New Use of Lead in the Pulp and Paper Industry

A NEW trend is taking place in the pulp and paper industry: conversion from dry to liquid alum. The inconvenience, bulkiness and expense of handling and storing dry alum have pointed up the advantage of the liquid form. For equal quantities of alum, liquid alum is less expensive to use than the dry. Delivery and handling are vastly simplified; labor costs are practically eliminated; performance is considerably improved. Some paper mills have reported up to 10 percent reduction in alum consumption, while at the same time producing a better, more uniform sheet.

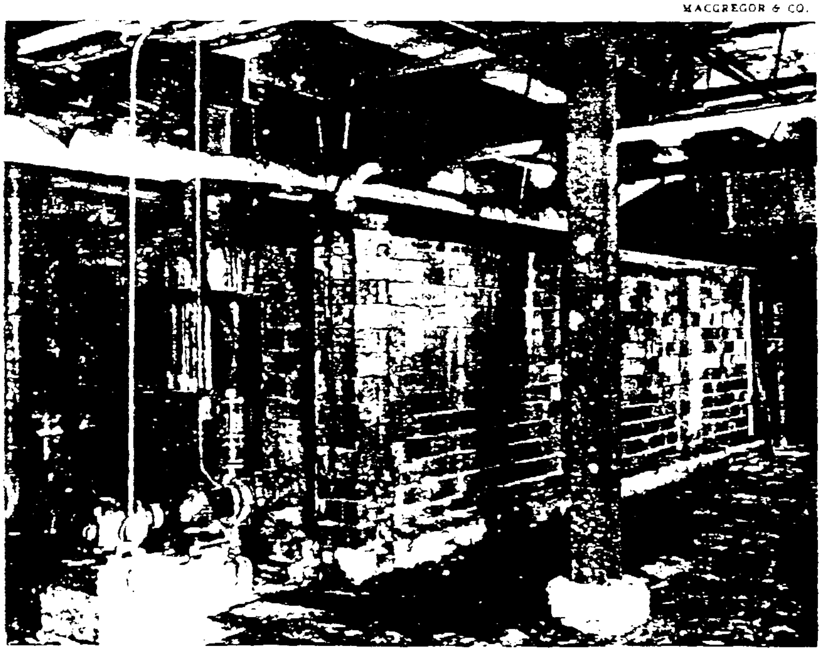
About two years ago the Detroit Sulphite Pulp and Paper Company decided to convert from dry to liquid alum and installed a complete system to take delivery right from the plant door to the point of use in the beater room. Lead pipe 2 and 3 in. in diameter, 1/4 in. wall, and 10-lb. antimonial sheet lead totaling 9½ tons were used throughout the system.

Operation of a liquid alum system is simple. The installation at the Detroit Sulphite Pulp and Paper Company shown on the flow sheet has exceeded expectations and given trouble-free service since it was first installed about 2 years ago. A 40 percent solution of alum is brought to the plant by tank truck and emptied by gravity through a connecting length of ordinary fire hose and 3-in. lead pipe to an 18,000-gal. storage tank. The storage tank is an old tile chest completely lined with 10-lb. antimonial sheet lead. The alum is pumped from storage to a 500-gal. auxiliary storage tank located at the high point of the beater room. A float switch controls the pump to maintain the proper level automatically. The auxiliary tank is a steel shell lined with 10-lb. antimonial sheet lead lapped over the upper edge. From this tank the alum flows by gravity to five 30-gal. measuring tanks, also lead lined, from where it is drawn off to the beaters as required for batch pulp processing.

From the main alum storage tank through the entire system to the beaters, the liquid alum is piped through 4 percent antimonial lead pipe. Joints between sections of lead pipe can be of the Van Stone type or "split joints"

The main liquid alum storage tank, capacity 18,000 gal. The tile tank is lined with 10-lb. hard lead sheet and inlet and outlet piping is lead supported in steel troughs.

MACGREGOR & CO.



Detroit Sulphite Pulp and Paper Company's 500 gal. lead-lined liquid alum auxiliary storage tank.

welded (burned) together. In this particular installation, vibration from the beaters and other equipment was a factor, so split joints were used on the pipe in the beater room. Over long spans the pipe is laid in angle iron supports hung from overhead. The method for supporting the pipe can best be seen in the illustration of the measuring tank.

