Public Relations Department

DUPONT

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DU PONT'S ROLE IN THE PAINT INDUSTRY

Du Pont's position in the paint industry stems from its development of smokeless powder in 1894, for nitrocellulose was a basic ingredient of both that type of powder and of lacquers which the company introduced early in the 20th century. In fact, Du Pont's paint business resulted from the company's early desire for industrial diversification based upon sound research -- just as smokeless powder had been developed out of the black powder chemistry on which the company's corporate foundations were laid in 1802.

Paints of a crude type are, of course, almost as old as man himself, with the earliest recorded types having been used more than 20,000 years ago as a decorative medium in Cro-Magnon cave painting. Ancient Egyptian mummy cases were painted and varnished with crude but exceptionally long-lasting materials. Earth oxides mixed with oils and tree gums were compounded into painting materials by the Chinese as early as 1800 B.C., along with lacquer made from what was known in that ancient Oriental country as the Varnish Tree. And white lead, still an ingredient of some modern day paints, has been found in a Grecian pottery box dating from 400 B.C.

AMERICAN COLONIAL PERIOD

Paints, in fact, were one of the earliest commercial products of the American colonies. Thomas Child, a Bostonian, opened the first paint mill in this country in 1692. Far removed from the complicated compounding lines of today, Child's mill consisted of a granite trough in which a granite ball was rolled over various pigments and oils to produce paint.

White lead, still used as an ingredient of some exterior paints, was first produced in the United States in 1804, and the first American varnish is believed to have been made in 1815. Zinc oxide came into use as a pigment about 1850, and ready-mixed paint was developed during the period from 1860 to 1870.

DU PONT ENTERS LACQUER FIELD

Although it probably was not a consideration in the acquisition decision, Du Pont's introduction to the paint industry came in 1904 when the company, still concentrating upon smokeless powder and dynamite as its major products, purchased the International Smokeless Powder Company of Parlin, N.J. A minor part of

that company's business was production of solvents and lacquer-type materials, including a line of clear and pigmented nitrocellulose lacquers. Like most lacquers of the period, these were of exceptionally low solids content, with solvents forming about 95 per cent of the product. But, as the best materials of that type then available, they found a ready market for protective coating of such articles as brass beds, lamps, artificial leather and even the mantles of early gas lights.

Du Pont not only continued International's development of nitrocellulose lacquers but strengthened its background in the paint industry by acquiring the American Lacquer Company and Miller Company in 1907. Eight years later, it acquired the Arlington Company of Arlington, N.J., an aggressive manufacturer of pyroxylin plastics, lacquers and pigmented nitrocellulose enamels marketed under the trademark "Pyralin" for both spray and dip coating of small metallic and wooden articles.

HARRISON PURCHASE STARTS DU PONT IN PAINTS IN 1917

But Du Pont's real entry into the broad paint business came in 1917 when it purchased Harrison Brothers & Company, a major Philadelphia paint firm which had been founded in 1793 -- nine years before E. I. du Pont de Nemours, in fact, had built his first powder mills on the banks of the Brandywine near Wilmington. Harrison also was a major producer of sulfuric acid and pigments, both of which were to be important in other activities of the Du Pont Company.

The acquisition of Harrison Brothers was Du Pont's first major step in a chemical diversification program that has made the company today the nation's largest chemical manufacturer, with its original explosives business now accounting for an insignificant part of the company's business. And, perhaps more important, it marked the beginning of a scientific approach to paint formulation.

Science had scarcely touched the paint field in the decade prior to World War I. What few researchers there were, were connected with raw materials suppliers. Varnish making was almost a "black art," with formulations existing only in the heads of those in the industry, jealously guarded as "trade secrets" passed down by word of mouth from one varnish maker to his successor and never recorded in scientific fashion. Paint formulators "flew by the seat of their pants," adding pigments to varnishes whose chemical composition they could not obtain from the secretive varnish suppliers. Chemists, when they were employed by paint manufacturers, generally were used for control work only, with no real talent being devoted to paint formulation and research.

