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YOU STEP from the pressurized cabin of your laminate-and-clear-acrylic helicopter into the adjacent subway and are whisked by underground tube to the central office and production building of the Twenty-First Century Paint Manufacturing Corporation. The air conditioned comfort of the structures braces you. A few words to the secretary, a glance at the morning mail, and your day is initiated. A check of the previous day's production and shipping data, a hasty noting of the material whose due dates fall during the next five days, a few quick calculations on the slide rule, and you are prepared to feed the electronic compto-scheduler the requisite information for determining the day's schedule for the entire plant. Your calculations will enable you, by pressing the correct buttons, to automatically feed proportioned amounts of raw materials into a kettle, mill, or mixer, blend off the intermediates, and spectrophotometrically color-match the product. An analyzer will spectrographically determine the control characteristics of the batch, beaming the results on your office telescreen. Another lever, and the filling operation is begun, controlled by an electric eye.

You sit back, musing on the technical events of the day—the final tests on the newest UHF pigment disperser eliminating the need for emulsifiers, a preliminary report from the laboratory on the new vehicle whose rheology characteristics will enable the successful spray application of a 100 per cent non-volatile coating, and the acceptance by the leading boiler manufacturer of a white, non-yellowing, non-flammable, totally inorganic finish. Then you remember that correspondence on the negotiations for a 30 hour week. You begin to talk into the dictaphone, "October 20, 2001 . . ."

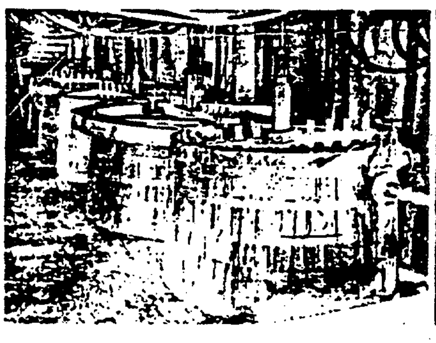
No, this is not a story that slipped off the pages of a Science-Fiction Magazine—merely a projection of what we might look forward to in about fifty years. Infinitely more complex manufacturing operations are carried on today by remote control. Why not finishes? When we consider the great contrast between the present status of the finishes field and that of fifty years ago, we realize that the foregoing projection is not unduly imaginative.

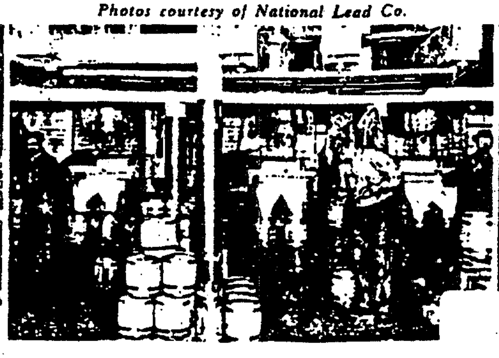
Secret Art

AT the turn of the century the paint and varnish industry was just faintly beginning to feel the impact of organic chemistry on its classical formulations. Tung oil had been introduced to the varnish world

Left: Rake tubs are used to remove impurities from white lead mixed with water. Center: White lead in oil is being packaged in kegs from filling bench. Right: Row of white lead settling tanks.

Photos courtesy of National Lead Co.





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just a few short years before, laying the groundwork for the first major technical advances in many years. While today tung oil is considered an almost indispensable raw material it was not so highly rated at first. As with any unfamiliar raw material, many mistakes were made in its use and because of their ignorance in the proper treatment of tung oil, some manufacturers were ready to blame their failures on the tung-oil properties themselves. Although they knew that tung-oil varnishes were more repellent to water than linseed-oil varnishes, and that rosin varnish makers had successful methods of using it, they also found, to their dismay, that their varnishes frequently underwent decomposition while standing and often gelled during processing. Over the years varnish makers have learned how to cope with these difficulties and today, despite an occasional "monkey", for the most part this problem has been eliminated.

Instead of looking to the laboratory for new raw materials and improved methods, it was customary in those days for the old formulas to be passed along faithfully from one generation to the next: white lead carbonate in linseed oil for paint, and fossil gums in various natural oils for varnishes. Progress was slow because the guardians of the ancient recipes, lacking scientific knowledge, had no means of predicting the consequences of even a trivial modification. Thus, they feared change as an evil in itself. Nevertheless, the so-called secrets of the trade, such as pre-bodying of the oils, use of driers, preparation of the hard resins, etc., served them well and many excellent and durable products were available to the paint consumer. These varnishes were mostly dark materials, compared to the products of today, and as a rule they took as long as 48 to 72 hours to dry.

