Rotary Mixers For Chemical Plant Lined With Heavy Sheet Lead

THE ability of lead to withstand the attack of corrosive materials has been of service to the chemical industries for many years. Much of the equipment used in handling these materials is in the form of lead or lead lined tanks, pipes, valves, ducts or other containers which remain stationary while their contents flow or are pumped through them. However, occasional functions require moving equipment to produce results which can not be obtained in static containers.

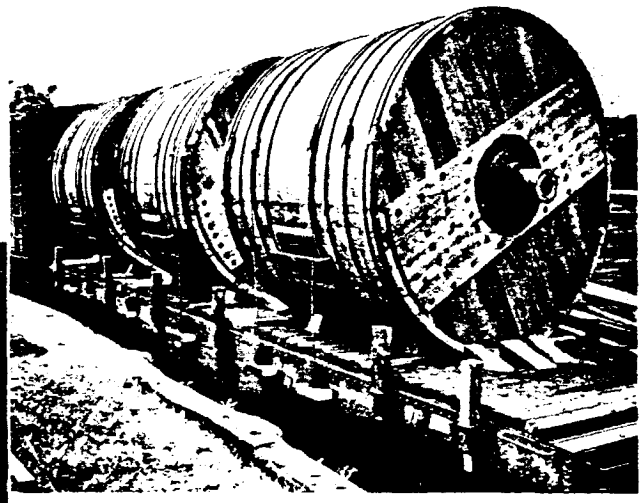
Illustrated herewith is an example of such equipment. Shown on a flat car are three lead lined wooden drums which are intended to revolve as mixers in a chemical plant. These drums, made by the Hauser-Stander Tank Co. of Cincinnati, are 10 ft. in diameter, built of 8-ft. cypress staves 3 in. thick with baffles to lift and turn the material being mixed. Heavy cast hubs provide bearings for the supporting shafts on which they turn.

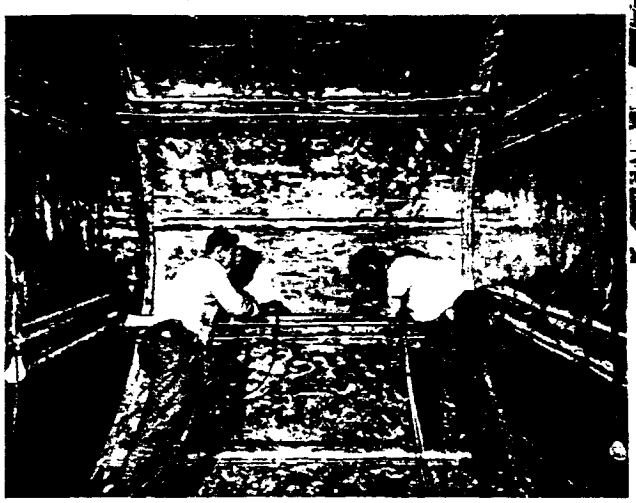
The lining is of 8-lb. per sq. ft. tellurium lead with welded or "burned" joints throughout. The lining is secured in place by means of steel straps bolted through the lead and wood: the straps in turn are covered with strips of lead tightly sealed to the lining by welding. This is one of the most common and most satisfactory methods of fastening lead linings to wood tanks and it is often used on steel vessels as well.

Lead is also used in the moving parts of pumps, blowers, fans, rotary filters, filter presses and other process machinery in the form of linings, homogenous bonded coatings, spray coatings and solid castings. Valves have moving parts of lead which close tightly on lead seats to control the flow of corrosive solutions.

Since lead is easily worked to shape by hand as well as by any of the fabricating methods common to other metals, its application to various types of equipment both stationary and moving is not difficult. This together with lead's ability to withstand the attack of so many corrosive materials makes it of very great service to the chemical industry. The chemical industry is one of the major users of metallic lead and the provision of corrosion resistant is a sizeable industry in itself.