Little study had been started in those pre-World War I days on the fundamentals affecting such paint properties as flow, gloss, shelf stability, adhesion and chalking. The quality of the products left much to be desired, and, with the exception of asphaltic high-baking black enamels, no varnishes or varnish base materials had outdoor durability of as much as a year. Paints, generally compounded at the point of use by the painter, were of low solids content with consequent poor hiding power and very slow drying properties.

SCIENTIFIC CONTROL ENTERS PAINT PICTURE

With its dedication to research and chemical control, Du Pont embarked on a program of study designed to make paint manufacture a precisely controlled chemical process, rather than a "rule of thumb" business. Within a few months after acquiring Harrison Brothers, Du Pont purchased the Bridgeport Wood Finishing Company of Bridgeport, Conn., which not only made paints but also a line of specialties such as fillers and stains. In May, 1918, it acquired the Flint Varnish and Color Works, Flint, Mich., manufacturers of automotive and railroad coach finishes, and four months later, added by purchase the New England Paint and Oil Company of Everett, Mass. These acquisitions, along with that of the Chicago Varnish Company early in 1920, formed the nucleus of Du Pont's new Paint Division.

First major product of Du Pont's research in the new area was "Duco" nitrocellulose lacquer, developed by its Parlin laboratory and introduced in 1922. Its high solids content, in comparison with previous nitrocellulose type lacquers, provided a fast-drying film of superior durability and gloss and almost over-night captured a major share of the budding automobile industry's finish business. Its widespread adoption in the furniture and appliance industries, beginning with refrigerator manufacturers, was a logical extension of its success in the automotive industry.

"DUCO" FINISHES REVOLUTIONIZE AUTO INDUSTRY

The impact of "Duco" finishes on the automobile industry was tremendous, especially in the light of the mass production which was to come in the late 1920's, for it reduced finishing time from days to hours and provided finishes that would stand up for years instead of months. The best of the 1920 auto finishes, for example, required 26 days or more for application of up to a dozen coats of primers and varnishes, with their long drying times and hand rubbing requirements. "Duco" broke this bottleneck, introduced fast and efficient spray painting of far more durable finishes, and,

perhaps more than any other single factor, enabled the industry to develop its modern assembly line. Today, in fact, an automobile can be finished completely, from primer to top coat, in less than five hours.

In 1926, Du Pont began research on the synthesis of combinations of rosin and phenol-formaldehyde, which made possible the formulation of varnishes with much improved drying speeds for a given flexibility, as compared with the older fossil gum or rosin combinations. And, in the same year, the company introduced brush "Duco" lacquers both for household painting and in the industrial field, as a companion line to the spray "Duco" finishes, which six years earlier had revolutionized automobile finishing.

DU PONT LAUNCHES LABORATORY RESEARCH PROGRAM

Success of "Duco" finishes crystallized in Du Pont's mind the need for aggressive paint research, and in 1927, a Central Technical Laboratory was established in Philadelphia.

The Central Technical Laboratory, incidentally, is now the Marshall Laboratory, having been named in 1949 in honor of its first director, John Marshall. It is today the central research and sales development laboratory of the company's Finishes Division.

At that time, the Philadelphia plant of Du Pont's Paint Division had in its files formulas for about 22,000 paint, varnish and enamel products unclassified and filed only by date. One of the laboratory's first assignments was to review and classify this mass of data in a system which would make it usable as the basis of a planned research program and at the same time permit establishment of standard formulating practices. And while it may not sound glamorous by the usual standards of research work, that project provided the major building block for the company's future product development.

One of the laboratory's first research assignments was the development of new finishes based on modified alkyd resins and resulted in 1933 in the commercial introduction of a new line of "Dulux" alkyd enamels. These new film formers not only proved to have about the same weather resistance as the best nitrocellulose lacquers and drying speeds similar to the more brittle varnishes made from phenol-formaldehyde resin combinations, but were found to possess amazing toughness, flexibility and high luster without the rubbing required with older oleoresinous materials. Within 10 years, the "Dulux" alkyd enamels became one of the most important finishes used in the automobile industry, auto refinish trade, appliance manufacture, household equipment, marine, and structural

steel industries. Their outstanding whiteness and resistance to color change opened up a whole new area of use as the preferred architectural enamel.

