ANNUAL MEETING OF THE MEMBERS OF THE
LEAD INDUSTRIES ASSOCIATION

Chicago, Illinois — May 2-3, 1961

The annual meeting of the members of the Lead Industries Association was held on Tuesday and Wednesday, May 2-3, 1961, at the Drake Hotel, Chicago, Illinois.

Members Present	Representing
Max Adler	Allied Smelting Corp.
William R. Black	American Metal Climax, Inc.
C. K. Conard	do
Vincent E. Dorman	do
A. E. Lee, Jr.	do
John J. Lennon	do
David T. Steele	do
Jean Vuillequez	do
R. D. Bradford	American Smelting & Refining Co.
K. H. Brownell	do
A. J. Phillips	do
Simon D. Strauss	do
Carl A. Underhill	American Zinc, Lead & Smelting Co.
Carl A. Underhill, Jr.	do
H. L. Young	do
Richard A. Young	do
Frank Burless	The Anaconda Co.
Roland J. Lapee	do
Herbert M. Weed	do
Frank P. Barton	The G. A. Avril Co.
Julian S. Bers	Bers & Co., Inc.
Frank Green	Broken Hill Associated Smelters Pty., Ltd.
R. J. Hopkins	do
Otto F. Bauer	(C. Tennant, Sons & Co. of N.Y., Agents)
H. W. Halton	do
John Rathjen	do
W. G. Hiscock	(Consolidated Zinc Corp. Ltd.)
A. Y. Bethune	The Bunker Hill Co.
Roger H. Cutting	do
M. E. Elmore	do
Sidney R. Gill	do
W. G. Hewitt	do
George A. Larson	do
Harold E. Lee	do
C. E. Schwab	do

I. L. Barker	Cerro Corp.
Ivor Thompson	do
H. T. Fargey	Consolidated Mining & Smelting Co. of Canada, Ltd.
E. H. Gautschi	do
R. Hendricks	do
A. E. Turnbull	do
C. B. Anderson	Delco-Remy Div., General Motors Corp.
S. F. Miller	do
C. E. Bassett	Dixie Lead Co.
D. R. Carter	The Eagle-Picher Co.
John B. Wade	do
K. W. Green	The Electric Storage Battery Co.
E. R. Anderson	Ethyl Corp.
J. A. Costello	do
Harvey D. Ferer	Aaron Ferer & Sons Co.
Richard J. Propst	do
R. A. Gardiner, Jr.	Gardiner Metal Co.
Willard F. Haas	Hammond Lead Products, Inc.
Peter Murphy	do
W. P. Wilke, III	do
George H. Eddleman	Imperial Type Metal Co.
Ralph W. Johnson	Mac Gregor Lead Co.
J. V. Murph	Murdock Lead Co.
John Jennings	National Lead Co.
Emmett A. Torney	do
William J. Welch	do
William A. Oakey	Olin Mathieson Chemical Corp.
J. J. Sharkey	do
Francis Cameron	St. Joseph Lead Co.
Robert F. Doelling	do
Charles D. Henderson	do
William F. Hoffmann	do
Charles R. Ince	do
W. T. Isbell	do
Carleton C. Long	do
Donold K. Lourie	do
J. W. Sherman	do
John G. Wehn	do
J. Iche	Societe Miniere et Metallurgique de Penarroya
John N. Palmer	(International Selling Corp., Agents)
L. A. Creglow	United States Smelting Refining and Mining Co.
Oscar A. Glaeser	do
Daniel J. Herts	do
G. Howard Le Fevre	do
C. G. Rice	do
F. C. Smyers	do
F. L. Warner	do
Howard Novasel	Victory White Metal Co.
Reuben Viener	Hyman Viener & Sons
Robert N. Quenell	Western Lead Products Co.

Represented by Proxy

Alpha Metals, Inc.	Pend Oreille Mines & Metals Co.
Hecla Mining Co.	Revere Copper and Brass, Inc.
Metaleal Products Corp.	The River Smelting & Refining Co.
Newmont Mining Corp.	Shattuck Denn Mining Corp.
	Sunshine Mining Co.

Guests

H. J. Allemang	Eureka-Williams Co.
C. H. Allen	Vitalic Battery Co., Inc.
Richard J. Bauer	Henning Bros. & Smith, Inc.
Herman Becker-Fluegel	W. R. Grace & Co.
Karl Bennung	Chemical Coatings & Engineering Co.
Philip R. Blanc	Indussa Corp.
T. E. Brown	Hercules Powder Co.
Donald A. Carroll	Donald Carroll Metals, Inc.
Dave Chapman	Dave Chapman, Inc.
B. F. Dolan	E-Z-Go Car Corp.
Bernie Durham	Mearl Corp.
J. O. Edwards	Canadian Dept. of Mines & Technical Surveys
Gordon Eubanks	Clevite Electronic Components Division
Ernst L. Frank	Philipp Bros. Ore Corp.
Arthur J. Gervais	International Minerals and Metals Corp.
R. E. Giuliani	Hydrometals, Inc.
Martin Glenday	Clinton Engines Corp.
Paul Guterman	Metal Traders, Inc.
Fred M. Hall	Cordo Chemical Corp.
Paul V. Higgins	O. S. Tyson & Co., Inc.
Webster Hodge	Battelle Memorial Institute
W. D. Hook	W. R. Grace & Co.
Frederick R. Jeffrey	National Zinc Co., Inc.
Lindsay F. Johnson	The New Jersey Zinc Co.
Lloyd F. Johnson	Illinois Zinc Co.
J. J. Kelleher	Hercules Powder Co.
T. J. La Bounty	Mearl Corp.
Paul Linz	Primary Metal & Mineral Corp.
M. McMillan	Cleveland Electric Vehicle Co.
Dick Miller	Sportsmen's Service Bureau
J. R. O'Connell, Jr.	E&MJ Metal & Mineral Markets
H. F. Osterman	Branson Instruments, Inc.
John W. Patterson	Dept. of Mines & Technical Surveys, Ottawa
A. J. Payne	Electrolytic Zinc Co. of Australasia, Ltd.
E. C. Quinn	Chrysler Corp.
Charles W. Reene	Portland Cement Association
A. A. Scharf	Philipp Bros. Ore Corp.
Maurice D. Schwartz	Pacific Smelting Co.
Dick Seligmann	Branson Instruments
A. Sepulchre	NV Kempensche Zinkmij.
Morton M. Shapiro	B. Shapiro & Co., Inc.
J. A. Singmaster	Singmaster & Breyer, Inc.
James Southworth	Union Carbide Consumer Prod.
James V. Stafford	American Metal Market
George Strong	E. I. du Pont de Nemours & Co.
R. Lewis Stubbs	Lead Development Association, London
Mortimer J. Sullivan	International Minerals and Metals Corp.

W. E. Taylor	British Embassy
James H. Thomas	"Nucleonics"
Walter S. Thomas	Cleveland Electric Vehicle Co.
Takenori Tomita	Mitsui Mining & Smelting Co.
George L. Vincent	"Ceramic Industry"
Brian Wilson	"Steel"
Clark L. Wilson	Emergency Lead-Zinc Committee
J. Zimmerman	Miles Metal Corp.

Government Representatives

Earl T. Hayes	U. S. Dept. of Interior, Bureau of Mines
W. W. Hopton	U. S. Dept. of Interior
H. G. Iverson	U. S. Dept. of Interior, Bureau of Mines
Donald E. Moulds	U. S. Dept. of Interior
James A. Rowland	U. S. Dept. of Interior, Bureau of Mines
Harold Schroeder	U. S. Dept. of Interior, Bureau of Mines
Donald Shaw	U. S. Dept. of Commerce, Bureau of Foreign Commerce

Lead Industries Association Staff

Robert L. Ziegfeld, Secretary-Treasurer
David M. Borcina
Bruce Fader
Edwin D. Martin
Jerome F. Smith
Sid W. Turner
Homer S. Yetman

Expanded Research Program--LIA-AZI

Schrade F. Radtke, Director
A. R. Cook
Samuel E. Eck
Louis Kettler

The minutes of the previous meeting of April 6-7, 1960 were circulated to members after that meeting and no changes or corrections were received.

The president welcomed the participants at the meeting and made three suggestions:

1. Everyone agrees that the lead and zinc producers should use their own products as far as possible. He wondered whether each company had done enough to make their plants aware of the need to foster this practice. This he thought was particularly important in multi-plant and product companies.

2. He urged each company with a long lived interest in zinc and lead to do more applications engineering, more product selling. He thought there was a crying need for the type of marketing practiced by competitors like aluminum and plastics and that each company should supplement the work of LIA and AZI--work is complementary to the Expanded Research Program of each association.

3. He asked for more ideas on research. He said initially plenty of ideas were available because so little had been done but that now more fresh ideas were required to continue the program. He suggested that each company might set up its own method of collecting ideas from its organization.

REPORT OF NOMINATING COMMITTEE FOR DIRECTORS

Mr. Harvey Perer, member of the Nominating Committee for Board of Directors, reported for his Committee, composed, in addition to himself, of Messrs. W. B. Clancy, Chairman, J. J. Forst, L. J. Randall and R. J. Searls, and placed in nomination the following slate:

Julian Bers	Bers & Company, Inc.
R. D. Bradford	Federated Metals Division, American Smelting and Refining Company
D. R. Carter	The Eagle-Picher Company
J. A. Costello	Ethyl Corporation
W. H. H. Cranmer	New Park Mining Company
H. L. Day	Day Mines, Inc.
Andrew Fletcher	St. Joseph Lead Company
K. W. Green	The Electric Storage Battery Company
F. H. Hurless	International Smelting & Refining Company (Anaconda Sales Company, Agents)
Harold E. Lee	The Bunker Hill Company
J. A. Martino	National Lead Company
C. G. Rice	United States Smelting Refining & Mining Company
S. D. Strauss	American Smelting & Refining Company
Jean Vuillequez	American Metal Climax, Inc.
William Wilke, III	Harmond Lead Products, Inc.

There being no further nominations, the slate was unanimously elected.

REPORT OF THE SECRETARY-TREASURER

The secretary-treasurer reported to the membership on the 1960 activities and plans for 1961, his report having been ciruclated to members on April 14, 1961. See Exhibit A.

REPORT OF THE RESEARCH DIRECTOR

The research director and his staff reported on the progress of the various research projects and others being initiated. A copy of this report is available upon request. See Exhibits B, C, D.

ADDRESSES AT MEETING

The following talks were delivered at the annual meeting:

*Lead and Zinc in a Changing World.....R. L. Stubbs, Director-General, Lead Development Assn., and Zinc Development Assn., London

*How Mass Communication Works for a Basic Industry.....Charles W. Reene, Director of Educational Services, Portland Cement Assn.

*New Patterns in World Automotive Competition.....E. C. Quinn, Vice President--Sales Divisions, Chrysler Corp.

*Storage Battery Outlook.....C. H. Allen, Vice President, Vitalic Battery Co. and President, Association of American Battery Manufacturers, Inc.

Potential of Lead in Sporting Ammunition.....Dick Miller, Consultant, Sportsmen's Service Bureau

**Markets for Lead in the Nuclear Industry, When, Where, Why and How Much..... James H. Thomas, Market Research Manager, "Nucleonics" Magazine

*Opening "New Frontiers".....D. M. Borcina, Assistant to Secretary, LIA

*Lead Zirconate-Titanate.....Gordon Eubanks, General Sales Manager, Clevite Electronics Components Div.

**Ultrasonic Cleaning.....H. F. Osterman, Vice President, Marketing, Branson Instruments, Inc.

*Small Engine Ignition with the "Spark Pump".....Martin Glenday, Manager, Special Products, Clintonetics Div., Clinton Engines Corp.

Pearl Pigments.....Bernie Durham, Sales Manager, Mearl Corp.

*Thermoelectrics and Miscellaneous.....Sid W. Turner, Metallurgical Engineer, LIA

Flexible Room Dividers...Dave Chapman, Dave Chapman, Inc., Industrial Design

**Australian Developments.....R. J. Hopkins, Manager of Research, Broken Hill Associated Smelters Pty., Ltd.

**Lead-Epoxy Materials.....Karl Bennung, President, Chemical Coatings and Engineering Co.

Leaded Vinyls.....Fred M. Hall, Sales Manager, Cordo Chemical Corp.

*The Potential for Lead as an Acoustical Material...Bruce Fader, Chem.Engr., LIA

*Battery Powered Delivery Trucks.....M. McMillan, Vice President and General Manager, Cleveland Electric Vehicle Co.

Personnel Carriers.....Beverly F. Dolan, President, E-Z-Go Car Corp.

Battery Powered Passenger Cars.....H. J. Allemang, Pres., Eureka-Williams Co., Div. of National Union Electric Co.

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* Copies now available to members interested.
** Copies expected soon from authors.

ANNOUNCEMENT OF ELECTION OF OFFICERS

The election of the following officers for the ensuing year at the meeting of the Board of Directors on May 2 was announced:

Jean Vuillequez, President and Chairman of the Board
Joseph A. Costello Vice President
Charles R. Ince Vice President
Simon D. Strauss Vice President

Secretary

RLZ:RH

ANNUAL REPORT OF THE
SECRETARY - TREASURER
FOR THE YEAR 1960

A copy of my annual report has been mailed to all members. It lists the details of publications of the Association produced in 1960, of our advertising and publicity programs, of the activities of our staff, and other projects in which the Association has been engaged. I hope all of you will find time to read it. Also, please take a few minutes to look over the displays in this room of our promotional materials and some of the new lead products that are coming along. I want to reiterate Dick Miller's invitation to any of you who are interested in shooting a little lead into the air within a few minutes of the hotel and to call your attention to the electric truck and automobile which are available for inspection and demonstration just outside. Inquire at the registration desk if you are interested in shooting or seeing the truck and car.

As a time saver I'm not going to read my detailed report here. Instead I want to discuss in a general way our approaches to the problem of increasing markets for lead. I say "approaches" in the plural because there are many. Generally speaking each different approach can be useful, but they must be coordinated and balanced, with each being fitted into its proper place. In my opinion, anyone who thinks that magazine advertising alone, or publicity alone, or exhibits alone, or direct mail alone, or technical service alone, or even research alone will do an adequate job of increasing lead markets to any major extent is deluded. Also, anyone who thinks that a major impression can be made without major expenditures is deluded.

At the core of the Association's program to develop lead markets is, of course, our personalized technical service. Our technically trained staff, enhanced this year by the addition of an architect, is well versed in the capabilities of lead in many fields. It attempts to make as many personal visits to potential important lead users as possible in the course of a year and to work with them in applying lead to their problems. It conducts a wide service by correspondence and telephone, and furnishes us with the technical information we need for our publications and advertising.

At best, however, each man can maintain relations with relatively few people in this way, say several hundred a year, and these contacts are necessarily limited to the number of men we can put in the field. This type of personal work is exceedingly effective, if you have the right men, as I believe we have, but it is also exceedingly costly. Somehow our message has to reach more people, and some means have to be used to create "hot" leads for these men.

A somewhat analogous approach permitting contacts with more people at less expense but not so selective nor under such favorable conditions is the trade show exhibit. These we use to a limited extent in certain industries. While we have found these shows useful, they must be carefully selected and exhibits carefully planned; and generally contacts thus made require further follow-up in one way or another. These exhibits are also valuable sources of names of people with some interest in lead for our mailing lists.

Next we come to the mass approaches which are dependent upon and complementary to the personal approach. Space advertising in selected fields offers an opportunity to get a brief message to a lot of people at low cost. In technical markets I do not believe that it often results in actual sales of a product, but it can be used to sell ideas, to create a favorable atmosphere for other means of contact, and to yield many valuable leads for follow-up. It can create an image for our products and let industry know that we are alive. It has the advantage of hitting selected groups repeatedly in a planned manner.

Direct mail advertising, which we also use, permits us to bring a more detailed and technical message to selected groups and is valuable by itself or as a complement to space advertising. Obtaining and maintaining good mailing lists is difficult and costly, and in this our other forms of promotion are helpful. The cost is entirely dependent on how many people we try to reach in this way and how detailed a message we wish to convey.

We also employ technical publicity as a market development tool. This method is low cost but cannot be planned as methodically as advertising and often cannot go into the detail of direct mail. It is, however, useful, and reprints are valuable aids in support of our other approaches.

This brings us to research, of which you will hear much more from the next speakers from our Expanded Research Program. There is no question of the need for extensive research in our complex and ever-changing economy, and our industry is to be complimented on its recognition of this fact. Now research is of two kinds, that done by our own industry with the laudably selfish purpose of finding new markets for our products and that done by other industries to solve their own problems or develop new products of their own.

The promotional approaches we are using tie in with both of these. In the first instance, nobody today beats a path to your door even if you do have the best mousetrap in the world. You have to tell the world, or at least industries that should be interested what you have that will help them. In the second instance, broad dissemination of technical knowledge about lead will encourage others to try it in their own efforts to solve their problems and tell them how to use it most effectively.

Now all of these methods have been used by LIA for many years in varying degrees. I think our industry is to be congratulated in that today we are making the broadest effort in our history. Our magazine "Lead" first saw the light of day in 1931, the same year in which we published the book "Useful Information about Lead," which was modernized and expanded in 1952 as "Lead in Modern Industry." A lot of other literature and

advertising has appeared in the intervening years. For example, our Red Lead Technical Committee was established in 1943, followed by its comprehensive test program on paint formulations and publication of Red Lead Technical Letters.

The need for carefully planned research was recognized in 1954 with authorization to form the Technical Steering Committee, which was done the following year. On the heels of this came the Cable Sheathing Task Group, also in 1955, which planned the research on continuous extrusion of lead cable sheathing and conducted negotiations for a joint project with the John Robertson Company for a program which culminated in an agreement with that company to build an experimental press. This was done in 1957, and actual testing, started in the spring of 1958, was successfully concluded soon thereafter.

There also followed in 1955 the formation of the Ceramics Technical Committee. This resulted in publication of "Lead in the Ceramic Industries" in 1956 and a program of graduate research fellowships in 1957. Also in 1957 Battelle Memorial Institute was engaged to make a systematic study of our industry's research needs and their report was received later in the same year. Likewise late in 1957 the architectural-engineering firm of Skidmore, Owings & Merrill was commissioned to study possible expansion of lead's construction applications. The report, made in 1958, came up with preliminary information on lead for noise control developed by Bolt Beranek and Newman and subsequently expanded to its present promising proportions.

In 1958 the Expanded Research Program was organized and research established on a much broader basis. You will hear more of that later. Concurrently the promotional efforts of the Association were also extended to a point where we now feel we have a rather nicely balanced, though still modest, promotional effort. Our industry deserves credit for its vision and strong support. Yet we still have a long way to go.

My remarks would not be complete without mentioning a problem our industry has that is not common to most other metal industries. It is the toxicity of lead. Just as important as any research and promotional effort is our knowledge of lead toxicity and our ability to tell people how to use lead safely. Adverse publicity and the fear of lead poisoning are obstacles we have to overcome just as much as any other lack of knowledge about our products. This has been an important activity of LIA for years and should continue to be, on an even larger scale.

I have presented these remarks in the hope of accomplishing several purposes. First, I think it should be on record that our industry has done and is doing a constructive job of trying to solve its own problems. There has been too much criticism and not enough recognition of progressive efforts. Second, I hope it will serve as a reminder that no market development tool can be neglected if we are to succeed in our avowed purpose to increase the use of lead, and care must always be exercised to see that all the parts fit into a balanced, smoothly running whole. Third, I feel that our greatest chance of success lies in providing technically competent people in many industries with all the knowledge we can develop

about our own materials and helping them to apply this knowledge to the development and use of their own products.

SUMMARY OF ASSOCIATION ACTIVITIES--1960

DIRECT MAIL ADVERTISING

1. "Lead." Again this magazine dealing with a variety of lead uses was circulated four times to a list of over 50,000 users and potential users of the metal, carrying a total of more than 1,200,000 individual messages about lead applications. It was "Lead's" thirtieth year of publication, and, for the start of its fourth decade of life, an entirely new and modernized cover has been designed better to reflect the modern image of lead and to conform with the magazine's modernized layout and coverage.

2. Industrial Truck Brochure. This 12-page booklet on the advantages of storage-battery-powered industrial trucks, which was prepared late in 1959, reached a total printing of nearly 100,000, including a German translation, at a cost to the Association of less than the cost of 5,000 copies. This was possible because battery companies, utilities and others purchased large quantities for their own distribution.

3. Terne Plate Roofing. A four-page flyer on the renaissance of terne plate (lead-alloy coated steel) roofing was prepared and circulated to about 16,000 architects and builders.

4. Sound Barriers. A technical report on the advantages of lead-containing sound barriers was prepared with the assistance of acoustical consultants Bolt Beranek and Newman and printed as a 12-page brochure. It was mailed to about 15,000 architects and engineers and a broad list of trade magazines. It also received a one-page review in "Progressive Architecture." As a result, more than 4,000 requests for copies and technical information have since been processed.

5. Construction Bulletins. Two previously printed "Lead Construction Bulletins" were reprinted as the original supply was exhausted. They dealt with lead shower pans and waterproofing and with lead chemical laboratory drainage systems.

6. Sweet's Catalogs. Our two four-page catalogs in Sweet's Architectural File and Sweet's Light Construction File were continued for another year. In addition, a new 12-page catalog was prepared and included in the 1961 Sweet's Design Engineering File. To answer inquiries and use at exhibits 7,000 reprints were obtained.

7. Ceramic Supplements. A new six-page supplement to "Lead in the Ceramic Industries" on leaded porcelain enamels for aluminum was issued and circulated to the 6,500 ceramists who have copies of the book. A second four-page supplement on leaded low-temperature porcelain enamels for steel was prepared and similarly distributed.

PUBLICITY AND REPRINTS

8. Anodes. A paper on nonsacrificial lead-alloy anodes for protection of steel against corrosion was reprinted from "Corrosion" magazine and reprints used in answering inquiries, distribution at trade shows, and circulation to members.

9. Lead Dome. An article prepared by LIA with the cooperation of, and signed by, the chief maintenance supervisor of the New Jersey State Prison Farm, describing 25 years of trouble-free service of the lead dome on the state prison at Rahway, New Jersey, appeared in "Heating and Air Conditioning Contractor." It was reprinted and distributed to some 15,000 architects and sheet metal contractors. It is interesting that LIA originally prepared the specifications for this dome 25 years ago.

10. Niagara Power Project. As a result of cooperation between LIA and the editors of "Materials in Design Engineering," a one-page article on the use of lead lubricating seals in this project appeared in that magazine.

11. Cooling Tower Antivibration Pads. We were instrumental in the publication in "Air Conditioning, Heating and Ventilating" of an article on these pads under the cooling tower of the skyscraper at 575 Lexington Avenue, New York, signed by one of the partners in the firm of consulting engineers for the building. Reprints were obtained and distributed to 15,000 architects and engineers. Another article on the same subject appeared in "Plant and Power Services Engineer."

12. "The Challenge of New Battery Systems." This was the title of a paper by the late C. G. Grimes, vice president--research, Electric Storage Battery Company, delivered at the annual meeting of the Association of American Battery Manufacturers. LIA reproduced it and distributed it to members.

13. Lead Welding. The chapter on this subject in the "Welding Handbook" of the American Welding Society was revised for publication in a new edition.

14. Sound and Vibration Attenuation. As a result of LIA cooperation with editors of "Steel" and "Chemical Week," an excellent article appeared in each on this general subject. Reprints of both were obtained for distribution to members and others.

