



Lead-Base Bearing Metals

Effecting Substantial Savings of Tin

ALTHOUGH lead-base alloys containing little or no tin have been used for certain kinds of bearing linings for many years, only since the war made tin conservation essential has it become generally recognized that, if proper precautions are taken, the lead-base alloys can satisfactorily replace tin-base alloys in practically all applications. By lead-base alloys is meant those containing less than 10 per cent tin and in many cases having much lower tin contents than that. They may be alloys of lead, antimony and a small percentage of tin with or without small quantities of arsenic, or they may be essentially lead hardened with the alkaline earth metals such as calcium and so on.

To make the change to lead-base alloys with satisfaction the principal precautions are properly to bond the lining to the shell and to use as thin a lining as possible. It is obvious, therefore, that the change can not always be made successfully when relining old bearings because the bearing may have been designed for a comparatively thick lining. However, it is possible to design and treat new bearings in such a way that lead-base alloys will prove satisfactory almost invariably and at lower cost than tin-base alloys.

Methods of preparation of the shell

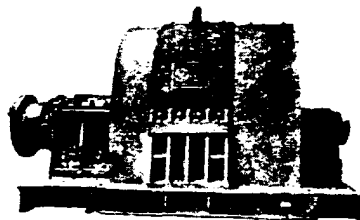
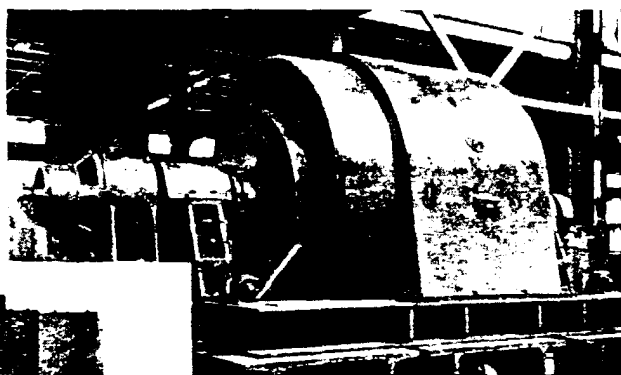
for lining with lead-base bearing metal vary to suit the condition and the metal of the bearing shell. One process which is now employed successfully on steel as well as cast iron which is especially difficult to handle is the molten catalyzed salt bath. Briefly, the essential steps of this process are as follows: machining or abrasive cleaning, immersion in molten catalyzed salt bath of controlled temperature for 5 to 15 minutes, water rinse, immersion in solution of salts to dissolve ferric oxide, water rinse,

etching in hydrochloric acid solution, immersion through a floating layer of molten zinc-ammonium chloride flux into a bath of lead-antimony-low-tin tinning metal which bonds with the iron shell. The operations are carried through in rapid sequence and the result is a thin coating of tinning metal which bonds readily with the lining.

Other processes involve special machining and handling methods, chemical cleaning or other means of providing scrupulously clean surfaces suitable for the application of the tinning metal. Whatever the method, the tinning must be continuous over the entire bearing if the application is to be successful.

The thickness, or rather, thinness of the actual bearing metal definitely in-

Below a 4,000-hp. 50-rpm reversing d-c steel mill motor equipped with lead-arsenic-antimony babbit bearings.



A 20,000-kva. 750-rpm synchronous condenser equipped with lead-arsenic-antimony babbit bearings

PHOTOS BY COURTESY OF
GENERAL ELECTRIC CO.

