Next industry: electric vehicles?

When the House and Senate voted to overturn President Ford's veto of the electric vehicle bill, the way was paved for the beginning of what could become a major new American industry —the production of electric trucks and passenger cars.

The bill authorizes the Energy Research & Development Administration (ERDA) to undertake a Federal program of research, development and demonstration projects designed to promote electric vehicle technologies and to demonstrate the commercial feasibility of these vehicles.

Known officially as the "Electric and Hybrid Vehicle Research, Development, and Demonstration Act of 1976", the bill provides for a total of $160,000,000 to be spent during fiscal years 1977-79. The funds will be used to achieve three primary goals set forth in the bill:

- Encourage and support accelerated research into, and development of electric and hybrid vehicle technologies.
- Demonstrate the economic and technological practicability of electric and hybrid vehicles for personal and commercial use in urban areas and for agricultural and personal use in rural areas.
- Facilitate, and remove barriers to, the use of electric and hybrid motor vehicles in lieu of gasoline and diesel-powered motor vehicles, where practicable.

These goals are parallel to those the Lead Industry Association has been working toward for a number of years. The Association's active and vigorous support of education and information programs involving electric vehicles is well known. Foremost among these programs has been the use of GoLIAth®, the battery powered lightweight truck that was purchased to illustrate the effectiveness of lead batteries to power such vehicles, for a wide variety of demonstration projects in more than 25 U.S. and Canadian cities.

These continuing support programs involve a variety of electric vehicle demonstration projects that can help build a vital new industry for this country. Large-scale production of electric vehicles will not only provide additional jobs, but it can go a long way in solving the nation's dependence on imported oil to run the nation's millions of internal combustion vehicles. Battery power will also help improve the environment in cities since electric vehicles are quiet and do not pollute the air.

tery/Gasoline power possible solution for metro taxi problems

vehicle that combines the advantages of both electric and gasoline ered engines could provide a solu- to a major problem faced by the n's more than 170,000 taxis: how rofitably transport 2.5 billion pas- ers annually while complying with onmental regulations concerning motive pollution.

e vehicle, a prototype produced by swagen, Inc., was among five spe- designed city taxis introduced in June at the Museum of Modern in New York City. The vehicles he result of a program called "The Project: Realistic Solutions for y." The project was made possible rants from Mobil Oil Corp. and rban Mass Transportation Admin- ion of the U.S. Department of portation.

the five prototypes, the VW taxi is nly one that uses a hybrid power Upon starting up, the VW City s electric motor current comes from ehicle's lead acid batteries. Once xi reaches a speed at which the IC e operates efficiently, it takes over sk of supplying the main driving to the wheels. Demand on the c motor decreases accordingly, and ally comes to an end.

vehicle can operate on completely on-free electric power supplied by 12-volt, 80 ampere hour lead batteries in inner-city core areas. er areas, where it is desirable to e internal combustion engine, the ity Taxi is switched to hybrid operation. In this case the driving power is derived from both the electric motor and the gasoline engine. The taxi's pollution emissions are considerably lower than those of vehicles equipped with conventional internal combustion power plants.

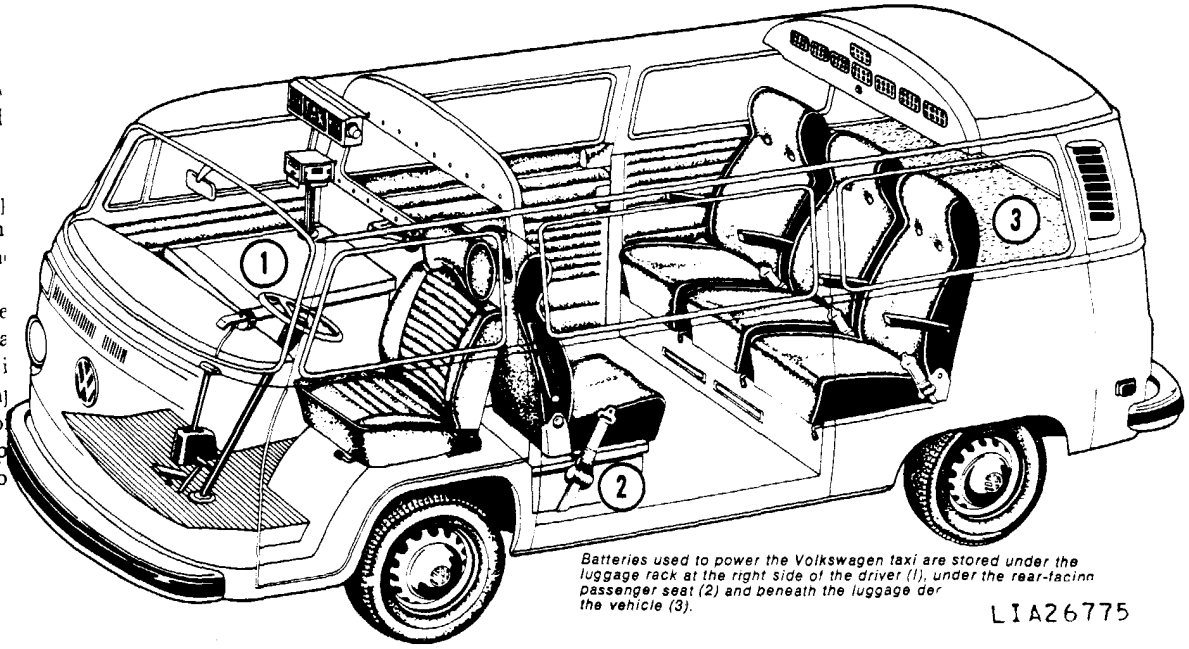
When the gasoline engine produces more power than is needed for driving requirements, the electric motor functions as a generator, running on excess power from the gasoline engine. The resulting energy is stored in the vehicle's batteries.

The VW taxi has a top speed of 43.5 miles per hour when operating on electric power supplied by the lead acid batteries. With the IC engine, the vehicle can achieve 64.6 mph speeds. The type of driving the taxi encounters determines how often the batteries must be recharged from outside sources utilizing conventional electric current.

For even distribution of weight, the eleven batteries that supply power for the taxi's electric motor are housed in three cabinets. They are located in the right side of the driver's compartment, under the rear-facing passenger seat, and beneath the luggage deck at the rear of the vehicle.

The design of all five taxis is based on criteria established by the Museum of Modern Art in cooperation with the N.Y. City Taxi and Limousine Commission, engineering consultants, and representatives of the New York City taxi industry. In addition, vehicles resulting from the program were designed to improve the quality of life in the urban environment by using less energy, decreasing noise, pollution and traffic congestion and provide safe, comfortable accommodations for both the driver and passengers.

Wide sliding doors of Volkswagen City Taxi provide easy entry and exit.

