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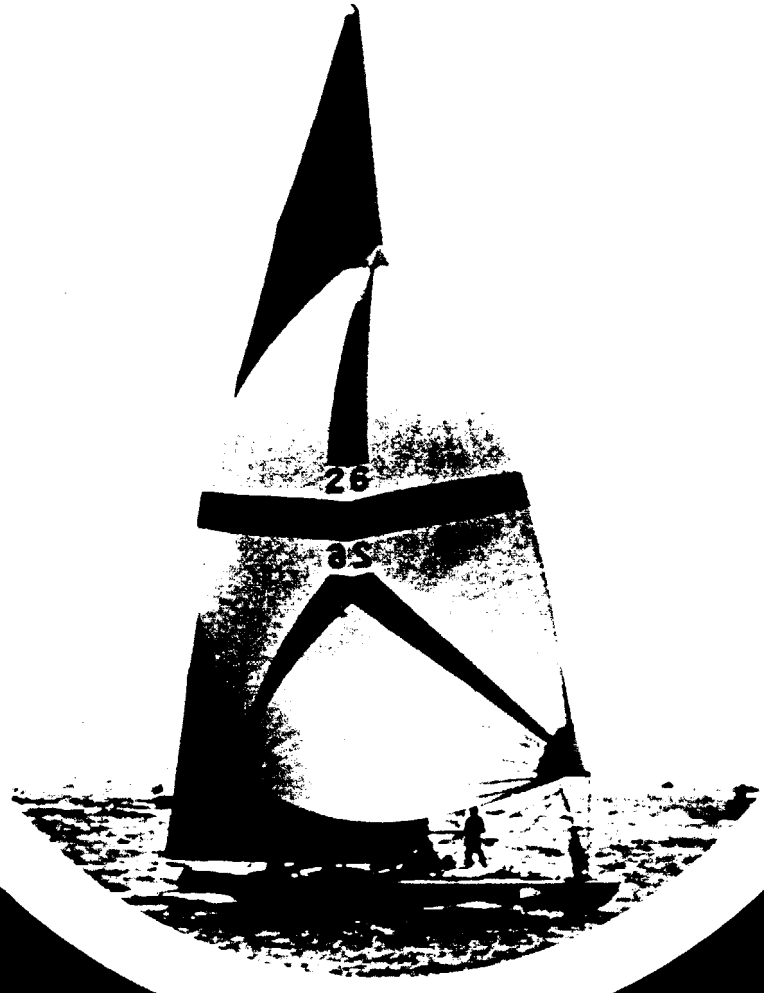


GOLIATH

Key factor in rebirth of electric truck industry

Paul C. Henshaw
President, Homestake Mining Company; President and Chairman of the Board of Lead Industries Association, Inc.

Members of the Lead Industries Association can look back on 1974 with the deep satisfaction of having been responsible for a demonstration and education program to help develop a dynamic new industry: short-haul electric trucks.

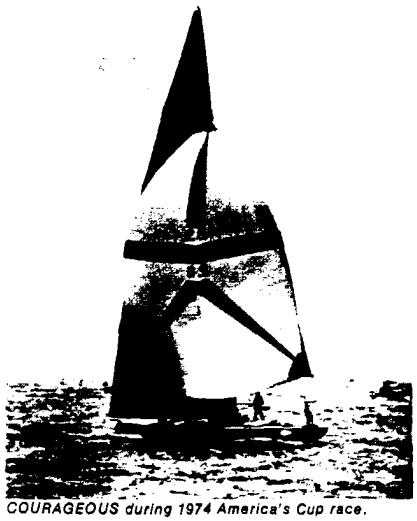
The Association's program has been highlighted by GoLIAth, the battery-powered electric truck that was introduced in early January. GoLIAth played a dominant role in helping LIA inform both the general public and potential purchasers of electric trucks about specific advantages resulting from their use and the role lead batteries can play in providing power for this form of transportation.

Since January, GoLIAth has been featured in test and demonstration programs in more than 25 major U.S. and Canadian cities . . . from coast to coast. GoLIAth has transported sewing machines, newspapers, mail and tools. The truck also has transported men and machines for park maintenance, water and electric meter readers, environmental technicians and a wide variety of other personnel.

The battery powered electric truck concept, through GoLIAth, has appeared in many of the nation's major magazines and newspapers, and the vehicle has been featured on both local and syndicated television programs. Literally millions of people who learned about GoLIAth now know that lead battery-powered work vehicles are one answer to the nation's transportation problems.

Location of lead keel is clearly visible in this view of COURAGEOUS being hauled out of water at Newport for servicing prior to winning final race.

Workmen grout out concrete mold used to pour 10-ton lead keel for COURAGEOUS.



COURAGEOUS during 1974 America's Cup race.

Materials selection key factor in America's Cup yacht design

Yachts competing for the America's Cup, the foremost international yacht racing trophy are among the world's most expensive vessels—as much as $6 million per yacht. America's Cup yachts also have the distinction of being the most painstakingly and scientifically-designed of any racing yachts.

For example, various types of sails—some of them costing as much as $5 thousand each—have been developed for use on days when there is little wind and days when there is considerable wind. Hull materials also have played an important role in the design of the yachts. Wood was the primary material used for America's Cup yachts until 1970 when the use of aluminum was permitted. And lead has, by tradition, always been used for the keel of America's Cup yachts. In fact, it might be said that if the prestigious America's Cup trophy had a bottom (it doesn't), it would likely be made from lead because of the critically important role lead plays in designing yachts built to compete for the trophy.

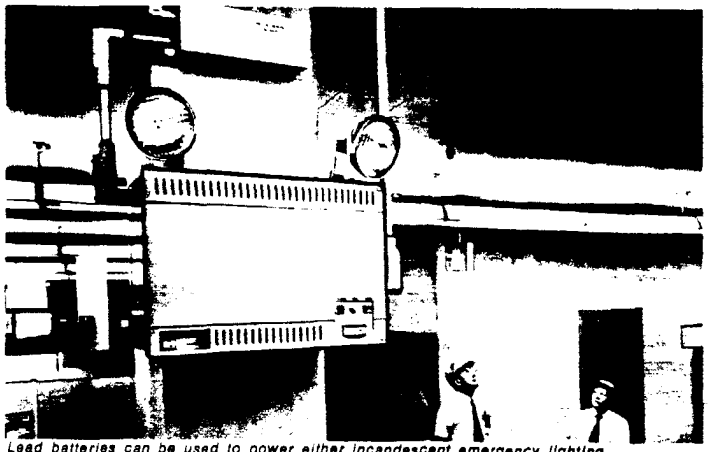
A close look at COURAGEOUS, winner of this year's trophy race against the Australian challenger, SOUTHERN CROSS, gives an indication of the importance lead plays in the sailing characteristics and performance of the 12-meter class yachts that traditionally compete in the 123-year-old classic. According to Bob Carrick, spokesman for the COURAGEOUS builders' syndicate who put up the more than $1 million to build the yacht, the role lead played in the vessel's design and performance was, in part, determined by the fact that aluminum was selected for the hull.

