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lead

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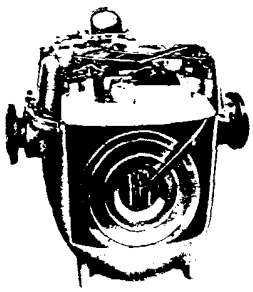
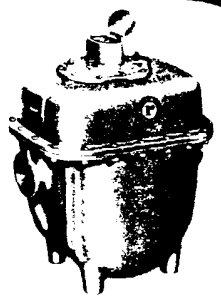


TERNE-COATED STEEL DIAPHRAGMS Assure Long Meter Life



Whether of the natural or manufactured type, gas is one of our most useful and valuable resources. It is employed almost universally in homes, offices, public buildings and manufacturing plants throughout the country. The gas meter was introduced when gas came into use for illumination in the city of London in 1810.

These first meters were of the wet type and were very accurate but the fact that they contained water as a sealant caused many problems. To overcome these inherent faults, the dry or diaphragm type of meter was developed. It was the forerunner of the displacement type in use today.

Perhaps the most readily recognized type of gas meter is that used in residential service. It is the familiar box-shaped, four chamber unit known in the trade as the "tin meter." It is made from tin plate carefully sealed with lead alloy solder. This type of meter, however, is not suited for heavy duty industrial use because of its limited working pressure and easily damaged housing.

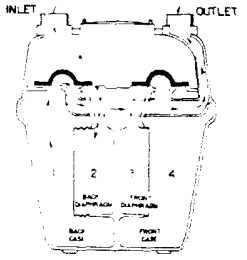
Industrial meters like most modern, positive displacement gas meters, are similar in operation to the working of a double acting steam pump. The pump has four cylinders, two for steam, two for the fluid being moved. A series of valves, controlled by the movement of the opposed pump pistons, change the direction of the steam from one cylinder to the other and at the same time perform a like function on the fluid cylinders. In the case of the pump, the steam is vented to atmosphere while the fluid is carried to its destination. Most large capacity, high pressure meters for heavy duty service are similar in design to the Rockwell Manufacturing Company 3000 meter made in their De Bois, Pa. plant. Here the cylinders are replaced by chambers, the pistons by diaphragms with valving similar to that in a steam pump.

Two chambers are cast integrally with the meter body and the two diaphragms placed within the body are completely sealed from each other and have a 90° phase relationship. Each reaches its potential every 90° of rotation creating a smooth running uninterrupted gas flow meter. The breathing motion of the diaphragms, moving back and forth, is transformed into rotary motion which turns the index dials of the meter. This is also used to control the valves. The diaphragms have a double duty to perform, first to propel the meter index and second to displace the proper amount of gas. The valves control the time at which the gas is admitted and also the amount passed through the unit.

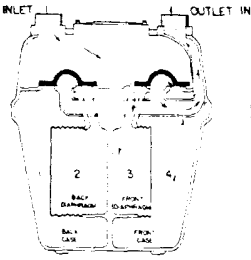
Because these meters must meet all kinds of environmental conditions in measuring everything from sewage, propane, natural, manufactured and other types of gas, they must be built to withstand the most severe service. The units must be trouble free to provide for long, uninterrupted service. On Rockwell's 3000 meter the diaphragm bellows are of rubber and the diaphragm pans are made of terne, a lead-alloy coated steel that provides for maximum service life. Terne was selected for this application because it is sufficiently rigid, is easily worked and is highly corrosion resistant.

The complete diaphragm includes an outer and inner pan, a bellows and clamps to hold the assembly together. The outer terne pan is stationary and has an inlet-outlet port as well as a drain to permit accumulated liquids, that have condensed inside, to be drawn off. The inner terne pan is movable and the linkage that drives the valve movement and the index dials are connected to it. Two of these completed diaphragm units mount on the valve plate which in turn fits on top of the valve body. The design, with inlet and outlet flanges on the body permits the meter to be proved, inspected or repaired without removing it from the line.

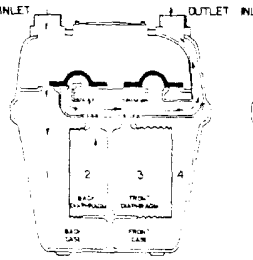
Back Case is emptying. Back Diaphragm is filling. Front Diaphragm is empty and the Front Case has just filled.



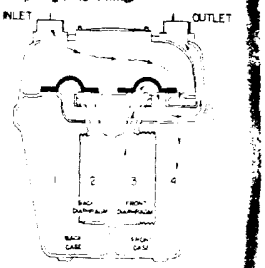
Back Case is now empty. Back Diaphragm is full. Front Diaphragm is filling, and the Front Case is emptying.



Back Case is filling. Back Diaphragm is emptying. Front Diaphragm has filled, and the Front Case is emptied.



Back Case is now completely filled. Back Diaphragm is empty. Front Diaphragm is emptying and Back Diaphragm is filling.



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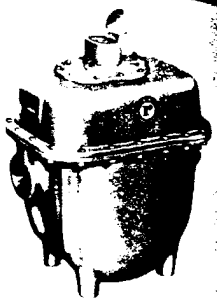

...n of the ...the other ...rm a like ...inders. In ...steam is ...the fluid ...ion. Most ...re meters ...re similar ...Manufac... ...r made in ...Here the ...chambers, ...ms with ...a steam

...integrally ...two dia... ...body are ...ch other ...ationship. ...every 90° ...h running ...eter. The ...aphragms, ...is trans... ...on which ...he meter. ...he valves. ...uble duty ...the meter ...place the ...he valves ...the gas is ...nt passed

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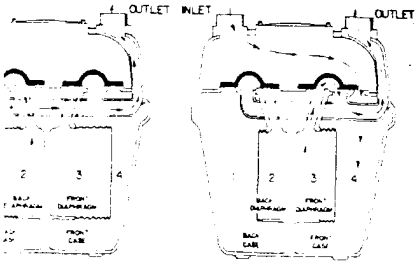
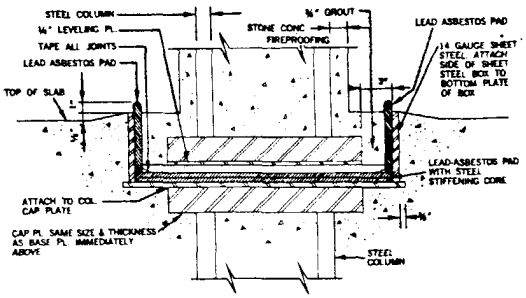
Back Case is now completely filled. Back Diaphragm is empty. Front Diaphragm is emptying and Back Diaphragm is filling.