Alum is one of the important chemicals used in paper making. It is introduced along with a sizing agent into the pulp beaters to produce coagulation and fibre coating. It makes the paper more water repellant and also adds strength, firmness and hardness. Alum neutralizes alkalinity of pulp and water. It helps pigment and filler retention and reduces pitch and sticking. Raw water is treated with it in the filter plant to remove turbidity and color.

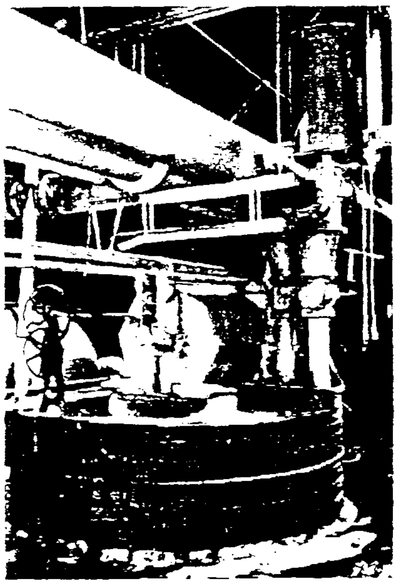
Papermaker's alum is aluminum sulphate ($Al_2(SO_4)_3 \cdot 14.5\ H_2O$), a chemical which is corrosive to practically all of the common materials of construction with the exception of lead and its alloys. Upon contact with lead, alum forms a thin protective film consisting essentially of lead sulphate which successfully stops further reaction. The introduction of any products of corrosion harmful to the pulp stock is thereby avoided. This advantage is particularly important in the making of fine papers where absolute freedom from chemical impurities is imperative.

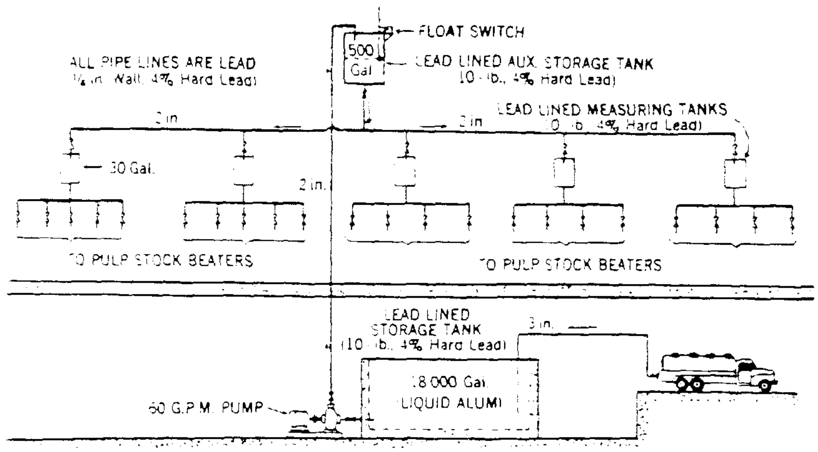
Lead is used wherever liquid alum is used: in 1) storage vessels, 2) conveying lines, 3) feed tanks and 4) measuring boxes. Employed chiefly for its excellent resistance to the corrosive attack of alum, lead also has other advantages. It has proven to be one of the easiest materials to keep clean; it gives extremely long service; it can be repaired in place. In addition, lead is not valueless after its useful service life or obsolescence of the equipment. It may always be salvaged at the highest relative rate of any of the common corrosion resistant materials.

Lead has another point in its favor: it can be used equally well as a lining in wood, steel, concrete or tile tanks. Tanks of these materials which are no longer serviceable for their intended purpose, but are still strong enough to hold the load, can be lined with lead and used just like a new tank. This is actually what was done when an old tile chest at Detroit Sulphite was converted to the main alum storage tank.

Liquid alum in a lead protected system offers real advantages in economy and efficiency over dry alum methods. This is a fact proven by the number of paper mills that have already converted or are presently converting to liquid alum.

One of the lead lined 30 gal. liquid alum feed tanks supplying five pulp stock beaters, one of which is shown. Feed lines are lead.





Flow sheet of the liquid alum system at the Detroit Sulphite Pulp and Paper Co. plant.