15. Technical Developments. A brief Review of recent technical developments in lead was prepared and published in "Steel" magazine.

16. Battery-Powered Delivery Trucks. An article on these trucks was prepared and published in "Food Processing" magazine with a 45,000 circulation. About 5,000 reprints were obtained for further distribution.

17. Lead Shielding for Portable Reactors. An article on this subject was prepared and printed in "Materials in Design Engineering." Reprints were sent to members and our list of nuclear engineers.

18. Bearings. Through cooperation with editors of "Materials in Design Engineering" and "Design News," two articles appeared on two new types of lead bearings. Reprints were circulated to members and others interested.

19. Chemical Construction. A broad article on the use of lead for chemical construction was prepared and published in "Chemical Engineering." Reprints were circulated as a Chemical Construction Bulletin to our own mailing list of chemical engineers and chemical engineering schools.

20. "Lead--Its Alloys and Compounds." The annual article on this subject was prepared and printed in "Industrial and Engineering Chemistry." Reprints were distributed to a selected list of 1,600 people.

21. Value of Publicity. The value of space obtained in trade magazines for publicity emanating from LIA and its agency in 1960, figured at advertising space rates for the editorial space occupied by the publicity, was approximately $100,000. About two-thirds of this was attributable to feature articles covering a broad range of subjects which included, but were not confined to, nuclear shielding, roofing, storage batteries, sound and vibration control, stained glass, sheet lead, ceramics, plumbing and chemical construction.

TECHNICAL PAPERS AND LECTURES

22. Metal Dealers. A lecture on the uses of lead was delivered before the Detroit Metal Dealers Association.

23. Cable Sheathing. Technical reports of the research program on continuous extrusion of lead cable sheathing were rewritten and consolidated into a paper which was delivered by the Research Director before the fall meeting of the American Institute of Electrical Engineers. Copies were distributed to members and the power distribution industry.

24. Ceramic Research Paper. A paper based on research supported by LIA's Expanded Research Program at Pennsylvania State University appeared in the "Journal of the American Ceramic Society." It was reprinted for distribution to members and others.

25. Naval Reserve Lecture. A one-hour lecture with particular reference to new lead uses in national defense was delivered before a large group of Naval Reserve Officers in New York.

26. Lead Shower Pans. A paper on lead shower and safe pans was delivered before the annual meeting of the American Society of Sanitary Engineering.

27. Annual Review. The annual review of the lead industry was prepared and appeared in "Engineering and Mining Journal."

EXHIBITS AND MEETINGS

28. Annual Meeting. A successful annual meeting of LIA, with one session held jointly with the American Zinc Institute, was conducted in St. Louis.

29. Trade Show Exhibits. LIA had promotional exhibits at the following important trade shows:

National Home Builders Show
Design Engineering Show
National Association of Plumbing Contractors Show
Industrial Building Exposition

30. Meetings Attended. In order to maintain close contact with the varied groups in industry that may affect the use of lead, and to keep a finger on the pulse of associated industries generally, many meetings of industry groups were attended. A partial list follows:

Signal Corps Battery Conference
Association of American Battery Manufacturers
Sea Horse Institute (corrosion)
American Ceramic Society
American Mining Congress
Porcelain Enamel Institute
American Institute of Mining, Metallurgical and Petroleum Engineers
American Society for Testing Materials
National Association of Corrosion Engineers
National Association of Plumbing Contractors
National Association of Home Builders
American Institute of Electrical Engineers
American Chemical Society

31. Plumbers Apprenticeship Contest. At this week-long contest held at Purdue University, LIA provided a judge for the lead work, prizes for the three best lead workers, and lead materials to be used by the contestants. Also it supplied an instructor for the refresher course for plumbing instructors teaching lead work.

SPACE ADVERTISING

32. Advertising Schedule, 1960. Following is the advertising schedule run by LIA last year:

Publication	Pages	Circulation	Subject
Materials in Design Engineering	6	31,000	Properties and uses
Product Engineering	6	42,000	" " "
Engineering News-Record	9	81,000	Metallic lead for construction
" " "	4	81,000	Metal protective paints
Marine Engineering/Log	4	16,000	" " "
" " "	2	16,000	Lead anodes
Bulletin of American Ceramic Soc.	12	8,000	Lead in ceramics
Ceramic Industry	4	6,000	" " "
Ceramic Age	6	8,000	" " "
Brick and Clay Record	4	5,000	Lead glazes for clay products
Metal Product Manufacturing	4	15,000	Leaded porcelain enamels
" " "	2	15,000	Lead pearlescent pigments

Total circulation was over 200,000, with individual sales messages totaling nearly 2,000,000.

HEALTH AND SAFETY

33. Alleged Lead Poisoning from Drinking Water. A lawsuit against an apartment building owner in Milwaukee making this allegation was entered more than a year ago. Because of the harmful effect a decision in favor of the plaintiff would have, we have very actively aided in preparation of the defense, since the facts indicate the complaint to be without foundation. The trial has been postponed several times since last fall, and it now appears that the plaintiff is not anxious to have the case come to trial because of the strength of the defense.

34. Toxicity Research. A meeting of members and interested industrial medical men and toxicologists was held under LIA auspices to consider the need for research on lead toxicology and a proposal for such work from Harvard, as well as other possible approaches. The need for such research was generally agreed upon but it was recommended that details of approach be undertaken by a smaller group of experts.

35. Childhood Lead Poisoning. A grant of $2,000 was made to Dr. H. D. Smith of the Cincinnati Children's Hospital Research Foundation to determine lead's actual share of responsibility for mental retardation which lead poisoning in children is alleged to cause.

36. Health and Safety Bulletins. Three of these Bulletins were circulated to members during the year.

37. Air Pollution Regulations. The trend toward state and federal regulation of the general atmosphere in communities, much as factory atmospheres have been regulated in the past, has required close watch of developments in this area.

38. Lead Poisoning from Pottery. Two cases of lead poisoning from improperly fired pottery, fortunately not serious and accompanied by full recovery, led to a vast amount of unfavorable publicity and started agitation for control of the use of lead in glazes. To forestall governmental controls and avoid recurrence of such incidents, we initiated a jointly financed study of solubility tests and lead tolerances with the U. S. Potters Association under Dr. Robert A. Kehoe of the Kettering Laboratories at the University of Cincinnati Medical School.

39. Lead Poisoning in Cattle. Assistance was rendered the Southern Pacific Railroad in preparing defense of a suit for the poisoning of cattle resulting from sandblasting a lead-painted bridge.

40. ASA Committee. We have continued to serve on the American Standards Association committee dealing with hazards to children from lead-containing paints. It met several times during the year.

41. Moonshine Whiskey. LIA lodged a strong protest with the Internal Revenue Service over scare publicity issued by that organization involving the danger of lead poisoning from drinking illegal liquor. In this, at our request, we were joined by the U. S. Department of the Interior. However, publicity had already issued by the time the protests were made and received wide attention in the papers.

42. Alleged Lead Poisoning from Lead Paint. Considerable assistance has been given the Delaware River Port Authority in preparation of its defense of a suit brought by several painters who allege that they contracted lead poisoning from spray painting the Delaware River Bridge at Philadelphia with red lead paint.

43. Meetings. Among meetings attended in the interest of our health and safety work were those of the Air Pollution Control Association, Industrial Health Conference, and Industrial Hygiene Foundation. Our health and safety director was a speaker at the Industrial Health Conference, which was sponsored by five major organizations in that field.

44. Health and Safety Director. The Association suffered a great loss in the untimely and sudden death of Manfred Bowditch, health and safety director for over 12 years, at mid-year. The Board has authorized his replacement, but a suitable man has not yet been located. Meanwhile the health and safety work has been carried on by the Secretary, as best he could, with the help of Mr. Bowditch's many friends in the industrial hygiene field.

MISCELLANEOUS

45. Information Bulletins. Nine of these bulletins were circulated to members during the year.

46. New Headquarters. The Secretary is proud that he was instrumental in the location of and negotiations for the new headquarters of LIA, American Zinc Institute and the Expanded Research Program of AZI-LIA. The enlarged and improved quarters bring all three groups conveniently together on an entire air-conditioned floor laid out completely to our specifications and at a cost considerably lower (nearly $10,000 a year) than the amount previously authorized by the Board. The move was made on May 2.

47. Statistics. The Annual Statistical Review was prepared and circulated to members. Also the introduction to the lead section of the "Year Book" of the American Bureau of Metal Statistics was prepared. There has been no change in regular statistical services, although efforts were made from time to time to eliminate discrepancies in statistics emanating from various sources and to speed up statistical services.

48. Meetings. Among meetings of association members during the year, aside from the Annual Meeting and those called by ERP, were: Board of Directors (2), Industry Development Committee (2), Pigments Technical Committee (2), Ceramics Technical Committee (2), Metallic Lead Products Advisory Committee (1).

TECHNICAL SERVICE

It is impossible in a summary report of this nature to give an adequate idea of the technical services rendered by members of the staff from day to day by telephone, mail and personal visits. The following contacts are cited only to give a general idea of these activities which probably occupy more staff time than any other.

49. Soundproofing. IBM (business machines), U. S. Plywood Corp. (wall panels), New Castle Products (folding doors), Marley Co. (cooling towers), Permacel-Le Page, Inc. (adhesives), Mare Island Naval Shipyard (hull damping compounds), Dave Chapman, Inc. (movable partitions), Minnesota Mining and Manufacturing Co. (adhesives), Buffalo Forge Co. (blowers), Chemical Coatings and Engineering Corp. (leaded epoxies).

50. Metal Products. Ohio State Highway Dept. (bearing plates), U. S. Army Corps of Engineers (ICBM launching bases), Phoenix Building Products (waterproofing), New York Park Department (roofing), James W. Ruderman, consulting engineer (Pan Am Building), and many architects.

51. Paints. Pennsylvania and Michigan State Highway Departments (traffic marking paints), Crystal Essence Co. and Mearl Corp. (pearl pigments).

52. Nonsacrificial Anodes. Electro Rustproofing Co.

53. Ceramics. Barrows Porcelain Co. and Monarch Aluminum Co. (porcelain enamels), O. Hommel Co. (frits), A. O. Smith Co. (glass coatings), Minnesota Mining and Manufacturing Co. (glass beads), Branson Ultrasonics and Clevite Corp. (piezoelectrics), E. I. du Pont de Nemours & Co. (porcelain enamels), Pemco Inc. (frits).

STAFF

The entire staff is to be commended for the high degree of initiative, energy, intelligence and loyalty with which it has conducted its work during the past year. The sudden loss of our health and safety director in June was, of course, gravely felt, but we have managed to meet all urgent health problems in the interim although some of the more routine, yet important, work has undoubtedly suffered. New dictaphone equipment has enabled the clerical staff to handle an increased volume of work without increasing personnel.

At the year end certain staff changes were approved in the interest of efficiency. It was decided to replace one metallurgical engineer by an architect to provide better technical service to the construction industry. It was also decided to add one more man to work on technical publicity and general technical service work, and to discontinue advertising agency handling of publicity. Both of these changes have been made since the first of the year, but the position of health and safety director still remains open.

We feel that at the moment we have a highly efficient and capable staff.

Respectfully submitted,

Secretary

RLZ:JRH

Annual Report
for the Year 1960

The Treasurer respectfully submits the report of the audit of the accounts of the Association as of December 31, 1960 by Haskins & Sells, as follows:

* * * * * * * * *

HASKINS & SELLS
Certified Public Accountants

2 Broadway
New York 6

March 30, 1961

ACCOUNTANTS' OPINION

Lead Industries Association:

We have examined the balance sheet of Lead Industries Association as of December 31, 1960 and the related statement of income, expenses, and reserves and supplemental schedules for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and statement of income, expenses, and reserves and supplemental schedules present fairly the financial position of the Association at December 31, 1960 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

(Signed) Haskins & Sells

* * * * * * * * * *

LEAD INDUSTRIES ASSOCIATION

BALANCE SHEET, DECEMBER 31, 1960

A S S E T S

CASH:		
Operating funds (including savings bank deposits, $115,859.38)	$382,311.80	
Employees Pension Plan Fund (savings bank deposits)	137,935.27	
Total cash		$520,246.87
ACCOUNTS RECEIVABLE		200.50
ADVANCES FOR TRAVEL EXPENSES		1,875.00
AIR TRAVEL DEPOSIT		425.00
TOTAL		$522,747.17

LIABILITIES AND RESERVES

ACCOUNTS PAYABLE		$ 11,805.81
RESERVES:		
Ordinary Fund	$ 56,074.98	
Health and Safety Fund	25,819.50	
Industry Development Fund	72,489.58	
Expanded Research Program	218,622.07	
Employees Pension Plan Fund	137,935.27	
Total reserves		510,941.36
TOTAL		$522,747.17

NOTES:

(1) Expenditures for furniture, fixtures and equipment are not capitalized, but are charged to expense at the time of purchase.

(2) The amount of the employees pension plan fund reserve is based on an actuarial computation and covers both past service and current service costs.

LEAD INDUSTRIES ASSOCIATION

STATEMENT OF INCOME, EXPENSES, AND RESERVES
FOR THE YEAR ENDED DECEMBER 31, 1960

	TOTAL	ORDINARY FUND	HEALTH AND SAFETY FUND	INDUSTRY DEVELOPMENT FUND	EXPANDED RESEARCH PROGRAM	EMPLOYEES PENSION PLAN FUND
INCOME:						
Membership assessments	$737,001.00	$103,959.00		$268,004.00	$365,038.00	
Transfers between funds		(25,750.00)	$25,750.00			
Interest on savings bank deposits	9,010.25	933.49	619.18	709.17	1,772.94	$ 4,975.47
Miscellaneous (including sales of publications)	1,555.83	447.36	164.00	944.47		
Total Income	747,567.08	79,589.85	26,533.18	269,657.64	366,810.94	4,975.47
EXPENSES:						
Salaries and payroll taxes	157,600.70	28,350.78	10,754.27	83,498.49	34,997.16	
Rent and light	17,955.28	10,019.60		5,000.00	2,935.68	
Office supplies and services	6,349.53	2,222.88	249.54		3,878.11	
Travel	30,771.69	5,221.58	1,173.39	13,331.51	11,045.21	
Association dues	961.13	52.00	223.50	$57.50	148.13	
Entertainment and luncheons	3,666.10	1,405.07	130.59	2,130.44		
Meetings (net of fees, $1,970.00)	3,107.48	1,940.19	102.21	875.92	109.16	
Telephone and telegraph	4,968.69	2,373.86	244.72	670.51	1,679.60	
Books and subscriptions	1,213.38	243.90	833.79	353.52	242.17	
Group life insurance	1,131.65	1,056.60			75.25	
Printing	809.47	809.47				
Mailing	3,085.16	1,509.75	133.92	1,606.66	835.83	
Test Program	1,000.00			1,000.00		
Legal, accounting, and consultation fees	5,760.27		761.00	2,223.00	2,776.27	
Pension plan costs	1,075.00	10,154.71			1,075.00	(10,154.71)
Conventions and exhibits	20,669.11			20,669.11		
Furniture and fixtures	4,433.13	2,628.04			1,805.09	
Moving and new space expenses	4,887.47	3,071.82			815.65	
Miscellaneous	8,420.97	3,197.36	3,222.99	1,471.72	528.90	
Cost of publications, net (see Schedule A)	54,101.75			54,101.75		
Advertising and publicity (see Schedule B)	53,108.63			53,108.63		
Research projects (see Schedule C)	178,171.28				178,171.28	
Expenses - net	563,667.07	74,657.61	17,868.92	240,597.76	241,077.49	(10,154.71)
EXCESS OF INCOME OVER EXPENSES FOR THE YEAR	183,700.01	4,732.24	9,044.26	29,059.88	125,733.45	15,130.18
RESERVES, JANUARY 1, 1960	327,241.35	51,342.70	16,775.24	83,829.70	92,988.62	122,805.09
RESERVES, DECEMBER 31, 1960	$510,941.36	$ 56,074.94	$25,819.50	$ 72,889.58	$218,622.07	$137,935.27

( ) Denotes red figure.

NOTE: Administrative expenses in the Expanded Research Program are paid, for the most part, to American Zinc Institute, which handles the accounting for the program.

LEAD INDUSTRIES ASSOCIATION

SUPPLEMENTAL SCHEDULES FOR THE YEAR ENDED DECEMBER 31, 1960

SCHEDULE A

COST OF PUBLICATIONS, NET

"Lead"	$ 20,611.77
Architectural Flyers and Construction Bulletins	2,435.92
Reprints	1,970.63
Ceramic supplements	8,000.00
Pigment Technical Letters	3,000.00
Sweet's Catalogs	6,928.65
Sweet's Design Catalog	5,655.39
Battery Brochure	134.41
Sheathing Flyers	585.39
"Lead Work for Modern Plumbing"	4,351.36
"Sound Attenuating Characteristics of Lead"	4,432.23
TOTAL	$ 58,101.75

SCHEDULE B

ADVERTISING AND PUBLICITY

Advertising space:	
Product Design	$ 9,540.96
Construction	7,765.00
Pigments	7,480.62
Ceramics	9,017.44
Anodes	2,880.18
Total	36,665.20
Advertising production	7,736.87
Publicity	8,087.79
Apprentice contest	618.77
TOTAL	$ 53,108.63

SCHEDULE C

RESEARCH PROJECTS

Powder metallurgy - Rensselaer	$ 13,522.92
Lead coated steel - National Research	2,003.00
Reinforced lead - Armour	14,461.81
Vibration attenuation - Lessells & Associates	26,363.77
Sound attenuation - Goodfriend, etc.	2,461.13
Lead alloys - Armour	28,769.21
Lead Chemicals - A. D. Little	30,276.30
Heat emissivity - New York University	6,000.00
Ceramics	28,240.00
Lead organic compounds - Organisch	5,813.77
Pigments for water soluble vehicles - Eagle-Picher	15,628.19
Surface characteristics of lead - University of Melbourne	4,000.00
Miscellaneous research	634.18
TOTAL	$178,171.28

April 1961

MEMBERS OF THE LEAD INDUSTRIES ASSOCIATION

Allied Smelting Corp.	5116 W. Lincoln Ave.	Milwaukee 14, Wis.
Alpha Metals, Inc.	Box 34, Bergen Station	Jersey City 4, N.J.
American Metal Climax, Inc.	1270 Ave. of the Americas	New York 20, N.Y.
American Smelting & Refining Co.	120 Broadway	New York 5, N.Y.
American Zinc, Lead & Smelting Co.	Paul Brown Bldg.	St. Louis 1, Mo.
The Anaconda Co.	25 Broadway	New York 4, N.Y.
The O. A. Avril Co., Lead Products Div.	Langdon Farm Rd. & Seymour Ave.	Cincinnati 12, Ohio
Bers & Co., Inc.	Ashland & Lewis Sts.	Philadelphia 24, Pa.
*Broken Hill Associated Smelters Proprietary Ltd.	Collins House, Box 1291 K	Melbourne C1, Aust.
*Broken Hill South, Ltd.	Box 194 C, GPO	Melbourne, Australia
The Bunker Hill Co.	660 Market St.	San Francisco 4, Cal.
Cambridge Smelting Co.	100 Pacific St.	Cambridge, Mass.
Cerro Sales Corp.	300 Park Ave.	New York 22, N.Y.
Circle Wire & Cable Co.	5500 Maspeth Ave.	Maspeth, L.I., N.Y.
*The Consolidated Mining and Smelting Co. of Canada, Ltd.	Box 1030 Place d'Armes	Montreal 1, Canada
Consolidated Smelting Corp.	4700 E. Nevada	Detroit 34, Mich.
Day Mines, Inc.		Wallace, Idaho
Delco-Remy Div., General Motors Corp.	2401 Columbus Ave.	Anderson, Ind.
Dickson Weatherproof Nail Co.	Box 590	Evanston 4, Ill.
Dixie Lead Co.	Box 6625	Dallas, Texas
The Eagle-Picher Co.	American Bldg.	Cincinnati 1, Ohio
The Electric Storage Battery Co.	Box 8109	Philadelphia 1, Pa.
Ethyl Corp.	100 Park Ave.	New York 17, N.Y.
Evans Lead Div., National Lead Co.	Box 1467	Charleston 25, W.Va.
Federated Metals Div., American Smelting & Refining Co.	120 Broadway	New York 5, N.Y.
Aaron Ferer and Sons Co.	101-19 S. 8th St.	Omaha 8, Neb.
*The Firestone Tire & Rubber Co.	Box F, Firestone Pk.	Akron 17, Ohio
Gardiner Metal Co.	4820 S. Campbell Ave.	Chicago 32, Ill.
Goldsmith Bros. Div. of National Lead Co.	111 N. Wabash Ave.	Chicago 2, Ill.
Hammond Lead Products, Inc.	5231 Hohman Ave.	Hammond, Ind.
Hecla Mining Co.		Wallace, Idaho
Imperial Type Metal Co.	3400 Aramingo Ave.	Philadelphia 34, Pa.
International Smelting & Refining Co. (Anaconda Sales Co., Agents)	25 Broadway	New York 4, N.Y.
Knapp Mills, Inc.	23-15 Borden Ave.	Long Is. City 1, N.Y.

*Associate Member

Lead Products Co. Inc.	Box 1341	Houston 1, Texas
Lucky Friday Silver-Lead Mines Co.		Wallace, Idaho
John R. MacGregor Lead Co.	4520 W. 15 St.	Chicago 23, Ill.
Metalead Products Corp.	2901 Park Blvd.	Palo Alto, Cal.
Murdock Lead Co.	Box 5298	Dallas 2, Texas
National Lead Co.	111 Broadway	New York 6, N.Y.
New Park Mining Co.		Keetley, Utah
Newmont Mining Corp.	300 Park Ave.	New York 22, N.Y.
*North Broken Hill, Ltd.	Box 1903R, GPO	Melbourne, Australia
Olin Mathieson Chemical Corp.		East Alton, Ill.
Pend Oreille Mines & Metals Co.	Old Natl. Bk. Bldg.	Spokane 8, Wash.
Phelps Dodge Copper Products Corp.	300 Park Ave.	New York 22, N.Y.
Price Battery Corp.		Hamburg, Pa.
Revere Copper & Brass Inc., Foil Div.	196 Diamond St.	Brooklyn 22, N.Y.
River Smelting & Refining Co.	Box 5755	Cleveland 1, Ohio
Rochester Lead Works, Inc.	390 Exchange St.	Rochester 8, N.Y.
St. Joseph Lead Co.	250 Park Ave.	New York 17, N.Y.
Shattuck Denn Mining Corp.	120 Broadway	New York 5, N. Y.
*Societe Miniere et Metallurgique de Penarroya	12 Place Vendome	Paris 1, France
Sunshine Mining Co.	West 300 Mission Ave.	Spokane 1, Wash.
United States Smelting Refining and Mining Co.	62 William St.	New York 5, N. Y.
The Victory White Metal Co.	6100 Roland Ave.	Cleveland 27, Ohio
Hyman Viener & Sons	5300 Hatcher St.	Richmond 5, Va.
Vulcan Lead Products Co.	1545 W. Pierce St.	Milwaukee 4, Wis.
Western Lead Products Co.	P.O. Box 2291	City of Industry, Cal.
*The Zinc Corp. Ltd.	Box 384 D, GPO	Melbourne, Australia

*Associate Member

HASKINS & SELLS
CERTIFIED PUBLIC ACCOUNTANTS

TWO BROADWAY
NEW YORK 4

March 30, 1961

ACCOUNTANTS' OPINION

Lead Industries Association:

We have examined the balance sheet of Lead Industries Association as of December 31, 1960 and the related statement of income, expenses, and reserves and supplemental schedules for the year then ended. Our examination was made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the accompanying balance sheet and statement of income, expenses, and reserves and supplemental schedules present fairly the financial position of the Association at December 31, 1960 and the results of its operations for the year then ended, in conformity with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Haskins & Sells

LEAD INDUSTRIES ASSOCIATION

BALANCE SHEET, DECEMBER 31, 1960

A S S E T S

CASH:		
Operating funds (including savings bank deposits, $115,853.38)	$382,311.40	
Employees Pension Plan Fund (savings bank deposits)	137,935.27	
Total cash		$520,246.67
ACCOUNTS RECEIVABLE		200.50
ADVANCES FOR TRAVEL EXPENSES		1,875.00
AIR TRAVEL DEPOSIT		425.00
TOTAL		$522,747.17

L I A B I L I T I E S
A N D R E S E R V E S

ACCOUNTS PAYABLE		$ 11,805.81
RESERVES:		
Ordinary Fund	$ 56,074.94	
Health and Safety Fund	25,819.50	
Industry Development Fund	72,489.58	
Expanded Research Program	218,622.07	
Employees Pension Plan Fund	137,935.27	
Total reserves		510,941.36
TOTAL		$522,747.17

NOTES:

(1) Expenditures for furniture, fixtures and equipment are not capitalized, but are charged to expense at the time of purchase.