Although aluminum potentially reduces the overall weight of the yacht, it still weighed in at 12½-tons. This is about the same weight as previous 12-meter yachts that have competed for America's Cup. The major difference in the overall design of the yacht is the fact that because lightweight aluminum was used for the hull, additional lead ballast could be added to her keel. The keel's weight and how it is distributed are key factors in determining how fast the yachts can sail and how quickly they respond to commands.

A heavy keel is important for several reasons. It contributes to an increased ballast-to-displacement ratio and thus insures more stability under sail. For example, the lead keel of the COURAGEOUS weighs 20,000-lbs., while the total displacement of the yacht is about 25,000-lbs., thus providing the best desired ballast-to-displacement ratio. Additionally, lead's low density provides a lower center of gravity within the yacht. This factor gives more stability to the yacht, allowing it to sail faster into the wind. A final advantage of using lead ballast is the fact that it results in a heavily-weighted counterbalance to the tendency of the sails on windy days to capsize the yacht.

COURAGEOUS was built at the Minneford Yacht Yard on City Island, located on Long Island Sound off New York City. The 10-ton lead keel for the yacht was cast in a concrete mold. The concrete was formed by pouring it in a wooden frame that held a keel-shaped plug. After it had set, workmen dug out the plug and then poured molten lead into the cavity left by the plug.

The yacht was designed by Olin Stephens of Sparkman and Stephens, an internationally-known yacht design firm headquartered in New York City. Stephens has been involved in designing America's Cup winners as far back as 1937. He has designed or collaborated on such America's Cup winners as RANGER, COLUMBIA, CONSTELLATION and INTREPID. In addition to being America's Cup winners, all the yachts shared one other thing in common—they all featured lead keels that helped them win the trophy.



Lead batteries can be used to power either incandescent emergency lighting, seen in foreground; or fluorescent lighting seen in background.

Interior view of supermarket illuminated by emergency fluorescent lighting powered by batteries.

Flashlight actuates light-sensitive mechanism used to test battery powered emergency lighting system.

Technician seen in left view checks centrally located console system used to power emergency fluorescent lighting in meat processing plant. Insert view shows close-up of battery-powered system.

Lead batteries power emergency lighting for commercial and industrial buildings

Improved lead batteries that are virtually maintenance-free are playing an increasingly important role in providing needed electrical energy required for a wide variety of industrial and commercial uses. They range all the way from providing temporary power for the entire lighting system of industrial plants to providing power for small-size, wall-mounted emergency illumination systems used to safely evacuate industrial and commercial areas during a power outage. In some cases, the batteries supply direct current to power the lighting systems while in other cases, the direct current (dc) supplied by batteries is changed to alternating current (ac) for use in powering fluorescent lights.

Emergency lighting is so important that the majority of states and municipalities have enacted laws requiring such lighting. It is also set forth in the National Electric Code, Article 700. The National Fire Protection Association's Life and Safety Code, Section 5-10, also requires adherence to the emergency lighting requirements.

Whether emergency lighting is installed because of laws or it is done voluntarily, lead battery-powered standby illumination installations represent a low cost insurance protection against possible theft, injury or even loss of life resulting from panic following unexpected blackouts due to primary power failure.

Emergency lighting is most frequently used in offices, industrial plants, stores, theaters, auditoriums and other locations where people work or gather. Emergency lighting is installed to provide sufficient illumination for people to safely exit a building without injury or panic if the primary power fails. In some cases, emergency lighting keeps a building or plant in limited operation. Exits, hallways, stairways, machinery areas, first-aid rooms, communications centers and hospital operating rooms are a few examples of areas requiring emergency lighting.

Lead battery-powered emergency lighting has the primary advantage of providing instantaneous light, since there is no start-up time involved such as that required for engine-powered generators. However, emergency lighting is often supplemented by engine-powered generators, which take over during extended blackouts. Such generators are frequently started by a bank of lead acid batteries.

Emergency battery-powered lighting can be installed using either of two basic approaches: various areas to be illuminated can be served by single units, each containing its own battery and charger connected to as many as eight lamps; or a building-wide system can connect many lamps to a central battery-charger console system. It is for these reasons that a wide variety of battery systems are available—all the way from 6-volt to 115-volt emergency lighting systems.

For limited applications in relatively small areas, single 6-volt or 12-volt emergency lighting units are preferable. Usually mounted on walls or partitions, such units can control as many as eight lamps from a single unit. Remote 25-watt lamps can be located up to 62-ft. away from 6-volt batteries and up to 225-ft. from 12-volt batteries when properly connected. By running wires through walls, a single lead battery unit can illuminate several rooms or areas simultaneously.

The use of maintenance-free batteries, which are widely available, permits emergency lighting installation in almost any location. This is a definite advantage because prior to the wide use of maintenance-free battery power for emergency illumination, traditional batteries providing such power had to be installed so they were easy to reach for watering on a regular cycle of maintenance.

For new construction, where ten to 100 lamps are involved, a 32-volt system with a power source—the battery, charger and console—can be located in a central area. This eliminates the need for individual battery units located throughout a building and it uses less space since only the lamps are located in areas to be protected. A typical 32-volt console, which is about the size of an average bookcase, can be used to illuminate nearly a dozen locations. A smaller area consisting of, perhaps, four rooms could be illuminated by a combination of 6-volt and 12-volt units.

Some of the newest battery-powered emergency lighting systems feature inverters that convert the direct current from the batteries to alternating current. Any standard, rapid-start fixture using 20, 30 or 40-watt, fluorescent lamps can be connected to the battery-powered converter system. Such systems use 12-volt lead acid batteries and they can be used to power single-lamp or multiple-lamp illumination. Some of the systems can be adapted to provide power for both fluorescent and incandescent illumination. A typical large-capacity unit can be used to operate four fluorescent lamps (with a total of 120-watts), plus three 25-watt incandescent remote lampheads. A typical installation would be in a communications center where the fluorescent lights would be used to illuminate critical exit areas while the incandescent lights would illuminate fire hose locations and exit signs.

New York harbor beauty gets 80,000 gallon cosmetic coating

Foreign visitors entering New York City by ship are greeted by the spectacular Verrazano Narrows Bridge, which dominates the entrance to the city's harbor. The world's largest suspension bridge (4,260-ft.) links the New York City boroughs of Staten Island and Brooklyn, and provides access to the heavily populated and industrialized areas of adjacent New Jersey and Long Island.

