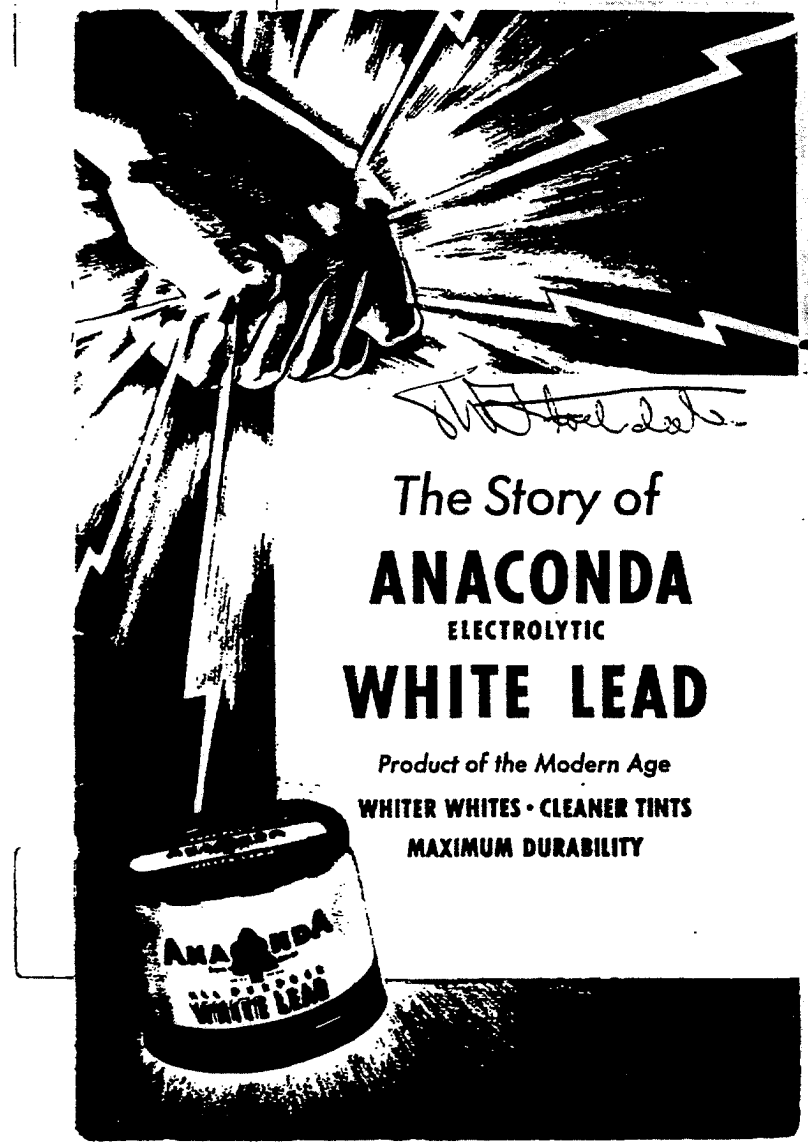



*The Story of*

# ANACONDA

**ELECTROLYTIC**

# WHITE LEAD

*Product of the Modern Age*

**WHITER WHITES • CLEANER TINTS**

**MAXIMUM DURABILITY**

N10034

PNYC00000083



*Typical scene of the rugged Utah country where complex lead-zinc ores are mined — the beginning of Anaconda White Lead.*

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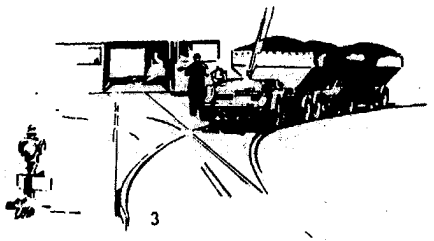
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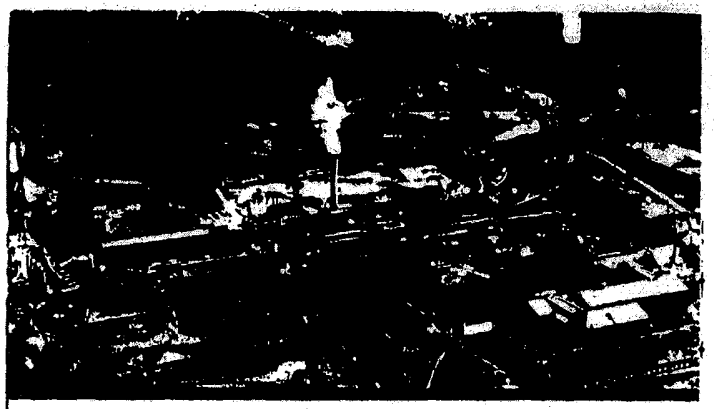


