LEAD INDUSTRIES ASSOCIATION
420 LEXINGTON AVENUE
NEW YORK 17, N. Y.

METALLIC LEAD PRODUCTS DIVISION

CONFIDENTIAL

[redacted] DIVISION

ADVISORY COMMITTEE

METALLIC LEAD PRODUCTS DIVISION

New York, N.Y. April 21, 1950

A meeting of the Advisory Committee of the Metallic Lead Products Division was held on April 21, 1950, at the Lawyers Club, New York.

PRESENT	REPRESENTING
W. F. Murdock	The Eagle-Picher Co.
L. Halpern	Federated Metals Division American Smelting & Refining Co.
W. P. Carroll	National Lead Co.
W. J. Welch	National Lead Co.
R. Charrington	North American Smelting Co.
C. R. Ince	St. Joseph Lead Co.

Robert L. Ziegfeld, Secretary-Treasurer
David M. Borcina

The meeting was called to order at 11:00 A.M.

The secretary stated that there was no permanent chairman of this group and that it was in order to elect one at this time. Nominations for chairman of this group were therefore opened.

Mr. Randolph Charrington's name was placed in nomination and there being no further nominees, it was regularly moved, seconded and carried unanimously that nominations be closed.

There being no dissenting votes cast, it was regularly moved, seconded and carried that Mr. Charrington serve as permanent chairman.

The chairman requested the secretary to report on the action taken by the full committee at its Chicago meeting. The secretary stated that no formal plan for increasing the activities of this Division had been presented at the Chicago meeting but the consensus

of opinion of those present was to increase the activities of the Division as soon as possible. He was instructed to discuss with the Advisory Committee the possibility of enlarging the program.

The question was then raised as to the effectiveness of the work in the plumbing and water works field. The secretary reported that the work was particularly effective prior to the war when three field men were employed, each covering a different geographical area.

The secretary reported that he estimated it would cost approximately $10,000 for each additional field man placed on the staff and that if it is decided to enlarge the staff, some consideration be given to an increase in the salary of Homer S. Yetman who had received no increase for several years and who had, single-handed, been conducting this work over the entire country.

After some discussion, it was felt that two additional field men would be most desirable, thereby increasing the budget to approximately $45,000 and that a salary increase of $1,000 per year for Homer S. Yetman be approved. The secretary was thereupon instructed to poll all subscribers to this Division as to their approval or disapproval of the action taken by this Committee and that in so doing, he notify them that the increased budget met with the approval of the companies represented at this meeting.

AMERICAN WELDING SOCIETY

The secretary then read a letter received from the American Welding Society, which is attached as Exhibit "A."

It was the opinion of the group that the Association cooperate to the fullest extent and that an Association staff member be appointed to the main committee and work through a subcommittee composed of personnel from member companies.

SOLDER STANDARDIZATION

The chairman requested that consideration be given to some method of solder standardization to avoid much of the misrepresentation that is prevalent in the industry. After some discussion, it was felt that this should be tabled for further consideration at a later date.

SEAL OF APPROVAL

The secretary reported that because of various conditions, many of the companies licensed to use the Seal of Approval on plumbing goods had discontinued this practice to a large extent. He said that with the proposed staff increases, the Association would be in a position effectively to police the use of the Seal of Approval and asked the Committee to present its views. The Committee felt it very desirable again to stress the importance of the "Seal" and requested the secretary to notify all licensees by letter of its importance and to request that they use it on all products meeting the requirements of the licensing agreement.

There being no further business, the meeting adjourned at 12:45 P.M.

Secretary

Exhibit "A"

AMERICAN WELDING SOCIETY
33 West Thirty-Ninth St.
New York 18, N.Y.

Simon A. Greenberg
Technical Secretary

April 19, 1950

Mr. Robert L. Zierfeld, Secretary
Lead Industries Association
420 Lexington Avenue
New York 17, N.Y.

Dear Mr. Ziegfeld:

Please accept our sincerest thanks for the time you spent with us on Tuesday discussing the future activities of the AWS Committee on Brazing and Soldering.