(2) The amount of the employees pension plan fund reserve is based on an acturial computation and covers both past service and current service costs.

LEAD INDUSTRIES ASSOCIATION

STATEMENT OF INCOME, EXPENSES, AND RESERVES
FOR THE YEAR ENDED DECEMBER 31, 1960

	TOTAL	ORDINARY FUND	HEALTH AND SAFETY FUND	INDUSTRY DEVELOPMENT FUND	EXPANDED RESEARCH PROGRAM	EMPLOYEE PENSION PLAN FUND
INCOME:						
Membership assessments	$737,001.00	$103,959.00		$268,004.00	$365,038.00	
Transfers between funds		(25,750.00)	$25,750.00			
Interest on savings bank deposits	9,010.25	933.49	619.18	709.17	1,772.94	$ 4,975.47
Miscellaneous (including sales of publications)	1,555.83	447.36	164.00	944.47		
Total income	747,567.08	79,589.85	26,533.18	269,657.64	366,810.94	4,975.47
EXPENSES:						
Salaries and payroll taxes	157,600.70	28,350.78	10,754.27	83,498.49	34,997.16	
Rent and light	17,955.28	10,019.60		5,000.00	2,935.68	
Office supplies and services	6,349.53	2,222.88	248.54		3,878.11	
Travel	30,731.69	5,221.58	1,173.39	13,331.51	11,005.21	
Association dues	961.13	52.00	203.50	557.50	148.13	
Entertainment and luncheons	3,666.10	1,405.07	130.59	2,130.44		
Meetings (net of fees, $1,970.00)	3,107.48	1,940.19	182.21	876.92	108.16	
Telephone and telegraph	4,968.69	2,373.86	244.72	670.51	1,679.60	
Books and subscriptions	1,273.38	243.90	433.79	353.52	242.17	
Group life insurance	1,131.85	1,056.60			75.25	
Printing	409.47	409.47				
Mailing	4,084.16	1,509.75	133.92	1,604.66	835.83	
Test program	1,000.00			1,000.00		
Legal, accounting, and consultation fees	5,760.27		761.00	2,223.00	2,776.27	
Pension plan costs	1,075.00	10,154.71			1,075.00	(10,154.71)
Conventions and exhibits	20,669.11			20,669.11		
Furniture and fixtures	4,433.13	2,628.04			1,805.09	
Moving and new space expenses	4,887.47	4,071.82			815.65	
Miscellaneous	8,420.97	3,197.36	3,222.99	1,471.72	528.90	
Cost of publications, net (see Schedule A)	54,101.75			54,101.75		
Advertising and publicity (see Schedule B)	53,108.63			53,108.63		
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Expenses - net	563,867.07	74,857.61	17,488.92	240,597.76	241,077.49	(10,154.71)
EXCESS OF INCOME OVER EXPENSES FOR THE YEAR	183,700.01	4,732.24	9,044.26	29,059.88	125,733.45	15,130.18
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RESERVES, DECEMBER 31, 1960	$510,941.36	$ 56,074.94	$25,819.50	$ 72,489.58	$218,622.07	$137,935.27

( ) Denotes red figure.

NOTE: Administrative expenses in the Expanded Research Program are paid, for the most part to American Zinc Institute, which handles the accounting for the program.

LEAD INDUSTRIES ASSOCIATION

SUPPLEMENTAL SCHEDULES FOR THE YEAR ENDED DECEMBER 31, 1960

SCHEDULE A

COST OF PUBLICATIONS, NET

"Lead"	$ 20,611.77
Architectural Flyers and Construction Bulletins	2,435.92
Reprints	1,970.63
Ceramic supplements	4,000.00
Pigment Technical Letters	3,000.00
Sweet's Catalogs	6,924.65
Sweet's Design Catalog	5,655.39
Battery Brochure	134.41
Sheathing Flyers	585.39
"Lead Work for Modern Plumbing"	4,351.36
"Sound Attenuating Characteristics of Lead"	4,432.23
TOTAL	$ 54,101.75

SCHEDULE B

ADVERTISING AND PUBLICITY

Advertising space:	
Product design	$ 9,540.96
Construction	7,746.00
Pigments	7,480.62
Ceramics	9,017.44
Anodes	2,880.18
Total	36,665.20
Advertising production	7,736.87
Publicity	8,087.79
Apprentice contest	618.77
TOTAL	$ 53,108.63

SCHEDULE C

RESEARCH PROJECTS

Powder metallurgy - Rensselaer	$ 13,522.92
Lead coated steel - National Research	2,000.00
Reinforced lead - Armour	14,461.81
Vibration attenuation - Lessells & Associates	26,363.77
Sound attenuation - Goodfriend, etc	2,461.13
Lead alloys - Armour	28,769.21
Lead Chemicals - A. D. Little	30,276.30
Heat emissivity - New York University	6,000.00
Ceramics	28,240.00
Lead organic compounds - Organisch	5,813.77
Pigments for water soluble vehicles - Eagle-Picher	15,628.19
Surface characteristics of lead - University of Melbourne.	4,000.00
Miscellaneous research	634.18
TOTAL	$178,171.28

Exhibit B
May 2-3, 1961

FOR RELEASE NOT EARLIER THAN
4:00 P.M., Tuesday, May 2, 1961

EXPANDED RESEARCH PROGRAM REPORT

By Dr. Schrade F. Radtke
Director of Research
Expanded Research Program - Lead Industries Association

Our program has now moved into its third year. I think we should take stock of our position, review the progress of our research and take a look at what we have accomplished. The industry has achieved surprising success in this brief span of time and the program has grown larger with each year. It is befitting, therefore, that in spite of its glamor, we do not overlook the most important factors in our research, and that we remember the solid foundation on which our program has been built, and the combined support the industry has put behind this effort.

It would be easy to take pride in the ever growing dollars in our budget - but dollars alone don't produce anything. Money is inanimate and accomplishes nothing in itself. Machines merely repeat what man tells them to produce. Only people have the ability to make significant advances. Dollars provide people with the time to devote to this program and machines and equipment provide the tools needed for investigating new uses for our metals.

Behind the research report, to be presented today are long hours of imagineering, planning and programming which is done by our industries' technical people in our working technical committees. These steps are followed by screening of research proposals, selection of contractors,

(Presented at 33rd Annual Meeting
Lead Industries Association
Chicago, Illinois, May 2, 1961

award of research contracts and the follow-up to make certain that our research needs are met. All this requires highly competent technical manpower, dollars for expenses to travel to meetings and to confer with contractors and finally, it demands time away from assigned company responsibilities to see that this industry-wide program of research meets with success.

The technical data are then passed on to the sales and marketing people of the many companies in our industry, who in turn make studies as to how this information can most effectively be used to further their business and to increase the sale of lead and zinc. In like manner, the information is put in the hands of the Lead Industries Association and the American Zinc Institute to permit promotion of the perfected developments.

Returning again to the technical committees and to the technical personnel of the member companies, here is where the vital cooperative effort is made: the pooling of industry information, the assistance to the Expanded Research Program, to our research contractors, and to each other. These are the people who make the industry stand together to insure the technological progress of lead and zinc. Without this industry backing, without the solid support of its people, we in the Expanded Research Program could not accomplish our goals effectively.

While I have talked about the committee function in this program, it is only one facet of the total effort put in by the industry people. At the risk of becoming tiresome I will briefly outline several case histories showing what the companies have done to advance our program. These cases do not appear in any of our budgets and have not been reported previously.

In our program for development of improved techniques for sheathing cable we had outstanding cooperation from the John F. Robertson Company who designed the equipment, installed it and participated in paying for the operating costs to improve the machine. The American Smelting and Refining Company and the Anaconda Company provided the materials used in improving the machine. We had representatives of the cable sheathing companies who offered their technical advice and suggestions. Of very great significance was the outstanding work done by representatives of the Anaconda Company in carrying out the physical testing and metallographic examination of the products produced on the equipment. The Lead Industries Association contributed by working with us in the final write-up of the technical paper covering this development.

In our study of lead-base alloys at Armour Research Foundation, the American Smelting and Refining Company and St. Joseph Lead made available to our contractors background information on lead alloy development to assist them in their work. Consolidated Mining and Smelting Company as well as American Smelting and Refining Company provided extremely high purity materials which were used as the base stock for the alloy study. To reduce the high cost of analyzing lead alloys and the difficulties in carrying out such analyses, we had outstanding cooperation from American Smelting and Refining Company, St. Joseph Lead, Eagle-Picher, COMINCO and Cerro de Pasco who provided the analytical data for the wide series of alloys which was prepared. Other member companies furnished information on metallographic techniques and offered help to facilitate progress of the program.

In our investigation of the behavior of lead asbestos pads we had outstanding cooperation from New York Central who provided background information on the use of these pads as well as from the Abernathy Company

which made all the test samples employed in our investigation.

In our examination of new techniques for producing high strength lead alloys the American Smelting and Refining Company conducted the first evaluation of test materials which proved the feasibility of this approach for producing new high strength creep resistant alloys. Subsequently special lots of materials and alloys were presented to the contractor by American Metal Climax and Consolidated Mining and Smelting Company. In addition, Anaconda and American Smelting and Refining Company lent assistance in proper metallographic techniques, as we were now working in new areas where existing techniques were no longer effective.

In lead for sound attenuation we have had excellent help from Cordo Chemical, Bar Ray, various naval research laboratories, Dave Chapman, Inc., Mohasco Industries, Curlator Corporation, American Viscose, United States Plywood, United States Gypsum, Broken Hill Associated Smelters, St. Joseph Lead, American Smelting and Refining and COMINCO. Each of these organizations contributed sample lots of materials or provided us with information for our study and evaluation. The U. S. Navy, which is conducting a related program, provided us with the results of work they have done in this area.

One of the major objectives of this program is that we are able to produce cheap lead sheet at minimum cost in large tonnage quantities. Initially Consolidated Mining & Smelting Company developed a continuous casting process for producing starting sheets. Broken Hill Associated Smelters took up this idea and expanded it into a commercially feasible piece of equipment which has been designed, built and operated in their South Melbourne laboratories. Because of the inherent simplicity of this technique and its adaptability to many of the needs in our program,

Broken Hill Associated Smelters prepared an outstanding movie on this device which will be shown to you on Wednesday morning May 3 at 9:00 o'clock at the opening session. This device will be ultimately of tremendous importance to us in our sound attenuation program. In addition, these two companies have developed manufacturing cost data and have experimented with various alloys which can be cast and have made this information freely available to the industry. In addition, Broken Hill Associated Smelters have studied methods for adhesive bonding of lead sheet which have also been made available for future incorporation in this program. Interestingly enough two of our member companies are constructing new office facilities and are using lead at this early date in the construction of their building to permit practical application of the developments in this research effort.

In our study of new methods for producing lead coated steel stock we have had the wonderful cooperation of the American Can Company which has worked closely with us in establishing specifications and in testing the final product from the standpoint of bonding, corrosion, formability and adherence. The steel samples for this program are also supplied to us by the American Can Company so that we will have material of uniform quality for evaluation. We are studying the effects of surface conditions on the chemical and mechanical behavior of lead. Broken Hill Associated Smelters are assisting markedly in this program and are providing the high purity materials from COMINCO as the base stock for our testing. In addition, they are spending considerable time with the contractor for this research to assist us, because of the long distance involved between our headquarters and the source for the research.

On our very important program for the development of new lead organic compounds and new applications we have had vital help from our associated

companies: The Ethyl Corporation, National Lead, Associated Ethyl in England as well as the Quartermaster Research and Engineering Command of the Quartermaster Corps located in Natick, Massachusetts. These companies and organizations have provided analytical help and information on the safe handling of these materials. Eagle-Picher Company, National Lead, The Ethyl Corporation, Hammond Lead have all made significant contributions to the research which is being conducted at Eagle-Picher on lead primer pigments compatible with water reducible systems. This help has been in the form of technical consultation, sample materials and the provision of background data developed at each of these companies' own expense. We will soon award a contract to the Eagle-Picher Company for investigation of lead pigments for exterior paints. At a very reasonable cost we are obtaining tremendously valuable background and experience from the Eagle-Picher Company which ultimately will be made available to the benefit of our industry as a whole.

We have many ceramic fellowships located in the universities here and abroad. Our member companies have provided background information as well as many important sample materials for our students. We have just recently initiated a program to develop improved methods for high speed plating of lead. U. S. Smelting, Mining & Refining Company have turned over to us data which they have developed in this field for the assistance of our contractor. We are looking at problems which are encountered in lead plating tanks where electrochemical corrosion is involved. The Enthone Division of American Smelting & Refining Company, National Lead and the British Non-Ferrous Metals Research Association all have provided background data to assist us in this area.

I am sure that I have omitted other important contributions made by our member companies and by our associated companies but I have used these few examples to illustrate the really vital contributions, that are being made. When someone asks about the dollars being spent by our industry I always hesitate, because the exact dollars which appear in our Expanded Research Program do not truly reflect this tremendous industry cooperation and contribution to the over-all program. It is impossible to convert into dollars the broad experience of our industry, their background, and the preparation of sample materials, yet I hope that I have shown you just how important the industry backing is to us in our Expanded Research Program and how we could not make the progress we have made were it not for this tremendous help. Also, I have not pointed out this remarkable industry contribution simply as a pat on the back for the industry, rather do I want to show how much our industry is behind this program and how vital their solid contributions are to our progress.

One of the very important programs we have had in the past and which has continued to achieve success for the industry is the program for the development of improved techniques for sheathing electrical cables with lead. This program has been initiated originally by the Lead Industries Association in cooperation with the cable manufacturers. There have been several machines developed in the past for the continuous extrusion of lead; but, their range of capabilities was limited to chemical lead and to copper bearing lead. The machines were not able to produce the high strength lead alloys which have found such wide application for cable sheathing of electrical conductors. As I have mentioned before, the John F. Robertson Company offered to look into this program and to modify the existing design of the Hansson Robertson Machine to permit continuous

extrusion of the cable sheathing alloys. These alloys, of course, are antimonial lead, arsenical lead, tellurium bearing lead and related alloys. In 1958 progress was still slow and tedious but by the early part of 1959 success was achieved and all the alloys were produced on a pilot plant basis. Certainly not all the production problems were solved but the feasibility of extruding these alloys on the Hansson Robertson Press was conclusively established. Sample cables were sheathed and the physical properties were found to be at least equal or better than material produced on the conventional intermittent hydraulic press. Throughout this program, our member companies supplied the materials, the cable manufacturers furnished us with free consulting services and special mention must be made of the contribution of Mr. Claremont Snyder of the Anaconda Company who did all the evaluation of the physical properties of materials. When the results obtained from the new machine design promised a significant commercial potential, the information was brought together and a paper was written for presentation at the American Institute of Electrical Engineers. LIA staff contributed significantly to the preparation of the paper and without their help we would not have been able to meet the deadline for presentation of the paper. The information was disseminated in countries around the world. To describe the apparatus we prepared a short film which had been presented at our first industry meeting. This film, together with the data, has also had very wide circulation. At the beginning, the response to the equipment was lukewarm and there was some question as to the value of the development which had been accomplished. However, after the presentation of the paper and the discussions held in the various countries trade interest increased and we have recently learned that during 1960 there were 16 of these machines sold in Europe, 6 in Japan, 4 in the

United States and one in Australia. The delivery schedule of one of the suppliers of this equipment requires completion of one new continuous-extrusion press every three weeks for the entire year of 1961. Other manufacturers of this type of equipment are doing extensive research to modify their own apparatus for producing the alloys I have mentioned or similar alloys. These improvements certainly mean continued use of lead in cable sheathing, retention of our present markets and the arrest of the decline in the use of lead in cable sheathing.

This case history highlights two very important factors which deserve special emphasis. First, that once a technical advancement has been developed, it must be followed up by wide dissemination of the information to stimulate other people into considering the knowledge and making use of it. Unless this is done the benefits of research are entirely wasted. Secondly, that the published research data did not produce an immediate response, and that there was a lag in time before full use was made of the information and before procurement of the equipment was stepped up.

Thus we learn that people must be patient and time must be allowed for research results to become fully effective. We see that approximately five years have elapsed from the inception of the idea to its successful realization in terms of new sales and increased consumption of lead for cable sheathing.

In conclusion, I want to emphasize the progress which has been made possible only through full support on the part of the industry. This is not the work of one man or of a few men; it is the work of the entire industry in which technical people as well as sales people are playing an important part to insure the success of our efforts. The results cannot be achieved over night. As a matter of fact, in this particular case

which I have described, five years have transpired before the effects of an idea were realized.

I have talked about the results of only one program, and now I want to turn the program over to Mr. Eck and to Mr. Cook who will discuss our over-all program and the progress we are making. Thank you.

Exhibit C
May 2-3, 1961

FOR RELEASE NOT EARLIER THAN
4:00 P.M., Tuesday, May 2, 1961

EXPANDED RESEARCH PROGRAM REPORT
(CHEMICAL AND ELECTROCHEMICAL)

By Albert R. Cook
Research Engineer
Expanded Research Program - Lead Industries Association

Of the 28 research projects dealt with in our last quarterly report Dr. Radtke has asked me to consider for presentation to you today those dealing with the electrochemical and chemical aspects of the use of lead.

The use of lead in paints is a subject of immediate practical interest and importance and we are particularly pleased that one of our own members, the Eagle-Picher Company is carrying out research for us at their Joplin laboratories under the direction of Mr. Harold Harner. Their assignment to develop a primer paint for steel incorporating lead compounds and water soluble vehicles has already demonstrated the rust-inhibiting value of a number of lead compounds not hitherto recognized. As a result of their work so far, we have confirmed the value of a number of old favorites and have added some new ones to the list. Some examples of effective corrosion inhibitors are red lead, basic and normal lead carbonate, chromate, silicate and silicochromate and lead dioxide. Of particular interest is the discovery that reducing compounds of lead containing nitrogen show anti-corrosive properties. These would include lead nitrite, cyanate, and cyanamide. The complex ferricyanide also showed anti-corrosive properties. The next phase of this work will be to develop vehicles which are compatible with the preferred lead compounds and in this rapidly developing field we shall be choosing the best available from the industry, and we hope paint manufacturers will see their opportunity and join us in the development of vehicles suitable for our special purpose.

(Presented at 33rd Annual Meeting
Lead Industries Association
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This (No. 1) is Orville Ross at Eagle-Picher's lab applying paint in controlled film thickness with a wire wound RDS Laboratory Coating Rod. Bill Arrandale (No. 2) determining dry film thickness of paint on test panels. The instrument being used is the Magna-Gage which makes use of the magnetic properties of the basic material in its thickness determination. Mr. Marvin Long (No. 3) measuring the front impact resistance of a test paint on automotive steel by means of a Gardner Variable Impact Tester. Mr. Howard Hughes (No. 4) determining film hardness by means of the Sward Hardness Rocker. This (No. 5) is Mr. Howard Hughes inspecting test panels in the humidity cabinet. (No. 6 and 7) the salt spray cabinet. Mr. Everett Ritchie (No. 8) assessing results after the salt spray test.

These slides give you some indication of the detailed and painstaking work which is involved in our research and which is normally summarized for us in quite a few words.

We are glad to say that Eagle-Picher Company has agreed to conduct additional research for us. The new project will be the development of water-based paints for wood for exterior use and will cover those surfaces not dealt with in the present research.

It is particularly fortunate that both these programs are to be handled by the same group since much of the information developed in our present program will be applicable to the new one.

The high speed plating of lead is a project on which work has only recently been started. Our contractor is Graham, Savage & Associates and this slide (No. 9) shows Dr. A. K. Graham, President and Director of Operations. This (No. 10) is Mr. H. L. Pinkerton, our investigator and an electrochemist of long experience. The purpose of this investigation is to develop high speed plating processes which will allow lead-coated steel to compete in the non-food container market, for architectural uses and for use as a shield

against atomic radiation. The properties of electroplated coatings are different from those obtained by other methods and it is very likely that quite thin films will provide good corrosion protection. However, this is something which we must put to practical test in this investigation.

(No. 11) This is a plating cell used to determine limiting current density. It includes provision for rotating the cathode to simulate high speed plating. (No. 12) Measuring the thickness of the lead coating using a Dermitron. (No. 13) Adhesion and ductility are measured in this hydraulic press. (No. 14) Samples of lead-coated steel. The rods were plated in a small cell designed for rapid screening of additive agents for the plating bath. This again is an example of a program whose success would have early practical implications for our industry, tackling as it does problems in the large potential markets in the container and building industries.

It is not at all difficult to appeal to the imagination with projects of the type just discussed.

Here (No. 15) are some gentlemen discussing your research into lead organic compounds. They are, left to right, Dr. G. M. van der Want, subdirector of Organisch Chemisch Instituut of Utrecht, Holland, Prof. G. J. M. van der Kerk, Director, Mr. L. C. Willemsens and Mr. M. Ruiter. These gentlemen are at present evaluating the known methods for establishing chemical bonds between lead and the carbon atoms in organic chemicals. As a result of this work lead compounds are produced which are then tested to get an insight into the relation between chemical structure and the antifungal activity of lead compounds. There would be wide application for an efficient fungicide.

Dr. van der Kerk's group is particularly qualified for its work on organolead compounds on account of their widely acclaimed work with tin compounds which had important results for the tin industry. Included in the investigation will be work on the stability of these new lead compounds. To the chemi-

cal industry an interesting possibility demonstrated by the work so far is that lead compounds may be used as initiators for polymerization at high temperatures. The normal types of radical formers such as peroxides, azo compounds, etc. function at much lower temperatures and here we see the possibility that lead compounds may operate over a wide range of temperature.

This (No. 16) is Mr. Willemsens searching for a solvent for crystallization. (No. 17) Mr. Ruiter at the cracking apparatus. (No. 18) An investigation into the effect of tributyllead acetate on broad beams.