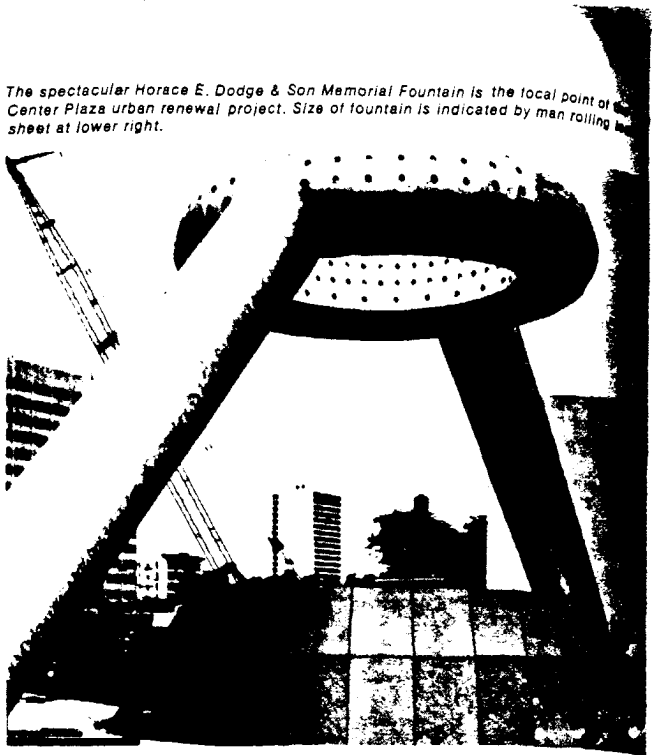


Batteries used to power the Volkswagen taxi are stored under the luggage rack at the right side of the driver (1), under the rear-facing passenger seat (2) and beneath the luggage der the vehicle (3).

LIA26775

Lead provides water stopper for spectacular new fountain

Lead burners for Allied Lead, Chicago, burn joints of lead sheets used to waterproof base of new $2 million fountain in downtown Detroit.



The spectacular Horace E. Dodge & Son Memorial Fountain is the focal point of [illegible] Center Plaza urban renewal project. Size of fountain is indicated by man rolling [illegible] sheet at lower right.

As part of the continuing effort to revitalize downtown Detroit to attract business and commercial interests that have been fleeing to suburbia, the city is undertaking massive urban renewal. Concentrated along the downtown waterfront area, one of the major projects is a new eight-acre park and recreation area called Civic Center Plaza. Focal point of the plaza, designed by Isanu Noguchi of Noguchi Fountain & Plaza, Inc., New York, is a magnificent modern fountain.

The $2 million installation, waterproofed with lead, was donated by the late Mrs. Horace E. Dodge in memory of her late husband and son. The computer-operated fountain will be a constantly changing spectacle of water and lights. Sheathed in gleaming stainless steel, it rises 25 feet in the air and resembles a doughnut-like ring, 25-feet in diameter. The ring is supported by two stainless steel legs.

The fountain includes 22 downward jets of water originating from the underside of the ring. There also are 34 upward jets, rising from inside of the fountain well to heights of up to 8 feet above the ring. In addition to these 56 jets, 120 fog jets mist all around the ring. All of the jets operate at different scheduled intervals. As an added variation, the water frequently fills the well and overflows.

About 60,000 gallons of water constantly recirculate in the fountain at the rate of 17,000 gpm. The movement of the water is handled by four underground pumps located beneath the fountain's well. Two pumps operate at 250-lbs. and two at 150-lbs., for an 800-lb. capacity.

Ten banks of computerized programs provide 31 different combinations of water sequences, and five independent lighting displays. The air and water temperature and wind velocity are monitored to determine the water display to be programmed.

The use of lead figured prominently in the fountain's construction. The metal's ability to provide a watertight membrane was essential since accommodations for shops and parking facilities have been provided beneath the plaza, which is 15 feet above ground level.

Approximately 100,000-lbs. of 6-lb. sheet lead (3/32-in. thick) was used to waterproof the fountain area. Of this amount, 700-lbs. of burning bar was used to join this sheet lead moisture protection system. The sheet contained 4¼ percent antimony, .06 percent copper, and an arsenic content of 0.07 percent to provide for increased corrosion resistance and to decrease thermal expansion. Lead sheets measuring 8-ft. by 22-ft. were used to minimize the number of joints and help insure the watertight integrity of the lead.

Four lead burners at a time were employed, and two passes were made on each joint to bring it up to the standard lead welding code.

John E. Green Plumbing & Heating Co., Highland Park, Mich., continuously poured 600 yards of concrete for the dish-shaped base on which the fountain sits. The lead installation then followed a standard sequence. The 12-in.-thick concrete dish was covered with a cold-applied brush coat of bituminous coating, followed by 60-lb. felt. After the sheet lead moisture protection system was installed, another bituminous coating was applied. This system was topped by a black granite surface.

The fountain's well is also protected by a lead waterproofing system topped with a granite surface. The well is located in the center of the two stainless steel legs that support the fountain. From the perimeter of the 120-ft. diameter dish there is a 3-ft. incline to the well. The well is 25-ft. in diameter, 7-ft. high and weighs 100 tons.

By constantly changing its display, the fountain will not only enhance the beauty of the area, but impress onlookers as well. What they will not see, however, is lead working undercover to prevent water leakage problems.

The multi-million-dollar Renaissance Center, another renewal project, located on the waterfront immediately adjacent to the plaza, forms a majestic backdrop for the fountain. The complex includes a multi-purpose hotel, apartments and office buildings that soar above the skyline in a series of dramatic towers sheathed in tinted reflective glass.

Source: Allied Lead, Inc.

Popularity of Tiffany-style creating a leaded stained glass dynasty

rall view of Somers Stained Glass workroom, showing some of the more than 80 styles of lamp oes the company produces.

ned glass craftsman uses lead caming, seen at to assemble skirt for stained glass lamp as that seen in background.

The increased popularity of hand crafted Tiffany-style chandeliers and table lamps is responsible for what could become a business dynasty based on leaded stained glass.

The grandson of the founder of Somers Stained Glass, Deer Park, N.Y., is now learning the fine art of designing and executing leaded stained glass from his father and uncle. They own and operate the Long Island company, which was started by their father in 1947. And it is likely that the grandson might one day be joined by some of his brothers, sisters and cousins if the company continues to expand. The company is one of the country's largest producers of both leaded stained glass lamps and chandeliers as well as windows, ceilings and similar types of decor.

"During the past six years," the company president Harold Somers reports, "we have expanded both the size of our plant and the number of employees to keep up with the demand to produce Tiffany-style lamps and chandeliers. From an original staff of three and some part-time help, we now employ nearly 15 people."

The company produces more than 80 styles of leaded stained glass Tiffany style chandeliers and table lamps. About 100 designs are usually on display. Other items are kept in reserve stock and, in addition, components of more popular designs are kept in stock and only need to be solder-joined as needed.

Production facilities at Somers Stained Glass are immaculate and, unlike many production plants, they are open to the public. "The public is fascinated with the various steps involved in producing leaded stained glass," says Somers. "They want to see how stained glass is cut, how it is assembled, and how it is solder-joined like putting a huge, colorful puzzle together," he says, adding that letting the public see the work being done is a valuable sales tool.

"Our customers learn first-hand the amount of hand labor and time involved in joining and soldering leaded stained glass," he reports. "It is for these reasons our customers appreciate the fact that our prices don't compete with inexpensive, mass-produced work that is called leaded stained glass. Our designs, like the originals by Tiffany, are valuable pieces of art. They are an excellent investment as well as a means of helping to insure the continuation of a centuries-old art form."

The company produces three basic Tiffany-style designs: rectangular shades that are primarily made up of rectangular and square glass squares, conical-shaped shades with a two or three inch skirt; and a wide variety of domes that incorporate many sizes and colors of stained glass shapes, fruit, flowers, etc.

The first step in producing rectangular and conical shaped designs is to cut the glass that will be required for the design. Then the extruded lead that is used to frame the glass sections is cut to the desired length. Called caming, the lead has a channel about $\frac{1}{8}$-in. deep along the side. The channel holds the glass sections in place while they are being joined and, after soldering, they provide the strength required to help support the lamp structure. All soldering is accomplished with 60-40 tin lead solder.