LEAD Lowers the Curtain on Vibration and Noise at Kennedy Center



There's hardly a concert hall in the U. S. where one might find Brahms, Bizet, and Eugene O'Neill all being played in the same room—back to back. But in 1969 this may conceivably occur at the new John F. Kennedy Center for the Performing Arts in Washington, D. C.

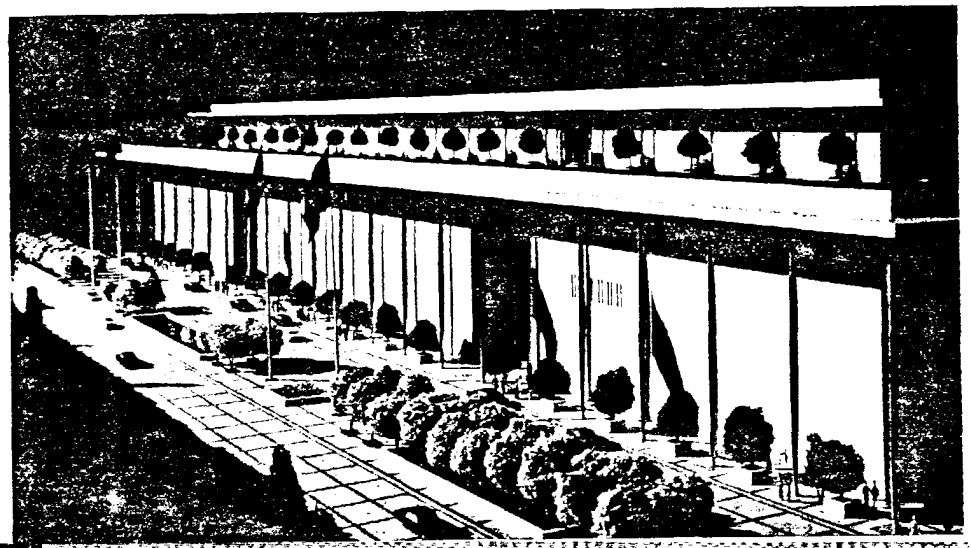
The 600 ft. x 360 ft. Kennedy Center building is a steel frame structure that incorporates all three functions of concert hall, opera house and theatre. Each of the three was designed as an independent "box" contained within an overall shell. Conceived by architect Edward Durell Stone of New York City, the Center also houses a smaller, 510 seat theatre, a multipurpose roof-terrace pavilion, restaurant, coffee house and exhibit areas. Parking for 1,600 cars is provided on three levels in the building's substructure. The building itself is located on a seventeen acre site on the East bank of the Potomac River which overlooks Theodore Roosevelt Island.

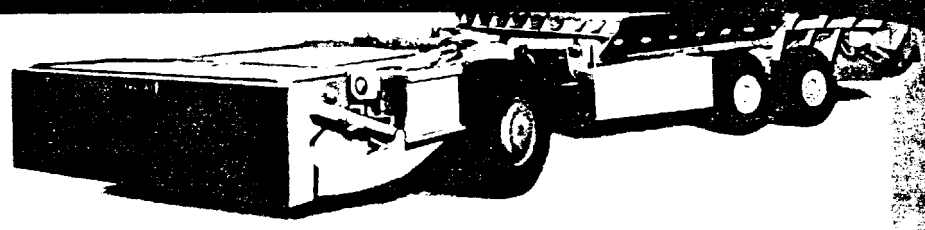
To achieve acoustical separation for each of the three halls, architect Stone located two long galleries between them. In addition to using heavy double masonry walls and roof, each building rests on lead anti-vibration pads that completely isolate each structure from vibration generated in nearby buildings, the Rock Creek and Potomac Parkway that passes beneath the building's cantilevered terrace, and from nearby Washington National Airport.

The pads were of standard 1-in. thick construction. They consist of an envelope of 8-lb. (1/8-in. thick) lead enclosing two layers of 3/8-in. thick asbestos roll fire felt, with a 12-ga. steel stiffening sheet in the center to facilitate handling. They were placed in elevated positions on the columns for engineering reasons involving accessibility and a desire to keep them close to the areas they were intended to isolate. A total of 82 pads were installed, about evenly divided between the three halls. They totaled about 1,000 sq. ft. in area and utilized approximately 10 tons of lead.

The box into which the individual pads were placed (see illustration), is unusual although not unique. The purpose of the box was to avoid the necessity for through-bolts, which, no matter how carefully detailed, run the risk of short circuiting the pads.

Credits: Architect, Edward Durell Stone
Structural Engineers, Severud-Perrone-Sturm-Conlin-Bandel
General Contractor, John McShain, Inc.
Lead Work, John F. Abernethy
Acoustical Consultant, Dr. Cyril M. Harris





Powered by lead-acid batteries, the Jeffery Ramcar no longer needs route restricting trailing cables

Batteries Cut the Umbilical Cord

In the mining industry, because of the heavy power demands for tramming big loads, the job has long been assigned to cable reel-type shuttle cars. Power to drive these units comes from a large insulated trailing cable that winds or unwinds on a reel as the tram moves away from the power source. This trailing cable severely limits the total length of travel and the ability of the vehicle to move around obstructions. Technological advances during the last 15 years in the design of lead-acid batteries with 70% more capacity into the same space, have made it practical to produce a mine haul vehicle which eliminates the range limiting trailing cable and frees the units from limited haulage routes.