Colorful Plastics Stabilized with Lead Compounds

ONE of the fastest growing industries of this decade is the manufacture of the many colorful and utilitarian vinyl chloride plastic materials that are being used for floor coverings, shower curtains, draperies, upholstery, electrical insulation and a host of other applications. The tremendous growth of this industry, from 1 million pounds in 1939, to over 300 million pounds in 1949, is due in large measure to the development of stabilizers, made, strange as it may seem, from the dull gray metal, lead. A description of the manufacture of vinyl floor coverings will explain this strange paradox.

The Delaware Floor Products Co. of Wilmington, Del., in the manufacture of its plastic floor covering Flor-Ever, uses vinyl resins that are high molecular weight polymers of vinyl chloride or co-polymers of vinyl chloride and vinyl acetate. In the processing of these resins, temperatures above 300 deg. F. are necessary and at this high temperature, hydrogen chloride is released which, unless checked, results in the degradation of the resin. To stabilize the resin at the high temperature of processing, it is necessary to control the free hydrogen chloride by chemically combining it with a material that in combination would in itself be inert. It is at this important phase of the operation where lead enters the process.

Lead in the form of such compounds as the carbonate, silicate, salicylate, or the more basic salts such as tri-basic lead sulphate, di-basic lead phthalate, dibasic lead phosphite and dibasic lead stearate, is introduced into the process and chemically combines with the hydrogen chloride forming insoluble salts as rapidly as the gas is released. Without these lead stabilizers, the end result would be discoloration and frequently loss of strength and flexibility and other desirable physical properties.

Oxidation of the vinyl resins at the processing temperature, another factor in resin degradation, is also avoided by the use of such lead salts

Marbleized tile floor covering made from lead stabilized vinyl resins, as shown, do not harden or become embrittled with age. Because of their non-porous surface, they are easily maintained.

as lead salicylate and dibasic lead phosphite. These prevent the oxidation of the resin constituents which if unchecked would destroy the plasticity of the vinyl resin. In effect the lead salts serve as an anti-oxidant.

The importance of the addition of lead salts to the vinyl plastics does not end with the processing of the material as their properties are needed even after the plastic material is in the hands of the ultimate consumer.

Vinyl floorings and most other vinyl products are exposed to sunlight and other sources of heat which, without the use of a stabilizer, would result in embrittlement, tackiness and undesirable color formation. The trigger in this reaction is the ultraviolet light of the sun which is an oxidation catalyst that promotes oxidation and dehydrochlorination. It is therefore necessary to screen out these destructive rays by the use of opaque pigments or certain inorganic compounds. Lead salicylate and complex salts of lead mono-silicate are useful in this application.

R. K. Petry, research director, Delaware Floor Products, Inc. reports ". . . it may be said that specific lead salts are excellently suited for use as heat and light stabilizers for vinyl floorings. They combine the necessary characteristics of acid acceptors, anti-oxidants and ultra-violet light screens."

Vinyl resins, stabilized with lead, provide floor coverings as well as the many other uses of this important plastic material with resiliency, flexibility and most important, the material retains these characteristics almost indefinitely. In particular, floor coverings made from the vinyl resins have remarkable resistance to wear and abrasion and outstanding chemical resistance. Floor coverings made from the vinyl resins do not harden or become embrittled on aging and because of their non-porous surface, are easily maintained. They are available in a number of colors as well as marbleized patterns, in both yard goods and tile form.

Lead Assures Permanent Anchorage in Concrete

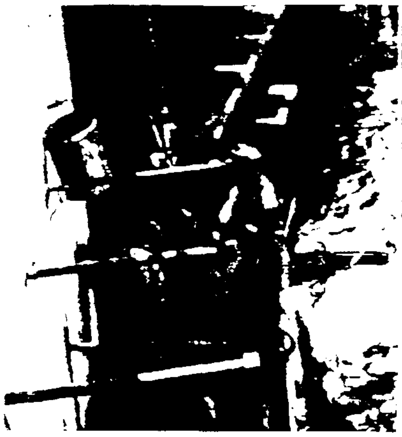
FASTENING objects to concrete, stone or brick facings is another one of the many difficult jobs successfully accomplished with that most versatile of the common metals, lead. In this application, lead's softness and springless qualities are used to advantage by the "Cinch" Anchoring System to insure a permanent anchorage in concrete.