Most of the company's leaded stained glass shades and chandeliers are sold directly to the public. Interior designers and decorators are also finding the wide selection of designs a preferred source for furnishing homes, apartments and commercial and institutional interiors.

LIA26777

Solder helps keep Benjamin Air Rifles on target

Like their fathers and grandfathers before them, thousands of junior marksmen throughout the country are learning the rudiments of firearms with Benjamin air rifles and pistols. However, most of these youngsters are not aware that tin lead solder is largely responsible for the long life and reliability of these guns, as well as their authentic action and target accuracy.

Benjamin Air Rifle, a St. Louis-based company, has been one of the nation's leading producers of high-compression air rifles and pistols for the past 74 years. During that time, much of the firm's reputation for turning out a quality trouble-free product has been attained through the use of solder to join the principal gun components.

Another indication of the company's high standards is its continued use of cartridge brass (a 70/30 copper-zinc alloy) for the rifle and pistol barrels to assure maximum durability. In addition, the rifle stock continues to be made of walnut. "We plan to keep using these materials as long as we can," asserts Ray Katt, secretary of the company. "Substituting plastic would only cheapen the product. We want to maintain our reputation for quality." Insistence on end product quality is clearly evident in the soldering of the rifle's various components. The sights, shot retainer, shot tube and assembly stud are all hand soldered to the rifle barrel. However, the air chamber, which is used for air storage, is automatically soldered inside the barrel.

Due to the inaccessibility of the air chamber once it has been manually inserted in the barrel, a solder preform is used for this soldering operation. The pre-shaped 40/60 tin lead solder ring around the chamber melts when heat is applied to the barrel on an indexing machine. This automatically joins the chamber to the barrel.

In producing the pneumatic pistol, the air chamber is screwed into the barrel. All necessary soldering of other components is done by hand in much the same manner as the rifle parts.

When the soldering of the rifle's air chamber has been accomplished, the assembly stud and other components to be hand soldered are positioned on the barrel. After brush coating with flux, the next four soldering steps are performed. This involves torch heating 60/40 solder to join the front sight, rear sight mount, shot retainer (breech end) and shot tube assembly and assembly stud to the barrel. One operator is responsible for completing an entire barrel.

Upon completion of the barrel assembly, each is carefully checked for faults, and excess solder is removed. The assembly is then plated, thoroughly inspected, and sent to the production area. Here the gun is completely assembled and tested. It is then ready for packing and shipment.

Although certain innovations have been made on the Benjamin air rifle over the years, the company still takes pride in displaying one of its 50-year old models. The gun looks much like its modern counterpart, right down to the soldered metal components.

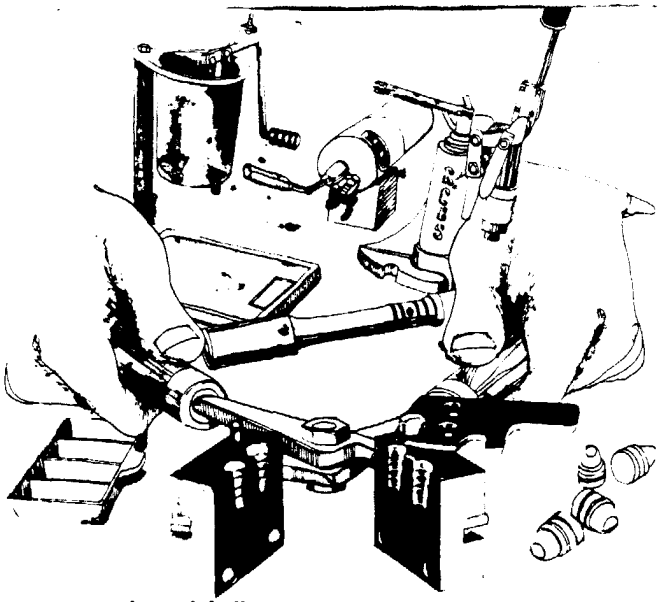
Source: NL Industries

Ray Katt, Secretary of Benjamin Air Rifle, holds 50-year-old air rifle (background) and modern day version.

Operator torch heats 60/40 tin lead solder to join rifle barrel assembly components at Benjamin Air Rifle.

...or and senior marksmen

Home cast bullets provide low cost, accurate sporting ammunition



In recent years, there has been an increased interest in skeet and target shooting for pleasure and sporting competition. This, in turn, has led to a greater desire on the part of the participants to decrease the cost of ammunition they expend.

Many avid shooters and handloaders have found that with judicious choice of components and large quantity purchases, they can cut ammunition costs 50 percent or more by casting their own bullets.

Home casting also provides the reloader with the ability to customize bullets for his rifle and pistol cartridges. The do-it-yourselfer has the option of sizing the bullets in a variety of diameters, thus fitting his bore diameter precisely to obtain greatest accuracy.

Lead is considered the ideal bullet material since it offers the bullet caster workability and is easily cast or swaged into the required shape. The original cast bullet has been in existence since the invention of firearms. It is composed of lead alloy and is formed by pouring the molten alloy into a precision-made mold.

Bullet alloys normally contain tin and antimony, in addition to lead. All three elements serve a purpose. Lead imparts mass to the bullet, while the other elements influence hardness casting temperature, and casting tolerance.

The home caster uses many alloy compositions for his bullets. Blends of scrap with caulking lead or plumber's lead, lead wire, cable sheathing, linotype lead or wheelweights and sinkers are possible. Pistol bullets are usually cast from a purer lead than rifle bullets. The rifle's velocity and length of barrel call for a harder metal composition.

The most important piece of equipment for home casting is the malleable iron bullet mold. There are over 500 bullet designs and weights to choose from, and almost every one is available as a single, double or four-cavity mold. The multiple cavities allow the bullet maker to cast a number of bullets at once. Beginners are advised to choose bullets of medium grain weight, and a single cavity mold, which is the least expensive.

Other necessary equipment includes a casting mallet, mold handles, pot dipper, hand bullet sizing die and larger expander ball for combination dies. The novice need not invest in an expensive electric furnace. A simple cast iron pot can fill the same function when placed on a stove top burner, electric hot plate or camp stove. After casting, bullets can be lubed merely by placing them in a shallow pan and pouring melted lubricant in to the desired depth. A sizer-lubricator, which applies the desired amount of lube while bringing the cast bullet to final dimensions, can be purchased later when the caster becomes more proficient.

The bullet casting operation itself consists of just four basic steps:

1. Melting the bullet lead.
2. Pouring the bullet lead into the mold.
3. Removing the bullets from the mold.
4. Sizing and lubricating the bullets.

The lead heating operation should be carried out in a well ventilated area (not an enclosed space) and the casting temperature of the lead pot should not greatly exceed the melting point of lead, or approximately 650° F. These precautions will prevent any hazard from inhalation of lead fumes.

The time it takes for the bullet lead to melt in the pot can be used to clean oil off the mold. In addition to oil, the mold should be clean of other foreign substances such as water which could result in splashing when the molten metal contacts the foreign substance in the mold. Splashing of the molten metal could result in burns if the hot metal contacts the skin.

