Dutch Boy Primer-Undercoater

This product has exceptional merits:

1. Provides dense hiding and an even-sealing first coat on either new exterior wood or old painted surfaces.
2. Dries to a low sheen.
3. Drying time: overnight—can be recoated safely in 48 hours.
4. Ideal primer in two-coat system, using Dutch Boy Bright White or one of our tinted paints as a finish coat.
5. Dutch Boy Primer-Undercoater should always be used as received in the package.
6. Normal spreading rates—500 square feet per gallon on smooth unpainted wood; 600 square feet per gallon over old painted surfaces.

Dutch Boy Bright White

This is a non-tintable outside white paint and possesses outstanding qualities:

1. Gives exceptional hiding.
2. Produces a dazzling white exterior finish that *stays* white.
3. Presents a surface that continually renews itself, permitting rain to wash away dirt, thus keeping its fine appearance.
4. Has great durability, wearing down slowly and evenly to a satisfactory surface for repainting.
5. Especially designed as a white finish coat paint for use over Dutch Boy Primer-Undercoater, either on new unpainted wood or on old painted surfaces.
6. Will produce a satisfactory one-coat job over a previously painted surface that is in good condition.
7. A finish coat paint that should be applied in *white only* and as received in the package.
8. Spreading rate—600 square feet per gallon.

Dutch Boy House Paint in Color

Our line of colored house paints has a number of superior qualities:

1. Formulated to meet the demand for clean, sharp tints of excellent color retention under weather exposure.
2. Produce surfaces that not only look their best when freshly painted but that retain their brightness and cleanliness as time goes on.
3. Especially formulated to assure stability in color and uniformity in appearance.
4. Can be intermixed to produce intermediate tints.
5. Should be used just as mixed in the can over Dutch Boy Primer-Undercoater, which may be tinted to the approximate shade of the respective House Paint with colors-in-oil.
6. The number of tints available cover the range of light shades most commonly used on exterior surfaces.
7. Spreading rate—600 square feet per gallon.

Dutch Boy Sash and Trim Colors

This is not only a high quality line but it has a number of special uses:

1. Colors are true and retain their gloss and brilliancy for a satisfactory time, due to the high quality of the color pigments and paint oils used in their manufacture.
2. Remarkably durable, smooth as enamel and easy to apply.
3. Dry to hard, high-gloss finishes.
4. Can be intermixed to produce any number of intermediate colors, but should not be used as tinting materials in exterior paints.
5. Ideal for exterior use on parts of the home calling for strong colors, such as sash, shutters and doors, as well as for store fronts, fire escapes, fences, railings, signs, decorative metal work, lawn furniture and play equipment.
6. When used on new wood surfaces, the first coat should be Dutch Boy Primer-Undercoater, which may be tinted to a shade of the trim color selected.
7. Before applying to new or old weathered metal surfaces, all rust and scale should be removed and a coat of Dutch Boy Semi Quick-Drying Red Lead paint applied.
8. Should not be thinned, but used just as they come in the can.
9. The line includes the most commonly used colors, plus black and white.
10. Spreading rate—600 square feet per gallon.

Dutch Boy Wonsover

This line of one-coat wall finishes is outstanding in its field:

1. Dutch Boy Wonsover not only gives one-coat coverage but it is a real oil flat paint that can be washed like new.
2. It requires no priming coat. It goes on right over wall board, brick, aged unsized plaster, previously painted wall and woodwork surfaces and even wall-paper and water-mixed paints.
3. Dirt, fingermarks, smudges and even grease can be removed easily. They do not sink into the surface because Dutch Boy Wonsover is a real oil flat paint. Therefore it can be washed again and again with soap or a reliable wall cleaner.
4. Easily applied with either brush, roller or sprayer—flows and levels out to an even, rich-looking flat finish.
5. Sets dust free in a few hours—dries hard overnight.
6. Leaves no unpleasant after-odor.
7. The line includes the more popular present-day tints for interior walls, plus white.

PAINTING TIPS

1. Before painting with Wonsover, loose or scaling particles of the old finish coat should be removed.
2. Cracks should be filled with patching plaster and spot-coated with Wonsover.
3. Finer cracks or bad stains should receive a first coat of Wonsover a day before putting on the final coat.
4. The paint should be stirred thoroughly.
5. For spray application it may be necessary to add a small amount of mineral spirits or turpentine.
6. No glue size should be used on unpainted plaster or wallboard.
7. Freshly plastered surfaces should be allowed to age for a reasonable time in order to avoid "hot spots."
8. Allow about one gallon for each 500 square feet.

WARNING

Dutch Boy Wonsover should not be used on furniture. Neither is it designed as an under-coater for enamel although it is a perfect primer for interior gloss wall paint.

BLACK AND YELLOW LINE

The important items in this line are, of course, Dutch Boy Soft Paste White Lead and Dutch Boy Pure White Lead Paints, the latter including a ready-to-spread Exterior Primer and an Outside White. These are the greater volume and profit producers in the black and yellow line.

The supplementary Dutch Boy products in the line were designed especially to assure the best possible painting jobs with Dutch Boy Soft Paste White Lead. Moreover, these companion products make it possible for the painter who "mixes his own" to handle *any* painting job, exterior or interior, on *any* building material with the few items in the line. To the painter the black and yellow line in his shop means the economy of low inventories and practically no wastage of materials.

To the dealer the stocking of the black and yellow line means that with a small investment he can satisfy *any* painting need of his customers. Moreover, its high rate of turnover and satisfactory markup make the line attractive to the dealer from a profit angle.

In the following pages we will discuss the end-use advantages of each item in the black and yellow line of Dutch Boy products, many of which will be of sales value to the dealer in contacting his customers.

Dutch Boy Soft Paste White Lead

Constant experimental work by our Laboratories and resulting improved manufacturing methods and equipment make it possible for the salesman or dealer to include current improvements among the many end-use advantages of Dutch Boy Soft Paste White Lead:

1. Stepped Up in Whiteness
   a. Whiter white jobs.
   b. Cleaner, truer, tinted jobs.
2. Heavier and Better Body Than Ever
   a. Increased hiding.
   b. Smoother brushing.
   c. Solid, evenly hidden jobs.
3. Convenience
   a. Pours from the keg.
   b. Mixes readily with paint oils and varnishes.
   c. Easily made into paint.
4. All-Purpose
   a. Makes paint for *all* coats on *all* surfaces.
   b. White or easily tinted to exact color wanted.
5. Economy

   Figured by the gallon, by the yard, by the job or in years of service, paint made from Dutch Boy Soft Paste White Lead is high in quality and low in cost.

Dutch Boy Exterior Paint Oil

(LINSEED REPLACEMENT OIL)

Dutch Boy Exterior Paint Oil was developed during the last war to conserve linseed oil needed by the armed forces and for food purposes, but it proved to be so satisfactory when used with white lead for gloss finishes that it was decided to continue marketing it in peace times. The oil is a careful blend of pure linseed oil, mineral spirits and drier—nothing else. Part of the oil is heat-treated or polymerized. Important facts about the product are:

1. Added to paste white lead, it produces a typical white lead and linseed oil paint film—durable and economical.
2. It may be used any place where it has been the practice to use raw or boiled linseed oil in paint—to thin white lead, red lead, other pastes, paints, etc.
3. It is designed to give to paints the same general working properties as those formerly made with straight linseed oil.
4. There is ease of brushing and good hiding.
5. Leveling qualities are as good, if not better, than when paint is made with straight linseed oil.
6. Setting up is a little more rapid due to the higher volatile content but this has the advantage of reducing dirt collection during the drying period.
7. Since the product contains drier, none need be added.
8. Standard white lead painting formulas may be followed except for the finish coat. This requires a little less vehicle and should include a small amount of turpentine.

Dutch Boy Liquid Drier

Advantages in using Dutch Boy Liquid Drier in paints containing raw linseed oil:

1. Best insurance against poor drying tackiness, dirt collection and early chalking.
2. Especially made to avoid surface drying and resulting wrinkling of the paint.
3. Does not curdle or discolor white paint.
4. Economical because one pint to six gallons of white lead and raw linseed oil paint gives the best results.

NOTES

1. No drier needed in white lead mixed into paint with boiled linseed oil or Exterior Paint Oil (Linseed Replacement Oil).
2. No drier needed in Dutch Boy multiple pigment paints.

Dutch Boy Lead Mixing Oil

When used with white lead, Dutch Boy Lead Mixing Oil produces a glossless paint that has a number of advantages that appeal to the applicator and property owner:

1. Produces smooth, velvety, durable flat finish for interior surfaces—plaster, wall-board or woodwork.
2. Produces weatherproof, solid-looking flat finish for exterior surfaces—wood shingles, brick, stucco, concrete or stone.
3. A complete vehicle—nothing need be added.
4. Mixes, tints and applies easily.
5. Can be used for all coats on new plaster or wallboard—it seals as well as decorates.
6. Makes ideal enamel undercoater because of excellent sealing and flowing qualities.
7. Can be stippled to an attractive orange-peel effect.
8. Retains good appearance under repeated washings.
9. When tinted with Dutch Boy Colors-in-Oil, does not wash out or streak under repeated washings.
10. With white lead on exteriors it wears down slowly and evenly by gradual chalking.
11. With its superior spreading rate and durability, Dutch Boy White Lead and Lead Mixing Oil paint is low in cost when figured by the yard, by the job or in years of service.

Dutch Boy Flatting Oil

Among the important uses of Dutch Boy Flatting Oil are:

1. With Dutch Boy White Lead to make a sharp, well-defined, stippling flat paint.
2. This stipple has exceptional beauty of finish and because of its texture and hard matte surface is preferred by craftsman as a ground for decorative painting.
3. Dutch Boy Flatting Oil is used extensively for mixing decorative glazes with Dutch Boy Colors-in-Oil because it requires no varnish protective coat.
4. It mixes readily with oil colors to produce superior wood stains.
5. Dutch Boy Flatting Oil is widely used by painters for thinning interior paints.

Dutch Boy Colors-in-Oil

Here is what consumers get in Dutch Boy Colors-in-Oil:

1. High tinting strength—a little color tints a lot of paint.
2. True tone—they make clean, sharp tints true to shade or tone.
3. Quick-mixing—so soft and finely ground they disperse in paint easily and quickly without streaking.

And here is what they save:

1. Trouble—clear, clean tints.
2. Time—quick-mixing.
3. Money—less color needed.

TIPS FOR USERS

Here are some very practical hints you can pass along to customers who buy Dutch Boy Colors-in-Oil:

French Ochre: A permanent, clear, brownish yellow. Produces attractive red brown or tan tints of good durability.

Raw Sienna: A permanent brownish yellow. Widely used to produce light cream tints and tan shades with a soft green undertone. Used with Chrome Yellows in making distinctive creams. With Raw Umber it produces warm grays. Very effective as a glazing color.

Burnt Sienna: This very permanent red brown color is used principally in glazes and oil stains, such as cherry and mahogany. In tinting, it is used to advantage to impart the warmth lacking in other coloring materials.

Raw Umber: A permanent brownish gray. Used extensively for graying bright tints. Excellent as a glaze for antique finishes. Many users prefer it to lampblack for producing gray tints. It is often used alone or in combination with Raw Sienna to make oyster whites.

Burnt Umber: A permanent reddish brown of gray cast. The permanency of the color makes it ideal for use in exterior stains such as those for shingles. Also used extensively in making pleasing shades of warm browns and grays. A most dependable color for glazing or graining purposes.

Lampblack: The most permanent of all colors. An essential color for making gray shades. Also used in combination with other colors to impart gray effects.

C. P. Chromium Oxide: A grayed yellow green. The most permanent of the green colors. Thinned with the proper vehicle, it is often used alone as a sash and trim color. It is of course used in lighter shades when let down with white for the same general purposes.

C. P. Chrome Greens: Bright, permanent, chemically-pure colors of very high tinting strength. Available in three shades—Light, Medium and Dark. Frequently used alone with a

P A R T I V

PRACTICAL AND TECHNICAL INFORMATION

EXTERIOR HOUSE PAINT

When the word "paint" is mentioned to a layman the chances are that in his mind a picture arises of a tin can containing a semi-viscous material or he thinks of a white or colored shiny surface. This is not a paint man's conception of paint or at least it should not be.

The fact that paint is fluid and put up in cans is incidental and temporary and paint does not perform its function in that form. Although paint is produced as a liquid, this only serves to allow application. It is as a film formed on the surface of an object that paint performs its services as a protective and beautifying agent.

Chemical Changes

Exterior house paint consists of a mixture of pigment which is solid and of drying oil which is liquid. After such a paint has been applied the conversion of the liquid coat into what is known as a dry film is due to chemical changes taking place within the oil and causing its solidification to the extent that a film is obtained. These chemical reactions do not stop after the paint has dried but continue until the film's final destruction. This, as well as the fact that a paint film may be subjected to other influences which may act chemically on the individual constituents of the film, explains the importance of a paint's composition.

Physical Structure

However, a paint film's behavior is not dependent alone on its chemical composition. Its physical structure is of equal importance. It must be borne in mind that a paint film is a three dimensional entity. It has length, width and depth, and occupies a volume. The manner in which the various ingredients are distributed physically and build up a film (in other words, its structure) may have important bearing on its performance. This may be illustrated by drawing comparisons with other more obvious structures. For instance a steel bridge may be weak because of faulty construction. On the other hand a wooden bridge may be strong because of sturdy construction. By the same token a paint film may be resistant notwithstanding the presence of a binder which by itself is easily destroyed, while it is possible to obtain weak films with practically indestructable pigments.

To sum up: a paint film's performance depends on its structure as well as on its composition. These factors are inter-related and therefore cannot be separated in explaining the performance of a film or in predicting its possible behavior.

PAINT FILM REQUIREMENTS

The requirements which a paint film on the exterior of wooden houses has to meet are many and varied. Such a film has to be opaque and smooth. It has to adhere to the surface on which it has been formed. It has to have sufficient thickness to provide adequate protection. In addition it has to have durability and maintain good appearance during its period of service.

In the past, films have been built up with three coats of paint. In the order of their application they provided:

1. Adhesion.
2. Hiding and film thickness.
3. Appearance and film protection.

In recent years paint systems have been developed in which two coats of paint produce a satisfactory film. The first coat of this type of system combines the properties of the first two coats mentioned under the older method of film construction.

TWO-COAT SYSTEM ADVANTAGES

Compared to the older three-coat system the two-coat system offers many advantages, one of the most important of which is its economy, due to the fact that the main cost of a paint job is labor for application. The following discussion will deal exclusively with the two-coat method of film construction.

It is obvious that since the two paint coats serve a different purpose their composition and structure must vary. However, they should be so constituted that they are mutually compatible. In order to formulate paint intelligently it is necessary to consider all factors involved in such a manner that a picture may be developed of the paint film's ultimate physical appearance. Without this it will not be possible to predict its probable behavior and determine its suitability for the purpose for which it is intended. Consideration should be given first to the structure of the film which a paint is required to produce. Then the individual ingredients may be introduced.

STRUCTURE

Since a paint film consists of solid materials (pigments) suspended in the solidified vehicle, the quantities of each of these major constituents to be used in a paint should be determined first. Variations in the proportions of these elements may produce marked differences in the physical appearance of a paint film and also differences in behavior and performance.

To illustrate some of the possibilities which may result, a comparison may be made between paint films containing higher or lower pigment content. In the former, enough pigment may be present so that some of the particles protrude through the surface and produce a flat finish. When the pigment concentration is low the pigment particles may all be covered by the oil content and form a continuous smooth surface producing a glossy finish. Naturally the behavior of films of different pigment concentration may differ substantially on outside exposure and in their resistance to the elements.

The following drawings give some idea of what such films might look like in cross section:

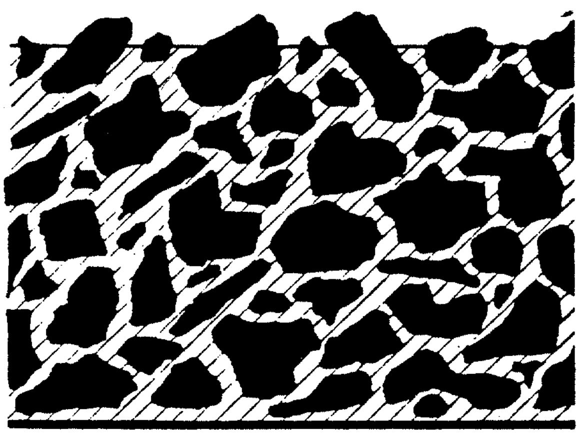

Figure 1

Cross Section of Flat Paint Film

Note that pigment content is sufficiently high to permit particles to protrude through the surface of the film and produce a flat finish.

