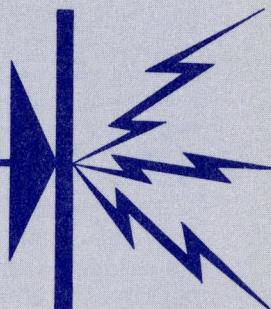


AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS



**1962 PACIFIC ENERGY  
CONVERSION CONFERENCE  
August 13-16, 1962**

**DIRECT  
CONVERSION**



- THERMIONIC
- PHOTOVOLTAIC
- FUEL CELLS
- ENERGY STORAGE
- THERMOELECTRIC
- MAGNETOHYDRODYNAMICS

Direct conversion of heat into electric power is changing rapidly from a laboratory vision to working hardware. Attend this conference to learn the status of the art and practical applications for today and the future.

**Fairmont Hotel • San Francisco**

Sponsored By

SAN FRANCISCO SECTION OF A.I.E.E.

## PROGRAM OBJECTIVES

Energy conversion is receiving more attention today than ever before. The need for self-contained, reliable power sources has spurred scientific effort to major proportions. Though efficiency of the several systems may still appear to be low, reliability and compactness offer real advantages. The fundamentals of MHD, thermionics and thermo-electric principles have been well developed as disclosed in the technical journals during recent months. However, it is appropriate that at this conference we will evaluate the accomplishments and restate objectives in keeping with the engineering progress that has been made.

Efficiency and cost are two important considerations of paramount interest to engineers. Material limitations are constantly changing and the economic factors which applied last year are somewhat different today. Perhaps of more significance is the opportunity afforded through progress in energy conversion to incorporate self-contained power sources where no other solution would do the job. Transportation vehicles, communication relay stations and portable instruments are all fields having need of smaller and lighter weight power plants.

At this conference both mechanical and electrical engineers will gain an appreciation of the importance of energy conversion sources and the possible areas of successful application. This is a meeting designed for engineers. Presentation of the state of the art is in the hands of scientists and research engineers who have been working in the several phases of energy conversion. It is reasonable to assume that there are differences of opinion concerning the limitations and technical problems which currently exist. Panel discussions have been provided as the best media for exchange of ideas and audience participation.

It is the general feeling of the committee sponsoring this meeting that early application and continued rapid progress in this field depends upon effective communication between those now working in this field and those who are most concerned with what energy conversion can do. This is a conference for exchange of views between engineers and scientists. It is hoped that after this conference each one who has participated or attended the several sessions which have been planned will return to his office or laboratory with a feeling of greater understanding and confidence in the future of energy conversion.

**JOHN C. BECKETT**  
General Committee Chairman

# Program

(See pages 8-9 for room locations)

## Monday, August 13

**8:00 A.M.**—Registration—Lobby

**10:00 A.M.**—Keynote Address—Grand Ballroom

**Presiding: Conference Chairman, JOHN C. BECKETT,**  
Palo Alto Engineering Co.

**DR. C. C. FURNAS,** Chancellor, University of Buffalo  
"Background and Future of Energy Conversion"

Dr. Furnas, Chancellor of the University of Buffalo, holds a Ph.D. in Chemical Engineering from the University of Michigan. Prior to this he has been Physical Chemist, U. S. Bureau of Mines, Professor at Yale University, Director of Research Laboratories at Curtis Wright, and Vice-President of Cornell Aeronautical Laboratory. He has served on or headed numerous National Technical and Defense Committees, including two years as Assistant Secretary of Defense for Research and Development.

## THERMIONICS

**Session Chairman: HERMAN MILLER,** General Electric Company

**11:00 A.M.**—"Thermionic Power Generation"  
Grand Ballroom

**DR. ROBERT W. PIDD,** General Dynamics Corporation

Dr. Pidd, Manager, Direct Conversion Program, General Atomic Division, General Dynamics Corporation, obtained his Ph.D. in Physics at the University of Michigan. He has served on the faculty at the University of Michigan and Johns Hopkins. He directed the initial operation of the University of Michigan's 100 BEV synchrotron. He was a consultant to the Rover Project at Los Alamos. He presently is directing development of thermoelectric and thermionic devices for direct conversion of fission energy to electrical energy.

