LEAD INDUSTRIES ASSOCIATION
420 LEXINGTON AVENUE
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CONFIDENTIAL

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NOT FOR PUBLICATION

SUBJECT: REPORT OF FOURTH ANNUAL BATTERY RESEARCH AND DEVELOPMENT CONFERENCE

To Members of the Lead Industries Association:

The Fourth Annual Battery Research and Development Conference under the auspices of the Power Sources Branch of the Signal Corps Engineering Laboratories, Fort Monmouth was held on May 23 and 24, 1950 at the Berkeley-Carteret Hotel, Asbury Park, New Jersey. These Conferences are held annually to acquaint the battery industry with the progress of Signal Corps battery research and development programs and to encourage cooperative interchange of information on the art of battery manufacture.

The following are abstracts of technical reports on storage batteries that may be of specific interest to members of the Lead Industries Association.

Very truly yours,

Robert L Ziegfeld

Secretary.

METEOROLOGICAL BATTERIES

by
Arthur F. Daniel
Power Sources Branch

Purpose:

The purpose of this investigation is to develop batteries meeting the peculiar power requirements of meteorological equipment. These requirements have continuously changed during the last few years because of the need to obtain accurate meteorological data in the upper stratosphere regions.

Experimental Work:

The experimental work has included:

1. Development of a lead-acid battery for meteorological uses.
2. Development of vacuum packing and vacuum filling techniques.
3. Investigation of numerous electrochemical systems which might be useful as power sources for meteorological batteries.
4. Development of water-activated meteorological batteries.
   a. Magnesium-silver chloride battery.
   b. Magnesium-cuprous chloride battery.

Comments:

A small lead-acid storage battery was developed having satisfactory performance characteristics for powering radio-meteorological equipment. This battery was about 2 in. x 6 in. x 1 in. in size and weighed approximately 500 grams.

Future:

Future plans will include:

1. Periodic review of electrochemical systems to determine if any advances have been made in the art which will make these systems better suited to meteorological applications than those presently being used.
2. Development of batteries using these new and promising electrochemical systems.

NEW STORAGE BATTERY SYSTEMS

by
Dr. L. L. Carrick
University of Michigan

Purpose:

The purpose of this study is the development of a storage battery for military use employing lead coated aluminum grid with the objective of improving battery performance and conserving weight.

Experimental Work:

Experimental work has included:

1. Application of modern plating techniques to provide an adherent impervious coat of lead and to eliminate the danger of local action.

2. Investigation of grid design and thicknesses, oxide materials and other battery components to achieve optimum performance under operating conditions.

3. Construction and testing of 12 V. batteries using these lead plated aluminum grids. At the present time, 15 plates, .043" thick, have been used in the 45 A.H. battery and 29 such plates in the 90 A. H. battery. These experimental batteries have shown excellent performance at room temperatures and at extreme low temperatures when discharged at high rates.

Comments:

It was stated that a lead coated aluminum grid battery weighing 30% less than conventional battery with equal number of plates met operating requirements at - 70°F. Such a battery developed 300 amperes for 1 minute but did not meet volume requirements.

The above battery was made up of 0.0033-0.0034 in. thick grids with a 0.0012-0.0014 in. aluminum coating.

Usual battery pastes have proven unsatisfactory as reflected in erratic performance at low and high discharge rates. As a result it is planned to carry out studies with pastes of varying densities. Difficulties have been experienced with positive paste composition in particular.

Future:

Future plans include a continuation of the above investigations to improve the performance of those batteries by:

a. Continuing work on paste densities.
b. Using lead plated aluminum posts and other parts.

LOW TEMPERATURE CHARGING OF LEAD-ACID BATTERIES

by
Eugene Willihnganz
National Battery Company

Purpose:

The purpose of this investigation is to develop a lead-acid battery which can be charged at a low (-40°F) temperature. Present batteries, after a partial discharge require a week or more for recharge unless the battery is first warmed up to a moderate temperature.

Experimental Work:

Low temperature charging has been studied by several experimental methods to establish the nature of the barriers to charge acceptance.

In negative plates charge acceptance appears to be limited because the lead sulfate, formed during discharge does not dissolve readily during the subsequent charge. Organic expanders play a considerable part in this process but when the expanders are omitted, part of the barrier still remains to make low temperature charging a very slow process.

In the positive plate, charge appears to be limited by the formation of a lead compound which has the properties expected of amorphous lead peroxide. The material builds up a charge voltage so high that oxygen is evolved even at comparatively low charge rates.