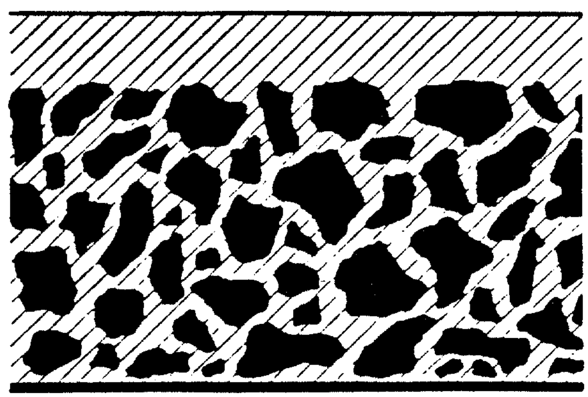

Figure 2

Cross Section of Exterior House Paint Film

Note that the lower pigment content allows the oil to cover the particles and form a glossy finish.

---

*Slanted lines represent oil content and irregular black spots the pigment particles.

In order to be able to draw the foregoing pictures the volume proportions occupied by pigment and vehicle have to be known. Since materials of such great difference in specific gravity are involved, weight figures would not supply the necessary information. For instance, a mixture of half pigment and half vehicle by weight would not give a paint film in which half the volume would be occupied by each. The average specific gravity of pigment is somewhere in the neighborhood of 4.50 and of vehicle *.900. This means that under those conditions 50% pigment by weight would equal only 16⅔% pigment by volume.

PV EXPLAINED

Naturally with each variation in specific gravity of one or more of the ingredients this volume figure would change, notwithstanding the maintenance of equal weight proportions. In order to avoid confusion and to obtain a mental picture of the film which a paint might produce, the proportion of pigment is often expressed in a percentage by volume calculated on the total non-volatile ingredients in a paint. The latter comprise all those materials which remain in the film after the paint has dried. They include the pigment and the non-volatile portion of the vehicle. This figure is designated as PV, indicating a pigment—non-volatile vehicle ratio. For instance, a paint having a PV of 30 means that 30% by volume of its film forming constituents is represented by pigment.

Since the primer of a two coat paint system is to provide among other things film thickness it should form a dense coat and a high pigment volume is required. Moreover, a large volume of pigment in such a paint can be used to obtain a flat or semi-flat finish which produces compatibility with the next coat and provides a good bond so that the two coats of the system may act as one film.

Successful PV's for Primers

The most successful pigment concentration for first coats seems to lie between PV's of 35 and 40. However, it is obvious that such pigment-non-volatile oil mixtures are of rather thick consistency and in order to be able to apply such paints, fairly large proportions of volatile are required to thin the paint to brushing consistency.

For the finish coat the requirements are different. This is the coat which provides the outer surface to a paint film, requiring resistance to the weather or other outside influences. In addition it contributes the beautifying qualities which demand sufficient hiding and most often a pleasing glossy finish.

Successful PV's for Finish Coats

The pigment is responsible for a major portion of these qualities. It provides protection but cannot continue to do so unless it is held in place by the binder, the non-volatile vehicle. A finish coat has to be so constructed that the binder will enable the pigment to perform its function. A larger proportion of vehicle is required, which at the same time produces the glossy finish. However, too large a proportion of oil introduces conditions which are detrimental.

Although the oil keeps the pigment in place the pigment protects the oil. In films with high oil content the pigment has a tendency to recede into the depth of the film and in so doing cannot be in close enough proximity to the surface layer of oil to protect it. A most effective balance in pigment and non-volatile vehicle for finish coats is between the general limits of PV 28 to 31.

*Specific gravity of water is 1.000.

Application of a priming coat followed by a finish coat of the structure described in the foregoing paragraphs will provide a continuous paint film with a solid base, sufficient thickness and a good smooth outer surface.

COMPOSITION

Within the limits set by the structural requirements, specific raw materials are introduced to obtain the desired physical structure and chemical composition of the paint film. These include pigments and vehicles which will be discussed in subsequent paragraphs.

PIGMENT

As hitherto stated a pigment can increase the durability of a vehicle. This increased strength may be due to either physical or chemical action or both.

Physical protection includes the ability of some pigments to shield a vehicle from the intense action of the destructive rays of the sun. This type of protective process is generally associated with colored pigments.

Chemical protection can be provided by those pigments which will react in specific ways with the vehicle and form more resistant compounds.

In white exterior house paint, the action of the pigment which contributes most substantially to the extension of the life of the vehicle is generally of a chemical nature. White pigments may be divided into two groups—reactive and non-reactive. The reactive pigments, by chemical combination, increase considerably the durability of the vehicle, which in outside house paint consists mostly of linseed oil. The reactive pigments include white lead and zinc oxide.

White Lead

In another chapter white lead's chemical reactivity and function in a linseed oil paint have been described. As it reacts with the oil it delays its ultimate destruction and also forms lead soaps which provide adhesion and flexibility to a paint film.

Zinc Oxide

This pigment also reacts with linseed oil forming soaps. These soaps have their own typical characteristics. In particular they are hard and for that reason zinc oxide forms hard and brittle films. Moreover, zinc oxide in a paint film will eventually form water-soluble derivatives which cause so-called "washing."

The non-reactive pigments have other functions to perform.

Titanium Dioxide

Titanium dioxide's most valuable asset is extremely high hiding power. In fact, in a multipigment paint, it is used mainly to build up the hiding to the required degree.

As titanium dioxide in its simplest form is entirely non-reactive it is easily subject to chalking. In the presence of zinc oxide which forms water soluble compounds, titanium dioxide provides a paint with so-called self-cleaning properties.

Extender Pigments

This generic name is applied to non-hiding pigments, such as barytes, magnesium silicate (asbestine) and whiting. Most of these are inert although a few are reactive. The reactivity of the latter, however, is very mild and hardly ever is it a consideration for their use.

The function of the extender is principally in filling up available space in the pigment phase to reach the required volume not occupied by the other pigments used. Extender pigments make it possible to do this economically, because their cost is very low. Moreover, extenders may act as plasticizers in the paint film. They usually produce soft films and their presence helps avoid excessive hardness.

The white pigments just mentioned are those generally used in formulating an exterior house paint. It must be added, however, that many modifications in each of these groups are available and that their correct choice may have important bearing on the performance of a paint as well as on that of the paint film.

VEHICLE

A vehicle can be divided into two parts: non-volatile and volatile. The first remains in the paint coat after it has reached the so-called "dry" stage and consequently must possess film-forming properties. The volatile leaves the drying paint by evaporation and is used to impart sufficient fluidity so that the paint may be applied.

Linseed Oil

Linseed oil is the most widely used material as the film-forming ingredient in exterior house paint. It is available in many modifications, each one being chosen for use in paint to meet particular circumstances and requirements.

The different grades of normal viscosity may vary in acid number. Oils of different acid number are selected in order to meet production requirements as well as to control soap formation.

Differences in viscosity are taken advantage of to give a paint body and gloss whenever necessary. Moreover, oils of heavy viscosity do not readily penetrate porous surfaces and can contribute to the sealing qualities of a paint.

Volatile

The most widely known volatile in paint undoubtedly is turpentine. However, it is not the most generally used by the paint manufacturer. Most paints contain so-called mineral spirits as volatile thinners. They are petroleum derivatives which are produced in many grades varying in specific gravity and the speed with which they evaporate. These qualities may influence substantially the application properties of a paint and consequently the fact that so many types are available provides the paint manufacturer with another means of adjusting his products.

FORMULATING PAINT

Formulating a paint consists of the selection of the proper type of raw materials and the proportions in which they shall be used. Naturally many factors have to be considered. In addition to the purpose for which the point is designed, the conditions of application, etc., personal preference enters into the situation most prominently. Moreover, it should be understood that in general all ingredients contribute specific characteristics and the desire to accentuate one particular property in a paint of necessity results in a reduced opportunity to impart other qualities.

For that reason a paint formula of a high grade paint usually represents a compromise in ideas, the purpose being to design a paint which most completely suits the expected requirements. It is understandable that there are so many different paints of varying compositions on the market, since so many factors have to be considered and since opinions on their importance and the manner in which the many requirements may be met vary so widely.

It is always tempting to judge paints from the formulas given on the labels on the cans. However, as hitherto explained, it is impossible to obtain a picture of the structure and composition of the film from the weight figures usually given. Although translation into volume proportions would help, even that does not disclose full information.

The fact of the matter is that no one should ever venture to express an opinion of the quality of a paint while only the general formula is known. Only experts familiar with all details could take a chance at predicting a paint's behavior.

In selling paint, therefore, stress should not be laid so much on its composition as on its known performance, obtained from observation of its behavior under practical conditions.

WHITE LEAD

White lead, or basic lead carbonate, is a white opaque pigment consisting essentially of a double compound of lead carbonate and lead hydroxide. It is made by a number of different processes, in all of which metallic lead is combined with oxygen, carbon dioxide and water to form basic lead carbonate.

The commercial white leads made by the various processes show variations in chemical composition and, consequently, in physical characteristics.

Exposure of metallic lead to the influence of the atmosphere will form some white lead. This may be observed when a lead pipe or a sheet of lead has been out in the weather for some time. A very thin coat of a white substance will have appeared, and this is basic lead carbonate. Since this process of nature is corrosion and not erosion, there is no wearing away of the lead pipe or sheet lead and the action of the oxygen, carbon dioxide and water in the atmosphere on the lead stops as soon as the thin coat of basic lead carbonate is formed. Such coatings have been known to shield lead objects from further changes for centuries, demonstrating the unusual protective qualities of white lead.

Depending on nature to produce white lead, however, would take much too long and prove very costly. The formulation of white lead is speeded up by using acetic acid. In the presence of acetic acid, metallic lead, oxygen and water will form a compound called basic lead acetate which readily reacts with carbon dioxide to produce basic lead carbonate or white lead. Only a small amount of acetic acid is needed as it is not consumed and is not part of the final product. It is released when the basic lead carbonate is formed and thus can take part repeatedly in the reaction.

ALL PROCESSES BASICALLY THE SAME

All processes used for the manufacture of white lead are based on the foregoing principles. The various methods of production show differences in the form of the raw materials, the method of introduction into the process and the equipment employed.

The raw materials required are lead, acetic acid, carbon dioxide and water. The lead used is generally of a highly refined grade known as corroding lead.

The acetic acid used has varied through the ages. Many centuries ago sour wine was employed; later, vinegar was used. Nowadays, refined acetic acid of varying concentrations is used.

Carbon dioxide is formed as a gas when carbon compounds oxidize or burn which may take place under many varying conditions, from rapid combustion to slow fermentation processes. When sour wine or vinegar was used as a source of acetic acid, tan bark supplied the carbon dioxide. At present, carbon dioxide from burning coke is utilized in several manufacturing processes.

Water is present in all of the processes. The acetic acid solution contains water. Where carbon dioxide gas is used which has been generated in a coke fire, the water is added as such or as steam. Finally, in some processes the reaction actually takes place in water.

In the different processes for manufacturing white lead the equipment is adjusted to the form in which the raw materials are introduced and the way the chemical reactions are produced.

Dutch Process

The Dutch Process is one of slow corrosion generally requiring 100 to 120 days. Lead buckles or perforated discs of lead are placed in corroding pots, resting on a narrow ledge or shoulder part way up the inside wall of the pot. In the bottom, a small amount of dilute acetic acid is placed. These pots are placed in rows on a floor covered with spent tanbark which has been wet down thoroughly. Planks are laid on top of the pots and another layer of pots containing buckles and acetic acid is placed on top of these planks and the procedure is contained until a stack of 10 or more layers has been built up. In these stacks, the fermentation process of the tan-bark supplies the heat and the carbon dioxide. The heat is sufficient to volatize the acetic acid which in conjunction with air and water forms basic lead acetate, which is in turn converted to basic lead carbonate by the action of the carbon dioxide from the tan-bark.

This method of manufacture, as well as the product it produces, was considered standard for many years. However, new processes have been developed, short descriptions of which follow.

Carter Process

In the Carter Process the white lead is formed in large, slowly rotating cylinders. The lead is introduced in the form of fine powder. Carbon dioxide is admitted through the head of the cylinder in the form of gas and a weak solution of acetic acid is sprayed into the cylinder at intervals. As the cylinder revolves, finely divided lead is carried up on the inside wall and rolls to the bottom so that new particles are continually exposed to the action of the corroding agents. Thus, the entire batch reaches a completely corroded state in from 12 to 14 days. In addition to the saving in time the process lends itself better to the exercise of closer control.

Thompson-Stewart Process

Metallic lead is subjected first to an oxidation process. The resulting product, made into a water slurry, is placed in a tank. After treatment with air and carbon dioxide in the presence of small quantities of acetic acid, white lead is precipitated.

This process is National Lead Company's most recent development. It is very fast and permits strict control. The operation is flexible and different types of white lead, each of particular uniformity, can be manufactured in this way.

Euston Process

Metallic lead is melted and run into water where it forms a mossy, spongy mass of "feathered" lead. This spongy lead quickly oxidizes and when lead acetate solution is added, the oxide is dissolved and the basic lead acetate is formed. This lead acetate solution is clarified and treated with carbon dioxide to form basic lead carbonate.

Sperry Process

This is an electrolytic process which is carried out in a concrete cell having a lead anode and iron cathode separated by a porous diaphragm. The lead anode is immersed in sodium acetate solution and the iron cathode in sodium carbonate solution. Under the influence of the current, basic lead carbonate forms near the surface of the lead anode. The solution flows continuously from the anode removing the white lead as it is produced and depositing it in regular settling tanks.

Finishing Processes

After the white lead has been formed by any one of these processes, it must be carefully washed, screened and in some instances, ground. It is then in the form known as white lead water pulp.

The white lead water pulp may be either dried and ground for delivery to the paint maker, ceramic manufacturer or other user as dry white lead, or it may be mixed with linseed oil and made into white lead paste. When linseed oil is added directly to the white lead water pulp, the white lead has such great affinity for the oil that the latter displaces the water. It is not necessary to first dry the white lead to make white lead and oil.

COMPOSITION OF WHITE LEAD

The manufacturing processes in use today for the production of white lead make it possible to produce a number of types varying in physical properties as well as composition. Most commercial white leads have a lead carbonate content within the range of 62 to 70 per cent, well within the limits allowed in Federal and A. S. T. M. specifications.

OTHER WHITE HIDING PIGMENTS

Titanium Pigments

Titanium dioxide (TiO_2), although known as early as 1790, did not become important commercially as a pigment until the 1920's.

Titanium pigments are made in different types and grades. Those known as "pure pigments" may vary in hiding power, whiteness, chalking resistance, etc., due to differences in crystal structure and from the addition of very small quantities of certain chemicals. A group of composite types are also available. They consist of mixtures of 30 percent titanium dioxide with 70 percent of either barium sulphate, calcium sulphate or magnesium silicate.

Titanium pigments are characterized by high brightness and whiteness. The straight titanium pigments are very opaque and have the highest hiding power of any of the white pigments. The effective hiding power of titanium oxide in paints depends on the manner in which it is used, i.e., type of paint, concentration of pigment, etc. The introduction of titanium dioxide furnished the paint industry with a pigment that was five to seven times stronger in hiding power than the more common white pigments. The hiding power of titanium dioxide is sufficiently high, so that when used in composite pigments to an extent of 30%, the resulting pigments have greater hiding power than other white pigments with the exception of pure zinc sulphide.

Titanium dioxide is unreactive chemically and resistant to attack by acids and alkalies, and to discoloration by gases. For the same reason titanium dioxide does not react chemically with paint vehicles. This means that the pure untreated types, of which the original characteristics have not been changed by the addition of chemicals, do not form soaps with the oil in exterior paints. Titanium dioxide in combination with zinc oxide imparts self-cleaning properties to an exterior house paint.

The high opacity, brightness and whiteness, as well as the non-reactivity, of titanium pigments have led to their wide use in interior and exterior paints and enamels, paper, rubber, ink, oil cloth, rayon, linoleum, plastic and other products. They also are used in ceramics and welding rod coatings for their chemical properties rather than their physical characteristics.