1930's SPUR NEW DEVELOPMENTS IN AUTOMOTIVE FINISHES

The early 1930's also saw several developments which entrenched Du Pont finishes even more deeply in the automotive field. Early in 1934, Du Pont introduced its Calibrated Mixing Set, a series of small volumetric measures which enabled refinishers to mix in their own shops automotive colors to match factory color standards. For the first time, refinishers could duplicate the colors in the original car finish, and this simplified greatly the problems of paint touch-up and damage repair.

In 1935, Du Pont introduced "Preparakote" primers to the refinish trade, making "Dulux" finishes the preferred repaint system in upwards of 80 per cent of the refinishing of trucks, buses and other commercial vehicles. Here "Dulux" finishes displaced the older "Duco" nitrocellulose lacquers on an economy and ease-of-use basis.

"Duco" metallic colors were introduced in 1935 to provide a whole new line of sparkling, deep-sheen colors for automobiles. Two years later, "Pyralux" nitrocellulose finishes were offered for lower cost touch-up and over-all refinishing, although they were to be discontinued as a "wartime casualty" early in the next decade.

Expansion of manufacturing facilities continued during the 1930's with the company purchasing the Mountain Varnish & Color Works, Toledo, Ohio, in mid-1934, and building a new plant in San Francisco the following year. In 1937, construction was begun on a new plant in Fort Madison, Iowa, although it was 1940 before that facility began production, and in the same year, Du Pont introduced the first commercial finishes based upon urea-formaldehyde resins.

GROWTH OF INDUSTRIAL TRADE SALES FINISHES

After several years of field testing, Du Pont also introduced in 1937 an improved white paint for exterior use, based upon titanium dioxide pigment rather than the traditional white lead. About this time the company also introduced its well-known and now widely accepted Color Conditioning for Industry program, one of the most important factors in taking industrial painting out of the drab color stage and moving it into the scientific use

of color from the standpoint of area coding, safety designation, employee morale and maximum visual value.

Incidentally, until 1929 Du Pont had sold its consumer paints to retailers through wholesalers. At that time, the company decided to open its own retail-wholesale stores in five metropolitan centers -- Youngstown and Columbus, Ohio; Birmingham, Ala.; Syracuse, N.Y.; and Memphis, Tenn. By 1950 the number of Du Pont stores had risen to 60, remaining at that level until 1953 when the company abandoned its retail store operations and began paint distribution through Du Pont warehouses and independent retail dealers.

Alkyd resin primers and top coats pioneered by Du Pont in the 1930's were replaced about 1939 with alkyd-urea formaldehyde types which offered shorter bake times, better hardness and superior color retention as industrial finishes. The early 1940's saw introduction of polyvinyl formal resin wire coatings and nylon enamels as insulating materials.

EFFECTS OF WORLD WAR II

World War II represented a difficult period for both Du Pont and the rest of the paint industry. "Dulux" finishes virtually were abandoned due to a shortage of phthalic anhydride, and manufacture of "Duco" lacquers was curtailed sharply. War-caused shortages of labor, raw materials and equipment items continued to plague the industry through 1948, although by that time the paint industry had attained an annual sales volume of a billion dollars. Two years later, the outbreak of the Korean conflict again caused material shortages, and Du Pont was forced to give first priority to automotive finishes and temporarily cut back its development and production of other types of paints.

Perhaps the most significant changes throughout the paint industry in the post-World War II period were the entrance of many small companies into the paint business and the advance in technology on the part of all manufacturers. The combination of these factors made it difficult for the older, and especially the "quality," producers to maintain a rate of growth proportionate to the total industry.

DEVELOPMENTS FOLLOWING WORLD WAR II

First new products to come out of Du Pont's finishes laboratory after World War II were the "Metalli-Chrome" finishes in 1946. These were hard, durable lacquer enamels containing finely divided metal particles which gave to auto finishes a new, sparkling iridescence.