Comments:

The following experimental data was presented on the effect of addition agents on charge acceptance.

ADDITION AGENT	CHARGE ACCEPTANCE (Amperes)
Blank	0.14
$(Hg_2)_2 SO_4$	0.13
$(Na)_2 SO_4$	0.15
$Al SO_4$	0.13
H_3PO_4	0.14
$Zn SO_4$	0.13

Future:

Addition agents are being studied to find something which may give lead sulfate particles which are more finely divided than those now being formed.

The charge process for the negative plate will be studied further to learn whether any other line of attack holds any promise.

The charge process of the positive plate will be studied to look for a possible method of increasing charge acceptance.

SINTERED-PLATE NICKEL-CADMIUM STORAGE BATTERIES

by
Dr. A. Fleischer
Nickel-Cadmium Battery Corporation

Purpose:

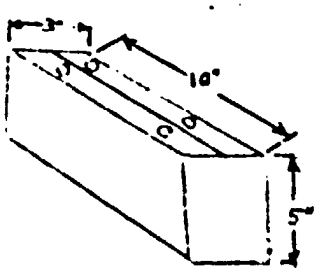
Investigations have been conducted on the sintered plate nickel-cadmium storage battery with the aim of developing an alkaline storage battery for certain applications for which the lead acid battery is inadequate.

Experimental Work:

Investigations on the sintered plate type of nickel-cadmium storage battery, as reported at the Third Annual Conference, have been continued. On the basis of data available at the time of the last meeting, two batteries have been selected for evaluation by service tests. These two batteries, a twin-cell model adapted to the volume of the lead-acid Battery [illegible], and a five-cell model adapted to the volume of Battery BB-22[illegible], have been assembled in individual cemented cases using temperature-resistant polystyrene sheet. The volumes of the cemented cases have been taken conservatively to allow for the necessary allowances in the design of a molded case for suitable wall thickness, tolerance and draft.

Comments:

The two batteries with sintered plates, described above, were reported to have passed the Signal Corps vibration test. The polystyrene plastic case was described in considerable detail. The following schematic diagram of the case was projected.



Future:

Batteries will be tested and evaluated and specifications established.

DESIGN FACTORS FOR SINTERED PLATE BATTERIES

by
Dr. Ernst G. Baars
Power Sources Branch

Purpose:

The purpose of this paper is to outline from a theoretical point of view, and to correlate with experimental work already accomplished, the factors governing the performance of the sintered plate nickel-cadmium alkaline storage battery.

Experimental Work:

Experimental work has been accomplished following these lines:

1. Impregnation of sintered nickel plaques of different thicknesses (0.65 to 4.5 mm) with nickel and cadmium salt solutions, using different methods of impregnation.

2. Single electrode studies of the aforementioned plates during forming and cycling at various rates (20 hours to 1 minute discharge) and temperatures (80°F to -40°F).

3. Testing of German sintered-plate batteries, including some preliminary experiments on charge acceptance at -40°F.

Future:

Future work will be concerned primarily with:

1. Completion of experimental work along previous lines to check the theoretical predictions.

2. Oscillograph and related studies of the polarization of sintered plates during charge and discharge at different temperatures. The results of these studies are expected to indicate further lines of attack towards the improvement of battery performance.

3. Assembling of complete batteries, using, with suitable separators, positive and negative sintered plates designed for optimum performance according to the preceding single electrode studies.

4. Testing of such batteries to check performance during charge, discharge and storage as well as during cycling and life tests.

Other papers presented at the Council were as follows:

Manganese Dioxide	
SCEL MnO_2 Program	Mr. Charles H. Clark, SCEL
Crystal Phases of MnO_2	Dr. S. Benedict Levin, SCEL
Leclanche Dry Cells	
The Effect of Iron in Dry Cells	Mr. Henry Adie, SCEL
Packaging Materials	Mr. Erick O. Linden, SCEL
The Magnesium Dry Cell	Dr. Roy Kirk, Dow Chemical Co.
Low Temperature Primary Battery Systems	Dr. Alfred B. Garrett, Ohio State University
Mechanism of the Manganese Dioxide Electrode	Dr. W. C. Vosburgh, Duke University
Low Temperature Dry Cells	Dr. Clarence K. Morehouse, Olin Industries
Miniature Dry Cells	Mr. Paul Marsal, Union Carbide and Carbon Corp.
Development of High Rate Primary Batteries	Mr. Fred Hochberg, SCEL