Zinc Oxide

Zinc oxide is one of the oldest white opaque pigments and is made by two processes. In one process, known as the French process, metallic zinc is heated in a special furnace and vaporized. The zinc vapor on contact with air forms the zinc oxide. In the other process, known as The American process, zinc oxide is made directly from zinc ore by roasting a mixture of ore and coal in a special furnace. French process zinc oxide particles are rounded or spherical. American process zinc oxide is available with either rounded or acicular particles predominating.

In the paint industry zinc oxide is used chiefly in white and light colored exterior house paint in combination with titanium dioxide and white lead. Zinc oxide provides a cleaning action in the mixed pigment paints so that the paint sheds accumulated dirt. About 10 to 20 per cent zinc oxide in the pigment portion will provide this cleaning action. Larger amounts of zinc oxide are to be avoided because of the tendency of zinc oxide to cause cracking and scaling. Zinc oxide is a basic pigment and reacts with most paint vehicles. If the zinc oxide content of paint is high or if the vehicle is especially reactive with zinc oxide, the excessive amount of reactive products formed cause the film to be hard and inelastic which results in cracking and scaling on exposure to the weather. Small percentages (5 to 10%) are also used in white industrial coatings to prevent yellowing.

Leaded Zinc Oxide

Leaded zinc oxide is a white pigment which is composed of basic lead sulphate and zinc oxide. It is made either directly from a lead and zinc containing ore by a process similar to the American zinc oxide process or by mechanically blending zinc oxide and basic lead sulphate pigments. The pigment produced by the first mentioned process is termed "cofumed" and by the latter process "blended."

The lead zinc ores as they are mined are best suited to producing a pigment containing about 35% basic lead sulphate and about 65% zinc oxide. The 35% grade of leaded zinc oxide is therefore sold in greatest quantities. However, a 5% grade and a 50% grade are commercially available.

Practically the entire production of leaded zinc oxide is used in exterior house paints as a source of both lead and zinc pigments where low cost is of primary importance.

Zinc Sulfide Pigments

Lithopone is the oldest and most widely used zinc sulfide pigment. It is composed of about 28% zinc sulfide and 72% barium sulfate. It is made by forming these compounds by the interaction of zinc sulfate and barium sulfide solutions. When the two solutions are combined the insoluble zinc sulfide and barium sulfate are precipitated together.

Lithopone is used in interior oil and emulsion paints and in enamels. Its use in exterior paint is limited to the cheaper grades as it does not have good weathering properties. The use of lithopone in interior paints is decreasing constantly with the increased use of titanium pigments.

The production of pure zinc sulfide as a pigment was a later development. It is a very opaque pigment and has greater hiding power than any of the white pigments except titanium oxide. Pure zinc sulfide is used in interior paints and enamels.

Zinc sulfide barium pigment and zinc sulfide magnesium pigment contain about 50% zinc sulfide. The zinc sulfide barium pigment is made by chiefly adding zinc sulfide to Lithopone and is used in interior paints. Zinc sulfide magnesium pigment is made by blending zinc sulfide and selected magnesium silicate and is used to some extent in the cheaper grades of exterior paints.

Antimony Oxide

Antimony oxide, Sb_2O_3, is a white pigment which is used chiefly in white and light colored industrial coatings to increase the durability of the coating, particularly to decrease chalking. Antimony oxide is also used in fire-retarding coatings in combination with chloride compounds. Under heat, antimony chloride is formed which tends to retard combustion.

Physical Properties

Certain physical properties of white lead are shown in the following table:

Bulking Values	
Pounds per solid gallon	56 to 57
% Light Reflection	92
Oil Absorption	8 to 15
*Tinting Strength	100 to 220
Hiding Power	
Sq. Ft. per lb. over black	15 to 23

WHITE LEAD IN PAINT

As is well known white lead is used extensively in paint, particularly in exterior house paint. Usually this type of paint is a mixture of pigment which is solid and of linseed oil which, of course, is liquid. The drying of a paint takes place when the liquid portion solidifies. This is caused by chemical changes, mostly oxidation, which are induced by the atmosphere. However, this oxidation reaction does not just stop when the paint is dry but keeps on going. Continued oxidation of any organic material such as linseed oil eventually causes it to break down.

Films consisting of linseed oil alone fail quite rapidly. In fact, it is not possible to make a linseed oil paint of reasonable durability if nothing is done to reduce the rate of destruction to which the oil is subject.

In order to retard the failure of the oil, white lead is used. White lead is reactive, that is to say, it combines with linseed oil forming more stable compounds, thus delaying the destruction of the oil.

Some of these compounds are lead soaps which, in addition, serve other purposes. They possess a unique particle structure and consist of a series of radiating rods growing from a central core. They are flexible and interlaced in a paint film, they provide strength and flexibility as well as adhesion.

Another result of white lead's affinity for linseed oil is that they mix very readily. This is important in the paint factory where it contributes to the ease of making paint.

White Lead's Contributions to Paint

White lead also possesses substantial hiding power and excellent whiteness. The fact of the matter is that white lead adds more desirable qualities required in a good paint than any other white pigment can provide. The properties which white lead contributes to a paint may be summed up as follows:

1. Mixing and grinding ease
2. Package stability
3. Hiding
4. Brushability
5. Leveling
6. Drying action
7. Whiteness
8. Film strength
9. Flexibility
10. Tint retention
11. Adhesion
12. Gloss
13. Weather resistance
14. Fool-proofness

All these qualities add up to what may be termed "fool-proofness," a contribution of major importance to paint. Moreover, it explains why white lead is the only white pigment which by itself, with a suitable vehicle, will produce a paint of outstanding quality.

Other Uses

White lead is used for other purposes. They include the manufacture of pottery, colors, caulking compounds, putty, heavy duty greases and special adhesives and cements.

---

*Based on standard sample Dutch White Lead 100

COLORED PIGMENTS

The colored pigments used in paints may be divided into two classes, natural pigments and chemical pigments. The natural pigments are produced by processing colored crude ores and this consists of grinding to reduce particle size, drying to remove moisture and in some cases calcining to dehydrate and oxidize the ores. The chemical pigments are made by combining chemicals to form the desired pigments.

The following table lists the more common colored pigments, shows whether they are natural or chemical and indicates the manufacturing process used to produce them.

	ORANGE	
Chrome Orange C	Chemical	Precipitation of basic lead chromate.
Orange Mineral	Chemical	Roasting white lead or litharge.
	RED	
Indian Red	Chemical	Calcining ferrous sulfate.
Red Iron Oxide	Chemical	Precipitation of iron hydroxide and calcining.
Toluidine	Chemical	Precipitation of organic coal-tar compounds.
Venetian Red	Chemical	Co-precipitation of hydrated iron oxide and calcium sulfate, followed by calcining.
	BLACK	
Bone Black or Drop Black	Chemical	Burning bones.
Carbon Black	Chemical	Burning gas.
Iron Ixoide Black	Natural	Grinding magnetite.
Graphite	Chemical	Heating coke to high temperature.
Lampblack	Chemical	Burning oil.
Precipitated Black Oxide	Chemical	Precipitation of iron oxide followed by oxidation.
	BLUE	
Phthalocynine	Chemical	Roasting copper and phthalonitrile.
Prussian	Chemical	Precipitation of ferric ferrocyanide.
Ultramarine	Chemical	Calcining siliceous materials.
	GREEN	
Chrome Green	Chemical	Precipitation of chrome yellow with prussian blue.
Chromium Oxide	Chemical	Roasting potassium dichromate.
Phthalocyanine	Chemical	Chlorination of phthalocyanine blue.
	YELLOW AND BROWN	
Burnt Sienna	Natural	Calcination of raw sienna.
Burnt Umber	Natural	Calcination of raw umber.
Chrome Yellow	Chemical	Precipitation of lead chromate.
Hydrated Iron Oxide	Chemical	Precipitation of iron hydroxide, followed by oxidation.
Ocher	Natural	Grinding ore lower in iron content.
Raw Sienna	Natural	Grinding ore higher in iron content.
Raw Umber	Natural	Grinding ore containing iron and manganese.
Van Dyke Brown	Chemical	Precipitation of iron hydroxide followed by oxidation.

Colored pigments are sold as dry powders or are ground into paste with linseed oil or some other vehicle. The linseed oil pastes are called "colors in oil." If the color is ground in a Japan varnish, the paste is called "Japan color" or "superfine color."

Colors in oil are used principally by painters for tinting or for making colored paints. Dry colors are used by manufacturers of paints, inks, linoleums, calcimines and other water paints. Japan colors are used by sign painters, and, to a limited extent, by painters for tinting enamels.

WHITE BASIC LEAD SULFATE

Commercial white basic lead sulfate is a pigment used widely in mixed pigment paints. It is known also as "basic sulfate white lead" and "sublimed white lead."

The commercial product is not a single compound; it is a composition of basic lead sulfate and uncombined, or free, normal lead sulfate. The various grades are distinguished both by method of manufacture and the lead monoxide (PbO) content.

White basic lead sulfate is made by fume processes and also by a chemical process.

Two Fume Processes

In one fume process, lead sulfide ore (galena) is subjected to a high temperature in an oxidizing atmosphere. In another process, molten lead is sprayed into a jet of ignited fuel gas in the presence of sulfur dioxide gas. In both processes the basic lead sulfate is formed in furnaces as a fume, which is drawn through a cooling system to a bag room, where it is collected.

Chemical Process

In the chemical process, metallic lead is first atomized. The finely divided, partially oxidized lead is then mixed with water. Sulfuric acid is then added to form white basic lead sulfate.

Depend on Method of Manufacture

The physical and chemical properties of white basic lead sulfate depend upon the method of manufacture and the PbO content of the pigment. The chemical process basic lead sulfate is higher in PbO content, whiter, higher in hiding power and produces thicker paints than the fume process basic lead sulfates. It has needle-like, or acicular, particles.

Compared with basic lead carbonate, white basic lead sulfate has a lower specific gravity and therefore a higher bulking value. The typical chemical composition is as follows:

	Fume Type	Chemical Type
Lead sulfate ($PbSO_4$)	85%	72%
Lead monoxide (PbO)	15%	28%

Physical Properties

Physical properties of white basic lead sulfate, of both general types, are as follows:

	Fume Type	Chemical Type
Specific Gravity	6.3	6.4
Bulking Values		
Pounds per solid gallon	52	53
Oil Absorption	9–12	14
Tinting Strength*	85–100	130
Hiding Power (Sq. ft. per lb.)	10–13	16

IN EXTERIOR PAINTS

Practically all of the commercial white basic lead sulfate made is used, in combination with other pigments, in prepared exterior paints. In most instances, it is used only as part of the lead pigment portion, the balance being white lead carbonate.

*Based on standard sample Dutch White Lead 100.

When used in paints, white basic lead sulfate exhibits properties somewhat similar to those of white lead carbonate. It is not as effective, however, as may be deduced from its inability to produce a single pigment paint suitable for exterior use.

Effect on Films

The paint films produced with white basic lead sulfate are softer, and chalk more readily and more heavily than those produced with white lead. This means that although dirt is shed more readily by the basic lead sulfate film, the tint retention is poorer, and the durability is lower.

The lead monoxide content of basic lead sulfate is an important index of its quality, since it indicates the relative proportions of basic lead sulfate and normal lead sulfate. The latter has little value as a pigment and should be kept at a minimum. The chemical process is preferred to the fume processes because it permits production of white basic lead sulfate with a lead monoxide content of 25 to 28 per cent at which the most satisfactory pigment properties are exhibited.

RED LEAD

Red lead is a brilliant orange red pigment used widely in metal protective paints. It is an oxide of lead and its chemical formula is Pb_3O_4 (4 parts of oxygen to 3 parts of lead). Technically, it may be called trilead tetroxide.

Commercial red lead contains some litharge, or lead monoxide (PbO), and is generally graded according to the "true red lead," or Pb_3O_4 content. Thus there are four grades—85%, 95%, 97% and 98% red lead, all of which are used commercially for various purposes.

Red Lead is made by heating litharge (PbO) in a furnace at a temperature of from 900° to 950° Fahrenheit. Within this temperature range the litharge takes on additional oxygen from the air and becomes red lead. The reaction starts at a rapid rate, but as the litharge acquires a layer of red lead, its active surface is decreased and the reaction slows down. It takes about 24 hours to make the 85% grade, but a longer time—48 hours or more—is required for the higher grades.

The kind of litharge used influences the oil absorption, paint thickening power, particle size and other properties of the red lead produced. Red lead of higher oil absorption and paint thickening power is obtained when fume litharge is used. This type is called fume red lead.

Character and Properties

The essential properties and functions of a metal protective primer that will provide maximum protection are: (1) the inclusion of a constituent which inhibits and stifles corrosion by preventing the reactions causing corrosion; (2) the formation of a continuous film to exclude from the metal the environment which can cause corrosion; (3) the maintenance of flexibility in the film so that it can conform with the stresses set up by temperature changes; and (4) the retention of good bonding properties so that adhesion of the paint film will be maintained, not only initially but for a maximum period of time.

STANDARD OF PROTECTIVE PAINTS

Red lead, used either as a single pigment or combined with other paint pigments, possesses properties which enable it to fulfill the requirements of each one of these specifications. It ranks high as an inhibitor pigment and it also imparts additional qualities to a paint which promote adhesion, toughness, and elasticity in the paint film. In fact, red lead's durability and long service under difficult conditions has become a generally accepted standard of performance for metal protective paints the world over.

Authorities agree that, for the priming coat or coats, a paint should be rust inhibitive if it is to give satisfactory performance.

There have been many tests conducted, both in the field and in the laboratory, to show very definitely and conclusively that red lead is an inhibitive pigment and its presence, therefore, imparts important protective qualities to a paint for metal.

Forms Tough Films That Adhere

When mixed with linseed oil or other suitable paint vehicles red lead has the ability to form tough, elastic and tenacious paint films which remain on the metal, as a closely adhering, unbroken coating for a long period of time. This is due in large measure to the fact that the red lead reacts with the fatty acids in the vehicle, forming lead soaps which strengthen both the paint film and the bond between the film and the surface.

Another factor that contributes to the excellent rust inhibitive properties of red lead is its alkaline nature which creates an alkaline environment over the metal surface on which the red lead paint is used. It is well known that iron and steel do not corrode in an alkaline environment.

The oxidizing properties of red lead also influence its ability to inhibit corrosion.

Red lead is readily mixed with linseed oil and other paint vehicles. Paints made with it, according to generally accepted formulas, show excellent brushing qualities.

Fume Red Lead

Fine particle size is another characteristic of red lead. Fume red lead is even finer in particle size than regular furnace red lead. It shows somewhat higher oil absorption, and has greater paint-thickening power; in other words, it is particularly suitable for use when it is desired to prepare a full-bodied paint with a minimum amount of pigment.

The bright orange red color of red lead has led some individuals to inquire concerning its suitability for use as a finishing coat, or as the base for deeper reds such as brick red. Red lead upon exposure tends to fade rather quickly, because the surface of the film carbonates, due to reaction with the carbon dioxide and moisture in the air. The carbonate is white, and this in many instances makes it unsuitable to use red lead as a finishing *color*, though it does not detract in the least from the durability and protective value of the film.

TYPES AND PHYSICAL PROPERTIES OF RED LEAD

Type Red Lead	*% True Red Lead* Pb_3O_4	*Lbs. Per Solid Gallon*	*Oil Absorption*
85% Regular	85—87	75.0	5.0—7.0
95% Regular	95—96	74.0	5.0—7.0
95% Fumed	95—96	74.0	7.0—9.0
97% Regular	97—98	74.0	5.0—7.0
97% Fumed	97—98	74.0	7.0—9.0
98% Regular	98—98.7	73.5	5.0—7.0
98% Fumed	98—98.7	73.5	7.0—9.0

The 85% grade of red lead should be kept in dry form. It should not be mixed with the paint vehicle until just before the paint is to be used. The 95% grade, mixed into paste with raw linseed oil, can be stored for about a month before it begins to harden. When paste is to be stored for longer periods of time, it should be made with the 97% or 98% grades.

USES

Approximately a third of all the red lead manufactured is used in metal protective paints, either alone or in combination with other pigments. It is available in three forms: dry, paste and paint.

For many years the only vehicle used with red lead was linseed oil—raw, boiled or a combination of the two. Concurrent with the development of synthetic resin vehicles, however, special quick drying red lead paints were formulated and have given excellent results.