For the sake of the records and just in case you want to pass this information along to any of your members I am jotting down below the essence of our discussion:

By a recent action of the AWS Board of Directors the AWS Committee on Brazing has enlarged its scope to include soft soldering as well. The name of the Committee has also been changed to the AWS Committee on Brazing and Soldering. It is intended that this Committee will undertake to prepare information on brazing and soldering. Currently the Brazing Committee has decided to undertake preparation of a manual on brazing which would provide sound, technical, practical information helpful to users of brazing. Information might be included on brazing materials, methods of brazing and techniques involved, methods of testing and such fundamentals as symbols and definitions. The exact nature of the manual is not definite since as you probably appreciate, changes in approach are frequently suggested in the course of a Committee's activities. With the inclusion of soft soldering within the scope of the Committee it is intended that similar information will be prepared for soldering and included in the manual.

We would very much like to have the Lead Industries Association's cooperation in this activity. It is thought that if you would appoint one or two representatives to the Main Committee and through these members organize a subcommittee on soft soldering, the activities on soft soldering could be conducted parallel with the present activities on brazing.

Please regard this as a formal invitation to your Association to designate one or two members to represent the Lead Industries Association

on the AWS Committee on Brazing and Soldering. While you may feel free to designate anyone you may wish to, we would like to suggest that consideration be given to the appointment of Mr. D. M. Borcina of your staff as one of the representatives. We are prompted to suggest Mr. Borcina's appointment on the basis of the very excellent cooperation we received from him in the preparation of Chapter 36 - Lead and Zinc of the new Welding Handbook. We have received many fine comments on this chapter and I believe you have received some favorable comments yourself based on the reprints you have secured.

The other representative should preferably be from a producer of soft solders. The Committee on Brazing and Soldering at present includes users of soft soldering in the communications, electrical and automotive industries and we are planning to invite a few additional user representatives from the radio and television industries and the canning industry.

I hope the above information is adequate to enable you to select the representatives requested. If not, do not hesitate to ask any questions.

It would greatly expedite matters if we could have the representatives selected within the next week or ten days. Our Technical Activities Committee, which is the Committee that approves all technical committee appointments, is to meet shortly and we would like to be able to submit the names of the new members for approval at that time.

Sincerely yours,

Simon A. Greenberg (Signed)

Technical Secretary

SAG:MW

CC: Mr. A. M. Kugler

Lead Welding

Reprinted from WELDING HANDBOOK *Third Edition,*
American Welding Society

Compliments of
LEAD INDUSTRIES ASSOCIATION
420 Lexington Avenue
New York 17, New York

CHAPTER [illegible]

LEAD AND ZINC*

A. LEAD

[illegible]

The [illegible] of lead is [illegible] to the welding of other metals [illegible] being to join two separate [illegible] metal into one continuous piece. [illegible] the technique used to bring [illegible] result differs considerably [illegible] lead and other metals. An important difference in gas welding lead to lead is that no flux is required. In the past the common term for lead welding has been *lead burning*. Since the result of the operation is a true weld this is a misnomer.

Probably the first successful attempt at welding was done on lead. This has been shown by samples of lead pipe dating back over 1800 years. The Romans of that era had complete water distribution [illegible] and most of the pipe used to [illegible] and [illegible] were [illegible] and [illegible] the method of [illegible] a [illegible] form of welding as compared to methods of today.

[illegible]

As a raw material lead is marketed in [illegible] Pig lead is [illegible] in several grades as specified in the [illegible] *Standard Specifications for Pig Lead* (Serial Designation: B29-43). (See Table 1).

The various grades of lead find their principal use in certain applications but are not necessarily confined to those applications. For example, corroding lead, because of its high purity, is most extensively employed in the manufacture of white lead and other pigments. Chemical lead, acid lead and copper lead are widely used under corrosive conditions. Common desilverized lead A, common desilverized lead B and soft undesilverized lead are essentially for general purposes.

