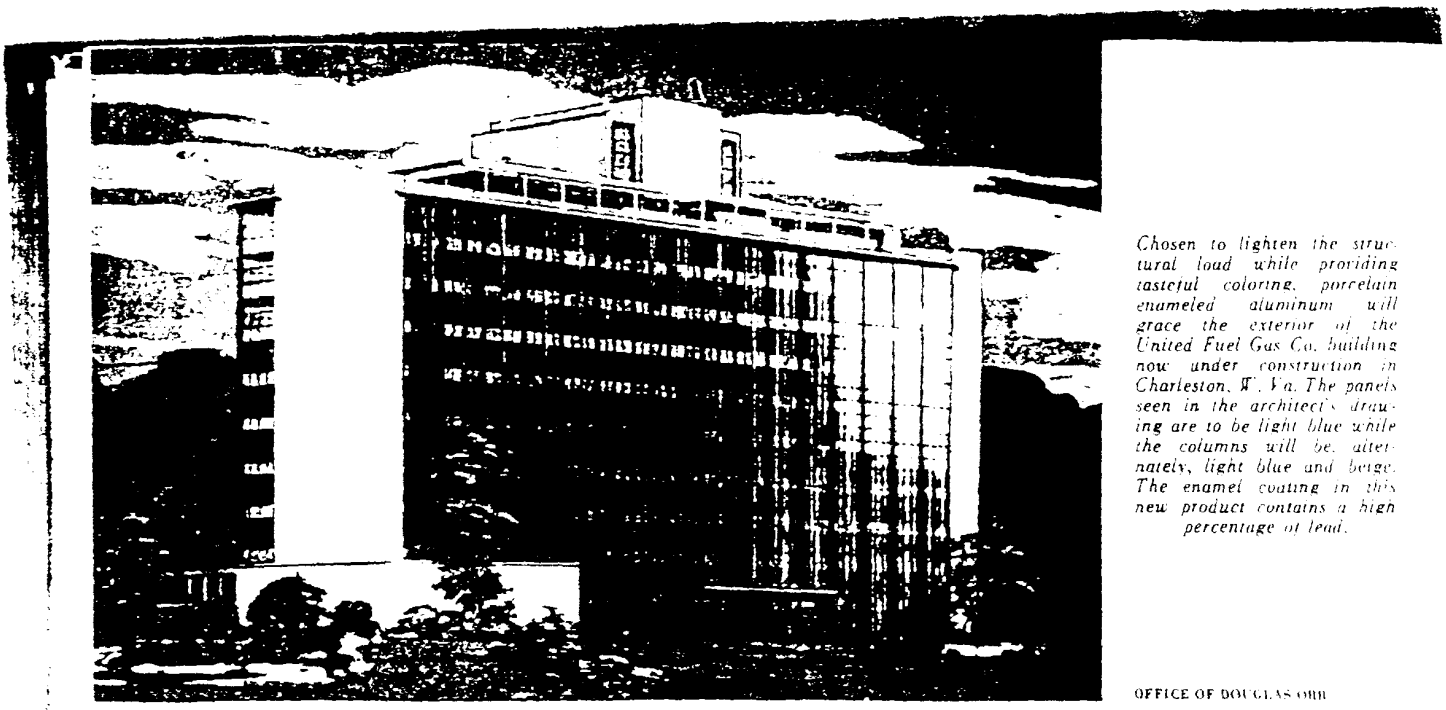


Chosen to lighten the structural load while providing tasteful coloring, porcelain enameled aluminum will grace the exterior of the United Fuel Gas Co. building now under construction in Charleston, W. Va. The panels seen in the architect's drawing are to be light blue while the columns will be, alternately, light blue and beige. The enamel coating in this new product contains a high percentage of lead.

OFFICE OF DOUGLAS ORR

Colorful Porcelain Enameled Aluminum Made Possible With Lead

IN Charleston, W. Va. the United Fuel Gas Co. is erecting an 11-story office building whose exterior will be beautified by light blue panels and columns of both beige and blue. At Penn Station in New York train announcement signs, lettered in bright yellow on a red background, are almost floated into place because of their lightness. And New York City subway riders are soon to be treated to tasteful interior decoration, part of it accomplished by a material they have never seen, in 200 cars recently delivered to the city's Transit Authority.