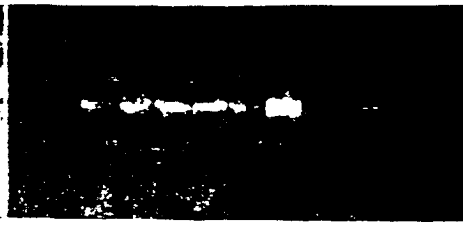
"Cinch" anchors as they are commonly known are rings of lead and iron and made in many sizes and several types to accommodate bolts required for anchoring anything from a backyard clothesline to mooring posts for giant liners. In all applications, the calking principle in holes in concrete or stone is the same, a ring of lead is compressed against the sides of the hole and over and around a ring of iron through which or in which the bolt is located. The "work" is then fastened to the bolt.

In properly mixed concrete or stone, "Cinch" anchorages will not pull out or work loose. Under severe overloads, the bolt will give before the anchor elements weaken.

In a test conducted by the New York City Department of Docks in pier construction to determine the holding strength of a "Cinch" anchorage, a 12 x 12 in. x 22 ft. 10-in. yellow pine backing log was anchored to a granite coping block on

"Cinch" bolt anchorage for a heavy duty rolling mill gear unit in the plant of the Aluminum Co. of Canada and a closeup of one of the bolts.





Three "Cinch" anchor units, each consisting of an iron and lead alloy ring, on a stud bolt. This type anchor was used on the Aluminum Co. job and for the fenders of a Canadian National Railway ferry terminal shown, left and right, under construction.

a concrete, waterfront retaining wall. One-inch, three-unit "Cinch" anchors were used in 6½ in. deep holes in the granite. A vertical pull of 90,000 lb. failed to disturb the anchorage.

Noteworthy recent uses of "Cinch" anchors on Canadian projects include the installation of heavy duty rolling mill gear units in the Kingston, Ontario, plant of the Aluminum Co. of Canada, and for fenders in the Borden, P.E.I., car ferry terminal of Canadian National Railways.

On the Aluminum Co. job, the gear units were anchored to an existing concrete foundation. Holes were drilled in the concrete to a depth of two feet. Stud bolts 2½ in. in diameter, threaded at one end and with 2 in. steel collars welded to the other end to provide heads for the anchoring units, were placed in the holes in the concrete. Four "Cinch" Anchor units, each consisting of a conical-wedge iron ring and a lead alloy ring, were placed, one at a time, around the stud bolts and each calked in turn to refusal.

After all bolts were positioned and calked in the concrete foundation, a length of sway pipe was placed around each bolt and two feet more of fresh concrete was poured. After this was well set, grout was run in around the bolts to fill the holes completely to the top of the concrete.

The gear units, which will drive a 1,000 h.p. cold sheet four-high rolling mill, were then installed and bolted down.

The CNRR job called for "Cinch" Anchors placed in vertical bases and provided added evidence that these anchors work perfectly no matter what the position of the foundation—side-wall, bottom or overhead. The car ferry terminal was in use during construction and it was not possible to embed the bolts that would support the waling timber in the concrete during pouring as the job had to be completed in short sections.

The solution, of course, was to install in small numbers as needed, after the concrete was set, bolts fitted with "Cinch" Anchor units. In this manner, erection of the waling timber and fender could proceed progressively. With this method of construction, no bolts were left protruding to cause damage or be damaged. A total of 315 two-unit "Cinch" Anchors, 1¾ in. in diameter, were used.