Varnish Technology

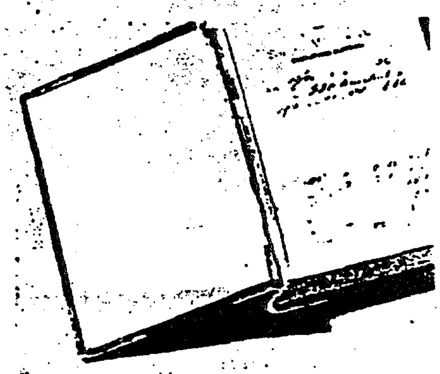
THE art of combining oils, particularly linseed, with hard gums had been developed over many centuries, and the products thus produced were, as today, of many qualities, ranging from the unexcelled violin varnishes and great master painters' vehicles to cheap, dark, brittle wood varnishes. The manufacturer of 1900 used formulas and procedures hardly differing from those listed in the first printing of Watin's varnish formulary in 1772, usually considered the beginning of "modern" varnish technology. Manila, kauri, and zanzibar were still the most popular resins. Shellac, damar, sandarac, mastic and colophony (common rosin) were the resins generally used without oil in solvents such as alcohol and turpentine. These were known as spirit varnishes.

The varnish kettles, as in so many installations used today, were mostly copper, about three feet in height and in diameter, with the bottoms riveted on. When that gave out, a new bottom was added. This was done successively until the height of the kettle became too small for use. It was set on a small frame "truck" used to move the kettle around. The coke fire, below the floor level, was started early in the morning, to be hot for the varnish maker. The gum, as varnish resins were called, was heated over the fire with constant stirring by the use of a wooden-handled iron rod thrust through a hole in the loose-fitting cover. The "run" was over in about thirty minutes, during which time 10 to 30 per cent of the gum was lost through "vaporization." Thermometers were seldom used, as the desire was "only" to melt the resin, though temperatures in excess of 650° F were often reached.

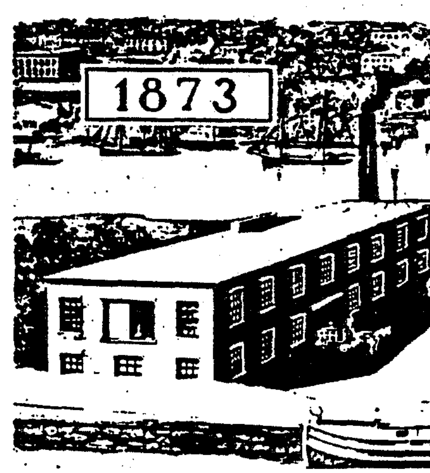
The linseed oil was simultaneously heated in another kettle at temperatures ranging from 90° to 500° F, after which it was slowly added, with continuous agitation, to the gum kettle, after removal from the fire. When all the oil had been added, the cooking was resumed at approximately 500° F until a drop cooled clear. German practice called for more extended cooking and bodying of the linseed oil and a correspondingly shorter period during which the gum and oil were together. Many varnishes were made as short as 3 gallons of oil to 100 pounds of resin. This was due to the fact that the gloss and depth of the varnish were the important properties and, of course, the resin contributed most highly to these factors.

Due to the risk of fire, wet burlap was constantly on hand for smothering purposes and thinning was performed at a distance from the open

Artist's conception of the Sherwin-Williams Co. building in Cleveland, Ohio as it looked in 1870.



1873—Sherwin penned first formula.



First Sherwin-Williams factory located on site of present Cleveland plant. Machinery consisted of boiler, engine, mixer, mill and putty chaser.

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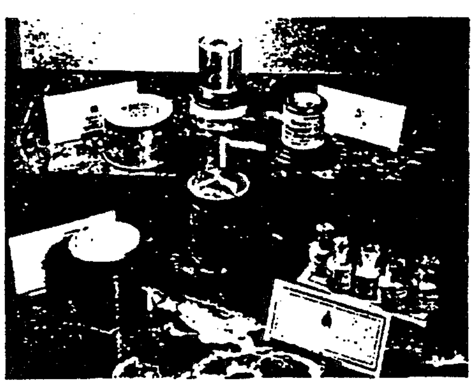
1880—first can of Sherwin-Williams' paint.

Coach color show card—1887.



Dry colors used for wax flowers—1873.
Photos courtesy of Sherwin-Williams Co.

fire. Naturally, this was done while the varnish was still quite hot and much turpentine was lost. Because the art was older and the areas more thickly settled (necessitating more precautions), European equipment was further advanced than American equipment. Closed varnish kettles of aluminum, copper, or enameled iron, often in batteries with their stacks leading to a common condenser, were the rule rather than the exception. As restrictions on atmospheric pollution, to say nothing of the noxious odors, increased, American manufacturers began using condensers, especially for gum running.

Compared to our present day alkyd resins, the color was quite dark. "Inert atmosphere" was an unknown scientific marvel. Hand-sorting of the gums and extremely careful cooking were necessary to manufacture the lighter colored and more expensive grades, which were, nevertheless, usually inferior to the darker with respect to durability. This was so because the pale sorts were of a lower melting point than the darker portions of the gum, necessitating a lower cooking temperature. Another reason for the lower cooking temperature was the desire to keep the color development to a minimum.

