilns near Hagerstown, Md., was also utilized as a source of potash in 1932. (See *Chem. & Met.,* July, 1933, pp. 345-9). Cotton boll ashes from cotton gins in Oklahoma and Texas were sold for their potash content, while small quantities of alunite were shipped from Sulphur, Nev., and Marysville, Utah, chiefly for experimental use as fertilizer material.

Phosphate Rock.—The phosphate rock industry continued its downward trend begun in 1931, but declines in production and shipments were less than in the preceding year. Continued curtailment in mine production indicates the efforts of producers to keep production more nearly balanced with consumption. The quantity of phosphate rock mined in 1932 was approximately 1,711,000 long tons, according to preliminary reports of producers to the Bureau of Mines.

Fertilizer Consumption.—The drastic decrease in estimated consumption of all fertilizers from 8,165,000 tons sold in 1930 to 4,361,800 tons in 1932 was directly proportional to the decrease in farm purchasing power.

Sulphur and Pyrites.—The output of sulphur in 1932 dropped to less than one-half of the quantity produced in 1931, according to the Bureau of Mines, but shipments and exports recorded smaller decreases so that stocks were reduced. Output amounted to 889,700 tons in 1932 and shipments to 1,108,000 tons valued at $19,900,000. One new property in Louisiana was put into operation in October. Texas accounted for 98 per cent of the country's total. Production of pyrites decreased 44 per cent to 185,000 tons in 1932. Production from Missouri was recorded for the first time since 1920.

Alcohol.—Alcohol continued to play an important part in chemical industry, and 146,950,900 proof gallons were

Table II—Value of Output of Chemicals and Certain Related Products

NOTE.—Figures include products of establishments making primarily the articles specified and also (except as stated) those made as byproducts by other establishments. They cover only products made for sale as such.

[In thousands of dollars]

	1923	1925	1927	1929	1931
CHEMICALS					
Acids	79,006	79,274	88,176	98,620	66,850
Nitrogen and fixed nitrogen compounds	30,436	29,659	26,086	38,337	33,483
Sodium compounds	111,848	109,522	113,880	137,655	108,591
Potassium compounds	6,319	6,071	9,306	9,998	8,112
Alums and other aluminum compounds	11,067	11,581	13,563	15,949	10,761
Coal-tar products	121,893	112,201	106,057	130,652	103,088
Plastics	38,702	34,575	28,203	39,734	27,847
Inorganic chemicals, not elsewhere specified	151,068	137,273	159,353	205,170	138,009
Organic chemicals, not elsewhere specified	39,378	55,578	76,588	105,075	79,504
RELATED PRODUCTS					
Alcohol, ethyl, and distilled liquors[1] [2]	33,000	57,706	33,971	54,285	21,741
Bone, carbon, and lampblacks[2]	15,567	13,614	14,519	20,704	10,230
Compressed and liquefied gases[2]	53,384	55,533	61,864	71,293	56,705
Druggists' preparations[2]	78,577	80,921	108,502	124,989	107,313
Drug grinding[1] [2]	10,562	8,446	9,205	9,669	9,159
Essential oils[1] [2]	3,184	5,882	4,642	6,653	3,505
Explosives[2]	68,133	63,826	66,192	62,953	40,269
Fertilizers	179,950	195,040	173,810	222,731	140,718
Glue and gelatin	26,457	26,085	30,752	32,196	27,653
Linseed oil[2] [3]	76,752	94,050	73,582	75,341	43,509
Paints and varnishes[2]	412,076	481,313	527,109	574,880	362,064
Patent and proprietary medicines and compounds[2]	230,277	247,294	268,205	313,753	253,876
Perfumes, cosmetics, and other toilet preparations[2]	119,237	147,393	178,474	201,689	166,257
Rayon and allied products	59,051	88,008	109,888	149,546	132,632
Tanning materials, natural dyestuffs, mordants, and sizes[2]	33,410	31,224	30,929	33,615	24,091
Turpentine and rosin[1] [4]	35,167	42,364	39,903	36,282	16,506
Wood distillation products and charcoal[2]	29,761	25,238	27,571	30,289	11,488

[1]Data represent value of products of the industry.
[2]Data for 1929 refer to sales by manufacturers; those for other years, to production.
[3]Data represent production in the industry alone and do not cover the output of linseed oil made as secondary products by establishments classified in other industries.
[4]Crop year ended Mar. 31 following year specified.
Source: Bureau of the Census.

FOOTNOTES FOR TABLE III

(1) Figures are incomplete and do not include industries indicated by letter (*d*).

a Included in the U. S. and State totals but not shown in this table are the following industry groups: (1) Bone black, carbon black and lampblack, (U. S. totals 1931, $9,535,203, and 1929, $20,169,722); (2) Cleaning and polishing preparations, (1931, $48,007,349 and 1929, $50,779,632); (3) Druggists' preparations, (1931, $109,448,176 and 1929, $124,778,487); (4) Patent and proprietary medicines and compounds, (1931, $254,514,150 and 1929, $318,906,928); (5) Perfumes, cosmetics and other toilet preparations (1931, $158,174,699 and 1929, $193,440,550); (6) Drug grinding (1931, $9,159,361 and 1929, $9,669,220); (7) Essential oils (1931, $3,504,948 and 1929, $6,653,353); (8) Glue and gelatin (1931, $27,515,739 and 1929, $32,458,019; (9) Turpentine and rosin (1931, $16,505,745 and 1929, $36,281,632).

The following industry groups included in Table II were omitted from this table: (1) Baking powders, yeast, etc.; (2) Blacking stains and dressings; (3) Bluing; (4) Candles; (5) Grease and tallow; (6) Printing and writing inks; (7) Linseed oil, cake and meal; (8) Oil, n.e.s.; (9) Rayon and allied products; (10) Salt; (11) Soap.

(*b*) Cannot be shown without disclosing, exactly or approximately, the operations of individual establishments. Figures included in State and industry totals.

(*c*) State total cannot be shown without disclosing exactly or approximately, the operations of individual establishments. Figures included in United States total.

(*d*) Cannot be shown. Figures included in industry totals.

Table III—Value of Products of Selected Chemical Industries, by States, 1929 and 1931

(Source: Bureau of the Census)

State and Year		Total[a]	Alcohol, ethyl, and distilled liquors	Chemicals, not elsewhere classified	Compressed and liquefied gases	Explosives	Fertilizers	Paints and varnishes	Tanning materials, natural dyestuffs, mordants and assistants, and sizes	Wood distillation and charcoal manufacture
United States[a]	1931	$1,822,330,440	$21,740,611	$533,175,179	$41,806,112	$46,258,353	$154,349,887	$350,725,652	$26,469,119	$11,440,157
	1929	2,581,116,578	54,284,665	738,048,386	52,189,779	72,539,724	232,510,936	568,975,838	39,836,035	29,593,672
Alabama	1931	16,768,267	....	5,510,842	(b)	(b)	6,347,631	(b)	(b)	....
	1929	29,550,903	....	(b)	724,897	(b)	13,242,041	(b)	(b)	(b)
Arizona	1931	(c)	....	....	(d)	(d)	....	....	....	....
	1929	(c)	....	(d)	(d)	(d)	....	....	....	....
Arkansas	1931	1,217,308	....	(b)	(b)	(b)	658,557	....	....	(b)
	1929	3,604,479	....	802,770	(b)	(b)	2,265,103	....	....	....
California	1931	66,172,529[1]	1,217,610	21,280,565	2,594,260	4,804,225	3,415,736	19,127,709	(d)	....
	1929	88,550,747	2,311,280	24,636,002	3,514,556	(b)	5,517,940	26,393,866	(b)	(b)
Colorado	1931	1,640,270[1]	....	282,439	(d)	(d)	....	629,715	....	....
	1929	2,705,713[1]	....	751,138	(d)	(d)	....	1,101,579	....	....
Connecticut	1931	33,067,391	....	4,924,708	(b)	....	2,085,120	2,611,653	(b)	....
	1929	28,777,467[1]	....	4,465,635	(d)	....	3,181,350	4,812,279	(d)	....
Delaware	1931	11,320,967	....	(b)	....	....	585,480	(b)	(b)	(b)
	1929	16,177,910	....	(b)	....	....	678,886	(b)	(b)	(b)
Dist. of Col.	1931	809,448	....	(b)	(b)	....	....	....	....	....
	1929	791,106	....	(b)	(b)	....	....	....	....	....
Florida	1931	20,966,299	....	....	263,878	....	11,746,525	145,596	(b)	(b)
	1929	32,976,841	....	(b)	208,021	....	15,760,243	547,059	(b)	2,241,928
Georgia	1931	33,684,203	....	(b)	595,851	....	18,541,643	842,658	(b)	(b)
	1929	55,769,971[1]	....	(d)	868,878	....	29,252,800	1,489,497	360,770	(d)
Idaho	1931	(c)	....	....	(d)	....	....	....	....	....
	1929	(c)	....	....	(d)	....	....	....	....	....
Illinois	1931	182,351,498[1]	(d)	44,611,055	3,424,347	3,069,930	5,892,134	50,430,805	(d)	(d)
	1929	246,813,452[1]	(d)	60,395,800	3,768,813	4,116,612	8,101,734	90,399,091	(d)	(d)
Indiana	1931	40,408,602	(b)	7,050,505	1,254,641	(b)	2,840,439	5,908,127	....	....
	1929	61,175,691	(b)	13,798,041	1,750,879	(b)	4,992,676	11,689,829	....	....
Iowa	1931	11,175,308	....	2,614,337	(b)	(b)	....	397,660	....	....
	1929	16,618,100	....	3,061,034	600,682	(b)	....	738,892	....	....
Kansas	1931	2,383,284	....	(b)	417,085	(b)	(b)	(b)	....	....
	1929	3,450,693	....	(b)	585,146	(b)	(b)	(b)	....	....
Kentucky	1931	11,766,828	1,309,622	(b)	(b)	(b)	(b)	6,432,752	....	(b)
	1929	15,561,703	(b)	(b)	....	(b)	(b)	10,573,502	....	(b)
Louisiana	1931	14,940,102	3,269,870	1,394,893	893,649	....	3,453,565	1,626,904	(b)	636,149
	1929	37,610,663	13,592,515	(b)	(b)	....	8,349,043	2,486,314	(b)	(b)
Maine	1931	4,136,072	....	(b)	(b)	....	3,598,564	(b)	....	....
	1929	4,090,917	....	(b)	(b)	....	3,236,769	(b)	....	....
Maryland	1931	50,254,719	(b)	7,152,654	676,398	....	17,805,748	5,078,692	(b)	....
	1929	77,540,858	(b)	12,942,414	(b)	....	25,506,620	5,877,347	(b)	....
Massachusetts	1931	59,861,347[1]	(d)	14,700,407	1,506,271	(d)	3,895,973	10,674,240	2,278,907	(d)
	1929	82,347,244	(b)	19,103,023	1,743,866	(b)	3,874,229	15,825,855	4,849,556	(b)
Michigan	1931	117,201,257	....	36,870,104	1,774,437	(b)	(b)	25,447,182	(b)	2,173,331
	1929	166,405,428	....	53,183,206	2,309,749	(b)	(b)	43,692,920	(b)	6,365,848
Minnesota	1931	14,529,725	....	1,285,250	1,025,567	....	(b)	3,156,954	....	....
	1929	18,926,507	....	(b)	1,296,800	....	....	4,061,970	....	....
Mississippi	1931	4,051,924	....	....	....	....	2,595,890	(b)	....	890,378
	1929	7,734,534	....	....	....	....	3,572,147	(b)	....	2,433,713
Missouri	1931	68,058,307	....	10,790,373	1,455,625	2,360,100	(b)	18,766,654	....	(b)
	1929	97,391,394[1]	....	12,370,445	1,936,367	7,055,493	(d)	27,778,173	....	(d)
Montana	1931	(c)	....	(d)	(d)	(d)	(d)	....	....	....
	1929	1,896,136	....	(b)	(b)	(b)	(b)	....	....	....
Nebraska	1931	3,663,817	....	....	(b)	....	(b)	616,194	....	....
	1929	5,908,598	....	....	452,864	....	(b)	1,272,440	....	....
Nevada	1931	(c)	....	....	....	(d)	(d)	....	....	....
	1929	(c)	....	....	....	....	(d)	....	....	....
New Hampshire	1931	1,256,157	....	(b)	....	....	....	....	....	....
	1929	2,466,035	....	(b)	....	....	....	....	....	....
New Jersey	1931	275,504,604	1,463,709	111,887,171	4,004,296	(b)	5,512,089	55,362,880	9,124,319	....
	1929	354,688,717	(b)	155,782,630	5,464,748	(b)	7,124,287	82,292,896	11,143,491	....
New Mexico	1931	....	....	....	....	....	....	....	....	....
	1929	(c)	....	....	....	....	....	....	....	....
New York	1931	323,636,302	....	110,324,699	3,621,445	(b)	2,759,109	54,713,949	2,598,778	893,615
	1929	472,197,180	(b)	168,728,982	3,079,772	(b)	2,941,482	89,419,872	4,798,497	4,865,515
North Carolina	1931	26,447,402	....	(b)	(b)	....	15,244,307	(b)	869,373	(b)
	1929	42,277,618	....	(b)	(b)	....	22,956,326	(b)	1,638,130	(b)
North Dakota	1931	....	....	....	....	....	....	....	....	....
	1929	(c)	....	....	....	....	....	....	....	....
Ohio	1931	110,033,297[1]	....	35,717,363	4,062,559	796,468	9,929,241	34,448,097	....	(d)
	1929	168,264,559[1]	....	46,286,616	5,691,854	1,618,618	14,188,563	63,686,060	....	(d)
Oklahoma	1931	1,985,130	....	(b)	492,806	(b)	....	(b)	(b)	(b)
	1929	4,204,321	....	(b)	945,515	286,914	....	(b)	(b)	(b)
Oregon	1931	1,676,126	....	....	(b)	....	....	820,773	....	....
	1929	1,908,980[1]	....	....	207,362	....	....	1,450,738	....	....
Pennsylvania	1931	131,078,845	6,512,772	27,037,942	4,383,822	8,151,488	4,836,452	32,365,561	3,127,720	1,518,006
	1929	188,523,011[1]	12,615,816	48,111,312	6,735,840	11,969,844	6,729,984	48,965,801	4,544,638	3,654,306
Rhode Island	1931	5,617,674	....	1,896,209	....	....	(b)	(b)	1,137,461	....
	1929	7,657,089	....	2,505,125	(b)	....	(b)	(b)	1,359,981	....
South Carolina	1931	10,068,887	....	(b)	....	....	8,349,334	(b)	(b)	....
	1929	16,499,377	....	(b)	(b)	....	14,050,480	269,169	(b)	....
South Dakota	1931	(c)	....	....	(d)	....	....	....	....	....
	1929	(c)	....	....	(d)	....	....	....	....	....
Tennessee	1931	37,093,501	....	17,443,428	525,225	(b)	3,661,983	1,335,201	(b)	1,805,416
	1929	45,984,840[1]	....	18,819,789	598,970	(d)	7,061,986	1,827,003	916,705	3,371,319
Texas	1931	17,449,900	....	3,208,834	1,569,796	(b)	1,080,430	2,483,282	....	....
	1929	26,149,301	....	4,191,015	2,183,154	(b)	2,920,748	3,118,219	....	....
Utah	1931	1,738,327	....	(b)	283,896	(b)	....	(b)	....	....
	1929	3,471,640	....	(b)	353,497	(b)	(b)	(b)	....	....
Vermont	1931	1,151,646	....	....	....	....	(b)	....	....	....
	1929	1,663,971	....	....	....	....	(b)	....	....	....
Virginia	1931	40,049,390[1]	....	20,917,442	1,265,430	....	14,472,852	722,820	1,256,270	....
	1929	47,035,012[1]	....	20,681,676	1,327,422	....	20,661,916	611,868	1,979,115	....
Washington	1931	7,079,537	....	1,935,655	627,376	(b)	215,646	952,180	....	(b)
	1929	10,346,078	....	1,308,760	688,174	(b)	402,704	1,709,274	....	(b)
West Virginia	1931	26,839,790	....	21,741,013	1,146,761	(b)	(b)	1,950,660	....	(b)
	1929	30,279,111	....	22,858,635	825,949	634,066	(b)	3,726,014	....	(b)
Wisconsin	1931	22,265,651	....	(b)	965,657	(b)	(b)	7,414,588	(b)	(b)
	1929	32,139,282	....	(b)	1,403,440	(b)	(b)	13,555,554	(b)	(b)
Wyoming	1931	(c)	....	....	(d)	....	....	....	....	....
	1929	(c)	....	....	(d)	(d)	....	....	....	....

made in the fiscal year ended June 30, 1932. Of this figure, 14,238,800 gal. were made synthetically and 124,552,375 gal. from molasses by fermentation. The amount of denatured alcohol produced declined from 86,308,900 wine gal. to 78,329,500 wine gal. in year ended June 30, 1932, according to the Bureau of Industrial Alcohol. Of significance is the increase in the quantity of specially denatured alcohol largely due to the new and increasing use of such alcohol in the form of solvents. The total output of specially denatured alcohol was 44,031,300 wine gal.

Methanol.—Production of synthetic methanol increased during 1932 to 7,634,000 gal., while refined wood distillation and crude methanol from this source continued to decline to 1,526,000 and 2,481,000 gal., respectively. Not quite as much was produced in the first four months of 1933 as was made in the corresponding period of 1932; production of refined methanol from wood distillation amounted to 490,000 gal. and of synthetic to 1,280,800 gal. during the January-April, 1933, period.

Naval Stores.—Total quantities of turpentine and rosin distilled from crude gum reported for the crop year 1931-32 were: turpentine, 24,341,800 gal.; rosin, 1,570,900 bbl. (of 500 lb.). In addition, wood distillation plants reported the output of 3,141,000 gal. of turpentine and 333,500 bbl. of rosin during the calendar year 1931. Stocks on hand March 31, 1932, of 7,058,400 gal. of turpentine and 1,034,300 bbl. of rosin were considerably higher than on the same date mentioned in 1930.

Petroleum Gases.—The liquefied hydrocarbon gases continued to deserve their title of "depression-proof products," since in 1932 they showed an increase of approximately 5,000,000 gal., or 17 per cent over 1931 sales. Since 1927 this industry has made remarkable progress: total sales of 1,000,000 gal. in that year, expanded to 33,600,000 gal. in 1932, according to figures of the Bureau of Mines.

Several records were made in the United States export trade in chemicals in 1932, notwithstanding the large reductions in the totals. For the first time in history American nitrate exports were greater than imports and also for the first time United States exported more synthetic nitrogen than byproduct nitrogen. Exports of carbon black established a new record by exceeding all previous years.

For the second successive year, imports of chemicals and allied products were less than exports. To understand these changes, it is necessary to do some brief reviewing. During the first 15 years of the twentieth century, imports of chemicals and allied products accounted for 60 per cent of the total foreign trade in chemicals and exports for around 40 per cent; in 1932, imports were 42 per cent and exports 58 per cent of the total. In 1930, the balance of trade was struck for the first time, when both exports and imports exceeded $172,000,000.

The greater importance of exports in the past decade is partly explained by the establishment of a synthetic organic chemical industry and subsequent exports of these commodities, the greater demand created abroad for commodities, such as carbon black, in which the United States is the dominating world factor and chief source of supply, and the lessened imports of key commodities, due either to substitution of one commodity for another or the development of domestic industries.

The transition from natural to synthetic products and the development of these domestic industries is evident from the character of foreign trade. In the export trade, those commodities to show increases or new business in 1932 were chiefly of synthetic origin. Somewhat more explanation is necessary with regard to imports. Whereas at the start of the century, for example, crude materials and supplementary commodities made up 42 per cent of the chemical imports into the United States, in 1927 they accounted for 73 per cent and consisted largely of natural raw materials, such as Chilean nitrate, shellac and other varnish gums, tung oil and dead or creosote oil.

In 1932, however, the percentage was reduced to only 57 per cent, due to lessened quantities of nitrate, as mentioned above, of varnish gums (partly on account of the development of the synthetic resin industry), to the greater use of synthetic camphor, to expansion of such domestic industries as creosote oil and of the development of domestic sources of materials, such as potash, with lessened dependence upon foreign countries for our requirements. Foreign trade in chemicals is to be the subject of a subsequent article in *Chem. & Met.*

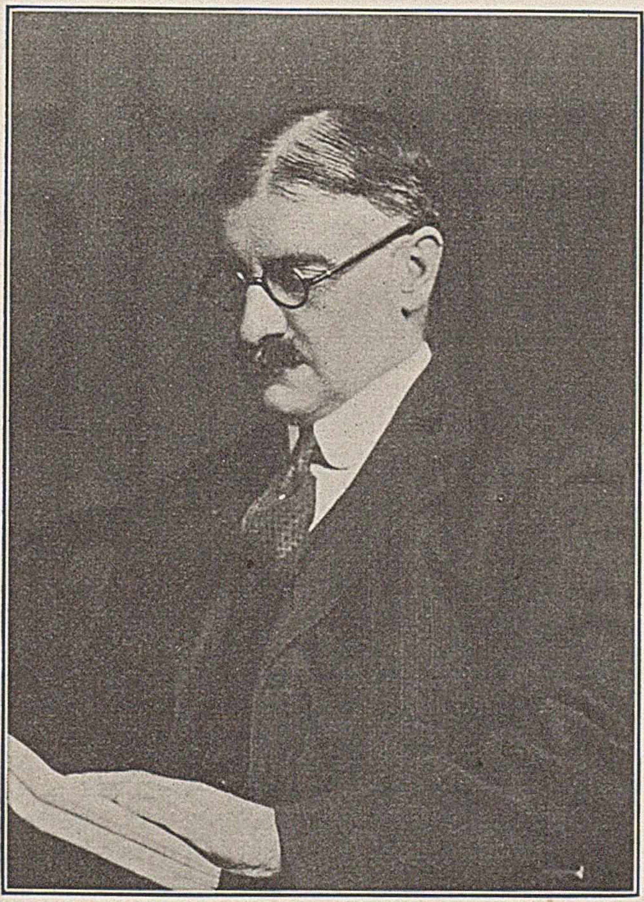
Table IV—Exports and Imports of Chemicals and Related Products, by Groups

[In thousands of dollars]

Group	Exports (excluding re-exports) 1929	1930	1931	1932	General imports 1929	1930	1931	1932
Grand total	212,275	172,585	130,960	95,261	232,977	172,785	117,814	72,068
Chemical group (8)	152,109	127,855	100,094	70,408	[1]144,062	[1]112,070	[1]82,738	[1]47,852
Coal-tar products	17,875	17,557	10,308	8,752	22,823	16,273	11,164	9,158
Medicinal and pharmaceutical preparations	21,468	17,799	15,103	10,027	6,421	4,948	3,972	2,530
Industrial chemical specialties	15,439	15,589	13,754	9,949	30,698 (specialties and chemicals)	23,321 (specialties and chemicals)	17,215 (specialties and chemicals)	14,450 (specialties and chemicals)
Industrial chemicals	27,166	23,017	19,774	14,958				
Pigments, paints, and varnishes	29,113	21,689	15,127	10,366	3,823	2,613	2,012	1,445
Fertilizers and materials	20,441	15,283	13,011	8,653	72,340	59,151	44,733	17,858
Explosives and fuses	4,549	2,950	1,733	1,281	960	911	566	371
Soap, washing powders, etc	7,277	5,993	4,301	2,847	1,263	1,082	815	578
Perfumery and toilet preparations	8,784	7,979	6,981	3,575	5,725	3,703	2,249	1,460
Related products from other groups	60,166	44,730	30,866	24,853	88,915	60,715	35,076	24,216
Naval stores	29,678	21,415	13,261	10,951	335	213	57	103
Other gums and resins	1,319	1,282	1,043	636	35,302	21,238	13,074	7,810
Crude drugs and botanicals	3,690	2,576	2,413	1,193	10,581	7,678	5,925	5,005
Essential oils	2,436	1,993	1,472	1,311	7,576	5,643	3,654	2,746
Linseed and tung oils	288	214	111	60	15,711	12,693	4,437	3,435
Sulphur	18,278	12,972	9,269	7,424	......	......	......	......
Pyroxylin products	3,326	3,238	2,558	2,806	2,713	1,500	957	591
Matches	138	154	103	51	3,435	1,452	1,435	922
All other[2]	1,013	886	636	421	13,262	10,298	5,537	3,604

[1]Includes articles not distributed by groups valued at $11,000 in 1929, $70,000 in 1930, $9,000 in 1931, and $2,000 in 1932.
[2]Includes bones, gelatin, glue, natural dyes, casein, and waxes.
Source: Bureau of Foreign and Domestic Commerce.

Electrochemists' Meet at Chicago Fair



Prof. R. S. Hutton of Cambridge, England
Second Joseph W. Richards Memorial Lecturer

EDITORIAL STAFF REPORT

THE WORLD'S FAIR at Chicago has attracted scientific and technical societies. The Electrochemical Society had planned for years for this Chicago Convention which was held during the first week in September, and the well-rounded program was much appreciated. There were two sessions that were particularly attractive to members and guests,—the Thursday morning international convocation on corrosion at which Dr. Frank N. Speller presided, and the Friday evening celebration commemorating the 100th anniversary of the discovery by Michael Faraday of the two basic laws which form the foundation of electrochemistry.

The president, Dr. John Johnston, formally opened the sixty-fourth meeting of the Electrochemical Society and then turned the chair over to Dr. Speller of Pittsburgh. The program included contributions from Great Britain, France, Germany, Holland and Czechoslovakia, besides those from the United States. It was pointed out repeatedly during discussion that the ever-increasing use of steel structures, together with the increasing cost of labor and materials, have made the problem of protecting iron and steel against corrosion one of prime economic importance among all civilized nations. Compared with 25 or 30 years ago, the problem is more intricate today due to several factors. One of these factors is the ever-increasing pollution of the atmosphere due to the combustion of millions of pounds of fuel in those very centers where steel structures are rapidly displacing structures of wood and stone. Another factor is the wide variety of steel used today as compared to 30 years ago.

W. H. J. Vernon, of the department of scientific and industrial research, Teddington, Middlesex, England, in presenting his findings on the role of the corrosion product in the atmospheric corrosion of iron emphasized the importance of the primary (invisible) oxide film as compared to the secondary rust subsequently developed. Formation of a continuous oxide film having protective properties is favored by screening the specimens from suspended particles in the atmosphere, which themselves give rise to a characteristic rusting, although the relative humidity may be considerably below the dew-point. A fundamental change in the rate of rusting (from a retardation to an acceleration) takes place at a critical humidity in the neighborhood of 65 per cent saturation; this change is linked up with hygroscopicity of the rust. Additions to the iron of alloying elements may, it was suggested, act either by stabilizing the primary film or by reducing the hygroscopicity of the secondary rust.

Paints for Protection

It will be recalled that it was not so long ago that several paint manufacturers maintained that any steel could be effectively protected against corrosion if the right paint were used and this were properly applied. At Chicago one outstanding fact was emphasized, namely, that the protective action of paint is much greater when applied to surfaces of steels which in themselves are corrosion-resistant than when applied to ordinary steels. S. C. Britton and Ulick R. Evans of Cambridge, England, in their scientific study of protective painting, stressed the importance of the chemical properties of the pigments. The life of a paint coat depends upon four variables. Conclusive evidence was obtained on the effects of substances such as rust, mill scale, salt and moisture shut in beneath the paint coat, besides possible variations in the compositions of paints.

Commenting on the findings of Britton and Evans, Dr. A. H. Sabin, the paint patriarch of America, referred to tests made by Dr. G. W. Thompson some 25 years ago in which paint pigments were suspended in distilled water, each in a separate container, with pieces of cleaned iron, agitating the suspension with air. There seems to be no doubt that red lead inhibits corrosion of the steel. Paint properly selected and applied will last from seven to ten years before renewal is necessary.

Manfred Ragg of Hamburg, Germany, supported the findings of Britton and Evans in his independent investigations. As compared with other pigments, red lead has a decided, protective value when applied as a paint to iron and steel surfaces. The electrochemical interaction between the lead oxide and the metallic iron of the surface appears to be of secondary importance as far as rendering the iron resistant to rust is concerned.

Electroplating for Protection

The following three papers were concerned with the protective action of electrodeposits: A. W. Hothersall of the research department, Woolwich, England, carefully investigated the adhesion of electrodeposited coatings to steel. Ladislav Hajda and Stepan N. Popov of Czechoslovakia made a thorough investigation of the adherence of metal deposits applied to steel and other metals. They developed a special technique in mounting the specimen for examination under the microscope.

Local Couples and Passivity

E. Herzog of the laboratory of applied chemistry, University of Lille, France, concentrated his attention on the local or point-to-point couples on the surface of iron and steel in his paper, the protection of iron in aerated salt solutions by cathodic deposits. Any means devised to develop a uniform potential all over the surface will render the steel rustproof. Specifically, this can be brought about by retarding the oxidation of the hydrogen formed at the cathode areas or points. Thus, for example, Herzog had found that applying a thin film of PbO or ZnO to the surface of Armco iron reduced its potential from 0.4 volts to less than 1/10 of this value. This would help to explain why certain pigments in paints are preferable to others as far as protection against corrosion is concerned.

Karl Daeves of Düsseldorf, Germany, compared the life of painted ordinary steel with that of painted copper-bearing steel. Results show that a definite correlation does exist between the composition of steel and the life of the protective coating applied to it. For instance, paint and zinc coatings show a considerably better adhesion to copper steels than to ordinary steel. And K. H. Logan of the U. S. Bureau of Standards reported at length upon many years of study of the protection of pipes against soil action.

Theory of Corrosion

Prof. O. P. Watts of the University of Wisconsin has for years followed the development of the electrochemical theory of corrosion originally proposed by Dr. Whitney of Schenectady. For this convention he tendered the opinions of various authorities in the corrosion field and presented briefly a summary of the present status of the electrochemical theory. W. D. Bancroft of Cornell advocated that the factor which stops corrosion in most cases is the formation of a protective film. William Blum of the Bureau of Standards submitted the statement that the whole theory of electrolytic corrosion implies that corrosion is caused or accomplished by passage of electrons through the metal from the part that is corroding to some part that is not corroding. From this standpoint it is locally immaterial whether the electrons come from inside or outside of the system. Evans maintained that the electrochemical view of corrosion is something more than a theory, since in certain cases the currents flowing between different parts of the metal have been measured and found to account for the corrosion which is actually observed. But the experimental facts give no warrant for the supposition that simple combination is impossible. Colin G. Fink of Columbia University stated, "Our researches covering many years have fully supported us in the belief that all corrosion in aqueous solution is electrochemical in nature. We have never found a case which we could describe distinctly as chemical corrosion."——"Tests carried out by Dr. F. J. Kenny proved beyond a doubt that local point-to-point couples exist in the surface of a metal such as steel." W. H. Hatfield of Sheffield, England, advocated that there seems to be no reason why direct attack should not sometimes occur, even though most cases should prove to be largely or entirely electrochemical in character, and there are certain cases which are difficult to conceive of as other than instances of direct chemical attack." Speller felt that it may now be regarded as established that in substantially all cases of corrosion at ordinary temperatures the driving force of the corrosion reaction between metal and environment is electrochemical. Professor Watts concluded: "After thirty years, Whitney's statement that corrosion is electrochemical in nature still stands as our best definition of the electrochemical theory of corrosion."

Corrosion Tests of the A.S.T.M.

The Electrochemical Society had invited the American Society for Testing Materials to cooperate with it at this international convocation on corrosion. Dr. Carl D. Hocker of the Bell Telephone Laboratories briefly reviewed the outstanding work done by the A.S.T.M. Tests are being conducted on a large scale at seacoast, industrial centers and rural districts, also tests in running water, acid, brackish and drinking water. Finally, tests are also carried out on metals immersed in the ocean. Increased corrosion resistance upon the addition of copper to steel is noticeable in all tests as soon as the copper concentration is approximately 0.13 per cent. The heavier the coating of zinc galvanized sheets, the longer the life. The last three papers of the symposium were contributed by Prof. H. L. Lochte and his associates at the University of Texas. They dealt with the electrochemical behavior of iron in corrosion cells.

At the conclusion of the session President Johnston in his usual gracious manner thanked Dr. Speller, in particular, and also Dr. Evans for their splendid efforts in making this internation corrosion symposium possible and so unusually attractive.

Acheson Medal Presented to Fink

Thursday evening the presentation of the Edward Goodrich Acheson medal was made to Colin G. Fink "for distinguished services in electrochemistry" together with the prize of $1,000. William G. Harvey of the Aluminum Co. of America, in introducing the medalist, referred briefly to his various achievements, his work on contact catalysis, ductile tungsten, platinum substitutes, insoluble anodes, chromium plating, tungsten plating, and aluminum plate. Dr. Fink's hobbies have been in art. His work on the restoration of ancient bronzes and recently his discovery of the electroplating art of the old Egyptians were mentioned in particular. In accepting the medal and prize Dr. Fink referred to his indebtedness to many of his associates without whose assistance and inspiration his researches would have been impossible. He also announced that the thousand dollars was to form the nucleus for a fund in honor of Dr. E. F. Roeber, the first editor of *Chemical and Metallurgical Engineering,* whose inspiration was so largely responsible for many of the outstanding accomplishments in American electrochemistry. The interest on this fund is to assist young research electrochemists. The fund is to be known as the "Roeber Research Fund." After the presentation, members and guests enjoyed a delightful dance which lasted till the small hours of the morning.

Faraday Day

Sept. 8 was scheduled on the official program of the Century of Progress as Faraday Day, Auspices Electrochemical Society. The Illinois Host Building was put at the disposal of the Society for the whole day. The man directly responsible for the program was Dr. G. W. Vinal of the Bureau of Standards. The morning was devoted to visits to the electrical building and to the radio and communication building with the General Electric Co. and the Westinghouse company acting as hosts.

In the afternoon a session was held in the auditorium of the Illinois building and John J. Mulligan, chief metallurgist of the U. S. S. Lead Refinery of East Chicago, presided. The session was given over to papers on electrolysis. E. Newbery and S. M. Naudé of the University of Cape Town, South Africa, described a new method for the electrolytic refining of mercury using a mercurous perchlorate electrolyte. A second paper by Professor Newbery was on metallized-glass hydrogen electrodes. Dr. F. H. Getman of the Hillside Laboratory, Stamford, Conn., determined the potential of the tellurium electrode. A. L. Ferguson and George Dubpernell carried out a thorough investigation on overvoltage at the University of Michigan.

