Lead Protective Devices In High Voltage X-Ray Machines

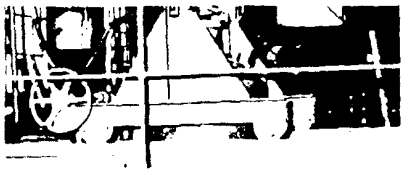
WITH the increase in both medical and industrial uses of X-rays and the development of very high voltage X-ray generating units has come the necessity for greater attention to the protection of persons working in the vicinity of such units. The American Standards Association is currently working on a safety code for the industrial use of X-rays and radium.

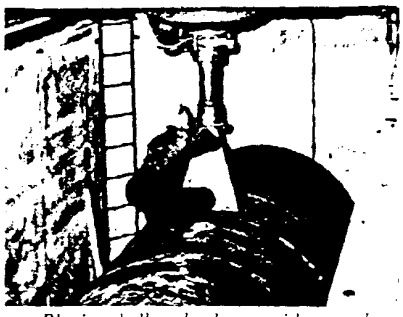
The provision of adequate general protection near the X-ray generator can be greatly facilitated if the emission of rays from the tube can be controlled and directed only to those fields in which the rays will be actually useful. The most modern generating units are so designed and constructed as to provide the greatest possible amount of such control.

Because of its great density, lead is the most efficient material for absorbing radioactive energy. In relation to its absorptive capacity, lead is the least bulky and the lightest weight material generally available. For these reasons lead is an extremely valuable material for use in the construction of X-ray generators as well as in the enclosure of areas where such units are situated and operated.

Recent developments in X-ray equipment include 1,000,000 and 2,000,000-v. units for therapeutic work and industrial radiography. In these machines the actual X-ray tube projects from one end of a steel transformer tank assembly. The end of the tube is fitted with a massive hollow lead cone which functions as a nozzle to confine the X-rays to a narrow beam which can be directed to the exact field to be treated or radiographed. The cone may be made in various forms for different uses or it may be adjustable to supply reflected rays at right angles to the axis of the main beam. On medical units this cone is made to cover the entire length of the tube outside of the transformer tank assembly. The amount of radiation which escapes from the assembly behind the lead cone is negligible.

On certain types of lower voltage units the entire tank containing the transformers and tube is lined with sheet lead and fitted with a lead cone or adjustable lead diaphragm. On still lower voltage units in which the tube is separate from the transformer assembly the tube casing is lined with lead, sprayed with lead on the outside and furnished with caps with lead inserts.

