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S. D. KIRKPATRICK, *Editor*

MAKE HASTE SLOWLY

WE WERE LATE in getting started with our re-armament program. Already there is mounting pressure on the part of the public to show results. Already there is a great temptation to rush headlong into a frenzied drive for production—a process that may well lead to dire consequences.

Increased output must not be gained at the expense of health and safety. Multiple shifts and overtime work will often be necessary to meet the demands being put on industry but we must not lose sight of the fact that there is a limit to human endurance. The British Health of Munitions Workers Committee has shown that the rate of output per man falls off rapidly as the proportion of overtime increases. Nor are engineers and plant executives exempt from damage to health and efficiency through overwork. Such men, who must give themselves unstintingly to their jobs, are not readily replaceable. The best interests of the national defense program demand that man-power be conserved if our industries are to maintain high productivity.

There is a second and more startling consequence of haste which must constantly be in our minds. Serious plant accidents that result in great losses of life and property are all too frequent in periods of emergency. Within the past few weeks we have witnessed at least one major disaster and several minor ones that have taken an unprecedented toll of fatalities from among the employees of chemical industry. The primary causes of these accidents may never be determined but it would be eminently unfair to the companies and governmental agencies involved to imply that any lack of safety precautions was a contributing factor. These plants and arsenals were built and operated in accordance with the best knowledge and experience of men who are recognized leaders in our profession. In extending our sympathies to those who have suffered these great losses, let us resolve to help in every way we can to prevent the recurrence of any tragedies of a similar nature.

Chemical industry has set some enviable records in accident prevention during recent years. In 1939 it ranked seventh in frequency and seventeenth in severity of accidents among the thirty major industries charted annually by the National Safety Council. This progress has been made because the industry thoroughly believes in safety and has gradually developed the knowledge and skill to protect its workmen against its inherent hazards as well as those common to all of industry. These statistical records will now suffer a temporary setback as a result of the recent casualties but the basic safety work of the industry must be renewed with redoubled energies.

Finally, quite apart from human hazards, is the rather obvious futility of trying to move too fast with new technical developments. One reason for the sound growth of chemical industry, which is almost unique among industries, is the standard chemical engineering sequence of laboratory-to-pilot-plant-to-commercial-production. Extraordinary defense needs may prove a temptation to skip steps in that process, to rush into even larger units without necessary knowledge and experience. But it is important to remember that we cannot now afford to build any more inoperable chemical plants like some the Armistice saved in 1918. Nor do we want any white elephants of surplus capacity and obsolete equipment to plague the industry when this emergency is over.

For all these reasons, and others you can easily deduce, we say, "Make haste slowly—and safely!"

FROM AN

FIGHTING THE SABOTEUR

RECENT EXPLOSIONS and fires in plants of the process industries again spotlight a serious problem which every division of industry must face if it participates directly or indirectly in defense measures. Here is a twofold responsibility: First to take the necessary precautions against accidents from human and equipment failure and second, to prevent the opportunity and chance of willful damage.

In this latter responsibility, the Department of Justice is ready to aid. It has specially trained men in its sabotage prevention squads who will assist industries in making surveys of men, methods and equipment. Any plant that does not feel thoroughly certain of its own precautions can secure cooperation by addressing the Federal Bureau of Investigation in Washington with respect to any undertaking having importance from the national defense. There may be a number of cases where this skilled and strictly confidential cooperation may be needed. Chemical industries should not hesitate to ask for it where such need is evident.

MAKINGS OF GOOD INSPECTORS

AN EXPERIENCED CHEMICAL ENGINEER, whose modesty prevents our use of his name, has written of some of his experiences in American explosives plants during World War I. We had asked his opinion about the need for chemically trained inspectors. "There is no question," he said, "about the necessity for having inspection work stem from within the service. Outside efforts would only add to confusion . . . I recall with some sadness a pathetic condition at the .... plant during 1917-18. The personnel department at Washington had sent us three young men as inspectors. None of these had ever seen smokeless powder before and they were naturally scared stiff. The superintendent was having his troubles with the labor gang, so I had to take the boys over myself. Ended up by placing them in the laboratory where they remained for the duration of the war. Under no circumstances were they cut out to be inspectors."

"In my opinion here are some of the qualifications that good inspectors should have:

(a) Outstanding loyalty to the country, above bribery and knowing something about discipline, preferably as a result of service training.

(b) Knowledge of men plus some experience in handling skilled labor. Rejection of material may play havoc not only with production but with morale.

(c) Chemically-minded, yes, and metallurgically minded too, but of even greater importance is to be endowed with an awareness of the simple principles of science."

In conclusion our friend adds a thought that can well be pondered by all of us: "When we get into the war game, we are in a grimy business. It demands real men with character as well as initiative."

AMMONIA VS. NITRE

WHEN THE PRESENT EMERGENCY has passed there may be from 50 to 100 per cent more capacity for ammonia synthesis in the United States than can be used on peace-time activities. Some of this will be government-owned equipment in plants that presumably are to become strictly standby defense units. But some of the surplus will be owned by big chemical enterprises. At least the latter will represent a potentiality of surplus production that is already worrying some executives.

If the present military program is expanded to provide capacity to service 4 million men under arms, as Washington now talks, there will be still greater demands for ammonia or nitric acid. Recently it has been suggested that this further increase be accomplished by use of Chilean nitrate rather than by building more ammonia-oxidation capacity. This proposal has three real merits. It would eliminate the threat of greater idle surplus ammonia capacity. It would permit necessary production of nitric acid with less immediate new capital investment by the government. It would give Chile a market for some of the nitrate which that nation now finds difficulty in selling elsewhere.

There can be no simple generalization as to "the best plan" for such complicated circumstances as are now being met. But chemical engineers will be wise in avoiding the hasty conclusion that there is no justification for return to the old nitre pot

EDITORIAL VIEWPOINT

to meet the prospective demands of explosives manufacture. Such warning is probably not amiss just now when this question must be settled with one eye on the diplomatic consequences in Chili while the other is looking out for a cheap and ready source of needed nitric acid.

WHAT OF THE AFTERMATH?

EVERY UNJUSTIFIABLE RISE in prices brings us that much nearer to a peak from which descent is almost sure to prove disastrous. We need only go back to the history of chemical prices during World War I to recall the dizzy heights reached in that period of inflation. And anyone who had to liquidate high-cost inventories in 1920 and 1921 at ten cents or less on the 1919 dollar, knows how ruthless were the processes of deflation. This time, if at all possible, we want to avoid that terrible ordeal.

It is probably inevitable that some prices will rise. In a number of cases there may be adequate justification. But if this country is going to escape governmental control and the type of price-fixing that has been forced on all the warring nations of Europe, it is time that all industries try their best to forego reckless and unjustifiable increases. Chemical industry has already shown its desire for stability at fair-profit levels. Let us hope we can continue on that course during this emergency.

PREPARING FOR CONSCRIPTION

NEWS that chemical plant employees will not be exempted as a group from military service has been received with surprise in some quarters. Even though a chemical plant is an essential industry working on Government orders, the law expressly forbids any wholesale exemption of technical men. Each case will be decided individually. Actually "exemption" is not a good word to use in this sense. "Deferment" is the proper term.

Employers should note this important point because it means a number of things to them. They can never be certain that key employees will not be drafted six months hence so they are therefore allowed but six months to train substitutes. It thus becomes essential for every employer to take stock of his personnel. He should determine which men are most likely to be drafted and should make arrangements for replacements. In cases where replacement is very difficult or impossible, the employer should be prepared to apply to the local draft board for deferment of service for such individuals. It has been admitted by Government spokesmen that employers' applications are likely to receive greater consideration than employees'.

There is, however, no occasion for immediate alarm. It seems unlikely that the first draftees will be inducted into service before December 1. Meanwhile employers have an opportunity to formulate their policies in regard to military service. They are not required to "guarantee" the employee a job after his period of service; however, they must show just cause for not doing so. Many companies in the chemical industries have already announced policies of aiding the draftees in other ways as well. Most of them will maintain group insurance premiums. Many will pay the draftee two, three or four weeks' pay upon his induction. Some have even volunteered to make up the difference between Army pay and his former salary. A few have offered to contribute to the support of the draftee's family in case a married man should be drafted; however, it is improbable that men with dependents will be drafted in the present program.

Employers who show willingness to cooperate by adopting some of these policies will probably receive preferential treatment in their applications for deferment.

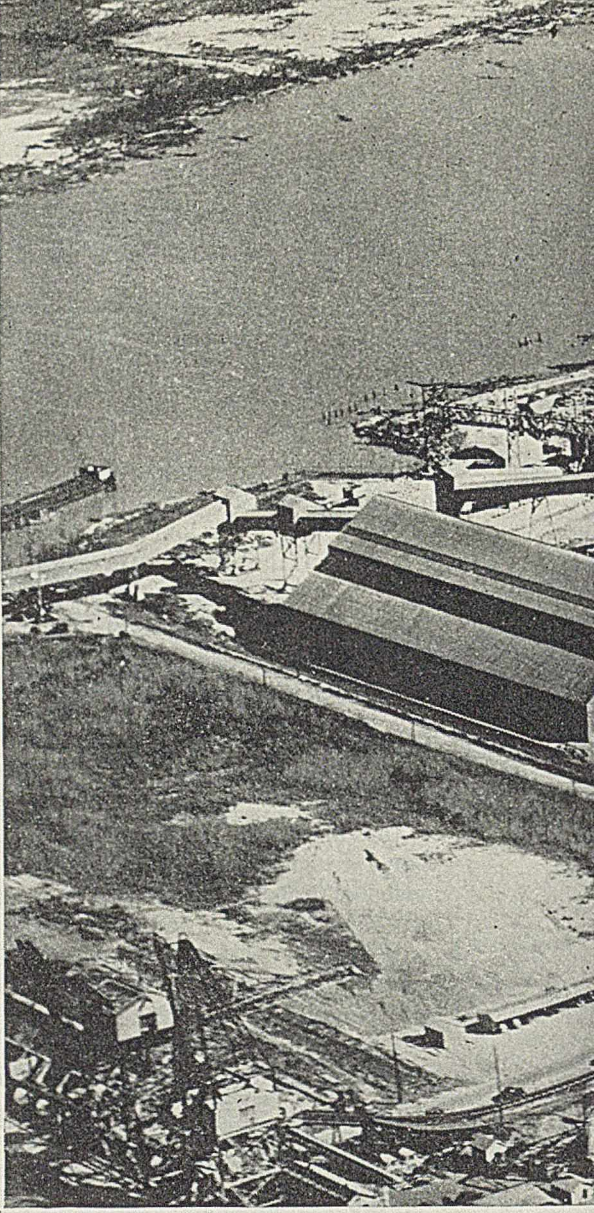
THE WATCHED POT

LIKE THE PROVERBIAL WATCHED POT, the national defense program seems as though it will never boil — at least that's the way the general public probably views the situation. Actual deliveries of warships, guns and explosives are still a long way off. But all this only proves that getting ready for a big military program takes time.

It is going to be a responsibility of many chemical process industries to take some part in explaining this situation to outside critics. Some delays seem inexcusable. Others represent inevitable time factors. There is an opportunity for cooperation between those of us who should understand the difference and the many outside of the industry who do not. We are a bit more likely to be believed when we say that it takes a full year to build a large explosives plant or even longer to complete research, development and final manufacture of an entirely new product for which new processes and equipment are necessary.

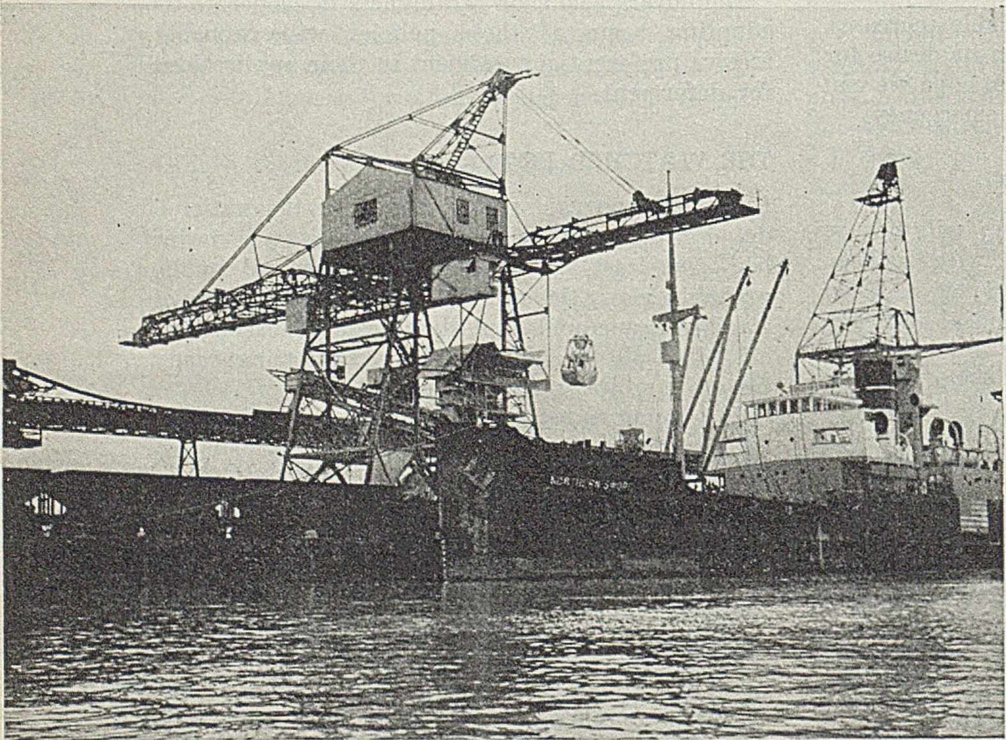
Making Alumina at Mobile

JAMES A. LEE *Managing Editor*
Chemical & Metallurgical Engineering



Chem. & Met. INTERPRETATION

This is an unusually splendid example of straight-line flow of materials, the raw materials entering at one end and the finished alumina leaving from the other. The layout differs from that usually seen. Here production is limited to a single product, and that is made in such an enormous volume that it is most efficient to house each step in the process in an individual building. Because of the tremendous volume of materials that must be handled conveying equipment has played an important part in this great plant.—*Editors.*

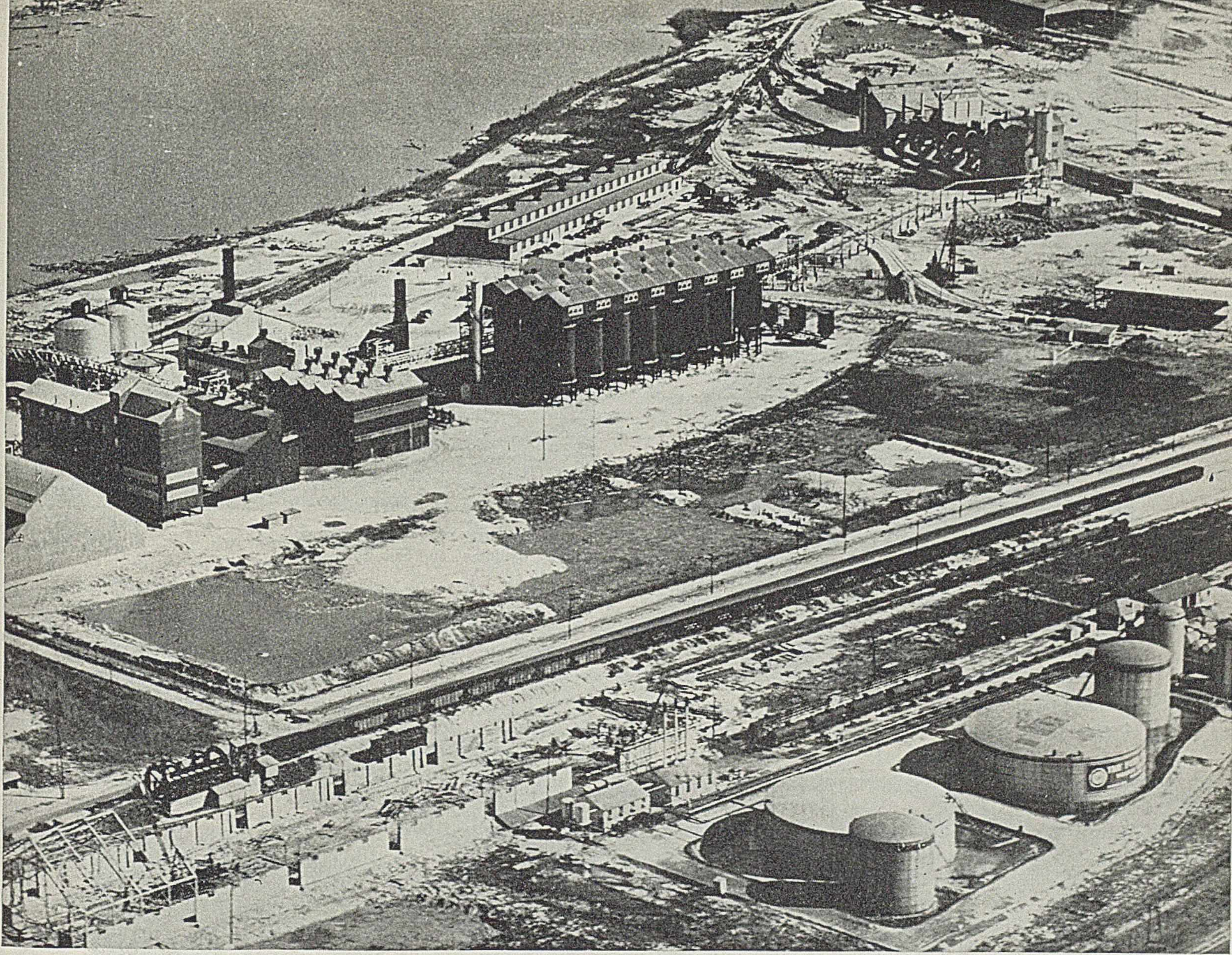


Bauxite from Surinam is unloaded at the Mobile plant of the Aluminum Company of America shown above

ONE OF THE GREAT NEW CHEMICAL PLANTS that is playing an important part in industrializing the heretofore agricultural South is that of the Aluminum Ore Company, a subsidiary of the Aluminum Company of America, at Mobile, Ala. Many of the plants are being located at the source of the raw materials of which the southern states have been so abundantly supplied by nature; however, in this case the plant site was chosen at the Port of Mobile because of its accessibility to the Company's ships bringing the raw material, bauxite, direct from deposits across the Gulf of Mexico.

The operations of the plant were planned so as to take full advantage of straight-line flow of materials, the raw materials entering at one end and the finished product leaving from the other.

The layout differs from that usually seen. Here production is limited to



a single product, and that is made in such an enormous volume that it is most efficient to house each step in the process in an individual building.

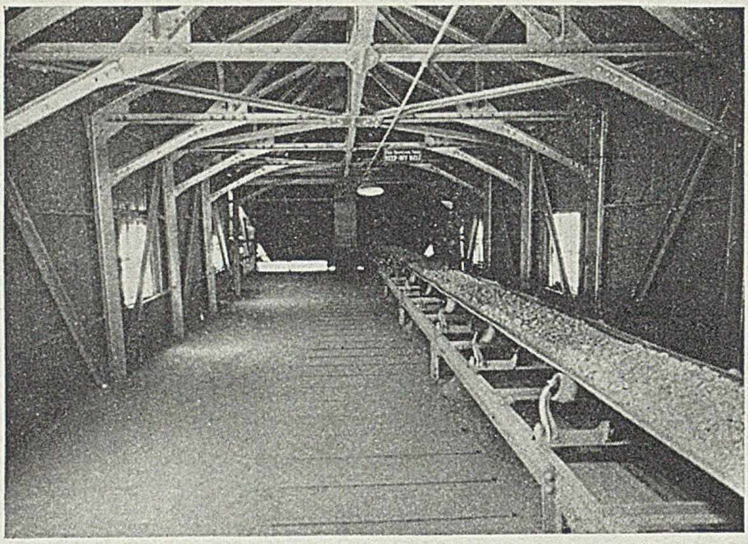
A plant site was selected along the river so that the bauxite could be transferred from ship to storage at the plant with a minimum amount of handling. It is sufficiently large to permit considerable expansion of the present manufacturing facilities. The first unit which was completed about two years ago was designed for a capacity of 500,000 lb. of anhydrous alumina per day, but the efficiency has been so far improved that the plant has exceeded this amount. The capacity of the plant at present is 1,000,000 lb. per day, although by Jan. 1, 1941, this capacity will have been increased 50 per cent.

The principal raw materials used in producing alumina are bauxite, lime, and soda ash. All of these can be obtained from domestic sources, but this plant located on tidewater secures its bauxite from Surinam. It is brought across the Gulf of Mexico in boats, through the Mobile River and Three-Mile Creek, where it is unloaded by the bulk-handling facilities of the Alabama State Docks. The clam-shell buckets and gantry cranes unload the bauxite onto a belt conveying system which discharges in an enormous storage building. A hopper in the floor of the building discharges the material onto another belt conveyor which carries the bauxite to the grinding building. All tramp iron that may be present is first removed by passing the ore over magnetic pulleys. It is then dropped into a primary hammer mill. The mill discharge is carried by screw conveyor and bucket elevator to the screen feed bins. These bins discharge onto vibrating screens which separate the fine material. The oversize tailings are conveyed to their special bins which feed two secondary hammer mills. The discharge from the secondary mills is also conveyed to the screen feed bins. The two-stage grinding is a closed circuit with the screens producing bauxite, 100 per cent of which has the desired fineness.

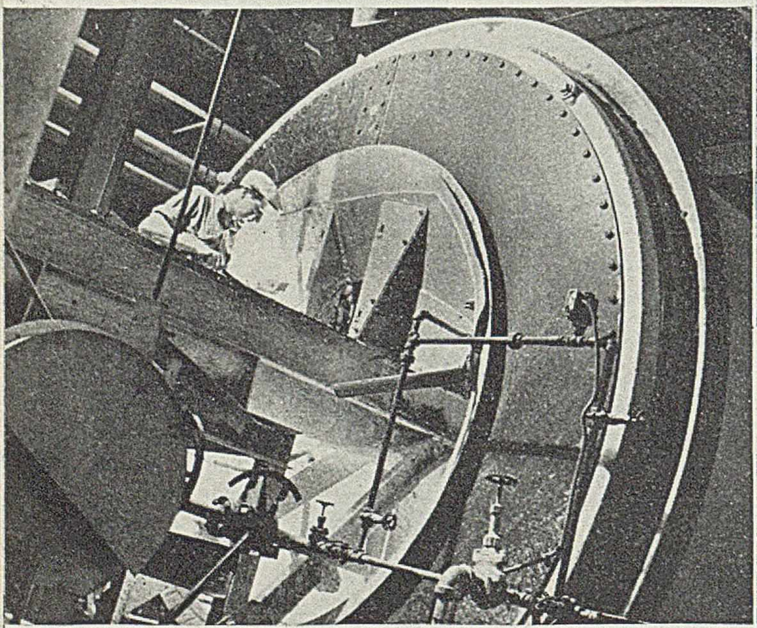
Lump quicklime is unloaded from freight cars by a track hopper onto a belt conveyor which also terminates in the grinding building. Grinding of the lime is done in another hammer mill. The two ground raw materials are transferred by screw conveyors and bucket elevators to the fine material bins located in the adjoining mixing building.

These materials are spouted by gravity through butterfly valves into weigh hoppers. Individual charges of bauxite and lime are weighed at regular intervals. The relative amounts depend on laboratory analyses of the bauxite and the liquor with

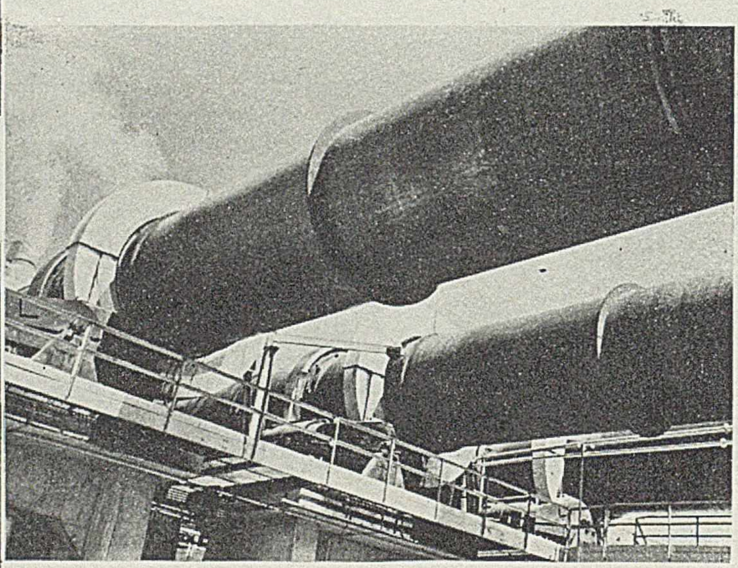
The aluminum trihydrate is separated from the spent liquor in thickeners



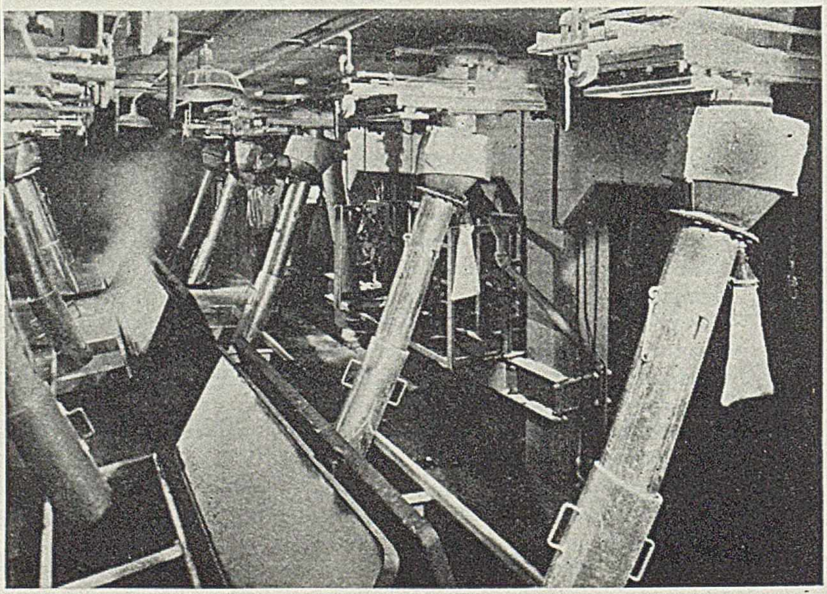
Bauxite is conveyed from the great storage building on belt conveyors



Aluminum trihydrate slurry is pumped to Dorrco filters where most of the moisture is removed. It is discharged from the filters into screw conveyors leading into calcining kilns



Trihydrate is heated white hot to drive of the chemically combined water



Loading alumina into special covered hopper cars to be taken to other plants to be reduced to the metal which it is to be mixed before being processed.

This liquor is a solution of caustic soda which dissolves alumina from the bauxite, forming a solution of sodium aluminate and leaving in suspension the impurities of the bauxite. Impurities consist principally of iron oxide, titanium oxide and silica.

An electric timer blows a signal horn at regular intervals. On this signal the operator drops the charge from the weigh hopper into a mixing vessel located below. A stream of liquor flows into this mixing vessel. Rotating paddles stir the contents of the mixer and a slurry is discharged from the mixer and pumped to the next building where the digesters are housed.

In the digesters the slurry is mixed with an additional volume of preheated liquor, and steam is injected to raise the temperature. The resulting thin slurry flows to a series of digesting vessels which are equipped with agitating paddles on central horizontal shafts.

During passage through the digesters, the mixture is held at elevated temperatures for a sufficiently long time to allow completion of the chemical reaction. This consists of the solution of the alumina as sodium aluminate and precipitation of dissolved silica in the form of sodium-aluminum silicate.

SODIUM ALUMINATE LIQUOR

On leaving the digesters, the sodium aluminate liquor with a suspension of impurities known as "red mud" passes through tanks where the pressure is reduced and the liquor is thereby cooled. The steam evolved is used in tubular heaters to preheat the liquor on its way to the digesters. Condensate from all tubular heaters is recovered for use as boiler feed, wash water for the subsequent product, and make-up for the mud washing system.

The suspension of mud and liquor is pumped to Kelly filter presses, the leaves of which are covered with cotton duck. The mud cake deposited on the press leaves is given a two-stage washing, after which the press is opened and the mud removed from the leaves by a stream of water from a rubber hose. The mud falls through hoppers into the mixing trough. From here the mud slurry is pumped to settling ponds located on Blakely Island across the Mobile River from the plant site. The overflow from the mud settling ponds is returned to the plant for use as wash water in the Kelly presses. The mud itself is a waste product at the present.

Liquor filtrate and weak liquor resulting from mud washing in the presses are conveyed through a trough to a filtrate tank located just outside the filter press building. From the filtrate tank the liquor is pumped to a series of elevated coolers.

Liquor from the coolers flows by gravity into a storage tank and is then pumped to the precipitation department. Further cooling is provided if necessitated by high atmospheric temperatures, and the liquor then goes to precipitating tanks. These are cylindrical tanks 24 ft. in diameter and 75 ft. high, in which means are provided for circulation of the contents. Each tank full of liquor is given a seed charge of previously precipitated aluminum trihydrate and circulated for from 30 to 60 hours. During this operation approximately one-half of the alumina content of the liquor precipitates as aluminum trihydrate and is deposited upon the seed charge particles.

When the circulation is stopped, the contents of the tanks are pumped into thickeners where the precipitated hydrate is separated from the liquor, the final clarification being accomplished by Dorr tray thickeners. Part of the hydrate which settles in the thickeners is returned to process as seed charges for subsequent precipitator tanks of liquor. Clarified liquor overflowing the tray thickeners has soda ash added to make up for the soda losses of the previous cycle. It is then passed through preheaters and returned to the process.

The balance of the hydrate is removed from the bottom of the thickener and passed through a series of washing thickeners. These thickeners are large tanks similar to those in which the hydrate is settled. On leaving each washing thickener the hydrate slurry is diluted with successively weaker wash water in a counter-current wash. The slurry of washed hydrate is then pumped to a storage tank in the calcining department.

From the bottom of this storage tank hydrate slurry flows by gravity to Dorrco filters which discharge into screw conveyors feeding the rotary kilns. These kilns are 9½ ft. by 250 ft. Natural gas is used as the fuel.

COOLING THE ALUMINA

The material leaves the kilns at 1800 deg. F. after having lost the chemically combined water as well as free moisture. The hot alumina passes through a refractory spout into a rotary cooler in which the temperature is reduced by a blast of cooling air. A large part of the cooler construction on the feed end is stainless steel. Hot air from these coolers supplies preheated air for the combustion in the kilns.

On leaving the coolers the alumina falls into a Peck conveyor which elevates it to the top of the shipping bin. It passes through vibrating screens before dropping into the bin so as to remove lumps.

ALUMINA IS SHIPPED

From the shipping bin the alumina is spouted into the top of specially designed steel hopper bottom cars spotted on a track scale. The cars have a capacity of approximately 75 tons, and are used to transport the product of this plant to the reduction plants of the parent organization, the Aluminum Company of America. These latter plants are located where hydro-electric power is available. In the loading department are also facilities for bagging alumina for shipment to other customers.

The plot on which the plant was constructed is sandy low ground which made it necessary to sink approximately 20,300 piles. At the present time, the level of the entire area is being raised several feet by means of sand deposited as dredge spoil from adjacent operations.

Machine shops and locker room-restaurant building are brick construction with book-tile roof. The boiler, air compressor, bauxite storage and calcining buildings are steel, covered with corrugated galvanized sheet. The grinding, mixing, digester, heater, filtration and precipitation buildings are covered with Robertson protected metal sheeting.

The last of these is unique, for only the operating floor which is at the top of the precipitating tanks is enclosed. These great 75-ft. tanks are in four rows of eight each. The operating floor of each is supported by steel beams fastened to the tank a few feet below the floor; they do not extend to the ground. While they are grouped and appear from the ground to be fastened together, each tank and its operating floor is separate. This is made necessary by the sway of the tanks when operated.

The writer wishes to take this opportunity to express his appreciation for the courtesies shown him on the occasion of his visit to the plant by Mr. Duncan Smith, general superintendent, and Mr. Richard S. Stokes, assistant general superintendent.

How Carbide Tests Equipment To Prevent Accidents

JAMES J. DUGGAN, *Director, Process Safety Department, Carbide & Carbon Chemicals Corp., South Charleston, W. Va.*

Chem. & Met. INTERPRETATION

Four-fifths of all serious injuries in chemical plants are due to mechanical causes, according to the accident prevention studies of the National Safety Council. It is highly important, therefore, that organized attention should be directed toward the elimination of mechanical hazards, especially those involving machinery and equipment. Carbide & Carbon Chemicals Corp. has done this effectively by setting up an independent Process Safety Department charged with accident prevention through periodic tests and inspection of its machinery and equipment. The work of this department and the benefits to be gained by this type of organization are presented here by its director in this abstract of the paper Mr. Duggan presented before the Chemical Section of the National Safety Council in Chicago on October 8, 1940.—*Editors.*

In 1934 the management of the Carbide & Carbon Chemicals Corporation decided to extend the scope of its safety work to reduce not only accident severity and frequency rates but to reduce mechanical failures and fire hazards. It was believed that the corporation could thus increase overall plant efficiency and help to assure continuity of production.

The theory was sound, and a separate department was established to originate and supervise test and inspection routines. This department was to be known as the Process Safety Department. Its direction was to be independent of those primarily in charge of production or equipment, thus allowing a free expression of opinion concerning the condition of the equipment and the character of its maintenance without being influenced by someone whose primary interests centered on getting maximum production or keeping maintenance at lowest cost. Freedom to state conditions exactly as found and to criticize constructively were considered the prime requisites for a successful test and inspection organization.

The Process Safety Department originated procedures based on sound engineering principles. The various code requirements, for example, were considered standard. Every source of information was utilized and where standard practice procedures were applicable to plant conditions they were included. The services rendered, however, were in no way intended to relieve a department supervisor of the responsibility for the safe operation or maintenance of his equipment. The procedures were intended:

1. To establish a system for periodically testing and inspecting all machinery, equipment, and safety devices.

2. To eliminate a possible cause of fire, explosion, or accident through decreasing the likelihood of any mechanical failure of equipment.

3. To record all tests, inspections, and repairs by providing suitable report forms and record systems for future reference.

4. To circulate all reports and information compiled to the department heads and all other interested persons that they may know as nearly as possible the condition of equipment.

5. To establish safe operating pressures by standardized re-test pressures and procedures, making each successive test or inspection identical, thus giving means for determining the exact conditions of equipment based on past tests.

6. To provide proper tools, instruments, and such other equipment as may be found necessary to carry on the test and inspection work as thoroughly and efficiently as possible.

7. To correlate corrosion rates and estimate the life of all equipment and to recommend the replacement of old or defective equipment before it actually fails in service.

8. Through the data thus compiled, to be of assistance in the establishment of design, construction, and maintenance standards.

9. To study the design of new equipment and plant layout in an effort to eliminate the repetition of conditions found to be hazardous.

10. To effect cooperation between production, maintenance, engineering, and inspection forces that each might benefit by the experience of the others.

11. To keep the plants perpetually new through the replacement of defective equipment or machinery.

The application was not found as difficult as originally anticipated. Investigation revealed the fact that a large portion of the necessary work was already being done. Efficient repair work was effected through the existing maintenance departments. Tests of some nature were being made following each repair for the purpose of determining the fact that satisfactory repairs had been made. Various inspection schedules had been established for the convenience of department heads. The record of such work, however, was very incomplete and lacking in detail and thoroughness. To make a long story short, much effort was being exerted with little benefit. Therefore, when definite procedures were put into effect the actual work performed was not materially increased and the small increase necessary was soon justified. When properly organized the total time chargeable to process safety work, which includes all fire protection work, is less than ½ of 1 per cent of the total plant man-hours.

Such a system, applicable to any type of industry, may be summarized as follows:

1. It must have the approval of the management.

2. The system for gathering data must be routine, specific in requirements, and efficient in operation.

3. Complete cooperation between all plant departments is essential to insure compilation of all data.

4. A report must be made of each repair as well as each test and inspection. Information concerning operating irregularities are valuable also in compiling an accurate service record. These reports must become a part of the record system.

5. A means of identification of all machinery and equipment must be provided. For example, equipment can be grouped such as motors, compressors, boilers, stills, etc., and numbered in rotation either by department or installation.

6. All test and inspection work must be under the supervision of one department to eliminate repetition and to insure complete coverage and the following of approved procedures.

7. All equipment should be prepared for test and inspection by the maintenance department mechanics or operating department personnel. This arrangement eliminates the necessity for duplication of effort. The actual test, however, must be applied, or at least supervised, by an authorized inspector.

8. Inspectors should confine their efforts to a detailed analysis of the present condition of equipment in order to establish the rate of corrosion or deterioration and the safe operating life of the equipment. When this information is passed on to the maintenance and design departments it will assist them materially in deciding the proper repair and/or change in design for future installations.

9. The reports submitted should form a "service record" of each individual piece of equipment and be kept in a convenient place accessible to all interested persons. If necessary, duplicate systems may easily be maintained.

10. When periodic test and inspection reveals equipment to be unsatisfactory for the operating conditions to which it is subjected, it should be removed to a less severe service or condemned and completely removed from service. This decision is reached by applying sound engineering principles, and by consultation with the plant engineering and maintenance engineering departments.

All information should be circulated to or made available to all units of a plant or plants within a corporation that they may judge similar equipment in similar service under their supervision. With this information available to maintenance and design engineering groups, future plant extensions or replacements can be made to the best advantage eliminating the repetition of hazardous conditions and assuring more efficient plant operation. Inefficiencies in the design and fabrication of machinery and equipment can many times be rectified if detailed field experience as reflected in the service record is called to the attention of the supplier.

The results to be obtained from a program of periodic test and inspection are far-reaching. The experience of the Carbide and Carbon Chemicals Corporation has proved that fact beyond a doubt. The equipment is better maintained and the personnel has been better educated as to mechanical limitations. A brief summary of this program as outlined indicates that:

1. Plant machinery and equipment have been operated more efficiently.

2. The plants have been provided with an additional means of fire prevention.

3. A continuing service record has been provided for all equipment.

4. Data have been compiled for future design and maintenance.

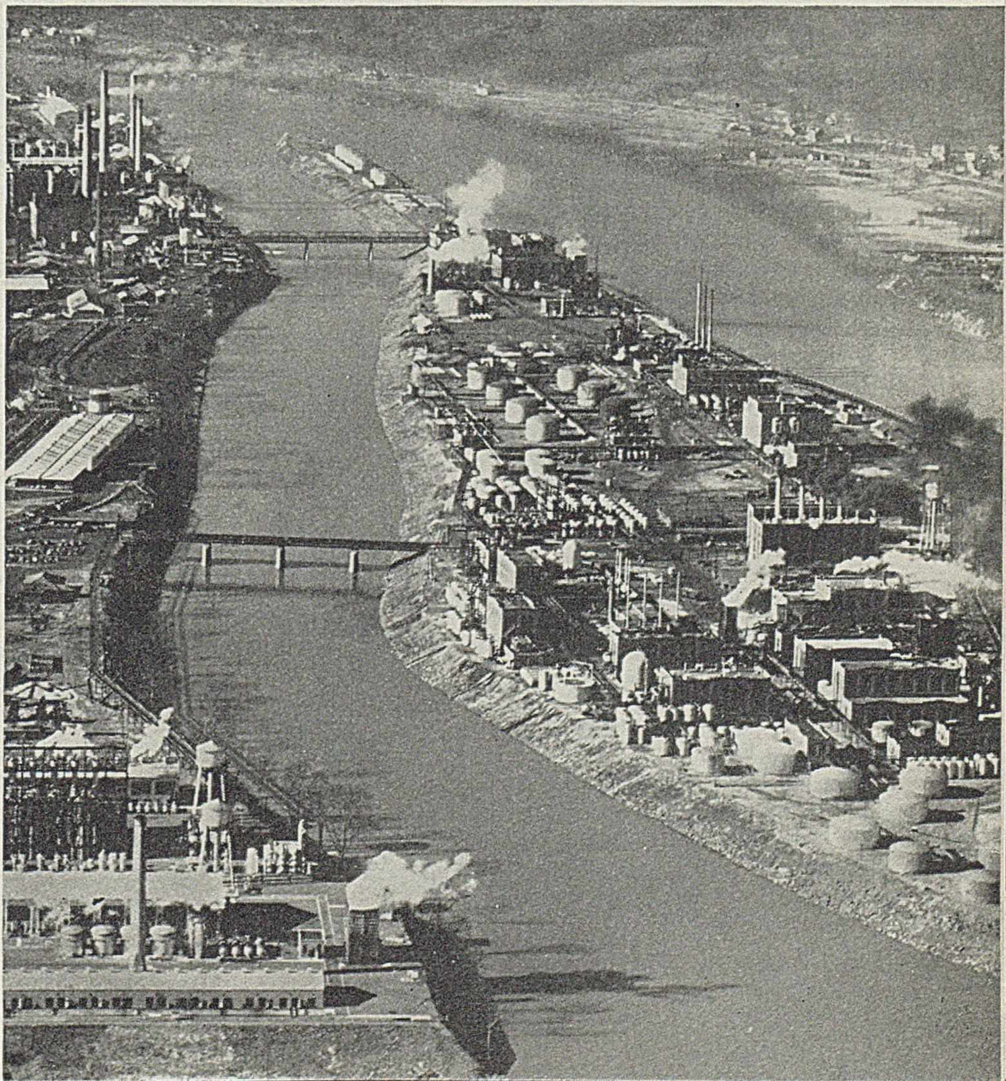
5. A means of education of the plant personnel has been effected through the circulation of detailed reports giving to them information heretofore not available as to the condition and limitations of equipment under their supervision and control.

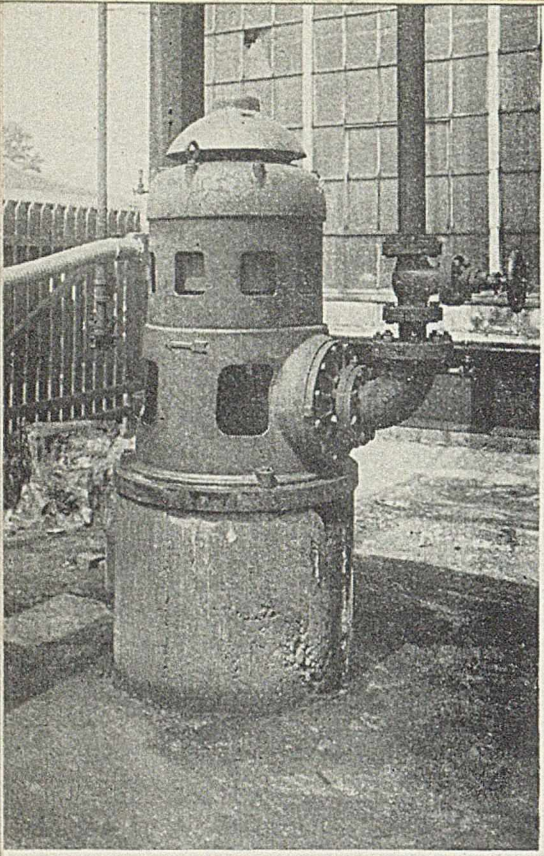
6. Overall plant efficiency has been increased.

7. Accidents have been prevented.

In a final analysis based on personal experience, I have found no excuse for accidents, that they can be eliminated, that prevention measures are economically sound and that there is enough available information on the subjects involved which, if applied to individual or specific problems, will enable any organization successfully to carry out an accident prevention program.

Safety is the No. 1 consideration at Carbide's famous chemical plant





This Sterling deep well turbine pump is one of 18 pumping from a depth of 700 ft. for the Westvaco Chlorine Products Co., South Charleston, W. Va.

Water Supply Equipment in the Process Industries

GRAHAM L. MONTGOMERY
Associate Editor, Food Industries, New York, N. Y.

Chem. & Met. INTERPRETATION

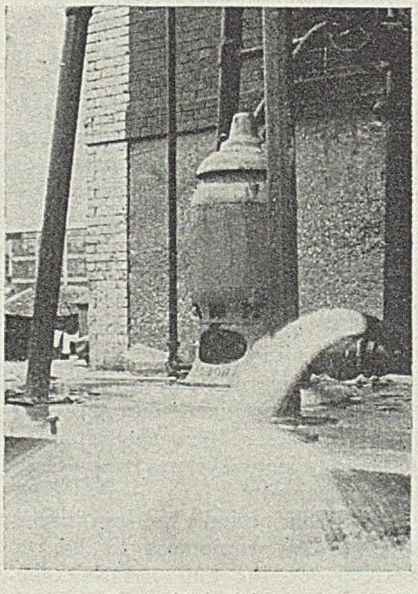
Suitable and economical sources for water is a problem that has recently come to the fore with many process industries. Increasing water costs owing to shrinking supplies, and the need for establishing plants in new locations for normal expansion or defense purposes, are among the causes for this interest. In the first article of this series, in September, the author discussed water requirements for process industries, and also the types of water supplies in various parts of the United States. This second paper deals with modern methods of water supply pumping. The third and concluding article, to be presented in our December issue, will have as its subject the solution of typical pumping problems in handling water and other liquids in processing, as distinguished from primary water supply pumping, as in the present article.—*Editors.*

PUMPING of water supplies for industrial plants has undergone considerable change during the past 25 years. At the beginning of that period, water pumping equipment was greatly different from that now usually seen in plants of the process industries. Wells were usually pumped by some form of reciprocating pump or by air-lifts and, while centrifugal pumps were beginning to appear in this service in considerable numbers, neither in design nor application could today's economies be realized.

Modern water supply methods are based in large part upon experience obtained in the supply of water for municipal and agricultural purposes in the more arid regions of the United States, like California and the Southwest. There, where most surface streams disappear during the yearly dry season and with few natural lakes to draw on, the meager supplies provided by impounding the scanty rainfall soon proved insufficient. Recourse was first had to shallow wells, which served for a time. Soon, however, the water level in these wells receded and it became necessary to tap the large supplies of groundwater lying at deeper levels.

As the depth of wells increased, the designers of well-pumping equipment were forced to develop pumps that would operate economically and without undue maintenance requirements at these deeper levels. The suction lift at which a pump can operate effectively is strictly limited, so that it became necessary to place the pump down in the well. As a result, the pump was compelled to raise the water to a greater discharge height, in which the distance from the pump in the well to the surface of the ground was added to the height (head) to which the water had to be raised above ground.

This evolution in design resulted in the development of the vertical deep well turbine pump, which because of its relatively high efficiency and its trouble free operation, has more or less pre-empted the field of well pumping. Modified designs of vertical pumps, suitable for pumping water at lower heads, were developed because of the success of the



Pomono deep well turbine pump operating on a head of 480 ft. in a chemical plant at Fort Worth, Texas deep well pump. More recently, vertical pumps have begun to be applied to many pumping operations other than water supply, because of their characteristics of good performance, low maintenance, small floor space requirement and self-priming operation.

Various pump manufacturers give these vertical pumps a variety of names, but the nomenclature of the Pomona Pump Co. will serve for illustration. The three important classes, according to this company, are the deep well turbine pump, the mixed-flow pump, and the propeller pump. The deep well turbine pump is essentially a centrifugal pump of the "turbine" type in which the water enters at the inner periphery of the impeller and, on leaving the outer tips of the impeller blades, passes through vanes which convert into pressure the velocity imparted to the water by the impeller. Since wells are limited in diameter, the diameter of the pump and hence the pressure head created by one impeller and set of vanes is also limited. Therefore, deep well pumps are usually made up of a series of turbine pumps, or stages, one above the other, so arranged that the discharge of the first stage enters the suction of the second stage, and so on.

A three-stage deep well turbine pump, arranged for direct-connected electric drive with surface discharge is shown in Fig. 1. As indicated by this sketch, the deep well pump is normally set in a well lined with a metal casing that is pierced in its lower portion to admit water from the water-bearing strata of the ground. Below the first stage of the pump is a bearing to hold the stub end of the pump shaft and a strainer to keep coarse grit out of the pump. Above the last stage of the pump a "column" or tube extends up to the top of the well, where it is rigidly secured. This column serves as a delivery pipe to conduct the water that is being pumped to the top of the well. It also serves as a means of support for the shaft bearings and it carries the weight of the pump. Discharge at the top of the well can be piped up to suit the installation. The pumping unit is submerged in the well to a point below the water level.

Deep well turbine pumps also can be driven from engines through gearing, or can be belt-driven from engine or motor.

