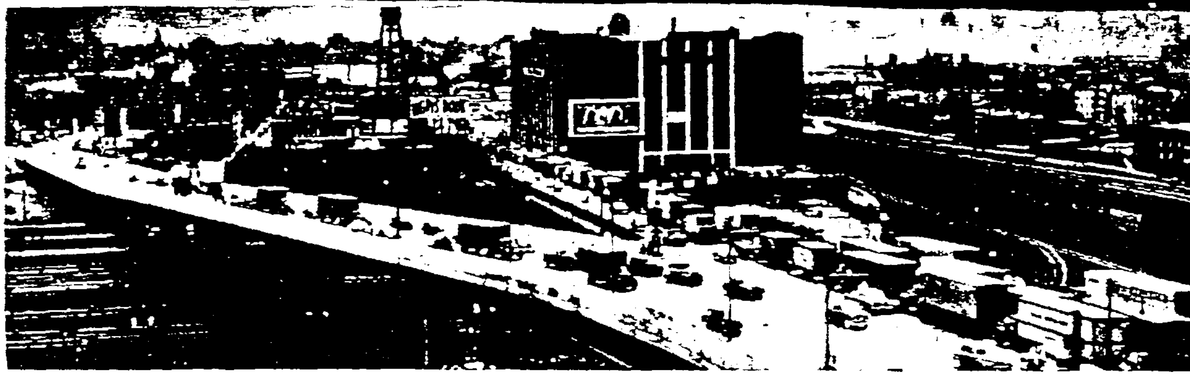


Tetraethyl Lead Helps Engine Efficiency Boost

TRUCK fleet operators have profited from a big bonus since 1949. Their trucks are doing a bigger job and more efficiently—yet are experiencing greatly improved engine life.

This is the picture that comes from a survey of trends in heavy-duty fleet operations made by a leading producer of tetraethyl lead, the almost-magic ingredient that raises the octane rating of gasoline. The better engines, the survey points up, demand higher and higher octane ratings which means higher content of tetraethyl lead, per gallon of gasoline. It is noteworthy that engine durability and load-carrying ability have increased side by side with those increases in the tetraethyl lead content of the fuels used.

The survey, which has been made annually since 1949, includes almost 2.4 percent of the nation's heavy-duty intercity truck fleets and represents over 2.5 percent of the total miles accounted for by heavy-duty intercity trucking operations. Fleets are divided into two broad classes—those with engines above and those with engines below 350 cu. in. piston displacement. Both groups were found to be carrying a more than 17 percent greater average gross load in 1954 than five years earlier. This finding, coupled with the fact that average monthly vehicle mileage did not vary greatly during the 1949-54 period, indicates that commercial engines are working harder than ever.

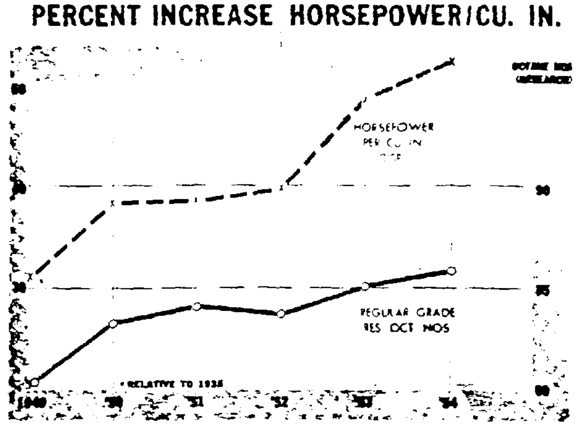
Witness to the added power of engines and the greater efficiency of gasoline is the fact that the average ton miles per gallon of these heavy-duty fleets increased more than 31 percent in the period, rising from 83 ton miles per gallon in 1949 to more than 109 in 1954. Meanwhile, benefiting from the increased antiknock quality of gasoline, horsepower per cu. in. of displacement of commercial engines rose 14.7 percent.