Porcelain enameled aluminum is the material common to each of these applications, although the word uncommon is more appropriately associated with the new material. Architects, designers and decorators have found in porcelain enameled aluminum a strong, light, colorful, highly workable, corrosion resistant material that sparks their imaginations. They are working industriously to exploit its possibilities.

Essentially, porcelain enameled aluminum is the wedding of glass and aluminum, for the vitreous enamel coating is a true glass. To the lightness, strength, and easy working of aluminum are added the hardness, color amenability and chemical inertness of glass. Oddly enough, the adaptation of the lightest common metal which porcelain enameled aluminum represents is made possible by the heaviest of the common metals, lead. Lead's place in the enamel coating for aluminum will be explained later.

The enamel coating adds considerable rigidity to the aluminum sheets. A coating, for instance, of only 3 mils on an 0.051 in. thick aluminum sheet increases flexural strength and resistance to surface denting by more than 60 percent. Porcelain enameled aluminum may be finished in matte or gloss and in multicolor effects. It is resistant to spalling or flaking off. If chipped or cracked the damaged area will not enlarge and, since the underlying aluminum does not corrode, repair is necessary only where damage is extreme, perhaps the complete deformation of a panel or component section.

For many applications the outstanding characteristic of porcelain enameled aluminum is its workability. Sheets of the material can be sheared, sawed, drilled or punched with little or no exposure of the metal and no progressive spalling of the enamel. Thus standard size sheets can be cut to size on the job with the elimination of costly prefabrication.

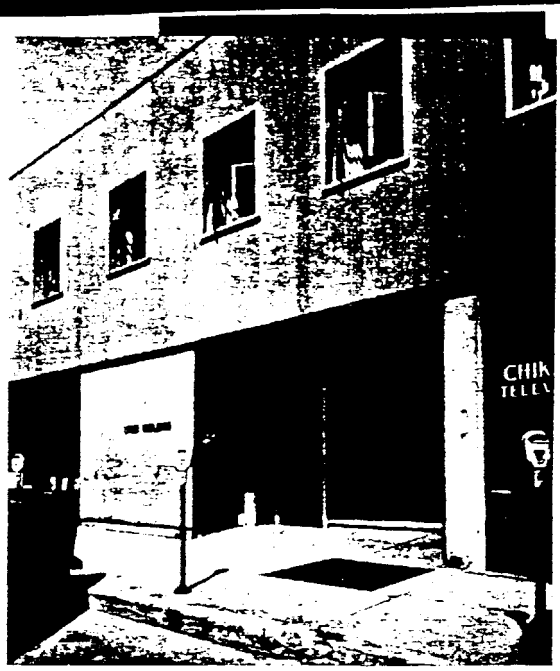
A big market for porcelain enameled aluminum is in the booming curtain wall field. Panels of porcelain enameled aluminum may be a fiftieth or even less than the weight of conventional wall so that large savings accrue from lighter structural framing because of reduced dead loading. As in all curtain wall construction the thinness of the panels produces greater floor area for given ground space. Panels are easy to ship and are erected easily in rapid, dry construction with comparatively few joints so that completion of a building is speeded. Once the panels are installed, rainfall becomes an efficient maintenance man for the glass surface. Allied to and, in fact, preceding, the use for curtain walls is the use of porcelain enameled aluminum for colorful facading of stores and buildings.