Lead lined mixing drums ready for shipment. Bolts holding anchor bars can be seen just above waters





Welding a seam in the lead lining of the mixing drum. Note cover strip over steel anchor bars on ends and just above heads of workmen

Sheet Lead and Competent Workmen Available to Fabricate Special Equipment

SPECIAL purpose sinks, table tops, small tanks and other devices are often problems which must be solved quickly and economically in equipping laboratories, schools, photographic studios and manufacturing establishments. In some cases such equipment is commercially available and in other cases there may be no article to fulfill the exact requirements. In either case sheet lead may often be used to fabricate on the job the most satisfactory type of furniture for the given purpose.

Sheet lead makes an ideal top for laboratory tables and certain types of work benches. It is highly resistant to most destructive chemicals, it cushions glassware against breakage, it will not damage delicate edged tools and it is ductile enough to self heal scratches or superficial cuts in its surface. Lead sinks and tanks can be conveniently made in any size or shape, can be con-

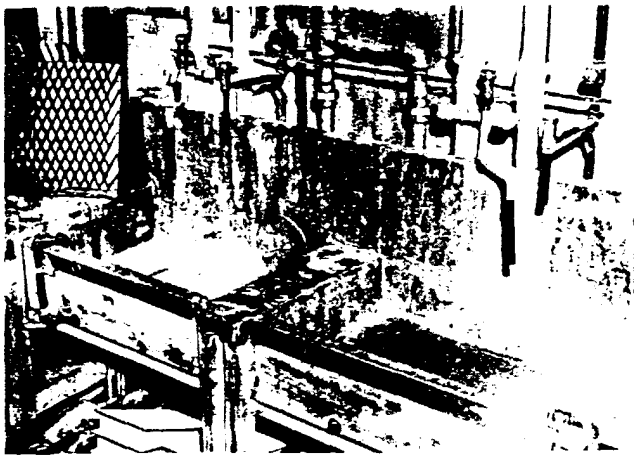
tinuous with table tops and they are not damaged by commonly used chemicals and solutions.

Sheet lead is, of course, commonly available most everywhere on short notice and men who are familiar with its use and handling are becoming more numerous. As a result of the efforts of the men of the plumbing trade and trade schools there are now more men who can do lead welding than there ever have been before. These men can cut, shape and fit sheet lead and can weld it into continuous leak proof coverings and linings. They can also provide and install corrosion proof welded lead piping properly connected to handle supply and drainage for such equipment.

Two splendid examples of effective uses of sheet lead are shown herewith. The first is a double sink with continuous drain-boards in a war plant near Chicago, made by plumbers who learned lead welding in the class sponsored by Plumbers Local 93 of Waukegan, Ill. The traps and waste lines are also of lead welded construction of ample size, installed with proper vents and adequately supported.

The second example is a laboratory table top in McKinley Vocational High School in Buffalo, N. Y. This table was covered by the day school boys in the plumbing class. It is of one-piece construction, sides turned down and dressed to shape at corners, with a lead lined sink welded in place. The lead is turned up against the wall columns and lead sleeves welded in place provide flashings for water and gas pipes passing through it.