A recent design of motor-driven deep well pump, shown in Fig. 2, is equipped with a submersible motor, instead of being driven from above as is the pump in Fig. 1. This design avoids the use of the long shaft extending down from the top of the well. Consequently there are fewer bearings, less friction loss and, where the well is not straight, there is avoidance of excessive wear on

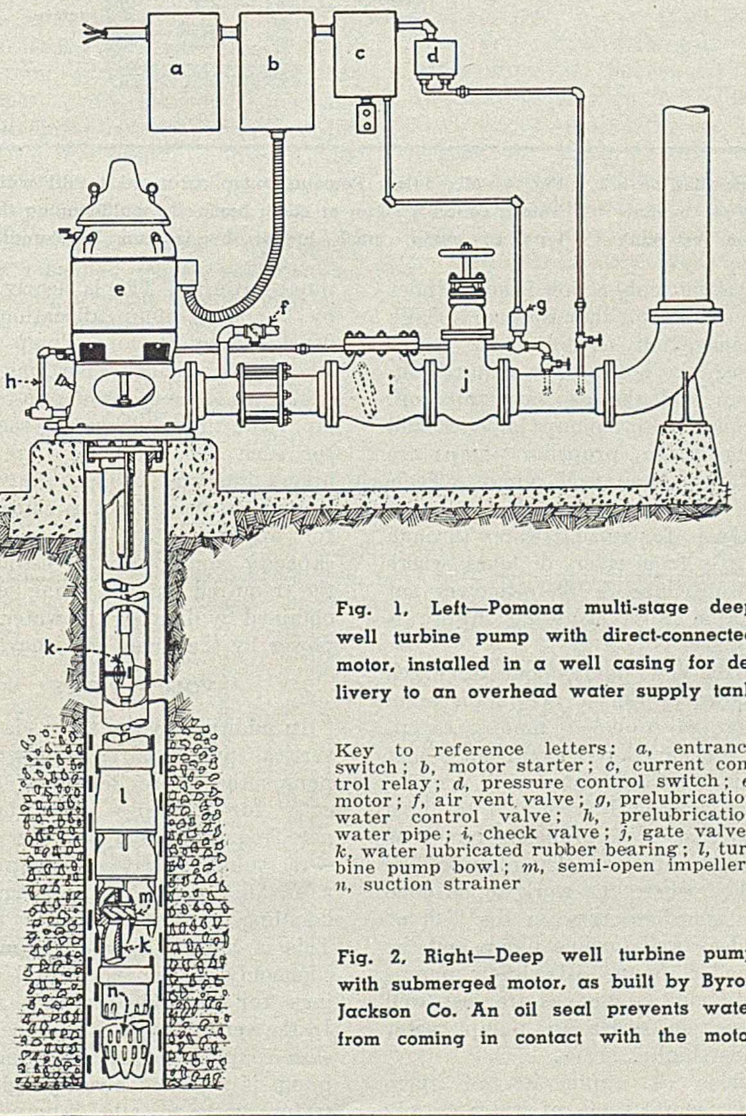
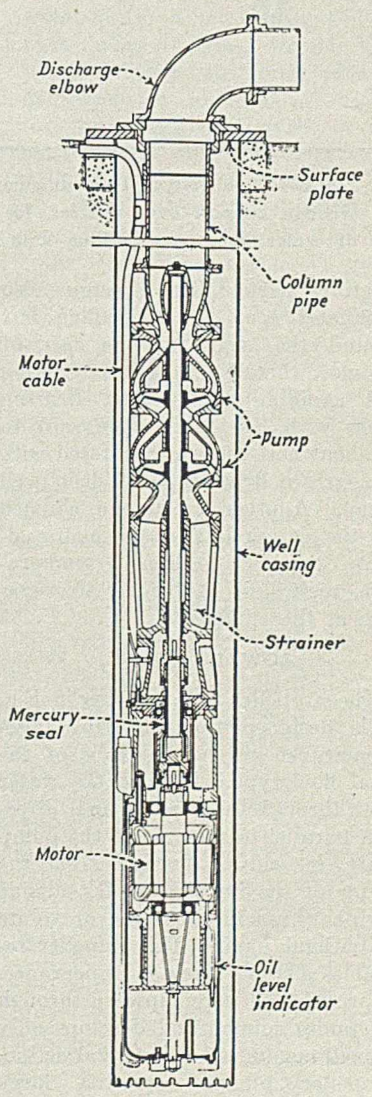


Fig. 1. Left—Pomona multi-stage deep well turbine pump with direct-connected motor, installed in a well casing for delivery to an overhead water supply tank

Key to reference letters: *a*, entrance switch; *b*, motor starter; *c*, current control relay; *d*, pressure control switch; *e*, motor; *f*, air vent valve; *g*, prelubrication water control valve; *h*, prelubrication water pipe; *i*, check valve; *j*, gate valve; *k*, water lubricated rubber bearing; *l*, turbine pump bowl; *m*, semi-open impeller; *n*, suction strainer

Fig. 2. Right—Deep well turbine pump with submerged motor, as built by Byron Jackson Co. An oil seal prevents water from coming in contact with the motor



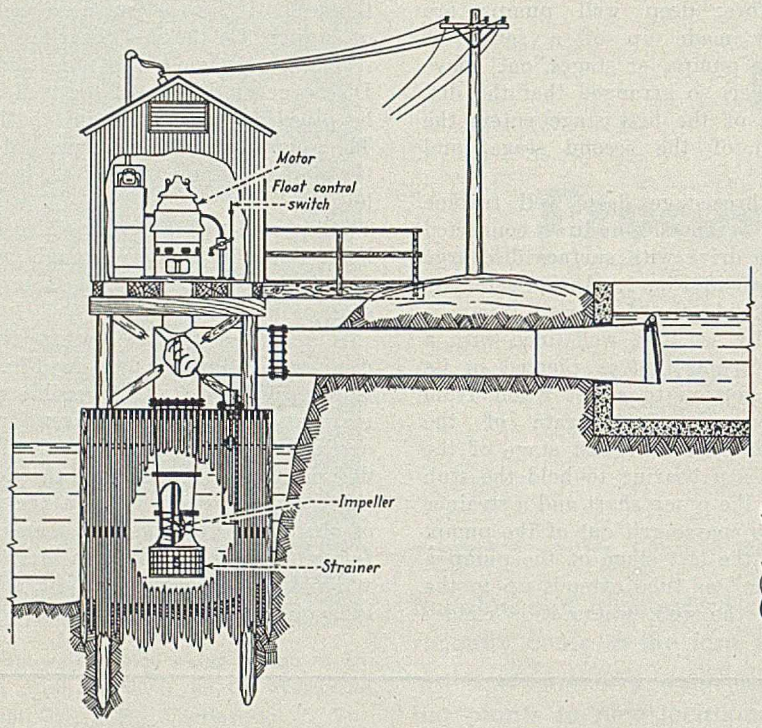


Fig. 3—Propeller type Pomona pump shown installed on a wooden support over a river, for lifting large amounts of water to a reservoir or tank situated on the bank

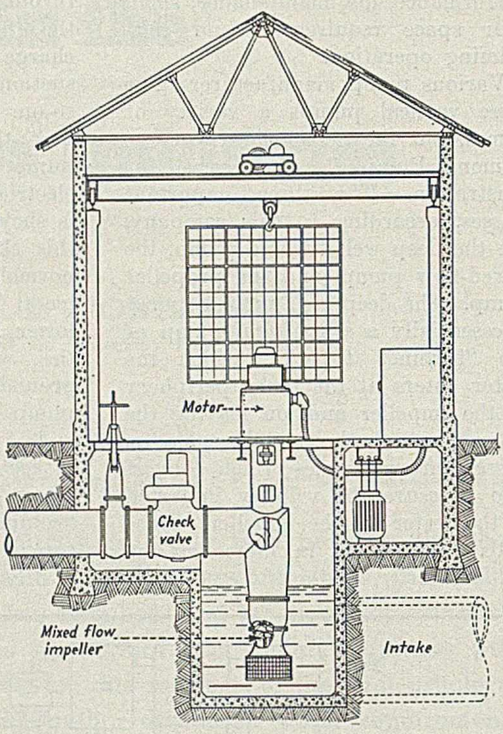


Fig. 4—Mixed-flow Pomona pump arranged to lift water from a concrete sump or catch basin. By multi-staging this type of pump, much higher heads can be handled

rotating parts. This design also eliminates need for a stuffing box around the shaft at the top of column, thereby reducing friction and avoiding any leaks. Bearing loads with this pump are said to be about half those encountered with the surface drive type of deep well pump. Another advantage claimed for the design is that the motor always operates at the same temperature, regardless of the air temperature at the surface.

LOW-LIFT PUMPS

The propeller pump shown in Fig. 3, is designed for delivering large capacity at low heads. It is of the axial flow type. That is, the water flows through the impeller in a direction parallel to the axis of the pump shaft, instead of flowing from the center of the impeller to its outside periphery, as in a turbine or volute centrifugal pump. This impeller resembles a ship's screw in appearance. It propels the water upward through the pump column and develops only a small amount of centrifugal action. Propeller pumps can lift large quantities of water compared to other pumps, but only at low heads. Under such conditions, they operate at high efficiency, but as the head is increased, the horsepower required increases and the capacity falls off. Except for the pump impeller and casing design, propeller pumps are similar to deep well pumps. Their main use in process industry water supply is for raising water through low lifts from rivers or lakes, where the water level is likely to vary but where a fairly constant supply is necessary.

Mixed-flow pumps, one of which is shown in Fig. 4, are in the main similar to propeller pumps, except that the impeller is modified, so that a pump of this type will produce a pressure head from two to three times that of a propeller pump of corresponding size. These pumps are applied where the work to be done is intermediate between the field of the deep well turbine pump and the propeller pump. Mixed-flow pumps can be multi-staged, as are deep well pumps, in order to pump water against higher heads.

Fields of application of these three general types of water supply pumps overlap. This is clearly shown by Fig. 5, a pump allocation chart developed by Pomona Pump Co. in which the shaded portions show where the three types of pumps overlap. The limits shown on the chart for each type of pump are based upon Pomona design, but other manufacturers offer the same types for approximately the same head-capacity conditions. An estimate of the required motor rating can be obtained by dividing the water horsepower by the pump efficiency.

VOLUTE PUMPS

In addition to the three classes of vertical pumps already described—pumps that were developed specifically for handling water but are now frequently used for other liquids—the volute centrifugal pump is also used, in vertical mountings, for handling water and other liquids. This is the same type of pump so commonly used in horizontal mountings for general pumping service. In the vertical type, it may be of the close-coupled design in which the pump is mounted directly below the motor, or the so-called "sump" pump design shown in Fig. 6 may be used, in which the pump is suspended from the motor base on a column of suitable length. In water supply work, these vertical volute pumps are adapted to installations where a suction lift is involved and are suitable for suction lifts up to a maximum of 20 ft.

Capacity for a deep well turbine pump will range up to about 10,000 gal. per min., while head will range from 50 to 800 ft. With the low-lift, propeller-type of vertical pump, capacities range up to 100,000 gal. per min. for a single-stage pump, with heads up to about 25 ft. Mixed-flow vertical pumps have capacity and head ranges between those of the deep well turbine and propeller pumps. The capacity and head range of volute centrifugal pumps will vary with the design and size. One well-known line has capacities from 20 to 450 gal. per min., with a head range from 60 to 250 ft.

VERTICAL PUMP APPLICATIONS

As indicated by the information given on the various classes of vertical pumps, equipment is available to meet with low operating and maintenance costs the water supply needs of any process industry plant. This equipment has undergone many years of development, with resulting improvement to the point where its reliability in service may be depended upon by the process industry plant needing definite quantities of water without interruption (see *Chem. & Met.*, Sept. 1940, page 622).

The ordinary application of this pumping equipment presents no difficulties not already solved in supplying water for municipal purposes, or in irrigation or other fields where vertical pumps are now the accepted means of water handling. Where deep wells are the source of supply, it is necessary to go to greater expense than when the supply is from shallow wells, because both the construction of the wells, and the deep well turbine pumps, cost more than is the case with shallow wells and pumps of lower head range. However, these deep wells are a necessity in some regions because no other adequate source of water is available.

Another reason for using deep wells as a source of water is the necessity for a supply at a low temperature. Water from streams, lakes or shallow wells will vary in temperature as the seasons change and may be as high in temperature as 90 deg. F. during the hot months. When cool water for use in condensers, cooling coils and like processing equipment is needed in large quantity, it may prove to be a saving to invest in a deep well and the necessary pumping equipment to supply naturally cool water rather than to depend on artifically cooled water.

However, in choosing a water supply, it is advisable to keep in mind that ground waters are likely to be harder and to have a greater mineral content than surface waters. This is particularly true in most of the states situated "between the mountains" and "away from the coasts," where considerations of national defense are causing many of the new process industry plants to be erected. This fact was brought out in the first article of this series (see *Chem. & Met.*, Sept. 1940, pp. 622 to 625, and particularly the table on p. 624).

Hard waters and those of high mineral content must be treated before they are suitable for use in many process industries. Even when such water does not enter into the process in any way, but is used only in cooling equipment, boilers and the like, its use may cause serious problems through the scaling up of equipment or stoppage of flow in pipe lines. For example, in a coal products plant in Indiana a new well was sunk to augment an insufficient water supply and to provide cool water to use in new cooling coils that were being installed in the benzol plant. Within two months, the coils had been so reduced in efficiency through scale formation that a different source of water had to be sought. And, incidentally, the cost of removing about 3/16 in. of flint-like scale from hundreds of feet of pipe in the coils drove home the lesson that it pays the chemical engineer to give thoughtful attention to the quality of his water supply.

Vertical pumps have not been so widely applied by industrial plants for pumping water from shallow

Fig. 6—Vertical "sump" type pump using a Sterling volute centrifugal suspended by a column from the plate supporting the motor

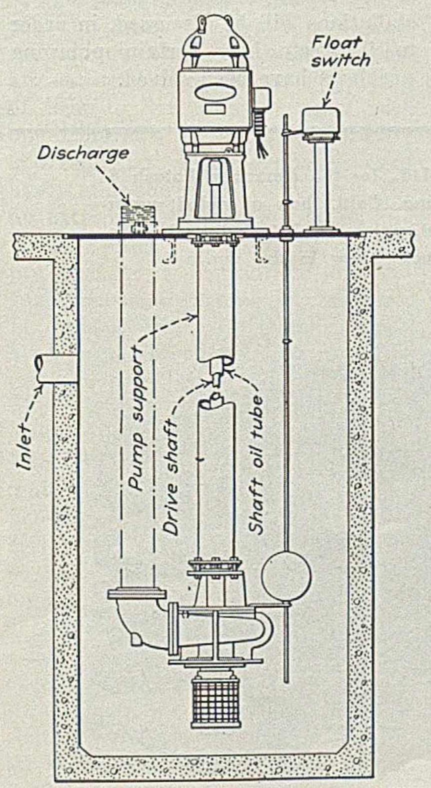
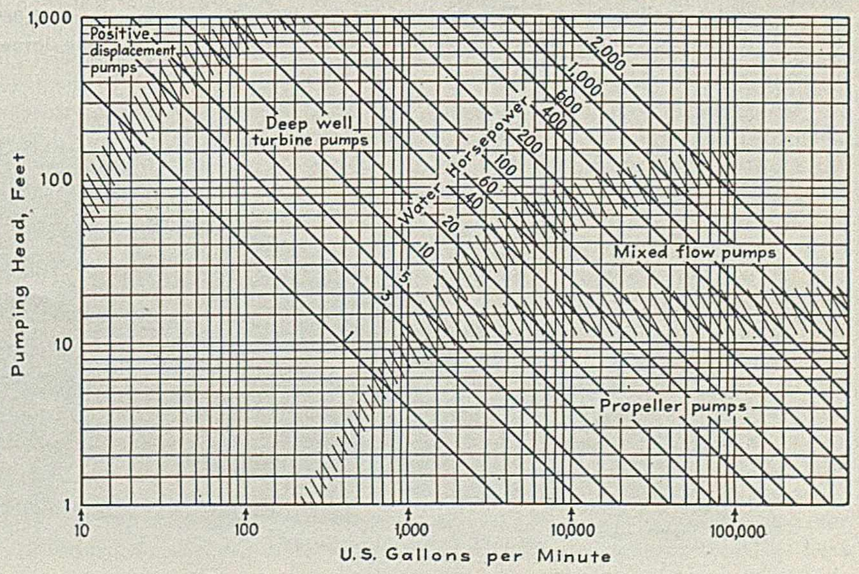


Fig. 5—Diagram developed by Pomona Pump Co. to show fields of application of deep well turbine, mixed-flow and propeller type pumps as used in water supply. Shaded portions show where the three types overlap



wells, streams and lakes as have horizontal pumps and other types of pumping equipment. However, such applications are now being made more frequently, not only because of the suitable characteristics of the pumps, but also because of the relatively low cost of installation. Vertical pumps can be suspended from a small and inexpensive structure in comparison to the foundation needed for horizontal pumping equipment of equal capacity and head.

SOME NOTABLE INSTALLATIONS

Near Fresno, Calif., a pumping installation supplies over 2,000 gal. per min. of cooling water from the San Joaquin River. Three vertical pumps are installed, each of 750 gal. per min. capacity at 362 ft. head. These pumps are seven-stage deep well turbine pumps, operating at 1,750 r.p.m. and each driven by a direct-connected 100-hp. motor. The pumps are installed over the river on a platform that is 50 ft. above normal water level. This platform and the walkway connecting it to the river bank are of trestle construction. While the whole structure is light in weight and inexpensive, it is ample to support the pumps on a level with the bank and above any possible high water. Such a construction is much less costly than the elaborate structure and precautions against flood that would be necessary if pumps of horizontal type had been used, rather than the vertical pumps that were selected.

In Southern California, near Los Angeles, a supply of water was sought from the normally dry bed of the San Luis Rey River. It was known that an ample supply of water existed below the river bed, so that a well in the river bed would tap a constant source. However, at certain times the river bed is subjected to flooding and any well in it had to be protected from contamination by flood waters and from scouring by flood, while the pumping equipment itself and its electric connections needed to be proof against flood damage.

In solving this problem, an 18-in. diameter well casing protected by a steel and concrete covering was extended to a depth of 42 ft.—below any possible scouring action of floods. In this casing is a 14-in., two-stage deep well turbine pump of 1,000 gal. per min. capacity at 60 ft. head. Motor drive for the pump is by a submerged motor below the pump unit, supplied with power from a cable buried 12 ft. deep beneath the river bed.

Above the river bed level, the well is capped with a steel housing, 26 in. in diameter and cylindrical in shape. This offers a minimum of resistance to flow of the stream during floods and to impact of flood debris. The discharge line from the pump is carried out of this steel structure and extends down to a point 12 ft. below the river bed where it runs through the same trench with the power cable, secure from damage.

While this water supply could have been secured in some other manner, the advantage of the method selected is evident from the simplicity of the work that had to be undertaken in the bed of the river in order to secure protection during periods of flood.

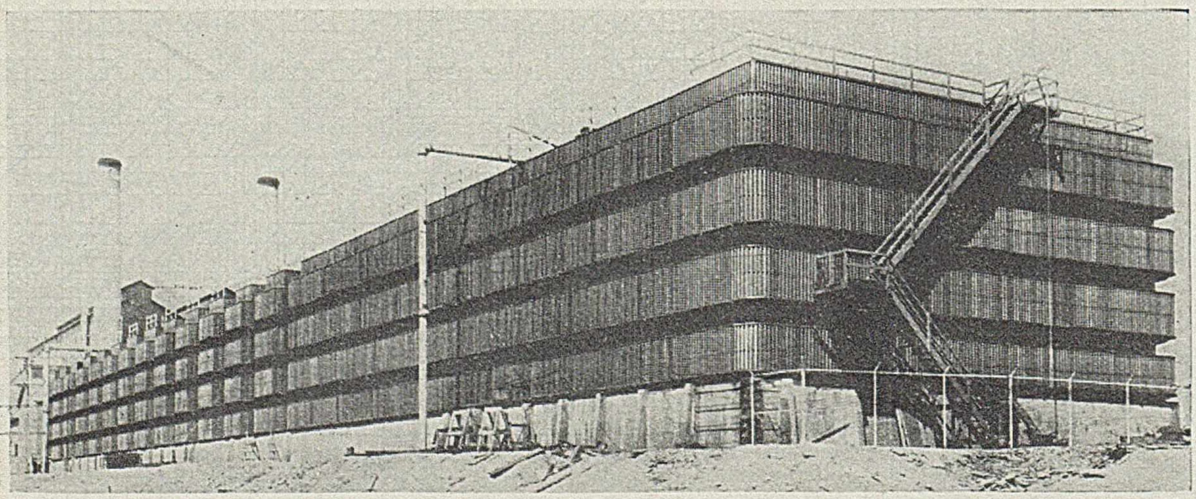
An unusual water supply, involving the use of two pumps in one well, has been installed in Riverside, Calif. The purpose of this installation was to provide a supply at three different rates of delivery, with a minimum of expense for both wells and pump-house.

UNUSUAL PROBLEMS

The well is 468 ft. in depth. For the first 50 ft. its diameter is 36 in., reduced to 20 in. for the remainder of the depth. Two deep-well turbine pumps, one of 1,200 and the other of 2,400 gal. per min. capacity are installed side by side in the well, each with a total head of 230 ft. Thus the installation has capacities of 1,200, 2,400, or 3,600 gal. per min., all at maximum efficiency. The reinforced concrete pump house necessary to accommodate this installation is only about 21x13 ft. in outside dimensions.

The three examples just given well illustrate how readily standard designs of vertical pumps can be adapted to unusual or difficult problems of water supply. In the same way, vertical pumping equipment, sometimes of standard and sometimes of modified design, is adaptable over a wide range of pumping problems occurring in the handling of water as well as other liquids in the course of processing operations. In the concluding article of this series, a number of these processing pumping installations will be discussed, in order to illustrate how certain pumping problems have been solved.

Where ground waters are too hard, frequently greatest economy can be achieved through the use of a water cooling tower. This modern aerator type atmospheric cooling tower, which was recently erected by The Fluor Corp., Ltd., for the American Potash & Chemical Co., at Trona, Calif., has a cooled water capacity of 25,000 gal. per min. It is believed to be the largest such tower in the world



Notes on the Design and Operation of a High Temperature Dowtherm System

RICHARD E. HULME *Chemical Engineer, Bradford, Pa.*

Chem. & Met. INTERPRETATION

Many high temperature heating processes are now being carried out through the use of indirect heat transfer media such as Dowtherm. Compared to direct heating, any vapor medium makes possible much closer control, usually with marked improvement in yield and quality of the product. In comparison with steam, however, Dowtherm vapor permits temperatures up to about 700 deg. F. at relatively low jacket pressures and still without appreciable deterioration of the medium. However, many new problems in design, materials and technique are thus introduced. The complex and interesting installation described herein furnishes much valuable information applicable in similar forthcoming installations.—*Editors.*

Success of certain chemical or physical chemical reactions depends largely on the maintenance of uniform temperature conditions. To obtain uniform temperatures heat must, in most cases, be either added or removed depending on the results desired. In the cases where heat is to be added the use of condensing vapors to supply the heat has a number of advantages. In high temperature systems, that is, in the temperature range of 450 to 700 deg. F., certain materials such as diphenyl, the Dowtherms and similar materials offer certain economic advantages over steam or direct heat.

Some time ago the writer had occasion to design such a system using Dowtherm "A" (eutectic mixture of diphenyl and diphenyl oxide) as the heat transfer medium. The unit as finally evolved has operated successfully between the temperature limits of 400 and 700 deg. F. for over a year. In arriving at the final design it was necessary to satisfy such limiting conditions as control of condensing temperature within plus or minus 2 deg. F.; definite restrictions on tube wall temperatures; the simultaneous supplying of heat to five different users each operating at a different temperature and requiring differing quantities of heat; and above all, provisions for an extreme degree of flexibility.

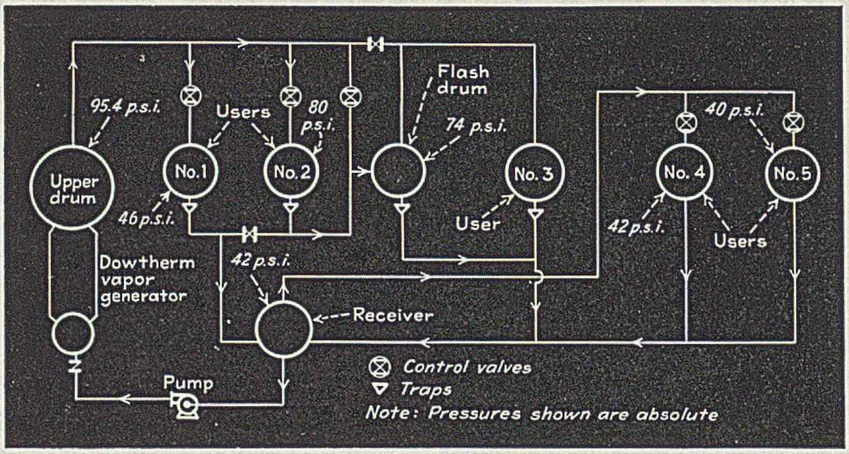
The system was designed to supply heat to a distillation unit engaged in close fractionation work. It replaces the conventional direct-fired furnaces commonly used in the petroleum industry in distillation work where temperature requirements preclude the use of steam. Fuel efficiency may be greater or less than with direct-fired equipment, depending largely on the complete design. Multiple flashing as here described makes it possible to obtain higher efficiencies than with a conventional Dowtherm system.

The unit was built out-of-doors except for some of the instruments which were all assembled inside a control room. It consisted of a Foster-Wheeler Corp. Dowtherm vapor generator with a rated capacity of approximately 1,600,000 B.t.u. per hour; five users or heaters with auxiliary equipment, a flash drum, a receiver and a pump. Dowtherm vapors at 95.4 lb. per sq. in. absolute (690 deg. F. saturated) pass from the generator through a 6-in. vapor line to two users, as in the flow diagram on the following page. The condensing pressure in each of these users is controlled by means of air-operated motor valves actuated by Foxboro pressure controllers. The Dowtherm condensate from these users discharges through two Hanlon-Waters drainer traps to a flash drum.

Pressure conditions are such that a little over 60 per cent of the entering condensate flashes into vapor in the flash drum. The balance of the vapor required to maintain pressure is admitted to the flash drum from the 6-in. main through an air-operated, motor-valve pressure controller, similar to that mentioned above, actuated by the flash drum pressure. The vapors from the flash drum supply heat to a third user. The condensate from both the flash drum and third user discharges through two Armstrong bucket type traps to a Dowtherm receiver. The pressure in the receiver is usually held low enough to allow from 15 to 20 per cent of the condensate reaching it to flash into vapor. The vapor thus formed is fed to two users, one of which is controlled by the desired condensing pressure in the user. The fifth user takes only the excess vapor, thus maintaining the receiver pressure constant. Both users are located above the receiver so that the hydrostatic head in the condensate return lines to the receiver make it possible to operate them at pressures a few pounds lower than the receiver pressure. If more vapor is required than is obtained from flashing it may be had by a small connection from the 6-in. main to the receiver.

The receiver acts as final receptacle for the liquid Dowtherm before it is pumped back into the vapor generator. It also acts as general storage point for all Dowtherm in the system when the unit is not in operation. Roughly 80 lin. ft. of $\frac{3}{8}$-in. copper tubing on the bottom of the receiver serves to keep the Dowtherm at 200 deg F. or higher while the Dowtherm is in storage so that there will be no delay in starting up. In practice the receiver has operated at pressures ranging from 4.5 lb. per sq. in. absolute, up to 43 lb., or roughly from 400 to 596 deg. F. The low pressure was of course obtained with the help of a jet condenser for removing any gas or air that accumulated in the system. When it is desired to operate without the fifth user in service it is only necessary to let the pressure in the receiver rise until a balance with the heat requirements of the remaining user is reached. Under these conditions the fourth user really controls the receiver pressure.

From this description it will be apparent that the Dowtherm is twice flashed at successfully lower pressures. The advantages obtained are a graduation of temperatures downward to meet the individual requirements of the users; a smaller quantity of heating medium circulated per unit quantity of heat transferred; and a greater operating temperature differential between the vapors leaving the generator and the liquid condensate returning to the generator. It is the relatively low latent heat of the Dowtherm "A" that makes double flashing feasible.



Hook-up diagram of Dowtherm vapor heating system with five users operated at different temperatures

The same jet condenser used to obtain low operating pressures was also connected to all users so that they could be purged of any gas that from time to time might accumulate. It was found that the proper location for the vent connection in a shell-and-tube type heater with the Dowtherm condensing in the shell was the top of the shell at the outlet end. Condensate accumulators or holders were not used, the condensate outlet being connected directly to the trap or drainer which was located roughly 2 ft. below the heater outlet.

All Dowtherm vent lines were equipped with steel valves. The small Chapman type 960 gave good service in this location. Gate valves were used principally to reduce pressure drop to a minimum. The same type of valve in the larger sizes was used in a number of liquid and vapor lines but was not entirely satisfactory because of leakage through the stem packing. In order to overcome this resort was made to a more expensive type of valve. The Crane type 33 XR 300 valve solved the problem. This valve has a deeper stuffing box and a lantern gland with a connection for introducing a lubricant. A third make of valve had to be removed because it froze in service and could not be moved even with a wrench. It appears that the best valve for this service is one of the outside-stem-and-yoke type, made of steel, having a deep stuffing box and no ground joints. Ground joints in either unions or valve bonnets have a tendency to freeze and gall in service. The same is true of internal threads. If threaded connections are used they should be seal welded for tightness. For these reasons it seems that flanged connections are more desirable than screwed. There are probably a number of other makes of valve that would function equally well in this service but it happens that my own experience has been limited to but five different makes. The control valves previously mentioned are of the rotary stem type and so far have given excellent service and no leaks.

For bolting materials on both flanges in piping and on heaters, S. A. E. 4140 alloy steel studs with heat-treated, oil-quenched carbon steel nuts were specified. Even with this material nuts will occasionally become frozen. In this case an application of a good penetrating oil will usually permit the nuts to be removed. Gaskets were of soft Armco iron and of the profile type. Aluminum gaskets also were tried. Sometimes they worked and sometimes they did not, probably on account of uneven pipe strains. Expansion and contraction strains in piping were taken care of by welding up expansion loops, using long-radius welding ells. Pipe bends were used in the 6-in. main vapor line from the generator. Every effort was made to keep stress values low and as few joints as possible were left for connections.

RELIEF VALVE PROBLEMS

Pressure relief valves are a problem. If an outside-spring type is used, there is the possibility of trouble from leaky stuffing boxes after the valve has opened a couple of times. On the other hand, an inside-spring type subjects the best tungsten springs to a gruelling test. We have both types and the one giving the better service is still undetermined. From my own observation what is needed is an outside-spring type with a lubricated lantern-gland-type stuffing box. It appears that once the Dowtherm-permeated packing solidifies and scores the shaft of any valve, there will be leakage.

Both piping and vessels were well lagged, using high temperature lagging next to the vessel, followed by 2 in. of 85 per cent magnesia and a waterproof covering. All but the small size lines have approximately 4 in. of insulation. In this particular case it was cheaper to provide a little more insulation than to erect a building around the plant. All lines, traps or vessels that were likely to plug up with solid Dowtherm when the unit was down were steam-traced using ⅜-in. copper tubing strung along the bottom of the pipes and terminating at a small trap.

Vent lines, unless steam-traced, are apt to plug up in cold weather. Theoretically they are supposed to handle only air, but actually they contain Dowtherm at times. If steam-tracing is not used and the temperature is likely to drop below the solidification point, it is desirable to have a number of steam connections strategically located so that a steam hose can be hooked up to thaw out the lines.

Dowtherm pumps can at times give difficulty. One of the big problems is apt to be excessive leakage through the stuffing box and hence the pump should have an arrangement that is easily accessible for repacking. In starting up, sufficient time should be allowed for steaming the cooling gland to insure melting all the Dowtherm soaked up in the packing as otherwise a scored shaft may result. It is a good plan to use a shaft with Stellited bearing surfaces to reduce trouble from this source. A second point to watch is expansion clearances both when the pump is cold and when pumping material at 560 deg. F. or hotter. Sound steel castings are essential for if there is a pin hole Dowtherm will manage to get through it.

Because of the time element in starting a pump the A. S. M. E. code requirement (P-318) for steam boilers, namely, that of having a spare pump, does not in my opinion accomplish the results desired in the case of Dowtherm. It is one thing to press a button and slap a water pump on the line, but an entirely different matter to try to do the same with a cold pump when the material to be pumped is at 560 deg. F. or higher.

Assuming a boiler is equipped with the usual gadgets so that the fuel supply is automatically cut off when (*a*) the electric current fails, (*b*) the fire goes out, (*c*) the boiler pressure goes above a predetermined point, or (*d*) the boiler feed pump refuses to pump, what happens when the last named contingency occurs? The level in the usual boiler will drop out of sight in about four minutes flat. Whatever corrective measures are taken will have to be done in that period of time. The reason why the level disappears so rapidly is two-fold: first, because of the high heat capacity of the boiler and setting, and second, on account of the low latent heat of the material which causes a rather large percentage of flashing as the pressure drops. Corrective measures should include a quick-acting positive fuel shut-off device. It would also help if the upper drum capacity were larger than dictated by vapor releasing surface alone. As long as the fire is out there is not so much danger of tube failure.

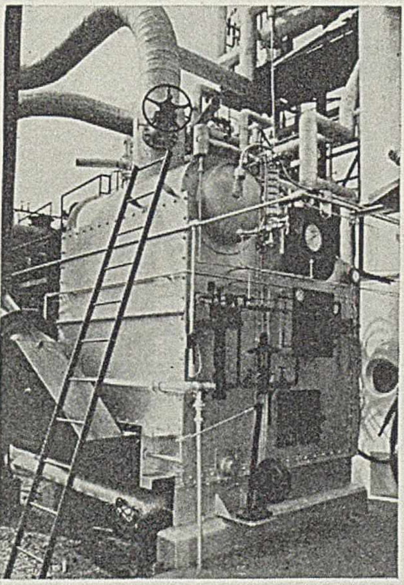
There are two courses of action open in such a predicament: either cut off the load, or try to start the pump, or both. Probably the best plan is to cut down on the load first to prevent losing the level entirely and then attend to the offending pump. Of course if it happens that the pump is electric driven and the stoppage due to a momentary power failure it may be just as well merely to start the pump again, relight the fire and go on.

I recall one stormy night when four such power failures occurred in a little over an hour. In this instance the pump was merely restarted in each case. In any event the operators should be prepared for any eventuality and know in advance what steps to take to correct. While such a condition may not happen often, it is usually preferable to avoid the possibility when practicable. It seems that a steam turbine drive is to be preferred over an electric drive when power interruptions are at all common.

EXCEPTIONS TO CODES

In pioneering any new system points are bound to crop up where divergence from whatever existing code is being followed seems desirable, or even necessary, in the interests of safety. Good sound "horse sense," plus a thorough technical knowledge, is the best guide here. In extending the A. S. M. E. boiler code to Dowtherm there are a number of points where exceptions are in order. A few examples will be cited.

Paragraphs P-273 and P-202 require safety valves to bear the A. S. M. E. stamp, and to be equipped with lifting levers, respectively. So far as the writer has been able to learn there is no approved A. S. M. E. valve for Dowtherm service manufactured at present. The proper valve seems to be a cast-steel valve with series 30 flanges (even if the pressure is only 20 lb.



Medium size Dowtherm vapor generator installed in a petroleum refinery

per sq. in.) and equipped with high temperature alloy steel trim. Lifting levers seem to the writer to be a hazard as they are now constructed. Severe burns could easily result from accidental or unauthorized tampering with them. It seems better to remove the valves periodically for inspection, cleaning and test, than to test them in place with Dowtherm. Once lifted it is difficult to get such valves to seat properly, resulting in leakage which in turn will necessitate a shut-down for repairs. Safety valves have to be bubble tight or leakage will result.

Paragraph P-294 would permit the use of try-cocks on Dowtherm vapor generators. It is only necessary to remember that you are handling an organic material that may burn when blown out into the air to realize that such devices are decidedly undesirable.

Paragraphs P-307 to 310 on blow-off connections and equipment are another case. Blow-off connections on steam boilers are used to help control the concentration of solids in the boiler water. The only solid that is at all likely to exist in a Dowtherm system is carbon derived from decomposition. When present at all it is not in solution as are salts in boiler water but is a finely divided precipitate which may be deposited on the heat transfer surfaces. If the boiler is operated at the commonly used temperatures decomposition will be negligible and no trouble will result. If, on the other hand, operation is at extremely high temperatures and for long periods of time, trouble from carbon plugging of the tubes in both the heaters and the generator may occur. Blow-off as used in steam practice does not seem to fit in here. If excessive carbon is suspected the best plan is to shut down periodically and clean out the system.

For one reason or another it will be necessary to add Dowtherm to the system from time to time. If Dowtherm containing water is added to the system while running, a violent pressure surge may occur when the water comes in contact with hot Dowtherm at about 560 deg. F. To avoid this it is well to dry out the Dowtherm before introducing it into the system. This can easily be done by fitting up an old Dowtherm drum with a steam coil, so that a temperature of 250 deg. F. can be reached to drive out moisture. After standing for about an hour at this temperature, or longer if convenient, the Dowtherm can be pumped to the receiver. The drum also serves as a convenient receptical in which to store any accumulation of Dowtherm that may occur when maintenance work is being done, or that recovered from pump leakage or from the jet condenser.

Operation of a complicated system requiring extreme flexibility, such as here described, is an art. Men who thoroughly understand refrigeration make excellent operators. This may seem strange but a man who becomes acquainted with all the details finds the two fields decidedly similar.

High on the Army's list of strategic materials are chrome chemicals, more than half of the raw materials for which come from far-off Rhodesia and New Caledonia. Sodium chromate and dichromate can, however, be made economically from domestic chromite ores, according to recent investigations at the State College of Washington. A complete process has been worked out and described by H. A. Doerner and other of the Bureau of Mines staff. Though not yet in commercial operation, the proposed process is outlined here because of current interest in raw materials vital to the National Defense which come from overseas.—*Editors.*

Producing Chromate Salts From Domestic Ores

DEPOSITS OF CHROMITE ORE having possible commercial value occur in Montana, California, Oregon, Washington and Alaska. Development of the California and Oregon deposits has been active in recent years (see page 541, U. S. B. of M. Minerals Year Book, 1938). However, the use of chromite for making chromate, dichromate and other chemicals accounts for only about 10 per cent of domestic and 25 per cent of the world consumption. At present the production of chrome chemicals is derived from imported ores.

Utilization of domestic chromite ores is, of course, of considerable interest to the U. S. Bureau of Mines. Consequently, a research program was initiated at Washington State Electrometallurgical Laboratories financed largely by the United States Chrome Mines, Inc. As a result of this work, conducted on a pilot plant scale, a process for making sodium chromate and dichromate was worked out in elaborate detail. It has been described completely, even to the mentioning of trade names and manufacturers' specifications for the proper types of equipment. Since all of these details are available elsewhere,* the present article will be confined to a description of the flowsheet and process fundamentals.

In the course of the investigation the chromite ore (roughly 50 per cent Cr_2O_3) was calcined with lime, magnesia, dolemite, soda ash and salt cake, separately and in combinations. The combination of raw material selected as most desirable from a consideration of process economics was: two parts chromite ore, three parts limestone, and 1.4 part soda ash by weight. The quantities mentioned in the following discussion apply to a proposed plant with a capacity of 20 tons per day of ore.

Before any chemical processing can be done the raw materials must be reduced to minus 150 mesh particles. Soda ash does not require pulverizing. Limestone and chrome ore do not require coarse crushing since both can be purchased in granular form. However, they are pulverized most efficiently in separate units, each consisting of a ball mill and air separator in closed circuit. One manufacturer has recommended a 42 by 72 in. ball mill for each.

Mixing is accomplished in a long conveyor by rotating blades, which discharges into the furnace.

Chromite reacts with soda ash and oxygen from the air to form sodium chromate and carbon dioxide. Practically complete conversion to chromate is obtained in a temperature range of 850 to 1,070 deg. C., providing calcining is done properly.

For this purpose an oil- or gas-fired mechanically rabbled reverberatory furnace of the Edwards type with a single hearth of about 2,000 sq. ft. area is recommended. The charge is carried across the hearth by heat-resistant alloy rabbles mounted on water-cooled arms.

Principal function of the limestone in the calcining is to increase the porosity of the charge and reduce the agglomerating effect of the two salts when the charge is rabbled. However, it has been established that the lime promotes oxidation of the ore in a chemical way as well as rendering this purely mechanical assistance. Side reactions that take place in calcining are the loss of CO_2 from the soda ash and limestone, and the oxidation of iron, magnesium and silicon present in the ore. Silica is the most objectionable impurity. It tends to prevent oxidation of the chromite and is even more potent in reducing the amount of water soluble chromate.

LEACHING THE CALCINE

Calcine from the rabbled hearth furnace is a more or less fused and lumpy sinter. Unless it is finely pulverized the chromate is not completely dissolved by leaching because the lumps become coated with insoluble and impervious compounds. However, satisfactory extraction may be attained by wet grinding, classification and countercurrent decantation followed by filtration.

For the two-stage grinding operation, one ball mill 5 ft. x 22 in. (30 hp.), one 5 ft. x 36 in. (40 hp.) and two bowl or countercurrent classifiers have been recommended.

The first compartment of the four-tray Dorr type thickener receives hourly 1,350 lb. of minus 150-mesh solids in a 42-deg. Bé. liquor containing 2,780 lb. Na_2CrO_4 dissolved in 5,170 lb. of water. Clear liquor

*Abstracted from Bulletin V of the State College of Washington. Pilot plant work was carried on by the Bureau of Mines, working with the Mining Experiment Station at the State Electrometallurgical Research Laboratories, Pullman, Wash.

Estimates of Operating Costs

(20-ton plant producing sodium chromate)	
20 tons 50 per cent ore at $20..	$400.00
30 tons limestone at $3.40......	102.00
14 tons soda ash at $17.90.....	250.60
6.5 tons fuel oil at $9.40......	61.10
Power, 8,500 kw.hr. at 0.5c....	42.50
Labor	100.00
Supervision	30.00
Laboratory	30.00
Supplies	75.00
Interest and depreciation (20 per cent)	137.00
Overhead, taxes, etc..........	30.00
Total	$1,258.20
Product, 60,000 lb. Na_2CrO_4 ($4H_2O$) Cost per pound......	0.021

overflowing weighs 4,870 lb. of which 1,700 lb. is the salt. For maximum settling rates and to conserve the heat required for subsequent evaporation, the mills, classifiers and thickeners should be thermally insulated as completely as feasible.

Underflow from the last tray of the thickener, containing about 42 per cent solids, is filtered and washed on a continuous rotary vacuum filter. Maximum displacement of the liquor requires that as large a proportion as possible of the makeup water be used to wash the filter cake. One manufacturer estimated that an 8-ft. x 12-ft. drum filter would be adequate.

PURIFICATION

Chromate solution obtained by leaching a calcine contains sodium aluminate and sodium silicate that must be eliminated to obtain a satisfactory product. The solution is alkaline, its pH ranging from 10.5 to 10.7, where a pure solution of sodium chromate has a pH of 8.04. The silicate and aluminate may be precipitated by addition of acid until a pH of 8.04 is obtained. Since H_2SO_4 has the disadvantage of leaving excess sodium sulphate in the solution, carbonic acid was found more effective. It is obtained cheaply and conveniently by passing flue gas through the liquor with mechanical agitation. About 400 gal. of liquor per hour is neutralized by 1,250 cu.ft. of flue gas introduced into two 54-in. Turbo-Mixers (with 18-in. duplex impellers) operated in series.

About 10 lb. per hour (dry weight) of hydrated alumina and silica are thus precipitated and are removed by an 18-in. plate-and-frame filter press.

SODIUM DICHROMATE

Sodium chromate is converted to sodium dichromate as follows:

$$2\,Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2SO_4 + Na_2Cr_2O_7 + H_2O.$$

Sulphuric acid is added to the 5,000 gal. Na_2CrO_4 storage tanks until the pH comes down to 4.7. Then the liquor is ready for evaporation.

For sodium chromate the unacidified liquor is evaporated in a forced circulation-type steel evaporator with an 18-in. steam chest and 300 sq.ft. of heating surface. It should be operated at 140 deg. F. and 1.20 lb. absolute pressure. Sodium chromate crystallizes out in an attached settler and is separated from its mother liquor in a 24-in. Bird continuous centrifugal. Total daily production is 60,000 lb. when operating for sodium chromate only.

The finishing of sodium dichromate is a bit more complicated. The evaporator must operate at 176 deg. F. and 2.79 lb. absolute pressure. At this temperature the sodium sulphate crystals are removed continuously in the same manner as sodium chromate crystals were removed. A water-cooled crystallizer is required, however, to drop out the hydrated $Na_2Cr_2O_7$ crystals (at 70 deg. F.), and even then only 70 per cent of the salt will crystallize. The liquor is separated, again by centrifugal, and returned to the evaporator. This unit produces 38,000 lb. of sodium dichromate and 18,000 lb. of sodium sulphate when operating for these products.

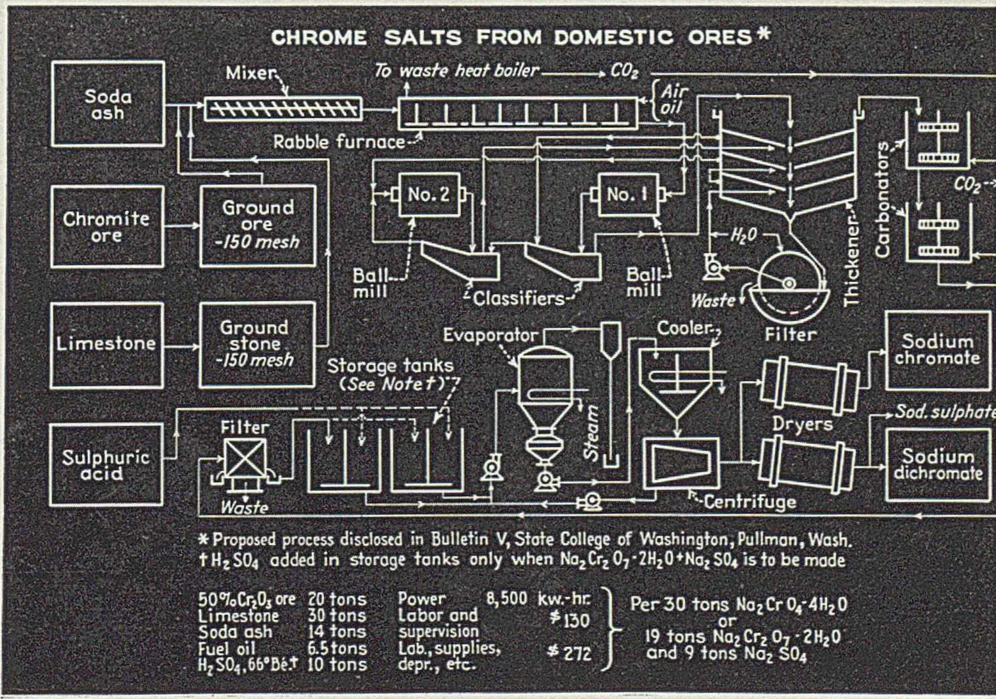
COST ESTIMATES

Prices for estimating purposes were obtained for all of the larger items of equipment. In many instances two or more estimates were received. The cost of equipment (f. o. b. factory) for the 20-ton capacity plant is approximately $125,000. Minor items, such as small pumps, motors, conveyors, pipe lines, etc., may add another $25,000. Freight charges to Washington would approximate $15,000, a building $30,000, and installation, $20,000. The total is $215,000, which may be in error 15 per cent. At least $60,000 is needed for working capital, a total investment of $275,000 to $300,000 for the 20-ton plant.

Operating costs are shown in the accompanying table. To produce the sodium dichromate, the cost of 10 tons of 66-deg. Bé. sulphuric acid at $22.50 must be added to the chromate cost. This gives a total of $1,492.20 per day. With a daily production of 38,000 lb., of sodium dichromate, the cost is $0.0391 per lb.

Two-thirds of the total cost is for raw materials, the chromite ore alone accounting for nearly one-third. Therefore, the costs that cannot be estimated precisely are a relatively small per cent.

The value of $20 per ton for chromite is nominal, intended to represent the price paid Pacific Coast producers for ore of 50 per cent Cr_2O_3 content. Ore of lower grade must be evaluated at a lower figure to obtain the same cost per pound of product, and at a still lower figure to produce the same daily profit. This point is likely to be disregarded by producers whose ores do not yield a high-grade product, and it explains why a high chrome content is considered essential for chromate production.



Specific Gravity and Viscosity Of Na_2CO_3 Solutions

DALE S. DAVIS *Wayne University, Detroit, Mich.*

Chem. & Met. INTERPRETATION

A satisfactory method of arriving at accurate values for the specific gravity and viscosity of sodium carbonate solutions has not hitherto been available. However, new and more reliable data recently have been published and they are now reduced to a simplified nomographic form for chemical calculations.—*Editors.*

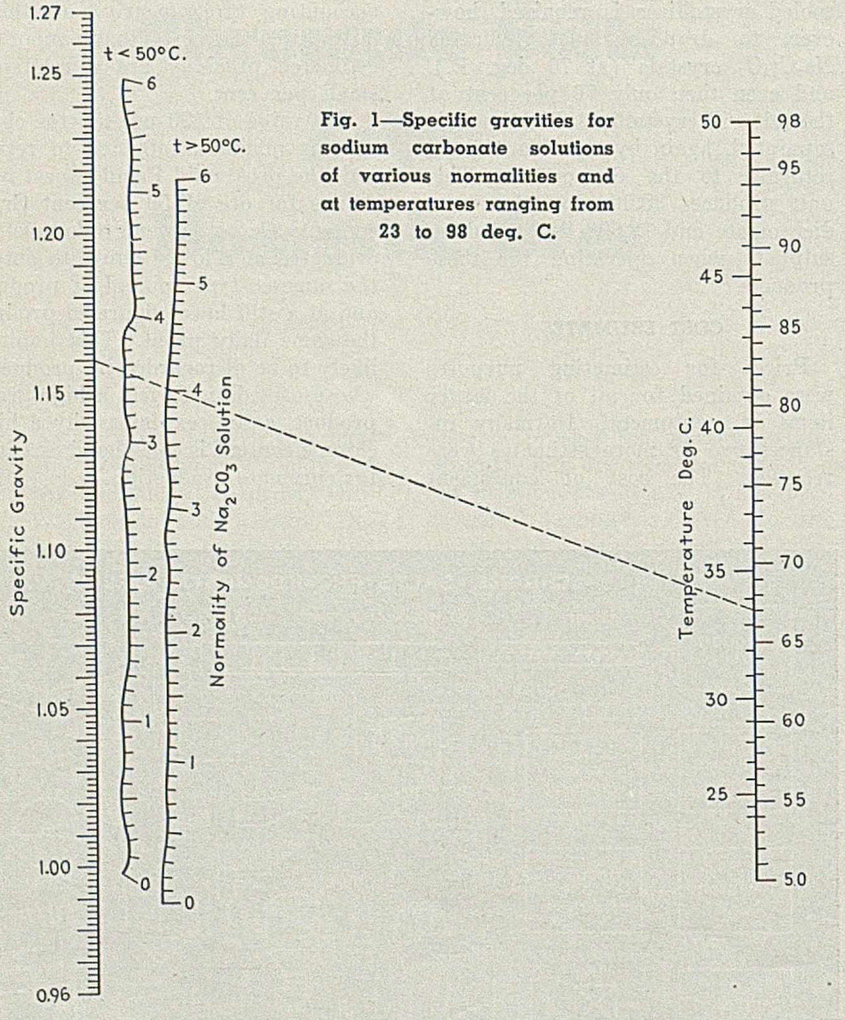


Fig. 1—Specific gravities for sodium carbonate solutions of various normalities and at temperatures ranging from 23 to 98 deg. C.