**12:00 Noon—Luncheon—Gold Room**

**Presiding: ROBERT H. MILLET,** Pacific Gas and Electric Co.

"Engineering Aspects of Energy Conversion"

**W. KENNETH DAVIS,** Bechtel Corporation

Mr. Davis, presently Vice-President, Scientific Development Department, Bechtel Corporation, obtained

## Monday, August 13 (Continued)

his M.S. in Chemical Engineering at the Massachusetts Institute of Technology. He was formerly the Director of the Division of Reactor Development, U. S. Atomic Energy Commission. Mr. Davis has been associated with the California Research Corporation, Ford, Bacon and Davis, Inc., and the University of California. He has been active in national technical and professional committee work including Directorship of the Atomic Industrial Forum. He is currently a member of the U. S. National Committee of the World Power Conference.

### 2:00 P.M.—"Theory and Experimental Performance of Cesium Thermionic Converters"

#### Grand Ballroom

**DR. GEORGE N. HATSOPOULOS, M.I.T.**

Dr. Hatsopoulos is both Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology and Chief Executive, of Thermo Electron Engineering Corporation, a company which he founded. He has carried on extensive research on axiomatic thermodynamics, irreversible thermodynamics, thermodynamics of electrical phenomena in metals and plasmas, thermoelectricity, MHD, thermionics, and has authored more than thirty papers in those fields. He was awarded the Pi Tau Sigma Gold Medal Award for Outstanding Achievements in the Field of Engineering for the years 1950 to 1960.

### 3:00 P.M.—Panel Session—Grand Ballroom

**Moderator:** DR. GEORGE N. HATSOPOULOS, M.I.T.

#### Panel:

**DR. HAROLD S. WEBSTER,** General Electric Company  
"Current Emission Phenomena"

**H. M. OGLE,** Applied Systems Corporation  
"In-Reactor Tests of Plasma Diodes"

**DR. WALTER REICHEL,** University of California at Los Alamos

"Plasma Diodes Utilizing Fission Energy"

**DR. ROBERT W. PIDD,** General Dynamics Corporation

## Tuesday, August 14

### PHOTOVOLTAICS

**Session Chairman:** EDWARD H. HULSE, Lawrence Radiation Laboratory, University of California

### 9:00 A.M.—"Photovoltaic State of the Art—1962"

#### Grand Ballroom

**WILLIAM R. CHERRY,** Director, Direct Energy Conversion Project, National Aeronautics & Space Administration

Mr. Cherry was associated for eleven years with the U. S. Armed Services Research and Development Laboratories. As Chief of the Advanced Device Development Branch, Solid State Devices Division, he was responsible for significant advances in single crystal growth and in micro circuits. He has also contributed to advances in conversion efficiencies of photovoltaic devices.

## Tuesday, August 14 (Continued)

### "N on P Solar Cells for Telstar"

**DR. JAMES M. EARLY,** Director, Semi-conductor Device Laboratory, Bell Telephone Laboratories.

Dr. Early obtained his Ph.D. in Electrical Engineering from Ohio State University. He has, for the past ten years, done extensive work on junction transistor analysis and experiment, transistor design, and on development of high-frequency germanium transistors. Dr. Early is a Fellow of IRE, AAAS and a member of the American Physical Society, Sigma Xi and Eta Kappa Nu.