Electroplating

Of the various plating solutions the nickel solution has always stood out among the rest on account of its high throwing power. However, it had not been definitely determined whether a low or high pH favored the throwing power. Dr. Russel Harr of the University of Wisconsin finds that the throwing power of high pH solutions is better than that of low under all conditions of temperature and current density. Dr. George W. Nichols of the University of Wisconsin investigated the effects of lactates on the nickel deposit and obtained some valuable results. The best deposits were obtained at a pH between 3.7 and 4.3. The ratio of lactate to nickel in the baths must be increased as the concentration of nickel is increased. L. E. Stout and C. L. Faust of Washington University, St. Louis, have continued their research on the deposition of the ternary Fe-Cu-Ni alloy.

Two reports were submitted by Prof. F. C. Mathers of Indiana University. The one by R. L. Bateman and himself was concerned with the electrodeposition of lead from dithionate baths. Excellent plates were obtained from 4 per cent lead dithionate containing 2 per cent free dithionic acid. Of the various addition agents tried, a combination of glue and beta naphthol gave the best results. The second report by M. Harbaugh and Mathers covered their results on the electrodeposition of bismuth. In this case they used a perchlorate bath containing 104 g./L. of perchloric acid and 40 g./L. of bismuth oxide. The addition agent used was a mixture of glue and cresol.

Dr. R. R. Rogers and John F. Conlon of the electrochemical laboratories of Columbia University described their findings on chromium plating from ammonium-chromate-sulphate baths; emphasis was laid on the use of the ternary diagram in investigating such a plating bath.

The honorary guest of the Society, second Joseph W. Richards Memorial lecturer, was Prof. R. S. Hutton of Cambridge, England. In introducing the speaker, Dr. Johnston referred to Dr. Hutton's many years of research and accomplishments, notably in the field of non-ferrous metallurgy, and to his recent appointment as Goldsmiths' Professor of Metallurgy. Dr. Hutton is one of the charter members of the Electrochemical Society. Illustrating his talk with a series of fascinating slides depicting some of Faraday's original apparatus and experiments, he gave the audience a picture of what the electrochemical world was like 100 years ago and emphasized the many outstanding accomplishments which were a direct sequence to Faraday's classic researches.

Aside from the interesting slides, two moving picture films were shown, one depicting the reactions taking place during electrolysis and the other a film loaned to the Society by the General Electric Company dramatizing Faraday's work in his laboratory. Dr. Vinal, who had taken great pains in building exact replicas of original Faraday apparatus, used these to demonstrate to the audience the two fundamental Faraday laws on which the whole are and industry of electrochemistry are founded.

Organo-Electrochemistry

The Saturday morning session was devoted to the rapidly increasing field of organo-electrochemistry. D. M. Overcash and Mathers of Indiana University described how it was possible to electrodeposit magnesium from organic solutions using, in particular, the Grignard reagent as the solvent. Results of a detailed study of the rate of solution of magnesium in acids were presented by Martin Kilpatrick and J. Henry Rushton of the University of Pennsylvania. Prof. Sherlock Swann, Jr. of the University of Illinois outlined his new method for electrolytic reduction of ketones using glacial acetic.

O. O. Fritsche, H. B. Wahlin and J. F. Oesterle of the University of Wisconsin tackled the difficult problem of making crucibles out of thorium oxide and after many most painstaking efforts submitted the following specifications together with detailed design of apparatus.

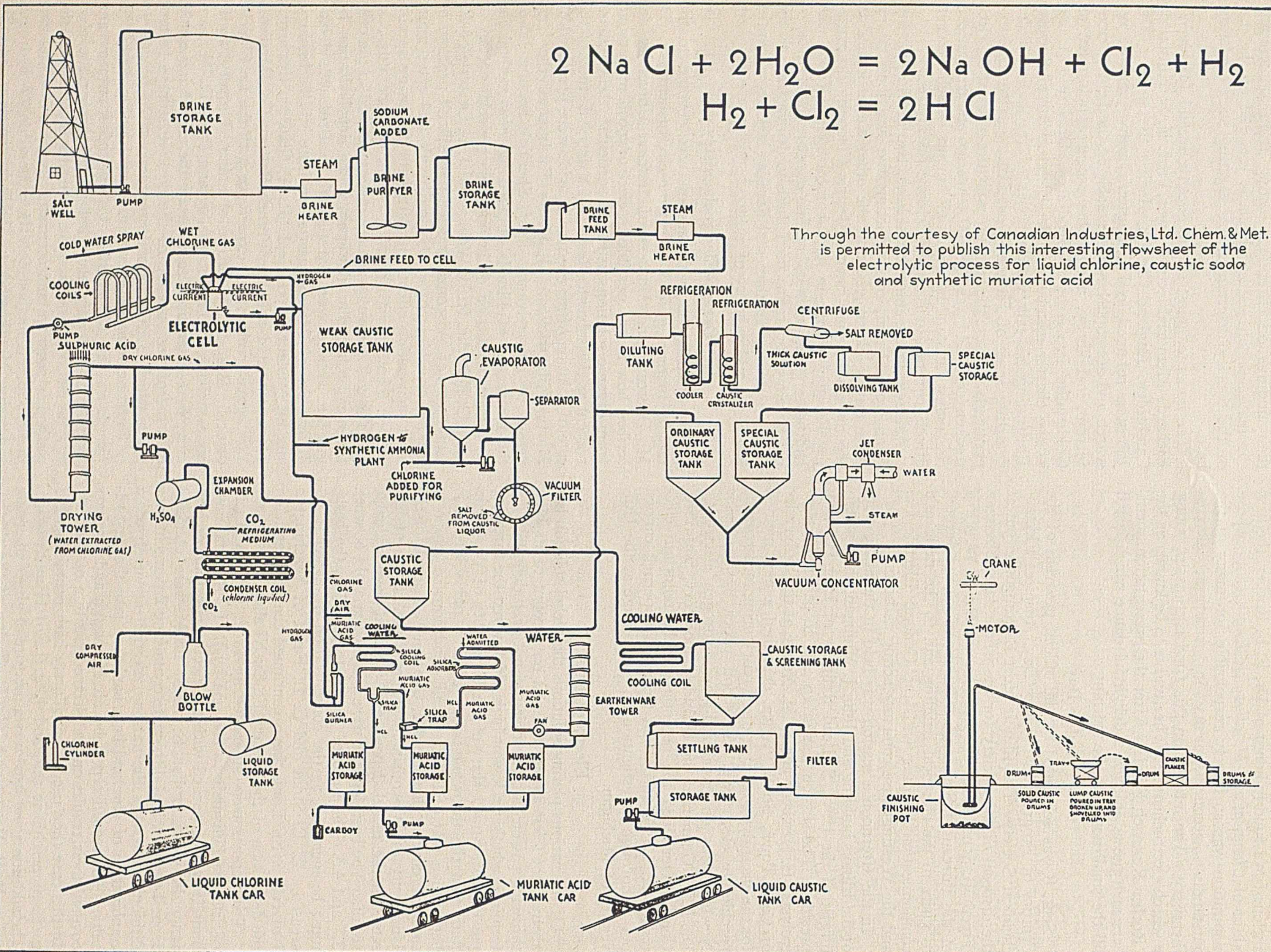
As is well known, graphite anodes are used in the cells for making metallic aluminum. The depolarization by graphite anodes was investigated by Prof. M. deKay Thompson of Massachusetts Institute of Technology, and his student, F. G. Seyl. R. A. Claussen, for many years connected with the French Battery Co., Madison, Wis., gave freely of his experience with the Le Clanché dry cell. Prof. O. W. Brown of Indiana University with his associates, Dr. R. L. Shelley and Prof. E. W. Kanning, were determined to ascertain the underlying causes of some of the buckling of the positive storage battery plates which is still met with in practice.

The concluding paper was presented by Dr. Frank N. Moerk of the Philadelphia College of Pharmacy and Science, on an apparatus and procedure for the electrolytic estimation of arsenic. Results indicate that the method is sensitive and accurate. In place of using zinc in the Gutzeit method for the generation of hydrogen and arsine, Moerk generates the hydrogen electrolytically.

$$2\,NaCl + 2H_2O = 2\,NaOH + Cl_2 + H_2$$

$$H_2 + Cl_2 = 2\,HCl$$

Through the courtesy of Canadian Industries, Ltd. Chem. & Met. is permitted to publish this interesting flowsheet of the electrolytic process for liquid chlorine, caustic soda and synthetic muriatic acid



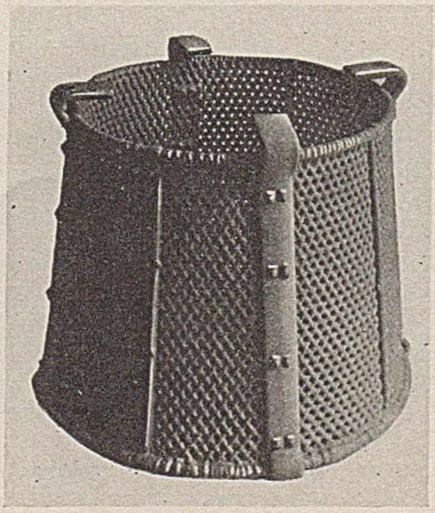
Rubber Coatings For Abrasion and Corrosion Resistance

By LEONARD CHURCH
Editorial Representative, Cleveland, Ohio

CORROSION resistance, wear and abrasion resistance, and insulation against electricity, heat, sound, or vibration, are all possible through the rubber coating of metallic parts. The lack of a rapid, convenient, and economical method of applying rubber to the surfaces of metal articles of irregular shapes has until recently restricted the use of rubber coatings. Now, however, adherent protective coatings of soft and hard rubber are readily applied to surfaces of any shape by the anode process.

In this process the articles to be coated with rubber are immersed in rubber latex, to which the necessary compounding ingredients have been added, and are given, in one rapid continuous operation, a coating of wet latex rubber of the desired thickness. This coating or "deposit" of rubber is dried and cured to a soft, semi-hard, or hard rubber state, depending upon the quantity of sulphur and other ingredients used. The formation of the deposits of unmasticated rubber from latex mixes is a triumph of modern colloid chemistry applied to one of nature's most interesting colloidal solutions.

It was not until early in the twentieth century that it was discovered that the small rubber globules in latex have a negative "anionic" electric charge, which electric charge was later technically utilized to deposit rubber for manufacturing purposes. Professor Henri at the Sorbonne University in Paris found in 1906 that because of this electric charge the rubber latex particles travel toward the positive pole when a direct electromotive force is applied. Subsequently, S. E. Sheppard, one-time student of Professor Henri, working with L. W. Eberlin at the Eastman Kodak Co., made further application of the science of colloidal chemistry in order to develop a manufacturing process for latex articles and coatings. They applied direct current to latex and artificial rubber dispersions containing sulphur and other rubber compounding ingredients in colloidal form. In this way they caused the negatively charged particles, comprising a complete rubber compound, to migrate to the vicinity of the metallic anode surface where they were coagulated by streams of positive ions migrating outward from the anode surface. These deposits could be cured to give high grade coatings of unmasticated rubber.



The corrosive action from plating solutions is eliminated when this tumbling plating basket is covered with soft rubber over the steel wire frame

Coincidental with this work of Sheppard and Eberlin, Paul Klein and Andrew Szegvari in Budapest, Hungary, were likewise depositing rubber through the utilization of the coagulating effect of streams of positive ions moving outward from the deposition surface. In some cases, this was accomplished on metallic surfaces in the same way as was done by Sheppard and Eberlin. In other cases the coagulating ions were caused to migrate, by the imposition of a direct electromotive force, from an anode compartment through a porous diaphragm to coagulate upon the surface of the diaphragm the desired deposits of latex rubber. In still other cases, the coagulating ions, instead of being impelled outward from the depositing surface at a constant rate of speed by an electromotive force, were allowed to diffuse from the depositing surface and thus coagulate the desired deposit. All these phenomena, observed by Sheppard and Eberlin, and Klein and Szegvari, were destined to form the basis of the present anode process. The various interests were merged in 1926 to form American Anode, Inc., which is jointly owned by the B. F. Goodrich Co., Eastman Kodak Co., and the Anode Rubber Co., Ltd., of England.

The name "anode process" came to be applied to the method of making rubber articles and coatings directly from rubber latex by the deposition of latex rubber and compounding ingredients by ionic coagulating action extending outward into the latex from the deposition surface. When the coagulating ions are impelled by an impressed electromotive force the process is called anode electrodeposition, but when the coagulating ions are allowed to diffuse from the depositing surface the process is called anode ionic deposition.

In both electrodeposition and ionic deposition the entire thickness of deposits is rapidly built up in one application, thereby saving time, cutting operation costs, and eliminating such defects and disadvantages of multiple dipping processes as air blisters and dirt specks between layers and the tendency of the layers to separate.

Rubber can be coated by electrodeposition upon a number of different metallic surfaces, but since zinc can be used as readily as any other metal and since the presence of zinc hydroxide and zinc oxide is not only not detrimental to the rubber, but useful for cure, zinc is usually chosen as the plating surface. Articles of other metals can readily and cheaply be given a light coat of zinc which is sufficient for the electrodeposition of rubber. The coating operation is remarkably rapid. In fact, it is common practice to electrodeposit 0.05 to 0.1 in. thickness of rubber in about the same time and at about the same electrical energy cost as in the deposition of 0.0005 in. of metal. The coating operation is also easily conducted. For example, a zinc coated metal article can be brought along on a conveyor, immersed in a latex deposition vessel, the current turned on, and from five seconds to five minutes later, depending upon the thickness desired, the coated article is removed and is ready to be dried and cured. From this it is readily seen that the process is extremely adaptable to mass production of rubber coatings.

Articles of metal or non-metal to be coated with rubber by ionic deposition are dipped in a solution of a latex coagulant, and the excess solvent is allowed to evaporate. The coagulant coated article is then immersed in a latex mix for a period of a few seconds or a few minutes, depending upon the thickness of rubber desired. During this immersion the coagulant diffuses from the article surface into the latex where the positively charged ions from the coagulant neutralize the electric charges on the adjacent rubber particles, and cause the coagulation, around the article, of a smooth, uniform deposit of rubber. The coated article is then removed from the latex, the excess coagulant is removed by washing, and the coating is ready for drying and cure. Ionic deposition, while not as rapid as electrodeposition, is still faster and more economical than simple repeated dippings for the building up of any appreciable thickness of rubber. Like electrodeposition, it is readily applicable to mass production.

Rubber coverings can be adhered to article surfaces so well that the bond is even stronger than the rubber itself. Anode rubber is extremely strong and tough. Table I shows average tensile and elongation data on several high rubber stocks. Individual tests have revealed tensiles up to 7,200 lb. per sq.in. with the elongation well above 800 per cent.

Table I—Anode Pure Rubber Stocks

Compound	Tensile (lb./sq.in.)	Elongation
A	5,943	973
B	5,120	955
C	5,500	930
D	6,695	905
E	6,890	860
F	6,003	843

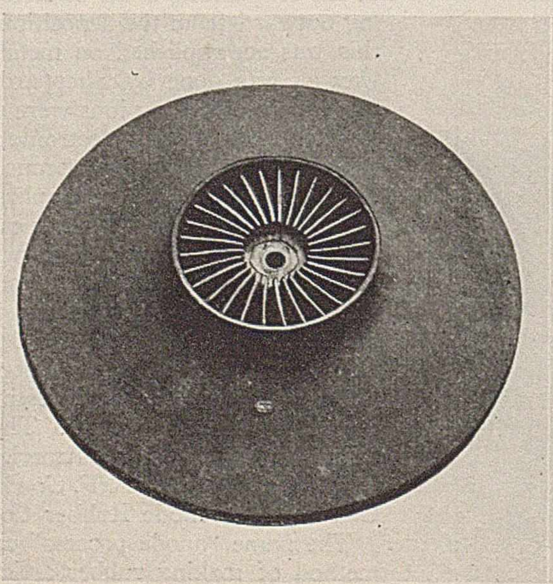
Table II—Stress-Strain Data on a Typical Anode Compound

Elongation Per Cent	Pull lb.
100	80
200	120
300	140
400	180
500	280
600	675
700	1,525
800	2,650
900	4,500
930	5,500

The unusual combination of high tensile and high elongation obtained with many of these stocks is unknown in masticated rubber.

Remarkably high tear resistance is characteristic of anode rubber. The excellent aging is indicated by the fact that commercial high rubber stocks often give tensiles of about 3,500 lb. per sq.in. after 21 days in the Geer oven at 70 deg. C. or after 144 hr. in the Bierer bomb at 70 deg. C. and 300 lb. per sq.in. oxygen pressure.

The resistance of coatings of soft and hard rubber at temperatures below 150-170 deg. F. to most acids and



Fan blade, used in the suction exhausting of ashes has had its useful length of service increased over 500 per cent with covering of soft rubber

Ventilating fans of the Buffalo Forge Co. are rubber coated when used in the presence of acid fumes, or other corrosive or abrasive operating conditions salts is well known. This excellent resistance can be used to advantage when rubber coatings are applied to such articles as plating racks, dipping baskets, screens, floats, stirrers, chemical laboratory apparatus and utensils, and a multitude of articles for special purposes. Where the volumes are large, many articles can be made of rubber covered steel much more cheaply than of other materials.

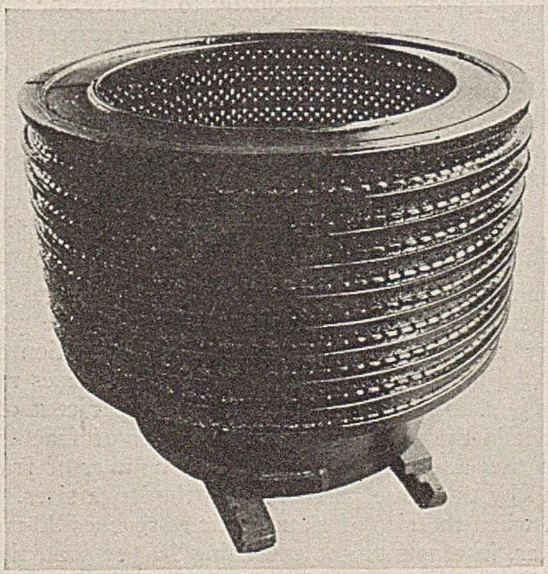
The remarkable resistance of rubber to wear and abrasion of the type encountered in screening gravel and in the wet handling of all abrasive materials make the application of anode soft rubber coatings to screens of wire and perforated metal, chutes and stirrers of economic value. Data are on record where rubber covered screens have handled four to six times the volume of material that could be handled by bare metal screens. Rubber covered impellers for handling rock dust have given three times as long service as bare metal impellers. There are a great many possible applications of such wear-resistant coatings in industry.

For Heat Insulation

Soft and hard rubber coatings having excellent electric properties can be applied to the surfaces of articles of metal or non-metal. Rubber coatings are also useful for insulation against heat, sound, and vibration.

Anode rubber coatings have many applications where elements of slightly flexible, anti-rattling or non-slipping qualities are desired. Many articles require rubber coatings for improved feel. Hard rubber covered metal handles have the advantage of strength, smoothness and low heat conductivity, while soft rubber covered handles have the additional property of softness. Rubber coatings can be applied to articles of almost any material. Coatings can, if desired, be made on forms and can be shipped in the uncured or cured state for later application to articles of metal or non-metal. Many metal articles such as toys are used under conditions where their hard surfaces and sharp corners cause a great deal of damage to furniture or other surfaces with which they come in contact. Rubber coatings applied to such articles improve their appearance.

Large centrifugal basket, rubber-coated to prevent corrosion



Illumination Characteristics Of Organic Plastics

PRACTICALLY all of the organic plastics may be produced in the clear form and find application as laminations for shatter-proof glass, for windows, in chemical plants and airplanes, for decorative displays, and for photographic film, Alfred Paulus and C. Scott Woodside of the Westinghouse Lamp Co. told members of the Illuminating Engineering Society at their convention at Lake Delavan, Wis. Some of these plastics transmit ultraviolet radiation, and are therefore of interest as window material for sun parlors and sanitariums. No doubt they will some day figure prominently in lighting fixtures designed to provide artificial sunshine for offices and homes.

Diffusing properties may be incorporated in plastics by two methods: First, by the addition of pigment which produces a cloudy appearance similar to that of opal glass; and, second, by means of surface treatment such as acid etching, sandblasting, or by the impressing of configurations.

Since organic plastics resemble glass in appearance and illuminating properties they are suitable for similar uses. As may be seen, plastics can easily duplicate the results to be obtained with a glass in regard to diffusion. However, it is only fair to differentiate between the quantities of light transmitted by the different materials. The wide variation in transmission is due to the kind and quantity of pigment used, as well as the actual size of the pigment particles. How the transmission of the cloudy-type plastic depends upon the thickness was illustrated. In general, as the diffusing property is increased the transmission is reduced and the reflecting properties increased.

Plastics which transmit little or no light fall into the opaque class and serve as good reflecting media. The reflecting properties of plastics and of other materials commonly employed in lighting fixtures were compared. An analysis suggested that plastics may be widely employed as reflecting equipment in indirect portables, suspended coves, and indirect bowls such as are now widely used.

Of particular interest to the architect is the fact that the light weight of the material permits the design of a much lighter supporting framework. This item of weight is also an important factor in reducing shipping and handling costs.

Because of their good molding qualities and because they can be made in a wide range of reasonably stable colors, organic plastics are already being used for many applications closely related to the lighting industry, such as switchplates, outlet receptacles, and hangars for fixtures.

Table I—Reflection Factors

Material	Mfg.	Samples Tested	Range in Reflection
Cellulose acetate	D	22	.41 to .92
Cellulose acetate	C	12	.46 to .63
Cellulose acetate	B	3	.46 to .52
Cellulose acetate	E	1	.55
Urea-formaldehyde	A	8	.48 to .86
Urea-formaldehyde	F	2	.44
Casein-formaldehyde	G	1	.50
Magnesium carbonate	..	..	.98
White plaster	..	..	.85
Porcelain enameled steel	..	..	.75
Aluminum (polished)	..	..	.68

COAL WASHING BENEFITS COKE

CHIEF BENEFITS DERIVED FROM THE WASHING OF COAL FOR COKING PURPOSES

1. Reduction of the ash and sulphur in the coke produced.
2. A 10 to 15 per cent improvement in the physical qualities of the metallurgical coke produced as determined by the tumbler barrel test.
3. Decreased yields of small size coke with a corresponding increase of metallurgical coke.
4. Twenty per cent reduction of hydrogen sulphide content in the coke-oven gas.
5. Increased yields of byproducts comparable with the increased percentage of volatile matter in the washed coal.
6. Increased porosity of the coke.
7. Increased production at the mines due to removal of more top and bottom coal.
8. Improvements in blast-furnace operations due to improved quality of metallurgical coke.

WASHING of coal before coking has afforded several significant changes in the operating practice and the results obtained at the world's largest byproduct-oven plant, Clairton, Pa., works of Carnegie Steel Co. (The full details of the coal-washing plant used at Clairton are described in *Coal Age,* June, 1933, pages 187-194, in an article from which this chemical engineering summary has been prepared.) This plant uses at capacity over 30,000 tons of coal per day from a group of mines in nearby Fayette County and one mine (Calumet) which supplies a coal of lower percentage volatile matter. Table I shows a typical day's mixture as received.

The quantity of low-ash low-sulphur coal available at these mines is rapidly diminishing and supplies can be maintained of proper quality without washing only by careful mining, close selection at the face, and a rejection (waste) in the mine of roof and bottom portions of the seam estimated at 24,000,000 tons in the present workings. With washing the full seam may be used, mechanical cutting and loading in the mine is feasible, and yet the desired quality can be delivered at the ovens for 60 years with present cheap short river haul.

The initial washing unit of 12,000 tons capacity per day of two 10-hour shifts was built for handling Bridgeport and Colonial coals (worst in both ash and sulphur). Recently only superior supplies have been handled, with full success. The complete plant will provide for treatment of all coal as soon as economic considerations justify installation. The plant, using the Rheolaveur process, takes coal from the dock unloading bins, treats it on either a two product or three product separation in both coarse and fine-coal plants. The washed products are remixed through mixing chutes, transfer conveyors, and shuttle belts before delivery to the stock bins over the ovens. Washed coal may also be loaded direct from the cleaning plant into railroad cars. This permits segregation for special tests or diversion of selected lots for outside use.

It was anticipated that, aside from the ash and sulphur reduction, the washing of these coals would effect a material improvement in the physical qualities of the coke produced. The importance of this point is shown by the fact that the unwashed Bridgeport coal when coked separately produced an undesirable coke for metallurgical purposes, due principally to its inferior physical structure. This coal, which contains the greatest percentage of slate and feebly coking bone coal, is considered most representative of the coal reserves. In order to produce satisfactory metallurgical coke, it was necessary to mix approximately 33 per cent of lower volatile and superior coking quality Calumet coal with the Bridgeport coal.

A coking test, made on 5,000 tons of Bridgeport washed coal, substantiated the results of smaller scale preliminary tests and showed that the removal of the slate and bone coal materially improved the physical properties of the resultant coke. The elimination of this slate and bone coal is most essential in the sizes ranging from $\frac{3}{8}$-in. to 20-mesh in that for each per cent of slate present in the smaller sizes the number of fractures set up by the slate particles exceeds the number of fractures set up by the same percentage in the large sizes. However, when the size of slate particles reaches 20-mesh or smaller, in amounts not exceeding 10 per cent, they are

OVEN OPERATION

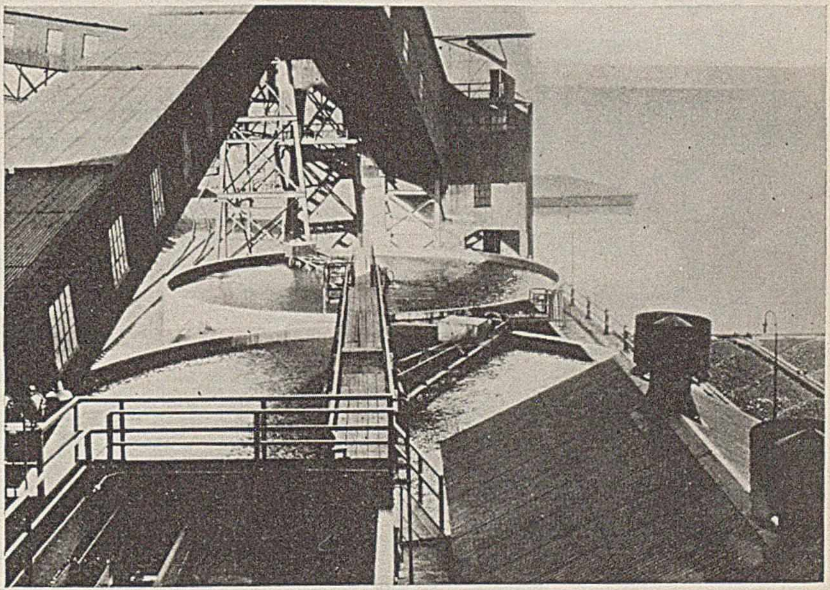
By H. W. SEYLER,
*Chief Chemist, Clairton Coke Works,
Carnegie Steel Co., Clairton, Pa.*

absorbed in the coke structure and become either inert in relation to the coke structure or actually increase the physical strength of the coke. It was, therefore, with a dual purpose in mind that the present coal-washing plant is operated; i.e., the improvement of the physical properties of the metallurgical coke as well as a reduction in ash and sulphur.

The effectiveness of washing of course varies with the size of the raw coal. Although it is the general opinion that little beneficiation is made on the sizes less than 48-mesh, a comparison of raw and washed coal, shows that some reduction of ash and sulphur is effected on the sizes down to 100-mesh. The effect of washing upon the character of the coal ash has not been as pronounced on the coals washed at Clairton as has been shown in other washing operations. Washing of the coal has increased the fusion point of the ash approximately 50 deg. F. and has reduced the iron oxide in the ash approximately

Average Comparative Analyses and Yields of Coke From Raw and Washed Coal

	Raw Coal Per Cent	Washed Coal Per Cent
Metallurgical Coke (*plus* 1¼*in.*)		
Analysis		
Sulphur	.92	.80
Ash	11.50	10.31
Yield	60.00	62.00
Fuel Index	80	91
Domestic Coke (1¼x¾ *in.*)		
Analysis:		
Sulphur	.92	.80
Ash	15.00	10.50
Yield	4.00	3.50
Coke Dust (¾ *in.*x 0)		
Analysis:		
Sulphur	1.00	.83
Ash	19.00	12.83
Yield	6.00	4.00



Dorr thickeners and transfer tower

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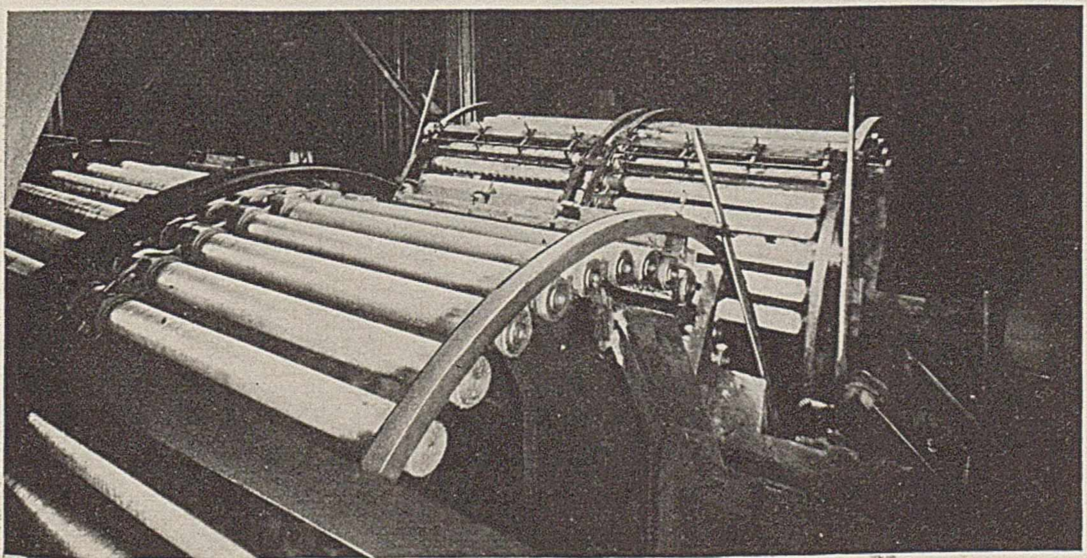
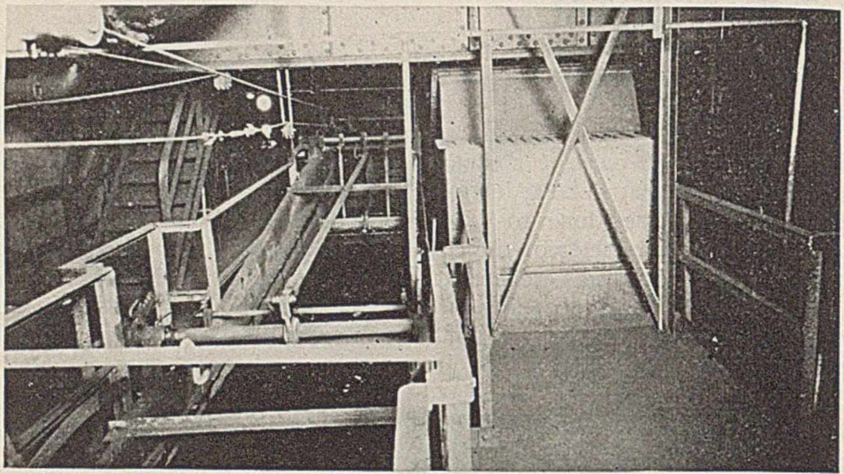


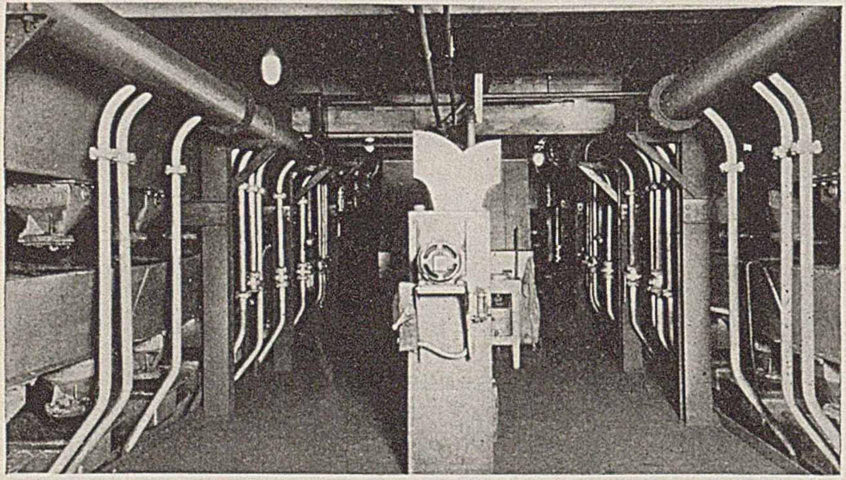
Genter type oscillating continuous filters

1 per cent. The calcium content of the ash is not affected by washing.

The main objection to the use of washed coal is its higher moisture content. As the increase in moisture content is found in the finer sizes, any segregation of these fines results in excessive packing and affects the free flow of coal from the oven bins and charging car hoppers, thus causing delays in oven operation.

Segregation of the fines in the oven bins can be overcome by a compartment bin of a honeycomb construction, provided that a uniform mixture of sizes is maintained at the washing plant. One of the two bins now being used for washed coal is of the compartment type and gives satisfactory results. It is advisable also to have this type of bin construction when using coals of lower moisture content, as segregation always takes place in large bins, and, as the finer sizes have a higher ash and sulphur content, any segregation that takes place affects the uniformity and quality of the coke.





The increase of moisture content of the coal causes an added operating cost for evaporation, condensation and subsequent processing of the excess water recovered as weak ammonia liquor.

Although the excess moisture carried by the washed coal is an added operating cost to the coke plant, it is considered at present to be more economical to evaporate this water in the coke ovens than by any independent process for effecting a substantial moisture reduction in the washing plant.

The disposal of refuse may be classed as an added objection to the use of washed coal due to the firing tendency when disposed of in piles or fills. The firing of the refuse is of considerable concern at Clairton, but, after a year of experimental work, sufficient progress has been made to give at least present relief. Plans are being made for the installation of a hammer-mill crusher at the top of the refuse bin at the washing plant, where the over-all refuse will be received from the elevator and crushed as fine as the wet refuse will economically permit. Considering the results of the tests to date, it is believed that this crushed refuse can be either disposed of as prepared or at least by sluicing into place.