Another significant Du Pont development, at the paint manufacturing level, during this postwar period was the "47 Process," an improved method for pigment dispersions using fine sand as a grinding mechanism. Research work on the process, which sharply increased the capacity of pigment grinding facilities and resulted in better products, continued through 1954 when basic patents were finally obtained by Du Pont. Licensing arrangements were extended to other paint manufacturers and more than 250 other paint makers are now licensed to use the process.

Sprayable coatings based on "Teflon" fluorocarbon resins, which provided exceptional corrosion resistance and non-sticking characteristics, were introduced to the industrial finishes field in 1947-48.

The results of post-World War II research began to come to fruition in the 1950's.

Du Pont introduced its "Flow Kote" rubber-base interior wall paints for home use in 1952 and offered in the same year a new line of "Tufcote" alkyd enamels for heavy-duty industrial applications, along with odorless solvents.

ACRYLIC FINISHES INTRODUCED IN 1953

In 1953, the company's automotive customers saw the first field tests of "Lucite" acrylic lacquers, outgrowth of a research project whose objective was the development of an automotive finish having the low cost features of "Dulux" enamel, the styling and fast-dry features of "Duco" lacquer, and durability superior to either of those products. The following year, an improved "Dulux" enamel known as "Dulux" 100, was introduced for those automobile manufacturers who preferred an enamel to lacquer in their finishing process. But "Lucite" acrylic finishes rapidly gained in popularity, accounting for about 20 per cent of Du Pont's total topcoat sales to the auto industry by 1957, with General Motors adopting them as its "Magic Mirror" finish on all units beginning with the 1959 model year. In fact, acceptance of the "Lucite" finishes was so great that in late 1961, Du Pont released to the auto refinish trade a "blending service" on "Lucite" lacquers, similar to the mixing programs offered earlier for use with "Dulux" and "Duco" finishes.

An improved version of "Dulux" enamel was introduced in 1966. The newer product dries dust-free 50 per cent faster than its predecessor. Under identical exposure conditions, new "Dulux" looks as good after three years' exposure as the previous product does after two.

Du Pont's acrylic resin finishes spread to the appliance industry in 1958, and in the same year the company introduced "Duco" Spray Magic aerosol paints for touch-up purposes, along with a new Color Master paint mixing machine which permitted retail paint dealers to mix, in their own stores, any of hundreds of scientifically matched shades of paint and enamel.

"LUCITE" PAINTS

"Lucite" acrylic house paints -- first of the water-emulsion type products with superior resistance to blistering -- made their appearance in 1959, being recommended initially for use only over bare wood with a specially formulated primer. The following year marked the introduction of 'Lucite' interior wall paint, a creamy thick, no-drip, thixotropic, emulsion type paint.

Combining all the advantages of emulsions -- easy application, touch-up and clean-up -- "Lucite" wall paint climaxed more than 20 years of Du Pont research into utilization of acrylic resins. For the "do it yourself" home market, it provided a wall paint that not only was much less messy than earlier oil-base paints, but spread fast and evenly, acting as its own primer over almost any type of surface. Users liked its extremely low sheen, outstanding color uniformity, and long color retention, and within a year or two after its introduction it had become the most popular interior wall paint in the Du Pont line.

Meanwhile, exhaustive consumer tests in the 1959-62 period indicated that "Lucite" exterior house paint need not be limited to use over primed new or bare wood, but could be applied successfully over any sound substrate, offering much longer life than conventional oil-base exterior house paints. As a result of the studies, 1963 marked the first year of aggressive, large scale promotion of "Lucite" acrylic paint as a superior exterior house coating.

Two early-1967 refinements included: a no-primer "Lucite" house paint for use on bare or previously painted wood, masonry, metal, and, in fact, every surface except staining woods; and for such woods as redwood, cedar, mahogany, and fir plywood, an all new latex primer, the introduction of which gives Du Pont an all-emulsion house paint system.

Late in 1967 Du Pont announced "Lucite" interior enamel, a latex of medium gloss in white and colors to match "Lucite" wall paint.