During this period the TEL content of gasoline increased substantially, rising from an average 1.6 ml. per gal. of regular in 1949 to about 2.2 ml. in 1954. In the same period the average life of piston rings, intake valves and exhaust valves showed a remarkable improvement. In 1949, the surveyed fleets had a mean piston ring life of 62,500 miles. In 1954, this figure had increased to 91,000 miles, for a gain of 46 percent. Similarly, in 1949, the fleets could expect 45,500 miles of service out of an exhaust valve. By 1954, this had increased 54½ percent to a level of 69,800 miles.

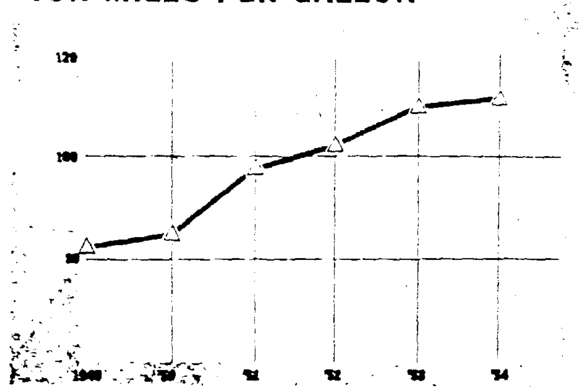
The survey of heavy-duty truck fleets is made periodically to provide continuing background data on the actual operation of heavy-duty intercity fleets, to establish significant trends in engine durability and operating characteristics, and to make available information on engine durability and engine trends to the oil industry and engine manufacturers.

One measure of improvement in engine performance since 1949, as tetraethyl lead content of gasoline increased, is shown, at left below, by the percent increase in horsepower per cubic inch for commercial engines compared with the increase in the average octane number (research) for regular grade gasoline. At right is plotted the increase in ton miles per gallon over the same period.

PERCENT INCREASE HORSEPOWER/CU. IN.



TON MILES PER GALLON



Lead In Contact Manufacture Of Sulphuric Acid

Corrosive sulphuric acid mist is handled by these lead electrostatic mist precipitators and ducts at the Baton Rouge, La. sulphuric acid sludge regeneration plant of Consolidated Chemical Industries, Inc.

THE Consolidated Chemical Industries Inc., acid plant at Baton Rouge, La., includes three sulphuric acid sludge regeneration units of the contact type. Each of the units, one converted to acid regeneration in 1945, the other two twin units built in 1953, uses lead extensively in its gas purification sections.

The sulphuric acid sludge regeneration plant is an example of a contact plant producing a wet burner gas, the occurrence of which is the reason lead is used. The wet sulphur dioxide gas produced at the burner must be economically dried and the sulphuric acid mist removed from the gas stream before entering the contact catalyst chambers. Gas purification in this type plant is very important in preventing catalyst damage and corrosion of equipment in the conversion section of the plant, and to insure a clean stack gas.

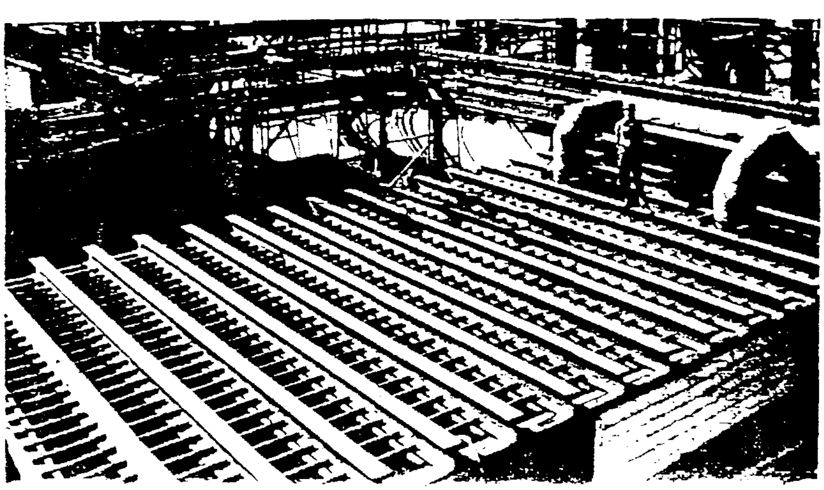
The Consolidated unit built in 1945 receives the hot, wet burner gas in hot gas scrubbers which cool the incoming gases with a counter-current stream of dilute sulphuric acid. These scrubbers are lead-lined steel vessels, the lead being protected from the intense heat inside the vesssel by brick sheathing. The lead roof on each scrubber is connected by lead ducts to lead downdraft coolers consisting of 6-in. diameter lead pipes and 24-in. headers over which cool water is cascaded. The wet acid gases are cooled below their dew point in the downdraft coolers and the dilute acid collected in lead-lined tanks. The downdraft coolers are connected by lead ducts to lead-lined and lead-roofed coke filters where the cooled gas stream has its entrained acid mist removed. The gases are then conducted through lead ducts to a drying tower and through the conversion and absorption section of the unit.