We have just asked Eltex Corporation to commence work on the development of processes for deposition of adherent lead films on metal and non-metal surfaces. By using chemical methods for laying down metal coatings on surfaces it is usually possible to obtain a very uniform and dense coating which would be expected to have good corrosion resistance. It is also clearly possible to lay down such a lead coating on complicated shapes and inaccessible parts.

The capability of coating non-metals also has interesting possibilities and we expect that if this research is successful there will be a number of interesting applications for lead in this area. Some of you may like to know that the method for reducing the ionic lead would be based on the adsorption of a metallic salt or complex which could be converted to catalytic nuclei capable of generating activated hydrogen supplied by suitable hydrogen donors. Dr. Harry Kroll will be conducting this investigation.

As a result of our committees' recommendations and with the help of Mr. Ziegfeld's staff, a survey has been carried out prior to instigating work on the electrochemical corrosion of lead in plating equipment. As a result of this investigation it now appears that there may be solutions to this problem already available. After appraisal of this survey we shall be in a position either to advise the industry how to overcome this widespread problem or we shall be able to instigate work secure in the knowledge that present practice has been thoroughly reviewed.

At the University of Melbourne we are sponsoring a fellowship program which is designed to improve our fundamental knowledge of the surface characteristics of lead. Little is known about the kinetics of adsorption and the initial stages of the reaction of oxygen on lead and this work should make an important contribution in this area. Our investigator, Mr. V. B. Tare, is working with evaporated films of lead which are first examined for thermal stability over a wide temperature range involving temperatures between -183°C. and 20°C. Electron diffraction patterns for the lead films are then examined in order to determine their crystalline structure. Electron micrographs then allow a determination of crystallite size. It may be of the order of 500 A° where an angstrom unit is one hundred millionth of a centimeter.

This work has given an insight into the effect of oxygen on the surface area of the film laid down by evaporation. The heat generated in the chemisorption of the oxygen probably causes sintering of the lead, leading to a reduction in surface area. After this initial reaction the rate of sintering is reduced due to the oxygen atoms acting as a barrier and decreasing the mobility of the surface lead atoms.

Such work as this, by throwing important new light on fundamental corrosion mechanisms can have important application over the long haul.

In addition to this project we are sponsoring a number of other research fellowships and the majority of these is being dealt with by my colleague, Mr. Eck. Forthcoming work will include further studies into organolead chemistry and the evaluation of existing lead chemicals.

I have given you a very brief indication of the following projects:

1) Lead in water dispersible paints for steel and for exterior application on wood.

2) High speed plating of lead on a program of research aimed at the canning and building industries -

3) An investigation into fundamental aspects of organolead compounds.

4) The plating of lead by chemical means to investigate the special characteristics of the electroless lead film.

5) An investigation of the corrosion of lead used for plating baths.

6) A fundamental approach to the oxidation of lead.

Our aim is to increase the effort on this area of research. Our last work at Arthur D. Little on lead chemicals pointed to some interesting areas for future study and we shall work toward the satisfactory definition of further projects in this field. Such possible applications as the use of lead in anti-fouling paints for ships and lead compounds to inhibit slime-producing organisms in jet fuel come to mind and will be carefully examined in relation to our overall program.

We are optimistic that the use of lead chemicals will be considerably increased in the future as a result of our research. Apart from the actual practical results of our program we are finding that our work provides a stimulation to other research groups in industry and in the universities to pay more attention to lead. Our industry can only profit by this all-round increase in research activity on our material.

Annual Meeting Minutes

Exhibit D
FOR RELEASE NOT EARLIER THAN May 2-3,1961
4:00 P.M., Tuesday, May 2, 1961

EXPANDED RESEARCH PROGRAM REPORT
(METALLURGICAL AND CERAMIC)

BY Samuel E. Eck
Research Engineer
Expanded Research Program - Lead Industries Association

It is a pleasure to be with you today to briefly describe the metallurgical and ceramic projects on the lead Expanded Research Program. Because of the many programs now in progress the comments on each of them will of necessity be brief and will be supplemented by slides to acquaint you with the people who are carrying out the research and the activities they are engaged in. For more complete descriptions of the individual programs there is available the latest Expanded Research Program Quarterly Report and also, there are exhibits on many research programs which we invite you to visit.

I would like to begin by describing two programs by which we are seeking improvement in mechanical properties of wrought lead products to eventually offer the lead consuming industry more self-supporting rolled and extruded shapes.

One avenue of attack consists of a continuing study of lead powder metallurgy at Rensselaer Polytechnic Institute. Through the powder metallurgy process new alloy systems and mechanisms for hardening have become available which show very promising results. The majority of the effort has been concentrated on the lead-copper alloys which, by powder metallurgy techniques higher percentages of copper can be retained in a more finely dispersed form than by conventional casting and working procedures.

We have a few slides which briefly outline how these powders are

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consolidated into wrought forms. Our first slide shows Mr. Baum, project engineer, using the microscope to determine the size and distribution of the copper particle within the lead powders. Interparticle size and spacing has pronounced effects on final properties. Prior to extrusion the powders are precompressed into small billets and extruded in the miniature tooling shown in the next slide in which a small extrusion produced by the tooling is also apparent. The consolidation of these powders into homogeneous wrought forms is achieved only by the working in precompactions and extrusions. No sintering process usually used in powder metallurgy is required.

Extrusions made in this manner have demonstrated excellent tensile, creep, and temperature stability characteristics. In the lead-5% copper alloy tensile strengths as high as 8,000 psi are achieved from as-received powders and 5,000 to 6,000 psi from oxygen reduced powders with ductility as high as 45% elongation. These strength levels coupled with the fact that the properties are retained on exposure to high temperatures are in their own right very commendable. An added benefit, however, is the fact that the creep strength of these powder extrusions is considerably in excess of those of any alloys prepared by conventional methods from cast ingot. At a creep stress of 3150 psi inverse creep rates of only 47.5% elongation per year result,--a level of performance not hitherto obtained in lead alloys.

The work on the lead-copper system as well as others will continue in view of the promising results achieved to date.

In a program at Armour Research Foundation another mechanism by which the properties of lead can be enhanced is being investigated. This involves reinforcing a lead matrix with metallic fiber components which is accomplished by infiltrating fiber structures with molten lead. Armour's work has developed techniques for successfully carrying this out and has shown that eccellent properties can be obtained from the lead-fiber composites.

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We have some slides which show the apparatus by which infiltration is carried out. The first slide depicts the aluminum mold partially filled with molten lead of the desired composition. The preformed and sintered steel fiber mat is being placed on top of the molten lead where it will float as long as the lead and steel do not mutually wet each other. The second slide shows the bell jar in place over the mold which is being filled with HCl gas which reduces the oxide coating on the steel fiber to allow wetting. As the steel surface becomes clean the fiber mat sinks into the molten lead and becomes infiltrated.

A major portion of the work has been devoted to evaluating gaseous fluxes to obtain wetting between the lead and the steel fiber mats. The most promising flux found is hydrogen chloride gas which has allowed good infiltration at temperatures as low as 750° as contrasted to 1800°F. for hydrogen.

The strength of these composites are found to be outstanding. Infiltrated fiber bodies of approximately 50% fiber density show strengths in the range of 15,000 psi and strengths as high as 26,000 psi have been obtained.

Another interesting observation is that lead will not separate from the fiber bodies once infiltrated even though the melting point of lead is far exceeded, and this may lead to important applications in bearings and solder composites.

The next slide shows how this effect may be put to use. In the center are some copper sections which have been soldered using a section of lead-fiber composite. The copper is wet only underneath the composite and lead does not flow beyond regardless of the soldering position. In addition the joint is strengthened by reinforcement from the fibers. This ability of the lead to melt yet remain in place may have important implications in bearings.

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While the fundamental program will soon be brought to a successful conclusion, we are at present considering further work on solder composites and bearings in conjunction with Armour and the Huyck Corporation who is sponsoring a major program on fiber metallurgy.

In the area of fundamental research we are conducting a comprehensive study of high purity binary and more complex lead base alloys at Armour to obtain a thorough understanding of the strengthening mechanisms by which various alloying elements enhance the properties of lead. Thorough understanding of these mechanisms we feel, will lead to alloys of improved mechanical, physical and corrosion characteristics.

In recent work the pronounced role that oxygen plays in lead alloys has been determined with regard to strengthening. Strengthening due to oxygen occurs rapidly after the solubility limit of approximately 6 ppm is exceeded and 15 ppm has been shown to increase strength by almost 300 psi.

We have a series of slides which show the process by which the high purity alloys are made in the laboratory. Our first slide shows Carl Reichel, the project engineer at Armour, removing the tarnished surface from high purity lead under an inert gas atmosphere to prevent the clean surface from reoxidizing. Only after the lead is finally cast does it come in contact with oxygen again. Our second slide details the high frequency melting furnace in which the alloys are made also under an inert gas. The high purity graphite mold is used and the melt is cast in a water cooled copper crucible that can be seen below the mold.

From this work considerable knowledge has been obtained on the potent role of oxygen in lead alloys which has always been present but not too well understood. The effect of numerous alloying additions has also been determined and now the investigation of more complex systems to study the interaction of alloying elements is being undertaken.

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We feel that this fundamental information will be of considerable value to our industry as well as to the consumers of lead products. Direct benefits are already arising from the program in the battery industry where some firms are using the fundamental information to advantage in their own research on grid alloys. The information is also being put to good use by many other contractors in the lead research program.

There are three programs in applications research for lead which I want to briefly describe.

The program to develop alternate methods for producing lead coated steel is presently moving forward in two separate directions. We have obtained lead coated steel by which the lead was applied by vacuum deposition techniques in very thin coatings for possible utilization in the container industry, and this preliminary material has been evaluated by a major container manufacturer recently. The results have shown that the vacuum metallized steel did not perform as well as conventionally produced terne coated steel from the corrosion standpoint but better from a forming standpoint. An initial economic study of producing lead coated steel by the vacuum metallization process indicates that potentially the process would be competitive to tinplate. The high cost of conventional terne has been the only limiting factor to its increased usage in that its superior corrosion resistance compared to tinplate is readily acknowledged. Because of the potential economies of the vacuum metallizing process consideration is being given to extending the study to overcome the deficiency of the preliminary material.

Only recently a program was initiated at the University of British Columbia to evaluate techniques for direct roll cladding of lead powders on steel. It is intended to study thicker coatings which may have architectural applications as well as the thinner coatings of more interest to the container industry. Cladding by this process is carried out by feeding the steel and

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particulant material simultaneously into the gap of a rolling mill, and adhesion is accomplished by the drastic working of the particulant materials as it is forced through the rolls. If technically feasible, the process has the advantages of coating only one side, applying heavier coatings than those obtained by hot dipping, and applying coatings of compositions other than tin alloys used in the hot dip process.

The majority of experimental work on our program at Lessells and Associates to obtain design criteria for the increased use of lead-asbestos pads for vibration attenuation has been completed. The intent for entering this program was to obtain additional vibration attenuation data on the pads so that greater usage will be made of them in applications other than building foundations and heavy machinery such as printing presses for which they have been used for numerous years. The technical results have shown, contrary to expectations, that the dynamic stiffness is considerably greater than anticipated and that the pads, therefore, will not be too effective in the lower vibration frequencies range. This, however, does not subtract from the efficiency of the pads at higher frequencies which are also of concern in many applications, and this combined with their long life and lower price compared to competitive materials insures their value in the vibration field.

At present we are in the process of interpreting the range of usefulness of the asbestos pads and reducing the experimental data to a form which can be used by vibration engineers in specifying their installation.

The high-spot investigation performed by Bolt Beranek & Newman on the uses of lead for sound attenuation in architecture demonstrated the potential of lead in this area. We have entered into a major research program with Lewis S. Goodfriend & Associates, acoustical consultants, to develop methods and materials for increasing the use of lead and lead products in architecture for the purpose of sound control.

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In the initial phase of this program, analyses are being made of composites of lead and other architectural materials in various constructions to determine the most feasible methods of incorporating lead.

Many lead and leaded materials are being considered for possible utilization including lead sheet, lead-plastic composites, leaded fabrics, and leaded damping materials. These are being considered in composite constructions with gypsum board, plywood, fiber board, steel, aluminum, cement-asbestos board, and other construction materials. In making analyses many factors must be taken into consideration such as the mass and stiffness of the individual materials and the composite, resonances, flextural wave characteristics and their effect on transmission loss in the mass law range and plateau area. These analyses are basically a screening mechanism by which final choice of structures to be evaluated will be delineated.

These preliminary studies have shown that the mass and limpness of lead result in outstanding improvements when laminated to conventional construction materials and in many cases yield the added transmission loss necessary to increase the performance of a wall system to elevate it from an inferior to a superior acoustical partition. The addition of equal thickness of lead to aluminum, for instance, vastly increases transmission loss performance, and this composite will receive further consideration for enclosures of high sound level machinery and office equipment. Combinations of lead and cement-asbestos board or fiber board also show promise for use in partition systems. From these initial evaluations it is easily seen that lead has deserved much more consideration for sound control in industry and architecture than it has previously been given. It is anticipated that lead will find many new and valuable markets in this hitherto unexplored area.

Finally, I want to review the many ceramics programs now being undertaken through fellowship grants to various universities throughout the

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country. This program is very diversified, investigating the many uses of lead oxide and other compounds in such systems as glazes, vitreous enamels, glasses, and dielectric ceramics. We feel this program contributes in many ways to the development of greater usage of lead compounds in the over-all ceramics industry. It produces fundamental technological information which is useful in its own right. Through publications of the research in leading ceramics and physical magazines, it stimulates the interest of others in further study of our materials. It provides a medium by which young scientific graduates are made aware of the many benefits lead contributes to ceramics systems, and it obtains the thinking of eminent scientists who supervise the fellowship programs on our products. Many publications have arisen directly from these fellowship programs which have appeared in leading scientific journals and many more are forthcoming.

In the program at New York University the thermal and spectral emissivity of lead compounds such as lead telluride and lead selenide are being measured and studies on the effect of surface characteristics on these properties are being carried out. From this program it has been observed for the first time that absorption and emission of radiation is a bulk characteristic rather than a surface phenomena as previously understood. Lead telluride and lead selenide have shown high emission characteristics and the present program is concerned with increasing these properties by alteration of the surface.

In the program at Clemson Agricultural College studies are being made on the wettability of lead glazes on many structural clay product bodies. The interrelationships between wetting, glaze maturity, adherence, and viscosity of lead glazes have been determined, and the superiority of lead glazes with respect to these properties strikingly demonstrated.

MR. SAMUEL E. BECK

At Pennsylvania State University the ceramic system, $PbO-La_2O_3-SiO_2$, has been thoroughly studied with respect to phase relationships and physical properties. In the next slide Mr. Argyle, the fellowship recipient, is melting a glass sample in a platinum strip furnace for subsequent evaluation. The small orange spot on the white shelf near the floor is the sample being melted. Two papers from this program have been submitted to the American Ceramics Society for publication.

Three programs are in progress at the Department of Ceramics Engineering of the University of Illinois. Our first slide shows Mr. Amin determining by x-ray diffraction the crystallographic make up of the opacifying phase in his study of low temperature lead bearing enamels for steel and aluminum. Molybdenum oxide has been found to be an excellent opacifier of lead enamels, producing good opacity without altering the low firing temperature as other materials do.

Another fellowship involving the study of reduction of lead compound on firing ceramic systems is also being carried out, and our next slide shows Mr. Haertling following the reduction process by resistivity measurements. The sample contained in the small tube furnace is being subjected to a controlled atmosphere of known composition to delineate kinetics of reduction.

The third program at Illinois is oriented towards electronic uses of lead systems, and in our next slide Mr. Wilcox is making measurements of dielectric constants and dissipation factors on the lead hafnate systems. It is felt that the lead hafnate-barium hafnate and lead hafnate-strontium hafnate systems will exhibit piezoelectric properties similar to lead zirconate-titanate transducer material and these properties are being explored.

MR. SAMUEL E. ECK

At Rutgers University lead glasses which devitrify during firing are being investigated as potential dielectric materials. In the next slide Mrs. Smyth, the fellowship recipient, is studying a diffraction pattern of a devitrified lead glass with Professor Koenig, Head of the Ceramics School at Rutgers. This team has been associated with our fellowship program since its inception and developed the very low-loss lead ceramic dielectrics which are receiving the attention of the ceramics industry. They have presented and published several papers on their work.

Basic physical properties of lead glasses are being studied on the fellowship program at Alfred University. Thermal expansion measurements are being made on glasses of the PbO-K_2O-SiO_2 system to determine the interaction of the three components on expansion properties.

Our last and most recently initiated fellowship program is being carried out at Pennsylvania State University where a study is being made of the thermodynamic behavior of lead oxide and hydroxide under high temperature and pressure. In the next slide Mr. White is preparing a high pressure and temperature experiment on lead compounds. The apparatus can be used to study decomposition reactions at pressures up to 600,000 psi. Many lead oxides that have been encountered so far including the well known phase PbO_2 in rutile form, Pb_3O_4 minium form, PbO tetragonal form and PbO orthorhombic form. Three less well known phases have been prepared including PbO_2 in orthorhombic form, Pb_2O_3, and $Pb_{12}O_{19}$ which they have established as being the same as the reported alpha PbO_x, Pb_5O_8 and Pb_7O_{11}.

This concludes the discussion of the lead metallurgical and ceramic program. It has been a pleasure to discuss these programs with you and I thank you for your kind attention.

FOR RELEASE NOT EARLIER THAN
12 NOON, TUESDAY, MAY 2, 1961

LEAD AND ZINC IN A CHANGING WORLD

By R. Lewis Stubbs
Director-General
Lead Development Association
and
Zinc Development Association
London, England

Since I spoke at the Institute's meeting in Chicago two years ago, the relative positions of zinc and lead have changed dramatically. Zinc, which for nearly thirty years had been looked upon as lead's poor relation, is now the more highly priced. From November 1958 in London, and December 1959 in the U.S.A., their prices have been diverging, that of zinc having risen as lead has slowly declined.

In December 1960 the price of lead on the London Metal Exchange fell to £62 a ton, its lowest for ten years and, although world consumption reached its highest ever in 1960, the price has as yet barely recovered despite the recent announcements of cuts in production.

Zinc consumption has expanded even more and it too reached a new record level last year. The London price, which rose in October 1959 to £98 a ton, its highest for several years, has now settled back to between £80 and £90 a ton, a level which appears to satisfy most producers and consumers -- or at any rate those outside the United States.

Indeed the world situation looks different when seen from the other side of the Atlantic. In contrast to the U.S.A., consumption of both metals in Europe has been rising steadily in recent years.

When U.S. stockpiling came gradually to an end in 1958-9, total world consumption of zinc was steadily growing and, the initial excess production no longer being

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(Presented at Joint Session of
American Zinc Institute and Lead Industries Assn.,
Chicago, Illinois, May 2, 1961)

taken for stockpiling, was soon absorbed. On the other hand, total world consumption of lead was not so buoyant and much of the production which previously went to stockpiling was added to producers' stocks which began to depress the market. The U.S.A. imposed import quotas in an attempt to protect its industry from the full impact of the growing surpluses outside, but even this protection, and reduced production due to strikes, did no more than delay the arrival of the changed situation.

In view of the problems confronting the industry it was not surprising that the conferences on lead and zinc, held by the United Nations in 1958 and 1959, should have led to the establishment, in February 1960, of the International Lead and Zinc Study Group. This new organisation has a membership of 26 countries, including the Soviet bloc, and embodies all those with important producing and consuming industries. It thus provides a forum at which the world situation can be authoritatively assessed, and at which producers have been able voluntarily to reach agreement on steps aimed at correcting the imbalances between supply and demand. Its press notices contain information which I am going to use in my review of the current situation.

THE CURRENT SITUATION

Zinc

The Free World's production and consumption of zinc metal have both risen by about 100,000 metric tons* a year since 1958. After taking into account imports from the Soviet bloc and changes in stockpiles -- acquisitions by the U.S.A. and then disposals by the United Kingdom -- there has been a reasonable balance between supply and demand for most of the time. The situation is summarised in the following table:

	1,000 metric tons				
	1957	1958	1959	1960	1961 (est.)
Metal Production	2450	2250	2320	2430	2540
Net Imports from Soviet bloc	60	70	65	75	75
Stockpiling (increase -)(decrease +)	-220	-65	-25	+35	+15
Metal Supplies	2290	2255	2360	2540	2630
Metal Consumption	2250	2230	2390	2460	2580
Balance (surplus +)(deficit -)	+40	+25	-30	+80	+50

* All figures in metric tons of 2205 lbs.

Only once since the International meetings began has it been felt necessary to restrict zinc supplies. In May 1959 several producers agreed to curtail sales but the continued rise in world consumption soon allowed these restrictions to be removed. There are now signs that during the past six months, supplies were again running ahead of consumption, possibly because the recent expansion in Europe has slowed down a little and as yet there seems to be no significant recovery in the U. S. demand.

Producers' stocks in the U.S.A. are at a high level and at present still rising, but elsewhere they are low and consumption is buoyant. For this reason, although some deterioration in the zinc position was noted at the last meeting of the Study Group in Mexico City in March, no steps were taken to restrict supplies especially as most members, except perhaps the U.S.A., seemed satisfied with present price levels.

In the immediate future further rises in consumption should be sufficient to absorb the increased production both from existing plants as well as from the new units shortly to be completed in Australia and other countries. An element of uncertainty is the Congo production, about 55,000 tons of zinc and 80,000 tons of zinc in concentrates a year, which might still be vulnerable to political upheavals.

Imports from the Soviet bloc have also grown a little in recent years, but no great increases are expected in the immediate future. The Soviet countries, whose production and consumption is rising steadily, but is not dealt with in this report, are cooperating in the work of the Study Group and seem to want stability in the world market.

For zinc then the immediate outlook seems reasonably good. Any imbalances that might occur should not be too difficult to correct, providing world consumption continues to expand.

Lead

Lead presents a different picture. Its world consumption has also risen since 1958, but by only 60,000 tons a year, a slower rate of increase than for zinc. World production, however, has fluctuated and in 1960 was slightly lower than in 1957.

After taking into account imports from the Soviet bloc, which although comparatively small are rising, and acquisitions for stockpiling supplies have exceeded consumption each year since 1957, as is shown in the table. Refined antimonial lead is included in both production and consumption figures.

1000 metric tons

	1957	1958	1959	1960	1961 (est.)*
Metal Production	2360	2250	2190	2270	2200
Net imports Soviet bloc	5	10	15	30	30
Stockpiling	-135	-80	-40		-75
Metal Supplies	2230	2180	2165	2300	2155
Metal Consumption	2140	1990	2155	2210	2280
Balance	+90	+190	+10	+90	-125

* After Mexico reductions

The voluntary restrictions on commercial sales made by several producers in May 1959 were continued right up to the meeting of the Study Group in Mexico last March. However, in the absence of corresponding cuts in production, the metal withheld was added to producers' stocks, which in the U.S.A. and in other countries outside Europe have now risen to very high levels.

In Mexico the Study Group was faced with a depressed lead market, high producers' stocks and a continuing surplus of new supplies over consumption. In the circumstances some of the main producing countries agreed to reduce production below the levels they had planned for 1961. Thus in Australia, Canada, Mexico, Peru, the U.S.A., Sweden and the Common Market refined lead production is to be curtailed this year. As a result Free World supplies of new metal will be approximately 2% (50,000 tons) below estimated 1961 world consumption, and production about 70,000 tons lower than in 1960.