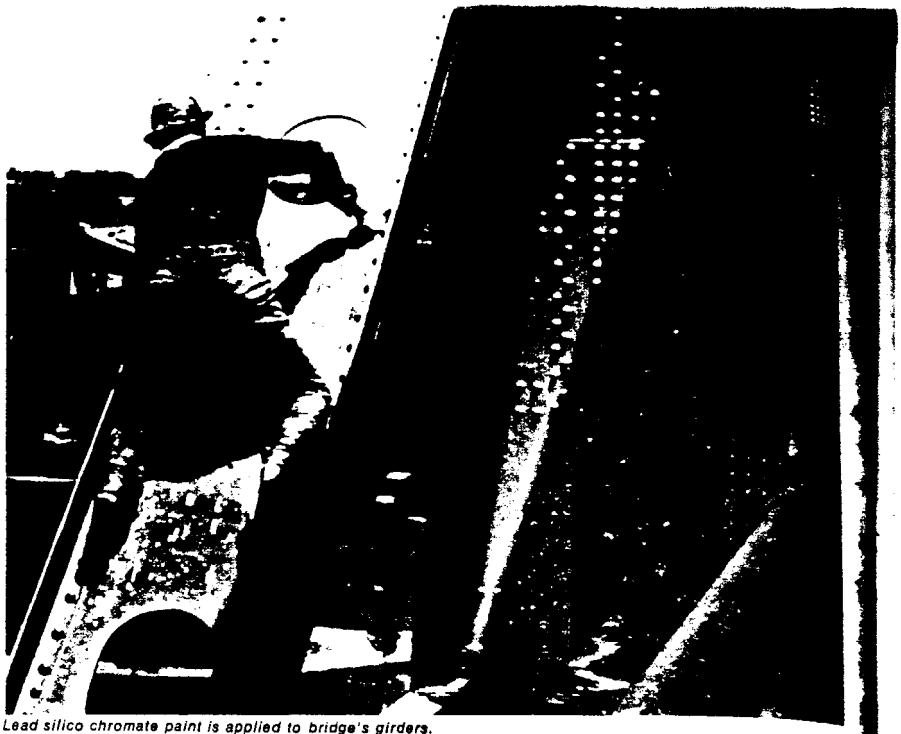
Now ten years old, the structure is currently being repainted; a year-long task requiring a 70-man crew and 80,000 gallons of paint.

Like numerous others, the bridge is situated in a severely corrosive environment. It must withstand attacks of salt-laden Atlantic Ocean fogs and surrounding waters, and other corrosives usually found in an urban/marine environment. To combat these factors, a paint system was specified that would provide the structure with maximum weatherability, corrosion resistance and an overall decorative appearance.

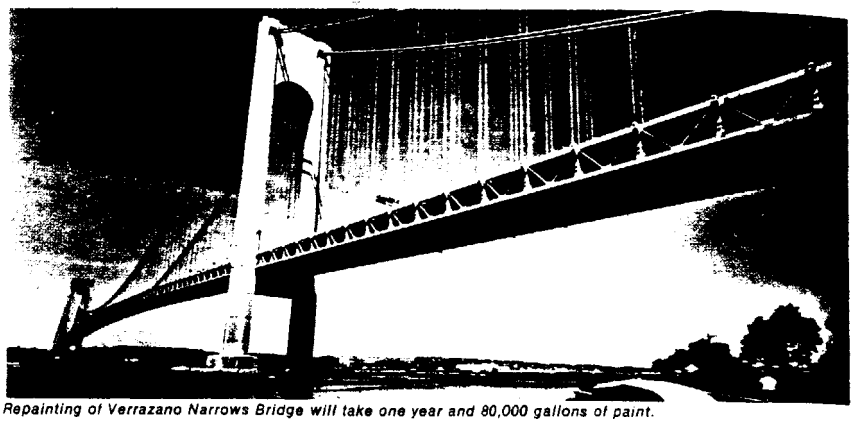
A key element in the coating system is a basic lead silico chromate anti-corrosive, weather-resistant protective pigment. The high lead content of the pigment helps to provide a compatible and durable paint system that offers superior protection against corrosive elements.

According to the Triboro Bridge and Tunnel Authority, although the Verrazano Narrows Bridge is higher and longer than any other within the metropolitan area, its painting does not present any unusual problems.

Lead-based paint system provides maximum weatherability, corrosion-resistance and an overall decorative appearance.



Lead silico chromate paint is applied to bridge's girders.



Repainting of Verrazano Narrows Bridge will take one year and 80,000 gallons of paint.

The first step in painting the bridge is to install the rigging and scaffolding, which hang about 350 feet above the water. Surfaces are then prepared by sandblasting heavily rusted areas, and by hand cleaning and washing less corroded areas. In the final step, a touch up and finish coat is applied. As a means of further protection, heavily rusted areas also receive an intermediate prime coat.

Prior to its official opening in November, 1964, the entire steelwork of the bridge was painted with lead pigmented paints. Areas included the 70-story towers, structural steel for the twin decks, and all other steel surfaces. They were coated with three or more coats of basic lead silico chromate paint.

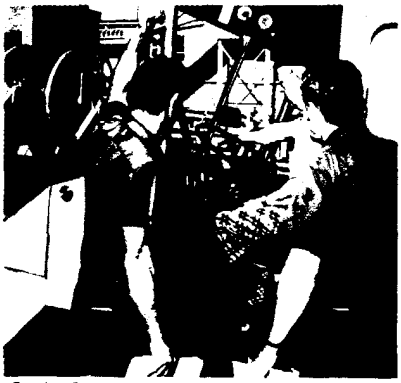
About 5,300 gallons of red lead contained in a linseed oil paste was applied to the more than mile-long cables that support the bridge. The combination red lead and linseed oil paste was applied to the full 7,205-ft. of each cable just prior to a final wrapping. This was accomplished with galvanized wire, which forced the paste deeply into individual strands that comprise the cables. A final protective coat of basic lead silico chromate paint was applied over the galvanized wire to conform with the corrosion protection system developed for the bridge.

Paint for the Verrazano Narrows Bridge is being supplied by the Amsterdam Color Works, Bronx, N.Y. This project is part of a $1,562,000 contract that includes the Triboro, Henry Hudson, Cross Bay and Throgs Neck bridges, all operated and maintained by the city's Triboro Bridge and Tunnel Authority. The organization has specified the basic lead silico chromate paint system for all of these bridges.

GOLIATH visits Expo '74 during 25-city cross-country tour

Visit to San Francisco included a demonstration of vehicle's capabilities at Pacific Gas and Electric Company.

GoLIAth was exhibited at Expo '74 in Spokane, Washington, for a one-month period.



Service Department personnel from Omaha Public Power District familiarize themselves with GoLIAth's electric-powered controls during van's stop in Omaha.