### 10:30 A.M.—Panel Session—Grand Ballroom

**Moderator:** DR. GERALD L. PEARSON, Stanford Electronics Laboratories, Stanford University

#### Panel:

**PAUL RAPPAPORT,** Head of Energy Conversion Section, RCA Laboratories

"The Status of Gallium Arsenide Photovoltaic Cells"

**DR. JOSEPH M. DENNY,** Manager, Materials Department, Space Technology Laboratories, Inc.

"Radiation Damage in Photovoltaic Converters"

**STANLEY G. SCOTT,** Applied Systems Corporation

"Some Considerations on Photovoltaic Systems Design"

**WILLIAM R. CHERRY,** Director, Energy Conversion Project, National Aeronautics and Space Administration

**DR. JAMES M. EARLY,** Director, Semi-Conductor Device Laboratory, Bell Telephone Laboratories

### FUEL CELLS

**Session Chairman:** JAY FROMAN, JR., Office of Naval Research

### 2:00 P.M.—"Hydrocarbon Fuel Cells—A Survey"

#### Grand Ballroom

**DR. HERMAN A. LIEBHAFSKY,** General Electric Company

Dr. Liebhafsky is Manager, Physical Chemistry Research, General Electric Company. He obtained his Ph.D. at the University of California. He was awarded the 1961 ACS Fisher Award in Analytical Chemistry. He has made significant contributions in the field of x-ray emission spectrography, use of counting statistics as a control for analysis of thin films, and the analysis of tungsten and molybdenum compounds in solution. He is co-author of the book "X-Ray Absorption and Emission in Analytical Chemistry."

**"The Fuel Cell Idea and Its Reduction to Practice"**

**DR. K. V. KORDESCH**, Union Carbide Corporation

Dr. Kordesch is Group Leader, Fuel Cell Project, Union Carbide Corporation. He obtained his Ph.D. from the University of Vienna. After serving as Assistant Professor of Chemistry at the University of Vienna until 1953, he came to the United States, joined the Technical Staff of the U. S. Army Signal Corps Engineering Laboratory and was engaged in battery research and in developing test equipment for rechargeable batteries. His field of interest includes fuel cells, primary and secondary batteries, gas electrodes and electronic circuitry. He has published numerous papers in his fields and is holder of several patents.

**3:30 P.M.—Panel Session—Grand Ballroom**

**Moderator:** DR. C. W. TOBIAS, University of California

**Panel:**

**DR. DAVID L. DOUGLAS**, General Electric Company

**"Current Status of Ion Exchange Membrane Fuel Cells"**

**DR. B. BAKER**, Electrochimica Corporation

**"Ammonia Fuel Cell—An Approach to an Economical System"**

**DR. MORRIS EISENBERG**, Electrochimica Corporation

**"The Outlook for Fuel Cells in Transportation"**

**DR. R. E. HENDERSON**, General Motors Corporation, Allison Division

**"Liquid Metal Cells"**

**DR. HERMAN A. LIEBHAFSKY**, General Electric Company

**5:30-7:00 P.M.—No Host Cocktail Party—Crystal Room**

**7:00 P.M.—Banquet—Gold Room**

**Presiding:** JOHN C. BECKETT, Palo Alto Engineering Co.

**"Energy Conversion Through the Looking Glass"**

**DR. J. A. HUTCHESON**, Westinghouse Electric Corporation

Dr. Hutcheson is Vice-President, Engineering, Westinghouse Electric Corporation. A graduate of the University of North Dakota, he was engaged from 1927 to 1943 in the design and development of radio communication and radar equipment. It was under his supervision that all such equipment built by Westinghouse during World War II was developed. In 1943, he was named Associate Director of the Westinghouse Research Laboratories and later was made Director and then Vice-President of Research. He has served on numerous National Defense and Research Development Committees, including Chairmanship of the Naval Research Advisory Committee.

**ENERGY STORAGE**

**Session Chairman:** W. W. GRUNDEL, The Electric Storage Battery Company

**9:00 A.M.—"Current Status of Sealed Nickel-Cadmium Storage Cells"**

**Grand Ballroom**

**U. B. THOMAS**, Bell Telephone Laboratories

Mr. Thomas is Head, Electrochemical Research and Development Department, Bell Telephone Laboratories. He is a graduate of the College of William and Mary, Williamsburg, Virginia. His chief fields of interest have been investigation of corrosion, tarnish and electrochemical kinetics with special emphasis on battery problems. During World War II, he worked on the Development of Sea Water Activated Batteries for Military Applications. He has authored numerous articles on electrochemistry for various professional and technical journals and has been active in technical society work.