Roberts and Mangold (*Ind. Eng. Chem.*, 31, No. 10, 1293, 1939) have presented excellent data covering the specific gravities and viscosities of sodium carbonate solutions over the temperature range of 22.5 to 98 deg. C., and the concentration range of 1 to 6 normal. The data appear in tabular form and as specific gravity-normality isotherms for 22.5, 40, 50, 60, 70, 75, 85, and 98 deg. C., and as viscosity-normality isotherms for 22.5, 50, 75, and 98 deg. C.

In view of the industrial importance of sodium carbonate and the desirability of readily usable specific gravity and viscosity data in connection with equipment design it has appeared worth while to correlate the data by means of empirical equations and to construct nomographic charts based upon these relationships. Such charts enable rapid and reliable interpolation and greatly extend the utility of the original data.

Above 50 deg. C., the specific gravity, δ, and the Centigrade temperature, t, are related by the expression

$$\delta = a\,t + b$$

while below 50 deg. C., the relationship is given by

$$\delta = a\left(\left(t + \frac{214.8}{(20 - t)^4}\right)\right) + b$$

where a and b depend upon the normality as shown by Table I.

The broken line in Fig. 1 indicates that a sodium carbonate solution having a specific gravity of 1.160 at 33.5 deg. C., has a concentration of 3.54 normal and that a solution having the same specific gravity at 67 deg. C., would test 4.01 normal. Table II illustrates the nature of the agreement between experimental values of the normality, N, and values read from Fig. 1, the average deviation being slightly under 0.4 per cent.

Correlation of the viscosity, μ, in centipoises, with normality, N, may be effected by the expression

$$\log \sin 10\,\mu = a N + b$$

Table I

Normality	Above 50 deg. C.		Below 50 deg. C	
	$a \times 10^6$	b	$a \times 10^6$	b
0	−563	1.0168	−399	1.0087
1	−600	1.0680	−434	1.0600
2	−629	1.1154	−539	1.1109
3	−653	1.1612	−570	1.1570
4	−633	1.2020	−672	1.2040
5	−722	1.2481	−634	1.2427
6	−735	1.2864	−526	1.2760

Table II

Obs'd. Normality	1.00			2.00			3.00			4.00			5.00			6.00		
t, °C.	δ	N	% Dev.	δ	N	% Dev.	δ	N	% Dev.	δ	N	% Dev.	δ	N	% Dev.	δ	N	% Dev.
22.5	1.047	0.98	−2.0	1.095	1.97	−1.5	1.141	3.00	0.0	1.185	4.00	0.0	1.225	5.00	0.0	1.262	6.02	0.3
40	1.043	1.02	2.0	1.090	2.02	1.0	1.134	3.00	0.0	1.177	4.01	0.3	1.217	4.99	−0.2	1.254	5.98	−0.3
60	1.032	1.00	0.0	1.077	1.98	−1.0	1.122	3.00	0.0	1.164	3.99	−0.3	1.205	5.00	0.0	1.243	6.02	0.3
80	1.020	1.00	0.0	1.065	2.00	0.0	1.109	3.00	0.0	1.152	4.02	0.5	1.190	4.99	−0.2	1.228	6.01	0.2
98	1.009	1.00	0.0	1.054	2.00	0.0	1.098	3.02	0.7	1.140	4.01	0.3	1.177	4.99	−0.2	1.214	5.99	−0.2

where 10μ is considered to be degrees circular measure and where a and b are defined by the equations

$$a = 0.15037 - 0.00063430\,t - e^{-2.8754 - 0.062725\,t}$$

$$b = -0.66694 - 0.0063237\,t - \frac{0.1059}{e^{0.07525\,(73.5 - t)} + e^{0.07525\,(t - 73.5)}}$$

The broken line in Fig. 2 indicates that the viscosity of a 3.30-normal solution of sodium carbonate is 1.40 centipoises at 50 deg. C. Table III lists observed and calculated values of the viscosity and their percentage deviations, the average discrepancy being about 0.5 per cent.

Table III

t, °C	22.5			50		
	Viscosity Centipoises		%	Viscosity Centipoises		%
N	Obs.	Chart	Dev.	Obs.	Chart	Dev.
1	1.201	1.180	−1.7	0.756	0.750	−0.8
2	1.564	1.573	0.6	0.976	0.980	0.4
3	2.116	2.110	−0.3	1.283	1.285	0.2
4	2.863	2.845	−0.6	1.678	1.690	0.7
5	3.980	3.920	−1.5	2.246	2.245	0.0
6	5.650	5.690	0.7	2.994	2.981	−0.4

t, °C	75			98		
	Viscosity Centipoises		%	Viscosity Centipoises		%
N	Obs.	Chart	Dev.	Obs.	Chart	Dev.
1	0.468	0.465	−0.6	0.347	0.349	0.6
2	0.584	0.589	0.9	0.428	0.429	0.2
3	0.746	0.746	0.0	0.530	0.526	−0.8
4	0.950	0.945	−0.5	0.647	0.646	−0.2
5	1.198	1.200	0.2	0.794	0.793	−0.1
6	1.521	1.524	0.2	0.960	0.967	0.7

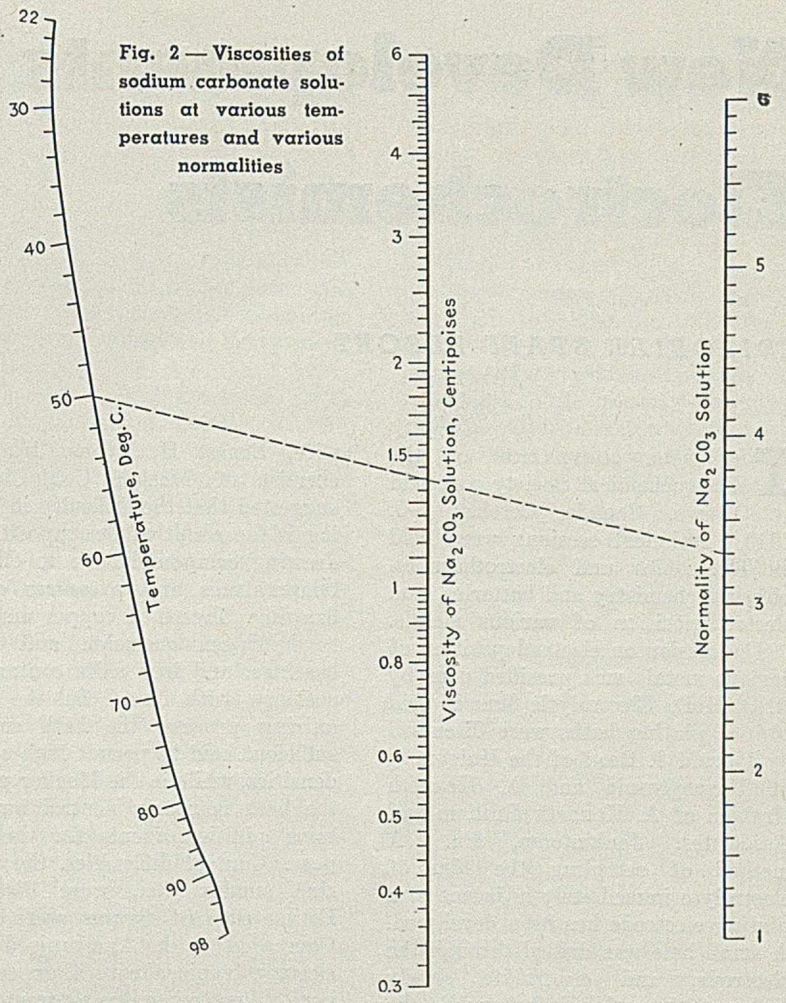


Fig. 2 — Viscosities of sodium carbonate solutions at various temperatures and various normalities

Galvanic Series in Sea Water

As a result of experiments conducted for the American Society for Testing Materials and reported by Committee B-3, an electromotive or galvanic series for metals and alloys in sea water has been established. The series was presented in graphic and tabular form in a paper by F. L. LaQue and G. L. Cox, who stated that the principal information obtained was the direction of current flow rather than the magnitude of the galvanic effect.

The metals and alloys in the following tabulation are divided into groups. Materials may change places within any group, depending on the incidental conditions of exposure. Likewise, galvanic effects in combinations of materials with others in the same group are not likely to be appreciable under most conditions. With any other combinations, the intensity of the galvanic action depends on the relative areas of the materials forming the couple, their distance apart in the series and the incidental conditions of exposure which generally affect corrosion reactions.

In general, it is unwise to combine materials where the area of the material higher in the list is relatively small compared with that of the material lower in the list. The reverse relationship is not likely to be troublesome. For example, experience has shown that the combination of Monel bolts in iron condensers in salt water service does not accelerate the corrosion of either the iron structure or the Monel bolts.

Magnesium
Magnesium alloys

Zinc
Galvanized steel or galvanized wrought iron

Aluminum 52SH
Aluminum 4S
Aluminum 3S
Aluminum 2S
Aluminum 53S-T
Alclad

Cadmium

Aluminum A17S-T
Aluminum 17S-T
Aluminum 24S-T

Mild steel
Wrought iron
Cast iron

Ni-Resist

13% chromium stainless steel type 410 (active)

50–50 lead tin solder

18–8 stainless steel type 304 (active)
18–8–3 stainless steel type 316 (active)

Lead
Tin

Muntz metal
Manganese bronze
Naval brass

Nickel (active)
Inconel (active)

Yellow brass
Admiralty brass
Aluminum bronze
Red brass
Copper
Silicon bronze
Ambrac
70–30 copper nickel
Comp. G-bronze
Comp. M-bronze

Nickel (passive)
Inconel (passive)

Monel

18–8 stainless steel type 304 (passive)
18–8–3 stainless steel type 316 (passive)

New Developments Discussed by Electrochemists

EDITORIAL STAFF REPORT

THE FALL CONVENTION of the Electrochemical Society was held at Ottawa, Canada, October 2–5, 1940. Technical sessions were held on electronics and electrothermics, physical chemistry and batteries, and electrodeposition of various metals.

The session on electrodeposition of various metals was presided over by R. O. Hull. Electrolytic films in acid copper plating baths were discussed by Harold J. Read of the University of Pennsylvania and A. Kenneth Graham of A. Kenneth Graham and Associates, Jenkintown, Pa. A method of sampling the film of electrolyte immediately adjacent to a plating electrode has been developed. A small hole was drilled through the electrode, and electrolyte slowly siphoned through this hole while the plating operation was in progress. Experimental results are presented for the acid copper sulphate plating bath. The copper decrease and acid increase in the cathode film were studied under various conditions of current density, copper concentration, acid concentration and temperature. Variations in acid concentration were found to affect the film more than changes in copper concentration. An increase in temperature markedly decreases the difference between the film and main body concentrations. The ratio of copper to acid in the film has been considered, and the results interpreted from this point of view. The effect of the location of the sampling hole in the electrode on the composition of the film was also studied. On moving the sampling hole horizontally from the middle to the edge of the electrode, little difference in the composition of the film was noted. Large differences in the film composition were found when the samples were taken from the bottom, middle and top of the electrode, even though the electrolyte was sufficiently well stirred to avoid stratification.

In discussing recent developments in electrogalvanizing round steel wire, Ernest H. Lyons, Jr., chief chemist of Meaker Co., Chicago, suggested that the difficulty in cleaning is the result of decomposition of drawing compounds due to elevated temperatures and pressures during drawing. Traces of copper may lead to hydrogen occlusion and brittle coatings, and iron salts contaminate coatings with iron. In the Bethanizing process, the bath contains sufficient acid to permit high current densities, while in the Meaker process the bath is nearly neutral but contains addition agents for this purpose. Contact difficulties, the use of zinc anodes, etc., were discussed. Estimated cost figures were given. Compared to hot galvanized wire, electrogalvanized wire is expected to have a longer life due to greater uniformity of coating as well as to heavier coatings available. Furthermore, the zinc coating is more ductile and adherent. Operating advantages and various tests for determining coating thickness were reviewed; the hydrochloric acid-antimony chloride strip test is recommended for general use.

THICKNESS TESTER

An electrolytic chromium plate thickness tester was described by Stanley Anderson and R. W. Manuel of the Crane Research Laboratories, Chicago. It is based upon the principle that the ampere seconds required for the anodic dissolution of a given small area of chromium plating are directly proportional to the thickness of the plating. The areas stripped for test are circular and 4.8 or 2.4 mm. in diameter. The moment an area has been completely stripped the potential of the metal in this area changes sharply. A solution of 1 N Na_3PO_4 and 1 N Na_2SO_4 is used as electrolyte.

The effect of glycerine upon the throwing power of plating solutions was discussed by F. C. Mathers, professor of chemistry at Indiana University and W. J. Guest, Kentucky State Employment Service, Louisville, Ky. Glycerine "foots," the residue remaining from the distillation of glycerine in soap manufacture, will produce bright cadmium plates from cadmium cyanide baths, according to Profs. Mathers and Guest. Many other addition agents were tried but none was as good as the glycerine "foots."

The bright copper plates obtained from various solutions heretofore proposed are not comparable in appearance with the bright nickel deposits commercially produced today reported Lawrence Greenspan, chemical engineer, New York, N. Y. Upon adding ammonium sulphate to the copper amine bath recommended by Brockman, bright ductile plates of copper were obtained. The new commercial bath contains 100 g./L. copper sulphate crystals, 20 g./L. ammonium sulphate, 80 cc./L. diethylene triamine.

Extensive tests made by Prof. Colin G. Fink of Columbia University and R. H. Lester of Mellon Institute, on indium sulphate plating baths have resulted in the following new data: Boric acid in an $In_2(SO_4)_3$ solution reduces the crystal size of the indium deposit and increases the current efficiency. The effect of adding NaOH to a solution containing $In_2(SO_4)_3$ and boric acid is to cause the current efficiency to go through a minimum; the quality of all deposits from this sodium containing solution is unsatisfactory. Aluminum sulphate when added to an $In_2(SO_4)_3$ solution reduces the crystal size of the indium deposit, producing the best quality plate the authors were able to obtain without the use of an addition agent. Gelatin in quantities of about 7.5 mg./L. reduces the current efficiency of the indium sulphate bath by about 20 per cent, but greatly improves the quality of the deposit. Solutions of $In_2(SO_4)_3$, either with or without $Al_2(SO_4)_3$, yield their highest current efficiencies at an equivalent concentration of about 0.10 M In_2O_3; 0.30 M H_2SO_4; 0.0173 M $Al_2(SO_4)_3$; and .0075 g./L. gelatin. Current density, 0.0325 amp./cm.^{2}; bath temperature 26 deg. C. Aluminum sulphate in the concentrations used appears favorably to affect the electrolyte layers next the cathode during electrolysis.

An equation of the form

$$\log(1 - e)I - m \log eI = b$$

in which m and b are constants, e the current efficiency, and I the current density in amp./cm.^{2} accounts for the variation of e with I, the temperature and composition of the indium bath being constant. The agreement is within the experimental error for plating indium, and also for plating zinc and manganese. The above equation is able to account for a considerable number of experimental results on different metals, and, as is shown, has a sound basis to recommend it.

AMINES AS ADDITION AGENTS

A group of amines was studied by Prof. J. L. Bray and F. R. Morral of Purdue University to determine their effect as addition agents in the electro-deposition of zinc. Amines of low number of carbon alkyl radicals showed a tendency toward good addition agent properties. The nitrogen in the amine in terms of grams N_2 per liter of electrolyte must be controlled so as to obtain the most beneficial effects of the addition agent. The length of the organic radical attached to the amine was found to have a decided influence. Other factors such as wetting properly and compound salt formation were studied and compared with the experimental data obtained with a few addition agents. These latter factors do not appear to be of the controlling type, such as the three factors above, for obtaining bright, ductile zinc deposits.

The deposition potentials of metals from fused alkali chloride-aluminum chloride baths was discussed by W. H. Wade, G. O. Twellmeyer, S. J. and L. F. Yntema of St. Louis University. An auxiliary platinum reference electrode (together with a platinum cathode and a carbon anode) was used to determine the cathode potentials of hydrogen and of six of the common metals dissolved as chloride in a fused NaCl + KCl + $AlCl_3$ bath operated at 156 deg. C. It was found that the order of deposition is the same as that in the voltaic series for aqueous 1.0 M sulphate solutions of these metals with the exception of copper, which is approximately 0.3 v. less noble than hydrogen; H, 0.87 v.; Co,–1.15; Ni,–1.16; Cu,–1.17; Fe,–1.47; Zn,–1.60; Mn,–1.91; Al,–2.02. These potential values apply to smooth bright deposits on a Pt cathode; dendritic or gray deposits were invariably obtained at somewhat higher potentials. At still higher potentials aluminum will deposit, besides the heavy metal added.

Metallized glass electrodes with films of Pt, Ir, Pd, Os, Rh, Ru, Ag and Au in various states—bright, black, etc., have been studied as oxygen electrodes in three electrolytes, solutions of H_2SO_4, KCl, and NaOH by H. G. Bain, now chemist at Saltcoats, Ayrshire, Scotland. No electrode has been found to give reproducible and constant theoretical values for the oxygen potential, although in a few cases potentials more noble than the theoretical single potential have been recorded, probably due to the presence of electromotively active oxides previously formed on these electrodes. Black osmium deposited on a base of bright platinum on glass has proved fairly reproducible and constant but not at the theoretical potential and only in acid and alkaline electrolytes. In neutral solution, palladium black deposited on a base of bright palladium on glass is fairly satisfactory, but again not at the theoretical oxygen potential. The phenomenon of motor-electrolytic-potential (m.e.p.) is very prominent and therefore has been studied with these electrodes since it appears to have considerable bearing on the reproducibility and constancy of these electrodes. It is considered that no single theory is at present capable of fully explaining the general behavior, including the m.e.p., of oxygen electrodes.

Two new papers were presented on the theory of potential and technical practice of electrodeposition by Charles Kasper of the National Bureau of Standards. The phases of the subject covered by these papers are linear polarization on some line-plane systems, and the flow between and to circular cylinders.

ANHYDROUS MAGNESIUM CHLORIDE

One of the features of the session on electrothermics which was presided over by J. W. Marder of the Westinghouse Electric and Manufacturing Co., was a paper dealing with the production of anhydrous magnesium chloride. It was presented by L. M. Pidgeon and N. W. F. Phillips of the National Research Laboratories, Ottawa. A study was made of the direct chlorination of magnesium oxide in the presence of carbon, producing anhydrous magnesium chloride suitable for the fused electrolyte process in the magnesium metal industry. Conditions were established under which (a) briquettes of magnesium oxide and carbon and (b) granular mixture of magnesium oxide and carbon could be successfully chlorinated. The differences in the manner in which granular material and briquettes must be treated in order to achieve complete conversion to oxide-free chloride were pointed out. Granular magnesium oxide of low bulk density may be considered as a preferred material for the production of anhydrous magnesium chloride.

STERILAMP

The electrical and radiation characteristics of the Sterilamp were discussed by D. D. Knowles and E. Reuter of the Westinghouse Lamp Division and an electrometer tube for laboratory and industrial use was the subject of a paper by L. Sutherlin and R. H. Cherry, of the Westinghouse Lamp Division and Leeds & Northrup Co., respectively.

Physical chemistry and batteries were discussed at the Friday session of which James P. Fugassi was in charge. A method has been developed by Anna P. Hauel, consulting chemist, Lancaster, N. Y., by means of which the reactions at and in the negative plates of the lead storage battery could be studied.

It is shown that during the first hours of formation the structure of the plates is radically changed and becomes, temporarily, almost impermeable. The structural changes during formation, especially toward the end of the process, are affected by the presence or absence of expanders. Curves showing the variations of the permeability of plates with and without expanders, during formation and after successive cycles, are presented. The conclusion is reached that the expander plays a very important function during the formation process. Miss Hanel also discussed micro-porous plates as diaphragms in storage batteries.

Among the other papers were: the electrolytic polishing of stainless steel by H. H. Uhlig, department of chemical engineering, Mass. Inst. of Tech.; the reaction between iron and water in the absence of oxygen, by Prof. M. de K. Thompson of M.I.T. and the hydrogen anode by Professor Thompson and H. V. Fairbanks.

Chem & Met PLANT NOTEBOOK

Timesaving Ideas for Engineers

NOMOGRAPHIC CHART FOR PRECISE DETERMINATION OF MOL FRACTIONS FROM WEIGHT PERCENTAGES

H. S. WINNICKI and L. N. CHELLIS Clarkson College of Technology, Potsdam, N. Y.

CHEMICAL ENGINEERING calculations frequently require the conversion of weight percentages of binary mixtures to a molal percentage or fraction basis, as in problems relating to distillation and absorption. The conversion, while simple, is subject to possible errors of calculation and is a serious time consumer when it must be repeated a number of times, as is usually the case. Several methods have been presented from time to time to simplify the calculation or to eliminate it entirely by graphical means.* However, all such methods which have come to the writers' attention have suffered either from a lack of high precision, or they have required a certain amount of calculation, or both.

Two nomographic charts presented on the following page were developed to obviate both of these difficulties. Owing to the requirement for high precision, numerous scales are necessary, giving the charts the appearance at first glance of being complex and difficult to use. Actually they are not, any one problem requiring the use of only six of the twelve scales. Normally the charts are used, as will be described, to determine the mol fraction of pure component *A* in a mixture of *A* and *B*, when the weight percentage of *A* and the molecular weights of *A* and *B* are given. However, by reversing the procedure the charts can readily be used to determine the weight percentage of *A* when both molecular weights and the mol fraction of *A* are given.

These charts solve the well-known equation:

$$X_A = \frac{W_A/M_A}{W_A/M_A + W_B/M_B}$$

where X_A is the mol fraction of *A*, W_A is the weight of *A*, M_A is the molecular weight of *A*, W_B is the weight of *B*, and M_B is the molecular weight of *B*. Fig. 1 covers the range from 0.01 weight per cent *A* to 50 per cent *A*; while Fig. 2 covers the range from 50 weight per cent *A* to 99.99 per cent *A*. The chart consists of scales *A* or *B* for molecular weight of *B*; *G* or *H* for molecular weight of *A*; *C* or *D* for pounds of *A* per pound of *B*; and *E* or *F* for mols of *A* per mol of *B*. In addition are scales *W* or *X* for converting weight per cent *A* to pounds of *A* per pound of *B*; and scales *Y* or *Z* for converting mols *A* per mol *B* to mol fraction of *A*. Note that the *W*, *X*, *Y* and *Z* scales are used in conjunction with the scales nearest to them. For example, the *W* and *C* scales are used together, as are the *X* and *D*, *Y* and *E*, and *Z* and *F* scales.

How to Use Charts

To illustrate the use of these charts, two problems are given, one falling in the range of Fig. 1, the other being covered by Fig. 2.

Problem 1—A binary mixture contains 20 weight per cent of compound *A* of molecular weight 150, mixed with 80 per cent of compound *B* of molecular weight 30. What is the mol fraction of *A*?

Starting on Fig. 1 at 20 weight per cent *A* (scale *X*) draw a horizontal line to scale *D* at 0.25 lb. of *A* per pound of *B*. Then connect 30 (molecular weight of *B*) on scale *B* with 0.25 on *D* and extend the line to the reference axis. Connect this last point with 150 on scale *H* (molecular weight of *A*). Note the sequence of scales used as *DBH* and, from the key given above the chart, note that the answer is read directly on the scale *F* as 0.05 mols *A* per mol of *B*. To convert this to mol fraction of *A*, read horizontally to 0.475 on scale *Z*. If the scale sequence had been *DBG*, then from the key the result would have been indicated as the value on scale *F* multiplied by 0.1. In this case the horizontal line would have been drawn from the new value 0.005 on the *F* scale to a value of approximately 0.00495 on the *Z* scale.

Problem 2—A binary mixture contains 97 weight per cent of compound *A* of molecular weight 24, mixed with 3 per cent of compound *B* of molecular weight 40. What is the mol fraction of *A*?

Starting on Fig. 2 at 97 weight per cent *A* (scale *W*) draw a horizontal line to scale *C* at 32.50 lb. of *A* per pound *B*. Then connect 40 (molecular weight of *B*) on scale *B* with 32.50 on *C* and extend the line to the reference axis. Connect this last point with 24 on scale *G* (molecular weight of *A*). Note the sequence of scales used as *CBG* and from the key note that the answer, as read on scale *F*, must be multiplied by 0.1. The result, therefore, is 54.7 mols of *A* per mol of *B*. Connecting the new point 54.7 on scale *F* by a horizontal line with scale *Z* gives the answer as approximately 0.9822 for the mol fraction of *A*.

* H. G. Nevitt, *Chem. & Met.*, 39, 1932, p. 673; A. J. V. Underwood, *Trans. Amer. Inst. Chem. Eng.*, 10, 1932, p. 145; T. C. Patton, *Chem. & Met.*, 41, 1934, p. 148; G. L. Bridger, *Chem. & Met.*, 44, 1937, p. 451; and J. S. Baker, *Chem & Met.*, 45, 1938, p. 155.

How to Store Coal to Avoid Spontaneous Combustion

AS DESCRIBED in a recent issue of the *Dow Diamond*, the Dow Chemical Co. has worked out an interesting and economical method of handling coal in storage which not only has materially reduced coal handling cost but has also completely eliminated coal pile fires. Dow's coal is delivered by lake steamer at Bay City, Mich., where it is piled to await transportation as needed over a 15 mile railroad to the plant. In the old method of storing the coal was dumped in conical piles of 8,000 to 12,000 tons. Weekly temperature readings in the piles showed a usual temperature rise of ½ deg. per day. Occasionally fires occurred and it was often necessary to repile the coal to prevent fires.

The new method of piling, which was worked out by the company's engineers, is to employ a Caterpillar tractor equipped with a bulldozer, and pulling a carryall, to move the coal from the point where it is discharged by the freighters to the storage area, where it is spread in a 4 or 5 in. layer and levelled and compacted with the equipment. Additional layers are added up to a height of 30 ft. The effect is to fill the voids with fines, prevent access of air and avoid the layer "flues" characteristic of conical piles. Without oxidation, no temperature rise has been observed even after 18 months storage. The method also facilitates rehandling to the cars, using a crawler-equipped crane with 4-yd. clamshell bucket.

Soybean Patent Correction

Incorrect patent numbers were given in the article on soybean processing, by Gordon W. McBride, which appeared on p. 617 of the September, 1940 issue. The correct patent numbers are 2,200,390 and 2,200,391, issued May 14, 1940 and assigned to the Pittsburgh Plate Glass Co. by Stephen E. Freeman.

These Charts Accomplish Precise Conversion of Weight Fraction to Mol Fraction

Without calculation and with a high degree of precision, weight percentage or weight fraction of a component in a binary mixture can be converted to mol fraction (or vice versa) by means of these charts. Fig. 1 covers the range from 0.01 to 50 weight per cent, and Fig. 2 from 50 to 99.99 weight per cent of compound *A*. Knowing the weight per cents and molecular weights of both compounds of the mixture, enter the chart on either scale *W* or *X*, as the case may be, then proceed horizontally to scale *C* or *D*. Extend a straight line through the point on *C* or *D* from the molecular weight of *B* on scale *A* or *B*, to the reference axis. Extend a second straight line from the reference axis to the molecular weight of *A* on scale *G* or *H*. Refer to key above for scale on which answer will be found, selecting the scale value on *E* or *F* as indicated, corresponding to the intersection. Proceed horizontally from E to *Y*, or from *F* to *Z*, as the case may be, for final answer in terms of mol fraction of *A* in the mixture. If key indicates that the value on *E* or *F* is to be divided by 10, do so, move to the new *E* or *F* value, and proceed horizontally to *Y* or *Z* for final answer. For instance, note on Fig. 2 where result on *F*, divided by 10, is 54.7 mols/mol.

KEY TO USE OF VARIOUS SCALES	
Using These Scales:	Find Answer On:
DBH	F
DAG	F
DBG	F ÷ 10
DAH	F ÷ 10
CAG	E
CBH	E
CBG	F ÷ 10
CAH	E ÷ 10

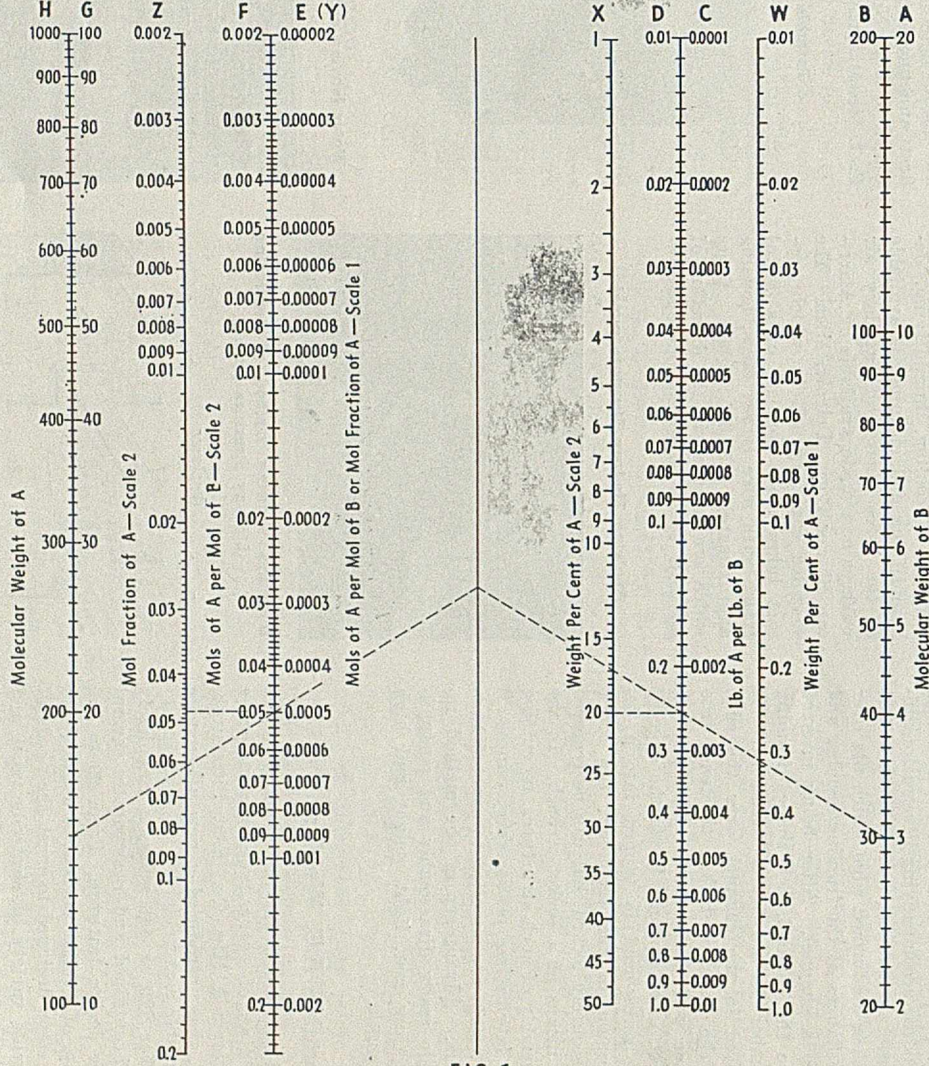


FIG. 1

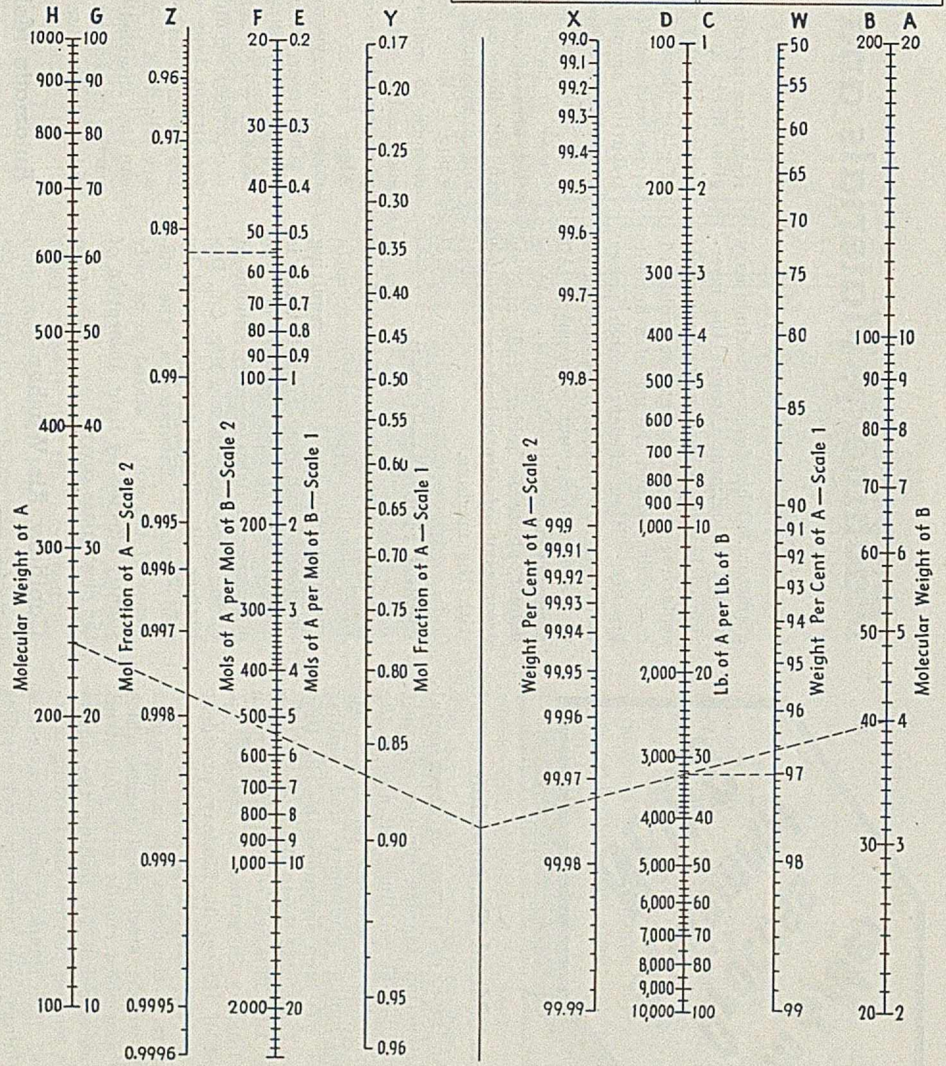


FIG. 2

Chem & Met Process Equipment NEWS

Machinery, Materials and Products

Sheet Metal Construction

An INGENIOUS TYPE of sheet metal construction adapted for use not only in industrial buildings but also in the fabrication of cabinets for dryers, air conditioning equipment and similar uses, has been announced by the Dry-Zero Corp., 222 North Bank Drive, Chicago, Ill. This new construction, known as Lindsay Structure, is the development of Harvey B. Lindsay, president of the Dry-Zero Corp. An interesting feature of the design lies in the use of light-weight steel panel sheets which are assembled rigidly with high structural strength by pulling the sheets into tension between the framing members. The company does not assemble buildings, but fabricates and supplies the necessary panels and framing members to specified dimensions and details.

As the accompanying illustrations indicate, the flat steel panels are provided with a die-formed edge which fits over the flanges of the framing member and into a channel. After being inserted into the channel, a U-shaped framing member known as a "tensioner" is placed in the channel, over the edge of the panel, and then tightened into place with lock screws which put the sheet into tension. When the edge of the screw-head is tapped into a depression in the tensioner, the screw is securely locked, but can be removed by means of a socket wrench. In the assembly of such structures, no cutting or fabricating is necessary since all materials are supplied to exact dimensions. Advantages of the method include ready disassembly and portability, low cost, light weight and high strength.

Portable A.C. Welder

FOR PRODUCTION and general-service welding of every type, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has introduced a new all-purpose portable a.c. welder which operates on either 220 or 440 volts, is completely self-contained and incorporates several new design features. From 20 to 250 amp. of welding current is available in 27 steps designed to meet the needs of a wide variety of electrode types and diameters. Other features include easy current adjustment through the insertion of bayonet plugs in the proper receptacles; and safety against prolonged overloads through the use of a built-in breaker. High efficiency, high power factor and low no-load losses are stated to assure maximum economy. All necessary accessories such as welding helmet, electrode holder, leads and an assortment of electrodes are supplied with the machine.

Sealed Fluorescent Unit

SEALED COVER construction which reduces cleaning and maintenance costs and permits use in locations requiring vapor-proof and dust-tight fixtures is available in the new "Sealed-Flo" line of fluorescent lights recently announced by the Benjamin Electric Mfg. Co., Des Plaines, Ill. Rated as vapor-proof by Underwriters' Laboratories, the efficiency of the unit is stated to be only slightly affected by light absorption of the clear glass cover.

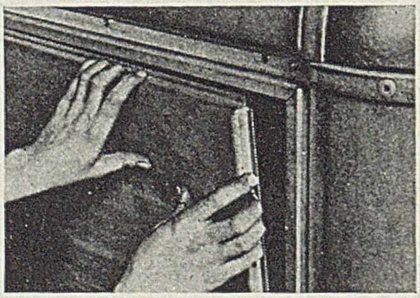
Capillary Air Washer

EXTENSIVE CONTACT SURFACE for bringing together air and water for evaporative cooling, humidifying, dehumidifying and cleaning, is available in the three classes of capillary air washers now made available by American Blower Corp., Detroit, Mich. The so-called capillary cell in which contact takes place consists of a metal frame with wire screen faces, housing approximately 57,000 glass fibers which are oriented in the direction of air flow so as to give numerous low-resistance passages of small size. The glass fibers are held in place by projecting slightly through a cross-mat of glass fibers on each cell face. These cross-mats serve also as water distributing agents, permitting the use of coarse, low-head sprays.

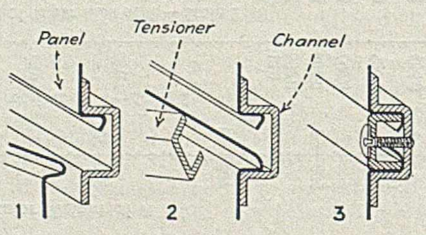
A standard 20x20x8½ in. cell is stated to have an effective glass contact area of approximately 125 sq.ft., an air flow capacity of 1,100 c.f.m. and a maximum water capacity of 9 g.p.m. Five years' experience is claimed to indicate very long life for such cells, with little possibility of plugging from ordinary outdoor air. Algae growth is said to be unlikely under ordinary water conditions.

The proper number of cells for the required air flow is installed in a washer which may be either of the con-current, counter-current, or counter-current type with heating or cooling coils. Only light-duty eliminators are required. Any desired capacity can be supplied, with special metal parts, if necessary on account of peculiar water conditions.

Applying Lindsay Structure panel



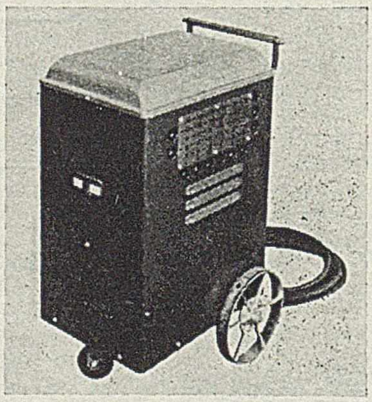
Diagrams showing method of tensioning Lindsay Structure panels



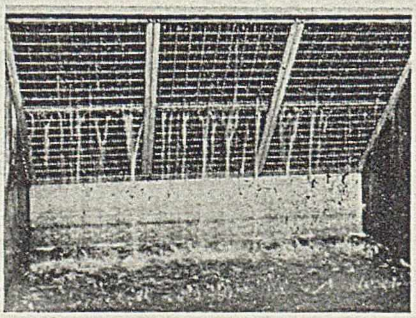
Automatic Molding Press

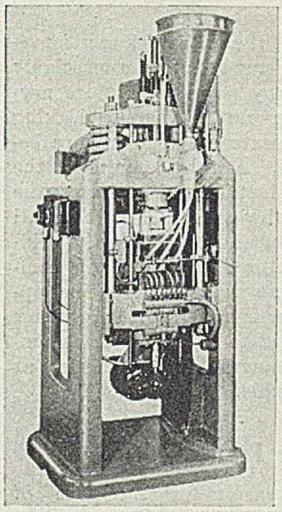
CONTINUING the development of the automatic molding press which was first announced three years ago (see *Chem. & Met.*, Nov. 1937, p. 674), the F. J. Stokes Machine Co., Philadelphia,

Portable a.c. welder



Water leaving cells of capillary washer





Automatic molding press with unscrewing device

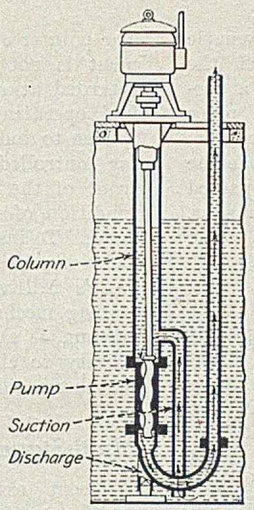
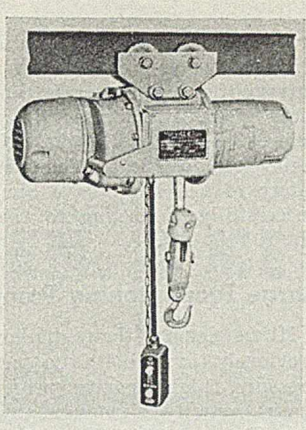
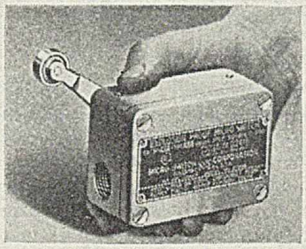


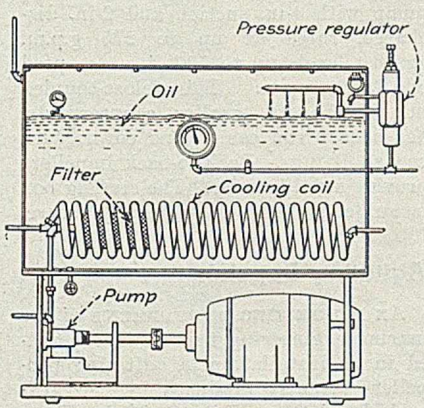
Diagram of submerged slip pump



Air-cooled electric hoist



Explosion-proof Micro Switch



New oil circulating unit

Pa., now announces availability of an automatic unscrewing device for use on the press which permits the completely automatic molding of threaded plastic parts such as bushings, knobs, ferrules, bottle caps, etc. Standard machine threads, internal or external and of any desired pitch, may be molded. With automatic operation and no operating attention except for occasional refilling of the molding powder hopper and removal of finished parts, the machine may be kept in operation for 24 hours per day and one man can tend a large battery of machines, according to the manufacturer. Production rates up to 1,000 or more units per mold cavity per day are claimed.

Simplified Slip Pump

Originally introduced three years ago (see *Chem. & Met.*, Oct. 1937, p. 625), by the Moyno Pump Div. of Robbins & Myers, Inc., Springfield, Ohio, the novel Moyno rotary pump has recently been made available by the manufacturer in a modified form suitable for the handling of slips, slurries and other suspensions. An important feature of the modified design is that the pump is of the submerged type, requiring no stuffing box. Also, as in the case of other pumps of this basic type, the pump is self-priming and has no valves. The construction is indicated roughly in the accompanying diagrammatic view. Slip is drawn into the suction pipe, passing into the pump proper which comprises a metal rotor of peculiar double-helical shape which rotates within a flexible stator element of comparable internal shape. It then passes out through the discharge pipe. Operation entails no incorporation of air bubbles, according to the manufacturer.

Materials Handling Equipment

Recent developments in materials handling equipment produced by the Philadelphia division of Yale & Towne Mfg. Co., Philadelphia, Pa., include a new line of 3,000-lb. capacity industrial trucks and a new air-cooled, low-cost electric hoist known as the "Load King."

The new truck, designated as KM-26, is a general utility model of the load carrier type, of light-weight welded steel construction, electrically operated and steering from all four wheels to facilitate handling in congested quarters. For the operator's safety the control platform is protected by a streamlined bumper. The new hoist, made in ¼ and ½ ton capacities, is available for lug, hook or plain trolley mounting with a choice of either right angle or parallel suspension. The provision of air cooling is claimed to eliminate excess braking heat and to permit heavier duty cycles. Weatherproof design is stated to permit operation of the hoist out-of-doors as well as under all normal plant conditions.

Oil Pressure Unit

To provide cooled lubricating oil at a uniform pressure to stuffing boxes equipped with lantern glands or certain types of seals, as well as to large bearings, the Durametallic Corp., Kalamazoo, Mich., has introduced an oil pressure unit of self-contained design consisting of a base, pump, motor, tank, pressure regulator, cooling coil, filter, pressure and level gages, filler inlet, vent connection and drain valve. A manual-type pressure regulator insures circulation at uniform pressure, as desired, up to 1,000 lb. A seamless copper coil is provided for water cooling to the desired uniform temperature. The pump, which is of the positive displacement type, enforces a uniform circulating rate. Safety requirements are met through the use of an explosion-proof motor, a vapor-proof lid on the tank, and an outside tank vent. These units are built in various sizes for the handling of from 1¾ to 14 quarts of oil per minute.

Explosion-Proof Switch

Listing for Class 1, Groups C and D, and Class 2, Group G hazardous locations has just been accorded by Underwriters' Laboratories to a new explosion-proof housing which is being supplied by The Micro Switch Corp., Freeport, Ill. This housing employed with the company's standard type Micro Switch, makes it acceptable for use in atmospheres containing vapors of ethyl ether, gasoline, acetone, lacquer solvents and similar materials, as well as for grain dust. As shown in the accompanying illustration, the switch may be actuated by a roller arm. The roller may either be parallel or at right-angles to the arm, or a bullet-nose push rod may be employed, all types requiring a maximum movement differential of 0.001 in. The switching unit inclosed within the cast-iron housing is listed for service up to 600 volts a.c., and capacity up to 1,200 watts.

High Temperature Valve

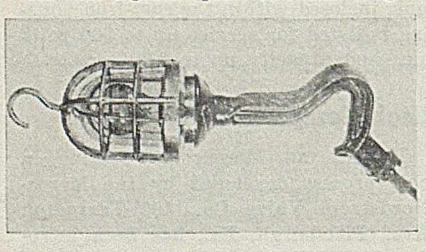
Known as Merchrome coating, a new process developed by the Merco-Nordstrom Valve Co., 400 Lexington Ave., Pittsburgh, Pa., has been introduced to make possible successful operation of lubricated plug cocks at temperatures as high as 1,000 deg. F. The Merchrome coating process is a development in which a welded coating is applied to the rotating surfaces of the plug and body of the valve, and in some cases to other parts as well. This coating is a complex metal alloy of extreme hardness and corrosion resistance. The hardness of approximately 54 Rockwell C is said to be maintained practically unimpaired at temperatures to 1,000 deg. F., while the corrosion resistance is reported as approximately equal to that of a stainless steel. Owing to the formation of an inseparable bond, the Merchrome may be applied to any desired thickness.

For high pressure service, plugs for such valves are lapped under heat into the bodies at a temperature corresponding to that of the intended service to provide extremely accurate fit at operating temperature. Although intended especially for high temperature operation, the Merchrome coating is stated also to be extremely resistant to abrasion at low, as well as high temperatures. An extremely low coefficient of friction is an important characteristic of the new coating. Several performance records are listed by the manufacturer. In one case a valve handling hot oils, at temperatures above 900 deg. F., has given over 5,000 hr. service. Several such valves have been used for handling vapor at 360 lb. pressure and 500 deg. F. In catalytic polymerization plants these valves are said to be operating at temperatures of 500 to 600 deg. F. and pressures from 1,375 to 1,950 lb. Several special alloy Merchromed valves are in operation at temperatures to 1,300 deg. F., handling hydrogen and hydrocarbon vapors.

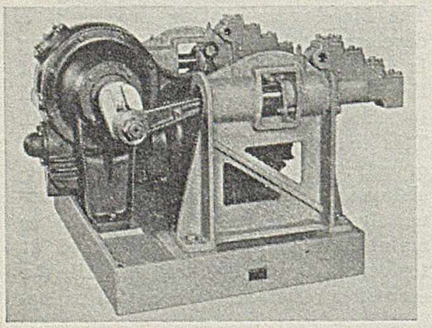
High-Capacity Lamp

For service in petroleum refineries, gas and chemical plants where considerable light is required, the Stewart R. Brown Mfg. Co., 258 Broadway, New York, N. Y., has developed an explosion-proof extension lamp of 100-watt size which is stated to have 2½ times the light capacity of any portable lamp of equal weight ever before listed by Underwriters' Laboratories. Special features include a safety grip of molded plastic said effectively to insulate heat, an extra heavy spark-proof hook and guard, an automatic circuit breaker which shuts off the current if the globe breaks, and a one-piece guard which must be in place before the lamp will light. Numerous rigid tests designed to demonstrate the safety of the lamp have been passed successfully, according to the maker.