Top — One of the Rheolaveur 48-in. main sealed-discharge washing launders. Bottom— Rheolaveur fine - coal plant and free-discharge Rheo boxes

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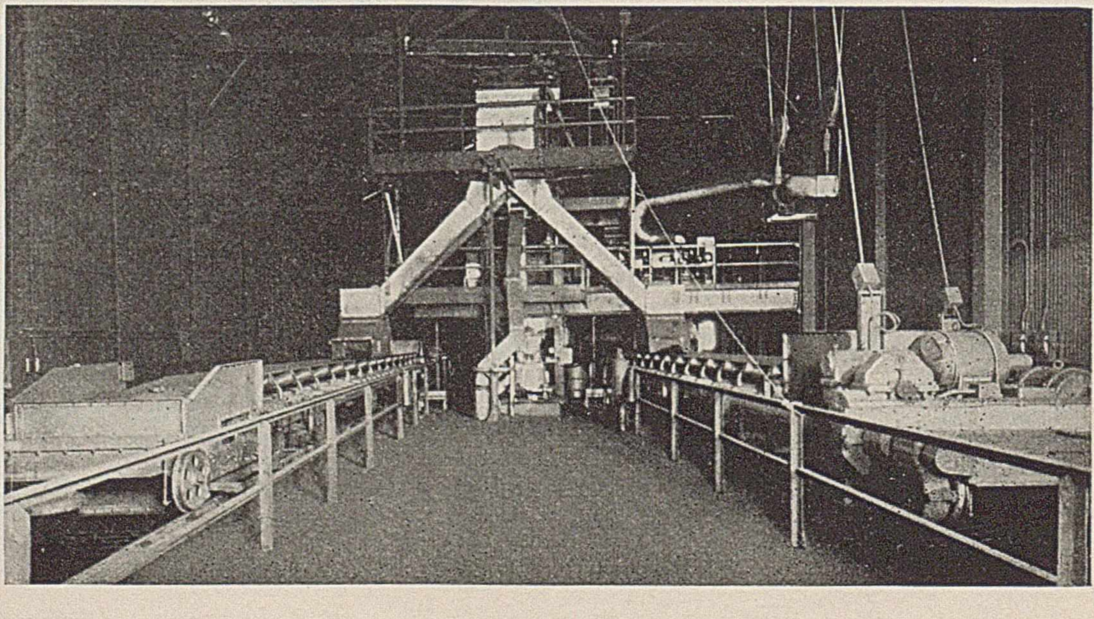


Discharge hopper of 42-in. raw coal conveyor belt; distributing chutes and shuttle conveyors above washing - plant bins

During the first 14 months the coal-washing plant was in operation, 2,613,135 tons of coal was washed. Although economic conditions have been such that the operation of the coke works has been subnormal, it is believed that a fair comparison of results from washed coal with those from raw coal can now be made. Table I shows the average comparative analyses and yields of coke from raw and washed coal.

A fuel index is calculated on the metallurgical coke by an empirical formula from the strength, hardness and brittleness as determined from the tumbler barrel tests. This index shows a 14 per cent improvement in the physical quality of the coke produced from washed coal, a conclusion substantiated in blast-furnace practice. Increased strength of the coke from washed coal as compared with unwashed coal also is shown by the comparative yields of coke dust which is produced by the breakage in pushing and handling the coke preparatory to loading. By washing the coal, the yield of dust is reduced one-third with a corresponding increase in yield of metallurgical coke. In addition to the improvements in the fuel index, a 1 per cent increase in porosity of the coke from washed coal is obtained.

The improvement of the physical qualities of the metallurgical coke, in addition to the reduction of ash and sulphur, has been reflected in blast-furnace practice to the extent of a 5 to 8 per cent reduction in coke consumption; a 5 to 10 per cent reduction in flux, with a subsequent reduction of 7 to 12 per cent in slag volume; a 5 to 8 per cent reduction in blast pressure, resulting in a substantial reduction in power requirements; and a 5 to 8 per cent increase in production of a lower sulphur pig iron. These improvements in blast-furnace practice, under the same operating conditions, were based on the average operation of five different plants which changed from coke made from raw coal to that made from washed coal.

The ash content in the domestic size coke is reduced to practically the same percentage as in the metallurgical coke, making this size a potential metallurgical fuel. In fact, at the present time, the domestic size coke is being shipped to the blast furnaces mixed with the metallurgical coke without apparent effect upon their practice. Increased fuel value is obtained likewise from the lower ash coke dust which is consumed as a boiler fuel.

The coking of washed coal shows an increased yield of byproducts comparable with the increased percentage of volatile matter resulting from the reduction in ash. A 20 per cent reduction of hydrogen sulphide is obtained in the gas from washed coal, which is important even under present conditions of consuming the gas without purification and will become more important should a gas purification plant be necessary, as the cost of removing hydrogen sulphide from gas is of considerable consequence. An additional benefit derived from the washing of coal is that more of the top and bottom coal is being removed from the seam. An estimate of this increase in production at the mines is not available at this time.

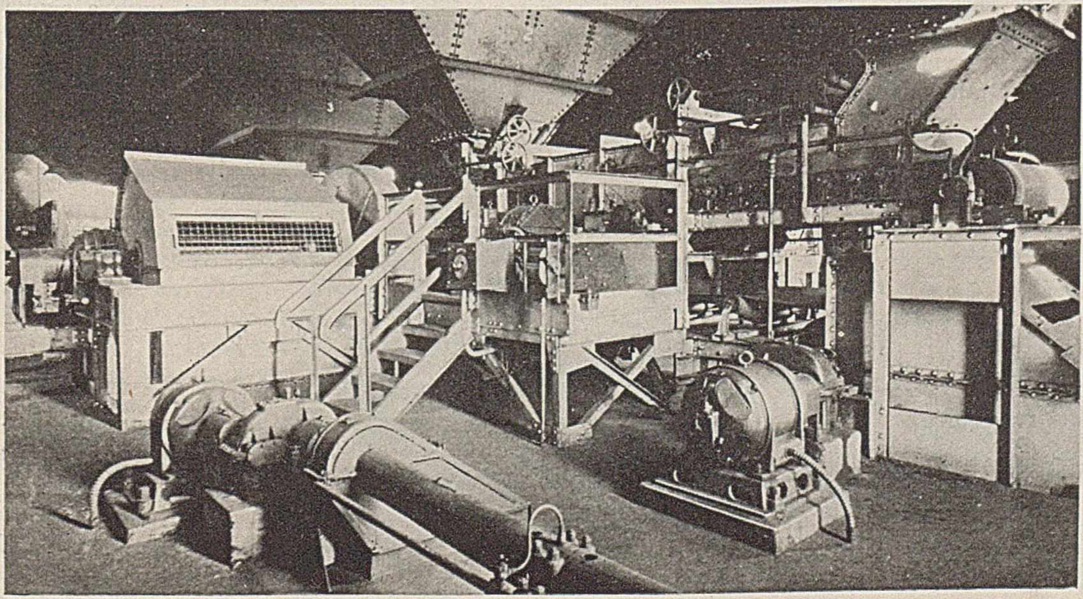
These improvements in coke-oven products and blast-furnace operations are being made by washing coals which show a comparatively small reduction in ash and sulphur, and it is anticipated that a much greater relative improvement can be shown when washing inferior coals which would show a greater ash and sulphur reduction.

Table II—Daily Tonnage Received From Mines of the H. C. Frick Coke Co.

Mine	Coal Carbonized Per Day Net Tons	Method of Delivery	Average Volatile Matter Per Cent	Average Ash; Per Cent	Average Sulphur Per Cent
Colonial..........	10,190	Barge	32.95	8.84	1.25
Ronco............	3,906	Barge	32.93	7.88	1.07
Palmer...........	8,665	Barge	32.90	8.10	1.04
Gates............	4,209	Barge	32.91	8.26	.97
Bridgeport........	2,272	Barge	33.60	9.58	1.70
Calumet..........	1,045	Rail	28.78	9.00	1.33
Total..........	30,287				

Table III—Comparison of Raw and Washed Coal

Sieve	Raw Coal Per Cent	Raw Coal Ash Per Cent	Raw Coal Sulphur Per Cent	Washed Coal Per Cent	Washed Coal Ash Per Cent	Washed Coal Sulphur Per Cent
Plus 3 in. square...	4.12	9.05	.90	3.64	7.46	.89
3x2 in. square.....	8.66	8.58	.99	7.95	7.85	.87
2x1 in. square.....	23.04	9.49	1.06	19.58	.7.58	.91
1x⅜ in. round......	27.10	9.10	1.07	31.70	7.69	.97
⅜ in.x20-mesh.....	28.84	7.60	1.09	25.49	6.70	.95
20x28-mesh.......	1.71	6.81	1.13	1.96	5.30	.95
28x48-mesh.......	3.10	7.06	1.18	3.58	5.28	.95
48x100-mesh......	1.79	8.09	1.62	2.32	7.89	1.47
100x200-mesh.....	.72	9.41	2.35	.81	9.92	2.33
Minus 200-mesh...	.92	11.04	1.95	3.03	12.30	1.86



One of the six variable-speed feeder conveyors that deliver raw coal to main collecting conveyor

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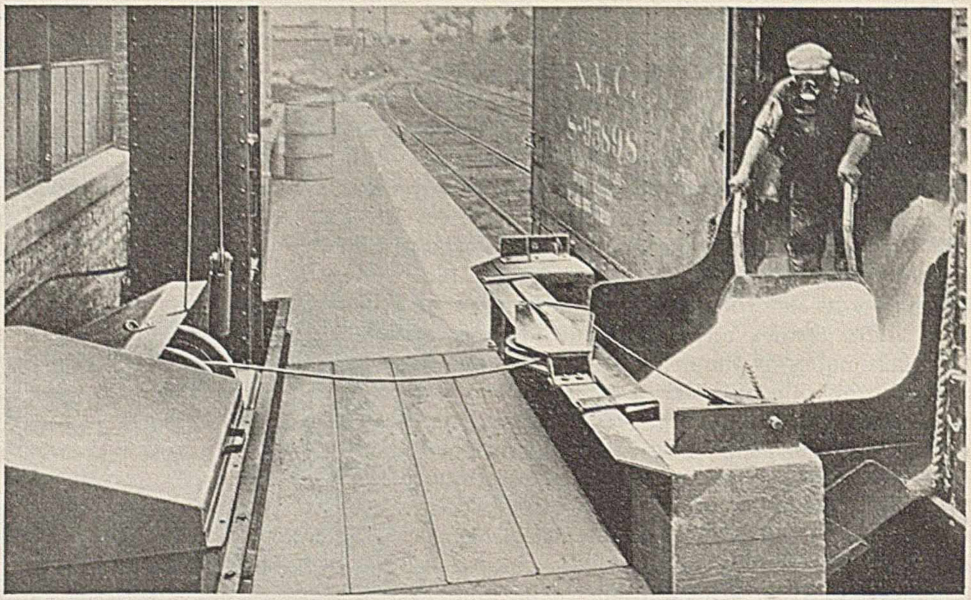

Fig. 1. Unloading soda ash from box car with power shovel

TRANSPORTING AND HANDLING BULK

KEEPING in step with industry in its march toward greater efficiency, the methods for handling chemicals in bulk have undergone many changes by the introduction of automatic devices that permit increased speed and safer and more sanitary operations. Not only have improvements been made in the larger units, such as the standard railroad cars, but much progress has also been made which is of benefit to the smaller user in the shipping, unloading, storing, and proportioning of batches.

In spite of the introduction of many special vehicle containers for bulk hauling, the standard railroad box car has lost no ground in the shipment of free-flowing chemicals. Efficient and economic unloading equipment will probably always insure this type of equipment an important place in the transportation system.

A typical unit for unloading bulk chemicals from standard box cars is shown in Figs. 1 and 2. This installation is used for handling bulk soda ash at an Illinois chemical plant. It is similar to many average-sized consumer installations for handling bulk pebble and ground lime, alum, soda ash, cement, fullers earth, and products of similar nature.

At this plant the material is unloaded through the car door with an automatic power shovel and dumped into a hopper of sufficient capacity to accommodate the intermittent discharges of material. A screw conveyor from the hopper maintains a uniform rate of feed to the bucket elevator. The rate of unloading, with a single shovel operator, is about 8 tons per hour, of light soda ash weighing 26 lb. per cu.ft.

The automatic power shovel, originally developed for

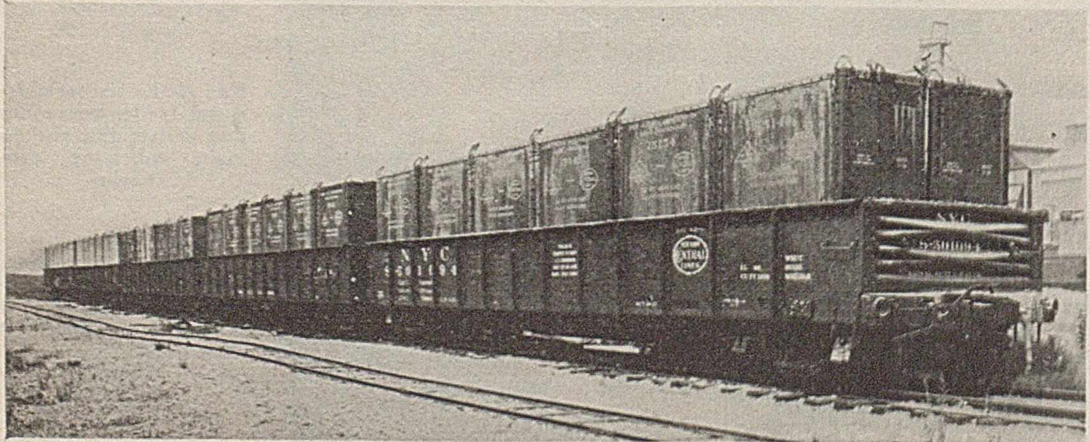

Fig. 3. Transporting pebble lime in 200-cu.ft. containers with drop-bottom outlets

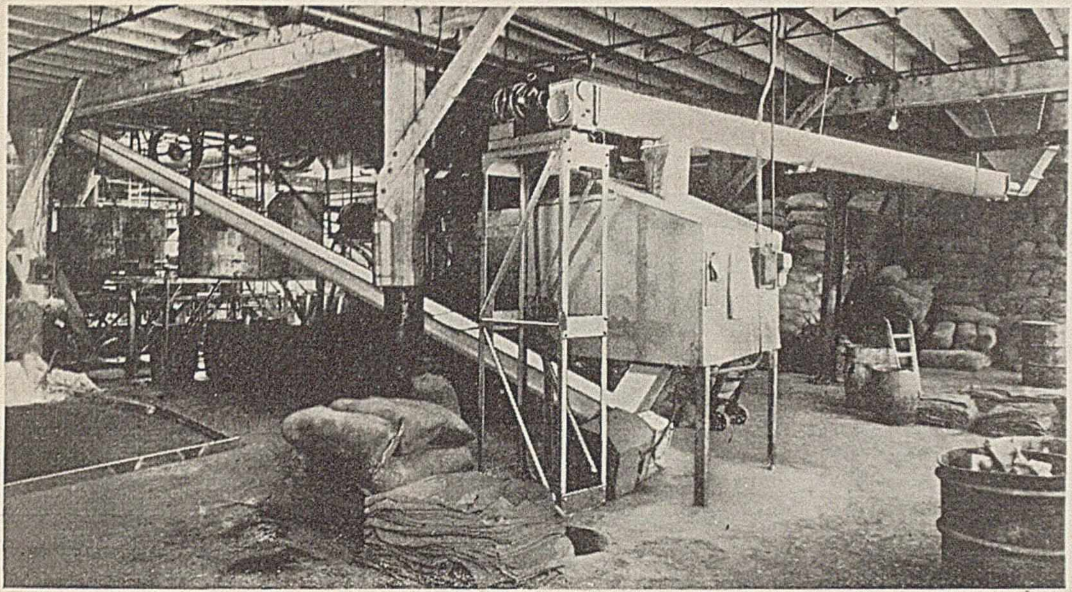

Fig. 2. Mechanical equipment for compounding and mixing batches of soda ash

CHEMICALS

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unloading grain, has proved well adapted to most free-flowing chemicals; it is a simple, most economical piece of equipment for capacities up to 1,500 cu.ft. per hour. Power is usually applied to the drum shaft by an individual motor with reduction drive. The mechanism includes a jaw clutch drive for automatic winding of the cable on the drum until the shovel reaches the car door. There the clutch is released, the scoop is pulled back to the end of the car, where the clutch again engages the drum to start the cycle over again.

Fig. 2 illustrates the mechanical batching equipment at the Illinois plant. Bulk soda ash is drawn from the storage tank by a screw feeder and a conveyor driven by a motorized gear reduction unit controlled from a position in front of the batching hopper and scale. As the scale registers the required batch in the hopper, the feeder and conveyor is stopped through the motor control. The batch is then discharged to a second conveyor delivering the soda ash to the compounding and mixing operation. The hopper and scale as well as the conveyor connections are fully inclosed and dust tight and easy to operate and control. The horizontal and inclined conveyors permit low headroom compared with a gravity-flow unit.

Standard railroad "L.C.L." container cars, shown in Fig. 3, are used for hauling bulk chemicals to consumers who are equipped with overhead cranes or facilities for handling the containers at the point of destination. The

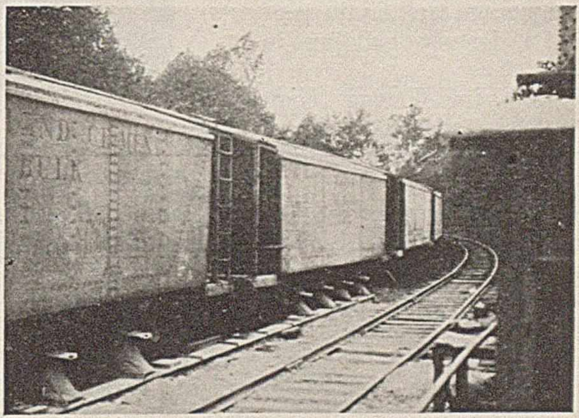

Fig. 4. Covered hopper bottom cars for discharging into track hopper or to conveyor system

lime containers shown in the illustration are used for transporting pebble lime from the South Chicago plant of the Marblehead Lime Co. to the open hearth furnace departments of the Inland Steel Co. and the Youngstown Sheet & Tube Co., Indiana Harbor. Twelve containers, each having a capacity of about 200 cu.ft., or 12,000 lb., and fitted with drop bottom outlets are set in a steel gondola car.

Where bulk chemicals must be elevated to high bins or storage tanks, the containers may be discharged into a hopper placed near the ground level, and elevated by means of conventional equipment, such as a bucket elevator.

Many special covered hopper bottom cars have been put in use for handling bulk materials. A typical design is shown in Fig. 4. Bulk cement, soda ash, lime, and bauxite are among the materials which have been handled successfully in this car. It is usually equipped with six or eight hoppers and outlets for discharging into a track hopper or a conveyor system. Connections to the outlets of the car hoppers are made with flexible canvas spouts, which attach to the hopper or the conveyor system. The economies made possible by these cars have attracted much attention, and several railroad companies have converted idle or obsolete hopper bottom cars into carriers for bulk cement or chemicals.

An interesting type of car for handling bulk shipments of chemicals is the Dry-Flo self-unloading car recently developed by General American Transportation Corp.; a description of this car was given in *Chem. & Met.*, May, 1932, page 286. Details of one of the latest models are given in Fig. 5. Fig. 6 shows the unloading of a car containing "Spheron," a new form of carbon black, at the Firestone Tire & Rubber Co.'s plant in Akron, Ohio. Shipments of this material are made in 50,000-lb. lots and an entire shipment may be unloaded and elevated to the storage tank on the roof of a 5-story building in 3-4 hr.

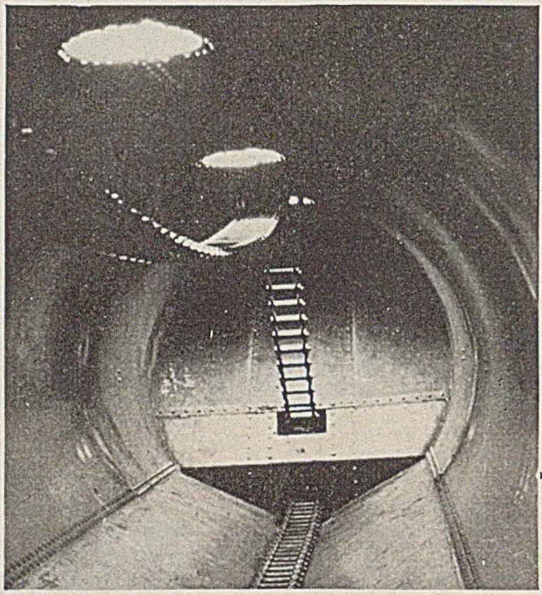

Fig. 5. Interior of Dry-Flo car, showing mechanism for unloading

For free-flowing commodities, such as cement, ground and hydrated lime, soda ash, salt, carbon black, and similar granular or pulverized materials, the vertical screw lift provides a successful and practical medium in many operations, even of large capacity. The horizontal screw feeder is adapted for use with box car unloading hoppers, special hopper bottom cars, or Dry-Flo cars. Vertical screw lifts are obtainable as standard units with 6, 9 and 12-in. diameter screws and with capacities ranging from 5 to 50 tons per hour, of chemicals weighing 20 to 100 lb. per cu.ft.

Many other improvements have also been made recently in the design of standardized bucket elevator plants with track feeders and hoppers, for unloading operations of moderate size and capacities to suit the smaller consumer. Large expensive pits have been eliminated, construction has been made weatherproof and dust-tight, and greater accessibility has been afforded. Conveyor elevators with gravity discharge, with inclined and vertical runs in one unit are also adaptable to some installations and conditions.

The concrete silo is one of the most economical storage units for bulk chemicals, under conditions where a fair supply must be carried on hand in case of delayed shipments or for other reasons. Some features of the large terminal grain elevators have been reproduced on a small scale in silo storage plants where bulk chemicals are unloaded, stored, and batched. One of the variety of arrangements is shown in Fig. 7.

Bulk material is unloaded from hopper bottom cars into track hopper *A* by conveyer No. 1, elevated and conveyed to storage by bucket elevator No. 2 and screw conveyor No. 3. Material from storage is reclaimed by screw conveyor No. 5, re-elevated and conveyed to the batching supply bin on the roof of the building by conveyor No. 5. Actually, conveyors No. 3 and 5 are one unit, with a reversible motor drive.

The batching supply bin has ample capacity for all operating needs, and when necessary it may be loaded directly from the car instead of from the silo, as shown in the illustration. Bulk material is fed to either of two batching hoppers, by the reversible screw feeder No. 6.

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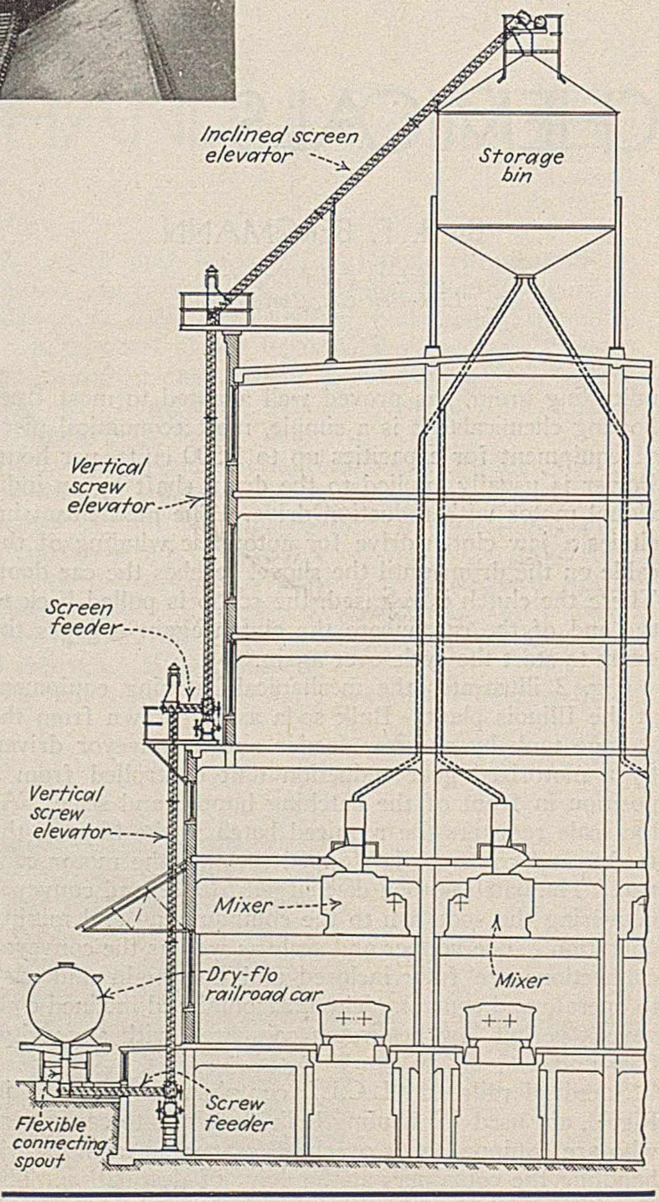
Fig. 6. Unloading carbon black from Dry-Flo car to storage tank on roof



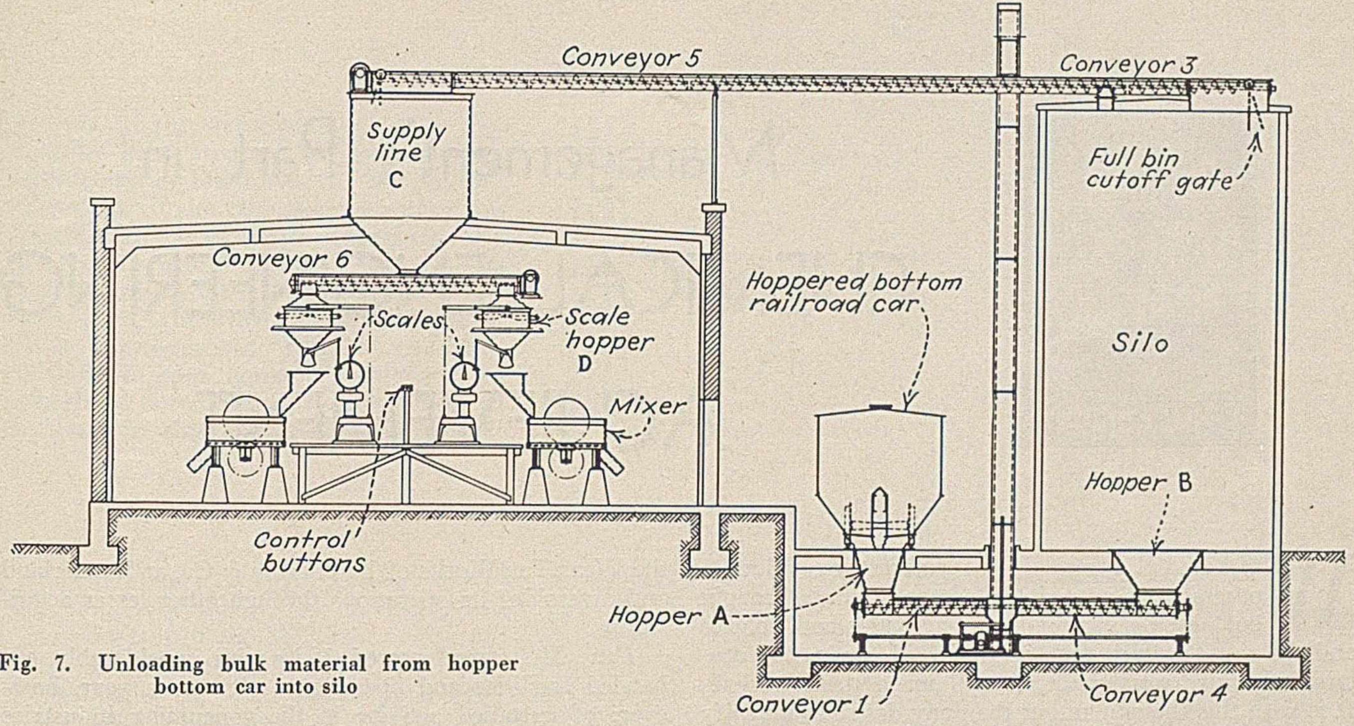


Fig. 7. Unloading bulk material from hopper bottom car into silo

The scale beams are fitted with adjustable, automatic cut-outs for stopping the feeder when the desired weight has been delivered to the hopper. The material is then dumped into the mixer. Dial scales indicate the rate at which the hopper is being filled; they may also be used for actual weighing, if desired.

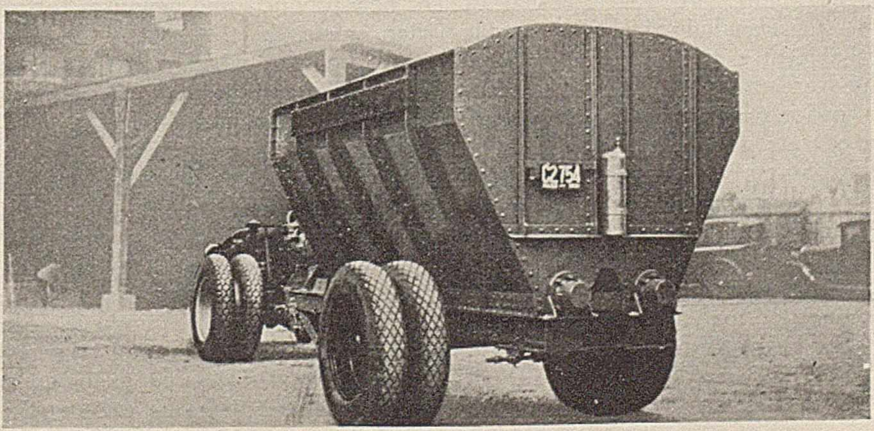
The entire installation makes a practical, fully inclosed, dustless, and virtually automatic unit for unloading, storage, batching, and proportioning of bulk chemicals at the consumer's plant.

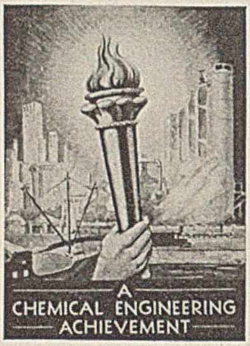
High speed of operation is one of the principal requirements for unloading units for trucks, a type of delivery now in general use for shorter hauls. Inclosed or covered trailer truck bodies can be designed to accommodate numerous industrial chemicals, and where no restrictions are imposed, this is often most economical.

An interesting design of a self-unloading truck trailer for bulk cement, recently placed in service by the Boston Concrete Co., Cambridge, Mass., is shown in Fig. 8. This trailer may be adapted to the handling of many bulk chemicals. The body holds 60 bbl. of cement; in the bottom are two helicoid screw feeders, mounted on solid shafts, with roller bearing thrusts at the forward end and special removable sleeve bearings at the rear end. The screw conveyors are driven by a 30-hp. Hercules gasoline engine through steel roller chain drives.

At the company's mixing plant a loaded trailer truck is backed into a shed and the material is unloaded into mechanical handling equipment. The trailer truck is unloaded in 15 min. by the two screw feeders. The gasoline engine easily starts the conveyors when the trailer body is filled with cement.

Fig. 8. Self unloading truck trailer for cement or bulk chemicals





Management's Part in CHEMICAL ENGINEERING ACHIEVEMENT

WHATEVER may be of interest or value to others in the record of a company can be brought out best by examining its activities and policies and the results which they produce. If the record contains anything worthwhile, it will make itself evident. It is with this thought rather than any desire to magnify the unusual success of the Monsanto Chemical Co. that this editorial review of its achievements is presented.

Chem. & Met.'s readers who knew the late John Francis Queeny realize that the founder of Monsanto built into its foundations certain definite principles of business conduct which remain the underlying philosophy of its management. One of these principles is "practical conservatism" by which he meant that brand of judgment which avoids excesses in times of plenty and panic in times of stress. It gives stability to men and organizations. It is positive and progressive. Another principle is "self-determination" which evades the impositions of outside influences, financial or otherwise, and permits management to pursue its own charted course. A third is "careful planning" all along the line in order that results may be forecast. It is based on knowledge and astute analysis.

Monsanto entered the depression with several property additions made in 1929. Up to that time its expansion had been primarily vertical. In that year its management decided that horizontal expansion was desirable in order to obtain increased diversity of operations and markets, to widen the territorial distribution of its heavy chemicals, and to secure able and efficient personnel to aid in its expanding operations. It was a period of general realignment in American industry and desirable properties became available at a time when they fitted into such planning and were therefore natural and logical additions. Each had something to contribute to Monsanto in the way of raw materials, byproducts, or markets, and in turn Monsanto had something to give each. Fortunately, the company was able to make this expansion without borrowing or seriously contracting its liquid resources.

The two most important acquisitions were the Merrimac Chemical Co. of Boston and the Rubber Service Laboratories and its subsidiary, the Elko Chemical Co. with works at Nitro, W. Va. The British subsidiary in 1929 strengthened its raw material position by acquiring the Wear Tar Works of Brotherton & Co. at Sunderland and diversified its operations through other lesser acquisitions.

Thus Monsanto entered 1930 with considerably expanded facilities and operations. It was a year, however, of curtailed activity in the consuming industries and this condition was reflected in all chemical sales. Analysis of the situation showed that the most effective way to combat the forces of the depression was to increase efforts in reducing production costs, developing new products and finding new uses for old products. The analysis also showed that the time was opportune for plant rehabilitation and replenishment of equipment. These two facts account for the major activities of the depression program.

It was natural that Monsanto should turn to research as one of the chief weapons against the depression. For many years its management has believed in persistent, well-planned research and has regarded adequate appropriations for it as essential investments. Throughout the depression it reaped the benefit of this policy. The research that had gone before contributed not only products and processes but skill and experience with which to attack new problems.

As competition increased with decreased demand, prices went lower. This situation demanded reduced production costs. Fortunately, a large part of the company's research had always been in the field of chemical engineering. While continuing to lower costs, it was able to direct research more and more to the development of new products and new uses for others. The St. Louis plant alone in the past three years developed fifteen new products which have contributed substantially to both sales and profits. The diversity provided by the companies acquired in 1929 also stood Monsanto in good stead not only in the way of products but in the interchange of raw materials and research skill. It was a case of mutual benefit.