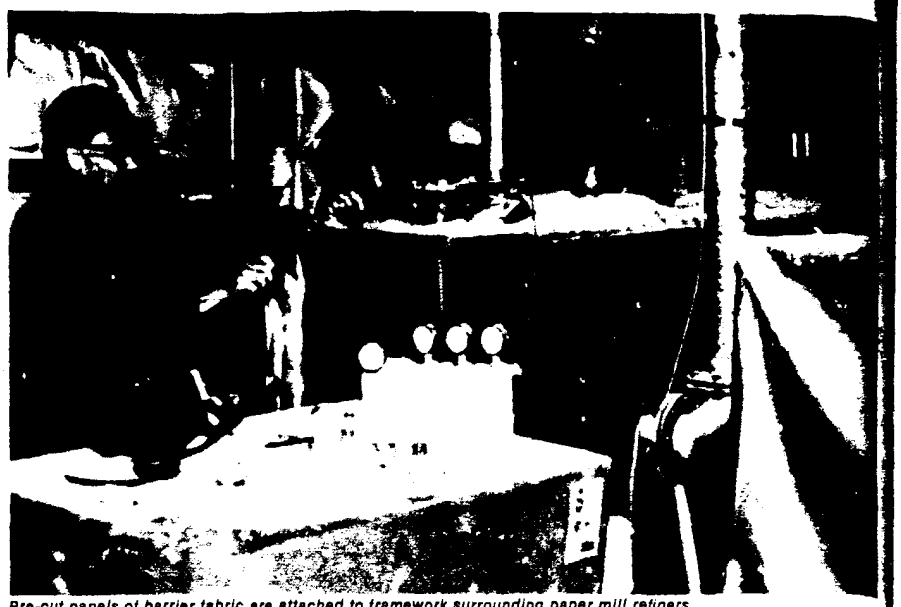
When the pot mixture becomes pourable, the mold is held with the sprue plate vertical. The spout of the dipper is placed against the sprue, and the mold and dipper are then rotated back to the right and the dipper is separated.

The sprue plate is then popped open with the casting mallet. At first there may be only a blob of metal in the cavity. However, as the mold temperature increases with subsequent casting, the bullet quality will improve until bright, sharp, clean bullets are being cast.

By the time the lead has reached optimum casting temperature, which takes about 30 minutes, the tin has separated and is floating on top of the pot. To put the tin back in the bullet alloy, the metal in the pot must be fluxed. This can be done with beeswax, tallow or a commercial fluxing agent.

The dross of impurities and dirt that floats to the surface after fluxing can be skimmed off. This should not be left uncovered, but deposited in a suitable (capped) container. The fluxing operation should be repeated at regular intervals during casting to keep the tin from separating again, and to remove impurities.

When the homemade bullets have cooled, they are ready to be sized to a diameter which suits the barrel of the caster's gun. The sizing is accomplished by swaging the cast bullet through a die which is bored to the desired bullet diameter. The bullet is then lubricated and a small metal cup called a gas check is applied to its base. This protects the bullet from the hot gases of the powder charge when the cartridge is fired. The bullet is now ready for reloading.



Pre-cut panels of barrier fabric are attached to framework surrounding paper mill refiners.

With leaded vinyl it's curtains for noise

Leaded vinyl and glass fiber reduced noise levels in this mechanical press from 92-94 dBA to 86-87 dBA.

Quite often, industrial noise problems can be solved quickly and quite easily without the use of overly expensive materials and ancillary equipment.

For example, a paper mill in northern New York State was faced with a serious noise problem that centered on two paper refiners used to shred wood fiber. Powered by electric motors at high amperages, these high-speed refiners emitted a disturbing high-pitched whine. Noise level readings taken at three different positions around the refiners disclosed noise levels in the range of 101-108 dBA.

The paper mill called upon Breton Industries, manufacturers of flexible noise control enclosures and curtains, to remedy the problem. The Amsterdam, N. Y. firm suggested "Quiet Closure", a 1 pound per square foot (psf) flexible barrier fabric that the company produces. The barrier, which combines leaded vinyl and fiber glass, can be hung, draped, folded and wrapped for versatile custom applications.

To begin the project, the mill's maintenance staff constructed a box-like framework of ¾-in. pipe connected by angle irons around that part of the refiners that generated the noise. Pre-cut panels of the leaded vinyl were then attached to the frame by means of mechanical fasteners and a hook and pile adhesive. Areas around the refiners' motors were left open to permit air flow and heat dissipation. Holes cut in the leaded vinyl permitted passage of shafts, inlet and discharge piping.

Following installation of the panels, noise level readings were again taken at the three positions around the refiners. Readings disclosed that the noise from the two refiners was reduced by about 6-13 dBA.

The use of leaded vinyl for noise control applications is increasing for both commercial and industrial sectors. Consisting of lead powder dispersed in vinyl and coated onto woven glass fiber, nylon or cotton; the limp flexible material resists passage of sound waves and minimizes noise transmission. This combination can provide a decrease in sound transmission of up to 25 decibels.

The leaded vinyl system used by Breton solved another serious noise problem for the manufacturer of automotive accessory equipment. Workers near a 60-ton mechanical press were being exposed to noise levels in the range of 92-94 dBA. Upon investigation, it was determined that the press' large gear box and fly wheel were responsible for the high level of noise.

A 10-ft. long by 16-ft. high curtain of 1 psf leaded vinyl and glass fiber was used to solve the noise problem. Installed on a 2-in. x 2-in. x ¼-in. angle iron frame, the leaded vinyl system lowered the noise level to a quieter 86-87 dBA, a reduction of 6 to 7 decibels. This noise reduction was accomplished although the top and bottom of the enclosure was left open. Subsequent treatment, including a fitted bottom cover and acoustical baffles attached to the ceiling reduced the noise level on the mechanical press to below 85 dBA, a significant total decrease.

...on land and sea

...and lead shielding provides shipboard ...

The Queen of Coquitlam embarks on her maiden voyage for B. C. Ferries in British Columbia. The vessel is one of two new ferries using lead shielding to protect passengers and crew from engine room noise.

In addition to playing an important role in helping to keep industrial machinery noise within OSHA-stipulated limits, lead has been successfully employed as a noise barrier for marine vessels for many years. A recent example is the use of lead shielding to muffle engine room noise aboard two new passenger ferries now operating in British Columbia.

Christened the Queen of Coquitlam and the Queen of Cowichan, the ferries provide greater passenger and vehicle capacity than the vessels they replaced. Each can carry 1,146 passengers and 360 cars and trucks. The capacities of the older ferries were 500 passengers and 192 vehicles. Each of the new ferries is 457 feet long, with a breadth of 89 feet. Power for each ferry is supplied by two 11,000 hp Diesel engines, and speeds of up to 23 knots can be achieved. Both crew and passenger areas are shielded by lead from the high pitched whine of the powerful Diesels.

Control room of Queen of Coquitlam, one of two new ferries operating in British Columbia, uses double-glazed glass and lead shielding in bulkhead at right for sound attenuation.

Approximately 3,800 sq. ft. of 1-lb. (1/64-in. thick) continuously cast lead sheet for sound attenuation purposes is aboard each ferry. The lead was employed in the control room, engineers' workshop and crew day-room. The rooms are connected by lead laminated steel doors. The sound proofing lowers the noise level for the occupants, and also serves as a noise barrier for the added comfort of passengers in the area.

The walls of all three rooms are shielded by a glass fiber-lead-glass fiber sound barrier. It is composed of 1½-in. of glass fiber bonded to the exterior steel wall, then a sheet of 1-lb. lead, followed by another 1½-in. of glass fiber. The composite structure is topped by a ½-in. of asbestos-based gypsum paneling on the interior side. In addition, the control room features a double-glazed glass viewing area for added noise reduction.

Burrard Drydock of Vancouver was responsible for both the construction and lead shielding of the Coquitlam, while Yarros, Ltd., Victoria, performed the same work on the Cowichan.

One ferry is traveling between Horseshoe Bay on the Mainland and Nanaimo, on Vancouver Island. The other is carrying traffic between Tsawwassen on the Mainland, to the British Columbia capital in Victoria, via the Vancouver Island port of Swartz Bay.