Jeffrey Mining Machinery Company of Columbus, Ohio, with its new RAMCAR® has introduced an entirely different concept in a haulage vehicle. It has resulted in the design and use of a vehicle which has an easily changeable lead-acid battery and handles the roughest of heavy-duty coal or ore haulage assignments.

The Ramcar is available in three basic models with load capacities ranging up to a maximum of 30 tons. With a new battery design, rated at a nominal 250 volts, the vehicle uses standard, time proved traction motors and controls. The new batteries permit the car to operate for a full shift, under most operating conditions, before a battery change is required. With this higher nominal voltage battery, the voltage drop-off is slow and gradual so that the battery works at practically full efficiency during the entire discharge cycle without the vehicle slowing down for the last half of the shift. The car takes advantage of high strength materials and modern design applications to increase payload and range of the unit.

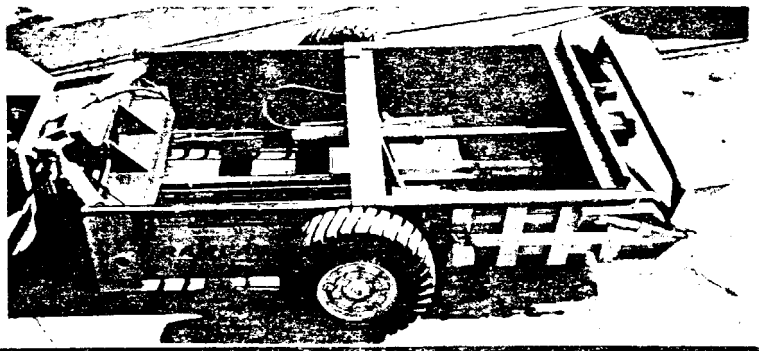
The unique design of the Ramcar makes a battery change possible with a minimum of manual labor and no external machinery. The battery literally lifts itself out of the vehicle onto the charging rack and conversely lifts a charged replacement battery back into the car. Built for minimum maintenance, the Ramcar has no mechanical differentials, no trailing cable, no complex wheel units or steering arrangements and no conveyor chain drive. Drive is by individual motor on each of the two drive wheels through speed reducers and roller chains. The vehicle is articulated and is steered with two hydraulic jacks activated by an electric motor pump hydraulic system. This steering system is accomplished by means of a universal type center coupling that joins the tractor unit to the load carrying trailer as a permanent unit.

One of the outstanding features of the car is its method of loading and unloading—from which it derives its name. To start an unloading cycle, the combination bumper tailgate is lowered hydraulically. Then a heavy duty hydraulic ram pushes an inner, telescoping portion of the hopper half way down its length. When this stops, the rear panel of the movable "ram" hopper continues to push until the load is completely discharged. It is operated in reverse for the loading cycle.

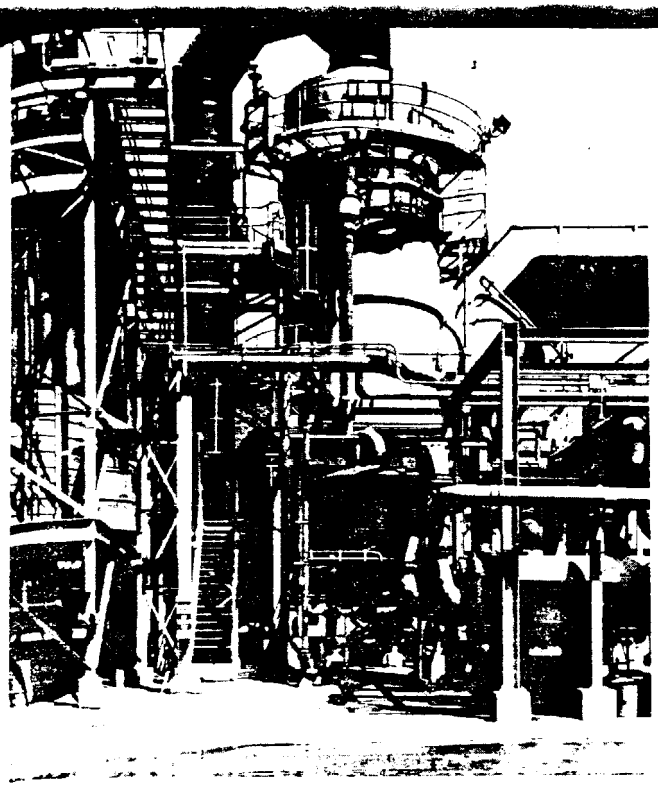
The operator sits sideways in the cockpit so that he can see equally well in either direction without having to turn around while driving or during the load unload cycle. Steering is controlled by a simple hand lever to be pushed in the direction that the car is to travel. Throttle and brakes are foot operated.

Economic justification for the use of these units (which initially cost slightly more than cable reel type shuttle cars) is in the fact that their efficiency increases the annual tonnage per unit hauled up to 35%.

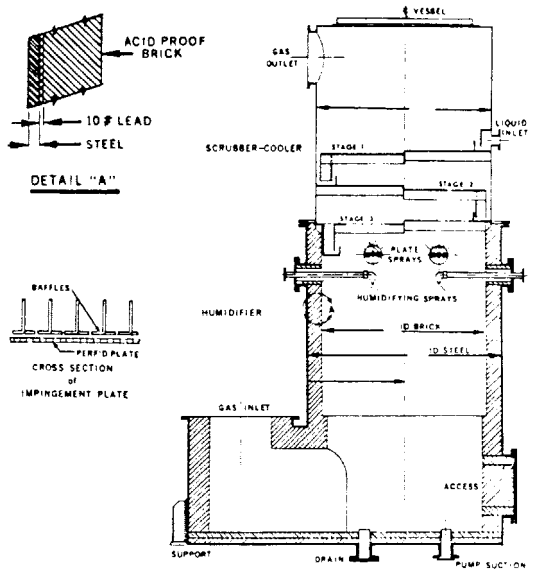
Activated by a hydraulic ram, the car can be completely unloaded in a matter of seconds



Battery operated hydraulic rams provide for easy steering of the articulated vehicle



Approximately 28,000 lbs. of sheet lead is required for the lining of a scrubber such as the one shown.



