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DICTATORS FOR INDUSTRY?

MUST WE come to dictatorships for industry? Already the leaders of one important member of the process group, petroleum, have seriously discussed such a plan and there are those who would apply the scheme to other raw materials, such as bituminous coal and lumber. Certainly, it is the trend of the day in Washington, and presumably dictatorships will soon be extended to agriculture, transportation and banking. Dictators usually get action and, sometimes, results. Proponents of the idea hold that the dictator who is right only half the time is likely to accomplish more good than harm. Their philosophy is that of the soldier's manual—in case of emergency, when the rules don't apply, *Do Something!*

But can the plan work equally well in industry? In normal times most of us associate the dictator with the "sick" industry, with the unsuccessful business that has run into bad times through mismanagement, unsound trade practices or disastrous and destructive competition. Yet many industries that once were models of efficient management are now completely demoralized as a result of conditions over which they had little or no control. If, as in the petroleum industry, the troubles are due to internal forces, such as uncontrolled production and resulting price wars, perhaps the dictator can help. If the difficulty arises from external causes, such as the drastic curtailment in markets which the fertilizer and cement manufacturers now face, it is hard to see how a dictatorship can accomplish anything more than can the individual management.

However, close observers see in the recent Supreme Court decision in the case of Appalachian Coals, Inc., a liberalizing of the anti-trust laws, which may pave the way for joint action in some of these fields. For example, it has been proposed that all of the cement plants in a certain limited territory might combine forces to the extent of allocating production and sales, at the same time turning over some of their idle facilities to the development of related lines of manufacture. Such a program, if legal, would call for at least a local dictator, or a directing board willing to take drastic action in subordinating the competitive interests of individual producers.

The more strictly chemical industries, even though suppliers of raw materials, are not faced with exactly the same problems that beset the bituminous coal, lumber, cement, oil and steel producers. A more diversified market, a sounder price structure, and a certain inherent resourcefulness have helped them in meeting the present emergency. Chemical dictators are neither necessary nor desirable at the present time. But if the plan can be of benefit to other fields, we see no valid reason why they should not try the experiment. Almost anything is better than indecision and inactivity. The temper of the times is for action—even if it takes a dictator to get it.

EDITORIALS

A Shorter Work Week For Business Revival

WORD FROM Washington, as we go to press, indicates the improbability that the Senate's 30-hour work-week bill will pass the House or that it would receive presidential approval. Hence, for the moment, the enemies of too much government in business can rest easily in the knowledge that legislated hours are still a thing of the future. Nevertheless, should business fail to follow the lead that has been suggested, nothing is more certain than that other, probably more successful, attempts to force the shorter work week will be made. If business is to be forearmed in resisting further incursions, it cannot play ostrich in the face of the situation that confronts us.

Although it vigorously opposed the Black bill, the American Engineering Council has given hearty approval to the principle of voluntary reduction in hours. The council doubts whether so drastic a cut as that proposed in the bill is needed, but it recognizes that our productivity has far outgrown the 48-hour week and that even in normal times re-employment of all those formerly engaged in production will not be possible without some considerable adjustment. Many individual engineers are of like mind. Some among them go even farther in advocating legislative intervention on the theory that by no other means can the full cooperation of industry be attained. And beyond even this, some of these engineers point to the need for increasing wage scales to offset decline in hours.

So many factors complicate our economic situation that it is impossible to say how far a reduction in hours and an increase in rates would go toward repairing the system. So far as these two alone are concerned, it seems clear that the machine is badly out of kilter. If seven men today can and do produce goods that in 1920 required ten, the other three must look elsewhere for their sustenance. But, as it has been shown, not all of those three can find employment in new or service industries and at least a part of their purchasing power must be withdrawn. The result is that not even the seven are needed for the reduced demand, which consequently is further reduced.

Suppose, however, that all ten are employed at reduced hours, but at the total wages of the seven. While some of this income will be spent which would otherwise have been saved, in the main the purchasing power is no greater than that of the seven and the group must either have the benefit of lower prices, or its standard of living will necessarily fall. Either result is deflationary and little better than retention of longer hours.

The day has passed when industry can afford to make only such concessions to labor as are forced. Thinking people are convinced that in raising the purchasing power of its employees, industry is no more than doing itself a service. Profits without business are as impossible as business without purchasing power for the rank and file. As a primary step toward recovery, nothing would appear to be more helpful than a concerted effort toward the 30- or 35-hour week, coincident with the wage increases necessary to restore the normal rate of dollar circulation.

Bargaining Tariffs May Have Their Chance

TARIFF NEGOTIATIONS with other nations are said to be a part of the administration program of relief and reconstruction. Many commentators seem to feel that these should be effected by the treaty-making machinery of the government. Our view is that another plan might well be adopted. We propose that the President be given the authority for negotiating tariff changes on the basis of economic agreements, but limited to a range not exceeding 50 per cent of the existing rates. This plan would give him the same authority that the Supreme Court has declared to be constitutional when adjustment is based on relative cost of production here and abroad. Congress may be persuaded to concede this much authority to the President with the simple restriction that his international agreements should take effect only if not vetoed by the Congress within 60 days of promulgation.

Such a procedure might be quite adequate from the standpoint of the process industries if it permitted the negotiations to be handled by those thoroughly conversant with the economic and technical problems involved. But a mere diplomatic exchange of ideas might leave our industries much embarrassed by loss of essential tariff protection without any regard to the economic values of the concessions when judged from the overall American point of view. We do not believe that President Roosevelt is going to permit any absurd "pure-diplomacy" methods to prevail. We believe it much more likely that the details of negotiation will be conducted by outstanding tariff specialists aided by the very complete and well-informed staff of the Tariff Commission. With such guidance, a reasonably sound adjustment might be made.

One of the most eminent tariff authorities in Washington has suggested that all these matters should be handled by a tariff negotiator who would represent the President and who, subject to the President's orders, would direct the work in a centralized, properly coordinated fashion. Presumably the Tariff Commission, a quasi-judicial body, is not set-up suitably to function in this capacity. It would require a tariff negotiator, an *alter ego* for the President, let us say.

Such a negotiator might well find opportunity to negotiate numerous bilateral treaties. As far as the chemical industry is concerned, an exchange of adjustments with Canada would be particularly desirable. Certainly it would clear the atmosphere of much present misunderstanding to have these matters frankly discussed with our nearest neighbor who is also our best chemical customer. The idea is worth trying. Re-establishment of world trade is an objective of far-reaching importance to industry, almost as much as to agriculture. No chance to aid it should be left unexplored.

Wanted: New Uses for Bromine

HISTORY tells us that most industrial chemicals have come into wide use either because of a specific and rapidly growing demand or because increased production or improved transportation have made them available at a price level on which they can compete with other commodities. In a sense, factors of both sorts have lately been operating to place bromine in a position where its use in many processes is now economically feasible. Since about 1926 the largest single outlet has been in the production of ethylene dibromide for use in the manufacture of a well-known brand of anti-knock motor fuel. Whether that application has reached its peak may now be open to some question for certainly the past year or so has seen the development of a number of competitive fuels that appeal to the pocketbook in times of depression. With production increasing, it is natural that the industry should be on the lookout for new uses, even at prices lower than those that now obtain.

Part of this saving might well come from economies in shipping and handling. Because of difficulties in transportation in the past many chemical consumers bought sodium bromide and then treated it with sulphuric acid to get the required bromine. It now appears practicable to ship the liquid anhydrous bromine in a new type of ceramic-lined tankcar. Judging from experience with other commodities this development alone might well open the way for large-scale utilization.

What are some of the fields in which new uses might well be developed? Occupying a position midway between chlorine and iodine, bromine may have certain of the properties of each. If so, might it not prove especially effective in water sterilization, particularly if it could combine the well-known goitre preventive properties of iodine with higher sterilizing power than chlorine and a lesser tendency to form undesirable tastes and odors? Some work has already been done in this direction on the Pacific Coast in connection with swimming pools, water supplies and sewage treatment. It is even being tried in the bleaching of pulp in a paper mill. We are told that in South Africa, acetylene tetrabromide is now being used as a flotation reagent in the recovery of diamonds. This suggests that other bromine compounds may have equally valuable uses in fields as widely divergent as water purification and mining. Chemists and engineers with imagination and initiative can well afford to do some active prospecting in a territory so promising of rich rewards.

Must Georgia's Experiment Come to Such an Untimely End?

PULP AND PAPER people all over the country are closely following the investigation now under way at Savannah, Georgia, to determine the possibilities of producing newsprint and other grades of white paper from the young southern pines. The results of the preliminary tests of Dr. Charles H. Herty held such great promise that the development received the financial support of the Chemical Foundation as well as appropriations from the state legislature of Georgia. The city of Savannah supported it by supplying a building, power, light, fuel, gas, water, wood and large financial contributions. Process equipment manufacturers loaned much of the apparatus. In the short time since the inauguration of this process, promising results have been forthcoming. But now, with the unexpected suddenness of an earthquake, comes the announcement that Georgia's Dictator-Governor Talmadge has dealt a severe blow in vetoing the State's appropriation for 1934 and 1935.

Before it can be definitely determined that newsprint may be made from southern pines on a commercial scale, some technical problems must still be solved. Up to the present, paper has been made on a 26-in. machine running not over 100 ft. a minute. It remains to be determined whether the manufacture of newsprint under practical mill conditions at 1,000 ft. a minute will change the properties of the sheet so materially as to make impossible the practical use of the paper on modern high-speed printing presses. Some grinding difficulties have been experienced due to the spongy character of the wood. Dr. Herty hopes to overcome this difficulty by the use of another type of pulpstone; nevertheless, this remains one of the technical problems. And it is yet to be determined whether this pulp is suitable for the production of the highest grades of white paper.

It is a shame that an investigation which has already shown so much promise should be terminated before it has been completed. The entire country and Georgia, in particular, has much to gain at a relatively small investment. The successful outcome means not only a market for Georgia's vast supply of pine but possibly another outlet for her clays and gum which are so abundant. It is a rare opportunity to have such a splendid set-up for carrying out the investigation. Dr. Herty is an enthusiastic leader with the interest of his native state at heart; his associates are trained pulp and paper engineers; and the equipment manufacturers are cooperating to supply machinery best adapted to the production of paper from the slash and other southern pines. It is to be hoped that Governor Talmadge will reconsider his decision—thereby proving that even dictators can be broadminded enough to change their minds when convinced that their actions are not in the public interest.

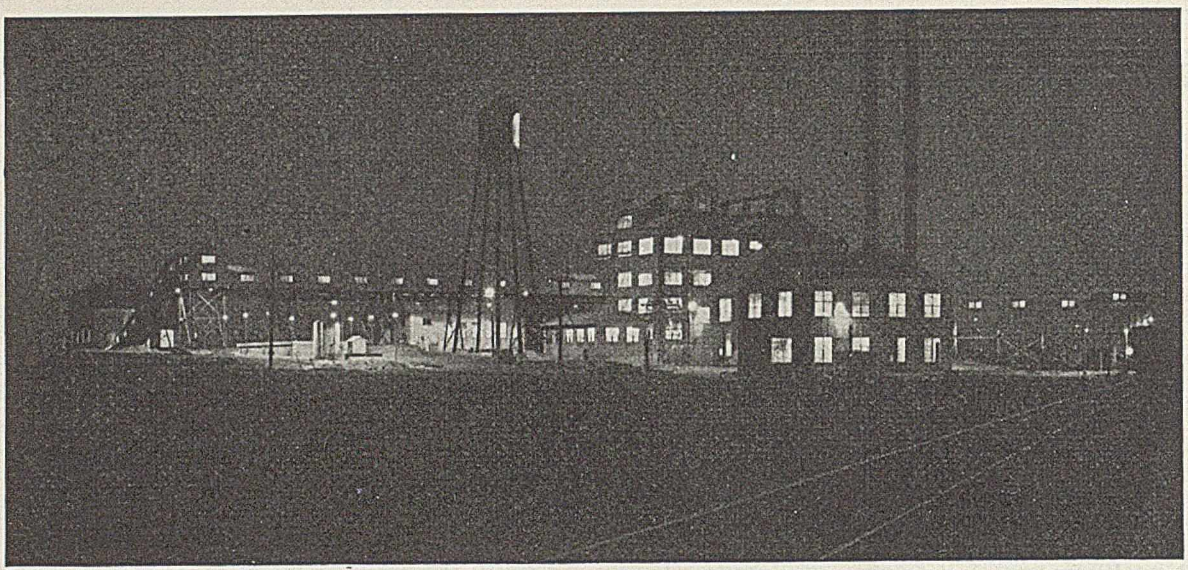


Fig. 1—Refinery of U. S. Potash Co., near Loving, N. M.

Building a Potash Industry In New Mexico

By C. A. WARD
Consulting Chemical Engineer
Carlsbad, N. M.

ONE of the most significant industrial developments in the United States since 1929 is the commencement of a new and profitable business based on the mining and refining of sylvinite and the production of commercially pure potassium chloride near Carlsbad, N. M. Not only has this industry solved numerous technical problems, but it has also demonstrated that the Permian basin of Texas and New Mexico holds commercially workable reserves of high grade and easily refinable potash salts, sufficient to meet every American demand for centuries to come. With reasonable freight rates, there is no apparent reason why this new industry should not be able to compete successfully with its older foreign competitors and make the United States permanently independent as regards its potash supply. (See *Chem. & Met.*, p. 115, March, 1933—Editor.)

Justus von Liebig, in 1858, seems to have been the first to discover the essential nature of potash as a plant food and the fact that it must be replaced artificially when it is removed from the land by cultivated crops. As a factor in the food supply of nations, its vast importance is beyond dispute. Prior to the World War, the United States imported about 99 per cent of its potash from Europe. Then when hostilities cut off these supplies, American potash prices advanced from about $50 per ton to values ranging from $80 to $600 per ton. During the war years, in the neighborhood of $50,000,000 was spent in an endeavor to develop independent sources in the United States. The greatest annual production in this period was in 1918, when 54,803 tons was turned out. Even this quantity represented but 20 per cent of the demand, and with the return of normal conditions foreign competition had, by 1921, forced domestic production as low as 10,171 tons of equivalent K_2O, as appears in Table I. With this abandonment of plants, investors suffered heavily and, with one or two notable exceptions, the possibilities of domestic potash production from the then known sources seemed to be remote.

One of these exceptions was the extraction of potash from Searles Lake (Calif.) brines which, during 1929, supplied about 15 per cent of the American demand. The other was the recovery of byproduct potash from molasses wastes in the distilling of industrial alcohol. But it is to new supplies, the presence of which was scarcely suspected during the war, that the country will in the future look for the bulk of its potash. With the California and Permian basin reserves, potash needs are never again likely to become pressing.

Before launching into the story of the New Mexico development, it will be well briefly to review the history of potash in Germany and Alsace-Lorraine. German deposits were discovered in 1851 when the Prussian government was sinking shafts for rock salt near Stassfurt. By 1861 the first plant for extracting potash from the "abraumsalze" had been completed at Stassfurt. It was not until 1904, however, that the Alsatian deposits were brought to light near Wittelsheim. The first of these began production in 1910 under German control and other deposits were opened by French and Alsatian capital. At the onset of the World War, Germany had 187 operating mines and Alsace 13. But even as early as 1909, competition had caused one potash war, the result of which was to force the Imperial German government into control of the potash situation. At the close of the War, German potash troubles became even more acute with the resumption of Alsatian competition, which was now in the hands of France, and the threat to its monopoly caused Germany to pass a law to compel the closing down of unprofitable mines.

By 1926 there were perhaps a dozen large companies operating in Germany. In the two preceding years, marketing agreements had been signed between the French and German producers, allotting foreign markets, in the latter year, in the proportion of 30 per cent for France and 70 per cent for Germany. The present agreement, which has three years to run, has been modified so that while the proportions remain the same for the first 925,000 tons, any excess is divided equally between the two countries.

With this background of European monopoly it becomes evident how important to the United States has been the question of discovery and development of its own deposits. American geologists had long hoped that potash in commercial quantities might be found in the Permian basin of Texas and New Mexico. It is to J. A. Udden, of the University of Texas, that the honor belongs for having first published evidence of the existence of such potash. This he had found in the Spur well drilled in Dickens County, Tex., in 1912. The first U. S. Government well for potash was drilled near Amarillo, Tex., in 1915 to 1917. This was unproductive. Since that time the Government has kept an investigator in the Texas-New Mexico field, watching the cuttings from wells drilled for oil and gas. Polyhalite was identified in some of these by the Geological Survey in 1921. In 1926 Congress authorized the expenditure over a five-

Table I — Production and Consumption of Potash in U. S.*
(Short tons of contained K_2O)

Year	Production	Imports	Apparent Consumption†
1913	Negligible	270,720	270,720
1914	Negligible	207,089	207,089
1915	1,090	48,867	49,777
1916	9,720	7,885	17,605
1917	32,573	8,100	40,673
1918	54,803	7,957	46,537
1919	32,474	39,619	88,326
1920	48,077	224,792	263,870
1921	10,171	78,698	85,243
1922	11,714	201,415	210,992
1923	20,215	209,950	227,455
1924	22,903	200,365	223,900
1925	25,448	258,217	283,081
1926	23,366	266,280	290,082
1927	43,510	244,155	293,183
1928	59,910	330,493	389,493
1929	61,590	324,638	374,362
1930	61,270	342,454	390,403
1931	63,880	214,785	262,935
1932	61,990	113,505	168,125

* Based on U. S. Government figures.
† Apparent consumption includes exports after 1921 and change in stocks after 1917.

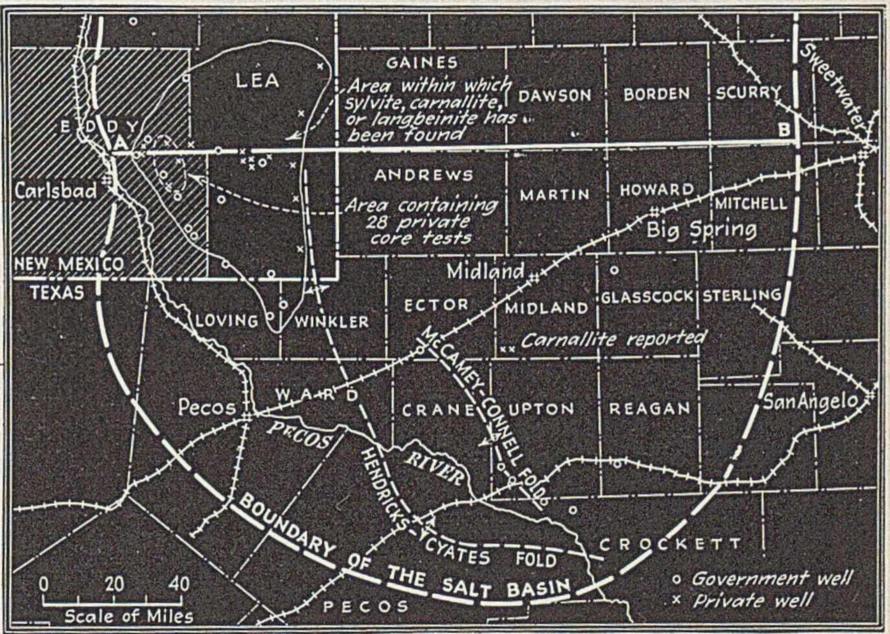
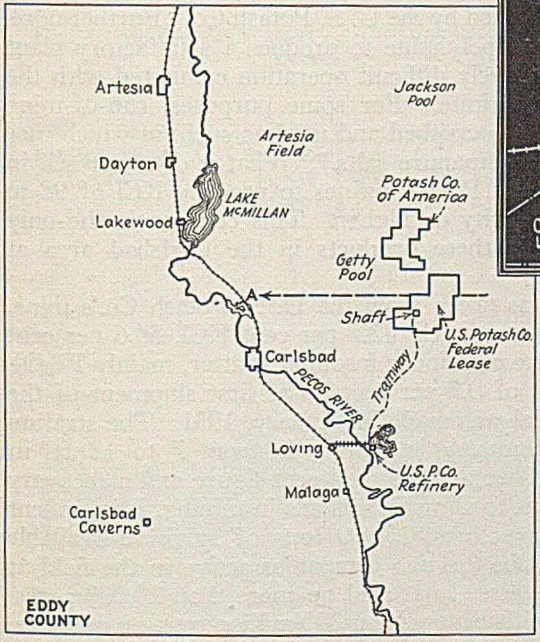
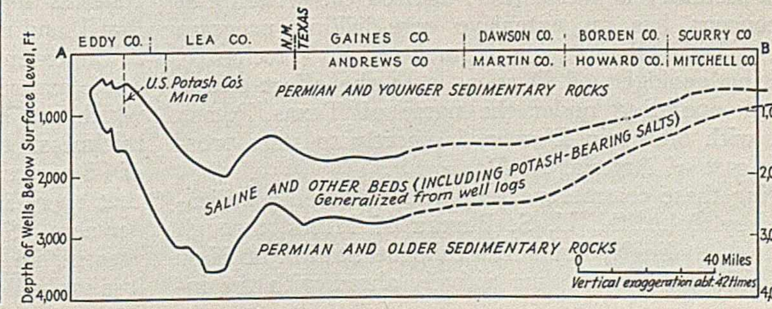


Fig. 2—Permian Basin Potash Field of Texas and New Mexico

Upper right, entire field; lower right, projected section of potash beds on the line AB (both after U. S. Geological Survey); Left, enlarged map of Eddy County, N. M., showing Federal leases of U. S. Potash Co. and Potash Co. of America, together with adjacent cities, oil fields and railroads





year period of half a million dollars for further potash prospecting.

As a result of the government investigation, which involved the drilling of 23 test holes, it was found that vast resources of polyhalite and at least one rich body of sylvinite (a mixture of KCl and NaCl) existed. The potash area is clearly indicated in the preceding maps of Fig. 2 which show the Permian basin, an enlargement of Eddy County, N. M., and a cross-section of the salt-basin area on a line slightly to the north of Carlsbad, N. M.

Potash, then, had been known to exist in the Permian basin since 1912, but it is to V. H. McNutt, a geologist of San Antonio, Tex., and to the Snowden-McSweeney Co., that credit should go for having first brought sylvite (KCl) to light, and for its successful commercial exploitation. In 1925 sylvite crystals were identified by the U. S. Geological Survey in a dry hole drilled by the Snowden-McSweeney interests on a prospecting permit issued to McNutt. As a result it was decided to put down a core test and analysis showed, in addition to considerable polyhalite and a thin bed of langbeinite, four potentially workable beds of sylvite of about 10 per cent potash content. Later in the same year McNutt and the Snowden-McSweeney people made their first application for a Federal permit to prospect for potash in New Mexico.

Formation of U. S. Potash Co.

Prospecting was continued by these interests under the name of American Potash Co. until, in 1930, this organization was incorporated as the United States Potash Co. Somewhat later an interest was acquired by the Pacific Coast Borax Co. and control is now vested jointly in the Snowden-McSweeney Co. and the British-owned concern.

Under the Federal leasing act, any one company is limited to six leases on Federal land, each of which may contain up to 4 square miles. U. S. Potash Co. was awarded 7,680 acres in 1930 at the minimum leasing royalty of 2 per cent as a reward for independent prospecting and discovery. Since this concern came into the field, other companies have followed and, including those at Searles Lake, more than 20 leases and 750 prospecting permits have been issued on Federal land alone, since the passing of the Potash Leasing Act in 1917.

Among these other companies may be mentioned: (1) Potash Co. of America, with G. W. Harris as president, and R. A. Pierce in charge of field operations. This company has cored at least 15 holes and is now sinking its first shaft. Its Federal leases, together with those of the U. S. Potash Co., are shown on the enlarged map of Eddy County in Fig. 2. (2) Officials of the New Mexico Potash & Chemical Co., of which R. A. Chase, at Carlsbad, is secretary and treasurer, advised the writer that this concern has an extensive core-drilling program ahead. (3) Further advice, from Dean E. Winchester, consulting geologist of Denver, is to the effect that a company operating under the name of Texas Potash Corp., with offices in Denver, is shortly to start prospecting east of Artesia, N. M.

During these commercial preparations for the utilization of sylvinite, the U. S. Bureau of Mines, through its Non-Metallic Minerals Experiment Station at New Brunswick, N. J., has gone actively ahead with the investigation of polyhalite. A comparison of the two materials is worth noting. Polyhalite in its purest state can contain an equivalent percentage of K_2O of only 15.6 per cent as compared with pure sylvite (KCl) which contains 63.2 per cent. Sylvinite, which is a mixture of KCl and NaCl, contains very close to 27 per cent equivalent K_2O as mined by the U. S. Potash Co. Furthermore, the refining of polyhalite to produce a satisfactory plant food is a relatively difficult operation compared with the refining of sylvinite. For some purposes, run-of-mine sylvinite may be crushed and used as such, in which case it is known as "manure salts." What it does not sell in this form U. S. Potash refines to produce KCl of 98 to 99 per cent purity or higher. This concern is the only one producing these products in the Carlsbad area at present.

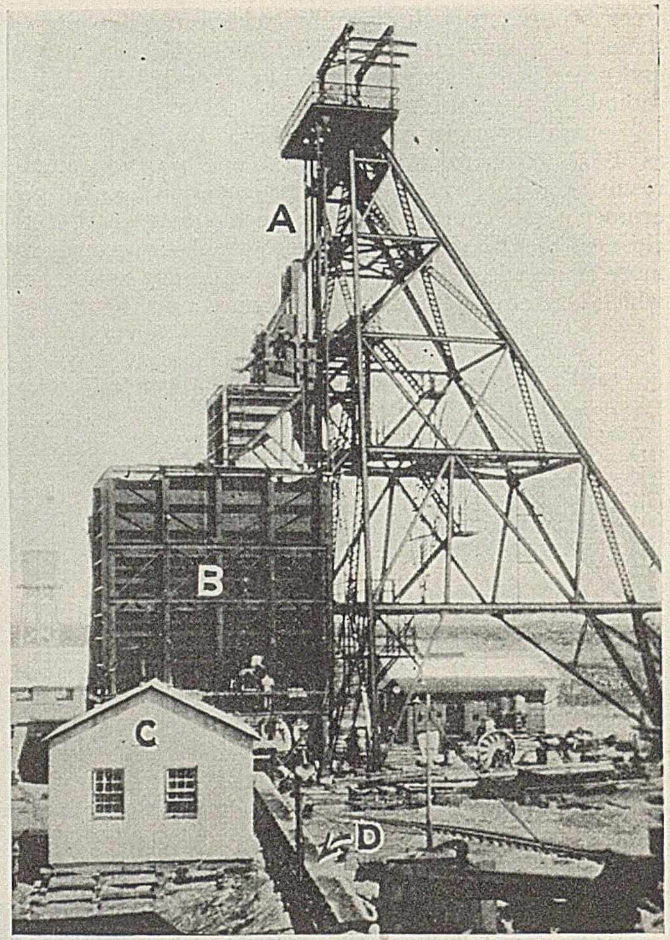


Fig. 3—Mine of the U. S. Potash Co. (A) Hoist and head frame; (B) 400-ton storage bin; (C) dry house; (D) conveyor to crushing plant

Sylvinite, as taken from the U. S. Potash Co.'s mine, contains approximately 42.7 per cent KCl, 56.6 per cent NaCl, and the remainder insoluble matter, mainly Fe_2O_3, to the extent of 0.7 per cent. The first shipment of the crude material was made in January, 1931. The stratum which the company is mining is from 7 to 12 ft. in thickness. If we assume the lower figure and a recovery of 75 per cent to allow for pillars in mining, it is evident that there is at least 15,000 tons of sylvinite available per acre. Since the two companies active in the field at present have already proved up more than 20,000 acres, it is probable that more than 300 million tons of sylvinite, running better than 25 per cent K_2O, are known definitely to exist. When it is considered that these leases would appear only as dots on the Permian basin map of Fig. 2, it is reasonable to believe that all potash requirements can be met for generations to come.

The sylvinite, which in the Company's No. 1 shaft is bottomed at 1,063 ft., is laid down practically flat with a maximum grade not more than 2 per cent. It is mined quite easily by the use of air-driven jackhammers but the quantity of explosive required is greater than in coal mining or in some hard-rock mines. A coal-mining under-cutter and two mucking machines have recently been placed in operation. Muckers are required to load at least eight 3-ton mine cars per man per shift at a flat rate of $4.25 per 24 tons loaded.

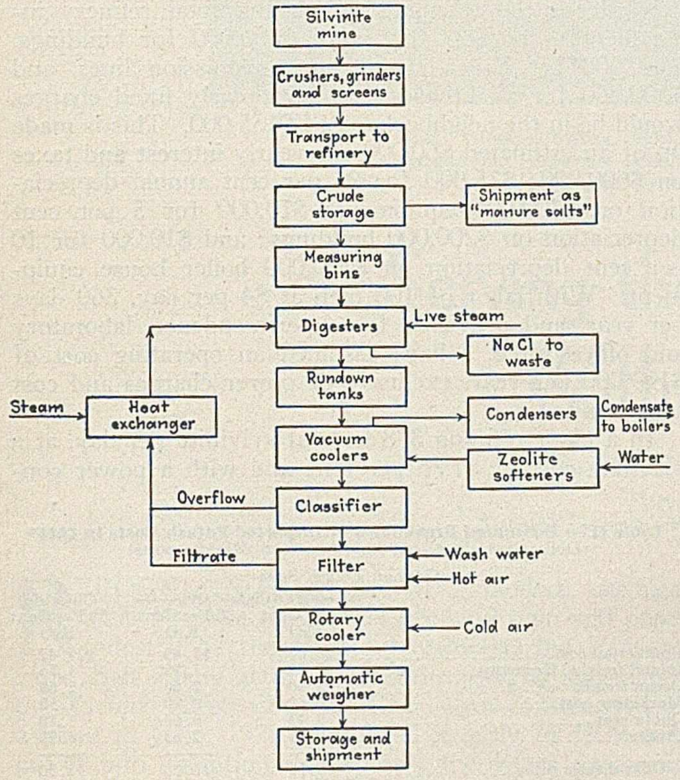


Fig. 4, Above—Flow chart of refining process of U. S. Potash Co.

Fig. 5, Below—Refinery of U. S. Potash Co. (A) Unloading shed; (B) belt conveyor; (C) machine shop; (D) refinery; (E) power house; (F) refined potash loading bin

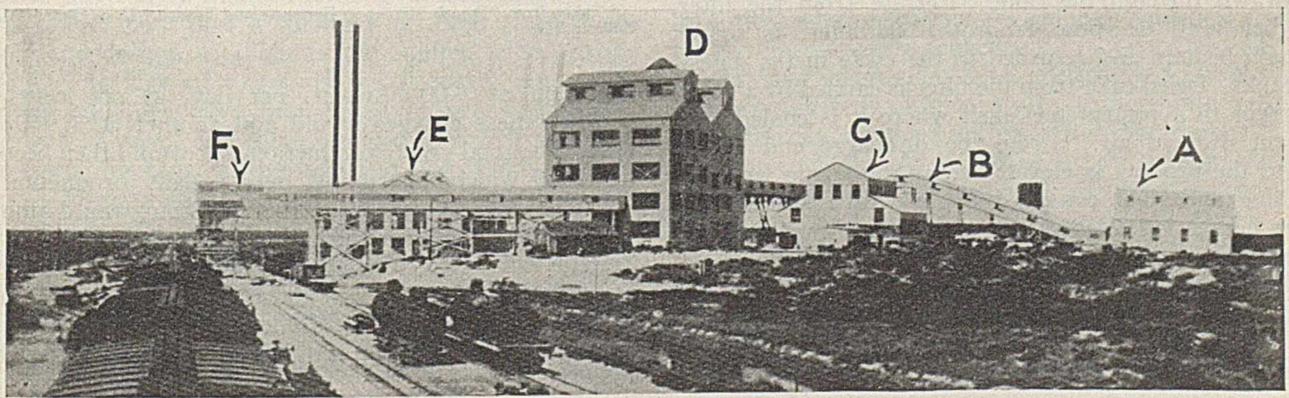
A new head frame shown in Fig. 3 was erected during the summer of 1932, together with a 400-ton bin. Sylvinite is hoisted by two 4-ton skips, with a maximum hoisting capacity of 1,200 tons per eight hours. This capacity is, of course, far above that of the refinery or the present crushing plant. From the bin, sylvinite is carried by a 24-in. rubber conveyor belt either to a stock pile or to the crushing mill, where it is first ground in a gyratory after which it is screened and the through material passed to smooth-roll crushers in parallel where it is ground to pass 8 mesh.

Crushed sylvinite is then transported by a company-owned, narrow-gage railway for a distance of 17 miles to the refinery (see enlarged map, Fig. 2). Here it is either refined or loaded into paper-lined standard-gage box cars on a spur track of the Atchison, Topeka & Santa Fe R. R. for shipment as manure salts. The refinery is situated about 5 miles east of Loving, N. M., and about a mile from the Pecos River. It was built to refine about 400 tons of crushed sylvinite per 24-hour day.

Refining Sylvinite at U. S. Potash Co.

Extraction of the KCl from the sylvinite depends on the fact that when a saturated solution of sylvinite in water is cooled from its boiling point, KCl precipitates out, contaminated only with what NaCl is entrained. At the plant elevation of 3,500 ft. above sea level, the boiling point of this saturated solution is 227 deg. F., at which temperature about 60 lb. of sylvinite will go into solution in 100 lb. of water. In cooling the solution from 227 deg. to 70 deg. F., approximately 16 lb. of KCl will crystallize out. If the mother liquor is again placed in contact with fresh sylvinite and heated to the boiling point, it will dissolve a further 16 lb. of KCl; but, still being saturated with respect to NaCl, it will dissolve none of the latter, leaving a residue of practically pure salt.

To carry out this cycle, the crushed material coming in via the narrow-gage railroad is dumped into a pit in the unloading shed shown at the right of Fig. 5. It is then elevated by a 24-in. conveyor belt to a steel bin, the top of which is flush with the third floor of the refinery building. From here it is elevated to a battery of six measuring bins which are used in charging 7 tons of crushed material into each of six cast-iron digestion tanks fitted with screens. The 7-ton charge is steamed for 30 minutes to raise its temperature, whereupon mother liquor from a later step, which, as noted above is unsat-



urated with respect to KCl, is pumped in. This mother liquor has previously been heated by passage through heat exchangers, heated by exhaust and live steam.

The cycle of operation in these digesters requires roughly 2¾ hours, including the loading, steaming, digestion with mother liquor, and the removal of the solution and residue. The digester charge is heated with live steam and the liquid circulated from the bottom of the digester to the top until saturation is completed. The solution is then dropped to a rundown tank and the undissolved NaCl which is left behind is put into solution in fresh water and pumped out to the salt flats. During 24 hours, therefore, each digester receives close to nine 7-ton charges, giving a plant capacity of about 378 tons of sylvinite (150 tons of KCl) per day. The hot, saturated solution from the insulated rundown tanks, one for each digester, is pumped to a series of three cast-iron Swenson vacuum crystallizers provided with propeller type stirring mechanism, surface condensers and steam-jet ejectors.

Vacuum Cooling Without Concentration

Operation of these crystallizers is interesting. The use of the sensible heat in a liquid to supply the latent heat of evaporation and hence to produce cooling is, of course, well known. (See *Chem. & Met.*, March, 1932, p. 133 and November, 1932, p. 594.) The novel feature of this installation arises from the fact that, were the evaporation permitted to decrease the total amount of water in any cooler, the solution would then become supersaturated with respect to salt, and NaCl would precipitate out along with the crystals of KCl. Hence it is necessary to add softened water from zeolite water softeners to each cooler in amount equivalent to the quantity of water removed from the cooler as steam. In this manner, salt is kept in solution, while the condensate removed from the surface condensers is returned to the boilers.

Rather than attempt to bring the boiling temperature of the saturated solution from 227 deg. down to 90 deg. in one step, three coolers in series are employed. The first reduces the temperature to about 170 deg., the second to 130 and the last to 90 deg. F. This method has given satisfactory service except where, occasionally, pressure has been reduced so rapidly as to cause priming which, of course, throws chlorides into the condensate. From the last of the coolers the magma of solution and crystals is pumped to a receiving tank, and from the tank to a cone classifier. Thickened material from the classifier flows to a top-feed 4x6-ft. Oliver rotary vacuum filter, on which the solids are dried by means of heated air drawn through the cake. Filtrate from the filter, together with overflow from the classifier, is passed through heaters and returned to the cycle in the digesting tanks. Dried cake from the filter is carried by a screw conveyor to a rotary steel shell where it is cooled by a current of cold air. From the discharge end of the cooler, the product is elevated to an automatic weighing machine and then conveyed by belt to a storage bin. From here it is loaded directly into paper-lined box cars for shipment.

Plant steam and power are supplied by two B. & W. Sterling boilers, each rated at 275 boiler horsepower, and by a 1,000-kva. turbo-generator set. High-pressure steam for the heat exchangers, digesters and ejectors, is tapped from the high-pressure line before the turbine. Low-pressure steam is available from one of the turbine stages or from a reducing valve. Fuel oil is supplied for the boilers. The principal factory buildings are built of steel, roofed and sided with J-M corrugated Transite, ½-in. thick, with lead flashings and gutters.

For the sake of comparison Table II, which is taken from U. S. Bureau of Mines Bulletin No. 274, is presented to show the breakdown of estimated cost of German and French potash salts, c.i.f. American Atlantic ports, in 1924. The writer has no certain figures for costs of American refined KCl, but the following estimates are submitted for what the reader may find them to be worth:

Sylvinite mining costs are probably in the neighborhood of 80 cents per ton, but to allow for development work, let us take a figure of $1.75 per ton of crushed sylvinite at the refinery. Assuming total refinery investment to be $600,000, with $200,000 for buildings, $100,000 for boiler-house and transmission lines, and $300,000 for all other equipment, yearly fixed charges would be in the neighborhood of $155,000. This is made up of an estimated $60,000 for yearly interest and taxes on $600,000; $75,000 for 25 per cent annual depreciation on $300,000 equipment; $10,000 for 5 per cent depreciation on $200,000 buildings; and $10,000 for 10 per cent depreciation on $100,000 boiler house equipment. With labor of 100 men at $4 per day, 360 days per year, and provision for superintendence, laboratory and office force, I have assumed an operating cost of $199,000 per year, exclusive of power charges and cost of sylvinite.

In a plant refining 378 tons of sylvinite per day, at a sylvinite cost of $1.75 per ton; and with a power consumption of 8,000 kw.-hr. per day, at one cent per kw.-hr., these charges would add another $266,940 per year. The total yearly production cost would then become $620,940 which, distributed over a daily production of 150 tons of KCl, or 54,000 tons per year, would amount roughly to $11.50 per ton produced. Adding to this the freight rates from Carlsbad to various points, such as $6.50 per ton to Galveston and $10 per ton to Cleveland, it would seem that New Mexican potash costs are very favorable in comparison with those indicated for foreign material.