Engineer from Chicago's Department of Environmental Control takes noise level reading at City's Osteopathic Hospital. Shuttling personnel to various sites was one of many varied assignments GoLIAth undertook during six-week visit to the Windy City.

GoLIAth, Lead Industries Association's (LIA) battery-powered electric delivery van has proven to be a most worthy ambassador in promoting the concept of lead battery-powered electric work vehicles.

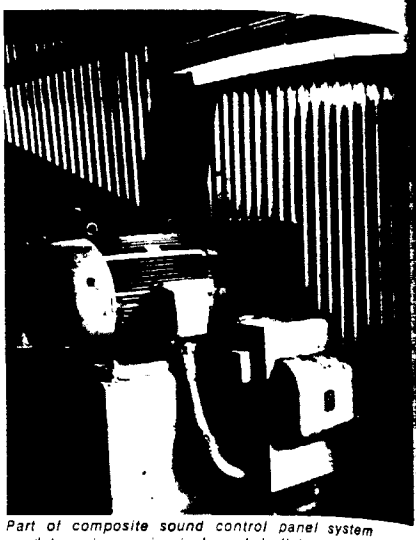
Since June, the van has visited 25 cities, across the United States and Canada as the integral part of LIA's promotional campaign to demonstrate the capabilities and economics of lead batteries to power multi-stop, short-range work vehicles.

Most visits included a press conference, jointly sponsored by the local electric utility and LIA. Press events were followed by a one or two-day demonstration period in which GoLIAth participated in a number of work situations. These included bulk newspaper, package and parcel delivery; park department maintenance work; use as a shuttle for electric utility maintenance and administrative personnel; and use by a municipal environmental agency to transport noise control technicians to various construction sites.

During these work situations, GoLIAth was viewed by the many officials from public utilities, industry, local and federal government and commerce who will determine the role electric delivery vans can play in their transportation programs.

Cities visited during this cross-country tour were: New York, Washington, D.C., Detroit, Slippery Rock, Pa.; Toronto and Ottawa, Canada; Chicago, Omaha, Denver, Salt Lake City, Seattle, Eugene, San Francisco, Los Angeles, Phoenix, Albuquerque, El Paso, Dallas/Ft. Worth, Joplin/Springfield, St. Louis and Cincinnati. GoLIAth also was exhibited at Expo '74, the International World's Fair in Spokane, for a one-month period. An estimated quarter of a million people saw the van. In addition, GoLIAth was one of the highlights of the Pacific National Exhibition in Vancouver, B.C., Canada, where it spent two weeks as part of the "Alternative Energy" exhibit.

Walls of boiler control room are lined with sheet lead.



Part of composite sound control panel system used to reduce noise in forced draft fans and ductwork.

Automotive plant required multiple noise solutions

The Chrysler Corporation and the Jerome Underground Transmission Equipment (UTE) Corp., recently faced a mutual problem: how to control noise from powerful, high-speed compressors. In both cases, lead not only helped to solve the compressor noise problems, but lead also helped Chrysler Corp. solve additional sound attenuation problems.

Chrysler's noise control problems were of more immediate concern since they involved one of the company's major manufacturing plants, the giant Hamtramck Assembly facility in Detroit. The plant assembles Chrysler's line of Dart, Valiant and other compact-size cars. Important to the efficient operation of the plant is an on-site facility that supplies more than 8,000,000 lbs. of steam daily.

Two major installations, a four-unit induced draft fan system and its associated ductwork and two high-capacity compressors are critical components in supplying steam and compressed air required for the plant. The four induced draft fans provide the huge volume of air needed to insure efficient combustion in the boilers that heat water to produce the steam. The compressors provide the required compressed air throughout the plant.

While both the compressors and the induced draft fan system were highly efficient in performing the job they were designed to do, they each produced noise that was unsafe and discomforting for employees.

To solve noise problems emanating from the 15,000-cubic-ft.-per-minute (cfm) compressors, Chrysler engineers relied on the sound attenuation experience of the manufacturer, Ingersoll-Rand (I-R). I-R has developed a highly-effective optional noise suppression system for its line of compressors that consist of a steel shroud laminated to a combination lead/foam barrier.

The lead/foam combination consists of a 1-lb.-per-sq.-ft. (PSF) (.0156-in. thick) sheet lead sound barrier sandwiched in an inch-thick layer of foam. It is applied over a previously sprayed-on undercoat layer and then the steel shroud is placed over the top of the enclosed section. The lead/foam combination and the steel shroud have reduced the 100 dBA compressor noise level. This noise level can be compared to a blaring radio, and it was reduced to 84 dBA, which compares to sounds heard on a busy city street corner. Overall, a noise reduction of about 67 per cent was realized.

To solve noise problems involving the four forced draft fans and their associated ductwork, Chrysler engineers specified a composite sound control panel system developed by Transco Inc., Chicago, Ill. Called Noisecon-12, the system was installed around the forced draft fans and ductwork leading to the boiler room and its use reduced noise levels from more than 100 dBA to between 82 to 85 dBA.

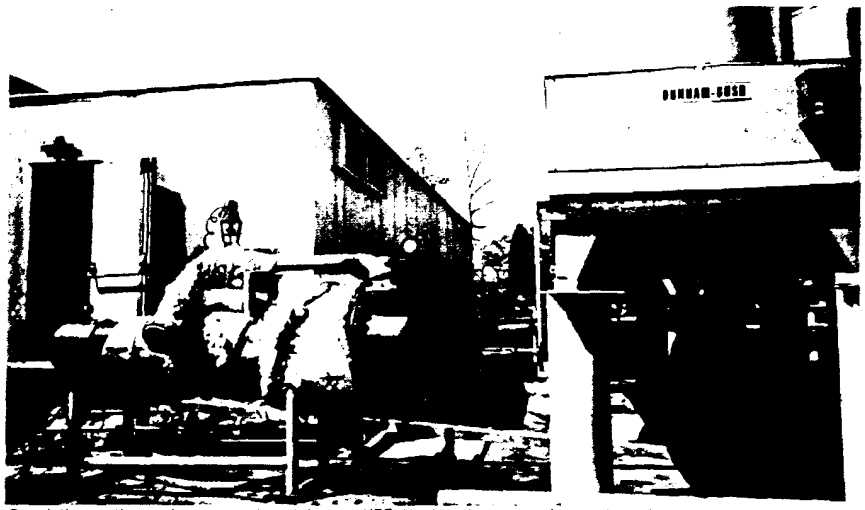
The noise transmission loss capabilities of the panel system are achieved through the use of both single and double layers of 1/64-in. thick sheet lead, weighing 1 PSF. For maximum efficiency, the lead was sandwiched between layers of mineral wool. An interior face of wire mesh on the sound-source side of the panel acts as a retainer, while the exterior face is aluminum. The system is available in box rib panels that are 40-in. wide, and in corrugated panels that are 32-in. wide. More than 760 sq. ft. of the panel system was used to enclose the forced draft fans and their associated ductwork. According to Transco, the panel system is also being supplied to Long Island Lighting Company to solve similar problems at the electric utility's Northport, L.I. generating plant.