As illustrated in the sectional view, 10-lb. sheet lead is used to protect the sides and 20-lb. sheet lead the base of this Peabody designed scrubber for sulphuric acid production.

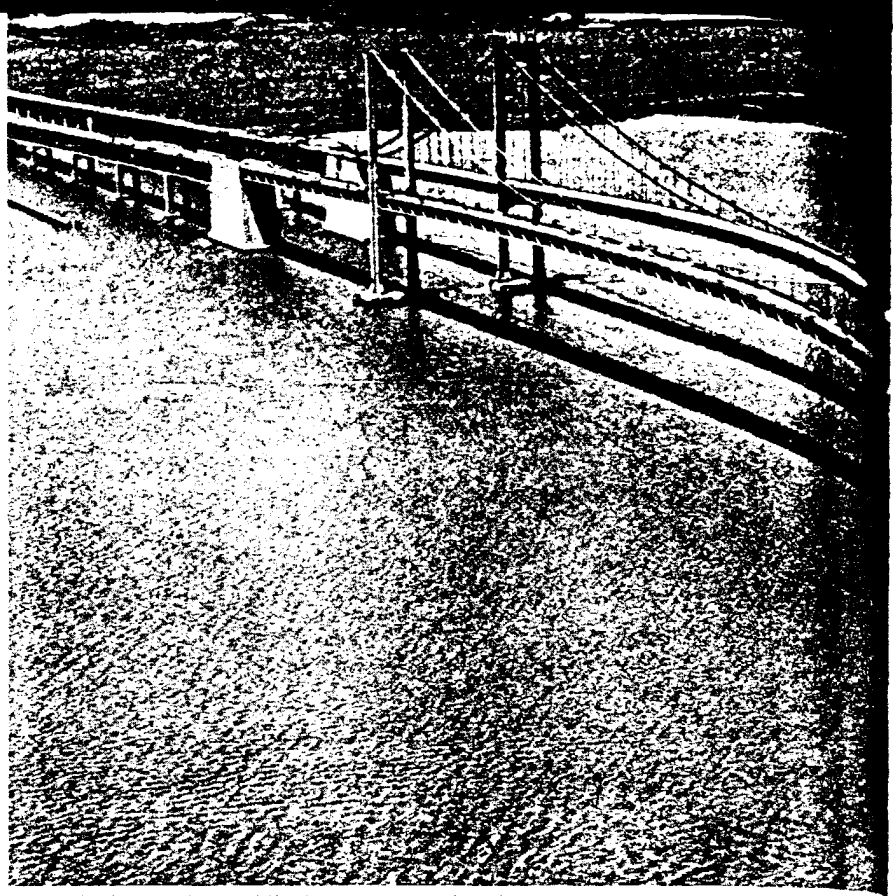
Gas Scrubbers Stop Corrosion With Lead

One of the largest single uses for lead calls for it to be continuously immersed in a sulphuric acid solution. That application is the lead-acid battery which provides reliable electric energy for the starting, lighting, and ignition of nearly 200 million cars and trucks throughout the world. Lead's ability to resist corrosive attack makes it the logical choice also for use in sulphuric acid production equipment.

One firm that utilizes much lead in this field is Peabody Engineering Corporation who design and manufacture SO_2 gas scrubbers. A typical application for a Peabody scrubber is in the nonferrous metals industry. Here, sulphuric acid is produced from SO_2 gas generated by roasting sulphur bearing ores at high temperature. In the roasting operation, along with a considerable evolution of heat and the formation of SO_2, a high percentage of the calcine is entrained in the gas stream leaving the roaster. This hot gas then enters waste heat boilers and following heat recovery, the gas is sent to an SO_2 purification system. Since the gas contains solid, liquid and gaseous impurities which must be removed efficiently, cyclone dust collectors, electrostatic precipitators and Peabody scrubbers are used in various combinations. Normally, the Peabody scrubber is the final dust collector. It removes the residual fine solids by direct contact scrubbing with water. At the same time the gas is washed, it is also cooled by the water. This helps to maintain a low water vapor content in the exit gases. Cleaned gas then enters the acid plant, is dried, and the SO_2 is oxidized to SO_3. From the converter, the SO_3 is absorbed by 98% H_2SO_4 in the absorption tower.

In handling the hot SO_2 gas, the lower humidification section of the Peabody scrubber must resist hot gas, and, intermittently, high concentrations of sulphuric and sulfurous acids. This lower humidifier section is fabricated of carbon steel, lined with sheet lead. Over the lead lining, acid brick is installed to protect the lead against the high temperature of the incoming gas. The scrubber inlet and main tower section, up to a height of approximately 15 to 25 feet, require this multi-wall construction of carbon steel, lead and brick as a suitable confinement for the hot corrosive gas. A lining of 10-lb. lead on the sides and 20-lb. lead in the base provides reliable service and is used throughout the sulphuric acid industry where wet-process purification is required.

Normally, the sheet lead is supported by lead covered steel straps bolted to the wall. However, in many cases strapping is not necessary as the brick lining holds the acid resistant lead sheathing in place. On special applications, the gas cooling and contacting trays as well as the other internal fixtures in the upper portion of the scrubber can be made of homogenous lead bonded steel.