Table II — Estimated Breakdown of Imported Potash Costs in 1924*
(Dollars per short ton, c.i.f. American Atlantic ports)

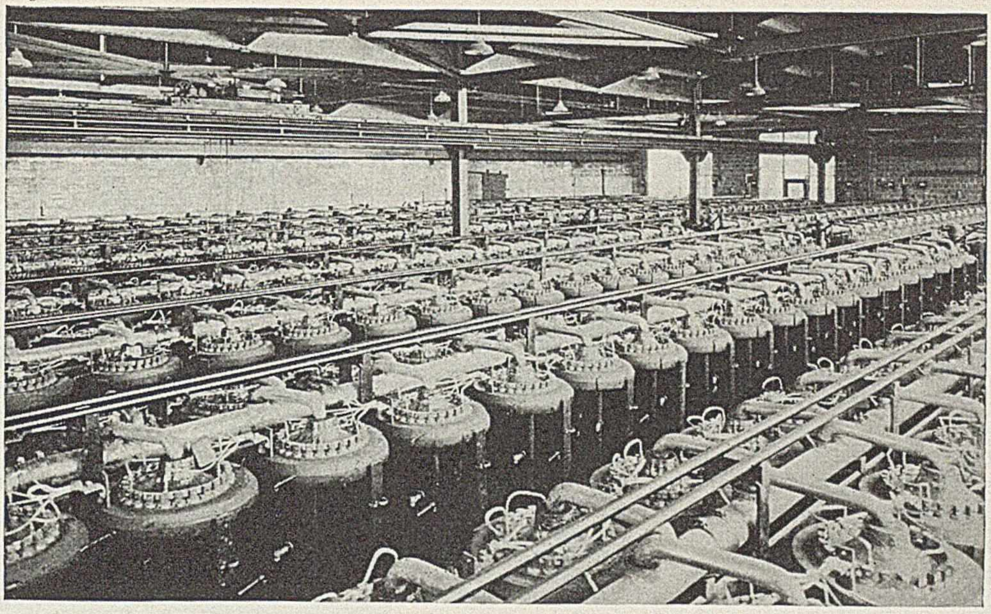
German Potash Salts

	Fertilizer Salts, 20 Per Cent K_2O	Fertilizer Salts, 30 Per Cent K_2O	Chloride, 50 Per Cent K_2O
Production cost	$3.63	$7.49	$21.42
Inland freight, Germany	1.75	1.75	1.75
Ocean freight to U. S.	2.60	2.60	2.60
Marketing cost	0.60	0.90	1.50
Quota cost	0.43	0.66	1.10
Profits	1.54	2.63	4.93
Official sales price	10.55	16.03	33.30

French Potash Salts

	Sylvinite, 20 Per Cent K_2O	Fertilizer Salts, 30 Per Cent K_2O	Chloride, 50 Per Cent K_2O
Production cost	$2.40	$5.82	$11.95
Inland freight, France	2.00	2.00	2.00
Ocean freight to U. S.	2.60	2.60	2.60
Marketing cost	0.60	0.90	1.50
Income tax	0.49	1.12	2.55
Profits	2.46	5.59	12.70
Official sales price	10.55	16.03	33.30

* Taken from "Potash Mining in Germany and France," U. S. Bur. of Mines Bulletin 274.



Cell room showing eight series of Gibbs cells used in producing chlorine gas, caustic soda, and byproduct hydrogen by electrolysis of brine

Serving the Northwest With Alkalis

By JOHN H. BAKER
Superintendent
Tacoma Electrochemical Co., Tacoma, Wash.

RECOGNIZING the need of a modern chemical plant to serve the rapidly growing pulp and paper industry of the Pacific Northwest, the Pennsylvania Salt Manufacturing Co., through its subsidiary, the Tacoma Electrochemical Co., began construction of a plant in June, 1928, completed it early in 1929, and put it into operation immediately thereafter producing liquid chlorine, caustic soda, and sodium hypochlorite. The 40-acre plant site bordering on the Hybelos waterway, in the city of Tacoma, Wash., was selected chiefly for its transportation advantages, providing docking facilities for ocean-going vessels as well as connection with the major Northwest and transcontinental railroad lines.

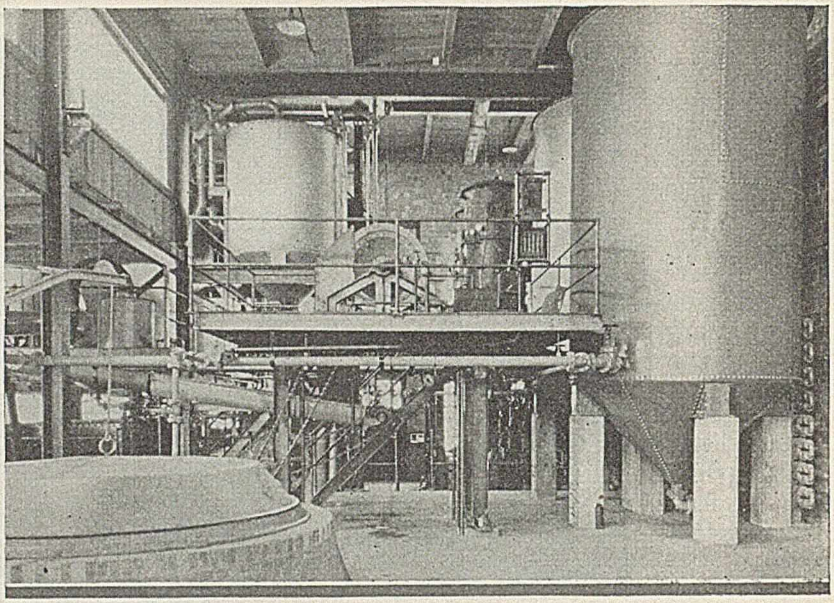
It is obvious to visitors making a tour through the plant that a great deal of thought has been given to the layout and design of buildings and equipment to provide straight-line flow of materials from unit to unit. The various buildings have been conservatively constructed of concrete, steel, and tile, permanency and fire protection being foremost in the minds of the designing engineers. High-pressure water hydrants and chemical fire extinguishers at points of advantage throughout the premises reduce the fire hazard to a minimum. Additional safeguard is provided by the distinctive color system for the pipe lines; maroon-red for acid, yellow for chlorine gas, and dark green for liquid chlorine. The plant is well lighted and a model of cleanliness and order, absence of confusion and lost motion being particularly noteworthy.

Common salt, the basic material, is obtained from the solar evaporation plants in California, in lots of 2,000 tons or more; it is unloaded directly from the hatchways of the steamers to reciprocating feeders on the docks and then transported to a cylindrical concrete storage tank by belt conveyors. Electric power is received from Tacoma's municipal plant at 11,000 volts, 3 phase, a.c. for the attractive price of about 3.5 mills per kw.-hr.; it is transformed to 110-440 volts a.c. for lighting and motor service, and to 180 volts a.c. for subsequent conversion into 250-volt d.c. power. This is accomplished by two 1,500-kw. Westinghouse rotary converters.

The first step in the process is the preparation of a saturated solution of sodium chloride which is pumped to the purification department. Impurities, such as calcium and magnesium salts, are removed and the purified brine is fed continuously by gravity into a battery of Gibbs cells, equipped with asbestos diaphragms. They were invented by A. E. Gibbs of the parent company and developed by the chemical staff under his direction. Electrolysis of the brine into chlorine gas, caustic soda, and byproduct hydrogen is accomplished therein.

The moist chlorine gas is drawn from the top of the cells through an acid-proof ceramic line and passed through sulphuric-acid dryers; the resulting anhydrous gas is liquefied by application of pressure at lower temperature. Refrigeration is supplied through a carbon-dioxide system; this refrigerant offers maximum safety, as it does not combine with chlorine; leaks therefore cause no damage aside from the increase in non-condensibles. Due to an excellent arrangement of control apparatus these operations are performed with a minimum of supervision.

From the liquefaction department the chlorine is passed to storage tanks. Dry compressed air is used to transfer the liquid product to steel cylinders holding 100 or 150 lb. net; to multi-unit tank cars (15 drums), class 106-A-500; or to single-unit tank cars (16 and 30 tons capacity), class 105-A-300. These are designed and constructed to meet the specifications of the Bureau of Explosives, the Interstate Commerce Commission, and of the American Railway Association. All containers are reconditioned at the termination of each trip; in addition hydraulic tests are conducted at frequent intervals in accordance with the Bureau of Explosives regulations.



A caustic pot at left, flaking machinery in center, with liquor cooling coils and tanks at right, and evaporating equipment in the rear

The accumulation of caustic soda at the cathode drains through a run-off connection at the bottom of the cell into a liquid meter, which measures the volume produced and collects a composite control sample. This weak cell liquor, containing 10 per cent soda and 15 per cent undecomposed salt, is fed to a rapid vacuum circulating evaporator, where it is concentrated to 50 per cent NaOH. Salt precipitated during the boiling is separated from the caustic liquor as a slurry by sedimentation in conical-bottom receivers; the salt is filtered from the slurry and returned to the brine purification process, while the caustic filtrate is sent back to the evaporators. The 50 per cent caustic liquor from the evaporators is further purified of most of the remaining salt and then fed to the finishing department. A portion of the 50 per cent liquor is marketed in tank cars.

The caustic finishing department consists of a battery of cast-iron pots, 10 ft. in diameter, 7 ft. deep at the center, and with a wall thickness of about 3 in., open-fired by oil burners using fuel oil of about 16 deg. Bé. The 50 per cent liquor is completely dehydrated in these pots, in which the volume is kept constant by addition of 50 per cent liquor to replace the water evaporated. After precipitation of iron and manganese the fused caustic is cooled to 50 deg. C. above solidification and pumped into steel drums of 750 lb. net capacity, where it solidifies.

Flake caustic soda is also produced. The flaking machine consists essentially of a water-cooled drum, immersed $\frac{1}{4}$ to $\frac{1}{2}$ in. in a reservoir of molten caustic. Rotating continuously at from 20-40 r.p.m., the drum picks up a layer of the caustic soda which, after solidifying on the cool drum surface, is scraped off with a "doctor" into a hopper equipped with a device to break up the sheet into small pieces. The flake caustic is then packed into steel drums by means of a screw conveyor; these drums have a capacity of 400, 100, or 50 lb.

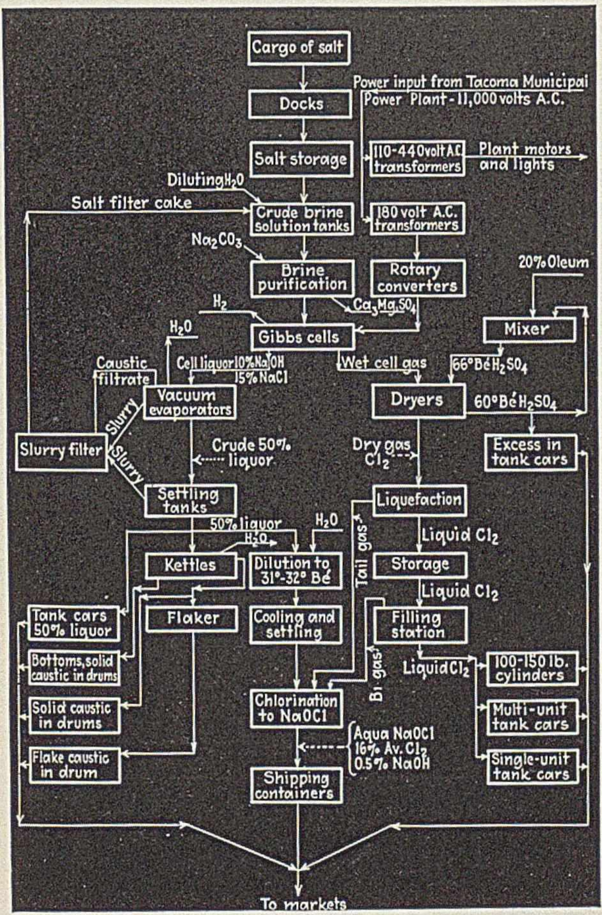
Drums are made on the premises in a well-equipped drum shop. The drum-head machinery consists of a squaring shear, circle shear, and a large forming press, through each of which the sheet is passed in quick succession in the order given. The steel sheet for the body of the drum is first put through a forming machine, rolled to the proper diameter, and then side-seamed by an ingenious device called a double-lock seamer. Next the drum is put through a beader and flanger and finished by fastening the heads to the body of the drum with a double lock-head seamer.

A concentrated aqueous solution of sodium hypochlorite, marketed under the trade name, "Clor," containing 16 per cent available chlorine, is produced by passing chlorine gas into a cooled solution of caustic soda of 31-32 deg. Bé. In actual practice 1.25 to 1.5 lb. of NaOH are used per pound of C1. This allows for the salt and other slight impurities in NaOH and also for the excess alkali used to stabilize the solution. Iron compounds are among those which have been found to effect a decomposition of sodium hypochlorite solutions. For this reason the caustic solutions are carefully settled and sometimes filtered before chlorination to remove any trace of iron present. The actual chlorination is carried out in concrete tanks to prevent contamination by iron. The finished sodium hypochlorite is shipped in 1, 2, and 5-gal. bottles, 12-gal. carboys, and 30-gal. rubber-lined drums.

Careful chemical control is maintained throughout the entire process; the raw material is examined for impurities and the purity of the brine fed to the cells is carefully guarded. Caustic content of the cell effluent is determined and the continual withdrawal of impurities is watched through the ensuing steps of evaporation. In a similar manner, the purification and concentration of the chlorine gas leaving the cells are carefully followed by analyses. This strict laboratory supervision results in uniform products of high purity.

Employees are all provided with gas masks, goggles, rubber gloves, and other appliances. "First-aid" cabinets are strategically located, machinery guarded, and the practice of "safety first" stressed by continual publicity and periodic safety meetings. These factors, together with the whole-hearted cooperation of employees, have enabled the plant to produce at time of writing a "no lost time" accident record of 730 days, of which it is justly proud.

Caustic soda is used in many industries. Over 65 per cent of the consumption is accounted for in petroleum refining, the manufacture of rayon and artificial silks, the production of other chemicals, and in soap making, each consuming practically equal quantities. There are a number of smaller outlets, such as export, the scouring and mercerizing of cotton textiles, the production of pulp and paper, the sale to direct consumers in the form of lye, the reclaiming of rubber, and the production of vegetable oils. Less than 6 per cent of the total may be distributed among less important industries.



From raw materials to finished products in the Tacoma plant

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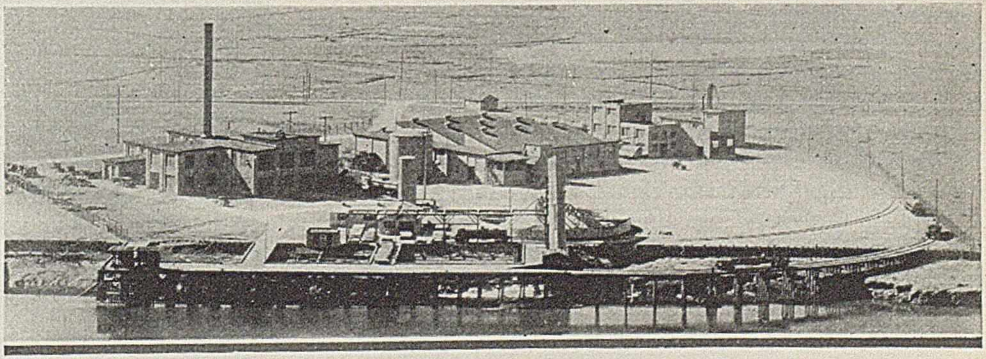


Plant of the Tacoma Electrochemical Co., Tacoma, Wash.

Sodium hypochlorite, which is produced by the recombination of caustic and chlorine, is growing in importance. It is a convenient bleaching agent for laundries and textile plants, and is used extensively for disinfection in the larger food producing industries, such as dairies, canneries, and packing plants, as well as in hotels and restaurants. Sodium hypochlorite is a suitable sterlizing agent for swimming pools and small water purification plants, and may be obtained in small quantities for domestic consumption both for sterilizing and bleaching.

Liquid chlorine does not deteriorate and is thus permanently available to the purchaser in its full strength. This property makes it the most important oxidizing agent among modern chemical commodities. Its greatest use is in the paper and textile trade for bleaching wood pulp, old stock, textile materials; it is also widely used as an aid in laundering. The new direct pulp-bleaching methods, using chlorine instead of the intermediate hypochlorite, applied directly to the pulp, have tremendously increased the importance of chlorine to the paper industry. Large quantities are used to treat tin and tin scrap for the production of tin tetrachloride, which is used for weighting silk; and more industries than ever before are using it to manufacture useful chlorine derivatives, or as an intermediate in preparing synthetic compounds.

In water purification its efficacy in producing a safe, palatable water has been increased by its joint use with ammonia and activated carbon, eliminating the medicinal taste problem and extending its powerful germicidal action to the consumer's faucet. Its value in sewage treatment as an adjunct to mechanical and biological processes is now well-established by long-term operating data. Operating efficiencies in the paper and power industries have been increased by using it in the destruction of slime.

The Pennsylvania Salt Manufacturing Co. is a pioneer in the manufacture of heavy chemicals. In August, 1852, at their Natrona works, it produced the first caustic soda made in the United States, and the first tank car shipment of liquid chlorine in this country was moved from the Wyandotte plant in 1909. The same spirit prevailed in 1928 when this company again pioneered by being the first to announce and organize a Northwestern chlorine-alkali plant to serve this rapidly developing section, particularly its pulp and paper industry. As a result of their foresight the Tacoma Electrochemical Co. today is an efficient plant with potentialities for future development to meet the needs of this section as its industries expand.

Emulsified Asphalt Industry Ignores the Depression

By J. MITCHELL FAIN and ARTHUR W. HIXSON

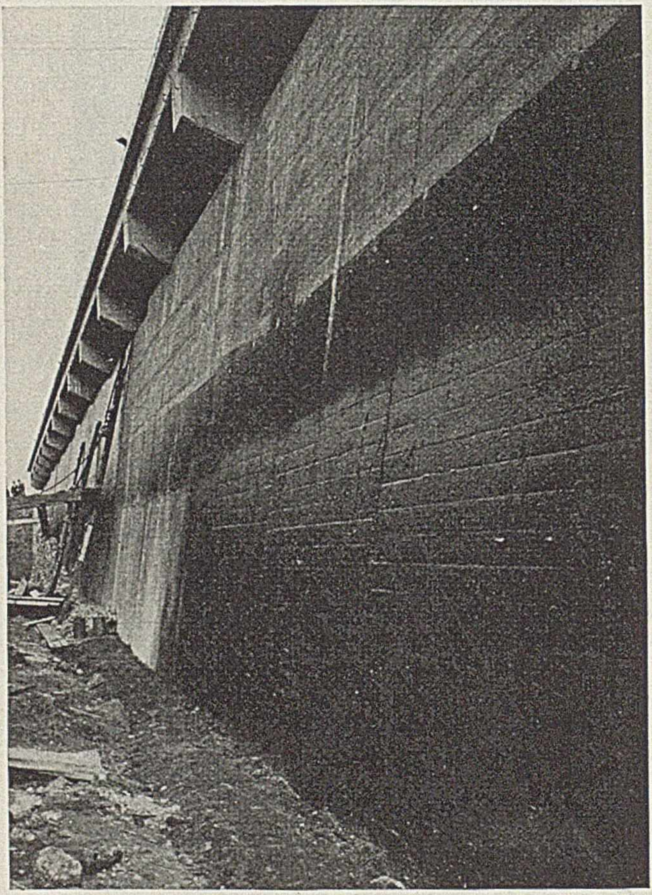
Respectively, Consulting Chemist, Foster D. Snell, Inc., Brooklyn, N. Y.
Professor of Chemical Engineering, Columbia University, New York, N. Y.

DURING the past decade the manufacture of asphalt emulsion has grown to an industry of considerable size; it has passed the experimental stage. Sales of emulsified asphalt and fluxes in the United States in 1931 amounted to 155,140 tons, compared with 113,185 tons in 1930, a gain of 37.1 per cent; no figures are yet available for 1932. While appreciable quantities of emulsified asphalt have been produced in the past, increased activity in this industry is now being shown, with prospects of considerable expansion in the future. No civilized country is without one or more emulsion factories. Together with other raw and finished products that have recently been made available by research and technical developments, emulsified asphalt is affecting many of our present-day industrial processes.

The oldest established use of emulsified asphalt is in road building. In Europe the technique of laying roads with asphalt emulsion has been developed to a high degree; it is there considered a standard material for second class roads. In 1929, Germany used 40,000,000 gal. for this work. The United States, according to the Bureau of Public Roads, at the end of 1929, the latest year for which complete figures are available, had 3,124,000 mi. of road, of which 2,360,000 mi. were non-surfaced or dirt roads and an additional 543,000 mi. were roads of a low type. A large field is opened for the use of emulsified asphalt and the ground work has already been laid.

Several advantages over the hot material are apparent; elimination of heating kettles and the possibility of application in damp weather come to mind at once. Experience with its use has demonstrated other features; the quantity of asphalt required is reduced; the asphalt is used only as a coating; the voids are thoroughly filled with aggregate; the reduced quantity of asphalt prevents bleeding or displacement under traffic; operation is not limited to the seasons of mild weather; roads have been laid with this material at freezing temperatures.

The charge has been made that asphalt emulsion tends to wash off the road when subjected to the combined action of rain or snow and mechanical grinding under the wheels of vehicles. Proper construction with an emulsion, the rate of break of which is adapted to the conditions at hand, completely eliminates this difficulty. The advantage of asphalt emulsions over cutbacks lies in the retention of the original structure of the asphalt as it comes from the refinery. No concern is felt, however, that emulsified asphalt will entirely



Courtesy Asphalt Emulsion Service, Inc.

Protection of railroad retaining walls with asphalt emulsion

replace asphalt in other forms; each has its definite place in road construction.

Emulsified asphalt is meeting with success in several types of road construction. In the case of a coarse aggregate road mix, after the base has been prepared, a prime coat of emulsion, if needed, is put on; the coarse aggregate is spread and leveled and a coat of asphalt mixing emulsion is applied. Mixing is accomplished by turning the stone once or twice with suitable equipment. The aggregate is shaped to proper cross-section and rolled lightly, and the key-stone is spread and rolled to secure uniform distribution. Quick-setting penetration emulsion is applied, whereupon the stone chips are spread, broom-dragged, and rolled. A final application of quick-setting emulsion is then made, followed by fine stone chips or coarse sand, which is spread, broomed, and rolled to a finished surface.

In some sections of the country pre-mixing of the aggregate with emulsion at the quarry or gravel pit is found more economical and more satisfactory than mixing on the road; a slow-setting emulsion should be used. The pre-mixed crushed gravel is spread on the road bed and finally, after sufficient time has been allowed for drying, a seal coat of emulsified asphalt and stone chips is applied.

The term "penetration" is used for a wearing surface constructed in the same manner as a coarse aggregate road mix, with the exception that no mixing is attempted. Coarse stone is spread, bladed, and rolled. A quick-setting asphalt emulsion is first applied; then a key-stone is distributed, broomed, rolled, and followed by a second application of asphalt emulsion. A cover of stone chips is finally spread, broomed, and rolled. Often a third application of emulsified asphalt as a seal coat and a final cover of chips are necessary to obtain a perfect seal and protection of the sub-base from surface water.

For the curing of concrete the emulsion is applied to the exposed surface of freshly poured, wet concrete immediately after finishing. Application is made in the form of a fine spray which covers the surface with a thin film of bitumen.

Asphalt emulsion is meeting with success in several types of road construction

For roads often affected by moisture, in which light asphaltic oils have been used as a binder, asphalt emulsions are coming into general use as a seal. A covering of asphalt emulsion and stone chips is used; protecting and wearing properties may be increased by a second application of emulsion and stone chips.

A satisfactory non-skid surface is obtained by the use of asphalt emulsions and stone chips on old bituminous pavements which have grown slippery under traffic.

Emulsions have likewise found use in the manufacture of fuel briquets. British patent 202,231 describes the process. Coal, peat, lignite, and similar products are pulverized, moistened with water, and mixed with the emulsion. The briquets are molded in a press, dipped in an emulsion similar to the binding agent, and finally dusted with powdered fuel.

Coating Wood, Stone, Metal

Emulsions are used for coating and impregnating stone, wood, metal, and felt. Asphalt emulsions used as paint may be made completely suspendable, permitting shipment to distant points without separation into the constituents. A study of the commercial methods of application, such as brushing, troweling, spraying, dipping, and ragging has led to the development of consistencies suited to each method. Emulsified asphalt has been utilized in considerable quantities for the waterproofing and dampproofing of concrete, roofing, cloth, and bags; heat insulators like magnesia and cork are also effectively waterproofed in this manner.

Mixed with portland cement, sand, and gravel, emulsified asphalt is used to advantage as a binder in mastic flooring. Not only does this material render the floor more waterproof, more resilient, and dustless, but repairs of concrete flooring may be accomplished without the tell-tale and unsightly cracks which characterize concrete floors repaired by the usual methods. The mastic may be troweled to a feather edge without impairing its binding properties, but care must be exercised to prevent checks and cracks in the floor caused by too rapid drying; small cracks are rolled out under traffic.

Asphalt emulsion is making a successful bid for use as a cement for rubber and composition tile, insulating board, and similar products. A material for this use must meet many special requirements; it must easily wet the surface to which it is applied; it must trowel without difficulty and without breaking down under the trowel; it must set within a narrow time limit and must resist the action of water and electrolytes after setting; it must have the physical strength to resist reasonable stress and shear and must not lose its strength and adhesive properties by time. An emulsion with special properties has been developed for this use.

Large quantities of asphalt emulsion have been employed as a sound deadening material for automobile bodies. For this purpose the physical properties of the emulsion, such as flow of the dried film under heat, cracking under impact in the cold, and body characteristics have to be narrowly controlled. In building construction, likewise, emulsified asphalt has found a place not only for this use, but also as a heat insulator, plaster bond, and dampproof material.

Several companies, both in this country and abroad, have been licensed to manufacture moistureproof and waterproof paper by incorporation of emulsified asphalt with the fiber either in the heater or at the paper machine. Difficulties caused by sticking of the felted sheet to the blanket and drying rolls of the paper machine have been overcome, as described in U. S. Patent No. 1,515,821, by the use of a multi-cylinder machine, the outer plies of the felted material being formed of fibrous material without the emulsion and the inner ply or plies being supplied with the emulsion. As only the outer plies, which contain no asphalt, are in contact with the blanket and drying rolls, sticking is entirely prevented. A variety of products, some already in use and others in process of development, are the result of this incorporation of asphalt with paper. The most important are floor tiles; molded products, such as pails and tube; sheathing paper; mulch paper; odorless moistureproof paper for use as food and soap containers; and waterproof paper embossed to imitate a leather finish.

Protective Coating of Steel

Asphalt emulsion has also found considerable use as a protective coating on structural steel and iron for covering tanks, metal roofs, bridges, pipe, metal sash, and similar materials, for underground application a mixture of asphalt emulsion and portland cement gives a coating which resists the abrasive action of stones and rocks in the soil. Panels of sheet iron, covered with a 6:1 mixture of asphalt emulsion and portland cement and buried in extremely corrosive soil for a period of two years, showed no signs of corrosion.

For the applications outlined, asphalt emulsions must possess special properties, almost every major use requires an emulsion whose characteristics must be modified to meet a certain requirement. Rarely may an emulsion developed for one industry be used in another without change. Consideration must first be given to the physical properties of the asphalt, such as melting point and penetration, which are of great importance; ductility, flash point, and fire point likewise enter into the picture. Emulsions are made with asphalts of several different grades, and manufacturers standardize on certain grades of asphalt in an attempt to make these grades serve the various purposes.

In emulsified form asphalt brings into view a host of new properties and each mode of application requires a suitable consistency, determined by various factors. Water content of the emulsion and particle size of the asphalt are of great importance; yield point and mobility must likewise be controlled. These are affected by length and intensity of beating and by treatment with certain bodying materials. Development of an apparatus which properly evaluates these characteristics and interprets field conditions in terms of laboratory tests is a problem in itself.

Where an emulsion is required which can be applied in a thick layer by spraying, the body must not be mobile; as a paint, an emulsion of low yield value and greater mobility is required. Thus the property of leveling is obtained.

Resistance to destruction of the colloidal system by freezing is an important requirement. In some types this is accomplished satisfactorily, but in other types complete protection has not yet been attained.

An emulsion suitable for road work must flow freely under all weather conditions; it must thoroughly and readily penetrate surfaces of aggregate to which it is applied and must break down soon after application, leaving a layer of pure asphalt thoroughly covering and bonding to the mineral road aggregate.

In spite of these differences, however, asphalt emulsions may be divided into three main types. Heretofore two main divisions have been employed: stable and unstable emulsions. To these a third or intermediate type may properly be added. Classification according to stability does not apply to the separation of an emulsion into its constituents by the action of gravity. Stable emulsions are dispersions of asphalt in water which are not broken down by addition of even strong electrolytes or by vigorous mechanical action. They may be mixed with fibers, lime, or portland cement and may be satisfactorily brushed out or sprayed; the time of set is relatively long. A prominent characteristic is that their dried film does not flow under heat as the cellular honeycomb structure surrounding each asphalt particle remains after coalescence and acts as a barrier to the inclosed asphalt. Mineral powders are largely used as emulsifying agents; bentonite, a clay with remarkable hydrating power, being the chief material of this type now employed. (*Chem. & Met.* Vol. 36, p. 477; Vol. 37, p. 490.) Asphalt, heated to a temperature at which it is readily fluid, and a suspension of bentonite in water flow together into a mechanical agitator. The asphalt stream is first broken up into strings, which then are subdivided into cigar-shaped particles, which on further treatment can be reduced to even smaller size. For the various uses to which emulsions are put an average particle size ranging from 5 to 25 microns is required. Another commercial process producing this type of emulsion is described in U. S. patent No. 1,783,365. Asphalt dispersions are prepared by mixing bitumen, aluminum-hydroxide paste, clay, and water.

Types of Emulsions

Emulsions of the unstable type are made from asphalt and water mainly by the use of soap as the emulsifying agent (*Chem. & Met.* Vol. 37, p. 425). With certain types of asphalt, notably Mexican asphalt, emulsification may be accomplished by the use of alkalis alone, the saponifiable ingredients contained in the asphalt taking the place of the fatty acids of the soap. Manufacture of the emulsion is at present usually a continuous process, both paddle mixers and colloid mills being used for the purpose. Addition of soap to the aqueous phase reduces the asphalt-water tension to such an extent that the work required to subdivide the asphalt is considerably less than that required for dispersing asphalt into emulsions of the stable or mineral-powder type. Hence with machines using equal quantities of power, production of emulsions of the unstable type stands in a ratio of about five to one to emulsions of the stable type. This is the case even though the average particle size of emulsions of the former type is smaller than that of the latter type dispersions. A definite technique in production of satisfactory emulsions of the unstable type is required, as all asphalts do not lend themselves to the purpose with equal facility. Composition and concentration of the soap solution must be carefully controlled, and the temperature of both soap solution and asphalt must be maintained within narrow limits. With the colloid mill the smallest average particle size is obtained with a gap of definite width. All these factors have a bearing on the size of the asphalt particle which, in turn, determines the suspendability of the emulsion and its applicability. Manufacturing control often includes a count of asphalt particles of different sizes and classification, by percentage composition, into groups of these sizes.

Emulsion of Intermediate Stability

Of late the demand for this type of product has resulted in the development of an emulsion of intermediate stability. This is accomplished in one of several ways. British patent No. 320,847 describes the manufacture of an emulsion of this kind suitable for use in road making or repairing. The dispersion is first prepared in unstable form, the particles having a size of 10 microns or greater, and is subsequently stabilized by the addition of an agent such as a protein or starch or other carbohydrates. U. S. patent No. 1,793,918 discloses the preparation of emulsions by use of a suspension of paste-forming colloidal material, such as bentonite, modified by adding to it an agent, such as soap, to reduce the interfacial tension between the aqueous medium and the asphalt and to facilitate dispersion with light agitation. Thus less emulsifying agent is required than if either were used separately. Some of the important properties of the other types are combined in this type of emulsion, which, upon drying, leaves a film more resistant to flow under heat than emulsions of the unstable type. It has a setting time between that of the other two types and a stability toward electrolytes and mechanical agitation approaching the stable type of emulsion. The ease of emulsification that characterizes the unstable type is retained by the intermediate type together with the correspondingly low conversion cost of asphalt to emulsion. Some additional treatment, however, is usually required.

Patents

The first appearance of bituminous emulsions in the patent literature is apparently that in German patent No. 40,020 of April 11, 1886, to Deutsche Asphalt A. G. Inorganic oxides are mentioned for use as emulsifying agents. Colloidal clays are first described for use as emulsifying agents in German patent No. 68,532, of July 1, 1891, to Grünzweig and Hartmann. German patent No. 521,129, of May 8, 1889, to the firm of Schülke and Mayra apparently first develops the use of soap as emulsifier. A patent covering a large number of emulsifying agents is German patent No. 170,133, of June 3, 1904, to Karl Mann, the American prototype of which is U. S. patent No. 834,830, of Oct. 30, 1906. Some important patents describing the use of clay as emulsifying agent include, together with those mentioned above, U. S. patent No. 1,134,573, of April 6, 1915, to Herbert Abraham and H. W. Haines; U. S. patents No. 1,198,769 and 1,198,955, of Sept. 19, 1916, to Clifford Richardson; U. S. patent No. 1,240,253, of Sept. 18, 1917, to M. A. Popkess; and U. S. patent No. 1,296,083, of March 4, 1919, to Robert Illemann. Early German patents covering the use of this emulsifier are patents Nos. 211,877, of Sept. 8, 1906, to Julius Kathe; No. 216,212, of June 25, 1907, and 244,307, of May 5, 1910, to Friedrich Raschig; and 296,271, of Aug. 3 and 298,700, of Oct. 8, 1916, to Carl Roth.

In *Zeitschrift für Angewandte Chemie* (Vol. 23, 1910) F. Raschig describes the use of aqueous clay for emulsifying bituminous tar. The dispersion to which was given the trade name Kiton was used as a dust palliative and road dressing material. He reported that attempts to emulsify petroleum were unsuccessful.

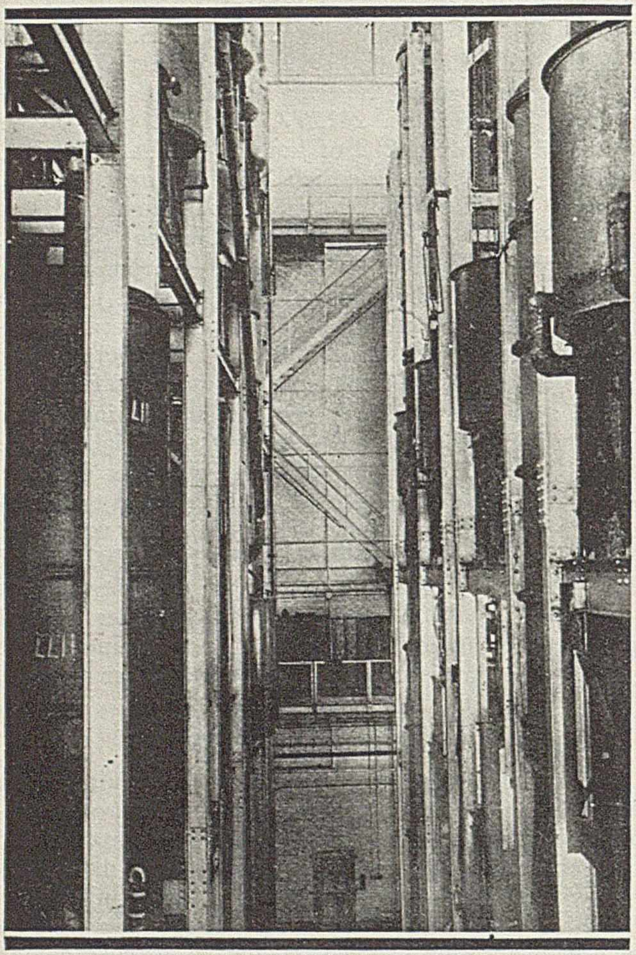
In all these methods, however, the emulsifying power of the mineral powder was comparatively slight. The ratio of bitumen to clay was relatively low and the product had only a limited use. Real impetus to manufacture of asphalt emulsions of the stable type was given by a process described in U. S. patent No. 1,302,810, of May 6, 1919, to L. Kirschbraun, which describes the use of bentonite. With this material a much higher ratio of asphalt to non-volatile matter was at once obtained. The emulsion was likewise improved in several other respects.

Emulsion Manufacture

The manufacture of asphalt emulsions requires close control. In the production of the stable clay-type emulsion the suspendability, emulsifying power, viscosity, and hydrogen-ion concentration of the clay should meet specifications and the asphalt must come within definite limits of melting point and penetration. The temperature at which emulsification proceeds should be watched closely and particle size and consistency of the final product at various temperatures should be checked carefully.

With the soap-type emulsion the bitumen used should likewise meet rigid specifications. The soap or ingredients from which the soap are made may be examined by the usual methods of analysis. Operating temperature must be carefully regulated, a condition which sometimes causes difficulties in the summer. The final product must meet tests for rate of break, viscosity, and particle size, and resistance to breaking by freezing as well as stability to mixing with aggregate are often required. Tentative A.S.T.M. specifications include a stone coating test in which 465 grams of clean stone, traprock, or hard limestone ($1\frac{1}{4}$ to $\frac{3}{4}$ in. in size, not more than 5 per cent passing a $\frac{1}{4}$-in. screen and 100 per cent passing a $\frac{3}{4}$-in. screen) is placed in a No. 10 sieve, drenched and washed with distilled water, allowed to drain for three minutes and transferred to a suitable pan in which the mixture is to be made. A 6-in. hemispherical iron dish has been found suitable for the purpose; 35 grams of emulsion is then mixed vigorously with the stone for three minutes, using a steel spatula. During the mixing period no sign of separation of the asphalt contained in the emulsion should appear.

Breaking of emulsions is of great importance to the practical road builder, and the "breaking-value" of an emulsion must suit the conditions of any particular job. A method has recently been developed in Germany by Hans Weber and Hermann Bechler which recommends itself for a more exact determination of the breaking-value.



Canada's Most Important

Rectifying columns and condensers. All stills are located in one central building to minimize piping

The members of the Electrochemical Society and their guests who attend the spring meeting of the organization on May 11, 12, and 13, 1933, in Montreal, will be given an opportunity to make an all-day excursion on the last day of the convention to Shawinigan Falls where the plant of the Shawinigan Chemicals, Ltd., is located. This "has become one of the greatest single chemical industries in the British Empire" and its many products and processes which Mr. Cadenhead has interestingly described for us in this article will be seen by those making the trip.—*Editor.*

▼

IN VIEW of the number of writers who have spent their energies on this subject which has been presented at numerous times and in numerous places during the last decade, the only excuse for this article lies in the fact that the various processes as at present carried on at Shawinigan Falls bear probably less resemblance to the original installations so often described than the Empress of Britain does to a conventional Noah's Ark.

In sketching in a background for a picture of this development, it has been deemed advisable to present briefly the origins of what has become one of the greatest single chemical industries in the British Empire.

In 1902, a scant 31 years ago, the Shawinigan Carbide Co. was organized to manufacture calcium carbide utilizing the low-priced electrical power generated at Shawinigan Falls. In 1916 the company, then known as the Canada Carbide Co., secured as its largest customer the Canadian Electro Products Co., which used as its chief raw material acetylene gas. From this was synthesized acetaldehyde, acetic acid, and acetone, at that time in demand for the manufacture of Cordite for the British Army. In 1927 the Canada Carbide Co. and the Canadian Electro Products Co. were consolidated into the Shawinigan Chemicals Ltd., wholly owned by the Shawinigan Water and Power Co.

At present the organization consists of:

(1)—The carbide division which produces calcium carbide for export and for the local generation of acetylene which is piped to the chemical division and also sells a comparatively small amount to a local Prest-O-Lite plant. Other products of the carbide division are byproduct calcium hydrate and an acetylene black of unique properties produced by thermal decomposition of waste acetylene.

(2)—The chemicals division produces as its major products acetaldehyde, acetic acid, ethyl acetate, butyl acetate, amyl acetate, and vinyl acetate in addition to a large number of allied products, esters and useful byproducts.

(3)—The stainless steel and alloys division operates the entire Canadian rights for Duriron and produces the various acid-resisting nickel-chromium steels for local consumption and for the pulp and paper industry of eastern Canada.