Varnishes and spirit varnishes were often "conditioned" or "clarified" by storaging for a length of time; some manufacturers claimed, as long as four years. Not only did this act as a filtering or settling procedure, but it was believed that the properties of the material were considerably enhanced by the passage of time, in a manner similar to that in which liquor is aged.

It is interesting to note also that even in the early 1900's, the manufacture of varnish was conducted as a definite business, independent of any other, and so subdivided that the same concern did not make all kinds of varnish. In fact, it was not unusual for some of the larger, as well as the smaller manufacturers to purchase varnishes, either for direct sale or for use in making some special product, from other makers who were particularly successful in certain lines of work.

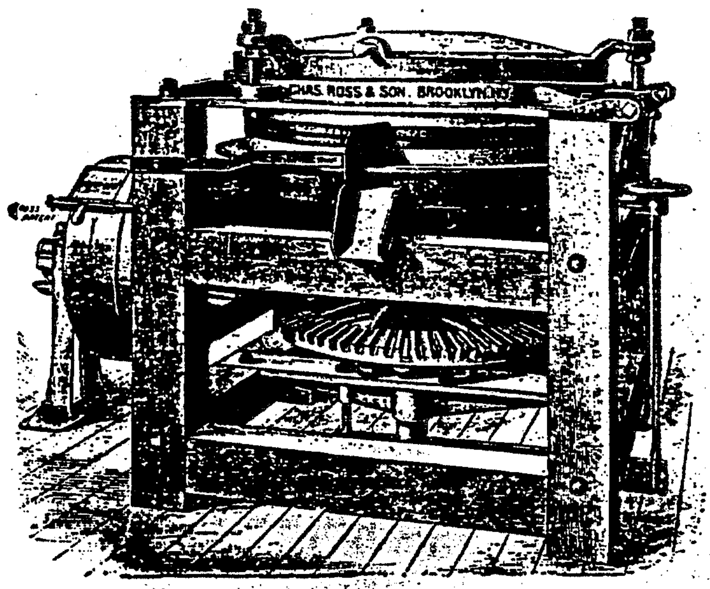
If the above procedures and methods do not seem unfamiliar, this is not surprising. Many of our vehicles today are manufactured in much the same manner as those of half a century ago. Admittedly, cooking facilities are superior, but a suprisingly small proportion of the kettles are Dowtherm equipped compared to the number using direct fire. On the other hand, although methods of manufacture have undergone relatively little change in the past fifty years, there have been unprecedented advances in vehicles—from a raw material point of view. It is especially in this area that the increased activity of chemists in the paint field has been notable, as evidenced by the many new and improved synthetic resins now available.

Chemical Approach

IT was less than twenty-five years before the turn of the century that the first graduate chemist entered the paint profession. Technological advancement, rebelling from customary practice, had a hard road at the outset. The guiding finger of the scientific method had influenced but few of the tradition bound varnish and paint makers. However, the inherently superior properties of China wood oil, over linseed oil, with respect to speed of dry, durability, hardness, resistance and also price, provided the necessary spur for scientific progress. Varnishes of this "conjugated" oil, even when made with rosin, proved superior to those made with linseed oil and fossil gums and furthermore they were much cheaper. With the advent of the first "synthetic" resin, ester gum (rosin-glycerol ester), progress toward the manufacture of intrinsically better products was well on its way. Chemistry was at last beginning to assume its rightful place in the paint industry.

With relative rapidity, further improvements in the "hard" portion of the varnish constituents occurred: rosin-modified phenolics, 100 per cent phenolic resins, coumarone-indene resins and finally, the maleic hard gums. In combination with tung oil, or for that matter, with linseed oil, or any other number of currently employed oils, these varnishes gave unequalled qualities of chemical and wear resistance, durability and pale color. In addition, these developments furthered the independence of American manufacturers from the vagueries of foreign sources, a trend which shows no sign of waning.

Not only are natural gas and petroleum derivatives taking the place of fossil resins, but even such items as China wood oil are being grown in this country. An increasing quantity of our requirements are coming from the growing areas of Florida and Mississippi. Thus, China wood oil may eventually be entirely free of dependence upon China as a source. In common with numerous other imported raw materials, quality varies greatly. Domestic production has reduced this factor to a minimum. In addition, due to the superiority of our machine presses far more oil is pressed from the seeds than is achieved in China. This has further aided the economic stability and induced the growth of the industry here.