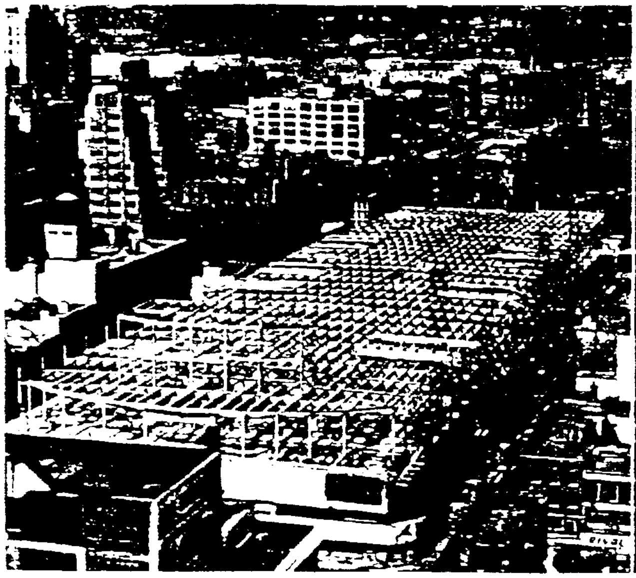
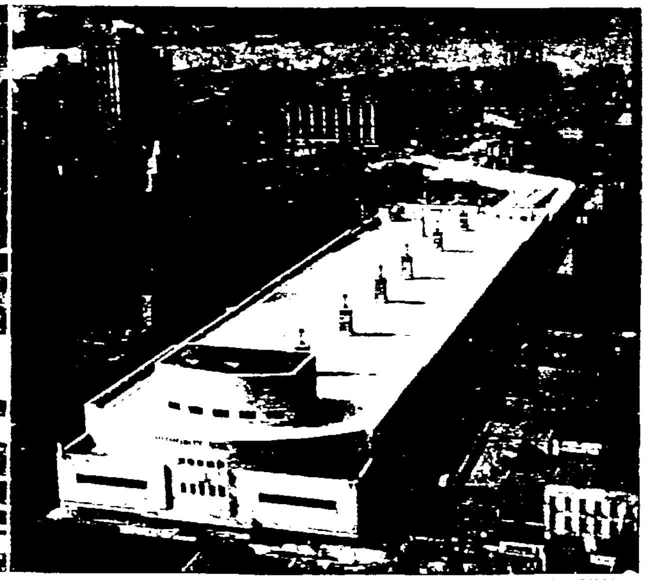
The two installations described involve heavy machinery and equipment, of course. However, the "Cinch" system, as previously indicated, is adaptable to unlimited application. Some of the articles or equipment ordinarily held secure by "Cinch" Anchors are: overhead runways, conveyors, fire escapes, sprinkler systems, plumbing and heating fixtures, electrical fixtures, line shafting, ventilating equipment, theatre and stadium seats, awnings, advertising sign supports, suspended ceilings and all manner of machinery.

Some Construction Details of Largest Bus Terminal

LARGE quantities of lead paint were used as protective coating on the thousands of tons of steel which went into the recently completed New York City Bus Terminal, the largest in the world. Officially opened on December 15th, 1950, the Terminal was built by the Port of New York Authority to provide an efficient and comfortable union station in the mid-town Manhattan area. The Terminal was also aimed at relieving street traffic congestion on the West Side, where it is located between 40th and 41st Streets, and 8th and 9th Avenues. Thousands of daily New Jersey and New York bus commuters, as well as long-distance bus travelers, are being accommodated in the huge Terminal which cost $24,000,000.

The 800 x 200 ft. Terminal is in sharp contrast to the skyscraper architectural theme of most buildings in New York City, but if it were upended it would reach to within five stories of the top of the seventy-story RCA Building in Radio City. It was constructed as a four-story, block-long structure to perform its two primary functions of relieving traffic congestion and centralizing the bus movements which during rush hours number some 5,000 buses handling 120,000 commuters. In addition, 10,000 long distance passengers can be handled daily.

Structurally, the Terminal is similar to a combined bridge and tunnel. The structural steel, most of which is

PORT OF NEW YORK AUTHORITY PHOTOS

The Port of New York Authority's New York City Bus Terminal, largest in the world, is shown while the red lead protected steel work was in progress and later, a few weeks before its official opening.

in individual beams, is heavier than the steel in the conventional New York skyscraper. Basically, the Terminal is a steel framework structure, fireproofed with reinforced concrete, with buff-colored exterior brick walls and granite exterior trim. The interior walls of the two concourses are finished in Hauteville marble. The walls at the bus levels are exposed concrete or brick.

The Terminal comprises five levels: the lower level for long distance busses; the Main Concourse; the Suburban Concourse; the suburban bus level; and the roof, where more than 450 passenger automobiles can be parked in a three-acre open area.

The structural steel supporting the roof was made sufficiently heavy to provide for immediate and future loads, in case the need arises to add a third bus level. The floors of the roof and the two bus levels are all of reinforced concrete designed to carry a 15-ton bus in any position on the floor.