As a result of these activities and its long-standing policy of financial independence, Monsanto was able to take advantage of depression prices to rehabilitate its plants and replenish equipment. Materials were cheaper, labor more plentiful, and production could be interrupted with less loss than during normal times. When the various acquisitions were made in 1929, it was con-

So far in the achievement series our articles have stressed the various contributions of technology. But behind the work of the chemical engineer lies the work of creative management, the policy-forming group that determines, guides and supports his progress. In chemical industry, "Monsanto management" has come to have a definite and constructive meaning which we have attempted to reflect in part in this editorial summary

templated that increased economies and efficiencies would be built into them. Major construction was at the Everett plant of the Merrimac company. This company also had a plant at Woburn, but it was obvious that consolidation of both plants at Everett was desirable from every standpoint. In the spring of 1930, a disastrous fire at the Everett plant, which was fully covered by insurance, made immediate rehabilitation necessary. It was decided to go the full way by rebuilding the units destroyed at Everett and moving to Everett those parts of the Woburn plant that were worth moving and abandoning the rest. The project was completed in the fall of 1931 at a cost of two and a quarter million dollars.

While this work was going on at Everett, substantial additions and installations of new departments were being made at the plants at St. Louis, Monsanto, Ill., Nitro, W. Va., Sunderland, England, and Ruabon, North Wales. Since the beginning of 1930, Monsanto has expended nearly five million dollars for additions to and expansions of plants. This figure does not include repairs and replacements for which more than two and a quarter million dollars were expended during the same period. Both of these expenditures were from income.

No record of Monsanto's depression activities is complete without accounting for the company's employees who contributed to its accomplishments. Reduced output and greater production efficiency decreased the need for labor but the company was able to use some of its released employees in its own construction work. New products also opened new avenues for the utilization of labor. To spread available work among as large a number as possible, the working week was shortened in 1931 from 54 to 44 hours. More than a year ago, the 40-hour week was initiated throughout all of the American plants. The net contribution to unemployment in 1930 and 1931 was small. In 1932 it was nil. Wage rates in general have not been reduced below the 1929 level.

In discussing employer-employee relations, Edgar M. Queeny made the following statement in his annual report for 1932:

"Our business is a complicated one. We manufacture in excess of 200 products, each in itself a small business with conditions of manufacture and distribution peculiar to it. Some processes are continuous, running twenty-four hours a day, seven days a week. Others, because of their nature or market conditions, require only intermittent operations. Our warehouses and district offices must give service every day but Sunday. Yet, no Monsanto employee in the United States has duties which require him to work more than forty hours a week. It is our belief that the shorter working week is the logical concomitant of increased industrial efficiency and that the greatest efficiency is attained by well-paid workers.

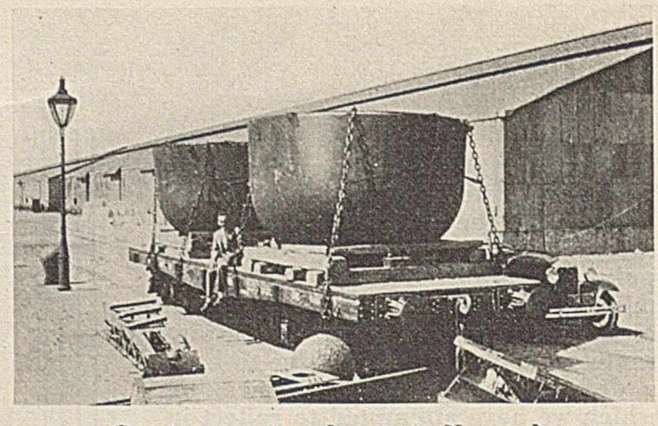
"Several years ago we introduced employee incentives into some of our operations with gratifying results. The principle has been extended until today practically every individual whose efforts contribute to the company's profits and whose contribution can be measured is working under the plan.

"In addition to salaries, our salesmen are rewarded on their ability to reach or exceed quotas assigned to them. Operating chemists and foremen receive bonuses varying in the degree that controllable elements going into costs of production under their supervision are brought below quotas that are re-established periodically. The work of packers, warehousemen, power plant engineers and others is compared with carefully determined standards and bonuses are paid as these standards are exceeded.

"Our employment policy has attracted a relatively higher type of labor than formerly was available. It has also promoted safety in our plants, an important factor considering the hazards inherent to chemical manufacture. Our Monsanto plant established a national no-lost-time record for chemical plants when it operated from February 21, 1930, to September 17, 1931; a period of one year and 207 days, comprising 1,461,156 man-hours without a single lost-time accident. By such an accident we mean one which prevents a man performing all his duties the day following an injury."

Reference has already been made to the conservative financial policy initiated by the elder Mr. Queeny. As far as can be ascertained, Monsanto charges against profits a greater percentage for obsolescence and depreciation of its plants than is considered necessary by the industry as a whole. This policy has enabled it to build up a substantial reserve as illustrated by the fact that although most of its plants were new or nearly so at the end of 1932, the reserve for depreciation and obsolescence exceeded 34 per cent of gross capital assets, exclusive of land. As the turnover in a chemical plant is not great, the element of depreciation is an extremely important one in the cost of sales. Its provision should be neither greater nor less than that which is actually being sustained in current wear and tear and obsolescence. Research and development and repairs and replacements are charged to the year's operations. In 1931 the company spent $463,955 in laboratory work, pilot plants to prove laboratory processes and for patent protection. This was 36 per cent of the net profit reported for that year. The comparable expenditure in 1932 was $383,411 or 38 per cent of net. During 1932, 71 patents were issued to Monsanto.

In conclusion, Monsanto's depression record might be summarized as follows: Its plants were kept in profitable operation. Earnings amply provided for regular dividend payments and the maintenance of its cash position. Its contribution to unemployment was small. Research work went forward unhampered by curtailed appropriations. New products and processes were developed. It acquired desirable properties and effected mutually profitable mergers. It launched and carried out the greatest building and expansion program in its history. In short, it prepared itself to participate more fully in the new industrial regime.



Cast iron caustic soda pots in Normandy

French Chemical Industries Use Cast Iron to Resist Corrosion

By A. MATAGRIN
Chindrieux, Savoie, France

AT THE beginning of the present century cast iron held undisputed leadership among the metals used in French chemical plants. Roasting furnaces, in the old chamber plants as well as in the modern contact plants, were made from cast iron and steel; ordinary cast iron offers greater resistance to sulphur dioxide in moderate concentrations than the special types high in phosphorus, manganese, or silicon. In the old Leblanc soda works where nothing but cast iron was used, corrosion was always a serious problem. The modern electrolytic plants are far better equipped, although cast iron is still widely used, frequently with rubber lining. Where contamination with iron must be avoided, such as in the production of acetic acid and in organic synthesis, special cast irons, enameled steel, nickel, aluminum, aluminum bronzes, and occasionally special steels are used. Alkalis are sometimes handled successfully in cast iron, which undoubtedly takes on a protective film. But the chlorides, especially magnesium chloride, the sulphates, and the nitrates always give difficulties, and in superphosphate plants cast iron equipment such as agitators and fans does not last more than four to five years.

In organic chemical plants where cast iron has numerous uses, mainly in the larger installations, many corrosion problems are encountered, often in combination with high temperatures. Sulphur is a frequent source of difficulty in petroleum refineries; recent installations in this field are utilizing galvanized iron, rustless steel, and sometimes aluminum. Copper is commonly used in wood distillation.

The use of iron of high purity has also been considered, although it is often a difficult question to determine which material has the greatest resistance, the pure metal or the alloy. That iron in the pure state has high corrosion resistance is clearly demonstrated by the famous iron pillars in Delhi and the abundance of wrought iron work on old buildings throughout Europe, which has withstood the attack of the elements for centuries.

Experience has often demonstrated that a pure metal may not always possess as great resistance to corrosion as some of its alloys. Sainte-Claire Deville's aluminum bronze, for instance, will withstand attack in cases where pure copper and aluminum fail, and cast iron sometimes proves more resistant than wrought iron or electrolytic iron.

In pipe lines for corrosive gases and for high-pressure work, for which the mechanical strength of copper is insufficient, wrought iron offers better resistance than common steel without a protective coating. But in underground pipe lines, without special protection against soil corrosion or stray currents, and for alkaline solutions, steel or above all cast iron are far superior to wrought iron. This may be attributed to protective films produced during the casting or rolling processes; machining whereby such films are removed would result in the loss of this advantage.

Electrolytic iron frequently offers many advantages inherent in its method of manufacture. This iron has an appearance resembling the best Swedish iron, and has many of its qualities. The price is reasonable, especially for the seamless tubes which are used to great advantages in many plants where corrosion is high. It has found wide application in the salt industry on account of its high resistance to sodium chloride solution, at least in the absence of air.

Certain constituents found in small quantities in ordinary cast iron may, if used in larger proportions, increase its chemical resistance. This does not, however, refer to phosphorus, which preferably should be kept as low as 0.04 or 0.03 per cent. Manganese, easily oxidized by moist air when in pure state, does not seem to have any detrimental effect upon the chemical resistance of white cast iron low in silicon (about 1 per cent). In foundry irons which generally contain 0.5 to 0.6 per cent manganese this constituent makes easier casting by increasing the fluidity of the metal, giving castings free from blow holes and with improved chemical and mechanical properties.

The behavior of manganese should be closely studied. Alloys with too high manganese content are attacked by acids and discolor alkaline solutions.

Silicon seems to be the important addition agent, with manganese playing only a secondary part. The first cast irons made with increased chemical resistance in view were also silicon irons. Although it is not necessary to go beyond 1.5 per cent silicon in ordinary cast iron, it is recognized that only the cast irons containing about 4 per cent silicon show noticeable improvement in resistance to atmospheric corrosion and to attack by acids; at lower silicon contents the manganese content should be increased by addition of spiegel, or a higher nickel content may be used to increase the chemical resistance. Only beyond 12 per cent does silicon really protect cast iron from all oxidation, the cast iron then approaches real ferro-silicon. Although the material added is not in itself so expensive, the process of melting becomes so difficult that a material increase in the cost of the metal results. Furthermore, the high-silicon content makes the metal hard and brittle and difficult to cast and machine. Finally, addition of silicon to cast iron does not increase its resistance to alkalis or to high temperatures.

Silicon Cast Irons

In spite of their shortcomings the silicon cast irons were the first cast irons with high chemical resistance which were fabricated and studied in France. The first patents were issued in 1903. In that year announcements were also made of the use of silicon cast iron in a plant in Lyons, for pipes used in the direct condensation of nitric acid; this alloy was also used in sulphuric acid plants, for concentrating pans.

The factors which have tended to limit the success of the silicon cast irons in France are their mechanical shortcomings, limiting their use to apparatus of simple construction, and precluding great and rapid temperature changes.

In addition to the regular constituents, silicon cast iron used in French industry occasionally contains other metals which may greatly affect the properties. One type which is low in carbon and high in manganese contains 0.25 per cent aluminum; in modern foundries there is a tendency to add a small quantity of copper, but the most common addition is nickel, which is generally considered to have a favorable effect on the chemical resistance, although it affects the graphitizing of the carbon less than does silica.

Chromium or Nickel Additions

A comparison of the chemical resistance of various types of cast iron is given in the table. It shows that with low silicon content chromium, or chromium and nickel must be added to obtain good corrosion resistance. Nickel always increases the resistance to alkalis, and chromium the resistance to nitric acid and hot gas. But more attention is given to the special nickel cast irons which are interesting on account of their high resistance to alkalis and high temperatures. When the price does not present an obstacle, addition of chromium, molybdenum, or tungsten to silicon cast irons results in improved chemical resistance.

The silicon cast irons tried in France up to the present time have always given satisfactory results with the silicon content about 14.3 per cent; with this content the mechanical and chemical requirements of the trade are satisfied as far as possible. If a less fragile cast iron is required, and one that can really be machined, an alloy of lower silicon content and consequently with less resistance to oxidation must be chosen. Thus the Ra cast iron which has excellent mechanical properties cannot be recommended under highly corrosive conditions. It does, however, show a resistance to dilute sulphuric acid almost three times greater than that of common cast iron. The American type, Meehanite, covering a range from 1 to 24 per cent Si, likewise has numerous applications in French chemical plants. Finally, M. C. Rossi, large producer of sulphuric acid in plants at Legnano and Pontemamello, has patented, in addition to cast irons with 13.15 per cent silicon resistant to this acid, a number of types with 20-21 per cent silicon, the content required to secure resistance to hydrochloric acid.

With a silicon content of 16.92 per cent as found in Jouve's Metillure (conforming to the content of 16-18 per cent recommended in 1917 by Kowalk) good resistance to acetic acid is obtained. Although not as good as tin in this respect, this cast iron is twice as good as copper and four times better than lead. It offers satisfactory resistance to attack by sulphuric and nitric acid, but not to hydrochloric acid and alkalis; with mixed acids the attack is greater than when the acids act separately. The effect of the low content of aluminum (0.25 per cent) has not been sufficiently studied, but the recent success of special cast irons with a small content of copper permits the assumption that some benefit may accrue from the addition of a small content of aluminum.

Table I—Comparative Chemical Resistance of Various Special Cast Irons (From Brousscool Furnaces, Haute-Marne)

Percentage of Alloying Elements							Corrosion Resistance				
C	Si	P	Mn	S	Ni	Cr	Sulphuric Acid	Nitrous Vitriol	Alkalis	Hot Gas	Atmospheric Action
3.95	1.30	0.15	0.85	0.07	2.00	....	2	1	3	2	2
3.90	1.60	0.20	0.85	0.07	....	0.95	3	3	2	4	3
3.90	1.60	0.15	0.75	0.08	....	....	1	2	2	2	2
3.40	1.65	0.62	0.52	0.08	....	0.85	2	2	2	3	2
3.20	1.85	0.45	0.43	0.09	....	....	3	2	1	1	2
3.40	1.80	0.82	0.51	0.07	1.50	0.55	2	2	3	3	3

Values given for resistance: 1: Poor; 2: Fair under certain conditions (concentration, temperature, etc.); 3: Quite good under certain conditions; 4: Satisfactory under all conditions. The data are based on laboratory tests, with exception of those obtained for atmospheric conditions.

Elianite with about 15 per cent silicon is used in the manufacture of picric acid. Vats and agitators of this metal resist sulphuric and nitric acid in moderate concentrations. For chlorination and concentration of these acids, however, Rossi's cast irons with 20-21 per cent silicon are used.

Silicon cast irons are giving satisfactory service in French plants producing acetic acid from calcium acetate; soap powder factories and soda works also are applying alloys made by Brousseval and other French foundries with good results. The best composition for these purposes appears to be 84 per cent iron; 0.8 carbon; 0.06 sulphur; 0.14 phosphorus; 14.5 silicon; 0.5 per cent manganese, with possible substitution of 1 per cent nickel for an equivalent of Fe:Si. But as silicon is dissolved in alkaline liquors, and, what is even more important, as it does not have the same beneficial effect as nickel where high temperatures and pressures are involved, metallurgists in France as well as in the United States are now showing great interest in the chemically and mechanically superior nickel cast irons.

The success of the new nickel cast irons was clearly demonstrated at the last World Foundry Congress and

International Foundry Exposition, held in Paris in Sept. 1932. Fear that the price would be too high caused much hesitance in France about introducing nickel in cast iron. But researches such as those conducted by J. S. Vanick and P. D. Merica, and finally the work by the French metallurgists Leon Guillet, M. Ballay, J. Galibourg, and others have finally awakened the interest in this material, and in the importance of secondary additions such as copper and chromium, and the influence of the perlitic or austenitic state of the alloy upon the chemical resistance.

Nickel affects graphitizing to a smaller degree than silicon. It simplifies the heat-treatment of the cast iron and improves the chemical and mechanical properties and the machineability. According to the nickel content the alloy may be perlitic (0-6 per cent Ni); martensitic, (7-11.5 per cent); or austenitic (above 13 per cent). The curve for the chemical resistance, which shows no perceptible rise for perlitic or martensitic cast irons exposed to alkalis, rises almost vertically for the austenitic types in respect to sulphuric and hydrochloric acid.

Among the other permissible constituents in cast iron must be mentioned copper which is rendered soluble by nickel and increases the resistance to acids; molybdenum, which increases both the hardness and the chemical resistance; and chromium, which increases the hardness and the chemical resistance, but which, when present in too large quantities, gives a white iron, or an iron mottled by formation of carbide.

The white and the martensitic nickel-chromium cast irons which are equally well regarded in France and in Italy possess great resistance to wear and are used in motor parts and rolls. But the perlitic types with 0 to 6 per cent nickel, of fine-grained structure of normal hardness, and with high resistance to alkalis of 1 to 1.5 per cent concentration, have been received with great interest by the chemical industry. Addition of chromium increases the machineability and permits use at temperatures up to 700 deg. C. Molybdenum renders them resistant to hot sulphuric acid. A German type with 0.5 per cent nickel, 3.25 carbon, 0.07 sulphur, 0.1 phosphorus, 1.3 silicon, and 0.28 per cent manganese is claimed to have high resistance to alkalis; the low content of phosphorus, an element as soluble in alkalis as silicon, may account for this. More nickel is needed in the perlitic cast irons, and Le Thomas and Le Romancer recommend the following additions: 3-3.2 per cent carbon; 1.2-1.4 silicon; 0.8-1.0 manganese; 0.05-0.09 sulphur; phosphorus less than 3; 0.5-0.8 chromium; and nickel about 1.5 per cent.

The austenitic nickel cast irons, especially those which also contain chromium and copper, are still more interesting on account of their high resistance to corrosion and elevated temperatures and the ease wherewith they may be worked and machined. Comparative corrosion tests of austenitic and ordinary cast irons at the recent International Foundry Exposition received much attention by the numerous visitors.

The austenitic cast irons are quite resistant to high temperatures and are suitable for boilers and retorts, and for motor parts. Their resistance to alkalis is not always superior to that of the perlitic nickel cast irons, and they cannot be recommended for nitric acid. But, according to reports from foundries, they are many times as resistant to hydrochloric acid (5-20 per cent) even when hot or aereated; to 25 per cent cold acetic acid; and to sulphuric acid (5-60 per cent). They are used extensively for valve and pump parts and in oil refineries. Wide application is also predicted in the field of artificial silk.

Enameling Cast Iron Abroad

SO FAR, the production of acid resisting enamel linings in Germany has been principally confined to coatings on cast iron. This is due largely to the fact that the cubical coefficient of expansion of cast iron lies nearer to that of the enamel employed than does the coefficient of sheet iron. Quite recently it has been found possible to line sheet iron with a relatively acid-resistant enamel, but the corrosion resistance in this latter instance is by no means equal to that obtained in the case of cast iron.

In any event, as the changes in the coefficient of expansion of the iron and the enamel mass do not produce parallel curves when plotted over a range of temperatures, the enamel must be so chosen as to possess a certain degree of elasticity.

The most satisfactory acid-resisting enamels are obtained by employing mixes as close in composition to those of Jena laboratory glass as possible.

The information given in the literature as to the most suitable composition of a cast iron for the purpose of enameling is rather conflicting. The manganese and sulphur are the really undesirable constituents. Silicon, on the other hand, influences favorably the decomposition of the iron carbide into graphite and ferrite, and is consequently a necessary constituent. As a rule, a content in cementite of over 90 per cent is desirable.

The technology of the application of the acid-resisting enamels differs from that of the ordinary enameling process only in regard to the final coat. This ground enamel is chosen so as to have a wide temperature softening interval; and consists usually of ground flint and of borax, with small quantities of felspar and fluorspar. This mass is applied to the cast iron by the wet process, and is burned on at a temperature of about 1,000 deg. C. It is white, and makes a firm bond with the metal. The wet covering enamel, finely ground, is sprayed on to this frit. On to the layer of wet coating enamel there is sieved a fine powder, similar to the enamel itself, after which the coating is thoroughly dried. This application process is generally repeated several times.

The temperature of burning depends upon the fusibility of the enamel, and is usually 1,000 deg. C. Burning is effected in muffle furnaces. It is effected under vacuum; by this means the formation of bubbles is stated to be completely avoided. The enameled pieces should be cooled slowly for if the cooling is too rapid, owing to the comparatively poor heat conductivity of the enamel, stresses are set up which lead to the formation of surface cracks. Really well-controlled cooling improves the acid resistance of the mass.

Based on an article appearing in *Die Chemische Fabrik*, June 1, 1933, and *Chemical Trade Journal*, July 14, 1933.

New Products in the Plastic Field And Their Producers

Revised Table Supplements Aug. 1931 and Sept. 1932 Lists

The plastics identified below are additions to or modifications (marked*) of the lists prepared by A. F. Randolph of the du Pont Viscoloid Company, Arlington, N. J., for *Chem. & Met.*, Vol. 38, pp. 461-464, and Vol. 39, pp. 523-524. The code and abbreviations used are:

C	Casein	P	Packaging material
CA	Cellulose acetate	PF	Phenol-formaldehyde or homologue
D	Resin used as ingredient	Px	Pyroxylin
F	Fabricator's trade name, not necessarily same as trade name of substance used	s	Soluble form, for lacquer, impregnation, etc.
G	Glycerol-phthalic anhydride resin	SG	Safety glass
l	Laminated board, etc.	t	turnery resin, not moldable
m	Molding compound	UF	Urea-formaldehyde
		V	Viscose
W	Wood fiber product		

Brit. Plas.—*British Plastics and Moulded Products Trader*, London, E.C.4

Kunstst.—*Kunststoffe*, J. F. Lehmann, München

"Sicherheitsglas"—by Bodenbender, pub. Bodenbender, Berlin-Steglitz.

Name	Description	Manufacturer or Reference
Acetex*	SG	Acetex Safety Glass Co Ltd., London, E.C.
Acetyloid	CA	Dai Nippon Celluloid Co., Osaka, Japan
Adarola	C, F	Jose Oregui, Renteria, Spain
Aerolite	SG	Duplate Corp., Pittsburgh
Aeroplex	SG	Aeroplex, Ltd., England,
Aethrol	Px, CA	**Kunstst.** vol. 22 p. 177 (1932)
Agfa-Pelloro	sheeting	AGFA, Germany
AK	PF, asbestos	U.S.S.R.
Akrol	glyptal (?) resin	U.S.S.R.
Alberit*	PFt	Chem. Fab. Dr. Kurt Albert, Wiesbaden, Germany
Alcolite*	Px, denture	Alcolite, Inc., Philadelphia
Alftalat	resins	Chem. Fab. Dr. Kurt Albert, Wiesbaden, Germany
Alkalit	phenol-phthalein resin	**Kunstst.** vol. 23 p. 15 (1933)
Alsimag	inorganic	American Lava Co., Chattanooga, Tenn.
Alvar	polymerized vinyl acetate	Shawinigan Chemicals, Ltd., Montreal
Amblold	C	Dai Nippon Celluloid, Co., Osaka, Japan
Armourplate Glass	"hardened" glass	Pilkington Bros., Ltd., St. Helens, England
Banda	F	Brookes and Adams, Ltd., England
Bebrit	molding compound	**Kunstst.** vol. 22, p. 245 (1932)
Beckacite*	PF	Beck, Koller & Co.,
Beckosol*	G	Inc., Detroit and Wien
Beroliet	C	Punfield and Barstow, Ltd., London, EC2
BeX*	PF etc., F	British Xylonite Co., Ltd., London, E 4
Bi-Triplex	bullet-proof glass	Soc. du Verre Triplex, Paris
Black Beauty	F	Rhein. Gummi- u. Celluloid Fab., Mannheim, Germany
Boltalite	F	Bolta Rubber Co., U. S. A.
Bonnyware	F UF PF	Reynolds Spring Co., Jackson, Michigan
Britannia	F	Cascelloid, Ltd., England
Camphorloid	Px	Dai Nippon Celluloid Co., Osaka, Japan
Cedeco	Coated netting	Haver u. Boecker, Oelde, Germany
Celerit	Modeling compound	Apotela, Ltd., Zurich, 6
Cellocaps	V, closures	Edison Swan Elect. Co. Ltd., London EC 4
Cellon-Drahtglas	CA, coated netting	Cellon-Werke, Dr. A. Eichengrün, Berlin-Charlottenburg
Cellushi	V, P	Dai Nippon Celluloid Co., Osaka, Japan
Celusa-Gewebe	Coated netting	Vereinigte Stahlwerke A. G., Hamm, Germany
Chauvelglas	Wire glass	C. Tielsch G.m.b.H., Altwasser, Germany
Christolit	PF, F	Christophery G.m.b.H., Iserlohn, Germany
Ciba*	UFm	Soc. Chem. Ind., Basel, Switzerland
Citalo	SG	Soc. anon. Citalo, Lodelinsart, Belgium
Clar-Apel	V, P	du Pont Cellophane Co., Inc., Wilmington, Del.
Cogebi	PF, F	Cie. Gen. Belge d'Isolants, Bruxelles
Colbox	Insulating materials	Blackall Bros. Ltd., London E 15
Cornit*	Molding powder	H. Weidmann, Ltd., St. Gallen, Switzerland
Crayonne*	CA, m, F	Crayonne, Ltd., Bexley, Kent, England
Cristaloid	PFt "organic glass"	France ("Sicherheitsglas," p. 307)
Crystex	V, P	P.P. Shapland, London, EC 4
Cygnet	molded resin, F	Edison Swan Elect. Co. Ltd., London EC 4
Defiance	C	Jos. Nathan & Co., Ltd., London
Dentagiene	F	Canadian Industries, Ltd., Montreal
Detel	chlorinated rubber	International Patent Co., Detroit, Michigan
Di-El	molding powder	H. Weidmann, Ltd., St. Gallen, Switzerland
Doplex	cellophane-faced fabric	**Textile World**, vol. 83. p. 73 (1933)
Drott	Px	Baltic-Landmaschinen G.m.b.H., Berlin
DS-Glas	SG	Deutsche Spiegelglas AG, Grünenplan, Germany
Duplate*	SG	Duplate Corp., Pittsburgh, Pa.
Duprene	synth. rubber	E. I. du Pont de Nemours & Co., Wilmington, Del.
Duradent	denture	Bakelite Dental Supplies, London
Durcoton	PF, impreg. textile	Meirowsky & Co., A. G., Porz am Rhein, Germany
Duroftal	synth. resin	Chem. Fab. Dr. Kurt Albert, G.m.b.H., Amoneburg-Wiesbaden, Germany
Duro-Kerit	PF?	Plastika m.b.H., Galalith Ges. Hoff., Harburg-Wilhelmsburg, Germany
Edelresanol	synth. resin	Resan Kunstharzfabrik AG, Wien
Ekco	F	E. K. Cole, Ltd., Southend-on-Sea,
Ekcozene	?	England
Epok*	molding powders	Brit. Resin Products, Ltd., Kingston, Surrey, England
Ericon	PFl, paneling	Merritt Eng. & Sales Co., Lockport, N. Y.
Erinite	resins	Erinoid, Ltd., Stroud,
Erinofort	CA	Gloucestershire, Eng.
Ernolith*	not a commercial product	
Esterpol	synth. resin	Glyco Products Co., Brooklyn, N. Y.
Ethanite	ethylene dichloride, Ca polysulphide	Wilfred Smith, Ltd., London, W C 3
Evaplastin	F	Evered & Co., Ltd., England
Fantasit*	C	Dynamit A. G., Troisdorf, Germany
Festellan	F	Allgem. Elekt. Ges., Berlin
Flexon	Modeling paste	D. C. Thomas, Reading, Berks, Eng.
Flitafast	F	Cascelloid, Ltd., England
Formica*	PFl, UFl	Formica Insulation Co., Cincinnati
Formvar	vinyl acetate resin	Shawinigan Chemicals, Ltd., Montreal
Futurit*	PF	Kabelgyar-Werken, Hungary
Gala	C	Cie. Celluloid-Petitcollin-Oyonnithe, Paris
G & E	insulation	Görner u. Engels Dresden
Gelva	polymerized vinyl acetate	Shawinigan Chemicals, Ltd., Montreal
Glacetex	SG	Glaceries Réunies, S.A., Bruxelles
Glutol	synth. resin	U.S.S.R.
Guardax	SG	Guardax S.G., Ltd., London, EC 3
Haskelite	PFl, paneling	Haskelite Mfg. Corp., Chicago
Haveg*	PF, asbestos	Säureschutz Ges., Berlin· Haveg Corp., Newark Del.

Name	Description	Manufacturer or Reference
Heleco	Px, F	H. Lehmann & Co., Frankfurt
Hercolyn	synth. resin	Hercules Powder Co., Wilmington, Del.
Homac	synth. resin	Walton Chem. Co. Ltd., Liverpool
Hominit	modeling compound	Apotela, Ltd., Zurich 6
Hornolith	C?	G. Probst, Nürnberg, Germany
Hortoced	coated netting	Haver u. Boecker, Oelde, Germany
Ideallith	C?	J. N. Bolkart, Nürnberg, Germany
Iditol	shellac substitute	U.S.S.R.
Incrinit	insulation	Christiani u. Nielsen, Hamburg
Indestructo*	SG	Add: British Indestructo Glass Co., Ltd., London; Belgian Indestructo Glass Co., S.A., Bruxelles
Isoplac	insulation	Soc. Isoplac, Paris XVII
Jonite	W	Akt. Torefors Sagverk, Sweden
Jubar-Organ-Glas	coated netting	Lorch & Hamm, Zweibrücken, Germany
Kilianit	PF, G	Bakelit G.m.b.H., Berlin
Koken	synth. resin	Nippon Paint Co., Ltd., Japan
Kolinit	lignite-cresol	Brit. Plast., vol. 4, p. 445 (1933)
Kopol	synth. resin	Beck, Koller & Co., Inc., Detroit
Lacrinite	C, PF, F	Lacrinoid, Ltd., London, E 7
Lactoloid	C	Dai Nippon Celluloid Co., Osaka, Japan
Lactonith	C?	Erste Estnische Kunsthornfabrik, Tallin, Estonia
Lancegaye	S.G	Lancegaye S.G. Co., Ltd., London
Lanoplast	cell. acetate flake	Cell. Acetate Silk Co., Ltd., Lancaster, England
Lasilac	molding compounds	Jos. Lucas, Ltd., Birmingham, England
Lastex	latex threads spun with fiber	U. S. Rubber Co., New York
Leolan	D	Leo-Werke, G.m.b.H., Dresden
Leuchtol	synth. resin	Nippon Resin Kogyo Co., Ltd., Japan
L. O. F	SG	Libbey-Owens-Ford Glass Co., Toledo, Ohio
Lonzoid	CA	Lonza-Werke, Waldshut, Germany
Lorival*	PF	Lorival Mfg. Co., Ltd. Southall, Middlesex, Eng.
Luglas*	SG, resin center sheet	Sicherheitsglas G.m.b.H., Kunzendorf, Germany
Lumina	SG	Lumina Sicherheitsglas G.m.b.H., Wien
Lumolit	W	O. Reinwald, Berlin-Wilmersdorf
Lupinit	C	Lupinit G.m.b.H., Mannheim, Germany
Lustilac	molding compounds	Jos. Lucas, Ltd., Birmingham, England
Luxene	PF, denture	Ransom & Randolph, Toledo, Ohio
Marbalin	PF? F	Federal Cutlery Co., New York
Micarta*	PFl, UFl, ware	Westinghouse El. & Mfg. Co., East Pittsburgh, Pa.
Modeloid	modeling compound	Leopold Dreifuss Labs., San Francisco, Calif.
Nameloid	CA?	Harold Mfg. Co., Ltd., Birmingham, England
Necolastic	cements	Imp. Chem. Ind's., London, SW 1
Negocoll	modeling compound	Apotela, Ltd., Zurich 6
Neoformolit	?	Nastukoff, Moskva, U.S.S.R.
Neoleukorit	PF	U.S.S.R.
Neophan	windshields	Deutsche Gasglühlicht-Auer-G.m.b.H., Berlin
Neo-Triplex	SG (CA)	Soc. du Verre Triplex, Paris
Neutex*	SG	Neutex Glasswerkstatten G.m.b.H., Berlin-Charlottenburg
Newtex*	SG	Newtex S. G. Co., Ltd., London WC 2
New-Wrap	V, P	Brit. New-Wrap Co., Ltd., Wigton, Cumberland, Eng.
Nigrolith	?	Kunstst. vol. 22, p. 176 (1932)
Nonflamm	F	Rhein. Gummi- u. Celluloidfab., Mannheim, Germany
Noveloid	products of cellulose esters and ethers	Imperial Chem. Industries, Ltd., London SW 1
Ondoita*	resin molding powder	Soc. anon. Francaise du Ferodo, Paris; Afcom, Ltd., London
Opalax*	CA? m, F	Crayonne, Ltd., Bexley, Kent, England
Ortolan	insulation	Gebr. Mayer, Esslingen Germany
Osalith	C?	Mathias Oechsler, Ansbach, Germany
Pantolit*	PF t	Augsburger Kunstharzfabrik, Augsburg, Germany; Punfield & Barstow, Ltd., London, EC 2
Panzerglas	German generic name for bullet-proof glass	
Papyrus	C	Jos. Nathan & Co., Ltd., London
Paralac*	PF s	Imperial Chem. Industries, Ltd., London
Parsimon	resins, etc	Ver. Stahlwerke, A.G., Düsseldorf
Peka Glas	SG	Plötze u. Kämpfer, Berlin
Pensulate	insulating mat'ls	Blackall Bros., Ltd., London, E 15
Pertinit	UF, F	Meirowsky & Co., Porz, Rheinland, Germany
Phoenixite	Px	N.V.Philips Gloeilampenfabrieken, Eindhoven, Holland
PK Glas	see Peka Glas	
Plasco	F	Cie. Gén. Mat. Plastiques Huningue, France
Plastose	molding powders	Soc. la Plastose, Paris IX
Plialite	s } rubber	Goodyear Tire & Rubber Co., Akron, Ohio
Plioform	m } resins	
Pollopas*	UF m	Add: Dynamit A.G., Troisdorf, Germany; Etabl. Kuhlmann, Paris
Polystl*	(error in previous list)	
Porcedent	vinyl (?) denture	U. S. A.
Posolite	modeling compound	Leopold Dreifuss Labs., San Francisco, Calif.
Prestellan	resins	Allgem. Elekt. Ges., Berlin
Probo	PFl F	L. Poulain, St. Ouen, France
Prophopla	?	Produits Photogr. et Plastiques
Protex	S G	Protex Glass Co., New York; Securex-Glas G.m.b.H., Berlin-Schöneberg
Prystaline	UFm	Soc. Nobel Francaise, Paris, VIII
Rainbow Ware	UF, F	Billmyre Mfg. Co., Ltd., London, SE 17
Ramos	PF, F	Universal Elect. Lamp Co., London, EC 2
Reflite*	synth. resin molding powder	Dante Badino, Genova, Italy
Reicolit	insulation	Reicolit G.m.b.H., Berlin
Resinox*	PF, m, s	Resinox Corp., New York
Resovin	vinyl resin denture	S. S. White Dental Mfg. Co., Philadelphia, Pa.
Revolite	PF impregn. cloth	Revolite Corp., Johnson & Johnson, New Brunswick, N. J.
Rhodialite	CA	Soc. Usines Chim. Rhone-Poulenc, Paris
Roanoid*	UF m, F	Roanoid, Ltd., Glasgow
Rockite*	PF m, s	F. A. Hughes & Co., Ltd., London, NW 1
Rosene	F	Cascelloid, Ltd., England
Roxon	PF, F	Roxon, Ltd., London, EC 4
Safetex	S G	Safety Safetex Glass Co. London SW 1
Salva-Glas	SG	Securex-Glas G.m.b.H. Berlin-Schöneberg
Securex*	SG	Securex-Glas G.m.b.H., Berlin-Schöneberg
Sécurit } Sekurit }	"hardened glass"	Glaceries Réunies, S. A., Bruxelles; Soc. Anon. St. Gobain, Chauny et Cirey, Paris; Bicheroux & Cie., G.m.b.H., Herzogenrath, Germany
Seracelle	CA, P	Courtaulds, Ltd., London
Sibor	SG	Soc. Verreries de Folembray, Folembray, France
Sidac*	V, P	Add: British Sidac, Ltd., England
Sigla	SG	Sicherheitsglas, G.m.b.H. Kunzendorf, Germany
Simplex	SG	Soc. du Verre de Sûrete Simplex
Splintex*	SG	Splintex S. G. Co., London EC 3; Soc. du Verre de Sureté Splintex, Penchot, France; Splintex Belge, S.A., Bruxelles
Starlite }	synth. resin	Soc. Gén. Const. Electro-mechanique, Limoges, France
Starpass }	U F	
Stoco	bituminous plastic	Jos. Stokes Rubber Co., Ltd., Welland, Ont.
Superez	CA, denture	Alcolite, Inc., Philadelphia
Superlit }	synth. resin	Stein, Berlin
Supertex }	SG	Supertex S. G. Co., London
Synobel	cements	Imp. Chem. Industries, London SW 1
Telconite	insulation	Telegraph Const. & Maintenance Co., London
Tempo	cellulose esters	Tempo Schallplattenfab. G.m.b.H., Berlin-Wilmersdorf
Tenatext	PFm, rag-filled	Allgem. Elektr. Ges., Berlin
Tenite	CA, m	Tennessee Eastman Corp., Kingsport, Tenn.
Tepperite	polystyrol denture	Martin Rubber Co., Long Island City, N. Y.
Thermose	CA (?) denture	Bakelite Dental Supplies, London
Thesit-Textil	laminated	Presswerk A. G., Essen, Germany
Thorax A*	SG, CA }	Mühlig-Union Glasindustrie A.G., Teplitz-Schönau, Czechoslovakia
Thorax N*	SG, Px }	
Tomophan	V, P	Tomaszov, Poland
Tornesit	chlorinated rubber	Herold A. G., Hamburg
Trelit	Px	Norway
Trilob	SG	Cie. Internat. Fabrication Mécanique du Verre, Bruxelles
Triplex*	SG, Px	Triplex S.G., Co., Ltd., London; Soc. du Verre Triplex, Paris
Trolit F*	Px	
Trolit S	} PF m	
Trolit Spezial*	}	
Trolit W*	CA	
Trolitan*	PF m (wood flour)	
Trolitan H.*	now called	
Trolitan Profile	Pollopas	Dynamit A. G., Troisdorf, Germany
Trolitax*	PF l	
Trolitul*	Polystyrol	
Trolitul-folien	?	
Trolon*	PF t	
Trolon-Platten	PF ? l	
Tylose S	methylcellulose	Chem. Markets, vol. 31 p. 48 (1932)
Tyrex	SG	Tyrex S. G. Co., San Francisco
Umbraced	coated netting	Haver u. Boecker, Oelde, Germany
Ureit	German generic name for UF resins	
Venite	Px	Bluemel Bros., Ltd., Wolston, Coventry, Eng.
Veracetex	SG	Glaceries Réunies, S.A., Bruxelles
Vinnapas	vinyl resin	Farben-Chem. vol. 3. p. 427, 465 (1932)
Vio-Ray	coated netting	Vio-Ray Co., Kansas City, Mo.
Vis	SG	Vetro Italiano di Sicurezza, S. A., Pisa, Italy
Viscoid	?	Kunstst. vol. 22, p. 169 (1932)
Vitreo-Colloid*	CA	Provincial & Foreign Investments, Ltd., Oxted, Surrey, Eng.
Vydon	vinyl resin denture	Lee S. Smith & Son, Pittsburgh
Westbury Ware	?	Kunstst. vol. 23, p. 108 (1933)
Xetal	SG	Xetal S. G. Co., Stapleford, Eng.
Xylose	benzyl cellulose denture	Bakelite Dental Supplies, London
Zellwonet	V, P	Wolf Netter, Ludwigshafen, Germany
......	creaseless textiles	Tootal, Broadhurst, Lee Co., Ltd., Glossop, England
......	PF	Fabryka Kabil, Krakow, Poland