**"Recent Development in Silver-Cadmium Batteries"**

**F. SOLOMON**, Yardney Electric

Mr. Solomon is Assistant Vice-President in Charge of Research, Yardney Laboratories.

He has served as Associate Director and Chief of Research at the Yardney Laboratories. For the past ten years his chief field of interest has been concerned with the development of silver-cadmium batteries and material research in associated areas.

**10:30 A.M.—Panel Session—Grand Ballroom**

**Moderator:** DR. MORRIS EISENBERG, Electrochimica Corporation

**Panel:**

**A. DANIEL**, U. S. Army Signal Corps  
**"Sealed Alkaline Storage Batteries"**

**H. N. SEIGER**, Gulton Industries  
**"Cycling Behavior of Sealed Ni-Cad Batteries"**

**F. SOLOMON**, Yardney Electric

**U. B. THOMAS**, Bell Telephone Laboratories

**12:00 Noon—Luncheon—Gold Room**

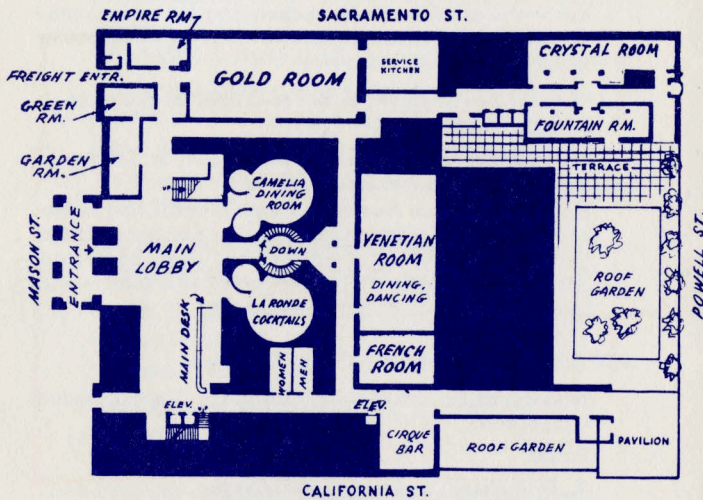
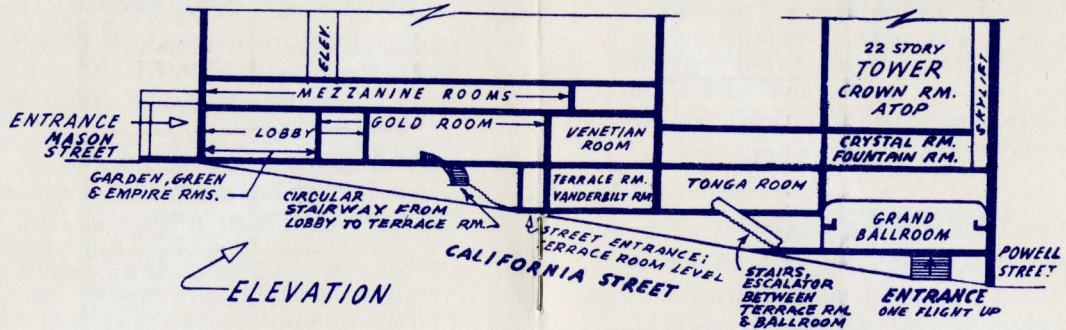
**Presiding:** M. G. LEWIS, Bechtel Corp.