*Head frame at mine shaft.*

THE METAL used in making Anaconda White Lead originates in the vast complex lead-zinc ore bodies found in the state of Utah. Mined and smelted in the West, lead bullion is then shipped to East Chicago, Indiana, where it is refined and used in the production of Anaconda White Lead. A brief, illustrated "*from mine to finished product*" story is presented on the following pages.

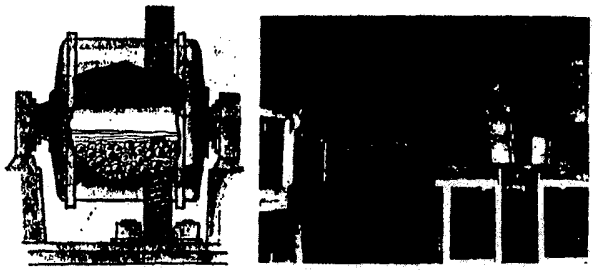
As mined, the ore contains lead, zinc, arsenic, antimony, silver, gold, and copper. This ore is shipped to Anaconda's subsidiary, International Smelting and Refining Company at Tooele, Utah, thirty-five miles southwest of Salt Lake City.





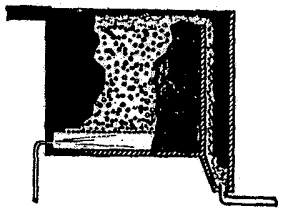
*Plant of International Smelting and Refining Company at Tooele, Utah.*

**AT TOOELE** the ore is first crushed to a fine dust and then subjected to a very interesting process to separate the metals from the non-metallic elements in the ore. This process, known as "flotation", depends for its action on pine oil. The crushed ore and oil, agitated and aerated in water, form a froth of fine bubbles to which minute particles of the minerals stick and are floated away from the rock or non-metallic part of the ore. The minerals thus floated off are called concentrates.

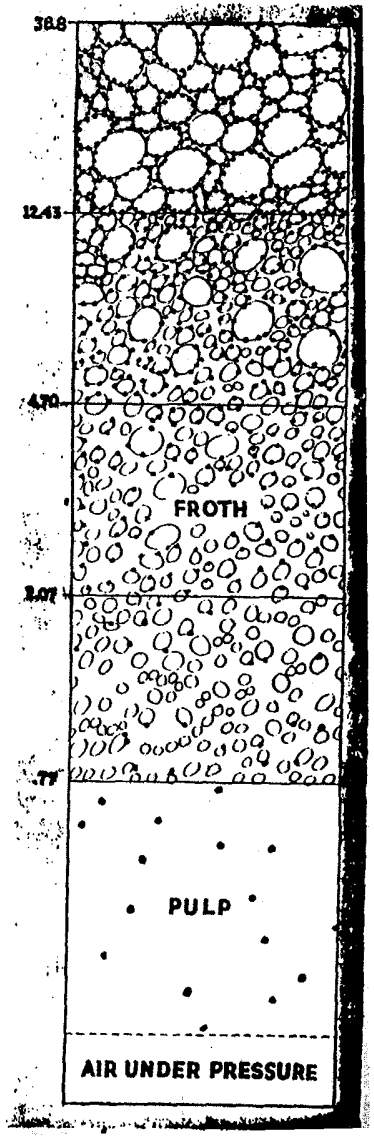


*Ball mills such as this are used to crush the ore for the flotation process.*





*The diagram shows clearly how the bubbles rising through the finely crushed ores carry with them fine particles of the metals, leaving the non-metallic portions to be discarded. The figures indicate how the percentage of concentrates increases at various levels of the tank. The sketch above shows how the concentrate-laden bubbles are removed from the top of the tank and pumped to driers.*