In addition, the company maintains two research groups, each with a personnel of about 15 men. The function of one group is to search for new industrial compounds and to investigate new processes; the other group, the plant research department, improves existing processes, chemically and mechanically, and introduces better methods with improved yields and lower operating costs.

The plant covers 25 acres and consists of some 60 buildings of substantial construction, designed to conform to the latest developments in chemical engineering. Operating at full capacity it employs about 1,000 men and consumes 75,000 hp. Annual capacities are: 100,000 tons of calcium carbide; 40,000 tons of marketable calcium hydrate; 1,000 tons of acetylene black; 50,000 tons of glacial acetic acid; 3,000 tons of ethyl acetate; 1,500 tons of butyl and pentasol acetate; and 1,000 tons of vinyl acetate. Situated 20 mi. from tidewater, served by two

Synthetic Organic Chemical Industry

By A. F. G. CADENHEAD
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Shawinigan Chemicals, Ltd., Shawinigan Falls, Canada

railroads, and with unlimited electric power at its disposal, its position as a low cost producer of synthetic organic chemicals on a large scale is unique and enviable.

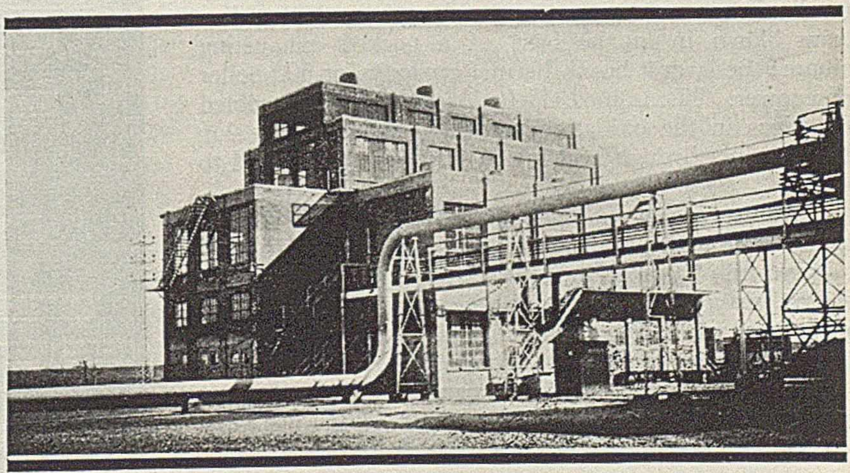
The lime plant consists of three Vulcan rotary kilns, 8 ft. in diameter by 125 ft. long, with a capacity of 120 tons of lime each per 24 hr., fired by pulverized fuel and operating with a lime to coal ratio of 4:1. Soft coal, pulverized in three Raymond mills, is blown into the kilns through a water-cooled burner pipe. In the winter the coal is freed from snow and dried to a desired moisture content before it is pulverized; this is done in a special apparatus which uses heat drawn from a shell outside the burner end of the kiln. At the head of the kiln the gases are drawn through waste-heat boilers after passing through settling chambers. Waste-heat steam generated supplies the limited requirements at the carbide plant, and the bulk of the steam is sent down to the chemicals division where it is utilized as process steam and for heating buildings. The gases leave the kilns at a temperature of 1,200 deg. F.; after they pass through the boilers they are discharged through stacks at a temperature of 400 deg. F. Some of this stack gas is used in other drying and low temperature heating processes. These boilers supply, at full capacity, a total of 900 boiler horsepower at a pressure of 140 lb. per sq.in. The steam is piped to the chemicals division through an 8-in. all-welded line, 3,500 ft. long, with a guaranteed maximum line loss of 5 per cent, at full capacity. The line is carried above ground on concrete piers, and in the winter snow stays on top of it without melting.

The lime is conveyed on an endless belt conveyor to bins above the carbide furnaces, where it is weighed on Richardson automatic scales, along with the coke, and dumped into mixing tanks, in ratios desired for the furnace charge.

The carbide furnaces, four in number, have the following capacities: 20,000 kw., 10,000 kw., 6,000 kw., and 5,000 kw.; they are three phase, 60 cycle; the three larger units are fitted with Soderberg electrodes. Total daily capacity is 300 tons of carbide. Carbide is tapped into cast-iron pots built in sections, each containing from two to five tons. After cooling it is crushed and screened and packed for shipment or sent to the gas plant. Here various types of machines handle sized carbide or dust and produce acetylene gas and lime hydrate, the latter of which has a large variety of uses. The gas is transported to the chemical division in a 24-in. pipe line, 3,200 ft. long, constructed of ⅛-in. welded plates. A 50,000 cu.ft. gasometer acts as a surge tank between the gas machines and the aldehyde process building. The gas line has a capacity of 3,000,000 cu.ft. per day of gas, at 4 in. water pressure. Gas is supplied from this system to the aldehyde and vinyl acetate process buildings and to the welding shops and laboratories. Waste acetylene from the process buildings is blown to the "black plant" where it is converted into acetylene black. This line has a gasometer similar to that in the main system.

Operations in the chemicals division may be divided into four main groups: (1) hydration of acetylene or the acetaldehyde process, (2) oxidation of acetaldehyde to acetic acid; (3) distillation of crude aldehyde and of crude acetic acid, and (4) production of solvents. Under the latter heading is also included small-scale production

Solvents division produces ethyl, butyl, pentasol, and vinyl acetates and other solvents



of a large and growing variety of compounds made from acetylene.

In the hydration of acetylene, the gas from the generators, 99.5-99.7 per cent pure, is forced by a Nash Hytor blower through a reaction kettle in which it is converted into acetaldehyde. The kettle is maintained automatically at a temperature of 80 deg. C., and the aldehyde formed with the excess acetylene then passes through a number of water and brine condensers where the bulk of the aldehyde condenses; it finally passes through a plate and boiling cap scrubbing column which reduces the aldehyde concentration in the gas to about 4 per cent by volume. From the scrubber the acetylene is drawn back to the suction side of the blower, where fresh gas is supplied to the circulation system from the main through a large meter. Thus the volume of the fresh gas replacing what has been absorbed is recorded and enters the circulation system. At the same time a small amount of gas is bled out of the circulation system continuously and sent to the acetylene black plant.

Hydration of Acetylene

The reaction kettle is of Duriron 4 ft. 6 in. in diameter and 23 ft. high. It is made up of sections cast at the stainless steel division as are all auxiliary Duriron pipe and fittings. The catalyst consists of mercury salts suspended in dilute sulphuric acid. From time to time the exhausted catalyst, mainly metallic mercury, is drawn from the bottom of the kettle and returned to the catalyst production department where it is again converted into active catalyst and pumped to the kettle. The word catalyst is here used in its broad sense.

As the hydration reaction is exothermic the temperature of the kettle depends on the amount of active catalyst present at any given time; the temperature is therefore controlled by the addition of catalyst and can be kept within a very narrow range. Perhaps the most outstanding point of interest is the fact that in earlier installations, 36 Duriron kettles of almost similar dimensions were required to do what is now accomplished in this one kettle. More than one factor however has contributed to bring this about.

The acetaldehyde from the condensers and scrubber is collected in 6,000-gal. tanks as a 20 per cent solution. Brine coils in each container keep the solution cool at all times of the year. From these containers, the crude aldehyde is drawn to three aldehyde stills with a total hourly capacity of 1,200 gal. of refined aldehyde. They are all of the continuous type, and heat is applied as live steam blown in at the base of a packed exhausting column; the largest has a thermal capacity for 500 boiler horsepower. The refined aldehyde is sent to brine-cooled containers in the oxidation building, and the still slop after passing through heat interchangers is discharged to waste.

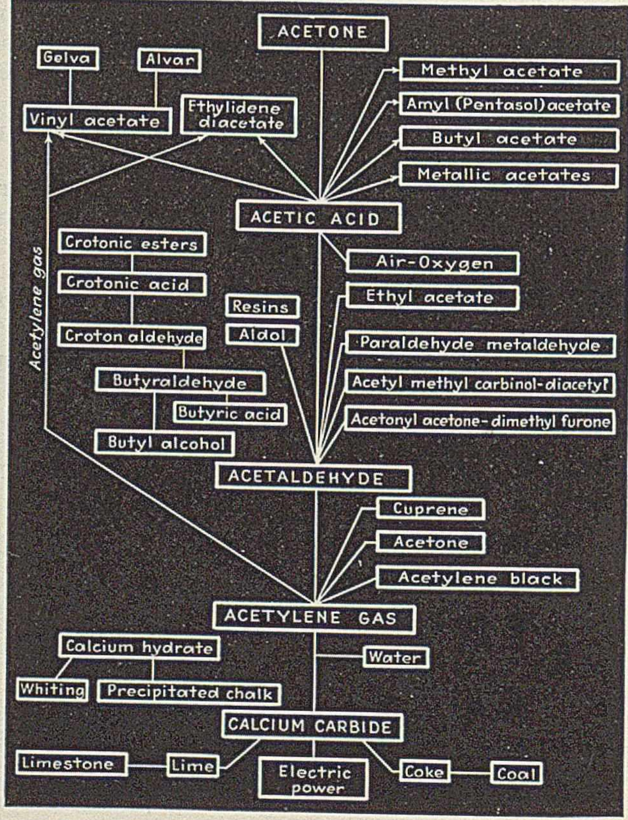
In the process of oxidizing acetaldehyde to acetic acid, acetaldehyde 99.9 per cent pure from the aldehyde stills is drawn into 1,000 gal. aluminum-lined steel kettles, the catalyst, manganese acetate, is added and air blown into the kettles which are maintained at a temperature of about 60 deg. C. and a pressure of 65 lb. per sq. in.

At the end of a 12 to 15 hr. period oxidation is virtually complete, and crude acetic acid 96-97 per cent pure is discharged to containers which feed the acetic stills. All aldehyde fractions are returned to the crude aldehyde system.

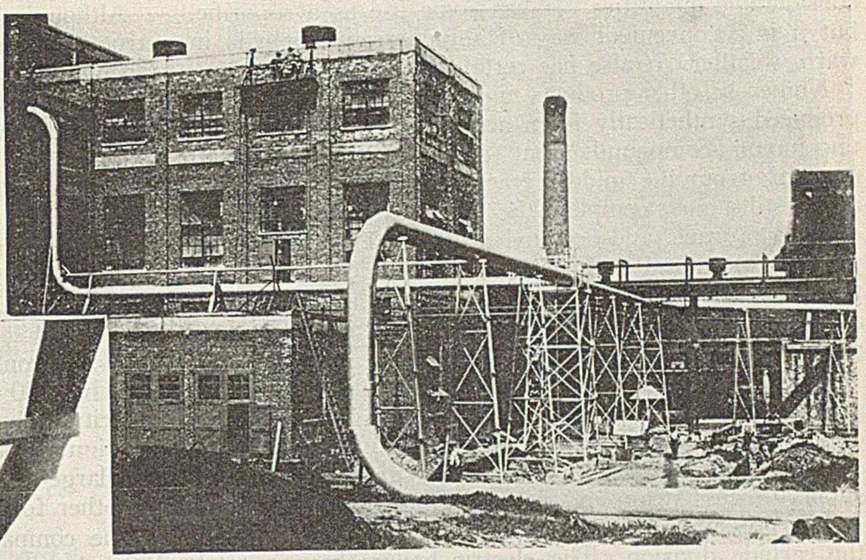
This oxidation process which initially gave more trouble than any other in the plant is now that it is better understood, the simplest and easiest of all plant operations. It may be run either as a continuous or as a batch process. In the latter case scrubbers of the same type as in the aldehyde process are required to remove the small amount of aldehyde vapor in the nitrogen discharge from the kettles. This dilute aldehyde is returned to the crude-aldehyde system. As during full production some 32 tons of oxygen are required per day by the oxidation process; this means the handling of between 150 and 160 tons of air; and of the residual 125 or 130 tons of nitrogen produced some is blown to a large gasometer where it is used to flush out and keep under an atmosphere of nitrogen all equipment containing either acetylene or acetaldehyde. It is also piped back to the carbide division and used in purging the acetylene generators. There are various uses to which this nitrogen will no doubt ultimately be put. In the meantime the bulk of it is wasted.

The acetic acid is refined in three continuous and four batch stills which turn out various grades of acid to supply the many market demands. The continuous stills have a combined capacity of 1,100 gal. of refined glacial acid per hour, while the total capacity of the batch stills is 500 gal. per hr. In these stills "B.P." and "edible" grades are produced.

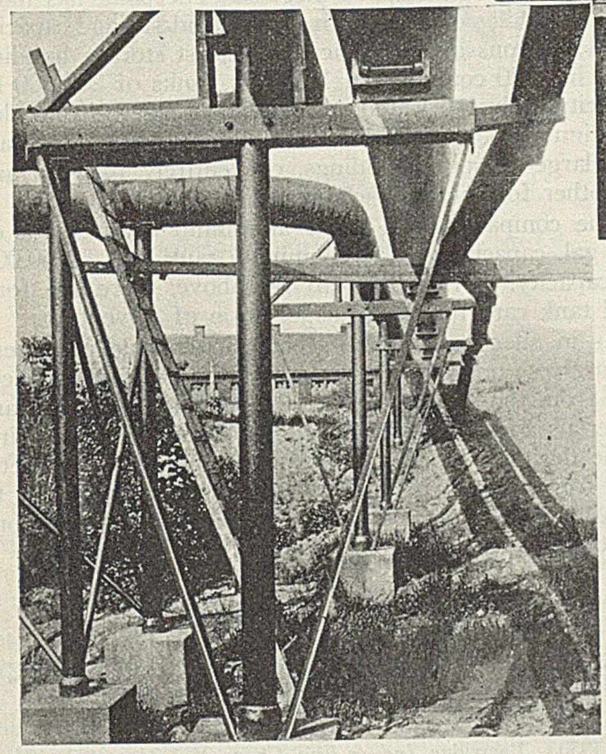
All aldehyde and acid stills are located in one building, centrally located to minimize piping. This building is 85 ft. high, 110 ft. long and 35 ft. wide, and the rather complicated equipment is so installed that any piece may be removed by an overhead crane and lifted down for



Gas line entering process building. The line is reduced from 24 to 18 in. diameter at the tee



Acetylene gas is transported in a 24 in. welded plate-pipe line 3,200 ft. long



replacement or repairs without interfering with any other equipment. Time required for shut downs is thus reduced to a minimum.

The stills have been described elsewhere, with the exception of a vacuum still to which residues from the boilers of the continuous stills and from the individual batch stills are pumped. Here the last of the acid is removed, and the residue, a thick tar when hot, which constitutes less than 1 per cent of the original still feed, is discharged to waste.

This material contains small quantities of many curious compounds which are concentrated from a vast bulk of crude acid, most of which would pass unnoticed in any operation on a lesser scale.

There is, in addition, a "middle fraction," also small in quantity, in which is concentrated a number of esters and ketonic bodies. Some of these esters are separated by further fractionation as such for the solvent market.

Ethyl acetate is made from refined aldehyde by the Cannizzaro condensation in the presence of the catalyst aluminum ethylate or aluminum ethoxide. Two molecules of acetaldehyde uniting to form ethyl acetate. The equation $2\ CH_3.CHO \rightarrow CH_3COOC_2H_5$ but partly expresses the reaction. Conversions are good and the yield is high. A small amount of β-butylene glycol monoacetate is formed and remains as a residue.

Butyl and pentasol acetates are made from the corresponding alcohols and glacial acetic acid by the usual esterification process. The capacity of the solvents department as stated is 500,000 lb. of ethyl acetate and 250,000 lb. of butyl and amyl acetates per month.

Vinyl acetate is produced by the reaction between acetic acid and acetylene gas in the presence of a catalyst. A plant with a daily capacity of two tons of this body was completed in 1932. By the simple addition of further kettles, its capacity may be increased to six tons.

Polyvinyl Resins

Vinyl acetate is the starting point for the series of polyvinyl resins known as the Gelvas and Alvars manufactured by this company. These synthetic resins are finding uses in every field to which resins are applicable, such as in the manufacture of phonograph records, in the production of plastics and molding powders, films, lacquer, and varnish bases, adhesives, and many other uses. Vinyl acetate is also the raw material for the manufacture of vinyl chloride, the source of the Vinylite resins.

Vinyl acetate polymerizes readily, particularly at summer temperatures, and in consequence is treated with a small amount of stabilizer before shipment. From this stabilizer it is recovered by a single distillation.

In addition to the above main products, both the polymers of acetaldehyde, aldol, and paraldehyde are manufactured and sold. Aldol, the di-mer of acetaldehyde produced by the action of hydroxyl ion is also the source of crotonaldehyde for which there is a small market.

A molecule of water is split off from the aldol during distillation at atmospheric pressure. Crotonaldehyde reduced by hydrogen forms butyl aldehyde, but this process is not now operated here. Crotonic acid is also made from the aldehyde by simply blowing air or oxygen through the aldehyde. From the crotonic acid various esters have been prepared which are of some interest as special solvents.

Paraldehyde, the tri-mer of acetaldehyde produced by the action of hydrogen ion on acetaldehyde, is sold in considerable quantities. It has some use as a soporific, but it is a convenient way of shipping acetaldehyde in warm weather. It also has certain uses as a solvent.

Numerous other products might be mentioned that are produced synthetically from acetylene, but three rather uncommon compounds that are recovered in small quantity from the middle fractions or residues of the acetic stills must complete the tale. These are diacetyl, dimethyl furane, and acetonyl acetone. The latter compound is produced by hydrating the furane and opening the ring. These compounds have a very limited market at present, but, especially in the case of diacetyl, distinct possibilities are offered.

The service building contains the ice plant, air compressors, and the steam plant. The steam plant consists of two B. & W. 250 hp. boilers with chain-grate stokers, supplemented by three electric steam generators which supply process steam and steam for heating buildings at 125-lb. pressure, in addition to the waste-heat steam from the carbide division. The electric boilers have a total capacity of 15,000 kw. (1,500 boiler horsepowers), and use three phase, 60 cycle, alternating current. The three steam generators occupy less space than one of the B. & W. units. The air compressors are of the Ingersoll Rand, two-stage type, four in number and capable of supplying 8,000 cu.ft. of free air per minute, the bulk of which is used in the oxidation process. The ice machines, four Ingersoll Rand, two-stage ammonia compressors, have a total capacity at 0 deg. F. of 1,750 tons of refrigeration per day. They supply brine at 0 to —5 deg. F. to condensers and storage tanks throughout the plant.

The enormous quantity of water used is furnished by seven centrifugal pumps with a total capacity of 27,000 gal. per minute. This water is supplied through a 48-in. cast iron pipe line, almost a mile long, at a pressure of 100 lb. per sq.in.

Although all the modern buildings are of fireproof construction, they are without exception protected by the Grinnell sprinkler system; and those process buildings where flammable liquids, vapors, or gases are handled or stored have all been fitted with the Grinnell deluge system.

The most satisfactory material for resisting the attacks of acetic acid is metallic aluminum. All refined acid from still condensers is handled throughout the plant and even in shipment in aluminum, with the exception of a small quantity which is shipped in glass. The plant has more than five miles of aluminum piping, and storage capacity for 1,600 tons of glacial acid. The last storage building built in 1930 contains ten 10x40 ft. tanks of 200,000 lb. capacity each, fabricated on the plant from $\frac{5}{16}$-in. welded aluminum sheet. In addition to this building there are two large shipping buildings, one entirely for acid and the other for acid and solvents.

The company owns 6,400 aluminum drums each of 100 gal. capacity and 12 aluminum tank cars of 60,000 lb. capacity. In addition to the above, there are four steel tank cars for the transportation of solvents.

As in all chemical plants corrosion problems present themselves; one of the greatest of these a proper selection from the vast variety of the so-called acid-resistant materials now available. While aluminum leaves nothing to be desired for conveying and storage of cold acetic acid from 85 per cent to 99.7 per cent, materials able to withstand the action of acetic acid under all conditions are continually being sought.

Literature since 1920 referred to:—Rooney, *Chem. & Met.*, Vol. 22, pp. 847-50 (1920); Matheson, H. W., *Chem. Age*, p. 464 (1922); Editor, *Ind. & Eng. Chem.*, pp. 955 and 1082 (1922); Niewland, *Chem. & Met.*, p. 576 (1923); Niewland, *Chem. & Met.*, p. 513 (1927); Niewland, *Can. Chem. & Met.* pp. 109 and 197 (1930); Partridge, *Ind. & Eng. Chem.*, Vol. 23, p. 482 (1931).

Dolomite in Fertilizers

DOLOMITE, or dolomitic limestone added to complete fertilizers which contain ammonium compounds will prevent them from increasing soil acidity. This is the answer of two U. S. Department of Agriculture chemists, K. C. Beeson and W. H. Ross, to the discovery that certain fertilizers increase the acidity of the soil. The discovery is considered especially important for the South, where much fertilizer is used.

For many years the mixed fertilizers of this country contained approximately equal proportions of Chilean nitrate of soda and sulphate of ammonia. Such mixtures were not acid forming. The new developments that have recently taken place in fixing the nitrogen of the air have changed the situation. Synthetic ammonia compounds now cost less than the natural nitrate of soda, with the result that they are largely replacing the latter in the manufacture of mixed fertilizers. Many of the complete fertilizers now sold in this country are therefore acid-forming in their influence on the soil. If the use of such fertilizers is to continue a serious decrease in the crop-producing capacity of the soils of the United States is likely to result. This has been the experience in other fertilizer-consuming countries.

Two methods are available for preventing an injurious increase in the acidity of the soil in spite of continued use of acid-forming fertilizers. The first consists in separately treating the soil with suitable applications of limestone. This treatment is now being successfully practiced for many crops, but it is not so effective in the case of other crops, such as cotton, that are sensitive to excessive applications of lime. The second method consists in counteracting the acid-forming qualities of the synthetic ammonia products by including in the mixture a sufficient quantity of a suitable liming material.

By using the minimum quantity of liming material required for this purpose, danger from over-liming is eliminated and the expense incident to a separate application of the material is avoided.

The experiments of Ross and Beeson show that although a limited quantity of limestone may be added in certain mixtures, in other mixtures the use of ordinary limestone causes serious losses of ammonia. No serious loss of plant food values results, however, when a suitable quantity of dolomite, or magnesian limestone, is used in fertilizer mixtures.

TURBINES TO FIT THE PLANT

By S. H. HEMENWAY
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East Pittsburgh, Pa.

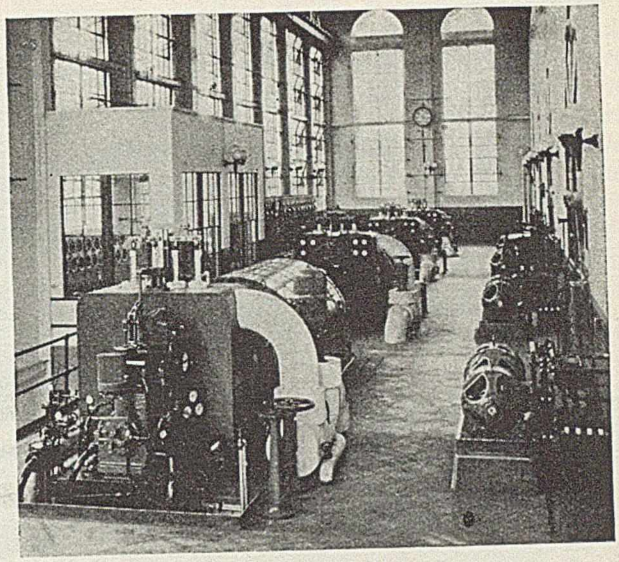

Fig. 1—Turbines supply process steam and maintain constant system frequency

During the past five years a large number of turbines have been placed in industrial plants to generate the power that can be gained as a byproduct of process steam requirements. Great ingenuity has been developed in designing these machines to fulfill particular plant conditions. Such turbines, in addition to developing power, may serve very special and necessary requirements of pressure and frequency control.

Prior to 1918 the standard steam pressure for industrial plants was 200 lb. The development and general application of boilers for higher pressures in industrial plants made possible the generation of a great deal of power in expanding the steam from the higher pressure to that used in the process. Many installations have been made with steam generated at 400 lb. and 600 lb., and a few with pressures up to 1,200 lb. A very comprehensive survey of the power possibilities of such steam generation was given in an article by C. B. Campbell (*Chem. & Met.*, Sept., 1927, pp. 554-9).

Byproduct power is realized by generating steam at a pressure higher than required in the process, and expanding it down to the process pressure through a steam turbine or other prime mover generating power. The heat of vaporization of the exhausted steam is used to carry out the process requirements. In a condensing steam-turbine plant such as is used in most central stations, the heat of vaporization of the steam at the exhaust pressure is an unusable endproduct that has to be carried away by the condenser circulating water. With the condensing steam-turbine cycle, the boiler must add to the feedwater the heat taken away to condense the steam in addition to the heat producing power. With the byproduct power cycle, the only heat in addition to that for the process is heat actually developing power.

The magnitude of the heat quantities in these two steam cycles is represented in Fig. 3. A larger quantity of steam is required to develop a kilowatt-hour with the byproduct power cycle, but the B.t.u. chargeable to power is less. Using the heat values in Fig. 3, with the mechanical efficiency taken as 98 per cent, and the electrical as 96 per cent, results in the following:

Condensing Plant

$$\text{Lb. steam per kw.-hr. (at turb. throttle)} = \frac{3{,}412}{375 \times 0.98 \times 0.96} = 9.65$$

$$\text{B.t.u. per kw.-hr. (at turb. throttle)} = 9.65\ (1{,}332 - 48) = 12{,}400$$

Byproduct Plant

$$\text{Lb. steam per kw.-hr. (at turb. throttle)} = \frac{3{,}412}{111 \times 0.98 \times 0.96} = 32.7$$

$$\text{B.t.u. per kw.-hr. (at turb. throttle)} = 32.7\ (1{,}332 - 1{,}221) = 3{,}630$$

What quantity of power can be obtained in expanding steam from a higher to a lower pressure is shown in Fig. 4. The middle curve shows that in expanding 50,000 lb. of steam per hour from 400 lb. throttle pressure to 100 lb. back pressure, 1,250 kw. of power is generated; from 800 lb. initial to 100 lb., gives 1,850 kw.; and if a throttle pressure of 1,200 lb. is used, 2,250 kw. of byproduct power results.

Dollar savings realized in byproduct power stations for which figures are available give testimony to the effectiveness of this way of saving money. A 1,000-kw. turbine installed in 1928 served as reducing valve between new boilers generating steam at 300 lb. pressure, 200 deg. superheat, and the old 150 lb. boiler-plant line supplying generating equipment and digesters. This unit operated at an average load of 750 kw. The owners state that the value of byproduct power generated in the first 12 months exceeded the cost of the additional equipment required for generating this power.

Because of the small increase in heat required to produce steam at some higher pressure, such as 1,200 lb., instead of at 200 lb., new steam-generating equipment is frequently justified on the basis of the increased efficiencies that can be realized in up-to-date generating equipment. As the increase in heat required is only 10 per cent for the extreme range of 1,200 lb., 200 deg. superheat, as compared to 200 lb., 100 deg. superheat, the increased efficiency of the new equipment may result in

Presented in slightly modified form before the Technical Assn. of the Pulp and Paper Industry, New York, Feb. 13-16, 1933.

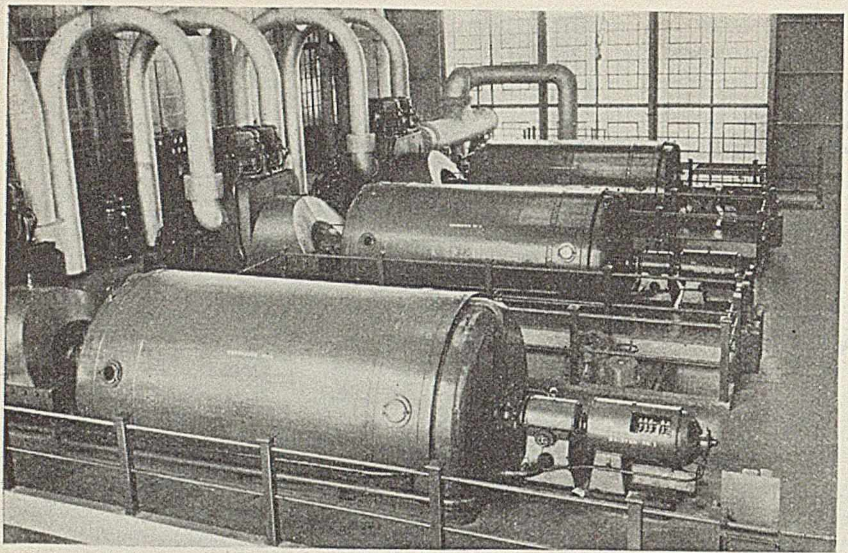

Fig. 2—15,000-kw. turbines in an oil refinery supply process steam and byproduct power

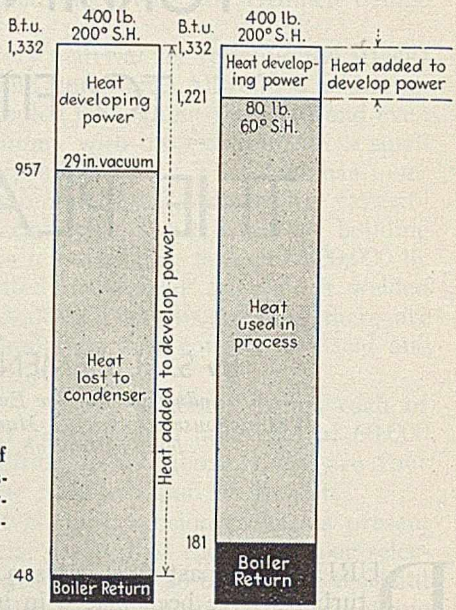

Fig. 3—Comparison of heat use in condensing turbine and byproduct power generation

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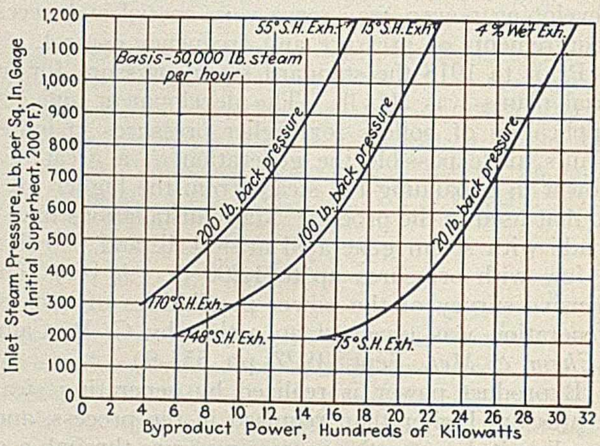
Fig. 4—Power obtainable with turbines exhausting to process



generating the steam at the higher pressure with even less coal than was used at the lower pressures. In this case the power obtained in expanding the steam in the turbine to the lower pressure is only subject to the capital cost of the new equipment.

A recent case of this kind concerns a mill having 6,740 boiler horsepower generating steam at 120 lb. in horizontal, return-tubular boilers. This equipment was in unusually good condition, operating at a boiler efficiency of 68-70 per cent. Two condensing turbines of 750 kw. and 1,250 kw. capacity were used, the balance of the power being taken from hydro units. Two new boilers were installed, generating steam at 425 lb., 125 deg. superheat, and having a combined capacity of 120,000 lb. per hour. This steam is expanded through a 3,000-kw. turbine to the old boiler pressure of 120 lb. The average turbine output is 2,000 kw. The old turbines are still available as spares. The efficiency of the new equipment so far exceeds that of the old that the overall costs have been reduced by the change.

Many such installations have been made in the chemical industries, showing that there is a very general appreciation of the advantages to be gained. But a turbine so installed may serve some other plant requirement so well that the power obtained comes even nearer to satisfying the urge to get something for nothing. The problem of steam-pressure control, temperature control, frequency control, or load control, is often of major importance. Turbines have been successfully applied to cover each of these requirements, sometimes two kinds of control being obtained on one machine.

Pressure Control at One Point

A turbine expanding steam from a higher pressure to a lower pressure may have a pressure regulator on the turbine exhaust. The turbine will then carry just enough load to satisfy the demand for steam at the exhaust pressure.

One of the largest installations of this type is at an oil refinery. Three 15,000-kw., 3,600-r.p.m. turbines take steam at 600 lb., 700 deg. total temperature, and exhaust at 135 lb. The steam passed through each machine is determined by the demand for low-pressure steam, and the electrical power so produced is used in the refinery to the extent of its demand, the balance being fed out to the utility company's line. The utility lines supply power to the refinery when the steam demand is insufficient to generate the power required. This installation is shown in Fig. 2.

Another type of control pressure at one point is the bleeder turbine, which bleeds out sufficient steam to maintain the desired pressure. In addition to the steam bled, sufficient steam is expanded to a lower pressure to generate the desired power. This turbine is then responsive to load as well as pressure.

Still another type of one-point pressure control is the throttle-pressure regulator. This finds application where a higher pressure boiler has been installed to supplement a lower pressure system. It allows the maximum power to be generated in the new high pressure generating equipment of higher efficiency. With this control the turbine passes more steam and carries a higher load where the throttle pressure increases because of a surplus of high pressure steam. An application of such controls is shown in Fig. 5.

The throttle-pressure regulator is frequently used on turbines taking steam from waste-heat boilers. The power generated is thus always the maximum obtainable from the steam so generated. The frequency of the system is determined by other prime-movers operating on a separate boiler plant, or by a utility line with which the plant may be tied in. This has had very wide application in steel mills where much waste heat is available.

An interesting paper-mill application of the throttle pressure control is a 5,000-kw. 25-cycle geared unit taking steam from a 600-lb. boiler in accordance with the steam available. This unit also bleeds at 180 lb. to the present boiler system and exhausts at 20 lb. to the paper-machine drying rolls.

Pressure Control at Two Points

Pressure may be controlled in two different lines by means of a back-pressure bleeder turbine. In this case the turbine bleeds at one pressure and exhausts at a lower pressure, both under pressure control. The load carried is strictly dependent on the demand for steam at the two pressures. Other prime movers on the line determine the electrical frequency of the system.

A number of turbines has been installed to bleed steam at a relatively high pressure, say 100 to 200 lb., and to exhaust at some lower pressure, say 10 to 50 lb. The pressure at which the steam is extracted may be changed by 25 lb. or so simply by changing the number of weights on the bleeder-pressure regulator. A corresponding change may be made in the exhaust pressure. A change in the plant process, requiring the extracted steam to be at an entirely different pressure, may be accomplished with the maintenance of the original efficiency by renozzling the turbine. A turbine installed for a boiler pressure of, say, 250 lb. may later be renozzled to be just as efficient with new boilers generating steam at 400 lb. or 600 lb. pressure, if this is taken into consideration in the original design.

Where waste-heat boilers are used, the turbine control may be arranged to induct steam into the turbine at the bleeder zone, when the process-steam demand is less than the quantity generated by the waste-heat boiler. When the process-steam demand is greater than the steam generated in the waste-heat boiler, steam will be automatically extracted from the turbine to maintain the pressure in the line. This arrangement is shown in Fig. 6.

A double-bleeder turbine may send steam out to two lines at two different pressures, each under pressure control. Sufficient steam is further expanded to a still lower pressure, generally that of a condenser, to carry the required load. Such a turbine may maintain the steam electrical frequency as well as supply steam at the two pressures. An example of turbines bleeding at two pressures is shown in Fig. 7.

In Fig. 8 there is shown an ingenious arrangement of turbines supplying steam at two pressures and generating power, not in accordance with steam demand, but in response to the electrical load demand. A steam accumulator balances the discrepancies between steam and load demands, thus avoiding the use of a condenser.

Temperature Control

Turbines frequently exhaust to a water heater where it is desired to maintain a constant water-outlet temperature with variable water flow. This may be accomplished by having a temperature-control element on the water outlet act on the turbine governor. The more usual way is to have a pressure regulator on the water heater, set for a pressure corresponding to the temperature desired.

A recent installation of this type was made on a 4,000-kw. turbine taking steam at 400 lb., 200 deg. super-

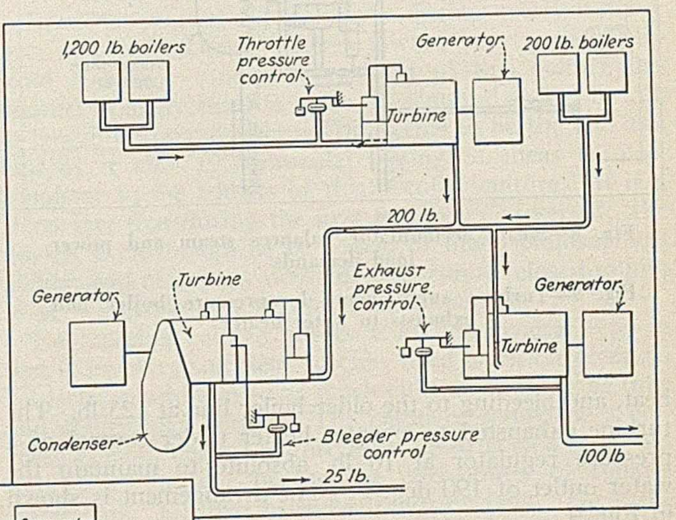


Fig. 5, Above—Turbines controlling pressure at one point

Fig. 7, Below—Turbines controlling pressure at two points

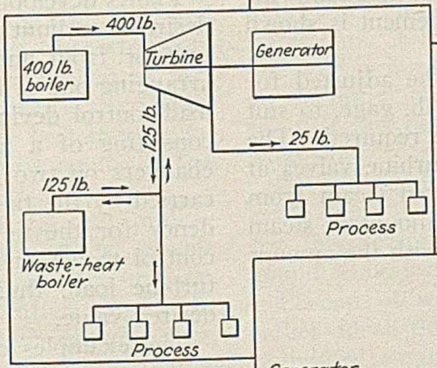


Fig. 6, Above—Turbine takes steam from waste-heat boiler or extracts to process as required

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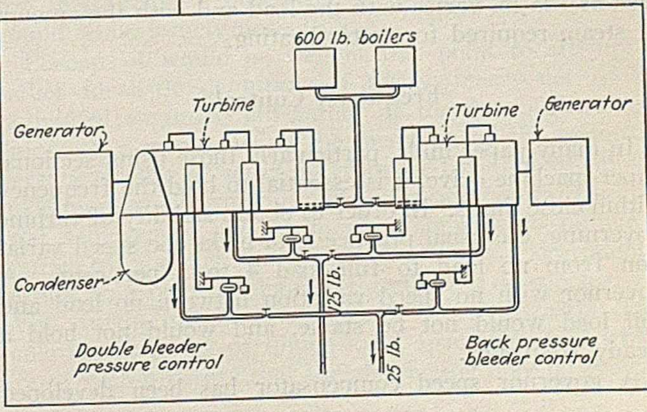
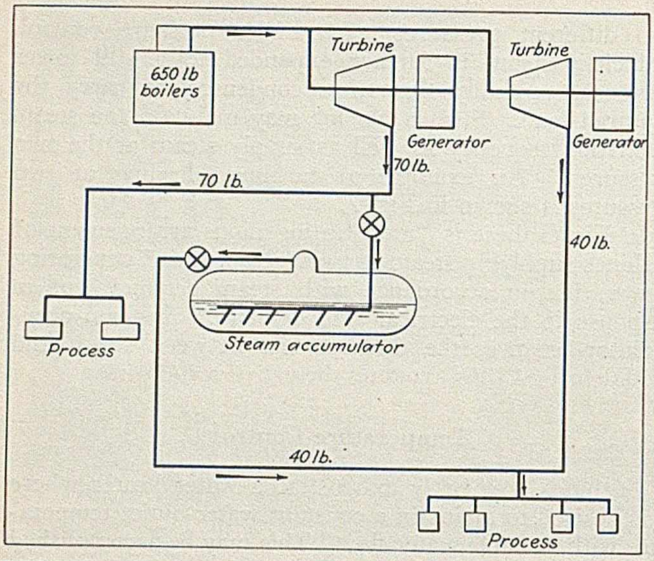




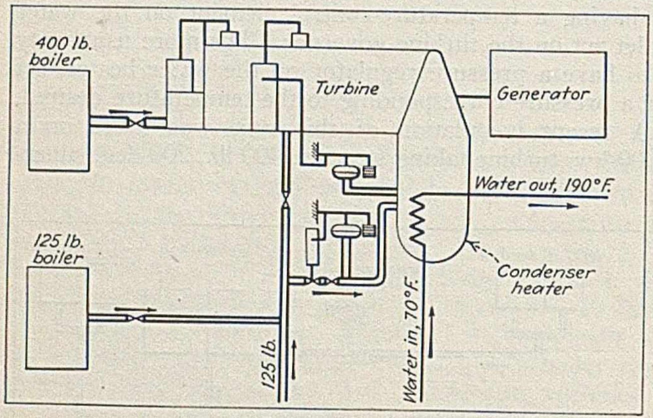


Fig. 8—Steam accumulator balances steam and power load demands

Fig. 9—Turbine supplements low-pressure boiler and exhausts to water heater

heat, and bleeding to the older boiler line at 125 lb. The turbine exhausted to a water heater under control of a pressure regulator at 10 lb. absolute to maintain the water outlet of 190 deg. F. The arrangement is shown in Fig. 9.