**"Future Prospects of Plasma Dynamics and Energy Conversion"**

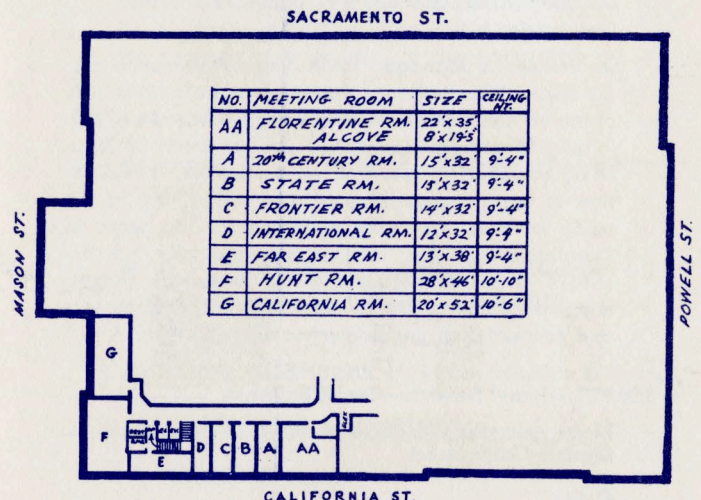
**DR. ARTHUR KANTROWITZ**, Avco-Everett Research Laboratory

Dr. Kantrowitz is Vice-President and Director of Avco Corporation. He holds a Ph.D. from Columbia University. He has served as Chief of the Gas Dynamics Section of the National Advisory Committee for Aeronautics and for a number of years was Professor of Aeronautical Engineering and Engineering Physics

# ROOM LOCATIONS FOR TECHNICAL SESSIONS

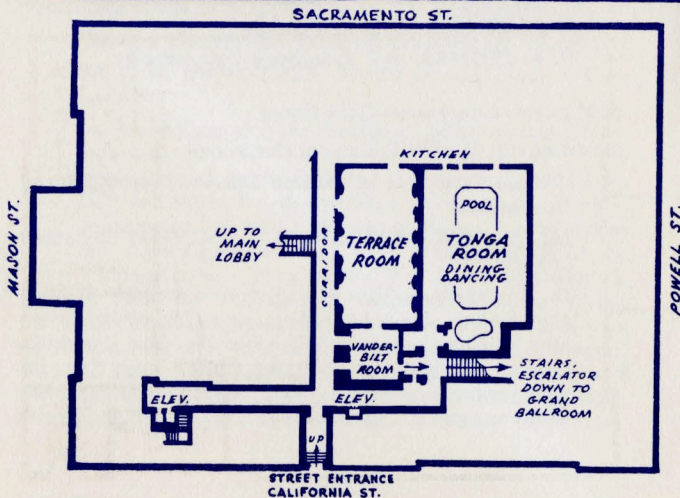


**MASON STREET LEVEL**

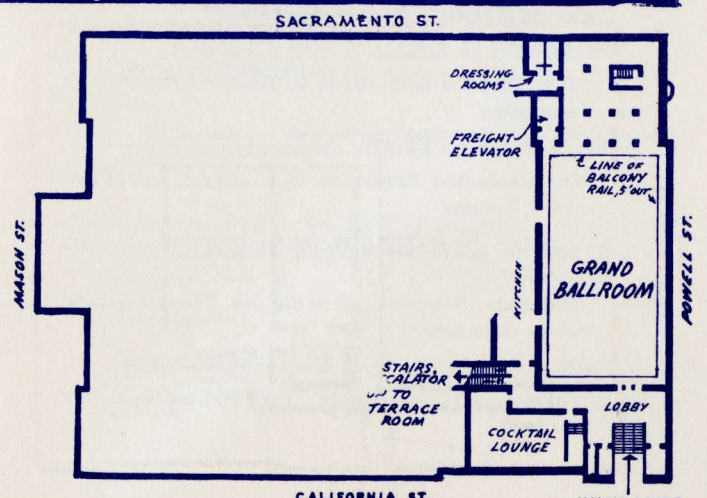


**MEZZANINE FLOOR**

## 4 Plans Showing Relationship of Room Locations



**TERRACE FLOOR LEVEL**



**GRAND BALLROOM LEVEL**

## Wednesday, August 15 (Continued)

at Cornell University. He has conducted considerable research in the field of physical dynamics and pioneered in the application of shock tube to high temperature gas problems. He has been both a Fulbright and Guggenheim Fellow at Cambridge and Manchester Universities.