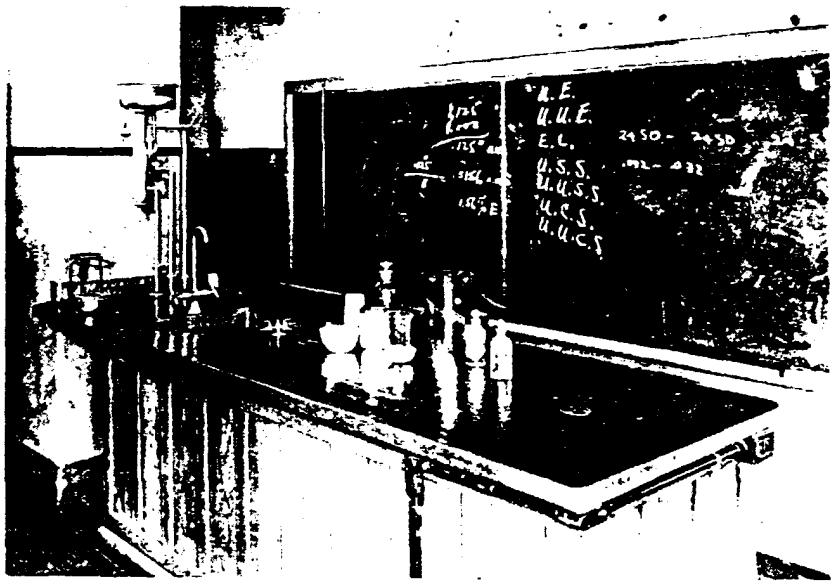
These examples serve to illustrate the fact that the plumber is more than just a man to unstop a clogged pipe. He is a trained mechanic who is versed in handling lead, a most versatile and adaptable material which possesses an extremely wide range of usefulness.



Lead lined sinks in war plants in Waukeegan, Ill. Note sinks, backs, drain boards and turned over front rim are all welded into one continuous leak proof unit

Traps waste and vents are also welded construction entirely of lead

Lead top with sink on laboratory lecture table in McKinley Vocational High School, Buffalo, New York. Sink and flashing sleeves on pipes to water still are welded to table top



HAUSER BOB PHOTO

Leaded Gasoline Helping to Win Battles

All gasoline being used by the air forces of the United States and its Allies contains tetraethyl lead. The manufacturers of this octane increasing lead compound are now producing for military use more than was used in all automobiles and airplanes in the United States and Allied nations in 1940.

Hot Dip Lead Alloy Coat
Fabricated Products In

THE lead alloy coating industry is a lusty youngster that has matured at an early age. It has long been recognized that lead and certain of its alloys, because of their great resistance to corrosion, should make highly effective protective coatings on other metals. Studies of the composition of suitable alloys, methods of application, and performance of the coated article, which have been carried on for years, were greatly intensified by the needs of war. The resultant process of coating with lead and lead alloys has received broad military and industrial acceptance, indicating a bright peacetime future for such protective coatings.

The following briefly summarizes the current status of lead alloy coating of fabricated articles. It is quoted from Metal Finishing News, published by Master Metalcoaters of Chicago, a firm long engaged in the application of finishes of various kinds to metal products and eminently qualified to evaluate lead alloy coating through unprejudiced and experienced eyes.

"When American industry rolled up its sleeves and got down to the serious business of production, it found a critical shortage of zinc, tin, cadmium, and other materials popularly used for metal finishing.

"But, peculiarly enough, there was ample lead available. Strangely, too, lead has long been known as a superb protection against corrosion and weathering. Your plumber and painter are old hands at using lead and lead paints.

"It was only a matter of time until the use of lead was perfected for metal finishing. Now, with an improved process of using hot lead alloy dipping, a new era of metal finishing has emerged.

"Hot lead alloy, besides having certain important advantages of its own, is making a distinct contribution to the war effort by saving appreciable amounts of cadmium, zinc, chrome, nickel and tin.

Infinite Uses

"Hot lead alloy coatings may be applied over any ferrous or non-ferrous fabricated metal parts, ranging from small castings, screws, bolts, and washers to large blanked, drawn, formed or cast housings, plates, strips, brackets, etc. It is especially recommended for an infinite array of military and naval equipment, where resistance to atmospheric exposure, lightness and durability are paramount. Communication equipment designed to function equally well in the jungles of New Guinea, the deserts of North Africa, bitter climate of Iceland, the extremes of heat and cold, and in low and high altitudes, have numerous lead alloy coated parts. Many radio and transformer boxes and other sheet metal articles in jeeps, trucks, tanks and airplanes are now being lead alloy coated. Lead coatings are also used for submarine hardware exposed to acid fumes, automobile tank filler tubes, battery lug bolts, marine engine valve springs, and a host of other military items.