SOME LEAD-BASE BEARING ALLOYS*

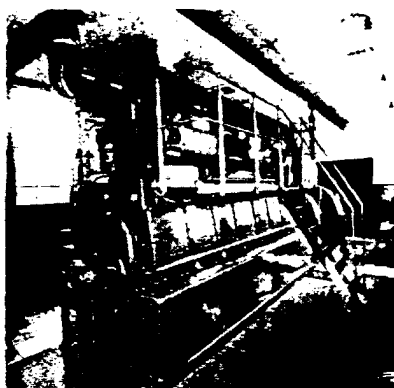
Composition, Per Cent						Brinell Hardness		Melting Ranges				Pouring Temperature	
Lead	Anti-mony	Tin	Arsenic	Copper	Silver	At 20 C.	At 100 C.	Solidus		Liquidus		Deg. F.	Deg. C.
								Deg. F.	Deg. C.	Deg. F.	Deg. C.		
Balance	15	2.0	—	0.25 max.	2.5	—	—	—	—	—	—	—	—
Balance	12.75	0.75	1.5 to 3.0	—	—	22	15	169	213	563	295	689	365
Balance	14.5 to 15.5	0.9 to 1.25	0.8 to 1.1	0.6 max.	—	21	13	—	—	—	—	—	—
Balance	12.5	10	—	0.4 to 0.6	—	27.5	13.6	471	244	195	257	621	327
Balance	10	6	—	0.25 max.	—	20	11	—	—	—	—	—	—
Balance	17	1.0	0.8 to 1.4	0.4 to 0.6	—	29	16	—	—	—	—	375	168

* Data From A.S.T.M. Standard Specifications for White Metal Bearing Alloys, Serial Designation B23-26, Emergency Alternate Provisions, EA-B23a.

fluences its performance in use. In the automotive industry linings as thin as 0.002 to 0.006 in. are employed, while large bearings may have linings up to 0.02 in. thick or more. Generally the thinner the lining the heavier the loads it can carry and the more its life will be prolonged. Pouring temperatures for the lead-base alloys are slightly higher than for tin-base and clearances must be increased slightly, from 0.002 in. to 0.0025 in. per inch of shaft on bearings up to 5 in. in diameter.

Lead-base alloys are being used successfully today in almost all kinds of bearing applications. Among these are automotive connecting rod, main and camshaft bearings. Diesel engine bearings, steel mill bearings, railroad car journal bearings, all kinds of electric motor bearings and a variety of other industrial applications. Speeds range from 25 to 3600 r.p.m. and loads up to 2,000 lb. per sq. in.

Such prominent industrial concerns as General Electric Company, Cooper-



COOPER-BESSEMER CORP.

Lead-base bearing metals are performing satisfactorily on stationery as well as marine Diesels

Bessemer Corporation and Chrysler Corporation have been among the leaders in adapting lead-base alloys to their bearing requirements and have thus contributed immeasurably to war conservation.

The accompanying table lists some lead-base bearing alloys together with some of their properties:

Red Lead Paint for Water Tanks

PUBLISHED in the June 1943 number of the Journal of the American Water Works Association is "Tentative Recommended Practice—Repainting Elevated Steel Tanks and Water Storage Tanks". Under the heading "Kind of Paint" this document states "Underwater exposure involves a very severe service for paint. The paint which, in general, has given the best results for this service is red lead and linseed oil paint (weighing 21 to 24 lbs. per gal.) containing small amounts of litharge which acts as a hardener."

The included proposed specification for quality of paint contains the requirement that "two pounds of litharge shall be added to each gallon of red lead paint" and requires that litharge be added to the paint not more than one half day before it is to be applied.

For under-water exposure it is best to reverse the usual painting procedure of making each succeeding coat of paint softer than the preceding coat. The effect of continued immersion in

water is to soften slightly even the most insoluble paint. Therefore it is best to have the final coat the hardest in order that the completed job will

Red Lead paint has proved in service to be most satisfactory for painting interiors of water storage tanks



CHICAGO BRIDGE AND IRON CO.

be most water resistant. In the case of a three coat job the first coat may be a heavy red lead paint. The second coat one to which 8 per cent by weight of litharge has been added and the final coat one containing 10 per cent of litharge.