Table 1—Chemical Composition of Pig Lead

	Corroding Lead[a]	Chemical Lead[b]	Acid Lead[c]	Copper Lead[d]	Common Desilverized Lead A[e]	Common Desilverized Lead B[e]	Soft Undesilverized Lead[f]
Silver, max., per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver, min., per cent		[illegible]					
Copper, max., per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Copper, min., per cent		[illegible]	[illegible]	[illegible]	....	....	....
Silver and copper together, max., per cent	[illegible]	....	....	....	....	....	....
Arsenic, max., per cent	[illegible]	....	....	....	....	....	....
Antimony and tin together, max., per cent	[illegible]	....	....	....	....	....	....
Arsenic, antimony, and tin together, max., per cent		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Zinc, max., per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Iron, max., per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Bismuth, max., per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Lead (by difference), min., per cent	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

* Explanatory Note

[a] [illegible] lead is a designation that has been used for many years in the trade to describe lead which has been refined to a high degree of purity.

[b] Chemical lead has been used for many years in the trade to describe the undesilverized lead produced from Southeastern Missouri ores.

[c] Acid lead is made by adding copper to fully refined lead.

[d] Copper lead is made by adding copper to fully refined lead.

[e] Common desilverized leads A and B are designations that are used to describe fully refined desilverized lead.

[f] Soft undesilverized lead is used in the trade to describe the type of lead produced from ores of the Joplin, Missouri district.

* Prepared by a committee consisting of G. O. Hiers, National Lead Co., Chairman; [illegible], Lead Industries Assn.; [illegible], The New Jersey Zinc Co.; J. R. Townsend, Consulting Engineer.

Lead is easily rolled into sheets, extruded into pipes and [illegible], cable sheathing, and in fact practically any desired cross-section. It is easily worked, forged and cast, and is alloyed with many other metals. Two alloys commonly used in welding are tellurium lead and antimonial lead, in both of which the alloying elements impart certain characteristics to the lead. The addition of tellurium, less than 0.1%, improves the work-hardening capacity of the lead. The addition of antimony, up to about 6%, increases the hardness and provides about twice the tensile strength of soft lead at ordinary temperatures. However, antimony lowers the melting point markedly depending on the percentage used.

Lead melts at 621°F. and boils at [illegible]°F. When freshly cut, its surface has a bright silvery luster which oxidizes to a dull gray. Lead is resistant to corrosion from ordinary atmosphere, moisture and water and is particularly effective against many acids, such as sulphuric and chromic.

In specifications the thickness of sheet lead is usually referred to by weight in pounds per square foot. The thickness in inches can easily be ascertained by following, in general, the formula 1 sq. ft. of lead 1/64-in. thick equals 1 pound. For example, 8 lb. sheet lead weighs 8 lb. per sq. ft. and is 8/64 or 1/8 in. thick.

Lead pipe is usually specified by inside diameter and weight per foot or by wall thickness.

HOW TO WELD

Processes Used

Gas welding is most commonly used for welding lead. Other welding processes have been used on an experimental basis only.

Special Tools of the Lead Welding Operator

The following tools are needed by the lead welder:

1. Welding torch tips ranging in drill size from about 78 to 68. The smaller tips are for use with 6 lb. lead and lighter, and the larger tips for heavier lead. Depending upon conditions and the welder's experience, torch tips larger than 68 drill size are sometimes used. Light [illegible] torches separated from the [illegible] type and easily accessible to the welder are preferred.

2. [illegible] and [illegible] of materials that will not dent or mar the lead, for dressing the [illegible] of lead to be joined so that they are suitably aligned for welding.

3. [illegible] for expanding one end of a length of pipe so as to [illegible] section of pipe to [illegible].

4. [illegible] and wire brushes for cleaning or removing oxide from the lead over the areas that are to become a part of the joint.

5. [illegible] tools for accurately cutting the lead.

6. [illegible] molds for use on vertical butt seams.

Gases Used

There are three combinations of gases commonly used. They are oxy-acetylene, oxy-natural gas and oxy-hydrogen. The oxy-hydrogen mixture can be used for all positions and is considered the most satisfactory fuel. In general, oxy-acetylene is satisfactory for all positions of welding. The oxy-natural gas mixture is satisfactory for the flat, horizontal and vertical positions.

Gas Pressure and Type of Flame

A low gas pressure, from 1 1/2 to 5 psi., is generally used varying with the type of weld to be made. The flame must be a neutral one inasmuch as a reducing flame will deposit soot on the joint and an oxidizing flame coats the molten globules of lead with an oxide film which acts as a barrier between the molten globules preventing coalescence. The length of the flame will vary, but is usually somewhere between 1 1/2 to 4 in. depending upon the pressure and volume of gas used.