The Navy, looking for even more particular characteristics than those already mentioned, was one of the earlier users of porcelain enameled aluminum. Originally they tried out the material in several destroyers as

partitions in wet spaces such as heads and shower rooms. The success of the experiment was such that 80,000 sq. ft. of partitions made from porcelain enameled aluminum have been installed on the carrier USS Saratoga and the USS Forrestal is also being fitted out with the material, after her launching several months ago. Lightness, ease of working and no maintenance were important considerations, of course, but so was the superior resistance to fire hazard and the friability of the vitreous coating. On one hand paint is eliminated, on the other the enameled aluminum has a higher melting point than the uncoated stock, whose low melting point has been an objection to such use of aluminum by the Navy. Concerning friability, under severe impact or bending the coating breaks up into powder or small bits, avoiding schrapnel-like large pieces. The Navy is also sponsoring experiments in color harmony as an effective morale booster, particularly in submarines. Porcelain enameled aluminum figures prominently in this investigation.

The variety of uses to which porcelain enameled aluminum has been put may be further indicated by its use for traffic signs, colored storm sash and architectural tile. The bright red strips that signify to the motorist a Texaco service station are in many instances of enameled aluminum. Airport runway markers of the material have recently been approved by the Civil Aeronautics Authority. And just about to come onto the scene are products made from aluminum castings that have been porcelain enameled—for instance, a line of cast aluminum cooking utensils whose outsides are pastel shaded with porcelain enamel.

Quick erection because of easy handling is another advantage of porcelain enameled aluminum like the pastel hued facing on this building. The surface is maintained by rainfall because the vitreous enamel coating is a true glass.



KAWNEER CO.

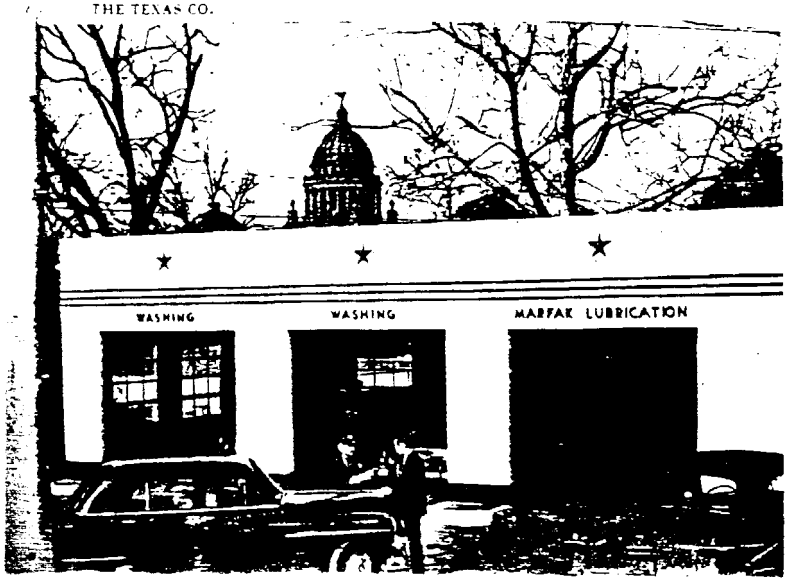
Lead, in the form of oxides and silicate, has long been used in the ceramic field. It imparts brilliance and clarity to glassware, it provides color in dinnerware and in the ceramic labels on many bottles, and it is a component of the enamel on power resistors. In the enamel for aluminum lead is prominent because of the low temperature requirement in working with aluminum. Enamel coatings are made from the product of pouring molten glass compounds into water, the glass shattering into fine particles which are called frit. The frit for the enameling of aluminum contains 30 to 50 percent lead. It fuses at a little above 950 deg. F. while the melting point of aluminum is 935 to 1215 deg. F.

A typical porcelain enameling of aluminum operation might be summarized so: The frit is ground in a ball mill in a water suspension. Meanwhile, the aluminum stock is pretreated, prefired and cooled. The suspension is then applied in a thin, smooth ground coat, which is generally unpigmented, by dipping, slushing or spraying. The stock is dried at low temperature and fired. Finally, after the ground coated stock is cooled to room temperature the cover coat (sometimes more than one) is applied by spraying and is fired.

LIA26053

The three bright red strips that tell the motorist he has come to a Texaco service station are often of porcelain enameled aluminum.