BOOKSHELF

New Deal Economics

Modern Industrial Organization. By *Herbert von Beckerath* (Translated by Robinson Newcomb and Franziska Krebs). McGraw-Hill, New York, 1933. 385 pages. Price, $4.

WITH HIS BACKGROUND as a professor of economics, following an extended career as an industrialist and German government official, Dr. von Beckerath is singularly well qualified in the task he has assumed of surveying the status of industrial organization in Europe and in North America. In its present appearance, the volume is a translation of one that was completed during the boom years and published in Germany in 1930. Where it was necessary to take cognizance of the economics of the New Deal, the translators have done so, but in the main the viewpoint remains that of the author, strictly in the classical school and concerned with tried rather than with the newer experimental theories.

For students of industrial organization, particularly for those with a bent toward European models, the work should be indispensable. For others, it will prove heavy going in many places, for the ponderous character of the original German has not been eliminated entirely. In any event, however, there are portions, notably the chapters on "Industry and the Markets," "Influencing Supply and Demand" and "Government and Industry" which should be worthwhile reading even for those without interest in the minute workings of the cartel in all its variations.

Business Under the Recovery Act. By *Lawrence Valenstein* and *E. B. Weiss*. Published by Whittlesey House, McGraw-Hill, New York. 314 pages. Price, $2.50.

TIMELINESS is an important asset in the present business situation. Every industry and most professions face the immediate problem of drafting a code or regulating their business activities to accord with a blanket code or agreement already adopted. Many puzzling problems of interpretation are involved and beyond these are more far-reaching effects of this legislation on business policies and practices. Because of the authors' background and experience—one is president of an advertising service and the other a one-time member of the editorial staff of *Printers' Ink*—they write most informatively of the place and future of advertising and selling in the new scheme of things. These chapters comprise six of the thirteen and will doubtless help the chemical sales manager in mapping his course during the next few months. But the whole of the book, with its excellent appendix, attempts a complete answer to the question in the mind of every business man: "How will this Act affect me?—How will it affect my business?"

For Engineering Economists

Value Theory and Business Cycles. By *H. L. McCracken, Ph.D.* Published by Falcon Press, New York. 270 pages. Price, $4.

Reviewed by *Theodore M. Switz*

THESE FOUR YEARS of grinding depression have been forcing intellectually curious engineers to seek some explanation of the phenomenon of the business cycle. Unfortunately, most of them, including the Technocrats, approach the problem without any theoretical or historic perspective. McCracken's "Value Theory" gives a very readable account of the development of modern economic thought on this subject. In addition he has the merit of approaching the problem from the viewpoint of "value theory," which is to economics what thermodynamics is to chemistry. A number of misstatements of the theories of Marx and Ricardo do not detract from the value of the book to the engineering reader who is approaching this subject for the first time.

Chemistry in Industry

Industrial Chemistry. By *William Thornton Read*. John Wiley & Sons Co., New York, 1933. 576 pages. Price, $5.

Reviewed by *Theodore R. Olive*

EVERY CHEMICAL ENGINEER, on occasion, and for the good of his soul, should take stock of the technical situation throughout the broad expanse of chemical engineering industry, beyond the confines of his own immediate, particular interest. Professor Read has given him such an opportunity in his pleasantly written, authoritative and enormously informative book. True, the primary purpose of the author was to instruct the student and the teacher of chemistry and chemical engineering; but he has succeeded in striking a happy mean between the text book and the technical work which should appeal equally to the unfledged and to the experienced engineer.

Emphasis has been placed upon the unit operations of chemical engineering which have been presented adequately, though compactly in a special chapter. Other sections give a picture of the place of chemistry in industry and its economics, the work of chemists and chemical engineers, the organizations and sources of information in the field not ordinarily covered in text books of this type. The balance of the book is more nearly conventional in treatment, although it improves on its predecessors in the matter of illustrations, which are uniformly informative rather than decorative. Perhaps it suffers, at times, in comparison, by reason of the industry grouping chosen, which is based on chemical similarity, rather than on use or process. Thus explosives appear in three chapters, fertilizer materials in two and caustic soda in two. Leather, probably to its own surprise, finds itself lumped with wool, silk and casein.

However, the fault is small, particularly for the straight-through reader. For others, the index may solve the problem (it does not in the case of caustic soda). In the main, minor criticisms aside, the book is admirable, marking in the reviewer's opinion a new high in industrial chemistries of the less voluminous persuasion.

The Colloidal Elements

Inorganic Colloid Chemistry. Vol. I, The Colloidal Elements. By *H. B. Weiser*. Published by John Wiley & Sons, Inc., New York, 1933. 389 pages, 45 fig. and 56 tables. Price, $4.50.

Reviewed by *Frederick E. Schmitt, Jr.*

AS THE TITLE, "The Colloidal Elements," indicates, this volume is concerned primarily with the methods of formation, properties, and applications of the elements in the colloidal state. After a chapter dealing with general methods of preparation, separate divisions are in turn devoted to the metals and the non-metals. In the descriptive portions of the text are included the methods of procedure for preparing the several sols and for investigating their characteristic colloidal properties. In the theoretical sections, critical discussions are given of the mechanism of sol formation, the composition and constitution of sols, and the nature of adsorption processes with especial reference to the catalytic action of colloidal substances. In the section dealing with applications, consideration is given to the principles which underlie the more important uses of the colloidal elements in the industrial arts and in biology.

Inasmuch as the usual treatment of colloidal behaviour is by reference to the physical properties of certain organic substances, it is to be seen that Prof. Weiser, in compiling, arranging, and interpreting a mass of information which would otherwise lie scattered, has produced a book to fill a very definite vacancy in the field of chemical literature.

Hausbrand Up-to-date

EVAPORATING, CONDENSING AND COOLING APPARATUS. Fifth English Edition. By *E. Hausbrand* (Translated by A. C. Wright, revised and enlarged by Basil Heastie). D. Van Nostrand Co., New York, 1933. 503 pages. Price, $8.

THERE can be small question of the value of an engineering work which runs into two German and five English editions. As a matter of fact, "Hausbrand" has for many years been a classic in evaporation, a distinction which it doubtless will still hold for many years to come. For those who are not familiar with it, be it said that the book undertakes a handbook type of treatment, containing hundreds of tables that are indispensable for evaporator and condenser designs. To the slight annoyance of American engineers, all of this material must be converted from the metric system. Also somewhat unpleasant, at least to American eyes, is what appears to be a slipshod job of printing. For engineers who know the book in its previous editions, be it noted that a valuable new chapter on heat exchange practice current in England and America and on the Continent has been added by the most recent reviser.

Institute Publications

TRANSACTIONS OF AMERICAN INSTITUTE OF CHEMICAL ENGINEERS. Vol. XXVIII, 1932. D. Van Nostrand Co., Inc., New York. 346 pages. Price, $6.

In addition to the papers presented at the Schenectady-Corning meeting, June, 1932, and the Washington meeting, Dec. 1932, this volume contains a chapter dealing with the Silver Anniversary of chemical engineering in America.

PETROLEUM DEVELOPMENT AND TECHNOLOGY. Transactions of American Institute of Mining and Metallurgical Engineers, Vol. 103. Published by the Institute, New York. 426 pages. Price, $5.

This is the eighth in the series published by the Institute's Petroleum Division. It includes chapters on petroleum engineering and research, economics, stabilization, production statistics for petroleum and natural gas, and, of particular interest to the chemical field, a summary of developments in refinery engineering during 1932, written by Walter Miller.

Correction

The price of McGraw-Hill's "The Technical Man Sells His Services" by Mr. Edward Hurst is $2, not $5 as recently published in these columns.—Editor.

STANDARDS AND SPECIFICATIONS FOR METALS AND METAL PRODUCTS. U. S. Bureau of Standards Miscellaneous Publication No. 120. Prepared by George A. Wardlaw, under direction of A. S. McAllister, Chief of Division of Specifications. 1,359 pages; Buckram. Superintendent of Documents, Government Printing Office, Washington, D. C. Price, $3.00.

AN EXTENDED résumé of nationally recognized standards and specifications for ores, metals, and manufactures, except machinery, vehicles, and electrical supplies.

THE ENGINEER'S MANUAL OF ENGLISH. By *W. O. Sypherd* and *Sharon Brown*. Scott, Foresman & Co., Chicago. 515 pages. Price, $2.

THIS MANUAL is designed to serve as a textbook in English composition for engineering students and as a reference book on technical writing for the practicing engineer. After a discussion of the general technique required in all good writing, the author devotes the remainder of Part I to the treatment of those forms of writing with which engineers are mainly concerned, such as correspondence, reports, technical articles, bulletins, catalogs, and specifications.

Part II contains specimens of various types intended to serve as models for practice and study, and as reading in engineering literature. Many of these specimens have been supplied by engineers, manufacturers, and publishers.

ANNUAL REPORT ON THE PROGRESS OF CHEMISTRY FOR 1932, Vol. XXIX. The Chemical Society, London, England. 344 pages.

ENGLAND'S annual review of progress made in general, analytical, organic, and inorganic chemistry, biochemistry, geochemistry, and radioactivity.

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.

Company Law and Business Taxes in Great Britain, by Walter Jaeger. Bureau of Foreign and Domestic Commerce, Trade Promotion Series No. 147; 15 cents.

Trading Under the Laws of Germany, by H. C. Harris. Bureau of Foreign & Domestic Commerce, Trade Promotion Series No. 150; 15 cents.

Directions for Sampling Coal for Shipment or Delivery, by George S. Pope, Revised by N. H. Snyder. Bureau of Mines, Technical Paper 133; 5 cents.

Wages and Hours of Labor in the Pottery Industry, 1925 and 1932. Reprint from the *Monthly Labor Review*. U. S. Department of Labor, April, 1933; 5 cents.

Lead Poisoning in a Storage Battery Plant, by Albert E. Russell and others. Public Health Service Bulletin 205; 5 cents.

Contact Sprays for the Japanese Beetle, by Walter E. Fleming. Department of Agriculture Circular 280; 5 cents.

The Residual Effects of Warfare Gases, by Harry L. Gilchrist and Philip B. Matz. Chemical Warfare Service, unnumbered document; 10 cents. Parts I and II of this document discuss chlorine and mustard, respectively.

Newsprint and News Ink, by B. L. Wehmhoff and others. Government Printing Office, Technical Bulletin No. 18.

Distribution of Butter, Cheese, Evaporated and Condensed Milk, and Ice Cream. Bureau of the Census, Census of Distribution, 1930. Agricultural Commodity Series, unnumbered document; 10 cents.

Carbonizing Properties and Constitution of No. 2 Gas Bed Coal From Point Lick No. 4 Mine, Kanawha County, W. Va., by A. C. Fieldner and others. Bureau of Mines Technical Paper 548; 10 cents.

Trade Practice Conferences. Federal Trade Commission, unnumbered document; 15 cents. Summarizes approved regulations of 150 industries.

Materials Used in Manufactures: 1929, by Tracy E. Thompson. Bureau of the Census, unnumbered pamphlet; 5 cents. Statistical summary of raw materials used in manufacturing in the United States.

Lime, Marble, Granite, Slate, and Other Stone Products. Bureau of the Census, Census of Manufactures, 1931; 5 cents.

Instructions for Installation of Aluminum Alloys on Vessels of the United States Navy. Navy Department, Bureau of Construction and Repair, unnumbered pamphlet; 5 cents.

Laboratory and Field Tests of Concrete Exposed to the Action of Sulphate Waters, by Dalton G. Miller and Philip W. Manson. Department of Agriculture, Technical Bulletin 358; 10 cents.

Yearbook of Agriculture, 1933. Department of Agriculture, unnumbered document; $1.00 (cloth).

The Composition and Distribution of Phosphate Rock With Special Reference to the United States, by K. D. Jacob and others. Department of Agriculture, Technical Bulletin 364; 10 cents.

Mineral Production Statistics for 1931—Separate pamphlets from Bureau of Mines on: Phosphate Rock, by B. L. Johnson, 5 cents; Copper, by C. E. Julihn and H. M. Meyer, 5 cents.

The Clay-Products Industries and Sand-Lime Brick, 1932. Bureau of the Census; rotoprint. Includes statistics on clay products (other than pottery) and non-clay refractories, pottery, including porcelain ware.

The Coloring of Mature Citrus Fruits With Ethylene Gas, by J. R. Winston and R. W. Tilden. Bureau of Plant Industry; mimeographed.

Manganese, General Information, by Robert H. Ridgway. Bureau of Mines, Information Circular 6729; mimeographed.

Petroleum and Natural-Gas Studies of the United States Bureau of Mines, by H. C. Fowler. Bureau of Mines, Information Circular 6737; mimeographed.

Economic Aspects of Gold and Silver, by Scott Turner. Bureau of Mines, Information Circular 6740; mimeographed.

A Study of Subsurface Pressures and Temperatures in Flowing Wells in the East Texas Field and the Application of These Data to Reservoir and Vertical-Flow Problems, by C. E. Reistle, Jr., and E. P. Hayes. Bureau of Mines, Report of Investigations 3211; mimeographed.

Mineral Production Statistics for 1932—Preliminary mimeographed statements from Bureau of Mines on: Tungsten; platinum and allied metals; feldspar; sand and gravel; fuller's earth; chromite; tin; coke and byproducts; barite and barium; cadmium; recovery of metals from secondary sources.

PLANT NOTEBOOK

Alignment Chart for Plant Dilution Problems

By Norman M. Wickstand
Meriden, Conn.

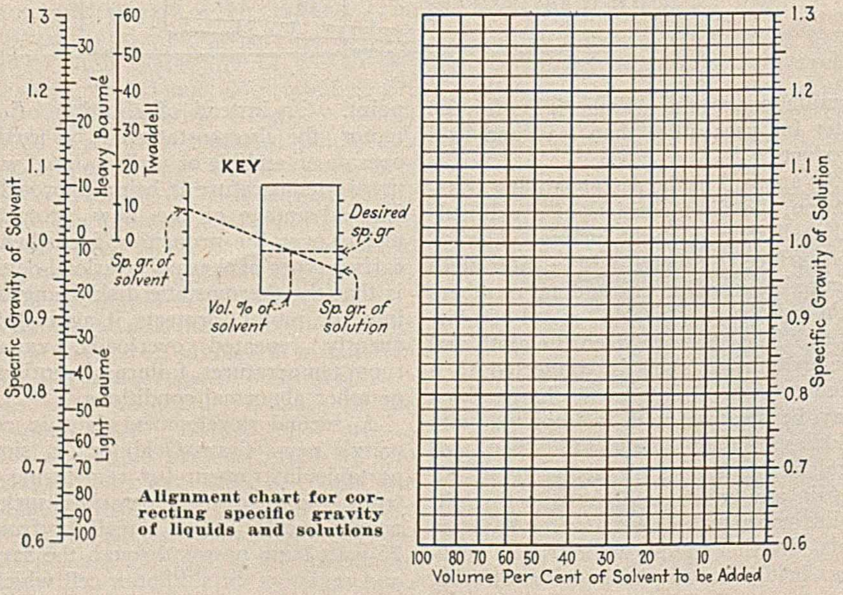
IT IS FREQUENTLY necessary to dilute a solution or pure liquid with a solvent so that a final solution of definite specific gravity is produced. This can be accomplished readily through use of the formula:

$$\frac{A-D}{D-S}100=\text{Vol. per cent of solvent}$$

where A=specific gravity of solution or pure liquid; D=specific gravity of the desired solution; and S=specific gravity of the solvent. This equation is accurate except in so far as there is generally some volume contraction when the solvent is added to the solution. Consequently, it is necessary to add less solvent than indicated, making up to the final specific gravity by cut-and-try solvent additions.

Use of the equation, therefore, or of the accompanying alignment chart which is derived from it, is chiefly to give an indication of the approximate magnitude of the necessary addition. By means of the chart, without calculation, the chemist or the operator can determine whether the quantity of solvent to be added to a 10-gal. batch is of the order of pints or of gallons. Knowing the approximate quantity he can immediately add a little less than this, after which the gravity of the resulting solution can be determined and the dilution completed by smaller additions.

To use the chart lay a straight-edge from the specific gravity of the solution, on the scale at the right, to the specific gravity of the solvent, on the scale at the left. A horizontal line through the specific gravity of the desired solution will then intersect the straight-edge at a point vertically above the required volume per cent of solvent on the horizontal scale. If the intersection should fall off the scale, interchange the solution and solvent. Conversion scales are provided for hydrometers calibrated in degrees Baumé or Twaddell.

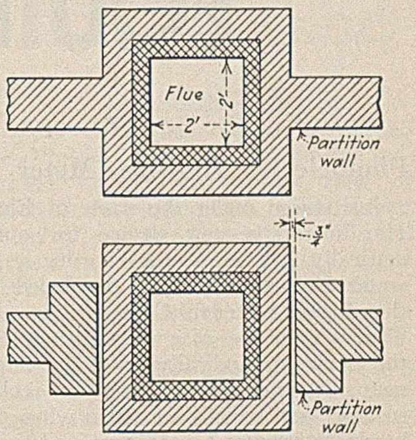


Alignment chart for correcting specific gravity of liquids and solutions

Correcting Bad Practice in Chimney Construction

By Fred D. Hartford
Denver, Colo.

TEMPTATION to utilize the brick parts of furnaces as building walls or partitions, or as supports for machinery frequently brings trouble to the plant maintenance man. For example, the upper sketch above shows the horizontal cross-section of a brick chimney built into a partition wall. Apparently the chimney had been calculated to act as a pilaster for the wall. The furnace combustion gases entered the chimney above 1,000 deg. F. and contained a large percentage of sulphur trioxide. The expansion of the chimney shattered the junction between it and the partition walls leaving the latter unsupported. In addition, the movement tore away the chimney flashing from the roof.



Original construction above; corrected construction below

In operation the furnace was shut down for repairs at intervals of three or four months. On cooling, the chimney would not return to its original position because of the accumulation of dust in the crevices opened up by the expansion. When the chimney was again heated, it would "grow" still further. Moreover, when the flue was cold, the sulphur trioxide imprisoned in the brickwork would attract moisture and then swell the brick still more. Accordingly, about every alternate furnace shutdown required not only the rebuilding of the flue but also of the adjoining walls as well, adding materially to the maintenance cost.

The lower sketch shows how the chimney was finally repaired. The new chimney was laid up with hard burned brick laid in acid and heat resisting mortar. The adjacent walls were built of common brick and cement mortar. The new arrangement has withstood half a dozen shutdowns and apparently is as good as ever. Incidently, the roof flashing of the chimney was replaced by a sheet-lead skirt unattached to the roof itself so that expansion causes no trouble at this point.

NEW EQUIPMENT

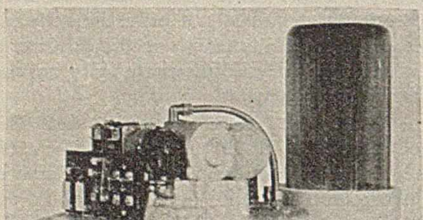
Photoelectric Hardness Meter

Introduced under the name of Elgin Hardimeter, a new device for automatically checking the hardness of water has recently been developed by the Elgin Softener Corp., Elgin, Ill. Through the use of a photoelectric cell the device periodically tests the hardness of water produced by a zeolite softener and sounds an alarm when the hardness reaches a predetermined limit. The instrument is also used to check the brine wash water so that the softener will not be placed in service before the brine has been completely removed.

The method of accomplishing these results is very simple. A sample of water from the soft water supply line is led into a glass cylinder at intervals and to this water a small quantity of a chemical is added. The slightest hardness causes a change of color and turbidity so that the current output of the photo-cell, which is illuminated by a beam of light passing through the glass cylinder, is proportional to the hardness. The hardness can thus be read on a meter scale. Furthermore, when it surpasses the limit for which the instrument is set, an alarm is caused to ring. During washing after regeneration, the instrument automatically tests the wash water for zero brine content, again giving an alarm when the softener is ready to be put back into service.

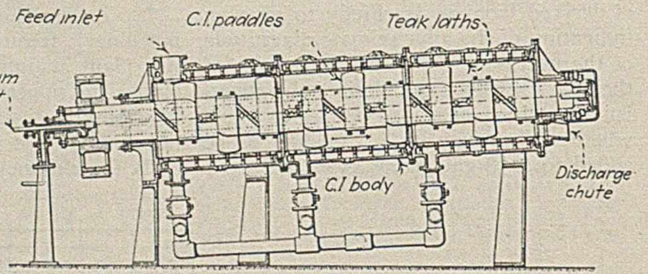
A second model of Hardimeter is built for water which varies appreciably in color or turbidity. In this instrument, two photo-cells and two test cylinders are used. Simultaneous samples enter the cylinders and the chemical is added to one. The electrical circuit of the cells measures the difference between the light-absorbing characteristics of the two samples and the result is thus independent of the original turbidity or color of the water.

Automatic hardness-control meter



Novel Vacuum Filter

Dewatering of pulp in such industries as paper, chemicals, china clay, whiting, cement, ceramics and food products is handled efficiently, according to an article appearing in a recent edition of the *Industrial Chemist,* by a new vacuum filter manufactured under the name of the "Waring" by Samuel Hodge & Sons, Ltd., 130 Leadenhall St., London, E.C. 3, England. This company holds sole manufacturing and selling rights for the filter for uses other than lead and lead products.



Cross section of new Waring vacuum filter

As appears in the accompanying illustration, the filter consists of a cylindrical shell set at a slight incline. The inner surface is covered with a filter cloth secured to wooden longitudinal members held within a suitable metal framework. The space between the cloth and the cylindrical shell is connected to a vacuum pump. A central shaft, which may be steam-heated, is supplied with paddles which distribute the feed against the filter cloth, agitating it, filling in any cracks, and transporting the solids toward the discharge. At intervals, division plates with graded openings bridge across the interior, offering resistance to the passage of the material and necessitating additional pressure from the paddles to force it through. The pressure facilitates the removal of further water. In handling whiting, for instance, this construction is said to make possible the reduction of water content of the slurry from 70 per cent to 18-20 per cent.

Time-Temperature Controllers

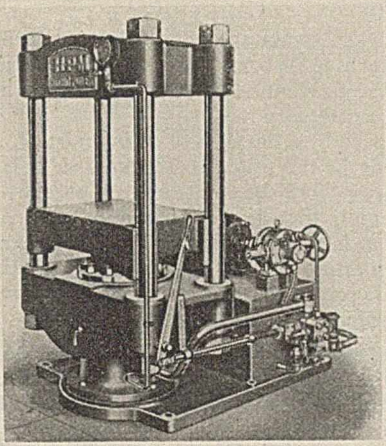
The Bristol Co., Waterbury, Conn., has announced the introduction of a new series of time-temperature and time-pressure controllers. These instruments combine in one case this company's "free vane" mechanism for the operation of temperature or pressure controllers, together with an air-operated timer. The new controllers are available in a range from —40 to 1,000 deg. F., or, in pressure, from 10 to 2,000 lb. In one model, the timing cam consists of a large disk of sheet aluminum, which may be cut by the user, while in another model, a smaller aluminum cam is supplied, together with an indicating pointer for temperature or pressure.

Electrical Equipment

Several new developments have been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. One of these is the "Thermoguard" motor which has a built-in disk thermostat to shut off the motor before the temperature of the insulation reaches the danger point. Or instead of shutting off the motor, the thermostat may be used to operate an audible or visible signal when unsafe temperature is being approached. The advantage of the new protecting means over the protection furnished by earlier types of thermal overload devices is that the thermostatic disk, being built into the motor, protects it against frequently repeated overloads, variable room temperatures, failure of ventilation or other abnormal conditions.

A second development is this company's new Trans-O-Meter, a simple portable instrument for registering the transparency of flat materials such as paper, textiles, etc. The light from a 25-watt lamp passes through the sample and registers on a Photox cell which is connected to a microammeter calibrated to read percentage transparency. The Photox cell is a copper oxide disk which generates current according to the amount of light striking it. Its sensitivity approaches that of the human eye.

This company's lamp division at Bloomfield, N. J., has developed a refractory-protected mercury switch in nominal ratings from 3 to 50 amp. Contact is made within a refractory chamber between two pools of mercury. An atmosphere of inert gas dissipates the heat of the arc and prevents of loss of fluidity of the mercury.



"Hydro-Power" press with power unit at rear

Self-Contained Hydraulic Press

Doing away with the separate accumulator and auxiliary pumping equipment, the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, has recently developed a new line of self-contained hydraulic presses for many applications, in each type of which the hydraulic power is supplied by an individual power plant which is part of the machine. The pressure is developed by a "Hydro-Power" unit consisting of a variable-delivery radial pump (described in the July, 1933, issue of *Chem. & Met.*) driven by a direct-connected motor, both mounted on a base which serves as a reservoir for the oil used as the pressure fluid. The pressure exerted by the press and the speed of the ram are subject to close automatic regulation through control of the output of the power unit.

Among the advantages claimed for the new presses are: savings in installation costs and in floor space, with no restrictions as to location. Because of the "Hydro-Power" feature the presses have adjustable pressure capacity and variable working speed. They are available in standard pressure capacities from 25 to 500 tons with square or open-side platens varying in increments of 12 in.

Four-Duty Couplings

Four functions of starting, coupling, cushioning and load-limiting are combined in the new Falk-Rawson coupling recently announced by the Falk Corp., Milwaukee, Wis. Essentially, the construction involves merely two drum-shaped members, one attached to the driving shaft and the other to the driven shaft. Between the driving and driven members are inserted floating segments, made usually of brake lining reinforced with lead. The amount of lead is calculated to give the required centrifugal pressure for carrying the load. The outer segments, used for starting, are actuated by the driving member and the inner by the driven member. The new coupling is said to permit the motor to gather speed quickly, while the driven machine is slowly accelerated, thus making possible a smaller motor than would be necessary to supply the required starting torque were the coupling not employed.

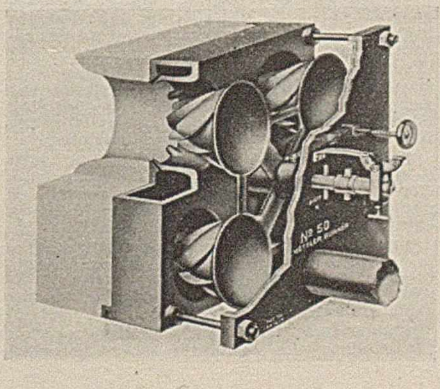
Transparency Meter

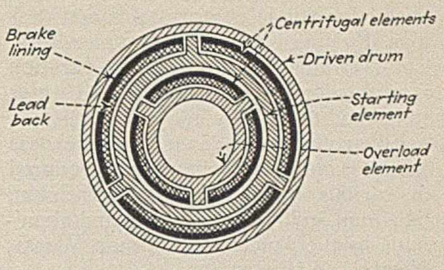
Transparency of paper, liquids, films and other materials may be measured readily by means of the new Trans-O-Meter recently announced by the Weston Electrical Instrument Corp., Newark, N. J. The apparatus consists of a Weston Photronic cell, a rheostat, a lamp, a filter, a microammeter and a sample holder. The apparatus is operated by determining the light transmission of a standard sample, calling this 100 per cent, and then determining transmission of other samples in terms of the standard. Reference should be made to the standard after each reading to insure constancy of the light, which is obtained from an ordinary 60-watt or smaller incandescent bulb.

Universal Burner

For the combustion of either gas or oil, using air with or without preheat in oil stills, industrial high-temperature furnaces, smelting furnaces and large modern boiler plants, the Lee B. Mettler Co., 406 South Main St., Los Angeles Calif., has recently developed the No. 50 Universal Entrained-Combustion burner, a phantom view of which is shown herewith. The burner assembly consists essentially of five parts, a refractory mixing block, a gas manifold, an air control consisting of four dampers, which are part of a single casting, a cast-iron burner front, and a quick detachable steam-atomizing oil burner, furnished as standard equipment. The burner covers the capacity range from 125 to 1,000 boiler horsepower, and for smaller sizes is made with two mixing tubes instead of four, giving one-half the capacity.

Phantom view of combination burner





Cross-section of Falk-Rawson coupling

Equipment Briefs

The Hays Corp., Michigan City, Ind., has developed a new form of CO_2 recorder-indicator in which the automatic Orsat which analyzes the gas is placed near the flue, while the indicator-recorder is located at the boiler front.

For measuring temperature in the range from minus 40 to plus 335 deg. F., C. J. Tagliabue Mfg. Co., Brooklyn, N. Y., has developed a new line of inexpensive, dial-type indicating thermometers with 5-in. dials and black Bakelite faces.

The Foxboro Co., Foxboro, Mass., has announced a new line of 2-in. indicating pressure gages guaranteed to be accurate within 1 per cent of the total scale. The gages are made in both vacuum and pressure ranges.

A new hydrostatic tank gage, known as the Tank-O-Meter, for measuring liquids in depths up to 675 in. of water, has been developed by the Uehling Instrument Co., Paterson, N. J. The gages are of the balanced type, compensating for the tank pressure. Air pressure is supplied by a small hand pump.

High power capacity, long flexing life, and low stretch are important features of a new belt, known as the Goodyear Emerald Cord V-belt, recently announced by the Worthington Pump & Machinery Corp., Harrison, N. J. The fabric is bias-cut and, depending on the size, the belts are provided with one endless cord in one plane or two endless cords in two planes.

"Labtop Seal" is a new paste-type

protection for laboratory table and desk tops developed by the Kewaunee Mfg. Co., Kewaunee, Wis. The preparation is said to be resistant to acid and water stains and to polish while it protects.