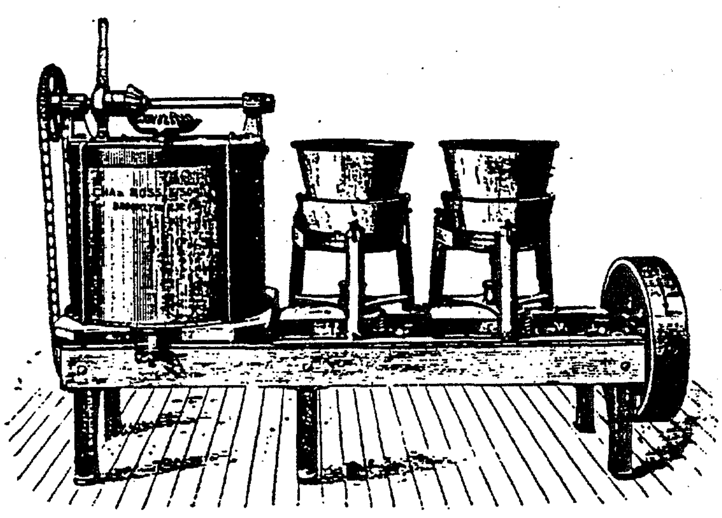
White lead and color mill used by the paint industry at turn of the century.

Photos courtesy of Chas. Ross & Son Co.

Vehicle Development

IT has not been until recently that improvements have been effected in the oil portion of vehicles. The introduction of the newer commercial oils—soybean, oiticica, etc.—was the first step in this direction. The advent of the second World War with its attendant scarcities (in part caused by our inability to procure material from other parts of the world), as well as with the stimulation resulting from the recent development of "dehydrated" (conjugated) castor oil, led to the upgrading of various oils and the improvement of the resistance and drying properties through such methods as vinylation, catalytic isomerization and fractionation.

One of the most far-reaching vehicle developments was the introduction in the late twenties, and subsequent development and expansion through the thirties, of glyceryl phthalate varnishes. These alkyd resins, with their almost infinite number of variations—in oil "length", type of drying or non-drying oil, multitude of polyhydric alcohols other than glycerol, such as pentaerythritol and sorbitol, polybasic acids, such as maleic anhydride, in addition to the phthalic anhydride, and the addition of modifying agents, such as phenolic resins and rosin—form the basis for innumerable air-dry and baking finishes. These finishes are noteworthy because of their initial gloss and gloss retention, adhesion, outdoor durability, flexibility, and chemical and abrasion resistance. The high application solids combined with the low cost of these versatile materials have greatly increased their use in the past two decades.



Combination of paint mills and mixers used in early 1900's.

Lacquer Development

TURNING to a consideration of lacquers, the value of nitrocellulose was already established in 1900. At that time, pyroxylin finishes came into extensive use for photographic purposes. Naturally, other uses suggested themselves, but to adapt them for use on metals or wood, suitable solvents had to be found. At that time it was a formidable problem and the first solvents that were found useful were nitrobenzene and ethyl ether, both of which were used in

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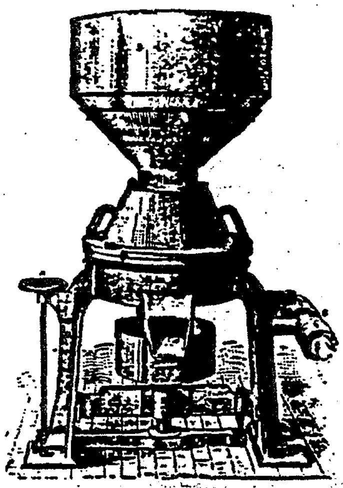


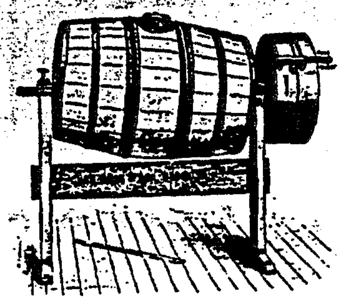
Conical burr stone paint and ink mill was quite popular amongst paint manufacturers in 1900's.

conjunction with methyl alcohol. Naturally, these mixed solvents had many objectionable qualities and as the demand for suitable lacquers increased, a great deal of research was undertaken to find suitable solvents for nitro-cellulose. Among the solvents which were tried at first were acetone, methyl nitrate, butyric ether, benzoic ether, formic ether, methyl salicylate, amyl formate, amyl acetate, amyl butyrate, and many others. Except for the amyl esters few of these were found to be of practical use. Amyl acetate was the most popular and the demand for this purpose was so great that the world supply did not meet requirements. Pyroxylin finishes were modified with various resins, such as shellac, manila, sandarac, damar, mastic, tolu, benzoin, etc. The most serious difficulty experienced with these solutions was due to the fact that most of the resins contained acids which caused the film to decompose on aging.