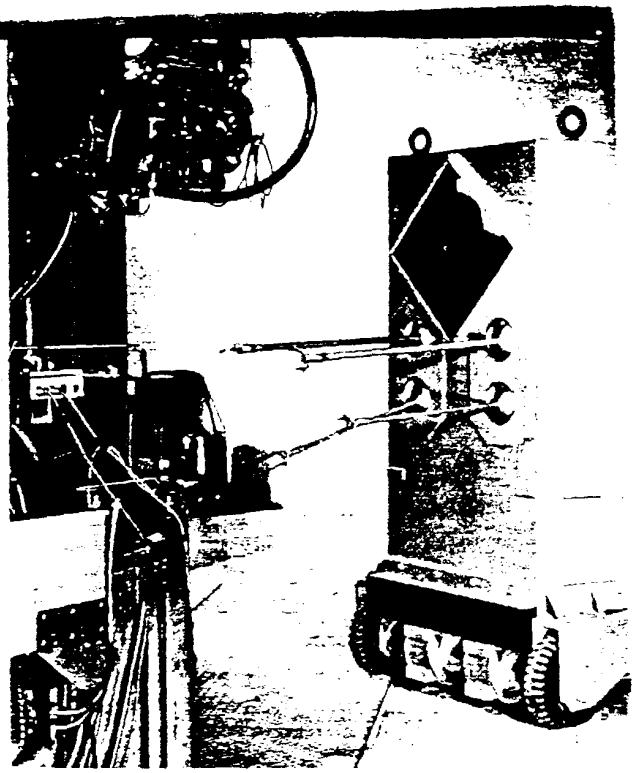
THE TEXAS CO.



Aluminum castings which have been porcelain enameled are the objects of this young lady's scrutiny.

MONARCH ALUMINUM MFG. CO.

Cold Setting Lead Cement In Mobile Radiation Shield



Not a man from Mars, but a worker at the Argonne National Laboratory who can safely approach the cyclotron target area in this mobile lead shield equipped with manipulators.

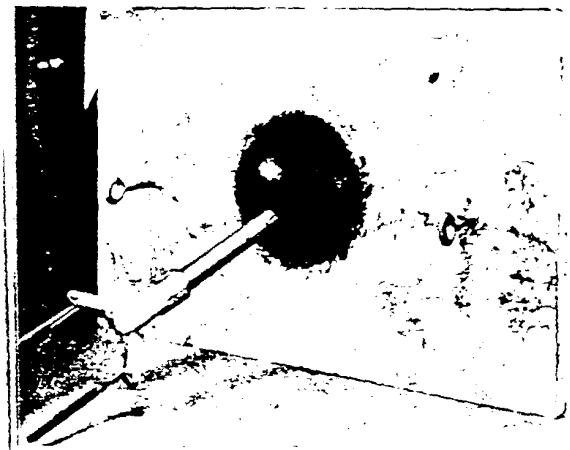
A UNIQUE radiation shielding device makes use of lead in novel form in addition to more conventional employment of the metal. In order to enable personnel to transfer radioactive materials without the use of a cave and to approach the cyclotron target area while the magnet is on, the Argonne National Laboratory at Lemont, Ill. has developed a mobile lead shield. The device, basically, is a 4-in. thick lead shield with a nonmagnetic stainless-steel skin. Large enough to hold two observers or one operator, it is mounted on a battery-powered chassis and is equipped with a window of heavily-leaded glass for viewing, and ball-joint manipulators for remote handling. It was in the construction of the ball and socket joint that a problem arose as to how to construct a joint from a high density material, such as lead, which would function properly and at the same time prevent entry of harmful radiation. Cast metallic lead would not work nor would any other material having high enough density.

The problem was solved through the development of a cold-setting lead cement mixture which could be poured into simple wooden forms around the balls themselves. The mixture is poured cold and sets to a cement-like consistency with a density of from 515 to 525 lb. per cu. ft. (Cast lead has a density of 707 lb. per cu. ft.) Composition of the mixture is as follows:

Lead shot, 3/16 in. diameter maximum, ballast type	76% by wt.
Lead powder, 100 mesh	17% by wt.
Cement, expanding type	5% by wt.
Water	2% by wt.
Aerosol (for better wetting)	Trace

The water and cement are first mixed to a slurry, after which the lead powder is added while stirring continuously. The lead shot is then worked in to form a uniform dispersion. The mix sets slowly permitting small batches to be conveniently poured. The forms can be constructed of wood, fiber, metal or plastic coated with parting grease. Forms are removed from 16 to 21 hours after pouring.