In addition to silencing the compressor and its associated forced draft fans and ductwork, Chrysler engineers also used sheet lead to line the plantside walls of the boiler control room. Approximately 14 sheets of 2 psf sheet lead were used.

According to Chrysler engineers, lead was selected for the installation because of its excellent attenuating properties. The engineers report that because of lead's sound deadening properties, no other sound attenuating materials were considered.

Noise problems solved by Lead

Underground utility specialists enclose source of compressor noise

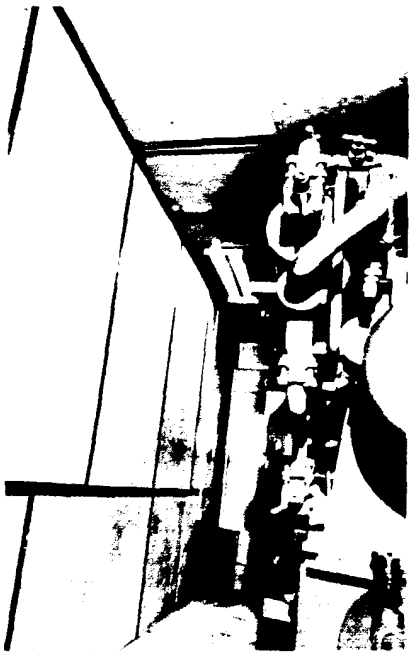


Regulating station undergoes testing at Jerome UTE. Heat exchanger equipment is at right.

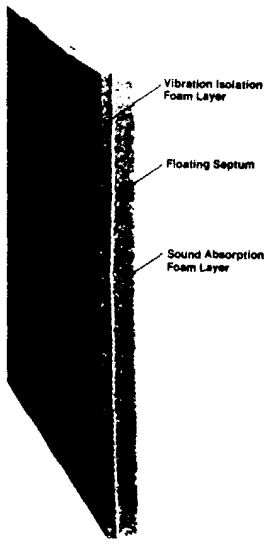
Jerome Underground Transmission Equipment (UTE) Corp., is the nation's leading designer and manufacturer of underground equipment for utilities. In meeting the underground electric power transmission needs of large cities, Jerome developed a dielectric fluid cooling system to control the temperature of an underground, high voltage, electrical cable installation. The dielectric fluid, which is kept at a specifically regulated temperature, is maintained under high pressure in the pipe which contains and protects the high voltage electrical cables. At selected intervals, the dielectric fluid is transferred through a refrigeration system utilizing large compressors to cool it and high-capacity pumps to return the cooled dielectric fluid back into the system .

Refrigeration stations designed for the new underground installation, rated at 250-350 tons. are powered by 200-250 hp compressors and 100-hp pumps. During the early stages of design, it was recognized that noise levels would have to comply with strict city codes. The decision was made to add a noise-suppressing "liner" to the interior of the structures that house them.

Jerome engineers selected a noise control panel system developed by the Soundcoat Co., New York City. It involved covering the inside of the 40-ft. long, 13-ft. wide, 11-ft. high structures with Soundcoat's LF (lead/foam) system. It consists of a lead septum enclosed in a ¼-in. polyurethane foam sandwich. Soundcoat's single LF system was selected for the project, meaning that a 1-lb. psf sheet lead septum was used to attenuate the sound. The system, comprised of 24 x 48-in. sheets, was installed in about eight hours.


Interior walls of station contain lead septum enclosed in ¼-in. polyurethane foam sandwich.

Jerome engineers report that noise levels inside the structure were reduced by 5 to 7 decibels to a level of 85 dBA by using the Soundcoat single LF system. This reduction was attributed to the elimination of the reverberating effects of the compressors and pumps. Noise levels exterior to the unit were more dramatically reduced and are now in compliance with N.Y.C. codes. The company expects to complete installation of the first of the two regulating stations in the immediate future.



Noise control panel system consists of lead septum enclosed in polyurethane foam.

of the body being studied.

New Lead iris and shutter combination reduces X-ray exposure

Recent Federal regulations designed to eliminate unnecessary radiation during medical and dental X-rays are expected to further the use of lead for X-ray shielding, a traditional application of the metal.

For example, Machlett Laboratories, Inc., Stamford, Conn., has developed a special camera-like X-ray shielding unit consisting of a lead iris and lead shutter. The assembly, an integral part of the new line of the company's X-ray collimators, helps to reduce extraneous radiation from medical and dental diagnostic equipment.

Simply stated, the lead iris stops radiation coming from any point other than where the X-ray is focused. The iris opens and closes simultaneously with the lead shutters.

According to Machlett, a subsidiary of the Raytheon Company, the unit operates either manually or by a preprogrammed computer to direct the diagnostic mechanism only to the specific area of the anatomy being X-rayed. The unit adjusts automatically to the size of the X-ray film receptor in use, thus reducing over exposure.

The shutter/iris assembly weighs about 2½-lbs. and measures 4 x 4-in. It is produced from close tolerance "leaves" that are cast from lead. After casting, the components are finished to a polished surface before being joined.

Lead is one of the primary materials most often selected in the design of X-ray and nuclear shielding—such as protection required for technicians involved in nuclear medicine, nuclear research and production, etc. The first consideration in preventing penetration of rays is density, and lead, the most dense of any commonly available material, provides the greatest protection per unit of thickness. Because its surface is smooth, lead does not readily become contaminated with dirt or other material which, in turn, may become radioactive. Additionally, the ease with which it can be cast, extruded, rolled, machined or otherwise formed, combine to make it one of the most efficient shielding materials.

Collimator unit installed beneath conventional X-ray tube contains lead iris/lead shutter combination.

"Towfish" being lowered for submersible scanning.

Technicians prepare to test "Side Scan Sonar" equipment.

Lead shows the way under water

Increased activity in undersea exploration has created a need for materials that can operate successfully under the extremely high pressures and potential hazards found in the oceans' depths.

One manufacturer of undersea search and survey equipment has found lead to be a suitable material for use in its equipment. Klein Associates, Inc., Salem, New Hampshire, manufactures "Side Scan Sonar" equipment used for a variety of undersea tasks that include: mineral surveys, archeological searches for ancient ship wrecks, and pipeline tracking for oil companies.

According to the company, lead plays an important role in its "towfish", a torpedo-like submersible that contains the sonar equipment used in underwater exploration. A towline carries electronic sonar signals from the submersible to the surface vessel that monitors the equipment.

