LEAD INDUSTRIES ASSOCIATION

420 LEXINGTON AVENUE
NEW YORK 17, N. Y.

April 13, 1955

SUBJECT: MATERIALS THE RAILROADS BUY - THE STORY OF LEAD PART 2

To Members of the Lead Industries Associations

Attached please find a copy of Part 2 of the article "Materials the Railroad Buy - The Story of Lead," reprinted from the February, 1955 issue of "Railway Purchases and Stores."

Part 1 of the article was sent to members on January 26, 1955.

If you would like additional copies of either of these articles we shall be glad to supply them upon request, as long as our supply lasts.

Very truly yours,

Secretary.

Materials the Railroads Buy

The Story of Lead

Part 2

Reprinted from

RAILWAY PURCHASES AND STORES

February, 1953

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LEAD INDUSTRIES ASSOCIATION

420 Lexington Avenue

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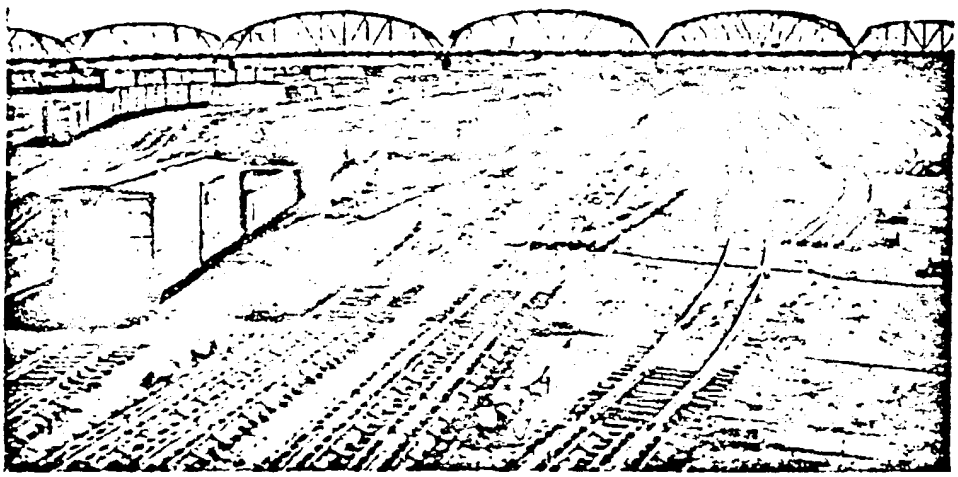


Standard A. A. R. solid type lead-base bearings make possible the vast inter-change of freight cars in classification yards as shown here

Materials the Railroads Buy

No. 18 of a Series

The Story of Lead—Part II

ROBERT L. ZIEGFELD AND DAVID M. BORCINA

SECRETARY AND ASSISTANT TO SECRETARY, RESPECTIVELY, LEAD INDUSTRIES ASSOCIATION

As well as being the principal lead producing country of the world, the United States, as can easily be imagined, is the largest consumer of this most versatile metal.

Industrial consumption of lead in the United States has averaged roughly 1,100,000 tons a year since 1946 with about a third of this consumption attributable to its use in lead-acid storage batteries. The second largest consumer for the last three years has been the production of tetraethyl fluid, a use that has grown from nothing in 1923 to more than 160,000 tons in 1954. The cable industry, in third place, easily outdistances the many other uses as indicated in the table of United States consumption shown on page 68.

As old as lead is, the table graphically portrays the fact that the bulk of the lead consumed today is in uses developed in the twentieth century.