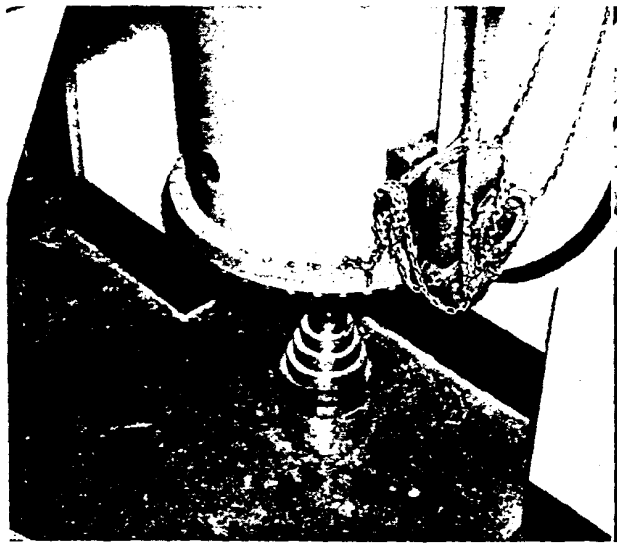




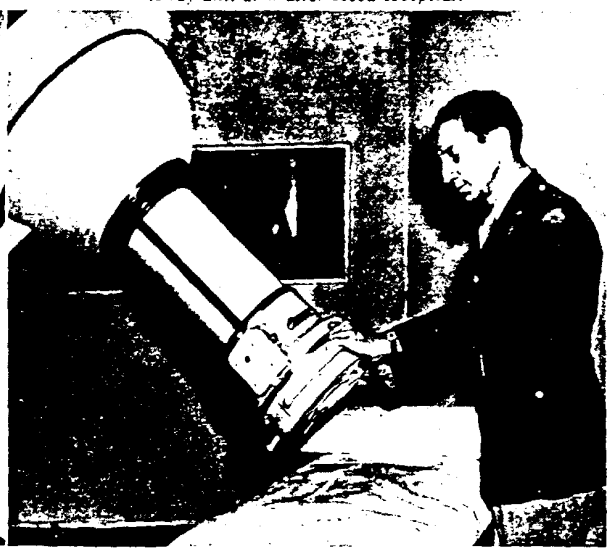
Placing hollow lead pyramid around path of X-ray beam to confine rays to working area.

There are a number of supplementary pieces of lead equipment which are used to control and confine the X-ray beam to the useful area and to improve the result of its work. One of these, a thick walled pyramid-shaped box, is used as an extension of the cone to surround the beam. Thick lead plates are also used for this purpose as well as to provide a barrier back of the film and absorb that part of the beam which penetrates the

1,000 volt X-ray unit in an ordnance plant showing lead cone at end of X-ray tube.



Major M. J. Friedman adjusting the lead cone of the 1,000,000 X-ray unit at Walter Reed Hospital.

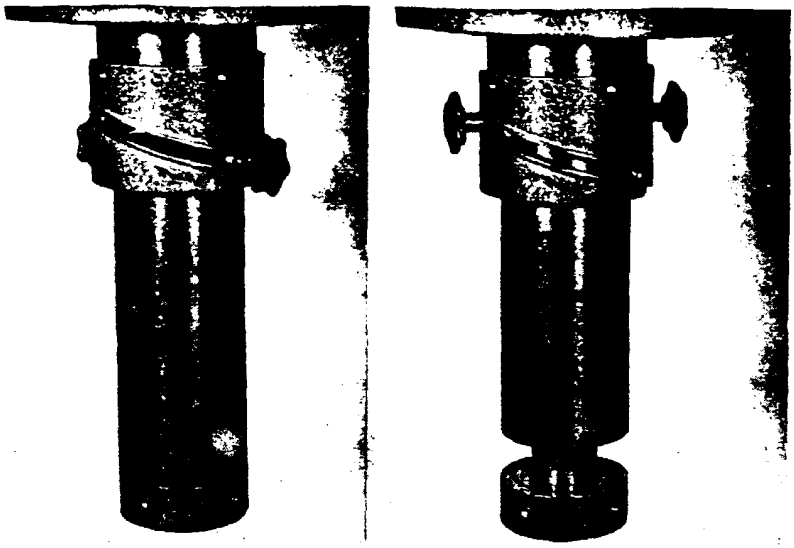


PHOTOS COURTESY GENERAL ELECTRIC X-RAY CORP.

LIA2586C

radiographic subject. Under some conditions it is desirable to surround the object to be radiographed with a tightly fitting pattern or silhouette of thick lead to prevent radiation outside the desired field striking the film.

All of these and many other special devices of lead are used for limiting the amount of radioactive energy which may escape during the operation of the X-ray generators. They are, however, only primary protection and must be supplemented by protective X-ray proof walls or, in case radiography is done in the field, by the most careful control of the locations of personnel during the time the machine is in operation. Great quantities of lead are used also in the construction of rooms housing both industrial and medical X-ray equipment.



Lead shutter for 1,000,000 volt X-ray unit. Left, position permitting escape of transmitted beam; right, position providing reflected beam.

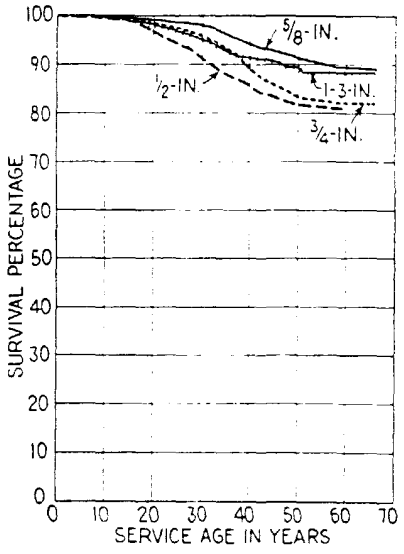
Lead Services Show High Survival Rate In Survey of Water Works Facilities

IN considering the durability of materials used for water service lines, it is of course possible to draw much more accurate conclusions if data is available which allows comparison of the total number of services which have been installed with the number which have been retired over a long period of time than if only the records of mortality are available. A very valuable study which allows such comparison to be made appears in the August, 1945, issue of the Journal of American Water Works Association.