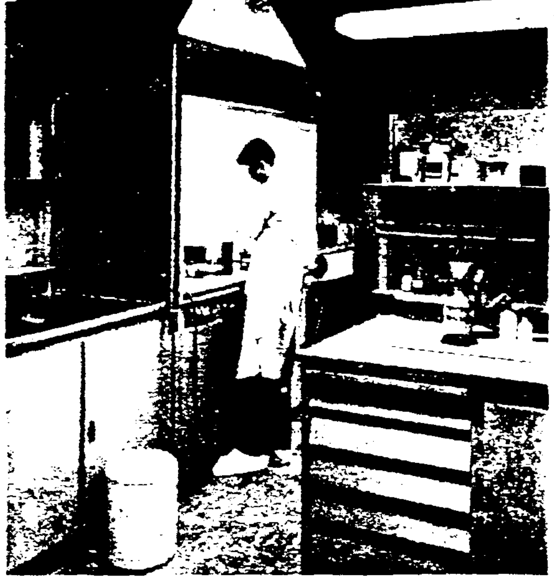
The acid regeneration units built in 1953 have their burner gases cooled in a gas scrubber before being conducted through large lead ducts to the electrostatic precipitators. The precipitators are constructed entirely of sheet lead supported in a steel strap and angle framework. The gases emerge from the precipitators minus the entrained sulphuric acid mist and are conducted through more large lead duct work to the drying towers. The dried sulphur dioxide gas is converted to sulphur trioxide and absorbed in concentrated sulphuric acid in the conventional manner.

Lead was selected for this installation because of its unexcelled corrosion resistance, ease of repair and field assembly and a factor that is often overlooked in selecting materials of construction, the unusually high salvage value. Lead in its service as a material of chemical construction is metallurgically unaltered by corrosive action. There are many instances on record where plants constructed with lead after becoming obsolete were converted to new designs and the original lead used once again. The economies of such a re-use are most attractive.

A wooden coke box lined and roofed with sheet lead where acid mist is removed before entering the precipitators.

At right, lead downdraft coolers where wet acid gases are cooled below their dew point.





Radiation shielding for experimental setups in this low level radiation laboratory is achieved by a 1-in. lead covered table top within the hood, lead bricks and heavily leaded glass. Hood sections themselves are disposable material.

Some of the small sized lead containers used to ship radioisotopes from Oak Ridge National Laboratory. Containers run up to blocks of lead weighing several tons.