Fine-rolled foils, down to a thickness as low as one micron, have been produced in various metals including platinum, paladium, gold, copper, nickel and aluminum, by the American Platinum Works, Newark, N. J.

D. W. Haering & Co., Chicago, Ill., has announced a new anti-corrosion service for the uses of air-conditioning equipment. The company conducts daily analyses of the water and specifies protective treatment.

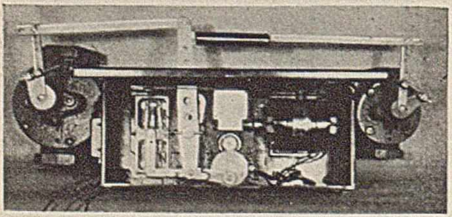
Improved Burners

Babcock & Wilcox Co., 85 Liberty St., New York City, has announced several new burners, including a steam-atomizing burner for heavy oil, tar, pitch and acid sludge, and a combination oil and gas burner. In the former, the steam is admitted to the annular space around the central fuel barrel and is projected across each outgoing stream of fuel at the nozzle plate, thus effecting complete atomization and resulting in a short, turbulent flame. In the latter, the burner is a combination of this company's mechanical atomizing oil burner with a burner in which gas is broken up into small streams and discharged at right angles into a venturi throat through which the air for combustion passes.

Multi-Position Controller

To meet the problems introduced by widely varying demand for heat in furnaces and other equipment, the Automatic Temperature Control Co., 34 East Logan St., Philadelphia, Pa., has recently developed a new multiple position controller, given the designation of Type 305. This device is used with an instrument having five separate contacts, two either side of a normal setting. It gives two definite valve positions for each contact between the extreme low and extreme high contacts in the actuating instrument. One of these positions is assumed following a drop in temperature, and the other following a rise. This system is said to be practically independent of time lag conditions and to maintain the furnace temperature within narrow limits. It is intended to fill a gap between the conventional two or three-position controller and the complete balancing controller built by the same company.

New multiple-position controller

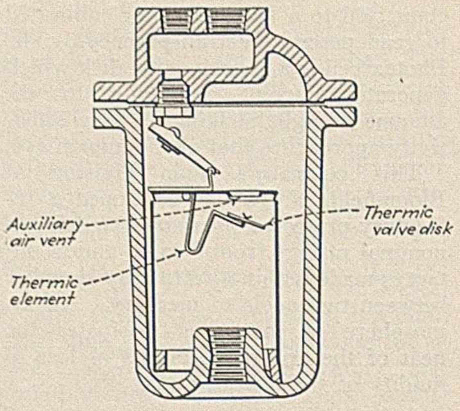


Odor Remover

Complete removal from air of a wide variety of odors, including amyl acetate and other acetates, mercaptans, hydrogen sulphide and other gases and vapors is said to be effected by a new odor filter recently developed by the Consolidated Air Conditioning Co., 942 Chrysler Bldg., New York City. This equipment is available both for air-conditioning systems and for industrial systems, the latter employed for the production of pure air for processing and for the elimination of plant nuisances. The filter employs a bed of granular, activated, coconut-shell carbon as the absorbing agent. It is stated that in most installations, filters will operate about one year without reactivation. Filters are built up of steel units in which the carbon is retained by 22-mesh wire cloth.

Vented Trap

To promote quick heating, an automatic, auxiliary air bypass, operated by means of a strip of thermostatic bimetal, has been incorporated in its inverted-bucket steam traps by the Armstrong Machine Works, Three Rivers, Mich. The air vent is made much larger than is customary with fixed vents and is closed by a flat disk of stainless steel. As long as the trap is cold, the disk is held away from the vent and air escapes so rapidly that the bucket cannot float. The vent is immediately closed when steam is admitted. Once the trap is hot, further air mixed with the steam is vented through a standard fixed vent.



Trap with thermostatic air vent

Correction: In an article on p. 433 of our August issue, describing the Simpson Intensive mixer, the name of the manufacturer, National Engineering Co., 549 W. Washington Blvd., Chicago, was inadvertently omitted.

MANUFACTURERS' LATEST PUBLICATIONS

Blowers. Roots-Connersville-Wilbraham, Connersville, Ind. — Bulletin 21-B16 — 4 pages with engineering data on Victor-Acme blowers.

Burners. Lee B. Mettler Co., 406 South Main St., Los Angeles, Calif.—Catalog Sect. 2—48-page book on burner specifications and installation drawings, with an extensive section on useful information and combustion engineering data.

Metal Cleaning. Philadelphia Quartz Co., 121 South Third St., Philadelphia, Pa.—Booklet 331—12 pages on the use of sodium metasilicate for electrocleaning of metals.

Compressors.. Ingersoll-Rand Co., 11 Broadway, New York City—Form 1604E—48 pages on portable compressors, tools and equipment.

Controllers. Mason-Neilan Regulator Co., 1190 Adams St., Boston, Mass.—Bulletin 2000-c—24 pages illustrating and describing this company's compensated pressure-control instruments.

Deodorizing. Schutte & Koerting Co., Philadelphia, Pa.—Bulletin describing the Lurgi vacuum, two-stage, deodorizing process offered by this company for the treatment of vegetable and animal oils.

Equipment. Jas. P. Marsh Corp., 2073 Southport Ave., Chicago, Ill.—Catalog 68—General catalog on this company's line of gages, valves, traps and other heating equipment.

Filter Presses. D. R. Sperry & Co., Batavia, Ill.—Bulletin 4—32 pages with engineering data and description of this company's filter presses, illustrating many typical installations.

Flowmeters. Schutte & Koerting Co., Philadelphia, Pa.—Bulletin 18-R—12 pages on the several types of float flowmeters made by this company under the name of Rotameter.

Generators. McLeod & Henry Co., Troy, N. Y.—4-page folder describing the use of this company's silicon carbide refractories in the lining of water-gas generator furnaces.

Lacquers. Hercules Powder Co., Wilmington, Del.—Form 522—8 pages on the relative effect of nitrocellulose, gums and plasticizers on discoloration.

Refractories. Standard Fuel Engineering Co., Detroit, Mich.—6-page folder describing the properties and application of the various members of this company's line of "Zero" high temperature refractories.

Tanks. Struthers-Wells Co., Warren, Pa.—Bulletin D-1—4 pages on this company's line of "Silver White" multi-purpose containers in stainless steel, aluminum and Inconel.

"Thiokol." Thiokol Corp., Yardville, N. J.—12 pages on the properties and uses of this solvent-resisting, rubber-like olefin polysulphide compound.

Valves. Edward Valve & Manufacturing Co., East Chicago, Ill.—10-page booklet describing the properties and application of EValloy, a stainless iron alloy for valve trim used by this company.

Valves. Jenkins Bros., 80 White St., New York City—Catalog 23—Describes fully 400 valves in many types; gives useful data tables.

Welding. Linde Air Products Co., New York City—"Fabrication of Oxwelded Piping," a 160-page book describing design, layout and construction of welded piping, superseding the earlier book on this subject published in 1929.

NEWS OF THE INDUSTRY

Thirty-three hundred chemists attended American Chemical Society convention in Chicago last week. Chemistry bureau with headquarters in Paris established to collect and disseminate technical and scientific information. Colin G. Fink starts movement to establish research fund in honor of E. F. Roeber. Large number of exhibits for forthcoming Chemical Show.

Annual Safety Congress Will Open Oct. 2

As a part of the Twenty-second Annual Safety Congress and Exposition to be held at the Stevens Hotel in Chicago Oct. 2-6, the Chemical Section of the National Safety Council will hold two sessions, one in the afternoon of Oct. 2 and one on the morning of Oct. 4. John Roach, Deputy Commissioner of Labor of New Jersey, will act as chairman of the chemical sessions.

A total of 266 different industrial units in the chemical industry, employing an average of about 74,000 men, reported their 1932 accident experience to the National Safety Council. These plants, as compared with a like group for the previous year, showed a reduction of 14 per cent in frequency of disabling injuries; but these plants had the worst experience since 1926 in the severity of accidents. There was a drop for 1932 in permanent partial disabilities and temporary injuries but a sharp advance in fatalities.

The Chemical Section safety program will be introduced Oct. 2, with "Résumé of the Year's Activities" by general chairman John Roach. The question "Is the Chemical Industry Making Progress?" will be discussed by Ira V. Kepner, of the Pennsylvania Salt Mfg. Co. The topic "Inspection and Repair of Stainless Steel Equipment" will be discussed by Clayton E. Plummer, of the Robert W. Hunt Co. There will be a talk on "Safety in High Pressure Chemical Operations" by E. C. Curtis of the Mathieson Alkali Works.

At the second session, the subject "Application of Automatic and Remote Control to Chemical Operations from a Safety Standpoint" will be discussed by J. V. Alfriend of Westinghouse Electric and Mfg. Co. There will be a talk on "Safety's Ally—Improving the Human Feature by Teaching the Employee the Elements of His Job" by C. S. Ching, of the United States Rubber Co. There will be election of officers and a general round table discussion of "What Should the Chemical Section Study in the Future?"

Varied Program Arranged For T.A.P.P.I. Fall Meeting

Coinciding with the Diamond Jubilee of the pulp and paper industry of Wisconsin, the fall meeting of the Technical Association of the Pulp and Paper Industry has been scheduled for Appleton, Wis., Sept. 26-28. The program for the three-day session includes a total of 21 papers which will deal with various phases of pulp and paper production.

On Sept. 26, the subjects under discussion will include: "Alkaline Process for Obtaining High Yields of Pulp From Aspen Wood," by R. L. Davis; "Study of the Factors Influencing the Chlorination of Mitscherlich Sulphite Pulp," by E. H. Voigtman; "Contribution to the Knowledge of Rosin Sizing," by H. W. Bialkowsky; "Observations Relative to the Physical and Chemical Changes Taking Place in the Cooking of New White Rags," by E. R. Laughlin; "Critical Study of the Methods for the Determination of Alpha Cellulose," by H. F. Lewis and B. L. Browning.

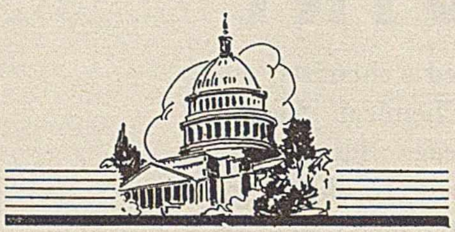
On Sept. 27 the topics and speakers will be: "Penetration of Western Hemlock Chips by Calcium Bisulphite Liquor," by C. E. Hurbesky and G. H. Chidester; "Chemistry of the Alkaline Wood Pulp Processes IV. Is There a Critical Temperature for the Sulphate Process?" by J. S. Martin, M. W. Bray and C. E. Curran; "Forest Products Laboratory Research on Paper Machine Variables," by W. A. Chilson and P. K. Baird; "Influence of Stock Temperature and Hydrogen Ion pH Concentration on the Sheet Properties of Kraft Paper Sized With a Special Starch Sizing," by W. A. Chilson, F. A. Simmonds and P. K. Baird; "Comparative Serviceability and Processing Effects of Oval, Cast Iron and Circular Rods in the Rod Mill," by C. E. Hurbesky, P. S. Billington and P. K. Baird; "Effect of Relative Humidity on the Moisture Content and Bursting Strength of Container Boards," by C. O. Seborg, R. H. Doughty and P. K. Baird; "Capillary Rise of Water in Fibrous Sheets and Possible Applications," by F. A. Simmonds; "Some Factors Affecting the Interweb Adherence of Single Plies Used in Laminated Sheets," by R. H. Doughty and P. K. Baird; "Properties of Groundwood Pulp I. Chemical Properties of the Screen Fractions of Black Gum and Slash Pine Groundwood Pulps II. Effect of Varying the Proportions of Fiber of Various Size Upon the Physical Properties of Groundwood Pulp," by E. R. Schafer and Matti Santoholma.

At the closing session on Sept. 28 the program includes: "Application of Statistical Methods to Testing of Pulp and Paper," by F. A. Simmonds and R. H. Doughty; "A Comparison of Sheet Machines for Pulp Evaluation," by R. H. Doughty and C. E. Curran; "Emulsified Paraffin Wax Sizes," by R. M. Cobb, Chamberlin and Dombrow; "Color Standards for Wood Pulp"—A Discussion led by John L. Parsons; "Report on Tests of Regular and Stabilized 18-8 Alloy Welds in Sulphite Liquor by TAPPI Materials of Construction Committee."—J. D. Miller, chairman; "Analysis of Alkaline Black Liquors of Varying Sulphidity by the Ammonia Distillation Method," by M. A. Heath, M. W. Bray and C. E. Curran; ending with a paper on the subject of "Vocational Education," by H. G. Noyes.

NEWS FROM WASHINGTON

By PAUL WOOTON

Washington Correspondent of Chem. & Met.



ONLY BY looking on the Tennessee Valley project as an attempt by a beneficent authority to establish a planned social economy can it be properly understood. Such an understanding may forever elude crass minds that are interested only in its physical aspects. Dr. A. E. Morgan's reference to Norris Dam as an "educational center" is beyond them. And for such folks there is very little yet that is tangible in the revelations made by the triad which constitutes the Tennessee Valley Authority.

The proving ground for long-range planning will inevitably become the scene of conflict with the old economic order that has merely grown. Skeptics chuckle when predicting that whatever may be accomplished in the Valley's 40,000 square miles will not turn out to be so very different from the economic hodge-podge characterizing the rest of the U. S. A. But to one industry at least, and to others later, perhaps, the TVA is a force with which they must come to terms or retire.

Back in the 'teens when Arthur E. Morgan tamed the flood waters of the obstreperous Miami River in Ohio there was much criticism of his very deliberate tactics. But the Miami Conservancy became a reality in a much shorter time than even the optimistic had anticipated. The Miami project was not impregnated with the social ideals that Dr. Morgan cherishes for the Tennessee Tract but his opponents don't give a hang about that.

And so the very deliberation of Dr. Morgan and his colleagues is a challenge. They may have something up their sleeves but it is probably under their hats. No policy could be defined with greater clarity than their pronouncement on power. That this was pretty plainly laid down for the TVA in the law does not detract from the lucid exposition of that policy in every phase of its application.

"The business of generating and distributing electric power is a public business. . . . "Private and public interests in the business of power are of a different kind and quality and should not be confused. . . . 'The interest of the public in the widest possible use of power is superior to any private interest. . . . "Where the private interest and this public interest conflict, the public interest must prevail. . . . "Where there is a conflict between public interest and private interest in power which can be reconciled without injury to the public interest, such reconciliation should be made."

There you have the constitution of economic independence so far as power is concerned. Then follow the by-laws: "The right of a community to own and operate its own electric plant is undeniable. This is one of the measures which the people may properly take to protect themselves against unreasonable rates. Such a course of action may take the form of acquiring the existing plant, or setting up a competing plant as circumstances may dictate.

Effect on Utilities

"The fact that action by the Authority may have an adverse economic effect upon a privately-owned utility, should be a matter for the serious consideration of the Board in framing and executing its power program. But it is not the determining factor. The most important considerations are the furthering of the public interest in making power available at the lowest rate consistent with sound financial policy, and the accomplishment of the social objectives which low cost power makes possible. The Authority cannot decline to take action solely upon the ground that to do so would injure a privately-owned utility.

To provide a workable and economic basis of operations, the Authority plans initially to serve certain definite regions and to develop its program in those areas before going outside.

The initial areas selected by the Authority may be roughly described as: (a) The region immediately proximate to the route of the transmission line soon to be constructed by the Authority between Muscle Shoals and the site of Norris Dam; (b) The region in proximity to Muscle Shoals, including northern Alabama and north-eastern Mississippi; (c) The region in the proximity of Norris Dam (the new source of power to be constructed by the Authority on the Clinch River in north-east Tennessee).

Extension of Area

At a later stage in the development it is contemplated to include, roughly, the drainage area of the Tennessee River in Kentucky, Alabama, Georgia and North Carolina, and that part of Tennessee which lies east of the west margin of the Tennessee drainage area.

To make the area a workable one and a fair measure of public ownership, it should include several cities of substantial size, (such as Chattanooga and Knoxville) and, ultimately, at least one, city of more than a quarter million, within transmission distance, such as Birmingham, Memphis, Atlanta, or Louisville.

While it is the Authority's present intention to develop its power program in the above-described territory before considering going outside, the Authority may go outside the area if there are substantial changes in general conditions, facts, or governmental policy, which would necessarily require a change in this policy of regional development, or if the privately-owned utilities in the area do not cooperate in the working out of the program.

Nothing in the procedure here adopted is to be construed in any sense a commitment against extending the Authority's power operations outside the area selected, if the above conditions or the public interest require. Where special considerations exist, justifying the Authority going outside this initial area, the Authority will receive and consider applications based on such special considerations. Among such special considerations would be unreasonably high rates for service, and a failure or absence of public regulation to protect the public interest.

Every effort will be made by the Authority to avoid the construction of duplicate physical facilities, or wasteful competitive practices. Accordingly, where existing lines of privately-owned utilities are required to accomplish the Authority's objectives, as outlined above, a genuine effort will be made to purchase such facilities from the private utilities on an equitable basis.

Accounting should show detail of costs, and permit of comparison of operations with privately-owned plants, to supply a "yard-stick" and an incentive to both private and public managers.

The accounts and records of the Authority as they pertain to power, will always be open to inspection by the public.

Delegation of Supervision

In other departments, TVA policy has not yet been defined but to each of the three members of the board has been assigned the responsibility for certain of the various plans to mold an 18th century civilization, as Chairman Morgan calls it, to a pattern of economic development.

To Chairman Morgan is delegated supervision of all matters concerning Norris Dam and reservoir and town at Cove Creek; land and regional planning, including subsistence homesteads (but not agriculture) and housing; educational and training programs, other than agriculture; engineering, including studies, plans and construction for the control and use of water and mineral resources (except Muscle Shoals dam and power house and electrical transmission and distribution) and matters concerning raw material for fertilizer; social and economic organization and planning; forestry, soil erosion and conservation methods (tentatively). Chairman Morgan will share with Dr. Harcourt A., (the other) Morgan, matters relating to industry and its association with cooperatives, besides adminstration of general functions and coordination of a unified program.

All affairs relating to agriculture are placed in charge of Dr. H. A. Morgan. This includes rural life planning and matters relating to localized industry and its relation to agriculture. In addition, Dr. H. A. will direct the design, construction and operation of smelters for phosphorous and for potash; a research program into the nature and behavior of fertilizers; the purchase, blending and sale of fertilizers; a chemical engineering department, and a program of research and development in the manufacture of fertilizers, cement and dry ice; maintenance and operation of Nitrate Plant No. 2 at Muscle Shoals; plans for a cement plant.

David E. Lilienthal heads the legal department and has charge of all land appraisal, purchase and condemnation; distribution of power, including relations with purchasers and prospective purchasers; all matters relating to the operation of the hydro-electric and steam-electric plants at Muscle Shoals; construction and operation of transmission lines, development of standardized accounting methods for power generation, transmission and distribution, and the supervision of power accounting for the Authority; proposals to exchange power for power sites, and transportation rate problems.

Chemical Engineering Development

The power issue has monopolized attention to date but appointment of Dr. Harry A. Curtis, former Yale professor of chemical engineering as chief chemical engineer for TVA, presages definite developments in that direction in the near future. Nitrate Plant No. 2, the wartime white elephant, may possibly be utilized for producing fertilizer. Certainly fertilizer is going to be made somewhere. The law virtually requires this on a scale to determine commercial cost, and if possible to cheapen fertilizer for the farmer. But there are 3 questions which the TVA must decide before it commences operations:

(1) To make ammonia at Muscle Shoals or buy it? The decision will probably hinge on the bookkeeping system adopted by TVA. On one cost-accounting theory ammonia can be made locally for about 3c. a pound. The commercial delivered cost would be about 4½c. Customary industrial bookkeeping methods (which, incidentally, are to be followed in power matters) would not show such a wide margin.

(2) Recovery of potash from Valley minerals has been proposed. This might be combined with phosphoric acid production but would more likely to lead to rock treatment, with cement raw-material as a byproduct. But to make all the potash required for fertilizer equivalent to Muscle Shoals capacity would necessitate production of more than 5,000,000 barrels of cement a year. Despite recent statements from TVA that refer vaguely to plans for a cement plant; nothing along this line now appears imminent. These did, however, start the rumor that the Authority, will make its own cement for Cove Creek dam, but this would require only 500,000 to 1,000,000 barrels.

(3) Furnace methods of phosphoric acid and phosphate fertilizer manufacture will unquestionably be tried out on a substantial commercial scale. Enthusiastic advocates urge making enough to correspond to the capacity output of Nitrate Plant No. 2. That would supply 10% to 15% of domestic requirements and the fertilizer industry naturally is galled by this idea. In prospect is a much smaller plant, perhaps 5,000 to 10,000 tons per year of phosphoric acid. Several commercial groups would like to be partners in phosphate developments but TVA will probably go it alone. It has the power to utilize anybody's patents, with action for damages in the appropriate district court the sole remedy for the patent owner.

Newsprint may be the first objective in the development of forest products. This would put to work a substantial percentage of the Valley's population on reforestation without competing with any other domestic industry and would tie in with the desire to eliminate submarginal farm land and eventually give employment in the neighborhood type of industries.

All told, existing industries need not fear competition from TVA unless they are moss-backed. New industrial enterprises will be encouraged as a means of establishing an inter-dependent balance between agriculture and industry. By raising purchasing power, such projects will tend to keep the people of the Valley happy at home and so reduce the surplus of labor in the cities. There is no limit on the development program. The TVA has $50,000,000 at its command and is authorized to issue 3½ per cent bonds for another $50,000,000 when needed.

The TVA steadfastly refuses to be regarded as a unit of the administration's emergency program. Dr. Morgan asserts that the Government has put up $5,000,000,000 in one form or another to overcome the depression. The TVA's $50,000,000 stake is only 1 per cent. This will be used to relieve unemployment locally so far as consistent with its long-range purpose. TVA has acknowledged the existence of a plagued outside world to the extent of announcing that it will contract only with firms which subscribe to NRA codes.

Hearing on Fertilizer Code

Hearings on the code of fair practice for the fertilizer industry, presided over by Deputy Administrator C. C. Williams, opened on Sept. 6. The code was presented by John T. Watson, president, International Agricultural Corporation, after an introductory statement by Charles J. Brand, secretary and treasurer of the National Fertilizer Association. The code presented represents approximately 80 per cent of the industry.

The main provisions of the code establish a 40-hour work week except for foremen, superintendents, managers, salesmen and officials. It provides also that during the rush of the planting season employees may exceed this maximum up to 60 hours a week, but shall not exceed an average of 40 hours over any 4-month period. Minimum rates of pay are fixed in the code at 35 cents an hour in the Northern area, 25 cents in the Southern area, 35 cents in the Midwest, 40 cents on the Pacific Coast and 20 cents in Puerto Rico.

The right of collective bargaining is recognized and child labor is eliminated.

Sulphuric Acid

One of the moot points before the hearing was the question of whether makers of sulphuric acid should come in under the terms of the fertilizer code or under the chemical code.

On this question General Williams said: "Sulphuric acid is one of the great basic commodities in many industries. This code has provisions covering sulphuric acid, so has the zinc code and others. That means this commodity will be under several codes. I do not believe this to be a reasonable way to handle it. It is impracticable to include manufacturers of sulphuric acid under the operations of several codes and I believe, therefore, that it should come under the chemical code."

Fred H. Oliver, secretary and treasurer of the National Potash Producers Association, expressed the belief that the potash industry should present its own code, to be considered as a subdivision of the chemical code.

N. Y. Chemical Engineers Picnic at Westport

FIFTY OR MORE members of the recently formed New York Section of the American Institute of Chemical Engineers held their first summer outing at Westport on Tuesday, Aug. 29. Many brought their wives and traveling by train and motor arrived at the historic Connecticut village early in the forenoon. During the morning a round of golf was played at the Long Shore Country Club with high honors going to John M. Weiss, S. L. Tyler, C. R. DeLong, and Ralph Shafor.

An out-of-door buffet luncheon followed at the old Westport mill as the guests of J. V. N. Dorr, president of the Institute as well as of the Dorr Co. Later Mr. Dorr spoke informally on the history of the Westport mill and the motives which had impelled him 15 years ago to acquire it as an ideal location for a research and testing laboratory—in the country, close enough to the city to be convenient yet far enough away to give a research worker the proper inspiration and mental attitude for creative work. Then George Darby, research manager, spoke briefly on the type of work for which the Westport mill was equipped and assisted by Dr. Roberts and others the visitors were conducted through the laboratory.

Water sports, such as swimming and canoeing in the mill pond and stream, featured the amusements of the afternoon. A few of the more adventurous engaged in canoe-tilting with honors rather equally divided between Lincoln T. Work and Judson A. DeCew. A widely publicized encounter between Walter S. Landis, Cyanamid vice-president, and H. O. Chute, Chemists' Club chair-warmer, failed to materialize.

Through the courtesy of Mrs. Bedford, wife of the late E. T. Bedford, executive officer of Standard Oil Co. of New Jersey and the Corn Products Refining Co., the beautiful gardens of this estate were thrown open to the ladies, who visited them in the afternoon. These gardens are said to be one of the show places of southern Connecticut.

P. E. Landolt of the Allied Process Co., New York, is chairman of the local section, and George A. Prochazka, is secretary. Anthony Anable of the Dorr Co. was chairman of the Committee on Arrangements.

Large Deposit of Potash Uncovered in Chile

DISCOVERY near Antofagasta, Chile, of what are claimed to be inexhaustive deposits of potassium chloride, has been reported to the Department of Commerce.

The deposit is said to cover practically the entire salar (dry Salr lake) de Atacama, and an area measuring 25 by 75 kilometers has been staked out by interested parties, which comprises less than one-third the area of the lake.

The economic marketing of potash from the desert region of the new discovery, which now lacks transportation facilities, will necessitate construction of a railroad of 100 kilometers, it was reported, but no information is available as to whether such a line is now planned.

McFadden Made Manager Of Paint Association

THE joint committee comprising members selected by the National Paint, Oil, and Varnish Association and the American Paint and Varnish Manufacturers' Association has selected Thomas J. McFadden as general manager of the two associations and of the educational bureau conducted jointly by them. The position of general manager was made vacant by the death of George V. Horgan last May.

Mr. McFadden has been connected with the activities of the paint associations for several years. Since the death of Mr. Horgan, he has acted as acting general manager. Previously he had been manager of the Unfair Competition Bureau of these associations and also had charge of legal and practical association matters.

Instructive Exhibits for Chemical Show

ANNOUNCEMENT from the management of the Fourteenth Exposition of Chemical Industries, which is scheduled for the first week of December at Grand Central Palace, New York, states that already the number of exhibitors who have taken space is better than for previous expositions.

The previous exposition held in 1931 had as exhibitors, 358 of the nation's leading companies and organizations. The audience of 100,000 arrived from 789 cities and towns in 45 of the United States, and from 100 cities and towns in 38 foreign countries. Exhibits this year will be built to be interesting. Not only will they represent their firm, not merely will they be instructive.

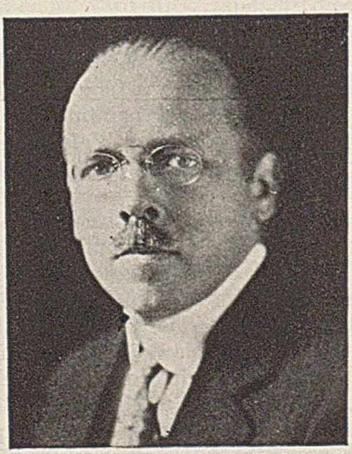
This is part of the new psychology of exhibit presentation. Arrangement of size, sequence, and relationship of the component parts of each exhibit, the use of animation, and the tendency to show not only the material and the apparatus, but to make the visitor understand just how it is used, is part of the trend from static to dynamic exhibit style.

Back of the new trend is a growing realization of the value of visual education brought to a high point of expression through the Century of Progress and its Hall of Science. Great has been the wave of popular acclaim greeting the scientific and commercial exhibits at Chicago.

Research Fund Established in Honor of E. F. Roeber

IN accepting the 1933 imprint of the Edward Goodrich Acheson medal for distinguished services in electrochemistry, Dr. Colin G. Fink announced that the prize of $1,000 which accompanies the award is to form the nucleus of a fund established in the honor of the late Dr. E. F. Roeber, a founder and former president of the Electrochemical Society. In September, 1902, with the late Prof. Joseph W. Richards and others he helped to establish *Electrochemical Industry,* the predecessor of *Chem. & Met.* and he continued as its editor until his untimely death Oct. 17, 1917. Dr. Fink declared that it was Dr. Roeber's inspiration that was largely responsible for many outstanding accomplishments in American electrochemistry.

Eugene Franz Roeber
1867-1917



Colin Garfield Fink

International Chemistry Bureau Established

AN international office of chemistry, with headquarters in Paris, was recently formed for the purpose of gathering, classifying, and disseminating information in the field of technical and scientific chemistry. The conference held to determine the policy of the new organization consisted of the following members: F. Donker Duyvis, member of the Council of Patents, The Hague; P. Dutoit, professor at the University of Lausanne; F. Haber, director of the Kaiser Wilhelm Institute, Berlin; E. Hauser, member of the Academy of Sciences, Madrid; Ch. Marie, secretary of the Comite International des Tables Annuelles de Constantes, Paris; N. Parravano, president of the Comitato Nazionale di Chimica, Rome; G. Peny, president of the Federation of Chemical Industries of Belgium, Brussels; J. C. Philip, professor at the Imperial College of Science and Technology, London. The official name and address of the institution is Office International de Chimie, 49, Rue des Mathurins, Paris 8e.

Colgate-Palmolive-Peet Sued Over Patents

SUIT was filed in the U. S. District Court at Wilmington, Del., on Sept. 6 by Eastern Manufacturers, Inc., of Jersey City, N. J., requesting the court to compel Colgate-Palmolive-Peet Co. to assign to the petitioner letters patent Nos. 515412 and 918603. The bill of complaint alleges that in 1928 Zieley Processes Corp. turned over to Colgate & Co. its secret process for production of fatty acids from paraffin for the manufacture of soap; that within a year a new corporation, the Eastern Manufacturers, Inc., was formed to exploit the process and that Colgate & Co. and Zieley each received half the capital stock of the new corporation. Later Colgate & Co. assigned its interest in the new company to the defendant.

Record Attendance at A.C.S. Chicago Meeting

THIRTY-THREE hundred chemists, over a thousand more than ever attended an American Chemical Society convention in the long history of the society, gathered in Chicago the week of September 11. The occasion was the annual fall meeting. The program included many interesting features such as the presentation of the Willard Gibbs Medal to Richard Willstatter and the American Chemical Society's Award in Pure Chemistry to F. H. Spedding, and the reception by A Century of Progress in honor of the foreign guests, Doctors Willstatter, Karrer, Barger, and Bronsted.

At the Council meeting it was decided to reduce the society dues to nine dollars a year which will include the weekly news letter. Subscription to *Chemical Abstracts* will cost six dollars additional and a rate of three dollars each will be made to subscribers to *Industrial and Engineering Chemistry* and to the *Journal of the American Chemical Society*. A combination offer of twenty dollars includes dues and subscriptions to all the publications of the society.

A symposium of particular interest to chemical engineers was that on industrial and engineering chemistry. The oxidation of pyritic sulphur in bituminous coal was discussed by Prof. D. B. Keyes and associates at the University of Illinois. Some observations upon the effect of continued heating in asphalts were given by Calvin H. Corey and Alfred W. Sikes. E. W. Reid in a very interesting manner discussed the solvent industry which has been making such great progress in recent years. New detergents was the subject of a paper by R. A. Duncan. Modern developments in applied cellulose chemistry, synthetic rubber, physical properties of DuPrene compounds and modern developments in synthetic resins were among the other subjects that attracted wide attention.

The general program of the convention featured four prominent scientists. Charles R. Downs addressed the group on the production of maleic acid and phthalic anhydride. F. C. Frary used as his subject, research on metals and alloys. C. E. K. Mees of the Eastman Kodak Company discussed modern photography and used as his subject photographing the rainbow and W. F. G. Swann, director of the Bartol Research Foundation of the Franklin Institute, presented the current viewpoints of cosmic rays.

CALENDAR

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, fall meeting, Roanoke, Va., Dec. 6-8.

TECHNICAL ASSOCIATION OF THE PULP AND PAPER INDUSTRY, fall meeting, Appleton, Wis., Sept. 26-28.

NATIONAL METAL CONGRESS AND EXPOSITION, Detroit, Mich., Oct. 2-6, 1933.

AMERICAN PETROLEUM INSTITUTE, Chicago, Ill., Oct. 24-26.

FEDERATION OF PAINT & VARNISH PRODUCTION CLUBS, convention and paint show, Chicago, Ill., Oct. 26-28.

FOURTEENTH EXPOSITION OF CHEMICAL INDUSTRIES, New York, week of Dec. 4-9, 1933.

Ammonium Sulphate Plant Planned in Norway

ACCORDING to a report from vice-consul George M. Abbott at Oslo, the Norsk Hydro-Elektrisk Kvaelstofaktieselskab, the most important manufacturer of nitrates in Norway, has announced that it will construct an addition to its plant at Heren for the manufacture of ammonium sulphate, a product which this company has not previously made. The plant is expected to be complete in about one year and according to newspaper reports will cost several million kroner. Norwegian consumption of ammonium sulphate is negligible, and the product of the new plant will be sold abroad.

The Norsk Hydro has refused for the present to give any information regarding the size or capacity of the new plant. The company's new plant for the production of soda ash is practically complete and will be opened during the fall. The capacity will be 18,000 tons per year.

Italian Export Trade in Chemicals Increases

ITALIAN foreign trade in chemicals and allied products during the first four months of 1933 surpassed the figure for the corresponding period of 1932. Exports were valued at $7,000,000 and imports at $7,500,000 for the first four months of the current year. Of interest in the outgoing trade was the marked increase in shipments of crude-sulphur, bergamot and lemon oils, copper sulphate, and ammonium sulphate. Although the quantities exported of citric acid, tartaric acid, citrate of lime, and crude tartrates, all commodities in which Italy formerly was the chief world producer held up and in some cases exceeded preceding years' figures, the values were only about half as much.

Salt Cake Drying Process Developed in Canada

A REPORT to the Department of Commerce states that Metallics and Non-Metallics Limited has obtained, during the past year, a Dominion charter and purchased the Ingebright sodium sulphate deposit north of Maple Creek. This company is backed by Toronto interests who own patents on a new process for drying sodium sulphate for which they have great hopes. They are at present erecting an experimental full-sized unit, at Hull, Quebec, and hope within the next two or three weeks to make a trial run of 100 tons of salt which they have had shipped from White Shore Lake, near Oban, Saskatchewan.

