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AMERICAN CHEMICAL INDUSTRY

THE CHEMICAL COMPANIES

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D. VAN NOSTRAND COMPANY, INC.
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The corrosion research laboratory, established in 1938, has been active in almost all phases of petroleum technology. Two outstanding developments are an inhibitor for protection of gasoline pipe lines from internal corrosion (1939) and a vapor-phase inhibitor for rustproofing steel in a container or package without either coating the steel or rigorously excluding moisture. In 1946 the latter won the U. S. Naval Ordnance Development Award.

Fundamental research is strongly emphasized at Emeryville because of its importance in furthering basic advances in technology. In the field of petroleum production this research has led among other things to the successful acid-solvent treatment of oil wells (1936), improved water-base drilling fluids (1936), improved methods of analysing drilling cores (1938), advances in knowledge of oil field flow (1938), and improvements in oil-base drilling fluids (1942). This research was transferred in Dec. 1945 to a new Shell Oil laboratory in Houston, Tex., which is closer to field operations.

Because of its experience in separation processes, Shell Development was invited by the War Production Board in 1944 to participate in a government-sponsored emergency effort to find means of increasing the then seriously inadequate capacity for penicillin. A process was developed during 1944-45 which surmounted separation difficulties to the extent that both recovery and product purity were markedly increased, and the process is now used in one or another form by several manufacturers of penicillin. Similarly Shell Development participated actively in a government-sponsored cooperative effort to establish the molecular structure of penicillin by chemical and spectroscopic means, with a view to possible synthesis. Other special cooperative war projects included the development of vehicle-mounted flame-throwing type weapons, the study of gasoline storage stability under desert conditions, and the investigation of various aircraft fuel and lubricant problems.

SHERWIN-WILLIAMS COMPANY has been producing high-quality paints, varnishes, lacquers, insecticides, chemicals, etc., for 80 years. In July 1866, Henry A. Sherwin, then 24, joined in partnership with Truman Dunham to sell white lead, linseed oil, colors, brushes, glass, etc. Then very little ready-mixed or prepared paint was on the market. Mixing paint was practiced only by professional painters. D. R. Averill of Newburg, a suburb of Cleveland, in 1867 invented a ready-mixed paint which would not settle in the package, but he did not use materials which would cover or wear well. Sherwin would have nothing to do with such ready-mixed paint, but realizing the possibilities of the prepared paint business, he left his partnership with Dunham to go into the manufacture of paints himself.

In 1870 he was joined by Edward P. Williams, part owner of a glass-manufacturing company which sold glass to Truman Dunham & Co. They became partners under the name of Sherwin, Williams & Co., starting with a modest capital of $2,000. In 1884 this partnership became the Sherwin-Williams Co., whose present capital and surplus surpass $60,000,000. The partners in 1873 bought from the Standard Oil Co. an old one-story cooper shop on the site of the present Cleveland plant. Their first paint-making machinery consisted of one secondhand stone mill and a putty chaser. Through successive plowing profits back into the business and bringing in additional capital, the manufacturing facilities now embrace 32 plants in the United States, Canada, and South America, occupying some 700 buildings. The trained chemical staff which started with one chemist, Dr. Percy Neyman, M.I.T. graduate hired by Henry Sherwin, now includes several hundred.

Until 1898 manufacture was confined to paint, then merely a mechanical mixture of pigments with oils or varnishes. The Cleveland factory, however, operated

a department for refining, boiling, and otherwise treating linseed oil and for manufacturing driers, grinding Japan, and other items. The products marketed included a complete line of oil paints for the exterior of houses and buildings—flat, semi-gloss, and enamel paints for interiors. A wide variety of paints was supplied to railway and steamship companies, and to manufacturers of vehicles, agricultural implements, and many industrial products. This development of paints and varnishes was under the direct supervision of J. C. Beardslee, who joined the staff in 1880 and served as general superintendent, 1886-1910, continuing as a director. He was much interested in all manufacturing problems until his death in 1928.