A unique feature of the ferries is that they are reportedly the first passenger vessels in the world to use an emergency slide system for evacuation purposes. The system has inflatable escape chutes from the sun deck to the water level. When operated, they form a small dock on the water from which passengers can transfer to inflatable life rafts.

The sun deck includes seating in two solariums, which give a commanding view. Just below is the passenger deck, which has carpeted lounge areas, a cafeteria and a snack bar. Escalators transport passengers to this deck from all vehicle parking facilities. The main deck is arranged to carry both large trucks and passenger cars. Vehicles are loaded and discharged at either end.

In the center section, between the engine casings, are four lanes with 16-foot clearance for trucks. In addition, outboard of the casings, are two passenger car lanes on either side. A gallery deck to port and starboard of the high clearance section provides four additional passenger car lanes. Vehicles use inclined ramps on each end of the main deck to reach the gallery deck. An upper car deck is also provided with eight lanes for vehicle parking.

Source: Canada Metal Co., Ltd.

GoLIAth® proves its worth in Washington working environments

Philip E. Robinson (center), President of Lead Industries Association, turns over keys to GoLIAth to Ed Donnelly, Associate Director of National Capital Parks (NCP) in Washington, D.C. John Hoke (left) Urban Parks Specialists of NCP, looks on.

The U.S. Government, which owns and operates the largest number of non-military vehicles in the country, is the primary target for the 1976 Lead Industries Association (LIA) battery-powered electric truck promotion program.

Highlighting this program is GoLIAth, the LIA battery-powered delivery van. The electric vehicle has been in demonstration service with two major government agencies during the year, the Library of Congress and the National Parks Service. It also has been used as a combination educational classroom and demonstration vehicle for members of the Environmental Protection Agency, and the Federal Energy Administration. Both organizations are playing a leading role in the development of a market for electrics in general, and electric trucks in particular.

GoLIAth began its Washington service early in 1976 with the Library of Congress, which serves as a storehouse for official government records. The LIA van was used to transport a variety of these documents to and from various Congressional offices, Congressional committee rooms, etc. In its two months of operation GoLIAth clearly showed it could replace IC vehicles for such tasks.

Early in June, GoLIAth began demonstration service with National Capital Parks (NCP) which is believed to have one of the nation's largest and most diversified fleets of electric vehicles. The LIA van added another dimension to the more than 12 types of electric work maintenance and transportation vehicles operated by NCP in Washington.

A regional unit of the U.S. Department of the Interior's National Parks Service, NCP operates twenty electric vehicles in East Potomac Park and West Potomac Park in the vicinity of the Lincoln Memorial. In efficiently transporting work crews and maintenance equipment in both areas, GoLIAth continues to demonstrate the many advantages of battery-powered short-haul vehicles. This has been its principal function for the past two years.

During the summer, the delivery van was also used at times to service the Festival of American Folklife, which was located in the Mall area. The Department of the Interior purchased 30 electric vehicles to service this Festival.

In addition to GoLIAth, electric vehicles in the NCP fleet include:

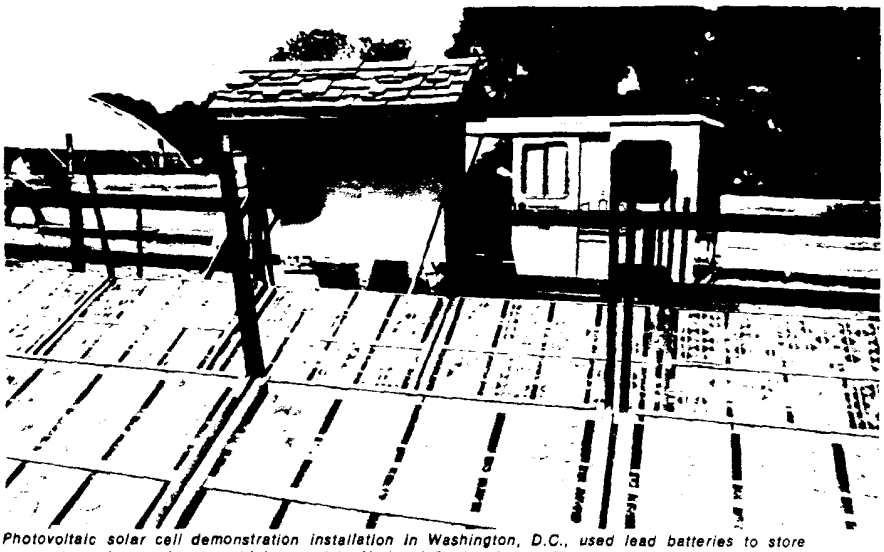
- An 18-passenger bus used as a shuttle between the organization's headquarters and the Department of the Interior and other NCP divisions. The bus eliminates the need for staff cars to transport personnel, and saves gasoline.
- An 8-passenger and a 14-passenger covered top carrier.
- A hybrid electric utility truck incorporating a small 5 hp. lawn-mower-type gasoline engine to charge on-board batteries between regular plug-in charges.
- Two types of cargo carriers.
- Specially adapted dump truck, tractor, compactor and trash pick-up vehicles.
- A battery-powered motor cycle.

A specially designed electric charging station for the vehicles is available at the maintenance site of the Festival, as well as other NCP locations.

According to John Hoke, NCP Urban Park Program Specialist, his organization has been using electric vehicles since 1972. He reports that, at that time, he was seeking a means of maintaining and servicing the magnificent rows of elm trees in the Mall area without damaging their delicate root systems which run very close to the earth's surface. Standard IC vehicles have what he describes as a heavy "footprint" because of the immense weight transferred by the vehicle's tires. The weight, which he estimated to be as high as 75 psi, contributes to destroying root systems.

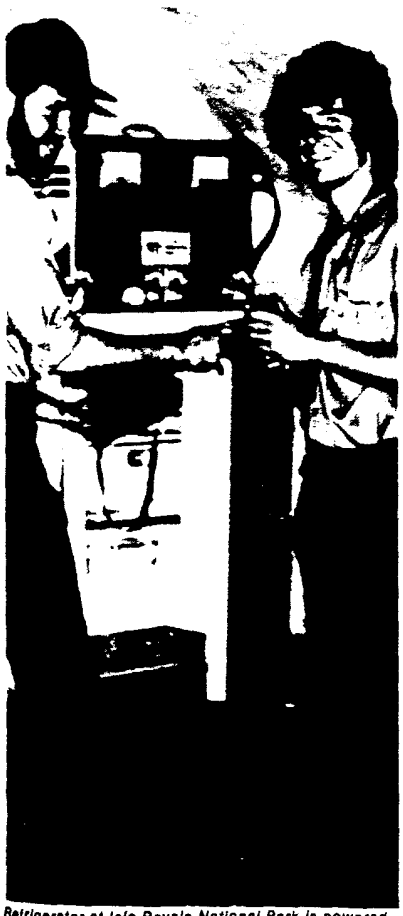
NCP first experimented with golf cart type electric vehicles which have special wide-track tires that leave a much lighter footprint, as low as 15 psi, less than a human footprint, that does not damage the roots. Since that time, he reports a constantly expanding use of electrics since they are quiet, do not pollute, and are much more economical to operate and maintain than IC vehicles.

Seven of the more than 12 different types of electric vehicles used by National Capital Parks in Washington, D.C.



Photovoltaic solar cell demonstration installation in Washington, D.C., used lead batteries to store energy to recharge electric vehicles used by National Capital Parks. GoLIAth, used to transport personnel to service installation, is seen in background.