At Mexico City, the U. S. Government repeated the offer, previously made last September in Geneva, to barter agricultural products for surplus stocks of lead

held by producers at the end of 1960 and, if these barter deals (which are believed to involve about 75,000 tons of producers surplus 1960 stocks and about 25,000 tons of new production from concentrates accumulated previously) are satisfactorily concluded, the producers' excess stocks outside the U.S.A. should be reduced to more normal levels. These impending stockpile transactions, together with the curtailments in production, should strengthen the price of lead and help to stabilize the market, so benefiting producers both in the U.S.A. and elsewhere.

Nevertheless it is important to recognise that these voluntary curtailments by some producers would not be easy to repeat unless they were applied more widely and shared more equitably. However, now that production has been curtailed it will perhaps be slow to rise again above industry's immediate requirements.

RECENT TRENDS IN CONSUMPTION

The Study Group's assessments of the current situation have provided a basis for far-reaching decisions on levels of production, and this work will continue. However, it is not the function of the Group to develop consumption, the basis of our long term prosperity, even though its work may lead to more stable prices, so desirable for encouraging it. The long-term prosperity of lead and zinc will depend on rising consumption so let us see how they have fared during the past ten years.

Focus on 1950. Then lead and zinc were becoming scarce and soon the International Materials Conference was set up to ensure that the available supplies were distributed fairly among consumers in the Free World. Shortages persisted for several years and led to forecasts of the depletion of world resources within a few decades. During the next ten years the price of zinc was to fluctuate between £61 and £190 a ton, and that of lead between £62 and £180 a ton. These gloomy prognostications and the instability of prices no doubt spurred on our competitors and led some of our own customers to look for substitutes.

In these circumstances it is both surprising and encouraging that the use of both metals expanded at all. In fact the total world consumption of zinc grew by nearly 4% a year and by the end of 1960 was about 43% higher than in 1950; lead grew

by nearly 2-1/2% a year and by about 25% during the period. In 1950 the U.S.A. took half the Free World's zinc and lead, and Europe, which was only beginning to recover from the war, took only a third. Now the position is reversed, Europe accounting for half and the U.S.A. for only a little more than a third. Consumption in countries outside Europe and North America, especially Japan, Australia and India, is also growing and now accounts for about 15% of the world total -- twice the tonnage of 10 years ago.

Europe is still the largest and most promising market. In almost all European countries consumption of both metals is rising steadily and in 1960 record levels were achieved nearly everywhere. In ten years the total for lead has gone up from about 650,000 tons to one million tons a year -- a 50% increase -- and for zinc from about 700,000 tons to 1,100,000 tons a year -- a slightly greater increase. For both metals the sharpest rise has been in Germany, the rapid growth in France at the beginning of the period having levelled off in recent years.

Considered statistically the developments in Europe are most promising, but the patterns of consumption for both are very different from those in the U.S.A.

Uses of Lead 1959

	Cable Sheathing	Batteries	Sheet & Pipe	Tetra-ethyl	Others
Europe	30%	20%	22%	4%	24%
U.S.A.	6%	34%	5%	15%	40%

In 1959 the principal uses of lead (new and secondary) in Europe was for cable sheathing, a minor use in the U.S.A. Sheet and pipe, also minor uses in America, are more important in Europe. Perhaps the most encouraging feature of the European pattern is the much smaller consumption resulting from the use of automobiles, which accounts directly or indirectly, for half the lead used in the U.S.A. Motor car production is booming in Europe and every year sees more cars on the roads.

Uses of Zinc 1959

	Galvanizing	Brass	Sheet	Die Casting	Others
Europe	29%	28%	17%	11%	15%
U.S.A.	38%	15%	4%	40%	3%

For zinc (new and secondary) there are similar differences between European and American patterns of consumption. The biggest use in Europe is for galvanizing which takes 29% of the total compared with about 38% in the U.S.A. In Europe brass runs galvanizing very close, taking 28% compared with only 15% in the U.S.A. Sheet zinc is third -- 17% compared with a mere 4% in the U.S.A. Die casting, which is your first use, consuming 40% of the total, still only accounts for 11% in Europe although it is growing steadily.

Within this European pattern there are great variations between countries. Thus only in Belgium and France does sheet galvanizing take more zinc than jobbing galvanizing, which is highly developed in the U.K., Germany and Italy. Sheet zinc for building is more important in Belgium, France and Germany where it is the most popular building metal. The traditional uses of both metals continue to account for a significant part of consumption in Europe, and are holding their ground. The newer uses of zinc such as strip galvanizing and die casting are still to be fully exploited. The use of lead will grow as more batteries and tetraeythl are required.

Looking further ahead the political and industrial development of Asia, Africa and South America should benefit zinc and lead. Japan is an outstanding example of the growth that can be achieved; during the last ten years her annual consumption of zinc has risen from 50,000 to 190,000 tons and of lead from 27,000 to 93,000 tons. India also is now beginning to expand rapidly and there zinc has risen from 25,000 to 60,000 tons and lead from 8,000 to 25,000 tons a year. It is not too much to expect that soon other emerging countries will reach the stage when their economies will become significant consumers.

Australia also has a remarkable record of growth in zinc consumption, from 52,000 to 94,000 tons a year.

Against this promising picture let us now examine the recent trends in zinc and lead in the U.S. Bear in mind that your techniques are followed all over the world and so will influence not only European manufacturers, but perhaps even more strongly, the emerging countries who rightly want to adopt the latest ideas and whose choice will not be restricted by the need to use existing equipment.

In the U.S.A. both lead and zinc consumption are now lower than in 1950. Their decline from the peaks of five years ago has been watched with concern from abroad and it is of little comfort to zinc and lead that copper consumption is also lower.

The individual uses of lead and zinc do not seem to have changed much during the period although it is encouraging that the newer uses -- die casting and strip galvanizing -- have continued to expand. For lead the most significant change has been in cable coverings which now take only 60,000 tons a year compared with 140,000 tons a year ten years ago. Some of the smaller uses have fluctuated and several have grown.

However these variations do not account for the overall decline in consumption, nor does the lower production of automobiles and the possible saturation of the market for consumer goods, even though they have obviously played their part. During the period about which we are speaking your population grew by 26 million, nearly 15%, and your industrial production rose by over 20%. Even more significant was the doubling of your aluminium consumption and the even greater growth in the use of plastics. Both have been very vigorously promoted in North America, more so than anywhere else, and it would seem that they have made inroads into the markets previously held by the traditional metals.

THE FUTURE

Taken as a whole our survey of the last ten years contains much to encourage optimism about the future -- steadily rising consumption in Europe and the prospect of

increasing demands from other countries as standards of living improve and populations increase throughout the world. However the recent trends in the U.S.A., where consumption of zinc and lead has not grown with the rise in industrial production, and is now lower per head of population than it was a few years ago, is a warning that the future cannot be taken for granted. Nevertheless, given reasonable stability of price and larger promotional campaigns, our markets should grow.

The Study Group will no doubt continue to provide information on which production can be planned and so make our short-term problems easier to solve. Soon it is going to publish a statistical bulletin containing very prompt and comprehensive figures of production, stocks and consumption in the Free World. The Group is also going to study measures for achieving long-term stability for zinc and lead, including commodity agreements. Whether such arrangements will ever be necessary and whether they would be adopted and welcomed by industry remains to be seen. It took five years to prepare the first agreement on tin.

As well as seeking greater stability of prices -- so important to producers and consumers alike -- the producers might also give some attention to the service they give their customers. Do we consider what the customer wants, and do we provide him with a service comparable to that given by our competitors?

Before looking at promotional work I should like to say how highly we in Europe regard the Expanded Research Program which is supported by producers in the British Commonwealth as well as in the United States. We have great hopes that it will bring many benefits in the future and appreciate the way in which we are able to follow the work in detail. However the results of research can be long in coming and by their very nature are unpredictable. It would be unfortunate if our new enthusiasm for research were to allow us to overlook the many valuable properties and existing uses of zinc and lead. They could do more with publicity than they have had recently. Greater promotional efforts in the U.S.A. aimed at retaining and expanding the markets for both metals in face of the vigorous competition from new metals and materials would, I believe, help to stimulate consumption all over the world.

Now I should like to describe briefly some of the work we are doing in Europe.

The Zinc Development Association is, I think, well known to you, and through the visits of various teams sent over by the Association and its affiliated members, the Zinc Alloy Die Casters, the Zinc Pigment Development and the Hot Dip Galvanizers Associations, you will have heard much about the activities of our group. We have numerous committees dealing with technical problems and promotional work, and we publish advertisements, issue booklets, make films, give lectures and participate in exhibitions, all on a scale at least comparable with that of similar bodies in the U.S.A. The Lead Development Association is not yet so big, but it too covers much the same field and its committees and staff are actively engaged in encouraging the existing uses of lead as well as seeking new ones.

Of perhaps even greater interest are the ways in which producers and fabricators in Europe are cooperating to develop existing uses and to find new uses for zinc. The European Pressure Die Casting Committee and the European General Galvanizers Association are both known all over the world through their successful international conferences; the next conference on galvanizing will be held at Interlaken from the 4th to the 9th June 1961, and a record attendance is expected. Other European committees deal with technical matters and developments and information is also exchanged regularly on analytical techniques. Recently a new European committee -- Zinc in Architecture -- was set up to study sheet zinc in building and to coordinate the existing work to promote it. Its first bulletin, similar to those of the other European organisations, will soon be published in English, French, German and Italian.

We rate this cooperation highly and attribute to it and to the energetic work of the various European development associations, and especially those in France, Germany and Italy much of the credit for the recent expansion in zinc consumption.

There has so far been less cooperation in promoting lead, but only a few weeks ago the Directors of the European Associations met in London to prepare plans for the regular exchange of views and cooperation on much the same lines as zinc. We

are now working together on some of the promising new uses for lead such as sound attenuation and radiation shielding.

As we expand our promotional work in the U.S.A. and in Europe let us also take steps to encourage interest in lead and zinc in the newly developing countries. For many years now the British Associations have had arrangements for the wide distribution of their publications in India and Africa and we hope soon that, with the assistance of our members, we will be able to follow up this initial work by the establishment of competently staffed offices in these countries. If a chain of information offices for zinc and lead could be set up throughout South America, Asia and Africa, the benefits in the long run would be immeasurable and would amply repay the expenditure involved.

None of us in the lead and zinc industry can have any doubts about the valuable role our metals can play in a changing world. We will have only ourselves to blame if they do not fulfill our expectations and continue to expand their consumption.

# # #

HOW MASS COMMUNICATIONS WORK FOR A BASIC INDUSTRY

Charles W. Reese

Director of Educational Services
Portland Cement Association

I am pleased to have opportunity to tell you something of the work of the Portland Cement Association. We share more than a few common interests. Lead, zinc and cement were a part of early history...and yet new uses of each are abundant today. This speaks well for the integrity of these materials and for the progressive spirit of our industries.

As in the case of your own groups, our efforts on behalf of the cement industry in the United States and Canada take many forms. That part of our work which I would like to discuss, however, can be identified in one word: "Communication."

In the need for communication, I'm sure that we have deep common interest. There is nothing mysterious about communication...it is basic. It comprises the strands connecting your industries. It links the researcher, engineer, sales representative and customer. Nearly everything important to the achievement of your purposes depends on clear communication. The best research finding, the best promotion idea, the best product is worthless unless the right people know about it at the right time.

Note that I refer to clear communication. Today business people simply do not have time to ponder something vague or confusing...such as this definition of concrete (slide) which a tongue-in-cheek editor ran in a recent issue of a trade magazine.

We try for the other extreme: plain, simple, understandable information. Concrete is a mixture of cement with water, and sand, gravel or other suitable materials. It will harden to form many useful shapes.

Those of us who work day-to-day with any product have difficulty realizing how little others know about it. Also, we may not recognize the degree of difference among users. Even college seniors studying mechanical, civil or chemical engineering speak quite different languages and already are so specialized they cannot readily talk with each other. In the construction industry, we must communicate with military, highway and dam construction experts...architects, builders, contractors and public officials. The farmer, the business man, and the housewife will always talk and think differently. Each must be reached in terms he understands.

Presented at the 33rd annual meeting--Lead Industries Association
Drake Hotel, Chicago, Illinois, May 2, 1961

We endeavor, therefore, to apply a few basic rules in our communication which I'm sure are not original:

1. Never go over recipient's head
2. Use ordinary English--not mathematics, abbreviations or special terms
3. Present one or two main ideas
4. Tell story more than once

Having established some ground rules, who carries out this responsibility, and how?

Good communication today requires special skills. Communications people have long since ceased being a hybrid between a shipping clerk and a press agent. They are professionals, as much responsible for the success or failure of an organization as other professionals on the management team. It follows, then, that an organization should have sufficiently skilled people for the communications assignment.

There are, of course, many ways of reaching people. This meeting is a good example. However, an important part of our Association's promotion depends on reaching large numbers of people quickly, economically and regularly. This mass communication function is the main area of my responsibility, and I would like to tell you something of how we carry out such work. (Slide--Advertising, Public Relations, Publications, Motion Pictures.)

To communicate effectively with diverse groups through these well-traveled avenues, top-notch creative work is necessary. We try to be realistic enough to know that information must be transmitted to busy people who frequently are indifferent to our message. Thus, each advertisement, booklet or film requires careful definition of purpose. Each is a separate creative challenge.

Advertising is our most direct avenue of mass communication. It can exert considerable influence on how people think and act. It helps build a favorable climate of opinion essential for the successful promotion of concrete in major markets.

We use trade and professional magazine advertising to carry the story of concrete to architects, engineers, builders, contractors and public officials who specify materials for a large part of all paving, structural and conservation construction. Our consumer advertising appears in national magazines directed to prospective home buyers, farmers, influential business groups and the public at large. In all, about 370 national advertisements will run this year, all processed and placed through the J. Walter Thompson Company, our advertising counsel.

You might ask why we use magazines for national advertising. Basically for four reasons: (Slide--Selectivity, Flexibility, Continuity, Economy--with discussion).

Here are advertisements representative of approaches we currently are using to promote specific markets: (Slides--typical national and local ads--with discussion).

Our national advertising program is no more important than local advertising carried out by most of our 35 district offices. Last year more than 15,000 messages such as these were sponsored by PCA district offices in newspapers, farm papers, local magazines. Radio and television also were used. Local advertising is closely coordinated with our national campaigns.

Many of these ads were especially prepared for use in a particular city or state to help solve a specific business problem. In covering 49 states and 170 metropolitan areas, this represents a substantial creative assignment. The advertising agency's 12 field offices throughout the country maintain continuing contact with our districts in carrying out this program.

In view of the substantial growth of the cement industry during the past decade, it is increasingly important that the public understand and think well of our industry and product. To help achieve this, PCA public relations people employ a variety of techniques.

Public relations literature is frequently quoted and has proved one of our best methods in this field. It tells the story of the contributions of the industry in terms of engineering, research, safety and educational activities.

Our public interest motion pictures have much the same character. An exception is an annual newsreel showing interesting and outstanding uses of concrete which is widely utilized by schools, civic clubs and other community organizations. Most of our public relations films are placed with motion picture distributors. Last year more than one-half million saw these films in person and over five million viewed them on television.

Our publicity and public relations work is divorced from product advertising. However, we use institutional advertising as a public relations tool. This is a typical advertisement (slide) directed to editors, broadcasters and thought leaders.

Many young people go to work after high school. Thus they are an important part of our population to be reached. In the past two months we have distributed for high school use approximately 23,000 copies of the publication, "The Making of Cement," shown here (slide). Also, our Public Relations Bureau provides information and display materials to colleges to reach tomorrow's architects and engineers.

As another means of communication, the Public Relations Bureau prepares speeches, presentations and releases. As to releases, we avoid indiscriminate mass mailings. What is released must be legitimate "news."

Our largest single public relations activity is editorial service. Bird-in-hand clippings indicate that articles prepared in whole or in part by the bureau appeared in 479 national and regional magazines in the past year.

Additionally, the Public Relations Bureau has responsibility of coordinating its work with that of full-time public relations representatives in most of our district offices. There is constant inter-flow of information and ideas among this group. Each field representative tailors his work to the promotion needs and objectives of the district office.

In public relations as well as product advertising, services of the J. Walter Thompson Company are utilized. Usually this is for a special PR campaign when time or talent is not available internally.

Because public relations work is subtle and frequently indirect, it sometimes is able to impart knowledge or persuade a favorable opinion where direct promotion might antagonize. Public relations is also a two-way street. It can do much to increase the understanding and use of our product; it also should help interpret the wants, needs and desires of the public to the enlightenment of overall industry promotion.

A third major tool in PCA's communications program is literature. Our current index includes over 500 numbered publications. About 6,000,000 pieces of literature are distributed per year, largely through field offices. The form varies from a simple mailer to a complicated technical book. This year we expect to produce some 40 new publications, more than 30 of which will be in color.

Since World War II the engineering field has mushroomed, and our production of literature has expanded to keep pace with related needs. With increasing specialization and diversification in markets, we seem to be relying even more than heretofore on literature to help back personal promotion work. Emphasis is placed on good publication design and efficient distribution. All publication work is done internally with the exception of printing, which is purchased on a competitive bid basis.

The number of motion picture projectors in churches, schools, civic clubs and community organizations has increased from 25,000 to more than one million since World War II. This growing emphasis on visual communication represents a fourth important opportunity to tell the story of concrete through well conceived educational motion pictures.

There are about 80 titles in our catalog illustrated here (slide) which vary from general interest productions to specialized training films. As you see, we expect to release 12 new films this year. All steps in the production of these motion pictures also are accomplished internally with the exception of the final laboratory processing. This makes for efficiency and a low cost per picture which cannot be matched commercially.

Our advertising, public relations and publications activities require a great variety of still photographs for illustration. This coverage also is accomplished by our photography crews who spend a great amount of their time in the field.

In mass communications we try to present clear, positive information to audiences important to decisions favorable to concrete. We strive for

the straightforward and, if you will, simple approach. However, we look for ideas that stand us apart from the crowd. There is nothing so powerful as a useful idea conveyed to the right people at the right time.

Most basically, there is the ever-present consideration: how to do the best job at the least cost. In choosing means of communication, we ask ourselves these questions: (Slide--Purpose to be served? Audience to be reached? Message to be conveyed?).

There is no pat answer or formula. Most frequently several avenues of communication are used to accomplish our purpose. And of course we must always think in terms of a total promotion program in which all action is coordinated.

More than ever before, there is need for skillful and vigorous communication. Perhaps you will agree that the advances of the 60's hold highest promise for those industries in touch with the people.

Speech by E. C. Quinn, Vice President - Sales Divisions, Chrysler Corporation, at the combined annual meeting of the American Zinc Institute and the Lead Industries Association, Drake Hotel, Chicago, Illinois, May 2, 1961, 10:15 A. M.

NEW PATTERNS IN WORLD AUTOMOTIVE COMPETITION

I am very happy to take part in your meeting this year. The automobile industry and the zinc and lead industries have operated in close association for a long time -- to their mutual great benefit. My main purpose today is to talk about some of the challenges and opportunities that people in your industries and mine are going to encounter as we move deeper into the Sixties. But before I do that, I would like to talk about the automobile industry's immediate prospects as they appear to us in Detroit. The automobile industry being the biggest consumer of your products -- die castings and galvanized sheet, batteries and body solder -- I know that what happens from day to day in the industry is of the highest interest to you.

The most reliable indicator of current levels of activity in the automobile business is the daily rate of retail sales -- and by studying the daily rates of retail sales over a period of weeks or months we can often spot significant trends. For example, last October and November the rate of new-car retail sales was approximately 21,000 a day. In December the rate fell to 19,000 a day. And in January it fell again to 15,000 a day -- where it stayed right on through February without any further declines. In March the daily rate rose to 17,800, with a further estimated rise to 18,400 for April. The spring upturn is now well underway.

Solid evidence that the spring upturn of retail sales of new cars may be the sustained rise we've all been looking for comes from a similar examination of recent trends in the daily rate of retail sales of used cars. In October and November, used cars were selling at a rate of 26,000 a day. In December that rate fell sharply to 23,000. But instead of following the downward trend of new-car sales into January,

the daily rate of used-car sales snapped back up to 25,000 in January, 25,600 in February, and 29,000 in March. Preliminary figures indicate that used-car sales held steady in April. This evidence of recovery in used-car sales is important to us because, as you know, used-car sales normally improve in advance of new-car sales.

For a minute or two let's take a look at some of the broader trends that provide additional reasons for optimism. It is now about a year since the first indications of an economic downturn appeared, and if experience with the other postwar recessions has any validity, this should mean that improvement in general business activity is not too far away.

Defense and other types of federal and local government outlays are being increased, and inventories in many lines of business need to be rebuilt. Personal savings are at a very high level, so the money and credit are available to be used when the buyers decide to use them. It is clear that consumers have been holding back on their purchases -- especially their purchases of durable goods like automobiles. But we know they like the automobiles that the industry has brought to market this year. We know also that the older cars are being retired from use at the fastest rate on record. So the basic automotive needs are there, along with the means for filling those needs.

On the basis of these indications, we estimate that new-car sales this month and next month will be back up to the level of 19,000 to 20,000 per day -- which was the level of sales reached in the fourth quarter of 1960. If this rate of sales can be reached and sustained, U. S. retail new-car sales for 1961, including sales of about 400,000 imported cars, should come very close to 6 million units. This would mean a good volume year for the industry, even though it would be somewhat below the level of last year, when total new-car retail sales amounted to 6.6 million.

We all know that developments in the automobile industry over the last few years have had a profound effect not only on the automobile industry itself, but also on the industries associated with it. One of the most important of these developments has been the increasing popularity of the smaller cars. In the more-car-per-car market that was at its peak in the mid 1950's, it seemed clear to us in the industry that people would go on year after year demanding wider, lower, longer cars -- better equipped and with a wider range of luxury options.

The automobile market, however, has been changing, and one way to measure the degree of change is to compare the popular-priced 4-door sedans of 1958 with those of 1961, including the compact sedans. In 1958 the average length of these volume cars was 207 inches. In 1961 it is 202 inches -- or five inches shorter. In 1958 the average car-weight was 3,418 pounds. In 1961 it is 3,250 pounds -- or 168 pounds lighter. The V-8 engine hit its peak in 1957. In that year it powered 80 per cent of the cars sold in the volume sector of the market. In 1961 -- partly because of the excellent performance of the current six-cylinder engines -- the V-8 is powering 57 per cent of the cars sold in this sector of the market -- a reduction of 23 percentage points.

What does today's strong demand for smaller and more economical cars mean to the automobile industry? One way to answer this question is with a single phrase -- profit squeeze. The popularity of smaller cars has reduced the industry's average wholesale price per unit. And what does the great demand for these cars mean to the zinc and lead industries -- in fact, to just about all the industries associated with the manufacture of automobiles? Well, I don't think we need a mathematician with a slide-rule to tell us that building smaller cars requires less material per car. And we are building lots of smaller cars. The average compact now accounting for a large share of the low-price volume market is 26 inches shorter and over a thousand pounds lighter than the average car of 1958.

For these and related reasons, what happens in the compact market is of vital interest to your industries and to mine. And it would be helpful to all of us if we had a blueprint of the future showing exactly how popular the compacts are going to become. Unfortunately, no such blueprint exists. We do know, of course, that although the growth curve of the compacts is flattening out, it is still rising. Compacts -- which last year accounted for 27 per cent of all domestic retail sales of new cars -- are now accounting for 34 per cent. And it appears likely that this figure for the current model run wi'l be one or two percentage points higher.