During these years paint and varnish formulas were greatly improved. Laboratories were established in all plants and extensive research was conducted for many years at Chicago. Here finished products are tested, besides being subjected to field exposures in Florida and elsewhere. During recent years many new products have been developed. One of the most outstanding is Kem-Tone, a water-miscible synthetic resin emulsion paint for interior use over wallpaper, plaster, or painted walls. Innumerable paint, enamel, and varnish products have been especially developed for individual household requirements; for manufacturers of automobiles, furniture, machinery, and many other products; for railroad-car builders and shipbuilders. During both World War I and II, enormous quantities of paint and similar products were supplied to the War and Navy Departments and to manufacturers of equipment, ammunition, and all other military requirements. The Company's chemists also assisted government departments in the development of new products to satisfy exacting specifications for unusual war conditions.

The first departure from simple paint manufacture was in 1898 when the production of varnishes for household and industrial use was undertaken. These were made from natural resins, vegetable oils, and turpentine or mineral spirits. Since then natural resins have been displaced by synthetic resins and a wide variety of new oils and reducers have been introduced, yielding protective coatings far surpassing the early simple finishes. These chemical developments were supervised by E. C. Holton, an M.I.T. graduate and chief chemist from 1892 until his death in 1934. He worked very closely with J. C. Beardslee in research covering paint and varnish, raw materials, and new formulas. As the business grew, he supervised all chemical research, including paint, varnish, lacquers, dry colors, dyes and intermediates, and insecticides, contributing much to the Company's growth. In his later years, Holton was assisted by Dr. C. D. Holley who joined the Acme White Lead & Color Works in 1907 and came with Sherwin-Williams when it absorbed Acme in 1920. From then until his death in 1942, he supervised all paint formulas to bring them up to the highest Company standards.

Sherwin-Williams' real entry into the chemical industry came about in 1896 when the manufacture of dry colors was undertaken in a pilot plant at Cleveland, under Holton's direction. The first product was red lead eosin vermilion. In 1901 a large dry-color plant was erected and production of *p*-nitroaniline and toluidine reds was begun under H. M. Ashby. A large volume of such reds went to agricultural implement manufacturers. Inorganic colors, including lead chromate yellows, chrome greens, iron blues, etc., and many organic lakes, were also marketed. The Cleveland plant was soon outgrown and in 1903 a much larger one was erected at Chicago, to which the production of dry colors was moved.

With the outbreak of World War I, a department was established for the manufacture of aniline dyes and intermediates which had been imported from Germany. This has grown to be one of the Company's major divisions. At the same time the Color Department, now under the supervision of M. B. Doty, had been greatly enlarged, many new products added, and former colors much improved.

The standards of five years ago are no longer considered satisfactory. Today shades and tints are much stronger, colors have much greater light resistance, opacity is much more dense, texture permits a more rapid rate of grinding. Great progress has been made in the manufacture of benzidine yellows ever since domestic production started about 15 years ago. The present standards are much better than foreign competition. Molybdate orange, which was first marketed about 10 years ago, is proving to be a very valuable color. Chrome greens today are much more permanent to light and grind much more easily than those of the 1930's. Phthalocyanine blue, produced about 10 years ago, is the most outstanding blue color development during the last 100 years, combining a high degree of all desirable properties with none of the disadvantages previously known in blue pigments.

For many years research had been conducted attempting to produce dispersed or paste colors direct from dry-color pulp without resorting to the process of drying out the water, breaking up the lumps into a powdered dry color, and then mixing in oil or varnish. This effort was successful in 1929, when a complete line of dispersed colors and flushed inks was put on the market. Sherwin-Williams is today one of the leading producers of fine pigments for the paint, lacquer, printing ink, floor covering, rubber, and allied industries.