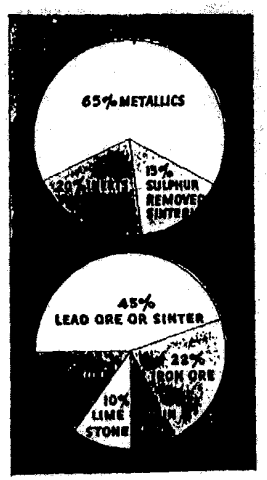





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*Right: Composition of concentrates. Sintering burns up the 15% sulphur content.*

*Right: Composition of concentrates with various slag-forming fluxes added. Charge is now fed to the blast furnace for smelting.*

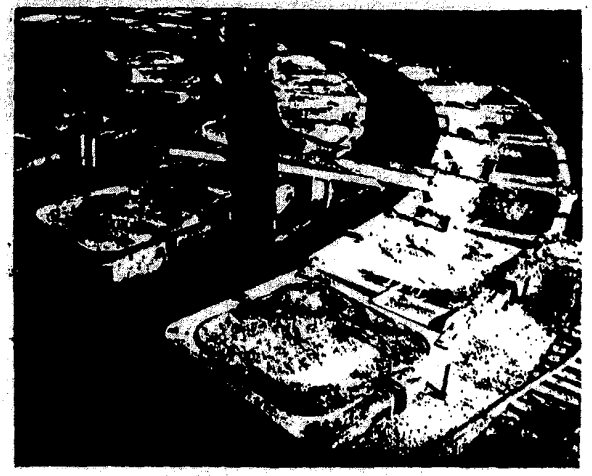



**THE CONCENTRATES** thus formed are dried and go through a process known as sintering. Sintering burns the sulphur from the concentrates and forms a clinker of fine materials. It now remains only to mix the clinker with various fluxes, materials which combine with unwanted elements to form a slag, and to feed the resultant charge to a blast furnace for smelting.



*Tapping a blast furnace.*

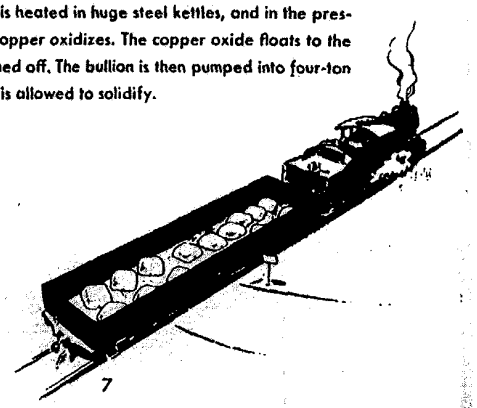




*Casting lead bullion in four-ton moulds.*

**THE BLAST FURNACE** is a reducing furnace where metallics in combination with other elements are reduced to the metals themselves. Remaining non-metallics are discarded as slag.

The blast furnace produces actual metal which, even though other metals are present, looks exactly like lead. This metal is called bullion. It is heated in huge steel kettles, and in the presence of air the copper oxidizes. The copper oxide floats to the top and is skimmed off. The bullion is then pumped into four-ton moulds where it is allowed to solidify.





PNYC00000086



*Home of Anaconda White Lead—East Chicago, Indiana*

These pigs or blocks of bullion are removed from the moulds and shipped by rail to East Chicago, Indiana, for refining.

**THE ANACONDA PLANT** at East Chicago, Indiana, 20 miles southeast of Chicago, receives the four-ton blocks of bullion from the West. Here the various metals present in the bullion are separated by the Parkes' process. A good quality of common lead is finally obtained, and from this Anaconda White Lead is made.

First, the four-ton blocks are removed from the car by heavy tongs into a kettle for melting down. Thus the refining begins.

*Refining starts with melting down the four-ton pigs.*





*Slaked lime is added to the molten metal.*

To the surface of the molten bullion, lime is added—common slaked lime, such as the builder uses. The temperature is raised, and by agitation and the introduction of high pressure air beneath the surface of the bullion, the metal is "softened".

