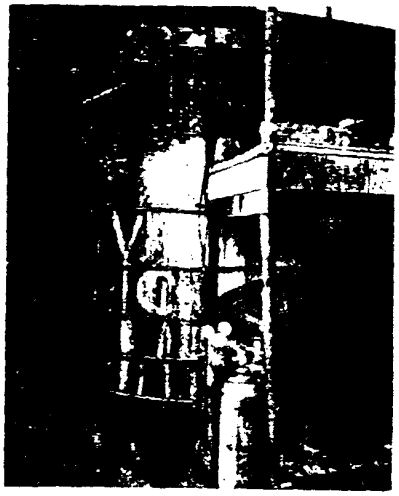
Tank Maintenance Problems Solved By Simple Lead Lining Procedure

LEAD lined equipment for process work is found widely distributed in general manufacturing as well as throughout the strictly chemical field. Few industries operate without recourse somewhere along the production line to corrosive materials which can well be handled in lead or lead lined vessels. It may be no more than soldering flux or it may be an acid pickling solution but the corrosion resistance of lead in many cases provides the solution to otherwise difficult maintenance problems.



View of work in progress shows bolts securing lead lining at left and excess lead at top to be turned down over rim of tank.

The accompanying photographs show work in progress on the lining of a tank used by an animal food producer in the processing of an important by-product, tallow. This tank in the plant of the Kentucky Chemical Industries, Inc., of Cincinnati, Ohio. is used in a purification process in which the tallow is treated with sulphuric acid. The lining is of 12-lb. sheet lead, which is $\frac{3}{16}$ in. thick.

These pictures are particularly interesting in that they illustrate the simplicity of the procedure in lining a tank of this sort. It can be clearly seen in the cover picture of the inside of the tank that the lead bottom was installed first. Then one of the four sections of the lead walls was set in place and secured at the edges with bolts through the tank wall. The two adjacent sections were set overlapping the bolts and they in turn were bolted on the free edge. The fourth section overlaps these last bolts so that all bolts are now covered.

The lining is completed by welding the overlapping edges to the adjacent sheets. Thus the bolts are entirely covered and the joints made leak proof in one welding operation. The excess lead which can be seen projecting above the lip of the tank in the exterior view will be turned out over the edge to protect the end grain of the wood staves and to provide additional support for the lining.

In deeper tanks additional support would be provided in the form of vertical steel bars spaced 18 to 20 in. placed over the lead and bolted through the tank wall. These bars would in turn be covered by strips of lead welded to the tank wall. Thus no metal other than lead would be subjected to contact with the acid.

The installation of this tank lining was made by T. F. Parham, lead welding contractor of Cincinnati, Ohio.

Plumbing Codes Strengthened By Application Of Accepted Standards

ONE of the important details in the revision and modernization of plumbing codes is the inclusion of up-to-date standards for materials which have been accepted by the trade and sponsored by responsible manufacturers as well as by the Government.

In many cities such revision is underway and in some localities improved codes have already been put in force. Two midwestern cities, Tulsa, Oklahoma, and St. Louis, Missouri, while revising their codes, have included the most recently adopted standards for lead and lead products. One of the important additions to the codes of both of these cities is the requirement that all lead pipe and fittings must comply with the U. S. Department of Commerce Commercial Standards CS95-41 (Lead Pipe) and CS96-41 (Lead Traps and Bends) or the Lead Industries Standards. St. Louis also requires that calking lead shall comply with CS94-41 (Calking Lead).

The Commercial Standards were promulgated in 1941 by the Bureau of Standards of the U. S. Department of Commerce and they provide a nationally recognized specification for the respective materials to which they refer. The Lead Industries Association Standards which are referred to in the Commercial Standards were established previously but the two are substantially identical.

In addition, the L.I.A. Standards provide a means by which manufacturers who comply with their requirements may be licensed without cost to mark their products with the Association's Seal of Approval as a guarantee that such requirements have been met. The Association maintains an inspection service to protect the integrity of the Seal.

The requirement in a plumbing code that all lead materials bear the Seal of Approval is a forward step in ensuring the use of the proper materials and at the same time it provides a quick and positive check on these materials for the use of the plumbing inspector. The Tulsa Code includes such a requirement but even where it is not mandatory, the use of the Seal is recognized and encouraged by plumbing inspectors.