This pressure regulator may readily be adjusted for pressures of from 2½ lb. absolute to 2½ lb. gage, to suit various water temperatures that may be required. The regulator controls the opening of the turbine valves at the 125 lb. zone to pass just the required steam from that pressure to the water heater. The amount of steam bled at 125 lb. varies with the load and with the amount of steam required for water heating.

Frequency Control

In many paper mills, particularly those using sectional paper-machine drive, it is essential to hold the frequency within close limits. In order to obtain stability of turbine governing, the usual practice is to make the speed variation from no load to full load 4 to 5 per cent. A governor with no speed variation between no load and full load would not be stable, and would not hold a steady frequency.

A governor speed compensator has been developed combining the stability of the usual turbine governor with the characteristic of holding the same frequency at all loads. This it does by bringing the frequency back to the mean value after any load change. The compensator may be applied to any condensing, non-condensing, or bleeder turbine. Generally only one turbine on the system should be so equipped, and this must be of sufficient capacity to carry all of the load swings.

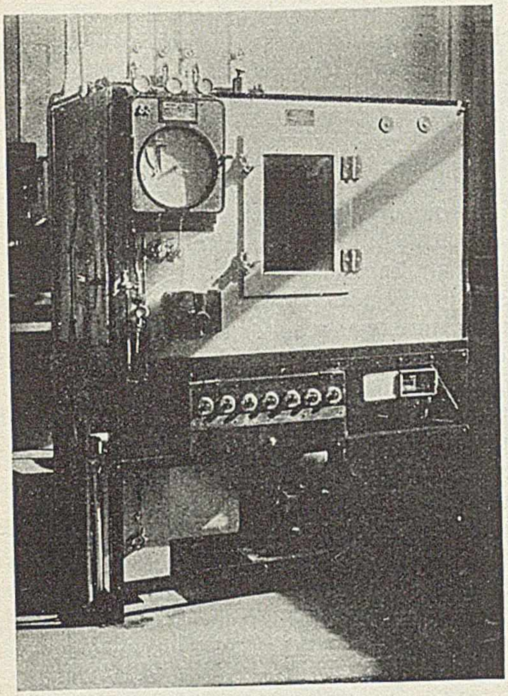
In one plant, we have four non-condensing turbines of 1,000, 1,500, 3,000 and 4,000 kw., operating at 385 lb. throttle pressure, and exhausting at 35 lb. pressure. When operating tied in with an outside power source, these units take steam in accordance with the process steam demand under back-pressure regulator control. Under this mode of operation the frequency is controlled by the outside line. At times when the electrical load is smaller, these units operate separate from the tie-line. The control is so arranged that any one unit may then operate under control of the constant-speed compensator, the others operating under back-pressure control. The unit operating with the speed compensator then controls the frequency of the system, and takes the load swings. Fig. 1 shows this installation.

Plants in sparsely settled areas may take power from a tie-line traversing a great distance of open country. Such a line may at certain seasons be subject to interruptions due to electrical storms. When a back-pressure turbine, or a back-pressure bleeder operates "floating" on such a line, provision is sometimes made to shift the turbine from steam-pressure control to speed-responsive control in case of a change in system frequency. On one such installation, this change-over is made when the frequency varies plus or minus 1½ cycles from 60 cycles. After the change-over to speed-responsive control, the frequency is automatically maintained within ¼ cycle. Under this operation too much process steam may be supplied, and hence may have to be relieved through a relief valve; or too little, which will be augmented by a reducing valve.

Load Control

Plants developing their own power frequently find it desirable to limit the power demand taken from a hydro unit or from an outside line. This may be done by arranging one of the turbines to operate in response to a load-control device. At one plant such a load control, consisting of a wattmeter element, operates the speed changers on two of the four turbines to keep the load carried by the tie-line substantially constant. Any tendency for the tie-line to pick up load causes the load control to act on the turbine governor to increase the turbine load, thus decreasing the tie-line load to the desired value.

The examples cited are representative of turbine installation arrangements to secure the maximum power from the steam generated in connection with industrial processes. The operating requirements of industrial turbines are as diverse as the industrial plants and the industrial processes using them. New plants, new processes, and new conceptions of plant economy bring new requirements of turbine control continually to the fore. It is to be hoped that the turbine applications here considered will bring a wider appreciation and utilization of their money-saving potentialities.



Carrier drying cabinet for determination of drying rates

THE OBJECTIVES OF A COURSE IN CHEMICAL ENGINEERING

By W. R. VEAZEY

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Case School of Applied Science
Cleveland, Ohio

PRIMARILY, the objective of a course in chemical engineering is to train young men in such a way that they shall be able to enter most easily and expeditiously into the creative side of chemical and allied manufacture and control. Secondary objectives have to do with their ability to function properly in relation to other people. We are concerned with the making of a product commonly called a chemical engineer—a product which is recognized as a valued human commodity, yet is scarcely to be defined in any terse statement. It is difficult to set proper limitations about his field of activity, because his contributions to world progress multiply from year to year.

It is perhaps unfortunate that most successful chemical engineers have reached their present vantage points by following extremely diversified paths of training. Very few have had the same preliminary education and each has had his own peculiar personal characteristics. The proper approach, therefore, to the problem of preparing a "blueprint" of a chemical engineer is to consider a composite of the qualifications of the best representatives of this profession rather than to examine a few examples of individual success.

From this viewpoint, it seems obvious that preliminary training must be of such a character as to provide a very broad and general foundation, as early specialization must be avoided because it too often misses the mark. The candidate, after reaching more mature years, decides that he wishes, perchance, to enter the electrochemical field, and behold, he has been given a highly specialized course in petroleum refining. He naturally curses this stupidity and lack of foresight.

On the other hand, the fact must be kept in mind that the graduate must be able to do a few things well when he first takes his place in an industrial enterprise. If he lacks such ability, the so-called hard-headed, close-fisted executives of the industry will deny him the opportunity to develop and display his budding abilities.

In recent years there has been a distinct trend in many arts and pure science courses toward very general cultural training. And the resultant of this culture has seemed in many cases to mean an acquired ability to talk at length on any subject. This seems to be the end and aim of it all. Experimental testing of ideas is most repulsive to the addicts of this peculiar culture. It is a stern fact that during the first few years of service, the novice, even though he be a man of much philosophical ability, will find many doors of opportunity closed to him if he is capable only of "much speaking."

Engineering culture differs from the general type in that it involves sufficient specific, hard work on practical subjects, in addition to as much cultural training as time and ability may permit. The engineer should be a cultured person, but his culture must be of such a type that tomorrow's testing proves the correctness of today's statements. On that basis he stands or falls. He is the one who is buried instead of the patient if he performs an operation and the patient dies. We must not lose sight of this peculiarity when we plan for an engineer's education.

Great freedom of election of studies by students generally leads to "snap courses" or poorly balanced ones; for this reason a good course in engineering will be found to be largely non-elective.

Perhaps it would be well at this point to attempt a rather idealistic definition of an engineer—not of an individual engineer, but rather of the group characteristics. We would define the members of the group as persons capable of selecting from the base-line of human imaginings the sector most likely to point toward industrial achievement, and who are then able to pursue a course of abstract reasoning, guided by experimental testing, to a point of definite formulation of conclusions. Who, furthermore, are competent to visualize this formulation in terms of dimensional space concepts which are of such a nature that the abstraction may be evolved by plan and structure into an industrially useful arrangement of matter.

As a matter of practical work-a-day observation, four types of engineering personalities normally enter into the make-up of the successful group.

First, those who are skilled in picking proper problems for others to solve; such men become identified with engineering management.

Second, abstractionists, competent in fundamental research and mathematical formulation.

Third, practical development men, skilled in visualizing the abstract formulations in terms of concrete entities and in building working models.

Fourth, construction and operating superintendents, capable of beginning with working models and proceeding with the building and operating of full-sized plants on the most economical basis.

We have no statistical data on the proportions of each of these classes required in practice, but our own general observation leads us to assume the following orders of magnitude: 2 managers to 1 abstractionist, to 25 development experts, to 80 construction and operating superintendents.

A few good managers can pick enough fruitful research problems to keep a large group of research and development workers busy indefinitely (and, incidentally, to keep the financial men busy finding the money to carry on the enterprise). A few high-class abstract thinkers can evolve sufficient worthy conclusions to tax to the utmost the resources of a large organization if the ideas are to be commercially developed. It seems evident, then, that the major attention in a four-year undergraduate course in chemical engineering should be centered upon the needs of the third and fourth classes, the development, production, and operating engineers. The needs for abstract thinkers must be filled from the ranks of the higher grade degree men in the field of pure science, and the management group must draw from those trained from school days by long industrial experience and contact.

Having glanced at general objectives and backgrounds, perhaps we may now turn with profit to a brief consideration of some more immediate aspects of the problem of a course in chemical engineering.

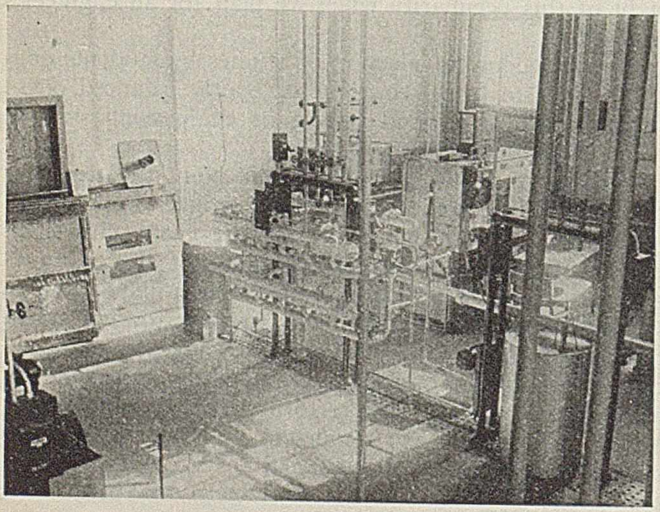
Experience has long ago convinced us that we must regard the school as a "hot house" where seeds are planted and seedlings sprouted and cared for until they are able to take root and grow in a sterner environment. Engineers cannot grow to full stature in a scholastic environment, and a well-designed course of study will keep this fact to the fore.

The formal school period is successful in its function if it produces in each student a definite mental attitude coupled with adequate knowledge (a state of mind which always regards a problem unsolved until tangible, economically sound, commercial results have been obtained). While the mind of the scientist is properly satisfied with a clear explanation of fundamental causes, the engineer can be content only when natural laws are utilized to satisfy some human need. In his school period of training the engineer must therefore attain certain objectives. He must know well a large part of the subject matter which he studies in the first two years. He must acquire the ability to analyze, weigh, evaluate, conceive, devise, and create in connection with the problems presented to him in the last two years. He must learn that passing courses, making points for graduation, and winning a diploma is an almost total waste of time, if that is all he acquires from his school processes. He must learn to be absolutely honest in the performance of all experimental work and in the consideration of natural laws and theories about scientific matters. He must learn that when an attempt is made to falsify the record for the purpose of saving time or labor, the truth cannot be perceived and without truth in engineering all investment of ourselves results in total loss. Nothing is more ridiculous and absurd than to deal dishonestly with natural laws. They always win.

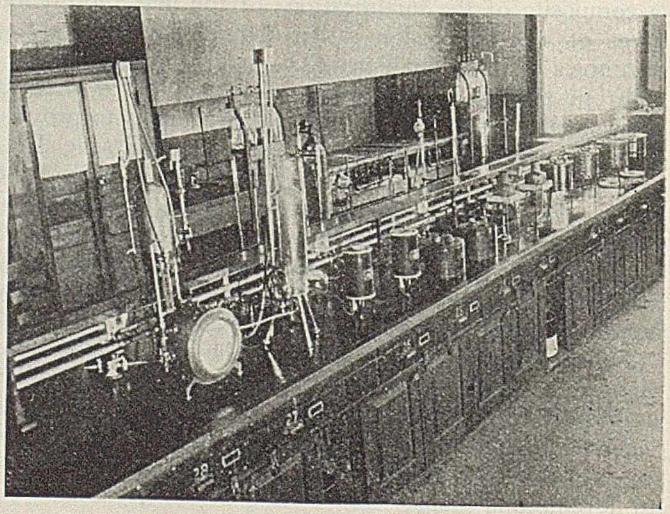
A good diet is not exclusively this or that, but consists rather of a proper proportioning of food elements, each in its right amount and applied at the right time. So the mental diet of the engineering student must consist primarily of work on the material presented in the course of study, properly seasoned with humanistic activities, such as athletics, literary work, and social functions.

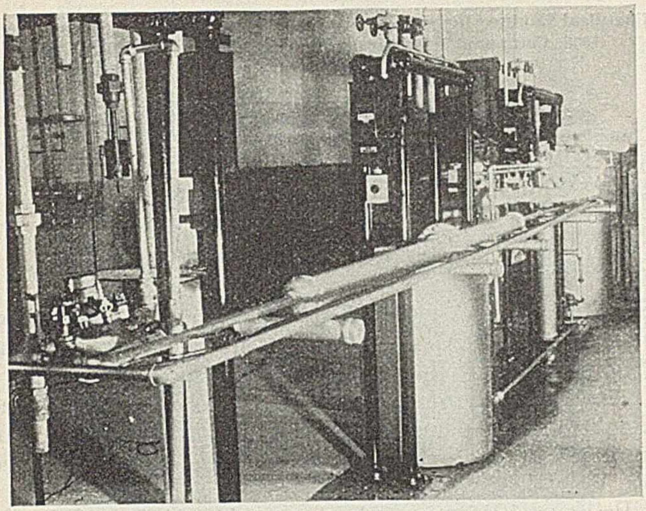
An attractive apple is one which has a core filled with healthy seeds, seeds that will grow when planted in a new environment. It also has a fleshy body of nutritious

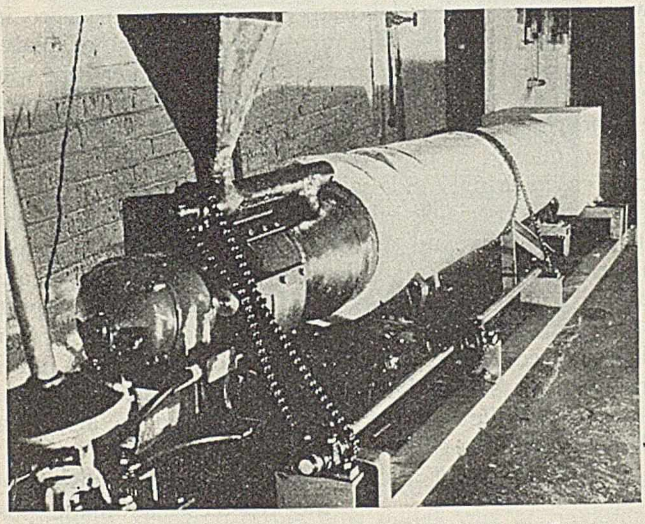
View in laboratory showing service outlets



Testing apparatus for fuels and lubricants







Above: Installation for determination of friction losses in pipes

Below: Gas-fired rotary dryer for determining drying capacities and heat balances

material, and an attractive outer skin. If the apple were all skin, its value would be small; it would be just a piece of wood. If it were all flesh, it would quickly rot, because it is not properly protected from decay; if all seed, it would undoubtedly be classed as a nut.

So with the engineer! During his school period he must build for himself a seed core of mental attitude capable of great accomplishment in later life. He must acquire a body of nutritious knowledge to sustain him while the seeds germinate, and he must develop a skin of social and physical graces which makes him attractive to other men. Over-emphasis of any one element must not be permitted if we are to avoid producing a "blockhead," a "brainy freak," or a "social nut."

In later life, engineers are definitely responsible for the making of things of quality, in quantity, at a low cost, and in such a way that human misery is prevented and life generally enriched. It is this humanistic element that makes engineering really fascinating. Realizing this side of the problem we can see that there is no such thing as an independent, self-sufficient branch of engineering. For when we set out to produce definite things of high quality, in quantity, at low cost, and in such a way that everybody lives better than before, then it is evident that more than engineering and science is involved. Our teaching must definitely make the student think of life in terms broader than the mere technical details involved.

Science, philosophy, economy, religion, poetry, and romance readily find their place in this concept of engineering, and the game is fascinating, but it is ultimately worth while only in so far as it succeeds in assisting plain, common-place people to be happier in their everyday life.

The job of schooling the chemical engineer, viewed in this light, is a large order, and should be so planned that the best objectives and mental attitudes may be established in the student's mind and in a way that will tend to guide him toward the proper goals.

After the first year of conditioning, our method is to devote the sophomore year largely to the acquisition of fundamental scientific data and laws. The junior year is a rather detailed inquiry into the language of engineering and the application of principles of science as displayed in historical engineering accomplishments, and the gaining of an acquaintance with the unit process equipment of today. We also touch a little upon the economic and social aspects of life. The senior year directs its attention to the application of the student's knowledge and ability; to the analysis and solution of new and original problems, research methods, equipment and plant design, and more detailed economic and social studies.

What Chemical Engineers Should Study

Illustrative of such studies of the needs of chemical engineering education is that of the American Institute of Chemical Engineers which, after an intensive and extended study, has reached the conclusion that a properly balanced 4-yr. course in chemical engineering should cover the following subjects:

	Per Cent		Per Cent
Chemistry	28	Physics	8
Chemical engineering	12	Mechanics	6
Other engineering	14	Other sciences	2
Mathematics	12	Cultural subjects	15
Electives	3		

The Institute "believes that the training in chemical engineering should include not only lecture and classwork, but also a generous amount of laboratory use of chemical engineering equipment on a semi-plant scale.

"Instruction in chemical engineering design, chemical engineering economics, and a thorough training in the fundamentals of chemical engineering unit operations is essential.

"It is also desirable that the department of chemical engineering present a course on Sources of Information or its equivalent to familiarize the student with patent literature, governmental reports, bibliographies, trade catalogs and journals, abstract journals, publications of societies, the resources of libraries, and the activities of scientific and technical organizations throughout the world." In this connection, a reading knowledge of at least one foreign language is required.

The Institute recommends that chemical engineering curricula omit courses in civil engineering (except relating to materials of construction), sanitary engineering, mining engineering (except geology), electrical engineering beyond its fundamentals, and other branches of technology, with a view to reserving such subjects for graduate studies.

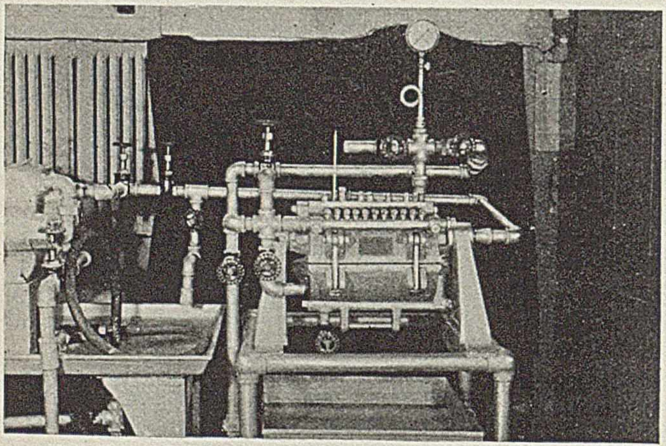
The Institute emphasizes the importance of a proper training in English and other cultural subjects vital for full realization of professional opportunity in any field. In its report of Dec. 15, 1931, the Institute recognized eighteen institutions in the United States as prepared to teach chemical engineering according to acceptable standards. Those included on the accepted list were*:

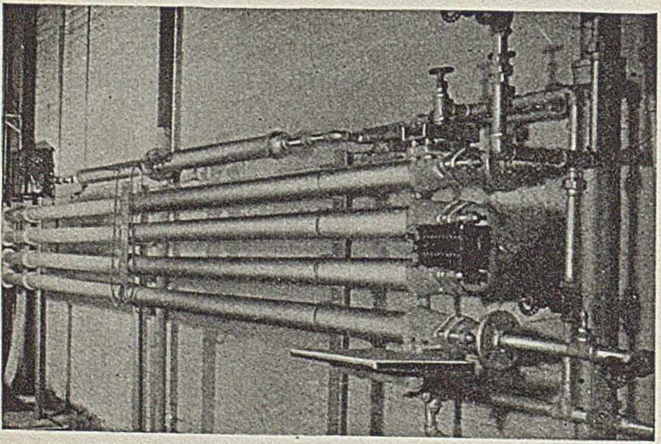
Armour Inst. of Technology	Rensselaer Polytechnic Inst.
California Inst. of Technology	University of Cincinnati
Carnegie Inst. of Technology	University of Iowa
Case School of Applied Science	University of Michigan
Columbia University	University of Minnesota
Iowa State College (Ames)	University of Pittsburgh
Massachusetts Inst. of Technology	University of Washington (Seattle)
Ohio State University	University of Wisconsin
Polytechnic Inst. of Brooklyn	Yale University

A position on this list is not a permanent acquisition, but frequent checkups are made to determine whether the favorable conditions still prevail. This fact is quite stimulating and is a decided aid in securing the cooperation of administrative officers and trustees in providing conditions and equipment as may be needed to maintain a favorable rating.

In passing, it may be of value to picture the evolution of chemical engineering at Case School of Applied

*Lehigh and Purdue have since been added to the list.





Above: Sweetland experimental pressure filter
Below: Concentric-pipe heat transfer apparatus

Chemical Engineering Course at Case School of Applied Science, 1886-1933, Compared With Present Schedule of American Institute of Chemical Engineers.

	A.I.Ch.E. Schedule	Case 1886	1896	1906	1916	1926	1932	1933
Chemistry	28%	53.8	60.5	50.4	47.4	45.7	25.5	25.8
Chemical engineering	12	0	0	0	2.8	5.1	19.0	15.6
Other engineering	14	0	0	16.8	18.9	17.6	14.5	14.8
Mathematics	12	15.8	11.6	8.1	6.6	7.5	11.6	11.6
Physics	8	11.8	8.6	7.1	7.3	7.4	7.7	7.8
Mechanics	6	0	0	5.1	2.8	4.2	4.5	4.2
Other science	2	5.4	7.7	2.9	1.7	3.7	0.7	0.7
Cultural subjects	15	13.2	11.6	9.6	9.7	8.8	16.5	15.6
Electives	3	0	0	0	2.8	0	0	3.9

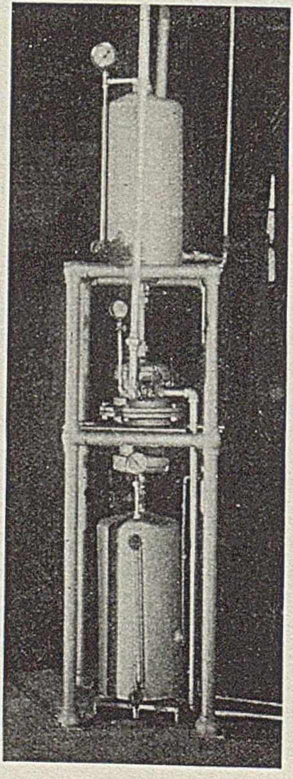
Science. In the statistical table is shown a comparison of the course at Case over about five decades, with the 1933 schedule of the Institute of Chemical Engineers.

Another item of interest which has been given due weight in our plans for the future is the changes in employment opportunities for chemical engineers since the War.

Prior to 1915, more than one-third of the graduates went into analytical laboratories; 78 per cent were included in the fields of graduate study, teaching, analytical laboratories, and research, and only 22 per cent were engaged in plant development and operation, general engineering, and sales. After the War, 55 per cent have been employed in plant development and operation, general engineering, and sales; 22 per cent in research (chiefly industrial); with only 23 per cent in graduate study, teaching, and analytical laboratories. A change has therefore been made in the curriculum, with greater emphasis on unit processes and the quantitative aspects of chemical engineering operations. Studies of the financial, economic, and social welfare phases of industry are also stressed. These facts have necessitated a decrease in the amount of time allotted to analytical chemistry and to general descriptive subjects.

During the past three years generous provision by the trustees has made possible extensive additions to laboratory equipment to permit proper changes in the curriculum to meet present-day conditions. This new equipment, representing an expenditure of more than $30,000, is not conventional in type, but a rather unique setup for laboratory instruction. The design and layout of this new apparatus and the formulation of experimental procedure has been in charge of Dr. C. F. Prutton, associate professor of chemical engineering. The pictures and captions used in this article are a few taken from those prepared by him in connection with a lecture, on Feb. 15, before the Cleveland section of the American Chemical Society. On the same occasion, the writer delivered a paper on the aims and objectives of a course in chemical engineering, similar to that given above.

Experimental filter for vacuum or pressure



Courtesy Georgia Forest Service

A 20-year-old stand of Longleaf Pine in Georgia

Georgia Pines for Sulphite Pulp and Newsprint

By GEORGE M. ROMMEL
Formerly Industrial Commissioner for Savannah
Savannah, Ga.

IN THESE DAYS of change and progress, the systematic research effort now under way at Savannah, Ga., to determine the possibilities of young southern pines for the manufacture of white paper and newsprint is receiving wide attention. The vision of these possibilities inspired gifts totaling more than $50,000 from the Chemical Foundation, Inc.; it won the cooperation of machinery manufacturers who furnished much of the equipment on a non-profit basis; it attracted annual appropriations of $20,000 from the State Legislature of Georgia, and brought the Savannah community into the picture with a building, power, light, fuel, gas, water, wood, and direct financial contributions totaling fully as much as the appropriation made by the state. It produced in a remarkably short time an experimental plant said to be the last word in excellency. (For a detailed description of the plant, see *Chem. & Met.*, Vol. 39, August, 1932.) Unusual in such ventures, results began to appear in a few months. Starting at scratch on Jan. 2, 1932, pulp from the new plant was exhibited the following June.

Visitors come to the plant, some of them in a skeptical frame of mind, and leave impressed not only by the idea behind it but with the soundness of the policies and the methods of the management. A large party from the State Legislature inspected the plant last winter, the Senate adjourning its sessions over the week-end and coming *en masse*. The State Solons returned to Atlanta enthusiastic over what they saw and determined to carry on. The Legislature voted later to continue the annual appropriation of $20,000 for a second two-year period.

If a new Georgia industry is to develop on this foundation, the leaders in the pulp and paper business must be convinced that there are merit and profits in the proposition. Many persons who are well known in the industry have come to Savannah from time to time, most of them unheralded and unannounced, making their visits quietly. Now, as a result of the persuasive enthusiasm of Dr. Charles H. Herty, the genius behind all this, and in response to the invitations of the Georgia Forestry Association and the Savannah Chamber of Commerce, a large group of leaders in the industry, chemists, executives, and so on, truly a representative body, are planning to sail from New York, April 28 via the Ocean Steamship Co. On arriving at Savannah they will attend the annual meeting of the association May 1 and 2, to see for themselves the work of the Georgia Experimental Pulp and Paper Plant and to get acquainted with the timber owners of Georgia, who believe that they have the greatest tree-growing country east of the Rocky Mountains and welcome the chance to prove it.

As readers of *Chem. & Met.* know, Charlie Herty himself is actively in charge of the plant. He has an amazing way of winning the interest and firing the enthusiasm of the technical men in the industry. First, George C. MacNaughton was supervisor, and then W. G. (Bill) MacNaughton who succeeded him last January when George joined the Everett Pulp and Paper Co. at Everett, Wash. In charge of the testing laboratory is W. F. Allen; Bruce Suttle, an old hand in the southern kraft business; George Lindsay, loaned by the Pusey and Jones Co., and F. W. Hendrix look after the machinery; and a group of young chemical engineers; James Dempsey, S. W. Noble, J. S. Fox, and F. S. McCall, most of them volunteers, make up the rest of the staff, together with two colored men whose strong muscles and loyal hearts are highly valued and whose faces are not barred from official staff photographs.

Those who know Herty do not need to be told of his rigid insistence on factual data to back up statements. That fundamental principle of research is consistently adhered to in the conduct of the plant at Savannah. No figures are released until they have been duplicated; if for any reason it is necessary to make generalizations such statements are always hedged around with cautionary provisos and admonitions.

The rapid growth of southern pines is the first point to be remembered in this new pulp and paper story. It has been told so often that it need not be stressed here, but there is a new angle which seems to show that pine-tree production may be added to Georgia farm practice to the advantage of the farmer.

Intercropping Experiment

Marion Renfroe, a Brooks County, Ga., farm boy, got the idea that he could do something interesting with slash pine on his father's farm by growing corn between the rows of trees to pay for the cost of planting them. So he measured off two acres, got seedlings from the State University at Athens, and kept careful records of every item of cost, including taxes, interest, and other expenditures. At the end of the first year, he had $3.27 above costs, with the trees and planting all paid for by the net proceeds from his corn crop. At 1 year and 3 mo. his trees averaged 4 ft. in height, with some of them 6 ft. high. Young Renfroe planted corn between the rows the second year, at the end of which time they were 7 ft. high, twice as high as trees planted at the same time on similar land near by which was not cultivated. The Savannah plant has made paper out of slash pine thinnings 7 yr. old. Renfroe's experiment seems to indicate that it is possible by cultivation to shorten still further the time required to produce pulpwood, paying for the trees at the same time by intercropping. It may be only 5 yr. between seed and market.

We are dealing with simple arithmetic. You can get pulpwood from Georgia pines in 10 yr. or less from seed. Using Forest Service estimates as the basis, the maximum time for Georgia pine is not over one-third the time required to produce spruce pulpwood in the most favored sections of the North. If we compare the time required to produce some of the wood used in northern mills, that from northern Russia for example, or even some native spruce, it is as low as one-twentieth or even less.

In most of the Georgia pine country natural reforestation will reproduce the forest stand and for best results the young trees should be thinned. After the surplus saplings are removed, later thinnings are large enough for pulpwood. Where artificial planting is done somewhat thickly, the first thinnings will do for pulpwood. These thinnings are a potential source of enormous future supplies. Production of pulpwood based to a large extent on thinnings from an integrated forest industry takes Georgia at one jump out of the possible category of a country devastated to feed the pulp mills.

The second point to remember is that young Georgia pines contain no heartwood. In the case of slash, longleaf, loblolly, and shortleaf pine, and probably with Virginia also, heartwood does not begin to form until the tree is at least 25 yr. old. Up to that time the tree is composed entirely of sapwood which contains no more resin than northern spruce. This young pine sapwood was never differentiated from run-of-the-woods southern pine until Herty began his work on it some 5 yr. ago. He has proved that it is to be regarded as an entirely new paper-making material.

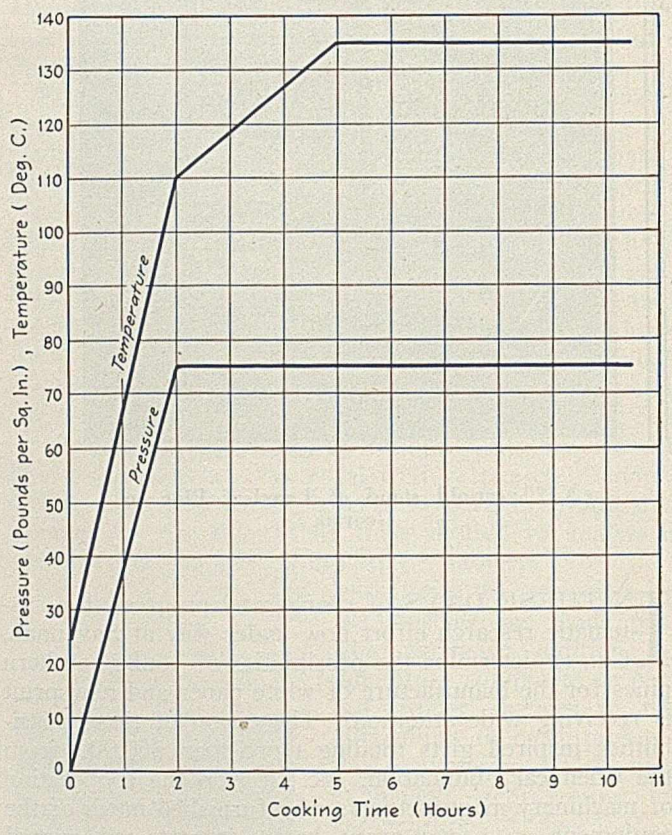


Fig. 1—Varying Cooking Conditions

The third point is a physiological puzzle. The gum turpentine from which the naval stores of commerce are distilled is not in the tree as it stands. Cut the smallest of slash or longleaf saplings and the gum pours forth. But a chemical analysis of the wood does not reveal its presence. Where does it come from? How can you get it if it isn't there? The answer is a paradox, and "a paradox", an old professor once told me, "is something which sounds like a lie but isn't".

Basing his statement on the findings of Tschirch of Switzerland, Herty's explanation is that the resin found in the sapwood of southern pines and other conifers on chemical analysis should be classed as "physiological resin", while that which exudes when the tree is wounded is of a different nature and should be regarded as a pathological product secreted instantly by the tree to heal the wound. This seems to be the only explanation which is satisfactory in the light of our present knowledge of pine-tree physiology. The healing function is obvious, because in naval stores practice regular and successive chippings are necessary throughout the season to maintain the flow of gum. There may be an analogy between the activity of the cells of a pine tree under the stimulus of a wound and that of certain cells in the animal body. The secretion of the salivary glands, for example, is enormously stimulated by hunger.

When the work began at Savannah it was assumed that a certain time should be allowed for the wood to season after being cut, in other words, "for all the gum to run out". It was therefore thought necessary to let

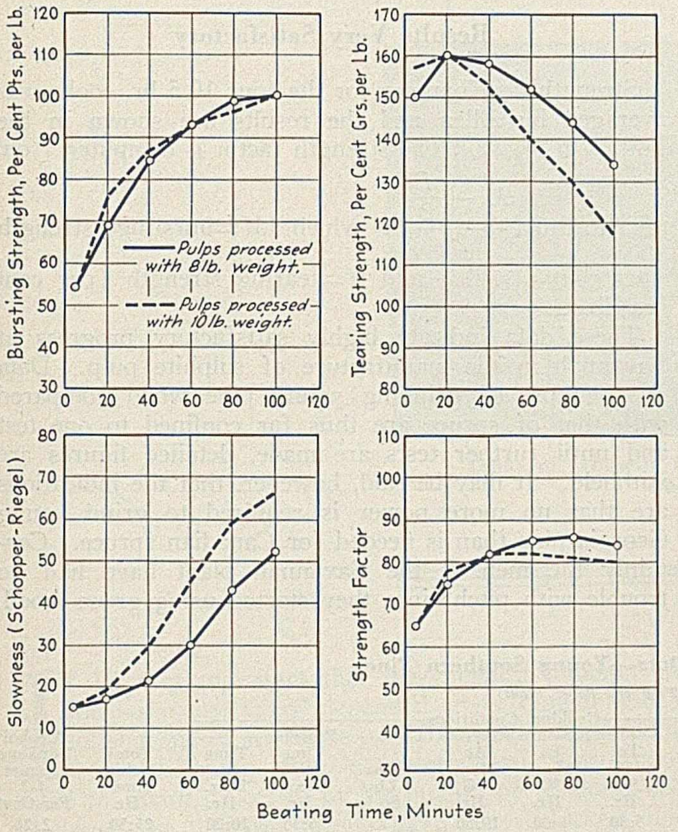


Fig. 2—Average of the strength for four 10.5-hr. cooks

the tree lie for three to five weeks for this purpose. But in this time sap stain often develops, a fungus which thrives abundantly on cut sapwood during the summer. Wood contaminated with it made grey pulp and real trouble loomed. Then the thought was suggested to try green wood freshly cut. And it worked. Within 24 hr. of the time that longleaf and slash trees were standing in the forest, the wood cut from them was converted into beautiful white pulp. Groundwood which meets rigid standards of color is made from this green pine. There is no trouble from gum or resin at any stage of the process from pulping and grinding to finished paper. All wood used now at Savannah is green and freshly cut. That adds another talking point to the whole proposition, for it materially simplifies the storage problem, both for the manufacturer and the producer. It makes Georgia pulpwood a daily farm crop, like eggs and milk.

Readers of this article who have accepted the truth of the statements as to the rate of growth of southern pines, the freedom of young trees from heartwood and the resin phenomenon will want to see the technical evidence of the suitability of the wood of young Georgia pines for white paper and newsprint. I am privileged to give some of the cooking and testing data from the Savannah plant, taken from a hitherto unpublished paper by W. F. Allen and presented with Dr. Herty's permission.

The species studied thus far have been slash pine (*pinus heterophylla*), longleaf (*P. palustris*), loblolly (*P. taeda*), shortleaf (*P. echinata*), and Virginia (*P. Virginiana*), the first two of which are the source of practically all the naval stores produced in the United States. In the following data from the plant laboratory detailed figures are shown on cooks of slash, loblolly, Virginia and a mixture of slash and loblolly. There is no necessity to discriminate between the pulping characteristics of different species. Each species was studied separately at first, but when the results were compared, even after having subjected the resulting pulps to every known test, no differences were apparent. Hence, Allen concludes that "the sulphite pulps from all species of young Georgia pines are so similar that it is impossible to distinguish between pulps produced from any species."

Sulphite From Young Pine Thinnings

After having made 46 cooks under close study it was decided to determine "optimum cooking conditions conforming to the practice used commercially." The first cook following this decision was made at a low temperature, the total time required being 25 hr. and 50 min. (See No. 47, Table I). This pulp had an excellent color and closely resembled commercial Mitscherlich pulp. In Allen's opinion, "this cook proved beyond any doubt that sulphite pulps conforming to all commercial demands were possible from young pine thinnings," giving evidence of the point at which commercial newsprint sulphite was possible.

The next step was to study the effects of cooking for a shorter time at higher temperature. So, in succeeding cooks the temperature was gradually raised and the time shortened. In the first 5 cooks for which data are given (Table I) the temperature rise to 110 deg. C. required from 4 to 5.5 hr. It was evident that at least 2 hr. could be cut from the total cooking time without injury to the resulting pulp and a change was made gradually in that direction until the time for the temperature rise to 110 deg. C. was reduced to 2 hr. with a total cooking time of 10.5 hr. There was no injury to the pulp produced and every evidence of complete penetration. (See cooks Nos. 56 to 59 inclusive, Table 1).

Good yields of screened pulps were obtained from these cooks, with a maximum of 49 per cent a minimum of 39 and a usual run of 43 to 45 per cent. According to Allen, "The yield of flat screenings (rejection on 0.012 in. cut plates) has in every case been within the limits of commercial practice and in most cases has been exceedingly low. The maximum yield has been 6.10 per cent, minimum yield 0.13, with the average between 0.25 and 0.75 per cent.