Rotating parts cast into place are grease coated and rotated free within 8 to 12 hours after pouring. The ball- or rotating parts *should not be oiled* as this will cause them to bind. If the rotating parts are not moving freely, the grease should be removed and a creamy slurry of water and "Time-saver Lapping Compound" (Time-saver Products Co., Chicago, Ill.), the yellow label type for soft metals, is applied to the moving parts. After



The construction of a radiation-shielded, ball-joint socket for the Argonne National Laboratory mobile shield presented a problem. It was solved, at low cost, by the development of a cold-setting lead cement that could be poured into easily constructed wooden forms around the ball itself.

working the parts, the excess is wiped off and these parts will work freely without oil.

The compression strength of the mixture after setting for 30 days ranges from 2200 to 2500 psi. Shielding properties are approximately $1\frac{1}{4}$ times as effective as steel for gamma ray energy up to 1.33 Mev.

The ease and speed with which the material can be cast in forms has suggested other applications where special shapes are required for radiation shielding, such as the laboratory flask shield which is illustrated. The new cement joins lead in its more customary forms of sheet, brick and in glass as a means of effective, low-cost, radiation protection.

The cold-setting, high-density lead cement developed at the Argonne National Laboratory suggests other applications for easily-made shielding in special shapes like this laboratory flask shield made from paper forms.

Baptistry Made Waterproof With Lead Lining

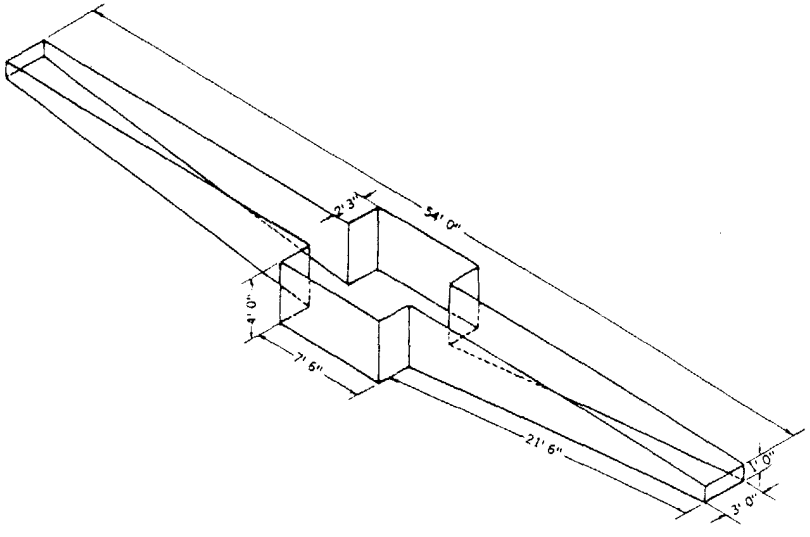
AN installation seen less usually than the more common applications of lead for waterproofing was the recent lining with lead of the baptistry of the First Baptist Church in Tulsa, Okla. For baptism by immersion, the baptistry was an enlargement of a previous smaller one, which was lined with another material.

With entrance and exit passages the baptistry measures 54 ft. in length. At its central portion it is a 7 ft. 6 in. square, 4 ft. deep. Lining the entire baptistry required 2400 lb. of 4-lb. lead. The necessary joints were soldered for a complete seal and the lead was attached to the vertical walls by so called bulls' eyes (a brass screw and washer holds the lead to the surface, a wiped disc of solder covers the fastening device for waterproofing).

Wherever the lead was in contact with new concrete work made necessary by the enlargement, it was coated with asphaltum. This is necessary, only for the curing period, to protect the lead from corrosion by the free lime present in the uncured concrete at that time. Once the concrete has cured the danger of corrosion no longer exists.