All of the structural steel received a shop coat of red lead paint conforming to Port of New York Authority Specifications. This paint was composed of 25 lbs. of dry red lead per gallon of linseed oil (a mixture of 2 parts raw and 1 part bodied oil by volume). In addition to the shop coats on all the structural steel, lead paints were used as the first and second field coats on the exposed steel in the elevated ramp which connects the Terminal with the Lincoln Tunnel.

The tables included are the requirements of the Port of New York Authority specifications for first field coat and second field coat or finish paint.

The structural steel in the main structure encased in concrete received a coat of asphaltic paint over the red lead shop coat.

The 2,100 tons of ramp steel work and 9,100 tons of steel in the Terminal Building were erected by the Harris Structural Steel Company.

The ramp is constructed of reinforced concrete slab on steel girders supported on 55 steel and 28 concrete columns. In addition to the 2,100 tons of steel, 2,700 cu. yds. of concrete have gone into its construction. Gull Contracting Company was the contractor for the ramp foundations and Corbetta Construction Company built the ramp superstructure.

To assure ice-free operation, the elevated part of the ramp is equipped with a radiant heating system and the under part of the concrete roadway is insulated to assist this system. The six miles of heating pipes encased in the concrete will be filled with an oil base liquid which will be heated by steam and then circulated through the system. The system is designed to melt one inch of snow per hour over a total area of more than an acre and a half.

It is estimated that approximately 40 tons of lead were used in shop coats and field coats on the steel for the Terminal Building and the ramps. Additional quantities of lead were used in some of the interior paints.

Two of the three red lead and white lead paint protected ramps leading from the Bus Terminal to the Lincoln Tunnel. The upper ramp is for cars using the roof parking area.

FIRST FIELD COAT PAINT

	Percent by Weight Minimum	Maximum
Red Lead	75.0	—
Magnesium Silicate	—	25.0
*Alkyd Resin Solids and Driers	50	—
Petroleum Thinners	—	50

PV = 30 percent minimum

Note: Sufficient lamp black shall be added to distinguish this paint from the shop coat.

SECOND FIELD COAT OR FINISH PAINT

	Percent by Weight Minimum	Maximum
Basic Carbonate White Lead	40	—
Leaded Zinc Oxide	35	—
Chrome Oxide Green	-	—
Magnesium Silicate	—	15
Carbon Black	As required for shade.	
*Alkyd Resin Solids and Driers	50	—
Petroleum Thinners	—	50

Pigment = 44 to 46 percent by weight
Vehicle = 54 to 56 percent by weight
Wt./Gal.= 11.9 lb. minimum

* A soya oil modified glyceryl phthalate alkyd containing a minimum of 23 percent by weight of phthalic anhydride.

The plumbing drainage system required 400 lead connections which were comprised of 4-in. extra-heavy lead bends and lead stubs. Lead was also used for calking the underground cast-iron drain lines.

As a self-supporting corporate agency of the States of New York and New Jersey, operating without burden to the taxpayers, the Port Authority was created by treaty in 1921. It deals with the planning and development of terminal and transportation facilities, and with the improvement and protection of the commerce of the Port District.

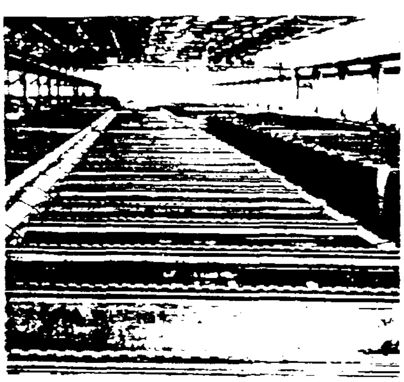
The Port Authority operates the Holland Tunnel and also built and operates the Lincoln Tunnel and George Washington Bridge spanning the Hudson River, and the Bayonne and Goethals Bridges and Outerbridge crossing connecting Staten Island and New Jersey which joins the States into one vast industrial, residential and recreational area.

The bi-State agency's terminal facilities also include the Port Authority Building at 111 Eighth Avenue, Manhattan, housing the Union Railroad Freight Terminal; the Port Authority Grain Terminal at Gowanus Bay, Brooklyn; La Guardia Airport and New York International Airport in New York City; Newark Airport and Teterboro Airport in New Jersey; Port Newark; New York Union Motor Truck Terminal and Newark Union Motor Truck Terminal.