Another result of chemical research has been the production of lacquers having application non-volatiles approaching that of such materials as alkyds, 35 per cent and over. Because cellulose nitrate alone makes an unsatisfactory film of poor durability, flexibility and adhesion, chemists have developed, during the past twenty-five years, a host of modifying alkyds, plasticizers, and hard resins, which overcome to a large extent the deficiencies of cellulose nitrate. In so doing, they have opened the door to innumerable other developments, such as the low-cost quantity production of butyl alcohol, numerous higher esters, glycol ethers and esters, both by fermentation and synthetically from natural gas or other hydrocarbon sources. These in turn stimulated the growth of our now gigantic synthetic organic chemicals industry. Another spur for this industry was the demand for ester-type plasticizers, not only for cellulose-nitrate compositions, but also for other cellulose esters, ethyl cellulose, and for the phenomenal vinyl resin field.

Other Synthetics

INCREASINGLY large amounts of vinyls are produced yearly and these polymers are gaining wide-spread acceptance as air-dry and baking finishes for specialty applications, particularly where extreme



Eccentric revolving varnish cutter and mixer for cutting shellac, dissolving resin and gums.

chemical resistance is required. In addition, Bakelite's famed "Wash Primer" systems have set a new standard for corrosion resistance. Even nitrocellulose, in conjunction with suitable compatible vinyl resins, yields lacquers of excellent abrasion and cold-check resistance.

In line with the desire to furnish superior products, air-dry and force-bake furniture finishes are becoming more popular as a way of improving the alcohol, heat, abrasion, and cold-check resistance beyond those which cellulose nitrate lacquers are presently capable of producing. The use of the recently introduced catalyzed phenolics may become competitive with the currently favored alkyd-urea combinations.

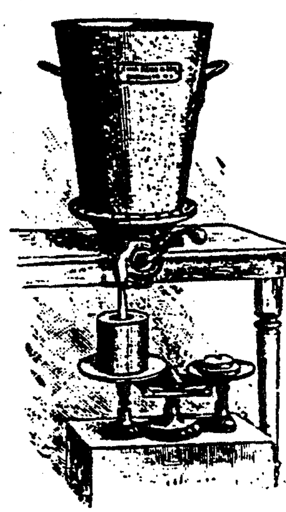
The introduction of urea resins, and subsequently of melamine resins in 1939, considerably enhanced the already desirable characteristics of the widely used alkyd materials. These butylated amines accelerate the speed of cure and increase the degree of chemical and abrasion resistance and hardness of the softer oil-modified resins. Thus our modern washing machine and refrigerator finishes have been made possible, with resistance properties that are almost unparalled in the field of organic coatings.

"High-bake" synthetic enamels, in addition to their tremendous use in the appliance field, have also gained a secure place for themselves in the automotive finishing business, where their high solids, excellent gloss and durability have won them a position competitive with lacquers. Their drying time has been shortened almost to that of lacquers by the copolymerization of styrene into the vehicle, at the same time retaining the other desirable properties.

Latices

CONSIDERABLE interest is apparent today in the use of chlorinated rubber and butadiene-styrene polymers for corrosion-resistant applications, as on air-conditioning units. And butadiene-styrene polymers are the vehicles for one of the newest and most sensational advances, emulsion-type water reducible paints.

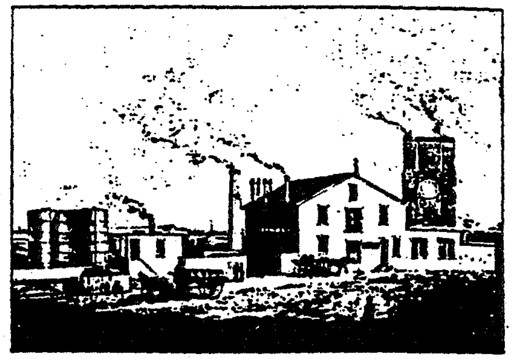
This branch of the art is still in its infancy and its maturity may very



Can filler for filling paste paints in cans.

well revolutionize the paint industry.' Ever since paint was manufactured for resale, it was the fond dream of the producers to use water as a solvent. While a whole segment of the industry is devoted to the manufacture of water finishes, these are limited to porous surfaces or for temporary finishes. The recent development of durable, washable and brushable water paints was a consequence of the unprecedented growth of the synthetic rubber industry. With the availability of new monomers, the rubber industry turned to the paint field as a potential outlet for its products. The success of the various latices in interior finishes has started a new branch of paint technology. It is too early to predict how large a portion of the present market it will replace. Although latex finishes have not as yet entered into industrial formulations, there is no technical reason barring their usage. The major difficulty thus far has been that of application but it will undoubtedly be resolved within a few years.

Latex paint is desirable not merely because it contains low cost water, but because the polymers comprising the latex have molecular weights so great that no known solvent can dissolve them. The magnitude of molecular size imparts resistance properties equal to no other known resin. The ever growing use of vinyl and Vinylite latex resins is an indication of their recognized superiority.



The Murphy & Co. works in Cleveland, Ohio as it looked in the 1880's.