When the Company decided to manufacture intermediates and dyes in 1914, the first attempt was at β-naphthol, in the Dry Color Department at Chicago, by superintendent R. V. Brown. It was soon found that the complicated manufacturing process was more than could be handled by the staff, so a Chemical Products Department was organized, which began to expand very rapidly. New men were brought in and a great deal of money was invested in plant, under the general supervision of H. J. Hain. Walter H. Cottingham, president at that time, was the guiding force of this effort and the entire program soon progressed successfully. He was instrumental in organizing the American Dyes Institute which brought together many chemical companies which had also undertaken to manufacture dyes and intermediates no longer available from abroad.

During the early war period the Company entered into the whole general organic color and intermediates field, which meant that a great many intermediates were made, including nitrobenzene, dinitrobenzene, aniline, nitrotoluenes, phenylenediamines, etc. The character of the Company was radically changed from that of a "Paint House." Many chemists were employed, including Dr. N. E. Van Stone who became and for many years has been in charge of all chemical development and manufacture. He succeeded Dr. Ney, a Swiss chemist experienced in the manufacture of dyes and intermediates in Germany, who for three or four years had direct charge of this development. W. A. Miller, L. E. May, and C. E. Deeds were among the other chemists employed.

The Sherwin-Williams Co. became one of the leading manufacturers of basic raw materials for the organic pigments industry. The major products were β-naphthol, β-nitroaniline, and m-nitro-p-toluidine. Another major item now manufactured is acetanilide. During World War II the Company was the largest manufacturer of this basic ingredient for sulfa drugs. It even converted certain equipment to manufacture sulfanilamide itself. For many years L. E. May was in charge of this department until his untimely death in Mar. 1946. Also during the war, Sherwin-Williams produced large quantities of dibutyl phthalate, enormous quantities of which were used for flashless gunpowder and as a plasticizer for lacquers.

Sherwin-Williams' first entry into the insecticide field came about very naturally. Walter H. Cottingham, who became general manager in 1898, foresaw that

the farmer producing more crops through control of insect pests would be able to keep his farm buildings and equipment well painted. The Company's distributing facilities enabled the marketing of insecticides at minimum expense, through its many paint and hardware dealers throughout the United States. The technically trained staff and factory facilities for dry-color manufacture could be readily converted to insecticides.

The paint pigment Paris green was the first item offered as an insecticide. It was so superior in quality that a large volume of business developed. However, it was also injurious to some crops. Research developed that lead arsenate was safer and in 1908 the Company undertook the manufacture of the basic type in paste form. Because of the great expense for glass packages and heavy shipping weight, dry lead arsenate of the acid type was developed in 1910 and has since been sold in ever-increasing quantities. The Company's first production of Bordeaux mixture was as paste in 1911, followed by a dry powder under the name of Fungi Bordo in 1914. Since that time many compounds of Fungi Bordo, arsenate of lead, and other arsenicals have been developed and marketed under proprietary names. Lime-sulfur solution was first produced in 1910, first in Chicago, and later at many other points so as to reduce shipping cost. E. C. Holton developed a dry form of lime sulfur in 1917 which was patented and continues to be sold in large volume. Production of calcium arsenate began at Chicago in 1916, and shortly after at the other plants.

As the sales for insecticides were developing all over the United States, it was felt desirable to establish a production center in the East. In 1919 the Frank Hemingway Co. of Bound Brook, N. J., manufacturers of insecticides since 1913, was acquired. In 1936 all manufacture of insecticides was consolidated at the very much enlarged Bound Brook plant under M. L. Sommerville, and production at Chicago was discontinued. The Company erected an insecticide plant at Oakland, Calif., in 1921, to handle the greatly increased Pacific Coast and Western demands.

The federal regulation against arsenic, lead, and other residues left on fruits and vegetables brought about the use of rotenone as an insecticide and the Sherwin-Williams Co. began to manufacture Roto-Dust in 1934. A year earlier it studied the use of copper sulfate as a fungicide and as a result, was the first to produce tribasic copper sulfate, now made under the name of Basi-Cop. The Company manufactures large quantities of DDT (Pestroy); the weed killer, butyl 2,4-dichlorophenoxyacetate (Weed-No-More); a scientific blend of insecticides and fungicides including DDT, rotenone, and other proven materials (Bug Blaster); and a very recent addition, hexaethyl tetraphosphate (Killex 100), for the control of red spiders and mites.