Given these conditions, what can we expect for the future? Is the automobile industry approaching a time when the profit squeeze will become even more intense? Are related industries in metals, glass, textiles, and other materials going to have to prepare for curtailed sales to the automobile industry? These are possibilities -- but before we call for crying towels let's look at a few facts.

To begin with, although the move away from the more-car-per-car market of the Fifties indicates that many motorists are highly interested in economy -- certainly many motorists are highly interested in other things as well. They want performance and convenience, comfort and space. Bigger cars -- from the standard-sized, all-purpose family vehicles to the luxury lines -- are still accounting for 66 per cent of domestic sales of U. S.-built cars, and we see a steady demand for these cars in the future. And speaking of the substantial demand for larger cars -- some of the so-called compacts are quite large when you consider their wheelbase, weight, and horsepower. In fact, all compacts introduced since the three major companies brought out their first ones in the fall of 1959 have been larger. Moreover, within a given line of compact cars, frequently the most popular model is not the most economical model available. Top series are very popular. According to the

most recent figures available, top series are accounting for 65 per cent of compact sales. In addition, about 40 per cent of all compacts are equipped with radios -- about 45 per cent are equipped with white sidewalls -- and 58 per cent are equipped with automatic transmissions. As the Wall Street Journal put it a few weeks ago, "Auto makers are finding that economy sells best when it's mixed with a little luxury" -- and to luxury we might add performance and convenience.

From your point of view it might be pleasant for me to assure you that all of these signs point to a quick return to the more-car-per-car market -- and therefore to automatically increased sales for zinc and lead products. But neither I nor anyone else can honestly make that prediction. Right now the automobile industry is going through the most sweeping transition in its history. It is gauging motorists' reactions to a wide variety of automotive products in a new kind of market. The relative stability of the automobile market of the Fifties has given way to variety, dynamic change, and now and then even confusion. Where once, only a few years ago, consumer demand seemed to move clearly in a single direction -- that of longer, lower, wider cars -- it now moves in all directions.

With the automobile market in its present state of change and with the undeniable popularity of the smaller cars -- where does hope for growth for our industries lie? How are we in the automobile industry going to counter the profit squeeze? And how are those of you in the zinc and lead and other related industries going to make up the amount of material that has been taken out of the average car unit due to the development of the compacts?

I would like to suggest that our greatest hope for growing markets -- markets for what you sell and I sell -- lies not in more-car-per-car, but in more-car-per-capita.

Let me explain what I mean. We in the automobile industry will continue to give the individual motorist all he needs or desires in the way of options, luxury, and large size -- in short, all he wants in the way of more-car-per-car. But it may well be that a major part of our future growth will be the result of the car population increasing faster than the population itself. Another way to describe an increasing ratio of cars to people is to call it more-car-per-capita.

Steadily increasing per capita car-ownership has been the traditional line of development for the automobile industry in the United States and in other industrialized countries as well. Here in the United States we have experienced phenomenal growth in per capita ownership since 1920. In that year, on the average, there was one car for every 13 people. Now, there is one car for every three people.

Our future over-all growth in per capita ownership will be more modest -- although in different sections of the country the rate of growth varies widely. As one automotive writer recently pointed out, if the 7,700,000 people in New York's five boroughs had to be evacuated by automobiles, almost every one of the available 1,300,000 cars would have to carry six people. In Los Angeles County, on the other hand, with its higher per capita ownership -- six million people and 2-1/2 million cars -- in a mass evacuation no one would need to ride in the back seat.

Clearly, more-car-per-capita is an established trend. There are many reasons for believing that it will be a continuing trend.

What are some of these reasons? Let's look first at one important population shift that will occur between now and 1965. The number of young people between the ages of 15 and 24 will increase by more than six million, or about 25 per cent. In the lower age-range of this group are the high-schoolers who are obtaining their first driving licenses, many times through driver-training classes at school --

which, by the way, are multiplying rapidly all across the nation. In the upper age-range of this group are the young-marrieds setting up new households. The sharp expansion of the 15-to-24 age group will provide a strong stimulus for the growth of per capita car-ownership in this country, because almost all of these young people will be first-time car-buyers. Since these young people are just getting started in life, there will be certain restrictions on their expenditures for personal transportation. But certainly they will provide an excellent market for economy cars and used cars. As I mentioned earlier, activity in the used-car market strengthens the whole industry. It keeps trade-in values high and encourages new-car purchases.

There are other reasons for looking ahead to substantial growth of per capita car-ownership. Take multiple-car families. In 1954, there were four million multiple-car families in this country. Last year there were seven million -- an increase of 68 per cent, or about 11 per cent a year. A continuation of this average rate of growth would mean that in 1965 almost 11 million families will own two or more cars.

Several factors contribute to the growing number of multiple-car families -- as well as to the greater use of automobiles generally. One is the rapid expansion of the population into the suburbs, which continues unchecked. As you know, a great majority of the suburban communities make little or no provision for public transportation, and the people in them must rely heavily on personal transportation. Two other factors are what we call the specialization of function and the personalization of ownership. In the past it has been the custom to think of the automobile as an all-purpose vehicle for the use of the entire family. But with modern life becoming increasingly complex and diversified, people have begun to think that

one car in the family is entirely inadequate. Most families want a car that is suitable for trips to other cities or for hunting and vacationing -- and they also want a car that is designed for the dozens of short hauls that suburbanites make every week. In other words, they are beginning to want a stable of two or more cars that are designed for various uses.

In addition to this specialization of function, we are seeing the beginnings of an increased personalization of ownership. Individual members of families are beginning to look upon the possession of their own personal car as a practical necessity, giving them mobility and independence in a world that has been geared to private rather than public transportation. This growing emphasis on specialized function and personalized ownership -- which is reflected in the increasing popularity of the compacts and station wagons -- could make the automobile markets later in the 1960's far bigger than the most optimistic of us now anticipate.

You have a tremendous stake in the future of the automobile industry, and you are interested in knowing as much as possible about how fast we in Detroit expect our market to grow. Since 1955 the market for new cars sold at retail in the United States has averaged a little better than six million units a year. We expect this average to rise in the next few years, and after 1965 the average year should produce close to seven million new-car sales. By 1970 the eight-million-car year is a definite possibility. And where the total number of automobiles now in use is approximately 61 million, by 1970 the number should be about 80 million -- or 19 million more than at present.

These are optimistic projections, but we believe they are justified. We look for substantial growth in our industry -- and, of course, this ought to mean substantial growth for your industries too. For example, the weighted average poundage of zinc die castings used in all makes and models from the compacts to the luxury cars --

based on figures provided by the Zinc Institute -- is 59 pounds. Using 59 pounds -- and figuring on the basis of a six-million-car year -- we conclude that the automobile industry consumes a total of 177,000 tons of die castings in an average year. If present consumption patterns should continue to prevail on into the Sixties, in the seven-million-car average year which we expect to come after 1965, the consumption of zinc die castings by the automobile industry could rise to 207,000 tons -- an increase of 17 per cent.

Or take solder. Our engineers tell me that 4-1/2 pounds is a conservative estimate of the amount of body and radiator solder used in the average car. Assuming the same base figures that we used for zinc die castings, we conclude the automobile industry's consumption of body and radiator solder for the manufacture of passenger cars could rise from its present 13,500 tons to 15,750 tons -- again, an increase of 17 per cent.

Now I realize, of course, that any time you project figures of this magnitude and complexity five to ten years into the future you must include some mighty big "ifs" in your projections. The dramatic changes in the last few years clearly illustrate how fast changes can come in the automobile business and how far-reaching the consequences can be. For example, the gas turbine engine is just one development that could revolutionize the industry. This engine has about 20 per cent as many moving parts as a comparable reciprocating engine, needs no radiator or liquid cooling system, and runs on anything that will flow through a pipe and burn.

There are bound to be many surprises ahead. The thing every company must do is to be strong enough and flexible enough to turn surprises into opportunities. Research and technology are going to be more important than ever before -- as you well know. Those of you in zinc die-casting, for example -- using the findings of

the research program you began financing at the Battelle Memorial Institute five years ago -- have been making real progress in the finishes of your products. And I understand that with regard to functional automotive parts, you are working with some promising alloys which are lighter, stronger, and better able to withstand temperature extremes. I also understand that some of you in the lead industry are carrying on research that may eventually find application in the automobile industry -- particularly in the field of anti-corrosive pigments. This kind of aggressive product research and forward planning -- reinforced by regular consultation with automotive engineers -- will go a long way not just in maintaining present zinc and lead consumption levels on into the Sixties -- but in raising those levels. One thing you can be sure of -- your competitors in metals and in plastics are not going to be standing still.

With your interests and investments all over the world, certainly you are aware that competition is not just national, but international. No one has made this point more clearly than it was made in last month's Harvard Business Review by Peter Drucker -- who believes that ultimately our strength in the world markets depends on our strength at home -- on what we as businessmen do to hold our costs in line here -- and on what we do to build quality into our products here. Every businessman, he wrote -- including the businessman in Kokomo, Indiana in the heart of America -- must ask himself one simple but all-important question: "What would I have to do to be able to compete in Osaka or Dusseldorf or Bordeaux?" Mr. Drucker then answered the question in the only way that it can be answered. "If a product cannot compete in foreign markets, then foreign products can drive it out of Kokomo."

We in the automobile industry are very much aware of the pressures of foreign competition. Evidence that we are meeting these pressures lies in the

receding tide of automotive imports. The high-water mark was reached in 1959, when 610,000 imported cars were sold in this country. In 1960, the first full year for the sale of the new American-built compacts, sales of imports fell back to about 500,000. And with the sales of imports still declining, it is generally felt that the import sales for this year will be in the neighborhood of 400,000.

Our competitive response is turning back the automotive challenge from abroad, and it is helping us tc move out into the world market and increase our exports. The American-built compact cars have turned out to be highly attractive in other parts of the world, because they combine what the motorists of many countries think of as luxury-car performance, comfort, and convenience with economy in the initial purchase price and low cost of operation and maintenance. In 1960, 47 per cent of the cars built in the United States and shipped from U. S. plants for sale in other countries were compacts.

It may very well be that -- with some relaxation of trade restrictions -- the wide range of U. S. -built compacts will become one of our most powerful competitive weapons in the international automobile market. And that market has vast potential for the growth of per capita car-ownership -- the same kind of growth as that which has characterized America since 1920. Generally speaking, Americans are now well-supplied with automobiles. The peoples of other countries are not. For example, in England in 1946, the first year after the war, one car had to serve 17 people. Now the same number of Englishmen have two cars at their disposal. That is an increase of 100 per cent -- with plenty of room for tremendous growth yet. As you would expect, the world automotive market outside of the United States is growing faster than our own. And by the end of this decade, when eight-million-car years may not be too unusual in this country, the market for automobiles outside the borders of the United States may very well be as big as or bigger than the United States market.

We in Detroit are increasingly aware of the enormous new worldwide challenges to our competitive ability. We have made good progress in meeting them over the past few years, and we intend to do even better in the years ahead.

It has always been an article of faith with us in the automobile industry that there is no such thing as an entrenched and unassailable position in the automobile market. Opportunity always exists for the automobile company that can come into that market with a new product idea and the will to promote that idea aggressively. The same thing may be said of the supplier companies. Year after year we have seen new automotive products make their bid for customer favor. The result of this competition has been a net gain for the motorist and an expansion of the country's economy.

Now we are witnessing the effects of this same kind of creative competition on a much bigger stage, and it will be a source of great satisfaction to all of us in the years ahead to make a contribution to the world economy through free and vigorous competition -- the same kind of competition that has helped to make our country strong.

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STORAGE BATTERY OUTLOOK--1961

C. Herbert Allen

President--Association of American Battery Manufacturers, Incorporated,
Vice President--Vitalic Battery Company, Incorporated and Southland
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I doubt if there are any here who do not already know that during the year 1960 the battery industry used less lead than it did during the preceding year. I can assure you that the battery manufacturing industry did not plan it that way. All of us would like to see our respective markets increase rather than decrease. It should be remembered that 1959 was the biggest year in the history of automotive battery manufacturing and, when both replacement and original equipment batteries are considered, 1960 was not very far behind 1959. In fact 1960 storage battery production was exceeded only by that of 1959 and record-breaking 1955. In 1960 the decrease in replacement batteries required was mostly offset by the increase in original equipment batteries used for new car production. The decrease in total production was actually less than one per cent. Replacement battery production was down approximately 4 per cent, original equipment production was up 8 per cent.

Battery sales in units and in dollars have not kept pace with the increase in automobile registrations in the United States. Since 1954 automobile registration has increased approximately 26 per cent. Battery production has increased only 11 per cent. Mileage driven by these automobiles, as estimated by the Bureau of Public Roads, has increased a total of 28 per cent. Vehicle miles per battery have increased 15 per cent since 1954.

This can mean only one thing, ie, batteries manufactured during recent years are lasting longer than they did several years ago. All of us realize that more efficient utilization of leady materials does not immediately help the volume of your business, but it does place your industry and my industry on a more firm footing for the future. In order to compete with other types of batteries or other energy sources, we must all strive for economy and reliability and longer battery life. Let's not tempt "necessity" in the old adage "Necessity is the Mother of Invention."

United States Bureau of Mines reports show that lead used by the battery industry in 1960 was approximately 7 per cent less than was used in 1959. Since total battery production in 1960 decreased less than one per cent from 1959, this indicates that there was less lead being used per average battery during 1960 than was the case in 1959. The same report for 1960 shows a decrease of slightly more than one pound lead per battery from the 1954 statistics when the average lead per battery was 19.9 pounds.

Presented at the 32nd annual meeting--Lead Industries Association
Drake Hotel, Chicago, Illinois, May 2, 1961.

The replacement battery production reported by the Association of American Battery Manufacturers and original equipment batteries required for new vehicle production, together with the battery lead reported used by the United States Bureau of Mines indicate that lead per average vehicle battery was 18.3 pounds in 1960, a trifle less than the 18.4 pounds calculated for 1958. Dividing battery production into battery lead reported for 1959 gave 19.8 pounds. No explanation is offered at this time as to why the 1959 figure is that high, when the corresponding figures for 1958 and 1960 are lower, ie, 18.4 and 18.3 respectively.

Notwithstanding the fact that there is less lead per battery, they are lasting longer. Previously mentioned car registrations and battery production statistics confirm this statement. Batteries are lasting longer for several reasons:

1. You lead producers and fabricators are turning out a better product. You have made improvements which have helped us battery manufacturers to make better batteries.

2. Automobile manufacturers have improved the electrical systems to better protect batteries against deleterious overcharging and undercharging conditions. In other words, batteries in the new modern cars are less subject to failure even if neglected by the automobile user. The 12-volt battery is apparently doing a better job than did the 6-volt battery.

3. Most battery manufacturers are now using more quality control measures than ever before and recently developed processes are resulting in better quality. Research towards that end is still in progress and should never stop.

Not too many years ago an average 6-volt automobile storage battery delivered only 20 to 25 watt-hours of electrical energy per pound of lead. Today it is common practice to see 6-volt and 12-volt batteries delivering 25 to 35 watt-hours energy per pound of lead when discharged at the 20 hour rate. The energy increase is even greater when making comparisons at the higher starting current rates of discharge.

Regular size passenger car 12-volt batteries today are using approximately 19½ pounds of lead each as compared with present-day average lead usage in 6-volt batteries of 16-1/3 pounds each, or approximately 19 per cent more lead is required for such 12-volt batteries. However, 12-volt batteries for compact and imported cars have the same or slightly less lead than is used in average present-day 6-volt batteries. A survey made by me indicates that average compact car batteries use one half to one per cent less lead than is being used in average 6-volt batteries. (Ref. Table II.)

Yes, batteries are lasting longer. They are lasting longer even though electrical energy requirements on practically all automobiles have been constantly increasing, and they are doing so using less lead per battery than five to ten years ago.

I am making these statements with full knowledge of the fact that for 1960 the American Automobile Association reports they have had another increase in "Emergency Road Service Calls" caused by "Battery and Electrical Breakdowns." However, the percentage of total calls was down to 24.76 per cent in 1960 from a high of 25.21 per cent in 1959. I believe the nomenclature "Breakdown" is misleading. Such statistics can only be accounted for by assuming that many of such calls did not necessitate replacement of the battery. Oftentimes a battery is accidently discharged when lights or other electrical accessories are inadvertently left turned on for extended periods of time while the vehicle is idle. Unless the automobile engine and generator are operating, the current thus removed can exhaust even a new fully charged battery in several hours. How else can we reconcile the fact that battery sales are not keeping up with the increasing number of vehicles being used, and are lagging the yearly increase in total vehicle miles traveled.

An educational program aimed at having batteries and electrical systems more frequently tested and advising vehicle owners on proper battery and electrical system service might do much toward eliminating such emergency road calls reported by the American Automobile Association.

As for future years, 1962 and beyond, the amount of lead per battery will become somewhat less than at present and battery life will become longer. However, as previously stated, batteries and battery lead required will not show a corresponding decrease. United States population and the resulting increased use of automobiles will have offsetting effects. The United States Bureau of Public Roads is charged with the responsibility of planning highways for future vehicle use. After a very exhaustive survey, they are anticipating increased vehicular usage and travel. In the year 1966 the population will be 195 million. Motor vehicles registered will be 89,161,000 instead of the 73,900,000 currently registered in the United States, a 21 per cent increase by 1966. They estimate that vehicle-miles traveled will be 899 billion as compared with today's 720 billion miles annually, a 25 per cent mileage increase. In 1971 motor vehicle registration will be 101,240,000, another 13 per cent increase, and in 1976 there will be 113,642,000 vehicles in use, a further 12 per cent increase, according to the Bureau, (53 per cent more in 1976 than last year). These estimates by the Bureau seem reasonable considering past increases and the population increase that is sure to take place. Unless there are drastic changes in the sources of electric power used in automobiles, lead for lead-acid batteries will probably be on the increase for years to come.

I have constantly strived to keep abreast of all research and development work. Nothing has been uncovered to my knowledge that has caused me to worry about new devices replacing storage batteries as a source of electrical energy as required in today's automobiles.

I made a detailed study of statistics pertaining to vehicles and batteries used in the United States and lead used by the battery industry. This study covered a period of 10 years beginning with the year 1950. I feel quite certain that what is going to happen this year or next year cannot

be forecast by studying only statistics covering production and sales of automotive accessories. In order to forecast what is going to happen in the future, it would be necessary, I am sure, to consider what is going to happen to the country in general. Economic conditions have an effect on the number of automobiles that will be used on the highways, the mileage traveled and the number of batteries required to replace those wearing out. However, recessional effects on the sale of replacement batteries are not normally as great as the effect on the general economy. The inventory situation of not only automobiles in dealer hands, but also the inventory of storage batteries in the hands of dealers, chain stores and in distributors' warehouses can have a big effect on the number of batteries that will be manufactured in any given year.

During the past two years domestic vehicle factory sales and imports exceeded new vehicle registrations by 1,559,000 units. This indicates a heavy dealer stock, therefore, new vehicle registration should exceed domestic vehicle sales and imports in 1961. The excess should be approximately 500,000, ie, 6,490,000 domestic vehicle sales plus 400,000 imports and 500,000 excess over production equals 7,390,000. I used this figure for estimating new vehicle registrations for the year 1961.

To arrive at total registrations in the United States, the scrappage of vehicles and inventory adjustments, as calculated in the statistics for this paper, were averaged for the past five years. That quantity, 4,481,000, was used to balance out as an inventory adjustment for the year 1961. Thus 1960 total registrations of 73,897,000 plus estimated 1961 new vehicle registrations of 7,390,000 minus scrappage and inventory adjustment of 4,481,000 equals estimated 1961 total vehicle registrations of 76,806,000. I used this figure as an estimate for 1961 total registrations.

We know that, for various reasons, inventories of batteries in warehouses of dealer and chain stores were materially reduced during the year 1960. Consequently this reduction in stock at the sales outlets caused an important reduction in the demand for batteries from manufacturers. I do not believe the production of storage batteries will suffer because of stock reduction again this year.

Replacement batteries required in 1961 will probably exceed the quantity required in 1960. The net result is that the total 1961 requirements for storage batteries should be approximately the same as were required during the year 1959.

The demand for replacement batteries in the first months of 1961 is starting out well ahead of the corresponding 1960 period. New vehicle production is behind 1960. The net result on total batteries required is 6,106,590 for 1961 compared with 5,236,545 for last year:

	1960	1961
Replacement batteries shipped through February	3,505,800	5,091,500
Vehicle production through February	1,730,745	1,015,090
Total batteries required	5,236,545	6,106,590

This shows an increase of 870,000 batteries or 17 per cent more for 1961 than for 1960, ie, January and February only.

A review of the data on Table IV shows that 15.9 per cent of a year's batteries are required in January and February. On that basis, total battery production for 1961 should be 38,350,000. However, two months' battery production cannot be used to make an accurate forecast. I therefore resorted almost entirely to opinions expressed by other battery manufacturers to estimate 1961 total battery production.

It should be remembered that the replacement battery business is still seasonal. I have reviewed shipping reports compiled by the Association of American Battery Manufacturers by calendar quarters. The statistics are shown on Table IV. Some indication that battery sales are leveling out and becoming steadier is apparent but the change is rather slight. The United States Replacement Battery Industry figures indicate shipments for recent years are running 21 per cent, 19 per cent, 30 per cent and 30 per cent respectively for the first through the fourth calendar quarters of a year. Approximately 20 years ago, United States Replacement Battery shipments were 21 per cent, 16 per cent, 30 per cent and 33 per cent for the first through the fourth calendar quarters respectively. From the above it is seen that the last calendar quarter now accounts for 3 per cent less shipments than it did 20 years ago. The second calendar quarter accounts for 3 per cent more shipments now than it did 20 years ago. Average shipments during the first and third calendar quarters are the same as they were 20 years ago.

The average number of original equipment batteries required during the highest calendar quarter for the past three years varies to about the same degree as do replacement batteries. There is a difference however. Batteries for original equipment are required in greatest quantities during the first and second calendar quarters. Batteries for replacement purposes are required in greatest quantities during the third and fourth calendar quarters. This has a slight leveling off effect on total lead required by quarters for original equipment and replacement batteries combined. However, the total for the last six months of a year averages 57 per cent of the year's total. The corresponding figure for replacement batteries alone during last half of a year is 60 per cent. Fifty seven per cent of original equipment batteries are required during first half of a year.

Your main interest, I know, is how all this adds up in terms of lead tonnage.

Statistical Table III indicates a weighted average lead content of 17.6 pounds of lead alloy and lead materials per battery. That weight when multiplied by battery production in 1960 falls short of the total usage reported by the Bureau of Mines. The last report I have from that Bureau shows the battery industry used 347,000 tons of lead during 1960. In consideration of usual upward revisions, I have estimated that final tonnage for 1960 will be 354,000. Deducting 38,000 tons estimated use for industrial, aircraft and other special types of batteries, leaves 316,000 tons used by the automotive battery industry. As before, it is anticipated that half of this quantity will be in the form of antimonial lead alloys--the balance in the form of lead oxide. That quantity divided by the total automotive batteries manufactured in 1960 gave an average lead weight of 18.3 pounds. To alleviate that inconsistency, I increased the battery lead weights determined, as shown on Table II, by applying the factor 1.044. Lead per battery was then estimated as shown on Table III.