Engineers usually specify the composition of red lead-linseed oil paint on the basis of the number of pounds of dry red lead used with one gallon of linseed oil. Standard high quality red lead-linseed oil paint contains 33 pounds of red lead to the gallon of oil. This has given excellent results for many years and is still being used to a considerable extent. However, even lighter paints have been found thoroughly satisfactory for use on structural steel.

Quick Drying Red Lead

Quick drying red lead paints are in considerable demand for marine painting and also for certain industrial operations where time is a vital factor. Alkyd resin and phenolic resin varnish, properly selected so as to avoid excessive reaction with the red lead, may be used in the vehicles of such paints. Only the more highly oxidized red leads—the 97% or the 98% grades—should be used for such paints.

ORANGE MINERAL

Orange mineral is identical with red lead in composition. However, it is somewhat brighter in color and finer in texture.

The manufacture of orange mineral differs from the manufacture of red lead in only one respect. Whereas, in the latter instance the process starts with litharge, the manufacture of orange mineral starts with basic carbonate white lead. White lead is roasted or calcined in a reverberatory furnace, where it releases water and carbon dioxide and takes on oxygen, yielding a red lead of high Pb_3O_4 content—95% or more.

Character and Qualities

Orange mineral is very similar in character and qualities to red lead. Its outstanding quality is its color, which is a very clear orange red, and is very uniform. Orange mineral is finer in pigment particle size than ordinary red lead, though some regular type red lead equals it in this respect.

HOW USED

Orange mineral is used principally in the manufacture of vermilions and printing inks. Its excellent tone, high degree of purity of color, fineness, fluffiness and high degree of oxidation make it particularly desirable for these purposes.

ZINC CHROMATE (ZINC YELLOW)

Zinc chromate (zinc yellow) is a greenish yellow pigment that is most frequently used as a corrosion inhibitive ingredient in the manufacture of metal protective paint primers.

It is made by mixing a solution of potassium dichromate with a soluble zinc compound, such as zinc sulphate or zinc chloride. The mixing in a tank equipped with an agitator continues for about twelve hours when zinc chromate is formed. After several washings to reduce the soluble sulphates or chlorides to a minimum, the resulting solution is filtered, dried and ground, whereupon the zinc chromate is ready for the market in dry form.

Physical Properties

The particle size of zinc chromate is very small and among its other physical properties are the following:

Specific Gravity	3.4
Bulking Value	
Pounds per solid gallon	29
Color	Greenish Yellow
Color Retention	Excellent
Tinting Strength	Poor

USES

When used in the manufacture of metal protective paint primers, zinc chromate is usually combined with other pigments, such as iron oxide and silicates.

Zinc Chromate's effectiveness as a corrosion inhibitive pigment is due, primarily, to its soluble chromate compounds which result in the formation of a protective film on the surface of the metal. It is usually mixed with a resin type vehicle rather than straight linseed oil. This is necessary because zinc chromate needs the added control in its rate of solubility that is provided by a resin type vehicle.

Zinc chromate is also used in the formulation of bright green sash and trim paints, which are mixtures of zinc yellow and a blue pigment.

BLUE BASIC LEAD SULFATE

Blue basic lead sulfate, sometimes called "blue lead" or "sublimed blue lead," is a slate gray pigment obtained by heating lead ore in special furnaces which are a development of the Scotch hearth furnace used to produce metallic lead.

Blue basic lead sulfate is composed of a mixture of basic lead sulfate, lead sulfide, lead sulfite and carbon. It may also contain a small percentage of zinc oxide. The slate gray color is derived from the lead sulfide and carbon content. The product may vary in composition due to differences in the ore from which it is made.

Properties

Blue basic lead sulfate chemically inhibits corrosion and is an anti-corrosive pigment. In this regard, however, it is less effective than red lead. Blue basic lead sulfate has good paint making properties in that it grinds and mixes well with linseed oil and other paint vehicles. It is of fine particle size and has good hiding power.

The physical properties of blue basic lead sulfate representative of overage production are shown in the following table.

Color	Slate Gray
Bulking Value	
Pounds per solid gallon	34
Oil Absorption	
Pounds of oil per 100 pounds pigment	9.0

USES

The use of blue basic lead sulfate is almost entirely limited to structural metal priming paints, particularly the lower priced gray primers. It does not hold its gray color sufficiently well to be satisfactory for use in finish coat paints. Blue basic lead sulfate has higher bulking properties and sells for less per pound than red lead, which make it a lower cost inhibitive pigment. However, the amount of blue basic lead sulphate used is only about one tenth the amount of red lead used for metal protective paints.

DRYING OILS

As is well known, paints and varnishes are fluid materials. They are used to provide protection and/or decoration to innumerable objects. Applied in thin coats and exposed to the atmosphere, they undergo changes which cause them to solidify to the extent where they form "dry" films. This transformation from "wet" coat to "dry" films is called drying. Drying may be due to different causes. In general it results either from evaporation or from chemical conversion while in many cases a combination of both takes place.

Drying by evaporation is simple. It occurs when solutions are used, for instance a resin solution such as shellac and alcohol. Applied in thin coats and exposed to the atmosphere, the alcohol will evaporate and deposit the solid resin as a dry film.

Drying by chemical conversion is more complex. However, the reaction which may be considered as contributing most to the desired effect is one of oxidation. This occurs when liquid materials are used which have the ability to absorb oxygen from the atmosphere and in so doing are transformed into a solid state producing "dry" films.

Products which possess the characteristic of being able to absorb oxygen are commonly called drying oils. Of these there are many different types varying in drying, as well as in other properties.

IN PAINT AND VARNISH INDUSTRY

Drying oils may be vegetable oils or fish oils. Their use in the paint and varnish industry is extensive. Each individual type has particular characteristics which are not limited to variations in drying capacity.

These special properties are important because oil does not only function as an agent to convert a "wet" coat into a "dry" film but it also may contribute specific qualities to a film to meet definite requirements.

In general oils are a combination of glycerine and fatty acids. Glycerine is a somewhat thick, sweet tasting, colorless liquid. It has a variety of uses and is employed in manufacture of cosmetics, medicines, plastics, explosives. Fatty acids are substances which when combined with lye or any other such material will make soap, including the ordinary laundry variety.

The differences in performance of the oils depend greatly on the types of combined fatty acid they contain and the proportion of each kind present. The acids vary a great deal in their ability and capacity to absorb oxygen.

Subjected to Many Tests

In order to identity an oil or to examine its qualities for particular purposes, many physical and chemical tests have been devised. They include such determinations as specific gravity, color, viscosity, acid number, iodine number and a host of others.

Of these the iodine number is probably the most widely known constant. It represents the result of a test designed to obtain some insight into an oil's drying power. Since oils dry mainly by oxidation, the amount of oxygen which an oil takes up might be interpreted as a measure of its ability to dry. To simplify and speed up matters in laboratory tests, oxygen is replaced with iodine. Hence "Iodine Number," which expresses the number of miligrams of iodine absorbed by one gram of oil. Although the result of such a test can provide valuable information, one should never judge the quality of an oil by this constant alone.

In addition to tests on oils, methods to examine the character of resulting films have been developed. They include gloss, hardness, flexibility and many other determinations.

OILS GROUPED AND THEIR USES

The combined results of years of testing and experimentation seem to justify the grouping of vegetable and fish oils into three categories:

Drying Oils
Semi-Drying Oils
Non-Drying Oils

The drying oils may be divided into

Hard Drying Oils
Soft Drying Oils

The paint and varnish industry is interested in the hard and the soft oils and also in the semi-drying oils.

The hard oils dry to a hard film. They are used mainly in varnishes and in enamel vehicles. In most cases these oils also show good water and alkali resistance which makes them particularly suitable in industrial finishes for use on iceboxes, automobiles, etc.

Soft oils produce a softer film than the hard oils. They are consequently more flexible. For that reason they are useful in making coatings for materials which are subject to substantial expansion and contraction. Moreover, this type of oil shows good resistance against the normal influence of the atmosphere, particularly in combination with some reactive pigments. Naturally the oils in this group are widely used in house paint.

The semi-drying oils, as the designation implies, take a long time to dry. They also form soft films. However, they do find a place in the industry. Their slow drying is due to their composition. The proportion of high oxygen absorbing constituents is low. This offers the advantage that they are less subject to yellowing. Moreover, some of the oils in this group are obtainable at reasonable prices.

Here follows a more detailed description of the best known and most used varieties of drying oils.

LINSEED OIL

The oil which is most widely used for making paints and varnishes, particularly the former, is linseed oil.

Linseed oil is a vegetable oil obtained from the seeds of the flax plant. Flax is grown in many parts of the world. The largest sources of supply in the order of their importance are:

South America (Argentina and Uruguay)
North America (U. S. A. and Canada)
Russia
India

There are many other places which produce smaller quantities. Since there are so many countries with such great variations in crop conditions, and since differences in demand may be considerable, it is understandable that prices are subject to sudden and substantial fluctuations. This places flaxseed and linseed oil among the most speculative of commodities.

The oil is separated from the seed in hydraulic presses, or in expellers and more recently by solvent extraction. The product is yellow in color and of characteristic taste and odor.

Linseed oil is one of the better known drying oils which in its raw state can be used in paint. In other words, *raw linseed oil* has good film forming properties. It belongs to the soft drying oils and consequently produces flexible films.

May Be Treated

Raw linseed oil may be refined and otherwise treated. This is done to accentuate one or more of its particular characteristics, to instill properties it does not possess in its raw state and in general to adapt it to meet specific requirements.

Raw linseed oil dries in from 72 to 96 hours. Although the addition of pigment, notably reactive lead pigments, will speed up the drying process substantially, drying agents are generally used with all drying oils, including linseed oil. These drying accelerators consist of metal compounds, mostly lead, cobalt and manganese derivatives. They are dissolved in a volatile solvent and marketed as "*liquid driers.*"

Boiled

In order to simplify matters for the user, particularly the painter who mixes his own paint and to meet consumer preference in some parts of the country, linseed oils to which driers have been added are available. These products are known as "*boiled oils.*" They are made by dissolving metallic drying compounds directly in the oil at elevated temperatures.

Bleached

Raw linseed oil may be subjected to a number of refining processes. The simplest is the bleaching earth treatment. This results in *bleached oils* which are very pale in color, a desirable property for making both varnishes and white and light tinted paints.

Acid Refined

Linseed oil may be treated with acid. These *acid refined oils* possess excellent wetting qualities. They are particularly useful in the paint factory as this property helps to reduce the mixing and grinding time of many paint products. Moreover, in paints in combination with reactive pigments, acid refined oils have a tendency to produce larger quantities of soap which may be beneficial to the performance of a paint film.

Alkali Refined

Linseed oil may also be treated with alkali. *Alkali refined oils* are practically neutral. When subjected to high heat treatments they can be converted into excellent products. For that reason they are very popular in the varnish industry.

Naturally these refining processes may be applied with variations. Moreover, an oil can be treated chemically in addition to being bleached. Under those circumstances it is understandable that many different types of refined oil are available.

Needs Pigment

A linseed oil film by itself is not too resistant under atmospheric influences. However, the length of its useful life may be extended or its durability increased by either adding reactive pigments or by effecting changes in the chemical structure of the oil.

The use of pigments in the making of paint and the performance of this latter product are discussed elsewhere in this Manual. The changing of an oil's chemical structure may be the result of treatments to which it has been subjected.

Heat Bodied

When linseed oil is heated at fairly high temperatures for any length of time *heat bodied oils* are produced. In the process an increase in viscosity is effected, that is to say they have taken on body. This is due to the chemical changes resulting from the treatment.

Heat bodied oils possess good durability; they also have better wetting qualities and improved flow and gloss as compared to raw linseed oil. Moreover, due to their heavy body, they do not readily penetrate porous surfaces and so provide sealing and minimize absorption of subsequent coats.

Heat bodied oils are extensively used in varnishes. They are combined with resins in different proportions so that the desired properties such as hardness, gloss, durability, etc., are obtained. The resin hardens the oil but it is also true that the oil plasticizes the resin.

This, of course, also depends on the exact type of raw material used. The resin oil solution is further dissolved in a volatile thinner, resulting in a varnish. Special paint and enamel vehicles are made in very much the same way.

New Processes

In recent years new processes have been found or are in a fairly advanced stage of development which promise to make the oil adaptable for many other uses.

For instance, chemical conversion called conjugation permits the production of a type of linseed oil which could be reasonably classed in the lower brackets of the group of hard drying oils.

Moreover, methods are being developed whereby the glycerine in an oil may be removed and replaced with products of a similar chemical character but possessing different qualities. This opens up a wide range of possibilities of which the future importance cannot yet be predicted to its fullest extent.

From the foregoing it is quite obvious that linseed oil is a most flexible raw material. It can be adapted for many uses, and as it is usually readily available, it is understandably a most popular material in the paint and varnish industry.

TUNG OIL

Tung Oil, also known as China Wood Oil, is a vegetable oil obtained from the nuts of the tung tree. This tree, of which there are many varieties, is native to China and Japan. A number of years ago it was imported into our own country where it now grows in some of the Southern states.

The main sources of supply are of course the Asiatic countries, but care in its production have made the American variety of wood oil of greater uniformity and more reliable quality.

Raw wood oil is an amber colored liquid. At reduced temperatures (around freezing point) it solidifies into a yellow wax-like material. Cooking the oil at about 500° F. destroys this property.

Properly treated tung oil belongs in the class of hard drying oils. It rapidly forms hard films which show excellent water and alkali resistance. For that reason it is used extensively in quick drying finishes such as furniture varnishes, floor paints and in some types of baking enamels.

Incidentally tung oil offers an example where an "iodine number" might be misleading, as referred to previously. Notwithstanding the fact that wood oil dries extremely fast its iodine number is relatively low.

SOYBEAN OIL

Soybean oil is extracted from soybeans. The soy plant is grown in many parts of the world including the United States, where each year a substantial acreage is given over to it.

Soybean oil belongs to the semi-drying oils. In paint it cannot be used as the only oil of the vehicle. However, it can be successfully blended with more rapid drying types.

Soybean oil films possess good resistance to yellowing. With the development of new refining process it shows promise of more extensive use and a more prominent place in the paint and varnish industry.

DEHYDRATED CASTOR OIL

Raw castor oil, which is extracted from the castor bean, is a non-drying oil. However, its chemical composition permits its conversion into a drying oil, which is dehydrated castor oil.

This oil is very pale and belongs in the group of soft drying oils. As far as its other qualities are concerned it may be classified in between tung oil and linseed oil.

Because of its good color it is especially suitable for making pale varnishes and widely used in white enamel vehicles.

PAINT THINNERS

In all types of paint and enamel, liquids that evaporate after the film is applied are often used to reduce the consistency without changing the predetermined proportions of pigment and non-volatile vehicle. These volatile liquids are commonly called "paint thinners."

The most important function of the thinner in a paint is to regulate the brushing or spraying consistency without affecting the composition of the finished film. In the priming coat on new work and the first coat on repaint work, the thinner performs an additional function—it assists in the penetration of the oil vehicle and insures better mechanical anchorage of the paint film.

TURPENTINE

There are four types of turpentine: gum spirits of turpentine, steam distilled wood turpentine, sulfate wood turpentine and destructively distilled turpentine.

Gum spirits and steam distilled wood turpentine are produced in greatest quantities and are used by the consumers of paints and enamels. They are sold in paint stores in bulk or in sealed cans. Gum spirits of turpentine is produced by distillation of the crude gum obtained from pine trees. Steam distilled wood turpentine is made from pine wood, which is subjected to live steam in a digestor.

Sulfate wood turpentine, used to a very limited extent in paints, is obtained in the preparation of wood pulp by alkaline treatment. The pulp is boiled with a mixture of various chemical compounds and the steam evolved contains turpentine and other compounds.

Destructively distilled wood turpentine, obtained by the direct destructive distillation of pine and fir wood has a pungent, penetrating odor that limits its use in paints.

PETROLEUM SPIRITS

"Petroleum spirits" is the general name applied to the various types of volatile petroleum products used in the paint industry. The two types most widely used are mineral spirits and V.M. and P. naphtha (varnish makers' and painters' naphtha). Mineral spirits has a rate of evaporation similar to turpentine. It is widely used in the manufacture of house paints and is also carried by stores for consumer use. V.M. and P. naphtha is more volatile than mineral spirits, and is used by the manufacturer of paint and varnish, rather than by the painter.