100-watt explosion-proof extension lamp



High-capacity, high-pressure proportioning pump



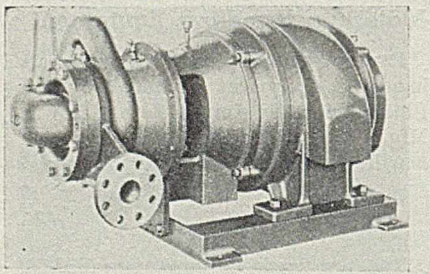
Large Proportioning Pump

Much larger than similar pumps previously available is a new high-pressure, high-capacity proportioning pump recently announced by Milton Roy Pumps, 3160 Kensington Ave., Philadelphia, Pa. The pump is of duplex construction, similar to other pumps of this company's design, but capable of handling up to 1,200 gal. per hour, compared with a previous maximum capacity of 212 gal. per hour. The particular unit shown in the accompanying illustration has a capacity of 480 g.p.h. against a pressure of 400 lb. Other units of the line are capable of pumping against pressures up to 20,000 lb. per sq.in. Various construction materials may be had for meeting almost any corrosive condition.

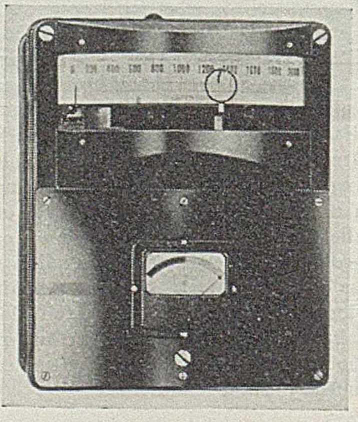
Electronic Pyrometer Controller

A new electronic circuit, using a single high-output vacuum tube of the all-metal type, is employed in the new electronic pyrometer controller recently announced by the Bristol Co., Waterbury, Conn. All moving parts in the control circuit, such as motors, depressor bars, toggle switches and open contacts are eliminated in this design. The pointer of the millivoltmeter movement is not engaged nor appreciably retarded at any point within its normal operating range, thereby leaving it free to indicate the temperature being controlled. A milliammeter at the front of the instrument indicates the condition of the control circuit at all times. To insure high accuracy, a cold-end compensator is used. This company's Millivac relay, the entire operating mechanism of which is under vacuum, is said to assure extreme sensitivity to changes in temperature at the thermocouple.

Two-stage centrifugal pump



New electronic pyrometer controller



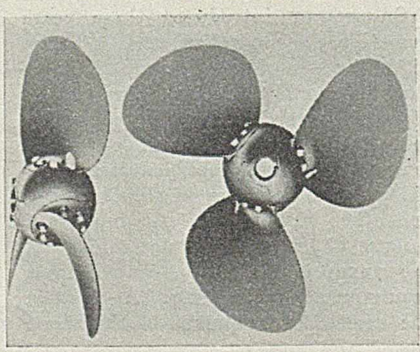
Multi-Stage Pump

Recent extension of the line of multi-stage "SSUnit" pumps put out by Allis-Chalmers Mfg. Co., Milwaukee, Wis., makes available a new two-stage pump with 4-in. suction and 2-in. discharge, rated at up to 275 g.p.m. against heads up to 500 ft. at a speed of 3,550 r.p.m. This close-coupled pump, like its smaller counterparts, has a cast-iron casing and cover, with bronze fittings. Back-to-back impellers provide axial balance. The stuffing box is subjected only to suction pressure.

Agitating Impeller

An interesting development of the marine engineering field is incorporated in an installation of agitating propellers recently produced by the Federal-Mogul Corp., Detroit, Mich. These propellers are used in the salt evaporators at the St. Clair, Mich., plant of the Diamond-Crystal Salt division of General Foods Corp. The installation consists of three three-blade impellers cast from Ni-Resist, each 45 in. in diameter and weighing 355 lb. assembled. As shown in the accompanying view, the blades are detachable, permitting adjustment to any pitch between 34 and 40 in. for most efficient operation. The blades are attached to the hubs by Monel metal studs and Elastic Stop Nuts. A further advantage of the removable blades is that installation was greatly facilitated since the parts could be put into the evaporators through existing manholes which would have had to be enlarged had assembled impellers been employed.

Marine type adjustable impellers used for salt evaporator agitation



CHEM. & MET. REPORT ON

Chemical Plant Safety and Fire Protection

TO PLANT MANAGERS, SUPERINTENDENTS AND CHEMICAL ENGINEERS

Always a vital factor in chemical plant operation, safety and fire prevention require even more serious consideration in times such as these. Expanding operations, multiple shifts, green men to be broken in while older employees work longer hours under heavier responsibility; these are some of the reasons why strictest discipline and the most carefully planned safeguards are now necessary to prevent accidents and personal injuries. And never for one minute must we forget that ACCIDENTS CAN BE PREVENTED! They don't just happen: They are caused. When there is sincere and energetic effort on the part of management to remove the causes and when employees cooperate in working safely, obeying instructions and using the necessary protective clothing and equipment, accidents will cease to occur, or at least become less frequent and less severe. Chemical industry has demonstrated by its fine safety records, that the latter goal can be achieved in more nearly normal times. This report proves that the good work can and must be continued NOW!

CHEMICAL AND METALLURGICAL ENGINEERING

October, 1940 Series A No. 7

TITLE OF REPORT Safety and Fire Prevention

TO Plant Managers, Superintendents and Chemical Engineers

FROM Chem. & Met. Editors

DATE October, 1940

Safety and Fire Prevention in Chemical Industry

INTRODUCTION

The purpose of this report is first to present somewhat statistically the status of plant safety in American chemical industry, then to analyze the principal causes of accidents and personal injuries in order to point out the means for their avoidance. Each plant presents its own problems, but the fundamentals of an adequate safety organization are the same in all industries. These simple rules are therefore presented as definite steps in a program any plant — large or small — can adopt. To assist the safety work of the individual plant or company, extraordinary facilities and services are available from such non-profit organizations as the National Safety Council and the National Association for Fire Protection. Closely allied with safety is the organized work now being done to conserve and promote industrial health through the elimination of occupational hazards and diseases. The whole program is one that takes on new significance in chemical industry as the latter expands its plants and develops new materials and processes to produce the many products needed by the national defense. This is industry's most urgent problem.

SUMMARY AND CONCLUSIONS

1. Chemical industry in 1939 set some enviable records in accident prevention, ranking seventh in frequency and seventeenth in severity among the thirty major injuries charted by the National Safety Council. But there is urgent need for improvement, particularly in the records of fatalities.

2. Contrary to popular opinion, most accidents in chemical industries are not caused by fumes and flames, but by slips and falls, common tools and machinery — the same as in all other industries. The reason is that the chemical group has learned how to protect itself against chemical hazards but has failed to conquer some of the common causes of injury.

3. Accidents annually cost chemical industry approximately $10,000,000 or $40 per worker per year. There are handsome dividends in safety work for those who go after them in the right way.

4. Fire prevention practices and equipment have changed to keep pace with the rapid developments of new chemical products and processes. Obsolete, antiquated fire extinguishers and fire-fighting apparatus had best be discarded before it is too late.

5. Recent chemical engineering graduates have been criticized because of lack of knowledge about industrial hazards and failure to appreciate the vital relation between safety and plant efficiency. Several educational institutions are awakening to the need for training in at least the fundamentals of safety engineering. Others should follow.

6. Full use of the facilities and services of the National Safety Council offers a ready means of checking the status and improving the progress of accident prevention in your plant or laboratory. More than 400 firms are already sharing in the benefits to be derived from the activities of its Chemical Section. There are probably almost as many more — especially small plants — that could be greatly benefited at a cost of but a few cents per employee per year.

Chemical industry is inherently hazardous yet its safety record is far better than that of most other manufacturing industries. This desirable condition has resulted from a thorough and intensive effort on the part of management to recognize potential hazards in plant operation and to provide the necessary safeguards and precautions to assure the safest possible working conditions. But that alone would not have proved effective had it not been for the equally intensive and intelligent cooperation on the part of the industry's employees. And of all the men employed in chemical plants, none have greater responsibility for safety than chemical engineers, chemists and technologists.

A. Status of Chemical Safety

Before reviewing some of the ways in which this cooperation for safety has been applied in chemical industries, consider the following facts and figures as revealed in "1939 Accident Rates in the Chemical Industry" recently published by the National Safety Council:

1. Injury rates in the chemical industry in 1939 were 37 per cent below the average for all industries in their frequency and 12 per cent below the general average in severity (See Fig. 1). The frequency rate for 417 chemical plants whose employees worked 305,535,000 man-hours was 7.48 (disabling injuries per million man-hours). For industry as a whole it was 11.83. The chemical severity rate was 1.26 (days lost per thousand man-hours) as compared with 1.42 for all industries.
2. As the trend curves in Fig. 2 well prove, there has been a substantial and consistent reduction in the frequency of accidents in chemical industry—a decline of 76 per cent since 1926. Improvement in the severity rate has lagged somewhat behind the frequency rate, but by 1939 it too had dropped 33 per cent as compared with the decline of 50 per cent for all industries.
3. The best 1939 injury records, as in most recent years, have been made by the larger plants. Both frequency and severity rates for the smaller plants were twice the average for large organizations, being 11.85 for frequency and 2.87 for severity as compared with 6.45 and 1.11.
4. Injury rates were lowest in chemical laboratories, alcohol and solvents factories, plastics plants and those producing paint and varnish manufacture. Frequency rates in these plants averaged less than 7.0 and severity rates were 0.50. Table I shows the disabling injuries in chemical industry in 1939 as classified by industrial groups.
5. The Old Hickory, Tenn., plant of E. I. duPont de Nemours & Co. holds the best known all time no-injury record in chemical industry—11,361,846 man-hours. This remarkable record, which terminated March 22, 1937, is also the best known safety record for any industry in the United States. Seven of the fifteen best all-time no-injury records recorded by the National Safety Council in May, 1939 were held by chemical companies.

So much for the credit side of our ledger. There are some liabilities in these same figures on accident rates in chemical industry which should not be passed over too casually.

1. The lag in the reduction of the industry's severity rate, particularly in recent years, has been due very largely to increases in the frequency of fatalities. Of all the various types of injuries recorded, these have shown the least improvement in frequency during the past 13 years. The 1939 fatality rate of 0.05 was up 8 per cent from 1938 and this increase reduced the overall improvement since 1926 to only 2 per cent.
2. Severity rates were highest in coal-tar distilling plants, fertilizer works and explosives manufacturing—averaging more than three times the rate for all groups.

B. Causes of Serious Accidents

During the past six years the National Safety Council has compiled summary reports from chemical industries that have listed 1,123 serious injuries and permanent disabilities. A most significant conclusion to be drawn from this study is that injuries in chemical industry arise from exactly the same causes as in most other industries.

Analysis of the circumstances and causes of 274 serious injuries in chemical plants discloses that machinery and plant equipment were the principal agencies of injury, being involved in 36 per cent of the cases. Presses and rolls were the next outstanding offenders, followed by pumps, fans, and mixers. Chemical pipe lines and tanks are responsible for fully 6 per cent of the accidents in the industry and a somewhat greater percentage of the severity. It will be noted from the following tabulation that chemicals figured in less than 10 per cent of the accidents, being less dangerous than working surfaces such as floors and ladders.

The principal way in which employees were injured was by being caught in or between the moving parts of machinery and other equipment—accounting for fully half of all serious cases. Falling, sliding and flying objects were next.

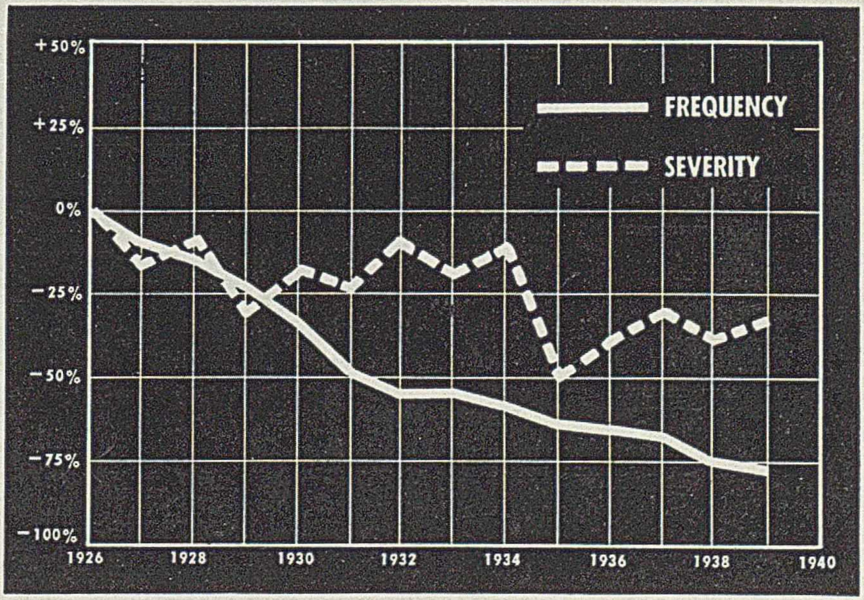
Agency of Injury	*Injuries*
Machinery	98
Working surfaces (floors, ladders, etc.)	29
Chemicals	26
Vehicles	20
Elevators and hoists	16
Pipe and pressure apparatus	15
Hand tools	15
Not otherwise classified	55
Total number of injuries	274

Type of Accident	*Injuries*
Caught in or between machinery and other equipment	138
Falling, sliding and flying objects	52
Falls from one level to another	28
Inhalation, absorption or swallowing	14
Burning and scalding	15
Struck against	12
Not otherwise classified	15
Total number of injuries	274

Mechanical causes were assigned to four-fifths of all serious injuries. Unsafe processes and working methods, improper planning and similar hazardous procedures were of most importance. As an example, lack of planning and coordination during a plant breakdown resulted in one injury because a foreman failed to make sure that all employees were in the clear before the equipment was started.

Here are the principal mechanical causes noted by the National Safety Council in its summary.

Mechanical Causes	*Injuries*
Unsafe processes, working methods, planning, poor housekeeping, etc.	100
Improper guarding	64
Defective agencies (design, construction, broken parts, etc.)	47
Non-use of protective equipment (principally goggles)	8
Not otherwise classified	3
No mechanical cause	52
Total number of injuries	274



Decline in frequency of accidents in chemical industry has been more consistent than in the case of their severity as reported by the National Safety Council

Personal causes such as disobedience of instructions, abstractions, recklessness and similar improper actions were responsible in one-half of the cases studied. As examples: a maintenance man lost an eye when he disregarded instructions to wear goggles when using a chisel and hammer; an operator sustained a fractured arm when he applied dressing to a belt running toward a pulley rather than away from it. Unawareness of safe practices or lack of knowledge or skill figured in 20 per cent of the cases as shown below:

Personal Causes	*Injuries*
Improper attitude	130
Unaware of safe practices or lack of knowledge or skill	77
Bodily defects	5
No personal cause	62
Total number of injuries	274

Thomas P. Kearns, superintendent of the Division of Safety and Hygiene in the Industrial Commission of Ohio drew the following conclusions from an extended study of the causes of accidents in chemical and allied industries.

This study would indicate that the dangers attending the manufacture of chemical products or other products in which their use is a basic necessity are no different from those found in other industrial classifications or in industry as a whole. It also serves to show that while the chemical group has fairly well protected itself against the hazards of physical contact with harmful chemicals, it still is confronted with the problem of eliminating the hazards common to all fields of production. Concentration of effort toward the controlling of these most prolific sources of accidental death and injury, is the most important step in the industry's safety program, following safety measures that will adequately protect chemical workers from those hazards peculiar to the industry itself.

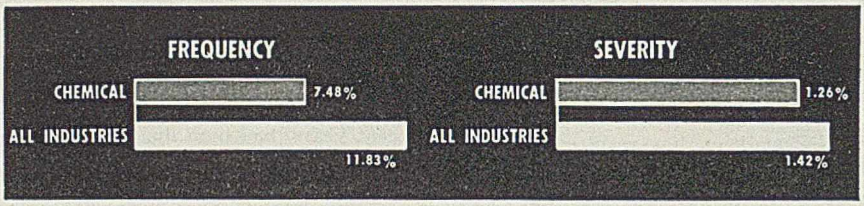
C. Costs of Accidents

On the basis of 250,000 employees in the chemical firms reporting to the National Safety Council, it has been estimated that the annual accident cost—direct and indirect—is approximately $10 million or $40 per worker per year. Here is what comprises the greater bulk of the annual cost bill for industrial accidents:

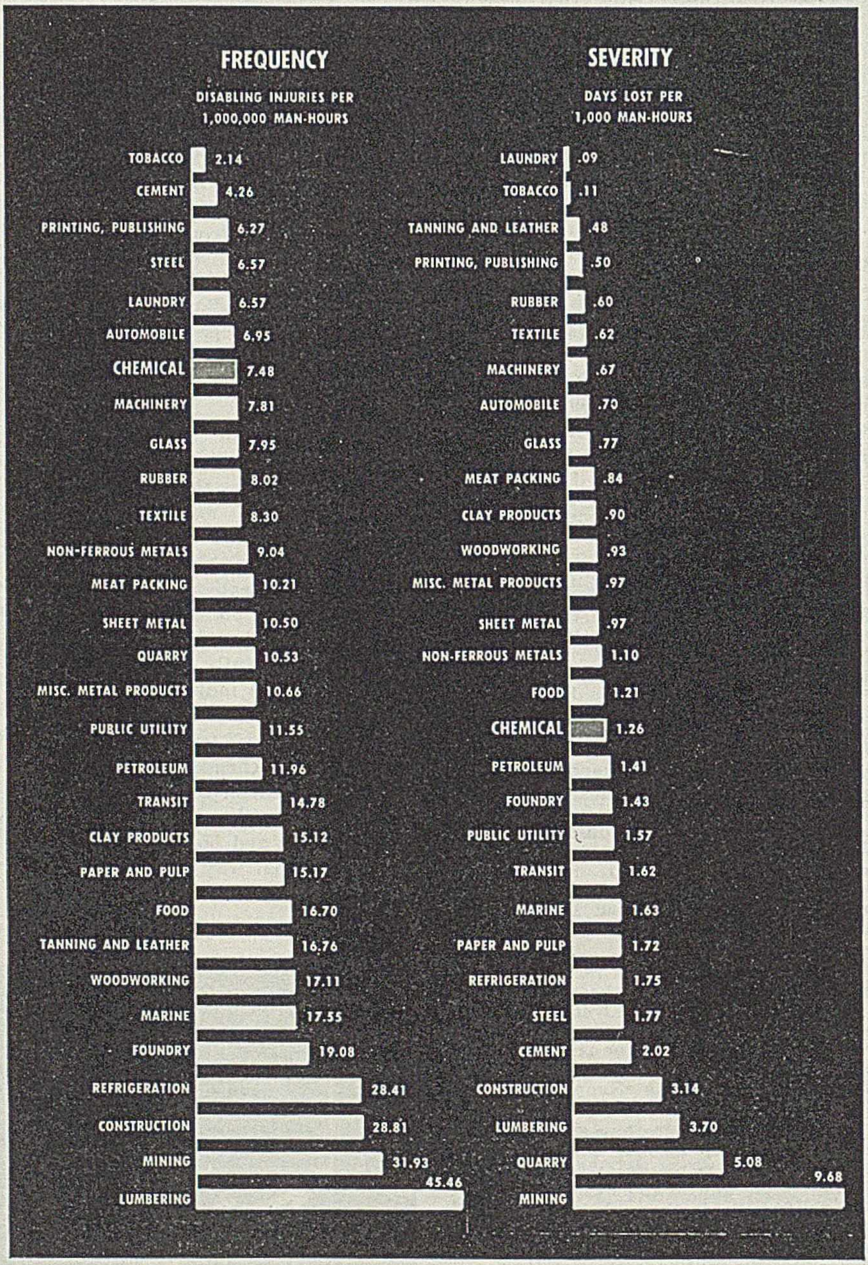
1. Time lost by injured employee.
2. Time lost by other employees through curiosity, sympathy, or aid to injured employee.
3. Time lost by foremen or other executives in giving aid, investigating cause, selecting, training, and breaking in a new employee, preparing insurance and state reports, attending hearings.
4. Damage to machines, tools, materials.
5. Interference with production, failure to fill orders on time.
6. Payments by employers under employee benefit systems.
7. Wages continued in full or in part, although injured employee may not earn them because of incapacity.
8. Profit lost on injured employee's productivity.

D. Organizing for Accident Prevention

Experience has taught chemical plant managers that the only sure way to develop and maintain a good accident record is to approach the safety problem with the conviction that it is important and worthy of serious attention by all employees—from top to bottom of the payroll. Each plant is a problem in itself but the fundamentals of an adequate safety organization are the same for one company as for another. A number of years ago a speaker at a National Safety Congress laid down these fundamental rules which should always be included in any plan for accident prevention: Chief among all requirements are interest and cooperation on the part of the company executives. Next is the appointment of an individual (or in a large company



Chemical industry may well be proud of its safety records as contrasted with those for all manufacturing industries. Figures are for 1939



In 1939 chemical industry stood seventh in accident frequency and seventeenth in severity among the thirty industries whose accident rates are charted annually by the National Safety Council of a department) responsible for continued and exacting supervision of all safety activities. A first job is the maintenance and study of the company's accident records. Other steps include the formation of safety committees, the establishment of an employee safety training program (to be operated in conjunction with any courses given in vocational training), supplying and insisting upon the use of all personal protective equipment as is necessary for the job, training some of the workers in first-aid procedure and the effective use of the facilities of local and national organizations which provide services or advice on safety matters.

More will be said later about the remarkable facilities and services of the National Safety Council. It is recommended that anyone concerned with the organization of an industrial safety program should consult Safe Practices Pamphlet No. 42 of the National Safety Council. An accompanying chart outlining the major activities of a typical safety and fire prevention department is taken from that publication. So too is the following summary of the eleven steps to be observed in starting an industrial safety program:

1. Management Leadership. Manager must do his part in helping to "put safety on the map."

2. Cooperation of Superintendent. Superintendent must make safety an integral part of the operating organization.

3. Appoint Safety Director. One man should be designated to represent the manager in directing the safety program.

4. Analyze Accident Records. After his appointment, the Safety Director should analyze the accident reports for the past year or two to learn, if possible, the how, who, where, when and why of each accident.

5. Hold Meeting of Operating Executives. All supervisors, foremen, superintendents, and operating heads should then be summoned to a general meeting presided over by the manager or general superintendent.

6. Make Inspection of Operations. Following this meeting each foreman should make a complete inspection of his department.

7. Start Mechanical Safeguarding. The safeguarding program should then be developed and carried out, making sure that the most serious conditions are corrected first.

8. Provide Facilities for Rendering First Aid. First-aid attendants can help to prevent accidents in addition to caring for injured workers.

9. Make General Announcement. Then the workers should be acquainted with the accident prevention plan.

10. Organize Educational Works. Formulate program to maintain interest, and increase safety knowledge of management, foremen, and workers.

11. Consider Engineering Revision. Consider methods for improving machinery, equipment, and processes to eliminate hazards and increase production efficiency.

E. Facilities and Services

The manifold activities and services of the National Safety Council provide means and materials for helping any company in any industry to carry on well balanced, practical safety work. The Council, which has its headquarters at 20 N. Wacker Drive, Chicago, Ill., is a non-profit, non-commercial organization which was organized by industry in 1913 to serve as a clearing house for safety information. It provides several thousand members in practically every field of industry with current data, facts and methods whereby accidents may be prevented and industrial efficiency improved. Membership dues covering the costs of all industrial services of the Council amount to only a few cents per employee per year.

Complete industrial membership in the Council provides a company with copies of all of the Council's publications, the two magazines *National Safety News* and *The Safe Worker*, the safety posters, safe practice pamphlets, sectional news-letters, foremanship training material, various accident statistical reports and free consulting services on matters affecting safety in plant operations. Industrial members are encouraged to conduct safety contests within their own plants for which attractive bronze plaques are provided by the National Safety Council as part of the complete membership program. Annual safety contests are also conducted by the various industrial sections of the Council.

In the 1939-1940 contests of the Chemical Section there were enrolled 170 plants employing 81,331 people who worked 164,669,820 hours. One-third of the contestants went through the entire period without a reportable injury. The best record was that of the Spruance rayon plant of the duPont Co. at Richmond, Va., which worked the largest number of man-hours without a reportable injury—5,325,987. The 1940-41 competition began July 1, 1940 with 36 new participants. R. C. Stratton, chemical engineer, Travelers Insurance Co., Hartford, Conn., is chairman of the Statistics and Contest Committee of the Chemical Section. As of Sept. 10, 1940 the membership in the Chemical Section of the National Safety Council was 433 members, of which 44 had been added during the past year.

As typical of the data and informational services provided by the Chemical Section of the National Safety Council is the following list of Industrial Data Sheets and Safe Practice Pamphlets of chemical interest published since the October, 1939, Safety Congress.

Typical informational services, provided by the Chemical Section, National

Table I. Disabling Injuries, 1939, Chemical Industry, by Industrial Groups

Industrial Group	Number of Industrial units	Man-Hours Worked (thousands)	Average Number of Employees	Number of Disabling Injuries: Death and Perm. Total	Perm. Partial	Temporary Total	Total	Time Charges: Death and Perm. Total	Perm. Partial	Temporary Total	Total	Injury Rates: Frequency	Severity
All Groups	417	305,535	144,378	40	1/2	2,073	2,285	240,000	106,005	39,090	385,095	7.48	1.26
Laboratories	13	4,202	2,062	0	0	3	3	0	0	16	16	.71	.003
Industrial Gases	8	4,303	2,109	1	1	5	7	6,000	60	101	6,161	1.63	1.43
Alcohol and Solvents Manufacturing	5	2,010	951	0	0	7	7	0	0	124	124	3.48	.06
Plastics Manufacturing	16	13,485	6,704	0	15	36	51	0	4,459	647	5,106	3.78	.38
Acid Manufacturing	40	19,739	9,623	4	16	56	76	24,000	10,250	1,701	35,951	3.85	1.82
Chlorine and Alkali Manufacturing	12	15,206	6,645	2	3	57	62	12,000	400	2,246	14,646	4.08	.96
Carbon Products	13	9,397	4,629	1	12	35	48	6,000	6,497	1,013	13,510	5.11	1.44
Dye Manufacturing	7	11,602	5,752	1	7	56	64	6,000	3,268	1,268	10,536	5.52	.91
Paint and Varnish Manufacturing	37	21,864	10,742	1	4	136	141	6,000	1,500	2,878	10,378	6.45	.47
Pharmaceutical and Fine Chemical Manufacturing	29	43,631	15,977	3	13	377	393	18,000	9,728	5,655	33,383	9.01	.77
Explosives Manufacturing	59	27,702	13,822	11	20	253	284	66,000	12,810	4,347	83,157	10.25	3.00
Soap Manufacturing	31	24,760	12,556	2	32	234	268	12,000	15,573	5,129	32,702	10.82	1.32
Coal Tar Distillers	17	1,155	558	1	0	16	17	6,000	0	224	6,224	14.72	5.39
Fertilizer Manufacturing	12	8,150	4,018	3	6	122	131	18,000	5,850	2,186	26,036	16.07	3.19
Salt Manufacturing	12	4,340	2,163	0	2	74	76	0	700	1,508	2,208	17.51	.51
Vegetable Oil Manufacturing	30	7,609	3,850	0	9	131	140	0	8,315	2,473	10,788	18.40	1.42
Not Otherwise Classified	76	86,380	42,217	10	32	475	517	60,000	26,595	7,574	94,169	5.99	1.09

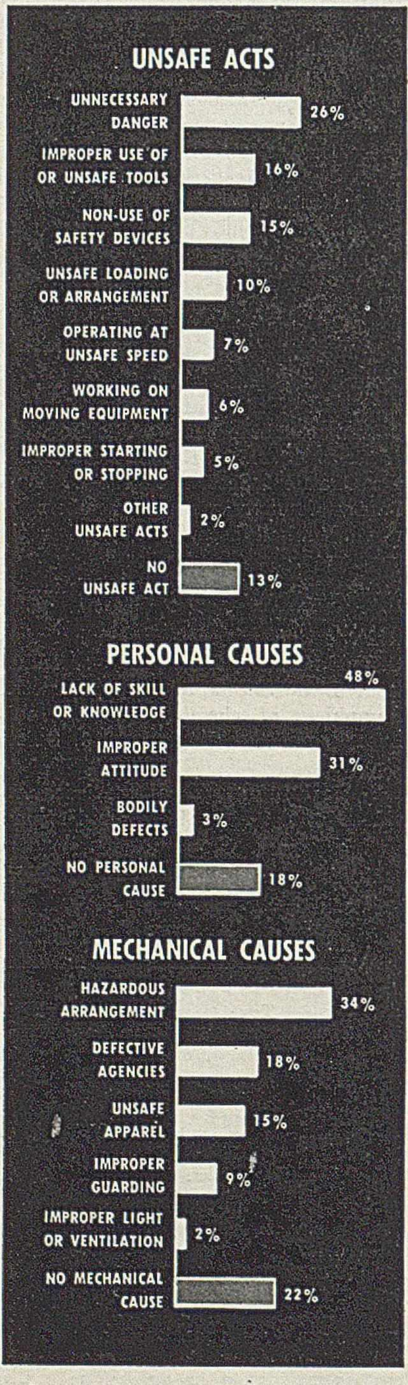
Safety Council, since Oct., 1939, meeting:

Industrial Data Sheets

November, 1940—D-Chem. 9, "Removing Acid from Carboys."
February, 1940—D-Chem. 11, "Dry Ice."
May, 1940—D-Chem. 34, "Naphthalene."
August, 1940—D-Chem. 35, "Toluene and Xylene."

The following Data Sheets are ready for publication:

D-Chem. 33, "Hydrofluoric Acid."
D-Chem. 36, "Cresylic Acid."
D-Chem. 35, "Bleaching Compounds."



Why accidents occur in industry. Source: 1,000 industrial injury accidents classified by the National Safety Council

Safe Practices Pamphlets

October, 1939—No. 3, "Safe Operation of Steam Boilers."
March, 1940—No. 14, "Goggles."
December, 1939—No. 33, "Hoisting Apparatus."
December, 1939—No. 35, "Conveyors."
October, 1939—No. 42, "Organizing a Complete Industrial Safety Program."
November, 1939—No. 49, "Construction and Equipment of Steam Boilers."
May, 1940—No. 50, "Fatigue."
February, 1940—No. 55, "Industrial Power Trucks and Tractors."
December, 1939—No. 68, "Pressure Vessels—Fired and Unfired (Part II)—Steam Jacketed Vessels, Digesters, Stills, Blow Cases, and Autoclaves."
December, 1939—No. 72, "Safety Committees."
January, 1940—No. 78, "Mathematical Tables and Data for the Safety Engineer."
May, 1940—No. 93, "Topics for Safety Meetings."
May, 1940—No. Chem.-2, "Fume Poisoning."
May, 1940—No. 97, "Safe Operation of Pulvertized Coal Systems."
July, 1940—No. Chem.-6, "Cyanide Compounds."
July, 1940—No. HP-14, "Benzol."
August, 1940—No. 76, "Portable Electric Hand Tools."
October, 1939—No. 84, "Safety Man in Industry."
May, 1940—No. 29, "Electrical Equipment in Industrial Plants."

Two additional Safe Practices Pamphlets are ready for publication:

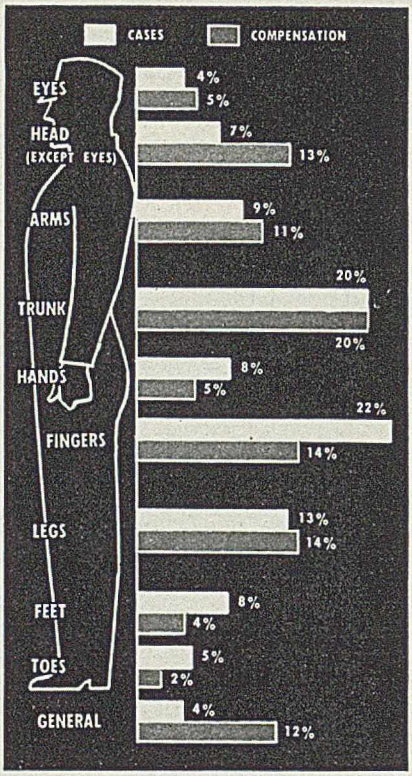
No. 27, "Industrial Sanitation."
No. 46, "Fuel Handling, Storing and Firing."

Note: These are typical of more than 2,000 safety and health practice pamphlets and industrial data sheets that are now available to members. Likewise there are more than 500 safety instruction cards from which the members of the Chemical Section may choose. Typical cards are shown in the illustration on page 706.

F. Industrial Health

Industrial health problems are also of concern to the National Safety Council as well as to a number of other private associations and governmental agencies that are active in this field. One of the newer organizations that is following the pattern set by industry in the safety movement is the Air Hygiene Foundation, 4400 Fifth Avenue, Pittsburgh, Pa. It now has approximately 225 member companies, employing about one million workers. Its purposes are to conserve the health of workmen by preventing illness and occupational disease, to serve as a central source of information on industrial hygiene and to supplement the health work of individual companies through organized research, medical and engineering studies.

In one of a recent series of Bulletins on "Industrial Health Defense," the Air Hygiene Foundation urges managements in all industries affected by the national defense program to redouble their efforts toward mitigating and protecting workers against potential health hazards. As plants are being expanded and workmen exposed to new hazards or forced to work overtime, there are



Where men were most frequently injured in industrial accidents in 1938

grave dangers through fatigue and overexposure. Exhaust and ventilating systems must be checked and efficiently maintained to make certain that they are not overloaded by the pressure of increased production. In short, industrial health is an asset or resource that must be carefully conserved if we are to maintain morale and efficiency in our plants.

Two years ago the National Association of Manufacturers established a Committee on Healthful Working Conditions to promote health in the industries of the country. This committee, headed by Dr. Victor G. Heiser, has studied factory health programs throughout the United States, giving special attention to the problems of the smaller manufacturing concerns. The results of these and other studies can be obtained without charge from the Division of Industrial Health, National Association of Manufacturers, 14 W. 49th St., New York City.

G. Eye Hazards in Industry

Eye hazards in industry exact a heavy and needless toll. The National Society for the Prevention of Blindness has calculated the net cost of industrial eye injuries at more than $100,000,000 a year. A single case of blindness in New York State may and frequently does cost the employer or his insurance underwriter as much as $30,000. Industrial management in recent years has been giving increased attention to this problem as improved practices have proved that eye injuries can be prevented. The problem is broader, however, than merely providing goggles, masks and other protective equipment. There must be continuous, sincere and well planned programs of educating workers and supervisors and fullest cooperation on the part of both management and employee.

H. Fire Prevention

Closely allied both with safety and industrial health activities is the necessity for adequate fire protection. In this field, too, there is a non-profit technical and educational organization, the National Fire Protection Association, 60 Batterymarch St., Boston, Mass. It was organized in 1896 "to promote the science and improve the methods of fire protection and prevention; to obtain and circulate information on these subjects and to secure the cooperation of its members in establishing proper safeguards against loss of life and property by fire."

The Association is authority for the estimate that there were 26,700 fires in manufacturing plants in American industry last year for which the loss was in excess of $50,000,000. This fire record has been shown to increase as production increases—thus emphasizing again the necessity for tightening our defenses against fire as well as providing special precautions to guard against the arsonist and the saboteur.

During the recent Fire Prevention Week (Oct. 6-12, 1940) many agencies combined to emphasize the necessity for a thorough-going study of fire prevention equipment and practices in industrial plants. Many manufacturers undoubtedly depend upon antiquated extinguishing equipment, rendered obsolete by recent changes in industrial processes and materials. Synthetic resins and rubber-like products, lacquers, high-test gasolines and volatile solvents, chemicals for plastics, synthetic fibers and finishes are cited as a few of the materials and processes that have posed new problems in fire prevention during the last few years.

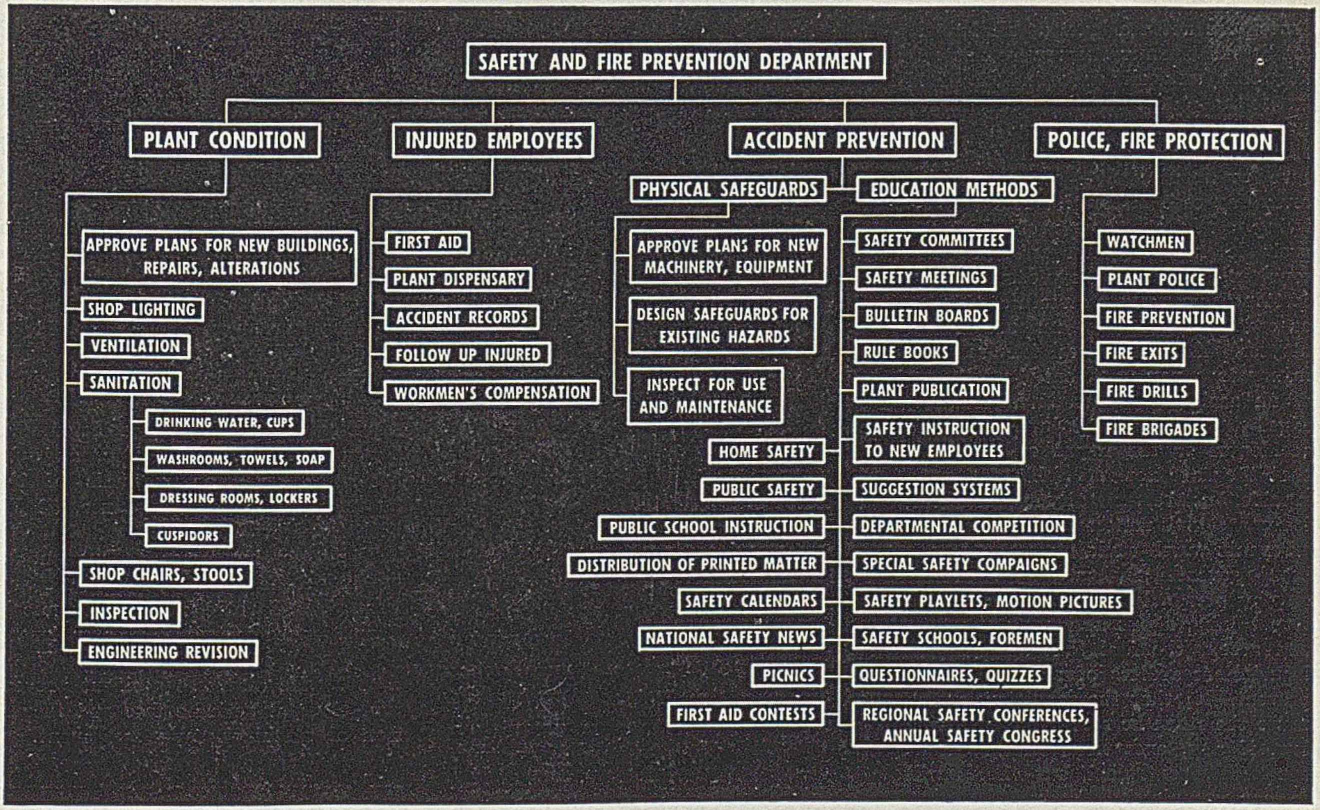
John Kidde, New York engineer and authority on fire protection methods, suggests three simple steps for any company to take in organizing its fire-prevention program:

1. Launch a campaign for topnotch plant housekeeping to eliminate careless habits and unnecessary hazards.
2. Teach employees how to fight fires, organize fire brigades and stage frequent fire drills.
3. Analyze the hazards and adopt the most advanced fire safe guards. In this last step the advice of insurance men, fire department officials and the manufacturers of fire-protection equipment can be of great help.

I. Safety Education

As the safety movement in industry has gathered momentum in recent years, an evident need has developed for college and extension courses in safety engineering and fire prevention. As an example of what can be done in this direction, the Massachusetts Safety Council in February, 1940, in cooperation with the Massachusetts Institute of Technology, sponsored a one-semester course of 15 two-hour lectures for the instruction of safety engineers, inspectors and others desiring to enter the field of industrial safety in New England. Although limited in the preliminary announcement to 100 students, a total of 132 were enrolled and all except a scant few completed the course. The lectures were given by outstanding engineers, including several representatives of chemical industries. The published lectures will serve as a textbook for similar courses in plant safety organization and in safety engineering.

At the recent June, 1940, meeting of the Society for the Promotion of Engineering Education, Prof. J. W. Greene, of Kansas State College, presented a thoughtful paper on the necessity for safety instruction in the training of chemical engineers for industry. In most institutions organized instruction in safety matters has been largely neglected. Greene suggests as a tentative program that every chemical engineering curriculum should provide, preferably in connection with laboratory courses in the unit operations and unit processes, (1) one or more formal lectures stressing the industrial significance and attitude toward safety, (2) demonstrations in



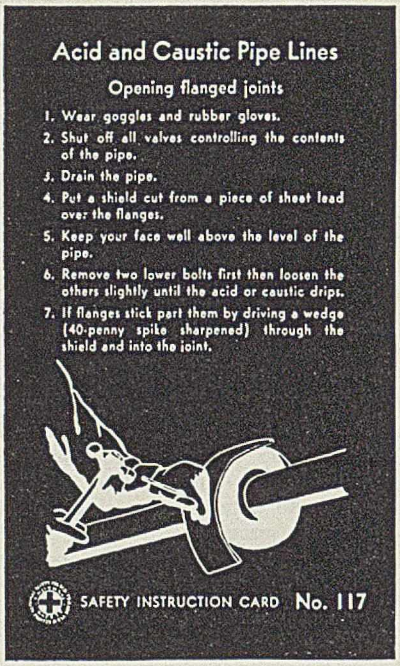
Outline of activities for a typical safety and fire prevention department. These duties are described in detail in Safe Practices Pamphlet No. 42 of the National Safety Council

flame propagation and practice in the use of fire extinguishers, (3) preliminary laboratory studies to include safety surveys of each operation, (4) appointment of one member of each laboratory group to act as safety man, (5) lectures and discussion of hazardous properties of flammable, explosive and toxic materials, preferably in connection with courses in technology.

For the man already in industry, however, the Annual Safety Congresses and Expositions sponsored by the National Safety Council offer a great deal in the way of education and experience. In addition to the general sessions, there are many sectional meetings at which technical papers are presented and discussed. The Chemical Section, for example, met at the Stevens Hotel in Chicago on Oct. 8 and 10, 1940 to hear papers from safety men representing Carbide & Carbon Chemicals Corp., E. I. duPont de Nemours & Co., Hercules Powder Co., and the Underwriters Laboratories of Chicago.

Harold L. Miner, Manager, Safety and Fire Protection Division of the duPont Co., discussed "Management and Employee Responsibilities in the Prevention of Personal Injuries." He pointed out that Webster defines an "accident" as "an event which takes place without one's foresight or expectation, an undesigned, sudden and unexpected event." Court decisions support this definition. Accepting this exposition of meaning it is apparent that many events (personal injuries) which have been classified as "accidents" are not accidents at all for the conditions causing them were not unexpected, unusual or unknown. The fact is that under certain circumstances or combination of conditions plus the human element, a personal injury is sure to result. We are constantly reviewing case histories, surveying existing conditions and predicting the probable number and severity of personal injuries which may occur during certain periods, from certain conditions or causes, for a given number of employees. This removes the result—injury to a person—from the category of an accident. When it is acknowledged that personal injuries are not accidental or the result of accidents, that they are not inevitable, not inescapable, but are, generally speaking, unfortunate and unnecessary experiences or events which could and should have been prevented; when we stop referring to personal injuries as accidents; stop talking about accident prevention and accept the fact that all personal injuries, regardless of magnitude, are preventable; that the conditions which cause them can be recognized and with few, if any, exceptions eliminated or adequately controlled, our efforts will be more completely effective.

Mr. Miner summarized the safeguarding responsibilities of supervision as follows:



More than 500 different 3x5-in. Safety Instruction Cards are available from the N.S.C. for giving the workman definite instructions on how to do his job safely and efficiently

Management's Responsibilities:

1. To see that all employees are properly instructed or educated to work safely; that they understand safety regulations as well as proper operating procedure.
2. The establishment and maintenance of friendly cooperation between the employer and the employee.
3. That all mechanical safeguards are in place, in good condition and functioning properly; that personal protective equipment is available, in good condition and used when necessary.
4. That every employee thoroughly understands that he is to work safely and so to supervise and direct him that he does so.
5. To be a leader and always set a good example.

Employee's Responsibilities:

1. To work safely at all times.
2. To obey operating instructions and safety regulations.
3. To use protective equipment whenever required.
4. To discontinue unsafe practices and report any observed to their supervisors.
5. To report promptly all unsafe conditions which are noted."

Charles L. Jones, safety engineer, Hercules Powder Co., was given the assignment of outlining methods and procedures for "The Safe Disposal in Chemical Plants of Empty Containers" (including tanks, drums, cans, bottles, gas cylinders, dismantled equipment and old pipe lines). A big subject, this is most important because the so-called "empty" container is usually more dangerous than the full one. This is especially true of containers which have been used for volatile solvents since even small residues may produce vapors that form explosive mixtures with air. Unlined drums used for corrosive acids are equally dangerous, due to the hydrogen that is formed in the acid's attack on the metal. Chemical manufacturers, to their misfortune, have found that only a source of ignition is required to change such an "empty" acid drum into a deadly bomb. The obvious remedy but not always the easiest, is to make certain that every discarded container or piece of equipment is thoroughly and properly cleaned. After you have removed all flammable, poisonous or corrosive materials, safe disposal or salvaging of old containers is not a difficult or hazardous undertaking.

In his paper Mr. Jones also called special attention to the excellent series of Safe Practice Manuals issued by the Manufacturing Chemists Association, 608 Woodward Building, Washington, D. C., the report on safe handling and use of gas cylinders by the Compressed Gas Manufacturers Association, 11 W. 42nd St., New York City, the regulations for shipping hazardous chemicals by the Bureau of Explosives of the American Railway Association, 30 Vesey St., New York City, and the accident prevention manuals of the American Petroleum Institute, 50 W. 50th St., New York City.

The paper by James J. Duggan, director of the Process Safety Department of the Carbide & Carbon Chemicals Corp., is abstracted at greater length on pages 678-9 of this issue of *Chem. & Met.* He discusses accident prevention through periodic test and inspection of machinery and equipment.

Reprints of this 8-page Report are available at 25 cents per copy. Address the Editorial Department, Chem. & Met., 330 West 42nd St., New York, N. Y.

Facts YOU NEED TO KNOW ABOUT...

Top-Feed Filters

For coarse, quick-draining, crystalline materials that require dewatering, washing, and drying

In general, any suspension in which the solids settle readily can be filtered on a top-feed filter. However, since the rotary-drum vacuum filter is more flexible and easier to operate, use of the top-feed filter is limited to coarse, rapid-settling crystalline solids —especially where the solids are to be dried and where washing is not particularly important.

Like other vacuum filters, the top-feed filter employs a rotating drum wrapped with a porous filter screen through which the filtrate is drawn by a vacuum. However, instead of being fed from below, the slurry is fed into the top of the drum. Then too, the unit is completely enclosed, and hot gases are used to dry the cake.

Coarse materials are readily handled in a top-feed filter because they settle quickly and form a cake which drains rapidly and permits the passage of hot gases for drying.

ADVANTAGES

Two Units in One—Top-feed filters serve as both a dewatering and a drying unit. Thus, they eliminate the need for a separate dryer, saving equipment costs and floor space.

Bone-Dry Product—The heated gases provide thorough drying of the filter cake. This is especially true if V-shaped drum sections are used, for they permit an ample supply of gases to pass through the cake.

High Capacity—Slurry is fed continuously to the drum and the filter cake is continuously discharged. Hence, the rate of output is considerably greater than where the slurry must be filtered in batches, as with the pressure filter. Also, the quick-draining materials handled can be dewatered and dried rapidly in thick cakes, which further increases the capacity of the unit.

When a bone dry cake is to be delivered, the capacity range is between 100 and 900 lb. per sq. ft. of filter area per hour. Much higher capacities can be obtained when only partial drying or no drying is required.

Low Operating Costs—Operation is fully automatic. One operator can supervise several filters, and labor costs are low.

LIMITATIONS

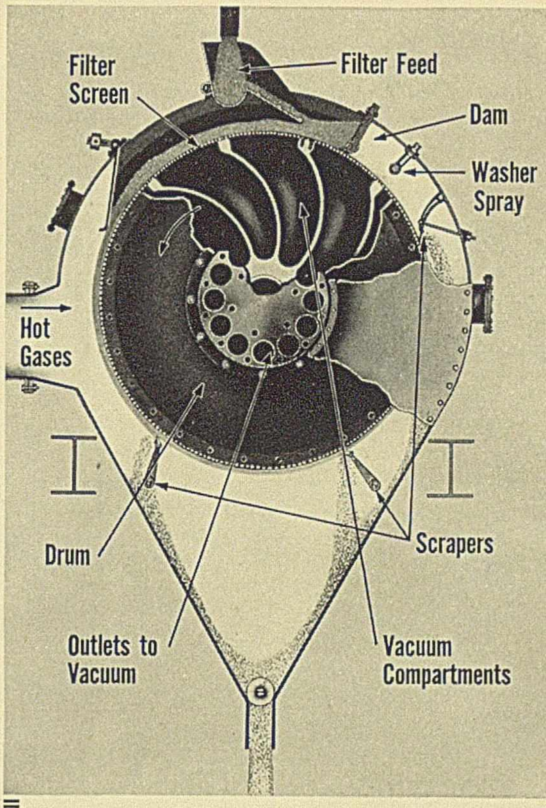
Top-feed filters are not suitable for filtering finely divided suspended materials. These require a longer time to settle than is allowed by the top-feed filter. Furthermore, they form a dense filter cake which will not pass the hot gases. For such materials, the ordinary tank-type vacuum filter is preferable.