Attractive Appearance

"The appearance of the finish is bright to a semi-lustre, hardly distinguishable from a cadmium or zinc plated finish. The coating of thread bolts makes a particularly attractive job.

Mechanical Superiority

"The ease of soldering without acid flux makes lead alloy coatings desirable for electrical and radio parts. Besides, it maintains good electrical surface conductivity longer than other metals.

"Many fabricated parts which are spot-welded, riveted or hand-soldered can be coated and soldered at the same time by simply tacking here and there, and then lead alloy coated.

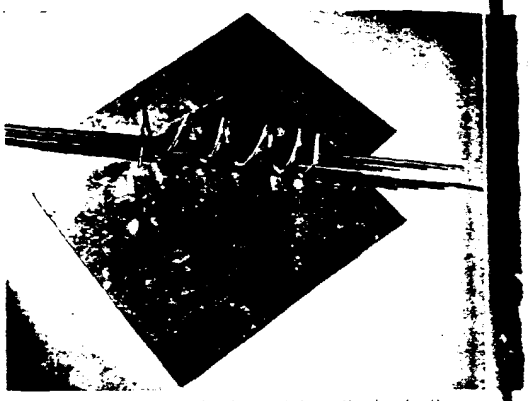
"Hot lead alloy coating acts, too, as a very good lubricant for drawing operations, because of its extreme plasticity. It is also an aid in forming operations.

"From the cost standpoint, coating by the hot lead alloy dipping compares to galvanizing. Its saving over other types of finishing is considerable. But most vital in these wartime days, lead alloy coating is readily available and in many respects superior to the usual finishes."

Master Metalcoaters apparently are not alone in their opinions. A number

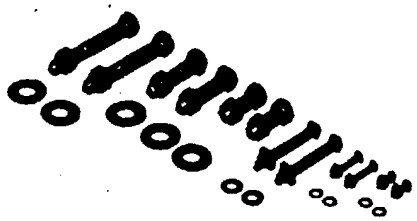
U. S. ARMY SI

Army Signal Corps radio SCR 300 in use at Case. Enclosing case which is also carrying pack is of st hot dip coated after fabrication with lead alloy, and finished



Sample sheets and wires of hot dip lead alloy coated steel. Note freedom from cracking at heel of right angle bend

Bolts and washers of hot dip lead alloy coated ste



LIA25814

ng Applied to Many For Armed Forces

units of case for SCR 300. Relatively lead alloy coatings (.0015 in.—.002 in.) n these pieces to seal joints with spot welded attachments

in chassis fabricated of steel and lead alloy coated

of lead alloy coated steel have approximately .001 in. thick

OTHER PHOTOS BY DAYTON SNYDER

of other metal finishing concerns of long standing have entered the commercial job lead alloy coating field. At least two well known steel companies, Weirton Steel Co. and Continental Steel Corp., are marketing lead alloy coated sheet, while the latter also coats wire with lead alloy. Telephone pole line hardware is being lead coated by the Western Electric Co., and other manufacturers are applying lead alloy coatings to a variety of their own products.

Among fabricated products which are being or have been lead alloy coated successfully and are not mentioned in the quotation from Metal Finishing News are gasoline and other tanks of various sizes, battery boxes, heater assemblies, seamless tubing and mufflers.

Some questions about lead alloy coatings may arise in the minds of those who are only familiar with other metallic coatings or with early attempts at lead coating. What lead alloys are used? How do they protect? How do they hold paint? How hard are they? How thick are they?

