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The  
Wonder Book  
of Lead

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## The Wonder Book of Lead

You shall read of this wonderful metal—older than the ruins of ancient Greece, with much romance and beauty in it.

If you will read these pages, you will learn much that will surprise you—much that will repay you for your time.

You will find that in your daily life the uses of lead are countless. In some of its forms, lead's presence in your business life, in your home or social activities is often unsuspected, but vitally important.

Some of this knowledge of lead may be of practical benefit to you. Whether it is or not, we feel sure that you will find entertainment and educational interest in this little book.

### Lead and Electric Devices

You do not think of lead when you start your automobile, or turn on the lights of your car. Yet, these are very largely made of lead.

Inside the battery are "grids" (perforated plates) of hard lead, i. e., metallic lead hardened with a small admixture of antimony.

Upon these lead grids is spread a paste made of red-lead in the case of the positive plates and litharge in the case of the negative plates. Both red-lead and litharge

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are oxides of lead. These lead-oxide covered plates are immersed in sulphuric acid called the electrolyte, held in a hard rubber container. Even the hard rubber container contains lead. The chemical reaction between the plates and electrolyte with which the battery is filled produces electric energy.

The electric storage battery has a thousand duties to perform. It furnishes the power for operating submarines, great diesel engines and railway signals. You will find it in central lighting stations, factories, mines, wireless and telephone plants.

And the hydrometer, an instrument used to test the liquids in these batteries by recording the specific gravity, is weighted with leaden shot and the glass of which it is made often contains lead.

#### When the "Fuse Blows Out"

Sometimes your electric lights may go out suddenly. A fuse has blown out. Do you realize what that means? The fuse is nothing more than a little section of pure lead wire inserted into the circuit of copper wire which carries the electric current. When a fuse "blows" the lead wire in the fuse has melted because an amount of current heavier than the wire should carry has entered them and overheated them. The melting of the lead wire has broken the current and stopped its flow thru the house, thus preventing a possible fire danger.

The electric line is made of the weakest part of the electric line is made of the weakest part of the electric line. If there is a weak point in the electric line, it will blow out. The electric line is made of the weakest part of the electric line. If there is a weak point in the electric line, it will blow out. The electric line is made of the weakest part of the electric line. If there is a weak point in the electric line, it will blow out.

power houses. But for it every costly electric device used would be in constant danger of destruction by the accidental overloading of the line with too strong a current.

Lead is used all along your electric system. It is in the storage batteries, in the cables which fasten wires together, in the electric boxes and in the rubber insulation wherever used. Also the telephone cables, which lie next to the twisted wires containing electricity, are sheathed in lead. Lead is used for this purpose partly on account of its flexibility, allowing the cables to be bent, and partly because of its resistance to moisture and the action of the elements.

Electric light bulbs are made of the superior lead glass because of the greater heat resistance which such glass affords and its greater brilliancy.

#### Bringing Unseen Stars to Our Eyes

You know that by the aid of telescopes, astronomers are able to study stars that were previously hidden to men—that as telescopes become more powerful, more stars and planets are discovered.

But perhaps you never knew that lead, the gray, heavy, unyielding metal, is an ingredient of the glass from which the finest telescopic lenses are made. Lead gives the qualities necessary to bend or refract the rays of light, increasing the power of the glass. In order to attain the desired object, the metallic lead is first burned in a furnace in the presence of oxygen at a high temperature. The lead is thereby turned into lead oxide, called red lead, which is an orange-red powder. This is mixed with the sand and other materials from which ordinary glass is made and the resulting glass is very different in its qualities from that made without the lead.

Apart from the knowledge that astronomers gain thru the telescope and pass on to us, this information about the heavens is made of practical benefit. It enters into the common affairs of our life. Time and tide, the seasons, in some ways the weather, are better understood because the telescope has brought the solar system down to earth.

#### There Is Lead in Other Lenses

Have you ever looked thru a microscope and seen the germ life that exists in a single drop of supposedly pure water—strange mysterious creatures, each one with some definite function for good or evil in the lives of man?

The vaccination made on your arm, the serum that may save you from diphtheria, the treatment with x-rays and molasses that protect you by their action on germs—all these were made possible when the powerful lenses of microscopes told men that beyond the smallest object the human eye can see, there are creatures that affect the progress and happiness of us all.

If you are a motion picture enthusiast, you have seen romance, foreign countries, the world's cities and their commercial or other human activities unfold before your eyes, because of the power of the lead glass lens. Pictures of the greatest dramatic productions of the past and present are brought to you alive; you may be a thousand miles away from the stage on which they are played.