New Plant Construction in Process Industries on Upward Trend

RECENT announcements of plans for the establishment of new plants for the manufacture of chemicals and related products and of plans for expansion in numerous existing plants direct attention to the rising trend in new construction activities within the process industries. An extensive building program, started by those industries in 1929, was carried to completion despite the depression, largely because the companies involved were not forced to seek outside financial help but were able to meet all expenditures from surplus.

According to compilations made by *McGraw-Hill Construction News Service* the total value of contracts awarded for new plant construction in the process industries from 1928 through July, 1933, was as follows:

NEW CONSTRUCTION IN PROCESS INDUSTRIES

Year	Value of Contracts Awarded
1928	$82,231,000
1929	125,328,000
1930	52,741,000
1931	20,869,000
1932	21,747,000
1933 (to Aug. 1)	22,878,000

The strong position of the chemical industry during a period of money stringency is exemplified by capital investments in such large projects as the Hopewell works of Allied Chemical & Dye costing perhaps $60,000,000; the Trail, B. C., plant of Consolidated Smelting & Refining with an outlay of upwards of $10,000,000; American Potash & Chemical development at Searles Lake amounting to $10,000,000. In addition many million dollars of expenditure are represented by plant expansions made by Westvaco, Tennessee Eastman, Shell Chemical, duPont Ammonia, and Union Carbide. A whole string of new rayon plants also was built between 1927 and 1930.

Within the past few weeks there is an accumulation of evidence to indicate that we have reached a turning point. There have been more new plant projects announced than at any time during the past three years.

It may be of interest to consider the history and status of a few of these projects:

Southern Alkali Corporation

Work is now being pushed to complete new plant at Corpus Christi, Texas, for the Southern Alkali Corp., a joint project of American Cyanamid Co. and Pittsburgh Plate Glass Co. The plant will manufacture alkalis and total expenditure will approximate $7,000,000. Planned to be in operation in 1934.

A tract of 300 acres on the harbor of Corpus Christi was acquired over two years ago for the location of the plant. Within six miles of the plant 6,000 acres of natural gas rights were secured. Sixty miles distant, 240 acres located on the Palangana Salt Dome, were purchased. Water will be pumped into the salt wells and the saturated salt brine solution will flow by gravity, through a 14-in. cast-iron pipe line, constructed on the company's right-of-way, from the wells to the plant. A dredged canal from the harbor in Corpus Christi will enable ocean-going vessels to dock longside the plant. Railroad facilities are provided by the Missouri Pacific, the Southern Pacific and the Tex-Mex.

The officers of the Southern Alkali Corporation are: president, Hugh A. Galt, director, Pittsburgh Plate Glass; vice-presidents, William B. Bell, president, American Cyanamid; Clarence M. Brown, chairman, Pittsburgh Plate Glass; Harry L. Derby, vice-president, American Cyanamid; H. S. Wherrett, president, Pittsburgh Plate Glass; secretary J. H. Heroy, director, Pittsburgh Plate Glass; treasurer F. W. Currier, treasurer, Pittsburgh Plate Glass.

Freeport Sulphur Co.

New plant for Freeport Sulphur Co. now under construction at Lake Grande Ecaille, La., following explorations and plans completed in 1931. Calls for expenditures of $3,000,000 to $5,000,000. This is one of the few projects for which outside financing has been asked. Early this year a new issue of 2,500,000 of 6 per cent cumulative convertible preferred stock was over-subscribed in the New York market. The equipment includes a large power and process steam installation, water treatment system, pumps, pipelines, materials handling equipment, etc. It is to be completed during the present year.

Monsanto Chemical Co.

A new alcohol plant will be erected at Everett, Mass., on land adjoining the Merrimac Chemical Co., a Monsanto subsidiary. Contracts have been let for the construction of the first unit, which will cost about $600,000.

This expansion includes the formation of a new Monsanto subsidiary, the New England Alcohol Co., in which Monsanto takes a majority stock interest. A minority stock interest has been taken by the Central Aguirre Sugar Co. of Boston. Arrangements have been made with this company to supply molasses, from its sugar properties in Porto Rico. No new financing is involved.

The plant is expected to be completed and in operation by the end of this year with an annual capacity of 3,000,000 gal. of alcohol.

Ethyl-Dow Chemical Co.

The first plant to be constructed on short for the recovery of bromine from the sea is now being built at Kure Beach about 20 miles south of Wilmington, N. C. The plant will be operated by the Ethyl-Dow Chemical Co., a new concern formed by the Ethyl Gasoline Corp. and the Dow Chemical Co. Result of research carried on since 1925, first by duPont and then by Dow Chemical engineers. Will call for expenditure of about $3,000,000—about one-half of which will be used immediately for plant construction at Wilmington, N. C. This will include pumping equipment, pipelines, chlorinating apparatus and a heavy investment in corrosion-resistant alloys and similar materials of construction.

American Potash & Chemical Corp.

Announcement was made late in August that the American Potash & Chemical Corp. would erect a plant at Trona, Calif., for production of soda ash and salt cake at a cost of $1,250,000. The plant will have a daily capacity of 100 tons of soda ash and 125 tons of salt cake. This project was part of an expansion program planned some years ago but was held up because of general business conditions in the last two years. The Dwight P. Robinson Co. of Los Angeles, which is the same company that has had charge of construction work at Trona over the past five or six years amounting to $20,000,000, is to carry on the new expansion.

Rayon Plant Expansion

Reference has already been made to the way rayon contributed so conspicuously to the boom in process plant construction at the beginning of the depression. In our August issue, page 421, we show a tabulation of plans that call for a 10 per cent increase in new plant capacity in the rayon industry—from 233,400,000 lb. as of July 1, 1933, to 259,500,000 lb. by the end of 1934. This will call for an expenditure of at least $25,000,000 and perhaps as much as $35,000,000. One of the largest projects is that of Tubize-Chatillon Corp. which will install 3,000,000 lb. of viscose by December, 1933, and 6,000,000 lb. in 1934. The first contract was awarded Aug. 11 to Fiske-Carter Corp. of Rome, Ga., for 400,000 lb. The Viscose Co. will add 2,000,000 lb. to capacity of its acetate plant at Meadville, Pa., and 8,000,000 lb. to the viscose plant at Parkersburg, W. Va. The American Bemberg and Glanzstoff companies of Elizabethton, Tenn., will start this month to add 4,800,000 lb. of which 2,100,000 lb. will be cuprammonium and the balance viscose rayon.

NAMES IN THE NEWS

ROBERT L. MOORE, formerly chief chemist of the Thermatomic Carbon Co., Pittsburgh, has recently become associated with the Marshall Asbestos Corp., Troy, N. Y., as technical director.

ERNEST B. MILLER, former operating vice-president of Davison Chemical Co. and Silica Gel Corp. has established a consulting service, specializing in sulphuric acid, fertilizer and silica gel processes. His office is in Baltimore, Md.

R. T. CONGER heads the engineering firm of Conger & Co. of Osaka, Japan.

T. A. BRYSON, who is one of the leading design engineers of centrifugal separators for the process industries, has been retained as consulting engineer by the American Tool & Machine Co. of Boston.

J. H. SAVILLE, vice-president of the Pyrites Co. of Wilmington, Del., is spending several months at the Rio Tinto Mines in Spain. He expects to visit England and Germany before returning to the United States.

PAUL M. GIESY, formerly director of research for E. R. Squibb & Co., Brooklyn, N. Y., is in charge of the department of English at the Newark College of Engineering, Newark, N. J.

M. S. EVANS, formerly engineer of tests, Department of Public Works, Allegheny County, Pa., is now testing engineer for the Pittsburgh Testing Laboratories, St. Louis, Mo.

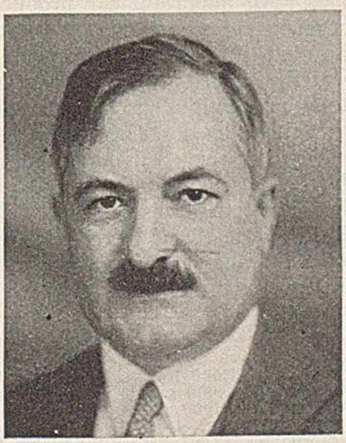
WM. H. WHITCOMB who was with Henry L. Scott Co., of Providence, R. I., for several years, is now director of laboratories, Interlaken Mills, West Warwick, R. I.

E. T. WOODS, plant engineer of the National Oil Products Co., Harrison, N. J., has been appointed works manager of that company. He will have charge of the production and maintenance departments and the laboratories, and will retain his position of plant engineer.

GEORGE BARSKY has resigned from the American Cyanamid Co. and will engage in general chemical consulting work with an office in New York City. Since 1926 he has been director of the experimental laboratory at Linden, N. J., and has also served as acting chief technologist of the company.

EUGENE W. LIEBEN is now assistant supervisor of the acid division of the Monsanto Chemical Co. at its Monsanto, Ill., plant. Mr. Lieben was formerly employed by the General Chemical Co. at its Laurel Hill, L. I., development laboratories.

DR. HARRY A. CURTIS resigned his position as chief of the research and development laboratories of the Socony-Vacuum Corp. on Sept. 1 and has accepted appointment as chief chemical engineer for the Tennessee Valley Authority.



Dr. Harry A. Curtis

BERNARD R. FREUDENTHAL, formerly consulting chemical engineer in the leather industries, in Boston, has joined the U. S. Antiseptic Laboratory, Inc., Baltimore, in charge of manufacturing operations. He has been elected treasurer of the company.

ROBERT C. KENNEDY of Boston, Mass., has joined the Mathieson Alkali Works, Saltville, Va., in the capacity of assistant chemical engineer. He received his degree of B.S. from the University of Florida and an M.S. from Massachusetts Institute of Technology.

JAMES W. OWENS has been appointed consulting engineer and director of the new welding division, National Weld Testing Bureau, of the Pittsburgh Testing Laboratory, Pittsburgh, Pa.

DR. E. B. AUERBACH, formerly president of the Berlin Chemical Society and active in the German compressed gas industry, has accepted a position with the Keith Dunham Co. of Chicago.

RONALD V. TAILBY, ceramic engineer, has joined the technical staff of B. F. Drakenfeld & Co., Inc., at Washington, Pa.

F. W. PICKARD, vice-president of E. I. du Pont de Nemours & Co., Wilmington, left August 19 aboard the steamship Ile de France for a business trip in Europe. He was accompanied by L. A. Yerkes, president of the Du Pont Rayon Co. and the Du Pont Cellophane Co.

C. DUNNING FRENCH, former general manager of William Waterall & Co., Philadelphia paint manufacturers, has organized the firm French, Williams and Grundy, Inc. This company will manufacture white paint materials.

OBITUARY

EVANS MCCARTY, retired vice-president of the National Lead Co., died on Sept. 2 at his home in Pelham Manor, N. Y. He was vice-president and director of several other firms, Titan Co., Inc., Titanium Pigment Co., United States Cartridge Co., and the William Harvey Corp., of which he also was general manager. He was a director of the Baker Castor Oil Co., Magnus Co., Inc., and the Metallurgical and Chemical Co. He was president of the National Pigments and Chemical Co.

C. W. RANTOUL, who for many years was prominent in the pulp and paper industry, died in London, England, on Aug. 28. In 1900 Mr. Rantoul was elected secretary and treasurer of the American Paper and Pulp Association.

E. F. DANIEL, JR., manager of the Baltimore office of the American Agricultural Chemical Co. died at Union Memorial Hospital on May 16. He was 66 years of age.

Mr. Daniel's entire business life had been devoted to the fertilizer industry. He started with the Virginia-Carolina Chemical Co., and for several years has served as a director and a vice-president of the American Agricultural Chemical Co.

WILLIAM HYND, vice-president and general manager of A. C. Hynd & Co., producers of pharmaceuticals and other chemicals, Buffalo, N. Y., died August 9 at his home in that city, following a short illness.

CHEMICAL ECONOMICS

Rates of productive activities at chemical plants showed considerable variation last month. Some branches of the industry failed to maintain the levels reached in the preceding month but decided gains were reported in other directions and the industry as a whole was slightly more active than it was in July.

WHILE reports of some curtailment in consuming demand were current in the market during the last month, total production appears to have been slightly above that reported for the preceding month. Decided gains were reported in the outputs of some producers which were largely counterbalanced by reduced operations on the part of other manufacturers. In some cases heavy withdrawals of stocks from producing points had restricted available supplies and made it necessary to hold up production in order to secure normal accumulations. In the second place a review of conditions in some of the consuming industries reveals that they cut down their raw material but little, if any, in August.

From data covering the use of electrical power, the index number for chemical production in August settles at 131.2 in comparison with 130.4 for July.

Data for activities in some of the most important consuming industries are available for July and show that with scarcely an exception, that consumption of chemicals in that month was considerably in excess of the total for July of last year. The comparative figures are given in the accompanying table. The showing for this year was especially favorable in the glass, automotive, artificial leather, paint, varnish, and lacquer, byproduct coke, and fertilizer trades.

Automobile production by members of the National Automobile Chamber of Commerce in August was 171,145 cars and trucks compared with 177,080 in July and 54,666 in August, 1932, according to a preliminary estimate by the Chamber. All important car producers with the exception of one and latter company had its largest production for this year in August so that it is evident that total production has maintained a relatively high level. The outlook for September is regarded as favorable with buying possibly speeded up the belief that later on prices will be higher and also because the industry code will cut down the allowance on cars turned over in trade for new cars.

	July, 1933	July, 1932
Acetate of lime, 1,000 lb...	3,096	816
Methanol, crude, 1,000 gal..	211	111
Methanol, refined, 1,000 gal.	153	84
Methanol, synthetic, 1,000 gal.	562	794
Automobiles, No............	233,088	109,143
Byproduct coke, 1,000 tons.	2,797	1,523
Glass containers, 1,000 gr.	2,322	1,677
Plate glass, 1,000 sq.ft.....	11,828	2,849
Cottonseed oil, crude, 1,000 lb.	51,745	29,281
Cottonseed oil, refined, 1,000 lb.	57,450	47,775
Pyroxylin spread, 1,000 lb..	4,348	1,474
Rubber reclaimed, ton.....	11,326	5,146
Rosin, wood, bbl.........	42,103	30,076
Turpentine, wood, bbl.	6,747	4,878
Sulphuric acid produced in fertilizer trade, ton.....	98,499	45,393
Sulphuric acid consumed in fertilizers, ton...........	71,372	32,590
Cotton consumed, 1,000 bales	600	279
Paint, varnish and lacquer, sales, $1,000............	22,090	14,430

Most recent reports from the glass trade state that production has been holding up well with some branches preparing for expansion in the near future although some seasonable decline may be expected in production of containers.

Running counter to influences which sought to hold down production of mineral oil, the Bureau of Mines reports a total output for July of 84,387,000 bbl. which represented an increase of 1,500,000 bbl. over the preceding month and a gain of 18,000,000 bbl. over July, 1932. Runs to stills in July amounted to 79,525,000 bbl. compared with 74,619,000 bbl. in June. With production allotments going into effect under the new code, refining operations will continue on a reduced scale with a probable proportionate decline in consumption of chemicals by the refining industry.

Production of pneumatic tires fell off somewhat during July, the total being 4,571 thousands compared with 4,880 thousands for the preceding month but production in July last year was only 2,893 thousands.

Consumption of silk in August is reported at 42,852 bales compared with 44,597 bales in July and with 59,905 bales in August last year.

For the first time the Textile Organon, published by the Tubize Chatillon Corp., is in a position to present a monthly index of rayon poundage deliveries from 1923 to date. This compilation, which will be presented monthly, has been made possible through the co-operation of producers representing the American rayon industry.

The daily average index for August (based upon 1923-25 as 100) was 423, which compared with 470 for July, 450 for June, 517 for May and with 406 for August, 1932. While these figures give the impression of a sharp drop having occurred since May, such does not appear to be the fact, it is pointed out, as the high May average was due in part to heavy withdrawals from surplus stock.

The index as calculated below is based upon actual figures received from manufacturers representing 98 per cent of the industry in the United States, inflated to 100 per cent, plus the foreign trade balance:

TEXTILE ORGANON INDICES OF RAYON DELIVERIES—UNADJUSTED INDEX

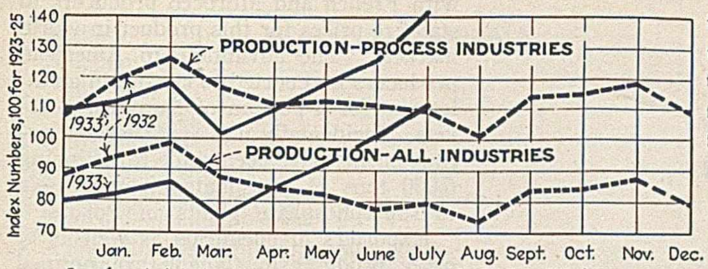
(Daily average 1923-25 = 100)

	August	July	June	May	Yearly Average
1933.....	423	470	450	517	*387
1932.....	406	213	137	148	293
1931.....	349	312	288	352	317
1930.....	219	179	225	237	244
1929.....	281	240	254	254	277
1928.....	197	169	178	175	214
1927.....	195	190	194	231	214
1926.....	138	118	71	98	131
1925.....	128	124	121	125	132
1924.....	86	71	77	73	93
1923.....	50	70	68	73	75

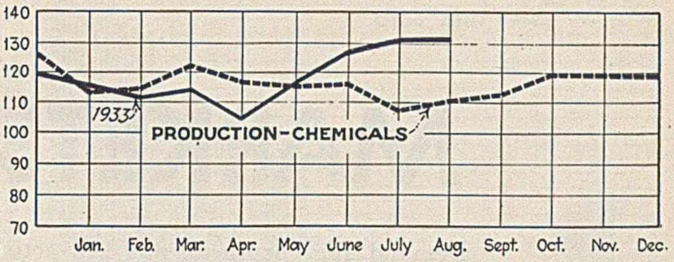
*Daily average for 1933 to date.

Index numbers used on the graph on the following page are as follows:

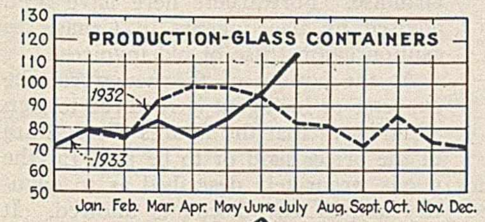
	July
Chemicals	130.4
Glass containers	112.9
Cotton consumed	132.1
Byproduct coke	103.4
Paint, varnish, and lacquer	95.2
Rubber reclaimed	110.3
Plate glass	163.3
Sulphuric acid	63.7
Pneumatic tires	140.7
Petroleum refining	106.7

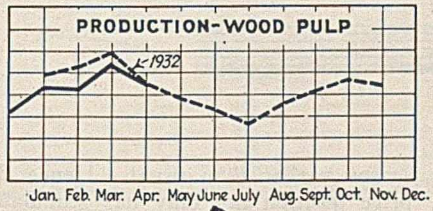


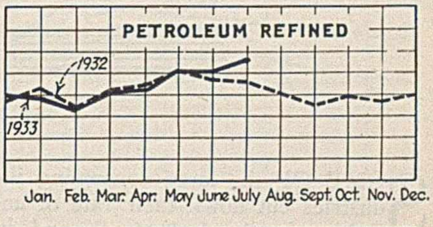
Based on electrical power consumption, data supplied by Electrical World

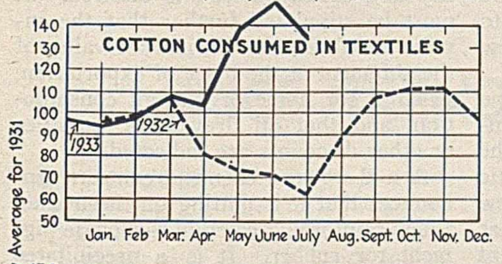


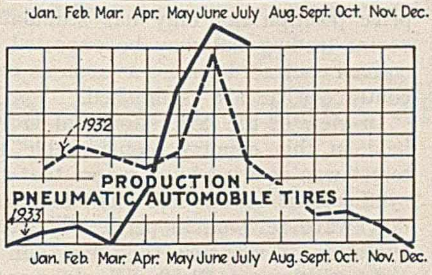
TRENDS OF PRODUCTION AND CONSUMPTION

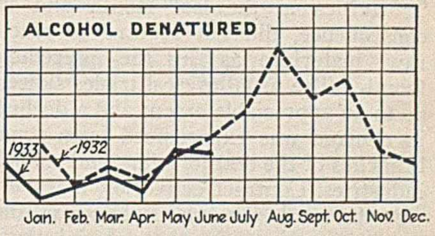


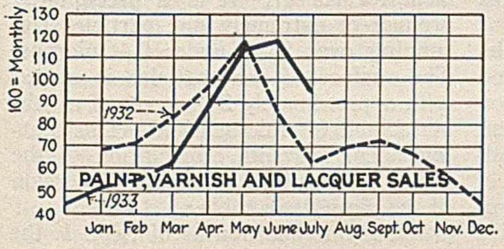


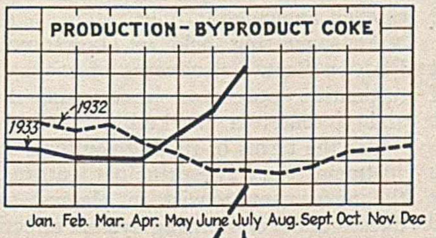


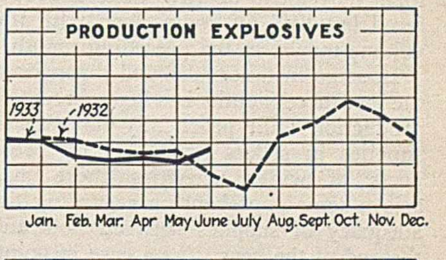


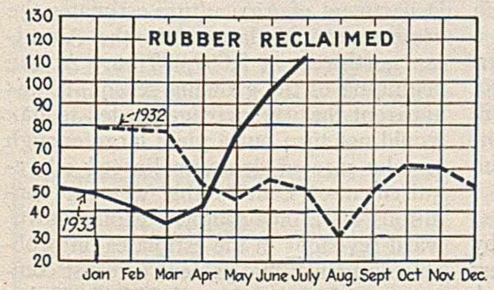


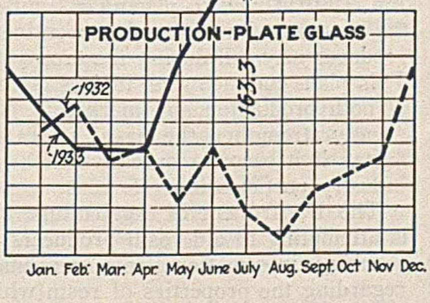


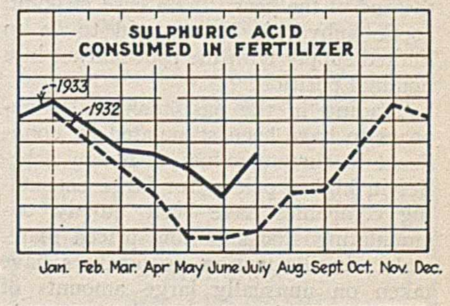


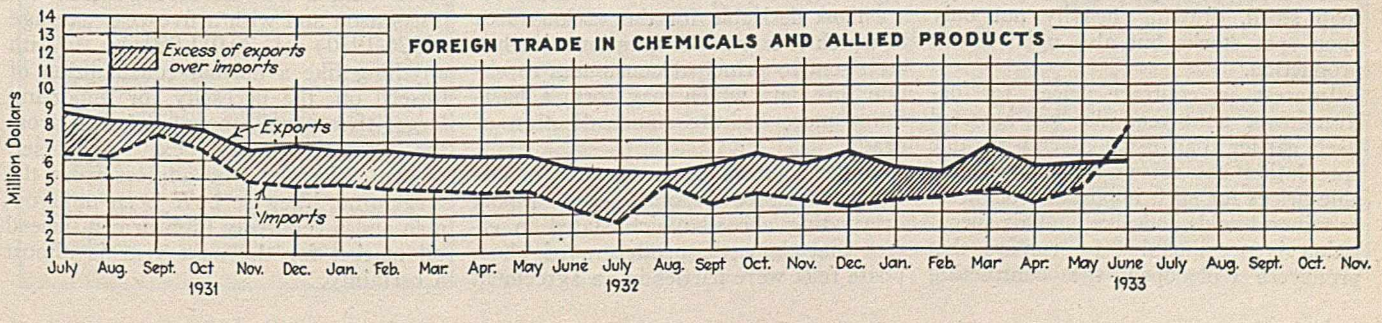












MARKETS

Demand for chemicals was less active during the month in some quarters but the total movement fell but little below the volume reported for the preceding month. In some cases consumption has kept up production and reserve stocks are small. Probability of higher prices caused quiet accumulation of low priced supplies.

SOME OF the large consuming industries cut down their rate of activities in the last month and in consequence, did not require so much raw materials as in the preceding month. The metallurgical trades slowed up to an appreciable extent and a decline in demand was experienced from some branches of the textile, paint, and rubber industries. Contract deliveries, however, went forward in regular volume and the total movement of raw materials suffered but little in comparison with the volume moved in the preceding month.

In some instances demand throughout the last three months has kept abreast of production with practically no reserve supplies in sellers hands. With prospects of wider activities there has arisen some apprehension regarding the adequacy of supplies between now and the end of the year. As a case in point, acetic anhydride is reported to be in limited supply with the spot market in a nominal position.

Trading in the past month also appears to have been stimulated by confidence in current values, if not by a belief in higher prices, for large consuming companies have been quietly accumulating stocks of low priced materials. In illustration, soapmakers have taken on unusually large amounts of soap stock, drawing heavily not only upon spot stocks but also upon future production.

Interest in contract prices for delivery over next year also has asserted itself earlier than usual as considerable speculation has arisen regarding probable prices for such important chemicals as mineral acids and alkalis. This speculation is accompanied by rumors that producers will open the contracting season earlier than usual. Hence the price position not only has stimulated recent trading but may be expected to enliven contract business as soon as new contract prices are established.

In view of the large stocks of iodine held in this country, considerable interest was aroused by a report that the syndicate in Europe had made a drastic downward revision in price. The new quotation is reported to figure out at only a little over $1.50 a lb. at current rates of exchange.

At a meeting held in Jacksonville, Fla., on Sept. 8 producers of rosin and turpentine agreed to limit production and to enter a marketing agreement under the terms of the Agricultural Adjustment Act. The principal features of the agreement consist in placing producers under a licensing system effective Jan. 1, 1934, and in placing a limit on the amount of rosin and turpentine a producer may sell during the crop year. This plan, embracing as it does control of both production and marketing, will greatly strengthen the naval stores industry if it becomes operative with full industry participation.

The Department of Agriculture also is attempting to aid rosin producers by securing information from consumers regarding the properties of rosin which are most desirable for the various uses to which it is put. A questionnaire has been sent to principal consumers to obtain this data which may form a basis for a more definite standardization of grades.

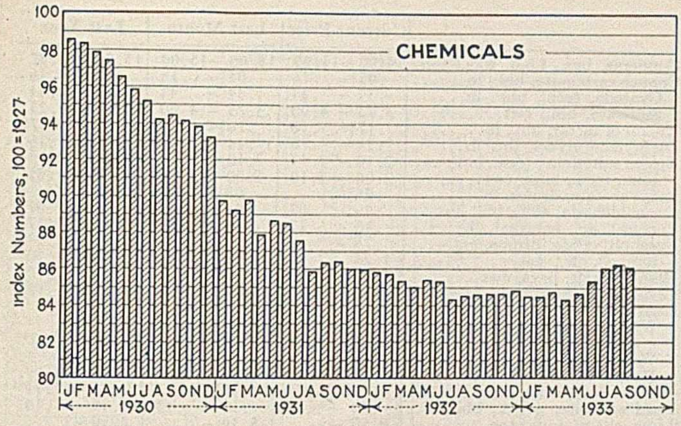
A development of importance in our export trade was found in a report originating abroad which stated in effect that domestic producers of phosphate rock were parties in an agreement with French and Morocco producers to stabilize prices for this product in world markets. The advantage to American producers is reported to consist in an allotment for a portion of European markets. Incidentally it is reported that arrangements have been made for shipping 6,000 tons of phosphates from Russia to superphosphate plants in Poland.

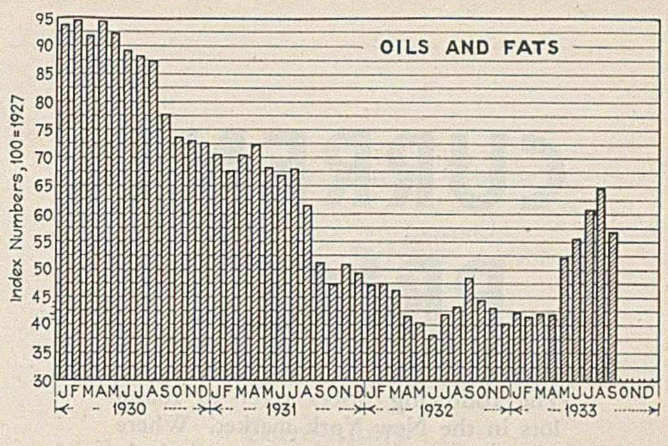
Exporters of chemicals as well as of other products to Canada are notified that beginning September 1, export consignments to Canada must be accompanied by a special form of invoice in triplicate on which must be noted the fair market value of the goods at time and place of shipment in addition to the selling price to the purchaser. The information is required by the Canadian customs in connection with the effort to prevent the underselling of foreign merchandise. Forwarders here have been advised by their agents in Canada to caution against use of old invoices.

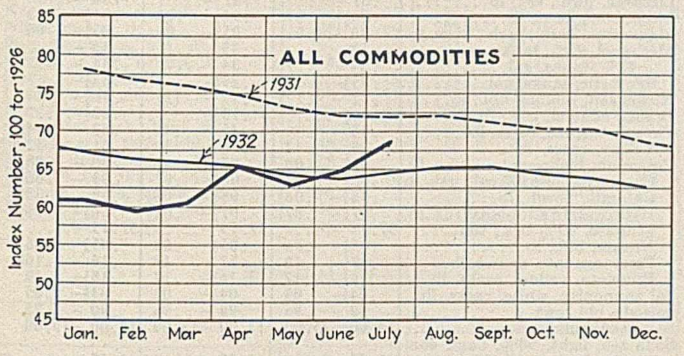
At the bottom of the new form the exporter or his agent is required to sign a statement that the figures thereon are of the prices paid or to be paid for the goods, accurately described as to quantity and of any discounts allowed. It must be stipulated further that the invoice exhibits the fair market value of the shipment at the place of exportation, whether for home or foreign consumption, and that all drawbacks, bounties or other discounts are indicated.

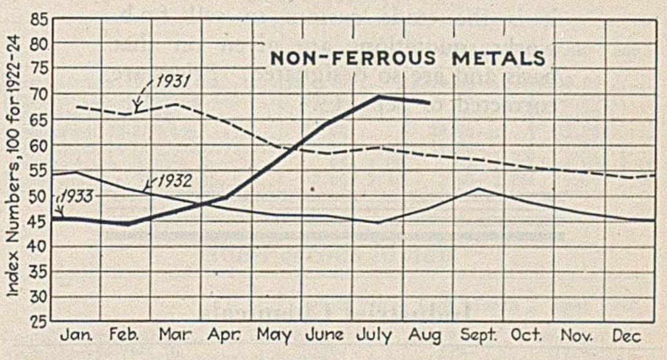
A mid-western chemical company announces that it is putting on the market a new reinforcing calcium carbonate pigment for rubber. It is a precipitated product of extremely fine particle size, running over 98% under 0.4 microns. The surface of the particles is coated with approximately 2 per cent of a rubber soluble organic material. This coating agent prevents cementation of the individual particles and gives dispersion of the pigment in rubber.

Based on condition as of Sept. 1, the Department of Agriculture estimates the present crop of flaxseed in the American northwest at 7,009,000 bu. At the beginning of the growing season, it was apparent that the acreage seeded to flax would not turn out a yield large enough to take care of domestic linseed oil requirements. Unfavorable weather conditions later on brought steadily downward revisions in the estimates on probable outturn. The present forecast compares with a harvest of 11,787,000 bu. last season and with a five-year average (1926-1930) of 20,011,000 bu. With anything like a normal consumption of linseed oil, the necessity for importing larger-than-usual amounts of seed from the Argentine in the next year is self evident. Recent crop advices from the Argentine, likewise have been unfavorable and a relatively high priced linseed oil market for the next year is almost a certainty.









PRICE TRENDS—CHEM. & MET.'S WEIGHTED INDEXES

ALTHOUGH the weighted index numbers for chemicals was lowered slightly compared with that for a month ago, there is every indication that this was but a temporary setback in the upward swing to values. The vast majority of chemical products presented a firm price tone which was intensified by the fact that some selections were in such limited supply that quotations for spot and nearby deliveries were little better than nominal. For instance, the output of acetic acid and acetic anhydride is well taken up by contract commitments with very little surplus stocks to take care of fresh buying, and consuming demand for some time ahead is expected to tax productive capacities.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	**86.09**
Last month	86.26
September, 1932	84.56
September, 1931	86.26

The upward swing to chemical prices was checked during the interval but the majority of offering developed no weakness and in a few instances quoted prices were little better than nominal because of limited stocks. The index number dropped slightly mainly because of weakness in turpentine.

Higher priced raw materials, generally increased overheads, and government influences—with no consideration of possible inflation—all are sign posts which point out the course which values are to follow. The basic law of supply and demand, irrespective of all artificial stimuli, must have its place, however, in any well considered price analysis. Any upward price movement which is not accompanied by a corresponding uplift in consuming demand may be questioned as to its stability and genuineness. Taking sulphuric acid as representative of the chemical industry because it ranks first in tonnage and in diversity of uses, it seems safe to predict that its consumption in the present year will outstrip that of last year by at least 1,000,000 short tons measured in terms of 50 deg. acid. Fertilizer consumption of this acid for the first seven months of this year was 142,111 tons larger than for the corresponding period of 1932.

Other important chemicals, including soda ash, caustic soda, and bichromates are admitted to have moved in larger volume this year than for the corresponding period of last year and attest that increased demand has been a factor in moving prices upward.

According to trade reports the contracting season for 1934 requirements will set in earlier than is usual for contract business to be written and it is a foregone conclusion that 1934 deliveries of such important chemicals as soda ash, caustic soda, and chlorine will command higher prices than were effective on deliveries through the present year.