"Cooks of both seasoned and green chips have been made. In no cases have any evidences prevailed indicating that green chips are more resistant to the pulping action than the seasoned chips. Pitch has not been evidenced in either case.

"No beneficial effect of a high content acid has been shown. It is evident that the maximum strength of the acid does not have to be over 5.50 per cent total SO_2, and prevailing indications seem to show that complete pulping is possible with an acid of 4.5 to 4.75 per cent total SO_2 and 1.00 to 1.40 per cent combined SO_2."

In discussing the preparation and testing of handsheets, Allen points out that the sulphite fibers of pine pulp are different from those of spruce. Under the microscope the pine fibers from the springwood ring are found to be "flat, ribbon-like, thin-walled and very transparent", while the fibers from the summerwood ring are dense and tubular and less transparent. For these reasons it was necessary to adapt the methods of refining pulp and the preparation of handsheets for physical testing to allow for the differences between pine and spruce fibers. Allen describes his methods as follows:

"The refining of the pulp was accomplished by means of a small laboratory beater equipped with controlled bed plate. The intensity of the beating may be either increased or decreased by adding to or taking weights from the control arm of the bed plate. The stock is added to the beater at 2 per cent consistency to the amount of 23 liters. The predetermined weight is added to the bed-plate control arm and the beating is allowed to progress for 5 min. at which time the first sample is taken. One liter of stock is removed and made into handsheets for physical testing and the quantity remaining after the sheets are made is tested for slowness by means of the Schopper-Reigel slowness tester. This same procedure is repeated at intervals representing beating time of 20, 40, 60, 80 and 100 min. utilizing both 8 and 10-lb. weights on the bed-plate control arm.

"All physical tests were made under controlled conditions of temperature and relative humidity (70 deg. F. and 65 per cent R. H.). The handsheets were subjected to these conditions for a period of 12 hr. before testing. The bursting-strength test was made on a Mullen tester and the results expressed in per cent points per pound basis weight 24x36—500. The tearing-strength test was made on an Elmendorf tearing tester and the results expressed in per cent grams per pound basis weight 24x36—500."

Data secured from physical tests of handsheets made from the cooks described in Table I are shown in Table II. Observe that two sets of data are given for cooks Nos. 56 to 59 incl., each of which had a total cooking time of 10.5 hr., one set of these data showing results with a weight of 8 lb. on the bed-plate control arm and the other set with a weight of 10 lb.

Results Very Satisfactory

Strength development for the four 10.5 hr. cooks was averaged by Allen and the results are shown in the graphs in Fig. 2. The strength factor is computed from the formula $\frac{M + \frac{E}{2}}{2}$ in which M=bursting strength (per cent pts./lb.) and E=tearing strength (per cent grs./lb.).

These data indicate highly satisfactory progress at Savannah in the manufacture of sulphite pulp. Data on the cost of grinding young pine wood compared with that of spruce are thus far confined to one test and until further tests are made, detailed figures are withheld. It may be said, however, that the indications are that no more power is required to grind young Georgia pine than is needed for Canadian spruce. Certainly the men at the Savannah plant have had no trouble with pitch since they started using green wood.

Table 1—Sulphite Cooking Data—Young Southern Pine

(Georgia Experimental Pulp and Paper Plant)

Cook No.	Kind of Wood (1)	Acid Analysis (2): Total SO_2 %	Free SO_2 %	Combined SO_2 %	Ratio of Acid to Oven Dry Wood (3): Gal. per Lb.	Lb. per Lb.	Cooking Conditions: Temperature Initial °C	Temperature Max. °C	Temperature Rise: To 110 °C Hr.	To Max. °C Hr.	At Max. °C Hr.	Pressure: Max. Lb./Sq.In.	Time to Max. Hr.	Time at Max. Hr.	Total Cooking Time Hr.	Alcohol Benzene Extract 1-2 Per Cent
47	Ly.	5.81	4.42	1.39	0.57	4.75	24	116	5:30	6:00	19:50	75	5:30	20:20	25:50	2.28
49	Ly.	5.50	4.42	1.08	0.76	6.28	23	120	4:00	6:00	12:00	75	5:30	12:30	18:00	....
50	Va.	5.84	4.51	1.33	0.60	4.96	25	127	4:25	7:00	10:45	75	4:30	13:15	17:45	....
51	Va.	5.45	4.18	1.27	0.59	4.91	24	132	4:00	5:30	11:30	75	4:30	12:30	17:00	2.80
52	Ly.	5.85	4.15	1.70	0.97	8.06	23	135	4:00	6:30	7:00	75	4:00	9:30	13:30	2.28
54	Sh.	5.64	4.06	1.58	0.69	5.75	24	135	3:00	6:00	3:50	75	3:00	6:50	9:50	2.61
55	Sh.	5.31	3.79	1.52	0.70	5.81	25	135	2:30	6:00	5:45	75	2:30	9:15	11:45	2.81
56	Ly.	5.54	3.99	1.55	0.62	5.18	25	135	2:00	5:00	5:30	75	2:00	8:30	10:30	3.32
57	Ly. and Sh.	5.48	3.88	1.60	0.59	4.92	25	135	2:00	5:00	5:30	75	2:00	8:30	10:30	3.37
58	Sh.	5.58	4.07	1.51	1.05	8.75	24	135	2:00	5:00	5:30	75	2:00	8:30	10:30	3.14
59	Va.	5.40	3.78	1.62	0.61	5.06	25	135	2:00	5:00	5:30	75	1:30	9:00	10:30	....

(1) Loblolly — Ly., Virginia — Va., Slash — Sh. (2) Analysis of acid as pumped to digester.
(3) Acid ratios calculated from volume of acid charged plus water in chips. Moisture content of green chips 52% to 58%.

Table 2—Physical Test Data of Pine Sulphite Handsheets

(Georgia Experimental Pulp and Paper Plant)

Cook No.	Consistency of Stock in Beater in Per Cent	Weight on Beater Bed-plate Control Arm in Lb.	After 5 Min. Beating: Burst	Tear	Slowness	After 20 Min. Beating: Burst	Tear	Slowness	After 40 Min. Beating: Burst	Tear	Slowness	After 60 Min. Beating: Burst	Tear	Slowness	After 80 Min. Beating: Burst	Tear	Slowness	After 100 Min. Beating: Burst	Tear	Slowness
47	2.0	8	....	....	....	76.8	147	17.0	90.4	138	30.0	103.0	136	36.5	105.5	135	51.5	82.0	128	62.0
49	2.0	8	63.0	153	14.5	73.5	146	15.0	76.1	141	16.0	92.0	139	20.5	97.0	127	28.0	106.0	125	37.0
50	2.0	8	45.4	157	15.5	65.3	153	16.5	84.0	150	18.5	99.9	140	24.5	102.8	137	31.0	98.5	147	41.5
51	2.0	8	26.6	153	12.5	56.6	173	14.0	72.5	179	16.0	84.4	193	20.0	96.5	170	27.0	103.5	164	34.5
52	2.0	8	29.4	110	13.5	52.3	125	15.0	70.4	129	17.5	73.0	132	23.5	78.0	132	37.5	86.8	128	43.5
54	2.0	8	55.8	139	14.0	73.3	141	15.5	83.4	136	19.0	99.2	128	26.0	103.0	121	42.3	101.5	114	57.0
55	2.0	8	32.6	112	14.0	55.6	146	15.0	75.4	151	18.0	92.6	145	22.0	97.8	150	31.0	106.7	138	42.3
56	2.0	8	48.6	152	14.0	66.7	156	16.0	85.4	155	19.5	91.5	148	29.0	96.8	145	44.5	99.7	134	52.0
57	2.0	8	52.4	145	14.0	66.8	164	16.5	84.4	163	22.5	98.2	161	32.5	104.5	157	47.0	99.8	148	58.5
58	2.0	8	62.0	142	16.5	74.6	143	18.5	84.0	142	25.0	89.0	135	32.5	93.2	117	47.0	96.3	116	54.5
59	2.0	8	54.7	161	15.0	67.4	175	16.0	84.5	171	19.5	93.3	163	24.5	102.0	155	33.0	106.5	138	43.0
56	2.0	10	50.1	145	14.5	66.0	156	18.0	84.4	155	28.5	93.0	142	45.0	97.5	132	58.5	98.7	126	63.5
57	2.0	10	52.5	159	15.0	76.7	171	19.0	88.0	171	26.5	95.2	159	44.0	98.8	148	58.0	108.0	137	66.0
58	2.0	10	55.0	157	15.5	74.5	153	19.5	82.0	139	34.0	85.6	132	47.0	89.2	120	60.5	93.3	101	66.5
59	2.0	10	54.3	165	15.5	85.5	160	18.0	94.5	147	28.5	99.8	129	44.4	101.0	119	59.5	105.0	103	69.0

Resinous Equipment Solves Corrosion Problems

EDITORIAL STAFF REPORT

Tanks of synthetic resin-asbestos reenforced by wooden staves

IT IS a strange fact that the chemical industry has for so many years depended upon outside aid in solving one of the most troublesome of its problems, that of developing suitable materials of construction. Had the main processes or the quality of products been involved the difficulty would have been attacked more vigorously a long time ago; but where the question is one of equipment only, the chemical engineer has fallen into the habit of looking to outside industries for assistance.

Surely he who uses the equipment should be in the best position to know the necessary requirements, and the chemical engineer should therefore be in close touch with the equipment manufacturer. Although he may not be called upon to do the actual fabrication, his is the problem of developing suitable materials for the various type of equipment used in the chemical plant.

About 15 years ago a German chemical producer, recognizing this need, developed a resinous, phenol-formaldehyde base material which is resistant to many of the most corrosive chemicals. The Säureschutz Gesellschaft was organized, and production of the Haveg equipment was started in 1922. During the latter part of 1932 the Continental Diamond Fibre Co. made arrangements with this firm for manufacturing the equipment in the United States, and the Haveg Corp., Newark, Del., was formed.

The resin material is available in several varieties to meet the specific requirements of the application. In some instances, the filler is varied (either asbestos or graphite is used); in others the change is made in the resin base. The standard variety, although unaffected by some of the alkalis, is primarily acid resistant; another grade has been developed especially for alkalis, and in the near future a type will be available upon which the development work has only recently been completed. This new grade has the advantage of being resistant to both acids and alkalis.

Installations in Europe

While there are very few applications in this country from which to draw experience, many are found in Europe, especially in Germany. For that reason several interesting foreign installations will be discussed in this article. The material has been used for handling sulphuric acid up to a strength of 50 per cent, concentrated hydrochloric, phosphoric acetic, lactic, oxalic, citric, and tartaric acids, formic acid, up to 40 per cent, sulphurous, and chromic (only when used in the dye industry) acids. Ammonia, milk of lime, sodium carbonate, sodium sulphide (alkali free), and neutral soap solutions do not affect Haveg, nor do the solvents, paraffin, carbon tetrachloride, trichlorethylene, formaldehyde, ethyl alcohol, and petroleum oils have any action on the resin. It is also inert to chlorine, aluminum chloride, calcium hypochlorite, hydrogen sulphide and peroxide, copper sulphate, zinc chloride, and potassium chromates.

One of the principal applications in Germany is in the production and use of dyestuffs and intermediates, where it is used in construction of the customary types of vats for dyeing, bleaching, carbonizing, and weighting. Even the drums, rollers, and various other parts of the dyeing equipment are made of Haveg. Other applications include storage and conveying vessels, centrifugal and plunger pumps, pipes and fittings, together with ventilators for removal of corrosive vapors.

Saving in Steam Consumption

Improved types of construction which offer not only material advantages but also actual savings are possible. The closed piece goods dyeing machine, for example, represents a marked advance over the type of machine which was formerly standard. Corrosive mist causing damage to buildings and machinery is entirely eliminated, and actual saving in steam consumption amounting to more than 50 per cent is afforded.

The ease of cleaning a vessel with smooth, non-porous surface makes this type of equipment particularly attractive to the dye industry. It can be cleaned with the aid of a hose and water and changes in the dye liquids can be made quickly and safely, even from dark shades to light.

A German coal-tar producer is using several vats made of this material. One tank is used for evaporating ammonium sulphate in concentrations suitable for crystallization at boiling temperatures. Another Berlin manufacturer is using Haveg for tanks, pipe lines, and fittings in handling hot hydrochloric acid, either alone or mixed with other chemicals. And a chemical producer has found that it resists hot phosphoric acid of various concentrations and purities. He has also observed that the fluosilicic acid in the phosphoric acid has no action on the resinous material of the equipment, the towers in the Cottrell precipitators showing no ill effects from corrosion after several years' use.

In a chemical plant Haveg equipment is used for handling hypochlorite, peroxide, zinc hydrosulphite, under both neutral and alkaline conditions, hydrosulphites, neutral and acid, permanganate, bisulphite, and other corrosive liquid. It has been found satisfactory for the manufacture of phenol sulphonic acid.

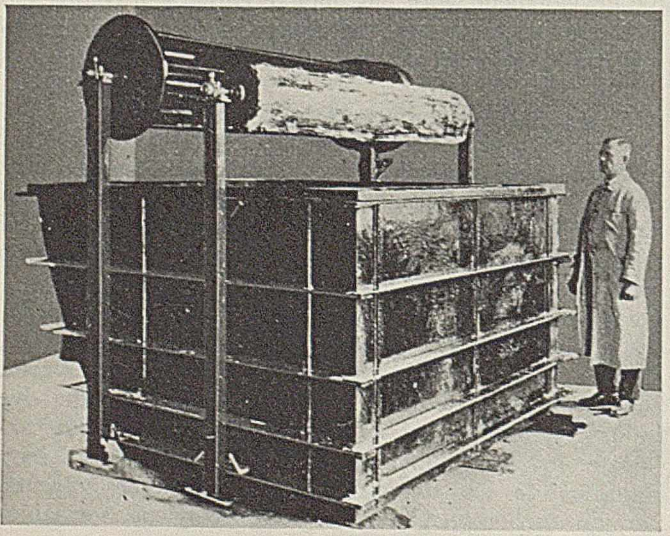
One of the most important uses for this material is in the construction of pickling tanks. In England such tanks installed three years ago are performing satisfactorily even with a bath composed of hydrochloric acid containing five per cent of nitric acid. It is being used by another manufacturer in the electrolysis of nickel and copper and is reported to be entirely satisfactory for handling sulphuric acid pickling solutions.

In Germany, it has been used for several years in the construction of vats and filter presses, and it is also used in the production of vanillin. And from the same country comes the statement that Haveg pipe lines have been used over a period of time with hot waste liquors, containing dilute sulphuric acid and fatty acids. It is also used in handling sodium sulphate and sodium chloride.

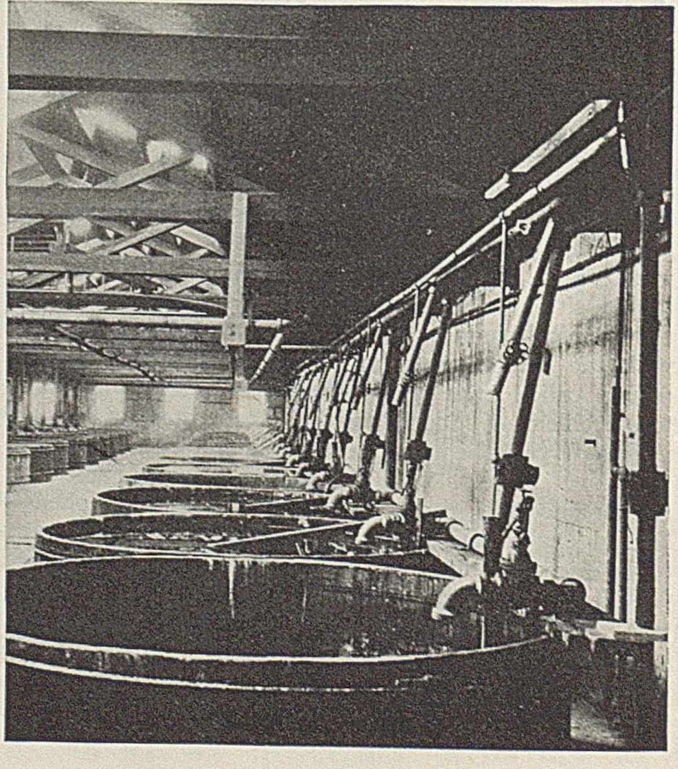
Although it has been available to chemical producers in the United States for a short time only, it is already finding its way into several plants for such purposes as pickling tanks, hydrochloric acid absorption towers and flues, and dyestuff vats and drying trays.

Haveg should not be used for handling oxidizing and strongly alkaline solutions. It is attacked by nitric acid, chromic acids, and by sodium and potassium hydroxides. Sulphuric acid over 50 per cent and such organic materials as pyridine and acetone attack this resinous material. However, as previously mentioned, another variety has recently been developed to resist the stronger

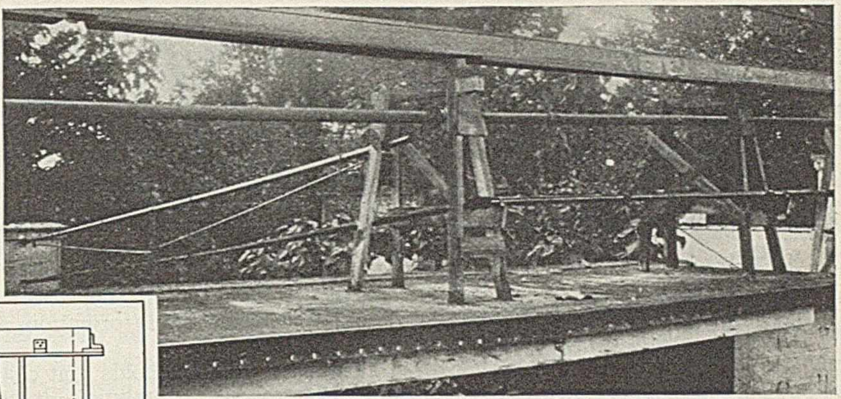
Dyeing machine with resinous rollers



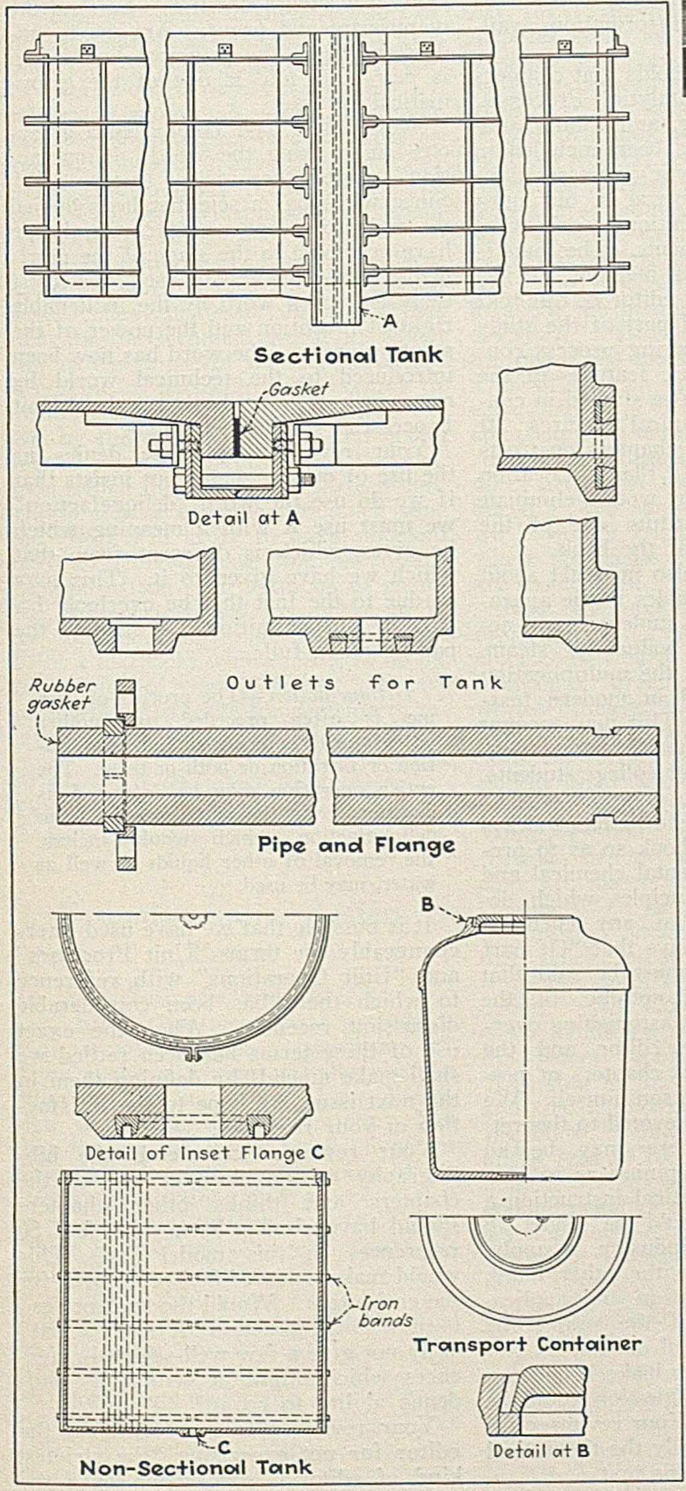
Resin pipe line handling hydrochloric acid



Pipe line exposed to weathering for about a year gives no evidence of attack from atmospheric corrosion



Construction of sectional and non-sectional tanks, transportation containers, and pipe lines for the handling of corrosive chemicals.



This resin-asbestos equipment may be easily machined, and may be cut, drilled, or turned. Inlet or outlet connections may be fitted into equipment in place and outlets no longer required may be easily sealed

alkalis, and it is expected that it will be available in the near future.

At present the manufacturing facilities of the company limit the size of a single unit to 9 ft. in diameter and 9 ft. in height. These units are solid, seamless, and jointless. When larger equipment is required, smaller units are first molded with suitable flanges. These units are then fastened together and the joints filled with a special cement which forms a strong bond between the two sections, providing the same chemical resistance as the main body.

Wall thickness varies according to the size of the vessel and the use for which it is designed. Metal bands are sometimes used for reinforcement, and pressure piping is strengthened by a covering. Dilecto, a laminated synthetic resin product, may be provided in the form of outlets or any other accessories when desired.

Physical Properties

The physical properties of Haveg are interesting. The compressive strength is about 10,400 lb. per sq.in., bending strength 5,600 lb. per sq.in., and resistance to shock high. The specific gravity is 1.6.

This material may be used at temperatures up to 130 deg. C. and may be cooled from this temperature to the freezing point without cracking; it is not affected by rapid temperature changes, and hot and cold liquors may therefore be used in rapid succession without danger of fracture of equipment. It does not suffer from long use at 120 deg. C. or low temperatures. The heat conductivity is low, which means economy in steam consumption as well as good working conditions.

Haveg has a close, impervious, homogeneous structure and a smooth surface, which makes cleaning easy. The surface is non-absorbent and the material is tough and does not deteriorate easily. Therefore, it permits savings in repairs and replacements with their accompanying loss of time. It may be allowed to remain idle for long periods of time without deterioration and may be again placed in operation without delay.

It is easily machined and may be cut, drilled, planed, turned and the like. New inlet or outlet connections may be fitted into equipment in place, and outlets no longer required may be easily sealed. Accidental damage also may be effectively repaired. Surface damage need cause no concern as the material is uniformly resistant throughout.

OTHERS' VIEWS

Unit Processes or Operations? The Author Replies

To the Editor of Chem. & Met.:

Sir—In your March issue you published a review by Prof. A. W. Hixson of Columbia University of a chemical engineering textbook entitled "Unit Processes and Principles of Chemical Engineering" which I edited and for which I wrote the introduction and three chapters. The other chapters were written by the following well-known chemical engineers:

Heat and Power, Crosby Field; Evaporation, Alfred L. Webre; Principles of Fractional Distillation, Theodore Baker; Steam Distillation, James W. Lawrie; Dry Distillation and By-product Recovery, F. W. Sperr; Filtration, Charles L. Bryden; Electric Heating, Robert M. Keeney; Catalytic Processes, P. H. Emmett; Absorption of Gases, Andrew M. Fairlie; Electrolysis, L. D. Vorce; Separation of Solids and Liquids From Gases, Percy E. Landolt; Costs and Financing, George A. Prochazka; and Factory Location, F. L. Warner.

As your reviewer found much to criticize and very little to commend in this volume, I believe that your readers would be interested in a reply to the criticisms on my own behalf and that of the other contributors.

Your reviewer devotes nearly a third of his article to a statement of the principles which should govern one who writes or edits a textbook. I can agree quite completely with this statement of principles. In fact, he has outlined the plan which was given to the authors to follow when preparing the various chapters. Each author prepared his chapter according to this plan embodying the results of his extended and successful experience in a specialized field of chemical engineering. The faults which Professor Hixson has found must therefore be due either to the execution of the project or he may have overlooked many essential features of the book.

Professor Hixson criticizes the scope of the book for two reasons. He finds some important unit operations lacking, such as agitation and mixing, crushing and grinding, etc. We plead guilty to these omissions. Your reviewer overlooked the third paragraph of the Preface, where the reason is given for the selection made. We preferred to limit the scope of this textbook to a number of well-developed processes rather than attempt to cover the entire field of chemical engineering superficially. We do not believe that the college student in four years can learn everything which he needs in practice. We also did not think that this book would be the only source of information available.

Professor Hixson holds that chapters on Electrolysis, Catalytic Processes, Costs and Financing, and Plant Location should not have been included in this textbook. Catalytic processes have been the basis of several of our most successful and revolutionary chemical engineering developments. The same is true of electrochemical methods. It has always seemed to the editor of this text that a vitally essential part of the study of a chemical engineering process consisted of the economic features of the process which should be studied in connection with the technical features. It is my belief that the chapters on Costs and Financing and Plant Location which your reviewer would eliminate from this text constitute one of the most valuable parts of the book.

Your reviewer is also in doubt about including the steam tables in the appendix, thus giving the student ready access to the thermal values of steam. We now suspect that the multiplication table is not included in modern textbooks on arithmetic. This may account for the astonishing mathematical deficiencies of some of our college students.

Your reviewer also quotes a part of the Preface "to this end he has endeavored to develop this book so as to present (a) the fundamental chemical and physical-chemical principles which determine the course of any chemical reaction." He then says that "Of part (a) of this plan it must be said that there is practically nothing in the book." This is a most astonishing oversight—either by the editor and the authors of the various chapters or possibly by Professor Hixson himself. We count some 81 pages devoted to theoretical discussion. There may be an honest difference of opinion as to how great a load of theoretical instruction a college graduate should be asked to carry with him into industry, to apply, if he is able; or, on the other hand, how much of illustration and application of the theory of the subject he needs to have presented during his college course in order to make his theory a useful tool. This question could be profitably discussed. Your reviewer has chosen to ignore entirely the theoretical discussions given in this text.

Your reviewer has much to say about the "inexcusable grammatical errors and confusing terminology" of the text. As to "inexcusable grammatical errors" we must beg our prosecuting attorney to present a bill of particulars. We cannot find them, neither have the various well-qualified critics who read the manuscript and proof. Are we to understand that "the principal liquid fuel is *petroleum oil*" is one of the grammatical errors?

We seem to have committed a grievous sin in using the word "deliquefaction" when "there is no such word." Since when has a scientist been denied the right to invent a word? Surely we have not come to the stage of the petrified progress of the Chinese. We insist there is such a word by the inalienable right of invention and the power of the printing press. The word has now been introduced to the technical world by even such a poor book as the "Unit Processes" would seem to be.

Your reviewer not only denies us the use of our language, but insists that if we do use the word "deliquefaction" we must use it with a meaning which he gives, which is different from that which we have given to it. This may be due to the fact that he overlooked a part of our definition. We quote the paragraph in full:

> *Deliquefaction.*—The process of drying is often preceded by another process of dewatering such as evaporation or filtration or both of these. The entire operation may be described as dewatering or the more general term deliquefaction, which would include the removal of other liquids as well as water, may be used.

It is possible that we have used interchangeably the terms "Unit Processes" and "Unit Operations" with reference to which there has been considerable discussion recently. When the exact use of these terms has been settled we shall make amends by defining them in the next issue, we hope to the satisfaction of your reviewer.

Your reviewer commends the bibliography at the close of one of the chapters and thinks other chapters should have similar lists. We find 50 references in this model list. This would make a list of 800 references for the entire text. Would the student read even a small fraction of such a list? Why not give a few well-selected references which might be within the student's ability to cover?

Your reviewer further criticizes the editor for not exercising "the strictest kind of editorial supervision over the able contributors" to this volume. Is the student going to find such standardized literature when and if he reads the 800 references your reviewer would have available? May not the very differences in points of view, interests and experiences of the thirteen contributors make this volume more valuable to the student because the editor did not iron out all the individuality from the various chapters?

The authors and editor of this volume can pick up a few crumbs of commendation in the last paragraph of this review, which is a sort of *pot pourri* of criticism and commendation. This part of the review seems to suggest a sort of college grading system of the various chapters. We would conclude that your reviewer would grade two chapters *A* and seven chapters *B*. The remaining seven chapters must either be rated as poor or should not have been included in the text to make room for the six which Professor Hixson believes should have been included.

College textbooks, as well as college graduates when they leave the tutelage of the college professor, must find that niche in the technical world in which they can give useful service. Progress in making of textbooks and teaching of chemical engineering is to a large extent by the method of trial and error. We of course trust that the textbook upon which the editor and thirteen contributors have expended so much time and effort will prove to have sufficient merit to achieve some progress toward the goal of the ideal textbook of chemical engineering, and not prove to be the outstanding example of how *not* to write a textbook, which seems to be the opinion of your reviewer. We are quite willing to leave the decision to the jury of your many intelligent readers.

J. C. Olsen
Professor of Chemical Engineering,
The Polytechnic Institute,
Brooklyn, N. Y.

Formulae Curio—Letters Patent

To the Editor of Chem. & Met.:

Sir—"Give me any old formula or analysis and I'll get a patent on it." Thus spoke a cynical metallurgist the other day during a lunch-hour discussion of patents and inventions. Not that he had the inside track on patent procedure, but judging by some of the strange concoctions and processes that issue from time to time from the Patent Office he had no reason to doubt his ability in that direction.

He was not bragging either for "Be-it-known-that-we" (the preamble used in the older applications) possess a small but choice collection of these official documents that prove it. We mean that prove he wasn't bragging. We regret we are not informed as to how successful these patents were commercially, but, some at least, are interesting and illuminating.

Early in 1902 one "Be-it-known-that-I" was successful in obtaining a patent containing the following claim:—"An alloy consisting of iron, hydrogen and copper." A dwarf for brevity, but a heavy-weight for breadth. (No. 692,198.)

This secret of the ancients came a month later. "A composite metal resulting from fusing the following elements in approximately the following proportions by weight: Copper 84 parts, tin 4 parts, iron 6 parts and salt 5 parts." This metal covers much territory, for it "may be used for all general purposes—such as for the manufacture of sharp and blunt tools, armor plate, bridge structure, or, in fact, any place where a strong, tough, durable material is desirable and which will not corrode." (No. 694,224.)

Leaving alloys and going back a decade or so we discover a novel whitewash or whitewash-paint. It is "composed of the cactus plant, lime, eggs, and water thoroughly intermingled and in about the quantities substantially as described." It is of interest to know the quantities involved per batch were 5 lb. of lime, 5 qt. of water, 4 dozen eggs, and 5 pt. of cactus juice," and also that this whitewash-paint is more "durable and beautiful in color than any other article of the kind hitherto produced." We cannot vouch for it, for we have not tried it; we never lived where the cactus grows and cheap eggs are so plentiful. (No. 401,122.)

Now we have an "insecticide"—for prairie dogs. "A poison for prairie dogs, consisting of strychnia, cyanide of potassium, green coffee berries, and whites of eggs, saccharine matter, and food, substantially as and in the proportions set forth." It may also be used to kill other kinds of animal life as "vermin, including birds and insects." Well, we should think it would. But what a strange world—where prairie dogs are insects and birds are vermin. Caution—"To destroy prairie dogs, the composition should be placed close to their holes; but it is better not to place it in the holes"—so reads the specification. (No. 456,602.)

We could go on and tell you from the patent records how to make a "Dressing for Fish" from bread crumbs and spices, or what to do when "Making Hash." But what's the use, and it might lead to foolish arguments in the home. Besides we think we have given enough evidence to bring us back to our starting point—the metallurgist was not bragging, but merely asserting a patent fact.

Cincinnati, Ohio Pat. Grant

P. S.—A new one just came to light. It was issued only a few weeks ago (No. 1,891,450) and we throw it in for good measure. It is a "Coal Briquette," to wit, "A briquette comprising comminuted particles of fuel matter held together by a binder of cheese." Can this be a case of cheese dietetics applied to coal? We wonder.

Staying Heat Exchanger Heads —Simple and Leakproof

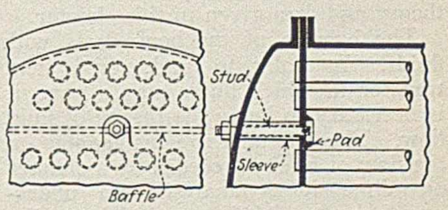
To the Editor of Chem. & Met.:

Sir—In his article in the December, 1932, issue on "Designing Heads for Tanks and Heat Exchangers," C. O. Sandstrom gave a suggestion for preventing the bulging under pressure of dished heads for tubular heat exchangers.

In ordinary tanks slight bulging of the heads is not objectionable, but in heat exchangers using baffled heads to provide for a number of passes, any opening between the baffles and the tube sheet would cause short-circuiting, with consequent decrease in the efficiency of the equipment. The suggestion was to insert stay bolts running from head to head through a certain number of tubes that were made larger than the others to compensate for the reduction in tube area arising from the presence of the bolt.

The writer wishes to suggest another method which he has recently used for the same purpose. This scheme is shown in the accompanying drawing. The stays are rather short studs screwed into the tube sheets, which are reinforced by pads welded on to increase the thickness. The threaded hole for the stud is not drilled clear through. The studs are housed in sleeves which are welded into the baffles so as to make tightening most effective and at the same time to serve as stiffeners for the baffles.

Among the advantages of the method may be mentioned the facts that: (1) Leaks through the stay-bolt threads cannot occur, since the fluid is excluded from the bolt housing by the head gasket. (2) Since the studs are short, they are subject only to very small elongation from internal pressure. (3) Different sized tubes in the same exchanger are unnecessary.



Staybolts running through sleeves welded into the baffles prevent bulging of heat exchanger heads

This construction was used successfully a year ago by the writer in building an all-cast-iron exchanger. There is no reason why the method should not be equally satisfactory for ordinary steel tubular exchangers, as shown in the sketch.

Bernard Kramer
Mechanical Engineer
Pittsburgh, Pa.

BOOKSHELF

Heat Transfer—in Theory And in Practice

Heat Transmission. By *W. H. McAdams*. Published by McGraw-Hill Book Co., Inc., New York. 383 pages. Price, $5.

Reviewed by *Albert B. Newman.*

NEARLY ALL industries have processes which involve heating, cooling and heat exchange, but until recent years the theory underlying the design of equipment for these operations was insufficient to be of interest to practicing engineers. The author of this book, by directing research and by correlating the data of other workers, has been a leader in the development of a sound and unified basis for the accurate design of heat transmission equipment. He has presented the conclusions and much of the supporting data in systematic form in this book.

The first chapter covers steady state heat conduction through single solids of various shapes, through solids in series and through liquids and gases. The second chapter treats the temperature distribution in solids in process of heating or cooling, before the steady state is reached. These chapters are brief and cover many of the important cases. While the subjects of these chapters could be made the basis of a large book, the material presented is wisely selected to fit the restricted space.

The chapter on "Radiation of Heat" is taken from the heretofore unpublished notes of Hottel, who has made substantial contributions to the application of theory to engineering design. The examples show what a wide variety of practical cases in furnace design can be handled by the use of the theory and data given in this chapter.

The balance of the book deals with fluids. In order to understand heat transfer in which fluids play a part, it is necessary to know the theory of fluid flow. There is an excellent chapter on the flow of fluids, preceded by a chapter on dimensional analysis, an understanding of which is prerequisite to the study of turbulent flow. The reviewer believes that the chapter on flow of fluids, although brief, is better than the treatment of this subject in any existing engineering book. It is pleasing to note that the values of dimensionless ratios have been presented on the basis of consistent units, so that any set of consistent units will give the same value for the same case. While the mixed units used in some textbooks are justifiable for restricted use, the adoption of consistent units greatly simplifies comparisons between the published researches of physicists and engineers. In a chapter introducing convection, the stagnant film concept is clearly explained. The rest of the chapters are on the heat transfer to and from fluids inside pipes, fluids outside pipes, and the heat transfer due to condensing vapors and boiling liquids.

Notable features of the book include the recommended procedure for design in each of the important cases, for the benefit of the practicing engineer whose time is limited; a bibliography of over 500 references; and the tables of properties. For use as a text, this book might be thought inadequate because of the omission of the derivations of important fundamental equations. The reviewer believes this is not a disadvantage, however, as it leaves the instructor the choice of giving the derivations in his lectures or requiring the student to derive the equations or look them up in other works. While the worked-out examples are an aid to teaching, there is need of a set of problems to give the student practice. The addition of problems would relieve the busy instructor of the necessity of synthesizing problem material and would make the book a fine text for a one-semester course on heat transmission and fluid flow.

pH Becomes Practical

pH and Its Practical Application. By *Frank S. LaMotte, William R. Kenny* and *Allen B. Reed.* Williams & Wilkins Co., Baltimore. 262 pages. Price, $3.50.

Reviewed by *Sheppard T. Powell*

ABOUT the only logical reason for the publication of a scientific book is to disseminate data which will be useful to interested persons. If a published text does not fulfill these requirements it descends to the plane of pure commercialism and there is no excuse for its existence. Unfortunately, many such publications are released annually. It is particularly gratifying, therefore, to review such an excellent book as the one under discussion which is not subject to this stigma. Many books on hydrogen-ion determination have been published in recent years but the majority of them have been concerned primarily with the theoretical phases of the art and with analytical procedure. In most instances, the discussions have involved physico-chemical concepts and have been entirely beyond the scope of average analytical workers or others not specifically trained in this field. The widespread application of pH control in many industries has demanded at least a working knowledge of this subject which hitherto has been difficult to obtain from the more advanced works.

The present book by Dr. LaMotte and his associates completely fulfills this need. The book is divided into two sections, A and B. Section A covering forty-eight pages, is devoted to a clear and comprehensive discussion of the mechanism of hydrogen-ion determinations. The remainder of the book relates to the practical applications of hydrogen-ion determinations in the industries. This portion of the text, as indicated by the title, covers practical control procedure and the results of such control in a large number of diversified industrial processes. It alone would warrant a place for this book in any scientific library.

Rare-Element Minerals and Manganese in Canada

Rare-Element Minerals of Canada. By *H. V. Ellsworth.* Published by Canadian Department of Mines, Geological Survey, Ottawa, Canada. Economic Geology Series No. 11. 272 pages. Price, 40 cents.

Manganese Deposits of Canada. By *G. Hanson.* Published by Canadian Department of Mines, Geological Survey, Ottawa, Canada. Economic Geology Series No. 12. 120 pages. Price, 20 cents.

COMPREHENSIVE reports on these important mineral subjects are made available in these documents to those interested in either the mineral resource or economic significance of Canadian supplies. The rare-element document deals with the following metals, among others: Lithium, rubidium, and caesium; beryllium; zirconium and hafnium; tantalum and columbium; the rare earths; uranium and thorium; and the radioactive elements.