Welding Rods

Filler metal is generally used, in the form of welding rods in sizes from 1/4 to 3/8 in. in diameter. The smaller sizes are used for light weight lead and the larger sizes for heavier lead. The selection very often depends upon the welder's preference. The welding rods should be of the same composition as the lead to be welded. For example, if 6% antimonial

lead is being welded, then a 6% antimonial lead welding rod should be used.

Working Precautions

The portions of the lead that are to become a part of the joint should be scrupulously cleaned by shaving or wire brushing. This includes the inner surface of pipe joints in contact as well as the exposed areas. On square butt joints the abutting edges as well as the surface on which the reinforcement will be deposited should be cleaned. On lap joints the edge and underside of the lapping sheet and the underlapping sheet extending beyond the lap to the end of the area over which the weld will be deposited should be cleaned.

Fig. 1—Butt Joint for Sheet Lead ¼ In. [illegible]

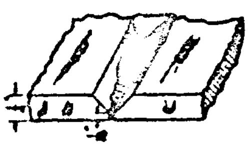

Fig. 2—V-Butt Joint for Sheet Lead Over ¼ In. Thick

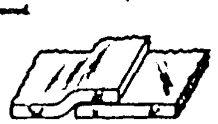

Fig. 3—Lap Joint in Sheet Lead

Types of Joints

(a) *Sheet*—There are three basic types of joints commonly used in welding lead sheet. These are the butt, lap (see Figs. 1, 2 and 3) and flange types. On flat work the butt and lap types of joint can be used interchangeably depending upon conditions of installation. On vertical and overhead welding, the lap joint is almost always used. The flange joint, which is not illustrated, is used only under special conditions.

(b) *Pipe*—The butt joint is usually preferred, with the lap and cup joints as alternatives on lighter weight lead, up to about ⅛-in. thick. (See Figs. 4, 5 and 6.) The flange joint is also used on larger diameter pipe but differs from the flange joint in sheet lead. The flange for pipe joints is cast or made from sheet lead and then welded to the pipe.

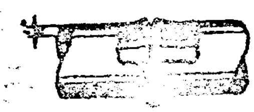

Fig. 4—Butt Joint for Pipe with ¼ In. [illegible]

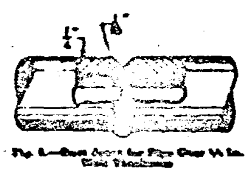

Fig. 5—Butt Joint for Pipe Over ¼ In. Wall Thickness

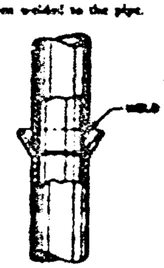

Fig. 6—Cup Joint for Pipe in Vertical Fixed Position

Preparation for Welding

The lap joint is prepared by lapping the edge of one member over the other about ½ to 2 in. depending upon the thickness of the lead. The thicker the lead the greater should be the lap. The underside, top and edge of the upper member are scraped clean as is the top of the lower member. Cleaning is necessary only over the area that is to become part of the welded joint.

The butt joint is prepared by placing the edges of both members together. For material weighing less than 8 lb. (⅛-in. thick) no beveling of the edges is necessary. However, for heavier weights the edges should be beveled to an included angle of 45 to 90 deg. except for a root face of 1/16 in. minimum, usually without root opening. (See Fig. 2.) The root faces should be shaved clean as well as the top surfaces of the two parts over the area forming the joint.

The flange joint for use with 4 lb. and lighter sheet is prepared by turning up the ends of the sheets to be joined, both sides and edges of the upturns being thoroughly scraped clean and then butted together.

Manipulation of the Torch

Manipulation of the torch and the kind of flame used depend on the type of joint being welded and the position of welding. In general, a semi-circular or V-shaped motion is used. The molten lead is controlled and flowed with the flame, thus accounting for the circular or herringbone appearance of the joint. Each semicircle or Vee is made in one continuous operation, the flame being flicked away from the work at its completion. (See Figs. 2 and 7.)

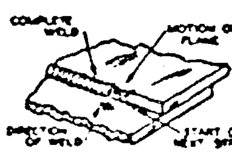

Fig. 7—Technique of Welding Lap Joint in Flat Position

In welding in the horizontal position, a soft bushy flame is most desirable; in the vertical and overhead positions a more pointed flame is generally used. This will vary to some extent with each welder.