Engineers recognized by observation long ago that litharge, added to red lead paints immediately before application to steel, produced a paint film that was highly resistant to damage by immersion in water. The reasons for the superior performance of litharge-bearing red lead paint are of more recent discovery. It has been found that litharge and linseed oil react readily to form compounds known to chemists as "lead soaps". Red lead and linseed oil also form lead soaps but more slowly because red lead is less reactive with linseed oil than is litharge. These compounds form on each particle in radiating tentacle form which tend to interlock with the tentacles of adjacent particles to give strength to the film. At the same time the oil is drying and it seems to become quite solid but it actually remains slightly elastic. For paints used on exteriors this elasticity is desirable but for under-water exposures greater hardness is required. The formation of lead soaps on the litharge particles adsorbs some of the oil thus hardening the paint and making it more resistant to water.

More recent studies of litharge-linseed oil reactions seem to indicate that glycerine compounds in the oil may separate from their organic compounds and unite with the litharge, imparting additional hardness to the paints by forming the well known litharge-glycerine cement commonly used in industry.

It is not necessary to give tank interiors any further treatment before putting them into service; the red lead-litharge paint is complete protection. It is common practice to tint the second coat with lamp-black, so that any "holidays" or missed areas will show up, and to return to the straight red lead color for the final coat. Litharge should not be used in the red lead on the outside of the tank which should be treated the same as any other steel structure.

Lead-Coated Steel Sheets Available For General Sheet Metal Work

FURTHER usefulness of lead as a corrosion resistant coating on iron and steel is indicated by the development and improvement of hot-dip lead-coated steel sheets. Although certain experimental work done in the past indicated that good results might be obtained with lead on sheets, the general acceptance and use of long ternes and galvanized sheets deterred the final development as well as a marketing campaign which would have brought about a general use. Also the tendency of lead-coated steel samples to develop rust stains on the surface gave the impression that the coating did not cover completely and so would not give adequate protection.

More recent research and reference to some almost forgotten test samples still under exposure have shown that lead-coated ferrous sheets are remarkably durable and that they stand up well in severely corrosive atmospheres. The surface rust stains which were once thought to be signs of incipient breakdown have been found to be merely superficial. They disappear very soon when the microscopic pin holes which allowed them to form are filled and stopped by the products of oxidation.

In addition to their durability lead-coated sheets possess several other desirable characteristics. They take and hold paint well. They may be painted immediately upon fabrication without aging or other special preparation. The lead alloy coating is ductile and withstands bending and forming without showing a tendency to crack and flake off. Lead-coated sheets can be die formed, the lead coating actually helping the process by acting as a lubricant to the dies. Since lead coatings are applied at comparatively low temperatures, there is little tendency for the characteristics of the steel sheet to change under influence of the heat of the coating bath.

The renewed interest in lead coating of iron and steel sheets is due in part to shortages of other metals which

have normally been used for this purpose. However, the lead-coated sheets have advantages which will cause their use to be extended after the war emergency has passed.

The Continental Steel Corporation of Kokomo, Indiana manufactures lead coated steel sheets under the name of "Lead-Sealed" sheets. This company has long been interested in the use of lead as a coating on steel and has done much of the experi-



Heating ductwork fabricated from lead-coated sheets

mental work which preceded the commercial production of the lead coated sheet metal.

Color Research Recorded with White Lead Paint in Charleston Restoration

CHARLESTON, South Carolina, early became one of the important shipping centers of the United States. By the end of the eighteenth century many luxurious homes had been built and the city had begun to develop an architectural style peculiarly its own. Although the leisurely tempo of life and a knowledge of homes in the West Indies undoubtedly influenced the plan of the Charleston house, the studied detail and elegance of execution of the interior woodwork are surely a heritage from the colonial builders of New England.

The citizens of Charleston are fully

aware of the beauty and historical significance of their charming old houses and are untiring in their efforts to preserve them. One of them, recently acquired by the Charleston Museum, is the Joseph Managault house on Meeting Street.