Looking west toward the Delaware shore, the twin bridges stand majestically against the river

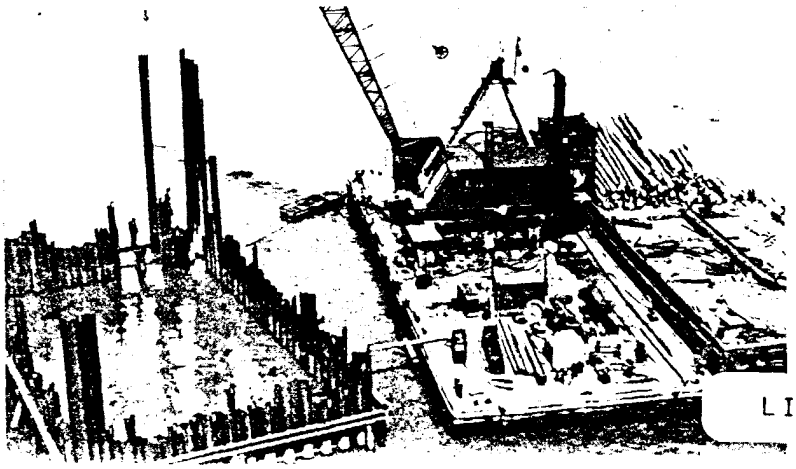
Red Lead Primer Gets . . . DOUBLE

The driver who is Washington bound on the New Jersey Turnpike for the first time in several years need not think he is getting double vision as he approaches the town of Deepwater, N. J. He is really seeing two identical bridges as he speeds toward the Delaware River. The second span, connecting Deepwater with New Castle, Delaware, was built to ease heavy traffic congestion. It now makes possible four lanes of traffic in each direction on this heavily traveled route.

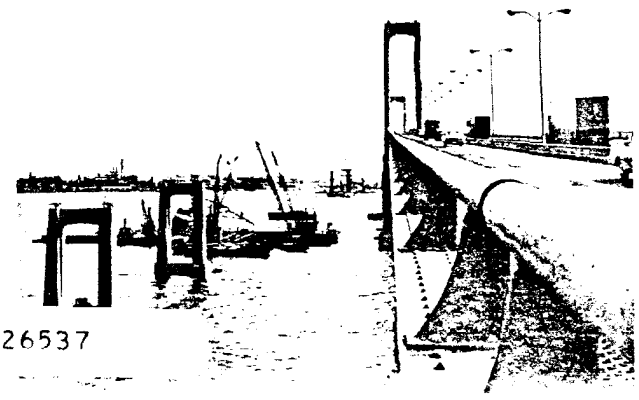
The twin bridge was started in 1964. It was dedicated in early September, 1968, with ceremonies attended by Hubert H. Humphrey, the Vice President of the United States, Charles L. Terry, Jr., Governor of Delaware, and Richard J. Hughes, Governor of New Jersey. The new span, designed as a joint venture by E. Lionel Pavlo and Howard, Needles, Tammen & Bergendoff, both of New York City, runs parallel to the older one just 250 feet to the North. The contract for the foundations and substructures was handled as a joint venture by J. Rich Steer, Inc., Perini Corp. and J. H. Pomeroy & Co., Inc. Fabrication and erection of the steel work for the West approach superstructure and the suspension bridge superstructure was handled by the Bethlehem Steel Corporation, the East superstructure by Harris Structural Steel Company.

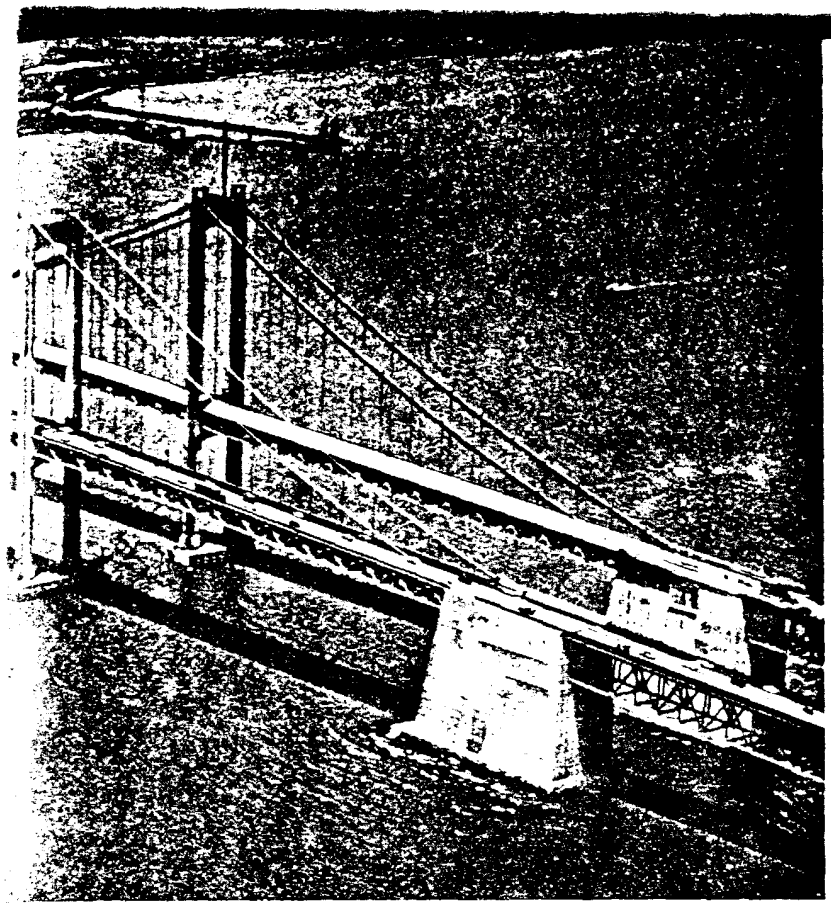
In developing the specifications for the new span, the consulting engi-

Driving piling to form the cofferdams in which the massive cable anchorages were constructed.



Amid a cluster of barge mounted cranes, the two 418-foot high towers start to take form.





s the first line of protection against corrosion for the old as well as the new structure.

OSURE ON THE DELAWARE

ieers and the office of Mr. William J. Miller, Jr., Director of the Delaware River & Bay Authority, specified lead is the first line of defense against the nroads of corrosion.

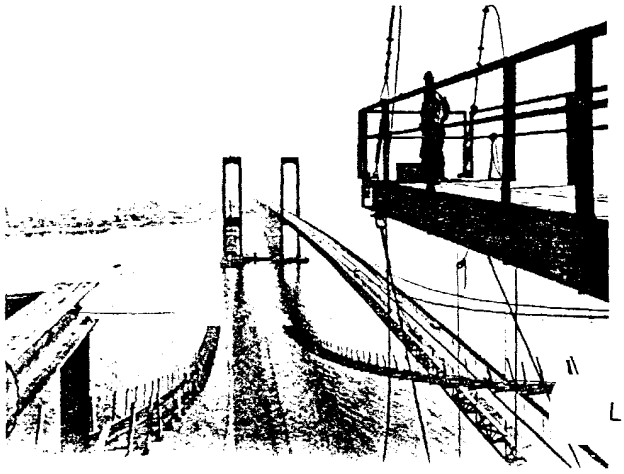
After spinning was completed, the ompacted cable was given a coat of 96% red lead in oil paste in advance of wrapping. The paste contained 100 pounds of red lead powder to 8½ pounds of linseed oil.