Sun powered equipment for remote locations



Refrigerator at Isle Royale National Park is powered by solar energy, similar to display seen above.

The Department of Interior's National Park Service (NPS), already a leader in advancing the use of battery-powered electric work vehicles, is also taking the helm to develop the use of solar energy to power lead batteries used to operate a variety of work vehicles and field equipment.

For example, electricity from photovoltaic solar cells is being used to operate a small refrigerator at Isle Royale National Park, Michigan, a roadless area of wild animals, forests and lakes situated in northern Lake Superior, which is accessible only by boat and floatplane. Used to protect perishable foods at a remote trail construction camp on Isle Royale, the camper-sized refrigerator is fitted with three panels of photovoltaic cells which convert the sun's light into electrical power. During the daytime the electricity is used to operate the refrigerator and to charge six conventional automobile batteries located on a stand under the refrigerator. The lead batteries provide about 600 ampere hours of storage. They are used to power the refrigerator during the evening and on overcast days, thus assuring continuous operation of the appliance.

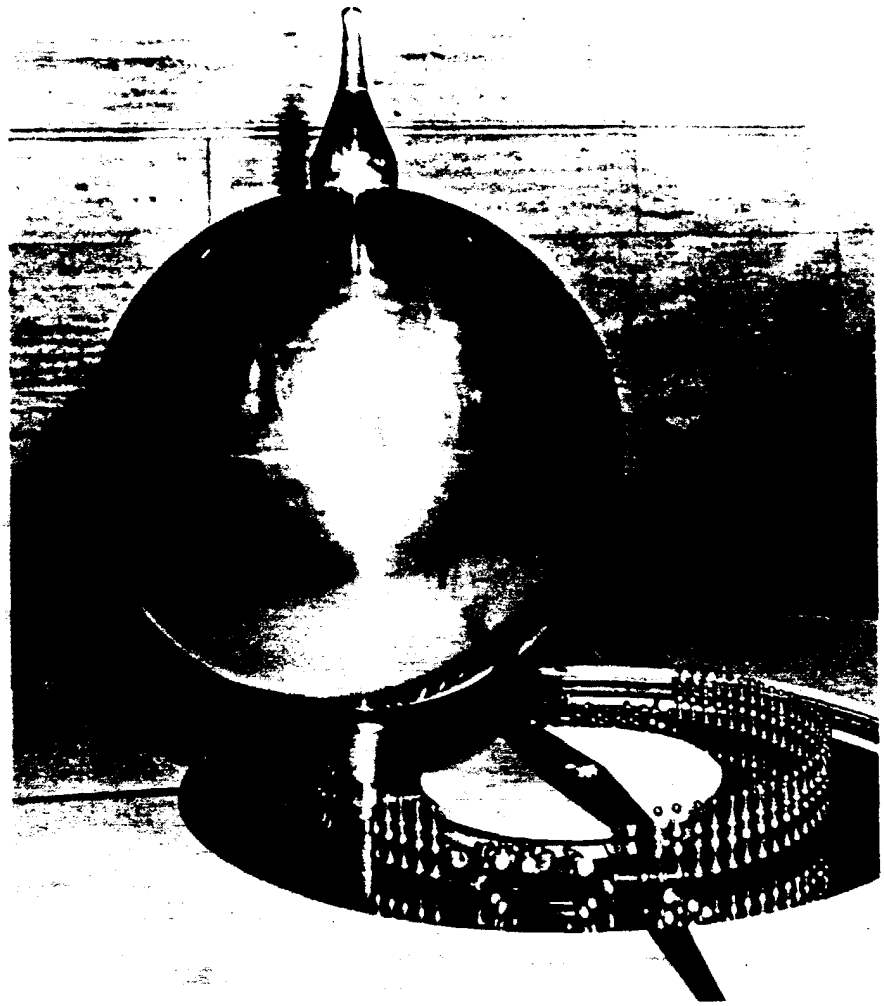
The park's location is an appropriate demonstration and test site for determining the viability of solar power for remote areas, not only for NPS sites but also for off-shore islands and other remote areas that do not have access to regular electric power. This project, in cooperation with NPS, is the first of a number of solar cell demonstrations to be conducted by the National Aeronautics and Space Administration's (NASA) Lewis Research Center located in Cleveland, Ohio. NASA Lewis is responsible for the Photovoltaic Test and Application Project, which is part of the national photovoltaic conversion program directed by the Energy Research and Development Administration (ERDA).

Washington, D.C.'s Festival of American Folklife was the site of another solar energy demonstration project this past summer. There a solar cell array was used to charge lead batteries in a variety of electric work and transportation vehicles owned by National Capital Parks (NCP), a regional unit of NPS. Lead Industries Association's (LIA) own battery-powered van, GoLIAth®, which was in demonstration service with NCP at the Festival, was among the vehicles used to transport maintenance personnel to solar site.

The photovoltaic array provided about 1.7 kilowatts of electricity during the peak sunlight hours and was prepared by NASA's Lewis Center. The photovoltaic cells used in this demonstration were purchased from commercial solar cell manufacturers.

These solar tests and demonstrations are designed to: determine the operating characteristics of a variety of solar cell systems and subsystems; devise and implement the methods and equipment to measure solar cell modules under environmental conditions; and to demonstrate those applications of solar cell systems which are cost effective today and will have a substantial impact on the nation's energy requirements in the future. According to NASA, although solar cell arrays are still relatively high priced items, the total life-cycle cost of solar cell power systems for remote locations, such as Isle Royale, is consistently lower than the cost of fuel and transportation for alternate power sources.

Lead-filled pendulum tracks earth's rotation



Visitors to Franklin Institute observe action of lead-filled Foucault pendulum as it tracks earth's rotation.

A lead-filled pendulum that illustrates the rotation of the earth on its axis is one of the star exhibits at Philadelphia's Franklin Institute. Called the Foucault Pendulum, it graphically demonstrates the earth's movement daily for many visitors to this internationally-known museum.

Focal point of the exhibit is the pendulum itself, which is a 100-lb. stainless steel ball, filled with 1,700-lbs. of lead pellets, each about 1/32-in. in diameter. The wire, in turn, is gripped by a large steel ball, supported by three steel ball bearings, ceiling-mounted at the top of the museum's main stairwell.

The 3-ft. diameter base of the exhibit has a ring of 96 pegs, spaced 1-in. apart around the circumference.

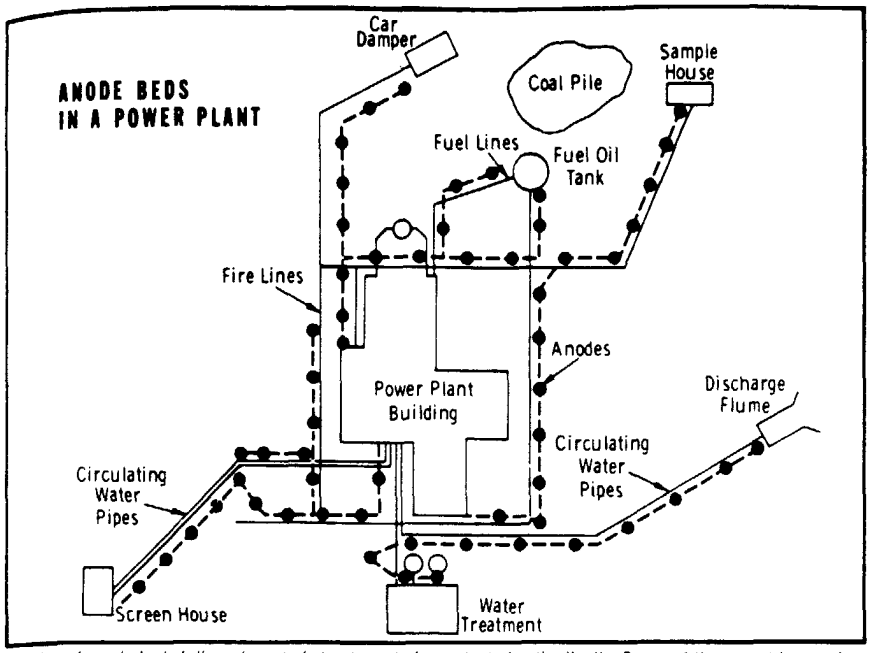
The daily demonstration of the earth's rotation starts each morning, when the precision balanced and precisely weighted pendulum is set in motion. The direction of the pendulum's swing remains constant, although it appears to change with reference to the base of the exhibit. The illusionary effect is caused by the pendulum's swing, which is independent of the earth's rotation.