Your camera and its lens keep alive for you the faces of people and the forms of things you love. By the physical history of the world is being made day by day. Should there be some collision due just eyes, spectacles and reading glasses will help you to see more clearly.

The glass for all these lenses, of whatever sort, requires lead.

#### The Jeweler's Indebtedness to Lead

It is always a source of wonder to the average person how imitation diamonds and other jewels can be made so perfect as to rival the mined jewels. Few know that they owe their brilliance to lead. The latter enters into their composition in the same way as explained elsewhere in connection with quality glass. The metal is first changed into litharge or red lead and mixed with the other ingredients.

Lead is also an important asset to jewelers in other ways. They use lead anvils, hammers and mallets in working up the stones upon which they are to be set. The reason for this is well explained here. It is lead's remarkable malleability which makes it suitable. Lining cups are made with a lead alloy base covered with a thin plating of gold or silver. Plated ware is composed of a white metal which has lead in it.

Lead weights are the actuating force in some clocks as springs are in other kinds. Pendulum bobs are also often made of lead.

#### In Assaying Gold and Silver

Writing of jewelers reminds us that lead aside in the form of litharge is used in assaying or analyzing gold and silver ore, the metals that form the basis of the jewelry business.

When gold or silver ore is brought to the assayer, it is crushed and heated to a high temperature. Two fused litharge and charcoal are added with the ore. The heat and charcoal change the litharge back to metallic lead. The gold or silver particles unite with

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the molten lead and are poured off, thus separating the gold or silver from the quartz and other substances combined in the ore. Separating the gold or silver from the lead, by means of oxidation in a furnace, is a very simple process. The lead oxidizes. The gold or silver doesn't.  
The amount of gold or silver obtained by this method establishes the value of the ore.

#### Making All Sorts of Things Tight

Contrast lead's utility in the jewelry store and in the device as the grindstone. A grindstone has a hole in the middle. An axle is centered in the opening and molten lead is poured into the space between the axle and stone to hold the former in the exact center.

In a similar way 3,000 years ago, Assyrians fastened eyeballs in holes drilled in stone by pouring molten lead into the hole around the ball. This practice is important to industry even today. Did you ever stop to think how things are fastened to a stone or brick wall? It is easy enough to fasten things to wood. All we need to do is to drive in a nail with a hammer or use a screw. The wood fibers are elastic and when the nail or screw is driven in, the wood presses so tightly against the intruder that it is difficult to pull it out. But with stone, brick or concrete it is very different. Try to drive a nail or screw into these materials. You succeed only in crumbling the hard, brittle material away, and when you finally have made a hole your nail or screw fits so loosely that it will drop out of its own weight. It is worthless for the purpose of attaching an additional object. Here is where lead comes in. Ingenious man has for centuries solved the problem by melting lead and pouring it into a hole around a bolt. When the lead cools it unites the bolt

with the stone or concrete wall so snugly that a great weight may be suspended from it. Large iron pipes, such as gas and water pipes, are also made snug at the joints by pouring molten lead in the joints.

In recent years improvements have been made in the use of lead for "packing," as these practices are called. Instead of melting the lead, one of the modern devices is to shred the lead into threads and pack it into the hole around the bolt or into the pipe joint with a hammer and tamping tool. Owing to the metal's great malleability, the lead strands pack together into a dense, compact mass, practically the same as if the metal had been poured in hot and allowed to cool. This shredded lead is sometimes called lead wool and is especially valuable in packing gas-pipe joints where the use of fire might ignite escaping gas. It is also superior to the molten method for pipe joints where motion of the pipes might loosen a poured joint.

Another modern version of the use of lead for making things tight is the expansion bolt. This consists of a bolt upon which is placed a threaded iron nut, the sides of which are tapered, like a part of a cone. This conical iron nut fits into a lead washer. A hole is made in the stone or brick just large enough to admit the lead washer. The workman then forces the iron nut into the lead ring or washer and drives them both into the hole. The iron nut expands the soft lead washer against the sides of the hole and into every crevice, thus anchoring all the washers with the bolt firmly into the hole. This is the strongest fastening possible in a stone or concrete wall or floor.

The thousands of seats in the famous Yale Bowl at New Haven are anchored to the terraced concrete floor by means of these lead expansion bolts; on many piers which nowadays are frequently made of concrete, the mooring posts to which great vessels are tied up are

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held securely in place by the same sort of device only larger and heavier. Railroad tracks are secured to concrete and gas or water piping is conducted along the sides of walls by means of these lead expansion bolts. Hundreds of similar uses are found for them.