As in all rotary-drum filters, the filtrate from top-feed filters is somewhat turbid. Where a polished filtrate is desired, the rotating-leaf, pressure filter should be used.

TYPICAL APPLICATIONS

Top-feed filters are used extensively with all quick-draining crystalline materials. They are used in the production of ordinary table salt, potassium dichromate, ammonium chloride, and lead and zinc sulphides, as well as for washed foundry sand.

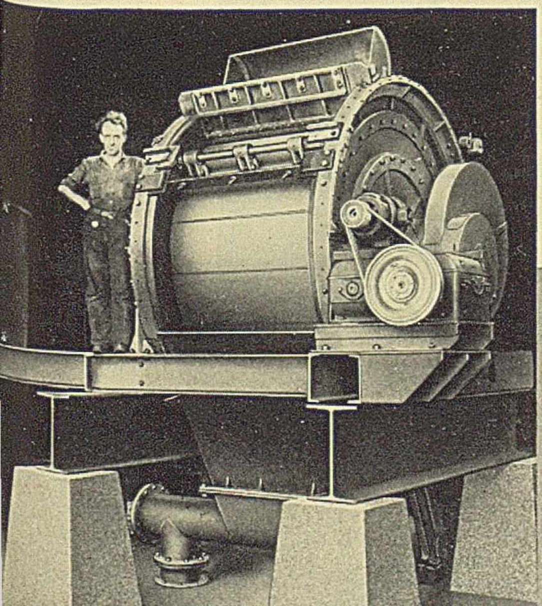
SWENSON offers a complete line of top-feed filters for every operating condition. For more complete information, write for new bulletin, "Dewatering and Drying in One Unit."



PRINCIPLE OF OPERATION

Slurry flows from the feed box on to the drum, forming a pool against the dam. The vacuum in the drum pulls the filtrate through the filter screen and the solids remain, forming a cake on the screen. As the drum revolves, hot gases pass through the filter cake and out to a vacuum receiver—thoroughly drying the cake. The dry crust that forms on the filter cake is removed by adjustable scrapers. The final scraper removes the entire cake. The filter medium is then washed by sprays.

Below: Swenson top-feed vacuum filter for use in dewatering and drying salt.



SWENSON EVAPORATOR COMPANY

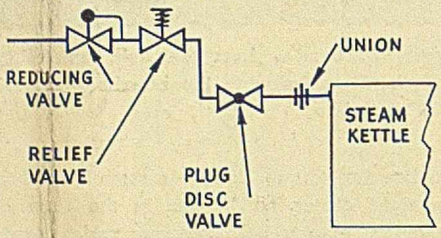
Division of Whiting Corporation • 15669 Lathrop Ave., Harvey, Ill.

SWENSON
FILTERS

EVAPORATORS • CRYSTALLIZERS

HERE'S how the chef in a mid-western hospital discovered something about valves that is significant to any plant with extensive piping. The chef raised the lid of a steam kettle ready to dish up a savory beef stew. Instead, he found a badly scorched mess.

By his clock he knew that it had not cooked too long—the heat should



have been constant—but something had happened—something beyond his control.

The engineer of the hospital diagnosed the trouble thus: "Pressure regulator's gone blooey," he stated. "Look at the sediment in this reducing valve. If you had that much junk inside of you, you would fail, too."

When W. F. C., the Crane Representative, appeared in response to a telephone call, he quickly found the answer. Obviously, simply cleaning the regulator was asking for more trouble later—Preventive Maintenance dictated some form of protection for the kettle to prevent extreme temperature from ruining more food.

The answer was simple—see the hookup at left. A Crane relief valve, placed on the low pressure side of the pressure reducing valve, gave assurance that in the future, failure of the pressure regulator would not result in further disaster to beef stews.

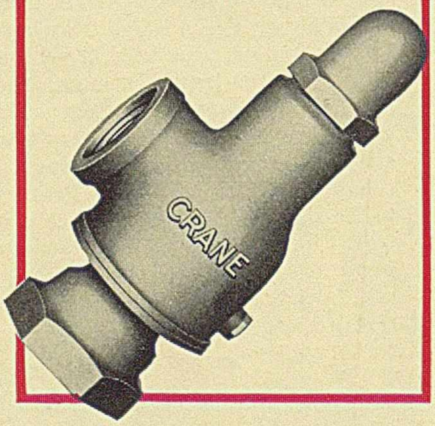
RESULTS: (1) No more danger of uncontrolled steam under high pressure reaching the cooking kettles. (2) One more user of valves and fittings has learned that Preventive Maintenance prevents further trouble from valves by recommending the correct valve of the correct materials in the correct hookup. (3) Another valve user has found that he can be assured sound advice on piping problems by calling the Crane Representative.

This case is based on an actual experience of a Crane Representative in our Kansas City Branch.

YOUR PLANT IS SAFER WITH CRANE RELIEF VALVES

You may never have occasion to worry over scorching a beef stew, but in your plant—in fact, in almost every plant—the judicious application of relief valves on pipe lines will prevent many maintenance problems from becoming serious—save many dollars in time lost or material destroyed, as well.

Crane relief valves are made in brass, iron and steel—designed to control air, gas, water or steam. Available in sizes from ⅜″ to 5″ to meet every requirement where a relief valve may be necessary.



1940 85th YEAR

CRANE

CRANE CO., GENERAL OFFICES:
836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

MAKING ALUMINA

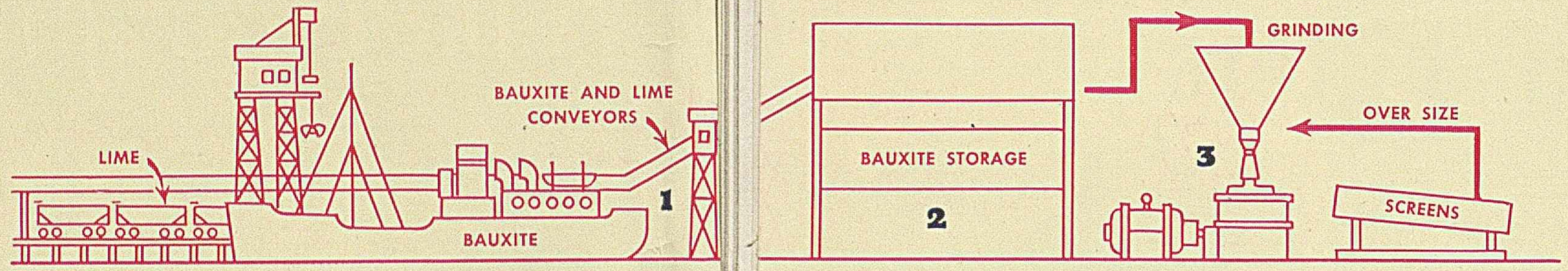
Aluminum is playing a particularly important role in the defense plans of this country. Fortunately, the Aluminum Company of America, through its subsidiary the Aluminum Ore Company has recently greatly expanded its facilities for the production of alumina from which the metal is made. The first unit of a plant at Mobile, Ala., which was completed about two years ago was designed for a capacity of 500,000 lb. of anhydrous alumina per day, but the efficiency has been so far improved that the plant has exceeded this amount. The capacity of the plant at present is 1,000,000 lb., although by January 1, 1941, this capacity will have been increased 50 per cent.

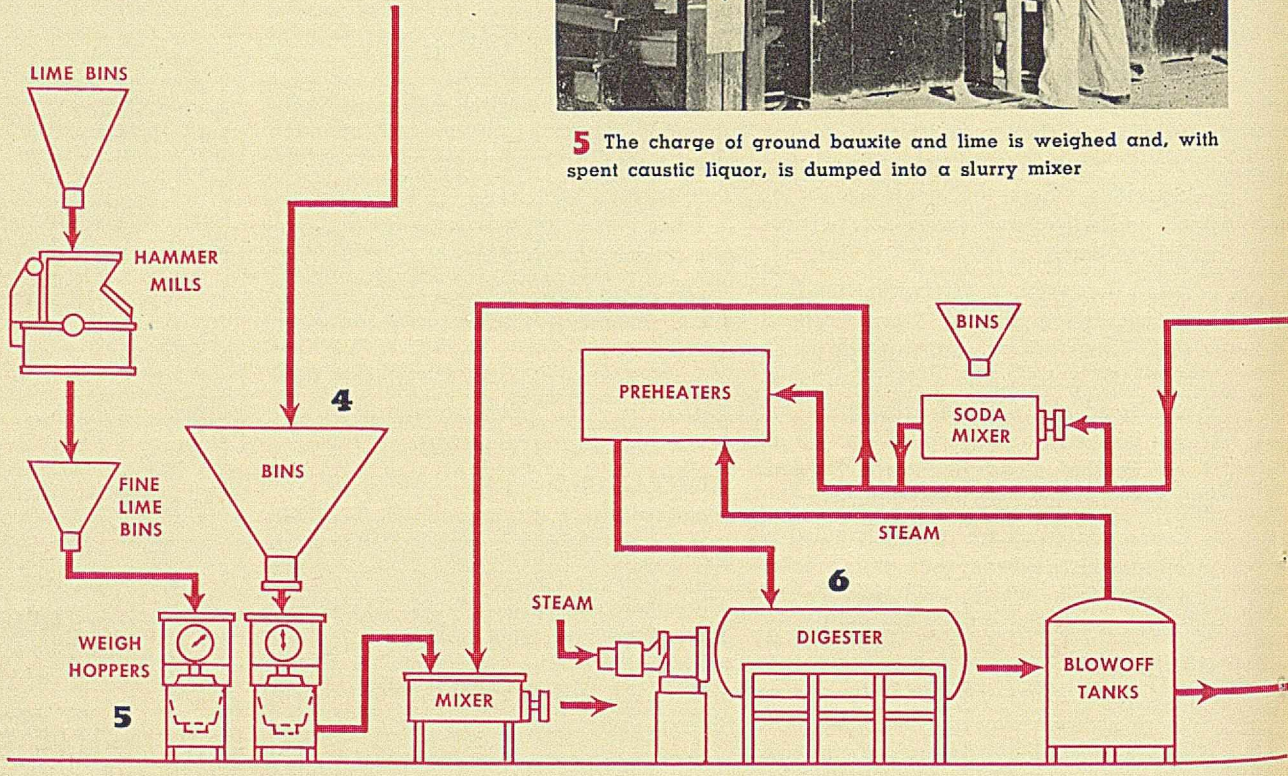
The principal raw materials used in producing alumina are bauxite, which is brought in from Surinam, lime and soda ash. The bauxite and lime are ground. Individual charges are weighed. The relative amounts depend on analyses of the bauxite and liquor with which it is mixed.

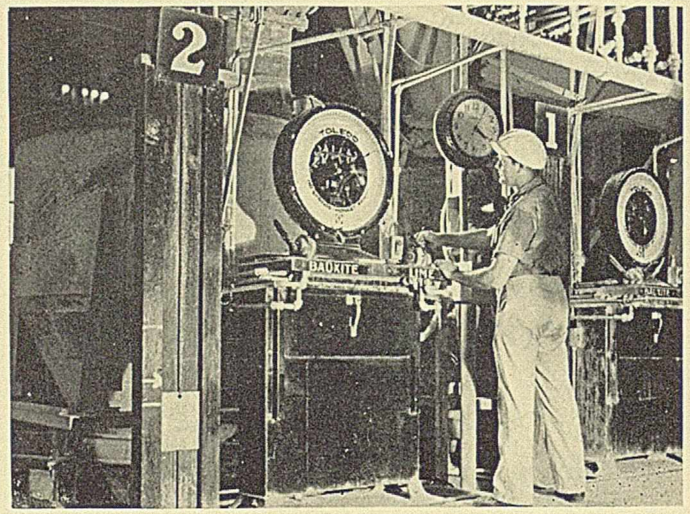
This liquor is a solution of caustic soda which dissolves alumina from the bauxite forming a solution of sodium aluminate and leaving in suspension the impurities. The slurry is digested at elevated temperatures to allow for complete chemical reaction. This consists of the solution of the alumina as sodium aluminate and precipitation of dissolved silica in the form of sodium aluminum silicate.

The aluminate liquor is separated from the red mud in Kelly presses and pumped to the precipitation department. A seed charge of previously precipitated aluminum trihydrate throws out about one half of the alumina content as trihydrate. The hydrate is then separated from the liquor and clarified in tray thickeners. The slurry of washed hydrate flows to Dorreo filters which discharge into the rotary kilns. The anhydrous alumina passes through a rotary cooler and is carried by a Peck conveyor to the shipping bins from which it is transferred to the plants of the Aluminum Company of America to be reduced to the metal. For a more detailed description of the process, see pages 674-77.

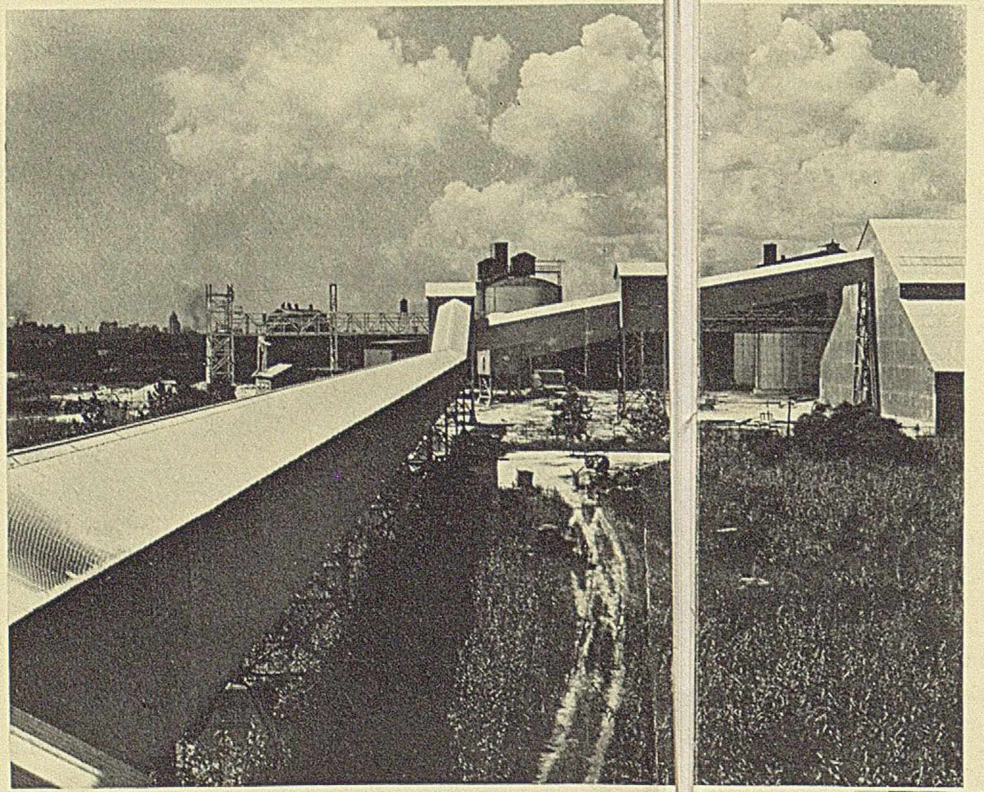
CHEMICAL & METALLURGICAL ENGINEERING
OCTOBER, 1940 • Pages 707-710





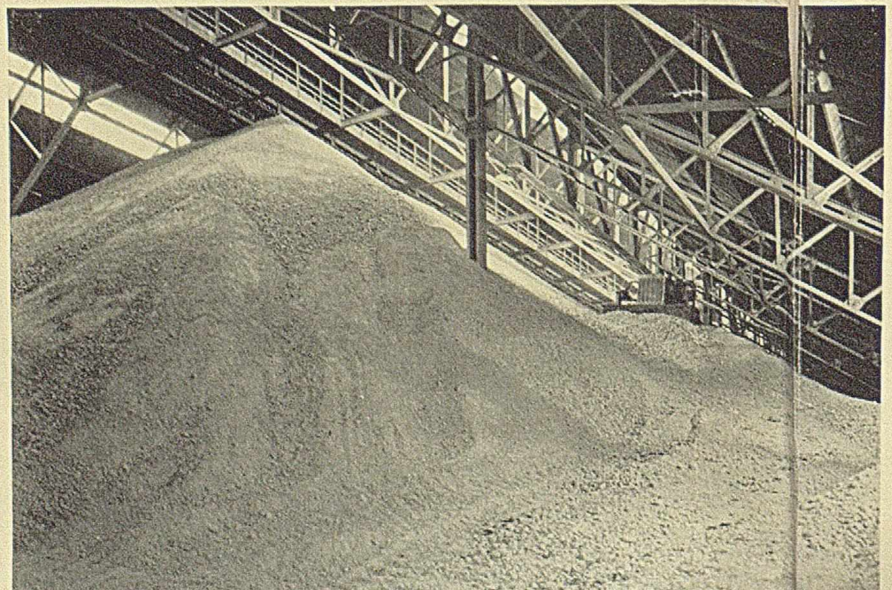


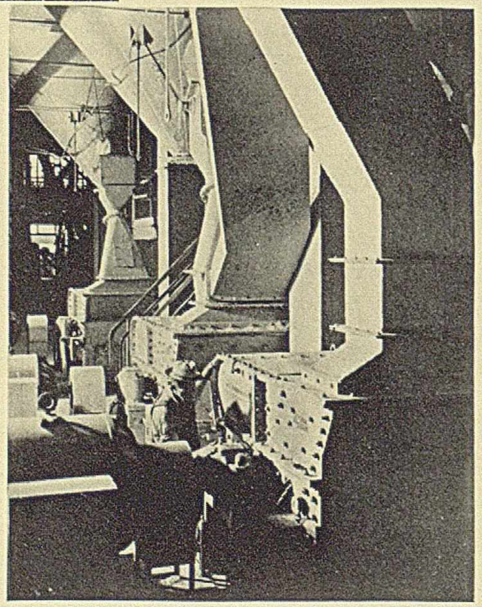
5 The charge of ground bauxite and lime is weighed and, with spent caustic liquor, is dumped into a slurry mixer



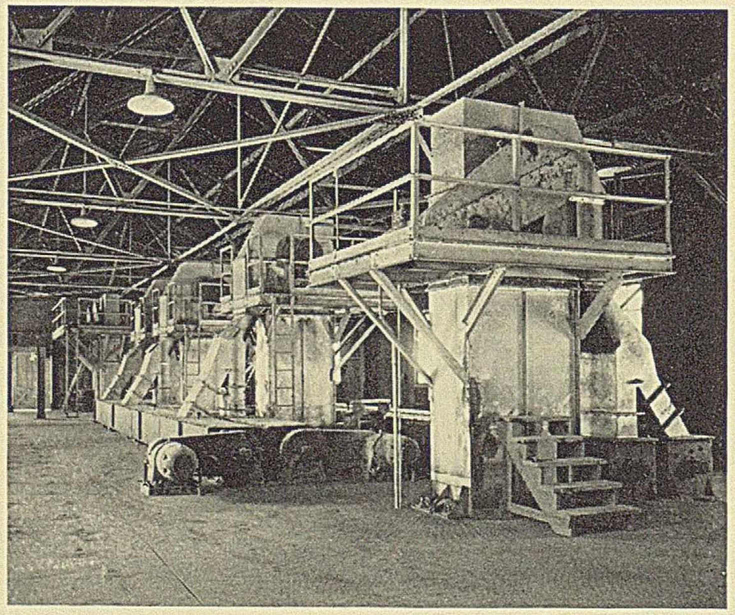
1 Conveyors carrying bauxite from the bulk unloading plant of the Alabama State Docks Commission to the bauxite storage building of the Aluminum Ore Co. at Mobile

2 The enormous bauxite storage. To obtain some idea of the size note the bulldozer in the right center. A hopper in the floor of the building discharges the material onto a belt conveyor which carries the bauxite to the grinding building



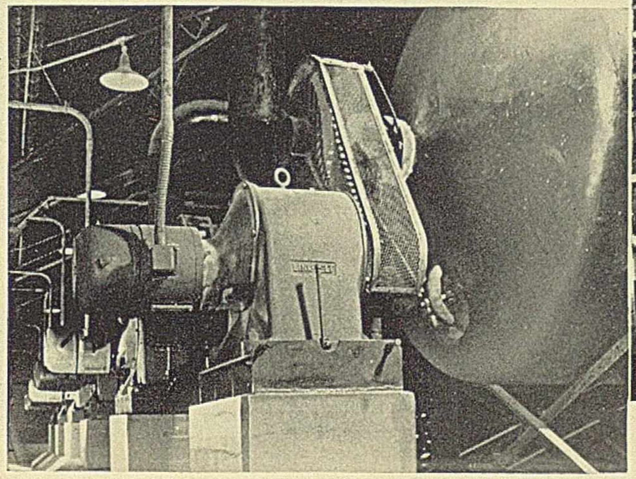


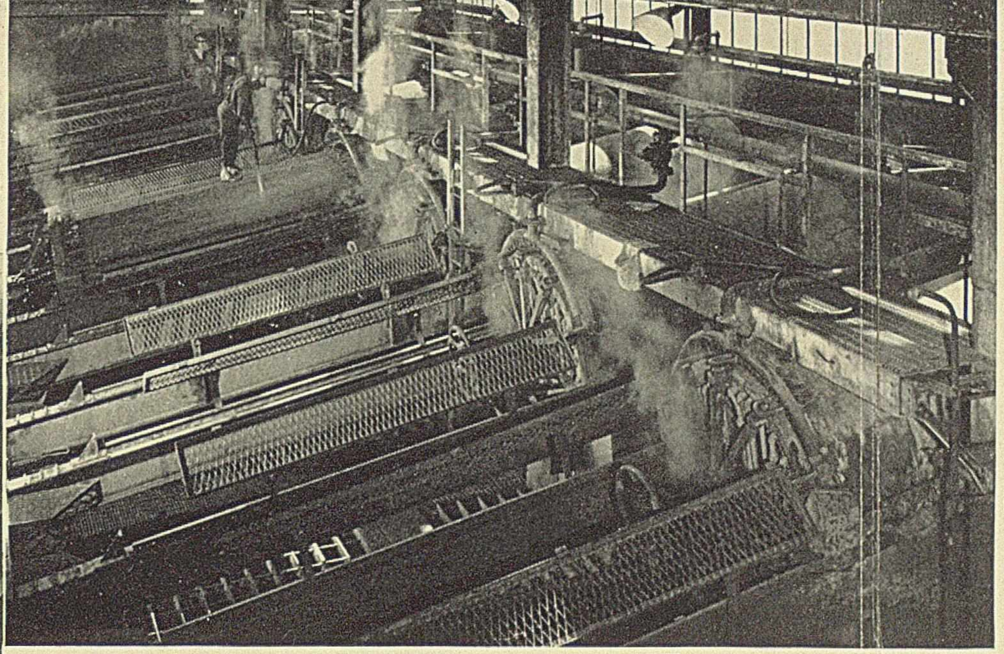
3 At the start of the Bayer process the bauxite is ground in hammer mills and screened



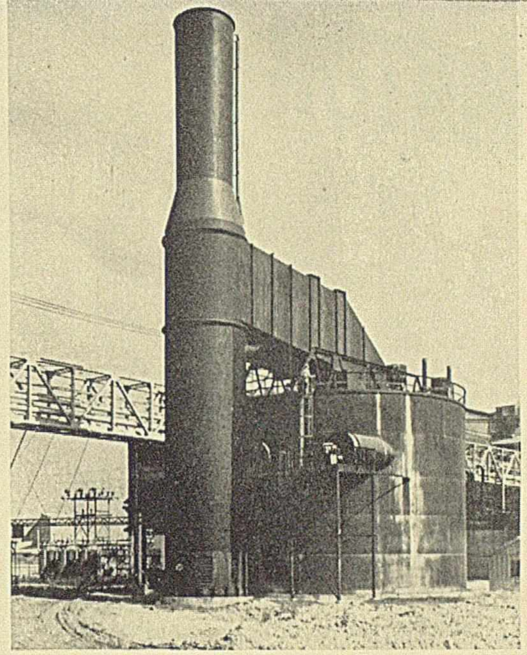
4 The fine bauxite screw conveyor delivers the material to the cylindrical storage bins. These serve as screen feed bins

6 From the slurry mixer, the charge goes to the digesters where a preheated solution of caustic is added. Under pressure the caustic dissolves the aluminum hydrate to form a solution of sodium aluminate

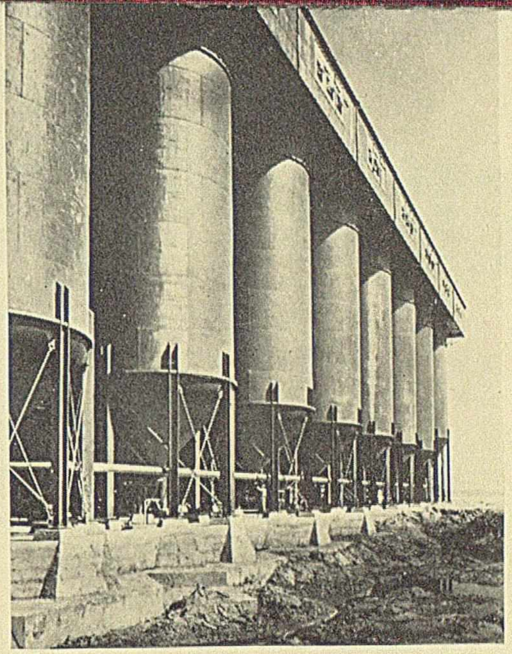




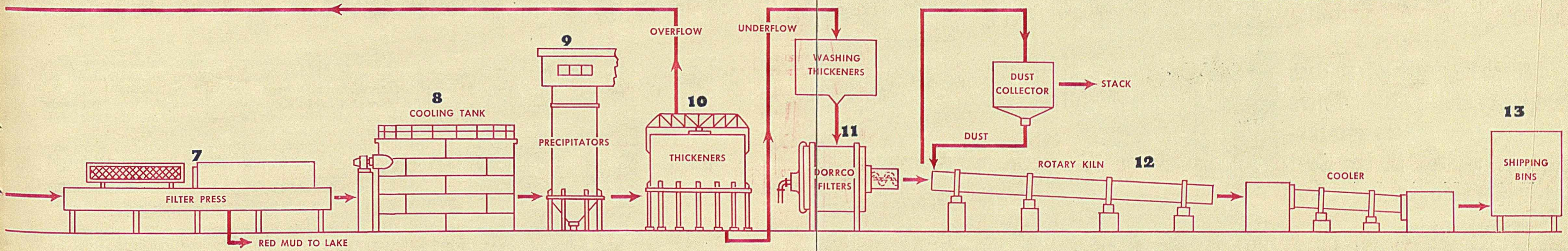
7 Sodium aluminate liquor is separated from the red mud residue in Kelly filter presses. The mud is pumped under the Mobile River to a settling pond



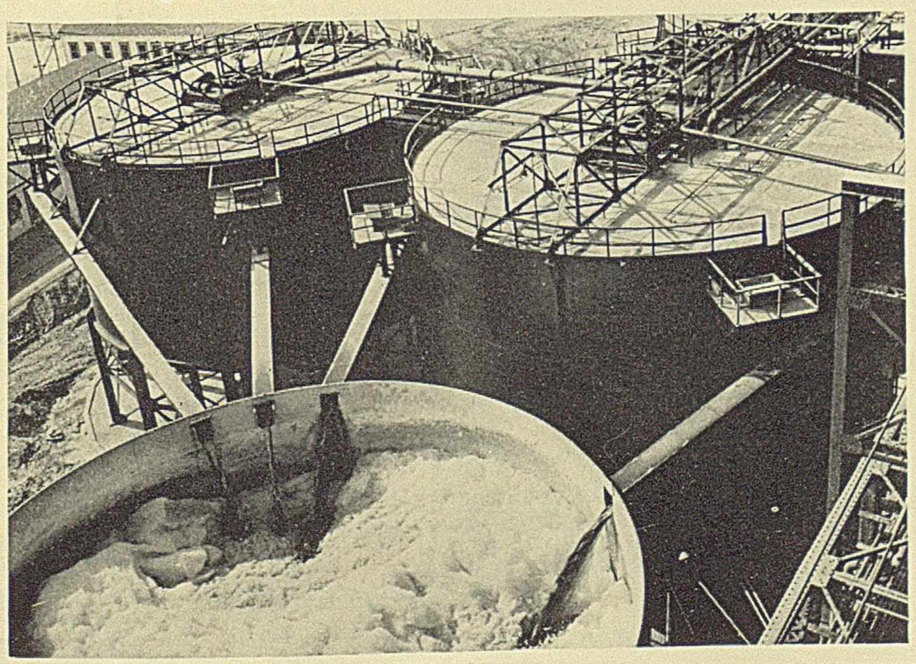
8 Sodium aluminate filtrate is pumped through a cooling tank to reduce its temperature

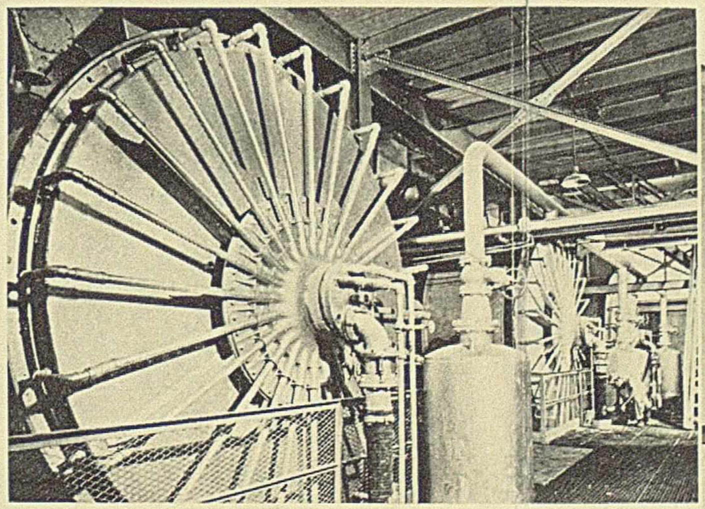


9 Cooled sodium aluminate solution then goes into precipitating tanks as high as a five story building. In these tanks, a seed charge is added and the trihydrate precipitated



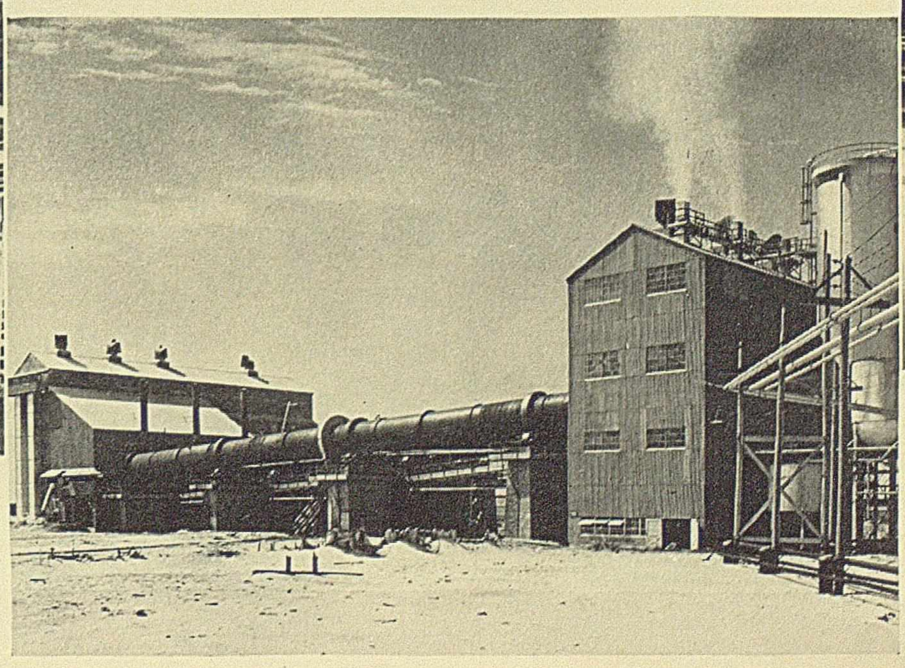
10 Spent liquor tank with thickeners in the foreground. The final clarification is accomplished by Dorr tray thickeners. Part of the hydrate is returned to process

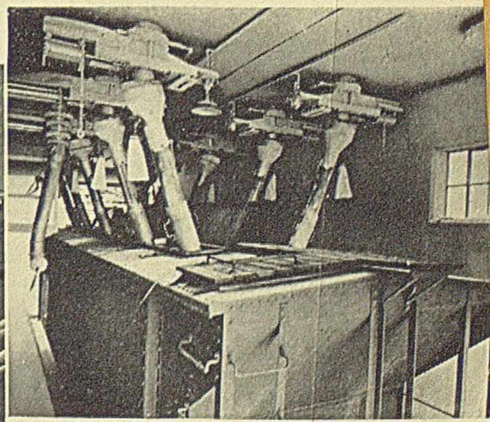




11 Aluminum trihydrate slurry is pumped to Dorrco filters where most of the moisture is removed. It is discharged from filters into screw conveyors leading into kilns

12 In large rotating kilns the aluminum trihydrate is heated white hot to drive off the chemically combined water





13 From the shipping bin the alumina is spouted into the top of specially designed steel hopper bottom cars spotted on a tract scale

WANT THIS KIND OF MOTOR PERFORMANCE IN YOUR PLANT?

Read These Interesting True Case Histories of How Allis-Chalmers Lo-Maintenance Motors are Providing Long-Life . . . Low-Cost Motor Service to Industry!

GET THIS type of up-to-date motor performance in your plant . . . and assure yourself long motor life plus low maintenance . . . with Allis-Chalmers Lo-Maintenance Motors.

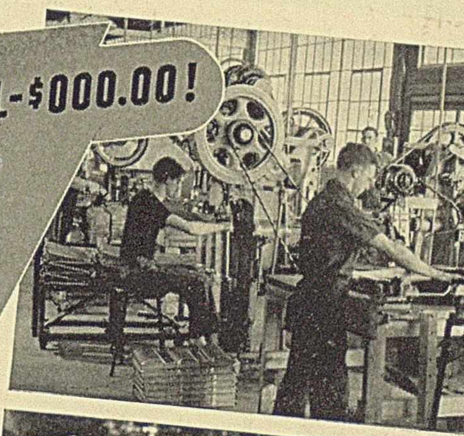
For, in Lo-Maintenance Motors, you get such "full-measure" features as—distortionless, twistless stator . . . indestructible, removable rotor . . . high carbon steel frame . . . no skimping anywhere on materials or workmanship!

These are important features . . . designed to give you motor performance that is more than just a rated horsepower. Let the engineer in the district office near you explain them to you. Call him . . . today. Or write Allis-Chalmers, Milwaukee.

A 1241

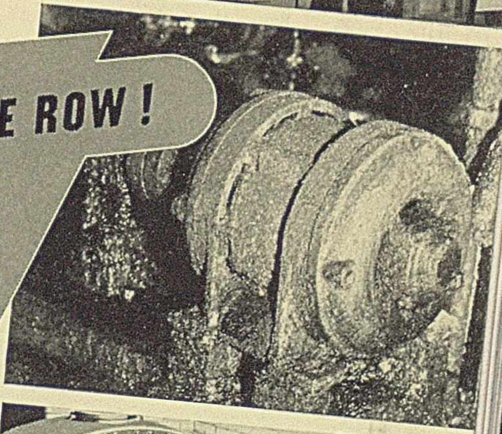
8½ YEAR REPAIR BILL–$000.00!

In this Cincinnati factory, 119 Allis-Chalmers Lo-Maintenance Motors have gone more than 8½ years without one cent spent for repairs . . . typical of Lo-Maintenance money-saving performance.



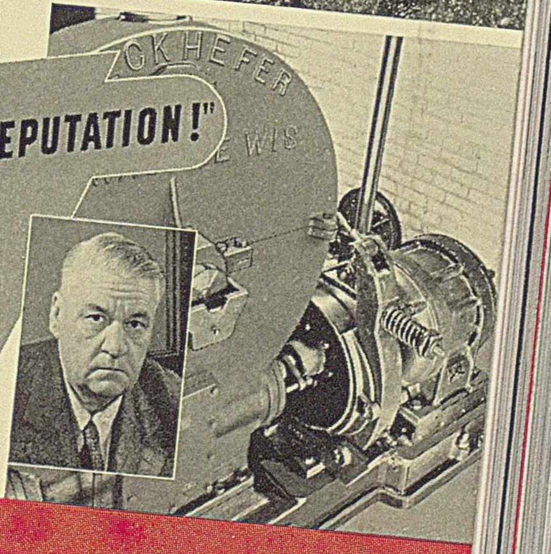
5 YEARS ON SUICIDE ROW!

Not a pretty picture! But this Lo-Maintenance Motor was running perfectly five years after it was installed on "suicide row" in this chemical plant, where adverse operating conditions wrecked other motors in 60 to 90 days!



"HELP PROTECT OUR REPUTATION!"

"Allis-Chalmers Lo-Maintenance Motors help us protect our reputation as builders of elevators that won't break down"—says E. F. Kieckhefer, vice-president, A. Kieckhefer Elevator Company.



Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

A-C

ALLIS-CHALMERS
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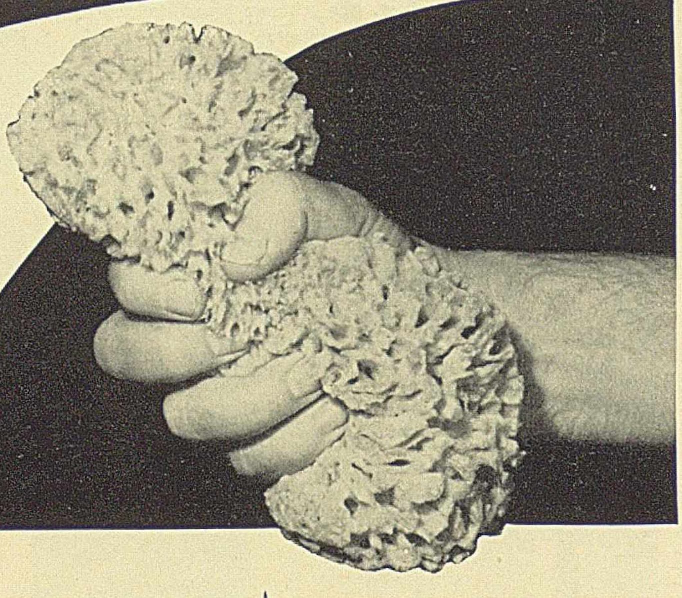
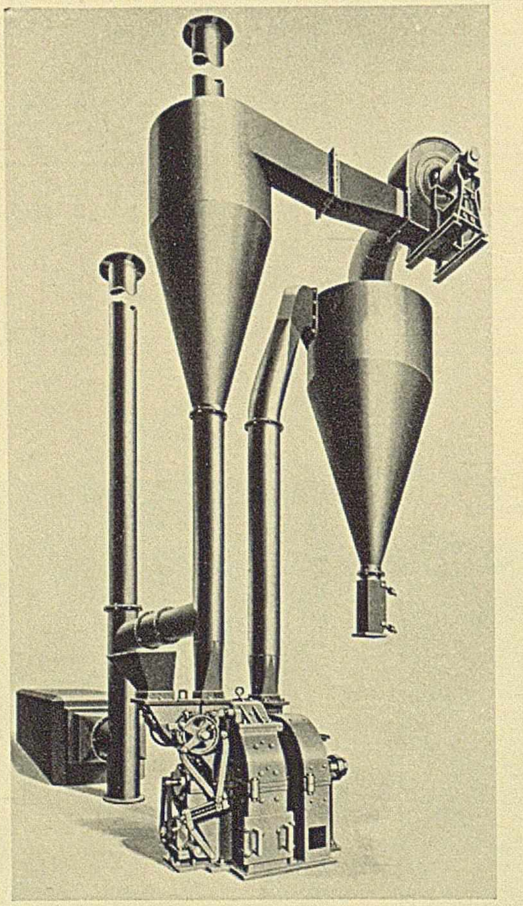
TO THE LAST DROP



RAYMOND *Flash* DRYING SYSTEM



Raymond Imp Mill equipped with Flash Drying System. Diagram shows typical flow sheet of a drying and grinding operation.

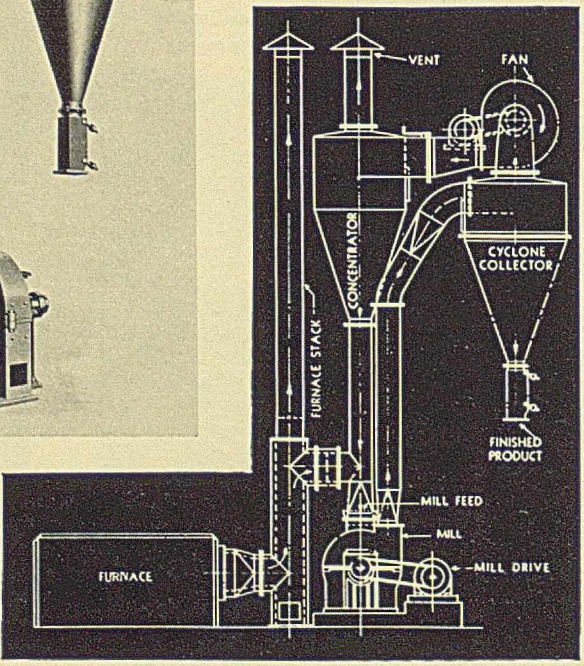
By this method, you can remove as much moisture from your product as you desire, and obtain a uniform finished material of specified dryness and fineness.

That shows the possibilities of the Raymond Imp Mill with Flash Drying which is now being used in the chemical and process industries for such unusual operations as:

Handling resins for the manufacture of plastics, in which the moisture is reduced from 50% to 1%, and the product delivered in powdered form.

Dehydrating and disintegrating steamed bone, direct from the presses, and producing a fine, dry bone meal for feed or fertilizer purposes.

Calcining and grinding raw gypsum for making plaster . . . also for removing water of crystallization from blue vitriol for making an extremely fine mono-hydrated copper sulphate, used as an insecticide.



Write for information on Flash Drying, if you are processing such materials as:—

Industrial Wastes
Filter-press Products
Insecticide Materials
Fertilizer Products
Chemicals and Foods
Yeast, Grains, Whey

RAYMOND PULVERIZER DIVISION

Combustion Engineering Co., Inc.

1311 North Branch St CHICAGO

Sales Offices in Principal Cities
Canada: Combustion Engineering Corp., Ltd., Montreal

Technical, Industrial, Personal

Chem & Met NEWS

TECHNICAL PROGRAM ARRANGED FOR CHICAGO CHEMICAL SHOW

A National Industrial Chemical Conference has been scheduled as one of the features of the National Chemical Exposition which will be held at the Stevens Hotel, Chicago, Dec. 11–15, under the auspices of the Chicago Section of the American Chemical Society. The program will open on the morning of Dec. 12 with Bruce K. Brown, general manager of research and development, Standard Oil Co., Chicago, presiding. Walter G. Whitman, head of the department of chemical engineering, Massachusetts Institute of Technology, will deliver a paper on "New Developments in Synthetic Chemicals and Materials for Fuels and Lubricants." E. V. Murphree, Standard Oil Development Co., New York, will follow with a discussion on "New Developments in Synthetic Chemicals and Materials in the Rubber Industry." In the afternoon H. E. Howe, editor of *Industrial and Engineering Chemistry*, will serve as chairman. C. A. Elvehjem, professor of agricultural chemistry, University of Wisconsin, will speak on "Service of Chemistry to Human Nutrition" and H. G. Knight, chief of Bureau of Agricultural and Engineering Chemistry, Department of Agriculture, will speak on "Service of Chemistry to Agriculture."

At the morning session on Dec. 13, C. D. Hurd, professor of organic chemistry, Northwestern University, will preside. Colin G. Fink, head of the division of electro-chemistry, Columbia University, will read a paper on "The Influence of Electrolytic Processes on the Development of the Chemical Industries." C. L. Gabriel, vice-president of Commercial Solvents Corp., will take for his subject "The Influence of New Solvents on the Development of the Chemical Industries" and E. C. Britton, director of organic research, Dow Chemical Co., will speak on "The Influence of the Friedel-Crafts Reaction on the Development of the Chemical Industries." William F. Henderson, chief chemist, Visking Corp., will conduct the evening session at which an illustrated lecture on "Color Photography" will be given.

Allan Abrams, technical director, Marathon Paper Mills, will be in charge of the final session on the afternoon of Dec. 14. Papers will be presented as follows: "Effect of New Resistant Materials on Modern Industrial Chemical Development" by James A. Lee, managing editor, *Chem. & Met.;* "Effect of Economic Conservation of Byproducts on Modern Industrial Chemical Development" by L. W. Bass, assistant director, Mellon Institute of Industrial Research; and "Instruments for the Chemical Industries" by John J. Grebe, director of physical laboratory, Dow Chemical Co.

Chem & Met Pictured Flow Sheet

TWO PACIFIC COAST COMPANIES CELEBRATE 50TH ANNIVERSARY

The present month marks the completion of a half century of existence for the Pacific Coast Borax Co. which is celebrating its golden anniversary throughout the month. The first borax deposits discovered were in Death Valley and the ore was transported by the famous 20-mule team across more than 160 miles of desert to the railroad at Mojave. Later deposits of colemanite were uncovered and the company moved its operation to Borate, Cal., where the first calcining plant in California was established. In 1927 a move to Boron, Cal., was made where deposits of rasorite had been found. From the calcining plant at Boron, the ore is now transported to one of the country's largest borax refineries at Wilmington, Cal.

The Fluor Corp. of Los Angeles is the second company on the Pacific Coast which is observing its golden anniversary. On Oct. 8 the company held open house at its new plant with members of the oil, gas, and allied industries as guests. A handsome souvenir program was prepared for the occasion containing the story of the company's 50 years of existence. The company originally operated in Wisconsin but moved to California in 1912. J. S. Fluor, founder of the company still holds the office of president but has retired from active management.

LARGE NUMBER OF EXHIBITORS FOR POWER SHOW

More exhibitors have already reserved space for the 14th National Power show than the total enrollment at the last show two years ago, the management reports.

With the opening of the Exposition still two months away, upwards of 270 leading manufacturers of power production equipment have closed contracts for space in Grand Central Palace, New York, where the show is to be held during the week beginning Dec. 2.

In making reservations for space at the show, several manufacturers informed the management that their exhibits are so new that they could not be completely cataloged for another month, as final tests on impending products were still to be analyzed. Still others, especially those who are exhibiting new materials, had not yet determined how many prospective applications are yet ready to be revealed.

Material entered in the directory of the show includes everything for the power plant from a complete line of materials and products utilized in the combustion of fuel, through a long line of feed-water treating devices, heaters and economizers, boilers and superheaters to various appliances for the utilization of steam.

NEW ETHYLENE GLYCOL ANTI-FREEZE INTRODUCED BY duPONT

Development of a high-boiling anti-freeze, called "Zerex", based on ethylene glycol, was announced Sept. 18 by E. I. duPont de Nemours & Co. In making the announcement, Dr. R. L. Dodge of the Ammonia Department, pointed out that ethylene glycol permits high temperatures in automotive engines and also in car heaters used to condition interiors.

A full-scale ethylene glycol plant now operating as a part of the Belle, W. Va. works of the Ammonia Department, is said to utilize a new process which is the result of four years of intensive research work. Dr. Dodge pointed out that this basic ingredient of the new anti-freeze was built up synthetically from coal. He showed that its chemical structure corresponded to two molecules of methanol with a molecule of hydrogen removed. Mehanol, he said, was also made synthetically at the Belle works. In fact, methanol is the base for a lower-boiling anti-rust, anti-freeze, Zerone, introduced two years ago by the duPont company.

ENGINEERING COMMITTEE FOR DEFENSE TRAINING

On Sept. 26, an advisory committee was appointed as an aid to the Office of Education on Engineering Training for National Defense. Members of the committee include Andrey A. Potter, dean of engineering, Purdue University, chairman, R. E. Doherty, president, Carnegie Institute of Technology, Gibb Gilchrist, dean of engineering, A. and M. College of Texas, H. P. Hammond, dean of engineering, Pennsylvania State College, W. O. Hotchkiss, president, Rensselaer Polytechnic Institute, R. S. McBride, consulting engineer, Washington, Thorndike Sayville, dean of engineering, New York University, C. C. Williams, president, Lehigh University, B. M. Woods, department of mechanical engineering, University of California, and Allen W. Horton, Jr., U. S. Office of Education, secretary.

News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

Contracts for large construction and production jobs by chemical process industry are being closed almost daily in Washington between the Government and chemical firms. Details summarized later in these pages show that at the end of September $100,000,000 in such contracts had been officially signed. The other pending projects will have a very much larger dollar value since as October began there were announcements of tentative agreements and projected plants having greater dollar value than the contracts then closed.

Some rather ugly factors have injected themselves into the planning. There is some evidence, enough to show the existence of these factors, with respect to rather selfish-interest efforts on the part of certain industry groups. Thus far the chemical groups have not been so involved.