The ring of pegs at the base rotates at the same rate as the rest of the earth, while the pendulum continues to swing in the same plane, due to inertia. As a result, the ball knocks down the pegs, at the rate of about one every twenty minutes.

Recently, this popular demonstration was halted for about a week for refurbishing work. The suspension wire was replaced by Riverside Metals Co., Riverside, N.J. The mounting was cleaned and repaired by SKF Industries, Philadelphia, supplier of the ball bearings. There was no need to replace the stainless steel ball or its lead contents. Over the next ten years the newly installed mounting and wire is expected to accommodate more than 30 million movements of the pendulum.

Modeled after the original pendulum hung in the Pantheon in Paris by Jean Leon Foucault in 1851, the Franklin version was installed in 1924.

Lead-covered grounding cable reduces cathodic protection costs



Location of anode beds follows layout of structures to be protected cathodically. Fewer of these cast-iron and graphite anodes are needed when lead-covered cable is used for grounding.

Repairing and maintaining the extensive underground piping and other structures required for power plant operation can be expensive and time-consuming. To help overcome these problems, built-in corrosion protection usually is provided. However, an effective cathodic protection system to prevent corrosion of underground metallic structures can, in itself, be a costly proposition when combined with the necessary grounding required.

One route to cost reduction is to employ lead-covered cable for grounding instead of bare copper. An economic study conducted by Sargent & Lundy, a Chicago-based engineering consulting firm, reveals that savings in grounding and cathodic protection for a typical plant can exceed $22,000. In certain cases, the need for cathodic protection can be eliminated entirely. And the lead-coated grounding arrests corrosion at congested plant locations.

Attempting to apply cathodic protection in an area where bare copper grounding is used can create problems, according to S. Z. Haddad, Assistant Head of Sargent & Lundy's Electrical Analytical Division. The layout of the ground cables in relation to outdoor piping often makes it difficult to achieve protection, due to the shielding effect of the larger underground piping.

The side of a pipe closest to an anode bed of the cathodic protection system may be well protected. However, the other side of the pipe might not receive enough protective current to prevent it from reacting with an adjacent copper ground cable. Also, the current requirement of a copper ground conductor is much higher than that of the steel pipes to which it is electrically connected.

In other words, providing cathodic protection to steel structures entails sending a greater current to copper ground conductors in the area. The actual current requirement for copper will depend on the resistance between the copper conductor and the earth, the resistance between the underground piping and the earth and the surface areas of the copper conductor and the underground piping.

These parameters vary considerably from one installation to another. This variation accounts for the wide range reported in the current requirement for copper conductor. Mr. Haddad reports the current requirement for copper to be about twenty times that of bare steel for a typical power plant installation.

The adverse effects of grounding on underground metallic structures would be eliminated if a metal less corrosive than copper could be used as ground conductor. However, copper is the only commercially available metal that meets all ground conductor requirements. By extruding a jacket of lead over the copper ground conductor, one can take advantage of copper's good qualities and, at the same time, minimize its corrosive effects. Because lead is closer to steel in the electromotive series than copper, it will cause a significant reduction in the corrosive action of the grounding system.

The Sargent & Lundy study compared the relative cost of using lead-covered ground conductor instead of bare copper at several power plant installations. The results consistently favored the use of lead. Its advantages were found to be more pronounced at stations where soil resistivity was relatively high. The use of lead and stainless steel ground rods in these cases eliminated the need for a cathodic protection system entirely. This serves to offset the additional cost of the lead-coated cable.

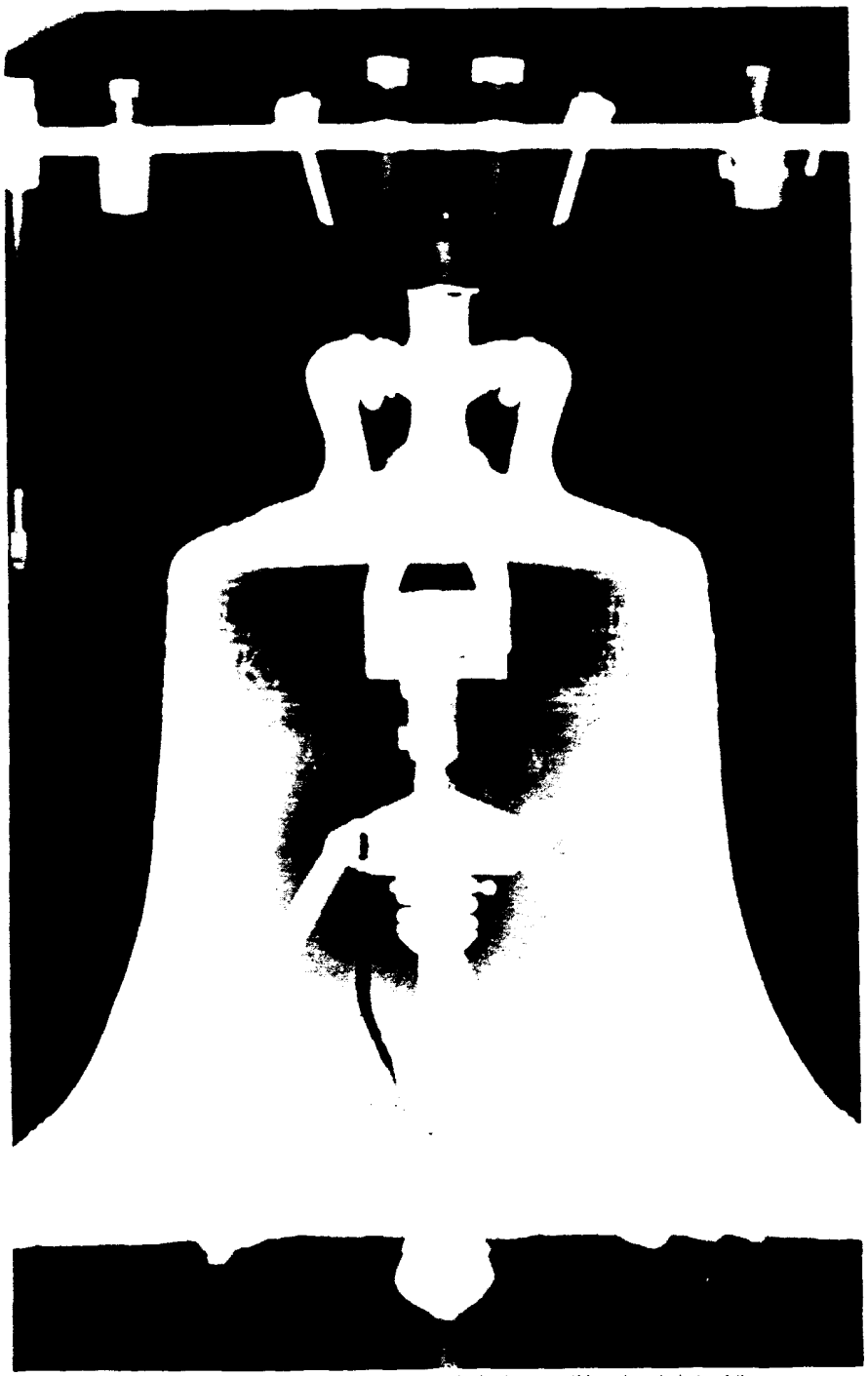
Mr. Haddad points out that where soil resistivity is low, corrosion will take place due to the soil's corrosive nature. This means that cathodic protection will be required, regardless of the type of ground conductor used. But with a lead-covered conductor, a smaller cathodic-protection system can be employed. So cost savings are still realized, although the magnitude of the saving is not as great.