Built in 1790 by Gabriel Managault, architect, for his brother, Joseph, it is considered by many to be one of the finest examples of the Adam style in the city. The finely carved interior woodwork and the beautifully executed ornamental plaster ceilings are of special interest. Restoration, while not complete, has been carried

The application of white lead paint to the stair hall has been completed

E. A. REILLY



Woodwork first coated, walls in preparation for white lead paint



forward sufficiently to enable the U. S. O. to make temporary headquarters in the house.

Paint played a most important part in the interior decorations of the houses built in the early days of this country. The palette available to the painter was limited by the available color pigments but this limitation was not a serious handicap to the tasteful selection of schemes of decoration. In restoring the Managault house special attention is being given to

the colors used on the walls and woodwork in order that the final result will be authentic in every way.

The original paint was carefully studied for color as it was removed and the entire repainting of the interior with pure white lead paint is being carried out in the same colors which the first occupants found to be suited to their taste. Pure white lead is ideal for protecting the delicate detail of intricate carving and modeling. It flows on smoothly and covers thor-

oughly without building up at surface intersections. It is easy to tint to the exact shade desired and has a satiny texture that is neither flat nor glossy which will stand repeated cleaning.

As a result of the careful study of the original colors, the beautiful and interesting color combinations throughout the house will be as truly authentic records its original beauty as the wood and plaster they adorn although the white lead paint that displays them will be new and fresh.



THE principle ingredients of first quality paint have been for many years white lead and linseed oil. These time tested materials continue to hold their places as basic materials for paint and the use of white lead continues with no modification made necessary by the demands of war and armament production. Linseed oil however, is not as plentiful as could be desired and certain adjustments are being made which will extend the supplies of this material to the greatest possible number of users without impairing the quality of the paint in which it is to be used.

As a result of shortages of fats and oils it has become necessary to conserve supplies of linseed and other drying oils and the War Production Board has issued Conservation Order M-332, effective July 1, restricting the amount of oil that may be used per gallon of paint to 3.75 pounds. This order applies to exterior house paints and interior and exterior structural steel paints. To bring about corresponding savings of oil in paint mixed from paste or dry pigment on the job the order further limits the non-volatile content of linseed oil delivered to users to approximately 70 per cent by weight. This means that oil used in

thinning paints will consist of approximately two-thirds linseed oil and the remainder volatile thinner.

To meet these requirements and at the same time provide a material with sufficient body to make a workable paint, linseed-replacement oil (Federal Specification TT-O-371) has been developed. It is a mixture of raw linseed oil, thickened or heat-bodied linseed oil and thinner. It has the consistency and working properties of straight linseed oil and can be used in place of the latter in any white lead or red lead paint. The paint it produces will have substantially the same brushing qualities, the same easy workability and high hiding power. It

will set up a little more quickly and will, therefore, have less tendency to collect dust during the drying period.

There is no reason to expect that the use of linseed-replacement oil will change, materially, the durability of pure white lead paint. Experience has shown that long wearing paint films can be produced with less linseed oil than is commonly used. Painters often adjust their mixing formulas to suit the porosity of the surface to be painted without adversely affecting the durability of the paint. The limitations set up by Conservation Order M-332 were determined with the advice of representatives of the paint industry. They have been tested by members of the industry as well as by the Bureau of Standards. The linseed-replacement oil is a thoroughly dependable paint vehicle which will make it possible for property owners to carry on the vitally important work of building maintenance with the full advantage of the dependability of pure white lead paint.

White lead pigment continues to be freely available. The results of Conservation Order M-332 will be to make the greatest possible amount of mixing material available for turning it into first quality paint.

LEAD comes to you this month without its usual envelope. Military needs and labor shortage are limiting the amount of paper available for civilian uses.

We believe that LEAD is serving a useful purpose in publishing information on the uses of materials and we expect to continue its publication.

However, we wish to cooperate in every possible way in all conservation measures and so we will dispense with the envelopes for the duration. We hope you will receive LEAD in good condition.