Lead Shielding In Radioisotope Handling

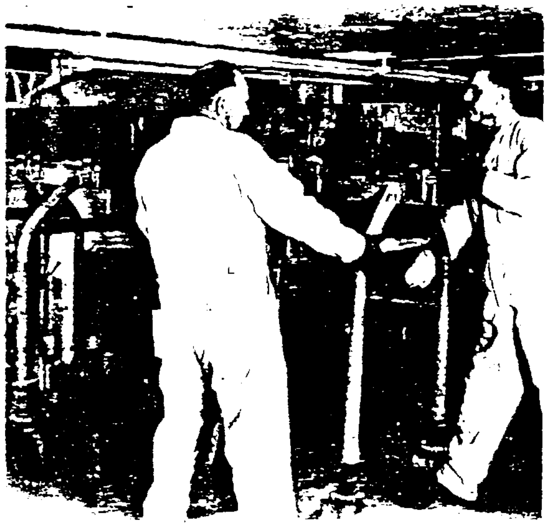
RADIOIODINE, according to one scientist, can be used to destroy all or a portion of a thyroid, at a cost less than 20 percent of surgery and without hospitalization. Radium-beryllium neutron sources are used in the development of soil moisture gages, and radiozirconium in the tracing of catalyst flow in cat crackers. Quantitively, the boom in peaceful, commercial applications of radioisotopes may be measured in terms of the 2,416 firms and institutions counted as users of radioisotopes in 1954. Of these, 1,020 were industrial firms.

Shipping isotopes from the various AEC installations, and further processing and use of them in hot and semi-hot and low-level laboratories calls for adequate protection against the harmful effects of radiation. Lead, because of its high-density and space saving ability is used in numerous types of shipping containers, storage containers, handling equipment and for permanent and temporary barrier shielding in the several classifications of radiation laboratories.

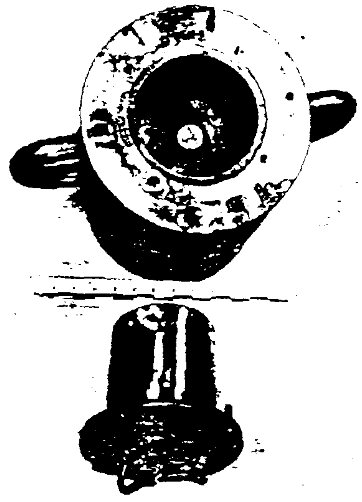
Laboratories may be classed, according to the level of radioactivity, as follows: hot laboratories, in which from 20 to 10,000 curies may be handled, semi-hot laboratories for levels of 1 to 20 curies, and low-level or tracer laboratories for lower values.

A massive leaded-glass window, three feet thick is used for observation purposes at the Esso Research Center in Linden, N. J., a true hot laboratory where a cobalt-60 pipe of 3,500 to 4,000 curies strength is used. In large installations like this, where space-saving is not important, four feet of concrete is used for the principal shielding, but lead plugs are used on holes of the well where the radioactive pipe is stored, and lead shields around the holes through which the arms of the master slave manipulator extend into the cave room. The pipe itself is stored in a 2½-ton pig of lead. The major purpose of the Esso Research Center is to explore the possibilities of using radiation to promote chemical reactions essential in oil refining and possibly useful in the production of petrochemicals.

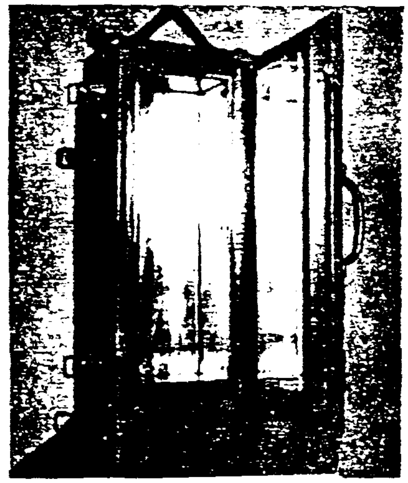
A representative low-level radiation



Portable tunnels with 3-in. lead walls are used to shield radioactive samples drawn from the uranium-graphite chain reactor at Oak Ridge.