#### Lead in Your Home

No fact about lead is more striking than its presence in your home life. The glazed surface of porcelain bathtubs and the tiled walls of bathrooms and kitchens contain lead. It is present in the rubber stopper of the waste pipe.

Your shaving cream and tooth paste may be in collapsible tubes made of lead, coated with tin within and without. The foil wrapper about the cigarettes in your pocket is tin-covered lead.

The tea served in your home probably came across the ocean in a tea chest lined with lead foil so that the tea may be perfectly sealed from air and moisture.

Fine table glasses and cut-glass bowls contain lead. You have often wondered why cut glass is so heavy. It is because it is from one-third to one-half lead. Lead increases refracting power and thus gives cut glass its brilliance.

If your table lamp has a shade of ornamental glass, the shade is made of leaded glass which is as well as the stripes which are of lead as in the design.

#### Lead at Every Meal

Perhaps that heading doesn't sound so appetizing to you, but let some dairy repast be served on fine translucent china and the attractiveness of the dish is increased. The small part of the attractiveness of the meal is due to the lead in the china which makes the china attractive—that makes possible that smooth, hard, delicate glass on the surface.

Stop a moment and think how often pottery glazing enters into your life. There is the bathtub and the wash bowl, and the kitchen sink and the tiled walls mentioned on another page. There are the glazed dishes in which the cooking is done, from which you eat and drink. And the glazed vases on your mantelpiece. And then there are the porcelain electric insulators that carry your telephone and electric wires.

All these china and porcelain articles are molded from clay. The tough biscuit ware, as it is called at this stage of the process, is then baked and hardened; then dipped in water pulp made of white-lead or litharge (a lead oxide) and other glazing materials. This leaves a deposit on the surface which, when fired, melts and fuses into the biscuit ware and forms the glaze with which you are familiar.

#### Stopping the Leaks

If there is ever a leak in the water pipes in your house, you know how simple a matter it is for a plumber to repair the hole. The solder used is made of lead and tin. The peculiar virtue which makes a lead-and-tin solder valuable is that this alloy melts at a lower temperature than either of the metals does alone. Tin melts at 450°F. If it were desired to join two pieces of tin together, it could not be done by melting tin and applying it to the joint, for it would require 450 degrees of heat to melt the solder and that would melt the work to be joined. But add some lead to the tin, making a lead-tin solder. You now can melt this solder by applying only 250 degrees of heat, and the tin you are working on will not now melt. The same principle allows us to join lead wires by using a lead-tin solder, as the lead wires will not melt until raised to 620°F., while the lead-tin solder will melt at a point 252 degrees below that.

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### The Toys the Children Use

You remember Field's beautiful poem:

"... And the little toy soldier is red with rust,  
And the musket moulds in his hands."

The Little Boy Blue of today plays with toys that do not rust or mould. His soldiers are made of lead. The fine casting quality of lead permits it to be moulded into an infinite variety of shapes. Therefore, the toy-makers use it extensively.

The whistle which he blows with such gusto is of white metal containing lead.  
And the toys that father likes best (his golf sticks) are balanced in some cases with lead.

### Lead to Destroy Friction

Not only must the moving parts of machinery be made as smooth and anti-frictional as possible but, as the strain of machinery comes in large measure on the bearings, these must be made of proper materials to resist the pressure. Bearings are the stationary parts of the machine which support the rotating parts. They must be hard enough to withstand the load and still be of softer metal than the shafts that rotate in them, because the softer metal will take whatever damage may come from grit or lack of alignment, and it is much less expensive and less trouble to replace a journal bearing than to take down and replace a journal shaft. Therefore lead, combined with tin, antimony and in some instances copper, is used to make a suitable alloy.

Engine bearings, dynamo and motor bearings, hose shafts, counter-shaft, hauler and pulley bearings, and those required for heavy stamping, rolling or grinding machines all contain lead, except in some cases where the greater resistance of a tin-base metal is a more exact-

Lead-tin solder adheres to most metals so as to make perfect joints. Aluminum is an exception. It requires a special solder.

Canners use lead-tin solder extensively in sealing the fruit and vegetable cans, with which you are very familiar.

### Lead—the Healer

Before we leave your house we must touch on the medicinal properties of lead.