The manufacture of these products is a highly specialized procedure involving distillation and refining. Petroleum contains various mixtures of hydrocarbons which are first separated according to boiling point into the five main groups. The low boiling point thinners naturally evaporate first. As the temperature is raised gradually, the higher boiling point hydrocarbons evaporate. Ingenious equipment makes it possible to control, very critically, the separation of the different portions.

Petroleum spirits of various types are available in considerable variety, and can be obtained from most manufacturers to meet specifications submitted by the consumer.

RESINS

The word "resin" is used as a group name for a multitude of organic compounds of complex composition. Since the term "resin" includes a wide variety of materials, such as varnish resins, plastics and rubbers, a simple definition covering the entire range can not be given.

Resins most useful in the protective coating industry in general answer the following descriptions.

Varnish resins are transparent or translucent solids or semisolids, usually yellowish to brown in color. Many of them soften and melt when heated and, with a few exceptions, they are soluble in oil or volatile organic liquids (solvents).

Resins may be of natural origin or artificially synthesized (built up). The natural products may originate from tree exudation as in the case of Kauri gum and ordinary gum resin. Others, such as shellac, find their origin in insect secretion. Also some natural resins have been formed by plant decomposition of which some types of asphaltum are examples. Many different types are found in each of these classes.

The synthetic resins cover an even wider field than the natural materials and as time goes on they are becoming more numerous with further development.

The most generally known synthetic resins are phenolics, which include Bakelites. They are, to a considerable extent, condensation products of phenol and formaldehyde. Other much used synthetic resins are the alkyds which are reaction products of glycerine and phthalic anhydride.

Resins are combined with oils and volatile solvents to produce varnishes or enamel vehicles. The use of natural resins was prompted by a desire for better gloss and greater hardness than could be obtained with oil alone.

The synthetics more recently developed also provide faster drying and generally better durability to enamel and varnish films.

There are great variations in the different resins in their ability to impart certain specific properties. Their value and usefulness depend on their solubility, color, hardness, chemical resistance and numerous other characteristics.

To the painter, the phenolics and the alkyds are of greatest interest. The use of phenolics has markedly increased the durability of spar varnishes. The alkyds have made it possible to produce improved architectural enamels and trim paints. In addition, synthetic resins find wide application in industrial finishes, such as those used on automobiles, refrigerators and other manufactured products.

SUPPLEMENT ONE

THE FOUNDERS—*A Tribute*

THE FOUNDERS

A Tribute

In the first chapter of this Manual we concentrated on the policies that have made our Company great in peace and war times and that have been responsible for maintaining its leadership in the lead industry. But of interest and significance are the humble "beginnings."

As in the biography of any great man, credit is given to his parentage and antecedents for many of his qualities of greatness, so should this Manual pay tribute to the rugged individualists who founded National Lead Company. The companies which they brought into the newly founded national organization were, many of them, pioneers in white lead manufacture in their respective communities. Several could lay claim to upwards of a half century of successful white lead business, and the history of one of the founding companies stems back to Revolutionary days.

When incorporated in 1891, with W. P. Thompson as its first President, National Lead Company included about 25 concerns, the most important and strongest of which had their headquarters in nine large cities—Boston, Buffalo, Chicago, Cincinnati, Cleveland, New York, Philadelphia, Pittsburgh and St. Louis.

The historical sketches on the following pages are confined mainly to founding companies about which we have been able to locate interesting material. The order in which they appear was determined by the age of the founding companies in the respective cities.

PHILADELPHIA

Back to Revolutionary Days

While still the brilliant British red-coats swaggered through the streets of Colonial Philadelphia and shortly before the first Continental Congress met in Carpenter's Hall, a certain young gentleman, one Mordecai Lewis, was duly taken into the firm of Neave and Harmon, changing its name to Neave, Harmon and Lewis—importers of white lead, red lead and other merchandise. That was in 1772.

This was the first step in the creation of the business which now bears the name of John T. Lewis & Bros. Company—our Philadelphia Branch—a business that expanded beyond the dreams of its founders.

Thus was established in business the founder of a family of able executives who have not only guided the destinies of the Lewis Company but have had an important part in the development of National Lead Company.

Has Oldest Bank Account

In addition to its being the oldest of the founding companies of National Lead Company, John T. Lewis & Bros. Co. has another claim to longevity honors in its possession of the oldest bank account in the oldest bank in the United States. The account was opened January 16, 1781, in the bank of North America, which was chartered by an Act of Congress only nine days previously, and has been kept open continuously since then.

By 1781, the year the British Commander, Lord Cornwallis, surrendered and the Colonies became an independent nation, Mordecai Lewis assumed full control of the firm, changing its name to Mordecai Lewis & Company.

An interesting memento of the times is an original bill dated May 1, 1787, which discloses the sale of "twelve hundred-weight of ground white lead" to the Pennsylvania Hospital at 90 shillings per hundred weight or 21½ cents per pound.

When Mordecai Lewis died in 1799 the business was carried on under the old name by his sons, Mordecai and Samuel Neave Lewis. In 1806 they formed a partnership, M. & S. N. Lewis, who acted as independent selling agents for Mordecai Lewis & Company.

White lead and oxides were first manufactured in 1820 and shortly afterwards linseed oil and colors, setting a rigorous standard for purity that has never been lowered since.

John T. Lewis Incorporated

It was in 1856 that John T. Lewis, grandson of Mordecai Lewis, consolidated the Mordecai Lewis and M. & S. Lewis concerns under the firm name of John T. Lewis and Brothers, which in 1888 was incorporated.

Edward F. Beale, son-in-law of John T. Lewis, entered the Company in 1875 and was elected President in 1889. Financial control passed to National Lead Company when it was organized in 1891 and Mr. Beale was elected as a member of its first Board of Directors.

The other founding company located in Philadelphia was the Western White Lead Company, about which little is known today.

NEW YORK

First Incorporation and a Mystery

The Brooklyn White Lead Company, one of the four strong New York companies that helped found National Lead Company, was incorporated in 1825, thus becoming the first white lead business in the United States to take advantage of this form of organization. But probably its most important claim on our interest is based on the unique characters who were among the incorporators. Even a mystery is disclosed in the lives of two of the founders. All were men of prominence in their day, public spirited and strong individualists.

The venture which led to the formation of the Brooklyn White Lead Company originated about 1800 when two chemistry professors, Dr. Federal Vanderbergh of Albany, N. Y. and Dr. Josiah Noyes of Clinton, N. Y., began experimenting in the manufacture of white lead and chemicals.

By 1823 the experimental work had included actual manufacturing of white lead in a small way and it was on June 13 of that year when a co-partnership agreement was signed by Augustus Graham, David Leavitt and Elijah Humphreys with Josiah Noyes & Company. Two years later Augustus Graham and Mr. Leavitt bought out their associates in the Noyes firm and incorporated under the name of The Brooklyn White Lead Company, with an authorized capital of $100,000 of which only $52,800 was issued. David Leavitt was elected president, a position he held until his death in 1879.

Failure of the company's efforts to manufacture a product equal in quality to the white lead imported from England, this country's chief source of supply at that time, finally moved August Graham to study English methods first hand. He went there in 1832 and got the information he sought while employed as a workman in one of the best factories in England. Upon his return to America the English methods were adopted, to the immediate improvement in the company's white lead and its profits.

Outdid Damon and Pythias

Among the most interesting of the strong personalities who founded the Brooklyn White Lead Company were John B. and Augustus Graham, whose successful and honorable careers were made unique with mystery, romance and a business and personal relationship that outdid that of Damon and Pythias. The "brothers" Graham were not related and their names were not Graham. John Graham was born John Bell somewhere in the North of Ireland in 1784 and came to America at the age of nineteen, obtaining employment with a Frederick, Md., merchant by the name of August King. The friendship between the two men became so deeply affectionate and mutually trustful that at the suggestion of Augustus they assumed the role of brothers, under the name of Graham, united their capital and launched a business and personal relationship that lasted until death separated them.

When the Brooklyn White Lead Company was incorporated in 1825, John Graham accepted stock of none too promising value at that time in payment of a substantial loan he had made previously to Augustus without security. Further evidence of their mutual faith was the fact that they never kept separate accounts, took funds each needed from a common purse and when final settlement was made, divided their joint holdings without the slightest disagreements.

Leavitt Met Financial Crisis

David Leavitt, the first President of the Brooklyn White Lead Company, was probably the greatest financial genius in the early history of the white lead industry.

In addition to maintaining a sound financial policy for the Brooklyn White Lead Company, Mr. Leavitt served as President of the Fulton Bank from 1826 to 1837 when he was elected to the Presidency of the American Exchange Bank of New York, which became one of the most powerful banks in the city.

It was in 1843 that he faced a severe test of his ability as a financial organizer. He and his bank were heavily invested in State of Illinois Canal bonds and a large additional amount of money was needed to complete the project and protect the investment. After a long bitter fight the Illinois legislature finally voted to pledge the credit of the State and Mr. Leavitt made two trips to London to supplement local assistance with loans from two of the great banking houses of that city. At that time Thomas Ford was Governor of Illinois and later in his "History of Illinois" he gave Mr. Leavitt credit for the success of the negotiations.

The Brooklyn White Lead Company became largely a family organization and when their father died, first Edward Leavitt and then at his death Sheldon Leavitt took the Presidency, but Reginald P. Rowe was the real manager from about 1885 until it was merged into the National Lead Company.

Atlantic Branch Formed

On April 3, 1890 the Jewett White Lead Company, the Bradley White Lead Company and others were consolidated with the Brooklyn White Lead Company under the name of the National Lead and Oil Company of New York. On December 8, 1891, all of these properties were acquired by the National Lead Company and were operated as the National Lead and Oil Works Branch with R. P. Rowe as Manager. On that date Mr. Rowe was also elected a member of the first Board of Directors of National Lead Company.

Meanwhile the Atlantic White Lead and Linseed Oil Works had also been made a branch of the National Lead Company and on July 1, 1893, the business of the two branches was consolidated into the Atlantic Branch with Romulus R. Colgate as Manager. He also had been elected in 1891 to National Lead Company's first Board of Directors. Mr. Rowe was made Manager of the Atlantic Branch in 1901 and was elected Vice-President of National Lead Company in 1904, holding both positions until his death.

Jewett Uses Whale Oil Factory

Next to the Brooklyn White Lead Company, the oldest manufacturer of white lead among our founding companies in the New York area was The Jewett White Lead Company, first organized as John Jewett & Sons. In the Atlantic Branch office is a large bottle filled with white lead and labeled, "Sample of the First White Lead Made at the Jewett Works, June 1830."

The Jewett family established their first white lead mills in an old whale oil factory, which had its origin in Revolutionary days. During the Civil War the main building of the Jewett Works was used as a barracks to train Federal soldiers.

The organizers of the white lead concern were John Jewett, John Jewett Jr., James R. Jewett and George W. Jewett. The business was managed successfully for about 50 years when all the members of the original family having died, it was reorganized in 1882 with only the treasurer, Charles H. Jewett, bearing the family name.

When the company was absorbed by National Lead Company ,its plant had a capacity of 3500 tons of high quality white lead annually.

Atlantic Most Successful

The "Atlantic White Lead and Linseed Oil Company," incorporated in 1866, was probably the most successful financially and manufactured products most widely accepted by the trade of any of our founding companies in the New York area.

Almost from its incorporation, the company paid substantial dividends to its stockholders, often over 20% on its capital stock.

Robert Colgate was the first President of the Atlantic White Lead and Linseed Oil Company and its principal stockholder, owning 330 of the 500 shares issued of $1,000 each. Edward Austin owned 140 shares, A. W. Colgate 25 shares and S. J. Colgate 5 shares.

Almost immediately after incorporation, the Robert Colgate & Company, founded in 1845, was appointed general sales agents of the Atlantic White Lead and Linseed Company with an annual commission of 2½ per cent on all sales and 1½ per cent on "all receipts and disbursements made for account of the Company." This arrangement was cancelled effective January 1, 1886, due to the death of Robert Colgate during the preceding year. The business was conducted thereafter in the name of the Company instead of through the agents, Robert Colgate & Company.

Paid Secretary $6,000 in 1885

When Samuel J. Colgate was elected President on October 30, 1885 all the capital stock was owned by the Colgate family, but at the subsequent annual meeting George W. Fortmeyer, a long-time employee and who many years later was to become Manager of the Atlantic Branch and a Director of National Lead Company, was elected Secretary of the Company at an annual salary of $6,000.

In the early days of his employment, Mr. Fortmeyer was practically a one-man business. In the morning he would hitch up his horse and buggy and call on the trade. In the afternoon, he would pack, bill and deliver the products for which he had orders.

With the exception of the Cornell Lead Company of Buffalo, little of historical interest is known of the other New York State founding companies, which included the Bradley White Lead Company, the Ulster Lead Company and the Union White Lead Manufacturing Company.

BUFFALO

First Buffalo White Lead Manufacturer

It was early in the year 1840 that a young chemist by the name of Henry Roop left his home in Buffalo for a visit with friends in New York City and vicinity. While making a few business calls in Brooklyn, he took advantage of an opportunity to inspect a white lead factory, asking a number of questions to satisfy the natural curiosity of a budding young scientist.

Returning to Buffalo he immediately began an intensive study of the practical and scientific phases of white lead manufacture with the idea in mind of entering the business.

When he considered himself sufficiently informed to take the risk and with borrowed capital of $3,000 he built a small wooden shop and started the manufacture of white lead. This was in 1841 and Henry Roop became the first manufacturer of white lead in Buffalo.

The product was fair in quality, considering the rather primitive method of manufacture. For instance, he had two sets of stones which were driven by horses.

Buffalo Mayor Invests

The infant business survived the first year and at that time attracted additional capital amounting to $9,000. The business began to make money and shortly afterwards got the attention of Sheldon Thompson, who was the first mayor of Buffalo to be elected by popular vote. He added $20,000 to the capital and in 1844 the plant was expanded and equipped with the latest machinery of the day.

Shortly after getting into operation, all the new buildings were completely destroyed by the historic gale of 1844. With no break walls to protect it, the entire lower city was submerged by the huge waves whipped up from Lake Erie by the high winds.

Undaunted by the catastrophe, the company moved all the machinery that could be salvaged to a new location, where an even larger and better equipped factory was built. Prosperity followed, according to an old account, which stated that "the concern made money as fast as any factory ought to."

During this period in white lead history, the principal source of supply of pig lead was the "Galena District" in northern Illinois and Southern Wisconsin. An interesting custom of the times was the auction of pig lead held daily by the smelters. Sheldon Thompson's son, A. P. Thompson, was his father's buyer for many years, often riding to and from the mines on horseback. The lead was carted by oxen to Milwaukee and brought down the lakes in sailing vessels.

When Mr. Roop retired from active business because of ill health, the firm's name was changed to Thompson & Company and was taken over by Sheldon Thompson and his son, A. P. Thompson, and his son-in-law, Edward Warren. Sheldon Thompson died in 1851 and Mr. Warren in 1863, the business being carried on by A. P. Thompson.

Katherine Cornell's Ancestor Enters Business

It was in 1852 that Mr. Roop, his health recovered, again entered the white lead business. With Gibson T. Williams and Samuel G. Cornell he formed the Niagara White Lead Company. Mr. Cornell, it is interesting to know, was the great-grandfather of the famous American actress, Katherine Cornell.

In the early 1860's Mr. Roop again retired because of ill health and the Niagara White Lead Company passed into the hands of Samuel G. Cornell and his son, S. Douglas Cornell. At the same time they purchased Thompson & Company, abandoned the latter's plant and consolidated the two companies under the name of S. G. Cornell & Son.

About two years later A. P. Thompson bought back a half interest from the Cornells and in 1867 the Cornell Lead Company was incorporated. Samuel G. Cornell died in 1879 and his son in 1910.

When the company was sold to National Lead Company, it became known as our Buffalo Branch, and A. P. Thompson served as Manager and as one of the first elected Directors until his death in 1911.

BOSTON

Historical Salem Contributes

Perhaps when you think of Salem, Mass., you recall the infamous witch trials there in the early days of our Country, but the Old Town made other more civilized contributions to history. One that is of special interest to us of National Lead Company was the incorporation in 1868 of The Salem Lead Company, one of our founders and destined to be the cornerstone of our Boston Branch.

Almost from its incorporation, the Salem Lead Company had offices in the "Hub City" so in effect it was a Boston concern practically throughout its existence.

When the company was absorbed by National Lead Company, it was operated as a subsidiary of the latter under the name of National Lead Company of Massachusetts. Walter Tufts was Treasurer and General Manager and later became one of the Directors of National Lead Company.