Positions of Welding

Welds in a Flat Position—The butt joint is the most commonly used type for flat welding, and has been described previously. For thin sheet, 1/16 to ⅛ in. (2 to 4 lb.), flanges 1 to 1½ times the sheet thickness may be bent up, cleaned and butted together. Lap joints are sometimes preferred, due to simplicity of fitting. [illegible] of moving the torch in a [illegible] path toward the lap and [illegible]. Filler metal is generally used, although none is used on the first pass. Flat welds are illustrated in Figs. 1, 2, 3 and 7.

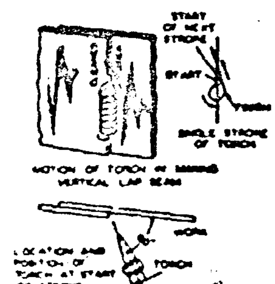

Fig. 8—Technique of Welding Lap Joint in Vertical Position

Welds in a Vertical Position—Lap joints are used almost exclusively for welding in the vertical position. Welding is begun at the bottom of the joint and the flame is applied to the lead at the junction of the front and rear sheets. When the edge of the front sheet becomes molten, the flame is carried with a circular downward motion back into the sheet and completely liquefying the overlap. Then the flame is carried almost horizontally over the underlapping sheet fusing the front and rear sheets together. Welding rod is not generally used. (See Fig. 8.)

In rare instances, butt joints are used but this is more of a molding operation performed with molds held in place and

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lead melted into one bead with the joint by directing the flame into the mold.

Welds in an Overhead Position—The overhead position is the most difficult of all for welding lead and is to be avoided if at all possible. However, if it is necessary to weld in this position, the lap joint is most suitable and as sharp a flame as possible must be used. Of necessity, the beads should be small and the operation completed as quickly as possible. No welding rod is used. The pressure of the flame and capillary attraction are usually sufficient to hold the molten lead in place.

Fig. 9—Overhand Technique for Welding in the Horizontal Position

Horizontal Joint on a Vertical Surface—There are two methods of making joints in the horizontal position; the overhand, which is the easier and therefore the preferred, and the underhand. Both are of the lap type. In the so-called overhand method, the lower sheet to be joined is the overlapping sheet and the edge of the lap is left slightly open. The flame is inserted into this opening and welding done in what amounts to a flat position. (See Fig. 9.) The lap is not used as filler metal but becomes part of the face in which the welding is performed. Filler metal is supplied by a welding rod. The underhand method is necessary if the upper sheet laps over onto the lower sheet. The lap is dressed tightly against the lower sheet and welding is performed by using the downside lap edge as filler metal. The flame is pointed at the lower sheet and cut into the overlap when the bead is formed. No welding rod is used. The underhand joint (see Fig. 10) is almost as difficult to weld as joints in the overhead position and should be avoided wherever possible.

Fig. 10—Underhand Technique for Welding in the Horizontal Position

Pipe Joints

For best results in welding pipe joints the work should be planned so that as few joints as possible have to be made in place. Where the pipe can be rotated horizontally, welding can be performed in what amounts to a flat position.

Where rolling is not possible and the pipe is in a horizontal position a butt joint is used. To avoid overhead welding the procedure usually followed is to cut a vee section in the upper part of one end of the abutting pipe. This allows access to the lower part of the joint which is then welded from the inside of the pipe.

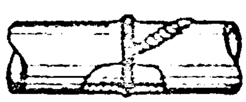

Fig. 11—Technique for Welding Pipe in the Horizontal Fixed Position

The vee cut is then replaced and welded from the outside as in the upper part of the joint. (See Fig. 11.) An alternative method is to cut tee-slots in the upper part of both ends of the pipe, folding back the lead and following the same procedure as above.