### THERMOELECTRICS

**Session Chairman:** W. G. EVANS, Westinghouse Electric Corporation

**2:00 P.M.—“The Basic Concepts of Thermoelectric Power Generation”**

**Grand Ballroom**

**DR. ROBERT R. HEIKES**, Westinghouse Electric Corporation

Dr. Heikes is Manager, Solid State Phenomena Department, Westinghouse Research Laboratories. He obtained his Ph.D. at the University of Chicago. Since joining Westinghouse in 1951, he has been continuously engaged in research on magnetics, investigation of the characteristics of rare alloys and in the study of semi-conductor phenomena. His work in Thermoelectrics and related investigations has resulted in his authoring over 25 technical papers, many of which report on the material requirements and properties of thermoelectric devices.

**3:00 P.M.—Panel Session—Grand Ballroom**

**Moderator:** DR. ROBERT R. HEIKES, Westinghouse Electric Corporation

**Panel:**

**PHILIPP H. KLEIN**, Sperry Rand Research Center

“An Economic Approach to the Selection of Thermoelectric Materials for Intensive Study”

**DR. ROBERT H. EUSTIS**, Stanford University

“Heat Transfer Limitations in Thermoelectric Generation”

**DR. CLINTON M. KELLEY**, University of Denver

“Thermoelectric Properties of a Liquid Semi-Conductor System”

**DR. JAMES D. RICHARDS**, Minnesota Mining and Manufacturing Co.

“Materials Selection Criteria for Thermoelectric Power Generation”

**PAUL H. EGLI**, U. S. Naval Research Laboratory

“Thermoelectric Materials: The Present and the Potential”

## Thursday, August 16

### MAGNETOHYDRODYNAMICS

**Session Chairman:** DR. ROBERT PARDEN, University of Santa Clara

**9:00 A.M.—“MHD—Principles, Application and State of Development”**

**Grand Ballroom**

**DR. RICHARD J. ROSA**, Avco-Everett Research Laboratory

Dr. Rosa is Principal Research Scientist, Avco-Everett Research Laboratory. He obtained his Ph.D. in Engineering Physics at Cornell University. Since joining the Laboratory in 1956, he has been principally associated with MHD and its application to flight and power generation. He has directed Research and Development of MHD electric power generation since the program's conception at the Laboratory.

**9:45 A.M.—Panel Session—Grand Ballroom**

**Moderator:** DR. R. J. ROSA, Avco-Everett Research Laboratory

**Panel:**

**DR. G. W. SUTTON**, General Electric Company  
“Cycle Analysis and Efficiencies of MHD Generators”

**DR. DANIEL BERSHADER**, Lockheed Missiles & Space Company  
“Conducting Fluid Boundary Layers”

**DR. VERNON H. BLACKMAN**, MHD Research, Inc.  
“Non-Equilibrium Electron Phenomena in MHD Channels”

**DR. H. H. WOODSON**, M.I.T.  
“MHD AC Power Generation”

**DR. STEWART WAY**, Westinghouse Electric Corporation  
“Reduction of Operating Temperature in MHD Power Plants”

**2:00 P.M.—Meeting of the Ad Hoc Committee on Science and Electronics Division—Handling of New Energy Sources”**

**State Room**

**Chairman:** H. W. HENKELS

**Vice-Chairman:** PHILIPP H. KLEIN

## REGISTRATION

Registration at the Conference will be in the lobby of the Fairmont Hotel during the following hours:

- 4:00 - 7:00 p.m. Sunday, August 12th
- 8:00 - 5:00 p.m. Monday, Tuesday and Wednesday
- 8:00 - 10:00 p.m. Thursday

Everyone attending any portion of the Conference must register. The registration fee will be as follows:

General	\$15.00
Wives of Conference Attendees	No Charge
Students	\$ 1.00
Delegates to Student Activities Conference	No Charge

One bound copy of the Conference proceedings will be given to each General Registrant. Student registration does not include a copy of the Conference proceedings. Extra copies of the Conference proceedings will be available to all registered attendees at \$5.00 per copy.

Students must submit evidence of student status when registering.