Uses of Lead

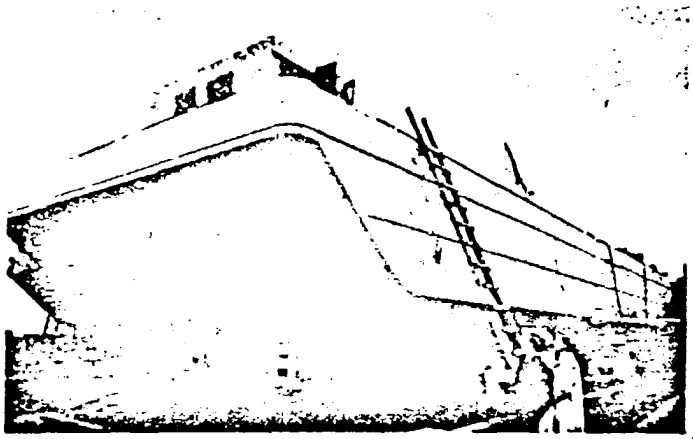
Some of the important developments and uses of recent years, not indicated in the consumption table, include lead soaps for greases, lead in steel for better machineability, leaded frits for porcelainizing aluminum, lead molds and lead compound stabilizers for plastics and of course its use as a shielding material in atomic energy installations and shipping containers for radioactive material.

The use of lead in bearings has been fairly consistent in recent years requiring in the neighborhood of 30,000 tons of lead a year.

It is a strange paradox that lead, one of the heaviest of the common metals, plays such an important role in lightening the task of transporting our goods and ourselves. Lead's anti-frictional properties are being utilized to some degree in practically every modern mode of transportation in which safe, efficient and economical operations depend on a bearing surface.

Lead hardened and strengthened with small amounts of tin, antimony and arsenic, or even smaller percentages of the alkaline earth metals, is a standard anti-friction material for many types of bearings, and one of the major consumers of lead for this purpose is our vast railroad system. Many years ago the Association of American Railroads standardized on lead-base bearings for freight cars used in interchange. Like the cars themselves, these railroad bearings must be completely interchangeable. They must provide dependable "all weather performance with simple maintenance and minimum standby inventories.

Lead-base bearing metals offer high resistance to compression yet are soft enough to prevent wear of the more costly and hard to replace axle. They possess the plasticity necessary to absorb foreign particles which normally would score the shaft. Should the



A red lead primer protects the steel surfaces of this railroad barge ready for launching at the Bethlehem Steel Company's yards

axle journal itself become badly scored, the lead bearing installation permits it to be turned down as much as 1/2 inch below the original diameter and reused.

The ease with which lead-base bearing metals conform and adjust automatically to slight irregularities in the machining and alignment of the shaft and the fact that these bearings permit a 10 per cent tolerance in the diameter of the car journals to which they are applied, simplifies maintenance and makes possible rapid repairs and replacement at railroad repair yards.

Not only freight and passenger cars make use of lead's anti-frictional properties for bearing purposes, but diesel locomotives, electric locomotives and multiple unit cars are also equipped with lead-base bearings in the form of traction motor support bearings.

Of particular interest to cost-conscious operators is the fact that these solid bearings have high scrap value and after serving a long and useful life, can be reclaimed.

A typical machine for making sand molds into which the brass casting for the car bearing back is poured

Tetraethyl

Tetraethyl lead, the second largest consumer of lead,

Lead Consumption in the United States (a)
(In Short Tons)

	1952	1953	Estimated 1954
White lead	22,900	17,800	20,000
Red lead and litharge (b)	76,700	88,600	78,000
Storage batteries	351,000	367,800	330,000
Cable	142,600	148,600	125,000
Building	58,100	59,100	52,000
Tetraethyl	148,700	162,400	168,000
Ammunition	38,200	45,100	39,000
Foil	2,100	4,400	4,000
Bearing metal	38,500	39,600	27,000
Solder	72,700	78,700	72,000
Typemetal	27,400	26,700	27,000
Calking	45,200	48,200	50,000
Other uses	112,900	118,200	108,000
Total	1,131,000	1,262,000	1,100,000