Several other lead sections included in both of these codes, while not new, are of interest as examples of careful consideration of protection of public

health and property. Lead welded or "burned" joints are acceptable as well as wiped solder joints. All vent stacks must be flashed with lead and all shower stalls must be waterproofed with sheet lead pans properly protected against green cement. This protection consists of bituminous paint applied to both sides of the lead and tar paper or roofers felt over the lead.

The Tulsa code provides that all lead branches or stubs shall be at least 6 in. long so that the flexibility of the lead may act to protect the piping system and the fixtures should movement occur.

Both cities prohibit the use of the rigid Durham system in buildings of three stories or less and in the ground work of all buildings. Both cities also require the licensing of plumbers as a means of protecting the public against irresponsible workmen.

The Standards mentioned in the preceding paragraphs are all available and may be obtained free of charge on request from the Lead Industries Association, 420 Lexington Ave., New York 17, N. Y. Also available is Federal Specification WW-P-325, dated September 6, 1944, which covers lead pipe, traps and bends and which can be used in lieu of the above mentioned standards if so desired.

Midwestern Plant Installs Large Lead Pan Under Plating Shop Floor

SINCE many of the solutions used in electroplating processes are corrosive, the plating industry makes extensive use of lead for tank linings and protective shields and coverings of various kinds. Lead serves so well for this purpose that United Platers, Inc. of Detroit, Michigan, recently covered the entire floor of their second floor plating shop with sheet lead to protect the concrete from disintegration by spilled solutions and to eliminate leakage into the basement below.

Since it was necessary to move all equipment, the work was done over a week end. A cushion of 6 layers of builders felt was first mopped down over the concrete. The lead was then laid, smoothed out and fitted with all joints butted for welding.

The firms lead burner, then welded the sheets together so that the entire floor of the room, 105 ft. by 18 ft., was covered by a single pan of 8-lb. sheet lead, turned up 12 in. or more at the sides and provided with suitable drains. The lead was then coated with a bituminous compound over which was laid a pavement of acid resisting brick.

This shop commonly turns out as much as 100 tons of plated articles per day. In handling this much material, much of it in small units which are in tumblers or other containers, considerable spillage and splashing of solutions and wash water are unavoidable but the continuous corrosion resistant lead pan will collect all liquids and convey them to the drains.

Smoothing lead sheets and welding seam in lead floor pan.

In addition to its use of lead as a construction material and for anodes, the plating industry is increasing the use of electroplating as a means of applying protective lead coatings. Under unusually severe conditions of exposure a lead coating which can be economically applied by electroplating will provide a high degree of protection from corrosion. It is especially desirable on springs because it reduces the possibility of hydrogen embrittlement.

United Platers, during the war, furnished lead plated parts for many types of equipment including some used in the atom bomb development. They also operate a large department for hot dip lead coating metal parts.

Lead plating shop which turns out several tons of lead electroplated bolts, nuts, washers, springs and other miscellaneous parts per day.

SPECIFY SEAL OF LEAD INDUSTRIES' APPROVAL MATERIAL

LEAD DATA SHEET

STANDARDS APPLICABLE TO LEAD PIPE AND CALKING LEAD

LEAD PIPE. Lead Industries Association's Standard for Lead Pipe bearing the Association's Seal of Approval.

U. S. Department of Commerce Commercial Standard C.S.-95-41.

Federal Specification for Pipe Bends and Traps; Lead (for) Plumbing and Water Distribution WW-P-325.

CALKING LEAD. Lead Industries Association's Standard for Calking Lead bearing the Association's Seal of Approval.

U. S. Department of Commerce Standard for Calking Lead C.S.-94-41 (Includes Lead Wool).

American Water Works Association Standard Specification for Laying Cast Iron Pipe, Sec. 10.4, Specifications for Lead.

The standards in each group are identical in substance.

STEPS IN INSTALLING A LEAD WATER SERVICE

Select proper class of lead pipe to carry anticipated pressure.

Cut off sufficient length of pipe from coil, allowing for gooseneck (see adjacent table) and reasonable slack to bypass any obstacles in trench. Pipe may be measured in coil and fittings may be attached to portion to be used without uncoiling.

Wipe corporation stop tailpiece (preferably angle type) to main end of lead pipe. Prepare service end of pipe by attaching curb stop, union or other connecting unit. Preparation of service pipe to this point may be done in shop.