Lead is a healer. Its value lies especially in counter-acting the effects of blood poisoning, skin diseases and burns. In some hospitals a white-lead paste is applied to burns. Sugar of lead (lead acetate) is a standard remedy for poisoning from poison ivy.

You know well the powers of old-fashioned mustard plasters to relieve pain. Have you ever used a lead plaster? It is effective when applied to wounds. Sugar of lead and lead plasters are found in practically every drug store.

### Protecting by Destroying

As a means for the protection of your home and your country lead stands foremost. The policeman maintaining law and order with the bullet and a lead-weighted club. Lead is the base of all rifle and machine gun bullets. Lead is the base of defense of country. They must be of lead because it has the necessary density to give the bullet its momentum. Steel may be employed for the bullet in the target, but for use as the bullet itself. Straps of lead which contain lead balls are mighty defenders of the country in wartime.

The farmer uses lead ammunition to protect his livestock and his crops from ravaging animals.

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the element than the anti-frictional qualities of lead. In such cases a bearing metal containing no lead is used. In either case the bearing is soft enough so that under pressure the wear comes on the bearing, not on the shaft.

#### Retarding Chemical Action

Lead is the only convenient metal which will resist certain acids. Therefore where these acids are made or used, lead is usually necessary in the conductors and in the pipes which convey the corrosive liquids from place to place.

In making sulphuric acid the acid chambers are usually of "chemical lead." This is metallic lead which contains a very slight percentage of copper. This combination of metals better resists certain forms of chemical action.

Iron vessels are "plumbated" or coated with lead to resist the action of acids. Even power pumps which are used to force corrosive chemicals thru pipes in factories are lead-lined.

#### What Rubber Means to You

Think what rubber means to civilization—to you. From your rattle and rolling ball of babyhood to your pipe-stem and cigarette holder, rubber enters into your daily life at every step. Your rubber boots, your pipes, mechanical goods, such as neckties and belting, garden hose, electrical insulation, telephone parts, water-proof clothing, fountain pens, combs, sporting goods, automobile tires and a multitude of other things. Where can you go and what can you do without rubber?

And then when you know that there is lead in nearly all rubber, and that the rubber industry is but one of

many where lead plays a vital part, you begin to realize what a tremendous influence lead has on your ways of life.

Rubber, as you no doubt know, comes from South American and East Indian forests in the form of a milky or latex secured from trees much as we secure sap from our domestic maples. It is congealed into a soft and semi-plastic crude gum by treatment with acid or smoke and comes here in that form. But in this state it lacks the toughness, elasticity and resiliency that make it so valuable to us. So it has to be cured—that is, heated and combined with sulphur and other materials, among which are inorganic, basic lead sulphate and white-lead—all derivatives of lead, the "wonder metal."

The next time you buy a rubber ball and think, "How can they make it so cheaply?" just remember that the time required for the manufacture was shortened by the use of litharge. And when you sometimes wonder what makes a particular rubber article very heavy, recall that it is probably due to the lead in its composition.

#### Fuel for Your Motor Car

Give a thought to that colorless, volatile liquid that makes your automobile go—gasoline. Gasoline and other light mineral oils, as you know, are made by refining crude oil. Crude oil or petroleum seeps up from the ground in the form of a black, ugly liquid. Compare it with clear gasoline, kerosene or with snow-white paraffine, all of which are extracted from it. It's hard to realize that these can be the products of the same substance, but they are. And lead plays a part in their refining.

The refining oils, such as gasoline and kerosene, are secured from the crude oil by distillation. But far substances as well as sulphur are contained in the so-called oils as they come from the wells. These give the oil a

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yellow fumes and cause it to smoke when burned. To remove the tar the oil is treated with sulphuric acid; then to remove the sulphur and the remaining trace of sulphuric acid, lead in the form of sodium plumbite is used. Litharge, a lead oxide, is dissolved in caustic soda to form the sodium plumbite which is agitated with the oil. The lead and sulphur combine, forming lead sulphide, and this settles to the bottom. The lead sulphide is removed, leaving the oil refined and clear.

#### Lead is as Old as History

Lead pipes had their place in the heyday of the early Roman Empire. Some of this pipe, 2,000 years old and in perfect condition, has been unearthed from ruins. From that period until the present day lead has been used for water and drain pipes. Regulations in many American cities demand that lead water pipes connect houses with the street mains.

Lead does not rust. Consequently it is called into play as a lining for iron pipes and valves for water supply. For certain uses lead pipe is lined with tin, and is sometimes covered with the same metal.