The joints between the wrapping and the cable bands were made water-tight by calking with lead wool. After the cable wrappings were completed, the openings between the halves of the cable bands were tightly calked with oakum saturated with red lead and then covered with a layer of lead wool, thoroughly compacted.

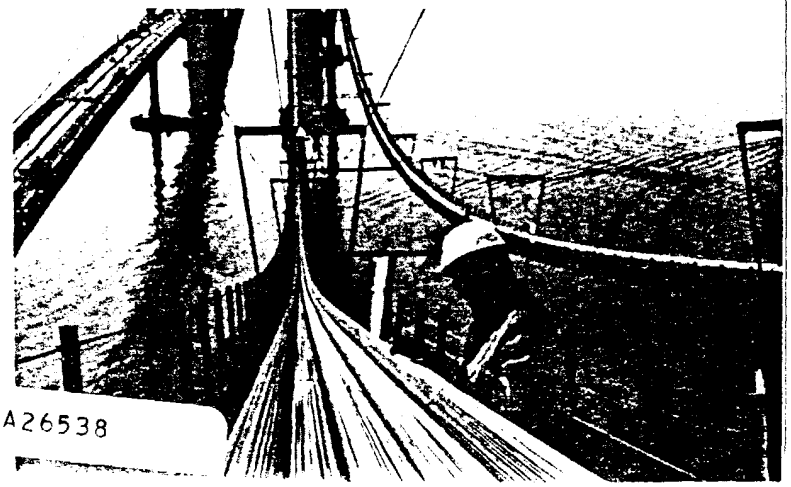
All of the superstructure was protected with a shop coat of proven red lead primer. A field applied coat containing red lead pigment was next. Two more coats of paint, one gray and the final gray-green were then applied. The system is expected to supply the same good service as has been experienced on the new bridge's twin.

With its main suspension span of 2,150 feet, the new bridge will also tie its twin as the 14th longest suspension span in the world. Clearance on both bridges is 175 feet above mean high water.

Erection of the sky-high foot walks take place as a prelude to the spinning of the main cables.

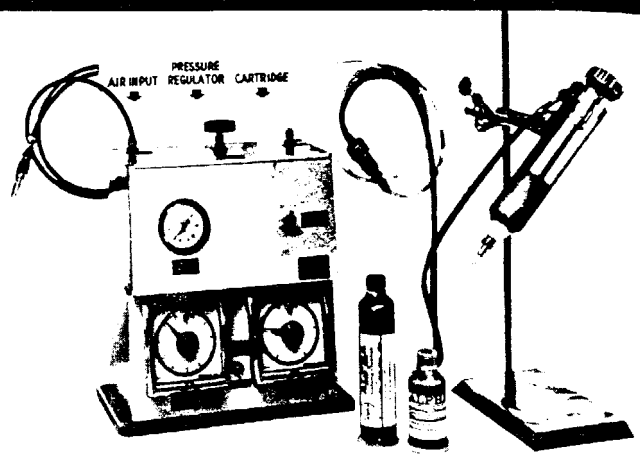


It takes 484 wires 0.196" in diameter to form a strand and 19 strands for each of the main cables that support the span.



New Tool for Metalworking Designers . . .

SOLDER AND FLUX MIXTURES



Typical paste solder applicator machine. Needle on reservoir varies in size and shape to suit solder placement needs.

Many firms are discovering that solder powder blended with fluxes and neutral suspending agents (called "paste solders") can improve quality, lower costs and boost production of assemblies. The reasons? Fluxing and solder placement are accomplished in one step: precise amounts of solder metal can be metered out by new automated dispensers: and nearly any alloy or flux can be incorporated into the paste.

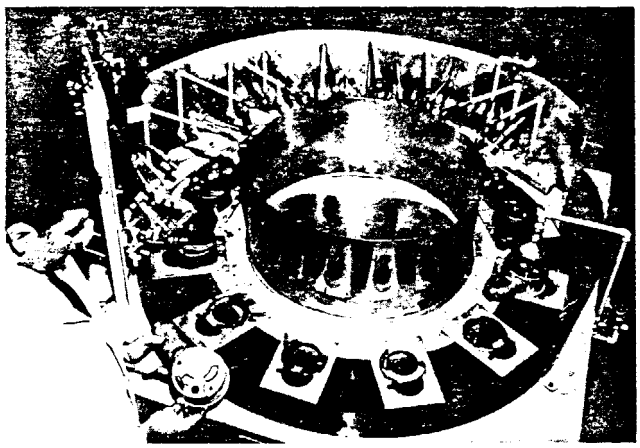
As with nearly any soldering operation, the heating method used with paste solders is more dependent upon joint configuration and properties of the materials to be joined than upon the solder alloy or flux. All forms of heating have been successfully used with paste solders. It is worth noting, however, that those methods which provide the most uniform increase in temperature to the melting point of the solder are most desired.

Naturally, in automated joining operations a method that brings heat to the joint quickly is important. Induction and focused infrared heat are two rapid and uniform heating methods. In addition to being clean, noncontact methods, both are reliable and swift, depending on the size of the solder joint and conductivity of the materials to be joined. Other good heating methods include flame, resistance, ovens, radiant heat, and, of course, the soldering iron.