Lay pipe in trench and bend P-shaped gooseneck to dimensions indicated in adjacent table. Pipe should be so oriented before bending that corporation union will approximately face. If corporation union is properly placed the curvature of the coil may be utilized as the beginning of the gooseneck which should extend to right so that any settlement will tighten rather than loosen the union. Gooseneck should lie horizontal to avoid trapping. If lead flange union is used substitute U-shaped expansion loop for gooseneck.

In rocky soil bed pipe in sand or earth, fill and cover with six to eight inches of sand or loose earth before backfilling. In corrosive soils such as muck or cinders or in locations where severe electrolosis may be expected lay lead pipe in wood or tile trough and cover with hot pitch.

SOLDER FOR LEAD SERVICE PIPE

Inside Diameter Inches	Approximate* Solder Required Per Joint Ounces
3/4	8
1	10
1 1/2	12
2	23

** These data are from the records of the water department of a large midwestern city. Quantities are subject to variation due to differences in individual technique.*

STEPS IN MAKING LEAD CALKED JOINTS

Prepare trench with ample bell holes for calkers. Provide blocking for centering and leveling pipe. Hold one or two strands of yarning material around bottom of spigot while it is stabbed into bell of preceding joint. Snug spigot against throat of bell and center spigot in bell, securing pipe in position with wedges or tamped earth.

YARNING. Place yarn in successive single strands long enough to overlap at ends. Stagger overlaps. Drive each strand home with yarning iron and when last one is in place thoroughly compact all strands. Leave space two inches deep for lead.

Inside Diameter Inches	Wall Thickness Inches	Outside Diameter Inches	Minim Outsi Circumfe Inch
			CLASS For Pressures up
3/4	0.203	1.156	3 1/2
1	.214	1.428	4 5/16
1 1/4	.210	1.670	5 1/8
1 1/2	.242	1.984	6 1/16
2	.252	2.503	7 3/8
			CLASS For Pressures up
3/4	.231	1.212	3 11/16
1	.246	1.492	4 9/16
1 1/4	.258	1.765	5 3/8
1 1/2	.288	2.706	6 3/8
2	.376	2.751	8 1/2
			CLASS 10 For Pressures up
3/4	.293	1.336	4 1/16
1	.298	1.596	4 7/8
1 1/4	.320	1.889	5 13/16
1 1/2	.386	2.272	7
2	.501	3.008	9 5/16

** This dimension measured with a steel tape provides a qui installed.*

*** This table is intended for estimating length of lead servic as 600 lbs. may commonly be obtained on special order. Wh*

WATERWORKS USES

POURED LEAD JOINT. Place asbestos joint runner around pipe tight against bell and draw tight with clamp. Build a fireclay pouring gate at least one inch above rim of bell.

Heat lead to a temperature such that "rainbow colors" appear immediately after surface is skimmed. Pour each joint continuously from one ladle if possible. If necessary, provide a second ladle and pour in relays. Fill to top of pouring gate to provide for shrinkage of cooling metal.

When lead has solidified remove runner and cut off sprue with fish tail chisel or cold chisel. Allow joint to cool before calking.

CALKING. Joints may be calked by hand or with pneumatic hammers. Go entirely around joint with each calking tool in the set beginning with the smallest. Finish with largest tool once around joint against bell and once against pipe.

LEAD WOOL JOINT. Take one or two turns of lead wool strand around pipe and drive into joint with yarning iron. Calk firmly into place and repeat the operation until the joint is filled. Do not overlap ends of succeeding strands. Feather each end and roll together to form a uniform continuous rope. Finished joint should be smooth and flush with face of bell.

PE

minal eight Foot unds	Length of Pipe in Goose Neck Feet	Width Across Goose Neck Feet	Number of** Feet in 100 lbs.
eight) r Square Inch			
3.00	2	1¼	33.3
4.00	2	1¼	25.0
4.75	2½	1½	21.0
6.50	3	1⅞	15.5
8.75	4	2½	11.3
Weight) r Square Inch			
3.50	2	1¼	28.5
4.75	2	1¼	21.0
6.00	2½	1½	16.6
8.00	3	1⅞	12.5
3.75	4	2½	7.2
S Weight) er Square Inch			
4.75	2	1¼	21.0
6.00	2	1¼	16.6
7.75	2½	1½	12.9
1.25	3	1⅞	8.8
9.50	4	2½	5.1

neans of checking the size and class of lead pipe already

of weight convenient for handling. Coils of weights as great nditions warrant even greater weights may be obtained.