The transducers that send out sound beams ("pings") to either side of the submersible, are an important part of the sonar package.

Contained within the transducers are piezoelectric ceramics, known as lead zirconate titanate (PZT). These ceramics possess a unique property known as piezoelectricity. This is a phenomenon wherein electrical impulses can be converted directly into vibrations, or the reverse.

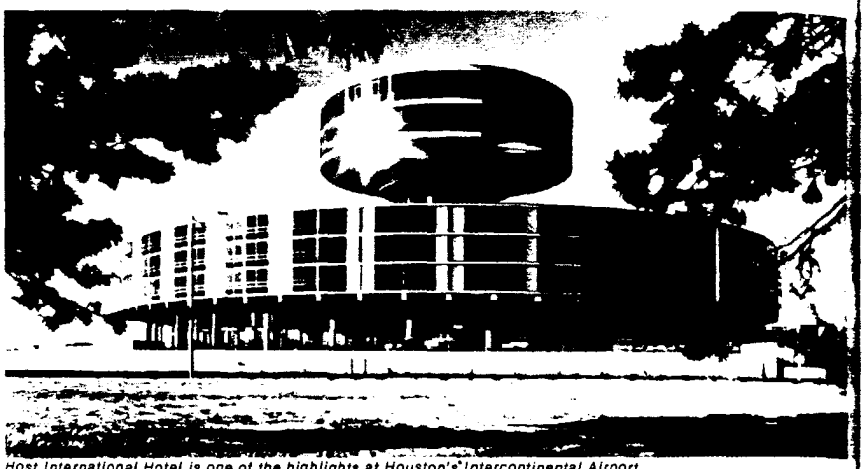
The transducer PZT ceramics are mounted in an array which is then encapsulated in polyurethane. An electronic impulse is sent from the towing vessel, down the towline, to the transducers. The pulse vibrates the PZT ceramics, thus generating sound that "pings" through the polyurethane window and the water to strike against the ocean bottom. Conversely, the rebounding echo vibrates the ceramic to create an electronic signal which is processed, recorded and amplified in the electronic data transmitted up the towline. A graphic recorder aboard the vessel then produces a continuous chart of the bottom topology.

Martin Klein, president of Klein Associates, claims that the PZT ceramic was specified because of its stability and efficiency as a sound generating medium. He says it has the added advantage of being able to handle the power required for the sonar scanning. Klein notes that lead is also used within the transducer as a sound absorbing material in combination with other acoustic materials.

Extensive use of lead in the nose of the towfish provides ballast and acts as a stabilizer. Klein says limited space within the small submersible required a material that provides weight with the best ratio of weight to size. He adds that lead meets these specifications and also provides a certain amount of shock resistance for the submersible should it strike an object beneath the water.

Lead sheet installed between slab and hung ceiling.

Lead vinyl tape was used to seal sheet lead around pipes, conduits and other members.



Host International Hotel is one of the highlights at Houston's Intercontinental Airport.

Quiet meeting rooms a feature at airport hotel

Noise from another room can be a distracting element during a business presentation, after dinner speech or other private function. This was an important consideration when William B. Tabler Architects designed the Host International Hotel, an integral part of the architectural concept developed for Houston's Intercontinental Airport.

The Hotel's Tower Suite is located in the center of the airport's terminal complex and it contains 16 private dining rooms. Adjacent to one another, any of the rooms may be in use at the same time and it was for this reason that noise control was an important design consideration. Like many of today's modern rooms, partitions between rooms in the Tower Suite stop at the level of a hung ceiling, leaving an open space or "plenum" between the actual concrete slab and the hung ceiling below it. Unless an efficient noise barrier material is installed, sound will pass through this plenum from one room to another.

The architectural firm specified sheet lead, which is recognized as one of the most efficient sound barriers, to solve these noise problems. Aside from its sound barrier qualities, sheet lead is simple to install and its easy formability makes it ideal for irregular surfaces.

Each dining room in the Tower Suite is separated by sliding partition doors hung from the slab. The 1-lb. per sq. ft. (.0156-in. thick) sheet lead was installed vertically between the slab concrete ceiling and the hung ceiling on each side of the steel track that holds the sliding partition. Because of the irregular concrete slab, the sheet lead was tucked under tightly to prevent noise from leaking through. As a further precaution, the sheet lead was lapped 1-in. at the seams and sealed with lead vinyl tape. The tape was also used to seal the sheet lead around pipes, conduits and other members where noise might filter through. Overall, a total of 1,800 sq. ft. of sheet lead was installed.

The 350 room hotel, operated by Host International, Inc., opened in 1972 and is one of the highlights of the Houston Airport complex. Its tiered, round shape reflects the nearby terminal pods of the airport. The circular form, plate glass and specially insulated curtain walls have been combined with the sheet lead plenum barriers to control aircraft noise.

Revival of an ancient art: Leaded stained glass

New York's famed Greenwich Village, is rapidly becoming a mecca for scores of people who, like thousands of others throughout the country, are learning the ancient art of producing a variety of useful, artistic products made from leaded stained glass. Adding to the ranks of leaded stained glass artisans are graduates of some of the nation's foremost design schools that now teach the art.

The Greenwich Village shop, called Custom Leaded Glass, is like many others across the country that specialize in producing custom-designed leaded stained glass windows, art objects, lamps and other accessories. In addition, Custom Leaded Glass also teaches the art of designing and producing leaded glass. According to Barry Cunningham, an owner of the shop and head of a group of instructors who teach students the art of leaded stained glass on an around-the-clock basis, young people are among the most enthusiastic students. The shop is handy for scores of students who work a wide variety of shifts—some are free for instruction in the evening, others at midnight, others in early morning hours.

"The renewed interest in leaded stained glass is primarily the result of a desire to make something with one's own hands, and to create a work of art that is both beautiful and functional," says Cunningham. "We are beginning to see more abstract and modern art forms as opposed to religious-type works of art," he says. "Art deco designs are also very popular. Tiffany style lampshades are among the most popular current designs." He adds that many students are interested in learning to repair the wide variety of stained glass designs that are being reclaimed from wrecked homes, churches and other structures.

Cunningham says the actual steps in producing leaded stained glass are relatively simple as are the tools used to produce the designs. "Like all forms of art, practice makes perfect," says Cunningham, referring to the extensive practice required to execute a professional design.

The first step in producing a design is to develop a pattern. Sometimes first produced on a small scale sketch, the pattern is eventually developed to desired size. The sketch is sometimes colored to approximate the "stained" or colored glass to be used. The final pattern is produced on paper similar to heavy duty wrapping paper. Careful attention is devoted to insuring that there is sufficient room for heart lines, the center lines that divide the glass sections through the use of lead strips.