Photos courtesy of the Interchemical Corporation.

Pigment Technology

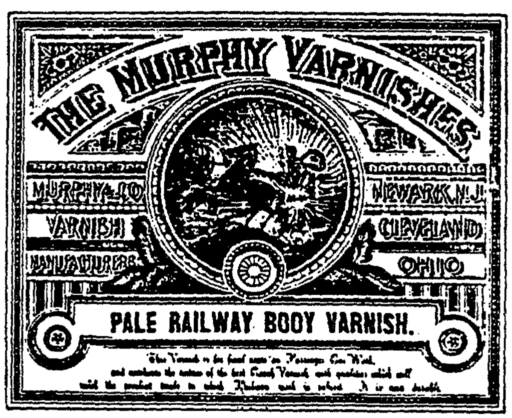
ALTHOUGH most of the major advances in the paint industry have been in the field of vehicles; pigments, too, have contributed their share of notable developments. Improved manufacturing procedures have outdated the need to be satisfied with a pigment "so fine that it would pass through a brass wire sieve of 200 meshes to the linear inch," as was true in 1900. Today, no pigment manufacturer would be foolish enough to offer such a coarse product. Manufacturing techniques have advanced beyond this crude stage. While the chemical compositions are essentially the same, the physical properties have been vastly improved.

One of the important developments in the field of new pigments was the introduction in 1918 of titanium whites. Since that time the use of these compounds has increased enormously because of their exceptional hiding power. At about the same time, synthetic iron oxides from ferrous sulfate were developed, making available quality pigments with less of the flooding and wetting difficulties encountered with the natural products.

The brilliant durable hues of phthalocyanine blues and greens were developed during the late twenties, setting new standards of permanency and light fastness in these colors. A promising new use for fluorescent pigments in advertising has led to the recent introduction of many brighter and more durable hues.

In contrast to the advances in pigments in general, dispersion techniques have shown slight improvement over the years. Despite the newest and most promising development of "flushing" pigments directly from an aqueous to an oil medium, the paint industry has been slow in the use of new dispersion techniques. Partly because of the costliness of new equipment and partly because of the lack of trained engineers to tackle the problems, obsolete grinding machinery has not been replaced. The three-roll and pebble mills still continue to provide the dispersion needs of the industry. In fact, the almost ancient stone mill is still used far more than the modern Keenok or Banbury mixers.

The efficiency of the pre-mix operation has been shown to be of utmost importance in attaining a good dispersion, yet more often than not, the mixers employed are hopelessly outmoded and inadequate. While the infrequent employment of engineers in paint plants is somewhat offset by the relatively large numbers of chemists employed, chemists are not usually trained in unit operations, production techniques and large-scale material handling. It is especially in these latter phases that the industry is still rather backward. Attempts have been made to overcome equipment defects by a free use of dispersion aids. Modernization of dispersion techniques is one



At Christmas in 1880 Murphy distributed a colorful booklet of nursery rhymes and stories "for little carriage makers and young car builders." Label is an illustration from story "The Car Painter's Boy".

Melting rooms in the Newark factory of the Murphy Varnish Co.

of the great tasks that remain for the future. The more progressive companies have recognized this and are slowly increasing the employment of engineers who are interested in dispersion problems.

Solvent Trends

THE edging out of turpentine as a reducer for paints by petroleum-derived aliphatics, and the appearance of the previously scarce higher alcohols and esters in tank car quantities are perhaps the two most notable events of the past half century in the solvent field. Better fractionation techniques have enabled the petroleum producers to become tremendous factors in the success of our industry. Commercial utilization of nitrocellulose, phenolics, vinyls and ureas, to cite but a few examples, would have been impractical except for the introduction and large scale production at reasonable prices of such widely used solvents as methyl ethyl ketone, butyl and ethyl acetate, and butyl alcohol. In their turn, producers of fermentation solvents have had to keep pace technically in order to compete with these developments. And, of course, the newest large-use solvent, water, continues in relatively abundant supply.

Chemical and Physical Testing

LET us consider now the factors which stimulated the development of accurate chemical analysis of paint products during the past fifty years, a development which was hardly foreseen in the early 1900's. In those days, because of the relative stability of formulations there was very little need to critically analyze a finished paint product, aside from the usual and most obvious practical tests. However, with the availability of an ever increasing number of new, promising, and potentially valuable raw materials, it became necessary to set up elaborate test procedures in order to ascertain their suitability and usefulness. Also, the enactment of various restrictive laws, which regulated the sale of prepared paints, made analysis a necessity.

Even before the phenomenal growth of extravagant advertising claims characteristic of the twentieth century, it had been the custom of certain paint manufacturers to unduly exaggerate the virtues of their products. Thus, paint consumers were awakened to the need of legal protection. Naturally, many of the analytical advances can be attributed to consumer groups and governmental agencies.