Boston Lead Company Has Ups and Downs

There is an interesting bit of industrial history back of the name under which our Boston Branch conducted its business from 1928 to December 20, 1945; namely, the National-Boston Lead Company. It is the story of a company that tenaciously retained its corporate name—Boston Lead Company—despite a failure, a reorganization, an amalgamation and the final consolidation with the National Lead Company of Massachusetts.

It was in 1829 that the Boston Lead Company was incorporated, the first white lead business in New England and the second in the United States to adopt that form of organization. There were 25 stockholders subscribing to 52 shares at $1,000 each. From the start the company manufactured lead pipe, sheet lead, red lead, litharge and white lead.

It was in 1863 that the company suffered a disastrous fire, but the directors voted to rebuild.

By 1872 the capital stock had been increased to $500.000 and the company prospered until reverses came in 1878 when it failed. The following July it was reorganized as the Boston Lead Mfg. Company and that same year, J. H. Chadwick, one of its executives, left the Company to organize the Chadwick Lead Works.

National-Boston Organized

Both companies prospered, but in 1901 they consolidated under the name of the Chadwick-Boston Lead Company. The Company was purchased by the United Lead Company, which in 1926 became a subsidiary of National Lead Company. It was not until 1928 that the Chadwick-Boston Lead Company was consolidated with the National Lead Company of Massachusetts under the name of The National-Boston Lead Company. On December 20, 1945 the name of our Boston Branch became officially The National Lead Company of Massachusetts.

From the Boston Lead Company came one of the Directors of National Lead Company—A. H. Broderick, who started with that company in 1876, was President of the Chadwick-Boston Lead Company and upon the latter's consolidation with the National Lead Company of Massachusetts was made Manager, which position he held until his death.

CINCINNATI

Oldest Founders in Midwest

Turning to the white lead manufacturing history of the Middle West, we find that the first of our founding companies to be organized in that section of the country were located in Cincinnati, Ohio. These were the Anchor White Lead Works and the Eckstein White Lead Company, which also have the distinction of being the first *successful* white lead concerns to be established in Cincinnati.

While not one of Cincinnati's pioneer manufacturers, the first successful white lead concern was established in 1828 by Roy MacChandless, a Scotsman who had been connected with the manufacture of white lead in Scotland and Richard Conkling, a Cincinnati painting contractor. Later this concern became the Anchor White Lead Company.

Anchor as a Trademark

The two men formed a co-partnership under the firm name of MacChandless & Conkling. They erected a small factory and lead bins on a site later used for the United States Post Office. They adopted an anchor as their brand and stenciled this trademark on their kegs.

Since there was no tanbark available at that time, the German process of manufacture was employed, corroding in spent manure. The vinegar used in corroding was made by the founders in their own plant from apples and beech shavings. The pig lead was cast into thin sheets in a pan, then rolled in spirals and placed in pots similar to those used in the Dutch process. The sheets were about eighteen inches long and six inches wide. The minimum time of corrosion was about forty days; the maximum sixty days.

Rival Enters Field

MacChandless and Conkling enjoyed their monopoly in the Cincinnati market for about eight years. Then, in 1836, a rival plant was erected by Townsend Hills. This concern later became the Eckstein Company.

During the next thirty years the Hills concern underwent a few changes while its rival underwent many. MacChandless had died in 1838 and the firm carried on under the name of Richard Conkling & Bros. It continued as such until 1842 when a new factory was erected and a new name adopted, Richard Conkling & Company.

In 1856 Conkling sold the business to a Robert Hogue who operated it under his name for about a decade.

Anchor Company Incorporated

In Cincinnati in 1866 the Hogue concern was purchased by A. T. and A. O. Goshorn and became known as Goshorn Bros. Eight years later, the firm was incorporated. Another member of the family, E. C. Goshorn, was taken into the firm and the name Anchor White Lead Company was adopted. In the following year a new factory, larger and with more up-to-date equipment, was erected.

Eckstein Company Incorporated

In 1865 Frederick Eckstein secured an interest in the plant founded in 1836 by Townsend Hills. This firm operated for several years under the name Eckstein, Hills & Company, and was finally incorporated in 1880 as the Eckstein White Lead Company. Three years later a modern plant was erected on the west side of Freeman Avenue between Seventh Street and the C. H. & D. Railroad, now a division ot the Baltimore & Ohio Railroad.

When in 1891 the Eckstein White Lead Company became a part of National Lead Company A. T. Goshorn was elected First Vice President of our Company. The Deer Creek plant of the Anchor White Lead Company was purchased at this time, but it was operated for only a year and then closed down, all subsequent manufacturing being concentrated at the Eckstein Freeman Avenue factory.

Goshorn Made Director and Manager

In 1895 E. C. Goshorn was elected a director of National Lead Company in succession to his brother, A. T. Goshorn, and served in that capacity and as manager of the Cincinnati Branch until his death in 1924.

The business of the Cincinnati Branch of National Lead Company increased to the point where expansion was necessary so the erection of larger buildings was begun in 1907 and completed in 1914.

ST. LOUIS

Had Four Strong Founders

Lead and pelts were the two most important articles of barter and commerce for several years after St. Louis was founded in 1764, money not being in common use.

In the 1800's the manufacture of white lead, red lead and other lead products, together with lead mining, became an important industry in the St. Louis area. It was quite natural, therefore, that St. Louis should have produced four of the ten or twelve stronger companies which organized the National Lead Company. They were the Collier, Missouri, Southern and St. Louis Lead and Oil Companies.

The pioneer of our St. Louis founding companies began operations in 1837 on Clark Street, between Ninth and Eleventh, which was later to become the Collier Works. This plant was sold to Joseph Charless and Henry T. Blow in 1842.

Editor Sells White Lead Interest

Mr. Charless had founded "The Missouri Gazette" in 1808, a weekly newspaper that was the first to be published west of the Mississippi River. He sold his interest in the white lead business to Mr. Blow in 1844. The Blow Factory was unfortunately in the path of the great fire of 1849, with the following results as reported in the Fire Department records:

> "The extensive white lead, castor and linseed oil and vinegar manufactory of Henry T. Blow, on the corner of Tenth Street and Clark Avenue, was almost entirely consumed. The loss was $100,000; insured for $48,000."

Mr. Blow rebuilt the plant in 1850 and the company was reorganized taking the name of Collier Works, apparently because George Collier, although not actively engaged in manufacturing, furnished most of the capital.

Collier Incorporated

The Collier White Lead and Oil Company was incorporated on September 1, 1851, with a capital stock of $150,000, to carry on the business of "manufacturing, buying and selling of white lead, red lead, litharge, castor oil, linseed oil and vinegar."

Mr. Blow was President until 1861, when he resigned and Colonel Thomas Richeson succeeded him in the office. During his connection of many years with the Collier Works, Colonel Richeson invented and put into use many improvements which lowered the cost of manufacturing.

The annual production of the Collier Works about 1883 was 4,000 tons of white-lead-in-oil, 100 tons of red lead, 100 tons of litharge, 100,000 gallons of linseed oil and 100,000 gallons of castor oil.

In 1881 fire again brought serious damage to the Collier Works, causing a loss of $167,250 on May 28 and $85,825 on September 21. However, the destroyed buildings were rebuilt and the business was flourishing when the Collier White Lead and Oil Company was incorporated in the National Lead Company in 1891.

St. Louis Lead and Oil Launched

The next member of the St. Louis group of National Lead founding Companies to organize was the St. Louis Lead and Oil Company, which took over the business in the State of Missouri, with a capital stock of $300,000. The charter contained this interesting clause:

> "This corporation shall pay into the State Treasury one per cent per annum on all net earnings for use of Soldiers' Orphans Home Fund."

In an advertisement in the 1865 edition of the St. Louis Directory, the newly organized company announced the purchase of the O'Fallon business, listed the products they had for sale and stated that "having facilities unsurpassed by any company in the United States, we solicit the patronage of wholesale cash buyers."

In the Spring of 1865 a plant was erected at a cost of about $200,000 on the site of the O'Fallon Plant. The plant produced white lead, litharge, linseed oil, castor oil and cotton-seed oil. Its annual consumption of raw materials in 1880 was 1,000 tons of pig lead, 50,000 bushels of castor beans, 100,000 bushels of flaxseed and 40,000 bushels of cotton-seed.

In 1892 a new plant was erected at the site of our present factory, 5548 Manchester Avenue, and the property at Second Street and Cass Avenue was sold in 1893 to the Pennsylvania Railroad for $200,000. In 1911 manufacturing was concentrated in the then greatly enlarged and modernized Manchester Avenue plant and later discontinued in both the Southern and Collier Works.

The St. Louis Lead and Oil Company supplied one of the first elected directors of National Lead Company—George O. Carpenter, who later became Vice President of our Company.

Southern in St. Louis and Chicago

In 1862 Henry Platt and Robert Thornburgh formed a partnership to engage in the retail drug business, abandoning the line shortly afterwards to merchandise paint, oil and glass.

In 1865 the firm built a white lead factory at Main and Lombard Streets under the name of Platt, Thornburgh and Company. Two years later it was incorporated as the Southern White Lead and Color Company with a capital stock of $120,000 for the purpose of manufacturing white lead, red lead, litharge, castor oil, linseed oil and acids, and the grinding and mixing of oils, paints and colors.

Among the executive officers of the newly incorporated company were names destined to become well known in the paint industry. William H. Gregg was elected President; Henry S. Platt, Vice President; F. W. Rockwell, Secretary; James Johnston, Superintendent. Mr. Rockwell was elected Second Vice President of National Lead Company on the day of its incorporation and years later Mr. Gregg's son, Norris B. Gregg, held a Vice Presidency until his death. Fletcher W. Rockwell was born in St. Louis when his father was Secretary of the Southern Company and was elected President of National Lead Company on January 12, 1938.

On February 9, 1876, the State Legislature granted a change in the name to the "Southern White Lead Company."

About 1880 the consumption of lead was 1,200 tons annually.

In 1887 the McBirney and Johnston White Lead Company of Chicago was absorbed by the Southern White Lead Company and from that time on the Company sold lead from both factories under the Southern Company brands.

Manufacturing in the company's factory was discontinued in 1912 when the city of St. Louis took the Southern corroding yards for a bridge site.

Missouri Lead Company Organized

The Missouri Lead and Oil Company was incorporated on March 2, 1872 with William H. Thompson as President and who was destined to become another St. Louis man to be elected to membership on the first Board of Directors of National Lead Company.

All records examined failed to give any information as to the location and capacity of their manufacturing plant. Their business address was 421-425 Main Street.

William H. Thompson resigned the Presidency in 1884 and the Missouri Lead and Oil Company was absorbed by National Lead Company in 1891. The Missouri Company brand was used for many years.

CHICAGO

Branch Included Two Founders

When National Lead Company was incorporated in 1891, there were two Chicago concerns listed as founding companies; namely, the D. B. Shipman White Lead Company and the Southern White Lead Company.

Mention of Mr. Shipman's election to National Lead Company's first Board of Directors is the only historical item that could be dug up about these two founding companies. However, we do know that the Chicago Branch from its inception has supplied able executives and strong members of the Board of Directors and has contributed substantially to the continued success of National Lead Company.

PITTSBURGH

Forming National Lead & Oil Co. of Penna.

According to available records, Pittsburgh had a white lead factory as early as 1813, operated by Anthony Beelen with J. J. Boudier, a Frenchman and owner of a laboratory, as his superintendent.

Through the years many white lead manufacturing ventures were launched, but it was not until 1849 that there was established the forerunner of one of the successful companies which became the founders of the National Lead & Oil Company of Pennsylvania, our Pittsburgh Branch. This was B. A. Fahnestock & Company, a wholesale drug house that also manufactured and sold white lead and which eventually became the Fahnestock White Lead Company. It is recorded that in the year 1849 this firm's white lead sales amounted to $65,000 and that 500 tons of lead, 1,820 barrels of vinegar and 15,000 gallons of linseed oil were consumed.

Became Industry Leader

Simon Beymer, destined to be one of the outstanding figures in the early days of the Pittsburgh white lead industry, came to that city in 1852 and took employment with B. A. Fahnestock & Company. Five years later he became a partner of B. L. Fahnestock and in 1867 he organized the white lead manufacturing firm of Beymer, Bauman & Company. Upon the death of Reuben F. Bauman in 1885, Mr. Beymer bought the estate's interest and organized the Beymer-Bauman Lead Company, of which he was President and his son, Hervey W. Beymer, Manager.

The Fahnestock White Lead Company, which, as has been mentioned, had its roots in B. A. Fahnestock & Company, was organized and incorporated in 1872 by B. L. Fahnestock, Benj. F. Vandecort and Benj. S. Fahnestock. It was operated successfully until its sale to National Lead & Oil Company of Pennsylvania in 1891.

It was in 1884 that the Davis-Chambers Lead Company purchased the white lead factories and properties of Barclay Preston, but nothing else historically is known about this founding company.

Supplied First President

While we lack historical data on the Armstrong-McKelvy Lead & Oil Company other than that it was organized by John H. McKelvy and Thomas M. Armstrong we do know that this founding company had the distinction of supplying the first President of the National Lead & Oil Company of Pennsylvania (our Pittsburgh Branch). This was Mr. McKelvy and he also was elected as one of the first directors of National Lead Company. He was succeeded by Charles F. Wells, Sr.

Another strong Pittsburgh man who came to National Lead Company in its early days was W. N. Taylor. He had been Vice President of the Scottdale Iron & Steel Company until elected President of the Davis Lead Company in 1904, which office he held until the concern was purchased by National Lead Company in 1907. It was then that Mr. Taylor headed the Pittsburgh Branch and became a Director of National Lead Company.

Pittsburgh supplied another member of the first Board of Directors of National Lead Company—Simon Beymer.

CLEVELAND

J. H. Morley Heads Business

The J. H. Morley Lead Company of Cleveland was incorporated May 20, 1887, purchasing the white lead manufacturing business, including buildings and real estate, of J. H. Morley & Company for $200,000, which represented the entire capital stock of the new corporation.

The J. H. Morley & Company were the successors of Morley & Cary, a firm organized in 1862. Mr. Morley and his associates obviously had had considerable experience in the white lead business, if we are to judge from the success with which the concern was operated before and after it was absorbed by National Lead Company. The Minutes of a Directors' meeting in 1890, for instance, disclose a dividend of 10% which, while not of "melon cutting" size common to the times, was an indication of substantial business.

J. R. Morley was elected the first President of the newly incorporated business, but resigned in six months and was succeeded by J. H. Morley. The latter continued to head the concern for several years after it became the Cleveland Branch of National Lead Company.

A Family Project

J. R. Morley Lead Company was a family project, J. H. Morley owning 875 shares and F. H. Morley, C. H. Morley and J. R. Morley owning 200 shares between them, or a total of 1,075 of a total capitalization of 2,000 shares. The officers until C. H. Morley died in 1889 were: J. H. Morley, President; C. H. Morley, Vice President; and F. H. Morley, Secretary and Treasurer.

There are interesting salary items in the Minutes of the Corporation. In 1887 the President received $5,000 and the same salary was accorded to F. H. Morley, Secretary and Treasurer. Two years later the President's salary remained the same, but the Directors voted $2,100 to the Vice President and Treasurer and $2,200 to the Secretary.

OUR FIRST BOARD OF DIRECTORS

92

In the preceding historical sketches of our founding companies mention was made of practically all the white lead pioneers who as officers and directors of the newly incorporated National Lead Company faced the numerous problems of this enormous combination. As a further tribute to these rugged individualists who so ably launched our Company on its road to success and as an added note of interest, our first officers and directors and their respective home cities are listed below:

OFFICERS

W. P. Thompson, President, New York
A. T. Goshorn, First Vice President, Cincinnati
F. W. Rockwell, Second Vice President, St. Louis
Chas. Davison, Secretary, New York

DIRECTORS

E. F. Beale, Philadelphia
Simon Beymer, Pittsburgh
George O. Carpenter, St. Louis
R. R. Colgate, New York
J. H. McKelvy, Pittsburgh
R. P. Rowe, New York
D. B. Shipman, Chicago
A. P. Thompson, Buffalo
W. H. Thompson, St. Louis

SUPPLEMENT TWO

PRODUCT LIST

NL 1 003589

PRODUCTS

SOLD AND MANUFACTURED BY NATIONAL LEAD COMPANY AND ITS BRANCHES, DIVISIONS AND AFFILIATED COMPANIES

Occasionally our salesmen are asked whether National Lead Company manufactures certain products, other than paint and, if so, where can information and prices be gotten.