This study is part of a survey of survival and retirement of water works facilities being conducted by the American Water Works Association. It is made from the files of the Denver Municipal Water Works of Denver, Colorado, by D. D. Gross, Chief Engineer and John Burgess with the cooperation of George F. Hughs, Executive Secretary and member of the committee on Survival and Retirement Experience With Water Works Facilities. It covers the entire distribution system and goes back to the original establishment of a public water supply in that city in 1872.

Although there have been changes in organization and consolidation of competing companies, the use of lead service pipe has been consistent throughout the system since the very beginning. At the time the study was made in 1940 practically all of the services were of lead. The tabulated results of the study indicate that the Denver Municipal Water Company is wise in continuing to require the use of lead pipe in all service installations.

Chart showing survival percentages in relation to age of lead water services in Denver, Colorado.



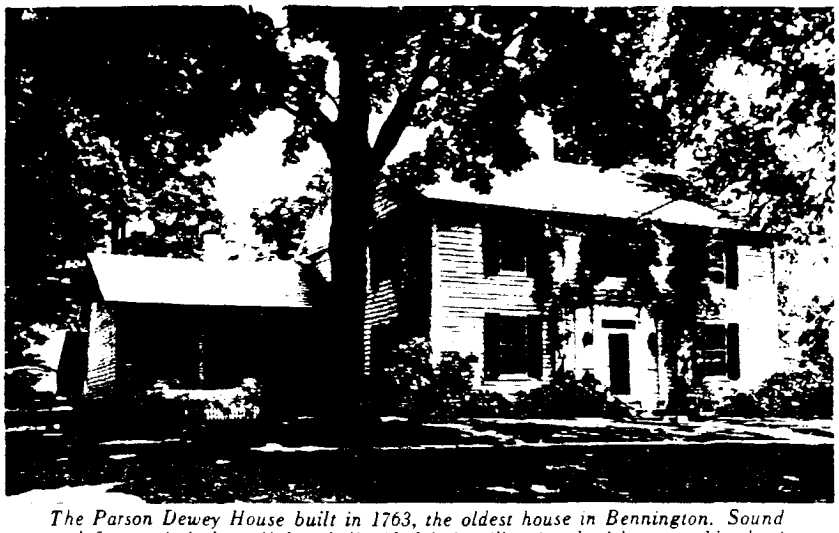
The very complete tables included in the published survey make interesting reading and reflect the conditions of prosperity and growth of Denver in the number of installations of new services. They also indicate very clearly how well lead service pipe endures through long periods of time. For instance, the records show that of the 75,729 lead services in sizes from ½ in. to 3 in. installed since 1875 only 5.1 per cent have been retired. Retirement does not necessarily mean that failure has occurred. Some installations, particularly in the older part of the city where change and development has been greatest, may have been superseded by new services or larger pipes. In addition the retirement of 46.4 per cent of 575,759 ft. of galvanized iron mains in sizes of 1 in. to 2½ in. installed since 1884 may have been the cause of removal of some of the services.

This record substantiates the statement made in connection with our analysis of water service installation costs in the May and September-October, 1944, and January-February, 1945, issues that the very slight excess cost of lead service installations over that of less durable materials is indeed a small price to pay for the years of security provided by lead service pipe. Many other cities also require lead pipe for all water services.

A Portfolio of American Landmarks

No. 33

Homes of the Founders of Bennington, Vermont



The Parson Dewey House built in 1763, the oldest house in Bennington. Sound and firm as it is beautiful and dignified it is still painted with pure white lead paint.

BENNINGTON, in the extreme southwest corner of the State of Vermont, was the first town chartered west of the Connecticut River. It was the headquarters of the Green Mountain Boys who under Ethan Allen were first organized to defend the New Hampshire Grants against the "Yorkers" who were attempting to extend the northern boundaries of New York State. Later, during the Revolutionary War the Green Mountain Boys at the Battle of Bennington stopped the advance of the British in what is considered by some historians to have been the turning point of the war.