A more careful examination of the situation shows that exaggeration was not general but mainly confined to the manufacturers of certain paste paints, ready mixed, and barn paints in which varnish was not the essential ingredient. The paint specialty houses prided themselves on the excellent coach and carriage paints, marine finishes and fine enamels they produced, and did not attempt to jeopardize their markets. A good many of these ethical manufacturers are still in business and today comprise the backbone of the paint industry.

We need not dwell on the details of the tests which were developed since 1900. They are very well known. Despite the vast improvements in techniques and the standardized methods developed by various specialized groups, such as the American Society of Testing Materials, the Bureau of Standards, the Federation of Paint and Varnish Production Clubs, and many others, the industry continues to rely largely upon the practical tests used since antiquity. No matter how precisely the chemical and physical data are recorded, the important tests are such properties as drying time, film toughness, elasticity, consistency, working properties, adhesion, flow properties and odor.

Consider many of the analytical problems facing the industry today. Nothing has yet replaced actual exposure conditions in the prediction of durability. The value of accelerated weathering, salt spray exposure, tropical chambers and other devices should not be underestimated, as they give preliminary data in a qualitative way. The question of film elasticity also is subject to much dispute. Witness the controversies raging on cold-check data. Now each time you pick up a technical journal you read of a new group reporting its investigation on "Factors Governing Adhesion of Paints." The time and value of the effort designed to re-

This laboratory in the Newark factory of the Murphy Varnish Co. was probably first in the industry. It was set up in 1876.

Stirring in driers in the making of fine grinding japans for Murphy coach colors.

place the educated fingernail must be staggering.

Control Testing

ON the other hand, raw material control has become more precise. Although the number of available paint materials has multiplied itself many fold, the freedom from natural products and the vagaries common to unrefined products of nature has actually tended to unshackle the paint industry. The introduction of synthetic raw materials has introduced an element of uniformity which can relieve the production department of many headaches. An alert and well equipped laboratory manned by a well trained chemist can, with little effort, keep a firm control on incoming raw materials.

With the armed services becoming the largest consumer of paint, the need for control is apparent. The general trend toward rigid specifications is widespread; large industrial users are being forced to issue airtight specifications as well as establish laboratories to enforce them. The detailed tests necessary to gain government acceptance are becoming a major cost factor to both the government and to the paint manufacturer.

It should be pointed out that some of the blame for cheaper grades of paints must be placed squarely on the shoulders of the consumer. Formulating for price without sacrificing quality is one of the important functions of the successful development laboratory, however, it is the reduction of cost accompanied by a reduction in quality which causes grief to both producer and consumer. The consumer must be made to realize that in paints as well as in automobiles you cannot buy a Cadillac for the price of a Ford.

Fifty years ago, the salesman was lucky indeed who had a good durable white enamel, the forerunner of today's industrial finishes. Colored varnishes were made by grinding such pigments as the iron oxides, chrome yellows and greens, English vermillion, prussian blue, ultramarine, para red, and lampblack, boneblack and asphaltums—for black—into varnishes. But a good, durable white enamel—that was a rarity indeed. Titanium dioxide pigments were not of importance until the start of the third decade of the century, and even then three-quarters of the pigment was blanc fixe and only twenty-five per cent was titanium dioxide. Lithopone was widely used in vehicles such as rosin varnishes or, sometimes, in rosin alone, for indoor flat wall paints. White lead and white zinc were, therefore, the principally used hiding pigments for white enamels, as well as for outdoor house paints. If extreme care were taken in the choice of raw materials and in the manufacture of varnishes, relatively pale end-products could be made. However, the cost was almost prohibitive. Thus, there were but two choices for moderately priced vehicles for the glossy white enamels. First, the use of damar cut in turpentine—this material produced soft finishes with poor durability and gloss retention. Baking, especially over iron, one of the largest outlets, improved the film qualities greatly. Second, the use of bleached shellac with lithopone and, later, titanium dioxide, as the pigments. This finish gave excellent results for most uses of the day. The zinc and lead whites could not be used because of the acidic character of shellac.

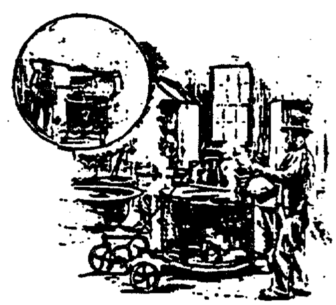
Today there are several vehicles which are virtually colorless—acrylics, vinyls, nitrocellulose lacquers and ureas—which can be used in the manufacture of white industrial enamels.