Such inquiries can be answered easily by reference to the product list on the following pages.

The inquiry should be passed along to the nearest office selling the product, either by the salesman or the prospect, whichever the latter prefers.

Such service has its good-will value, as well as serving the best interests of the Company.

HOW TO USE

It will be observed that the products are classified into the following five groups and in each case are arranged alphabetically:

METAL PRODUCTS
PAINT PRODUCTS
DRY PIGMENT PRODUCTS
OIL PRODUCTS
MISCELLANEOUS PRODUCTS

When a product is located, the next step is to note the numeral or numerals adjacent to it in the column headed "By Whom Sold." Then turn to the "Key" for the name and address of the office or offices handling the product under consideration. The same procedure, of course, applies in the case of the "By Whom Made" column.

KEY FOR CHECKING WHO MAKES AND SELLS PRODUCTS LISTED

A. National Lead Company (Headquarters) 111 Broadway, New York, N. Y.

NATIONAL LEAD COMPANY BRANCHES

1.	**Atlantic** National Lead Company	111 Broadway, New York, N. Y.
2.	**Baltimore** National Lead Company	214 Henrietta Street, Baltimore, Md.
3.	**Boston** National Lead Co. of Mass.	800 Albany Street, Boston, Mass.
4.	**Buffalo** National Lead Company	116 Oak Street, Buffalo, N. Y.
5.	**Chicago** National Lead Company	900 West 18th Street, Chicago, Ill.
	Detroit	1627 West Fort Street, Detroit, Mich.
	Milwaukee	744 North Fourth Street, Milwaukee, Wis.
6.	**Cincinnati** National Lead Company	659 Freeman Avenue, Cincinnati, Ohio
	Atlanta	Bishop Street, Atlanta, Ga.
	Louisville	1320 Heyburn Building, Louisville, Ky.
7.	**Cleveland** National Lead Company	1213 West Third Street, Cleveland, Ohio
8.	**Pacific Coast** National Lead Company	2240—24th Street, San Francisco, Calif.
	Los Angeles	932 Wilson Street, Los Angeles, Calif.
	Portland	1211 N.W. Glisan Street, Portland, Ore.
	Seattle	973 John Street, Seattle, Wash.
	Spokane	N. 908 Howard Street, Spokane, Wash.
	Tacoma	1013 A Street, Tacoma, Wash.
9.	**Philadelphia** John T. Lewis & Bros. Co.	Widener Building, Philadelphia, Pa.
10.	**Pittsburgh** National Lead Co. of Pa.	1376 River Avenue, Pittsburgh, Pa.
11.	**St. Louis** National Lead Company	722 Chestnut Street, St. Louis, Mo.
	Dallas	959 Terminal Street, Dallas, Texas
	Kansas City	1406 West 13th Street, Kansas City, Mo.
	New Orleans	516 Tchoupitoulas Street, New Orleans, La.
	Omaha	2810 A Street, Omaha, Neb.
	St. Paul	102 West Fairfield Avenue, St. Paul, Minn.

AFFILIATED COMPANIES AND DIVISIONS

12.	American Bearing Corporation	429 So. Harding Street, Indianapolis, Ind.
13.	American Lead Corporation	1600 East 21st Street, Indianapolis, Ind.
14.	Blatchford Co., E. W. (Branch)	63 Park Row, New York, N. Y.
15.	Canada Metal Company, Ltd.	721 Eastern Avenue, Toronto, Canada
16.	Combined Metals Reduction Co. (No N. L. ownership)	Stockton, Utah
17.	Evans Lead Corporation	Charleston, West Virginia
18.	Kirk & Son, Inc., Morris P.	2717 South Indiana Street, Los Angeles, Calif.
19.	Magnus Metal Corporation	721 Railway Exchange Building, Chicago, Ill.
	New York	111 Broadway, New York, N. Y.
20.	Master Metals, Inc.	2850 West Third Street, Cleveland, Ohio
21.	National Lead Company, S/A	Avenida Presidente Roque Saenz Pena 567, Buenos Aires, Arg., S.A.
22.	Titanium Pigment Corporation	111 Broadway, New York, N. Y.
	Boston	34 Midway Street, Boston, Mass.
	Chicago	104 S. Michigan Avenue, Chicago, Ill.
	Cleveland	Room 617, Penton Building, 1213 West 3rd Street, Cleveland, Ohio
	Los Angeles	2475 Enterprise Street, Los Angeles, Calif.
	Philadelphia	Widener Building, Philadelphia, Pa.
	San Francisco	350 Townsend Street, San Francisco, Calif.
	St. Louis	Carondelet Station, St. Louis, Mo.
23.	Titanium Division, National Lead Company	111 Broadway, New York, N. Y.

For information about the Baker Castor Oil Company, the Baroid Sales Division and the DeLore Division, see Page 10. Products identifying the lines handled by these organizations are also included under the product group headings.

METAL PRODUCTS

PRODUCTS	BY WHOM SOLD	BY WHOM MADE
Acid Concentrating Plants		
(Simonson-Mantius Vacuum Process)		
Chamber Acid	1	1
Sludge Acid	1	1
Spent Acid	1	1
Acid Separating Plants		
(Simonson-Mantius Vacuum Process)		
Sludge Acid	1	1
Alloys, Die Casting		
Lead	1-2-4-5-6-7-9-10-11-13-15-18-20	1-2-4-5-6-7-9-10-11-13-15-18-20
Tin	1-2-4-5-6-7-9-10-11-13-15-18	1-2-4-5-6-7-9-10-11-13-15-18
Zinc	1-4-5-6-7-10-11-15-18	1-5-7-11-15-18
Alloys, Slush Mold Casting	1-5-7-9-10-13-15-18-21	1-5-7-13-15-18-21
Alloys, For Aircraft Industry (See Kirksite)		
Aluminum Alloy Ingot	18	18
Aluminum Ingot	18	18
Antimonial Lead	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-2-3-5-6-7-9-10-11-13-18-20-21
Babbitt Metals		
Dutch Boy Trademarked	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-7-9-10-11-21
Others—any formula	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-2-3-4-5-6-7-9-10-11-13-18-20-21
Satco Ingot	19	
Bar Tin	1-2-3-4-5-6-7-9-10-11-14-15-18-21	1-2-3-4-5-6-7-9-10-11-18-21
Bars, Lead	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-2-3-4-5-6-7-9-10-11-15-18-20-21
Battery Grid Metal	1-2-3-5-6-11-12-15-18-20-21	1-2-3-4-5-6-11-12-18-20-21
Battery Straps	1-2-6-9-11-21	1-6-11-21
Bearings		
Armature	11	11
Bronze		
Finished	19	19
Rough	15-19	15-19
Bronze Backed, Babbitt Lined	12-19	12-19
Die-Cast	11-15-19	11-19
Journal	19	19
Satco Lined	12-19	12
Bends		
Flanged	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-10-11-15-21
Hardlead	1-2-3-4-5-6-7-9-10-11-15-21	10-11-15-21
Lead	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-10-11-15-21
Reducing	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-10-11-15-21
Blatchford Base (Printers)	5-14	
Block Tin Pipe	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-5-7-9-10-11-15-21
Britannia Metal	1-2-4-5-6-7-9-10-11-15-21	1-9-11-21
Bullet Core Bar Lead	1-2-3-4-5-6-7-9-10-11-15-18-20-21	1-2-3-5-6-7-9-10-11-15-18-21
Burning Lead	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-7-9-10-11-15-21
Bushings, Rough and Finished	19	19
Caulking Lead	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21
Cames, Lead		
Antique	1-2-4-5-7-10-11-15	1-11-15
Plain	1-2-4-5-6-7-9-10-11-15	1-2-4-5-6-7-9-10-11-15
Reinforced	1-2-4-6-7-9-10-11-15	1-7-11-15
Rustic	1-4-6-7-10-11	1-11
Smooth Faced	1-2-4-6-7-10-11	1-2-7-10-11
Casket Trimming Metal	1-2-5-6-7-9-10-11-13-15-18-20-21	1-2-5-6-7-11-13-15-18-20-21
Castings, Non-Ferrous, Rough and Finished	19	19
Chemical Apparatus, Special Lead Lined	1-5-15-21	1-5-15-21

PRODUCTS	BY WHOM SOLD	BY WHOM MADE
Cinch Anchors (See Expansion Bolts)		
Clock Weights	1-3-6	1-3-6
Cocks		
Bibb	1-21	1-21
Hardlead	1-15-21	1-15-21
Plug	1-15-21	1-15-21
Coils		
Lead Covered Copper	1-21	1-21
Lead Lined	15-21	15-21
Special Built-Up, Lead	1	1
Copper Aluminum Hardener	18	18
Counterweights	1-2-3-5-6-7-9-10-11-20-21	1-2-3-6-7-9-10-11-20-21
Discs for Collapsible Tubes		
Antimonial Lead	1	1
Tin Coated	1	1
Electro Cases	1-11-18	1-11
Expansion Bolts		
Cinch Anchors	1	1
Cinch Cylinders	1	1
Cinch Lead Screw Anchors	1	1
Ferrules, Combination	1-2-4-5-6-7-9-10-11-15-21	2-5-6-10-11-15-21
Fittings		
Flanged or Screwed	1-9-15-21	1-15-21
Hardlead Flanged	1-9-15-21	1-15-21
Lead Lined	9-15	15
Lead Lined Soil Pipe	1-9	1
Tin Lined	1-9	1
Flux	5-7-14-21	5-14-21
Fuse Wire	2-3-4-5-7-10-11-15-21	2-3-5-7-10-15-21
Gaskets		
Composition	1-2-3-7-10-11-15	1-2-10-11-15
Lead	1-2-4-5-6-7-9-10-11-15-21	1-2-5-7-9-10-11-15-21
Tin	1-2-5-7-9-15	1-2-5-7-15
Guards, Metal (Bearers)	1-5-10	1-5
Hammer Metal	1-2-3-4-5-6-7-9-10-11-13-15-18	1-2-3-5-7-9-10-11-13-15-18
Hammers		
Babbitt	1-2-4-6-7-10-11-15-18	1-2-4-7-10-11-15-18
Lead	1-2-4-6-7-10-11-15-18	1-2-4-7-10-11-15-18
Hardening Lead	1-2-3-4-5-6-7-10-11-15-21	1-2-3-4-5-10-11-15-21
Homogeneous Bonded Lead Lined Equipment		
Agitators	1-15-21	1-15
Digestors	1-15	1-15
Drums	1-15	1-15
Mixing Equipment	1-15-21	1-15-21
Plating Equipment	15	15
Tank Cars	1-15	1-15
Tanks—Others to Specification	1-15-21	1-15-21
Hoyt's No. 11 Babbitt Metal	1-2-4-5-7-10-11-15-18-21	1-7-10-11-15-21
Impellers	1	1
Impression Lead, Hoyt's		
Plain	1-2-5-6-7-10-11-18-21	1-11-21
Ready to Mould	1-2-5-6-7-10-11-18	1-11
Tin Coated	1-2-5-6-7-8-10-11-15-18	1-11
Ingot Lead	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-2-3-4-5-6-7-9-11-13-15-18-20-21
Key Leads	1-2-3-5-6-7-9-10-15	1-2-3-5-9-10-15
Kirksite "A" Alloy		
"A" Wire	1-2-3-4-5-6-7-9-10-11-15-18	1-5-11-15-18
Kettle-Koater	1-2-3-4-5-6-7-9-10-11-15-18	
Pig	1-2-3-4-5-6-7-9-10-11-15-18	1-5-7-11-15-18
Rolled	1-2-3-4-5-6-7-9-10-11-15-18	

PRODUCTS	BY WHOM SOLD	BY WHOM MADE
Lead Angles	1-2-3-6-7-10-11	1-2-3-10-11
Lead Anodes	1-2-4-5-6-7-9-10-11-15-21	1-2-5-7-9-10-11-15-21
Lead Balls	1-2-4-6-7-10-11-15-21	1-11-15-21
Lead Construction	1-21	1-21
Lead Counterweights	1-2-3-4-6-7-9-10-11-20-21	1-2-3-6-7-9-10-11-19-21
Lead Covered Equipment		
Copper	1-5-21	1-5-21
Non-Ferrous Alloy Pipes	5-6	5-6
Steel	1-5	1-5
Lead Discs	1-2-3-4-5-6-7-9-10-11-21	1-2-3-5-6-7-9-10-11-21
Lead Headed Nails	4-6-9-10	
Lead Lined Chemical Equipment		
Autoclaves	1-5-9-15-21	1-5-9-15-21
Stills	1-5-9-15-21	1-5-9-15-21
Sulphonators	1-5-9-15	1-5-9-15
Lead Plates	1-2-4-6-7-9-10-11-15-21	1-2-6-7-9-10-11-15-21
Lead, Pulverized	1-2-3-4-5-6-7-9-10-11-18-21	1-2-5-18-21
Lead Sinkers	1-2-3-5-6-7-10-11	2-3-5-11
Lead Sleeving	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-5-6-7-9-10-11-15-21
Lead Spacers	1-2-4-5-6-7-9-10-11	1-2-3-5-9-10-11
Lead Wire	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-4-5-6-7-9-10-11-15-18-21
Lead Wool	1-2-3-4-5-6-7-9-10-11-15-18-21	1-5-15-21
Mold Metal, Rubber	1-9	1-9
Music Plates	1-2-5-6-7-10-11-18	1-11
Needle Metal	1-2-9-11-15-21	1-9-11-15-21
Net Leads	1-3-5-6-9-11-15	1-3-5-9-15
Nickel-Bronze	11-15	11-15
Organ Pipe Metal	1-3-5-6-7-10-11-15-21	1-3-5-11-15-21
Ornaments, Lead	1-3-15	1-15
Pewter	1-2-4-5-6-7-10-11-18	1-11
Phosphor Bronze Castings	15	15
Phosphor Tin	1-4-5-6-7-11-15-21	1-11-15-21
Pig Lead	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-3-13-15-18-20-21
Pig Tin	1-2-3-4-5-6-7-9-10-13-15-18-21	1-3-13-15-18
Pinking Blocks	11	11
Pipe		
Block Tin	1-2-3-4-5-6-7-9-10-11-15-18-21	1-5-7-9-10-11-15-21
Brass, Lead Lined	1	1
Brass-Lined Steel	1	1
Brass, Tin Lined	1	1
Copper Lined Steel	1	1
Lead		
Antimonial	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-5-6-7-10-11-15-21
Chemical	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-4-5-6-7-10-11-15-21
Common	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-4-5-6-7-10-11-15-21
Composition	1-2-3-5-7-9-10-11-15-21	1-2-3-5-7-10-11-15-21
Tellurium	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-5-6-7-10-11-15-21
Lead, Tin Lined	1-3-15	1-3-15
Soil, Lead Lined	1	1
Steel	1	1
Steel, Lead Lined	1-15-21	1-15-21
Steel, Tin Lined	1	1
Printers Metals (See Type Metals)		
Pulverized Tin	1-2-3-4-5-6-7-9-10-11-18-21	1-2-5-21
Pumps		
Hardlead Centrifugal Acid	1	1
Lead Vertical Acid	1	1
Tin Lined Hardlead Centrifugal Acid	1	1
Reducers (Lead)	1-2-3-4-5-6-7-9-10-11-15-21	10