CALKING MATERIALS REQUIRED FOR LEAD JOINTS IN CAST IRON WATER MAINS

Size of Pipe	Approximate Weight of Lead per Joint 2 in. deep Pounds	Approximate Weight of Hemp per Joint Pounds
3	6.00	.18
4	7.50	.21
6	10.25	.31
8	13.25	.44
10	16.00	.53
12	19.00	.61
14	22.00	.81
16	30.00	.94
18	33.80	1.00
20	37.00	1.25
24	44.00	1.50
30	54.25	2.06
36	64.75	3.00
42	75.25	3.62
48	85.50	4.37
54	97.60	6.25
60	108.30	8.25
72	146.00	12.50
84	170.00	15.00

—Cast Iron Pipe Research Association

CALKING LEAD

Requirements as to composition of metal for calking lead of the American Water Works Association are identical with the requirements of the Lead Industries Association for calking lead bearing the Association's Seal of Approval and the U. S. Department of Commerce — Commercial Standard CS94-41.

These requirements are as follows:

Lead for calking purposes shall contain not less than 99.73 percent of lead.

Maximum allowable impurities:

	Percent
Arsenic, Antimony, and tin together	0.015
Copper	.08
Zinc	.002
Iron	.002
Bismuth	.25
Silver	.02

The purchase of calking lead bearing the Lead Industries Seal of Approval assures the user that it will comply in composition with the above requirements. The seal appears stamped or cast on each approved pig or ingot and on the package containing or label attached to lead wool.

Calking lead is furnished in pigs weighing from 60 to 100 lbs. each and in ingots weighing from 3 to 6 lbs. each. Ingots may be single units joined by wires or other means.

Lead wool is loosely twisted into rope and packed in bags or wound on reels.

A Portfolio of American Landmarks

No. 36

Skaneateles A Town In Central New York

The William Allen house built in 1830 is more imposing for the gleaming whiteness imparted to it by pure white lead paint.

SKANEATELES, New York, situated at the head of the lake of the same name is a charming village with a glorious view down the lake from its main street. It was a thriving settlement on the main road from Utica to Auburn at the beginning of the 19th century and there are a number of well kept fine old houses of that period in the town today, three of which are shown on this page.

The rapid change in taste in architecture which took place at that time is shown in the wide variation in style of these houses, all built within a relatively short span of time. In fenestration the facades are identical but the Wolcott house is quite evidently the earliest house of the three. The Allen house is typical of the more pretentious Greek Revival period with its Doric columns and full length parlor windows. The Parsons house shows unmistakable Victorian tendencies, although it retains the three graceful arches found so commonly through central New York.

These houses are treasured by their owners who have, in addition to a sentimental attachment to them, the responsibility for their safekeeping as historical documents. In the fulfilling of that responsibility they make regular periodic painting with pure white lead paint an important part of their maintenance programs.

The Spencer Parsons house built about 1840 has much well executed detail which has been properly preserved with pure white lead paint.

The Wolcott house when originally built in 1798 was but one story. The upper floor was added about 10 years later. An interesting note is the white lead painted siding of varying widths.

PHOTOS BY DAVID N. SNYDER

THIS IS NO. 36 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.

Lead Lined Equipment Used in Production of Newly Developed Chemical

THE construction of a plant to conduct, on a commercial scale, a chemical manufacturing process which is relatively simple in the laboratory entails considerable study and careful attention to the selection of construction materials. The corrosive action of the raw materials, the products, and the possible by products must be considered as well as the possibilities of contamination of the finished product through reaction with the construction materials. An interesting summary of such a study appears in the November 1945 issue of "Chemical and Metallurgical Engineering."