TRADE NAMES AND NAMES OF MANUFACTURERS OF ARTICLES DESCRIBED IN LEAD ARE OMITTED IN ACCORDANCE WITH LEAD INDUSTRIES ASSOCIATION POLICY. SUCH NAMES AND FURTHER DETAILS WHEN AVAILABLE, WILL BE GLADLY PROVIDED ON REQUEST

Materials for Lead Water Services Available for Utility Installation and Maintenance

THE complete coordination of the various Government orders controlling materials used in the installation of lead water services together with the free availability of lead pipe simplify the solution of one of the problems of water works maintenance engineers. The use of lead pipe for water services has been allowed by all of the lead conservation orders, the latest of which, General Preference Order M-38, dated May 26, 1943, makes no change in the status of this material. The use of the necessary fittings and solder required for use in installing lead water services are also specifically allowed by the respective orders governing these materials and the various Government agencies dealing with building construction allow the use of lead for this purpose.

Fittings are provided for by Conservation Order M-9-c, Copper, dated May 17, 1943, which exempts from any restrictions "corporation stops and couplings therefor, curb stops and couplings therefor, adaptors, unions, solder nipples and ferrules" for use in water supply and distribution. General Preference Order M-43, Tin, dated May 25, 1943, allows the use of solder containing 38 per cent of tin "for the installation and repair of

water service pipes connecting the piping of a structure with the outside water main." Thus the approvals for the use of the essential materials for the complete installation of lead water service pipes are of record in the official documents of the agencies controlling the respective materials.

In addition, the use of lead water service pipe is specifically permitted by the latest revisions of the Hous-



55 year old lead water service in perfect condition recently uncovered in Philadelphia

The pictures on this page are of lead water services installed in Philadelphia. There are many cities where the use of lead for this purpose has been standard practice for many years. The discovery of lead service pipes in perfect condition after having been buried for many years is not an uncommon occurrence. One pictured on this page has given "only" 55 years of trouble-free service but many older installations are known. The other pictures are of installations made in May, 1943. Being of the same durable material as the old installation, they can be expected to give their owners trouble free service beyond the life of the buildings which they currently serve.



Wiping lead service pipe to brass fitting and, above, lead service pipe in place

Curb stop wiped to lead service pipe ready for covering with cast iron stop box



ing Utility Standards, the Emergency Plumbing Standards for Defense Housing, the War Housing Critical List, the Critical Construction Materials Design Guide as well as the Army and Navy Munitions Board. In fact, there are, at present, no Government orders restricting the use of lead water service pipe.

**BUY
WAR BONDS
AND STAMPS**

Water tap with lead service pipe in place. Note bed of soft earth in rocky trench





No. 21

Old Mansions In New York City

THE great and modern city of New York is one of the oldest cities in the United States. Political as well as commercial history was made in the area now included within the city and there are many fine memorials commemorating both men and events. These are in the care of the city Department of Parks which takes special pride in a number of venerable buildings with important historical backgrounds. The buildings are kept in excellent repair and in most cases are in use as museums, meeting places or administrative offices.

Although the United States did not become a nation until after the War of Independence, this country already had a well established place in world economy. Men had made fortunes and had built luxurious homes like the three shown on this page. Each one of these houses figured in the stirring events of that war so long ago but each one is still as useful as well as a beautiful building. That they remain in such good condition is due to a strict program of careful maintenance which includes periodic re-coating with pure white lead paint.

It is significant that the Department of Parks of this great city, which is in a position to be well informed as to the quality and durability of the building materials it uses, makes the use of pure white lead paint a regular practice in maintaining the historical landmarks entrusted to its care.