For [illegible] in the vertical fixed [illegible] should be used. [illegible] is fused out [illegible] the [illegible] is directed into [illegible] together. [illegible]

[illegible]

Welding lead to other metals is usually [illegible] steel or copper. Lead-covered steel and copper are [illegible] equipment and are [illegible] to as homogeneous lead equipment. The other metals are prepared for welding by thoroughly cleaning them by sand blasting or pickling. A considerable amount of this equipment is made by fluxing the steel or copper and applying the lead manually with torch and welding rod. Lead coatings of $\frac{1}{16}$ to $\frac{1}{2}$ in. are quite common. However, it is not usually possible to build up to these thicknesses in one pass and subsequent passes are necessary. No flux is necessary on these latter passes.

Important uses for these materials are in vacuum vessels, jacketed vessels and heat exchanger coils containing high pressures. This equipment gives relatively good heat transfer and withstands repeated rapid heating and cooling cycles without buckling.

Welding Speed

The speed of welding butt joints in the flat position is not much different from the speed of gas welding steel. Speeds of 30 ft. per hr. are common with 6-lb. sheet lead. Granjon's formula for determining welding speed is:

$$V = \frac{1.57 \times 2.85}{T}$$

T = lead thickness, in.

V = welding speed, ft./hr.

Consumption of Welding Rod

On butt joints a rough rule of thumb for [illegible] is [illegible] rod to 1 ft. [illegible] lead are employed. [illegible] over 4 ft. per pound of [illegible]

[illegible]

[illegible] lead [illegible] or [illegible] a [illegible] the [illegible] In [illegible] such as [illegible] each seam should be [illegible] to [illegible] a temperature of [illegible] (See Chapter [illegible] for further information on lining by welding.)

CORROSION APPLICATIONS

Lead products which are welded include tank linings and containers and other equipment used to store, tabs, convey or otherwise come in contact with chemical solutions. In lead storage batteries connector straps are welded to grids and connector lugs are welded to strap posts by a semi-automatic process.

Figure 12 is an example of lead welding a seam in 10-lb. sheet lead with a finger-tip torch in the collect launder of a 100 ft. diam. lead lined settling tank, part of a set-up for purifying sulfur dioxide gas. Figure 13 shows workmen smoothing lead sheet and welding a seam in a lead flow pan being installed in a plating plant.

Welding of plumbing and roofing products is confined to waste and vent lines for chemical and laboratory tables. (See bibliography at end of chapter for sources of further information on the welding of lead.)

Supports for Sheet Lead Lined Tanks

Where high temperatures are used within the lead lined tank or rapid cycles

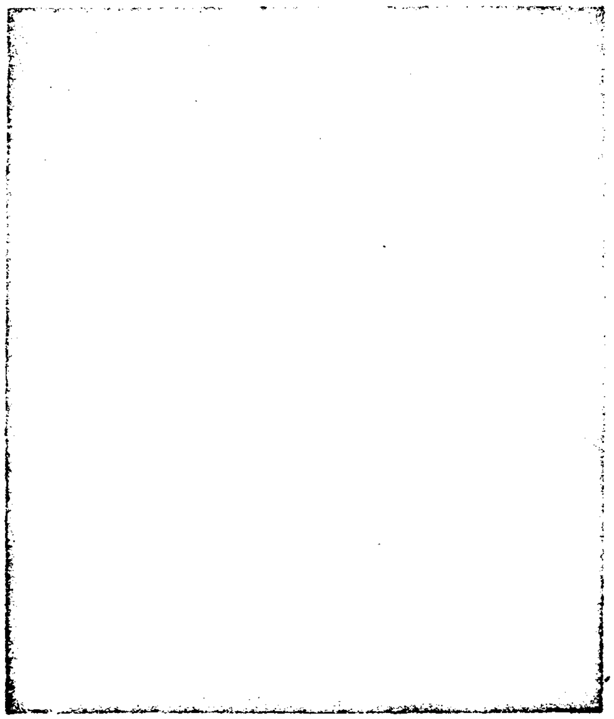

Fig. [illegible] -- Lead Lining a [illegible]-Ft. Diam. Settling Tank

of heating and cooling are encountered or the tank is a large one, it is customary to reinforce the sheet lead lining with flat or half oval steel bars. This is done, after a complete lead lining is installed, by placing the steel bars over the lead lining and bolting them through to the outer surface of the tank. The exposed steel bars are then covered with strips of sheet lead that are welded to the lead lining. Where exceptionally severe conditions are encountered, brick linings within the lead linings are used.