#### Many Organ Pipes Are Lead

When the inspiring music of the pipe organ in your church seems to vibrate in your blood, it is in your thoughts with lead. At such times which help to produce the beautiful tones; but some time when you are contemplating the other wonders of that noble instrument, you are aware that the organ pipes are largely made of lead. Formerly they were made of tin, but tin is too soft and buckled up with lead alloy because the non-vibratory character and the total quality of the lead alloy are better.

Incidentally, the player-piano in your home or in your neighbor's house may contain lead tubing and piano key leads.

While we are speaking of music, do you know that in your talking machine the speed of the mechanism is regulated by governor balls made of lead.

#### To Catch Elusive Fish

If you have fished—and who hasn't?—you know how important lead sinkers are in certain branches of the sport to carry the hook down to the desired depths. The weight of lead for its bulk makes it the proper metal for fish lines. Lead is sometimes used also to cover the shanks of fish hooks.

You will probably find lead wherever you find a need of compact weights for any purpose; not only plumb-bobs, check weights and cash weights but for holding down fishing nets, the hems of ladies' dresses and a multitude of other objects.

#### To Keep Outdoors Out

In the old days, in Europe, when "hot" bow chaps but how good" was the motto, and buildings had roofs made of lead. Lead pipes were used for water supply and for a thousand years ago lead had been employed for all kinds of work. Lead was used for the first time in London, with its leaded windows, in the year 1551. There is the date "A. D. 1589" on a lead pipe in the tower of Windsor Castle. Lead pipe is still in use in a building in Winchester, England, dating from 1620.

Hard sheeting is still used for making roofs water-tight and permanent. In addition lead is used extensively today on buildings, for valleys, ridges, flashings, gravel stops, cupola domes, gutters, eavings, leader

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pipes, bands for securing the pipes to the house, corners, skylights and moldings.  
Lead is the material used for all the above purposes when permanence is desired above cheapness of first cost. There is no "wear out" to lead.

#### Lead as a Fire-Fighter

Automatic sprinkling systems protect thousands of department stores, office buildings and factories against the danger. Along the water pipes project hundreds of heads. In every one there is a thin piece of fusible lead alloy which seals the head. The alloy melts at the low temperature of 160 degrees. If a fire starts a compass directly below melts the alloy in the safety system and this opens the water pipe from which immediately shoots out a stream of water upon the head. The water immediately extinguishes the fire. Incidentally, if the fire department should later be needed there is lead in the rubber hose which conveys the water to the burning building, in the fireman's rubber coat, in his helmet and in his rubber boots.

#### Torpedoes That Protect

While the nation spends hundreds of thousands of dollars for torpedoes as ammunition for its destroyers and submarines, railroads spend their money for torpedoes that protect lives by acting as signals to prevent collisions.

Lead again is an important factor, for the safety torpedoes are attached to a lead bar a foot or more long. The two ends overlap the rail and by being bent around it fasten the torpedoes. If a train strikes this, there is an explosion loud enough to warn the engineer of danger ahead. These torpedoes are used as fog signals on English railroads, especially in the big railroad yards.

Lead helps the railroads to safeguard freight and express packages. Car doors are closed. A wire is wrapped around the fastening. A disc of lead upon which a seal is stamped joins the ends of the wire. The breakage of the seal constitutes a penal offense. Express packages are handled in a similar manner and, by the way, the gas and electric meters in your own cellar are locked with lead seals.

#### What Is a Came?

Do you know what a came is? A came is the strip either of wood or metal which separates the panes of glass in a window. When you go to church and look at the stained glass windows—those colored pictures or ornamental designs of glass—you see a particular kind of came—small strips of lead which hold together the pieces of glass. No other material would be so suitable for this work, for lead comes are flexible and may be curved and bent at will to follow any desired outline in a picture. The non-corroding quality of lead is a further advantage which it possesses for the making of beautiful, stained glass windows.

#### To Give You Correct Weight

Lead is used to balance scales. Where weights are used they are first made lighter than their stamped weight and then adjusted by the addition of lead either poured into a depression or inserted in the form of shot and sealed in a hole.

In some countries, the government inspector's seal is stamped on the lead which is used to make the weight accurate.

### Printing with Lead

The line you are now reading was printed from a metal alloy made with lead. All type metal is chiefly lead, hardened by the admixture of some tin and antimony. Linotype, monotype, electrotypes and stereotypes are made of this combination. Think what lead has meant to men in this one field alone.