Feldspar. By *Hugh S. Spence.* Canada Department of Mines, Ottawa. 145 pages, illus. Price, 25 cents. The first and only previous report on feldspar issued by the Mines Branch was published in 1916. In the present report, the author has incorporated the results of field work conducted from 1927 to 1930, in the feldspar-producing districts of Canada and the United States. Canadian mines opened up since the previous report have been described in detail. Earlier worked properties are included in the list of mines and occurrences, but the earlier report must be consulted for a full description. Notes are given on the principal fields in the United States.

PLANT NOTEBOOK

Hazards With Compressors in Chemical Plants

In its "News Letter" for March the Chemical Section of the National Safety Council reported a peculiar sort of accident which is not as infrequent as one would imagine. Such accidents arise from failure to release the pressure on air or gas compressor cylinders before making a repair. In one plant, compressors were used to step gas up to a pressure of 3,000-5,000 lb. An expert trouble man in the employ of the compressor manufacturer was dismantling the high-pressure cylinders of one of these compressors. For assistants he had the general foreman, the chief shift operator and the regular compressor mechanic; and yet, despite the collective experience of these men, when the outside packing nut of the tail-rod gland was unscrewed, the packing let go and the 16-lb. nut was shot through the air with all the force of a cannon ball.

Casualties, miraculously, were negligible. One man's leg was struck a glancing blow, while a stool was knocked from under another. But in a second similar case, the service engineer who was attempting to remove the valve cover plate from the high-pressure discharge side of a compressor, without the formality of first closing the valve in the discharge line, was hurled against the wall of the building with sufficient force to fracture his skull.

Divided responsibility, as much as any other single cause, seems to have been to blame for both of these accidents. Before repairs of any sort are made on a compressor, some one man such as the operating foreman should be required to certify to its safety. In no other way is it possible to avoid the hazards of occasional carelessness.

CO_2 for Welding Safety

In a recent issue of *Oil and Gas Journal* an interesting method of welding hydrocarbon gas and liquid containers is described. Since carbon dioxide has a specific gravity of 1.52, it readily displaces the lighter air and hydrocarbon gases. If mixed with such gases to the extent of 20 per cent, it forms a non-explosive mixture, but for additional safety it has been customary to use about 40 per cent of CO_2 in mixtures in vessels to be welded.

In a test made recently in Tulsa carbon dioxide from a 30-lb. cylinder was admitted to a compartment in a gasoline truck until the gas mixture would not ignite at an opening in the tank top. Patches were then welded to the tank in the usual way, employing both oxyacetylene and electric equipment. The same method of protection has been used successfully in burning a hole through the wall of a tank containing 2-gal. of casinghead gasoline. It has also been suggested for the repairing of pipe lines in which an inert mixture can be produced, particularly for repairing large valves.

Protecting Finishes With Cellophane

Hunting for a method to avoid marring the lacquered surfaces on its small motors, which were piled one upon another in storage, a Middle-Western motor manufacturing company recently reported the discovery that Cellophane sheets placed between the motors completely solved the difficulty. The Cellophane was found to pull free from both paint and lacquer without leaving any imprint or fuzz.

Conversion Factors for Metric Linear Dimensions — By W. A. KOEHLER, West Virginia University

To Convert From to → / multiply by factor appearing at the intersection ↓	1 millionth micron ($1\mu\mu$)	1 Ångström unit (1Å or 1ÅU)	1 millimicron ($1m\mu$)	1 micron (1μ)	1 millimeter (1mm.)	1 centimeter (1cm.)	1 meter (1m.)	Interval factor or divisor
1 millionth micron ($1\mu\mu$)	1	10^{-2} 0.01	10^{-3} 0.001	10^{-6} 0.000001	10^{-9}	10^{-10}	10^{-12}	10^2
1 Ångström unit (1Å or 1ÅU)	10^2 100	1	10^{-1} 0.1	10^{-4} 0.0001	10^{-7} 0.0000001	10^{-8}	10^{-10}	10^1
1 millimicron ($1m\mu$)	10^3 1,000	10^1 10	1	10^{-3} 0.001	10^{-6} 0.000001	10^{-7} 0.0000001	10^{-9}	10^3
1 micron (1μ)	10^6 1,000,000	10^4 10,000	10^3 1,000	1	10^{-3} 0.001	10^{-4} 0.0001	10^{-6} 0.000001	10^3
1 millimeter (1mm.)	10^9	10^7 10,000,000	10^6 1,000,000	10^3 1,000	1	10^{-1} 0.1	10^{-3} 0.001	10^1
1 centimeter (1cm.)	10^{10}	10^8	10^7 10,000,000	10^4 10,000	10^1 10	1	10^{-2} 0.01	10^2
1 meter (1m.)	10^{12}	10^{10}	10^9	10^6 1,000,000	10^3 1,000	10^2 100	1	
Intervat factor or divisor	10^2	10^1	10^3	10^3	10^1	10^2	Chem. & Met. April, 1933	

NEW EQUIPMENT

Pneumatic Cement Pumps • Varidrive Motor • Improved Rubber Lining • Resistance-Welded Tubes • High-Pressure Exchanger • Tractor-Mounted Welder • Humidifying Heater • Speed-Reducer Motor • Thrustor-Operated Valve • Motorized Transmission • Indoor Cooling Tower • Fin-Tube Heater • Potentiometer Stabilog • Glass-Lined Autoclave • Self-Priming Pump • Manufacturers' Latest Publications

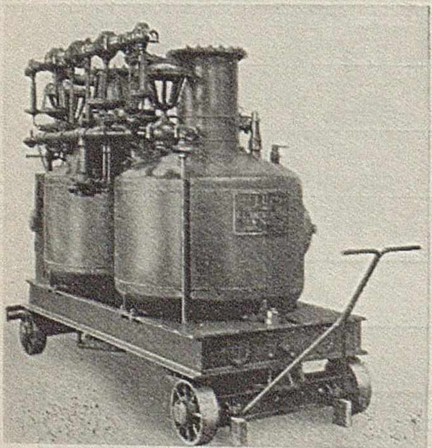
▼

Pneumatic Cement Pumps

To provide for the efficient movement of cement and other pulverized materials, F. L. Smidth & Co., 225 Broadway, New York City, has developed the "Fluxo" pump, which is now available in two types, a suction-feed and a gravity-feed model. In brief, the former consists of a pair of tanks mounted on a carriage which permits the pump to be wheeled alongside of the silo from which it is desired to withdraw the stored material. When connection has been made to the silo by means of a flexible pipe, the tanks are alternately subjected to vacuum and pressure. Material is thus drawn into one tank by suction while it is being expelled from the other by compressed air. The cement is aerated in passage through a special jet and flows much like water to its destination. The cycle of operation is controlled automatically so that continuous discharge ensues.

In the gravity-feed type, the pump is built with either one or two tanks, as conditions require. When the tank is filled, the inlet closes automatically and the compressed air is automatically applied. After the tank is empty, the inlet automatically opens for the next charge.

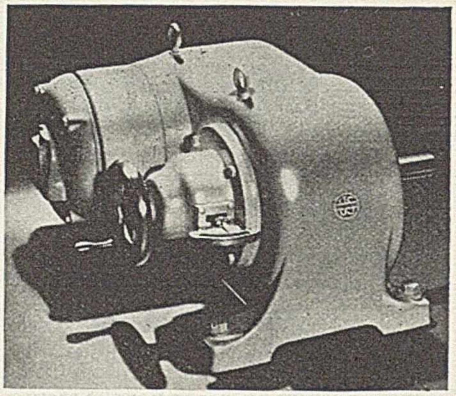
Suction-feed Fluxo pump



Varidrive Motor

A variable-speed drive with integral motor has recently been introduced by the U. S. Electrical Mfg. Co., Los Angeles, Calif., under the name of U. S. "Varidrive." The machine is built in a number of speed combinations from 25 to 10,000 r.p.m. and in standard models gives a speed variation of 2½ or 3 to 1. Special models provide for speed variations as high as 5 to 1. Drive capacities are from ½ to 7½ hp.

The Varidrive comprises a single casing on which is mounted one of this company's asbestos-protected, constant-speed motors, and in which is the variable speed mechanism. The latter employs a pair of special pulleys, one on the motor shaft and one on the variable-speed shaft, connected by a V-belt. Each pulley is formed from two opposed, conical disks which reciprocally expand and contract for higher or lower speeds. The respective driving diameters of the two pulleys are adjusted by means of a handwheel and the adjustment indicated on a scale. Remote, pushbutton control is also available. Among advantages the manufacturers claim high mechanical and electrical efficiency, speed control as close as 1 r.p.m., compactness, flexibility, few moving parts, complete anti-friction construction and low cost.



Motorized variable-speed transmission

Improved Rubber Lining

For handling acids of strongly oxidizing character, such as chromic and nitric, the B. F. Goodrich Co., Akron, Ohio, has developed a new rubber lining material. According to the manufacturer it has not hitherto been possible to handle such powerful oxidizing acids in rubber-lined equipment.

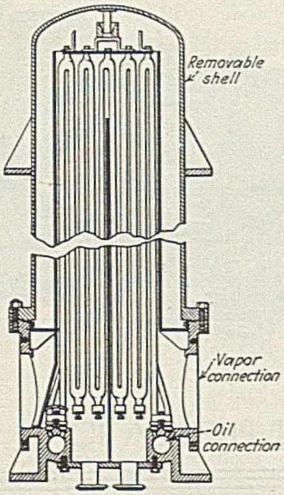
Resistance-Welded Tubes

Steel & Tubes, Inc., Cleveland, Ohio, announces the development of electric-resistance-welded boiler tubes which are to be marketed under the trade name of "Electrunite." The tubes are formed from strip steel which is continuously passed through a series of forming rolls and butt-welded by current traveling between wheel-like copper electrodes contacting the tube on either side of the weld. These tubes are available in all sizes up to 5 in. O.D. in Toncan iron, mild steel and copper-bearing nickel steel.

High-Pressure Exchanger

Vapor pressure up to 150 lb. per sq.in. and oil pressures to 1,500 lb. may be handled in a new vertical heat exchanger recently developed by the Lummus Co., 50 Church St., New York

City. The tube bundle of the exchanger comprises ten elements formed of 2-in. tubes through which the liquid travels in parallel streams from the inlet to the outlet manifold. Elements include ten stands of tubes connected at the top by Elesco integral-forged return bends and at the bottom by Elesco return bends with taper-plug closures. The enclosing casing is attached to a flange directly above the vapor connections and may



Vertical heat exchanger

readily be removed for inspection and cleaning. Exchangers of this type are regularly available in one and two-pass models, but because of the flexibility of the tube coil, can be supplied in other designs, as required.

Tractor-Mounted Welder

For use in remote places, General Electric Co., Schenectady, N. Y., has introduced a line of arc-welding apparatus mounted on Cleveland tractors. The manufacturer states that the nearest approach to this sort of apparatus previously has been the gas-engine-driven trailer unit which required an additional source of power for movement. In addition to supplying power for the welder, the power plant of the new unit serves to move the apparatus from place to place, and to motivate the tractor for hauling purposes.

Humidifying Heater

For the moistening of air in industrial plants, the B. F. Sturtevant Co., Hyde Park, Boston, Mass., has announced the development of three new heater-humidifiers with heating values ranging from 312 to 596 sq.ft. of direct radiation and evaporating capacities from 4½ to 9½ gal. of water per hour. A fan blows air through the radiator section and this air then evaporates water which is continuously supplied to a series of humidifying cups. The equipment includes pressure control of the steam line, a reducing valve for the water and a motorized valve for controlling water flow under the action of the hygrostat.

Speed-Reducer Motor

Combining a motor and gear-reduction unit, especially designed for relatively low ratios, the Falk Corp., Milwaukee, Wis., has developed what has been named the "Geared-Head Motorducer." These motors are built to provide any desired speed from 1/9 motor speed to about 2½ times motor speed. This variation is secured with a single-pair gear train, a construction which the manufacturer states to be simple, rigid and compact.

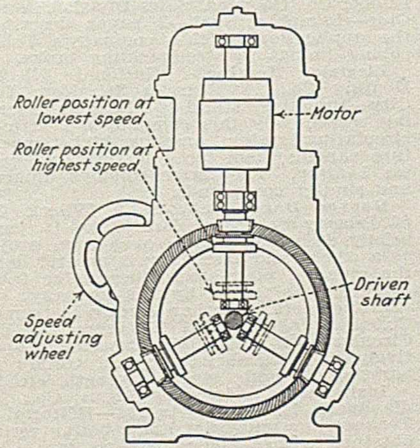
Thrustor-Operated Valve

Centralized remote control of gases and liquids under pressure is the object of a new Thrustor-operated control valve recently announced by the Northern Equipment Co., Erie, Pa. This device consists of a Copes Type B.I. valve, operated by a General Electric Thrustor mounted on the side of the valve by a bracket bolted to the valve bonnet. The Thrustor is a motor-operated hydraulic cylinder which applies a straight-line, high-pressure thrust on the valve lever to open or close the valve.

Motorized Transmission

Utilizing the principle of roller traction, the new Stanley "Speed Variator," a transmission giving infinitely variable speed within a range of 3 to 1, has been introduced by the Merritt Engineering & Sales Co., Lockport, N. Y. A motor built into the unit drives a ring gear which in turn drives three pairs of rollers arranged radially about the output shaft. Two disks secured to the output shaft receive their motion from the rollers with which they are in contact through a balanced thrust loading of the disks. Simultaneous radial adjustment of the roller pairs regulates the driving diameter and hence the speed of the output shaft. The spring pressure forcing the disks toward each other is predetermined so as to transmit full power at all speeds. The method of loading, as indicated in the drawing, is such that the shaft bearings carry no thrust, leaving only the normal shaft load reaction on the various ball bearing of the transmission.

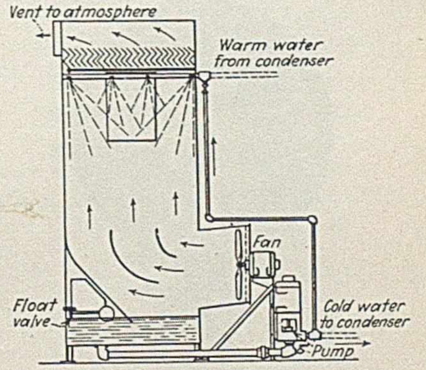
Cross-section of disk transmission



This unit is offered in sizes ranging from 2 to 20 hp., and in special models with a speed range as high as 9 to 1.

Indoor Cooling Tower

For the production of cooling water for refrigeration, air compressors, diesel engines, heat exchangers and other services, the Binks Manufacturing Co., 3114 Carroll Ave., Chicago, Ill., has introduced a new forced-draft spray cooling tower for indoor installation.



Indoor cooling tower

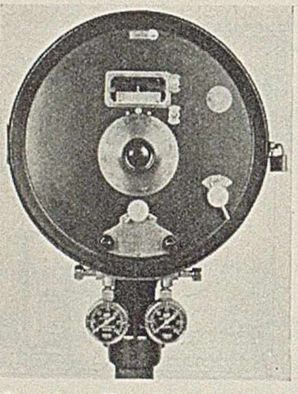
As indicated in the accompanying drawing, the tower consists of a chamber, vented at the top to the atmosphere, through which a fan forces air. From the reservoir in the bottom, cooled water is withdrawn by a pump and distributed to whatever apparatus requires it. Make-up water is supplied through a float valve. Warm water returns to the tower and is sprayed through non-clogging nozzles beneath the eliminator plates placed at the top. The tower is built in capacities from 5 to 50 g.p.m., capable of handling refrigerating machines in sizes up to 12 tons and air compressors in capacities to 1,200 cu.ft. per minute.

Fin-Tube Heater

As an extension to its line of Bentube heaters, the Griscom-Russell Co., New York City, has developed a new type employing its "K-Fin" extended-surface tubing in which continuous metallic contact between the fins and tubes has been provided. This heater, which is built also for cooling installations, employs initially bowed tubes which accentuate their curvature with increase in temperature. The tubes expand independently without binding or interference. This equipment is distributed exclusively through Hitchen Engineering Co., 155 East 44th St., New York City.

Potentiometer Stabilog

For use in potentiometer temperature measurement, the Foxboro Co., Foxboro, Mass., has recently introduced an instrument combining the automatic potentiometer method of temperature measurement with its Stabilog method of control. The new method is suitable for temperatures up to 2,800 deg. F. and is available for those systems requiring considerable distance between the point of measurement and the controller. The instrument is non-recording, but is so constructed that a recording potentiometer pyrometer may be operated from the same thermocouple.

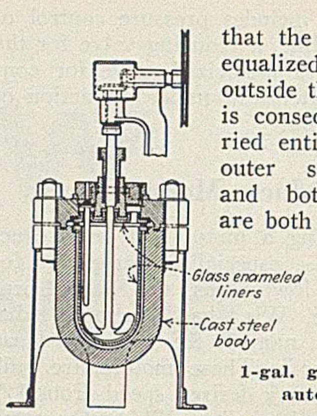


Non-recording potentiometer Stabilog

This company has also developed another new device known as a "Deoscillator" which, when used in conjunction with a pyrometer controller, is said to result in anticipatory control action. The Deoscillator is connected between the thermocouple and controller and acts to impress a slight additional voltage into the thermocouple circuit. This voltage increases that of the thermocouple when the temperature is low, and opposes it when the temperature is high, thus, it is said, preventing excessive overrun or underrun of the desired temperature.

Glass-Lined Autoclave

To facilitate experimental work at pressures as high as 1,000 lb. per sq.in., the Pfaudler Co., Rochester, N. Y., has recently introduced a 1-gal. glass-lined autoclave consisting of an inner cast-iron liner coated with acid-resisting glass enamel and a 2-in. cast-steel casing, complete with glass-covered thermometer well and agitator. The construction of this equipment is such



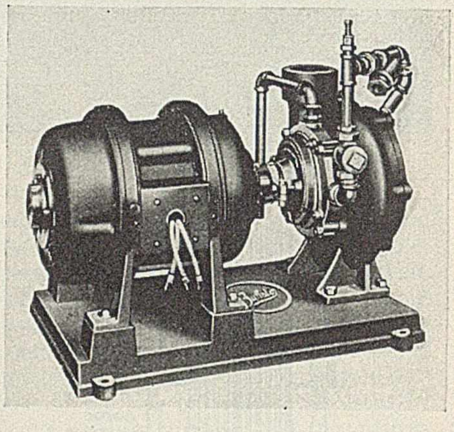
1-gal. glass-lined autoclave

that the pressure is equalized inside and outside the liner and is consequently carried entirely by the outer shell. Top and bottom liners are both replaceable.

Self-Priming Pump

Employing a built-in self-primer, made under license from the Nash Engineering Co., and of the same type used by that concern, Buffalo Pumps, Inc., Buffalo, N. Y., has developed a new single-suction pump for which two types of impellers are available. The open type is recommended for liquids containing solids and the closed type for clear liquids. Impellers are of bronze, cast iron or other metals, as specified. The pump is built for heads up to 150 ft. and in capacities to 450 g.p.m.

New self-primed pump



MANUFACTURERS' LATEST PUBLICATIONS

Achievements. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—40 pages on engineering achievements during 1932.

Activated Carbon. Industrial Chemical Sales Co., 230 Park Ave., New York City—43-page booklet on activated carbon, its uses detailed by industries, new developments, and the characteristics of Nuchar carbons.

Apparatus. Burrell Technical Supply Co., 1936 Fifth Ave., Pittsburgh, Pa.—Catalog 78—88 pages on this company's line of laboratory testing equipment for fuels, metals, etc.

Apparatus. Palo-Myers, Inc., 81 Reade St., New York City—4 pages on this company's pH meters and electrodes.

Chemicals. —Grasselli Chemical Co., Cleveland, Ohio—Bulletin G-3—20 pages describing the manufacture of brick using barium carbonate to prevent scum.

Chemicals. Philadelphia Quartz Co., Philadelphia, Pa.—Bulletin 31—14 pages on the use of silicate of soda in curing concrete roads.

Compressors. Sullivan Machinery Co., 30 Church St., New York City—Bulletins 88-D and I—Respectively, 8 and 4 pages on single-stage, direct-connected and belt-driven, angle compressors for air and gas; and 8-in. stroke angle compressors.

Compressors. Worthington Pump & Machinery Corp., Harrison, N. J.—Five bulletins of the W-850-S Series covering portable air compressors in capacities from 120 to 360 cu.ft. per min.

Corrosion Resistance. B. F. Goodrich Rubber Co., Chemical Sales Division, Akron, Ohio—Pamphlet 9021—7 pages describing the application of this company's Triflex rubber linings in steel pickling tanks.

Electric Heating. National Electric Heating Co., 154 Nassau St., New York City—Bulletins 86 and 87—Leaflets describing respectively this company's electric-oil circulating system and its high-temperature vapor system for industrial and process heating. The latter employs diphenyl and similar compounds.

Hoover Dam. Babcock & Wilcox Co., 85 Liberty St., New York City—16 pages briefly describing the Hoover Dam project as a whole, and describing in greater detail the gigantic plate-steel pipes to be fabricated for the project by this company.

Instruments. Amthor Testing Instrument Co., 309 Johnson St., Brooklyn, N. Y.—Circulars 106 and 107—Describe respectively hand tachometers; and testers for bursting strength, tensile strength, etc.

Instruments. Esterline-Angus Co., Indianapolis, Ind.—Bulletin 233—Editorial on Technocracy and brief items listing results obtained with graphic instruments.

Instruments. Mason Regulator Co., 1190 Adams St., Boston, Mass.—Bulletin 3000-C—32 pages on compensated temperature controllers, recording and non-recording, made by this company.

Insulation. Acheson Oildag Co., Port Huron, Mich.—Technical Bulletin 171.4—6-page reprint on the use of colloidal graphite in the electrical testing of insulation.

Materials Handling. Chain Belt Co., Milwaukee, Wis.—Folder briefly describing the range of power transmission and conveyor chains, materials handling equipment and other machinery made by this company.

Materials Handling. Hydro-Ash Corp., 115 South Dearborn St., Chicago, Ill.—14 pages on this company's method of hydraulic ash disposal.

Metals and Alloys. Aluminum Company of America, Pittsburgh, Pa.—44-page booklet describing the physical and corrosion-resistant properties of aluminum and its use in many chemical-plant applications.

Metals and Alloys. Titanium Alloy Mfg. Co., Niagara Falls, N. Y.—"TAM Daily Reminder," first issue of a monthly diary which in addition to space for notes will contain technical comments and data of interest to the metallurgical industry.

Packers. Bagpak, Inc., 220 East 42d St., New York City—4-page folder describing this company's equipment for the packaging of materials with automatic and semi-automatic paper-bag packers.

Power Transmission. J. L. Nelson, American Leather Belting Assn., 41 Park Row, New York City—Leaflet describing a series of 50 weekly reports by R. W. Drake, on transmission of mechanical power from electric motors to driven machines. This series is to be issued to all who subscribe to it.

Power Transmission. Smith Power Transmission Co., Penton Bldg., Cleveland, Ohio—Folder briefly describing the new Johnson variable speed reducer.

Power Transmission. U. S. Electrical Mfg. Co., Los Angeles, Calif.—Folders 770 and 777—Respectively describing this company's "Syncrogear" motors (motorized speed reducers); and the new variable-speed U. S. "Varidrive" motor.

Waterproofing. Master Builders Co., 7016 Euclid Ave., Cleveland, Ohio—Folder describing this company's new method of waterproofing concrete walls.

Water Purification. International Filter Co., 59 East Van Buren St., Chicago, Ill.—Bulletins 126 and 6007—Respectively, 4 pages on the "Hydrodarco" purifier for removing taste and odor from water supplies; and 6 pages on the use of activated carbon in industrial water purification.

NEWS OF THE INDUSTRY

Muscle Shoals Bill scheduled for prompt action. Rise in commodity prices adds to confidence in industrial revival. Government may not claim title or ownership to patents gained by employees. Many new products and new processes employed in German chemical industry. Singmaster patent for pigmenting rayon awarded to N. J. Zinc Co.

N. J. Zinc Wins Singmaster Patent Suit

A DECISION made by Judge Caffey, after a trial lasting three weeks, awarded to the New Jersey Zinc Co., U. S. Patent No. 1,725,742 for pigmenting rayon which patent was issued to James A. Singmaster in 1929 and assigned by him to the Tubize Chatillon Corp.

The Bill of Complaint alleged that in 1926 Singmaster, while in the employ of the New Jersey Zinc Co. as general manager of its technical department and obligated under its regulations to disclose and assign to his employer all patentable ideas originating with him while so employed, conceived the idea of incorporating pigments into the cellulose mass from which rayon filaments are spun; that he failed to disclose his invention to the zinc company, but left his employment on May 1, 1927 and after obtaining a patent on his invention in 1929 sold and assigned the same to the Tubize company; that the Tubize company never recorded the assignment to it of the patent and that when it dealt with Singmaster it had knowledge of his obligation to the zinc company. Mr. Singmaster denied that he conceived the invention while in the zinc company's employ, denied his obligation under the regulations of the company to assign any inventions he might make; alleged that he had disclosed his idea to the zinc company and that the latter had waived and released its rights therein; and alleged that he did not make his invention until after his resignation took effect. The relief asked by the zinc company was a decree directing the defendants to assign the patents, account for profits, and for an injunction.

Engineering Societies to Hold Joint Meeting

A JOINT meeting of the Iron and Steel Division of the A.S.M.E., American Welding Society, American Institute of Mining and Metallurgical Engineers, American Society for Steel Treating, and the Electrochemical Society will be held at the Engineering Societies Bldg., New York, on the evening of April 26. George H. Charls, secretary of American Iron and Steel Institute will act as chairman. Marcus A. Grossman, Illinois Steel Co., will speak on "Development of Stainless Steels and the Present State of the Art." Walter M. Mitchell will speak on "Uses and Applications of Stainless Steel" and F. M. Becket, president of A.I.M.M.E. will discuss Heat Resistant Steel. An exhibit of stainless steel products will be on view in the lobby.

I. C. I. Reports Larger Profits For 1932

LARGER profits and higher dividends in 1932 compared with 1931 were recently announced by the officers of the Imperial Chemical Industries Ltd. Gross profits were reported to be £6,415,425 compared with £4,668,685 in the preceding year, while net profits amounted to £4,729,072 compared with £3,408,290. In both years £1,000,000 was allocated to the central obsolence fund, while the provision for income tax in 1932 was considerably more than double the corresponding figure in 1931.

After payment of dividends on the preferred and ordinary shares and the allocation of £500,000 to the general reserve, the amount carried forward is £543,770 compared with £516,825 brought forward from 1931.

A final dividend of 3½ per cent will be paid on the ordinary shares, making a total dividend of 6 per cent for the year compared with a total dividend of 4½ per cent for 1931. A 6 per cent dividend was also paid for 1930, while for the three previous years the rate was 8 per cent.

Combustion Engineering Plans Reorganization

AFTER more than three years of receivership a plan of reorganization for the International Combustion Engineering Corp., has been submitted to creditors and security holders and the United States District Court.

The plan provides for a new company, International Combustion, Inc., to take over the business and assets, including foreign units. Creditors will receive 5 per cent debentures based upon the principal amounts of their claims as follows: International Combustion Engineering, 80 per cent; Combustion Engineering Corp., 30 per cent, and Heine Boiler Co., 50 per cent. Stockholders may subscribe for the new prior securities carrying 80 per cent of the common stock, to the extent that the creditors do not subscribe. Hayden, Stone & Co. have underwritten the plan for raising more than $2,000,000 new capital.

Preferred stockholders on April 10, opposed the plan. They claim that the plan squeezes the preferred stockholders out of their equity position; that it is put forward at a time when negotiations are under way for the sale of the company's foreign properties, for cash, to reliable British interests; and, that it is doubtful if the plan could be consummated without serious legal entanglements because creditors may be opposed to the offer of second-grade unsecured income debentures.

Chemists Set New Records In Washington Meeting

WITH MORE than 2,500 registrations and perhaps 3,000 in attendance the spring meeting of the American Chemical Society in Washington during the week of March 27 set several new records for that organization. Its 17 divisions held 48 technical sessions, at which more than 500 papers were presented. Dr. Charles E. Munroe, a founder and, in point of service the oldest living member, served as honorary chairman of the convention, and at a special dinner in his honor was presented with a diamond emblem of the society and a generous gift of gold certificates.

Four outstanding leaders in industry, science and research addressed the general meeting to discuss the relation of chemistry to the state, to the individual and to other industries and sciences. Harry L. Derby, president of the American Cyanamid and Chemical Corp., showed how the ten billion dollars now invested in the chemical industry of the United States contributes $700,000,000 in annual earnings in addition to human services of inestimable value. Charles F. Kettering, vice president of General Motors, said that chemistry can serve the individual best in the present emergency by contributing more knowledge of the basic facts of our industrial processes. He would apply the same mental attitude to economic subjects. Clear thinking, he holds, is necessary to "clean up the mess we are in." Charles M. A. Stine, vice president of the duPont company, graphed the advance of chemical industries and demonstrated their inter-relations and interdependence. Prof. Hugh S. Taylor of Princeton showed the over-lapping of chemistry and physics, and emphasized the fact that chemical research of the future will demand increasing knowledge of higher mathematics and statistical mechanics.

Dr. Irving Langmuir, Nobel Laureate in Chemistry and former president of the society, addressed one of the evening sessions on the physico-chemical theories of surface tension and adsorption. At the council meeting, it was announced that the annual award of $1,000 made by his brother, A. C. Langmuir, had been conferred on Dr. Frank Harold Spedding, of the University of California, in recognition of his spectrographic studies of the atom.

The next meeting of the society will be held in Chicago during the week of September 11. The spring meeting in March, 1934, is scheduled for St. Petersburg, Fla., and the autumn meeting of that year in Cleveland, Ohio. No action was taken, but it was suggested that in the spring of 1935, the society might meet in the metropolitan New York area and, in accordance with its own five-year plan, return to the Pacific Coast for the fall meeting of 1935.

Synthetic Plastics Grants License To Bakelite

ANNOUNCEMENT was made early this month by Synthetic Plastics Co., manufacturers of molding powders sold under the trade name "Beetle," that it had granted a license under its patent rights to the Bakelite Corp. for the field of urea resin molding compositions. Included in the patents of the Synthetic Plastics Co. are those covering the pioneer inventions of Drs. Fritz Pollak and Kurt Ripper, of Vienna, acquiring from the Pollopas Co. of England, and those covering the technical developments of the British Cyanides Co. of England, as well as the subsequent developments of the laboratories of the American Cyanamid Co. of which Synthetic Plastics Co. is a subsidiary.

Telephone Research To Be Unified

IN A series of changes preliminary to the unification next fall of the Bell Telephone Laboratories and the research department of the American Telephone and Telegraph Company, H. P. Charlesworth, assistant vice president of A. T. and T., has become assistant chief engineer, and E. H. Colpitts, also assistant vice president of A. T. and T., has become vice president of the Bell Telephone Laboratories.

It is contemplated that A. T. and T. will own the Bell Telephone Laboratories outright, and that the entire research forces will be concentrated at 463 West Street, where the laboratories are situated. The combined personnel will number about 4,500, principally research engineers.

Chemical Exposition Will Have Brewing Section

ONE sign of the times is the announcement just made that the Fourteenth Exposition of Chemical Industries will include a section especially devoted to the brewing industries, their processes and equipment. The exposition occurs during the week of Dec. 4, 1933. As usual, three floors of Grand Central Palace have been reserved. In keeping with the improved business attitude, the spirit of contest among exhibitors for choice positions along the various aisles, is reflected in the fact that already over one hundred and fifty companies have contracted for space at the Fourteenth Exposition. Through the section devoted to the interests of the brewing industries, the chemical exposition will contribute to the start which the beer industry will require.

Government Employes May Exploit Patent Rights

GOVERNMENT employees may privately exploit for their personal profit the commercial results of patents gained by them unless specifically a part of their official duties undertaken directly under instructions of their superiors. This is the general effect of the decision April 10 in the Supreme Court of the United States telling the government that it may not claim ownership or title to the patents of two Bureau of Standards' investigators, F. W. Dunmore and P. D. Lowell, fundamental to the design of radio receiving sets.

The lower courts in this case had decided that this work of the Bureau of Standards had been undertaken by the inventors voluntarily outside their official assignments, but had been allowed to continue with the knowledge of superiors after the patent conception had occurred. There was no question raised as to the fact that the work was done in official time using government facilities. But, the court says, this does not give the government more than a shop right to use an invention in its own interest.

The court finds that no right of administrative authority exists to deprive the individual employee of the rewards of commercial exploitation of his invention. It declares that the Congress has been silent on this point, and that until Congress acts employees may not be so deprived.

Patent Office Breaks Long-Standing Record

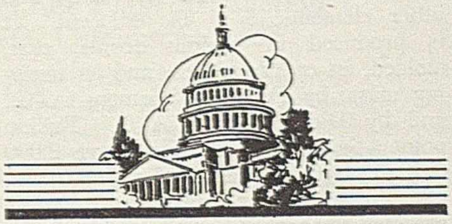
FOR THE first time in 21 years, all examining divisions of the Patent office of the Commerce Department were within four months of reviewing current patent applications on March 31, according to Commissioner Thomas E. Robertson. On the same date last year, only 12 divisions were less than four months behind, and 16 divisions were more than six months behind application.

Commissioner Robertson has made a special effort to expedite the review of applications, since many patent awards result in expenditures for plant equipment and enlarged payrolls and so assist economic improvement.

On March 31, there were 51,500 applications awaiting action. This compared with 80,145 applications a year ago, and an all-time record of 120,634 on July 31, 1930. At the close of March, 1933, of the 65 divisions, six were less than two months behind with their work; 20 divisions were less than three months, and all 65 were less than four months. The oldest new application for a patent awaiting action was filed on Dec. 1, 1932.

NEWS FROM WASHINGTON

By PAUL WOOTON
Washington Correspondent of Chem. & Met.



PRESIDENT ROOSEVELT'S determination to put more men to work is the signal for a forward drive that embraces not only the government but private industry. The effect of the President's whirlwind activity during his first few weeks in office was to mop up deflation to its very dregs. Now he has set his hand just as firmly to creating inflation; momentum is perhaps a better word. Public works construction is only an obvious expedient. Mr. Roosevelt is looking for a plan that will stimulate private industry to an extent that will absorb the enormous cost of both direct relief and public works and put men back to work where they belong.

The President is still seeking, striving for the instrument fitted to his hand and his purpose. The 30-hour week isn't his idea. It is, in fact, the first measure to command the support of a majority in either house that was not served up by the administration. He may adopt it in order to consolidate his position, hold his strength in Congress. But if he can manage it, the drastic character of this legislation will be modified. The conviction prevails among the brain trust, as among less conspicuous economists, that complete restoration of prosperity lies in shorter hours, higher wages, but a short work day and work week is not the instantaneous, powerful stimulant that the President is looking for now.

The President's plan for developing a great inland empire in the watershed of the Tennessee River, in which Muscle Shoals is the energizing unit, sets the old wartime plant in a new perspective. The President's ambitious plan would create a whole economy for this region, with production and demand growing hand in hand. In utilizing Muscle Shoals, the manufacture of fertilizer is subordinated to the generation and distribution of power and both are subservient to transforming the valley into a region of diversified agriculture and industry. The complete economic panorama which the President has attempted to bring into focus still lies beyond the horizon but Muscle Shoals has at last been given some significance in a frame that is designed to support it.

Everything that has been heard so far concerning tariff revision has been directed towards, not from, the White House. The President has as many, if not more volunteer advisers on this than on other subjects and it would appear that most of them have not been averse to ventilating their ideas publicly. It is safe to say only that for the first time in the history of the party, the Democrats will bargain for something in return instead of simply handing American markets to the world on a platter. And even if reciprocity proves to be an effective instrument, it will be sometime before duties are lowered on a wide range of goods.

Reciprocal tariff-making will depend on the power that President Roosevelt can wrest from Congress. Given wide latitude the President can ignore, if he wishes to take political risks, the prime obstacle to such a policy, which is the reluctance of any industry in the U. S. A. to sacrifice a little in order that another might gain much. If Congress will permit him only to negotiate reciprocal tariffs, which was the extent of the bill vetoed by Mr. Hoover, little can come from any agreement subject to nullifying reservations.

To satisfy constitutional inhibitions, there must be limitations on the authority delegated to the President but, Congress willing, these can be sufficiently broad to cover all practical circumstances. Negotiation of reciprocal trade agreements per se does not present any practical difficulty. While it is true that all most-favored-nations theortically would benefit, without reciprocating, from any concessions made by the United States in bargaining with a particular country, such bargains obviously would be confined to products commercially important only to this and that country.

Appointment of Dr. L. J. Briggs as director of the Bureau of Standards was greeted with approbation and may be regarded as assurance that the political affiliation or convictions of an incumbent or new appointee in the technical and scientific services of the Government will not be considered by President Roosevelt. The axe will fall on such units in common with others in retrenching the government's budget but their integrity will not be undermined. Reorganization probably will involve some of them but outward form actually has little disturbing effect on the pursuits of the scientifically-minded men in the laboratories.

Of profound significance to the scientists and technicians in the government's employ is the U. S. Supreme Court's decision that the government cannot appropriate an invention of an employee not specifically assigned to research in the same field. In affirming the judgment of lower courts that Francis W. Dunmore and Percival D. Lowell were not required, when employed at the Bureau of Standards, to assign to the government patents utilizing a.-c. current in radio receiving sets, the high court suggested that Congress should declare a public policy with reference to governmental control of patents. The courts are not competent, according to Associate Justice Roberts, to answer the question whether the patentee is to be allowed his exclusive right or compelled to dedicate his invention to the public.

Among various regulatory agencies that will assume added vigor and authority under the new administration is the Food & Drugs Administration. Rexford Tugwell, the assistant secretary, has impressed Secretary Wallace and President Roosevelt with his recommendations for tightening up the enforcement machinery of the Food & Drugs Act and the law itself.

President Roosevelt's shoulders are broad, as he has demonstrated, but he drew the line at assuming the oil industry's grief. He had competent reasons for stating that the federal government cannot go further than embargo interstate shipment of oil produced in violation of state laws but a political motive also is imputed to his dexterous handling of this situation. Among the insurgents in the industry that want no proration, no control of production, are John B. Elliott, oil producer, and J. Edward Jones, royalty broker, who were McAdoo's lieutenants in the campaign to put Roosevelt over in California.

Business is in a stronger position than is generally recognized, say economists in Washington. Prices of most commodities have advanced. When the increase is expressed in percentage it is particularly impressive.

Manufacturing no longer is being called upon to take the shocks incident to violent price declines. Prices of many manufactured commodities have improved. Large buying of capital goods cannot be deferred much longer. Those who hold that opinion base it on two factors. Machinery and equipment have been wearing out during the past three years. This is indicated by the activity in the manufacture of spare parts. The point rapidly is being reached where replacements must be made. The other factor is regarded as even a more potent one. In every line a small percentage of manufacturers have installed the latest equipment. With this and other expense-cutting innovations they have become the low-cost producers.

New Products and New Processes Are Prominent in Germany

From Our Berlin Correspondent

German consumption of mineral oils showed a decrease of about 10 per cent in 1932, compared with the previous year. This decline effected only imports, as domestic production was practically unchanged (230,000 metric tons, an increase in the Hannover production, and a decrease in Thuringia). Among domestic motor fuels a drop occurred in the production of benzol, on account of curtailment in the coking industry; this was partly made up by domestic production of gasoline by cracking and by the addition of a certain amount of alcohol as required by law. Total domestic production of motor fuel was 508,000 tons, with a consumption of 1,380,000 tons. Imports of gasoline from the United States dropped from 544,000 tons to 331,000 tons, whereas imports from the other Americas increased from 115,000 to 187,000 tons; practically no change was reported in imports from Russia (277,000 tons), but imports from Rumania dropped from 148,000 to 78,000 tons. Lubricating oils from the United States went down from 147,000 to 110,000 tons, while the Russian tonnage increased from 85,000 tons to 98,000 tons. Itemized consumption of imported mineral oils for the year was as follows: motor fuels, 1,380,000 tons (10.4 per cent decrease); petroleum, 120,000 tons (11.1 per cent. decrease); lubricating oils, 270,000 tons (15.6 per cent decrease); and gas oil, 370,000 tons (2.8 per cent decrease).