DOLLAR COST OF CATHODIC PROTECTION BY TYPE OF GROUNDING

ITEM	COPPER GROUNDING	LEAD-COVERED COPPER GROUNDING
Rectifiers and dc control cabinets ...	$ 9,300	$ 5,200
Power consumption		
Demand charge at $1,000/kw	$ 15,800	$ 8,300
Energy charge at 20 mils/kwh	$ 18,400	$ 9,700
Anodes		
Material at $80 each	$ 18,000	$ 9,600
Installation at $72 each	$ 16,200	$ 8,600
Cable splicing and cadwelding at $50 each	$ 11,300	$ 6,000
Ground cable		
Copper at $2.30/ft	$ 57,500	.....
Lead at $2.75/ft	.....	$ 68,800
Moisture-tight joints at $25 each	.....	$ 7,500
TOTAL COST	$146,500	$123,700

LIA26785

Lead plays role in X-raying and sheltering of Liberty Bell



The radiographic image of the entire Liberty Bell and its yoke is shown on this reduced photo of the largest intact industrial X-ray film ever exposed.

One of the world's best known historical symbols, the famed Liberty Bell, has been subjected to an X-ray examination for the first time in its 222-year existence.

The intensive radiographic inspection was conducted to determine the Bell's condition prior to its planned transfer to a new location for the Bicentennial year. The X-rays also will serve as a reference point for future studies. Radiographic studies of every section of the Bell were made, as well as an exposure of the entire Bell and its yoke. A special lead shield was used to protect participating personnel against harmful radiation.

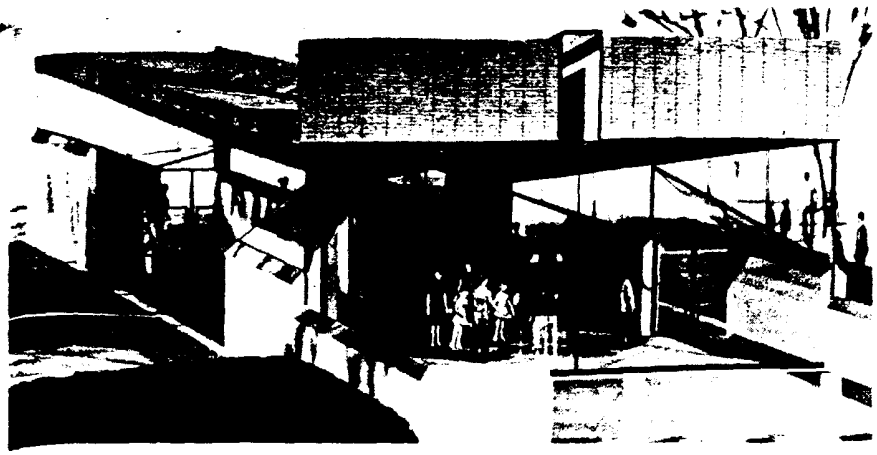
The X-ray of the entire Bell and yoke produced the largest radiograph ever made on a single, intact sheet of film, measuring 52-in. by 7-ft. Apart from the main cracking visible on the Bell's surface, the radiographs showed some additional shrinkage separations and some smaller cracks around the shoulder containing the inscription and foundry name.

Arrangements for radiographing the Bell were made by the U.S. Department of the Interior's National Park Service and Eastman Kodak Co., Rochester, N.Y. The entire procedure was carried out in two separate sessions. The first session was devoted to sectional radiography of the Bell to obtain detailed photos on 14-in. by 7-in., and 8-in. by 10-in. film. Forty exposures were required to cover the entire 3-ft., 2,080-lb. Bell using iridium-192 as the source contained in a 100-curie gamma ray projector.

Most exposures, where the Bell is 1¼-in. to 1½-in. thick, were made at 52 curies for 1¾ minutes at a source-to-film distance of 8-in. Two sheets of Kodak Industrex AA film were used with 0.005-in. lead screens in front and back of the film for radiation protection.

Near the lip of the Bell, where the thickness is 3-in., 100 curies were used for a 17-minute exposure at 22-

LIA26786



Model of Liberty Bell's permanent new home which makes it more accessible to the public. The structure's copper roof is lead-coated for added durability.

source-to-film distance. Because of the increased radiation, a dozen or more 2-in. x 4-in. x 6-in. lead bricks were stacked around the source as backstop for safety. For these exposures, a sheet of Kodak Industrex T film was added to the two sheets of AA film. Again, there were 0.005-in. lead screens in front and back.

The second session focused on the radiographs of the entire Bell and its yoke. To accomplish this, a single 7½ hour exposure of 670 curies of cobalt-60 at a source-to-film distance of 50-ft. was required. A 1,000 curie, cobalt-60 gamma ray projector with a specially built collimator was used. Designed to confine the radiation beam to 5-ft. diameter at the Bell, the collimator was made of lead, using a salad bowl as a form. The cobalt-60 source, just under ½-in. in size and contained in a stainless steel capsule, was transported to the site in a 2,000 lb. lead ball, 24-in. in diameter, surrounded by a steel jacket.

The exposure was made on a stack of 14 sheets of Kodak Industrex AA film. Each sheet was 52-in. by 7-ft. in size. The 14 sheets were tacked to a ¾-in. plywood board and the surface of the film pack was protected by a sheet of vinyl. The 14 radiographs made from one exposure represented the largest single sheets of unbroken industrial X-ray film ever exposed.

Dr. Karl E. Dorschu, manager of metallurgy and ceramics of the Franklin Institute, which is responsible for the Bell's care, noted that internal cracks had been known to exist in the Bell. "However, these and other casting defects had not been charted until the radiographing," he said.

None of the defects found in the Bell were sufficient to prevent its movement to a location across the street from Independence Hall. The move was made to make it easier for people to see and physically touch the Bell.

The $1 million glass-sided pavilion housing the Bell is 102 feet long and 35 feet wide. Sections of the wall on the east and west sides are of Bethal white granite. The height at entrance level is 15 feet, with the roof rising to 20 feet in the Bell chamber, to draw the gaze of visitors upward.

The structure features a 20 oz. psf standing seam lead-coated copper roof. According to a spokesman for Mitchell/Giurgola Associates, the architects, the lead coating was specified for increased durability, since the pavilion will be the Bell's permanent new home.

Ralph E. Turner, project director for radiography of the Liberty Bell, takes a last look through the riflescope which "aimed" the radiation source at the Bell and the large industrial X-ray film behind it. Turner's arm rests on the 2,000-lb. lead container holding 670 curies of cobalt-60..

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