Much research—both in the Company's laboratories and in foundations at colleges—is being devoted to the development of new products. Specialization in fruit and vegetable growing has brought up new problems, and trained entomologists and plant pathologists are conducting research in the field and presenting the Company's products to the grower. The marketing of insecticides is under the management of A. J. Gunderson. The insecticides business has grown until the Company now handles a larger volume than any other company in the United States.

To control more definitely the quality of paint ingredients, the Company entered into the manufacture of linseed oil, white lead, leaded zinc, lithopone, and synthetic resins, under the general management of George A. Martin, then manager of auxiliaries, who in 1922 became president. The present manufacture of white pigments and linseed oil is managed by S. B. Coolidge.

Manufacture of lead carbonate was undertaken in 1910 by the Old Dutch

process. In 1920 a Quick-Process plant was erected and has now entirely displaced the slow Old Dutch process. Also, a plant for the manufacture of red lead and litharge was added. As the exterior house paint made by the Company used large tonnages of leaded zinc, it was decided to enter into its manufacture. In 1904 the G & G Zinc Oxide Co. of Joplin, Mo., was bought and later moved to Coffeyville, Kans., near an advantageous supply of natural gas, reorganizing in 1906 as the Ozark Mining & Smelting Co. Sherwin-Williams established a lithopone plant in Chicago in 1917 and erected a new plant at Coffeyville in 1931.

The Company has devoted much attention to the manufacture and treatment of linseed oil. In 1902 a plant to crush flaxseed was erected in Cleveland, equipped with hydraulic presses and later, with screw presses. Many refined and treated oils are also produced. About 10 years ago, when tung oil became so difficult to procure because of the Chinese-Japanese troubles, Sherwin-Williams Co. was in the forefront dehydrating castor oil, which has greatly reduced the consumption of tung oil in varnishes and enamels. A solvent-extraction plant for linseed, castor, and soybean oils is being erected.

The development of synthetic resins began in 1928 at Cleveland. Having outgrown facilities by 1933, the production of synthetic resins was added at Chicago. Construction of other plants is under way at Oakland, Detroit, and Newark. The Company now manufactures a wide variety of alkyd and phenolic resins and varnishes, whose development was supervised by Dr. J. V. Hunn until very recently, when he transferred to research in oils and was succeeded by J. A. Arvin. Sales manager of dry colors, intermediates, pigments, and resins is B. M. Van Cleve, with offices in New York, and branches in Cleveland, Chicago, and San Francisco.

Shortly after World War I, the Company undertook the manufacture of nitrocellulose lacquers. A superior product, Opax, was developed in 1922, which found much favor for automobiles, furniture, aircraft, and many metal products. In 1926 a complete plant devoted exclusively to lacquers was erected at Chicago; production of lacquer materials was also undertaken at other plants. Dr. N. E. Van Stone was the active superintendent of this department for many years, later succeeded by F. H. Lang, present superintendent. A wide variety of lacquers—both clear and pigmented, also undercoaters and reducers, represent a very large proportion of the protective and decorative coatings sold by the Sherwin-Williams Co.

The Company attained its leading position in the paint and chemical industry through continuity of sound business management. Henry A. Sherwin, starting in 1866, was president and general manager until 1898, when he appointed Walter H. Cottingham as general manager after his successful management of the Company's Canadian business. In 1909 Sherwin retired as chairman of the board and Cottingham was appointed president. Under his administration, and until he retired to become chairman in 1922, the business had grown 25-fold. This great expansion included acquisition of Lewis Berger & Sons, Ltd., of London, the establishment of manufacturing branches in Australia and New Zealand, and offices and warehouses in many other cities. Also during that period, the Detroit White Lead Works and Martin-Senour Co. of Chicago were brought into the organization.