According to the board of industrial supervision in Saarbrücken the explosion of the 120,000 ton gas tank in Neunkirchen on Feb. 10 was caused by a small primary explosion started by a blow torch in an adjoining gas line, in which a small amount of gas was left. The flame caused by the explosion made the comparatively thin walls of the tank red hot. The heat made the packing ineffective, causing the gas in the lower part of the tank to become mixed with the air in the upper part, thus producing an explosive mixture.

A high-temperature refractory offering many advantages, Siemensite, was discovered accidentally in the production of ferrochrome low in carbon by the Haglund electric furnace process. A very high temperature is required in this process, to keep the slag liquid, and magnesite was not found suitable for lining. An attempt to line the furnace with the high-smelting slag produced in the process was found highly successful. The new material has the following chemical composition: chromium oxide, 20 to 40 per cent; magnesia, 18 to 30 per cent; alumina, 25 to 40 per cent; and other elements, 8 to 14 per cent. It is produced in various forms, cast, molded, in coarse pieces, and as tamping mass, by Friedrich Siemens A.-G., and by Didier Werke A.-G. Fusion point (Seger cone) is far above 2,000 deg. C.; with a load of 2 kg. per sq.cm. (30 lb. sq.in.) no reduction in compressive strength was observed at 1,810 deg. Tests to determine changes in volume, without load, between 0 and 1,200 deg., showed that only between 900 and 1,000 deg. are special precautions in handling necessary.

Used in Siemens-Martin furnaces the new refractory not only increases the life of the furnace, but an appreciable reduction in construction cost is made possible from 2–2.5 RM. per ton steel to 1.42 RM., with prospects of a further decrease to about 1 RM. It is especially well suited for construction of inclined furnace walls (55-60 deg.) and for the high temperature and corrosive slag encountered in this furnace. The great resistance to the corrosive action of slags makes Siemensite an excellent material for construction of furnaces and flues in chemical plants; in this field it is said to be far better than the Speckstein, formerly considered the most resistant to alkalis, although at 1,000 deg. C. the later dissolves completely in fused alkali within a period of 10 min., whereas Siemensite gave no evidence of corrosion. A tank for production of water glass, when lined with fire brick (chamotte), had to be repaired every 2-3 months; with Siemensite lining the tank has been in operation for 11 months without repair. Cost of good fire brick, about 150 RM. per ton, for Siemensite 330 RM. per ton. In Sweden the new material has been used with great success in furnaces for recovery of soda in cellulose plants; other applications are in continuous electric furnaces and in lime and cement kilns. Its high resistance to slags of all types suggests its use as acidproof material of construction in the chemical industry.

F. Thomas porcelain factory in Marktredwitz has developed a porcelain which, when hit with a wooden hammer, has an unusual clear tone, making it a fine material for gongs and bells.

Production of caustic soda without byproduct chlorine is accomplished in the Kiflu process, formerly discussed in this column. In this process sodium fluosilicate is used in closed circuit; only 4.94 tons of water is evaporated per ton caustic soda produced, compared with 6.41 tons in the ordinary process of causticizing soda.

Production of concentrated nitric acid without the use of sulphuric acid for removal of water is now possible by absorption of the nitric oxides produced in the oxidation of ammonia. Absorption is carried out at low temperature, under pressure; a reduction in production cost from 172 to 150 RM. per ton acid is made possible by this method.

A new process for the production of bleaching powder (CaOCl) (German patent No. 558,746, O. de Nora) utilizes a specially designed revolving tube for absorption of chlorine, in which a chlorine recovery of over 95 per cent is attained, leaving a residual gas practically free from chlorine.

An important simplification in the production of nitrocellulose is the nitration of plates of cellulose (German patent No. 551,007, V. Planchont). The method, which has been tried on a large scale eliminates nitration pots, acid heaters, agitators, and de-watering centrifuges.

Organic polyhalogens, such as naphthalintetrachloride, perchlorpentan, and others, with organic vehicles, are now used in soldering. These compounds are decomposed at the soldering temperature, forming hydrochloric acid.

The value of fire-proofing wood with sodium acetate, is disputed by Cellon Works, Charlottenburg, where tests have shown that the cellon lacquers used for many years are superior to the cheaper sodium acetate recommended by Schwalbe.

A new type of barrel, without any grooves, designed by Prof. G. Schlesinger, Berlin, is now being produced by Rhotart & Co., Berlin Rummelsburg. As the barrel is completely tight no paper lining is required in shipping powdered chemicals, thus permitting a saving in shipping weight.

The first shipment of wood for commercial production of wood sugar and chemically pure grape sugar has recently been received at the Mannheim-Rheinau plant of Deutsche Bergin A.-G. f. Holzhydrolyse.

Coal Conference Postponed

Owing to the unsettled economic conditions which might prevent a satisfactory attendance, curtailed university budgets, and also considering the general desire to concentrate interest in fuel and engineering matters on Engineering Week to be held at Chicago June 25-30, in connection with the 1933 Century of Progress Exposition, the sponsors of the Annual Midwest Bituminous Coal Conference have announced postponement of the Sixth Annual Conference to 1934.

Important Claims Made for Tellurium Alloys

IMPORTANT claims for tellurium alloys were made in a paper presented at a recent meeting of the Institute of Metals, London. An exhibit by Goodlass Wall, & Lead Industries, Ltd., of articles made from alloys of this type, was described in a recent issue of *The Metal Bulletin*. The amount of lead used is small, less than 0.1 per cent. An outstanding advantage is that none of the fundamental qualities of the lead is lost, while many desirable properties are gained. Most notable among these is the change to a finer grain structure; this change, which may easily be detected with the naked eye, insures a smooth surface and complete absence of coarse crystalline structure, with increased mechanical resistance to corrosion.

The chemical resistance to corrosion is said to be enhanced eight to twelve times, compared with ordinary chemical lead; absence of pitting is notable. Addition of tellurium also raises the temperature of recrystallization substantially, and the tensile strength is much increased by cold working, up to 80 to 100 per cent over that of ordinary lead. It may also be controlled, permitting the production of lead sheets of varying strength, an effect formerly not attainable.

Tellurium-lead pipe is soft, and has the property of becoming strengthened when subjected to strain caused by extreme cold, vibration, and bending. The higher resistance to fatigue and vibration is an important consideration in the laying of cables and supply pipe. The smooth surface reduces friction losses and minimizes any tendency to formation of accretions.

Chile and Sweden Agree On Export Claims

AN agreement recently was reached between the Governments of Sweden and Chile bearing upon the clearing of certain Swedish export claims with Chilean importers, according to a report to the Commerce Department Finance Division from Commercial Attache T. O. Klath, Stockholm. In accordance with the agreement, Swedish purchases of certain products from Chile, particularly nitrate and salt cake, are to be paid for by depositing a certain part of the proceeds in the Swedish Riksbank for account of the Chilean shippers to be cleared against non-paid Swedish export claims.

The Swedish Export Association, which is handling the barter agreement between the Swedish Tobacco Monopoly and Greece is also to handle the new Chilean clearing agreement. The frozen Swedish credits in Chile are estimated to amount to about 2,900,000 crowns, and if everything works out in accordance with the agreement, it is hoped that these will be liquidated by the end of 1935.

Chile Plans Production Of Calcium Carbide

ACCORDING to unofficial reports, local interests in Santiago plan to manufacture calcium carbide. In 1931 imports totaled 6,204 metric tons, of which Germany accounted for 61 per cent.

Based upon preliminary experiments, it is expected the product can be produced from raw materials available locally at prices competitive with the imported product.

Sale of Liquefied Petroleum Gases Gained in 1932

WITH an increase of approximately 5,000,000 gallons, representing a gain of 17 per cent over 1931 sales, the marketed production of liquefied petroleum gases during 1932 continued the increase which has been recorded annually during the past several years. The 1932 increase, however, did not equal that recorded for 1931, when marketed production of these gases was nearly 11,000,000 gallons larger than in the preceding year.

Sales of Liquefied Petroleum Gases, 1927-1932

	Gal.
1927	1,091,005
1928	4,522,899
1929	9,930,964
1930	18,017,347
1931	28,769,576
1932	33,630,236

The gases included are propane, butane, pentane and propane-butane mixtures. The gain recorded for 1932 was principally within the fields served by butane, especially for gas manufacturing purposes. The demand for propane was only slightly larger than in the preceding year. The distribution of 842,126 gallons of pentane is included in the quantities reported under pentane and propane-butane mixtures. Nearly all of the liquefied petroleum gases marketed during 1932 were produced at natural gasoline plants. Some companies, however, reported production at refineries.

CALENDAR

American Institute of Chemical Engineers, spring meeting, Chicago, Ill., June 14-16.

Electrochemical Society, spring meeting, Montreal, May 11-13.

American Petroleum Institute, Tulsa, Okla., May 17-19, 1933.

American Society for Testing Materials, Chicago, Ill., June 26-30, 1933.

American Chemical Society, 86th meeting, Chicago, Ill., week of Sept. 11, 1933.

National Metal Congress and Exposition, Detroit, Mich., Oct. 2-6, 1933.

Fourteenth Exposition of Chemical Industries, New York, week of Dec. 4-9, 1933.

Oil Cracking Patents Involved in Suit

SUIT alleging infringement of cracking patents and involving what is understood to be a Winkler-Koch cracking unit has been brought by The Texas Co. against the Republic Oil Refining Co. The suit, which has been filed in the United States District Court at Houston, Texas, alleges infringement of four patents of William A. Hall, of the following numbers: 1,175,909; 1,239,099; 1,239,100; 1,242,795; and two patents of Otto Behimer, the numbers of which are: 1,840,012; 1,883,850. The suit is brought by The Texas Co. as owner and assignee of the Behimer and Hall patents. The cracking operations in question are located at the Republic Oil Refining Co.'s plant at Texas City, Texas.

Universal Oil Products Company on March 9 filed suit in the federal court in Wilmington, Delaware, against Octane Oil & Refining Co., alleging infringement of the clean circulation patent No. 1,392,629 and also of patent No. 1,890,974. The Octane company's refinery, where it is alleged the infringement is being carried on, is at Baird, Texas.

Segregation by Uses of Marketed Production, Liquefied Petroleum Gases
(Figures in gallons)

Uses	Propane	Butane	Pentane and Propane-Butane Mixtures	Totals 1932	Totals 1931
Domestic	14,570,392	81,981	1,119,199	15,771,572	15,294,648
Gas Manufacturing	257,407	7,225,851	2,208,212	9,691,470	6,303,242
Industrial and Miscellaneous	354,072	7,353,856	459,266	8,167,194	7,171,686
Total	15,181,871	14,661,688	3,786,677	33,630,236	28,769,576
Shipped in — Cylinders or Drums	13,416,567	2,951	960,451	14,379,969	14,006,180
Tank Cars, Tank Wagons, or by pipeline	1,765,304	14,658,737	2,826,226	19,250,267	14,763,396
Total	15,181,871	14,661,688	3,786,677	33,630,236	28,769,576

Names in the News

Charles L. Reese

Charles L. Reese, newly elected president of the American Chemical Society to serve in 1934, was recently the guest of honor at a dinner tendered him by members of the Delaware section of the society.

Aldus C. Higgins was elected president and general manager of the Norton Co. on Jan. 17, on the retirement of Charles L. Allen, who has been the general manager of that company for 47 years and president since 1919. Mr. Higgins has been associated with the company since 1900, in the early years as manager of research laboratories, manager of research and abrasive plants, secretary from 1912 to 1919 and treasurer and general counsel since that time.

George N. Jeppson, vice-president in charge of production of the Norton Co. has been made treasurer of that company.

W. O. Hisey, formerly chemical engineer with the Celotex Co. and the Oxford Paper Co., is now connected with the P. H. Glatfelter Co. Spring Grove, Pa.

A. W. Downes formerly on the chemical staff of the University of Wisconsin has assumed his new duties in the South Charleston laboratories of the Union Carbide and Carbon Chemicals Corp.

B. C. Becker has been transferred from Peru, Ill., L. R. Gray from Houston, Texas, and J. B. Mull from East Chicago, Ind., to the Wood River Refinery of the Shell Petroleum Corp.

R. S. MacDuff has accepted a position with the Shell Petroleum Corp. in the refinery at Norco, La. He will have charge of all process tanks and superintend all tank transfers of oil and other products.

Henry Clapp Sherman, Mitchell professor of chemistry and executive officer of the Department of Chemistry at Columbia University, will be presented with the medal of the American Institute of Chemists. The award is being made in recognition of Dr. Sherman's food researches and his services to the profession through the training of chemists.

Emerson P. Poste, for eight years with the Chattanooga Stamping and Enameling Co. as chemical engineer, is severing his connection with that company and is establishing his own laboratory at 99 Market St., Chattanooga. Before joining this southern firm Mr. Poste was with the Elyria Enameled Products Co. and the Pfaudler Co. Irvin H. Barrows is associated with Mr. Poste as a consulting chemical engineer.

Frank H. Spedding, of the University of California, has been presented with the Langmuir award conferred annually on the most promising young American chemist for original work in the field of chemistry. Dr. Spedding's work disclosed more complete knowledge of the atom.

Roy C. Muir, for three years assistant to the late Charles E. Eveleth, vice president in charge of engineering of the General Electric Co., has been appointed manager of the engineering department. Mr. Muir will have direct charge of the company's works laboratories and the general engineering laboratory at Schenectady.

B. L. Boye has been elected president of the Asphalt Institute to succeed William H. Kershaw of the Texas Co. Mr. Boye, who has been with the Standard Oil Co. of New York for 33 years, is now in charge of that company's asphalt and fuel oil activities. J. E. Pennybacker continues as managing director of the institute.

Robert E. Wulff, chemical engineer of Los Angeles, Calif., has joined the chemical research and development staff of the Shell Oil Co. Mr. Wulff's most recent work has been the development of a process for manufacturing acetylene from natural gas.

D. M. Morrison has been appointed assistant superintendent of the new Shell Oil Refinery at Montreal. He is a graduate of McGill University and Cambridge.

W. L. Rambo has joined the research laboratory of the Shell Oil Co. of Canada at Montreal.

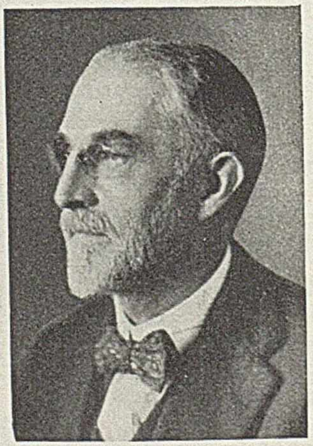
J. W. Boyle, formerly with Ritchie and Ramsey Co. of Toronto, and who recently entered the employ of the Miami Valley Coated Paper Co., Franklin, Ohio, as chemist has been appointed general superintendent.

Richard Willstaetter of Munich has been selected to receive the Willard Gibbs Medal for 1933. The award is made annually by the Chicago section of the American Chemical Society.

Obituary

Arthur M. Comey, retired chemist of Cambridge, Mass., died at his home April 7, at the age of 71. Dr. Comey was from 1906 until his retirement in 1921; director of the high explosives laboratory of the E. I. du Pont de Nemours Co. in Chester, Pa. Previously he had been a consulting chemist and also a professor of chemistry at Tufts College and an instructor at Harvard.

Born in Boston, Dr. Comey was graduated from Harvard in 1882 and later from the University of Heidelberg. His dictionary of chemical solubilities, first published in 1896, has long been considered a standard work of reference.



Arthur Messinger Comey

John Prochazka died March 22 after a long illness. He was a pioneer in the dyestuff industry which he entered in 1885. With his older brother George A. Prochazka he started the Central Dyestuff and Chemical Co. at Newark, N. J. in 1898. As chief chemist of this company he worked out many of the manufacturing methods. At the outbreak of the war he went to work in his usual vigorous fashion to develop a method for beta naphthol and soon had a factory process for this important intermediate. He was born in New York City, Oct. 12, 1862 and graduated from City College as valedictorian. Later he studied at Muhlhausen. He was a man of unusually broad scholastic attainments.

Walter E. Lummus died at his home in Montclair, N. J. on March 31. Mr. Lummus was born at Lynn, Mass., Nov. 30, 1867 and was the founder of the Walter E. Lummus Co., well known in the chemical and petroleum industries. He was a pioneer in the design and development of modern distillation equipment in this country. His first work in this field was in connection with the wood chemical industry in 1897, in improved distilling apparatus for refining methyl alcohol. The following years saw a rapid extension of his engineering designs and equipment to other branches of the chemical industry and the establishment of a world wide reputation which led to important installations in other countries. He was one of the first to apply modern distillation methods to the petroleum industry.

H. G. Barnhurst, of the cement department of the Babcock & Wilcox Co., died of heart failure during the night of March 18, at Chicago, Ill.

Laurence Arthur Carton, treasurer of Swift & Co., who died recently in Chicago, was an outstanding man in many respects. He was well known throughout the United States and among bankers abroad, both as a student of finance in all its banking and commercial ramifications and as a practical man of affairs.

Albert Gerstendorfer, former president of the Sapolin Co., New York City, died March 5 at his apartment in that city after an illness of several months. He was 69 years old. Mr. Gerstendorfer was one of the founders of the paint, varnish and enamel firm of Gerstendorfer Brothers, Inc., which was the predecessor of the Sapolin Co.

W. H. Gehbauer died March 23 in Springfield, Mass. He was 57 years old. Mr. Gehbauer was superintendent of the rag department of the Mittineague plant of the Strathmore Paper Co.

Walter W. Kuchler, for many years with the Roessler and Hasslacher Chemical Co., now the R. & H. Chemicals Department of E. I. du Pont de Nemours & Co., and widely known in the chemical industries, died Feb. 10 at Houston, Texas. At the time of his death he was motoring in Texas looking over his citrus fruit farm and was stricken with a heart attack.

Andrew C. Pearson, chairman of the board of the United Publishers Corp., New York, N. Y. died at his home in Montclair, N. J. March 31, aged 59 years. Mr. Pearson was born in Coffeyville, Kansas, Nov. 17, 1873. At one time he was vice-president of the Newton Falls Paper Co.

George. H. Schwartz died March 21, after a long illness, at his home in Lakewood, Ohio. He was 73 years old.

John Francis Queeny

John Francis Queeny, Monsanto's chairman of the board, died of a complication of diseases on the afternoon of March 19 at his home in St. Louis after an illness of several months.

Mr. Queeny was the founder of the company which bears his wife's maiden name. Under his direction Monsanto became one of the leading chemical firms in the country. He was born in Chicago, Ill., Aug. 17, 1859, and has been active in the chemical and drug business all of his business career. The completion of his sixtieth year in the chemical and drug industry was marked on March 22, 1932 with a testimonial dinner at which he was guest of honor.

Mr. Queeny was president of the Monsanto Chemical Co. until May, 1928, when he resigned to become chairman of the board. His son, Edgar M. Queeny succeeded him as president. He has been actively identified with inland waterways improvements and was a member of the executive committee of the Mississippi Valley Association. He was a member of many local organizations and active in civic developments.

J. M. Huber, president of the J. M. Huber, Inc., manufacturers of dry colors and printing inks, New York City, died March 2 at his home in Locust, N. J. He was 74 years old. Mr. Huber was born in Munich, Germany, and came to this country in 1886. Soon after his arrival he entered the manufacturing business, producing besides printing inks and dry colors, carbon black, china clays, natural gas and petroleum.

Fernando W. Martin, emeritus professor of chemistry and formerly vice-president of Randolph-Macon Women's College, died March 22 at his home in Lynchburg, Va. He was 69 years old. For 36 years he was head of the department of chemistry at this Virginia institution.

H. L. Troxell, a manufacturing chemist of Washington, D. C., died unexpectedly March 19 at his home in Emmitsburg, Md. He suffered a stroke of paralysis. Dr. Troxell was born at Emmitsburg on June 14, 1880, and received an education at Mount St. Mary's College and the University of Maryland. He engaged in the drug business before entering the manufacturing industry.

Edward J. Durr, formerly superintendent of the Procter and Gamble Co., Cincinnati, Ohio, died March 28. He was 74 years old and a native of Cincinnati. Mr. Durr had been employed by the soap company for 45 years at the time of his retirement.

William Wipperman, chief refining engineer for the Shell Petroleum Co. at East Chicago, Indiana, died March 12 in Milwaukee, Wis. He had been on a leave of absence for a year because of illness. Mr. Wipperman was 46 years old. Several years ago he had been a professor of engineering at the Texas A. & M. College.

Irving Post, president of the naval stores company bearing his name, died March 5 at his home in Savannah, Ga. Death was due to pneumonia which had followed an attack of influenza. He was 53 years old.

Mr. Post was born in Passaic, N. J. As a boy he entered the naval stores business with the S. P. Shotter Co. Ten years ago he joined the Naval Stores Marketing Corp. with headquarters in Savannah. When the activities of that organization came to an end he formed the Irving Post Co.

Francis K. Glidden, formerly vice-president and a founder of the original Glidden Varnish Co., died March 14 at his residence in Palm Beach, Fla. He was 77 years old.

CHEMICAL ECONOMICS

Rate of manufacturing activities in chemical industry did not change appreciably in March but reports on April operations indicate a speeding up of outputs. Different consuming outlets are taking on larger supplies of raw materials and prospects grow steadily more favorable

MARCH started off under very inauspicious conditions and manufacturing operations were sharply curtailed because of the banking holidays. As the financial situation improved the rate of production was accelerated and at the close of the month different industries were progressing more actively than at any time in the present year. Some producers of chemicals went ahead at a steady pace throughout the month and reported an output in excess of that for the preceding month. As a whole, however, production failed to establish substantial gains if daily production rates are considered but the greater number of working days resulted in an increased outturn. Based on consumption of electrical power the index number for production of chemicals in March was 113.8 in comparison with 111.2 for February.

Reports current regarding production in the present month indicate a higher rate of activity with gains also reported in different consuming industries. Heavy industries, such as steel, building, and metallurgical have been slow to respond but are now picking up. Sales of automobiles in April were larger than had been anticipated and the output for that month will run ahead of totals previously scheduled and may exceed the total of April, 1932.

While some branches of the textile trade have gone along without much change in pace, there has been a slower production and a slower demand for rayon and silk. Glass makers have been active and some alkali plants are reported to have increased operations because of larger demands for soda ash. Nothing definite has been done regarding the use of alcohol in gasoline but legislative action is expected soon.

The New Orleans Cotton Exchange reports fertilizer sales in the ten cotton States were higher in March than for the same month a year ago. This is the first time in several years that March sales have exceeded the year before.

The seasonal spurt in sales occurs in the months of March, April and May, and indications are that the increase over 1932 will be maintained.

General improvement in business during the last half of March, following the curtailment incident to the bank suspension, was reported by the Department of Commerce in its monthly survey of current business. Production for the month, however, was considerably lower than in February, although the usual seasonal trend is upward. All of the heavy lines of manufacturing were seriously affected, but certain branches of the textile industry operated at a relatively high level despite the prevailing difficulties.

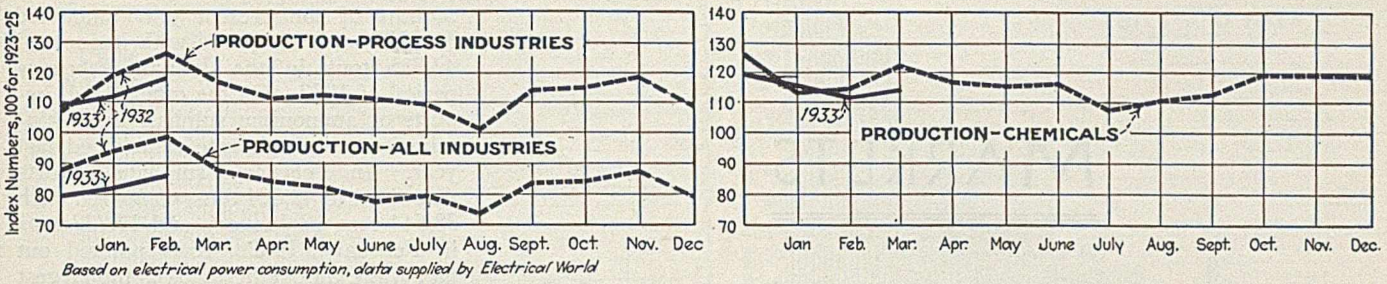
During February, production expanded, although manufacturing activity remained at the January level and the rise in the combined index was less than seasonal. Trends in the field of distribution, however, were mixed.

According to an estimate just compiled by the thirteen shippers' advisory boards, freight car loadings in the second quarter of 1933 will be 0.3 per cent less than actual loadings in the same quarter last year. The estimate is based on reports received from almost 20,000 shippers and constitutes the most favorable forecast received for any quarter since the end of 1929. Anticipated increases in shipments of coal and coke, cotton, sugar and molasses, citrus fruits, and ore and concentrates were expected to be offset by reduced distribution of other products. Automobiles and parts make the poorest showing in the prospective line up with a drop of 25.1 per cent predicted. The summary places declines in the movement of other goods at 5.8 per cent for chemicals and explosives; 3.2 per cent for paper and pulp; 8.3 per cent for fertilizers; and 7.4 per cent for petroleum and products.

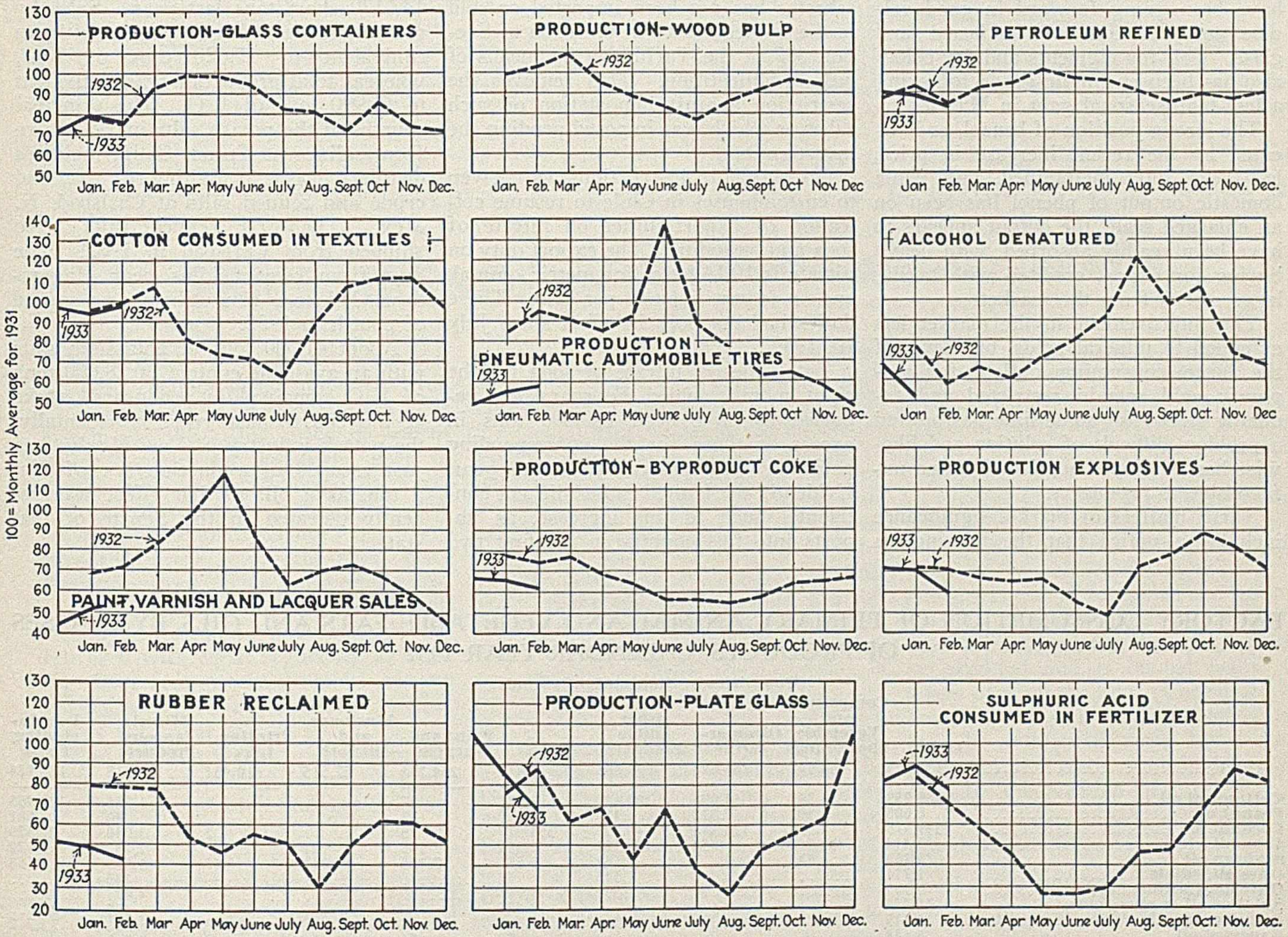
Index numbers used on the graph on the facing page were:

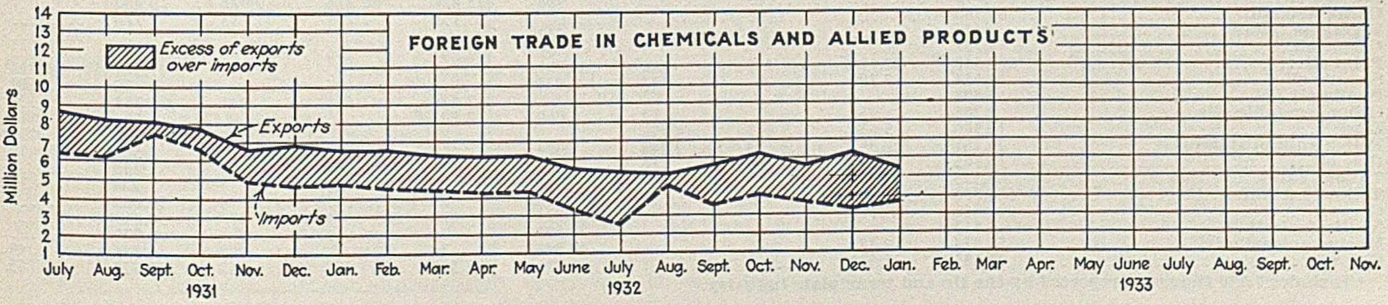
	Feb. 1933
Chemicals	111.2
All industries	86.0
Process industries	117.0
Cotton consumed	97.4
Byproduct coke	60.6
Explosives	60.0
Petroleum refined	81.9
Pneumatic tires	57.6
Rubber reclaimed	41.9
Glass containers	77.1
Plate glass	68.4
Sulphuric acid consumed	76.9

Production	Feb. 1933	Per Cent of Jan. 1933	Per Cent of Feb. 1932
Acetate of lime, 1,000 lb.	3,748	79.0	131.5
Automobiles, no.	106,814	82.1	91.0
Byproduct coke, 1,000 tons	1,639	91.8	82.1
Cottonseed oil, crude, 1,000 lb.	139,178	106.5	81.5
Cottonseed oil, refined, 1,000 lb.	113,517	101.2	70.2
Explosives, 1,000 lb.	16,008	90.1	88.6
Glass containers, 1,000 gross	1,585	96.9	102.4
Glass, plate, 1,000 sq.ft.	4,955	80.1	73.7
Methanol, crude, gal.	256,826	82.2	114.4
Methanol, refined, gal.	117,236.	70.1	105.3
Methanol, synthetic, gal.	339,300	96.2	62.1
Petroleum refined, 1,000 bbl.	61,042	92.4	95.7
Pyroxylin products, 1,000 lb.	701	96.7	52.6
Rosin gum, receipts, bbl.	30,639	87.4	103.7
Turpentine, gum, receipts, bbl.	2,826	44.9	74.2
Rosin, wood, bbl.	25,583	82.0	127.6
Turpentine, wood, bbl.	4,175	83.9	133.8
Rubber reclaimed, ton	4,303	86.4	53.2
Sulphuric acid by fertilizer industry, ton	99,699	86.9	95.3
Consumption			
Cotton, 1,000 tons	442	93.8	98.0
Silk, bale	32,665	70.7	71.2
Wool, 1,000 lb.	33,278	93.7	96.7
Fertilizer in South, 1,000 tons	298	145.4	81.6
Paint, varnish, and lacquer, sales	$12,348	103.3	75.9
Sulphuric acid consumed in fertilizer industry, ton...	86,558	86.2	108.2



TRENDS OF PRODUCTION AND CONSUMPTION





MARKETS

With the turn of the month improved demand for chemicals became more general. Fertilizer chemicals moved in a volume larger than had been expected and more activity was reported in the insecticide trade. Some branches of the textile trade have maintained a relatively high rate of manufacturing activity and deliveries have been going forward in good volume to producers of boxboard and glass. Call for pigments and dry colors also has been on the up-grade following a less-than-seasonal gain in March.

The strong position of benzol, as indicated by the recent increase in price, has been fully maintained, and while domestic output of phenol has been on an enlarged scale, the output appears to have been readily absorbed, with heavy buying for export credited with taking large stocks from the market.

The improvement in the market has extended to mineral acids, but some of the large consuming outlets for sulphuric acid remain restricted and reducing stocks for some time has offered a problem difficult of solution and likewise has developed a price situation unfavorable to producers.

Tariff matters of market significance included a notice that the hearing on phosphates and apatite originally scheduled by the Tariff Commission for April 17 had been postponed to May 22. A postponement also was announced for the hearing on oxides of iron, the time having been changed from April 25 to May 10.

The President approved the finding of the Tariff Commission that Russian asbestos has not been imported or sold in the United States in violation of Section 337 of the Tariff Act by means of unfair competition. This removes the restriction against importation of such asbestos which was imposed pending the investigation.

On March 15 instructions were given to customhouses in Chile to resume collection of export duties on nitrate of soda and on iodine. The export duty on nitrate is 10.14 pesos for metric quintal, and on iodine, 6 pesos per kilo. These duties had not been in effect since July 10, 1930.

Total sales of nitrate of soda for the eight months ended February are reported to have been 100,000 tons in excess of those for the corresponding period of the preceding nitrate year. Evidently the United States did not contribute much to this increase, as imports into this country in the first two months of the present year amounted to 2,872 tons, compared with imports of 42,215 tons in the January-February period of 1932. On the other hand, imports of ammonium sulphate are maintained at the high rate established last year. In February, sulphate imports amounted to 42,624 tons, compared with 38,644 tons in January and 19,232 tons in February, 1932. It is pointed out that while the Netherlands is the largest supplier to this country, with Belgium holding second place, Kwantung is forging ahead rapidly as a shipper, with our imports from that point amounting to 8,287 tons in January-February this year, compared with 446 tons in January-February, 1932.

Domestic production of potash, according to a report recently issued by the Bureau of Mines, amounted to 143,120 short tons last year. Sales by producers were 121,390 tons, with an equivalent of 55,620 tons of K_2O, whereas total production was equivalent to 61,990 tons of K_2O. The principal sources of the potash salts in 1932 were from salines at Trona, Calif., molasses distillery waste at Baltimore, Md., and crude and refined salts at Carlsbad, N. Mex. The first refined salts were shipped from Carlsbad in 1932. The dust from cement kilns near Hagerstown, Md., was also utilized as a source of potash in 1932.

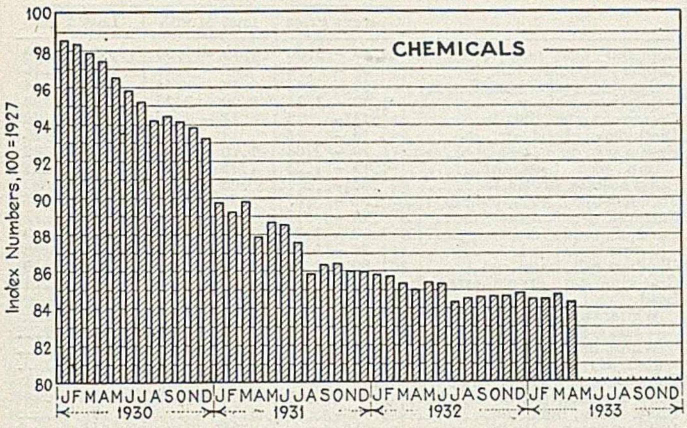
About 41,000 tons of potassium salts with an available content of 28,000 tons of K_2O remained in producers' stocks at the end of last year. Incidentally, the potash industry in New Mexico has just escaped a production tax of 20c. a ton, as a bill to that effect was recently defeated in the Senate of that state.

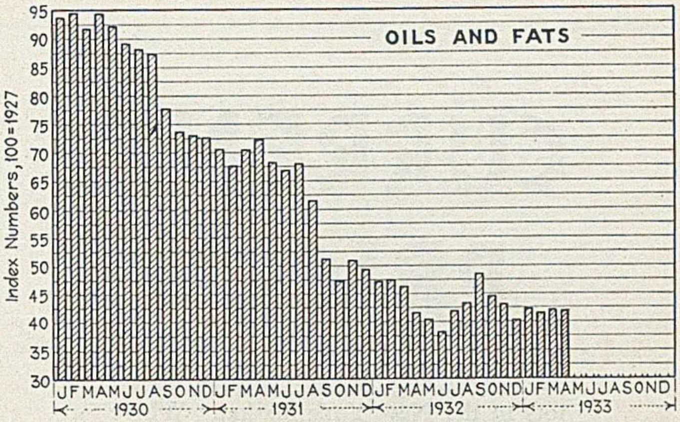
FACTORY CONSUMPTION OF PRIMARY ANIMAL AND VEGETABLE FATS AND OILS, BY CLASSES OF PRODUCTS, CALENDAR YEAR 1932

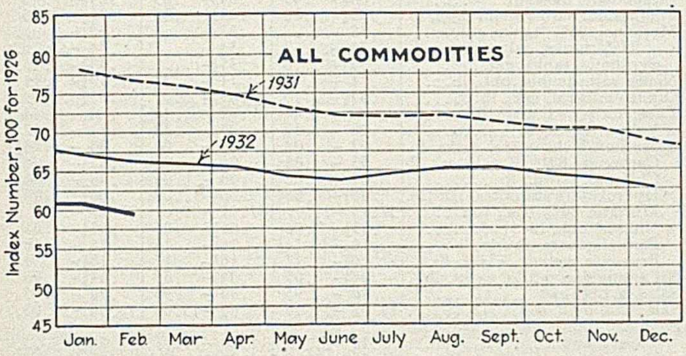
(Quantities in thousands of pounds)

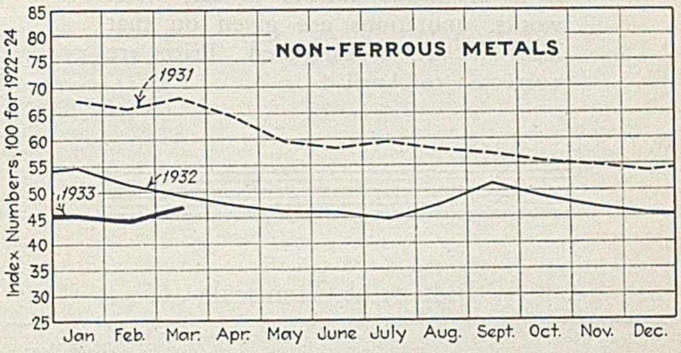
	TOTAL	Compounds and Vegetable Shortenings	Oleomargarine	Other Edible Products	Soap	Paint and Varnish	Linoleum and Oilcloth	Printing Inks	Miscellaneous Products	Loss Including Foots
Total	3,355,555	968,577	166,698	190,065	1,375,416	254,251	57,515	10,431	159,818	172,784
Cottonseed oil	1,083,959	834,367	15,096	100,129	3,583	37	....	8	1,786	128,953
Peanut oil	8,608	3,502	2,512	1,180	290	3	....	....	40	1,081
Coconut oil	549,515	8,332	123,219	40,853	353,527	13	....	2	1,040	22,529
Corn oil	42,414	3,067	54	27,330	2,532	136	21	....	2,152	7,122
Soybean oil	25,269	4,889	3	180	5,571	7,485	4,061	47	1,875	1,158
Olive oil, edible	1,711	....	....	1,516	52	....	....	....	143	....
Olive oil, inedible	6,383	....	....	....	1,912	....	....	....	4,471	....
Sulphur oil or olive foots	31,474	....	....	....	30,877	2	....	....	595	....
Palm kernel oil	16,615	....	....	11,310	3,565	....	....	28	....	1,712
Rapeseed oil	6,448	....	....	....	89	25	14	2	6,318	....
Linseed oil	219,746	....	....	....	985	173,816	32,375	9,078	3,492	....
China wood oil	67,948	....	....	....	....	59,158	7,299	713	778	....
Vegetable tallow	511	....	....	....	511	....	....	....	....	....
Castor oil	14,737	....	....	....	2,408	1,461	106	41	10,721	....
Palm oil	208,547	22,126	262	415	168,009	....	....	1	*9,324	8,410
Sesame oil	10,514	7,797	....	132	1,871	....	....	....	25	689
Perilla oil	5,808	....	....	....	....	3,226	1,651	143	788	....
Other vegetable oils	9,205	957	....	172	6,059	1,205	....	....	694	118
Lard	19,340	5,636	9,413	3,951	....	....	....	....	204	136
Edible animal stearin	24,251	17,357	3,684	2,243	374	....	....	....	580	13
Oleo oil	15,765	1,134	12,455	80	260	24	....	4	1,808	....
Tallow, edible	48,555	45,708	....	574	1,969	....	....	1	224	79
Tallow, inedible	585,896	....	....	....	549,186	23	....	4	36,683	....
Grease	202,860	....	....	....	143,724	23	....	294	58,819	....
Neat's-foot oil	3,817	....	....	....	27	11	....	....	3,779	....
Marine animal oils	51,974	2,185	....	....	48,944	38	....	2	756	49
Fish oils	93,685	11,520	....	....	49,091	7,565	11,988	63	12,723	735

* Includes 7,986 thousand reported by the tin and terne plate industry.