The lower index number for last month was largely due to reduced prices for solvents with particular reference to spirits of turpentine. But the naval stores industry has now taken definite steps toward industry control which not only places a limit on total production but also fixes maximum amounts which may be sold by producers. The effect of such industry legislation on prices is obvious and there has been no development in the last month which carried such clear cut price significance.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1927

This month	**56.70**
Last month	64.98
September, 1932	48.57
September, 1931	51.28

There was a sharp and rather general decline in prices for vegetable oils and animal fats during the last month. Crude cottonseed held an average level considerably below that of the preceding month and led in the downward movement. Linseed oil closed with a firm tone because of the poor seed outlook.

CURRENT PRICES

The following 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 Sept. 13.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.08½–$0.09	$0.08½–$0.09	$0.10 –$0.11
Acid, acetic, 28%, bbl., cwt	2.90 – 3.15	2.90 – 3.15	2.60 – 2.85
Glacial 99%, drums	10.02 –10.27	10.02 –10.27	8.89 –......
U. S. P. reagent, c'bys	10.52 –10.77	10.52 –10.77	9.64 – 9.89
Boric, bbl., lb	.04¾– .05	.04¾– .05	.04¾– .05
Citric, kegs, lb	.29 – .31	.29 – .31	.29 – .31
Formic, bbl., lb	.11 – .11½	.10½– .11	.10 – .11
Gallic, tech., bbl., lb	.60 – .65	.55 – .60	.50 – .55
Hydrofluoric 30% carb., lb	.06 – .07	.06 – .07	.06 – .07
Latic, 44%, tech., light, bbl., lb	.11½– .12	.11½– .12	.11½– .12
22%, tech., light, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Muriatic, 18° tanks, cwt	1.00 – 1.10	1.00 – 1.10	1.00 – 1.10
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	.11 – .11½	.11 – .11½	.11 – .12
Phosphoric, tech., c'bys., lb	.09 – .10	.08½– .09	.08½– .09
Sulphuric, 60°, tanks, ton	11.00 –11.50	11.00 –11.50	11.00 –11.50
Sulphuric, 66°, tanks, ton	15.50 –......	15.50 –......	15.50 –......
Tannic, tech., bbl., lb	.23 – .35	.23 – .35	.23 – .35
Tartaric, powd., bbl., lb	.24½– .25	.23 – .24	.23 – .24
Tungstic, bbl., lb	1.40 – 1.50	1.40 – 1.50	1.40 – 1.50
Alcohol, ethyl, 190 p'f., bbl., gal	2.415–......	2.415–......	2.53½–......
Alcohol, Butyl, tanks, lb	.095–......	.095–......	.113–......
Alcohol, Amyl	......–......	......–......	......–......
From Pentane, tanks, lb	.15 –......	.15 –......	.182–......
Denatured, 190 proof			
No. 1 special dr., gal	.33½–......	.33½–......	.34½–......
No. 5, 188 proof, dr., gal	.34 –......	.34 –......	.38½–......
Alum, ammonia, lump, bbl., lb	.03 – .04	.03 – .04	.03 – .04
Chrome, bbl., lb	.04½– .05	.04½– .05	.04½– .05
Potash, lump, bbl., lb	.03 – .04	.03 – .04	.03 – .04
Aluminum sulphate, com., bags, cwt	1.25 – 1.40	1.25 – 1.40	1.25 – 1.40
Iron free, bg., cwt	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Aqua ammonia, 26°, drums lb.	.02½– .03	.02½– .03	.02¾– .03
tanks, lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Ammonia, anhydrous, cyl., lb	.15½– .15½	.15½– .15½	.15½– .15½
tanks, lb	.05 –......	.05 –......	.05⅞–......
Ammonium carbonate, powd. tech., casks, lb	.08 – .12	.08 – .12	.10 – .11
Sulphate, wks., cwt	1.20 –......	1.20 –......	1.00 –......
Amylacetate tech., tanks, lb., gal	.14½–......	.14½–......	.16 –......
Antimony Oxide, bbl., lb	.08½– .10	.08½– .10	.06½– .08
Arsenic, white, powd., bbl., lb	.04 – .04½	.04 – .04½	.04 – .04½
Red, powd., kegs, lb	.13 – .14	.13 – .14	.09 – .10
Barium carbonate, bbl., ton	56.50 –58.00	56.50 –58.00	56.50 –58.00
Chloride, bbl., ton	61.50 –65.00	61.50 –65.00	63.00 –65.00
Nitrate, cask, lb	.07¼– .07½	.07¼– .07½	.07 – .07½
Blanc fixe, dry, bbl., lb	.03½– .04	.03 – .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt	1.75 – 2.00	1.75 – 2.00	1.75 – 2.00
Borax, grain, bags, ton	40.00 –45.00	40.00 –45.00	40.00 –45.00
Bromine, cs., lb	.36 – .38	.36 – .38	.36 – .38
Calcium acetate, bags	3.00 –......	3.00 –......	2.50 –......
Arsenate, dr., lb	.07 – .08	.07 – .08	.05½– .06½
Carbide drums, lb	.05 – .06	.05 – .06	.05 – .06
Chloride, fused, dr., wks., ton	17.50 –......	17.50 –......	18.00 –......
flake, dr., wks., ton	19.50 –......	19.50 –......	21.00 –......
Phosphate, bbl., lb	.07½– .08	.07½– .08	.08 – .08½
Carbon bisulphide, drums, lb	.05½– .06	.05½– .06	.05 – .06
Tetrachloride drums, lb	.05¼– .06	.05¼– .06	.06½– .07
Chlorine, liquid, tanks, wks., lb	.01¾–......	.01¾–......	.01¾–......
Cylinders	.05½– .06	.05½– .06	.05 – .06
Cobalt oxide, cans, lb	1.15 – 1.25	1.15 – 1.25	1.25 – 1.35
Copperas, bgs., f.o.b. wks., ton	14.00 –15.00	14.00 –15.00	13.00 –14.00
Copper carbonate, bbl., lb	.08¾– .16	.08¾– .16	.07 – .16
Cyanide, tech., bbl., lb	.39 – .41	.39 – .41	.39 – .44
Sulphate, bbl., cwt	3.75 – 4.00	3.75 – 4.00	3.00 – 3.25
Cream of tartar, bbl., lb	.17½– .18	.16½– .17	.17 – .17½
Diethylene glycol, dr., lb	.14 – .16	.14 – .16	.14 – .16
Epsom salt, dom., tech., bbl., cwt	2.10 – 2.15	2.10 – 2.15	1.70 – 2.00
Imp., tech., bags, cwt	2.00 – 2.10	2.00 – 2.10	1.15 – 1.25
Ethyl acetate, drums, lb	.08½–......	.08½–......	.10 –......
Formaldehyde, 40%, bbl., lb	.06 – .07	.06 – .07	.06 – .07
Furfural, dr., contract, lb	.10 – .17½	.10 – .17½	.10 – .17½
Fusel oil, crude, drums, gal	.75 –......	.75 –......	1.10 – 1.20
Refined, dr., gal	1.25 – 1.30	1.25 – 1.30	1.80 – 1.90
Glaubers salt, bags, cwt	1.00 – 1.10	1.00 – 1.10	1.00 – 1.10
Glycerine, c.p., drums, extra, lb	.10¼– .10½	.10¼– .10½	.10¼– .10½
Lead:			
White, basic carbonate, dry casks, lb	.06½–......	.06½–......	.06½–......
White, basic sulphate, sck., lb	.06 –......	.06 –......	.06 –......
Red, dry, sck., lb	.08 –......	.08 –......	.07 –......
Lead acetate, white crys., bbl., lb	.10½– .11	.10½– .11	.10 – .11
Lead arsenate, powd., bbl., lb	.10 – .13	.10 – .13	.10 – .14
Lime, chem., bulk, ton	8.50 –......	8.50 –......	8.50 –......
Litharge, pwd., csk, lb	.07 –......	.07 –......	.06 –......
Lithophone, bags, lb	.04½– .05	.04½– .05	.04½– .05
Magnesium carb., tech., bags, lb	.06 – .06¼	.05¾– .06	.05¾– .06
Methanol, 95%, tanks, gal	.33 –......	.33 –......	.33 –......
97%, tanks, gal	.34	.34 –......	.34 –......
Synthetic, tanks, gal	.35½–......	.35½–......	.35½–......
Nickel salt, double, bbl., lb	.12 – .12½	.12 – .12½	.10½– .11
Orange mineral, csk., lb	.10½–......	.10½–......	.09½–......
Phosphorus, red, cases, lb	.45 – .46	.45 – .46	.42 – .44
Yellow, cases, lb	.28 – .32	.28 – .32	.31 – .32
Potassium bichromate, casks, lb	.07⅝– .08	.07⅝– .08	.08 – .08½
Carbonate, 80-85%, calc. csk., lb	.06¾– .07	.06¾– .07	.05 – .06
Chlorate, powd., lb	.08¼– .08½	.08¼– .08½	.08 – .08½
Hydroxide (c'stic potash) dr., lb	.07⅜– .07½	.07⅜– .07½	.06¼– .06½
Muriate, 80% bgs., ton	37.15 –......	37.15 –......	37.15 –......
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05¼– .06
Permanganate, drums, lb	.17½– .18	.17½– .18	.16 – .16½
Prussiate, yellow, casks, lb	.16½– .17	.16½– .17	.18½– .19
Sal ammoniac, white, casks, lb	.04½– .05	.04½– .05	.04½– .05
Salsoda, bbl., cwt	.90 – .95	.90 – .95	.90 – .95
Salt cake, bulk, ton	13.00 –15.00	13.00 –15.00	13.00 –15.00
Soda ash, light, 58%, bags, contract, cwt	1.20 –......	1.20 –......	1.15 –......
Dense, bags, cwt	1.22½–......	1.22½–......	1.17½–......
Soda, caustic, 76%, solid, drums, contract, cwt	2.50 – 2.75	2.50 – 2.75	2.50 – 2.75
Acetate, works, bbl., lb	.04¾– .05	.04¾– .05	.05 – .05½
Bicarbonate, bbl., cwt	1.85 – 2.00	1.85 – 2.00	1.85 – 2.00
Bichromate, casks, lb	.05 – .05½	.05 – .05½	.05 – .06
Bisulphate, bulk, ton	14.00 –16.00	14.00 –16.00	14.00 –16.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03¾– .04
Chlorate, kegs, lb	.05¾– .07½	.05¾– .07½	.05¾– .07½
Chloride, tech., ton	12.00 –14.75	12.00 –14.75	12.00 –14.00
Cyanide, cases, dom., lb	.15½– .16	.15½– .16	.15½– .16
Fluoride, bbl., lb	.07½– .08	.07 – .08	.07½– .08
Hyposulphite, bbl., lb	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	3.25 – 3.40	3.25 – 3.40	3.60 – 3.75
Nitrate, bags, cwt	1.295–......	1.295–......	1.22 –......
Nitrite, casks, lb	.07½– .08	.07½– .08	.07½– .08
Phosphate, dibasic, bbl., lb	.02 – .023	.02 – .023	.0255 – .0275
Prussiate, yel. drums, lb	.11½– .12	.11½– .12	.11½– .12
Silicate (40° dr.) wks. cwt	.70 – .75	.70 – .75	.70 – .75
Sulphide, fused, 60-62%, dr., lb	.02¾– .03½	.02¾– .03	.02¾– .03
Sulphite, cyrs., bbl., lb	.02¼– .02½	.02¼ .02½	.03 – .03½
Sulphur, crude at mine, bulk, ton	18.00 –......	18.00 –......	18.00 –......
Chloride, dr., lb	.03½– .04	.03½– .04	.03½– .04
Dioxide, cyl., lb	.06½– .07	.06½– .07	.06½– .07
Flour, bag, cwt	1.55 – 3.00	1.55 – 3.00	1.55 – 3.00
Tin Oxide, bbl. lb	.50 –......	.50 –......	.28 –......
Crystals, bbl., lb	.35½–......	.36½–......	.25 –......
Zinc chloride, gran., bbl., lb	.05½– .06	.05½– .06	.06½– .06¾
Carbonate, bbl., lb	.09½– .11	.09½– .11	.10½– .11
Cyanide, dr., lb	.38 – .42	.38 – .42	.41 – .42
Dust, bbl., lb	..07– .07¼	.06¾–..07	.04½– .05
Zinc oxide, lead free, bag, lb	.05¾–......	.05¾–......	.05¾–......
5% lead sulphate, bags, lb	.05½–......	.05½–......	.05½–......
Sulphate, bbl., cwt	3.00 – 3.25	3.00 – 3.25	3.00 – 3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb	$0.09¼–$0.10	$0.09½–$0.10	$0.09¼–$0.10
Chinawood oil, bbl., lb	.07¾–......	.08 –......	.06 –......
Coconut oil, Ceylon, tanks, N. Y. lb	.03⅛–......	.03½–......	.03¾–......
Corn oil crude, tanks, (f.o.b. mill), lb	.04¾–......	.05¾–......	.04⅝–......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.03¾–......	.03½–......	.04 –......
Linseed oil, raw car lots, bbl., lb	.105–......	.104–......	.061–......
Palm, Lagos, casks, lb	.04½–......	.04½–......	.04 –......
Palm Kernel, bbl., lb	.04¾–......	.04¾–......	.04½–......
Peanut oil, crude, tanks (mill), lb	.04½–......	.05¾–......	.06¾–......
Rapeseed oil, refined, bbl., gal	.65 – .67	.66 – .68	.36 – .37
Soya bean, tank, lb	.08 –......	.08 –......	.03 –......
Sulphur (olive foots), bbl., lb	.06 – .30	.06½–......	.04⅝–......
Cod, Newfoundland, bbl., gal	.29 – .30	nom. –......	.25 – .26
Menhaden, light pressed, bbl., lb	.053–......	.053–......	.04 –......
Crude, tanks (f.o.b. factory), gal	.17 –......	.17 –......	.12 –......
Grease, yellow, loose, lb	.02¾–......	.03⅜–......	.03½–......
Oleo stearine, lb	.05½–......	.06 –......	.06¾–......
Red oil, distilled, d.p. bbl., lb	.06¼–......	.06¼–......	.06¾–......
Tallow, extra, loose, lb	.03⅜–......	.03¾–......	.03⅝–......

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb..	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl., lb.............	.80 - .85	.80 - .85	.80 - .85
Alpha-naphthylamine, bbl., lb..	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb....	.14½- .15	.14½- .15	.14½- .15
Aniline salts, bbl., lb..........	.24 - .25	.24 - .25	.24 - .52
Benzaldehyde, U.S.P., dr., lb....	1.10 - 1.25	1.10 - 1.25	1.10 - 1.25
Benzidine base, bbl., lb.........	.65 - .67	.65 - .67	.65 - .67
Benzoic acid, U.S.P., kgs, lb.....	.48 - .52	.48 - .52	.48 - .52
Benzyl chloride, tech., dr., lb....	.30 - .35	.30 - .35	.30 - .35
Benzol, 90%, tanks, works, gal..	.22 - .23	.22 - .23	.20 - .21
Beta-naphthol, tech., drums, lb..	.22 - .24	.22 - .24	.22 - .24
Cresol, U. S. P., dr., lb.........	.10½- .11	.10½- .11	.10½- .11
Cresylic acid, 97%, dr., wks., gal.	.45 - .46	.45 - .46	.49 - .52
Diethylaniline, dr., lb..........	.55 - .58	.55 - .58	.55 - .58
Dinitrophenol, bbl., lb..........	.29 - .30	.29 - .30	.29 - .30
Dinitrotoluen, bbl. lb...........	.16 - .17	.16 - .17	.16 - .17
Dip oil 25% dr., gal...........	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.........	.38 - .40	.38 - .40	.38 - .40
H-acid, bbl., lb................	.65 - .70	.65 - .70	.65 - .70
Naphthalene, flake, bbl., lb.....	.04¾- .05	.04¾- .05	.03¾- .04¼
Nitrobenzene, dr., lb...........	.08½- .09	.08½- .09	.08½- .10
Para-nitraniline, bbl., lb........	.51 - .55	.51 - .55	.51 - .55
Phenol, U.S.P., drums, lb.......	.14¼- .15	.14¼- .15	.14¼- .15
Picric acid, bbl., lb............	.30 - .40	.30 - .40	.30 - .40
Pyridine, dr., gal..............	.90 - .95	.90 - .95	1.50 - 1.80
R-salt, bbl., lb................	.40 - .44	.40 - .44	.40 - .44
Resorcinal, tech., kegs, lb.......	.65 - .70	.65 - .70	.65 - .70
Salicylic acid, tech., bbl., lb.....	.40 - .42	.40 - .42	.33 - .35
Solvent naphtha, w.w., tanks, gal.	.26 -......	.26 -......	.26 -......
Tolidine, bbl., lb..............	.88 - .90	.88 - .90	.86 - .88
Toluene, tanks, works, gal......	.30 -......	.30 -......	.30 -......
Xylene, com., tanks, gal........	.26 -......	.26 -......	.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..........	.14¾- .15	.14¾- .15	.06 - .10½
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...	.02¼- .20	.02¼- .20	.02¼- .20
Prussian blue, bbl., lb........	.35 - .36	.35 - .36	.35 - .36
Ultramine blue, bbl., lb.......	.06 - .32	.06 - .32	.06 - .32
Chrome green, bbl., lb........	.26 - .27	.26 - .27	.27 - .30
Carmine red, tins, lb.........	3.65 - 3.75	3.65 - 3.75	3.90 - 4.50
Para toner, lb...............	.80 - .85	.80 - .85	.75 - .80
Vermilion, English, bbl., lb.....	1.35 - 1.40	1.40 - 1.45	1.25 - 1.50
Chrome yellow, C. P., bbl., lb.	.15 - .15½	.15 - .15½	.16 - .16½
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.	.07 - .08½	.07 - .08½	.07 - .08½
Gum copal Congo, bags, lb......	.08 - .09	.08 - .09	.05 - .08
Manila, bags, lb............	.09 - .10	.09 - .10	.16 - .17
Damar, Batavia, cases, lb.....	.15 - .15½	.15 - .15½	.16 - .16½
Kauri No. 1 cases, lb........	.20 - .25	.20 - .25	.45 - .48
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 -......	40.00 -......
Pumice stone, lump, bbl., lb....	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb..........	.03 - .40	.03 - .40	.03 - .35
Rosin, H., bbl.................	5.25 -......	5.10 -......	4.30 -......
Turpentine, gal................	.47 -......	.49½-......	.46 -......
Shellac, orange, fine, bags, lb....	.24 - .25	.24 - .25	.20 - .25
Bleached, bonedry, bags, lb...	.24 - .25	.24 - .25	.18 - .19
T. N. bags, lb..............	.15 - .16	.15 - .16	.10½- .11½
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 -....
Wax, Bayberry, bbl., lb.........	.14 - .15	.14 - .15	.16 - .20
Beeswax, ref., light, lb..........	.22 - .27	.22 - .27	.20 - .30
Candelilla, bags, lb..........	.09 - .09½	.09½- .10	.11 - .11½
Carnuba, No. 1, bags, lb........	.29 - .30	.29 - .30	.21½- .23
Paraffine, crude 105-110 m.p., lb............	.03¼-......	.03¼-......	.03⅜- .03¼

Price Changes During Month

Advanced	Declined
Formic acid	Turpentine
Tartaric acid	Vegetable oils
Cream of tartar	Animal fats

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton.......	$200.00-.....	$200.00-.....	$200.00-.....
Ferromanganese, 78-82%, ton....	82.00-.....	82.00-.....	68.00-.....
Ferrochrome, 65-70%...........	.09½-....	.09½-.....	.10-.....
Spiegeleisen, 19-21% ton.........	27.00-.....	24.00-.....	25.00-.....
Ferrosilicon, 14-17%, ton.........	31.00-.....	31.00-.....	31.00-.....
Ferrotungsten, 70-80%, lb.......	.95- 1.00	.95- 1.00	1.00- 1.10
Ferrovanadium, 30-40%, lb.......	2.60- 2.80	2.60- 2.80	3.05- 3.40

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb...........	$0.09 -......	$0.09 -......	$0.06½-......
Aluminum, 96-99%, lb...........	.229-......	.229-......	.229-......
Antimony, Chin. and Jap., lb.....	.06¾-......	.07¼-......	.055-......
Nickel, 99%, lb................	.35 -......	.35 -......	.35 -......
Monel metal blocks, lb..........	.28 -......	.28 -......	.28 -......
Tin, 5-ton lots, Straits, lb........	.45⅜-......	.44⅞-......	.253-......
Lead, New York, spot. lb........	.045-......	.045 -......	.036-......
Zinc, New York, spot, lb.........	.0502-......	.0537-......	.0382-......
Silver, commercial, oz...........	.36¾-......	.36⅝-......	.28¼-......
Cadmium, lb..................	.55 -......	.55 -......	.55 -......
Bismuth, ton lots, lb............	1.20 -......	1.05 -......	.85 -......
Cobalt, lb....................	2.50 -......	2.50 -......	2.50 -......
Magnesium, ingots, 99%, lb......	.32 -......	.32 -......	.30 -......
Platinum, ref., oz...............	33.00 -......	33.00 -......	35.00 -......
Palladium, ref., oz..............	19.00 -......	19.00 -......	18.00 - 19.00
Mercury, flask, 75 lb............	63.00 -......	63.00 -......	47.00 -......
Tungsten powder, lb............	1.25 -......	1.25 -......	1.45 -......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton.......	$6.50 -$8.25	$6.50 -$8.25	$6.50 -$8.25
Chrome ore, c.i.f. ports, ton.....	16.00 -20.00	14.00 -18.50	17.00 -20.00
Coke, fdry., f.o b. ovens, ton......	2.25 -......	2.25 -......	3.25 - 3.75
Fluorspar, gravel, f.o.b. Il., ton...	17.25 -20.00	17.25 -20.00	17.25 -20.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit...........	.19 -......	.19 - ...	.23 -......
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb...............	.45 -......	.45 -......	.45 -......
Monazite, 6% of ThO_2, ton.......	60.00 -......	60.00 -......	60.00 -......
Pyrites, Span. fines, c.i.f., unit....	.13 -......	.13 -......	.13 -......
Rutile, 94-96% TiO_2, lb..........	.10 - .11	.10 - .11	.10 - .11
Tungsten, scheelite, 60% WO_3 and over, unit............	12.00 -......	10.00 -10.50	10.00 -10.50

INDUSTRIAL NOTES

Chicago Pneumatic Tool Co., with executive offices in New York has opened a branch office at 1028 Sixth Ave., South, Seattle, Wash. A. M. Andresen is in charge.

The General Electric Co., and four of its associated companies has announced the removal of its offices in New York City to the new General Electric Building, 570 Lexington Ave. at 51st Street.

The Jeffrey Mfg. Co., Columbus, Ohio, has acquired the entire patent, manufacturing, and selling rights for all devices formerly made by the Traylor Vibrator Co., Denver, Colo.

Lewis-Shepard Co., Watertown Station, Boston, Mass., has appointed George H. Corliss as sales promotion and advertising manager.

Struther-Wells Co., Warren, Pa., has appointed the Kerr Machinery Corp., Detroit, as its representative in Michigan exclusive of the northern peninsula. It also has named the National Equipment Co., Salt Lake City as its representative in Utah, Nevada, Idaho, Montana, and Wyoming west of Rock Springs.

Roots-Connersville-Wilbraham, Connersville, Ind., is now represented in the New England territory by Leo I. Smith, Belmont, Mass.

The Kron Co., Bridgeport, Conn., announces as new representatives: Equipment Engineering Co., New Haven, Conn.; R. S. Kerr & Co., Atlanta, Ga.; and Equipment Engineering Co., Indianapolis, Ind.

Pure Carbonic, Inc., New York, has moved its office in Baltimore, Md., to 227 South Central Ave.

Cedarburg Mfg. Co., Cedarburg, Wis., has acquired the property and patents of the American Electric Motor Co., formerly a subsidiary of Splitdorf-Bethlehem Electrical Co., Newark, N. J.

The Zapon Brevolite Co., has been formed to consolidate the business of the Brevolite Lacquer Co., North Chicago, and the western business of the Zapon Co., Wilmington, Del. Manufacturing will be centralized at the North Chicago plant with eastern production at Stamford, Conn.

NEW CONSTRUCTION

Where Plants Are Being Built in Process Industries

	This Month		Cumulative to Date	
	Proposed Work and Bids	Contracts Awarded	Proposed Work and Bids	Contracts Awarded
New England.....	$156,000	....	$476,000	$165,000
Middle Atlantic...	3,417,000	$566,000	6,936,000	3,984,000
Southern.........	278,000	80,000	6,554,000	3,547,000
Middle West......	157,000	245,000	1,423,000	728,000
West of Mississippi	175,000	....	11,024,000	14,064,000
Far West	1,886,000	1,410,000	4,550,000	2,344,000
Canada..........	106,000	12,000	4,899,000	359,000
Total..........	$6,175,000	$2,313,000	$35,862,000	$25,191,000

PROPOSED WORK BIDS ASKED

Chemical Plant — Barium Products Co., Modesto, Calif., contemplates rebuilding its chemical plant. Estimated cost $28,000 including equipment.

Distillery—Taylor & Williams, Inc., J. B. Dant, pres., 1479 South 4th St., Louisville, Ky., plans to construct a distillery on a 20 acre tract on 7th St. Rd. Leslie V. Abbott, 8 Kenwood Village, Louisville, is architect. Estimated cost $250,000.

Cyanide Mill—Pilgrim Mining Co., Chloride, Ariz., Fred W. Koehler, Gen. Mgr., 1004 Beau Arts Bldg., Los Angeles, Calif., plans the construction of a 100 ton cyanide mill at Chloride.

Fertilizer Plant — Apothecaries Hall Co., Waterbury, Conn., plans to rebuild its fertilizer plant recently destroyed by fire. Estimated cost $50,000.

Gas Plant—East Hull Gas Co., East Hull, England, plans extension to its plant, including vertical retort installation with capacity of 2,000,000 cu.ft. daily. Estimated cost $190,000.

Glass Factory—Jenkins Glass Co., Kokomo, Ind., plans to alter its plant and install new machinery. Estimated cost $29,000.

Chemistry Building—Washington State College, Pullman, Wash., had plans prepared for a chemistry building. Estimated cost $250,000.

Laboratory—Manhattan College, 242nd St. and Spuyten Duyvil, New York, N. Y., is having plans prepared by J. F. Delany, Archt., 162 East 37th St., New York, for the construction of a 3 story laboratory. Estimated cost $200,000.

Oxygen Plant — Keith Dunham Co., c/o James Dunham, 204 West Wacker Dr., Cleveland, O., has purchased a site at 3965 Jennings Road, Cleveland, and will build an oxygen plant. Estimated cost $100,000.

Paint Factory—White Co., 3200 East Biddle St., Baltimore, Md., M. M. Constam, Vice Pres., plans the construction of a 3 story, 100x110 ft. addition to its paint factory.

Paper Mill—Erving Paper Co., Erving, Mass., is receiving preliminary estimates for a concrete and brick addition to its paper mill. R. E. Palmer, 58 Suffolk St., Holyoke, Mass., is engineer.

Rayon Plant—Du Pont Rayon Co., Wilmington, Del., plans additions and improvements to machinery at its plant at Old Hickory, Tenn. Estimated cost $3,000,000.

Rayon Plant—E. M. Holt Plaid Mills, Inc., Burlington, N. C., plans to recondition former Belmont Mill on Highway 62, Burlington, for rayon plant. Estimated cost $28,000.

Oil Laboratory — Marathon Oil Co., Tulsa, Okla., had plans prepared by C. H. Blue, Engr., Thompson Bldg., Tulsa, for an oil laboratory building at Bristow, Okla. Estimated cost $100,000.

Recompression Plant—Humble Oil & Refining Co., Houston, Tex., plans the construction of a recompression plant at its refinery. Estimated cost $75,000.

Refinery—Atlas Refinery Co., F. Schroeder in charge, foot of Lockwood St., Newark, N. J., will soon award the contract for a 3 story, 50x55 ft. refinery. J. Knecht, 403 Ward St., Union, N. J., is architect. Estimated cost $28,500.

Refinery—Consolidated Petroleum Distributors Co., 315 Montgomery St., San Francisco, Calif., plans the construction of a refinery on Rough and Ready Island, Stockton, Calif. Estimated cost $1,500,000.

Refinery—Pennsylvania Refining Co., Butler, Pa., plans the construction of a new unit and improvements to its refinery at Titusville, Pa. Arthur G. McKee Co., 2422 Euclid Ave., Cleveland, O., will soon receive bids. Estimated cost $125,000.

Factory — McDanel Refractories Mfg. Co., New Brighton, Pa., is receiving bids for a 1 or 2 story, 40x130 ft. brick and steel factory. Jesse E. Martsolf, 512 3rd Ave., New Brighton, Pa., is architect.

Rubber Factory—Armstrong Rubber Co., 475 Elm St., West Haven, Conn., is having plans prepared by Fletcher-Thompson, Inc., architects, 1336 Fairfield Ave., Bridgeport, Conn., for a 2 and 3 story, 80x180 ft. reinforced-concrete factory unit. Estimated cost $50,000.

Rubber Plant—Henderson Tire & Rubber Co., c/o Bucyrus Chamber of Commerce, Bucyrus, O., plans to recondition plant here for its own use. Estimated cost $28,000 including equipment.

Rubber Factory—Plymouth Rubber Co., Inc., Revere St., Canton, Mass., is receiving bids for a 2 story, 24x27 ft. addition to its factory. J. R. Worcester & Co., 79 Milk St., Boston, Mass., is engineer.

Salt Plant—Warwick Pure Salt Co., Ltd., Warwick, Ont., plans the construction of a plant.

Tallow Factory—Peterson Tallow Co., 65th and Bay Sts., Oakland, Calif., plans the construction of a 2 story, 120x140 ft. brick, steel and concrete tallow factory at 63rd and Overland Sts., Berkeley, Calif. General contract bids are now being received by E. W. Remnitz, Engr., 1594 63rd St., Oakland. Estimated cost $50,000.

Tile Plant—Kraftile Co. Niles, Calif., is having plans prepared for rebuilding its tile plant recently destroyed by fire. Estimated cost $30,000 with equipment.

CONTRACTS AWARDED

Celluloid Plant—E. Horowitz, 204 Sheerer Ave., Newark, N. J., awarded contract for celluloid sorting plant on 3rd Ave., Kearney, N. J., to Ralph DeTrolio, 353 Highland Ave., Kearney. Estimated cost $28,000 including equipment.

Cement Plant—Huron Portland Cement Co., 1325 Ford Bldg., Detroit, Mich., awarded contract for 75,000 bbl. cement plant at Oswego, N. Y., to include bagging and loading plants, thirteen 90 ft. storage bins, to Burrell Engineering & Construction Co., 400 West Madison St., Chicago, Ill.

Chemical Plant—Harshaw Chemical Co., c/o E. S. Parkes, 1945 East 97th St., Cleveland, O., awarded contract for altering factory at 1000 Newburgh Ave., to M. Swisher, 1718 Lakefront Ave., Cleveland. Estimated cost $40,000.

Film Manufacturing Plant — DuPont Film Manufacturing Corp., M. Doorboe, Plant Engr., in charge, Washington Rd., Parlin, N. J., awarded contract for film manufacturing plant, including 2 story, 30x43 ft. color mixing building, 1 story filtering building and 1, 2 and 3 story, 17x42 ft. and 45x145 ft., casting building, to Wigton Abbott Corp., 143 Liberty St., New York, N. Y. Estimated cost $250,000 including equipment.

Ethyl Plant—Texas Co., Ave. A and 1st St., Bayonne, N. J., is building a 1 story addition to its ethyl manufacturing plant. Estimated cost $28,000 including equipment.

Experimental Building — Hoffman-LaRoche Co., Inc., Kingsland Rd., Nutley, N. J., awarded contract 1 story medicine experimental building to J. W. Ferguson Co., Inc., 152 Market St., Paterson, N. J. Estimated cost $28,000 including equipment.

Metallurgical Laboratory—Carnegie Steel Co., Carnegie Bldg., Pittsburgh, Pa., is building a brick and concrete metallurgical laboratory on Salt St., Youngstown, O., with its own forces. Estimated cost $16,000.

Glass Factory—Pittsburgh Plate Glass Co., 314 Girod St., New Orleans, La., is building a storage and distributing plant on Poydras St. between Loyola and Magnolia Sts., New Orleans. Estimated cost $80,000.

Glost Kiln — Salem China Co., Salem, O., awarded contract for tunnel glost kiln, 70 ft. diameter to have capacity of 250,000 pieces of ware, to Allied Engineering Co., Columbus, O. Estimated cost $40,000.

Pharmaceutical Laboratory—Eli Lilly & Co., 720 South Alabama St., Indianapolis, Ind., awarded contract for pharmaceutical laboratory building, to Leslie Colvin, 803 Continental Bank Bldg., Indianapolis. Estimated cost $165,000.

Potash Plant—American Potash & Chemical Corp., Trona, Calif., awarded contract for 3 story factory for the manufacture of soda ash and salt cake, to Dwight P. Robinson & Co., Union Oil Bldg., Los Angeles, Calif. Estimated cost $1,250,000.

Paper Factory—Owner, c/o Wigton-Abbott Corp., general contractor, 705 Park Ave., Plainfield, N. J., awarded contract converting piano factory into paper factory, to Wigton-Abbott Corp. Estimated cost $28,000 including equipment.

Pulp Plant—Standard Pulp Products Co., Plattsburg, N. Y., awarded contract for addition to plant, to J. Leck Co., 211 South 11th St., Minneapolis, Minn. Estimated cost $100,000.

Refinery—Union Oil Co., Union Oil Bldg., Los Angeles, Calif., awarded contract for improving its refinery at Oleum on San Francisco Bay, including extension of lubricating oil facilities and construction of new tanks, to Consolidated Steel Corp., 6500 Saluson St., Los Angeles. Estimated cost $160,000.

Tannery—A. Davis & Son, Ltd., 407 Rideau St., Kingston, Ont., awarded contract for alterations and additions to tannery to Richardson Construction Co., Ltd., 10 Adelaide St., E., Toronto, Ont. Estimated cost $12,000.

Varnish Plant—Federal Composition & Paint Co., Inc., 33 Rector St., New York, N. Y., awarded contract for 1 story varnish manufacturing plant at 414 Wilson Ave., Newark, N. J., to Anchor Building Co., 1182 Magnolia Ave., Elizabeth, N. J. Estimated cost $28,000 including equipment.