In order to assist me in arriving at conclusions as to the lead that will be required for the battery industry this year, I again sought the opinions of approximately 25 or 30 large and medium size battery manufacturers. The composite of opinions ventured is recorded in Table I of the statistics compiled for this presentation. I think it is important to point out that there was a remarkable similarity of opinions expressed by the various persons contacted this year, in contrast with a divergence of opinions expressed for the year 1960. This uniformity of opinion, it seems, lends weight to what we should expect during this year in the way of battery production and lead consumption by the battery industry.

The original equipment battery shipments, or production forecast of 6,950,000 units is based on the opinions expressed as outlined previously. The replacement battery forecast of 27,550,000 units for 1961 was also arrived at in the same manner.

The statistics on Table I show that the AABM ratio of reregistered cars to replacement batteries is 2.5 for the 1961 forecast. This ratio appears normal when compared with the ratio existing during the past four years.

The amount of lead required for the storage battery industry in 1961, as mentioned earlier, was based on both the opinions expressed in the poll of battery and supplier manufacturers, together with battery lead weight measurements previously mentioned and as outlined in Table II. It appears as a net result of all the various influencing factors mentioned, that the battery industry will use approximately the same quantity of lead this year as was used during 1960 (354,000 tons). Note that greater 1961 battery production is estimated using the same lead as was used in 1960 for less batteries. This concurs with my findings that the lesser lead weight per battery will partially offset greater battery production.

I made an attempt to correlate future battery production and battery lead consumption with forecasts made by the United States Bureau of Public Roads. The Bureau forecast gives estimates of population, vehicle registration and vehicle mileage for the years 1966, 1971, 1976 and 1991. Table V outlines the procedure used to project future battery and lead production.

The ratio "Total Vehicle Registration/Total Batteries" is not usually taken as an indication of battery life, but for purposes of the forecast, I believe it is sufficiently accurate since the same method is used consistently throughout Table V for each year covered. It should be pointed out that the Association of American Battery Manufacturers indicated life is based on replacement battery shipments and re-registered cars. The indicated life used in Table V is based on total vehicle registrations and total SLI battery requirements. The following comparison is made for information purposes only:

	1960	1959	1958	1957	1956	1955	1951
Life by above method (months)	25.6	24.8	26.5	23.9	24.0	21.0	22.7
AABM "Indicated Life" (months)		25.8	26.6	24.7	24.1	22.4	23.0

It is understood that the progressions used for arriving at future battery life and for estimating the future decrease in lead quantity per battery

are arbitrary. However, barring unforeseen changes in battery development and battery energy requirements per vehicle, the present trend indicates a change as shown in Table V tabulation.

Improvement in battery life over future years was projected assuming that future progress in that direction will not be as rapid a rate as occurred during the past five years. Progress now in planning and development stages will take place, but the effect of such known planning will not result in a fixed life increase every year. I have estimated that the rate of increase will decline each five years as indicated by the following:

Period	1955 - 1960		.380 years
"	1960 - 1966	an additional	.076 years
"	1966 - 1971	" "	.038 years
"	1971 - 1976	" "	.019 years

During this period of time unforeseen additional improvements may be made. The above estimate is based only on foreseeable improvements. Notice that a leveling off of life increase is indicated.

The "Lead per average Battery" in future years was projected by assuming that the rate of decrease indicated for the past five years will not continue. This is because present usage is determined to a large extent by 6-volt batteries which will become a smaller percentage of total production in future years. Apparently owners of older vehicles using 6-volt batteries are using low priced batteries with low lead content. We can't forget, however, that batteries for compact or economy cars may become a greater factor. If they reach fifty-fifty proportions, then average lead per battery will decrease more than is indicated in Table V. Weighing all the above possibilities, I assumed that the rate of decrease in lead content will decline as follows:

Year 1955	19.4 lb/battery actual	
Year 1960	18.3 lb/battery actual	5.6% decrease
Year 1966	17.6 lb/battery est.	4.0% "
Year 1971	17.2 lb/battery est.	2.0% "
Year 1976	17.0 lb/battery est.	1.0% "

This also shows a leveling off effect.

The net result as shown on Table V indicates there will be a general increase in lead required for future SLI battery production as follows:

Year 1960 actual	316,000 tons plus industrial battery lead estimate
Year 1966 est.	354,000 tons, a 12% increase plus industrial battery lead
Year 1971 est.	389,000 tons, additional 10% plus " " "
Year 1976 est.	429,000 tons, additional 10% plus " " "

The above may be an optimistic outlook, but that's what I get with my figuring and estimating.

I would indeed be negligent if I failed to acknowledge all the help I've received in compiling this information, statistical data in particular. Members of the Association of American Battery Manufacturers, my associates

at Vitalic and Southland Battery Companies, and battery manufacturers in general were cooperative beyond my expectations. United States Government Bureaus and the Automobile Manufacturers Association were also very helpful.

As an example, Mr. Ken Green, with whom most of you are acquainted, is a well recognized authority on battery raw material requirements, including lead. I know he recognizes the fact that I have used some information published over his signature early this year. He was kind enough to make a mass of information available to me concerning his latest thinking on the subject of lead requirements for batteries.

I note from the program that there are many other very interesting subjects that are being presented during this meeting. I am confident my attendance here will be well worth while. For this reason, as well as for the honor that has been mine through your invitation to address you here, I want to say thank you very much.

C. Herbert Allen

STATISTICS FOR LEAD INDUSTRIES MEETING - Chicago May 2, 1961

Automotive Battery and Battery Lead Statistics

(Units x 1000 except where indicated otherwise)

TABLE I

		Composite Opinion	Estimated 1961	* 1960	1959	1958	1957	1956	1955	1954
VEHICLES										
Registrations, U. S. Total	(1)		76,806	73,897	71,526	68,328	67,159	65,143	62,727	58,543
Registrations, new cars only	(2)		7,390	7,570	6,983	5,381	6,840	6,850	8,127	6,365
Re-registrations (by difference)			69,416	66,377	64,543	62,947	60,319	58,333	54,600	52,178
Registrations, annual gain			2,909	2,371	3,198	1,169	1,976	2,456	4,184	2,288
Sales, domestic from U. S. factories	(2)		6,490	7,473	6,375	4,786	6,791	6,474	8,685	6,153
Sales, exports from U. S. factories	(2)		300	361	312	304	373	398	447	401
Imports	(2)		400	895	719	459	273	112	60	36
Production, U. S. including military	(2)		* 6,950	7,905	6,728	5,121	7,220	6,919	9,169	6,601
Miles (total) U. S., (in billions)	(1)			720	700	665	647	628	603	561
Miles per vehicle, average (in miles)	(1)				9,720	9,658	9,591	9,623	9,615	9,608
Scrappage and "inventory" adjustment	(3)		8,481	5,149	3,785	8,212	8,868	4,394	3,983	8,077
BATTERIES (6 and 12 Volt Types)										
Production - U. S. Total SL I sizes		34,868	34,880	36,635	34,719	30,881	33,704	32,571	35,778	31,008
Production - Original equipment SLI sizes only	(4)	6,950	6,950	7,905	6,724	5,121	7,220	6,919	9,169	6,601
Production - Replacement SLI sizes only	(4)	27,550	27,550	26,330	27,495	25,270	25,943	25,018	25,828	23,771
Production - Tractor types (estimated)		180	190	200	290	268	278	277	377	227
Production - Exported SLI sizes only	(4)	184	190	200	210	222	271	361	404	409
(12 volt only, O.E.)		6,950	6,950	7,905	6,728	5,121	7,220	5,559	3,691	1,030
(12 volt only, replacement) est.		18,060	18,300	11,900	9,845	7,470	5,990	1,536	442	31
(12 volt total)		21,010	21,250	19,805	16,569	12,591	13,200	7,395	8,133	1,061
% 12 volt auto. batts., O.E. & replacement		60%	61%	57%	48%	41%	39%	23%	12%	4%
Ratio to re-registered cars	(4)		2.50	e.2.50	2.34	2.50	2.31	2.33	2.12	2.20
LEAD USED IN BATTERY MANUFACTURING										
Metal (grids, posts, etc., tons)	(5)		* 171	178	187	160	186	192	196	
Percent metal			48%	49%	49%	51%	52%	52%	52%	
Oxides of Lead (tons)	(5)		* 183	190	193	153	175	170	184	
Total in Batteries (tons)	(5)		354	* 354	381	313	361	371	380	337
Less industrial battery use (est.) ***			35	38	39	28	38	42	34	28
Lead in Auto. batteries (by differences) (tons)			319	316	343	285	323	329	346	309
Lead in Average Auto. Battery, (lbs.) (x1)			18.3	18.3	** 19.0	18.4	19.2	20.2	19.8	19.9

* - Estimated or forecast

• - Much of data shown for Year 1960 is subject to later revision when final reports are verified and checked by sources of information indicated.

** - Cannot account for variation in weight for Year 1959. Year end adjustment by B. of M. adding 20,000 tons to battery lead usage may explain.

*** - Ably forecast by Ken Green of E. S. B.

(1) - United States Bureau of Public Roads

(2) - Automobile Manufacturers Association 1961

(3) - Example = 1958 reg. & 1959 new reg. - 1959 total reg. = 68323 & 6963 - 71526 = 3785 adj. for 1959

(4) - The Association of American Battery Manufacturers, Inc. 1960 Year Book - For practical purposes, production considered same as shipments reported.

(5) - United States Bureau of Mines

Table II Lead Weights per Average Battery

	6-Volt Vehicle Battery	12-Volt Reg. Size Vehicle Battery	12-Volt Compact & Import Car Battery	Weighted Average
Estimated Flow for 1961	39%	39%	22%	100%
Per Ken Green notes 3/15/61	17.2 lb	20.3 lb	16.4 lb	18.23 lb
Smithers reports covering approx. 37 different brands and 78 types of batteries weighted by flow by size	16.7	21.7	16.8	18.67
Assay X on scrap batteries	15.6	17.3	15.6	16.26
Assay Y on scrap batteries	15.8	18.5	16.2	16.94
Averages	16.33	19.45	16.25	17.53
Bureau of Mines reported and adjusted battery lead usage gave a 1960 weighted average per vehicle battery of 18.3 lb. To adjust above to actual Bureau of Mines weights, factored by 1.044	17.05	20.31	16.97	18.30

The above variances between weighted averages calculated and averages based on Bureau of Mines report is probably due to need for weighting to compensate for variations in distribution quantities by different manufacturers and brands measured.

Mr. C. Herbert Allen — Storage Battery Outlook--1961

Table III

	Estimated Total All Sizes	6-Volt Vehicle Batteries	12-Volt Vehicle Batteries	12-Volt Compact & Import Car Batteries
Flow	100%	39%	39%	22%
Lead Weight each	18.30 lb	17.05 lb	20.31 lb	16.97 lb
Year - 1960 (batts.)	34,599,000	13,493,610	13,493,610	7,611,780
Lead required 1960 Tons	316,600	115,000	137,000	64,600
Year - 1961 (batts.)	34,880,000	13,603,200	13,603,200	7,673,600
Lead required 1961 Tons	319,200	116,000	138,100	65,100

SEASONAL NATURE OF BATTERIES REQUIRED FROM MANUFACTURERS (x1000) S.L.I. Types

Source - A.A.B.M. & A.M.A.

6 & 12 VOLT — TABLE IV

	REPLACEMENT BATTERIES*						ORIGINAL EQUIPMENT BATTERIES**						TOTAL REPLACEMENT & ORIG. EQUIPMENT BATTS.		
MONTH	1958	1959	1960	Three Year Aver.	Years % per Month	Years % per Quarter	1958	1959	1960	Three Year Aver.	Years % per Month	Years % per Quarter	Three Year Aver.	Years % per Month	Years % per Quarter
Jan.	2,004	2,672	1,865	2,180	8.3		873	845	811	676	10.3		2,856	8.7	
Feb.	1,803	1,791	1,641	1,745	6.6		466	579	788	611	9.3		2,356	7.2	
March	1,577	1,376	1,877	1,610	6.2	21.1	430	687	785	634	9.7	29.3	2,244	6.8	22.7
April	1,242	1,837	1,545	1,408	5.3		392	695	697	595	9.0		2,003	6.9	
May	1,458	1,593	1,650	1,566	5.9		429	660	731	605	9.2		2,171	6.6	
June	1,773	2,118	2,072	1,988	7.5	18.7	407	679	728	605	9.2	27.4	2,593	7.9	20.5
July	2,101	2,556	2,131	2,263	8.6		389	667	516	524	8.0		2,787	8.5	
August	2,333	2,728	2,550	2,537	9.6		231	295	371	299	4.6		2,836	8.6	
Sept.	2,706	2,869	2,708	2,767	10.5	28.7	118	339	487	315	4.8	17.4	3,082	9.4	26.5
Oct.	2,976	3,069	2,834	2,960	11.3		332	602	696	543	8.3		3,503	10.6	
Nov.	2,262	2,799	2,634	2,565	9.7		618	304	686	533	8.1		3,098	9.4	
Dec.	3,041	2,467	2,822	2,777	10.5	31.5	690	573	611	625	9.6	25.9	3,402	10.3	30.3
TOTAL	25,270	27,695	26,329	26,366	100.0%	100.0%	5,062	6,725	7,905	6,565	100.0%	100.0%	32,931	100.0%	100.0%

* - Source - Association of American Battery Manufacturers - B & B reports "Battery Shipments" from manufacturers assumed same as battery Production.

** - Source - Automobile manufacturers Association - "Vehicle Production" assumed each vehicle manufactured require a battery.

6/61

Table V — Projected Battery Life and Lead Usage

Year		1955	1960	1966	1971	1976
Population, Resident 48 States (000)	(1)	164,000	178,464	195,353	211,653	229,758
Motor Vehicles Registered, public & private (000)	(1)	62,727	73,897	89,161	101,240	113,642
Total Vehicles Registered/Total Batteries	(2)	1.75	2.13	2.21	2.24	2.26
Batteries Shipped or Manufactured (000)	(3)	35,775	34,635	40,300	45,200	50,200
Vehicle Miles Traveled (000 000 000)	(1)	603	720	899	1,051	1,200
Vehicle Miles/Battery		16,870	20,775	22,300	23,300	23,900
Miles per Vehicle (aver. per year)		9,615	9,740	10,080	10,515	10,575
Lead per Average Battery, Lb	(4)	19.4	18.3	17.6	17.2	17.1
Estimated Lead for S.L.I. Batteries, tons (000)		346	316	354	389	429
Battery Life indicated by above ratio (month)		21.0	25.6	26.5	26.9	27.1

(1) Source 1955 and 1960 Automobile Manufacturers Association Facts & Figures. Forecast for 1966 through 1991 by United States Bureau of Public Roads.

(2) Ratio obtained by dividing total vehicle registration by total batteries (AAEM "Replacement Shipments" and vehicle production requirements). This ratio assumed to indicate battery life in years. (O. E. & Replacement combined). Years 1955 through 1960 indicate increase of .38 years to life of average battery. Future life increase estimated by assuming that gain during 1960-66 will be .076 years, 1966-71 will be .038 years, 1971-76 will be .019 years increase to average battery life.

(3) Replacement battery shipments reported by Association of American Battery Manufacturers and batteries required by vehicle production reported by Automobile Manufacturers Association.

(4) Assuming lead per battery in future years will decrease as follows:

4% during 1960-66
2% during 1966-71
1% during 1971-76

OPENING "NEW FRONTIERS"

David M. Borcina, Assistant to the Secretary
Lead Industries Association

"New Frontiers," the designation that we have given to this session of our annual meeting, has nothing to do with politics. It is simply coincidental that the vigorous aggressiveness and initiative shown by the lead industry in opening "new frontiers" have taken the spotlight at a time when the term has struck the public fancy.

Thousands of our best scientists, hundreds of our greatest corporations, many agencies of our government are right now engaged in taking advantage of the properties of lead to solve their own problems, resulting in new lead products and uses. Why? Not because those people have a vested interest in lead, not because they want to do our industry a favor, not because lead is the only raw material they have not explored! No, but because the lead industry itself is talking lead as it never did before.

Through the power of technical advertising, technical publicity, and most of all, technical service, industry has been awakened to the possibilities of lead in modern technology. It has been our privilege, with the whole-hearted support we have had from the members of the industry, to disseminate the necessary technical information throughout industry as a whole and to cultivate, through technical service, the ground where our seeds have taken root.

This to us seems the surest and least costly way to open "new horizons." In this way the research dollar can be multiplied manyfold. In this way we can help industry to fill in the missing pieces of each particular jigsaw puzzle. We must know what lead has to offer and keep in close touch with industry to know what it needs.

That is how the Lead Industries Association and its staff operates. We try to know more about lead than anyone else, we try to know what industry needs, and we try to fill that need.

In this session we are attempting to give you a brief sampling of what is going on along some "new frontiers." Time is entirely inadequate to give you a complete picture. You will hear from a few people who have been attacking these frontiers with fresh vision. Some are people with whom we have had the privilege of working closely; others have been entirely on their own. All are typical of the people who are looking ahead with lead and who merit our help, wherever possible, to bring their ideas to fruition.

Once the technical aspects of our new product development are licked, the real selling job begins. That is our job too. We have to tell the world about the wonders of these new frontiers so that when they are opened, they will become populated with the right kind and number of customers.

Presented at the 33rd annual meeting -- Lead Industries Association, Drake Hotel, Chicago, Illinois, May 3, 1961.

How we function as the technical service voice of the lead industry may best be illustrated by a few case histories.

A recent visit with a large manufacturer of fans and blowers developed the information that they were seriously concerned with a noise problem in their newer equipment, equipment that was producing harmful noise levels. With the aid of the data contained in the Bolt, Beranek and Newman report entitled "Improved Sound Barriers Employing Lead," we were able to convince them that lead might be the solution to their problem. Fortunately for us, they agreed, and as a result they are currently conducting tests on lead materials.

Another case history I will describe deals with lead-asbestos anti-vibration pads. The vice president of the El Paso National Bank was in Montreal about a year ago, stopping at the Queen Elizabeth Hotel. His own bank was then planning a new headquarters building in El Paso on property over and around railroad tracks. Realizing the Queen Elizabeth Hotel was built over railroad tracks with no noticeable vibration problem, he went to see the maintenance engineer who told him about their use of the lead pads and that he could get further information from the Lead Industries Association. He contacted us, we sent him our folder and other data on the pads, and he recommended their use to the architects and engineers. Unfortunately for us, the architects and engineers had never slept at the Queen Elizabeth Hotel so we had a selling job to do. With the aid of the bank vice president, our selling job was adequate and the lead-asbestos pads remained in the specification.

Was this the end of it? Not on your life! The railroad now got into the act and hired a consulting engineering firm in Chicago. They then contacted us and the necessary data were sent along to them. The last we heard, last week, the lead-asbestos pads are being installed this week.

Many other requests for technical information on lead are received by the Association and some of these are displayed on a board in the back of the ballroom. I hope you will get a chance to look these over.

Some of the uses for lead that will be discussed during this session can not now be considered as using significant quantities of lead, but who among you would have said in 1925 that tetraethyl lead would become the second largest consumer of lead in the comparatively short period of a little more than thirty years. Perhaps we have here in one or more of the products to be discussed another TEL. Let us hope so!

Hope is not enough, of course! We will have to continue our aggressive approach to "New Frontiers" in lead and aid and abet every effort by technicians throughout industry to think lead and to use lead.

To provide the type of information that these technicians need and want, we as an industry must:

1. Develop the necessary technical information through research.
2. Inform the technicians what lead is doing and can do through mass communication channels.
3. Provide a personal technical service staff prepared to work with technicians on specific jobs.

As a result of forward looking members of the Association, we are currently engaged in all three steps to a greater or lesser degree. History will be the judge as to whether or not we are doing a proper and adequate job.

PZT AND ITS MARKETS

Gordon Eubanks, General Sales Manager,
Clevite Electronics Components Division.

Piezoelectricity is not a new phenomenon. It was first discovered in 1880 at the Sorbonne by Pierre and Jacques Curie. Their studies at this time were conducted with crystals of quartz, tourmaline and Rochelle salt.

The practical application of piezoelectricity was not significant until the early 1930's and was pioneered by the Brush Development Company of Cleveland, Ohio.

Severe limitations were discovered in crystalline materials and efforts were made to find improved materials. In 1940 it was discovered that ($BaTiO_3$) barium titanate could be treated electrically and be permanently polarized. This discovery promoted the use of piezoelectricity as ceramic could be prepared in sizes and shapes not attainable with crystals. One major limitation of barium titanate is its upper temperature limit of approximately 100° C. This limitation was overcome in the 1950's by the discovery of lead titanate zirconate ($Pb(TiZr)\ O_3$) with limiting temperatures around 300° C. The technical term for this ceramic is cumbersome to use in conversation so I will refer to PZT which is a registered trade mark of the Clevite Corporation.

I don't wish to dwell on the technical aspects of ceramic materials but the latter material is of interest to all of you because of its high lead content. A brief look at the percentages of material used in PZT formulae should be useful. By weight PZT contains approximately 65% lead oxide (PbO), 12% titanium oxide (TiO_2) and 23% zirconium oxide (ZrO_2).

In our operations at Clevite today we are using approximately 40,000 pounds of ceramic powder per month, or 13 tons of lead oxide. We realize this is not tremendous volume for the lead industry, but a look at the present and potential market is encouraging.

Today's market for piezoelectric ceramic is shared with barium titanate, but the trend is to PZT with its inherent characteristics of higher temperature operation, greater stability, uniformity and ability to withstand pressure.

Volume business today is concentrated in two areas, ultrasonic cleaning and sonar devices. Both of these product areas are expanding rapidly. Sonar in its broad sense is the military application of piezoelectricity to underwater sound detection. It is the counterpart of radar in air. Some commercial uses are for fish finders and depth finders in pleasure boats. I am certain you will hear more in this meeting concerning ultrasonic cleaning and its many varied applications. The number of units in this field is increasing but the volume of ceramic per unit is not large.

Other current markets for PZT include phonograph cartridge elements (large volume, small quantity ceramic), fuse elements for detonators, microphones, delay lines, accelerometers for vibration measurements. Most of the

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Presented at the 32nd annual meeting--Lead Industries Association,
Drake Hotel, Chicago, Illinois, May 3, 1961.

elements carry a rather high price tag based on required manufacturing techniques, but have a small volume of ceramic powder.

When we consider future market potential for PZT ceramics, it is difficult not to become over-enthusiastic. New product ideas are being generated so rapidly and by so many sources that evaluation of their merits is quite a problem. It has even been suggested that a piece of ceramic be imbedded in the heel of a woman's shoe. Every step would generate a spark and light a neon bulb. More serious ideas include spark ignition for oil or gas furnaces and clothes dryers, electrostatic air filters, atomization of fuel oil, speedometers, and, of course, spark pump devices for gasoline engines. The latter use of ceramic will be discussed by another speaker.

Many present products of PZT are used in markets which are expanding rapidly. Most significant to the lead industry due to the heavier tonnage, is in use of underwater devices. The military program for increases in the number of submarines and the expansion of oceanography as a study frontier will require increasing quantities of piezoelectric ceramic. We are only starting to produce ceramic electric wave filters but the future for the product is excellent. We anticipate sales of hundreds of thousands yearly.