The construction of the Terminal, which has a volume of 11,376,000 cubic feet and two miles of interior roadways, was under the general supervision of John M. Kyle, Chief Engineer of the Port of New York Authority. In addition to his regular staff of Port Authority Engineers he was assisted by Francis G. Carey, resident engineer for the Terminal.

Lead-Lined Electrolytic Cells in New Copper Refinery

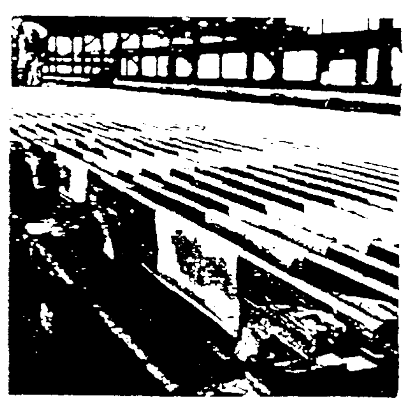
ONE of the world's largest electrolytic copper refineries has just gone into operation. Located at Garfield, Utah, and built by the Utah Copper Division of the Kennecott Copper Corporation, this great new plant will contribute 144,000 tons of refined copper to the nation's supply each year. It took approximately 2,520 tons of lead, probably a record amount, plus equally huge quantities of brick, steel, concrete and copper (for wiring and bus bars) to make it possible to produce this amount of refined copper. It also took 16 million dollars.

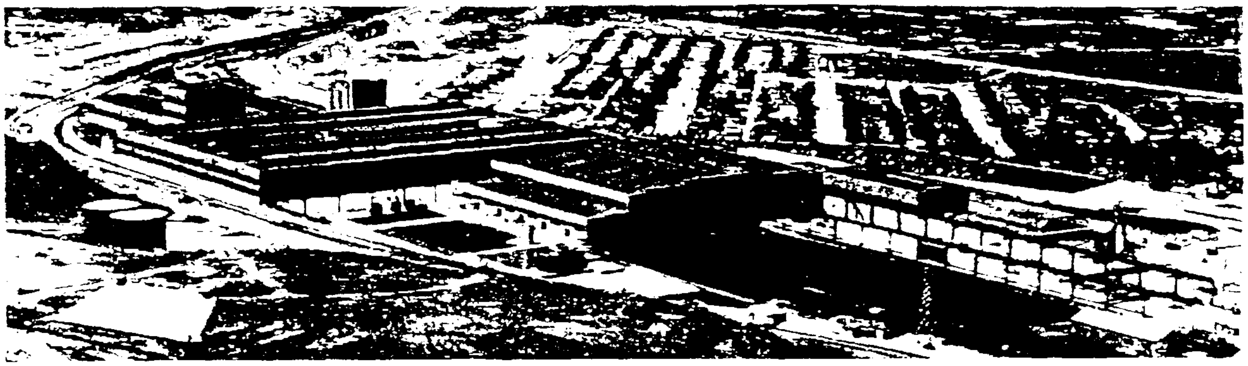


The ten buildings that make up the new refinery cover an area of about nine acres. The largest of these, the tank house, covers some 225,000 square feet and houses 1,346 electrolytic cells, 6 motor-generator sets and other auxiliary equipment. A panorama of the plant and several views of the tank house are shown here.

Operation of an electrolytic copper refinery is comparatively simple —providing the corrosive electrolyte is kept confined to where it belongs. Peace and quiet prevail as the impure copper cast into anodes is deposited out as pure copper on cathode sheets. All the "impurities" including gold, silver and other insoluble metals, settle to the bottom of the cells and form what is called the anode mud or slimes. This is later removed to recover the valuable by-

The lead lined electrolytic cells for copper refining in Kennecott Copper Corp. new refinery in Garfield, Utah. At right, anodes and cathodes are shown in place.





One of the world's largest electrolytic copper refineries, that of the Utah Copper Division of the Kennecott Copper Corp.

products. About 28 days are required to consume one anode during which period two cathodes are produced, requiring about 14 days each. At the end of this period the cathodes are removed and melted down in electric arc furnaces and cast into wire bars, ingots and other forms.