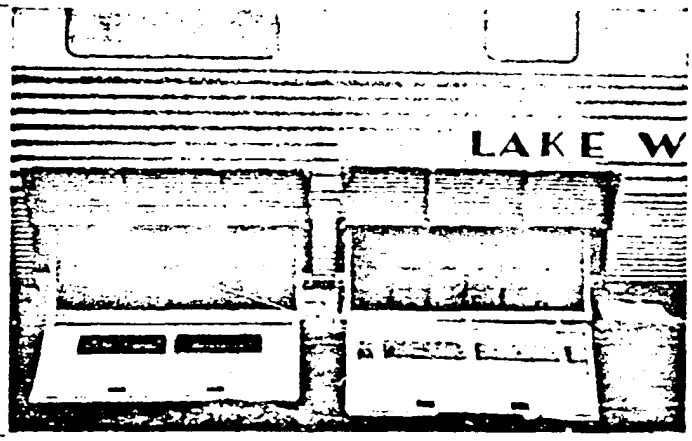
(a) Based on U.S. Bureau of Mines statistics.
(b) Exclusive of oxides for storage batteries.

is a heavy colorless liquid containing approximately 60 per cent lead. It is the active component in the anti knock compound and added to gasoline in minute quantities, 0.5 to 4 cc. per gallon, provides a substantial improvement in the anti-knock value or octane rating of the gasoline.

The basic ingredients of tetraethyl lead are pig lead, salt, hydrogen, alcohol and refinery gases. The pig lead is melted and mixed with sodium under a blanket of hydrogen to form a lead-sodium alloy. It is then solidified and ground and reacted with ethyl chloride to form tetraethyl lead. This is steam distilled and otherwise purified and then blended with ethylene dichloride, ethylene dibromide and dyes to form the anti-knock compound.

The Storage Battery

The lead-acid storage battery, a most efficient and economical source of electrical energy, was developed



Lead-acid storage batteries supply a constant source of power for passenger car lighting and air conditioning

by Gaston Planté in 1859, after a series of experiments that proved battery electrodes or plates made from two different forms of lead were superior to electrodes made with other metals.

Today's batteries are constructed essentially the same as that developed by Planté and consist of grids cast from a lead alloy containing small amounts of antimony and/or silver or other metallic constituents. A paste made of oxides and finely divided metallic lead is then applied to the interstices of the grid and with different mixtures, the negative and positive plates are formed. The cell is then assembled, using varying numbers of plates, and sulphuric acid added. The plates are then activated by passing an electrical current through them to convert the positive plate into lead peroxide and the negative plate into finely divided sponge lead.

In use, the battery plates on discharge react with the sulphuric acid electrolyte converting them to lead sulphate. Charging the battery is just the reverse. The lead sulphate is converted to lead peroxide and sponge lead and the sulphuric acid is regenerated, increasing the concentration of the electrolyte. This cycle is continuously taking place when the battery is connected to a generator such as is found in every automobile and on railroad cars.

The voltage of each cell remains constant, approximately 2 volts and the addition of plates to a cell only increases its capacity or life expectancy. The ordinary 3 cell-6 volt automobile battery contains roughly 60 to 70 per cent lead or about 20 pounds. The lead contained is split roughly half and half between metallic lead and lead oxide.

Lead covered cable is a product of extrusion. Mol-

PRIMER

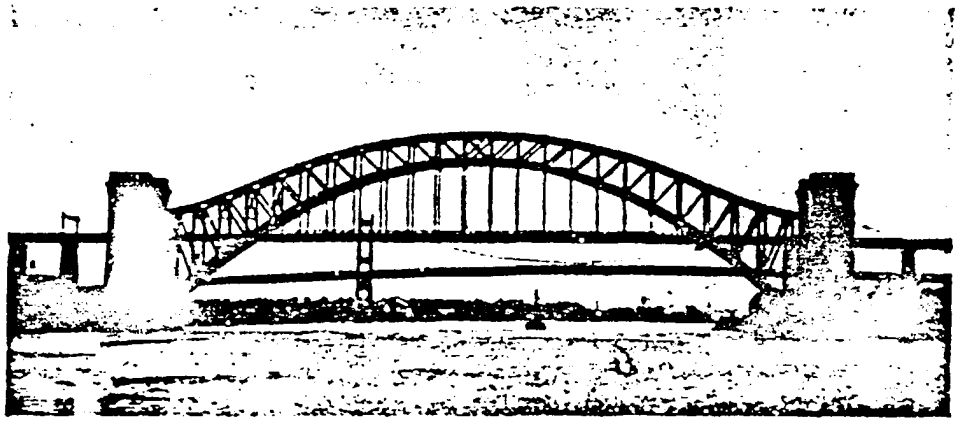
(Federal Specification, TTP-86a, Type III)
For Steel Completely Free of
Mill Scale and Rust (Fast Dry)