Bennington is now a prosperous manufacturing city, but, while its growth has required much new construction, many beautiful architectural landmarks remain. Here, as in so many other historic cities, owners of fine old houses continue the tradition of the preservation of the homestead with pure white lead paint, the long lasting sure protection upon which the early builders relied and which served them so well.

The two lovely homes on this page are today painted both inside and out with pure white lead paint which is equally effective as a protection against rigorous weather and the wear and tear of daily use.

The General David Robinson house built in 1795, now owned and occupied by Mr. William T. Jerome, Vermont State's Attorney, the 7th generation of the family to occupy the house.

Detail of the General Robinson house. The delicate carving is still perfect under its protective pure white lead paint.

PHOTOS BY DAYTON SNYDER

THIS IS NO. 33 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.

Pure White Lead Used Throughout In Restoration of Historic Vermont Church

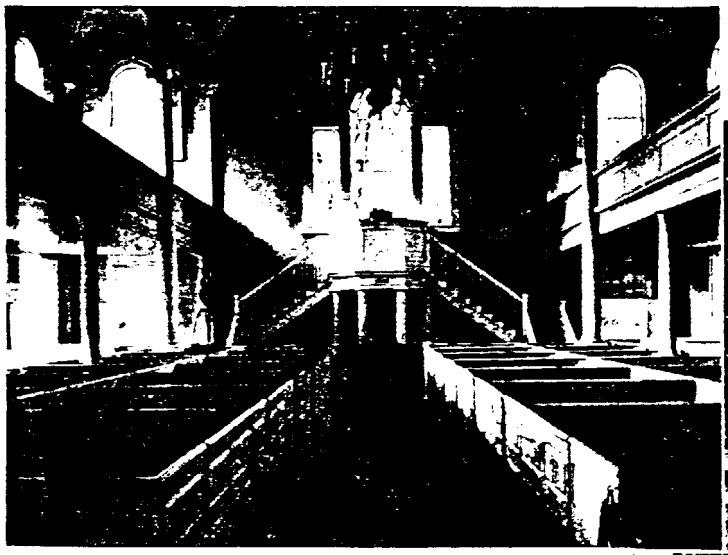
IN Bennington. Vermont, stands a church which is of unusual interest to students of history as well as to architects and all other lovers of the fine old buildings of the early days of this country. This building, known as the Old First Church of Bennington, was in 1937 faithfully restored to its original plan and design through the contributions of citizens throughout the State of Vermont. It has been dedicated as an historic shrine and its churchyard, where lie many of the outstanding figures of Vermont's history, has been made "Vermont's Sacred Acre."

The church faces the site of the first meeting house in the New Hampshire Grants which also sheltered the legislature of the Republic of Vermont until it became a state in the Union on March 4, 1791. The present church building. erected in 1806, was the work of Lavius Fillmore, a second cousin of Millard Fillmore, the thirteenth president of the United States. It shows the unmistakable influence of Asher Benjamin, whose book "The Country Builders Assistant" was published just one year earlier but there are many fine original details which indicate that Fillmore was an architect of ability and discrimination in his own right. The cost was $7,793.20 but it is doubtful if it could be reproduced for $100,000.00 today. It is certain that the one piece solid white pine columns and much of the timber structure could not be reproduced at any price.

Four separate remodeling and alteration operations had effected changes in the building which had eliminated or covered up many of the fine old details and only through painstaking study and research were they discovered and brought to light. Much of the paneling of the original box pews of the gallery was found built into straight pews in the same location and other original parts which could be used again were located but many details had to be designed and built new according to old photographs which fortunately were available.