The copper industry was publicly reprimanded by Defense Commissioner Henderson for allowing the price of copper to advance so sharply. Not very long before the lumber group suffered similar criticism. This effort shows that Henderson takes his industrial price-policing task seriously, as most of Washington anticipated. If it should happen that any chemical prices threaten to move upward too fast, there is sure to be similar action regarding them.

Commodity Controls

Export controls are being extended from time to time. Not only the commodities themselves, but also raw materials and the plans for new process equipment are so restricted. For example, not only aviation gasoline but also any plans for making that commodity or ingredients like ethyl fluid must get an export license before they can leave the United States. The control on scrap iron export was also extended to all classes of such metal, primarily as a restraint on Japanese activity. Further license rulings, amounting to embargoes, are to be expected if the Far Eastern situation does not clear up much faster than anyone expects.

Priorities on goods may also be exercised by the Government where the voluntary cooperation of manufacturers is not adequate alone. The Navy Department has, for example, announced its intention to conscript such materials needed for government purposes under some circumstances. This will be done especially when it is necessary to protect a manufacturer who is willing to cooperate with the Government against damage suits by nonessential users who have prior contracts for delivery in the manufacturer's books.

It is understood that some of the top government executives have less enthusiasm for this sort of seizure of industrial commodities than do some of the junior purchasing officers of the Navy. Some of these zealous workers have, in fact, had to be reprimanded for excessive enthusiasm or premature ordering. In one or two cases the chemical industry was involved. But in these cases the senior officials who really understood the problems were glad to cooperate when the spokesmen for chemical enterprise made clear that premature ordering was as dangerous for the Government as it was for the business man.

Labor Training

Conscription of youth may take an important number of chemical industry's workers. Training of replacement men is expected even where the employment is on projects of military importance, unless the man is really irreplaceable. The Government will assist in the training programs where necessary. A special unit in the labor division of the Defense Commission has been organized for this purpose. Working under Commissioner Sidney Hillman is C. R. Dooley, experienced personnel man of industry. The Office of Education also will aid in that special training of college grade required for the personnel which is of more than artisan or operative level. Industries anticipating shortages as a result of large expansion are being encouraged to come to Washington for conference on the means to be used in this training work.

It is also contemplated that there will be rosters set up in Washington showing available professional men who may be needed for certain specialties. The major engineering societies and scientific associations of the country are collaborating. Personnel bottlenecks are expected, but it is hoped that these can be largely anticipated and thus made of minimum difficulty to those manufacturing needed material.

Army Munitions Plants

The Army's munitions plant program began taking definite shape in September. Specific new contracts announced were for an $11,000,000 TNT and DNT factory to be built by Stone & Webster, Inc., at Wilmington, Ill., and operated by DuPont, and a $14,000,000 shell loading plant to be built and operated by Sanderson & Porter nearby. But considerable information was disclosed as to progress toward getting another half-dozen plants underway within a relatively brief time.

This disclosure came in the form of an Army announcement that it had sent "speedup" letters to a number of concerns with whom negotiations are (or were) in progress for which specific contract terms had not been completed. Progress thus disclosed, coupled with contracts already negotiated, showed that the Army is moving to equip four of its five munitions districts practically simultaneously.

Contracts for the raw materials for the powder plants have been slower in materializing than the factories themselves, but the latter represent the larger construction job so the Army expects everything to come out even. A major change in the munitions plant list was made in this field during the month, when the Army disclosed negotiations with Humble Oil Co. for a government toluol refinery. Previously the munitions program had been dependent upon private supplies of this TNT base.

The Humble Oil plant represents a step into the field of obtaining toluol from petroleum. It is understood several other oil firms also are planning to enter this field to supply the greatly increased TNT production schedule, but the Humble Oil plant is the only one presently included in the government program.

Following is a table of the munitions plant program as it stacked up at the end of September, divided by districts (see map, *Chem. & Met.* for September, page 643):

Munitions Plants in National Defense Program

Type Plant	Firm	Location	Amount
Area A:			
TNT-DNT	DuPont	Wilmington, Ill	$11,000,000
Shell loading	Sanderson & Porter	Wilmington, Ill	14,000,000
Shell loading	Not contracted	Union Center, Ind	14,000,000
Area B:			
Shell loading	Atlas Powder	Ravenna, O	14,000,000
Smokless powder	Hercules Powder	Radford, Va	25,000,000
	(This will be enlarged under a pending change order)		
Bag loading	Hercules Powder	Radford, Va	Not contracted
*Ammonia	Not contracted	West Virginia	$15,000,000
Picric acid	Not contracted	Ohio	4,000,000
Area C:			
Smokeless powder	DuPont	Charlestown, Ind	25,000,000
	(This will be enlarged under a pending change order)		
Bag loading	DuPont	Charlestown, Ind	Not contracted
Area D:			
Cotton purification	Not contracted	Tenn. or Miss	$6,000,000
*Ammonia	Not contracted	Not certain	15,000,000
Area E:			
Toluol	Humble Oil Co	Okla. or Texas	Not contracted
Smokeless powder	DuPont	Memphis	British plant

*Army is negotiating with DuPont and Allied Chemical & Dye for these plants.

In addition to this list, the Army has announced negotiations with Atlas Powder for another TNT factory and with DuPont for a tetryl plant, locations of which are undisclosed.

News "Fines"

Tin Supply—Even the pessimists were pleased by the accumulations of tin accomplished during August and September. Record shipments came from the Far East and the stock pile of the Government grew at an unprecedented rate. But the long shadow of the Mikado darkened the prospect and there is frequent unofficial admission that Japan may stop this movement at least temporarily. Washington therefore continues to encourage every possible effort to develop replacement materials on the chance that they may be necessary. However, the hope still is that rationing will not be required.

Bonneville Aluminum — Manufacture of aluminum for national defense began at Vancouver, Wash., with power from Bonneville Dam on Sept. 20. Washington officials heralded this "new industrial life for the entire Pacific Northwest," and urged that other mineral and metal industries come out to use this cheap power. Even the critics of the idea of federal operation of industrial enterprise agree that this particular tie-up has greatly accelerated increased aluminum output for the Government by private industry.

Draft-Men's Rights — Employers of young men taken into military training must consider responsibilities of reemployment, protection of seniority, insurance and social security privileges, and other rights granted by law. Incidentally, taking of these men from busy chemical industry projects is to be expected if the local boards so judge, and no let-down in labor standards or over-time limits can be expected. Substitute training thus becomes an urgent matter in some prospectively busy industries.

Western Phosphates—The fourth annual conference on development of the phosphate resources of the Western states met in Ogden, Utah, during September under the auspices of the Committee on Preservation of Phosphate Deposits and Their National Use, in affiliation with land grant college workers. The essence of the conference conclusions was an urging of continued subsidy for research, experimentation, and development of these mineral deposits with federal aid. Although urging that projects be undertaken by private industry, the desire shows through for the aid of public monies and a leaning toward a Western TVA.

Patent Entanglements—Again in September the Department of Justice indicated that it was going to look further into international patent agreements as these relate to national defense. However, there has been no evidence made public at the Capital which indicates any serious cases of interference with defense cooperation because there happened to be pre-emergency contract relations between American and foreign firms.

Where patent exchanges have been prevalent in a number of industries these have American participants of unquestioned cooperative spirit and action. And other cases, like the newspaper blast against magnesium producers, have proved to have no foundation whatsoever in fact. Some chemical-industry executives may be asked for explanations of international agreements. Effort to look into these matters seems entirely a sincere precautionary movement of Justice officials, with at most a minor flavor of a "fishing expedition."

Dietary Foods— Manufacturers who make claims regarding the dietary properties of a food or who make a special point of mineral constituents, vitamin content, or effectiveness for infant feeding, automatically place their products into the special class of dietary foods. They must then meet certain rigid standards as to the content or character of the goods and package with prescribed labels. Many foods of substantially identical material, for which these claims are not made, escape much of this regulation. In announcing hearings for the new standards of identity for these classes of goods, the Food and Drug Administration points out these important distinctions. The hearings to provide information on which the standards will be based were scheduled to begin Oct. 7. They will probably continue through most of the current month.

Small Security Issues —Borrowers requiring small amounts of money may be greatly helped by revision of SEC rules regarding that class of securities. Changes proposed have been submitted to many industrial and trade association critics for comment. If adopted the new regulation would greatly simplify the problems of firms desiring to issue securities in an amount not exceeding $100,000. In effect, the new rules would provide exemption from many former requirements of banking and report detail, and would permit more regional-office action.

Sugar Controversy — Sugar refiners and manufacturers of competing sweeteners spent more than two weeks in Washington arguing before Food and Drug Administration officials as to the proper requirements for these competitive sweeteners in canned fruit. Comparable controversy exists in the field of preserves and a number of other manufactured foods for which standards are later to be formulated, including bread, ice cream, and other outstanding groups. The issue is really one of label requirements, since all admit that the various sweeteners are dietically safe and proper.

Sugar Coating TNEC —Because industry, especially big industry, is so earnestly cooperating on defense programs, it has been decided that the TNEC report will be largely sugar coated. Senator O'Mahoney as committee chairman thinks big business has earned this reward for its defense efforts. Assistant Attorney General Thurman Arnold most enthusiastically disagrees with this philosophy, but in late September he was not making decisions on this point.

WORKERS IN CHEMICAL INDUSTRY FORM INTERNATIONAL COUNCIL

Workers from all sections of the United States and representing practically all divisions of the chemical industries met in Akron, Ohio, in September, for the purpose of forming an International Council under the American Federation of Labor. The conference adopted a constitution and elected the following:

H. A. Bradley, Akron, president; Richard Tomlinson, Chicago, sec.-treas.; Otto Butler, East St. Louis, Ill., Edward Moffett, Freeport, Texas, Fred Beyler, Hammond, Ind., Harold Land, Grand Saline, Texas, A. B. Miller, Edmonds, Wash., Richard Walsh, Philadelphia, Edward Dougherty, Jersey City, N. J., Mrs. Nona Fry, Memphis, Tenn., John E. Lewis, Baltimore, Md., vice-presidents.

The conference discussed industrial and organizational problems and adopted the following declaration:

"We the representatives of the many divisions of the chemical and allied products industries, begin our responsibility as an international labor council with reaffirmation of our loyal support of the principles of Democracy and the government of the free American people. We as workers in industries that are of key importance for defense purposes realize we shall face increasingly responsibilities of grave importance to us and the welfare of the whole nation. We have recognized that union organization is the first step in meeting our responsibilities. Organization puts us in a position to have a part in decision of matters by which our lives are shaped and to count for the development of democratic processes. Our employers have power because they control purchases of the buildings, materials and machinery of production. Workers acting together have power because they control the man power necessary to operate these plants.

"We hold that we have a right to a contract with our employers stipulating the terms on which we work. We believe in progress through the orderly process of joint conference and agreements. We must accept responsibility for advancing our own interests and securing for ourselves information and facts to prove our right to wages adequately compensating for our part in production and for working conditions conducive to most efficient production. We neither want nor will tolerate in our membership workers believing in and promoting policies subversive to democratic unionism or a democratic society."

NEW SYNTHETHIC FIBERS SOON WILL REACH COMMERCIAL PRODUCTION IN GERMANY

From Our German Correspondent

Staged in Breslau, capital of Silesia, to emphasize the contacts between the Reich and southeastern Europe, the recent "Dechema" exhibit "Manufacturing Materials and Chemistry" is reported to have been one of the most successful ever held. Under the auspices of the German Association for Chemical Apparatus, the combination congress and exhibition in the Century Hall of Breslau was arranged to give manufacturers an opportunity to see what is being done with available raw materials under wartime conditions in the Reich. Special emphasis was placed on new alloys, non-metallic products, and the latest synthetics, and many innovations in the building of chemical plant equipment were shown.

The economic reorientation on the European continent also benefited the Leipzig trade fair which held its 1984th session in its 700 years' history. Total sales at the autumn fair, which was held from August 25th to 29th, exceeded 300 million RM. At the more important spring fair this year, orders were placed worth 500 million RM, of which 40 million RM represented orders from abroad. In the autumn trade fair 20 countries and 6,600 firms arranged displays, the Soviet Union being officially represented for the first time since its exhibits of eight years ago.

In addition to participating in the Koenigsberg and Vienna autumn fairs, Reich manufacturers booked large exhibits at seven southeastern European fairs this autumn, including one in Sibiu, Rumania; Varna, Bulgaria; Zagreb, Yugoslavia; Bratislava, Slovakia; Prague, Bohemia; Belgrade, Yugoslavia; and Saloniki, Greece.

At the Leipzig trade and sample fair as well as at the recent Frankfurt fashion show, synthetics in clothing were given prominent display first manufactured by Roehm and Haas, Darmstadt, which have been coming into vogue in American markets, included glass shoes, belts, suspenders, buttons, etc. At the Frankfurt show, a bridal outfit completely of glass was exhibited. The accessories and shoes were of flexible "plexiglass," while the textiles used were woven with glass thread. Also in the field of women's wear is a new item which has attracted attention in the Reich and abroad. It is a "mosquito proof" stocking, resembling a fine silk hose and made of a special closely knitted material.

Latest synthetic fiber in the Reich is "Perluran," which will soon be manufactured on a large scale by I. G. Farben. The first completely synthetic fiber "Pe-Ce" (the name is abbreviated from polyvinyl chloride) has been introduced into chemical plants in the form of filter cloth, ropes, acid-resistant protective working clothes, etc. It is also being used for making fish nets because it will not rot and is not affected by the water. The disadvantage of the "Pe-Ce" fiber for textile use at present is that it cannot be boiled or ironed since it becomes soft at a temperature of 90 degrees C.

Made under a process similar to Dupont's "Nylon," I. G.'s new "Perluran" fiber will not soften until temperatures above 200 degrees C. and can be boiled and ironed. It is claimed to be considerably tougher and more elastic than silk. Exchanging experience and patents covering the new "Vinyon" fiber now being developed in the United States, I. G. reports that it is proceeding with a third fiber which it is claimed will represent a still further advance.

United States interest in developing a satisfactory substitute for silk is aimed partly to overcome dependence upon Japanese sources of supply and partly to improve on the natural silk, while the Reich development is largely motivated by a desire to utilize two of its limited number of raw materials, coal and lime. Of the other abundantly available raw materials, potash has seen an interesting development during the war. Whereas sales of nitrates and phosphates as fertilizers have been definitely curtailed, potash sales have experienced no restriction. This is due largely to the fact that the export decline has left large supplies available. Another factor is the addition of the Alsatian deposits to the Reich potash production capacity.

The development during the war in the field of phosphate fertilizers has not been favorable, partly because sulphuric acid,—which means sulphur imports,—is needed to produce superphosphates. Phosphate containing apatite is imported in increasing quantities from Soviet Russia, but before the outbreak of the war large quantities of phosphate rock were imported from the United States. Here is the reverse of the potash picture, for phosphate rock for a number of years was the largest item in U. S. chemical exports to Germany.

The difficulties besetting chemical manufacturers in Nazi-occupied territory is reflected in a recent report that four Danish superphosphate and sulphuric acid plants planned to close down shortly because their stocks of raw materials were almost exhausted. In spite of new processes for producing sulphur and acid from domestic materials, the supplying of elemental sulphur is still a problem. Only few chemical companies, for example, are producing carbon bisulphide. The largest share of production of this item—which happens to be expanding—is being supplied by artificial fiber manufacturers producing for their own companies. They are doing this partly to save freight charges and partly to be sure of having a steady supply.

Within the Reich, production of candles has also been curtailed. Since stearin and beeswax are no longer sufficiently available, paraffin mixed with hard wax is used. Production has also been standardized so that instead of 64 types of candles, only 14 are now being made. About half the candle output is supplied by three concerns which are also important manufacturers of paraffin for other uses.

Standardization in other industries is also proceeding rapidly. In the rubber industry, for example, an office has recently been established to regulate the sizes and technical specifications of rubber and synthetic rubber products. In the building of factories, too, economies are expected through standardization. A system for mass production of all building parts, based on uniform standard measurements has been developed by Prof. Albert Speer, builder of the new Reich's Chancellery and other public buildings. Through this step it is expected to save considerable materials, time, and labor in the construction of new factory buildings.

In the automotive industry, where civilian production has been greatly curtailed and models standardized, a revolutionary change in chassis design has been announced. Developed by Professor Kamm, director of the Motor Vehicle Research division of the Stuttgart Technical Institute, the new chassis design is claimed to effect fuel economies. It is stated that with an average weight automobile and normal carburetor, the new car gets 24 miles to the gallon at a speed of 87 miles per hour. A new gadget introduced in the automotive industry in Germany is a magnet which is attached by a screw inside automobile grease pans. This magnet picks up and holds fast all metal splinters and shavings from the moving parts of the engine so that they can be easily removed when the oil is changed.

A new product soon to be marketed in Vienna and invented by Albert Schroeder is an unbreakable, acid-, water-, and heat-proof phonograph record which it is claimed will outlast the ordinary product. A southern German paper factory has started large scale production of writing paper from the leaves and vines of potato plants. The quality of the new product is stated to be satisfactory. A new company, Harz G.m.b.H., was founded recently in Berlin with a capital of 1,270,000 RM to utilize processes developed by the Phrix G.m.b.H., Hirschberg, to utilize pine trees for high grade cellulose. The company plans to collaborate with the Deutsche Bergin A.G. fuer Holzhydrolyse, Heidelberg.

WORLD CHEMICALS PLANT CONSTRUCTION AFFECTED BY WAR DEVELOPMENTS LAST YEAR

The Bureau of Foreign and Domestic Commerce has issued a voluminous report on developments within the chemical industry abroad last year. The chapter touching on construction and expansion of chemical plants states that plants constructed in 1939 generally were fewer than in 1937 and earlier years. The keynote, perhaps, was the shelving temporarily of several important plants which had been planned for erection in 1939 or 1940. This was particularly true in Japan.

In Europe, plants were constructed in the areas of hostilities while the countries were still at peace, but, since other plants probably were destroyed, no details are given in this section. Spain is passing through a period of recovery from the extensive damage done to plants during the Spanish civil war, but so far as is known no expansion in plants was planned; work was confined to repairing the damage.

Canada—In Canada, a new caustic soda and chlorine plant commenced operations in 1939. Plans for the construction of a paint and varnish plant and an additional unit for the manufacture of chlorine were announced. A $20,000,000 explosives plant was planned for establishment early in 1940.

Cuba—A chemical plant was established in a suburb of Havana to extract salts of sodium, magnesium, and calcium, by the precipitation of sea water. The caustic-soda plant at Sague la Grande was reported to have changed owners but not to have been in operation. A plant for the production of barytes will soon be erected at Regla.

Argentina—Expansion of the chemical industry of Argentina continued, with several plants under construction or completed. One large paint factory was being erected in Buenos Aires. "Duperial" completed its enamel plant, started construction of the plant for the manufacture of aluminum sulphate, and planned to enlarge its sodium-sulphite plant. The new plant of Compania Quimica, which began operations the end of March 1940, contemplates the production of sodium hypochlorite, caustic soda, and carbon bisulphide. The Electrochlor combine expanded its anhydrous-ammonia plant. A new company was formed to produce alphacellulose from flax straw. The Government Sanitary Works Department is considering the erection of an electrolytic alkali plant, with an annual capacity of 500 tons of chlorine. Completion of the government powder and explosives plant was delayed.

Brazil—On January 6, 1940, the Brazilian President formally inaugurated the first phosphate plant in Brazil, at Ipanemo, which will manufacture superphosphates from apatite deposits in that locality. A large alcohol distillery was under construction at Ponte Nova. Machinery has been purchased for the production of a new plastic to be made from coffee beans. In Sao Paulo, the plant for production of copper sulphate and sulphuric acid was placed in operation. The Government has under construction two plants for the small-scale production of phosgene and mustard gas. In various parts of the country, new match, cosmetics, paper, and textile factories started operations.

Chile—In its program of national development, the government plans include stimulation of certain industrial chemical manufactures. Additional facilities for the manufacture of calcium carbide were being installed.

British Malaya—Expansions in British Malaya included the opening of six manufacturing plants. A modern paint plant and an ammonium sulphate plant began operations. Four small perfumery plants started operations during the latter part of 1939.

China—During 1939, rehabilitation and reconstruction of the chemical manufacturing and chemical consuming industries continued on rather an extensive scale in both Japanese dominated and Chinese areas, and much progress was made.

Manchuria—Industrialization continued in Manchuria, and seven chemical plants were completed during the year. The Manchurian Ammonium Sulphate Industry Co., began work on a 200,000-ton plant. The Manchuria Soda Co., has under construction plants for the manufacture of caustic soda at Dairen, Mukden, and Kaiyuan.

India—Further progress was made toward the development of a chemical industry in India. Two plants were almost completed, one for the manufacture of caustic soda and chlorine located near Calcutta, and the other for the production of soda ash in Punjab. The Mysore Chemicals and Fertilizers, Ltd., installed machinery for the production of ammonium sulphate. Two paint factories and one printing-ink establishment started operations in 1939. The Mettur Chemical and Industrial Corp. abandoned its caustic soda and soda ash plant after it was half completed. It is believed that heavy chemical production by Tata Chemicals, Ltd., in Borado State, will not be undertaken during 1940.

Australia—The large alkali plant under construction during the last three years was practically completed by the beginning of 1940, and it was planned to start operations in April. A factory, at Sydney, for the manufacture of synthetic resins commenced production. On March 7, 1940, the general manager of an alcohol company announced the building of a plant at Melbourne for the production of industrial alcohol. One of the largest manufacturers of cosmetics and toilet preparations announced that it would extend its factory.

Palestine—With the exception of the acceleration in the recovery of chemicals from the Dead Sea, little progress actually was made toward the industrialization of Palestine in 1939, although two factories for the manufacture of toilet preparations were established.

Turkey—Little progress was made during 1939 in the original, rather ambitious, industrialization program of the Turkish Government. The sulphuric acid plant, the caustic soda and chlorine plant, as well as the new cellulose plant, had not been completed, but construction in some instances was well advanced by the beginning of 1940. The synthetic nitrogen project has been abandoned.

International Cartels

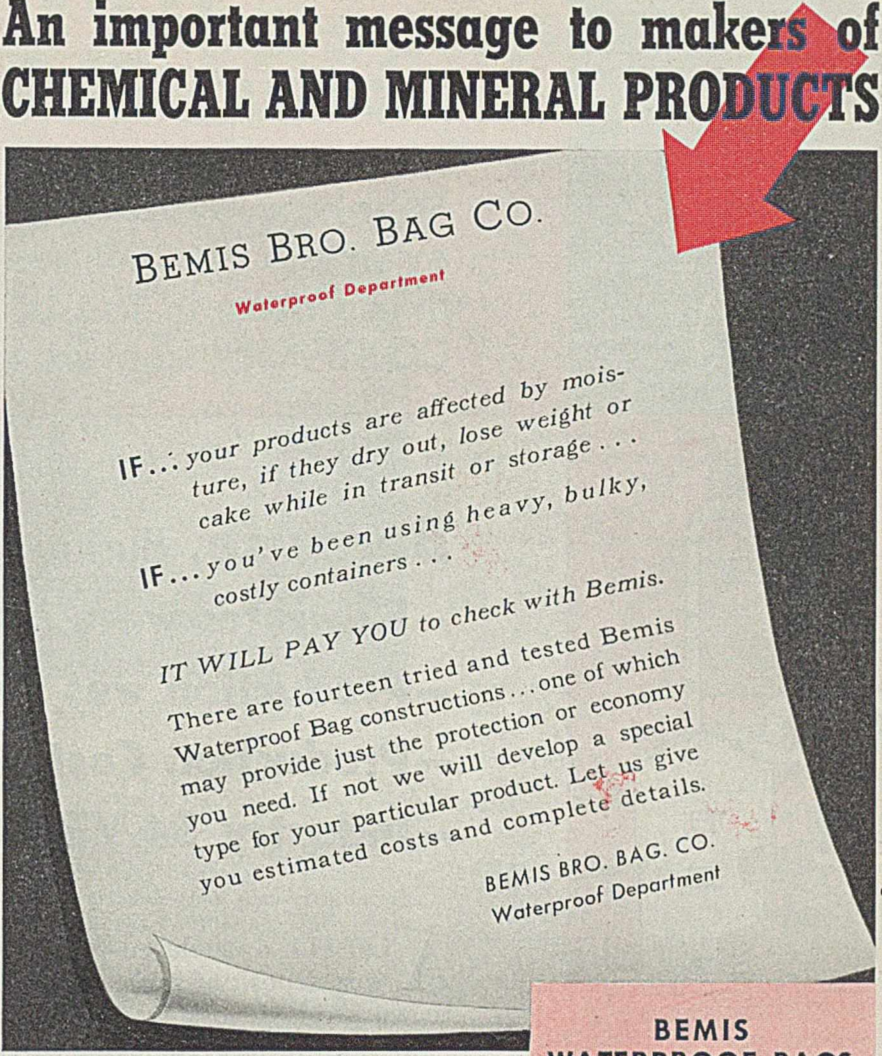
At the beginning of war, international commodity cartels ceased to operate, but in some cases nonbelligerent members managed to maintain informal contacts with the others. Foreign markets which belligerents were no longer in a position to supply were redistributed among the neutrals in one way or another, and prices were adapted to war conditions. At the same time, Belgian manufacturers endeavored to consolidate existing national agreements covering the home market and/or foreign countries.

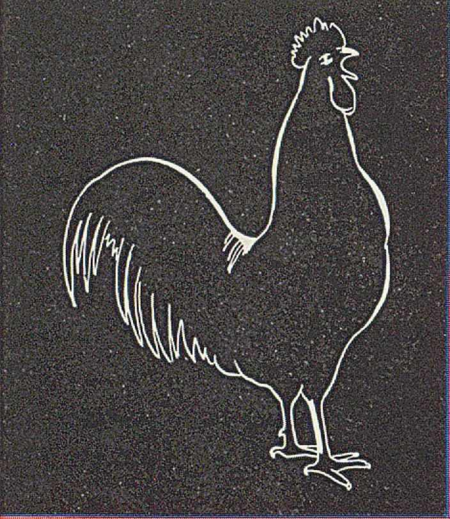
Nitrogen Cartel—Negotiations between the neutral members resulted in the constitution of a so-called "Petit Cartel," including Belgium, the Netherlands, and Norway, while contact was maintained with England, France, and Germany.

Superphosphates—The cartel which grouped France, England, the Netherlands, Germany, and Sweden no longer functions. The Belgian manufacturers' association, Comptoir General des Fabricants de Superphosphates, maintained domestic prices throughout 1939 at 2.50 francs per kilogram, per unit of phosphoric acid, in bulk. With the beginning of 1940, prices rose considerably.

Salt Cake—The International Salt Cake agreement having ceased to operate, the three Belgian producers were free to serve directly the markets formerly supplied through the cartel. The headquarters of the cartel was located at Frankfort-on-Main, and besides the German producer, included Imperial Chemical Industries at London, the French firm Kuhlmann, and the three Belgian firms. For certain other chemicals of which sales formerly were controlled by the Salt Cake Cartel, Belgian producers operated independently.

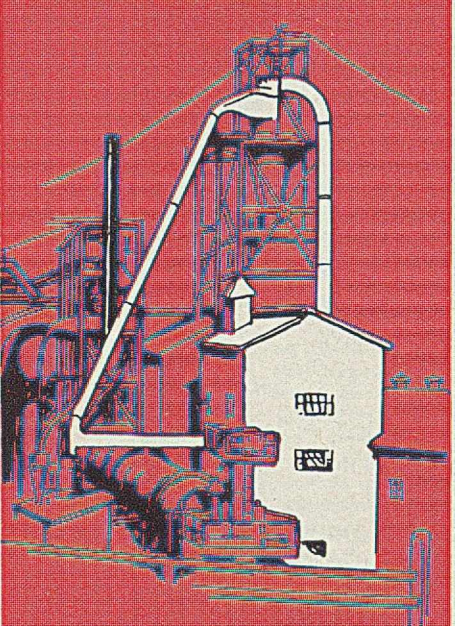
International Dye Cartel—The European cartel of dye producers, in which were grouped the German, French, British, and Swiss firms, also was disrupted, as was the hydrogen peroxide cartel formed by French, German, Swiss, and Belgian manufacturers.





Why CROW about ELEVEN years?

When so many firms can claim 50 years, or even 75 or 100 years, eleven years seems like a drop in the bucket. But THE DICALITE COMPANY can crow



Because, during those ELEVEN years—

—Flowrates were *increased*

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—Production *Costs* were *reduced*

—Industry SAVED MONEY

A LITTLE over eleven years ago, a group of men obtained rights to a vast deposit of high quality diatomaceous rock. The company formed to work this deposit was called "THE DICALITE COMPANY."

These men were long experienced in the industry. They knew this deposit was extremely valuable because it was predominant in elongated or *streamlined* diatoms. They knew how to process this rock to get full advantage of these *streamlined* diatoms.

As a result, FILTERAIDS are produced which have flowrates from $1\frac{1}{2}$ to 6 times higher than any other filteraids known, grade-for-grade.

Today, with the use of the proper grade and amount of the 10 available DICALITE FILTERAIDS, you get the clarity desired at a much faster rate of flow—or you get the normal rate of flow with materially LESS filteraid. Either way, you SAVE MONEY.

That's something to CROW about!

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GET THE BEST

NO *Engineering Service* NEEDED

Besides, when you use DICALITE FILTERAIDS in your processing, you do *not* need a *special* Engineering Service. Just follow the simple DICALITE instructions to get your filtration job done the way you want it done—brilliant clarity at LESS cost per unit of finished product.

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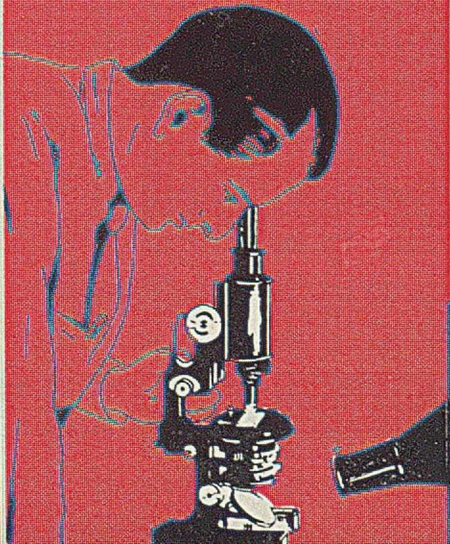
Do you know that THE DICALITE COMPANY is the *only* manufacturer who specializes *exclusively* in the research, production and sale of high quality diatomaceous filteraids and other products? All efforts—research, production and service—are devoted entirely to this end. Why accept anything less than DICALITE? Get the BEST.



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PERSONALITIES

E. F. W. Alexanderson and Leo H. Baekeland were honored

✦Leo H. Baekeland and E. F. W. Alexanderson were among the scientists honored at the dedication of the "Wall of Fame" at the New York World's Fair which lists first generation Americans who have made outstanding contributons in science, art, business and sports. Dr. Baekeland is a former president of the Inventors' Guild, and Dr. Alexanderson's 273 patents include important contributions to communications. He is with the General Electric Co.

✦Douglas M. Considine has accepted a position with the D. W. Haering Co., Chicago, Ill. His duties will consist of research problems in engineering and preparing data and studies for publicaton.

✦Daniel E. Igo has recently become associated with Graver Tank and Mfg. Co., East Chicago, Ind., in the capacity of sales and promotion engineer, specializing in fabricated stainless and composite steels. He was formerly associated with Lukens Steel Co.

✦A. J. Nydick has been appointed to the office of executive secretary of the American Council of Commercial Laboratories. The Council which was organized in 1937 is made up of testing and research laboratories located throughout the country.

✦A. Gordon King, who has been for 17 years a service engineer of American Gas Association, has been named secretary of the Technical Section of A.G.A. In this post he succeeds the late Hugh W. Hartman.

✦A. B. Huyck has been promoted to the position of engineer of manufacture of Brooklyn Union Gas Co., succeeding Harry L. Nickerson, who has been advanced from that post to the position of chief engineer. Mr. Samuel Green becomes assistant engineer of manufacture. Edward J. Murphy is now serving as chief chemist filling the position left vacant last July by the retirement of the late E. C. Uhlig.

✦Oliver V. Renaud who received his M.D. from the University of Illinois, has joined the staff of Foster D. Snell, Inc. and is in charge of clinical work.

✦A. F. Guiteras, who received his B.S. degree from Lafayette College and Ph.D. from Goettingen University, joined the staff of Foster D. Snell, Inc., October 1.

✦E. C. Herrington, for the past five years chief engineer for Herrington & Randall, Inc., Detroit, Mich., has been added to the staff of the Ferro Enamel Corp., Cleveland. Mr. Herrington will head Ferro's industrial oven division, recently expanded to offer to the general industrial field a complete line of ovens and finished production equipment.

✦H. E. Ardahl, formerly chief metallurgist of John Deere Tractor Co., Waterloo, Ia., has been appointed assistant to the vice president of Michiana Products Corp., Michigan City, Ind., producers of heat, corrosion and abrasion resistant alloy castings.

✦John H. Calbeck has been appointed director of research of the Pigment Division, American Zinc Sales Co., Columbus, Ohio. He succeeds Harlan A. Depew, who has resigned. Until 1927 Mr. Calbeck was director of research for the Eagle-Picher Lead Co. and later engaged in private research and consultant work at Joplin, Mo. Since 1932 he has been identified with the American Zinc Sales Co. as a consultant on special pigments development.

✦Harlan A. Depew has accepted a position with Sherwin-Williams Co. at Gloucester City, N. J. He resigned his position with the Pigment Division of the American Zinc Sales Co. at Columbus, Ohio, to accept the new position. Prior to going to the Columbus organizaton, Mr. Depew had been in the research organization of the New Jersey Zinc Co.

✦LeRue P. Bensing has been appointed representative of the Michiana Products Corp. in the Cleveland territory.

✦Donald C. Schaffert is now assistant chief chemist at Copperweld Steel Co.'s new plant at Warren, Ohio. He was previously connected with Republic Steel Corp.

✦G. L. Cunningham has joined the technical service department of the Columbia Alkali Corp., chemical sales

CALENDAR

OCT. 21-25, **National Metal Congress, Cleveland, Ohio**

OCT. 28-30, **Association of Official Agricultural Chemists, annual meeting, Raleigh Hotel, Washington, D. C.**

NOV. 11-15, **American Petroleum Institute, annual meeting, Stevens Hotel, Chicago, Ill.**

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

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

APRIL 7-11, 1941, **American Chemical Society, St. Louis, Mo.**

division of the Pittsburgh Plate Glass Co. A. E. Daley has joined the sales staff and will operate as a representative in the Chicago Metropolitan area. Dr. Cunningham, since 1930, has been research chemist at Mathieson Alkali Works, Niagara Falls, N. Y. He was born at Spartanburg, S. C. and graduated from the University of South Carolina and the University of Virginia. Prior to 1930 he served as laboratory assistant at the University of South Carolina and taught chemistry at the University of Virginia.

John V. N. Dorr

John V. N. Dorr, president of the Dorr Co. is to be the recipient of the Perkin Medal. Presentation will be made in New York on January 10.

✦HILLARY ROBINETTE, formerly president of the W. H. & F. Jordan Mfg. Co. has entered the employ of Commercial Solvents Corp. Mr. Robinette will promote the textile specialties recently introduced by the corporation.

✦ROBERT E. VIVIAN has been promoted to acting dean of the College of Engineering at the University of Southern California. Before going to California, Professor Vivian was director of research for the Metals Disintegrating Co., Elizabeth, N. J.

✦CLAIR N. SAWYER has been appointed assistant professor of sanitary engineering at New York University. Dr. Sawyer was graduated from the University of Wisconsin in 1930 with the degree of Bachelor of Science in Chemistry, from the University of Colorado in 1936 with the degree of Master of Science in Sanitary Chemistry and received the Doctor of Science degree in sanitary chemistry in 1938 from the University of Wisconsin. Since 1938 he has served as post-doctorate fellow in sanitary engineering in the University of Wisconsin.

✦HENRY J. MCKENZIE, executive vice president and general manager of Sterling Pump Corp., Hamilton, Ohio, manufacturers of deep well turbines and centrifugal pumping units, has been appointed president of that corporation to succeed Maurice Rothschild, who will continue as a director.

T. T. Watson

✦T. T. WATSON, who has been development and service metallurgist of Lukens Steel Co. since 1934, has been appointed research metallurgist in charge of all plant research. Mr. Watson was graduated in 1923 from the Royal Technical College, Glasgow, Scotland. Since 1930 he has been in the United States as a consulting metallurgist first and for the last nine years successively as member of the metallurgical department, development and service metallurgist and now research metallurgist for Lukens.

W. R. Schofield

✦W. RICHISON SCHOFIELD, formerly chief engineer of Leeds & Northrup Co., Philadelphia, has recently been appointed director of engineering. John W. Harsch, assistant chief engineer has been advanced to chief engineer and Mr. Harsch's former position has been filled by the promotion of John F. Quereau. Mr. Schofield joined Leeds & Northrup in 1916 and since 1928 has held the position of chief engineer. Mr. Harsch joined the company in 1924 and in 1928 became assistant chief engineer. Mr. Quereau has been with the company since 1929.

✦JOHN M. BUTLER has been appointed to the research and development staff at Bloomfield, N. J., of the Bakelite Corp., unit of Union Carbide & Carbon Corp. Dr. Butler recently received his doctorate in organic chemistry at Ohio State University.

✦KURT W. HAESSLER has become an associate with Herstein Laboratories, Inc., New York, N. Y. Dr. Haeseler will continue the general consulting practice which he has carried on for more than ten years.

✦ROBERT C. STANLEY, chairman of the board and president of International Nickel Co. was named as first recipient of the Charles F. Rand Gold Medal by the A. I. M. E.

✦C. C. HERMANN has been appointed chief engineer of Claude B. Schneible Co. of Chicago.

✦F. C. NACHOD is now on the research staff of Permutit Co. Dr. Nachod is located at Birmingham, N. J.

✦RALPH L. DICKEY has been elected president of the Kelley Island Lime and Transport Co. He succeeds George J. Whelan who has been elected chairman of the board.

✦ROBERT E. BRANNAN has become manager of molding material sales for the Bakelite Corp., unit of Union Carbide and Carbon Corp.

✦L. H. MILLER has been appointed to head Ferro Enamel Corp.'s liquid plastics division. He comes from the Pittsburgh Plate Glass Co.

✦WILLIAM A. HANLEY, director of Eli Lilly & Co., and head of its engineering division, was elected president of the A. S. M. E.

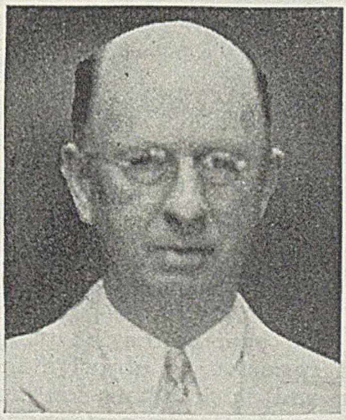
OBITUARY

✦EDWARD C. UHLIG, who recently retired from the post of chief chemist of Brooklyn Union Gas Co., died on August 20 at the age of 72. He was widely known for his many contributions to the science of gas-making and the control and research chemistry of the industry.

✦WILLIAM LASH MILLER, head of the University of Toronto chemistry department from 1921 to 1937, and an outstanding authority on chemical thermodynamics, died Sept. 1 at the age of 73. Professor Miller, member of the University staff for 48 years until his retirement two years ago, was known as an international authority in his field. He made distinguished contributions to chemical kinetics and to electrochemistry.

✦JOHN ANDERSON, chairman of the executive committee of Charles Pfizer Co., died October 4 at his home in Brooklyn, N. Y. He was 82.

✦WILLIAM H. MASON, vice president of the Masonite Corp. and inventor of the process of exploding wood, died at Rochester, Minn., following an operation at the age of 63, on August 25. He made his residence at Laurel, Miss. Mr. Mason was born in Sommers County, W. Va., in February 1877. He attended Washington & Lee University during 1887–1888. In 1928 he was awarded the gold medal of the Technical Association of the Pulp and Paper Industry for his work. The following year he was granted the John Price Wetherell medal by Franklin Institute in recognition of his achievements. He also received the first $1,000 prize awarded by the National Lumber Manufacturers' Association for improvement in the manufacture of lumber. Last Fall he received the pioneer award of the National Association of Manufacturers for Inventors who have opened up new industries in this country.



Edward C. Worden

✦EDWARD C. WORDEN, consulting chemist, who was head of the Worden Laboratory and Library at Millburn, N. J., died in his sleep at his home September 22. He was 65 years old. In the midst of his many other duties, Mr. Worden obtained the degree of B.S. in 1907 from New York University which gave him an M.A. two years later and an honorary doctor of science in 1921. He was chemist for the Clark Thread Co. of Newark, from 1902 until the establishment of his own laboratory at Millburn in 1914. During the last two years of the World War he was Chief of the Airplane Wing Coating Section of the Bureau of Aeronautics.

✦B. G. SLAUGHTER, consulting engineer, who supervised the construction of large industrial plants at Hopewell, Va., and Rome, Ga., for the Tubize Chatillon Corp., died Sept. 18, at his home after a heart attack. His age was 59. He was born in Bedford County, Tenn. and was a former vice president of the International Nickel Co., Inc. and one-time general manager of the Tennessee Copper Co. and president of the Tubize organization.

EMPLOYERS URGED TO PREPARE FOR REPLACING DRAFTEES

There is, and can be, no hard and fast rule governing the question of occupational deferment from compulsory military training under the draft act. The act itself prohibits blanket deferment for all workers in a single trade or activity even when it is known that a shortage exists and that the skill is one vital to national defense—toolmakers, for instance. Deferment is an individual matter, which local boards must decide in individual cases.

But every conceivable step is being taken to so regulate the decisions of local boards that the normal civilian economy and national defense procurement will not be interrupted. This is the guiding philosophy of all the voluminous regulations laid down for local boards, and the purpose behind each safeguard set up to insure that they are followed.

In the first place, it must be understood that occupational deferment of an eligible conscriptee is only a temporary postponement of his call to the colors; there are no outright occupational exemptions from conscription.

This firmly fixes upon employers the duty to prepare for replacing eligible men who may be called but whose immediate departure would disrupt plant operations. This requirement will be greater or lesser depending upon the rank in the draft of important employees. Finding or training a replacement for an employee whose number is tenth in the draft lottery will be much more pressing, for instance, than for an employee whose number is the three thousandth taken from the big glass bowl.

Draft officials continually stress this point of employer liability, and urge that employers anticipate the problem by making their own surveys of their employee roster, to determine which men are without dependents and in skilled jobs, and then to take steps to train others for those jobs. Some employers also are reported to be anticipating some loss of needed employees and are offering to make up for pay differentials to a percentage of workers who volunteer. Such policies will get sympathetic hearing from local boards when deferment is sought for other workers.

Deferment by local boards will be for specific periods, not to exceed six months. This can be extended for additional fixed periods where it is shown that replacements could not be obtained, despite reasonable effort.

There will be two principal tests for deciding occupational deferment. First is the employee engaged in an activity useful or productive and contributing to the well-being of the community or nation; second, is he engaged in an activity essential to national defense. To win deferment in either instance, it must be affirmatively shown that the individual cannot be replaced and that his removal would cause an "effective loss to such activity."

The national selective service staff,

in addition to supplying local boards with general regulations for procedure, will circularize lists of skills in which there are known shortages either now or expected within a year. Local boards will be asked to give serious consideration to all requests for deferment for employees in these jobs. (These lists are not public; may never be).

Application for deferment may come from employers as well as from employees; in fact, employer application probably will receive more sympathetic consideration. In addition, there will be Government appeal agents in each appeal area who will intervene where local boards refuse to grant deferment to men engaged in activities considered vital to defense procurement.

SAFETY MEASURES RECOMMENDED FOR DEFENSE PLANTS

The Army has released a "blueprint" of recommended steps to be followed in constructing new defense plant facilities to protect them from attack. The proposals are suggestive, not mandatory, but were released in reply to many requests for specifications for making defense plants safer from potential air raids.

It is unlikely that any elaborate and expensive protective measures will be recommended. The Army position has been and is that because of geographical isolation, no part of this country is likely to be subjected to sustained bombardment of the European type. Major recommendations for immediate action are provision for blackout and intelligent location.

Blackout can be achieved most simply in the case of the new windowless air-conditioned plants such as the new Allison engine factory. In other types of plant opaque shutters must be provided over all windows and provision made for ventilation. Outside lights should have means to cover them with blue shades, and white lines should be painted on walks and drives. It is recommended that concrete buildings, easily visible from the air, be painted some dark color blending with the surroundings.

Location away from towns and landmarks is desirable. Advantage should be taken of hills and broken and wooded ground. Trees, of about the same height as the buildings should be placed around the plant. When production methods will permit, separate buildings should be scattered in an irregular manner 100 or so yards apart, even at the sacrifice of some efficiency. As far as possible, each building should be independent, so that if put out of production, operation of other units will not be halted.

Duplicate power, water and gas lines are recommended, feeding into different distribution lines; or perhaps standby equipment. Utility lines and fuel tanks should be underground.

As regards actual protection against bursting bombs, no other present action is recommended but it is urged that provision be made in plans for future construction of underground shelters for workmen and storage for vital machines and parts.

MERCK & CO. WILL NOT SEEK EMPLOYEE EXEMPTION

George W. Merck, president of Merck & Co. Inc., has announced plans for cooperation with the National Defense Program and for the protection and security of employees who are called under the Selective Training and Service Act of 1940.

Although it is included in the class of essential industries and thus has an important part to play in the Defense Program, the company states that it will not seek deferment of military service for employees, except in cases where they cannot readily be replaced. The announcement says further that employees called out under the Selective Service Act will be given a week's pay if they have been employed continuously by the company for six months, two weeks' pay if for one year, and three weeks' pay if for two years or more.

LEADING INDUSTRIALISTS WILL LECTURE AT BROOKLYN POLY

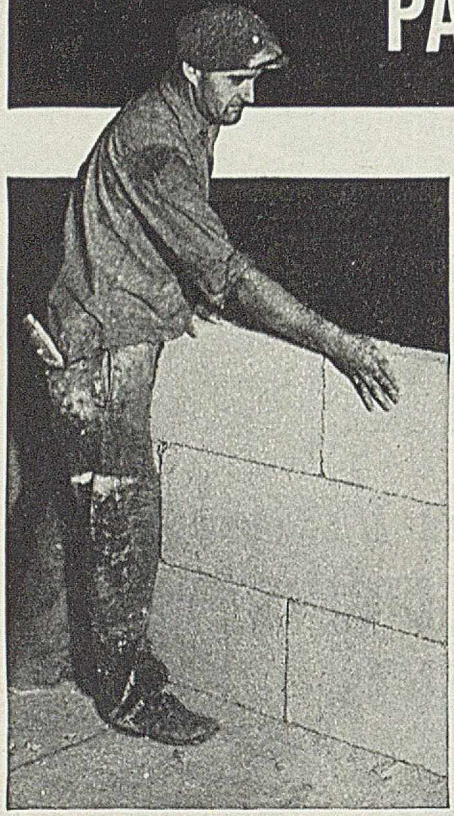
Advance Registrations for the first semester of the Graduate School of Polytechnic Institute of Brooklyn which has opened its 38th session indicate that the enrollment will exceed five hundred students.

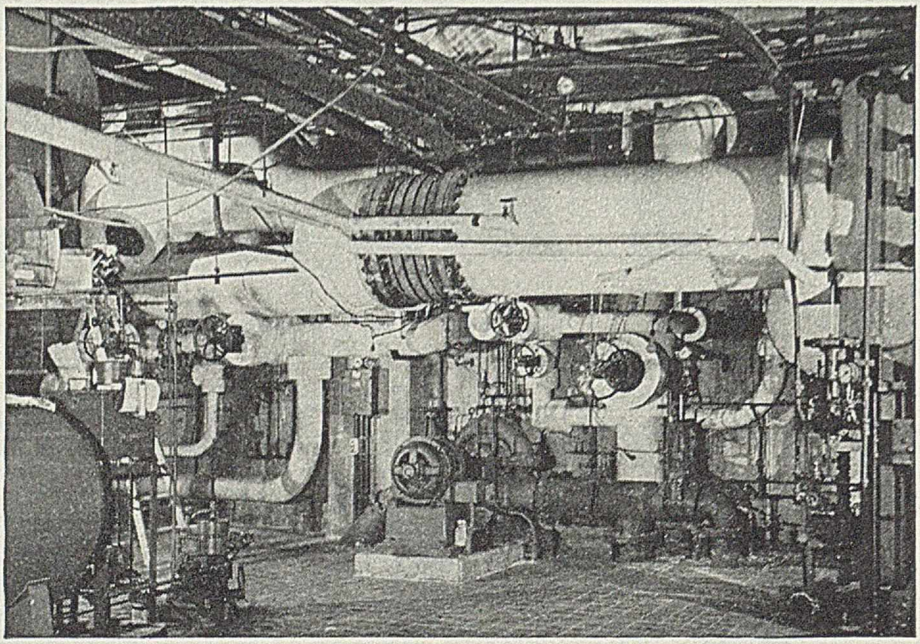
Following its policy of offering a number of highly specialized courses for advanced students majoring in definite fields, the Graduate School has appointed, among others, for 1940-41 the following authorities to teach special courses in chemistry and chemical engineering: Arthur A. Backus, vice-president United States Industrial Alcohol Co., Dr. Richard H. Carroll, director of research Climax Rubber Co., Dr. M. L. Crossley, chief chemist, Calco Chemical Co., Philip M. Groggins, senior chemist, Color and Farm Waste Division, United States Department of Agriculture, and Guy N. Harcourt, vice-president, Buffalo Foundry and Machine Co.