The lime then combines with the arsenic and antimony present, forming a dross which floats to the surface and is readily skimmed away. These by-product metals are, of course, sal-

*Arsenic and antimony combine with the lime and are skimmed off.*





PNYC0000087



*Molten metal is pumped to the desilverizing kettles where zinc is added.*

vaged as was the copper, previously removed. The metal in its molten state can be pumped like water and is so transferred to the desilverizing kettles where the gold and silver are removed. This is accomplished by the addition of zinc which again forms a dross. This dross floats to the top and is skimmed away by hand and treated by another process to recover the precious metals.

The lead, with the exception of the zinc content, is now com-



*Dross carrying silver and gold is removed by skimming.*

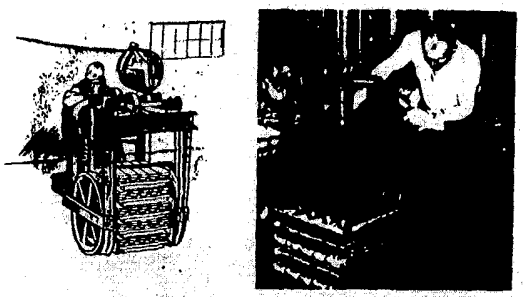




*Refining furnace where zinc is removed from the lead.*

mercially pure. The zinc is oxidized off in a reverberatory furnace leaving commercially pure common lead from which Anaconda White Lead is made. This lead is also cast into pigs or bars weighing 100 pounds and sold to make sheet lead, plumbers' supplies, cable sheathing, solders, and many other items of general use.

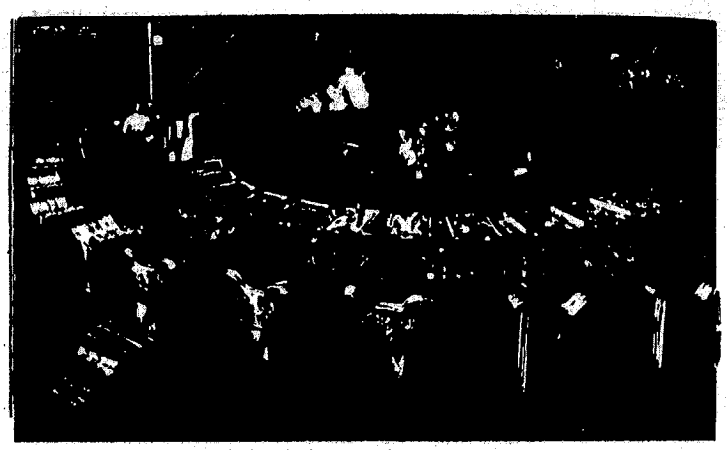
**THE LEAD** used to make Anaconda White Lead is transferred to a special moulding kettle and there, under the most careful



*One form of commercial lead—100-pound pigs or bars on special trucks.*



PNYC00000088

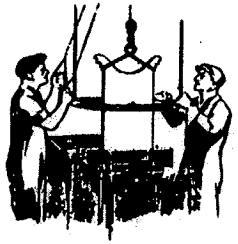


*Casting lead anodes for use in making Anaconda White Lead.*

control, is cast into sheets or anodes about an inch in thickness, some 20 inches wide, and 30 inches high. Such an anode weighs approximately 250 pounds.

These are straightened and placed in a specially designed car so spaced that they may be removed eighteen at a time and placed in electrolytic cells when the car is delivered to the white lead plant.

**A BETTER WHITE LEAD** is produced today because of a genius who knew no bounds, Elmer A. Sperry. At the age of





*Specially designed car with load of lead anodes.*





*Elmer A. Sperry. Inventor of the electro-chemical method of white lead production.*

14 he worked out twelve original solutions of the Pythagorean Proposition, known to all schoolboys as "The Dunce's Stumbling Block".

**MACHINERY,** moving parts, electricity—these things fascinated Sperry as a boy. His energy was tireless. He built everything from home-made windmills and glass-blowing outfits to fast-moving railroad hand cars. At the age of 19 his career began in earnest—first with dynamos and arc lamps, then electric locomotives and automobiles, better batteries, mining machinery—the list of his accomplishments is too long to enumerate.

During the World War his work for the U. S. Government was invaluable. Soon after, one of Sperry's many successful experiments in the field of electro-chemistry led to a revolutionary new process—the electrolytic production of extremely pure white lead from common lead. This patented Sperry process is used today *exclusively* for making Anaconda White Lead.