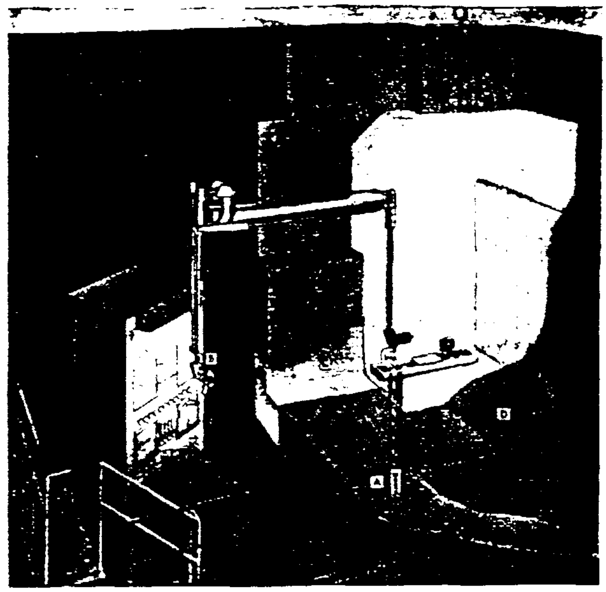


One of the types of lead-lined steel containers used frequently for safe radioisotope shipment.



This lead counting shield manufactured by Kenneth Lynch & Sons for Sandia Corp. weighs almost 1200 lb. for compact, low-cost radiation shielding.

laboratory is that of Tracerlab Inc. at Richmond, Cal. (higher lever radiation areas also exist at the same plant). The company was the first to manufacture radiation instruments and process radioisotopes for non-AEC use. Work in the low-level lab at Richmond is often done under hoods whose floors are equipped with 1-in. lead sheets to effectively protect workers legs and feet from large sources of radiation since workers easily remember to build adequate side and top shielding, but may forget to provide adequate shielding underneath their experimental setups. Their building blocks, in erecting temporary shields, are lead bricks, which are widely used for general shielding in laboratories.



Three feet of heavily-leaded glass (c) is used for observation at the Esso Research Center in Linden, N. J. where a cobalt-60 pipe of 3,500 to 4,000 curies strength is used in petrochemical research.

Gas Holders Protected By Red Lead

A RED lead paint of the multiple pigment type is used to prime all gas holders in the vast utilities system of the Consolidated Edison Co. of New York.

Con Edison, the more familiar name to New Yorkers, has its gas holders situated in a variety of environments from heavy industrial atmospheres to almost rural. More than that, the holders are peculiarly open to the battering of storm winds and the effects of direct blazing sun. To meet the wide range of service conditions, Con Edison employs a paint of the multiple-pigment type, the principal portion of which is red lead. The paint, since Con Edison is also concerned, in a continuous heavy painting schedule, with speeding up drying time and yet achieving the benefits of good wetting, has a linseed oil-alkyd resin vehicle.

Two coats of the primer are used on new work. Maintenance painting, done on schedule, has required only small area hand priming. Con Edison prefers performance standards rather than specification paints. Significantly, red lead paints have met Con Edison's stringent requirements for many, many years.

A red lead-multiple pigment formula, similar to that used on Con Edison gas holders, is as follows:

L.I.A. Formula 6-12

Composition	*Percent*
PIGMENT:	
Red Lead, 97% Grade	40.0
Zinc Chromate	7.0
Siliceous Iron Oxide, 85% Fe_2O_3	28.0
Magnesium Silicate	24.5
Aluminum Stearate	0.5
	100.0
VEHICLE:	
Alkyd Resin Solution (Fed. Spec. TT-R-266a, Type III)	57.7
Raw Linseed Oil	28.8
Petroleum Spirits	11.9
Lead Naphthenate (24%)	1.2
Cobalt Naphthenate (6%)	0.2
Manganese Naphthenate (6%)	0.2
	100.0

Pigment = 58.5%
Vehicle = 41.5%
Wt./Gal. = 14 lbs.
PV = 35

Dry for handling—about 8 hr.
Dry for recoating—about 16 hr.