The alloys now employed differ considerably from the most familiar older lead alloy coating known as terne metal. Terne metal before the war usually contained from 18 to 25 percent tin, balance lead. The newer alloys now so popular contain usually less than 2.5 percent tin, and also contain small percentages of other metals like antimony, silver or zinc. The tin content is sufficiently low so that the use of these alloys is not restricted by WPB's Tin Conservation Order M-43, which specifically exempts them from control. The addition of these alloying elements increases the fluidity of lead, the ability of the alloy to bond to steel, and its hardness so that it will stand a considerable amount of abrasion or mechanical abuse. In increasing the hardness, however, brittleness has been avoided so that the coating will stand considerable bending without cracking or flaking off.

The protection afforded by lead alloy coatings, unlike some other and older coatings, is not accomplished by sacrificing themselves. Quite to the contrary, they protect by placing over the metal to be protected an envelope of the most corrosion resistant common metal. "What about pinholes, then?" will be the question raised by those who realize that virtually no metallic coating can be pinhole free unless it is very thick. In the first place, the number of pinholes has been greatly reduced through improved alloys and application methods. Even more important, however, is the knowledge, gained both by test and actual service, that pinholes in lead alloy coatings seal themselves upon exposure.

Dr. Lyman J. Briggs, director of the National Bureau of Standards, is quoted in a 1941 publication of the American Iron and Steel Institute as follows: "In industrial atmospheres, evidently because of the sulfur containing gases present, the 'pinholes' are quickly sealed by the resulting corrosion products. In a less polluted atmosphere, the corrosion product from the underlying steel serves the same purpose and the coating is apparently much more protective than its appearance might indicate."

This statement has been borne out experimentally and by actual exposure. In salt spray testing of lead alloy coated articles, for instance, the appearance and protection are better after several hundred hours than in the early stages of the test. Also tensile tests of lead alloy coated articles after long actual exposure show little or no reduction of tensile strength, whereas articles with other coatings exposed for the same time showed a 50 per cent loss or more. Tests of this type have been conducted by the American Society for Testing Materials and others.

Thus lead alloy coatings are, first of all, highly protective in themselves. However, they have a further advantage in that when a painted finish is desired they form an excellent base for paint. Again quoting Dr. Briggs, "For steel articles which are to be painted, lead outranks all other metal coatings as a base for paint."

The thickness of lead alloy coatings can be varied between quite wide limits, depending upon the use to which the article will be put. Often it is possible to use a lead alloy coating thinner than a coating of some other metal, with the result that the lead alloy coated article is actually lighter

than if it were coated with another metal, despite the high specific gravity of lead. For severe conditions, the thickness of the coating can be increased, whereas under certain conditions, for instance if the coating is to act primarily as a die lubricant or paint base, lighter coatings may possibly be practical.

As War Production News, April 7, 1943, said, "New method of coating with lead alloy has important advantages. Should be investigated immediately by all contractors."

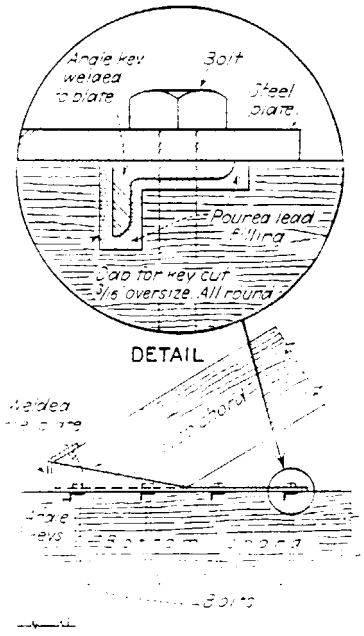
For other articles on this subject, see "Lead," January, 1943, September, 1943, January-February, 1944, and March-April, 1944.

Poured Lead Shims Used to Seat Keys of Splice Plates in Long Span Timber Trusses

IN the fabrication of trussed structures it is necessary that the connections be made in such a manner that there is no play or movement possible between the connected members. Such connections are difficult to make in wood trusses the members of which must be cut and fitted by hand. Several devices have been developed to overcome this difficulty and wood trusses have been used on many important industrial buildings in the past few years.