The lead lining provides an impervious membrane for the baptistry to protect permanently against leakage and moisture. It performs a function the same, for all practical purposes, as do lead safe pans under showers, soda fountains, food process rooms and wherever damage might result as a result of water seepage. The First Baptist Church hopes, in fact, some day to add tiling to their baptistry in which case the lead would become a true safe pan.

Waterproofing with the impervious membrane of a lead lining is common practice. At left, below, is the working drawing used by Watt Plumbing, Air Conditioning and Electric in installing a lead lining for the baptistry of the First Baptist Church in Tulsa, Okla. The job required 2400 lb. of 4-lb. sheet lead. At right is a view of the actual work at completion. Note the wiped solder "bulls' eyes" to provide a continuous lead surface.



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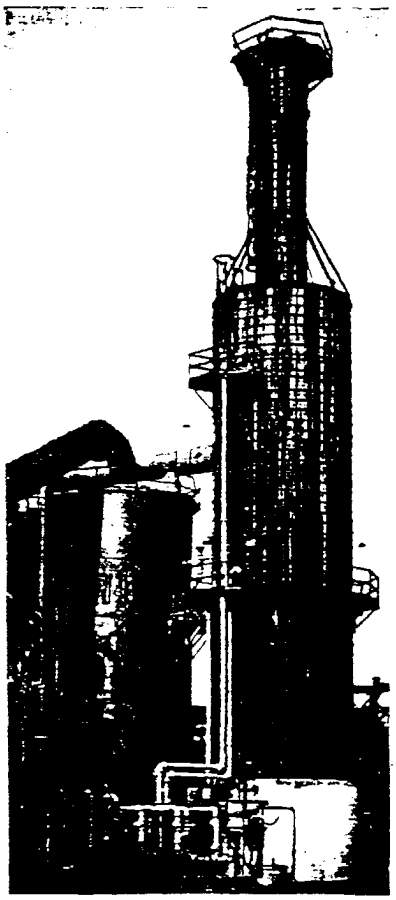
Lead Lining For Sulphur Dioxide Recovery Units

SULPHURIC acid is an invaluable commodity in practically all industries, but often it poses problems. It is, for instance, not only highly corrosive to practically all materials, with the notable exception of lead, but in even small amounts it can become a serious nuisance as an air or stream pollutant.

One specialized form of sulphuric acid production, the recovery of waste sulphur dioxide gas from sulphuric acid plants and its conversion to acid, has become an increasingly important field—largely because of the growing emphasis on air pollution prevention. In this development the Olin Mathieson Chemical Corp. has recently announced the perfection of a two-stage exit gas scrubbing process which has permitted increases as high as 20 percent in sulphuric acid plant operating rate. The process was developed originally by the Consolidated Mining and Smelting Co. of Canada, Ltd., and is known as the Cominco SO_2 Recovery Process.