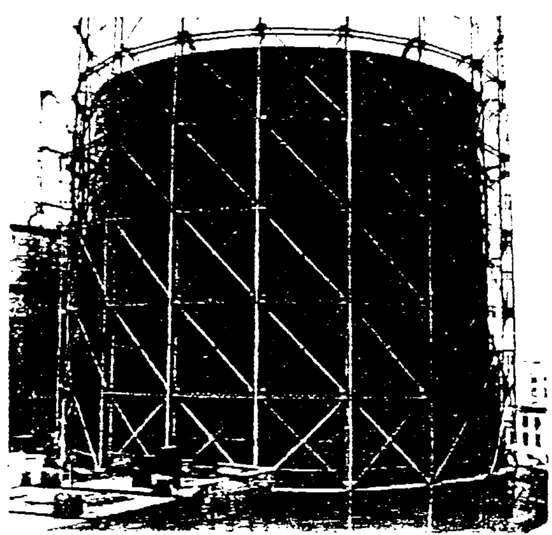
Another red lead formulation, widely used for the painting of gas holders, is the following:

L.I.A. Formula 6-8

Composition	*Percent*
PIGMENT:	
Red Lead, 95% Grade	76.1
Siliceous Red Iron Oxide (70% minimum Fe_2O_3)	23.6
Aluminum Stearate (Di)	0.3
	100.0
VEHICLE:	
Raw Linseed Oil	56.3
Alkyd Resin Solution (Fed. Spec. TT-R-266a, Type II, Class A)	30.6
Petroleum Spirits and Driers	13.1
	100.0

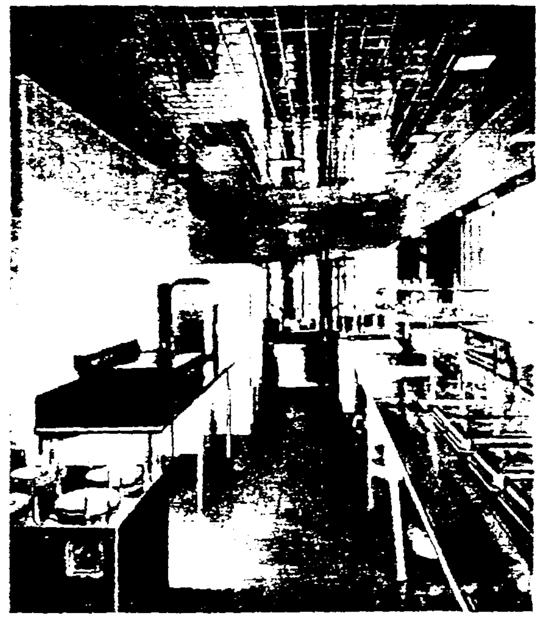
Pigment = 75%
Vehicle = 25%
Wt./Gal. = 22 lbs.
PV = 35

Dry for handling—about 16 hr.
Dry for recoating—about 24 hr.



A newly-painted 5 million cu. ft. gas holder of the Consolidated Edison Co. of New York, one of the many painted regularly by Con Edison with a red lead-multiple pigment primer.

Leaded Glazes Put The Gleam On Wall Tile



Easy to clean and maintain, lead glazed tiles are widely used on the walls and ceilings of restaurant kitchens.

COMPOUNDS of lead play an important role in transforming drab clay tile into the handsome material that may adorn the walls of our bathrooms, or kitchens, or other rooms, for that matter, in the home, and hospitals and certain industrial rooms outside. Lead oxide, in any of a number of compounds, is a substantial portion of glazes that color and cause to glisten the basic clay tile.

A typical wall tile manufacturing operation, in which leaded glazes are used, is that at the Matawan, N. J. plant of the Atlantic Tile Manufacturing Co., makers of "Mosaic" tile. The plant is laid out on one floor so that, in essence, raw materials come into the building at one end, flow continuously through the manufacturing processes, and come out the other end of the building as finished tile, ready to be shipped.

First the wet clay and other ingredients are mixed and pressed to shape. (A 4¼-in. x 4¼-in. tile is the standard piece, but trim and accessory products are also made at the plant.) The wet pieces are sent through a drying oven and then bisque fired in a kiln. Meanwhile, at an intermediate station, the glaze is being finely ground in ball mills as a simple aqueous mixture, containing perhaps twenty percent of lead monosilicate. (Atlantic uses this compound. Litharge, red lead or white lead might also be used depending on the type of glaze. In any case lead monoxide, PbO, is the essential ingredient.) When the tile pieces come out of the kiln, the glaze mix is sprayed on by ordinary spraying machines. The sprayed pieces then go into another kiln for their final firing.