**THE SPERRY PROCESS** for making white lead is somewhat the same in action as the platers' cell. Lead is removed from an



PNYC00000089



*View of electrolytic cell room.*

anode into solution, but instead of plating out, it is acted upon by other chemical elements to form white lead in the solution of the cell.

The technical description on pages 16 and 17 explains how lead, acted upon by electricity and chemicals, is turned into lead carbonate or white lead. The white lead formed in this manner is exceptionally pure. This reaction takes place in a concrete cell, and as the white lead is made it is washed out of the cell by circulating solutions.



*Wash machine for removing impurities remaining on the surface of anodes.*



PNYC00000090



*Circulating solutions r*

Each cell produces a
a day. The anodes,
and are replaced ev

Commercially pure c
metals that have bee
minute quantities pr
produced by the Spe
maintains a high-grad



# The Sperry Electrolytic White Lead Process

## A TECHNICAL DESCRIPTION

THE Sperry electrolytic cell as operated to produce white lead consists of a concrete cell in which are suspended lead anodes and insoluble iron cathodes. The cathodes are encased in porous fabric envelopes which act as diaphragms, separating the electrodes. Through the compartment formed by the fabric envelope surrounding the cathode is circulated the catholyte. This electrolyte contains sodium acetate and a large amount of sodium carbonate. The cell tank is filled with the anolyte which circulates around the submerged anodes and the outer surface of the diaphragm.

The anolyte contains sodium acetate and only a trace of sodium carbonate. Each electrolyte is maintained in rapid circulation about its electrode. The circulation systems of the two electrolytes are entirely independent, and no communication exists between the catholyte and anolyte save through the diaphragm of the cell.

The cell is placed in operation by passing direct current through the cell. Carbonate and hydroxide ions migrate under the influence of the current from the catholyte through the diaphragm to the anolyte; at the same time electrochemical equivalent amounts of lead ions dissolve from the surface of the lead anodes and pass momentarily into solution in the anolyte. Since the anions are more mobile than the cations the plane in which the ions meet is quite close to the surface of the anode. In this plane precipitation takes place, and white lead is formed. Due to a slight seepage of catholyte through the diaphragm the anions are transferred to the anolyte in amounts in excess of the reaction requirements. This results in complete precipitation of the lead ions dissolved from the anode.

The continuous flow of anolyte removes the white lead from the cell as fast as it is formed. From the cell the anolyte flows to a settler where the white lead is removed and the clean overflow from the settlers is returned continuously to the cell. The catholyte in its circulation external to the cell is carbonated to replenish the carbonate ions and neutralize excessive hydroxide ions formed at surface of the cathode.

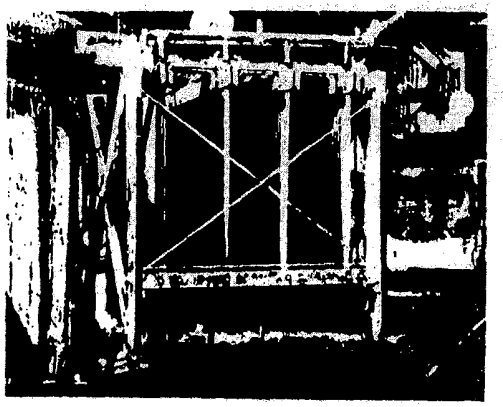
The settled white lead is removed continuously from the bottom of the settler to a filter where it passes through a countercurrent washing cycle to remove and recover the analyte solution. The washed white lead pulp is dried, ground and air floated, and is then barrelled in a dry pulverent form.

A study of the cell reactions indicates that the formula for white lead should be written $Pb(CO_3PbOH)_2$ and that this compound is formed through the reactions of the intermediate compounds $Pb(CO_3H)_2$ and $Pb(OH)_2$. The outstanding characteristics of electrolytic white lead—exceptional purity, brilliant whiteness and uniformity—are due to the ease with which cell reactions can be controlled and to the fact that in the cell only the lead is dissolved from the surface of the lead anode, other metals remaining on the anode surface in the form of a slime.





PNYC0000091



*Remaining chemicals are washed out on a suction filter.*

The removal of impurities by the Sperry process described, explains why only Anaconda offers the trade a white lead pigment, pure white in color. Such a white pigment, when mixed with colors gives true tones of the basic color; hence, brilliant colors that please.