The design and construction of the new refinery has utilized the most modern equipment and the latest methods known to the industry. The cells are 3 ft. 7 in. wide, 4 ft. deep and 13 ft. 6 in. long (inside measurement). They are constructed of reinforced concrete lined throughout with 8-lb. hard lead (3 percent antimony). All lead joints are welded together. Piping for conducting the corrosive electrolyte and launders and filters for purifying the electrolyte are all either constructed of hard lead or protected with a lining of hard lead. Piping ranges from 5/8 in. to 12 in. in diameter with wall thicknesses 1/4 in., 5/16 in. and 3/8 in.

The electrolyte is a mixture of about 25 percent copper sulphate, 18 percent sulphuric acid and the remainder is condensate with small amounts of impurities. The solution is kept at approximately 140 deg. F. Under these conditions, the use of lead is logical and, as a matter of fact, has shown itself to be the most economical corrosion resistant material to use. Lead has proven its worth in other electrolytic copper refineries; in most plating operations which begin as a rule with a flash plate of copper; in the phonograph record manufacturing industry and in a multiplicity of other industries utilizing dilute sulphuric acid alone or in combination with copper sulphate.

Another important consideration in selecting corrosion resistant linings, is lead's high salvage value. The fact that lead has relatively the highest salvage value of any of the common metals cannot be ignored when selecting it for service with corrosives.

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.

THE USE OF LEAD IN THE PULP AND PAPER INDUSTRY
Detailed description of various applications of lead in the modern pulp and paper mill. Covers all phases of paper pulp manufacture and treatment including sulphite acid manufacture, acid pulping, bleaching and stock handling.
Reprinted from "Paper Trade Journal," Oct. 26, 1950.

LEAD IN MODERN PLUMBING— WHY, WHERE, HOW IT IS USED
A 24 page booklet containing descriptive information as well as four pages of detailed drawings for plumbing installations in various type houses.

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.

A STUDY OF PAINTS FOR ENCLOSED STRUCTURAL MEMBERS IN STEEL HOUSING CONSTRUCTION
A reprint of a paper which was read before the General Meeting of the American Iron and Steel Institute, May 25-26, 1949, which sponsored the work. The study included some 34 kinds of paint systems.

AN INVESTIGATION OF PRIMERS FOR MARINE ATMOSPHERIC ENVIRONMENTS
Results of an investigation of synthetic vehicles and red lead mixed pigment primers over an exposure period of three and one-half years in a rigorous marine atmosphere. Reprinted from "Official Digest" published by The Federation of Paint and Varnish Production Clubs.

RED LEAD TECHNICAL LETTERS
A series of technical letters issued by the Red Lead Division, Lead Industries Association. The numbers and titles follow: (Available separately.)
- **Technical Letter No. 3—Red Lead Primers for Atmospheric Exposure**
- **Technical Letter No. 4—Red Lead Paints for Marine Exposures**
- **Technical Letter No. 5—Red Lead-Vinyl and Coumarone Type Paints**

NEW MARINE PRIMERS
An article on newly developed paint primers for metals exposed to marine atmospheres written expressly for the person who is not a paint technologist. Reprinted from "Marine Engineering and Shipping Review," March, 1949.

PHYSICAL AND CORROSION CHARACTERISTICS OF LEAD IN THE CHEMICAL INDUSTRY
A detailed discussion of the use of lead in the chemical industry presented before the National Association of Corrosion Engineers Conference, April 11-14, 1949.

COMPARATIVE CORROSION STUDY OF SOIL, WASTE AND VENT PIPE MATERIALS
A study undertaken to determine the relative rates of corrosion of six metallic pipe materials used or suggested for use in the plumbing soil, waste and vent system.
Reprinted from 1949 Yearbook of the American Society of Sanitary Engineering.

CORROSION FORUM
A series of one page articles on the use of lead as a material of chemical construction in contact with the following chemicals (available separately): Chlorine, Hydrochloric Acid, Hydrofluoric Acid, Industrial Alcohol, Sulphuric Acid, Sodium Chloride, Sulphur Dioxide, Phosphoric Acid.
Reprinted from "Chemical Engineering."

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.

FEDERAL SPECIFICATION TT-P-86a
Paint; Red-Lead-Base, Ready-Mixed
Covers four types of red lead base paints including two fast drying formulations. Many intended applications listed.

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

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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