PRODUCTS	BY WHOM SOLD	BY WHOM MADE
Ribbon		
Composition	1-2-3-7-9-10-11	1-2-3-7-9-10-11
Lead	1-2-3-4-6-7-9-10-11-15-18-21	1-2-3-4-6-7-9-10-11-15-21
Tin	1-2-4-6-7-9-10-11-15-18	1-2-7-9-10-11-15
Roof Flanges	1-2-3-4-5-6-7-9-10-11-15-18	3-5-11-15
Roofing Sheets, Hardlead	1-2-3-4-5-6-7-9-10-11-15	1-3-11-15
Sash Weights, Lead	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-7-9-10-11-15-21
Screens, Perforated Lead Plates	1-3-6-7-9-10-11	1-9-11
Screws, Brass Trap	1-5-6-7-10-11-15-21	15-21
Sheet Lead		
Antimonial	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-11-15-21
Chemical	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-5-7-10-11-15-21
Common	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-5-6-7-10-11-15-21
Composition	1-3-5-7-9-10-11-21	1-3-5-11-21
Crawlproof	1-4-6-7-9-10-11-15	1-10-11-15
Tellurium	1-2-3-4-5-6-7-9-10-11-21	1-2-3-5-6-7-11-21
Sheet Roofing Metal, Hardlead	1-2-3-4-6-7-9-10-11-15	1-3-11-15
Sheet Tin	1-2-3-4-5-6-7-9-10-11-15-18	1-5-11-15
Shot, Lead (All Sizes)	1-2-3-4-6-7-9-10-11-18-21	1-11
Shrapnel Balls	1-5-6-7-10-11-15	1-11-15
Simonson-Mantius Acid Recovery Plants	1	1
Sink Drains	1-3-7-10-11-15	1-3-11-15
Soil Pipe—Lead	1-3-6-7-9-10-11	1-3-6-7-9-10-11
Solder		
Acid Core	1-2-3-4-5-6-7-9-10-11-18	1-9
Bar (All Sizes)	1-2-3-4-5-6-7-9-10-11-13-15-18-21	1-2-3-4-5-6-7-9-10-11-13-15-18-21
Cake	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-4-5-6-7-9-10-11-15-21
Capping Bar	1-2-3-4-5-6-7-9-10-11-13-15-18-21	1-2-5-6-7-9-10-11-13-15-18-21
Drop	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-5-6-9-11-15-21
Fusible Bar	1-2-3-4-5-6-7-9-10-11-15-18	1-2-3-5-6-7-9-10-11-15
Fusible Wire	1-2-3-4-6-7-9-10-11-15-18	1-2-3-7-9-10-15
Hard	1-3-4-7-10-11-18-21	1-3-7-10-11-20
Ingot	1-2-3-4-5-6-7-9-10-11-13-15-18-21	1-2-3-4-5-6-7-9-10-11-13-15-18-21
Meter Bar	1-2-3-4-5-6-7-9-10-11-13-15-18-21	1-2-3-5-6-7-9-10-11-13-15-18-21
Paste	21	21
Pig	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21	1-2-3-4-5-6-7-9-10-11-13-15-18-20-21
Pulverized	1-2-3-4-5-6-7-9-10-11-15-18-21	1-5-15-18-21
Radiator Bar	1-2-3-4-5-6-7-9-10-11-13-15-18-21	1-2-5-6-7-9-10-11-13-15-18-21
Ribbon or Tape	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-5-7-9-10-11-15-18-21
Rosin Core	1-2-3-4-5-6-7-9-10-11-18-21	1-9-21
Segment (Cut Wire)	1-3-4-5-6-7-9-10-11-18-21	1-5-6-9-11-21
Sheets	1-3-4-5-6-7-10-11-15-21	1-5-11-15-21
Slabs	1-2-3-5-6-7-9-10-11-15-18-21	1-2-4-5-6-7-9-10-11-15-21
Tinners' Bar	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-4-6-7-9-10-11-15-18-21
Triangular Bar	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-4-5-6-7-9-10-11-15-18-21
Wire	1-2-3-4-6-7-9-10-11-15-18-21	1-2-3-4-6-7-9-10-11-15-18-21
Sounding Weights, Lead	1-2-3-4-6-7-9-11-15-18	3-9-11-15
Special Aeroplane Body Pattern Alloys (See Kirksite)		
Special Apparatus	1	1
Spelter	1-2-4-6-7-10-11-15-18-21	1-18
Stamping Metal	1-3-5-6-7-9-11-18	1-3-7-11
Strip Tin	1-2-3-5-6-7-9-10-11-18	1-2-5-7-9-10-11
Tank Connections		
Lead Covered	1-15-21	1-15-21
Lead Lined	1-15-21	1-15-21
Tanks		
Homogeneous Lead	1-15-21	1-15-21
Tin Covered	1-21	1-21
Tin Lined	1-5-15-21	1-5-15-21
Tape, Lead	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-5-6-7-9-10-11-15-21

PRODUCTS	BY WHOM SOLD	BY WHOM MADE
Tellurium Lead	1-2-3-4-5-6-7-9-10-11-15-21	1-2-6-9-10-15-21
Tempering Lead	1-2-3-4-5-6-7-9-10-11-21	1-2-4-5-9-10-11-21
Tin Anodes	1-2-4-5-6-7-9-11	1-2-5-7-9-11
Tin Bars	1-2-3-4-6-7-9-10-11-13-15-18-21	1-2-3-4-6-7-9-10-11-13-15-18-21
Tin Pipe	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-5-7-9-10-11-15-21
Tin Wire	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-5-6-7-9-10-11-15-18-21
Tinning Compound	1-3-4-5-6-7-9-10-11-15-18-21	1-2-5-15-18-21
Tint Plates	1-5-6-7-11	1-2-11
Traps, Lead	1-2-3-4-5-6-7-9-11-15-21	1-2-3-5-6-11-15-21
Tubes		
Lead	1-2-3-4-6-7-9-10-18-21	1-2-3-4-6-7-9-10-21
Lead Covered	1	1
Lead Lined	1-3	1-3
Tin	1-2-3-6-7-9-18	1-2-3-7-9
Tin Covered Brass	1-4	1
Tin Covered Copper	1	1
Tin Covered Steel	1	1
Tin Lined Brass	1	1
Tin Lined Copper	1	1
Tin Lined Steel	1	1
Tubing		
Antimonial	1-2-3-4-5-6-7-9-10-11-15	1-2-3-5-6-7-9-10-11-15
Block Tin	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-5-7-9-10-11-15-21
Composition	1-2-3-5-6-7-9-10-11-21	1-2-3-5-7-9-10-11-21
Hardlead	1-2-3-4-6-7-9-10-11-21	1-2-3-6-7-9-10-11-21
Lead	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-5-6-7-9-10-11-15-21
Tellurium	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-5-6-7-9-10-11-15-21
Type Metals		
Autoplate	1-2-5-6-7-14-18-21	1-2-5-7-11-13-18-21
Electrotype	1-2-5-6-7-11-13-14-15-18-21	1-2-5-6-7-11-13-15-18-21
Intertype	1-2-6-7-9-10-11-13-14-15-18-21	1-2-7-9-10-11-13-15-18-21
Linotype	1-2-5-6-7-9-10-11-13-14-15-18-21	1-2-5-6-7-9-10-11-13-15-18-21
Monotype	1-2-5-6-7-9-10-11-13-14-15-18-21	1-2-5-6-7-9-10-11-13-15-18-21
Stereotype	1-2-5-6-7-9-10-11-13-14-15-18-21	1-2-5-6-7-9-10-11-13-15-18-21
Typograph	1-2-7-10-11-13-14-18	1-2-7-10-11-13-18
Valves		
Lead Lined Acid	1-21	1-21
Tin Lined Acid	1	1
United Hardlead	1-15-21	1-15-21
Washers, Lead	1-2-3-4-5-6-7-9-10-11-18-21	1-2-5-9-10-21
Wedge Lead	1-2-3-4-5-6-7-9-10-11-15-21	1-2-3-4-5-6-7-9-10-11-15-21
Wire		
"A" Wire (See Kirksite)		
Iron, Lead Coated	1-9	1-9
Lead	1-2-3-4-5-6-7-9-10-11-18-21	1-2-3-4-5-6-7-9-10-11-18-21
Solder	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-4-5-6-7-9-10-11-15-18-21
Tin	1-2-3-4-5-6-7-9-10-11-15-18-21	1-2-3-5-6-7-9-10-11-15-18-21
Zinc		
Special High Grade	1-3-4-5-7-10-11-15-16-18	1-16
High Grade	4-5-7-10-11-15-16-18	16
Prime Western	1-2-4-5-6-7-10-11-15-18-21	1-18
Zinc Base Alloys		
Die Casting	1-5-7-10-11-15-18	1-5-7-11-15-18
Gravity Casting	7-10-11-15-18	7-11-15-18
Kirksite	1-2-4-5-6-7-9-10-11-15-18	1-5-7-11-15-18
Slush Casting	1-5-7-9-10-11-15-18-21	1-5-7-11-15-18-21

PAINT PRODUCTS

Products	By Whom Sold	By Whom Made
Colors-in-Oil (Full Line)	1-3-4-5-6-7-8-9-10-11-21	8-9
Painting Equipment		
Brushes, Ladders, etc.	8 (Sold only by Pacific Coast Branch)	
Putty	8-9	9
Ready Mixed Paints		
Enamels	8-21	8
House Paints (Exterior and Interior)	1-3-4-5-6-7-8-9-10-11	1-5-8
Industrial Paints	8-21	8
Lacquers	8-21	8
Sundries	8-21	8
Varnishes	8-21	8
Red Lead—Paints		
Liquid Red Lead No. 1—No. 5 (Black Finish Coat)—Marine	1-3-4-5-6-7-8-9-10-11	1-8-9-11
Metal Primer No. 050	1-3-4-5-6-7-8-9-10-11	1-8-9-11
Quick Drying	1-3-4-5-6-7-8-9-10-11	8-9-11
Semi Quick-Drying	1-3-4-5-6-7-8-9-10-11	9-11
No. 25	1-3-4-5-6-7-8-9-10-11	1-8-9-11
Paste in Oil	1-3-4-5-6-7-8-9-10-11	1-8-9-11
Wall Primer	1-3-4-5-6-7-8-9-10-11	1-8
White Lead		
Paints—Pure White Lead		
Exterior Primer	1-3-4-5-6-7-8-9-10-11	8-9-11
Outside White	1-3-4-5-6-7-8-9-10-11	1-5-8
White Lead in Oil		
Heavy Paste	1-3-4-5-6-7-8-9-10-11-21	1-5-8-9-11
Soft Paste	1-3-4-5-6-7-8-9-10-11-21	1-5-8-9-11
Pulp	1-5	1-5

DRY PIGMENT PRODUCTS

Products	By Whom Sold	By Whom Made
Barium Sulphate	See Baroid Sales Division & DeLore Division	Page 10
Barytes	See Baroid Sales Division & DeLore Division	Page 10
Blanc Fixe	See DeLore Division	Page 10
Calcium Carbonate	See DeLore Division	Page 10
Extender Pigments	See DeLore Division	Page 10
Fillers	See DeLore Division	Page 10
Lead Silicates		
Bisilicate	1-6-7-10-17	17
Monosilicate	1-6-7-10-17	17
Litharge		
Color Makers	1-3-4-5-6-7-8-9-10-11-17-18	1-5-8-9-11-17-18
Fumed	1-3-4-5-6-7-8-9-10-11-17-18	11-17
Glass Makers	1-3-4-5-6-7-8-9-10-11-17-18	1-8-9-11-17-18
Insecticide	1-3-4-5-6-7-8-9-10-11-17-18	1-8-9-11-17-18
Oil Refiners	1-3-4-5-6-7-8-9-10-11-17-18	1-8-9-11-17-18
Regular	1-3-4-5-6-7-8-9-10-11-17-18	1-8-9-11-17-18
Storage Battery Oxides	1-3-4-5-6-7-8-9-10-11-17-18-21	1-8-9-11-17-18
Varnish Makers	1-3-4-5-6-7-8-9-10-11-17-18-21	1-8-9-11-17-18
Mineral Primers	See DeLore Division	Page 10
Orange Mineral	1-3-4-5-6-7-8-9-10-11-17	1-9-11-17
Red Lead		
Barton	1-3-4-5-6-7-8-9-10-11-21	1-9-11-18
Fumed	1-3-4-5-6-7-8-9-10-11-21	11-17
Furnace	1-3-4-5-6-7-8-9-10-11-21	1-8-9-11-17-18
Glass Makers	1-3-4-5-6-7-8-9-10-11-21	1-8-9-11-17-18
Regular	1-3-4-5-6-7-8-9-10-11-21	1-8-9-11-17-18
Storage Battery	1-3-4-5-6-7-8-9-10-11-21	1-8-9-11-17-18

PRODUCTS	BY WHOM SOLD	BY WHOM MADE
Titanium Pigments		
"Titanox"—A (Anatase)	22	23
"Titanox"—RA (Rutile)	22	23
"Titanox"—B 30 (Barium Pigment)	22	23
"Titanox"—C (Anatase—Calcium Pigment)	22	23
"Titanox"—RC (Rutile—Calcium Pigment)	22	23
"Titanox"—L (Lead Titanate)	22	23
Titanium Sulphate Cake	22	23
White Lead		
Basic Lead Carbonates		
Carter and HTS	1-3-4-5-6-7-8-9-10-11-21	1-5-8
No. 111	1-3-4-5-6-7-8-9-10-11-21	8-9-11
No. 333	1-3-4-5-6-7-8-9-10-11-21	8-9-11
Basic Lead Silicate		
45X	1-3-4-5-6-7-9-10-11	9
Basic Lead Sulphates		
Blue	1-3-4-5-6-7-9-10-11	
Dutch Boy (White)	1-3-4-5-6-7-9-10-11	11
Whiting	8-21 See DeLore Division	Page 10

OIL PRODUCTS

Castor Oil, its derivatives and specialties	See Baker Castor Oil Co.	Page 10
Flatting Oil	1-3-4-5-6-7-8-9-10-11-21	1-8
Lead Mixing Oil	1-3-4-5-6-7-8-9-10-11	1-8
Linseed Oils		
Blown	1-5-6-9	1-5-9
Boiled	1-3-4-5-6-7-8-9-10-11	1-5-9
Dutch	1-4-5-6-9	1-9
Heat Bodied	1-5-6-9	1-9
Raw	1-3-4-5-6-7-8-9-10-11	1-9
Refined	1-5-6-9	1-9
Refrigerated	1-5-6-9	1-9
Special Processed	1-5-6-9	1-9
Liquid Drier	1-4-5-6-7-8-9-10-11	1

MISCELLANEOUS PRODUCTS

Copperas (Iron Sulphate)	23	23
Copper Sulphate	18	18
Hyposulphite of Lead (black and white)	1-9	9
Lead Acetate	1-6	
Lead Formate	A	9
Linseed Meal	1-9	1-9
MacIntyre Magnetite (Iron Ore)	23	23
Molspray	1-6	1
Oil Well Drilling Muds and Materials	See Baroid Sales Division	Page 10
Plumb-O-Sil (Precipitated Lead Silicate)	A	9
Pyrites Cinders	23	23
Sodium Sulphide—60% Flaked and Solid	23	23
Sulphuric Acid	23	23
Tribase (Tribasic Lead Silicate)	A	9
Zinc Chloride Solution (Chromated Solution)	18	18
Zinc Sulphate		
Solution	18	18
Flake	18	18

BAKER CASTOR OIL COMPANY

120 Broadway, New York, N. Y.

Products: The following list does not include all the castor oils, their derivatives and specialties. manufactured and sold by The Baker Castor Oil Company, but does cover their main lines:

- Baker's Castor Oil
  - Baker's AA Cold Pressed
  - Baker's Crystal "O" Cold Pressed
  - Baker's No. 3 Castor Oil
- Baker's Castung Oils (Dehydrated Castor Oils for Varnishes and Lacquers)
  - No. 103
  - No. 403-101–G to H Body
  - No. 403-101–Z and Z3 Body
  - No. 504–U to V Body
  - No. 504–Z3 Body
- Baker's Processed Oils (Solvents and Plasticizers for Nitro Cellulose Esters and Ethers)
- Baker's P Line Alkyl Ricinoleates (To impart flexibility to pyroxolin compounds)
- Baker's AN Series (For plasticizing water finishes—glue, casein, shellac)
- Baker's Ricinoleic Acids (Raw Materials for Alkyd Resins)

BAROID SALES DIVISION

NATIONAL LEAD COMPANY

830 Ducommun Street, Los Angeles, Calif.
1113 Second National Bank Building, Houston, Texas
502 Tulsa Building, Tulsa, Okla.

Products: The following list is representative of the products handled by this Division:

- Anhydrox
- Aquagel
- Baroid
- Baroco
- Barium Sulphate
- Barytes
- Bentonite
- Fibertex
- Glass Makers Barite
- Impermex
- Micatex
- Smentox
- Stabilite
- Zeogel

DE LORE DIVISION

NATIONAL LEAD COMPANY

Carondelet, St. Louis, Missouri

Products: The following list is representative of the products handled by this Division:

- Barium Sulphate
- Barytes (Refined Water Ground)
  - Foam-A
  - Baryta-White
- Blanc Fixe
- Calcium Carbonate
- Extender Pigments
- Fillers
- Mineral Primers
- Whiting
  - Verablanc
  - C-C-O-White