Spring of 1968 brought two new additions to the "Lucite paint line -- an exterior enamel and a floor paint. The new exterior enamel, companion product for "Lucite" house paint, is recommended for use on outside wood or metal trim. The new floor paint is recommended for use on inside or outside concrete patio, porch or basement floors.

The five-product "Lucite" line can meet 90 per cent of the average homeowner's painting requirements.

OTHER DEVELOPMENTS OF THE '60's

Polyimide wire enamel and insulating varnish, products of Du Pont's broad polymer research program, were introduced on a commercial scale under the trademark "Pyre-ML" in 1962. Retaining good mechanical and electrical properties over a temperature range of minus 310 degrees to 650 degrees Fahrenheit, they are among the most fire-resistant of organic polymers and are finding wide application in the electrical and electronic fields.

"Flintflex" lining, an unusually tough, flexible organic coating so smooth that few materials will stick to it, was introduced in the early 1960's and is being used widely as a chemically resistant lining for covered railroad hopper cars, food processing tanks, and industrial storage containers for dry bulk materials, including foodstuffs. It is a urethane-type product.

Also introduced by Du Pont in the early 1960's were "Budium" polymerized butadiene coatings for the metal container field. Low in cost, with outstanding resistance to nearly all types of foods, such coatings impart no taste to can contents and are expected to be adopted widely as an interior can lining in the food field and as a superior base coating for the interior of beverage cans.

The introduction of "Du-Lite" fluoropolymer enamel in 1965 brought unprecedented durability and color retention to the precoated metal siding industry.

The finish is designed for application to conversion coated aluminum and primed galvanized steel where exterior durability is vital, as in building panels.

"Du-Lite" has been used on numerous buildings from as far south as Florida to as far north as Alaska, including the huge Jones & Laughlin Steel Corporation complex in Hennepin, Ill.

Another area of large growth is the use of "Teflon" TFE non-stick finishes in both the cookware and kitchen appliance fields, where non-stick characteristics of the coatings eliminate the need for soaking and scouring of cooking utensils and other housewares. The anti-stick properties of "Teflon" finishes also have valuable applications for food, textile, paper, plastics, and other industrial processing equipment, as well as on gaskets, molds, and a variety of other articles.

In early 1967, Du Pont introduced a group of new coatings, along with a new trademark -- "Teflon-S' stratified non-stick and self-lubricating finishes. These coatings combine sufficient

hardness for heavy-duty service with the non-stick property already familiar to users of "Teflon" TFE and FEP non-stick finishes. They also offer other advantages, including easier application methods, lower baking temperatures, and the use of only one coat for many types of applications. "Teflon-S" finishes were not designed for use on cookware, but they quickly became useful on other consumer products, such as range hoods, snow shovels, and hand saws. Their potential applications by industrial and commercial firms are myriad, including conveyors, chutes, hoppers, and other bulk handling equipment; electrical equipment; valves, tanks, and linings; molds of may types; and other manufacturing machinery.

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Du Pont's plants for the production of paints, enamels, and other types of protective coatings marketed by the Fabrics and Finishes Department are located in Chicago, Ill.; Everett, Mass.; Fort Madison, Iowa; Flint, Mich.; Parlin, N.J.; Philadelphia, Pa.; South San Francisco, Calif.; Toledo, Ohio; and Tucker, Ga. Principal research facilities are located at the Marshall Laboratory in Philadelphia and the Flint Development Laboratory in Flint, Mich. Basic research also is conducted at the company's Experimental Station near Wilmington.

Du Pont's consumer paints are marketed through the Consumer Products Division of the Fabrics and Finishes Department. This group, established in 1962, reflects the company's intention to increase its emphasis upon the manufacture and marketing of finished consumer products -- a sharp departure from its first 150 years as primarily a supplier of chemical products for use and further fabrication by other firms. Product lines other than paints being marketed by this division include anti-freeze, the No. "7" line of automotive specialties, cellulose sponges, adhesives, and plastic toiletries.

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