PRICE TRENDS—CHEM. & MET'S WEIGHTED INDEXES

DEMAND from large consumers of chemicals did not show full seasonal increases in the last month and the rising price movement which existed in the early part of March was quickly followed by a return to previous levels and for some commodities quotations are now lower than they were before the short price flurry occurred. This is especially true of spirits of turpentine which went steadily up in price a month ago but fell back with equal regularity as trading in recent weeks brought out no developments which warranted higher prices for naval stores.

The fact that recent price movements have not been entirely in one direction, however, is in itself worthy of consideration. Grains, cotton, animal fats, etc., have shown a trend toward sustained higher price levels. Some of the metals have shown a similar trend. Furthermore, there is an optimistic undercurrent in the market for all commodities. There appears to be a tacit assurance that business will soon show noteworthy gains—a certainty that the trading basis will be on an ascending scale. Since the first of April, call for deliveries of chemicals has increased. But relating the actual or the prospective demand to price trends, makes it apparent that the average price level for chemicals will not rise very much in the near future unless something happens to upset the workings of the law of supply and demand. In many cases surplus stocks must be absorbed before any tax can be laid upon productive capacities, and productive capacities in general are far above any probable consuming power which may be met in our present stage of development.

Chemicals which are made from metal base have fluctuated more frequently than other selections with prices for the chemicals following more or less closely the variations in the metal markets. This is a logical sequence of varying production costs and the metal salts in the future doubtless will follow the same influences as in the past. The position of metals, however, has shown improvement. It is believed that copper production will now be held within bounds and more stable prices are predicted for lead and zinc. Mercury also has been firmer in the past month or more and there seems to be more stability to the metal markets in general than has been the case for some time.

Vegetable oils have responded to the stress of competitive conditions and the low prices asked for palm and coconut oils has weakened values for competing oils. Linseed oil has not sold as freely as expected and is quoted below the levels of a month ago. Cottonseed oil, however, has held fairly steady and may be influenced more by developments in the grain and lard markets than by the position of other oils.

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1927

This month	84.30
Last month	84.76
April, 1932	85.01
April, 1931	87.86

Lower prices for spirits of turpentine and for lead oxides were largely responsible for the drop in the index number for the month. The position of most chemicals did not change during the period but improvement in demand is expected to stabilize values.

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

Base = 100 for 1927

This month	42.01
Last month	42.26
April, 1932	41.55
April, 1931	72.27

Price advances of the preceding month were not sustained and an easy tone was common through the market for vegetable oils. Tallow held at fairly high levels and animal fats were firm at the close with grain markets tending upwards. Foreign oils were quiet with prices weak.

CURRENT PRICES

The following prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to April 14.

Industrial Chemicals

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.08½–$0.09	$0.08½–$0.09	$0.10 –$0.11
Acid, acetic, 28%, bbl., cwt.	2.65 – 2.90	2.65 – 2.90	2.65 – 2.90
Glacial 99%, tanks	8.89 –......	8.89 –......	8.89 –......
drs.	9.14 – 9.39	9.14 – 9.39	9.14 – 9.39
U. S. P. reagent, c'bys	9.64 – 9.89	9.64 – 9.89	9.64 – 9.89
Boric, bbl., lb.	.04¼– .05	.04¼– .05	.04¼– .05
Citric, kegs, lb.	.29 – .31	.29 – .31	.32 – .33
Formic, bbl., lb.	.10 – .11	.10 – .11	.10 – .11
Gallic, tech., bbl., lb.	.50 – .55	.50 – .55	.50 – .55
Hydrofluoric 30% carb., lb.	.06 – .07	.06 – .07	.06 – .07
Latic, 44%, tech., light, bbl., lb.	.11½– .12	.11½– .12	.11½– .12
22%, tech., light, bbl., lb.	.05½– .06	.05½– .06	.05½– .06
Muriatic, 18° tanks. cwt.	1.00 – 1.10	1.00 – 1.10	1.00 – 1 10
Nitric, 36°, carboys, lb.	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –......	18.50 –20.00
Oxalic, crystals, bbl., lb.	.11 – .11½	.11 – .11½	.11 – .12
Phosphoric, tech., c'bys., lb.	.08½– .09	.08½– .09	.08½– .09
Sulphuric, 60°, tanks, ton	11.00 –11.50	11.00 –11.50	11.00 –11.50
Sulphuric, 66°, tanks, ton	15.50 –......	15.50 –......	15.50 –......
Tannic, tech., bbl., lb.	.23 – .35	.23 – .35	.23 – .35
Tartaric, powd., bbl., lb.	.20 – .21	.20 – .21	.24½– .25
Tungstic, bbl., lb.	1.40 – 1.50	1.40 – 1.50	1.40 – 1.50
Alcohol, ethyl, 190 p'f., bbl., gal.	2.53½–......	2.53½–......	2.53½–......
Alcohol, Butyl, tanks, lb.	.113–......	.113–......	.113–......
Alcohol, Amyl	......–......	......–......	......–......
From Pentane, tanks, lb.	.143–......	.143–......	.203–......
Denatured, 190 proof			
No. 1 special dr., gal.	.34½–......	.34½–......	.34½–......
No. 5, 188 proof, dr., gal.	.38½–......	.38½–......	.35½–......
Alum, ammonia, lump, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Chrome, bbl., lb.	.04½– .05	.04½– .05	.04½– .05
Potash, lump, bbl., lb.	.03 – .04	.03 – .04	.03 – .04
Aluminum sulphate, com., bags, cwt.	1.25 – 1.40	1.25 – 1.40	1.25 – 1.40
Iron free, bg., cwt.	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Aqua ammonia, 26°, drums lb.	.02½– .03	.02½– .03	.02¾– .03
tanks, lb.	.02½– .02¾	.02½– .02¾	.02½– .02¾
Ammonia, anhydrous, cyl., lb.	.15¼– .15½	.15¼– .15½	.15¼– .15½
tanks, lb.	.05 –......	.05 –......	.05⅝–......
Ammonium carbonate, powd. tech., casks, lb.	.08 – .12	.08 – .12	.10½– .11
Sulphate, wks., cwt.	1.00 –......	1.00 –......	1.00 –......
Amylacetate tech., tanks, lb., gal.	.135–......	.135–......	.16 –......
Antimony Oxide, bbl., lb.	.07 – .08	.07 – .08	.06½– .08
Arsenic, white, powd., bbl., lb.	.04 – .04½	.04 – .04½	.04 – .04½
Red, powd., kegs, lb.	.09 – .10	.09 – .10	.09 – .10
Barium carbonate, bbl., ton	56.50 –58.00	56.50 –58.00	56.50 –58.00
Chloride, bbl., ton	63.00 –65.00	63.00 –65.00	63.00 –65.00
Nitrate, cask, lb.	.07¼– .07½	.07¼– .07½	.07 – .07½
Blanc fixe, dry, bbl., lb.	.03 – .04	.03 – .04	.03¼– .04
Bleaching powder, f.o.b., wks., drums, cwt.	1.75 – 2.00	1.75 – 2.00	1.75 – 2.00
Borax, grain, bags, ton	40.00 –45.00	40.00 –45.00	40.00 –45.00
Bromine, cs., lb.	.36 – .38	.36 – .38	.36 – .38
Calcium acetate, bags	2.50 –......	2.50 –......	2.50 –......
Arsenate, dr., lb.	.05½– .06½	.05½– .06½	.05½– .06½
Carbide drums, lb.	.05 – .06	.05 – .06	.05 – .06
Chloride, fused, dr., wks., ton.	18.00 –......	18.00 –......	18.00 –......
flake, dr., wks.. ton.	21.00 –......	21.00 –......	21.00 –......
Phosphate, bbl., lb	.07½– .08	.07½– .08	.08 – .08½
Carbon bisulphide, drums, lb.	.05 – .06	.05 – .06	.05 – .06
Tetrachloride drums, lb.	.06¼– .07	.06¼– .07	.06¼– .07
Chlorine, liquid, tanks, wks., lb.	.01¾–......	.01¾–......	.01¾–......
Cylinders	.05½– .06	.05½– .06	.04 – .06
Cobalt oxide, cans, lb.	1.15 – 1.25	1.15 – 1.25	1.25 – 1.35

	Current Price	Last Month	Last Year
Copperas, bgs., f.o.b. wks., ton.	14.00 –15.00	14.00 –15.00	13.00 –14.00
Copper carbonate, bbl., lb.	.07 – .16	.07 – .16	.07 – .16
Cyanide, tech., bbl., lb.	.39 – .44	.39 – .44	.39 – .44
Sulphate, bbl., cwt.	3.00 – 3.25	3.00 – 3.25	2.75 – 2.90
Cream of tartar, bbl., lb.	.14½– .15	.14½– .15	.19½– .20
Diethylene glycol, dr., lb.	.14 – .16	.14 – .16	.14 – .16
Epsom salt, dom., tech., bbl., cwt.	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Imp., tech., bags, cwt.	1.15 – 1.25	1.15 – 1.25	1.15 – 1.25
Ethyl acetate, drums, lb.	.08½–......	.08½–......	.10 –......
Formaldehyde, 40%, bbl., lb.	.06 – .07	.06 – .07	.06 – .07
Furfural, dr., contract, lb.	.10 – .17½	.10 – .17½	.10 – .17½
Fusel oil, crude, drums, gal.	1.10 – 1.20	1.10 – 1.20	1.10 – 1.20
Refined, dr., gal.	1.80 – 1.90	1.80 – 1.90	1.80 – 1.90
Glaubers salt, bags, cwt.	1.00 – 1.10	1.00 – 1.10	1.00 – 1.10
Glycerine, c.p., drums, extra, lb.	.10¼– .10½	.10¼– .10½	.10¾– .11
Lead:			
White, basic carbonate, dry casks, lb.	.06 –......	.06 –......	.06½–......
White, basic sulphate, sck., lb.	.05½–......	.05½–......	.06 –......
Red, dry, sck., lb.	.06¾–......	.06¾–......	.06¾–......
Lead acetate, white crys., bbl., lb.	.10 – .11	.10 – .11	.10 – .11
Lead arsenate, powd., bbl., lb.	.09 – .13	.09 – .13	.10 – .14
Lime, chem., bulk, ton.	8.50 –......	8.50 –......	8.50 –......
Litharge, pwd., csk, lb.	.05¾–......	.05¾–......	.05¾–......
Lithophone, bags, lb.	.04½– .05	.04½– .05	.04½– .05
Magnesium carb., tech., bags, lb.	.05¾– .06	.05¾– .06	.05¾– .06
Methanol, 95%, tanks, gal.	.33 –......	.33 –......	.33 –......
97%, tanks, gal.	.34 –......	.34 –......	.34 –......
Synthetic, tanks, gal.	.35½–......	.35½–......	.35½–......
Nickel salt, double, bbl., lb.	.11 – .11½	.11 – .11½	.10½– .11
Orange mineral, csk., lb.	.09¼–......	.09¼–......	.09¼–......
Phosphorus, red, cases, lb.	.42 – .44	.42 – .44	.42 – .44
Yellow, cases, lb.	.28 – .32	.28 – .32	.31 – .32
Potassium bichromate, casks, lb.	.07 – .08	.07 – .08	.08 – .08½
Carbonate, 80-85%, calc. csk., lb	.05 – .05½	.05 – .05½	.05 – .06
Chlorate, powd., lb.	.08 – .08½	.08 – .08½	.08 – .08½
Hydroxide (c'stic potash) dr., lb.	.06⅛– .06¾	.06⅛– .06¾	.06⅛– .06¾
Muriate, 80% bgs., ton.	37.15 –......	37.15 –......	37.15 –......
Nitrate, bbl., lb.	.05½– .06	.05½– .06	.05¾– .06
Permanganate, drums, lb.	.16 – .16½	.16 – .16½	.16 – .16½
Prussiate, yellow, casks, lb.	.16½– .17	.16½– .17	.18½– .19
Sal ammoniac, white, casks, lb.	.04½– .05	.04½– .05	.04½– .05
Salsoda, bbl., cwt.	.90 – .95	.90 – .95	.90 – .95
Salt cake, bulk, ton.	13.00 –15.00	13.00 –15.00	16.00 –18.00
Soda ash, light, 58%, bags, contract, cwt.	1.20 –......	1.20 –......	1.15 –......
Dense, bags, cwt.	1.22½–......	1.22½–......	1.17½–......
Soda, caustic, 76%, solid, drums, contract, cwt.	2.50 – 2.75	2.50 – 2.75	2.50 – 2.75
Acetate, works, bbl., lb.	.04¾– .05	.04¾– .05	.05 – .05½
Bicarbonate, bbl., cwt.	1.85 – 2.00	1.85 – 2.00	1.85 – 2.00
Bichromate, casks, lb.	.044– .05	.044– .05	.05 – .06
Bisulphate, bulk, ton.	14.00 –16.00	14.00 –16.00	14.00 –16.00
Bisulphite, bbl., lb.	.03⅝– .04	.03⅝– .04	.03⅝– .04
Chlorate, kegs, lb.	.05¼– .07½	.05¼– .07½	.05¼– .07½
Chloride, tech., ton.	12.00 –14.75	12.00 –14.75	12.00 –14.00
Cyanide, cases, dom., lb.	.15½– .16	.15½– .16	.15½– .16
Fluoride, bbl., lb.	.07 – .08	.07 – .08	.07½– .08
Hyposulphite, bbl., lb.	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt.	3.25 – 3.40	3.25 – 3.40	3.60 – 3.75
Nitrate, bags, cwt.	1.295–......	1.295–......	1.77 –......
Nitrite, casks, lb	.07½– .08	.07½– .08	.07½– .08
Phosphate, dibasic, bbl., lb.	.018– .02	.018– .02	.0255 – .0275
Prussiate, yel. drums, lb.	.11½– .12	.11½– .12	.11½– .12
Silicate (40° dr.) wks. cwt.	.70 – .75	.70 – .75	.70 – .75
Sulphide, fused, 60-62%, dr., lb.	.02¾– .03½	.02¾– .03	.02¾– .03
Sulphite, cyrs., bbl., lb.	.03 – .03½	.03 – .03½	.03 – .03½
Sulphur, crude at mine, bulk, ton	18.00 –......	18.00 –......	18.00 –......
Chloride, dr., lb.	.03½– .04	.03½– .04	.05 – .06
Dioxide, cyl., lb.	.06½– .07	.06½– .07	.06½– .07
Flour, bag, cwt.	1.55 – 3.00	1.55 – 3.00	1.55 – 3.00
Tin bichloride, bbl., lb.	nom.–......	nom.–......	nom.–......
Oxide, bbl., lb.	.29½–......	.27½–......	.24½–......
Crystals, bbl., lb.	.25½–......	.24 –......	.22½–......
Zinc chloride, gran., bbl., lb.	.06½– .06¾	.06½– .06¾	.06½– .06¾
Carbonate, bbl., lb.	.10½– .11	.10½– .11	.10½– .11
Cyanide, dr., lb.	.38 – .42	.38 – .42	.41 – .42
Dust, bbl., lb.	.04½– .06	.04½– .06	.04½– .05
Zinc oxide, lead free, bag, lb.	.05¾–......	.05¾–......	.05¾–......
5% lead sulphate, bags, lb.	.05½–......	.05½–......	.05½–......
Sulphate, bbl., cwt.	3.00 – 3.25	3.00 – 3.25	3.00 – 3.25

Oils and Fats

	Current Price	Last Month	Last Year
Castor oil, No. 3, bbl., lb.	$0.08¾–$0.09	$0.08¾–$0.09	$0.09½–$0.10
Chinawood oil, bbl., lb.	.05 –......	.05¼–......	.06 –......
Coconut oil, Ceylon, tanks, N. Y. lb.	.03 –......	.03¼–......	.03⅝–......
Corn oil crude, tanks, (f.o.b. mill), lb	.03⅛–......	.03⅛–......	.03⅛–......
Cottonseed oil, crude (f o.b. mill), tanks, lb.	.02¾–......	.02¾–......	.02⅝–......
Linseed oil, raw car lots, bbl., lb.	.074–......	.076–......	.064–......
Palm, Lagos, casks, lb.	.02¾–......	.02⅞–......	.03¾–......
Palm Kernel, bbl., lb.	.04½–......	.04½–......	.04⅞–......
Peanut oil, crude, tanks (mill), lb.	.03⅛–......	.03¼–......	.03⅛–......
Rapeseed oil, refined, bbl., gal.	.37 –......	.35 – .36	.37 – .38
Soya bean, tank (f.o.b. Coast), lb.	nom.–......	nom.–......	nom.–......
Sulphur (olive foots), bbl., lb.	.04⅜–......	.04¾–......	.04¾–......
Cod, Newfoundland, bbl., gal	.21 – .22	.19 – .21	.25 – .27
Menhaden, light pressed, bbl., lb.	.03⅞– .04	.03⅞–.04	.04 – .043
Crude, tanks (f.o.b. factory), gal.	.09 –......	.09 –......	.20 –......
Grease, yellow, loose, lb.	.02½–......	.02 –......	.02 –......
Oleo stearine, lb.	.03⅛–......	.04 –......	.04⅜–......
Red oil, distilled, d.p. bbl., lb.	.06 –......	.06 –......	.06⅜–......
Tallow, extra, loose, lb.	.02⅜–......	.01⅞–......	.02½–......

Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl., lb..	$0.60 –$0.65	$0.60 –$0.65	$0.60 –$0.62
Refined, bbl., lb	.80 – .85	.80 – .85	.80 – .85
Alpha-naphthylamine, bbl., lb..	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb....	.14½– .15	.14½– .15	.14½– .15
Aniline salts, bbl., lb	.24 – .25	.24 – .25	.24 – .52
Benzaldehyde, U.S.P., dr., lb....	1.10 – 1.25	1.10 – 1.25	1.10 – 1.25
Benzidine base, bbl., lb	.65 – .67	.65 – .67	.65 – .67
Benzoic acid, U.S.P., kgs, lb.....	.48 – .52	.48 – .52	.48 – .52
Benzyl chloride, tech., dr., lb....	.30 – .35	.30 – .35	.30 – .35
Benzol, 90%, tanks, works, gal..	.22 – .23	.22 – .23	.20 – .21
Beta-naphthol, tech., drums, lb..	.22 – .24	.22 – .24	.22 – .24
Cresol, U. S. P., dr., lb	.10½– .11	.10½– .11	.10½– .11
Cresylic acid, 97%, dr., wks., gal.	.42 – .45	.42 – .45	.49 – .52
Diethylaniline, dr., lb	.55 – .58	.55 – .58	.55 – .58
Dinitrophenol, bbl., lb	.29 – .30	.29 – .30	.29 – .30
Dinitrotoluen, bbl. lb	.16 – .17	.16 – .17	.16 – .17
Dip oil 25% dr., gal	.23 – .25	.23 – .25	.25 – .25
Diphenylamine, bbl., lb	.38 – .40	.38 – .40	.38 – .40
H-acid, bbl., lb	.65 – .70	.65 – .70	.65 – .70
Naphthalene, flake, bbl., lb.....	.04¾– .05	.04¾– .05	.03¾– .04½
Nitrobenzene, dr., lb	.08½– .09	.08½– .09	.08½– .10
Para-nitraniline, bbl., lb	.51 – .55	.51 – .55	.51 – .55
Phenol, U.S.P., drums, lb	.14¼– .15	.14¼– .15	.14¼– .15
Picric acid, bbl., lb	.30 – .40	.30 – .40	.30 – .40
Pyridine, dr., gal	.90 – .95	.90 – .95	1.50 – 1.80
R-salt, bbl., lb	.40 – .44	.40 – .44	.40 – .44
Resorcinal, tech., kegs, lb	.65 – .70	.65 – .70	.65 – .70
Salicylic acid, tech., bbl., lb.....	.40 – .42	.40 – .42	.33 – .35
Solvent napbtha, w.w., tanks, gal.	.26 –......	.26 –......	.26 –......
Tolidine, bbl., lb	.88 – .90	.88 – .90	.86 – .88
Toluene, tanks, works, gal	.30 –......	.30 –......	.30 –......
Xylene, com., tanks, gal	.26 –......	.26 –......	.26 –......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton...	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech., bbl., lb	.07 – .10½	.07 – .10½	.07 – .14
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...	.02¾– .20	.02¾– .20	.03 – .20
Prussian blue, bbl., lb	.35 – .36	.35 – .36	.35 – .36
Ultramine blue, bbl., lb	.06 – .32	.06 – .32	.06 – .32
Chrome green, bbl., lb	.26 – .27	.26 – .27	.27 – .30
Carmine red, tins, lb	3.90 – 4.50	3.90 – 4.50	5.25 – 5.40
Para toner, lb	.80 – .85	.80 – .85	.75 – .80
Vermilion, English, bbl., lb.....	1.10 – 1.20	1.10 – 1.20	1.45 – 1.50
Chrome yellow, C. P., bbl., lb.	.15 – .15½	.15 – .15½	.16 – .16½
Feldspar, No. 1 (f.o.b. N.C.), ton	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.07 – .08½	.07 – .08½	.07 – .08½
Gum copal Congo, bags, lb	.06 – .08	.06 – .08	.06 – .08
Manila, bags, lb	.16 – .17	.16 – .17	.16 – .17
Damar, Batavia, cases, lb	.16 – .16½	.16 – .19	.16 – .16½
Kauri No. 1 cases, lb	.45 – .48	.45 – .48	.45 – .48
Kieselguhr (f.o.b. N.Y.), ton...	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc, ton	40.00 –......	40.00 –......	40.00 –......
Pumice stone, lump, bbl., lb....	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb	.03 – .40	.03 – .40	.03 – .35
Rosin, H., bbl	3.90 –......	4.10 –......	4.10 –......
Turpentine, gal	.42 –......	.48½–......	.44½–......
Shellac, orange, fine, bags, lb....	.19 – .20	.19 – .20	.26 – .28
Bleached, bonedry, bags, lb...	.18 – .19	.18 – .19	.20 – .21
T. N. bags, lb	.08½– .09	.08½– .09	.12 – .13
Soapstone (f.o.b. Vt.), bags, ton	10.00 –12.00	10.00 –12.00	10.00 –12 00
Talc, 200 mesh (f.o.b. Vt.), ton..	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
300 mesh (f.o.b Ga.), ton....	7.50 –10.00	7.50 –10.00	7.50 –11.00
225 mesh (f.o.b. N. Y.), ton..	13.75 –....	13.75 –....	13.75 –....
Wax, Bayberry, bbl., lb	.14 – .15	.14 – .15	.16 – .20
Beeswax, ref., light, lb	.20 – .30	.20 – .30	.25 – .27
Candelilla, bags, lb	.11 – .12	.10 – .11	.14 –....
Carnuba, No. 1, bags, lb	.20 – .22	.22 – .23	.21½– .24
Paraffine, crude 105-110 m.p., lb	.03⅛– .03¼	.03⅛– .03¼	.03¼– .03⅜

Price Changes During Month

Advanced	Declined
Tin oxide	Red lead
Tin crystals	Litharge
Tallow	Orange mineral
Tin	Linseed oil
	Rosin
	Turpentine
	Platinum
	Lead

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%, ton	$200.00–.....	$200.00–.....	$200.00–.....
Ferromanganese, 78-82%, ton....	61.00–.....	61.00–.....	72.00–75.00
Ferrochrome, 65-70%	.09½–....	.09½–....	.10–.....
Spiegeleisen, 19-21% ton	24.00–.....	24.00–.....	27.00–.....
Ferrosilicon, 14-17%, ton	31.00–.....	31.00–.....	31.00–.....
Ferrotungsten, 70-80%, lb	.94– 1.00	.94– 1.00	1.00– 1.10
Ferrovanadium, 30-40%, lb	2.60– 2.80	2.60– 2.80	3.05– 3.40

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic, lb	$0.05⅛–.....	$0.05⅛–.....	$0.05⅛–.....
Aluminum, 96-99%, lb	.229–.....	.229–.....	.229–.....
Antimony, Chin. and Jap., lb	.0595.....	.06 –.....	.06 –.....
Nickel, 99%, lb	.35 –.....	.35 –.....	.35 –.....
Monel metal blocks, lb	.28 –.....	.28 –.....	.28 –.....
Tin, 5-ton lots, Straits, lb	.25½–.....	.24 –.....	.18½–.....
Lead, New York, spot, lb	.03½–.....	.0335–.....	.03 –.....
Zinc, New York, spot, lb	.0347–.....	.034–.....	.0317–.....
Silver, commercial, oz	.28 –.....	.27½–.....	.28½–.....
Cadmium, lb	.55 –.....	.55 –.....	.55 –.....
Bismuth, ton lots, lb	.85 –.....	.85 –.....	.85 –.....
Cobalt, lb	2.50 –.....	2.50 –.....	2.50 –.....
Magnesium, ingots, 99%, lb	.30 –.....	.30 –.....	.30 –.....
Platinum, ref., oz	26.00 –.....	30.00 –.....	40.00 –.....
Palladium, ref., oz	16.00 – 17.00	16.00 – 17.00	19.00 – 21.00
Mercury, flask, 75 lb	54.00 –.....	53.00 –.....	73.00 – 75.00
Tungsten powder, lb	1.45 –.....	1.45 –.....	1.45 –.....

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks., ton	$6.50 –$8.25	$6.50 –$8.25	$6.50 –$8.25
Chrome ore, c.i.f. ports, ton	14.00 –18.50	14.00 –18.50	17.00 –20.00
Coke, fdry., f.o.b. ovens, ton	3.25 – 3.75	3.25 – 3.75	3.25 – 3.75
Fluorspar, gravel, f.o.b. Il., ton...	17.25 –20.00	17.25 –20.00	17.25 –20.00
Manganese ore, 50% Mn., c.i.f. Atlantic Ports, unit	.19 –.....	.19 – ...	.25 – .27
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y., lb	.45 –.....	.45 –.....	.45 –.....
Monazite, 6% of ThO_2, ton	60.00 –.....	60.00 –.....	60.00 –.....
Pyrites, Span. fines, c.i.f., unit	.13 –.....	.13 –.....	.13 –.....
Rutile, 94-96% TiO_2, lb	.10 – .11	.10 – .11	.10 – .11
Tungsten, scheelite, 60% WO_3 and over, unit	8.00 –10.00	8.00 –10.00	10.50 –12.00

INDUSTRIAL NOTES

Chain Belt Co., Milwaukee, Wis., has appointed A. S. Kennedy as manager of its new branch office in Kansas City, Mo.

Johns-Manville Corp. has appointed T. K. Mial an executive vice-president of that concern. Mr. Mial will act as general sales manager of the power products department.

Northern Equipment Co., Erie, Pa., has appointed the J. W. Murphy Co. as its representative in the Chicago district with offices at 431 South Dearborn St.

The American Cyanamid & Chemical Corp., New York, has secured the exclusive sales rights on all ores, and "Mabelite" pigments manufactured therefrom, mined from the deposits controlled by the Eastern Mabelite Corp.

The Ludlow Valve Manufacturing Co., Troy, N. Y., has appointed the J. W. Frazier Co., 626 Western Reserve Building, Cleveland, Ohio, as its representative in Northern Ohio.

H. O. Swoboda, Inc., Pittsburgh, Pa., has appointed E. H. Merrick, 3020 Coleridge Road, Cleveland Heights, Ohio, as its exclusive sales representative in Northern Ohio.

Ludlum Steel Co., Watervliet, N. Y., has placed P. E. Floyd in charge of the Chicago territory with the title of district sales manager. Mr. Floyd formerly was associated with Associated Alloy Steel Co.

Sprout, Waldron & Co., Inc., Muncy, Pa., has moved its New York office to 223 Cowperthwaite Place, Westfield, N. J., David E. Smyth will be in charge of the office.

The Dunbar Engineering Co. announces the appointment of the Washington Engineering Co., 601 13th St. N. W., Washington, D. C., under the management of P. N. Israel, as its representative in the District of Columbia.

National Silicates, Ltd., Toronto, associated with the Philadelphia Quartz Co. and the G. F. Sterne & Sons, Ltd., of England, plan the erection of a plant near Toronto for the manufacture of silicate of soda.

NEW CONSTRUCTION

Where Plants Are Being Built in Process Industries

	This Month Proposed Work and Bids	This Month Contracts Awarded	Cumulative to Date Proposed Work and Bids	Cumulative to Date Contracts Awarded
New England	....	$29,000	$165,000	$109,000
Middle Atlantic	$975,000	87,000	2,273,000	790,000
Southern	....	175,000	2,041,000	356,000
Middle West	250,000	30,000	643,000	525,000
West of Mississippi	246,000	40,000	688,000	876,000
Far West	363,000	660,000	655,000	988,000
Canada	728,000	85,000	1,995,000	216,000
Total	$2,562,000	$1,106,000	$8,460,000	$3,860,000

PROPOSED WORK BIDS ASKED

Bleaching Compounds—Nevadel Agenc, Ltd., Garrison Rd., Fort Erie, Ont., plans to build an addition to its plant for the manufacture of flour bleaching compounds, etc.

Brass Factory—Canadian Ohio Brass Co. Ltd., Niagara Falls, Ont., plans the construction of a plant. Estimated cost $60,000.

Paint Factory—Northern Paint Co. Ltd., Winnipeg, Man., plans the construction of an addition to its plant.

Sodium Hypochlorite Plant—Dalgleisch & Co. Ltd., Montreal, Que., contemplates the construction of a plant at Toronto, Ont., for the manufacture of sodium hypochlorite.

Cyanide Mill—Manning Gold Mining Co., c/o W. F. Snyder, Felt Bldg., Salt Lake City, Utah, plans the construction of a 600 ton cyanide mill at Manning Mine Dump near Mercur, Utah. J. C. Ingersoll, c/o Company, is engineer.

Sulphite Mill—Bathurst Lumber Co. Ltd., Bathurst, N. B., will soon call for bids for a 50 ton sulphite mill.

Lead Smelter—U. S. Smelting & Refining Co., D. D. Muir, Jr., vice-pres., Newhouse Bldg., Salt Lake City, Utah, plans the construction of a lead smelter at its plant at Midvale, Utah. Estimated cost $100,000.

Tannery—John Dickson, Newburg, Ont., plans the construction of an addition to his tannery.

Factory—Canadian Electric & Brass Co. Ltd., Winnipeg, Man., plans the construction of a new factory. Estimated cost $50,000.

Cement Plant—Metropolitan Cement Co., W. D. Cloos, 261 5th Ave., is receiving bids for construction and equipment for cement plant on Meadow Rd., Raritan, N. J. Company will alter present potash plant and build addition. Estimated cost $500,000.

Paper Plant—Northern Paper Mills, Inc., Green Bay, Wis., contemplate the construction of a paper plant at Toronto, Ont. Estimated cost $175,000.

Paper Plant Improvements—Abitibi Power & Paper Co., 86 University Ave., Toronto, Ont., plans improving and altering its paper plant at Saulte Ste. Marie, Ont.; also installing 9,000 hp. electric boiler. Estimated cost $60,000.

Pulp Plant—La Have Pulp Co. Ltd., New Germany, N. S., manufacturer of groundwood pulp, plans to build an addition to its plant and will be in the market for equipment.

Starch Plant—George E. Full & Son, Charlottetown, P. E. I., manufacturers of potato starch, plan to increase the capacity of their plant.

Processing Plant—George A. Hormel Co. (packers), Bell St. Terminal, Seattle, Wash., plans the construction of a processing plant to take care of Northwest distribution. W. J. Brennan is local manager.

Oil Plant—Blue Ribbon Oil & Refining Co., Ltd., Winnipeg, Man., manufacturer of lubricating oils, plans to build an addition to its plant.

Refinery—Falcon Refining Co., Great Bend, Kan., will build a refinery. Estimated cost $40,000.

Refinery—Federated Oil Consumers, Ltd., c/o D. Austin Lane, Calgary, Alta., plans the construction of a refinery. Estimated cost $75,000.

Refinery — A. J. Smith Engineering Corp., represented by R. T. Coughlin, Bryte Bldg., Sacramento, Calif., plans the construction of a refinery at 16th and North B Sts. Estimated cost $40,000.

Refinery—Pure Oil Co., Grand Saline, Tex., plans to purchase an 85-acre site and build a crude oil refinery. Company will also manufacture gasoline and lubricating oils.

By-Products Plant—Sun Oil Co., Toledo, Ohio, contemplates the construction of a plant for the recovery of propane gas by-products from gasoline refinery. Estimated cost $250,000.

By-Products Plant—Sun Oil Co., Yale, Okla., contemplates the construction of a plant for the recovery of propane gas by-products from gasoline refinery. Estimated cost $150,000.

Refinery—Sun Oil Refining Co., Marcus Hook, Pa., plans the construction of a propane gas recovery unit at its refinery. Estimated cost to exceed $200,000.

Refinery—Wasatch Oil Refining Co., William Yeates, mgr., Bountiful, Utah, plans the construction of a vapor recovery and stabilizing plant at its refinery. Estimated cost $30,000.

Oxide Plant—Zinc Oxide Co. of Canada, Montreal, Que., plans the construction of a new plant.

Potash Refinery—Potash Co. of America, G. W. Harris, pres., 1019 Logan St., Denver, Colo., contemplates the construction of a 200 ton potash refinery at Carlsbad, N. M.

Soap Factory—St. Croix Soap Mfg. Co. Ltd., St. Stephens, N. B., plans to build an addition to its plant here.

Sugar Factory—Canadian Sugar Factories, Ltd., Raymond, Alta., plan to build an addition to their plant and will be in the market for machinery.

Beet Sugar Refinery—Amalgamated Sugar Co. (controlled by American Beet Sugar Co.), Steel Bldg., Denver, Colo., plans the construction of a beet sugar refinery at Burley, Idaho. Estimated cost $40,000.

Roofing Factory—Century Roofing Products Co., Spokane, Wash., plans to alter and recondition its factory here. Estimated cost $65,000.

Radio Laboratory — Constructing Quartermaster, Fort Monmouth, N. J., contemplates the construction of a radio laboratory. Estimated cost $275,000.

Structural Products—Gypsum Lime & Abastines of Canada, Ltd., Paris, Ont., plans the construction of a plant for the manufacture of fireproof structural products at Rochester, England. Estimated cost $100,000.

CONTRACTS AWARDED

Dextrine Manufacturing Plant—National Adhesive Corp., S. Ginsberg, Mgr., 1735 West Front St., Plainfield, N. J., awarded contract for manufacturing plant to Wigton Abbott Corp., 105 Park Ave., Plainfield. Estimated cost with equipment $28,000.

Gas Plant—Seattle Gas Co., J. F. Pollard, Vice-Pres., 1511 4th St., Seattle, Wash., awarded contract for improvements at Lake Union plant to Semet-Solvay Corp., 61 Bway., New York, N. Y. Estimated cost $100,000. New machinery will permit mixture of heavier grade oil with gas making materials.

Leather Factory—Irving Tanning Co., Inc., 38 Irving St., Salem, Mass., awarded contract for 2 story factory at Walnut and Wallis Sts., Peabody, Mass., to E. H. Porter Construction Co., 13 Wallis St., Peabody. Estimated cost $28,500.

Match Factory—Canada Match Co. Ltd., Hull, Que., awarded contract for rebuilding match factory to E. Brunet & Sons, Hull. New machinery will be required. Estimated cost between $50,000 and $60,000.

Paper Factory—Bogota Paper & Board Co., River Rd., Bogota, N. J., will build a factory. Work will be done by separate contracts under supervision of T. BonTheim, Engr., c/o owner. Estimated cost $28,500.

Refinery—Bales Oil Trust, Worland, Wyo., will build a topping plant at its refinery here. Estimated cost to exceed $40,000. Work will be done by separate contracts.

Refinery—General Petroleum Corp., 2525 East 37th St., Los Angeles, Calif., will soon start work on the construction of a distillation and purification plant at 109th St. and Western Ave., Torrance, Calif. Project will include cracking plant, gasoline stabilizing unit, pressure distillate re-run plant, additional service for cracking plant and pressure distillate acid treatment. Estimated cost $560,000. Fred Isaacs, manager, is in charge of project.

Refinery—Gulf Refining Co., Neville Island, Pittsburgh, Pa., will repair refinery and still recently damaged by fire. Work will be done by day labor and separate contracts. Estimated cost $30,000.

Coke Ovens—Globe Oil Refining Co., Lemont, Ill., plans to build coke ovens for fuel oil tar treatment. Contract has been let to H. A. Brassert & Co., 310 South Michigan Ave., Chicago, Ill. Estimated cost $30,000.

Pottery Plant—Harker Pottery Co., Chester, W. Va., awarded contract for warehouse addition to its plant here to J. H. Burkhart, 810 Oak St., East Liverpool, O. Estimated cost $25,000.

Rayon Plant—Industrial Rayon Corp., West 98th St. and Walford Ave., Cleveland, O., awarded contract for preparation building, warehouse addition and two 1 story fan-houses at its plant at Covington, Va., to Hughes-Foulkrod Co., 809 Schaaf Bldg., Philadelphia, Pa. Estimated cost $150,000.

Warehouse—Davis Leather Co., 23 Huron St., Newmarket, Ont., awarded contract for 3 story, 60x85 ft. warehouse to J. A. Vance, 288 Light St., Woodstock, Ont. Estimated cost $30,000.