However, when it was decided to use wood bowstring trusses of 200-ft. span in an addition to the plant of the Ryan Aeronautical Co. of San Diego, Cal., problems were encountered for which there was no ready made connector to solve. Steel heel plates had to be secured at the ends of the bottom chord and steel splice plates in the length of the chord had to be secured so that no movement could occur if the truss was to be prevented from sagging. The usual method of dapping in a key was hazardous because several keys would be necessary and extreme accuracy of cutting and fitting would be necessary if each key was to develop its calculated strength.

Detail of application of poured lead shimming of steel plate keys



The problem was solved by the simple means of cutting the daps large enough to allow $\frac{1}{8}$ in. to $\frac{1}{4}$ in. clearance around the keys and, after the members were assembled, filling the space with molten lead. The result was that each key was perfectly fitted to the timber regardless of inaccuracies in the keys or in the cutting of the wood.

Stanley Bourne, consulting engineer of San Diego, Cal., who designed the trusses says, "Should the point be raised as to the value of lead in compression as compared with the end grain of the timber against which it was bearing, it should be pointed out that whereas, for an unrestrained block of lead under compression plastic flow is to be expected, a relatively thin film completely filling a narrow space will not experience plastic flow in the same degree, because it is completely confined and restrained except at the extreme ends. Hence a soft material like lead may be expected to exhibit very high compressive value under such conditions."

The accompanying drawing shows the design of the heel plate and where the lead was placed to completely fill the spaces around the keys. Tests of the completed trusses under full load showed only $4\frac{3}{4}$ in. deflection at the center of the 200-ft. span. This is no more than a third of the amount of deflection that could be expected if the splices had been made in the ordinary manner and it indicates that use of poured lead key fillers provided a practically perfect solution for one of [illegible] problems of timber truss construction.

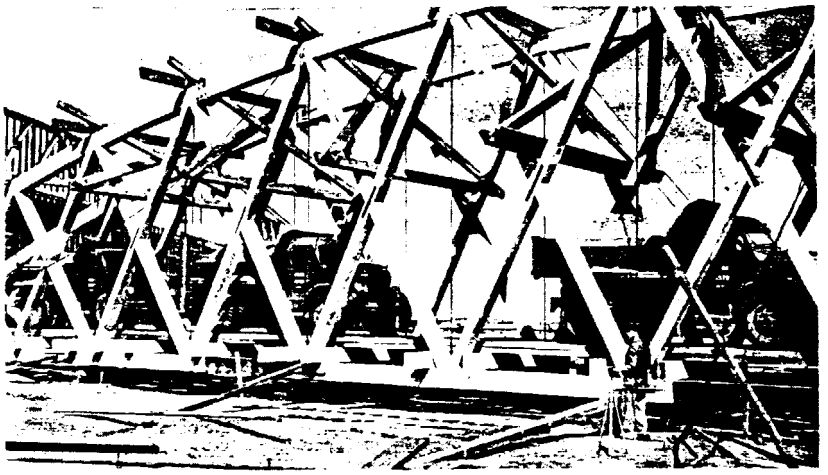


PHOTO COURTESY ENGINEERING NEWS RECORD

200 foot span timber trusses under test for deflection. Bottom chord splice plates visible near bottom of picture

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A Portfolio of American Landmarks

No. 27

Two Houses In Old Salem By Samuel McIntire

IN far too many cases the names of the designers of early American houses have been forgotten and the records lost so that it is difficult to study the work of any individual architect. Occasionally however such information is available and it becomes possible to witness the progress of an early American builder from a student of the classics to a brilliant architect.

The two houses shown herewith, built 22 years apart in Salem, Mass., by Samuel McIntire furnish such a comparison. The Pierce-Nichols house, built in 1782 is clearly the work of a thoughtful student of architecture who had studied Vignola and Asher Benjamin but who had not developed a sure feeling for scale although he was a sound craftsman who thoroughly understood construction.