The tiles are shown emerging from the spraying cabinet where the glaze is applied and being placed in saggers for the final firing.

It is in the kiln that the lead oxide goes to work. A glaze, it should be remembered, is nothing but a glass formed on a ceramic material. The lead oxide acts as a flux aiding the melting of the batch materials and imparting desirable qualities to the glaze after melting and in firing. Two of the most important of these qualities are foolproofness and the low melting range obtained, which, by reason of lower furnace temperature or shorter firing time, is a money saver. Finish characteristics given by a leaded glaze are luster, brilliance and smoothness. Lead's advantages in glazes may be indicated, as a matter of fact, by experience at Atlantic several years ago in which attempts to use leadless glazes proved unsuccessful.

Twenty-four hours after the pieces go into the kiln, they come out again as colorful, gleaming, easy-cleaning wall tile, completing the process except for inspection and grading.

One class of tile at Atlantic—the accessories, like soap dishes, glass and toothbrush holders and travel rack holders — are processed by single rather than double firing. These pieces are cast in plaster molds and are not fired in the raw cast condition. Because of their shape the pieces must be hand dipped in the glaze solution and then fired. Any unevennesses in the dipped coat smooths out when the glaze is in the molten state in the kiln.

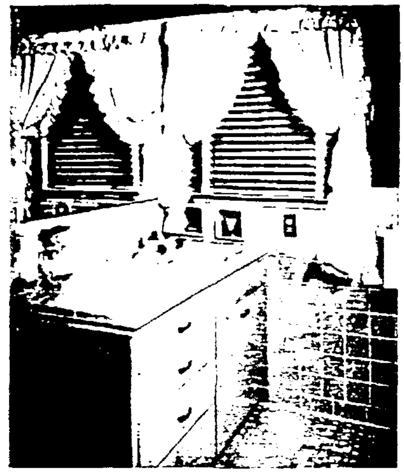
A leaded glaze representative of those used at Atlantic Tile might be expressed as follows:

Lead Monosilicate	20%
Frit*	21
Feldspar	20
Zinc Oxide	12
Barium Carbonate	4
Clay	8
Calcined Clay	5
Flint	10

plus coloring and opacifier

*Frit:	Na_2O	10.4%
	CaO	20.0
	B_2O_3	23.3
	SiO_2	46.3
		100.0

This glaze fires at approximately 1950° F.



A typical application of lead glazed tiles in a private bathroom of a modern home.

Lead Fixture Connections In Tulsa High School

ONE of the important phases of the present building boom is the construction of school facilities that are badly needed in so many areas of the country. There is no doubt that these facilities recently constructed and presently building will be needed and in use for a great many years. It is therefore important that quality materials be used from which a long life and low maintenance costs can be expected.

One of the major facets of any school building is the plumbing system. It is here that considerable care and thought should be given to the selection of quality materials if unsanitary conditions created by faulty materials and workmanship are to be avoided. One of the most vital points in any plumbing system is the connection between the rigid fixtures and piping.

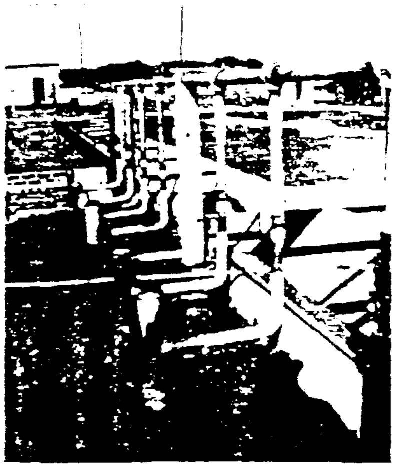
Probably two of the most important attributes of a material used for these vital connections is that it be flexible enough to provide for differential movement of the building and the rigid pipe lines and that it be durable enough to provide long and trouble-free service. Lead is one of the few low cost quality materials that meet these requirements admirably.