## TICKETS

	Price Each
Monday Luncheon	\$ 5.00
Tuesday Evening Banquet	\$ 8.00
Wednesday Luncheon	\$ 5.00
Friday Salmon Fishing Trip	\$17.00
Ladies' Tour	\$ 5.50
Student Activities Conference Luncheon:	
Student Delegates	No Charge
Student AIEE Members—Not Delegates	\$ 2.50
All Others	\$ 5.00

## STUDENT ACTIVITIES CONFERENCE

There will be an AIEE Student Activities Conference on Tuesday, August 14th. The Student Activities luncheon at 12:00 noon will be followed by a meeting of AIEE Districts 8 and 9 Student Delegates at 2:00 P.M. The price of the luncheon will be as follows:

Student Delegates	No Charge
Student AIEE Members—Not Delegates	\$2.50
All Others	\$5.00
Luncheon—Florentine Room	
District 8 Meeting—Frontier Room	
District 9 Meeting—State Room	

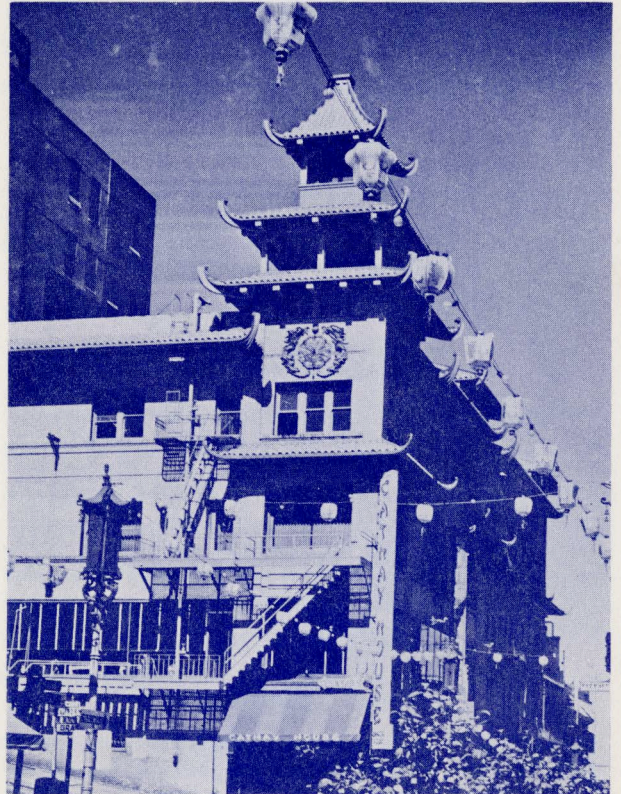
## LADIES' ACTIVITIES

The Garden Room is reserved for the ladies each morning for coffee, meeting friends, or just relaxing and getting acquainted.

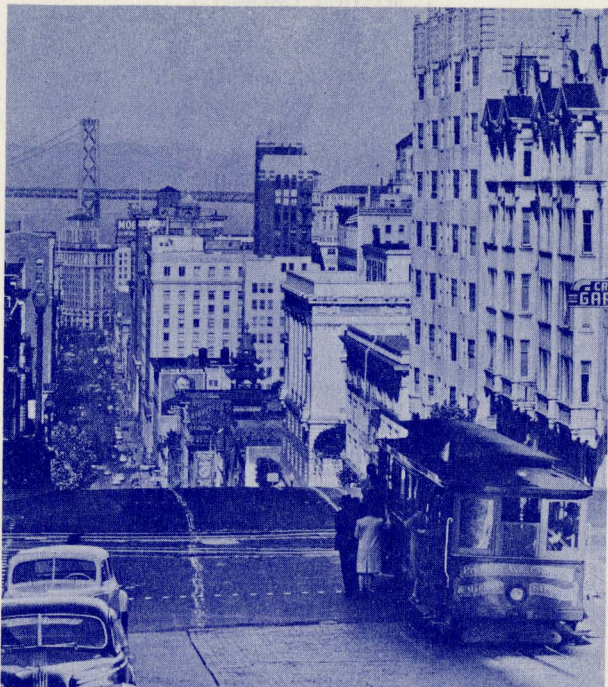
**TOUR:** The ladies' tour will leave the Fairmont Hotel by buses at 10:00 a.m., Tuesday, August 14, for a tour of McClelland's very unusual Gardenia and Orchid Nursery. Returning via the Great Highway along the coastline, you will see San Francisco's beach and the Presidio before crossing the Golden Gate Bridge. Luncheon will be waiting at the Alta Mira in Sausalito, overlooking the San Francisco Bay with a glorious view of San Francisco and the East Bay. Cost of the tour and luncheon will be \$5.50. Brochures, maps and suggestions are available at the Information counter for individual visits to Chinatown, Fisherman's Wharf, Coit Tower, Mission Dolores, Fleishhacker Zoo, and the De Young Museum, as well as the many other unique San Francisco points of interest.