Role of Research

IT is true that some of the old house paint formulas, as well as various other types, compare advantageously to those of the present, but nevertheless, the role that scientific research and development has played in the progress of the industry can hardly be overestimated. The giant strides toward better finishes could not have been made without the concentrated programs of the innumerable laboratories of the companies in the surface coatings and allied fields. Not to be overlooked either are the contributions of other industries, who, in an effort to find outlets for their products and by-products, have created many new raw materials for the paint industry. Besides new items, the old products were improved as a normal consequence of competition. The cooperation of the raw material suppliers' laboratories and the application and service laboratories of the paint manufacturers has resulted in many of our currently used formulas. These, together with the growing number of government laboratories, are responsible for the bulk of the specification finishes, setting higher standards of excellence than ever before.

Government divisions, such as the Regional Research Laboratories of the Department of Agriculture, The Department of the Army, The Department of the Navy and the Bureau of Standards, as well as privately sponsored research organizations, such as the Midwest Research, Southern Research, Battelle and the Mellon Institutes, are also advancing our progress. The number of educational institutions taking an interest in the surface coatings industry is constantly increasing. A few of these are the University of Cincinnati, New York University, the University of Michigan, Polytechnic Institute of Brooklyn, Northeastern University and the University of Louisville. In addition, industrial associations such as the Federation of Paint

Thinning the hot varnish with turpentine and pumping it to the receiving tanks.



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and Varnish Production Clubs and the National Paint and Varnish Association have stimulated scientific progress.

Years ago it was unheard of for several paint men to sit down together to discuss their mutual problems. However, with the growing technological advances, the need was recognized. The National Paint, Varnish and Lacquer Association, founded in 1933, was the outgrowth of almost fifty years of trade organization development. The work of the Association in fostering standardization, ethical practices, research, and in representing the industry before the state and federal governments, cannot be overestimated. The names of such men as George Heckel, Ernest Trigg and Henry Gardner bulk large in the recounting of the years of the development of the Association.

For over a quarter of a century the technical men of the industry have been represented by the Federation of Paint and Varnish Production Clubs.

An outgrowth of the Rubber Section of the American Chemical Society, the Paint and Varnish Division has, since 1927, been an instrumental medium in fostering the scientific advancement of the industry.

Numerous trade journals, weeklies as well as monthlies, attest to the growing interest and technical advancements that is pushing sales of paint and allied products to new heights.

As a result of this increased scientific activity, more and more industries are turning to the paint chemist for assistance in marketing their products, by adding the unique protective and decorative assets of finishes. Whole groups of products have been adapted to organic coatings, recruited from such varied former coating systems as porcelain and metal plating.

Increasingly, organic coatings are being called upon to perform greater feats of protection in situations hitherto considered impossible, for example, corrosion inhibition, antifungicide applications, chemical resistance and outdoor durability.

Yes, it is true that manufacturers in many diverse fields are turning to the paint industry for finishes that will make their products attractive, practical and less expensive. And it is also true, as stated above, that in contrast to fifty years ago, many more raw material manufacturers depend upon the paint industry as a consumer for their raw material products and by-products. Thus the petroleum distillers sell tremendous quantities of solvents—aromatic, aliphatic, and oxygenated—to producers of finishes as do the synthetic organic chemicals companies. Dyestuff houses sell their products for incorporation into stains. Coal tar producers have a lucrative business supplying solvents, dyes, and innumerable intermediates for the manufacture of resins and plasticizers. The trend toward diversification has brought many new companies from far afield looking toward paint, varnish and lacquer as an outlet for their wares. For example, Shell Chemical Corporation now produces glycerine, a vital constituent of alkyd resins, from petroleum, a province once exclusively that of the soap makers. Large portions of such diverse agricultural crops as flaxseed, soya beans, even oat hulls (from which is produced the solvent and resin intermediate, furfural), and grains (to produce alcohol), find good markets in the coatings field. Many metals, among them lead, zinc, chromium, cobalt, manganese, copper, and titanium, find important outlets in pigments and driers.

All of these industries have a great collective interest in the scientific progress of the paint industry. For, as research has given us better coatings, ever increased quantities of finishes have been produced. It seems probable that 1951 will be the fifth consecutive billion dollar year for the industry.

As a further consequence of the growing complexity of the paint industry, the character of the paint salesman has also been altered. The salesman of today must be a technically trained man who has spent years in the laboratory learning all phases of paint manufacture. The future holds great promise for such a man.

All in all, the paint industry is a dynamic, rapidly growing baby, with the future before it. It is gradually feeling its way as an integral part of the chemical industry and slowly rejecting the old fashioned, empirical ways. With the accelerated pace set by the mobilization and armament program, the progress of the next fifty years may very well dwarf the giant steps of the first half of this century.

MODERN PLANTS

Lower left: National Lead Company paint plant in Los Angeles, Calif.

Upper center: Pittsburgh Plate Glass paint plant at Torrance, Calif.

Lower center: Modern Socony Paint Products plant, Metuchen, N. J.

Lower right: Titanium dioxide plant of Nat'l Lead Co., Sayreville, N. J.