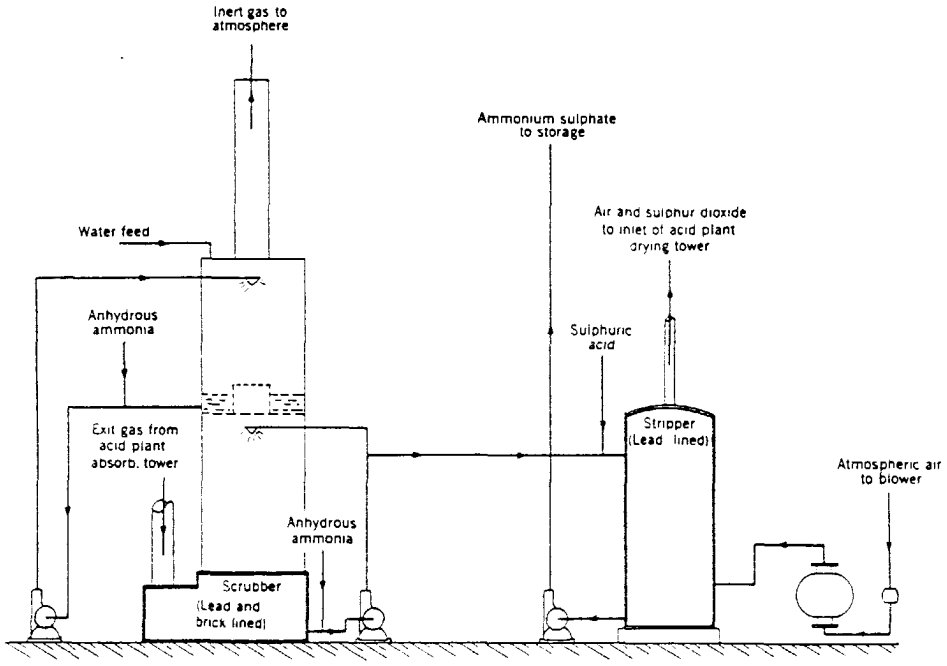


Towering into the air is the scrubber tower of the Olin Mathieson Chemical Corp.'s SO_2 recovery plant at Pasadena, Tex. The scrubber sump and the stripper adjoining the tower are lead lined.

Even at the most efficient rates of operation, contact sulfuric acid plants normally sustain some economic loss in the sulphur which is discharged into the air as exit gases in the form of sulphur dioxide and sulphur trioxide. The two-stage scrubber returns this sulphur to the production unit. Thus, not only are economic losses avoided but in areas where discharge of sulphur dioxide from the stacks could create an air pollution problem the process provides effective abatement while at the same time disposing of the recovered sulphur in such a manner as to avoid the equally unwelcome nuisance of water pollution.

The first system utilizing the process in the United States was put into operation more than a year ago by Olin Mathieson at its Pasadena, Texas plant. There the two-stage scrubber using ammonium sulphite-bisulphite scrubbing solution returns sulphur dioxide to the production unit and converts part of the acidic values in the exit gases to ammonium sulphate.

The unit relies for corrosion protection of the steel and concrete con-



Olin Mathieson's two-stage exit gas scrubbing process for the recovery of sulphur dioxide and conversion to acid has increased sulphuric acid plant operating rate as high as 20 percent, while avoiding air or stream pollution. Indicated in the schematic diagram at left are the lead lining of the stripper and the lead and brick lining of the scrubber sump. The lead is utilized because of its efficient protection against the corrosion of sulphuric acid in all concentrations up to 96 percent.

struction sections on lead and lead and brick linings. The scrubber sump is lined with 12-lb. chemical lead and covered with acid resistant brick. The stripper is a steel vessel lined with 10-lb. chemical lead. In both cases the lead is strapped to the vessel: in the scrubber sump directly to the concrete; in the stripper to the steel. The steel straps used are, in the customary fashion, covered with strips of lead burned to the lining to present a continuous lead surface. The recovery system has been in operation since August, 1953. Inspection after one year's service found the lead to be in excellent condition.

How lead is effectively and efficiently being used to handle and control sulphuric acid in all concentrations up to 96 percent has been covered in many previous issues of LEAD as well as in Lead Chemical Construction Bulletins, available from the Lead Industries Association, which deal specifically with the characteristics of lead in use with sulphuric acid.

Red Lead Protects Twin-Lift Bridge

SOME 14,000 tons of steel are going into the New York Central Railroad's new $18,000,000 twin-lift bridge which spans the Harlem River in New York City. In keeping with the railroad's established practice, a red lead primer was called upon to do the job of first line protection of the steel against the ravages of corrosion.

The new vertical lift structure — actually two almost identical bridges side by side, each carrying two tracks—is being constructed immediately to the west of, and then will replace, the present swing bridge between Manhattan and the Bronx. The first of the spans is already in operation. When the bridge is completed in 1956 it will carry all of the heavy train movements to and from Grand Central Terminal.