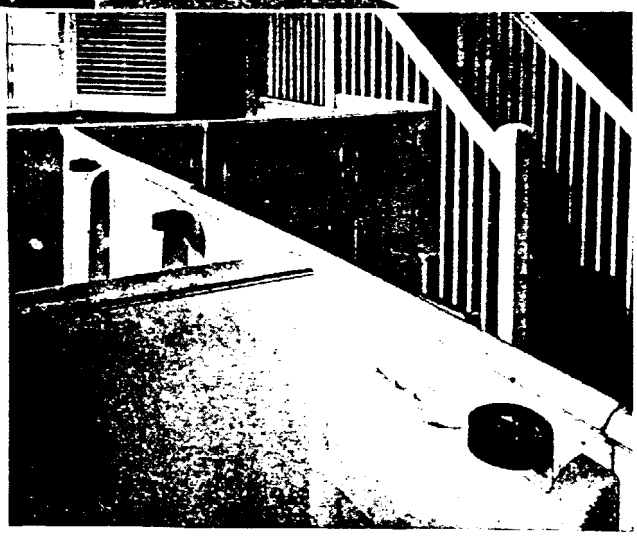
Under the floor in the balcony was

Old First Church at Bennington, Vermont, is another distinguished landmark protected by pure white lead paint.



The interior finish has the quiet sheen without glare which is characteristic of pure white lead paint.

Detail of the restored box pews and pulpit stair. Note perfect condition of pure white lead paint on top rail of box and door, and reproduction of old pewter candle holder fastened to side of pew.



found a battered pewter candle holder, one of which had been mounted in each pew in the original building. This fixture was reproduced in antimonial lead by T. F. McGann & Sons of Boston and one hundred of them attached to the sides of the pews make it possible to hold services by candle light on special occasions.

The beautiful soft white finish of the original interior could be reproduced only by the use of pure white lead paint which was so consistently used by the builders of the early American Landmarks. Accordingly, all of the interior walls and woodwork, both old and new, are painted with this durable material. The exterior as well is finished with pure white lead paint which has shown its worthiness of the responsibility it bears of protecting this historical monument by its past performance in protecting the venerable structure from the elements for so many years.

The architect for the restoration, Mr. Denison Bingham Hull, and the Minister, Dr. Vincent Ravi-Booth, are to be envied for their experience in planning and executing this project and they and all those who contributed their money and services are to be congratulated on the perfection of this historic shrine. The preservation of this historic building is a service to the entire nation.

Lead Calked Cast Iron Pipe Emergency Syphon Around Collapsed Sewer

THE speed with which large size air tight pipe lines can be laid for emergency use by means of lead calked cast iron pipe was demonstrated last February in Syracuse, New York, when the collapse of a large masonry sewer threatened a considerable area of the city with flooded basements and other damage.

When the diversion of two tributary sewers and the installation of several available 8, 6, and 4-in. pumps failed to stem the rising sewage above the break, it was deemed necessary to provide a bypass which would convey the waste to a point below the stoppage so that repair work could proceed.

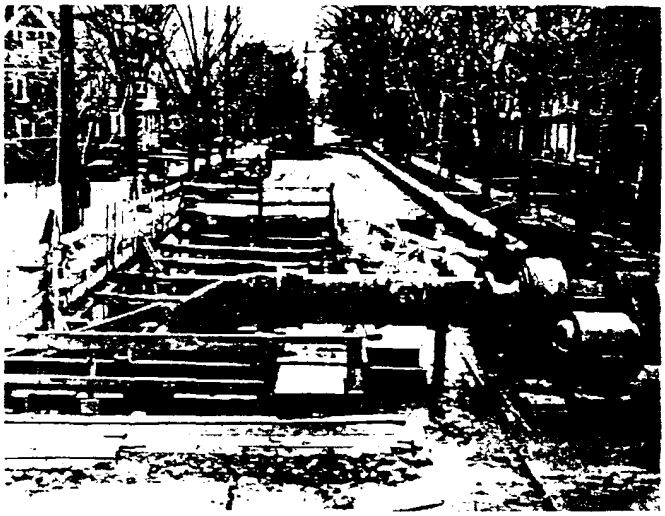
Preliminary studies indicated that a 20-in. pipe 350 ft. long to a manhole below the break would have sufficient differential head to act as a siphon if provided with a suitable priming device. The only pipe available was some 20-in. cast iron pipe belonging to the water division which was borrowed for the emergency and laid by the water division. Joints were run with lead and calked to insure an air tight line.