## GATHERING SPOT

The Garden Room at the Fairmont Hotel will be open from 4:00 to 9:00 P.M. Sunday evening, August 12. You are urged to drop in and meet your fellow attendees, the Conference speakers, the Conference Committee and their wives. This will be an informal get acquainted session where you can meet old friends and make new friends.



Pagoda tops and lanterns silhouetted against the sky spell CHINATOWN



Quaint cable cars climb San Francisco's storied hills

### MESSAGE CENTER

A message center for your convenience is located in the hotel lobby. The phone number is EX 2-1536. If you are expecting a call while attending the conference please give your caller this phone number and advise the message center where you may be reached.

### SALMON FISHING TRIP

Arrangements have been made for a salmon fishing trip on Friday, August 17. Participants will be picked up in front of the Fairmont Hotel at 5:30 a.m. and returned there after the trip at approximately 3:00 to 4:00 p.m. The fee will be \$17.00 per person. This includes transportation, boat fee, fishing tackle, bait, weights, out of state fishing license and a box lunch. Early advance paid reservation is requested, however, the final deadline for reservations is 2:00 p.m. Tuesday, August 14.

### TECHNICAL DEMONSTRATIONS

An outstanding group of technical demonstrations relating to the six fields of energy conversion covered by the conference will be available for your inspection between the hours of 1:30 and 7:00 p.m. Monday, Tuesday and Wednesday in the Green Room and the Empire Room.

### CONFERENCE COMMITTEE

- John C. Beckett**, Palo Alto Engineering Company—  
Chairman
- Robert H. Miller**, Pacific Gas & Electric Company—  
Vice-Chairman
- Karl M. Bausch**, Bechtel Corporation—Treasurer
- Edwin H. Stewart**, Applied Systems Corporation—Secretary
- A. W. Angell**, Oliver B. Lyman Company—Banquet
- Henry Bourne**, University of California—Students
- Carlton J. Daiss**, Anaconda Wire and Cable Company—  
Arrangements
- Wendell B. Freeman**, General Electric Company—  
Registration
- Paul H. Leech**, McGraw-Hill—Publicity
- Melvin G. Lewis**, Bechtel Corporation—Publications
- William F. Poynter**, Federal Pacific Electric Company—  
Exhibits
- Harvey N. Skow**, Westinghouse Electric Corporation—  
Program
- Mrs. J. C. Beckett** } Ladies' Entertainment  
**Mrs. R. H. Miller** }
- R. S. Gardner**, A.I.E.E. Headquarters Representative

### ADVISORY COMMITTEE

- Morris Eisenberg**, Electrochimica Corporation
- Robert H. Eustis**, Stanford University
- Jay Froman**, Office of Naval Research
- George N. Hatsopoulos**, Massachusetts Institute of  
Technology
- Edward H. Hulse**, University of California
- Clint Kelley**, University of Denver
- T. L. Martin, Jr.**, University of Arizona
- Herman Miller**, General Electric Company
- Robert Parden**, University of Santa Clara
- G. L. Pearson**, Stanford University
- Robert W. Pidd**, General Dynamics Corporation
- R. A. Ramey**, Westinghouse Electric Corporation



NOTES