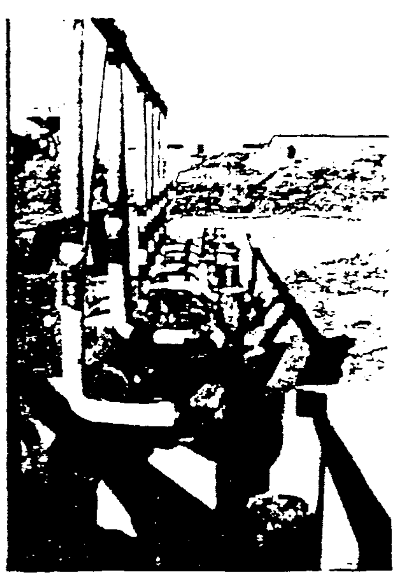
A recent example of how these advantages, inherent in lead waste pipe, traps and bends, have been put to practical use can be found in the now under construction Thomas A. Edison High School in Tulsa, Okla., Black and West, the architects.

Lead bends and lead stubs were

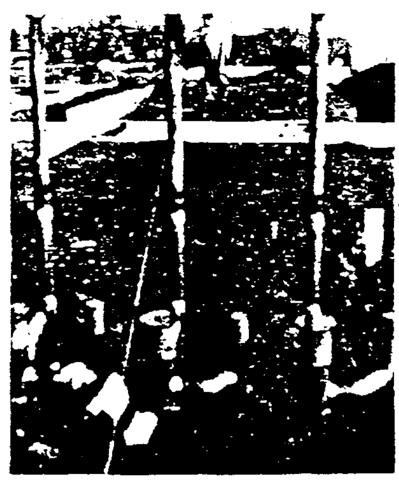
The new Tulsa, Okla. high school plumbing roughing-in includes lead bends for the water closets and lead drum traps for the urinals as shown below.

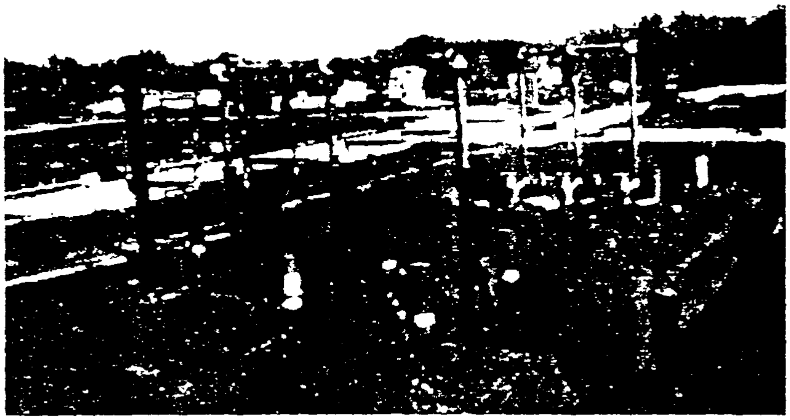
Lead stubs, as shown, are used for some of the water closet connections to the rigid piping.





All lead fixture connections are vented with lead pipe as shown here for the urinals.





The roughing-in for two of the toilet rooms in the new Tulsa, Okla. high school. Lead connections are used throughout for all fixtures, including lavatories shown on side wall.

used for connecting the 60 water closets to the rigid drainage lines as were lead drum traps with lead waste and vent connections for 28 urinals. Lead pipe was also used for the waste and vent connections for 48 lavatories and 132 sinks.

The plumbing contractor, W. F. Glenn Co., Tulsa, Okla., also took advantage of lead's superior qualities as a waterproofing membrane by using 4-lb. sheet lead, properly coated with asphaltum, for the pans under the 16 showers installed. Plumbing vent pipes passing through the roof were also flashed with 4-lb. sheet lead.

Despite the long life and trouble-free service that are expected of lead, the cost of installation is generally as low or lower than other materials available for such connections. One of the basic reasons is that with lead's flexibility no expensive fittings are required to make sharp or easy changes in direction as they can easily be made by bending the pipe itself: thus fewer joints are required.

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