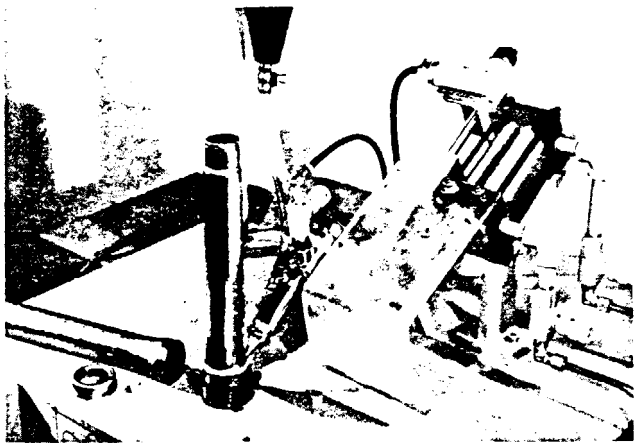
In addition to the above inherent advantages, other production advantages can be realized. Paste solders are highly advantageous in soldering vertical surfaces. Fixturing is simplified in these cases because the fixture does not have to locate the part in an unnatural position to hold alloy on the joint area. In some instances, this enables the parts to retain their self-locating nature. Prepositioning of the paste solder deposit on the assembly prior to heating is also possible with this technique.

To further the increased productivity available with paste solders, automatic paste applicating equipment has been developed. By automatically dispensing paste deposits directly to the joint area, a high degree of speed and mechanization is now available that was previously unrealized.

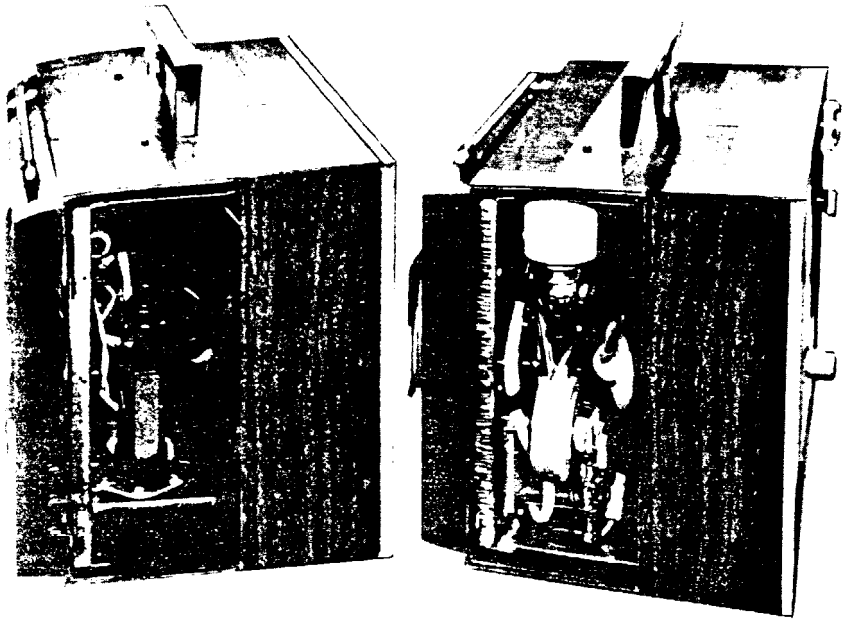
The applicator units generally consist of metering type guns with suitable control systems and paste storage tanks. The applicator guns are pneumatically operated, but mechanically controlled. Positive cut-off and positive displacement principles are followed to insure that consistent paste alloy deposits result. Automatic paste applicators can be adjusted to apply deposits in dot or stripe form with accurate repeatability automatically or can be adjusted to give an operator complete control of the placement and the deposit size.



Automotive applications for mechanized paste solder operations are many. Here oil filler tube on a power steering assembly receives paste stripe prior to soldering with a gas flame.



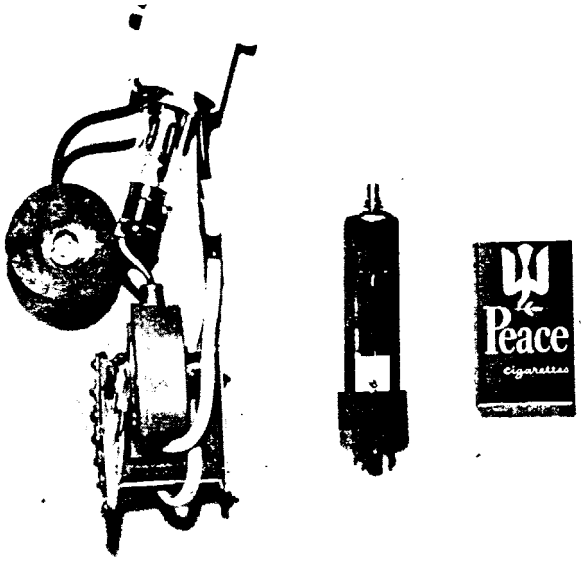
Here automatic machine places paste solder stripe around an oil filter tube assembly—and subsequently fixtures and solders the unit—all in one machine.



The 12" transistorized TV set at the left incorporates the newly-developed, winding-free piezoelectric flyback transformer while the model at the right has the conventional type.

New TV Transformer Design

The piezoelectric transformer center, is ⅕ the size and ¼ the weight of the conventional unit, left.



If you are one of those traditionalists who visualize a transformer as being made up of primary and secondary windings on an air or iron core, you will soon have to adjust to "space age" thinking. Now transformers are going "solid state." For example, wire windings are no longer necessary in a transformer that supplies high voltage for television picture tubes.

In their place is a newly developed high voltage transformer for transistor and tube applications. It utilizes leaded piezoelectric transducers. The device steps up voltage from 200V to 10.000V.

This has eliminated many thousands of turns of copper wire and the special insulation that enabled it to resist the heat and the high voltages involved.

In the new transformer, the piezoelectric element is a ternary solid solution of lead magnesium niobate, titanate and zirconate with various additives ... $PbTiO_3PbZrO_3Pb(Mg_{1/3}Nb_{2/3})O_3$. About 70% of the material by weight is PbO.

This transducer converts electrical energy to mechanical vibration and back to electrical energy of a higher voltage. When 200 volts AC is applied to the driving section of the transformer, mechanical vibrations are created. When it strikes the driven section mechanically, it creates a voltage of between 10.000 to 12.000 volts at 150uA.