HILTON-DAVIS CHEMICAL WILL EXPAND PLANT CAPACITY

The Hilton-Davis Chemical Co., Cincinnati, has offered 35,000 shares of common stock of the company for public sale. Net proceed of 25,000 of these shares are to be applied to plant improvements and additions. In presenting data on the company's operations, the figures showed that sales for the fiscal year ended June 30, 1940, reach a new peak. The company not only has more than doubled its sales in the last five years but its financial statement was noteworthy in that it showed a steady growth for the company even through the depression years.

DOES YOUR INSULATION INVESTMENT PAY A *FULL* RETURN?





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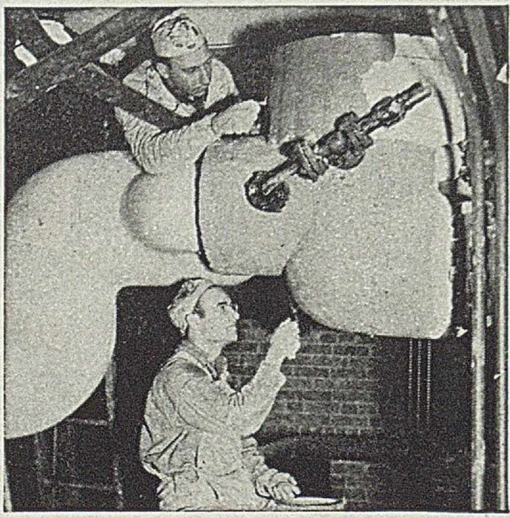

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New Titles, Editions and Authors

Chem & Met BOOKSHELF

Ag — MATERIAL OF CONSTRUCTION

SILVER IN INDUSTRY. By *Lawrence Addicks.* Published by Reinhold Publishing Corp., New York, N. Y. 636 pages. Price $10.

THIS VOLUME covers the results of a three-year program of intensive work done under the auspices of the Silver Producers Research Project, the purpose of which was to stimulate interest in the industrial possibilities of the metal. The investigations were made at the Bureau of Standards and at many universities. The numerous phases of the subject have been discussed by Dr. Addicks and 30 others who have been interested in the project.

The chemical engineer will find of particular interest the chapters dealing with corrosion resistance of silver and its alloys, silver as a catalyst, electro-deposited coatings, and sterilization. The use of silver as a material of construction for chemical engineering equipment is thoroughly covered in 43 pages. Its resistance to a large number of chemicals under various conditions of concentration and temperature is considered.

COLLECTED PAPERS OF WALLACE H. CAROTHERS ON POLYMERIZATION. Edited by *H. Mark* and *G. S. Whitby.* Published by Interscience Publishers, New York, N. Y. 459 pages. Price $8.50.

FIRST of a projected series of volumes on high polymers, this collection of papers forms an important contribution to a subject of constantly increasing importance. The papers fall into two main divisions: studies on polymerization and ring formation; acetylene polymers and their derivatives. They were reprinted without change, a short abstract is given for each, and the editors have added a few references concerning recent developments in the literature. Research chemists and engineers concerned with polymer studies, development and production will welcome this reference book.

HANDBOOK OF ENGLISH IN ENGINEERING USAGE. Second edition. By *A. C. Howell.* Published by John Wiley and Sons, New York, N. Y. 433 pages. Price $2.50.

Reviewed by *L. B. Pope*

WHEN COMMENTING on the qualifications which technical graduates should possess, men in industry almost invariably stress the ability to use the English language. Such ability is necessary in dealing both with men and with ideas. Good English, like good engineering, is based on the knowledge and application of various principles. This textbook, therefore, was planned as a reference book of recognized and accepted principles. Not only are words, sentences, punctuation and grammar discussed but there are also chapters on the characteristics of engineering writing, letters, reports and technical magazine articles. Numerous examples of incorrect and correct usage emphasize the various rules and add effectuality to the presentation.

By giving up-to-date information, logically arranged for handy reference, Prof. Howell has produced a book which could profitably be studied and used by almost all engineers. It is worthy of a place beside Perry, Marks and other handbooks on the engineer's bookshelf.

BIOGRAPHY

THE LIFE OF IRA REMSEN. By *Frederick H. Getman.* Published by *Journal of Chemical Education,* Easton, Pa. 172 pages. Price $2.50.

AS A BIOGRAPHY of a man important in the history of American chemistry, Prof. Getman's story is well and sympathetically told. He has had access to diaries, private letters and family memorabilia which enabled him to write a book which students of chemical history and Remsen's many friends will welcome. But more than the life of a great chemist and teacher, the book is a condensed version of the most important years in this country's chemical and chemical engineering history. Dr. Remsen saw the collegiate idea change from the viewpoint of chemistry as just a part of a general cultural training to that were it was a science and taught as such. He saw the general acceptance by industry of the idea of the necessity of adoption of the most scientific methods possible. And it may be said that the growth of these ideas was in a large part due to the teachings and writings of Dr. Remsen.

During his lifetime, Remsen was a member of numerous boards and civic commissions. Possibly his contacts with public officials led him to a thought which is probably more applicable today than when it was written: "Questions of tariff, of finance, of international relations would be dealt with much more satisfactorily than at present if the spirit of the scientific method were breathed into those who are called upon to deal with these questions."

SCIENTIFIC PRICE MANAGEMENT I, by *Allen W. Rucker.* Published by the Eddy-Rucker-Nickels Co., Cambridge, Mass. 30 pages; 6 charts. Price $5.

Reviewed by *S. D. Kirkpatrick*

THOSE WHO are familiar with the author's price-volume formulas, developed a decade ago, will welcome this simplified method for determining the increase in volume necessary to compensate for price discounts or added costs. Included in this plastic-bound manual are six calculator charts, each 9x12 in. in size and printed in two colors on cellophane covered index boards. With the help of these charts one can immediately read off the added volume required to justify a simple price cut or to offset increased production costs.

Fifteen different types of problems, taken from the management experience of the author's firm, serve as actual case studies to demonstrate the wide variety of practical uses to which this manual can be put. These range from pricing problems involving freight and advertising allowances to the revision of production schedules required to justify differential wage increases.

In general this book would seem to have its maximum value to sales and merchandise managers in consumer industries where price changes are frequent and apply to hundreds of different commodities. By the same token, it is probably of less value to production managers and engineers in the heavy industries, especially those who still carry their slide rules in their vest pockets. Even technical men, however, will welcome Mr. Rucker's mathematical short-cuts and approve of this introduction of more scientific methods into the pricing field.

OLD BOOK — NEW EDITION

KINGZETT'S CHEMICAL ENCYCLOPÆDIA, Sixth Edition. Edited by *Ralph K. Strong.* Published by D. Van Nostrand Co., Inc., New York, N. Y. 1,088 pages. Price $14.

IN *Chem. & Met.'s* REVIEW of the fifth edition of this encyclopedia (Aug., 1932), it was stated that "it always yields some helpful information on any subject." The same may be said of the sixth edition. Revision has consisted of addition of some new definitions, omission of a few relatively unimportant items, and amplification of previously included material where new information has become available. Much of the new material stresses economic aspects such as production, imports and exports, and includes several new tables. Apparently the latest available figures were for the year 1936 as most of the data given are for that year.

Style of presentation used in former editions has been retained. And many chemicals and compounds are defined or discussed only under general headings. For example, data for the three chemicals dichlorethylene, octyl alcohol and heptane are found under the headings of solvents, alcohols and hydrocarbons, respectively. Some items which should have been defined, have only literature references. For example, under the headings of plastics, nomograms, and parachor, there are no definitions, merely references to other books or periodicals.

For many years "Kingzett" has been a standard British reference book. However, it might be expected that under Prof. Strong's editorship, the book would have been Americanized to some extent. Such is not the case. The inclusion of many unfamiliar trade and proprietary names as well as the spelling which is used throughout emphasize the British origin of the book.

Space limitations are always a large factor affecting the completeness of definitions and the number which may be included in any encyclopedia or dictionary. In this one there is still much material which might be regarded as superfluous. Space for more material could have been gained by eliminating definitions of such words as "shovelling," "eggs" (28 lines), "limpid" and "diaphanous."

As with former editions, the most important and informative discussions are those covering general topics such as oils, radio-activity, waxes, solvents, and so forth. Under such headings will be found concise and well-written information.

THE STORY OF SUPERFINISH. By *A. M. Swigert, Jr.*, Published by Lynn Publishing Co., Detroit, Mich. 672 pages.

CHEMICAL ENGINEERS who may be interested will find in this book the story of Chrysler Corp's. Superfinish, told with the aid of more than 700 photographs, drawings and photomicrographs. Surface finish importance, measurement, and methods of production are discussed. (The advantages of Superfinish are reiterated throughout.) The new finish is produced by "bonded abrasives actuated by multimotion, slow speed, low pressure and in the presence of a lubricant."

ANALYSIS

ORGANIC REAGENTS USED IN QUANTITATIVE INORGANIC ANANLYSIS. By *W. Prodinger*. Translated by *S. Holmes*. Available from the Nordeman Publishing Co., New York, N. Y. 203 pages. Price $5.

PROBABLY everyone who reads these pages has observed, at one time or another, the characteristics precipitate of nickel dimethylglyoxime. This classic example of a specific reagent is but one of approximately two dozen organic compounds which are discussed in detail in this translation.

Considerable research work on specific and selective reagents has been done in the past few years. The importance of this book lies in the fact that much of this work is collected into one volume and appropriately introduced with modern theories of complex-molecule behavior. In the main "special part" of the text, directions are given for determinations for which each reagent may be used. In most cases, a method for preparation of the reagent is included.

OFFICIAL AND TENTATIVE METHODS OF ANALYSIS OF THE A. O. A. C. Fifth edition. Published by the Association of Official Agricultural Chemists, Washington, D. C. 757 pages. Price $5.

TESTS are made by agricultural chemists not only on soils and fertilizers but also on many related materials such as fruits, grains and such finished products as wines, drugs and paints. This well-known book of official methods is the recognized authority for all such tests. In this edition material has been supplied for four of the six chapters which appeared in the fourth edition without text. These are: Fish and Other Marine Products, Vitamins, Microbiological Methods, and Microchemical Methods.

DIRECTORIES

MANUAL OF SUGAR COMPANIES, 1940. 18th edition. Published by Farr & Co., New York, N. Y. 204 pages. Price $1 (paper), $1.75 (cloth).

IN ADDITION to full page reviews of 23 companies and synopses 160 other companies, this familiar manual contains latest available statistics on production, prices, distribution and so forth. A new section describing the sugar industry of the British West Indies is included in this edition.

BROWN'S DIRECTORY OF AMERICAN GAS COMPANIES. 1940 edition. Published by Robbins Publishing Co., New York, N. Y. 718 pages. Price $25.

PUBLISHED ANNUALLY, this volume presents a complete list of statistics of gas companies serving "the smallest borough to the largest city in the country." Data are given for operating gas companies, manufactured gas—byproduct coke oven companies and for holding and operating companies. Separate sections list Public Service Commissions, Gas Associations and Officials and Department Heads. This well-known directory is a necessary item in the library of any company having dealings with the gas industry.

TEXTS AND REFERENCES

EXPERIMENTS IN COLLOID CHEMISTRY. By *E. A. Hauser* and *J. E. Lynn*. Published by McGraw-Hill Publishing Co., New York, N. Y. 178 pages. Price $2.

CONTRARY to general belief, the authors state, experiments in colloid chemistry are neither too complicated nor too expensive for the facilities and budget of an average educational institution. And the 214 experiments in this text's 14 chapters seem to prove the point. Directions are clear and simple; most apparatus and materials will be available in the average college laboratory. Headings and sequence of the chapters conform with modern textbooks, in fact, the book could conceivably be used both in the classroom and the laboratory because all experiments are preceded with well-written material of a fundamental nature.

FOR STUDENTS AND TEACHERS

COLLECTED PAPERS ON THE TEACHING OF CHEMICAL ENGINEERING. Published by the American Institute of Chemical Engineers, New York, N. Y. 384 pages. Price $3.

Most of the papers presented at the Second Summer School for Chemical Engineering Teachers are included in this volume. Those who are concerned with the education of students of chemical engineering will find in it a wide variety of pertinent discussions. The 31 papers cover various aspects of several unit operations as well as other laboratory, lecture and administrative problems encountered by the teaching profession.

TEXT-BOOK OF PHYSICAL CHEMISTRY. By *Samuel Glasstone.* Published by D. Van Nostrand Co., New York, N. Y. 1,289 pages. Price $10.

Physical chemistry is, perhaps, the most important single subject in the entire curriculum of chemical engineering. And although there are now available several elementary textbooks on the subject, Dr. Glasstone's book represents the first attempt to produce a complete text of intermediate character. For this reason it will probably be welcomed by most teachers of chemical engineering.

The book follows the usual outline of subjects from atomic structure and atomic spectra to surface phenomena; discussions are complete and experimental methods are stressed throughout. It contains no problems for student solution as the author felt that, because there are works exclusively devoted to physico-chemical problems, the space could more profitably be devoted to references for further reading.

An unfortunate aspect of technical book publishing is that limited readership necessitates high prices. Undoubtedly this book will and should have wide acceptance by the teaching profession, but the price will be pretty steep for the pocketbooks of many students.

RECENT BOOKS and PAMPHLETS

Composition of Furnace Atmospheres Resulting from Partial Combustion of Gaseous Fuels. Bulletin No. 11. Published by the American Gas Association Testing Laboratories, Cleveland, Ohio. 96 pages. Price $1.25. With numerous charts and drawings this booklet presents practical means of obtaining furnace atmospheres of a predetermined composition. It is a guide to methods of interpreting test data obtained on gas-fired furnaces operating with a deficiency of combustion air. Also included are suggestions as to design of combustion chambers and burners in order to achieve a predetermined composition of flue gases, and new methods for determining heat content of flue gases containing unburned combustibles.

The Phosphate Resources of Tennessee. By R. W. Smith and G. I. Whitlatch. Published by Tennessee Division of Geology. Bulletin 48. 444 Pages. Price $1. Primarily a geological study, this booklet is the first part of a report on the deposits of an important phosphate producing state. It describes properties and operations of both commercial interests and the TVA.

A Survey of Plant-Food Consumption in the United States in the Year Ended June 30, 1939. By A. L. Mehring, Lola S. Deming and Herbert Willett. Published by The National Fertilizer Association, Washington, D. C. 86 pages. A detailed statistical report showing the grades of fertilizer used with data broken down by states.

Technology, Employment, and Output per Man in Iron Mining. By N. Yaworski and others. Work Projects Administration, National Research Report No. E-13. Available from Work Projects Administration, 1734 New York Ave., Washington, D. C. A study of the effects of technological changes on employment in the iron-mining industry. Included are discussions of long-time trends in employment, production, and output per man; factors increasing the output per man; changes in labor requirements and technology at open-pit mines; changes in labor requirements and technology at underground mines; progress in the benefication of iron ore; and employment prospects in iron mining. In 1937, approximately 26,000 wage earners produced nearly as much ore as did 60,000 in 1917. However, over a long-time view, the authors foresee greater rather than less employment, principally because of production trends and depletion of high-grade, easily accessible ore.

Lessons in Arc Welding. Published by the Lincoln Electric Co., Cleveland, Ohio. 136 pages. Price 50 cents. Consisting of a series of 51 lessons, this book will serve as an excellent textbook for trade and technical schools. Types of welds are described and instructions for making them are given. Numerous illustrations accompany the text and an appendix contains several pertinent questions on each lesson. These will aid in self-instruction and in classroom work.

Simple Blueprint Reading. Published by the Lincoln Electric Co., Cleveland, Ohio. 138 pages. Price 50 cents. With special emphasis on welding and welding symbols, this most recent of the Lincoln Company's helpful books on welding is an abbreviated but complete text on blueprint reading. It could profitably be used in conjunction with **Lessons in Arc Welding.**

Agricultural Alcohol for Motor Fuel. By C. Y. Hopkins. Published by Division of Chemistry, National Research Council of Canada, Ottawa, Canada. 9 pages. Price 25 cents. This document reviews the economic possibility of using certain Canadian agricultural materials. It calculates roughly the maximum prices which could be allowed if the alcohol is not to be excessively expensive for motor fuel. The report makes no recommendations nor general findings.

Directory of British Fine Chemicals. Published by the Association of British Chemical Manufacturers, London. 79 pages. Gratis to "bona fide users of chemicals." A revised listing of fine chemicals, with names of manufacturers, produced in Great Britain.

Synthetic Rubbers: A Review of their Compositions, Properties, and Uses. By Lawrence A. Wood, Circular C427. Available from Superintendent of Documents, Government Printing Office, Washington, D. C. Price 10 cents. A summary of facts and figures on the subject, listing about 30 varieties of synthetic rubber, almost all of which are in present commercial production. The varieties are grouped in six general classes according to chemical composition. There is also some discussion of the compounding and vulcanization of the different types.

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.

Correlation Index to Aid in Interpreting Crude-Oil Analyses, by Harold M. Smith. U. S. Bureau of Mines, Technical Paper 610; 10 cents.

Motor Carrier Safety Regulations, Revised. Part 7—Transportation of Explosives and Other Dangerous Articles, Effective June 15, 1940. Interstate Commerce Commission unnumbered pamphlet; 15 cents.

Quicksilver Deposits of the Mount Diablo District, Contra Costa County, California, by Clyde P. Ross. U. S. Geological Survey Bulletin 922-B; 10 cents.

Chromite Deposits of Grant County, Oregon, by T. P. Thayer. U. S. Geological Survey Bulletin 922-D; 45 cents.

Tungsten Deposits of Boulder County, Colorado, by T. S. Lovering. U. S. Geological Survey Bulletin 922-F; 20 cents.

The Gold Quartz Veins of Grass Valley, California, by W. D. Johnston, Jr. U. S. Geological Survey, Professional Paper 194; $2.50 (paper).

Statistics of Income for 1937, Part 2. Compiled from corporation income and excess-profits tax returns and personal holding company returns. U. S. Treasury Department, Bureau of Internal Revenue; 25 cents.

Federal Specifications. GG-H-941, Hydrometers; Syringe (for lead-acid storage batteries). TT-V-91a, Varnish; Shellac. WW-V-61, Valves, Cylinder; Oxygen (for standard industrial cylinders). HH-F-341, Filler, expansion-joint, preformed; non-extruding and resilient-types (for concrete). TT-P-23a, Paint; cold-water, interior, light-tints and white. ZZ-T-381c, Tires; automobile and motorcycle, pneumatic. W-B-131b, Batteries; storage, ignition, lighting, and starting. ZZ-G-421a, Gloves; rubber, surgeons'. ZZ-R-696, Rubber; denture. All of the above specifications are 5 cents each.

Methods of Applying Wood Preservatives, Revised April, 1940. Available only from Forest Products Laboratory, Madison, Wisconsin.

Carbonizing Properties and Petrographic Composition of Pocahontas No. 3—Bed Coal from Buckeye No. 3 Mine, Wyoming County, W. Va., and of Pocahontas No. 4—Bed Coal from No. 4 Mine, Raleigh County, W. Va., by A. C. Fieldner et al. U. S. Bureau of Mines, Technical Paper 604; 15 cents.

Petrographic Methods and Their Application to the Examination of Nonmetallic Materials, by George T. Faust and Alton Gabriel. U. S. Bureau of Mines, Information Circular 7129; mimeographed.

An Experimental Study of the Ignition of Firedamp-Air Mixtures by Explosives, by Etienne Audibert. U. S. Bureau of Mines, Report of Investigations 3518; mimeographed.

Portable Cabinets for Materials Used in Mineral Determinations, by Kenneth G. Skinner. U. S. Bureau of Mines, Information Circular 7127; mimeographed.

Tests of Salt as a Substitute for Rock Dust in the Prevention of Coal-Dust Explosions in Mines, by H. P. Greenwald, H. C. Howarth, and Irving Hartmann. U. S. Bureau of Mines, Report of Investigations 3529; mimeographed.

Diesel Locomotives in Gassy Mine Workings of Belgium, by Ad. Breyre and J. Fripiat. U. S. Bureau of Mines, Report of Investigations 3527; mimeographed.

Explosion Hazards in Storage Battery Rooms. By G. W. Jones, J. Campbell, R. E. Dillon and O. B. Benson. Bureau of Mines Technical paper 612. 16 pages. Available from the Superintendent of Documents, Washington, D. C. Price 10 cents. Contains descriptions of methods used and results of surveys made to determine amounts of hydrogen present in various large storage-battery rooms of the Boston Edison Co. Hazardous concentrations of the gas were found only when batteries were being charged.

Defense Against Chemical Attack. War Department, Basic Field Manual FM 21-40; 20 cents.

What Forests Give, by Martha Bensley Bruere. General and non-technical. U. S. Department of Agriculture, Forest Service, unnumbered pamphlet; 15 cents.

Mines of the Southern Mother Lode Region. Part II—Tuolumne and Mariposa Counties. By C. E. Julihn and F. W. Horton. Bureau of Mines Bulletin 424. 179 pages. Available from Superintendent of Documents, Washington, D. C. Price 60 cents. A comprehensive study, with numerous maps and illustrations, of the gold mines and other mineral industries of two California counties.

Sources of Heat for Cotton Drying; by Charles A. Bennett. Victor L. Stedronsky, and William J. Martin. U. S. Department of Agriculture, Miscellaneous Publication No. 385; 5 cents.

The Significance of Cotton Fiber Properties with Respect to Utilization, by Robert W. Webb. U. S. Department of Agriculture, Agricultural Marketing Service; mimeographed.

Commercial Fertilizer Used on Cotton —Crop Years 1922–1939—by States. U. S. Department of Agriculture, Agricultural Marketing Service Crop Reporting Board; mimeographed.

Commercial Fertilizer Used on Cotton —10 Year (1929–38) Average 1939, and 1940. U. S. Department of Agriculture, Agricultural Marketing Service; mimeographed.

Dairy Industry in the United States. Selected references on the economic aspects of the industry. U. S. Department of Agriculture, Bureau of Agricultural Economics, Economics Library List No. 11; mimeographed.

Farm Production, Farm Disposition, and Value of Soybeans and Cowpeas 1924–1936—by States. U. S. Department of Agriculture, Agricultural Marketing Service; mimeographed.

Refrigerated Warehouse Space Survey as of October 1, 1939, with Comparisons and Monthly Summary of Cold Storage Holdings 1938–1939. U. S. Department of Agriculture, Agricultural Marketing Service; multilithed.

Regulations for Warehousemen Storing Sirups, Approved December 11, 1939. Agricultural Marketing Service, Service and Regulatory Announcements No. 157; printed.

Effect of Ceiling Insulation Upon Summer Comfort, by Thomas D. Phillips. National Bureau of Standards, Building Materials and Structures Report BMS52; 10 cents.

Structural Properties of Tilecrete Type "A" Floor Construction. National Bureau of Standards, Building Materials and Structures Report BMS51; 10 cents.

Stoddard Solvent (Third Edition). National Bureau of Standards, Commercial Standard CS3-40; 5 cents.

Book Cloths, Buckrams, and Impregnated Fabrics, For Bookbinding Purposes Except Library Bindings (Second Edition). National Bureau of Standards, Commercial Standard CS57-40; 5 cents.

Wartime Control of Ocean Freight Rates in Foreign Trade, by Albert E. Sanderson. Bureau of Foreign and Domestic Commerce, Trade Promotion Series No. 212; 10 cents.

List of Publications of the Department of Commerce, July 1940 edition. Available from Department of Commerce, Division of Publications, Washington, D. C.

Chemical Developments Abroad, 1939, by C. C. Concannon and A. H. Swift. Effect of munitions and preparedness upon chemical production, consumption, and foreign trade. Bureau of Foreign and Domestic Commerce, Trade Promotion Series No. 211; 20 cents.

Rubber—History, Production, and Manufacture, by P. W. Barker. Bureau of Foreign and Domestic Commerce, Trade Promotion Series No. 209; 10 cents.

Census of Manufactures, 1939. The following preliminary reports covering industry operations for 1939 have been issued: Ammunition; Explosives; Rayon and Allied Products; Rubber Boots and Shoes; Rubber Tires and Inner Tubes; Reclaimed Rubber; Carbon Products; Batteries, Storage and Primary; Linoleum, Asphalted-Felt-Base and Other Hard-Surface Floor Coverings Not Elsewhere Classified; Corn Sirup, Corn Sugar, Corn Oil, and Starch. Available from Bureau of the Census, Washington, D. C.

Measurement of Production, by Woodlief Thomas and Maxwell R. Conklin. Discusses the problems involved in attempting to measure the course of production for industry as a whole and explains how these problems were met in compiling the Federal Reserve index, recently formulated. Available from Board of Governors, Federal Reserve System, Washington, D. C.

Survey of American Listed Corporations. Supplements for 1939 have been issued on the industry reports for cement, paint and varnish, and metal and glass container manufacturers. Available from Securities and Exchange Commission, Washington, D. C.

Mineral Resources, Production, and Trade of Argentina. Published in Foreign Minerals Quarterly, July 1940. U. S. Bureau of Mines; mimeographed.

Use of Wetting Agents for Allaying Coal Dust in Mines, by Irving Hartmann and H. P. Greenwald. U. S. Bureau of Mines, Information Circular 7131; Mimeographed.

A Twenty Years' Survey of the Use of Sheathed Explosives in Belgium, by Ad. Breyre. U. S. Bureau of Mines, Report of Investigations 3530; mimeographed.

Stemming in Metal Mines, Progress Report 2, by John A. Johnson, Wing G. Agnew, and McHenry Mosier. U. S. Bureau of Mines, Report of Investigations 3528; mimeographed.

Study of Brine-Disposal Systems in Illinois Oil Fields, by Sam S. Taylor, W. C. Holliman, and C. J. Wilhelm. U. S. Bureau of Mines, Report of Investigations 3534; mimeographed.

Testing Respiratory Protective Equipment for Approval, by H. H. Schrenk. U. S. Bureau of Mines, Information Circular 7130; mimeographed.

Discussion of Industrial Accidents and Diseases. Proceedings of 1939 Convention of the International Association of Industrial Accident Boards and Commissions, Milwaukee, Wis. U. S. Dept. of Labor, Division of Labor Standards, Bulletin No. 36; 20 cents.

Effective Industrial Use of Women in the Defense Program. Labor Department, Women's Bureau Special Bulletin No. 1; 10 cents.

A List of American Doctoral Dissertations Printed in 1938. Received in the Catalog Division from January 1938 to September 1939 with Supplement to Earlier Lists. Library of Congress; 50 cents.

Survey of Economic Theory on Technological Change and Employment, by Alexander Gourvitch. Works Projects Administration, National Research Project Report No. G-6. Available only from Works Projects Administration, 1734 New York Avenue, N. W., Washington, D. C.

Second Annual Report of the Administrator of the Bonneville Power Administration. A resume of the power contracts and negotiations, marketing of Bonneville power, and construction of the Bonneville system for the fiscal year 1939. Bonneville Power Administration; 50 cents.

Industries Important to National Defense Feasible of Establishment in the Pacific Northwest. A mimeographed report in three parts of the Bonneville Power Administration providing a broad view of the contributions that the mineral resources and low-cost electric power of the Northwest can make to the nation's defense. Available only from Bonneville Power Administration, Portland, Ore.

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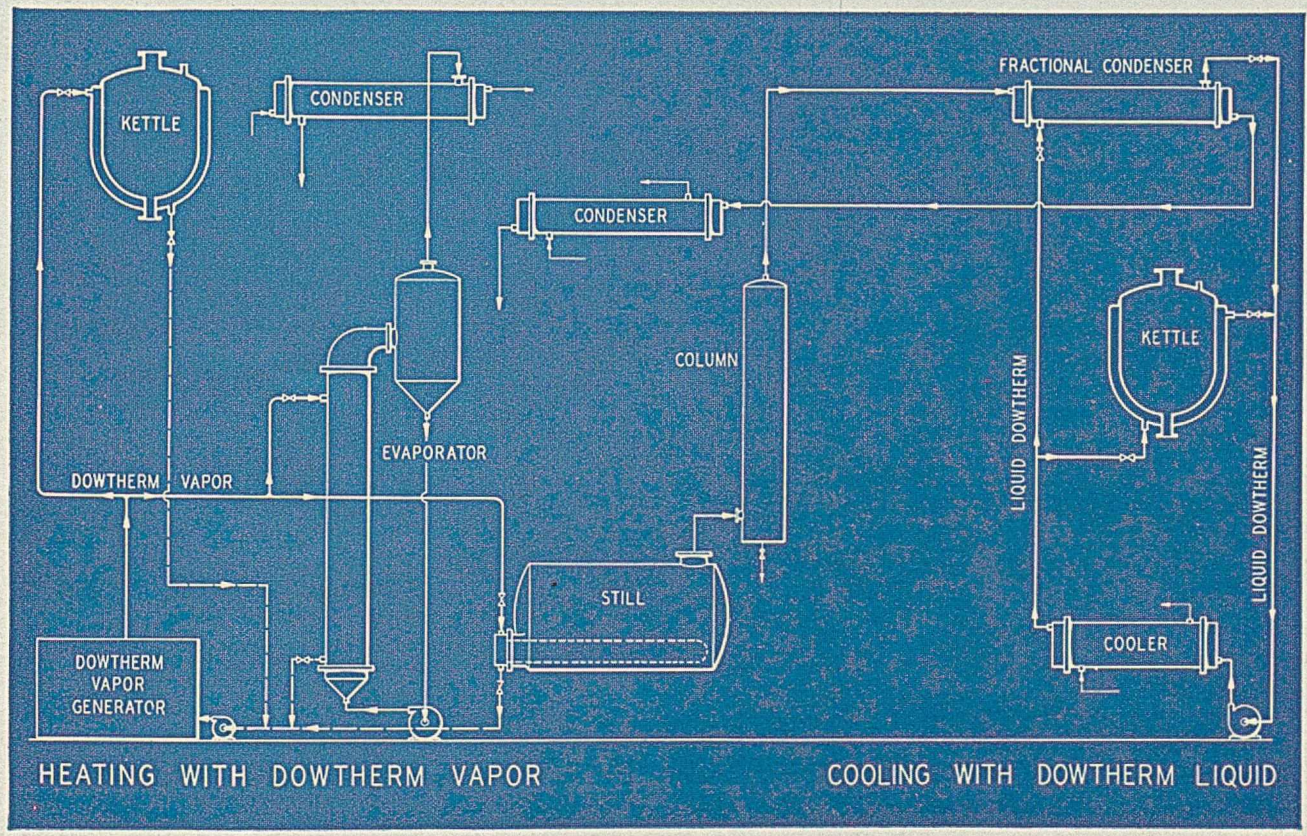

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Agitators. The Eclipse Air Brush Co., Newark, N. J.—4-page leaflet on this company's air-motored agitators, describing a wide variety of types ranging from laboratory to large production sizes.

Blast Gates. W. S. Rockwell Co., 50 Church St., New York, N. Y.—Catalog 402—12 pages giving description and detailed engineering data on this company's complete line of blast gates; includes several useful charts.

Chemicals. Baker & Co., 113 Astor St., Newark, N. J.—10-page book on the salts of the platinum metals and gold, with tabular information on properties and tables of useful information.

Chemicals. Carbide & Carbon Chemicals Corp., 30 East 42d St., New York, N. Y.—Chemical Group Folder No. 2—Leaflet describing and giving properties of eight glycols made by this company, with information on typical applications.

Chemicals. Michigan Alkali Co., Wyandotte, Mich.—56-page technical data book on this company's caustic soda, giving history of the company, physical and chemical properties of caustic soda, typical reactions, methods of packaging and handling. Includes extensive section giving useful information.

Chlorine. Mathieson Alkali Works, 60 East 42d St., New York, N. Y.—Revised 15x21-in. wall chart on safety in handling chlorine, giving 24 suggestions outlining the fundamentals of safe handling; chart covers containers, gas masks, leaks and first aid measures.

Dust Collection. Buell Engineering Co., 70 Pine St., New York, N. Y.—24-page book on this company's dust collectors, describing various types, discussing applications and going at considerable detail into the theory of dust collection as applied in this equipment.

Electrical Equipment. Bogue Electric Co., 80 Glover Ave., Paterson, N. J.—4-page leaflet announcing this company's ability to make shipments from stock, through recently expanded facilities, on low voltage generators for chemical use, motor generator sets for plating, and synchronous motors.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—GES-2411—20-page leaflet giving a brief outline of typical uses of various types of electronic devices for industry offered by this company.

Electrical Equipment. Westinghouse Electric & Mfg. Co., Dept. 7N20, East Pittsburgh, Pa.—Publications as follows: DD3145, 8 pages on vertical hollow-shaft motors for centrifugal pumps; F-8525, 4-page chart to facilitate the selection of small motors; Catalog Section 43-370, 12 pages on miniature panel instruments for electrical quantities; Catalog 30-000, 64-page quick-selector catalog, covering switches, circuit breakers, panelboards, motor controls and motors.

Equipment. Morse Bros., P. O. Box 1708, Denver, Colo.—Publications as follows: Bulletin 402, describes Morse-Weinig flotation cells; 405, 4 pages on this company's standard ball mills; 407, 4 pages on rake classifiers; 409, gives details on ore feeders.

Fire Protection. Walter Kidde & Co., Bloomfield, N. J.—Bulletin D-508—8 pages on carbon dioxide fire extinguishing systems, giving numerous views of systems installed in various industries and 15 typical installation diagrams.

Gaskets. Goetze Gasket & Packing Co., New Brunswick, N. J.—Catalog 53—64 pages on industrial gaskets, giving engineering data and showing new and improved products with complete size and price information.

Glassware. Corning Glass Works, Corning, N. Y.—Supplement to Catalog No. LP-18—8-page catalog and price list on this company's fritted laboratory glassware for filtration, extraction and gas dispersion.

Gratings. Blaw-Knox Co., Pittsburgh, Pa.—Catalog 1773—24 pages on this company's steel gratings and stair treads, with information on type of construction used, its advantages and applications. Safe-loading tables are included.

Industrial Soaps. Sugar Beet Products Co., Saginaw, Mich.—Leaflet describing this company's Formula SBS11 industrial hand soap for protection against skin irritation, infection and dermatitis.

Instruments. Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh, Pa.—Bulletin 337—4-page leaflet describing this company's Fyrite simplified Orsat carbon dioxide indicator for flue gas tests; also variety of bulletins describing improved engine indicators.

Instruments. Cochrane Corp., 17th and Allegheny Ave., Philadelphia, Pa.—Bulletin 2990—8 pages covering six different styles of mechanical and electrically operated liquid level meters made by this company.

Instruments. The Esterline-Angus Co., Indianapolis, Ind.—Bulletin 840—4-page folder describing this company's super-sensitive recorder for recording minute electrical quantities and many non-electrical phenomena.

Instruments. Republic Flow Meters Co., 2240 Diversey Parkway, Chicago, Ill.—Bulletin 801—12 pages describing in detail this company's line of multi-point indicators for draft and pressure, recently completely redesigned.

Instruments. Trimount Instrument, Inc., 332 South La Salle St., Chicago, Ill.—Bulletin 60—4 pages describing this company's new direct reading U-type manometers in a variety of designs; also flow indicators.

Lamps. Van Dyke Industries, 2857 South Halsted St., Chicago, Ill.—Bulletin 640—4 pages describing a variety of fluorescent lamps for desk and drafting use made by this company.

Laboratory Specialties. The Varnitron Co., 4865 West 21st St., Los Angeles, Calif.—Leaflet describing a variety of laboratory specialties such as brushes, stopcock lubricants, label varnishes and cements made by this company.

Materials Handling. Lewis Shepard Sales Corp., 295 Walnut St., Watertown, Mass.—Circular 10-202—Leaflet describing this company's open-end hydraulic lift trucks for the handling of heavy machinery.

Mixers. International Engineering Co., Dayton, Ohio—Catalog No. 75—12 pages on this company's portable and permanent agitators in a considerable variety of types, complete with engineering and dimension data.

Nickel and Alloys. International Nickel Co., 67 Wall St., New York, N. Y.—Publications as follows: Bulletin T-2, 32-page revised technical bulletin on the welding, brazing and soft soldering of Monel, nickel and Inconel, containing much new information; Bulletin T-5, revised technical bulletin on engineering properties of Monel with information on types available, mechanical, physical and chemical properties, and methods of fabricating.

Ovens. Despatch Oven Co., Minneapolis, Minn.—Bulletin 51—12 pages on this company's baking and drying ovens for synthetic and other finishes, describing methods of heat production and distribution, together with oven types.

Paints. American Abrasive Metals Co., Irvington, N. J.—Leaflet describing this company's Fera-Flow non-slip floor paint for industrial floors.

Power Transmission. The Carlyle Johnson Machine Co., Manchester, Conn.—10-page bulletin covering this company's standard type and Super-Johnson friction clutches; also dimension bulletin covering a new multiple disk type of clutch.

Power Transmission. The B. F. Goodrich Co., Akron, Ohio—170-page data book on V-belt drives. Gives alphabetical listings of belt requirements for numerous types of equipment. Also Catalog Section 2100, 4 pages of condensed information on this company's line of flat transmission belting.

Power Transmission. Hewitt Rubber Co., Buffalo, N. Y.—Folder describing this company's transmission belts, giving prices and engineering data on a number of different grades.

Power Transmission. Link-Belt Co., 307 North Michigan Ave., Chicago, Ill.—Book No. 1730—32 pages on power transmission practice in paper mills with particular reference to applications of silent chain drives and P. I. V. Gear variable speed transmissions; cost and comparative drive data are given.

Power Transmission. The Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J.—New drive data book on this company's Condor Whipcord endless belts in sizes from ¼ to 25 hp., listing more than 1,500 drives available with standard stock belts.

Power Transmission. Morse Chain Co., Ithaca, N. Y.—Bulletin R-40—92 pages on this company's roller chain, giving information on construction, applications and selection; includes numerous tables of engineering data.

Pumps. Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill.—Bulletin 5710—16 pages on this company's new line of Angleflow pumps in both vertical and horizontal types, designed for large capacity pumping in the lower head range. Also Bulletin 6930 R, 6-page folder describing this company's water lubricated turbine pumps with open impellers for motor, engine or turbine drive.

Rectifiers. Fansteel Metallurgical Corp., North Chicago, Ill.—Bulletin FI-3—8 pages on this company's selenium rectifiers with information on construction, characteristics, circuit arrangements and types available.

Resins. Irvington Varnish & Insulator Co., Irvington, N. J.—11-page bulletin on this company's Cardolite resins derived from cashew nuts, for use in binding asbestos and other materials, and in the lining of tanks for resistance against acids, alkalis and many solvents.

Rubber. Goodall Rubber Co., 5 South 36th St., Philadelphia, Pa.—Catalog 207—68-page general catalog on mechanical rubber goods, covering industrial and fire hose, couplings, conveyor and transmission belting, packing, clothing and technical data.

Screens. The J. H. Day Co., Cincinnati, Ohio—Bulletin 376—4-page leaflet describing this company's Ro-Ball gyrating screens in open and closed, single- and multi-deck designs.

Separation. Huntington, Heberlein & Co., Ltd., Upper Downing, Whitford near Holywell, North Wales—10-page bulletin describing principles and application of the H. H. Sink-and-Float process for ore concentration, with information on equipment required and separations effected.

Skin Protection. The Milburn Co., Detroit, Mich.—Industrial Dermatitis, 5th Edition—30-page book on industrial dermatitis, describing various types of skin infections with information on protective creams and ointments developed by this company for the various types.

Wire Rope. Macwhyte Co., Kenosha, Wis.—4-page leaflet discussing in detail character and results of internal lubrication used in this company's wire rope.

SEPARATING two or more solids suspended in a liquid.

CLARIFYING by throwing finely divided solids out of suspension.

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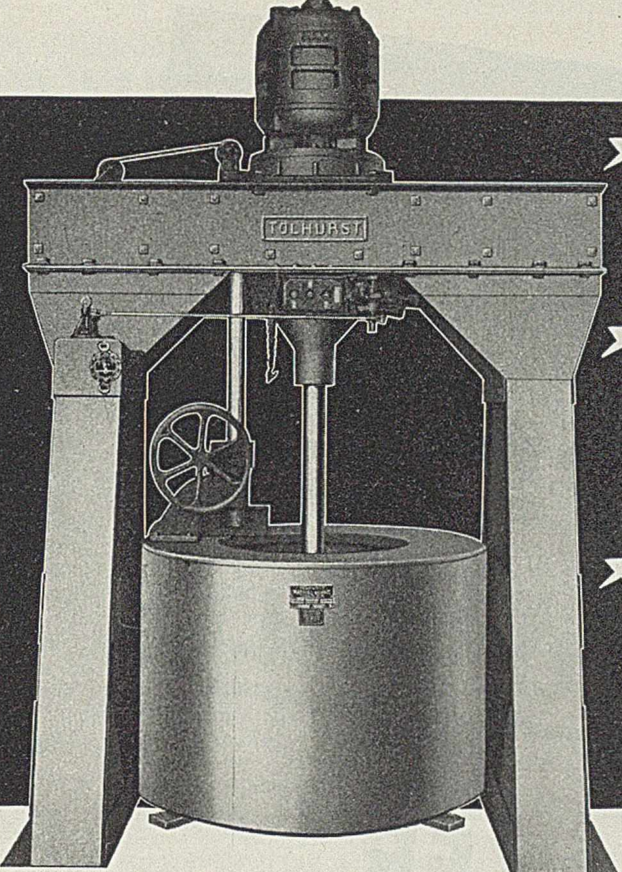

DRAINING a solid by removal of adhering liquid.

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Saves time ★ Cuts Costs

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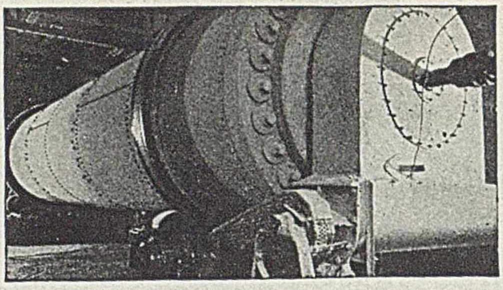

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Here is a case in which a small Louisville Dryer is doing a surprisingly big job. "Surprisingly big" because its only function is to salvage 180 tons of wet processing material a year—yet in doing so saves its owner, *every year*, a total of $2682! In other words, the $3500 Louisville Dryer can pay an *annual dividend of 76%!*

We bring this case to your attention simply to point out that Louisville *does* make small dryers as well as large—and that even the smallest installations receive the same careful engineering as our big, expensive jobs.

PROBLEM
To salvage wet processing material costing $20 per ton when new, in quantities of about 180 tons annually.

SOLUTION
A Louisville Rotary Dryer. Drying cost: $5.10 per ton of material dried, including all fixed charges.

RESULT
The customer saves $2682 per year which formerly went to the dump-heap.

Perhaps Louisville engineers can effect substantial savings in *your* drying operations. Or if, as in the case "blueprinted" at the left, you are now dumping wet materials after use, Louisville engineers may be able to show you how to reclaim them. In any event, you risk nothing to find out. Write: Louisville Drying Machinery Company, *Incorporated*, 451 Baxter Avenue, Louisville, Kentucky.

Chem & Met ECONOMICS and MARKETS

CONSUMPTION OF CHEMICALS REACHED HIGH POINT OF THE YEAR IN SEPTEMBER

REPORTS relative to activities in the principal consuming industries give evidence that the use of chemicals in September was larger than for any preceding month of this year. From the data at hand, the preliminary index for consumption of chemicals is placed at 148 as compared with a revised index of 144.16 for the preceding month and with 130.33 for September of last year. The consumption index started to move upwards rather sharply last year in August and September but despite this, the Jan.-Sept. period of the current year reports an advance of approximately 18 per cent over the like 1939 months. An active demand for chemicals was experienced over the final quarter of last year and the consumption index for the three months averaged 143.48. There is ample belief for the statement that the final quarter this year will establish an all-time high for the chemical industry both from a production and consumption standpoint.

Chem. & Met. Index for Consumption of Chemicals

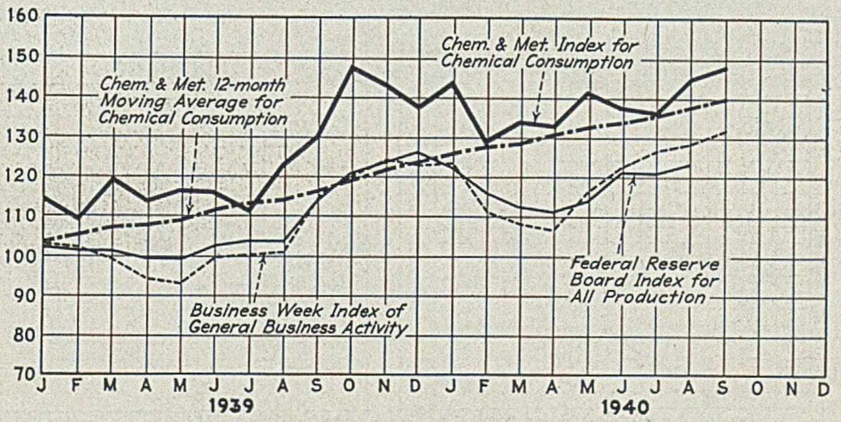
	July Revised	August
Fertilizer	26.10	27.88
Pulp and paper	19.50	20.45
Petroleum refining	14.13	14.16
Glass	11.94	13.08
Paint and varnish	11.05	11.83
Iron and steel	11.26	11.87
Rayon	11.44	12.09
Textiles	7.77	8.41
Coal products	9.06	9.29
Leather	3.94	4.27
Explosives	4.87	5.21
Rubber	2.71	2.92
Plastics	2.60	2.70
	136.37	144.16

Revised figures regarding manufacturing operations in August generally were higher than the preliminary ones and resulted in moving the index up to 144.16 as compared with 123.23 for August 1939. As a case in point, the output of paperboard set a new monthly high for the industry with production reported at 452,604 tons which exceeds that for any August on record. The all-time high was reached in October 1939 with an output of 506,466 tons. Production of glass containers also furnished a surprise as the 5,070 thousand gross was exceeded only by that reported for August 1937.

The outlook for the chemical industry for the last three months of this year may be well envisagd by a composite analysis of the manufacturing lines which are the largest consumers. Fertilizers, which are least affected by the defense program, will have the benefit of seasonal influences; pulp and paper are aided not only by the rise in general business but also because plant capacities have been enlarged to make up for loss in imports; glass plants curtailed operations during the hot-weather period and are now extending manufacturing schedules; the normal fall season for paints and varnish will be prolonged by government and private building programs; steel plants may be hard pressed to fill consuming requirements; rayon is making a new record for output of yarn; while consumption of wool was less than expected in August, textile mills are carrying orders which should insure a high rate of operation; the data as used in the index for consumption of chemicals for the explosives industry refer only to the totals used for industrial purposes and are not representative at present when high explosives for military use are becoming increasingly important.

According to the 13 Shippers' Advisory Boards, carloadings for the final quarter of this year will reach a total that will be 7 per cent higher than actual loadings in the Oct.-Dec. period of last year. If these estimates are borne out, rail movement of goods in that period will be larger than those for the corresponding months of any year since 1930. The estimates are based on loadings of 29 commodities and increased movement is expected for all but three of these. Percentage increases for the quarter are estimated as follows for some of the groups: automobiles, 22.1; ore and concentrates 20.6; iron and steel 11.1; paper, paperboard and prepared roofing 7.4; and chemicals and explosives 9.4.

Revenue freight delivered in motor trucks in August showed a gain in volume of 4.6 per cent over the preceding month and was 11.1 per cent higher than in August last year.