### The Floor of the Ocean

You have seen that lead helps to bring the stars down. It also is used to bring up information from the floor of the ocean.

When a ship is approaching a strange coast or a familiar shore in foggy, dark weather, you may see a sailor use a "sounding lead" to determine the depth of the water so that the vessel will not go aground.

A lead weight attached to a line is dropped overboard. In the bottom of the weight is a depression swartled with tallow. When the weight touches the bottom of the ocean the length of line measures the depth. When the lead is pulled up, the particles sticking to the tallow tell what sort of bottom is beneath.

When divers go under the water to bring back treasures lost in sunken ships, whenever they are engaged in under-water construction work, their suits and shoes are weighted with lead to keep them down.

And while we are thinking of the ocean, we may remind you that the keels of racing yachts are weighted with lead because it is heavy, takes up little room for its weight and does not corrode.

### For Preservation

But with the almost limitless uses of lead, the most important of all is the practical, common purpose of

preserving and beautifying buildings, outside and inside.

Iron rusts. Stones crumble. Bricks are eaten away by time. Wood rots. But over them with paint, keep the natural destroyers away, and their "lives" are extended indefinitely.

White lead and red-lead paints are used so extensively that we give them little thought. They resist moisture and the action of known and unknown destructive agents.

Ships, bridges, tanks, machinery—just why enumerate? The whole world is preserved by paint, and people everywhere are learning the wisdom in the phrase, "Save the surface and you save all."

White lead, which is the principal ingredient of good house paint, is one of the most interesting forms of lead. It is what is known by chemists as hydrated basic carbonate of lead and is made by subjecting pure metallic lead to the fumes of acetic acid and of carbonic acid gas in the presence of a moderate heat. The result is a beautiful white powder which is very heavy, very opaque and has a remarkable affinity for linseed oil. In this latter quality it is due much of its peculiar value as a paint pigment, though its fine working qualities, capacity for hiding power and other excellent qualities contribute greatly to its popularity and value.

Red lead, which is just as valuable as white lead as a preservative paint in all cases where light tints are not an essential, is an oxide of lead. The metallic lead is oxidized in a furnace where it is burned in the presence of oxygen. The first burning produces litharge, which has only one atom of oxygen in every one of lead. It is a peculiar fact that no matter how long this litharge is kept in the furnace at the oxidizing temperature, it will not take on any more oxygen, but if the temperature is lowered or if it is taken from the furnace, allowed to

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# The Wonder Metal

Now we have shown you some of the uses of this remarkable metal. There are many other uses on which we have not even touched.

But from what you have read in this little book we feel sure you will agree that the history and service of lead entitles it to be called a "wonder metal."

Additional information regarding any of the uses of lead and products derived therefrom is available in any of the following books, which may be obtained from the National Lead & Co. Pittsburgh, Pa.

NATIONAL LEAD COMPANY  
NEW YORK BOSTON CHICAGO ST. LOUIS  
CLEVELAND PITTSBURGH PHILADELPHIA  
LOS ANGELES SAN FRANCISCO  
NATIONAL LEAD & CO. PITTSBURGH

cool and then heated again to the proper temperature, the yellowish litharge will take on some more oxygen and turns to a brilliant orange color. This new product is red-lead.

It is used not only as paint for the protection of steel and other metals, where it has peculiar value, and for other painting purposes, but is also valuable in other uses which are mentioned in this book, such as in storage batteries, glass, etc.

An interesting thing about red-lead is that it may contain varying amounts of litharge (the lower oxide of lead, Pb<sub>2</sub>O<sub>3</sub>) dependent upon the manner of making it. This litharge usually exists as the core of some of the relatively coarser particles of red-lead. If these litharge cores are present to any great extent they will cause the drying (in a comparatively short time of some litharge) to be made with such red-lead—sometimes within two hours or forty-eight hours. For this reason the better kind of red-lead to use for paint making is that which contains not more than two or three per cent of litharge. Such red-lead is obtainable mixed with linseed oil into a paste form which will remain soft and workable for months.

The great bulk of the red-lead containing larger percentages of litharge is used for storage batteries, for making, etc., where the presence of the litharge is no detriment but rather an advantage.

Lead is present not only in the well-known white pigment, white-lead, and the flaming red-lead, but also in certain color pigments. It is important in making chrome yellow, chrome green and American vermilion.

Flake white, the artist's stand-by, and other "tube colors," are made from lead, and the collapsible tubes in which the artist's colors come are made of lead.

Lead—the lifeline and preserver. It is a wonderful service.

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