The new structure will be the fifth — and finest — of its line. Wooden bridges were erected originally, in 1841 (actually, a conversion of a highway bridge built in 1790) and in 1856, and the third structure, a double-track iron span, in 1871. The present steel bridge, constructed in 1897, has been modernized many times to care for the increasing size and weight of trains. The new bridge, built for the future, will be able to carry the heaviest foreseeable trains, and construction is being coordinated with various highway improvements in that immediate area. Raised, the new span will clear masts up to 135 ft. high, and will leave an open channel 225 ft. wide, compared with two present 100-foot channels. Overall, including approaches, the bridge will be 1,780 ft. long.

Soon to replace altogether the older bridge at right is the New York Central Railroad's twin-span lift bridge over the Harlem River in New York City. Like its predecessor, the new bridge depends upon red lead for first line protection against corrosion.

The primer used on the Harlem River bridge was applied over a surface which had been prepared by wire brushing. It was formulated in accordance with New York Central Specification No. B-3 as follows:

100 lb. red lead
4 gal. raw linseed oil
1 qt. turpentine
1 qt Japan drier
Wt./Gal. 22.9 lb. = 2%

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Now made possible by the publication of Volume 2 of the Steel Structures Painting Manual is the specification of the painting of a steel structure in the same easy, precise method as the steel itself is specified—by reference to a specification number. Entitled "Systems and Specifications" the new volume contains specific recommendations for painting a wide variety of steel structures and surfaces in diversified exposures. The recommendations cover surface preparation, pretreatment, paint application, paints and paint systems. Very prominent in the recommendations are red lead primers.

Copies of the 292-page "Systems and Specifications" may be had at $6.00 each, postpaid, from the Steel Structures Painting Council, 4400 Fifth Ave., Pittsburgh 13, Pa.

Also available in separate volumes are the 20 SSPC Paint Specifications and the 9 SSPC Paint System Specifications at a price of $1.50 for each booklet.

The following articles and reprints contain information, drawings and specifications on the use of lead products helpful to architects, engineers and others interested. They are available, free of charge, except where otherwise indicated, upon request to the LEAD INDUSTRIES ASSOCIATION, 420 LEXINGTON AVENUE, NEW YORK 17, N. Y.

MATERIALS OF CHEMICAL CONSTRUCTION ANNUAL REVIEWS — LEAD AND LEAD ALLOYS

Up-to-date reports on new developments in the uses of lead and lead alloys in chemical construction including research progress, engineering applications, and technological advancements. With bibliography, 1954 and 1953 reviews (editions are not cumulative) available. Reprinted from "Industrial and Engineering Chemistry," October, 1954 and October, 1953.

LEAD REFERENCE SHEET (Parts 1 & 2)

A short outline of the types, grades, and chemical and physical properties of lead in chemical construction, with a summary of the corrosion characteristics of lead in use with a large number of common chemicals and solutions used in various industries. Reprinted from "Chemical Engineering Progress," January and February, 1955.

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The corrosion resistance of lead and its alloys as materials of construction in the chemical process industries is shown for more than 188 industrial chemicals, citing the effects of concentration and temperature. Reprinted from "Chemical Engineering," February, 1953.

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A brief survey of the uses of lead in chemical construction reprinted from the materials review published in "Chemical Engineering," Nov. 1954.

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An informative as well as practical guide to lead welding. Reprinted from the "Welding Handbook, Third Edition" published by the American Welding Society.

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Lead flashings as used in an ultramodern house in Randolph, Vt. Reprinted from "National Roofer," October, 1954.

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Presentation of five new red lead paint formulations for use on galvanized surfaces, with and without top coats. Reprinted from "Paint and Varnish Production," May, 1955.

METAL PROTECTIVE RED LEAD PAINTS

The versatility of red lead in protective primers to meet a wide range of surface conditions, drying schedules and economic demands is described. Reprinted from "Paint and Varnish Production," January, 1951.

AN INVESTIGATION OF PRIMERS FOR MARINE ATMOSPHERIC ENVIRONMENTS

Results of an investigation of synthetic vehicles and red lead mixed pigment primers in a rigorous marine atmosphere. Reprinted from "Official Digest" published by The Federation of Paint and Varnish Production Clubs.

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BY ISAAC GOLDMANN COMPANY
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