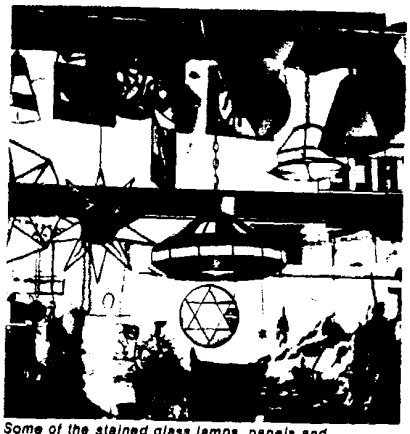
Glass is then scored (cut) according to the pattern (it's always wise to practice on scrap glass from a junkyard and to wear gloves until the technique is developed—the small wheel of a general purpose ball-end-type glass cutter purchased at hardware stores for about $1, is all that's needed). After the score is tapped, it is broken and cleaned. This is followed by cutting the lead to size, seating the glass in the lead and then assembling the other pieces. The next step is soldering and sealing.

According to Cunningham, two basic types of glass are used. Hand blown or "antique" European glass has the most intense color, unusual patterns and textures. It is expensive ($3.75 to $6 or more per sq. ft.) as opposed to machine rolled glass, which is less expensive ($1.50 to $2.65 psf), has a more even thickness and is easier to work.

Cunningham reports that the lead used to join the stained glass normally is available in 6-ft. strips and in widths that range from 1/8 to 2-in. Lamps use 1/4 to 3/8-in. lead, while panels require 3/16 to 1/4-in. wide lead. The lead, which is available with single and double channels, is kept wrapped in its original packaging to prevent oxidation. The lead is stretched and straightened before cutting and, after cutting, it is handled carefully to avoid crimping or twisting. Most lead for stained glass is joined with a 40 or 80-watt iron with a chisel tip and a 50/50 half tin, half lead solid core solder. Usually a mild rosin flux is all that is required for joining, but a corrosive flux could be used if the lead channels (cames) are heavily oxidized. This corrosive or acid flux must be removed after soldering, however.

Section of stained glass is seated in panel. "Horseshoe" glazier nails are set around perimeter of panel to prevent movement.

Lead caming is seen at top and lower left of photo, while tools used to cut and join are visible in right foreground.



Some of the stained glass lamps, panels and accessories on display at Custom Leaded Glass.

Improved Lead sheathed cable system permits fast

Detroit Edison has developed an improved lead sheathed, oil filled, underground cable system that was installed in record lengths, or "pulls". The pulls played a significant role in helping the utility to overcome a major problem: how to quickly and economically install 4.5 miles of underground cable in a congested area of downtown Detroit while causing as little traffic disruption as possible.

The installation is made up of 20 sections of lead sheathed cable and it has some of the longest pulls ever made by Detroit Edison. In fact, the installation contains possibly the longest single length of underground lead sheathed cable ever installed in North America.

The self-contained, lead sheathed, low pressure, oil filled (LPOF) cable the utility has adapted for the new installation is similar to the system that has been in use for many years by the electric industry. Modern welding techniques were used to join the cables when they were spliced and a specially-designed duct system developed to carry the LPOF cable.

Among the primary economical advantages that result from using the improved LPOF system is the fact that it permits the use of longer pulls. Consequently, several expensive joints normally required in an underground system were eliminated. The longer lengths between joints also decreased the number of manholes required. In addition, the "straight through" pull technique permitted by the improved system, allows for smaller manholes than those required for other systems. Finally, the sheathing hermetically seals each cable, and provides a final corrosion-resistant barrier to protect the cables should exterior components of the system become damaged.

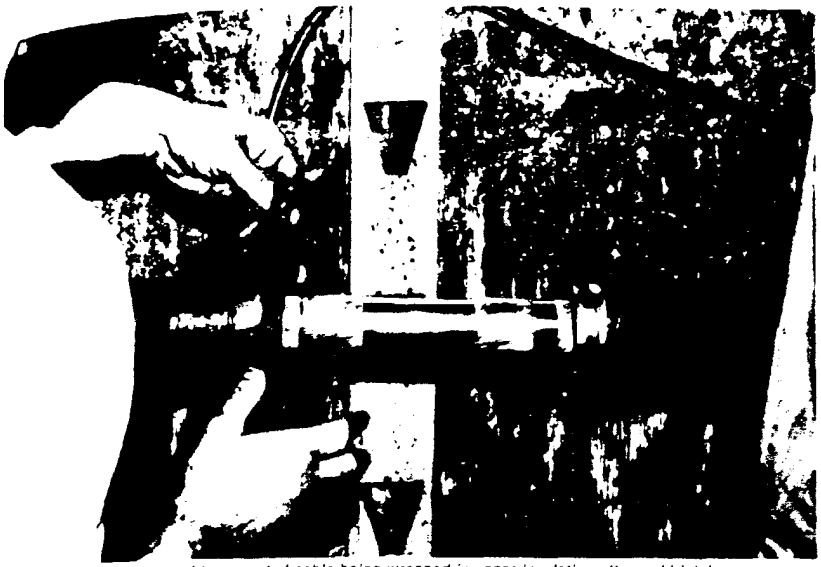
Un-colored area indicates lead sheathing.

Selection of the LPOF system by Detroit Edison is a notable departure from the utility's traditional 120KV underground system. It primarily consists of high pressure, gas filled, pipe-type (HPGF) cables.

Economic studies developed for the new underground cable circuits determined that an HPGF distribution system, utilizing 2 pipes on 5-ft. separation installed along the proposed route, would be time consuming and expensive as compared to 2 circuits in ducts. To overcome this objection, the utility reviewed the 40-year performance for some of the lead sheathed, high voltage cables of the oil-filled type. Because of the lead sheathed system's high performance, economic feasibility and equal maintenance, the decision was made to adapt the LPOF system for the new installation.

Heart of the utility's improved LPOF system is the lead sheathing. The sheathing—a standard 0.155-in. thickness of lead—is covered by neoprene-fiberglass tape. The tape is covered with hot-extruded 0.125-in. thick coating of polyethylene, thus forming an intimate bond between the lead sheathing and the jacket. The combined system of lead, neoprene-fiberglass tape and polyethylene have been tested to withstand in excess of 150-lbf/in.^{2} core pressure

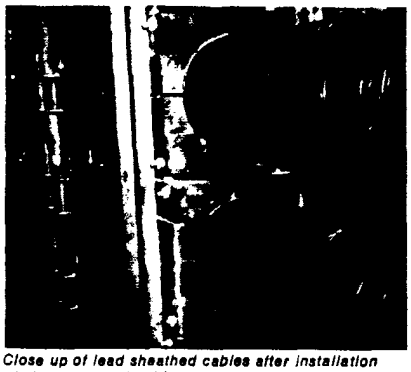
ster, more economical high voltage undergroundings



...sheathing is visible in right segment of cable being wrapped in paper insulation after weld-joining.