George A. Martin succeeded as president in 1922 after wide experience as manager of the several factories producing white lead, leaded zinc, linseed oil, etc. He greatly expanded the manufacturing facilities and was much interested in the establishment of plants in Havana, Buenos Aires, and Sao Paulo, Brazil. He added the businesses of Acme White Lead & Color Works of Detroit, Lowe Brothers Co. of Dayton, John Lucas & Co. of Philadelphia, and W. W. Lawrence Co. of Pittsburgh. Martin was a great leader and brought into the organization many

men who are now top executives. During his administration, up to the time he retired as chairman of the board in Dec. 1940, the business trebled. He was succeeded as president by Arthur W. Steudel, who had grown up in the ranks and directed the sales of dyes, intermediates, dry colors, and chemicals.

Under Steudel the distributing facilities of the Company had been greatly extended and now embrace 42 warehouses, over 390 branches in leading cities all over the United States, and over 150,000 retail outlets. Also, many new products have been introduced, including a complete line of household polishes and waxes, DDT-insect repellent, 2,4-D weed killer, and Bug Blaster. The business has increased over 50% since Dec. 1940, until it now approaches 500 times the volume of the first year. During 1941-45 the Company supplied enormous quantities of paints, varnishes, lacquers, and chemicals for military use. It also managed a shell-loading plant for the War Department.

This continuity of good management had guided a staff of long experience and at the close of 1946 there were over 13,000 employees of whom 1,020 had completed 25 years in the Company's service. Since the beginning of the business, 1,588 have served for 25 years or longer and 55 completed 50 years.

The present officers of Sherwin-Williams are: A. W. Steudel, president; H. D. Whittlesey, senior vice-president; M. J. Fortier, vice-president and general manager; S. B. Coolidge, vice-president and director of auxiliaries; C. M. Lemperly, vice-president and director of sales; L. H. Schroeder, vice-president and treasurer; N. E. Van Stone, vice-president and executive general manager of institutional special products; T. G. Murphey, secretary. The directors comprise Fortier, C. P. Jarden (retired), Lemperly, Schroeder, Steudel, Whittlesey, and L. W. Wolcott (retired) of Sherwin-Williams; A. D. Baldwin of Garfield, Baldwin, Jamison, Hope & Ulrich; C. S. Eaton, Otis & Co.; George Gund, president, Cleveland Trust Co.; D. A. Kohr, president, Lowe Bros.; G. H. Robertson, vice-president and general manager, Acme White Lead & Color Works; Thos. E. Wilson, Wilson & Co.

FOSTER D. SNELL, INC.'s present head, Foster Dee Snell, began consulting work while still a graduate student at Columbia University and an instructor in chemistry at the College of the City of New York. The first laboratory, however, was set up at Pratt Institute, Brooklyn, N. Y., where Dr. Snell began teaching industrial chemistry in 1923, immediately after receiving his Ph.D. from Columbia. Next year the laboratory hired its first full-time assistant. Just after getting her M.S. in chemistry, the consultant's wife, Cornelia Tyler Snell, served as an assistant, 1925-26, before continuing her graduate studies. In 1926 Cyril S. Kimball joined the Company, then a proprietorship, as an assistant.

Business came in during this period from a number of industrial plants in New Jersey which were struggling to conform to a new state law requiring treatment of trade waste before its discharge into rivers and streams. Detergents were then an important field of investigation for this group and have continued, from the early study of alkaline salts as soap builders to current studies of synthetic detergents and other surface-active agents.

The consulting work grew so rapidly that in 1927 a separate laboratory was opened at 35 Myrtle Ave., Brooklyn. Next year Dr. Snell resigned from Pratt Institute and opened an office at 130 Clinton St., Brooklyn. By 1929 the laboratory occupied two floors and had a staff of 25. At the end of 1930 the Company was incorporated in New York under the name of Foster D. Snell, Inc. The first directors were Foster D. Snell, president; Beatrice Fox, secretary-treasurer; Cyril S. Kimball, Ray Hedman, and Franklin Bivins. Financing was by issue of com-