PHOTOS BY COURTESY OF
THE NEW YORK CITY
DEPARTMENT OF PARKS

Lefferts House, near Prospect Park Brooklyn. Built to replace the original Lefferts Mansion which was burned during a skirmish preceding the Battle of Long Island in 1776. Now used as a meeting place by the D. A. R. and as a Museum



Jumel Mansion, Roger Morris Park, Manhattan. Built in 1765 by Roger Morris, a close friend of General Washington. Used by Washington as a headquarters in 1776. Was purchased in 1810 by Stephen Jumel. It now serves as a museum. The exterior well preserved with white lead, as valuable an exhibit as the historical treasures within



Gracie Mansion, Carl Schurz Park, Manhattan. Built in 1770. Served as first home of Museum of the City of New York but has lately been made official permanent residence of the Mayor of the City of New York. Situated near East River and in sight of Hell Gate to Long Island Sound it is securely shielded from the seacoast weather by its white lead paint



THIS IS NO. 21 OF A SERIES REPRESENTATIVE OF THE MANY AMERICAN LANDMARKS IN VARIOUS SECTIONS OF THE COUNTRY THAT ARE PRESERVED FOR THE FUTURE WITH PURE WHITE LEAD AND OIL PAINT. MANY OF THEM HAVE ALWAYS BEEN PROTECTED WITH THIS RELIABLE MATERIAL ACCORDING TO AVAILABLE RECORDS.

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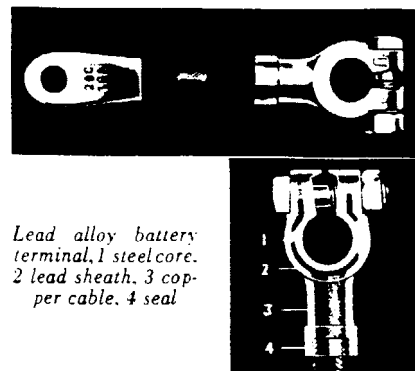
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New Battery Terminal Strong and Acid Proof

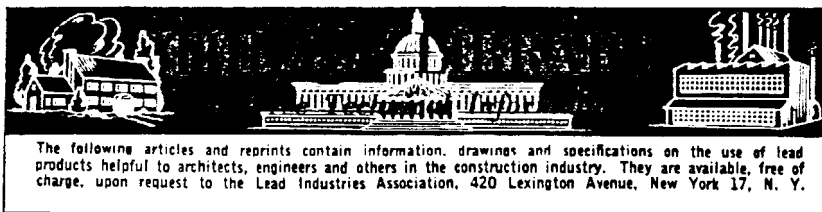
THE application of a steel-reinforced lead alloy terminal to automobile battery connections is helping to conserve batteries and generators. Loose or corroded terminals introduce resistances into the battery circuits. On cars with voltage regulators this results in "starving" the battery, eventually causing it to lose its effective charge. On cars not so equipped it may result in an overheated generator, a shorted condenser, burned out lights or other troubles. On any car it can result in starter failure and possible fire.

Commonly used metals strong enough to withstand the vibration to which automobile batteries are subjected are rapidly corroded by the acid fumes given off by the battery while under charge. Since lead is highly resistant to these fumes the Electric Auto-Lite Company has developed a steel-reinforced lead alloy terminal which is acid proof yet strong enough to be clamped immovably to the battery post.

This terminal is pressure cast of lead alloy around a steel core which is totally enclosed in the alloy. Before casting the end of the cable is placed in the mould and is thus bonded firmly to the terminal. The mould is so made that a collar of the lead alloy is formed around the insulation thus sealing the



Lead alloy battery terminal, 1 steel core, 2 lead sheath, 3 copper cable, 4 seal



The following articles and reprints contain information, drawings and specifications on the use of lead products helpful to architects, engineers and others in the construction industry. They are available, free of charge, upon request to the Lead Industries Association, 420 Lexington Avenue, New York 17, N. Y.

PROPERTY PROTECTION WITH WHITE LEAD PAINT

A 28 page booklet on the protective value, durability and beauty of pure white lead paint with quantity estimating tables, formulas and mixing and tinting instructions for exterior and interior use.

BRUSH UP ON YOUR PAINTING

A practical article on the selection and application of paint reprinted from *House Beautiful*, June, 1941.