This is a heavy duty, full red lead primer intended for use on sandblasted structures and factory fabricated equipment such as railroad cars, window sash, signal equipment, etc.

Composition		*Per Cent*	*Pounds*	*Gallons*
Pigment:	Red Lead (Fed. Spec. TT-R-191a, Type I, Class C)	99.7	1273.0	17.20
	Aluminum Stearate	0.3	3.5	0.46
		100.0		
Vehicle:	Alkyd Resin Solution (Fed. Spec. TT-R-266, Type III	84.0	523.0	67.50
	Aromatic Petroleum Spirits	14.5	90.0	13.70
	Cobalt Napthenate Drier (6% Co.)	0.3	1.9	0.20
	Antioxidants and Wetting Agents	1.2	7.8	0.94
		100.0	1601.0	100.00

Pigment = 87.3%. Vehicle = 32.7%. Wt./Gal. = 19 lb. PV = 38
Dry for handling – about 1 hour. Dry for recoating – about 4 hours

The composition of the brass back of a freight car bearing is here being tested for the proper proportions of copper, lead, tin and zinc. Similar tests are conducted for the lining metal for lead, tin and antimony



The steel work of the famous Hell Gate railroad bridge is protected against corrosion by a red lead base primer paint, another form of lead used extensively by the railroads

ten lead is placed in the chamber of a hydraulic press and allowed to solidify under pressure. Within the chamber is a hollow mandrel through which the cable core passes. When pressure is applied the lead is extruded through a die controlling the outside circumference carrying the cable core along with it. A pressure of somewhere around 55,000 lb. per sq. in. is required.

Lead as a Paint Pigment

Lead in an entirely different form, as a paint pigment, also finds extensive use on railroads. Many railroads protect and preserve their signal towers, bridges and other right-of-way structures from corrosion by painting them with red lead primers.

Developments in this field include better and more economical paint systems, from slow-drying formulations to primers that are dry for handling in one hour and ready for recoating in about four hours. This particular formula may be found on page 69.

Many railroads are involved in the construction and maintenance of freight-carrying barges and of particular interest to them are the various paint formulations that have been developed for this type of service. Inasmuch as the service requirements are so stringent, no one particular formula can be recommended without detailed knowledge of the various conditions that may be encountered. However, the general composition of the following primer may be of interest:

Marine Red Lead Primer

		Per Cent
Pigment:	Red Lead	56.0
	Zinc Oxide	8.0
	Silicate and Sulphate	36.0
		100.0
Vehicle:	Phenolic Varnish	16.0
	Linseed Oil	38.0
	Thinners and Driers	46.0
		100.0

Pigment = 79%. Vehicle = 21%. Wt./Gal. = 22.1 lb.

Besides railway structures, much rolling stock is primed with red lead base paints and research in this particular type of application has not been overlooked. Two low-cost primers have been developed that are dry for handling in four to six hours and ready for recoating in about 18 hours. Despite their low cost, field tests have indicated that these particular formulations have an unusually high degree of desirable characteristics for their particular use.

All of these recommended primer formulations are the result of extensive field testing and research by the Red Lead Technical Committee of the Lead Industries Association and are included in that committee's Technical Letter No. 8—Primers for Railroad Structures and Rolling Stock published by the Lead Industries Association, 420 Lexington Ave., New York 17, N. Y.

White lead, another highly regarded paint pigment is the base for a number of high quality multi-pigment paints used for beautifying and protecting wooden and other structures maintained by the railroads.

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