The Pingree house built twenty-two years later in 1804, while similar in composition and identical in fenestration, is certainly the work of a mature designer who was a master of scale and the effective use of decorative detail.

Both of these houses are of sturdy construction and both show evidence of having had the best of care since they were first constructed. They are owned by the Essex Institute which continues to provide them the best possible protection from the elements by periodic repainting with pure white lead paint.

The Pingree house built in 1804 owes much of its effectiveness to the pleasing texture of pure white lead painted flemish bond brickwork

Painted pure white lead paint accents the delicate wood detail against the soft grey color of the painted brick

The Pierce-Nichols house, built in 1782 is of all wood construction painted and protected with pure white lead paint. The delicate detail of the fence suggests that it may have been a later addition

THIS IS NO. 27 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.

More Data on Water Service Installation Costs Show Lead to be Most Economical Material

AS a matter of interest in the figures on the cost of water service pipe installation published in a recent issue, additional information has been sought in order to determine whether or not the comparisons then made would be consistent with conditions in other cities.

Data obtained from the books of the water department of a large midwestern city shows total costs of water pipe service installations slightly higher than those found in the eastern city which supplied the information for the previous examples discussed.

The following figures are an average of costs for several typical service installations itemized to illustrate the proportion the cost of lead pipe bears to the total cost of a water service installed.

	Main on near side. Service length 12 ft.	*Main on far side. Service length 40 ft.*
Permit and pavement repair	$50.00	$80.00
Pavement labor ..	12.00	24.00
Excavation	25.00	50.00
Backfill	12.00	24.00
Solder	0.68	0.68
Wiping 2 joints...	5.00	5.00
Tapping main including corporation cock	10.61	10.61
Roundway (curb stop)	1.19	1.19
Curb box	1.62	1.62
Lead Pipe	4.32	14.40
Total	$122.42	$211.50
Cost of pipe percentage of total..	3.52%	6.81%

Here as in the previous example only a small portion of the expense of installing a water service is in the cost of the pipe. Any saving effected by using a cheaper pipe material can be only a fraction of the cost of the lead pipe and must therefore be less than 3.5 percent of the total cost. On the other hand, when the less durable pipe fails the cost of replacement, which will approximate the cost of installation, will be more than thirty times the cost of the pipe.

Further research will no doubt show that some cities have lower costs of installation, especially smaller municipalities where administrative and other expenses will naturally be lower. However even under conditions where the lowest possible costs prevail, the price of a repair or replacement job is a large stake to bet against the small saving that can be accomplished by using a material less durable than lead.

The lead service lines that are being installed today in the cities where they are required by far sighted water departments can be expected to last at least as long as many known existing services which are now in perfect condition after 50, 75, and even 100 years.

The difference between the cost of lead pipe and that of a less corrosion resistant material is a small price to pay for the security provided by long lasting lead which has been consistently used for water pipe material for more than 20 centuries.

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.

RED LEAD FOR STRUCTURAL WORK
By Dr. L. L. Carrick, Director, Red Lead Research, Lead Industries Association
A discussion of the rust inhibitive qualities of red lead paint and the best means of making use of those qualities for the protection of structural metal. Reprinted from *Engineering News Record*, April 6, 1943.

***LEAD CARRIES ITS WEIGHT**
By Fred P. Peters
An interesting resume of many of the long established uses of lead plus information on a number of recently developed adaptations of the properties of lead to special purposes. Reprinted from *Scientific American*, June, 1944.

SOME PAINTING PROBLEMS AND THE ANSWERS
By Dr. F. L. Browne, Senior Chemist, Forests Products Laboratory, Madison, Wis.
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 Certigrade 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*.

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*.

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 *Product Engineering*, May, 1934.

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.

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.

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.

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