CHEMICALS INVOLVED IN THE MANUFACTURE OF POTASSIUM METABISULPHITE

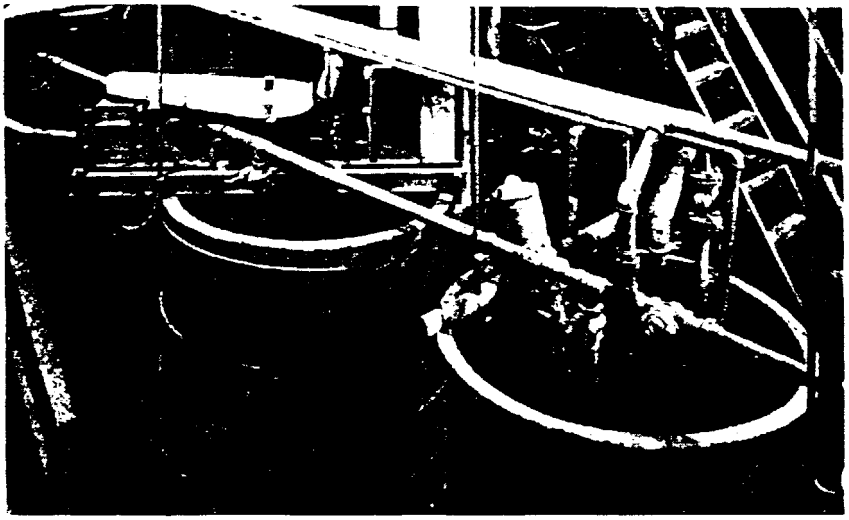
Key Used in Flow-Sheet	Chemical	Remarks
1	Sulphur dioxide	Liquid and gas
2	Sulphurous acid	Very corrosive.
3	Caustic potash	As 50 percent and less
4	Potassium sulphite	Essentially neutral.
5	Potassium bisulphite	Highly corrosive to iron.
6	Potassium metabisulphite	Moderately corrosive.
7	Potassium sulphate	Small amounts throughout system.
8	Oxygen	At high drying temperatures.
9	Sulphur	At high drying temperatures.
10	Ferric hydroxide	Precipitated.

Refer to flowsheet to find out in which pieces of equipment each of these chemicals does, or can, occur.

The chemical to be manufactured in this case was potassium metabisulphite which is being used increasingly as a fermentation arrester for wines, as a preservative for photographic solutions, and, to some extent, as a substitute for sulphur dioxide in the preservation of dried fruits. The study was made by G. S. Wheaton and R. S. Sunderlin of the Pittsburgh Chemical Co. of Vernon, Calif., when this company in 1941 was preparing to go into production of this chemical, thus becoming the second of the two known domestic producers.

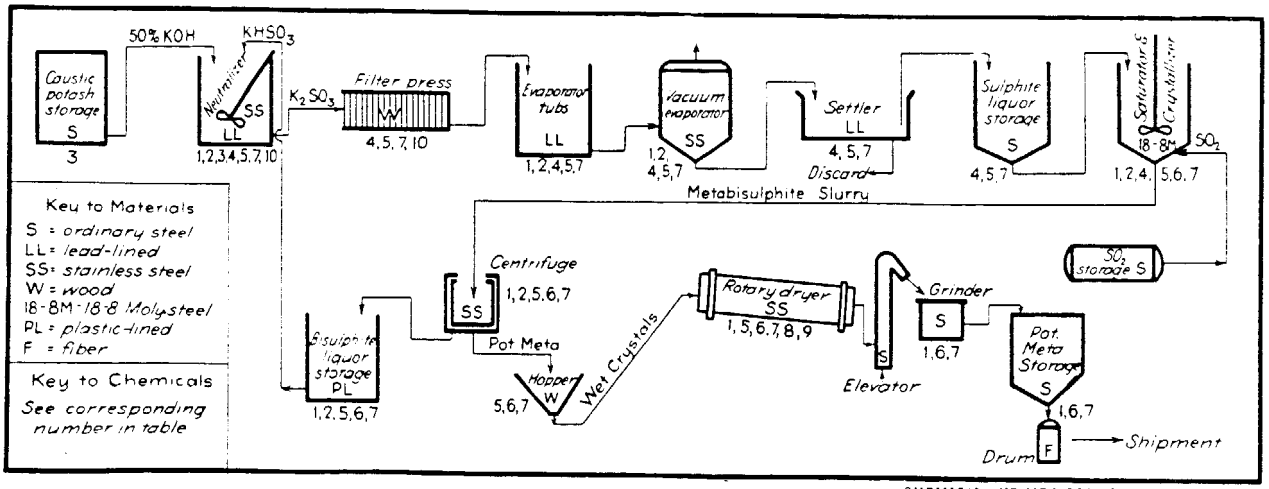
A list of the chemicals involved and a flowsheet clearly showing where each occurs in the process formed the basis on which the selection of materials for the various vessels was made. Careful attention to freedom from contamination as well as to durability of equipment and economy of construction resulted in the selection of lead as the lining materials for three of the larger vessels used in the process. In the first one where caustic potash is neutralized with bisulphite

(Continued on Page 8)



Lead lined tanks where caustic potash is neutralized with bisulphate solution.