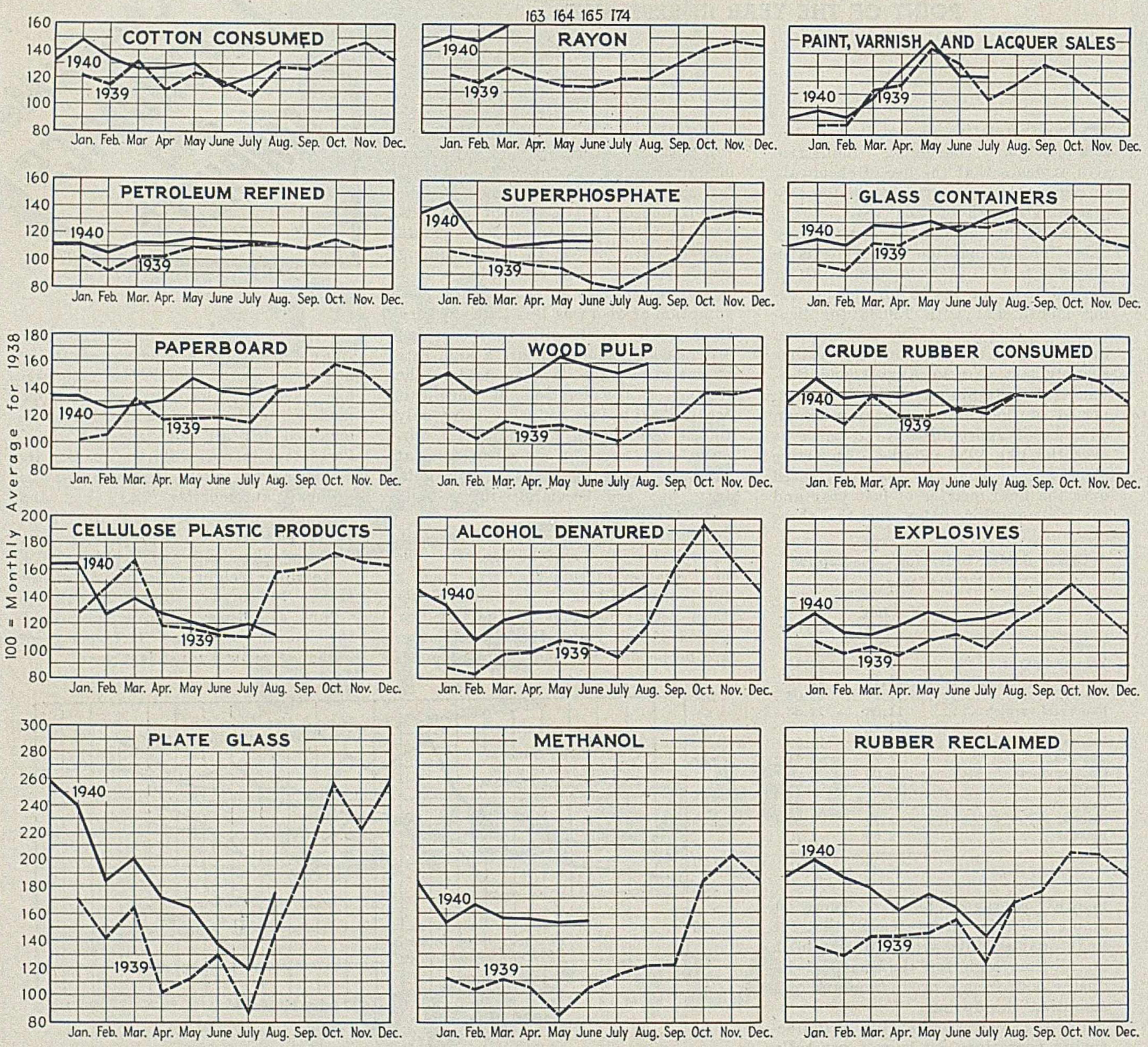


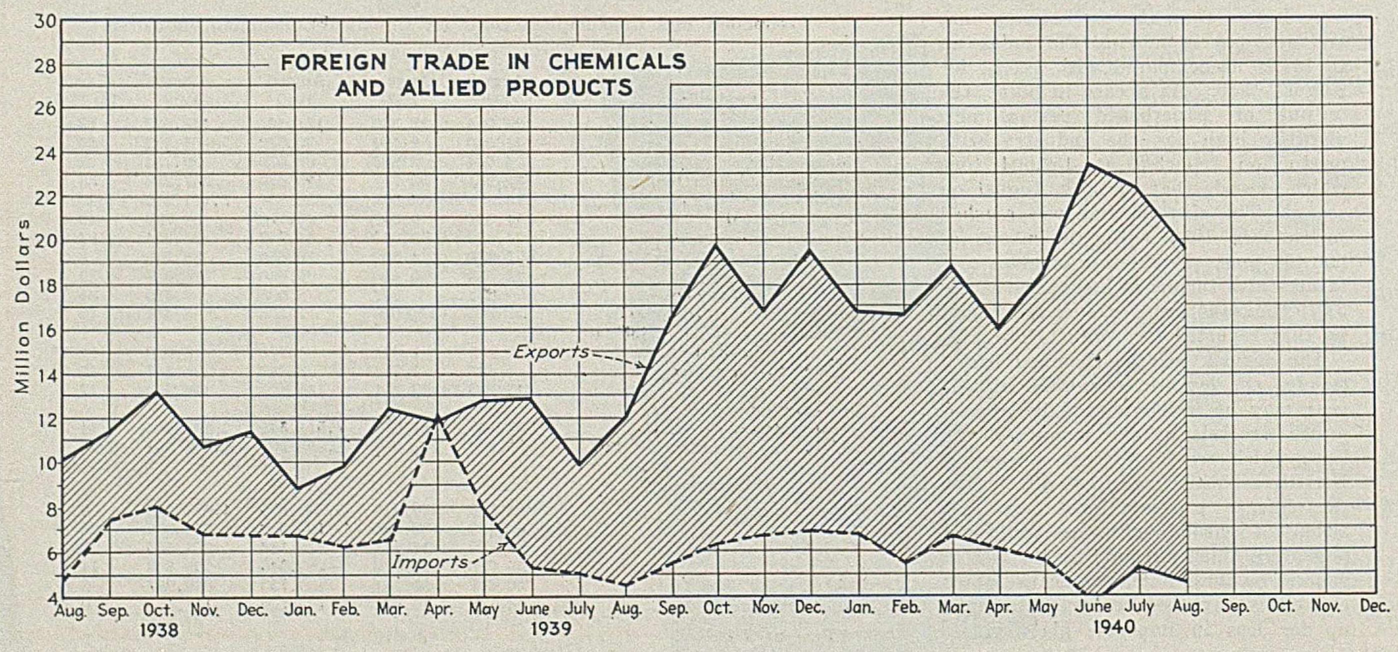
Production and Consumption Data for Chemical-Consuming Industries

Production	August 1940	August 1939	January-August 1940	January-August 1939	Per cent of gain for 1940
Alcohol, ethyl, 1,000 pr. gal	24,094	18,539	171,165	138,687	23.4
Alcohol denatured, 1,000 wi. gal	11,510	9.191	80,072	61,892	29.4
Ammonia, liquor, 1,000 lb	4,694	3,805	36,379	29,759	22.2
Ammonium sulphate, tons	62,254	50.717	463.679	347,288	33.5
Automobiles, sales, no	75,873	99,868	2,736,104	2,271,216	20.5
Benzol, 1.000 gal	11,357	9.007	85,170	60,793	40.1
Byproduct coke, 1,000 tons	4,682	3,653	34,753	25,224	37.4
Glass containers, 1,000 gr	5,070	4,802	36,556	33,740	8.3
Plate glass, 1,000 sq. ft	12,533	10,450	99,660	75,419	32.1
Window glass, 1,000 boxes	993	867	8,605	6,410	34.2
Nitrocellulose plastics, 1,000 lb	890	1,069	7,556	8,444	10.5*
Cellulose acetate plastics, 1,000 lb.					
Sheets, rods, and tubes	773	1,041	5,276	6,010	12.2*
Molding composition	1,422	1,034	8,287	6,551	26.5
Rubber reclaimed, tons	17,213	17,214	136,829	116,353	17.6
Steel barrels and drums					
Heavy type, no	958,120	851,087	7,811,595	6,266,565	24.7
Light type, no	255,682	201,567	1,855,288	1,513,141	22.6
Consumption					
Cotton, bales	654,503	628,448	5,088,375	4,688,166	8.5
Silk, bales	30,189	33,095	187,530	251,335	25.4*
Wool, 1,000 lb	32,370	34.311	234.538	251,485	6.7
Explosives, 1,000 lb	35,036	32,700	263,846	229,868	14.8
Rubber, crude, tons	50,477	50,481	400,728	368,927	8.6
Rubber, reclaimed, tons	14,179	16,846	123,709	113,114	9.4

* Per cent of decline.

Production and Consumption Trends





DEMAND FOR CHEMICALS IS RUNNING AT HIGHEST POINT FOR THE YEAR TO DATE

PRACTICALLY every major consuming industry has speeded up its demand for chemical products and the movement is on the largest scale for the year to date. In some cases producers have been well stripped of stocks and some of the coal-tar colors and dyes are reported to be in very small supply. In some instances the improved call for chemicals is due to increased operations at consumer plants but there are also evidences that certain buyers feel it desirable to build up larger stocks of raw materials.

While the majority of chemicals are quoted at unchanged price levels for delivery over the final quarter of the year, higher production costs have forced upward revisions in some cases, notably in such metal salts as copper sulphate, zinc oxide, lead oxides, and tin compounds. Other chemicals which have been held at low price levels because of competitive conditions have shown a tendency to harden as a result of increased demand and consequent lessening in sales pressure. No marked price changes seem imminent but there is a strong undercurrent and it is probable that producing costs will bring about some readjustments on a rising scale for deliveries over the first quarter of next year. Imported materials are subjected to varying price influences. Some producers abroad are cut off from a large part of their normal export markets and stocks at primary points are large enough to depress values. Other materials in demand in this country have been imported on a much reduced scale and prices have advanced because of the scarcity of supplies.

The position of vegetable oils and fats has not improved during the month. Edible oils are forced to meet keen competition from animal fats and crude oils of domestic origin present a weak statistical position. China wood oil holds at high price levels but is being consumed in a smaller way with greater inroads being made by substitute products. Prospects are favorable for increased demand for linseed oil but the large flax crop produced in this country in the present season has served to check price advances for the oil.

Among the materials which have been reported to be scarce in the spot market frequent mention has been made of sulphate of ammonia. Production of this chemical for the eight months ended Aug. 31 is reported at 463,679 tons. Imports for the same period were 36,822 tons thus giving a total supply of 500,501 tons but of this amount 99,822 tons were exported giving a net domestic supply of 401,141 tons. For the corresponding months of last year, production was 347,288 tons, imports 68,194 tons and exports 19,981 tons, or a net domestic supply of 395,501 tons. With an improved demand from domestic consumers this year it is easy to understand the sold-up position of the market.

Export trade in chemicals continues to run to large figures but is not so active as it was in earlier months of the year. This is due to the fact that some foreign markets formerly open are now closed to American trade. In the coal-tar group, exports of colors and dyes have increased notably this year with the eight-month totals being 18,423,809 lb. compared with 6,752,802 lb. for the corresponding period of 1939. Outward shipments of toluol for the same period amounted to 36,120,308 lb. with 1939 shipments relatively unimportant. Jan.-Aug. shipments of industrial chemicals this year were valued at $36,114,724 with the corresponding total for last year $17,680,007, the increase being well distributed among the separate items.

To a lesser extent foreign buyers have taken on larger amounts of pigments paints and varnishes. Mineral-earth pigments, lithopone, and titanium products have contributed largely to the increase while carbon black and white lead fell below the totals for the preceding year.

Export trade in fertilizers and fertilizer materials for the first eight months of this year were lower than they were last year the totals being 735,709 tons for 1940 and 1,008,400 tons for 1939. This decline is due entirely to the loss in shipments of phosphate rock and it is worthy of note that rock shipments in August showed material tonnage improvement.

Imports of chemicals in August were valued at $4,736,967 with industrial chemicals and fertilizer materials accounting for the larger part of the total. Imports of salt cake amounted to 13,698 tons, making the total for the year to date, 60,775 tons. Among the imports were 355,000 oz. of quinine sulphate and 100,000 lb. of iodine.

CHEM & MET.
Weighted Index of
CHEMICAL PRICES

Base=100 for 1937

This month	**99.24**
Last month	98.68
October, 1939	97.56
October, 1938	98.74

A stronger price tone was in evidence with metal salts especially feeling the effects of higher raw material costs. Denatured alcohol was marked up for final quarter delivery as was nitrate of soda packed in bags with the bulk price unchanged.

The Department of Commerce reports that imports of fertilizer potash into the United States during the first five months of 1940 were supplied chiefly by France. Receipts during the month of June comprised a single entry of 886 tons kainite, 20 per cent, from France, into the South Carolina Customs District. July importations were confined to a lot of 5,937 tons of potassium chloride—from Spain into the South Carolina Customs District.

The Assistant Commercial Attache at Madrid has reported that two cargoes of potash were shipped from Spain to the United States during recent months. It is assumed that one of these shipments was the item referred to above.

It is believed that the potash shipped from Spain constituted freshly mined material. The three Spanish producing companies operate a semi-official marketing and export association and it is understood that each of the three contributed a certain portion to the cargoes loaded for the United States.

Programs to accumulate stockpile supplies of toluol and materially expand the nation's productive capacity by new methods have been laid out by the defense commission to insure adequate and continuous flow of this essential raw material to the Army's proposed TNT factories.

Stockpile supplies will be obtained by government purchases of production from existing facilities, some of which have been idle because of a lack of normal markets. This will be used as a reserve to bridge any gaps in defense needs while facilities are being built to produce toluol from petroleum.

Most likely method of getting petroleum toluol is by recovering it as a byproduct in manufacture of high octane gasoline. Development of this method fits in with other defense plans to enlarge the productive capacity of this aviation fuel.

Both the amount of proposed stockpile accumulations and the extent of production expansion contemplated are military secrets. But this much can be said: the stockpile is looked upon more as a temporary bridge until new facilities are available and therefore will be on a somewhat modest scale.

CHEM & MET.

Weighted Index of Prices for

OILS & FATS

Base=100 for 1937

This month	**66.95**
Last month	67.43
October, 1939	82.15
October, 1938	73.50

With the exception of a few selections, an easy price position was maintained throughout the market for oils and fats. China wood oil is firmly held with shipments uncertain and olive oil foots have commanded higher prices. Crude cottonseed and soybean oils failed to improve their positions.

Chem & Met Current PRICES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.07½-$0.08	$0.07½-$0.08	$0.06 -$0.06½
Acid, acetic, 28%, bbl., cwt	2.23 - 2.48	2.23 - 2.48	2.23 - 2.48
Glacial 99%, drums	8.43 - 8.68	8.43 - 8.68	8.43 - 8.68
U. S. P. reagent	10.25 -10.50	10.25 -10.50	10.25 -10.50
Boric, bbl., ton	106.00-111.00	106.00-111.00	106.00-111.00
Citric, kegs, lb	.20 - .23	.20 - .23	.20 - .23
Formic, cbys., lb	.10½- .11	.10½- .11	.10½- .11
Gallic, tech., bbl., lb	.90 - 1.00	.90 - 1.00	.70 - .75
Hydrofluoric 30% drums, lb	.08 - .08½	.08 - .08½	.07 - .07½
Lactic, 44%, tech., light, bbl., lb	.06½- .06¾	.06½- .06¾	.06½- .06¾
Muriatic, 18°, tanks, cwt	1.05 -......	1.05 -......	1.05 -......
Nitric, 36°, carboys, lb	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks., ton	18.50 -20.00	18.50 -......	18.50 -20.00
Oxalic, crystals, bbl., lb	.10¾- .12	.10¾- .12	.10¾- .12
Phosphoric, tech., c'bys., lb	.07½- .08½	.07½- .08½	.07½- .08½
Sulphuric, 60°, tanks, ton	13.00 -......	13.00 -......	13.00 -......
Sulphuric, 66°, tanks, ton	16.50 -......	16.50 -......	16.50 -......
Tannic, tech., bbl., lb	.54 - .56	.54 - .56	.40 - .45
Tartaric, powd., bbl., lb	.41¼-......	.41½-......	.31¼-......
Tungstic, bbl., lb	nom.	nom.	2.35 -......
Alcohol, amyl	......-......	......-......	......-......
From Pentane, tanks, lb	.101-......	.101-......	.101-......
Alcohol, Butyl, tanks, lb	.09 -......	.09 -......	.08 -......
Alcohol, Ethyl, 190 p'f., bbl., gal	6.03 -......	5.98-......	4.54 -......
Denatured, 190 proof	......-......	......-......	......-......
No. 1 special, bbl., gal. wks	.30½-......	.29½-......	.28½-......
Alum, ammonia, lump, bbl., lb	.03½- .04	.03½- .04	.03½- .04
Potash, lump, bbl., lb	.03¾- .04	.03¾- .04	.03¾- .04
Aluminum sulphate, com. bags, cwt	1.15 - 1.40	1.15 - 1.40	1.15 - 1.40
Iron free, bg., cwt	1.60 - 1.70	1.60 - 1.70	1.30 - 1.55
Aqua ammonia, 26°, drums, lb	.02¼- .03	.02¼- .03	.02 - .03
tanks, lb	.02 - .02¾	.02 - .02¾	.02 - .02¾
Ammonia, anhydrous, cyl., lb	.16 -......	.16 -......	.15½- .16
tanks, lb	.04½-......	.04½-......	.04½-......
Ammonium carbonate, powd. tech., casks, lb	.09 - .12	.09 - .12	.08 - .12
Sulphate, wks., cwt	1.40 -......	1.40 -......	1.40 -......
Amylacetate tech., from pentane, tanks, lb	.11½-......	.11½-......	.10½- .10½
Antimony Oxide, bbl., lb	.13 -......	.13 -......	.11 -......
Arsenic, white, powd., bbl., lb	.03½- .03½	.03½- .03½	.03 - .03½
Red, powd., kegs, lb	.17 - .18	.17 - .18	.15¾- .16
Barium carbonate, bbl., ton	52.50 -57.50	52.50 -57.50	52.50 -57.50
Chloride, bbl., ton	79.00 -81.00	79.00 -81.00	79.00 -81.00
Nitrate, casks, lb	.08½- .10	.08½- .10	.07 - .08
Blanc fixe, dry, bbl., lb	.03½- .04	.03½- .04	.03½- .04
Bleaching powder, f. o. b., wks., drums, cwt	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, gran., bags, ton	43.00 -......	43.00 -......	48.00 -51.00
Bromine, cs., lb	.30 - .32	.30 - .32	.30 - .32
Calcium acetate, bags	1.90 -......	1.90 -......	1.75 -......
Arsenate, dr., lb	.06½- .06¾	.06½- .06¾	.06¾- .07
Carbide drums, lb	.04¾- .05	.04¾- .05	.05 - .06
Chloride, fused, dr., del., ton	19.00 -24.50	19.00 -24.50	21.50 -24.50
flake, dr., del., ton	20.50 -25.00	20.50 -25.00	23.00 -25.00
Phosphate, bbl., lb	.07½- .08	.07½- .08	.07½- .08
Carbon bisulphide, drums, lb	.05 - .06	.05 - .06	.05 - .06
Tetrachloride drums, lb	.04¾- .05½	.04¾- .05½	.04¾- .05½
Chlorine, liquid, tanks, wks., lb	1.75 -......	1.75 -......	1.75 -......
Cylinders	.05¼- .06	.05½- .06	.05½- .06
Cobalt oxide, cans, lb	1.84 - 1.87	1.84 - 1.87	1.67 - 1.70
Copperas, bgs., f. o. b., wks., ton	18.00 -19.00	18.00 -19.00	15.00 -16.00
Copper carbonate, bbl., lb	.10 - .16½	.10 - .16½	.10 - .16
Sulphate, bbl., cwt	4.75 - 5.00	4.60 - 4.85	4.75 - 5.00
Cream of tartar, bbl., lb	.34½-......	.34½-......	.25½-......
Diethylene glycol, dr., lb	.22 - .23	.22 - .23	.22 - .23
Epsom salt, dom., tech., bbl., cwt	1.80 - 2.00	1.80 - 2.00	1.80 - 2.00
Ethyl acetate, drums, lb	.07 -......	.07 -......	.061-......
Formaldehyde, 40%, bbl., lb	.05½- .06	.05½- .06¼	.05¾- .06¼
Furfural, tanks, lb	.09 -......	.09 -......	.09 -......
Fusel oil, ref. drums, lb	.16 - .17	.16 - .17	.12½- .14
Glaubers salt, bags, cwt	.95 - 1.00	.95 - 1.00	.95 - 1.00
Glycerine, c.p., drums, extra, lb	.12½-......	.12½-......	.12½-......
Lead:			
White, basic carbonate, dry casks, lb	.07 -......	.07 -......	.07 -......
White, basic sulphate, sck., lb	.06½-......	.06½-......	.06½-......
Red, dry, sck., lb	.07¾-......	.07¾-......	.08 - .....
Lead acetate, white crys., bbl., lb	.11 - .12	.11 - .12	.11 - .12
Lead arsenate, powd., bag, lb	.08½- .11	.08½- .11	.10 - .10½
Lime, chem., bulk, ton	8.50 -......	8.50-......	8.50 -......
Litharge, pwd., csk., lb	.06¾-......	.06½	.07 -......
Lithophone, bags, lb	.036- .04	.036- .04	.04 - .04½
Magnesium carb., tech., bags, lb	.06¼- .06½	.06¼- .06½	.06 - .06½

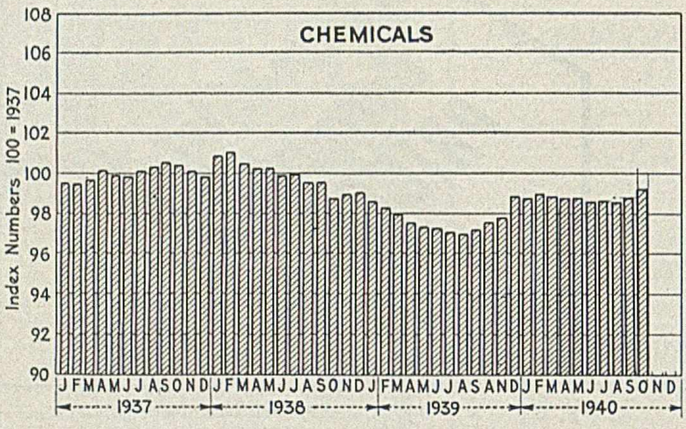
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Oct. 11

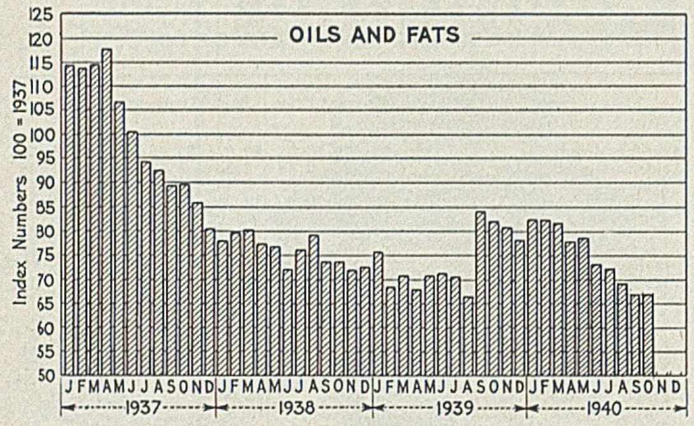
	Current Price	Last Month	Last Year
Methanol, 95%, tanks, gal	.29 -......	.29 -......	.31 -......
97%, tanks, gal	.30 -......	.30 -......	.32 -......
Synthetic, tanks, gal	.30 -......	.30 -......	.33 -......
Nickel salt, double, bbl., lb	.13 - .13½	.13 - .13½	.13 - .13½
Orange mineral, csk., lb	.10¼-......	.10¼-......	.10¾-......
Phosphorus, red, cases, lb	.40 - .42	.40 - .42	.40 - .42
Yellow, cases, lb	.18 - .25	.18 - .25	.18 - .25
Potassium bichromate, casks, lb	.08⅝- .09	.08⅝- .09	.08⅝- .09
Carbonate, 80-85%, calc. csk., lb	.06½- .07	.06½- .07	.06½- .07
Chlorate, powd., lb	.10 - .12	.10 - .12	.09¼-......
Hydroxide(c'stic potash) dr., lb	.07 - .07½	.07 - .07½	.07 - .07½
Muriate, 80% bgs., unit	.53½-......	.53½-......	.53½-......
Nitrate, bbl., lb	.05½- .06	.05½- .06	.05½- .06
Permanganate, drums, lb	.18½- .19	.18½- .19	.18½- .19
Prussiate, yellow, casks, lb	.15 - .16	.15 - .16	.15 - .16
Sal ammoniac, white, casks, lb	.05 - .06	.05 - .06	.05 - .05½
Salsoda, bbl., cwt	1.00 - 1.05	1.00 - 1.05	1.00 - 1.05
Salt cake, bulk, ton	23.00 -......	23.00 -......	13.00 -15.00
Soda ash, light, 58%, bags, contract, cwt	1.05 -......	1.05 -......	1.05 -......
Dense, bags, cwt	1.10 -......	1.10 -......	1.10 -......
Soda, caustic, 76%, solid, drums, cwt	2.30 - 3.00	2.30 - 3.00	2.30 - 3.00
Acetate, works, bbl., lb	.04 - .05	.04 - .05	.04 - .05
Bicarbonate, bbl., cwt	1.70 - 2.00	1.70 - 2.00	1.70 - 2.00
Bichromate, casks, lb	.06⅝- .07	.06⅝- .07	.06⅝- .07
Bisulphate, bulk, ton	16.00 -17.00	16.00 -17.00	15.00 -16.00
Bisulphite, bbl., lb	.03 - .04	.03 - .04	.03¼- .04
Chlorate, kegs, lb	.06¼- .06½	.06¼- .06½	.06¼- .06½
Cyanide, cases, dom., lb	.14 - .15	.14 - .15	.14 - .15
Fluoride, bbl., lb	.07 - .08	.07 - .08	.07½- .08
Hyposulphite, bbl., cwt	2.40 - 2.50	2.40 - 2.50	2.40 - 2.50
Metasilicate, bbl., cwt	2.35 - 2.40	2.35 - 2.40	2.20 - 3.20
Nitrate, bulk, cwt	1.45 -......	1.45 -......	1.45 -......
Nitrite, casks, lb	.06¾- .07	.06¾- .07	.06¾- .07
Phosphate, tribasic, bags, lb	2.25 -......	2.25 -......	2.10 -......
Prussiate, yel. drums, lb	.10½- .11	.10½- .11	.09½- .10
Silicate (40° dr.) wks., cwt	.80 - .85	.80 - .85	.80 - .85
Sulphide, fused, 60-62%, dr., lb	.02¾- .03½	.02¾- .03	.02¾- .03
Sulphite, crys., bbl., lb	.02¼- .02¼	.02¼- .02½	.02¼- .02½
Sulphur, crude at mine, bulk, ton	16.00 -......	16.00 -......	16.00 -......
Chloride, dr., lb	.03 - .04	.03 - .04	.03 - .04
Dioxide, cyl., lb	.07 - .08	.07 - .08	.07 - .07½
Flour, bag, cwt	1.60 - 3.00	1.60 - 3.00	1.60 - 3.00
Tin Oxide, bbl., lb	.54 -......	.51 -......	.54 -......
Crystals, bbl., lb	.38½-......	.39½-......	.50½-......
Zinc. chloride, gran., bbl., lb	.05 - .06	.05 - .06	.05 - .06
Carbonate, bbl, lb	.14 - .15	.14 - .15	.14 - .15
Cyanide, dr., lb	.33 - .35	.33 - .35	.33 - .35
Dust, bbl., lb	.09¼-......	.08½-......	.08½-......
Zinc oxide, lead free, bag., lb	.06½-......	.06¼-......	.06¼-......
5% lead sulphate, bags, lb	.06⅛-......	.06⅛-......	.06¼-......
Sulphate, bbl., cwt	3.05 - 3.25	3.05 - 3.25	2.75 - 3.00

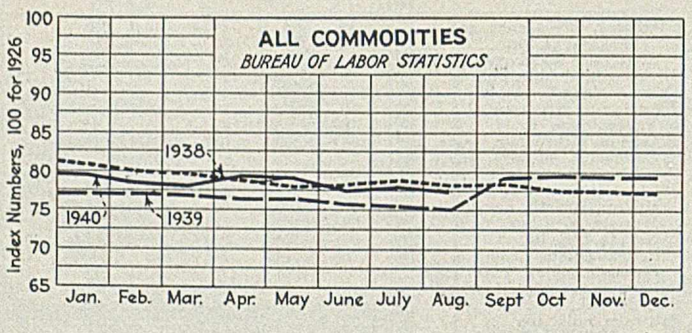
OILS AND FATS

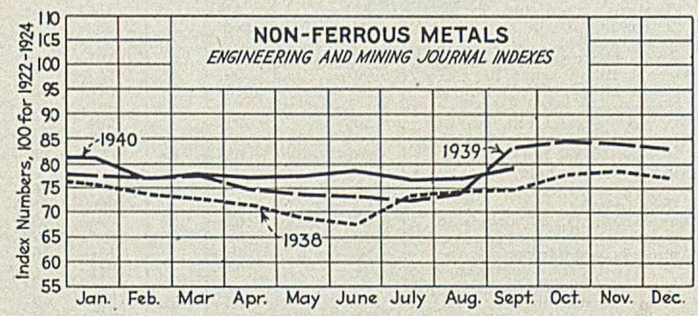
	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb	$0.10¾-$0.11	$0.10¾-$0.11	$0.09½-$0.10
Chinawood oil, bbl., lb	.26 -......	.26 -......	.28 -......
Coconut oil, Ceylon, tank, N. Y., lb	.02¾-......	.02¾-......	.04 -......
Corn oil crude, tanks (f. o. b. mill), lb	.05¼-......	.05¼-......	.06½-......
Cottonseed oil, crude (f. o. b. mill), tanks, lb	.04⅜-......	.04¾-......	.05¼-......
Linseed oil, raw car lots, bbl., lb	.083-......	.084-......	.105-......
Palm, casks, lb	.03½-......	.03½-......	.04½-......
Peanut oil, crude, tanks (mill), lb	.05¼-......	.05½-......	.07 -......
Rapeseed oil, refined, bbl., gal	1.10 -......	1.10 -......	.95 -......
Soya bean, tank, lb	.03⅞-......	.04½-......	.05½-......
Sulphur (olive foots), bbl., lb	.09¼-......	.08⅝-......	.10 -......
Cod, Newfoundland, bbl., gal	nom.	nom.	.32 -......
Menhaden, light pressed, bbl., lb	.061-......	.061-......	.076-......
Crude, tanks (f. o. b. factory), gal	.21 -......	.21 -......	.36 -......
Grease, yellow, loose, lb	.03½-......	.03⅜-......	.05¾-......
Oleo stearine, lb	.05½-......	.05½-......	.09 -......
Oleo oil, No. 1	.05¾-......	.06¼-......	.08½-......
Red oil, distilled, d.p. bbl., lb	.06½-......	.06½-......	.07⅞-......
Tallow extra, loose, lb	.03¾-......	.03¾-......	.06 -......

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb. ...	$0.52 -$0.55	$0.52 -$0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb....	32 - .34	32 - .34	.32 - .34
Aniline oil, drums, extra, lb......	.15 - .16	15 - .16	.15 - .16
Aniline, salts, bbl., lb	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb....	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb.....	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb....	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal...	.14 -......	.15 - .18	.16 - .18
Beta-napthol, tech., drums, lb....	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb...........	.09½- .10	.09½- .10	.10 - .11
Cresylic acid, dr., wks., gal......	.58 - .60	.58 - .60	.69 - .71
Diethylaniline, dr., lb...........	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb...........	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb...........	.15½- .16	.15½- .16	.15 - .16
Dip oil, 15%, dr., gal...........	.23 - .25	.23 - .25	.23 - .25
Diphenylamine bbl., lb...........	.25 - .27	25 - .27	.32 - .36
H-acid, bbl., lb	.45 - .50	45 - .55	.50 - .55
Naphthalene, flake, bbl., lb......	.07 - .07½	07 - .07½	.05½- .06
Nitrobenzene, dr., lb	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb	.47 - .49	47 - .49	.47 - .49
Phenol, U.S.P., drums lb.........	.13 -......	.13 -......	.14½-......
Picric acid, bbl., lb.............	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal	1.70 - 1.80	1.70 - 1.80	1.55 - 1.60
Resorcinol, tech., kegs, lb.......	.75 - .80	75 - .80	75 - .80
Salicylic acid, tech., bbl., lb......	.33 - .40	.33 - .40	.33 - .40
Solvent naptha, w.w., tanks, gal.	.27 -......	.27 -......	.26 -......
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal......	30 -......	.30 -......	27 -......
Xylol, com, tanks, gal.	26 -......	.27 -......	.26 -......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton....	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb	11½- .13	.11½- .13	.14 - .15½
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb...	.028- .30	.028- .30	02¼- .30
Prussian blue, bbl., lb	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb......	.11 - .26	.11 - .26	.10 - .26
Chrome green bbl., lb.........	.21½- .30	.21½- .30	.21 - .27
Carmine red, tins, lb..........	4.85 - 5.00	4.85 - 5.00	4.35 - 4.40
Para toner, lb	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb....	nom.......	nom.......	2.40 - 2.50
Chrome yellow, C.P., bbl., lb..	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb..	.06 - .06½	.06 - .06½	.06 - .06½
Gum copal Congo, bags, lb......	.08 - .30	.08 - .30	.06 - .30
Manila, bags, lb	.09 - .15	.09 - .14	.09 - .14
Damar, Batavia, cases, lb.....	.10 - .22	.10 - .20	.08 - .24
Kauri, cases, lb	.18 - .60	.18 - .60	.18½- .60
Kieselguhr (f.o.b. N.Y.), ton.....	50 00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	50.00 -......	50.00 -......	50.00 -......
Pumice stone, lump, bbl., lb.....	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb..........	.03 - .04	.03 - .04	.03 - .04
Rosin, H., 100 lb..............	2.22 -......	2.24 -......	.... -......
Turpentine, gal	40 -......	.37½-......	.33 -......
Shellac, orange, fine, bags, lb.....	.25 -......	.26 -......	.25 -......
Bleached, bonedry, bags, lb....	.23 -......	.25 -......	.24 -......
T. N. Bags, lb...............	.13 -......	.14 -......	.16 -......
Soapstone (f.o.b. Vt.), bags, ton..	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc 200 mesh (f.o.b. Vt.), ton...	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
300 mesh (f.o.b. Ga.), ton.....	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N.Y.), ton....	13.75 -......	13.75 -......	13.75 -......

Industrial Notes

Sterling Pump Corp., Hamilton, Ohio, has acquired the turbine pump division of the Roots-Connersville Blower Corp. of Connersville, Ind.

National Cylinder Gas Co., Chicago, has entered into an arrangement with the Bastian-Blessing Co., whereby it will use the facilities of the latter company and begin production of a complete line of gas welding and cutting equipment under the Rego trade mark.

Philadelphia Thermometer and Instrument Co., Philadelphia, has appointed the Precision Scientific Co., Chicago, distributors to the laboratory supply field for its line of regulators and relays.

Pittsburgh Equitable Meter Co., Pittsburgh, has elected A. D. MacLean vice-president. Since 1926 Mr. MacLean has been chief engineer of the company.

Arthur D. Little, Inc., Cambridge, Mass., has completed a chemical engineering building to be used for semi-plant development of projects originating in the laboratory.

Raybestos-Manhattan, Inc., has purchased the plant of Brighton Mills which is adjacent to the plant of the Manhattan Rubber Mfg. Division at Passaic, N. J.

Globe Steel Tubes Co., Milwaukee, has established a sales office at 1033 Broad St., Philadelphia with Paul C. Lewis in charge.

Elgin Softener Corp., Elgin, Ill., has opened a branch office at 215 North Mason St., Appleton, Wisc., with Ralph H. Williams as manager.

The American Cyanamid & Chemical Co., New York, is adding two new units to its plant at Kalamazoo—one to manufacture wax sizes and one to prepare casein for coating paper.

Insecticide Corp. of America, Medina, N. Y., has purchased the insecticide branch of the National Electro Chemical Co., Boston.

The Babcock & Wilcox Tube Co., New York, has appointed the MacFarlane Foundry and Honolulu Iron Works, S. A., Sagua la Grande as its representative in Cuba.

Prater Pulverizer Co., Chicago, is now represented in the eastern territory by Brown and Sites Co., Inc., 30 Church St., New York.

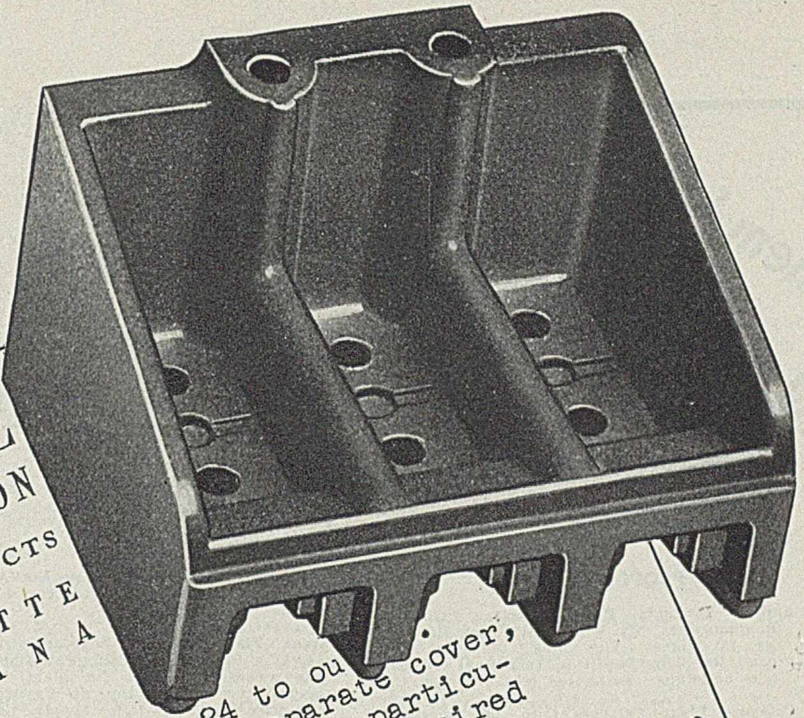
Chicago Pneumatic Tool Co., New York, has appointed P. J. Christy manager of its Philadelphia office to succeed A. M. Brown who is now manager of the new branch opened in Washington, D. C.

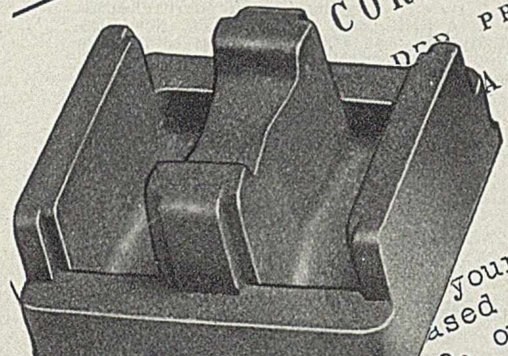
ANOTHER OUTSTANDING PRODUCT SUCCESS by MULLING in the

SIMPSON

INTENSIVE

MIXER



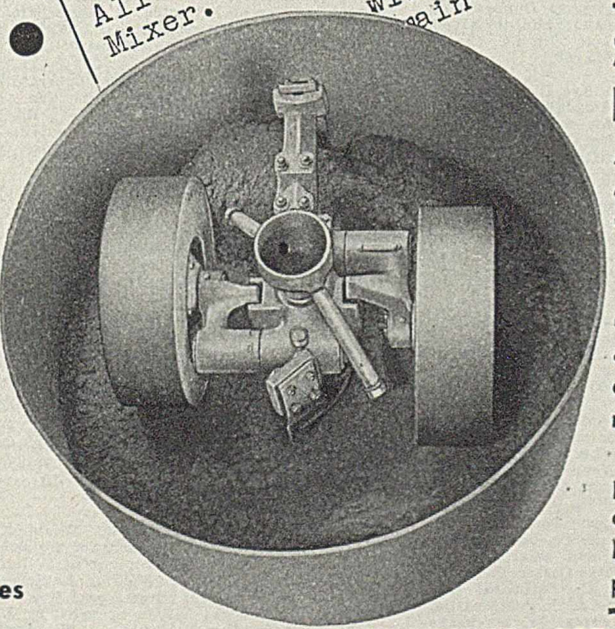


ROSTONE
CORPORATION
... PRODUCTS
...AYETTE
...IANA

In ac... your letter of May 24 to ou...
Wymer, w... ased to forward, under separate cover,
a sample of ...te, our inorganic plastic for particu-
lar use where high arc and heat resistance is required
in the electrical insulation field.

All ingredients for this material are mixed in a small Simpson
Mixer. ... will find this material of interest for your
...ain

Yours very truly,
ROSTONE CORPORATION



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A stiff body compound, in which the ingredients are resistant to combination and intimacy of distribution by the usual stirring treatment, readily yielded to the thorough-going mulling action of the Simpson Mixer.

The rubbing, kneading and smearing effect under pressure of heavy, wide-faced mullers, revolving on the material and adjustable to avoid grinding, results in a rapid distribution of all the elements of the mix and a strictly uniform body material.

The Simpson Intensive Mixer is a heavy duty, modern, precision machine, of high capacity and mechanical efficiency, low in power and maintenance cost. 3500 Simpson Mixers are in service on over 50 different classifications of process materials.

INVESTIGATE THE SIMPSON MIXER NOW FOR GREATER UNIFORMITY AND LOWER MANUFACTURING COST IN THE PROCESSING OF YOUR SPECIAL PRODUCTS

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MACHINERY HALL BUILDING, CHICAGO, ILLINOIS, U. S. A.

Manufacturers and Selling Agents for Continental European Countries:—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

Chem & Met New CONSTRUCTION

	Current Projects: Proposed Work	Current Projects: Contracts	Cumulative 1940: Proposed Work	Cumulative 1940: Contracts
New England	....	....	$280,000	$1,428,000
Middle Atlantic	$2,465,000	$230,000	12,130,000	13,678,000
South	....	4,430,000	12,455,000	39,245,000
Middle West	....	28,135,000	7,980,000	4,640,000
West of Mississippi	2,075,000	17,312,000	27,590,000	26,276,000
Far West	....	....	4,990,000	3,238,000
Canada	....	175,000	27,885,000	22,435,000
Total	$4,540,000	$50,282,000	$93,310,000	$110,940,000

PROPOSED WORK

Aniline Products Plant—American Aniline Products, Inc., Mt. Vernon St., Lock Haven, Pa., T. James, Vice Pres., plans to expand its plant facilities, including several new buildings. Estimated cost $250,000.

Celanese Plant—Celanese Corp. of America, Cumberland, Md., plans to construct a 3 story, 100x140 ft. addition to its plant. Estimated cost $125,000.

Chemical Plant—National Aniline & Chemical Co., 1051 South Park Ave., Buffalo, N. Y., plans to construct an addition to its plant. Estimated cost $40,000.

Clay Products Plant—Dickey Clay Mfg. Co., New York Life Bldg., Kansas City, Mo., is having plans prepared by Alfred Bemberg, Archt., 1036 New York Life Bldg., Kansas City, for a plant at Monroe and Quinotte Sts. Estimated cost $400,000.

Cotton Oil Mill—Planters Cotton Oil Co., East 5th Ave., Pine Bluff, Ark., plans to rebuild its mill recently damaged by fire. Estimated cost $50,000.

Factory—International Latex Corp., c/o Walter Carlson, Archt., Delaware Trust Bldg., Wilmington, Del., plans to construct a factory at Dover, Del. Estimated cost $50,000.

Gasoline Plant—Continental Oil Co., Continental Oil Bldg., Denver, Colo., plans to construct a natural gasoline and pressure maintenance plant in the Hull-Silk oil field, Archer Co., North Texas. Estimated cost between $300,000 and $400,000.

Grease Manufacturing Plant—Texas Co., Port Arthur, Tex., plans to construct and equip a plant for the manufacture of various grades of greases and byproducts. Estimated cost $300,000.

Oil Refinery—Bell Oil & Gas Co., National Bank Tulsa Bldg., Tulsa, Okla., contemplates the construction of an oil refinery and pipe lines for oil gathering system. Estimated cost $100,000.

Oil Refinery—Coastal Refinery, Port Isabel, Tex., plans to enlarge its refinery including construction of a lead plant for manufacturing highgrade or aviation gasoline. Estimated cost $225,000.

Oil Refinery—Robert C. Druesdow & Associates, 860 Omaha Natl. Bank Bldg., Omaha, Neb., is having plans prepared by Walter Steiner, Engr., Hynes, Calif., for the construction of an oil refinery at Falls City, Neb. Estimated cost $200,000.

Powder Factory—Hercules Powder Co., 900 Market St., Wilmington, Del., plans to rebuild its plant at Kenvil, N. J., recently destroyed by fire. Estimated cost $2,000,000.

Recycling Plant—Standard Oil Co. of Texas, San Diego, and Houston, Tex., plans to construct and equip a recycling and natural gasoline plant in the Sejita fields of Duval Co. in the vicinity of San Diego. Estimated cost $450,000.

CONTRACTS AWARDED

Ammunition Loading Plant—War Dept., Washington, D. C., has awarded contract for construction and operation of ammunition loading plant at Wilmington, Ill., to Sanderson & Porter, 52 William St., New York, N. Y., on cost plus basis. Estimated cost $14,000,000.

Butane Plant—Tidewater-Seaboard Oil Co., c/o Wm Baughan, Box 55, Palestine, Tex., has awarded contract for plant for the manufacture of Butane at Cayuga near Palestine to Frick-Reid Supply Co., 108 North Trenton St., Tulsa, Okla., at $62,000.

Carbon Black Plant—United Carbon Co., Aransas Pass, Tex., will construct a carbon black plant to utilize waste gas from Natural Gas Co. refinery in McCampbell Field. Work will be done by day labor and subcontracts. Estimated cost $200,000.

Carborundum Plant—Carborundum Co., Buffalo Ave., Niagara Falls, N. Y., has awarded the contract for a 1 story, 78x211 ft. addition to its plant to Wright & Kremers, Inc., Main and Pine St., Niagara Falls, N. Y. Estimated cost $50,000.

Chemical Engineering Building—Socony-Vacuum Oil Co., 26 Bway., New York, N. Y., has awarded the contract for a 2story,78x108 ft. chemical engineering building at its plant at Paulsboro, N. J., to Brown Bros. Construction Co., 303 North Richmond Ave., Atlantic City, N. J. Estimated cost will exceed $40,000.

China Factory—Bailey-Walker China Co., H. C. Bailey, Pres., Bedford, O., has awarded the contract for a factory to Dunbar Co., 8201 Cedar Ave., Cleveland; kiln to Allied Engineering Co., 4150 East 56th St., Cleveland. Estimated cost $45,000.

Distillery—Baltimore Pure Rye Distilling Co., Willow Spring Rd., Dundalk, Md., has awarded the contract for a bottling plant for distillery to Cummins Construction Co., 803 Cathedral St., Baltimore. Estimated cost $50,000.

Oil Refinery—Ashland Oil & Refining Co., P. G. Blazer, Pres., Winchester Ave., Ashland, Ky., plans to construct an addition to its refinery at Catlettsburg, Ky. Work will be done by day labor. Estimated cost $350,000.

Oil Refinery—Humble Oil & Refining Co., Baytown, Tex., will improve and enlarge refinery, including additional steel tankage facilities. Work will be done by day labor. Estimated cost $1,800,000.

Oil Refinery—Latonia Refining Co., Latonia, Ky., has awarded the contract for extensions and improvements to refinery, also pipe line work, to Dravo Corp., Neville Island, Pittsburgh, Pa. Estimated cost $80,000.

Paper Mill—Ecusta Paper Corp., H. A. Straus, Pres., Brevard, N. C., has awarded contract for improving and enlarging cigarette paper mill to Fiske-Carter Construction Co., Greenville, S. C. Estimated cost $2,000,000. J. E. Sirrine & Co., Greenville, S. C., Engrs. W. G. Perry, Jr. in charge of construction for engineers and J. F. Tate, Supt. Plant.

Paper Mill—Badger Paper Mills, Inc., Peshtigo, Wis., has awarded the contract for 1 story, 160x240 ft. mill to E. H. Meyer Construction Co., 75 Main St., Oshkosh, Wis.

Paper Mill—Southland Mills, Inc., c/o E. L. Kurth, Pres., Lufkin, Tex., has awarded the contract for new mill for the manufacture of newsprint paper to Merritt-Chapman & Scott Corp., 17 Battery Pl., New York, N. Y., at $1,800,000. Total estimate including machinery and equipment $5,000,000.

Processing Plant—Woburn Industries, c/o M. D. L. Van Over, Pres., Harrison, N. J., and c/o F. W. Hofmokel, port comr., Brownsville, Tex., will construct and equip a processing plant at Brownsville to handle castor beans and byproducts and extract oil to be used in the manufacture of insecticides and fungicides. Work will be done by day labor and subcontracts. Estimated cost of first unit $150,000; total estimated cost $500,000.

Pulp Mill—St. Marys Kraft Corp., St. Mary's, Ga., c/o Gilman Paper Corp., 530 Fifth Ave., New York, N. Y., has awarded the contract for the construction of a pulp mill at the mouth of St. Mary's River to Morton C. Tuttle Co., 862 Park Sq. Bldg., Boston, Mass. Total estimated cost $2,000,000.

Recycling Plant—Gulf States Oil Co., P. Kayser, Pres., Chronicle Bldg., Houston, Tex., will construct a recycling plant (strip plant) 15,000,000 cu. ft. gas daily, in San Salvador fields, Samfordyce, Tex., by day labor. Etsimated cost $250,000.

Research Laboratory—E. I. du Pont de Nemours & Co., Wilmington, Del., has awarded the contract for a chemical research laboratory addition at Arlington, N. J., to Salmond Schrimshaw Construction Co., 526 Elm St., Arlington, N. J. Estimated cost $50,000.

Research Laboratory—Research Laboratories, Ltd., Atlas Bldg., Toronto, Ont., Can., has awarded the contract for a 1 story 160x180 ft. laboratory at Leaside, Ont., to Milne & Nicholls, 57 Bloor St., W., Toronto, Ont. Estimated cost $100,000.

Rubber Factory—Dunlap Tire & Rubber Co. Goods Ltd., 870 Queen St., E., Toronto, Ont., Can., has awarded the contract for an addition to its plant to Milne & Nicholls, 57 Bloor St., W., Toronto, Ont., Can. Estimated cost $75,000.

Rubber Factory—B. F. Goodrich Co., T. T. Graham, Vice Pres., 500 South Main St., Akron, O., has awarded the contract for addition to its factory to C. W. & P. Construction Co., 634 East Buchtel St., Akron. Estimated cost $50,000.

Rubber Factory—Lee Tire & Rubber Co., Conshohocken, Pa., has awarded the contract for an addition to its plant to F. R. Heavner, Norristown, Pa. Estimated cost will exceed $40,000.

TNT Plant—War Department, Washington, D. C., has awarded the contract for design and construction of TNT plant at Wilmington, Ill., to Stone & Webster Engineering Corp., 90 Broad St., New York, N. Y., at $10,800,000. Plant will be operated by E. I. du Pont de Nemours & Co., Wilmington. Total estimate including equipment $14,000,000.

Toluol Plant—War Department, Washington, D. C., has awarded the contract to construct and operate a Toluol and explosive manufacturing plant at Baytown, Tex., to Humble Oil & Refining Co., Humble Bldg., Houston and Baytown. Work will be done by company forces. Estimated cost $9,500,000.