One last comment regarding the future products will point out the broad basis for scientific research in the use of piezoelectric ceramics. We have discussed products ranging from high production phono cartridge elements to heavy military applications. Recently one of the largest electronic companies announced a unique successful experiment with PZT sheet stock. By coating the surface with a luminous material they were able to excite the ceramic electrically and produce visual figures on the surface as in a cathode ray tube. Little imagination is required to visualize the TV picture tube of the future hanging from the wall in a picture frame.

To summarize, Clevite as a large producer is using lead oxide at the rate of over 150 tons per year in 1961. This quantity should double within two years, and at least double again in the following five years.

SMALL ENGINE IGNITION WITH THE "SPARK PUMP"

Martin J. Glenday, Manager, Special Products,
Clintonetics Division, Clinton Engines Corp.

The small engine line generally encompasses those gasoline, internal combustion engines with ratings between one-half and ten horsepower. During World War II there were approximately one million engines used in the four-year period. Since that period, the number of engines used has increased each year to the present volume of 4 1/2 million per year. The general turnover is every five or six years so there are approximately 20 to 25 million small engines in use in the country today. They find their use on lawn mowers, outboard motors, garden tractors, chainsaws, pumps, rototillers, hay balers, and numerous other utilities which make our American way of life what it is today.

Throughout the history of the gasoline, internal combustion engine, the ignition of the combustion mixture has been accomplished with an electric spark. The availability of electrical energy has been a major problem in the engineering, design, and application of the small engines. This has been a particular problem since the electrical energy has had to be in the form of high voltage to initiate a spark. The small engine line, by its definition, demands a certain degree of portability and, therefore, the transformation of chemical energy to electrical energy found its adaptation primarily in the larger engine design. Hence battery ignition is used in the automobile. The storage battery is adapted to the high current and low voltage output, but the ignition coil transforms the low voltage, high current to high voltage, low current as is necessary for the ignition spark.

In the small engine line the ignition spark has been accomplished by the use of the magneto. The magneto takes mechanical energy, a turn of the crank or pull of the starting rope, and transforms it to electrical energy. This transformation is accomplished through magnets and a coil for generating a low voltage, high current type energy, and then as in the battery system, it is transformed with the ignition coil to high voltage and low current as is required for ignition. The storage battery and various magneto systems have been in existence since the birth of the gasoline engine. Tremendous strides have been taken in the science of engineering the storage battery and the magneto, but there has always been the feeling that something was missing. Somewhere, somehow there must be a method of supplying ignition with undreamed of advantages over the storage battery and magneto systems. The professional men have been waiting for some breakthrough that would open the field for them in engineering and designing systems around some phenomenon that would suffice the needs not satisfied by the battery or magneto systems.

Since 1953, the engineers of the Clintonetics Division of Clinton Engines Corporation have kept a watchful eye on the developments within the ceramic industry, namely piezoelectric ceramics. In July, 1960, after experimentation and analysis, it was concluded that the stage of development was ready for the adaptation to the ignition systems in the small engine field. Clintonetics engineers recognized this major breakthrough and programmed accordingly.

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A program for experimentation and development was organized with Cleveland Graphite Bronze Corporation and work was begun. Cleveland Graphite Bronze Corporation had developed an ignition system around their advance ceramics and were also convinced that they had made a major step in the small engine field. Their system uses the spark pump to change mechanical energy to electrical energy and a switch to time the spark to the engine cycle. Their crystals in the spark pump can easily withstand the numerous design requirements in the small engine field. This spark pump develops high voltage directly without the need of a transformer coil such as the storage battery and magneto require.

To the people connected with the lead industries, this engineering accomplishment means that lead will be used in each spark pump crystal. It also means that the ignition coil is no longer needed in the small engine systems, however, it means even more than this.

The testing programs at Clintonetics Division of Clinton Engines Corporation and Cleveland Graphite Bronze Corporation have shown this system to have the undreamed of capabilities we had been looking for. The actual advantages are as listed below:

1. The elimination of breaker points, coil, and condenser.
2. Less engine weight.
3. Easier starting engines.
4. Longer engine life without maintenance.

Cleveland Graphite's system as applied to Clinton engines encompasses all four major advantages. The two main advantages as far as the user is concerned are easier starting and longer engine life without maintenance. For all practical purposes the ignition system will last throughout the engine life without maintenance and the spark plug life has been experienced at five times the present life. The other main advantage is that newer and improved starting methods are available since the spark pump output does not require any set speed to produce the required ignition.

Clintonetics has programmed customer testing of three hundred Clinton engines. These tests on lawn mowers, tillers, and commercial gocarts have confirmed our laboratory tests and developed enthusiasm throughout the country. Twenty thousand hours of testing have enlightened even the skeptics. The evolution of the piezoelectric systems within the ignition system provokes dreams of one-half inch spark pumps and switches, making room for larger output and lighter engines. If the magneto and battery systems are any form of a guide, ten years will see piezoelectric ignition systems on all small engines and most large multicylinder engines, including automobiles and trucks. The features of this would coincide with the automotive industry's trend to engine life, bearings with no grease jobs, batteries which would outlast the engine, infrequent oil changes, and life-time spark plugs.

Clintonetics and Cleveland Graphite Corporation are happy to bring this first breakthrough in a new revolutionary ignition system to the point of use by the public. We are sure the many advantages will promote engine sales, promote accessory sales, and be of untold benefit to the public.

THERMOELECTRIC POWER GENERATION AND LIGHT-WEIGHT CLAY BLOCKS

Sid W. Turner
LIA Staff.

I hope you've all had a chance to look at the demonstration model thermoelectric generator in the back of the auditorium. If not, drop back after the session and we'll be happy to demonstrate it. We've been publicizing this new use of lead in LEAD, where it has appeared three times and have written it up in the Information Bulletin several times. The reason for this interest on our part is that thermoelectricity looks like good new outlet for our product with a big future.

For those of you who are not familiar with thermoelectricity, it's a material that will create a current when heat is applied at one end. This would be power generation. The converse of that is: if current is passed through this material, one end will get hot and the other end cold. This phenomenon is called a "heat pump" and is the basis for thermoelectric refrigeration.

Which material is used for refrigeration or power generation depends on its efficiency — what the solid state physicist calls the "figure of merit." Figures of merit for different materials depend on the temperature range of application. It happens that in the temperature range for refrigeration — that is from room temperature down — the most efficient material at present is bismuth telluride. On the other hand, in the temperature range most useful for power generation — that is between about 350° F. to 1250° F. — the most efficient material to date is doped lead telluride. In short, the field for lead in thermoelectricity is in power generation.

In an actual power package lead telluride generators are capable of conversion efficiencies of about 7 to 9%. This is not enough to compete with the high efficiencies of the big land based utilities. But it is enough, so they tell me at Minnesota Mining & Manufacturing, to carve out a real commercial market for these devices in the auxiliary power and portable power package fields. In fact, they tell me at 3M that although they're happy to supply the military with lead telluride devices, their real aim is to develop commercial markets for thermoelectricity — and they're confident they can do it. They're not alone in this feeling either. Other companies, including Westinghouse, are also aiming for commercial thermoelectric markets.

Commercial uses can be separated into two classes. Auxiliary power from waste heat sources — where the electricity generated would be essentially free — and power packages for areas remote from power lines. Thermoelectric power is attractive for portable power packs because its efficiency, even though low, is comparable with small gasoline motor driven generators.

The first demonstration of a remote power source was the Snap III built by 3M for space vehicles (remoter from power lines you cannot get). The Snap III was never shot into space but the feasibility of thermoelectric power from an isotope heat source was demonstrated. It provided 7½% conversion efficiency

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Presented at the 33rd annual meeting—Lead Industries Association
Drake Hotel, Chicago, Illinois, May 3, 1961.

with relatively light weight and no moving parts. Some Snap III's have recently been built and are being placed into service. These and propane units of 4 to 10 watts will be used to trickle charge batteries to supply power for remote weather stations and buoys for the Coast Guard. The Snap I is being developed and will have an output of 300 kw.

One of the early commercial uses of lead telluride for remote power is by Northern Illinois Gas Company. They purchased a 10 watt generator from 3M to check the feasibility of powering the cathodic protection systems on their gas mains with these devices. Heat would be supplied by burned gas from the main. Their tests show that electricity from lead telluride packages is actually cheaper than from power lines.

An example of "waste heat" application that's getting serious attention at 3M is an auxiliary power supply for home gas heating furnaces. The big advantage here is that the home heating system is completely relieved of its dependance upon electric power lines and the danger of power failure. Thermoelectric units in this application provide the electricity to run fans and blowers, or pumps for hot water systems at essentially no cost for the electricity. After all, 25% of a furnace's heat goes up the stack anyway and the thermoelectric element introduces a negligible loss — yet produces the needed power without maintenance. The only cost is in the original investment for the installation. Present costs are about $35 a watt, but Minnesota Mining tells me that volume production will bring this down to comparative levels.

A big program is under way at 3M to make a production model of this home heating auxiliary power source. So far, they have support from 12 gas utilities. 3M is confident of the success of this program which would probably mean the conversion of all gas home heating furnaces to this type. Gas companies, after all, are anxious to get away from having to use the electricity in their products. An all-gas home is their aim. I might add that the same principle would apply to oil fired home heaters as well. Each one of these power packages would supply some 300 watts power and require about 5 lbs. of lead telluride. As there are approximately a million gas furnaces manufactured a year, this figures out to about 1,500 tons of lead for this one use.

Bringing the price of these things down to less than a dollar a watt would make thermoelectric power very attractive in large power packages too. Portable basic power supplies in the 5 to 10 kilowatt range are being developed right now. With the lower prices, it is anticipated that 100 to 1,000 kilowatt power supplies would be feasible by 1965. Power sources in this range are extremely interesting to the Navy. The reason here is fairly obvious. With sonar as sensitive as it is today, our undersea fleet with its payload of Polaris missiles really needs to cruise silently under the water — and this is just what thermoelectric power could make possible.

What about its use in the automobile? Replacing the generator is a possibility. Here several lead telluride elements using waste heat from the manifold could supply a continuous charge to the battery. I have been told that there are considerable engineering difficulties in this arrangement, however, but 3M feels that a real good bet is the trickle charging arrangement for battery powered cars and trucks.

As sometimes happens when new lead products are developed, one of the products they compete with are older lead products. The question is... will thermoelectric portable power packages compete with lead acid batteries? In certain cases, the answer is yes. On the 4 watt buoy power package, I spoke of before, a few pounds of lead telluride in this application replaces many more pounds of lead acid batteries. On the plus side, however, Minnesota Mining feels that an arrangement using lead telluride power to trickle charge batteries is extremely attractive and should make the battery much more competitive creating many new applications.

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I would like to turn from thermoelectricity for the last couple of minutes of my talk to tell you about a new ceramic product with, I think, a big future. That is lightweight glazed clay block.

Lightweight block is manufactured by incorporating into the fired clay large quantities of a bloated lightweight aggregate. Weights of this product are reduced dramatically. For example, standard block which is 12 inches by 8 1/2 by 8 1/2 in concrete weighs somewhere around 80 lbs. In standard brick it would weigh that or more. But lightweight block under 20 lbs. has been manufactured — and block between 20 to 30 lbs. has passed all of the structural standards for top quality concrete block.

Lightweight block like this gives real advantages to the architect because it allows faster and cheaper construction. Of course, lightweight concrete block is commercially available. Clay block is more expensive than concrete without any special features so that more than likely it won't compete directly with lightweight concrete block. But unlike concrete block the clay block can be glazed. This does give the clay block a competitive edge where color is desired. A lightweight clay block with durable, maintenance-free color is an excellent low cost building product for hospitals, schools, industrial plants and office buildings. A block 12 inches thick can be glazed on one side or both sides. One-block-thick construction of these glazed blocks would offer the beauty of color at low cost.

Pilot quantities of lightweight glazed clay block have been manufactured — all those that I've checked on have used at least 15 to 20% lead oxide in the glaze.

At a recent meeting in Chicago of people interested in lightweight clay block, an architect from the New York Housing Authority indicated his interest — and the interest of his department -- in this type of product. His reasoning was based upon cost. According to the Housing Authority, the cheapest way to build a building is with masonry and not with porcelain enameled steel or any of the other curtain wall products in use today. He quoted figures comparing installed prices of porcelain enameled steel versus installed prices of masonry. They were: porcelain enameled steel... $4 per sq. foot in place — masonry... $2.25 per sq. foot in place. In short, he wants to use masonry. However, maintenance is a problem — particularly of painted surfaces in the halls and entrance.

Sid W. Turner

Glazing the product is the answer, according to the Housing Authority's architect. A couple of installations have already been made by the Housing Authority at the Edgemere houses in Far Rockaway in Long Island, New York.

A prediction on lightweight block was made at the meeting I referred to before. It was made by the editor and publisher of one of the major ceramic magazines. His prediction —"In time, lightweight clay block will account for 12,000,000,000 brick units per year." We can assume that most of this will be glazed if we figure 6 brick equivalents to the sq. foot, and about a quarter of a pound of glaze per sq. foot — these are standard figures. This figures out to about 250,000 tons of frit per year. Figuring the lead content at 20% this would yield 50,000 tons of lead oxide per year. I think we would settle for a fraction of that.

THE POTENTIAL FOR LEAD AS AN ACOUSTICAL MATERIAL

Bruce Fader
Lead Industries Association Staff

From what you have heard here today you should have gleaned two important ideas --

First, lead seems to have an important role to play in many rapidly growing jobs of noise and vibration control, and . . .

Second, neither the basic theory nor knowledge based on experience is very widely spread among the people who should know most about the problems of noise control -- the architects, designers, and builders who will be using it.

Concerning the first idea, we can only be grateful to Mother Nature for making lead such a good acoustical material. Concerning the second, we can and should do something to bring at least a practical knowledge of how to use lead and leaded products to the people who need it. I think we can say that we are off to a good start on this job.

You know of the high interest we've had in the subject of lead for noise control. The Association has distributed about 15,000 copies of the Bolt, Beranek and Newman study to architects, builders, and design engineers. In addition to these, it has filled more than 5000 requests from individuals for this report. It has publicized some of the outstanding case histories of the acoustical use of lead. LIA staff members have visited, phoned, and written dozens of people with specific problems and specific questions. We haven't always had the right answers for them. Sometimes we have gotten into problems where we wonder whether anyone has the right answer. We have had some successes, too. We have seen encouraging results in folding doors, machinery enclosures, inherently noisy equipment and even, in one case, a pleasure boat.

From the talks you've heard today you've also gotten some idea of how complex the practice of noise control can be. Even the basic units of loudness and pitch are difficult to feel at home with. If you were to look up "decibel" in your dictionary, you'd find it defined as "the usual unit in the measurement of sound intensity." Apparently Webster doesn't feel very much at home with decibels either! According to the experts, if we were asked to turn up the volume control of a hi-fi set until the music was just twice as loud as it had been to start, most of us would have increased the decibel level by 6 to 10 db.

That gives us some sort of an understanding of the unit of sound that Alexander Graham Bell devised. In terms of it, let's look at what sort of a job lead can do.

If we could build an ideal room (slide) and partition it off with 8 pound lead into six compartments side-by-side, each partition would block out about 30 db of a sound pitched at middle C on the piano. Let's ring a bell pitched at middle C in compartment number one -- and ring it as loudly as we can . . . say with the same noise intensity that a four-engine jet aircraft produces: 160 db. Compartment number two, separated from that noise by only 1/6 inch of lead, will be, at 130 db, about as noisy as the noisiest factory you've ever been in. On the other side of the next partition, in compartment number three, with another 30 db blocked out, the middle C tone will come through with the intensity of a sub way train pulling into the station as you stand on the platform. Another partition away the sound has dropped

Presented at the 33rd annual meeting--Lead Industries Association,
Drake Hotel, Chicago, Illinois, May 3, 1961

to 70 db -- about as loud as a busy street. Still another and we are at 40 db -- a quiet conversation in your living room with the TV set turned off. And in the last compartment, after five drops of 30 db each, the 10 db of sound left is probably less noise than you have ever experienced. The quiet there would be comparable to the sound of your own breathing if you stood perfectly still, all alone, deep in the heart of a silent cavern.

Keep in mind that this was an "ideal" room. No one has yet learned to use lead so effectively in practice. Still, it is an ideal which can be and is being approached. One final point about our ideal room illustrates the complexity (not to say perversity) of the science of sound control.

We used only 5/8 of an inch of lead altogether to reduce the roar of a jet plane to the quietest environment we can imagine. Yet, had we used one single sheet of lead 5/8 inches thick, the original 160 db roar would have been reduced by 42 db to about 120 -- still very definitely in the boiler factory class.

Things are complicated still further by the fact that each pitch will have a different penetrating power for lead (and other) partitions. If, instead of a musical tone at middle C (about 260 cycles per second), we had started with "60 cycle hum" of a radio, each of our partitions would have dropped out 20 rather than 30 db. On the other hand, had we started with a piercing whistle of 4000 cycles per second, the lead barriers would have been nearly twice as effective with a drop of 56 db.

Manufacturers of high fidelity equipment tell us that they can faithfully reproduce any tone or combination of tones from 20 to 20,000 cycles per second. If we have good ears, we can actually hear this whole spectrum of sound -- and it is certainly there for us to hear. There is no one in this room who could not tell, blindfolded, whether he was listening to a friend speak to him in person or on the telephone. The difference between the sound of a "first hand" voice and the same voice on the phone is that the telephone company cuts out all but the essential frequencies. The phone is designed to reproduce frequencies between 200 and 2000 cycles per second. The difference between "first hand" and "telephone" voices lies in the omitted tones.

Just think of the combinations of pitch and intensity of sound involved in talking. And think, too, of the variety of buzzes, groans, whistles, honks, bumps, grunts, squeaks and roars that are produced by the humdrum equipment we surround ourselves with! -- the elevators that brought you to this session, the clatter of silverware and china at breakfast, or the sound of a bus going by outside the window.

When you stop to think about the amount of noise we make with telephones and televisions, trucks and buses, and all the other paraphernalia of living a la 1961 it would seem that there is a market now for materials to give us a little peace and quiet. Fortunately for us as acoustical product producers, 1962 is likely to be a little noisier than 1961. And so far as the obvious trend of mechanization can tell us, each succeeding year will be a little noisier still.

Another contributor to the growing burden of noise on the new frontier is the increase in city population -- more of us living closer together with more mechanization to make it possible.

Still another factor is the old battle cry that "they don't build them like they used to." It applies to so many of the products we use every day from our homes and office buildings right through our automobiles and, for that matter, pencil sharpeners. The stress today is on paring off any superfluous material and weight. By and

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large it is a healthy trend -- but it does leave us with light "dry wall" houses instead of heavy conventional construction and cast plastic rather than cast iron motor enclosures. With more of us crowded together in cities, making more noise with more gadgets, and having less mass between us and the noise, there most certainly will be an increase in emphasis on noise reduction.

In dealing with interested editors of the technical press and others, we've had to make an educated guess fromtime to time as to how much lead is going to be used in the noise control field. It is patent that nobody can make such predictions with accuracy. On the other hand, we have done more than glibly quote an optimistic figure. Our estimate has been that leaded plastic materials will be consumed at something like 300 to 500 tons of lead per year within the next few years. The use of sheet lead acoustically may be somewhat smaller, but should be a comparable figure. At the time we were asked these questions, materials like Mr. Chapman's Acousti-flex curtain were still in the planning stage and we have not allowed for the potential they add.

But the point to note in this is that a new concept like Acousti-flex did come into being and does add considerably to lead's possibilities. It is not an isolated example. The Navy, now faced with a host of difficult acoustical problems stemming from better sound detection equipment, has become interested in the use of leaded plastic. There is no guarantee that materials now available will fit the Navy's requirement. Still, we have witnessed tests which show a leaded plastic combination to be better than the best materials they have found to date. Should the Navy settle on this material, you can multiply any estimate we have made by a factor of five or ten in the immediate future. And it is to be expected that the knowledge that such a material exists will promote its use in solving tough industrial problems immediately. It is equally to be expected that from such a start lead will find acoustical uses in our homes, offices, and public buildings soon after.

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PRESENT STATUS AND THE FUTURE OF THE MULTI-STOP DELIVERY TRUCK

M. McMullan, Cleveland Electric Vehicle Co.

PRODUCTION OF ELECTRIC street trucks in the USA ceased in the early 1930's. A sizeable group produced prior to that time are still in operation. At least two of these Old Timers are 1912 CT heavy duty electric trucks with a capacity of 14 tons.

ABOUT FIVE YEARS AGO The Electric Storage Battery Co. decided there was a market for electric multi-stop delivery trucks if engineered specifically for certain applications. An electric truck was developed from the ground up and three different models were designed. The first was a Dairy model with a normal payload of 3,000 lbs. and 175 cubic feet. One of these vehicles is at this meeting for your inspection. The second was a General Purpose model with a normal payload of 3,000 lbs. and 430 cubic feet. The third model was a smaller vehicle with a normal payload of 1,500 lbs. and 190 cubic feet. There is always a give and take between payload, number of stops, terrain, mileage and type of road surface. Variable factors increase payload or mileage, etc.

THE ONLY REAL RESISTANCE in selling electric multi-stop delivery trucks has been the high initial cost. Statistics from field tests at Borden's and others, have been accumulated. A summary of the Borden tests is in the brochure which is available to you. The field test results clearly show the operating savings, even with the high initial investment, and this investment can be substantially reduced with volume. In addition, the initial investment need not be higher than gas trucks as the electric power can be purchased on a monthly billing basis, just the same as gasoline or electricity is purchased in present operations.

FUTURE MARKETS CAN BE estimated from the following:

1. There are 120,000 retail milk routes in the United States, of which 70% (or 84,000) are under 30 miles in length, and governed to speeds under 30 miles per hour to conform to urban speed limits.

2. Retail bread, parcel delivery, laundry and dry cleaning routes exceed 120,000 -- with an estimated 50% under 30 miles in length.

3. In England there are 35,000/40,000 electric multi-stop vehicles on the road with production exceeding 2,000 per year. I recently read of Coca Cola in Belgium buying 200 English electric delivery trucks for their retail routes.

4. The 1960 market for gasoline multi-stop vehicles in the USA was 42,000 vehicles. A modest ten percent of this market would be a substantial electric truck

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Presented at the 32nd annual meeting--Lead Industries Association, Drake Hotel, Chicago, Illinois, May 3, 1961.

manufacturing activity, and could use up to 9 million pounds of lead (4500 tons) annually, with Replacement batteries every seven years multiplying this amount.

5. In addition there are many special possibilities:

   a. American Telephone & Telegraph has 97,000 vehicles in its system. Sixty percent of these vehicles are 1/2 ton or less in capacity and average 30 miles per day.

   b. In-plant trucks in large plants such as Dow Chemical Co. at Midland, Michigan, with 150 one-ton trucks which never leave the plant site and have low daily mileage.

   c. All of you in the lead industry have vehicles which average less than 50 miles per day.

   d. The Post Office Department which is already purchasing three-wheeled electric vehicles, recently purchased up to 10,000 multi-stop gasoline vehicles of which certainly a large percentage should have been electric.

TO SUM IT ALL UP, the modern multi-stop electric delivery truck is in production and reasonable deliveries can be made. The potential market is substantial and it can become a worthwhile market for lead. Help is needed in promoting the use of these electric vehicles and your assistance is solicited both in promoting the use of electrics in all multi-stop delivery activities and within your own companies. Certainly the lead industry stands to gain materially from an expanded use of electric vehicles.