Flowsheet process for manufacture of potassium metabisulphite. Materials of construction are indicated by letter, chemicals, products and possible by products by number.



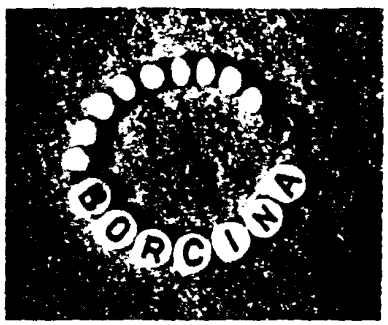
CHEMICAL AND METALLURGICAL ENGINEERING

Lead Seal on Identification Bracelet Protects Hospital and Baby

THE convenience and ease with which lead can be bent or crimped over a string or wire to secure it against tampering has long made it a favorite material for use in sealing important and valuable packages. We are all familiar with seals of this type used as protection for merchandise, money or other types of valuable property.

However, here is a lead seal used for a safeguard for an intangible treasure which, if lost, might never be surely and certainly regained—the identity of a new born baby. The tiny bracelet shown in the accompanying photograph consists of a string of lettered beads, spelling out the baby's surname, strung on a strong silk cord. The bracelet is prepared and the cord is threaded through two holes in the lead seal. Before the baby is taken to the nursery the bracelet is slipped over the hand, the cord drawn up around the little wrist and the seal firmly crimped over the cord.

The bracelet is not removed until the mother and baby have left the hospital and are safely home. Only by cutting the cord can removal be effected.



Identification bracelet for new born baby showing lead seal which guards against accidental removal (actual size).

This is an ingenious application of a very common use of lead. It is much quicker, more sure and more sanitary than the usual adhesive tape label and in addition the bracelet is much prettier.

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.

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, 1944.

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 *American Builder*, July, 1939.

COMMERCIAL STANDARDS:
Calking Lead, CS94-41
Lead Pipe, CS-95-41
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.

FEDERAL SPECIFICATION WW-P-325
For Pipe, Bends and Traps, LEAD
Part 5 of Section IV of the Federal Standards Stock Catalog, official publication by the Government Printing Office.

LEAD COATINGS ON STEEL
By Harold A. Knight, News Editor, Metals and Alloys
A thorough discussion of hot dip and electroplated coatings on steel sheet, wire and fabricated products including the technique of application, thickness of coatings, uses and advantages. Reprinted from the November, 1944 issue of *Metals and Alloys*.

LEAD X-RAY SHIELDING
Graphic chart based on recommendations of the International Commission on X-Ray and Radium Protection giving thicknesses of lead for respective voltages in millimeters, inches and pounds per square foot.

MATERIALS AND METHODS OF X-RAY PROTECTION
By George Singer, Acting Chief Radiation Section, National Bureau of Standards, Washington, D. C., and George C. Lawrence, Ph.D., National Research Council of Canada
A discussion of the materials suitable for use in shielding X-ray installations giving methods of and graphs for computing required thickness of barriers, based on tube current and distance as well as tube voltage. Reprinted from *Industrial Radiography* Vol. IV, No. 2, Fall, 1945.

LEAD LINED EQUIPMENT

(Continued from Page 7)

solution, the maintenance of a slight excess of bisulphite counteracts any tendency of the chemical to pick up metal.

The next vessel in line, the evaporator feed tank, must be lead lined because the liquor is not completely neutralized and has a dehydrating effect on wood. Iron pick-up must be carefully avoided. The rectangular settling tank is lead lined for the same reasons.

In this case as in many others the choice of materials, while based primarily on resistance to corrosion, was influenced by other factors such as cost of construction, ease of maintenance, availability and economy of operation. Because lead so often fulfills the greater number of such requirements, it is one of the most widely used metals for handling corrosive materials in the chemical industry. It is adaptable to many means of application and its suppliers and fabricators are readily available.

UPON REQUEST, THE LEAD INDUSTRIES ASSOCIATION WILL BE GLAD TO MAIL "LEAD" REGULARLY, FREE OF CHARGE, TO THOSE INTERESTED, AND WILL COOPERATE WITHOUT OBLIGATION IN THE SOLUTION OF YOUR LEAD PROBLEMS

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