Through the cooperation of the Worthington Pump and Machinery Co. and their customer, the Netherlands Government, a 24-in. low lift centrifugal pump was borrowed and a motor was provided by a similar arrangement with the General Crushed Stone Co. The pump was installed as a booster in the syphon and was used as a priming device.

With the pump in operation and the throttling valve partially closed, a 19-ft. negative head was produced by the syphon action in the pipe. This indicated that the line was sound and tight in spite of the speed with which it was laid and the cold weather working conditions.

A special advantage of the lead calked joint when used on an emergency installation of short duration is the complete salvagability of both the lead and the pipe. Dismantling of the pipeline can be accomplished without breakage or loss of either of these valuable materials.

350 ft. long 20 in. lead calked cast iron pipe syphon by-passing a break in main sewer line while repairs are under way.

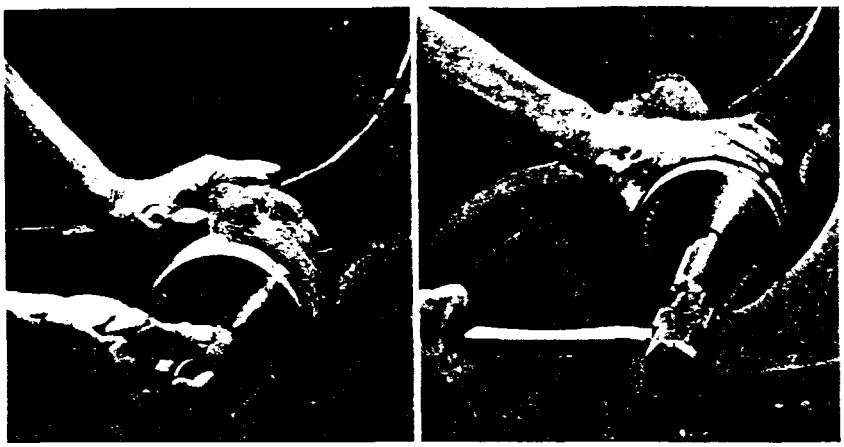


COURTESY ENGINEERING NEWS RECORD

Lead Wool Weights in Airplane Propeller Blades Aids in Obtaining Precise Balance

AN interesting use of lead wool in airplane propeller manufacture is for the addition of small amounts of weight to bring the individual blades to a uniform weight so that the assembly will be in balance. Propellers which rotate at high speed may, if only slightly out of balance, produce vibration severe enough to damage themselves, the engine or even the structure of the plane. Therefore every propeller blade must be carefully checked against a master blade and brought to exact weight.

To add weight to dural propeller blades such as those used on the P-38 Lightning fighter plane, the Curtiss-Wright Corporation makes use of lead wool inserted in a hole in the blade shank and tamped securely into place.



CURTISS-WRIGHT CORPORATION

Weighting propeller blade with lead wool. Left, inserting ball of wool in hole in blade shank. Right, compacting lead into solid mass with special tool.

Because precision control is exercised throughout the manufacturing process the weight required for balancing is seldom more than a few ounces. For this reason lead wool is especially suitable because the proper amount of lead can be easily plucked from the strand of wool, rolled into a ball and inserted in the hole in the propeller blade shank. A few blows of the hammer or a suitable tamping tool will compact the lead wool into a solid mass of lead and wedge it tightly against the sides of the hole.

Lead wool is made by pouring molten lead through a perforated nozzle from which it emerges as a tow of fine threads or strings. The tow is coiled into hanks or wound on reels for handling or shipping. Lead wool is used for a variety of purposes, mostly for calking such materials as cast iron pipe, flashing reglets, bolts, and seams in fabricated steel plate work. It is easily handled and can be pulled apart or divided into units of desired sizes by hand without the use of tools.