...nuously. Nominal operating pres... is approximately 40-lbf/in.²

...stallation of the new system also ...uded the development of a special ...-speed metallic inert gas (MIG) ...ding technique that was used for on... ...able joining. After this operation ...as completed, traditional wiping tech... ...were used to join the lead sheath... ...In the process, a two-part copper ...ve was slipped over the ends to be ...ned and, after the cable insulation ...as reapplied, the sleeve halves were ...ntered over the joint. Lead solder was progressively "puddled" onto the area and wiped to the rounded configuration of the cable. The result is a continuous hermetic seal that extends the entire length of the cable.



Close up of lead sheathed cables after installation of vise-like wooden blocks used to support cables in manhole.

The lead sheathed cable was installed in 20 sections. One section—comprising three cables—was 2,000-ft. in length. While it was desirable that longer lengths be installed throughout, the physical route of the installation as well as location of the terminals and street intersections, the grades and other subsurface conditions encountered in the project limited the remaining sections to shorter lengths. Regardless of these limitations, six sections exceed 1600-ft. in length.

Detroit Edison Company officials and the technicians who installed the lead sheathed system believe that, based on experiences gained through the design and installation of the new system, a modern 138KV self-contained, oil filled cable can be installed in urban centers in a manner that is both practical and economical. One factor that will help decrease costs of future high-voltage, underground installations is that utility studies indicate that lead sheathed LPOF cable systems can be installed with manhole lengths reduced from 16-ft. to 13-ft. This will provide additional savings in construction material and labor costs and will add to the system's expanded use since it will be more competitive with traditional systems.

NEW LISTINGS

"Lead Abstracts" and "Yearly Indices"

Bi-monthly abstract of all current world literature on lead and its products and published research. A general index is published annually. Must be requested on company letterhead. M-2

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Lead In Building

A four-part data sheet containing information on waterproofing, sound barriers, roofing and flashing and anti-vibration applications. A-13

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A chart presentation of the corrosion resistance of lead and its alloys against 188 chemicals from 0° to 3000°F. Six pages. H-3

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A Primer on the Lead-Acid Battery

A condensed story of the principles of the lead-acid battery and its chemistry, including some of the fundamentals and definitions of direct-current electric energy. Two pages. L-6

Lift Profits Electrically

Provides performance data on electric battery powered vehicles for industrial use. Cost calculators are designed to help buyer estimate depreciation, operating and maintenance costs. Sixteen pages. L-14

Electrics Get Key Post Office Tests

Reprint of a feature from Electrical World describing tests on the suitability and economy of electric battery-powered delivery trucks for the Postal Service. L-18

Electric Work Vehicles

A 12-page folder describing battery-powered short-haul delivery vehicles and comparing their economics to internal combustion delivery trucks. L-19

CERAMICS

Facts about Lead Glazes for Art Potters and Hobbyists

Detailed information on the proper formulation, firing techniques, handling, etc. of lead fluxed glazes used by art potters and hobby ceramists. Illustrated. Sixteen pages. B-11

SOUND BARRIERS

Directory of Acoustic Specialties

Summary of available materials for sound insulation by barrier, damping and absorption methods. Sixteen page list of materials by brand name and manufacturer. Eighteen pages. J-4

Lead a Major Factor in New Machinery Noise Suppression Systems

Description of techniques used to lower machinery noise levels with lead and lead composites. Lists machines that normally exceed noise level allowed by Walsh-Healey Public Contracts Act. Two pages. J-9

Lead Keeps Classrooms Quiet

Reprint illustrates how sheet lead was installed as plenum barriers between rooms in a Greenlawn, N.Y. school. Lead-shielded audiometric room will provide accurate hearing tests. J-13

Sheet Lead Plenum Barriers

Detailed description of acoustical plenum barriers and how to install them. Materials and installation procedures described and illustrated. Eight pages. J-10

Controlling Sound with Lead

Reprint cites three installations where lead is being used as a noise and vibration barrier: John Hancock Building; Baldwin-Wallace College; and New England Medical Center, Boston. Four pages. J-12

Practical Application of Sheet Lead for Noise Barriers

Discusses how the use of various thicknesses of lead bonded to or used in conjunction with other construction materials determines the Sound Transmission Class (STC) rating of walls and partitions. J-15

Lead Proves a Heavy Favorite as Sound Control Material

A reprint of a feature from Product Engineering illustrating lead's usefulness in sound attenuation to help meet OSHA noise requirements in factories and also on planes and trains. J-17

SOLDERING AND WELDING

Lead Welding

Reprint from *American Welding Society Handbook*, covers methods of welding lead, joint design, torch manipulation and welding speeds. Other sections cover safety promotions and common applications. Bibliography. Fourteen pages. I-1

Soldering Preforms

Circuits Manufacturing reprint discusses how the use of lead solder preforms save time and simplify task of joining metals for automated production. I-3

GENERAL

Publications and Films

Twelve-page catalogue listing the publications and films available from The Lead Industries Association, Inc. M-13

The U.S. Lead Industry

An annual review of activity within the industry that contains a general summary for the year and a series of charts and tables giving current statistics on lead production and consumption. M-14

Primary Lead Production Areas in the U.S.

For schools, libraries. 11"x14" map showing locations in U.S. of most lead smelters and refineries, and lead mines. M-11

Lead—a Modern Design Material

Summary of properties and forms of lead for radiation, sound/vibration control, electrical sources, soldering and ceramics. Eight pages. M-15

Use of Lead in the Automobile

Reprint of article from *Metals Week* discussing in detail the various applications of lead in the automobile. Four pages. M-17

Lead—The "Clydesdale" Workhorse in Space

Reprint from *Space World* detailing applications of lead in space exploration. Illustrated. Four pages. M-19.

Facts about Lead and Pediatrics

Presents data on prevention and control of lead absorption by both adults and children. Particular emphasis is placed on preventing lead intoxication in children from such sources as old leaded paint usually found in poor housing within blighted areas. M-20

Ecology in the New Lead Belt

Reprint describes cooperation of industry and environmentalists in developing southern Missouri lead mines. Eight pages. M-23

Childhood Lead Poisoning

Highlights on Midwest and Eastern conferences where childhood lead poisoning were discussed. Prepared in cooperation with the American Academy of Pediatrics. M-27

FILMS

Lead Matrix

A 26-min., 16mm color film. Demonstrates that lead is one of the basic elements in the matrix that binds our civilization together. To order, specify desired show date and one alternate date. No charge to borrow; viewer pays one way return postage. N-1

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