The white lead is settled out and washed on a suction filter. The wash solutions are pulled through the mass of white lead which adheres to the filter leaves.

This vacuum washing completely removes the chemicals used in making the white lead and leaves what is called a washed pulp.

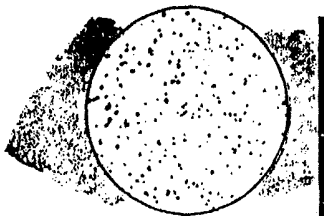


*Photo-micrograph of Anaconda White Lead showing extreme uniformity of particles.*



*Loaded suction filter.*





*This rotary filter completes the washing and removes most of the water.*

Being precipitated chemically, the white lead is extremely fine. Anaconda White Lead is so fine that 99% will pass through a 325 mesh screen, leaving less than 1% on the surface. A rotary filter completes the washing and removes all but 30% of the water. The filter cake is now in the form of a very sticky mass much like a heavy wet clay.

To maintain its whiteness and protect it from contamination by dirt in the air, it is dried beneath a hood on a metal hearth plate heated by steam.



*To maintain purity and whiteness, the white lead is dried on covered, heated hearth plates. Left: Discharge end. Right: Feed end.*



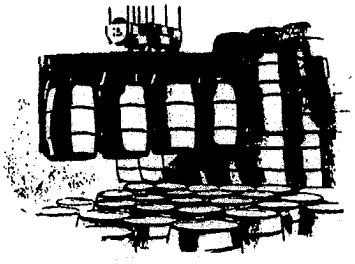
PNYC00000092



*Ground to a fine powder, the white lead is immediately barrelled.*

The mass is moved along, broken up and stirred by a rabble mechanism that finally discharges it dry after an hour or so of treatment.

In order to break up the lumps that form in drying, the product is put through a grinding process that crushes it to a fine powder and lifts the dust formed in an air stream some 18 feet high, thus insuring a product both uniform and very fine.



*Barrels are placed in storage four at a time.*



*Testing the dry*

**ANACONDA WHITE**
percent, practically all
grinding. The product

This is the dry white le
of high-grade mixed
Lead-in-Oil.

*Untouched photo of the relativ*





PNYC0000093



*Dry white lead is being mixed with pure linseed oil—*

## Anaconda Lead-In-Oil

Dry white lead is mixed with pure linseed oil of the very finest quality and double ground between stone wheels to insure the incorporation of all of the white lead in the oil. Because of the heat generated, the mills are water cooled.

The ground lead-in-oil is then placed in Anaconda's modern containers, weighed and sealed.

Anaconda Lead-In-Oil is easy to mix. No hours of stirring are necessary to mix settled pigments.

The particles in different white leads vary considerably in size and shape. The particles in Anaconda White Lead are properly balanced in size and number to permit perfect incorporation in linseed oil, assuring smooth brushing and good levelling. Fineness makes for better covering and hiding, producing an all-round paint of highest quality.

Due to the absence of impurities, Anaconda produces whiter whites. Anaconda White Lead will actually make a white spot on ordinary white lead.





*— and double ground between stone wheels (above).*



*Right: Sealing the familiar Anaconda White Lead containers.*

Its true white color permits cleaner tints that are strikingly brilliant. The pure white base, to which the tint is added, does not have the slightly muddy cast that is present in ordinary lead. Anaconda Lead-In-Oil weathers by a slow chalking process. It produces a film that will last for years and one that washes itself clean as it ages.

Inside or out, Anaconda White Lead surpasses as a decorative medium, yet costs no more.

Employ a good painter. He knows the different woods and how to treat the surface before applying paint. Then insist that he use Anaconda White Lead-In-Oil.

Anaconda White Lead-In-Oil is sold by leading paint and hardware stores and lumber yards. When you select paint, be sure to specify Anaconda.

**INTERNATIONAL SMELTING AND REFINING COMPANY**

PIGMENT DIVISION . . . EAST CHICAGO, IND.

*Subsidiary of Anaconda Copper Mining Company*



PNYC00000094




**WHITER WHITES • CLEANER TINTS • MAXIMUM DURABILITY**