All Lead Installation Plumbers Answer To "Can Plumbing Be Prefabricated"

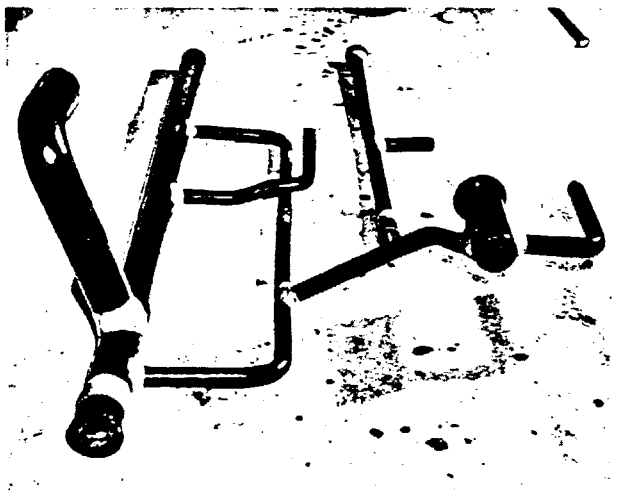
THE use of lead pipe for a soil stack is familiar to most plumbers especially under conditions where space restrictions make the use of cast iron difficult, but it is often assumed that high cost makes this use suitable only in emergencies. This assumption is not always justified because an all lead waste and vent frame properly planned and constructed can be an economical construction detail which will speed up construction and at the same time enable the workmen to do a large proportion of their work in the shop under conditions that may be more efficient than on the job.

The accompanying photograph shows a waste and vent frame for a complete bathroom, which has been fabricated entirely of lead in the shop, ready to be taken to the job and set in place in a house in Port Arthur, Texas. It will be necessary only to calk the brass ferrule into a cast iron fitting below the joint, strap the stack to a vertical support and provide proper support for the lead bend and the drum trap. The stack can be extended through the roof immediately or later when the plumber returns to install the water piping but in the meantime the carpenters will have had time to complete the framing and neither workman is in the way of the other.

In this case it is planned to continue the lead stack out through the roof with a flanged wiped joint to serve as a support for the pipe. It is interesting to note that the plumbing contractors, The City Plumbing Co. of Port Arthur, after carefully estimating the cost of this all-lead installation compared with the cost of the same installation in cast iron and lead, found little if any difference. Thus the saving of time and convenience of the package type of construction were achieved without sacrifice of economy.

This all-lead waste and vent frame is a very practical application of the idea of prefabrication to plumbing which is sometimes regarded as the biggest obstacle in the way of the prefabricated house. Actually it indicates that plumbers are ready to meet the challenge of prefabrication and at the same time to comply to the letter with the codes which are essential for the protection of the public health.

Prefabricated by plumbers but in compliance with the plumbing code, this all lead waste and vent frame is ready for installation with a minimum of labor to be performed at the site.



Delicate Soft Lead Gasket Rings Made By Die Casting Process

THE process of die casting which has gained tremendously in importance in recent years is particularly well adapted to the manufacture of lead articles. One of the most necessary articles in our daily lives, the newspaper, is produced largely by means of lead alloy linotype slugs which are essentially die castings of which thousands are made every day.

Linotype metal is a special alloy designed to have particular properties but other alloys of lead as well as pure lead can be fabricated economically by die casting. An instance in which die casting solved a production problem is illustrated in the accompanying photograph of copper jacketed sealing rings for use in 90-mm. armor piercing shells. Attempts were made to make the lead core of this gasket by other methods but none of them were feasible for reasons of excessive cost or unsatisfactory results. In addition, the thin section of soft lead was too easily bent to allow handling without deformation.

The die casting method was worked out by the J. Edward Ogden Company of New York City, manufacturers of an extensive line of fastening devices for which lead sleeves are die cast.

DIE CASTING MAGAZINE

Soft lead gasket rings for 90 mm. shells remain attached to gate to facilitate handling until copper jacket is applied.

This company was experienced in the manufacture of soft lead die castings and they have produced over 40 million of the rings in both 75-mm. and 90-mm. sizes.

The die casting operation delivered the rings in groups of three or four attached to a gate. Each group could be picked up by the gate without distorting the rings. The copper jackets were placed on the rings and they were pressed into place with the same operation which sheared the rings free from the gate. The ring with its jacket is stiff enough to be handled without damage.

The solution of the problem of economical manufacture of these delicate rings of soft lead is a demonstration that the desirable properties of lead need never be sacrificed for want of a means to make use of them. In this case knowledge and ingenuity found a way around the difficulty set up by the very property, softness, that made lead the most suitable metal for the purpose desired.

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 CARRIERS 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 *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.

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 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 for 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, 1944.

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.

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.

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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