The new transformer, designed by Wireless Research Laboratories, is mounted in a plug-in, 9-pin module that includes the high voltage rectifier tube. It is only ⅕ the size and ¼ the weight of conventional transformers which is extremely helpful in view of the present trend to miniaturization. Because there is no possibility of insulation failure and subsequent shorting of windings, the new transformer is expected to have a long service life. In addition to its use in television receivers, the unit has application to oscilloscopes and devices using Gieger and Muller tubes. Wireless Research Labs points out that with more than 11 million black-and-white and color television sets sold in this country in 1967 and with an equal number likely for 1968, a large potential for the device exists.

LIA26540

LEAD CABLE Contributes Reliability to . . . Ultra Modern Mass Transit

The 75-mile long BART System uses reliable lead sheathed cable for critical 12-mile portion of electrical system that required direct underground burial.

Unlike the New York City subway system that was built by interconnecting three totally unrelated lines, the designers of BART started from scratch. BART is short for Bay Area Rapid Transit District . . . San Francisco's answer to the increasing problem of traffic congestion.

A three-county subway, surface and elevated rapid transit system, it will cover some 75 miles and boast many innovations. And, being all new, the engineers and designers took advantage of technologies and materials that were non-existent when the New York subways were built. BART has spared nothing to assure absolute safety and reliability throughout the system. In line with these aims, as involving the electrical system, consulting engineers, working with BART's own staff of technical engineering experts, recommended highly reliable lead sheathed cable for that portion of the line requiring direct burial. For absolute certainty they felt that there was no better choice.

As an outstanding example of some of the departures from the design limiting parameters of older systems, BART will employ a wide gage track that measures 5'6" as compared to the standard gage of 4' 8½", giving much more room within the cars as well as assuring greater car stability. This will permit the use of light weight, 70' cars that will seat 72 passengers with greater riding stability and comfort. Plushly appointed, the cars will have wall-to-wall carpeting, wide aisles, recessed directional lighting, air conditioning and large tinted windows. Welded rails, installed in 1,400' lengths will provide a smooth, almost noiseless ride.

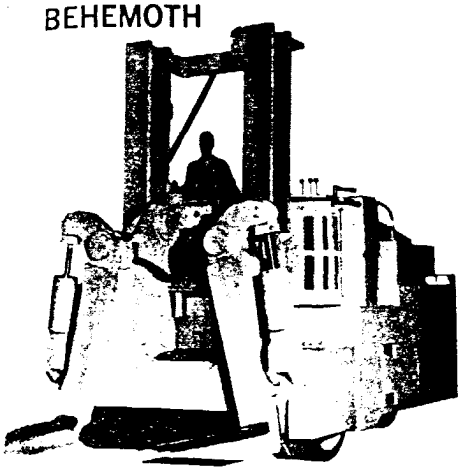
The first portion of the system to become operational will be the 20-mile section between the northern portion of Oakland and Hayward. This segment of the system is scheduled to open late in 1970. The transbay link to San Francisco will be added sometime in 1970. The entire system is being built at an estimated cost of $1.2 billion. It will connect communities in Alameda, Contra Costa and San Francisco Counties and will require about 100 contracting firms and about 7 years to complete. All-in-all, construction will demand a force of 8,000 workers.

The system's 4-mile, twin, transbay tunnel will be the longest underwater tube in the world. The subway and tunnel portions of the road will account for 19 miles of the total 75 mile distance with the balance made up of surface and elevated trackage. A total of 34 passenger stations are planned. These will be placed approximately 2 miles apart to serve the riding public. When in full operation, BART is expected to carry about 200,000 passengers a day.

LIA26541

INTERESTING ODDS AND ENDS ABOUT LEAD

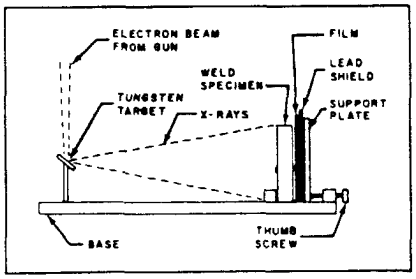
BATTERY OPERATED BEHEMOTH

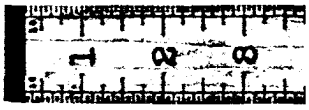


This lead-acid battery powered lift truck, according to the manufacturer Elwell-Parker Electric Company, is believed to be the largest ever built. It can handle up to 80,000-lb coils of steel with ease. The truck features a split and tilting ram that can handle one and two coils or a skid loaded with steel. The split rams can be operated together or separately. SCR pulse controls provide for maximum utilization of battery current. For all of its huge size, the unit has a remarkably short turning radius for excellent maneuverability. A "control bridge" allows for standup operation from either side of the truck, high visibility and ease of handling.

X-RAY TESTER FROM ELECTRON BEAM WELDER

A simple method for temporarily transforming a lead shielded electron beam welder into an X-ray testing device was developed by manufacturing engineers at a large aircraft plant recently. An electron beam in regular position is directed at a tungsten block that is mounted at a 45° angle. This target emits X-rays which are projected through the weld specimen to the film. By using Polaroid Type 55 P/N, positive-negative film, positive prints, obtained in 10 seconds, can be viewed immediately in a standard illuminator. This technique allows for immediate inspection of the weld.





LEAD SPRINGS ANYONE?

If you envision a lead spring as something heavy and without resiliency, you couldn't be further from the truth. The helix spring, shown here, of dispersion strengthened lead, dramatizes the material's higher levels of tensile and creep strength. It was successful in supporting twice the load of a spring made of pure lead showing remarkable recovery powers.

Another spring, at left, provides air suspension. It utilizes ceramic permanent magnets. The doughnut shaped magnets were placed on a plastic rod and stacked with like poles facing so that they repel each other to create a floating spring. Lead is used to improve the ceramic's magnetic properties.

BATTERY POWERED CAR LIFT

Here is a way to take the hard work out of changing a tire. It is done with a jack, powered by the car's lead-acid battery. It lifts the vehicle at the touch of a button. The new jack will replace any conventional jack now in everyday use.

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