SOME PAINTING PROBLEMS AND THE ANSWERS

By Dr. F. L. Browne, Senior Chemist,
Forests Products Laboratory, Madison,
Wise.

Reprinted from the *National Real Estate Journal*,
Sept., 1939.

STAMFORD'S DOUBLE LIFETIME HOME

A complete analysis of hard lead flashing, white lead paint, lead plumbing, plywood and red cedar. Certificate shingle details and installation methods. Reprinted from the *American Builder*, July, 1939.

STOP DEMON RUST

Leaflet giving concise, simple instructions in the use of the rust preventing qualities of Red Lead Paint in protecting farm machinery.

LEAD EQUIPMENT USED IN INDUSTRY

By F. E. Wormser, Secretary of Lead Industries Association

A summary of the uses of lead in the production and handling of corrosive chemicals. Reprinted from "Metal Progress" to be included in the next edition of "American Society of Metals Handbook."

DON'T GAMBLE WITH PAINT

An instructive article on the selection of paint for farm use reprinted from the March, 1942 issue of *Country Gentleman*.

WHITE LEAD PAINT FOR DEFENSE HOUSING

Reprint from Bulletin of the Producers' Council including specifications and graphic mixing instructions for exterior and interior White Lead Paint.

LASTING LEADWORK IN MODERN PLUMBING

By T. N. Thompson, Technical Editor,
Plumbing and Heating Journal
Reprinted from *Plumbing and Heating Journal*, Feb., 1939.

COMMERCIAL STANDARDS:

Calking Lead, CS94-41
Lead Pipe, CS95-41
Lead Traps and Bends, CS96-41

Official publications by the Government Printing Office of the above Commercial Standards as promulgated by the U. S. Department of Commerce through the National Bureau of Standards, effective June 25, 1941.

LEAD PLUMBING FOR DEFENSE HOUSING

Reprint from Bulletin of the Producers' Council including information on the Emergency Plumbing Standards and the Defense Housing Critical List.

NEW LEAD COATING PROCESS ELIMINATES USE OF ZINC ALLOYS

By W. Yonkman, Engineer, Western Electric Co.

A description of a successful hot dip lead coating process with complete instructions for changing over from hot dip galvanizing using the same equipment. Reprinted from *Products Engineering*, May, 1943.

SUMMARY OF NOTES ON LEAD ROOFING

A brief description of the uses of lead for roofing and flashing purposes and the proper practices of its application. Reprinted from "Sheet Metal Worker".

acid fumes away from the copper conductor.

The action of the storage battery is dependent upon a chemical reaction between sulphuric acid and certain lead oxides held in lead alloy frames or "grids". The same properties that enable lead to endure immersed in the acid make it proof against the fumes which quickly destroy most other metals.

PARTIAL LIST OF USES OF LEAD NOT RESTRICTED BY CONSERVATION ORDER M-38

Anodes
Anti-Knock treatment for motor fuels
Bearing metals
Calking lead, lead wool
Ceramics (Except as on ingredient of ornamental glass)
Chemical equipment—tanks, linings, piping, pumps, valves, filters, evaporators
Coatings on iron, steel and other metals
Collapsible tubes
Die casting for process work
Fittings—traps, bends, floor flanges, ferrules
Flooring in chemical and explosives plants
Gaskets and packings
Insecticides and chemicals
Manufacturing equipment for synthetic fibres
Metal pickling tanks, spray nozzles and piping
Mould material for casting plastics
Name and instruction plates
Paint pigments—white lead, red lead, blue lead, litharge
Pipe—soil, waste, water service and chemical
Plating tank linings
Roofing, flashing, gravel stops, damp proofing
Safety tread
Scientific and experimental apparatus
Sheathing for electric cables
Shot—ammunition
Shower pans, floor safes, waterproofing
Solder
Storage batteries
Substitution for more critical metals
Varnish making—driers
Vulcanizing moulds
Window cases—glaziers lead
X-ray and radium protection

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Casket hardware—casket linings
Foil

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